

# Wasson Creek Watershed Restoration Plan

2022

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Based on 2018 report by Coos Watershed Association and Advisory Team recommendations



Wasson Creek Watershed, 2001

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### ***Attached Separately***

Appendix A. Approved Permits

Appendix B. Floodplain Hydrology Restoration Plan

Appendix C. Vegetation Plan

Appendix D. Upland Restoration Plan – *Approved by SSNERR Commission*

Appendix E. Access and Interpretation Plan

Appendix F. Inadvertent Discovery Plan



## **Overview**

The Wasson Creek Watershed Restoration Project is designed to be the South Slough NERR's (SSNERR) latest and most innovative contribution to the science of coastal habitat restoration. These efforts, which SSNERR Stewardship, Research and Education Programs initiated nearly 30 years ago, along with the more recently established Coastal Training Program, continue to guide and educate coastal communities and managers about habitat restoration.

Since 1994, SSNERR has worked with technical advisors to restore the tidal and non-tidal wetlands along South Slough's Winchester Creek which were historically converted to support agricultural activities (e.g. Cornu & Sadro, 2002). SSNERR has restored approximately 55-acres of wetlands as part of the Winchester Tidelands Restoration Project (WTRP)(e.g., Cornu 2005), improving estuarine salmonid habitat throughout the Winchester system (e.g. Miller & Sadro, 2003), and testing methods for restoring lost coastal wetland habitat function and diminished ecosystem services. The Wasson Creek Watershed Restoration Project is the last site in the WTRP area in need of site-scale restoration. The Wasson Creek Project Area (Figure 1) was identified as a high priority restoration area in the SSNERR 2009 Upper Watershed Restoration Action Plan and the 2017-2022 Management Plan. The SSNERR acquired the recently harvested upper portion of the Wasson Creek drainage in 2012, providing the SSNERR with an opportunity to continue its innovative approach to restoration by demonstrating a holistic "ridgetop-to-estuary" approach to coastal restoration.

As with SSNERR's other WTRP projects the Wasson Creek watershed restoration project has the potential to restore critical tidal wetland habitat to numerous rare, endangered, and culturally important species including coho salmon, winter steelhead, and lamprey. But this innovative subbasin-scaled project has the additional benefit of also restoring or enhancing coastal forest habitat critical to the maintenance and growth of marbled murrelet and other key upland species populations.

The ridgetop-to-estuary Wasson Creek Watershed Restoration Plan (Plan) is designed to restore ecological value at the watershed level. This Plan seeks to target both terrestrial and aquatic habitats, using "Stage 0" principals (see Restoration Project Design below) to restore a wetland-stream complex in the lowlands, and silvicultural prescriptions to improve forest health in the uplands.

The Plan provides information on site location, gives a brief background on current conditions, and an overview of restoration objectives and approaches. The Plan is supplemented by six appendices, which provide greater detail on specific components of the project. The appendices include:

- A) Project permits, which includes original permits and a summary of their status.
- B) Floodplain Hydrological Restoration Plan, which details existing hydrological conditions and restoration methodologies for restoring a wetland-stream complex hydrology.
- C) Vegetation Plan, which outlines native species planting and invasive plant removal in the floodplain and riparian zones.
- D) Uplands Management Plan, which describes restoration thinning and planting activities for

upland areas.

- E) Access and Interpretive Plan, which includes a conceptual overview of improvements to existing public access, restoration of a historic structure for public use and protection, and interpretive themes. [*To be attached once completed*]
- F) Inadvertent Discovery Plan, which details actions to take if cultural resources are exposed.

### **Cultural Resources**

The SSNERR and The Coos Watershed Association (CoosWA) worked closely with the Tribal Historic Preservation Offices from the Coquille Indian Tribe and the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians (CTCLUSI) to complete an archeological survey and report for the 525-acre area within the Wasson Creek watershed. A cultural resources review was conducted for the entire Wasson subbasin and submitted to the State Historical Preservation Office (SHPO; Case No. 18-1234) and the US Army Corps. These documents are being revised and have been assigned a new Case No. (Appendix A). The cultural review is a confidential document and therefore could not be submitted with this report, but the original concurrence letter from SHPO and the Coquille Indian Tribe is attached in Appendix A. The CoosWA and SSNERR will continue to coordinate with SHPO and the Tribes to make sure that the design plans meet their needs, and an inadvertent discovery plan is in place for implementation (Appendix F).

### **Plan Development**

Since 2015 SSNERR has worked with CoosWA, the Coquille Indian Tribe and a robust technical Advisory Team to develop the Wasson Creek Watershed Restoration Plan (OWEB Grant #215-2039). Original designs were completed in 2018 under the guidance of an Advisory Team consisting of representatives from the following entities: Coos WA, Coquille Indian Tribe (CIT), CTCLUSI, Bureau of Land Management (BLM), Institute for Applied Ecology, Oregon State University (OSU), OSU Extension, Oregon Department of Forestry (ODF), Oregon Department of Fish & Wildlife (ODFW), US Fish & Wildlife Service (USFWS), and US Forest Service (USFS), along with private consultants like Yankee Creek Forestry and Aplondontia Services. With initial designs approved by the advisory committee, the Coos WA submitted and received the required permits or concurrences (Appendix A). The permits have been subsequently updated and a summary of permit status is included in Appendix A. In 2021/2022 the SSNERR worked with the Advisory Team to incorporate latest restoration methodologies and expert suggestions, which have strengthened the Plan. The Plan is now ready to face potential project funding organizations' proposal review teams.

### **Project Area Location**

The Wasson Creek Watershed Restoration Project lies within the SSNERR, a more than 6,000-acre protected area in the Coos estuary on the southern Oregon coast. The SSNERR is located on the traditional lands of the Miluk Coos people, who have managed these lands for abundance since

time immemorial. The continued connection of the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians, the Coquille Indian Tribe and the Confederated Tribes of the Siletz Indians to these lands and waters is important for restoration success. The Wasson watershed is approx. 525-acre, with 22-acre of lowlands (17-acre in the main and 5-acre on the upper valley) and 503-acre of upland forest. Wasson Creek is a tributary of Winchester Creek, the largest freshwater source to the South Slough estuary (Figure 1).

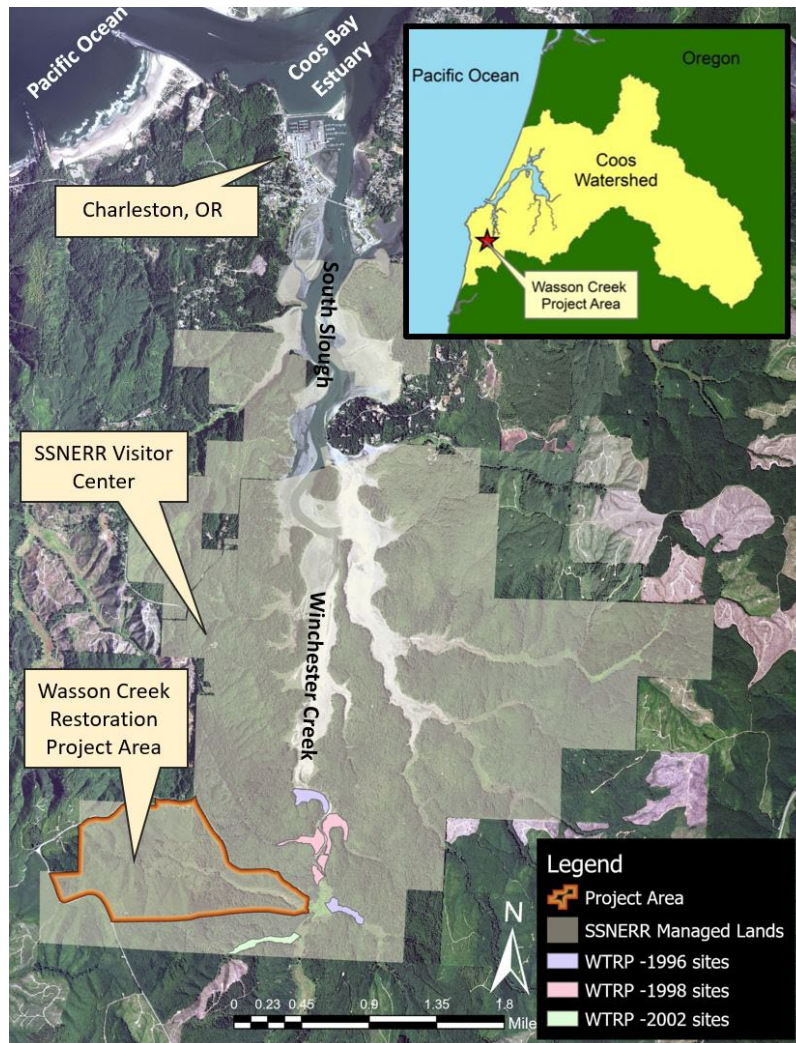


Figure 1: Wasson Creek Project Area (orange polygon) within the South Slough NERR and Coos Watershed (insert).

Topographic and hydrologic features in the Wasson Creek watershed influence the restoration needs and restrict use of restoration methodologies. The 22-acre Wasson Creek floodplain is divided, about 3,500-ft up the valley (along the central axis), by a geologic constriction (~90-ft wide)(Figure 2). Above the constriction a 5-acre floodplain is defined as the Upper Valley, while the 17-acre Main Valley extends below the constriction to the confluence with Winchester Creek at the downstream end. Based on hydrologic conditions, the Main Valley is further assigned three management areas, Main Valley Upper, Main Valley Middle, and Main Valley Lower (Figure 2).



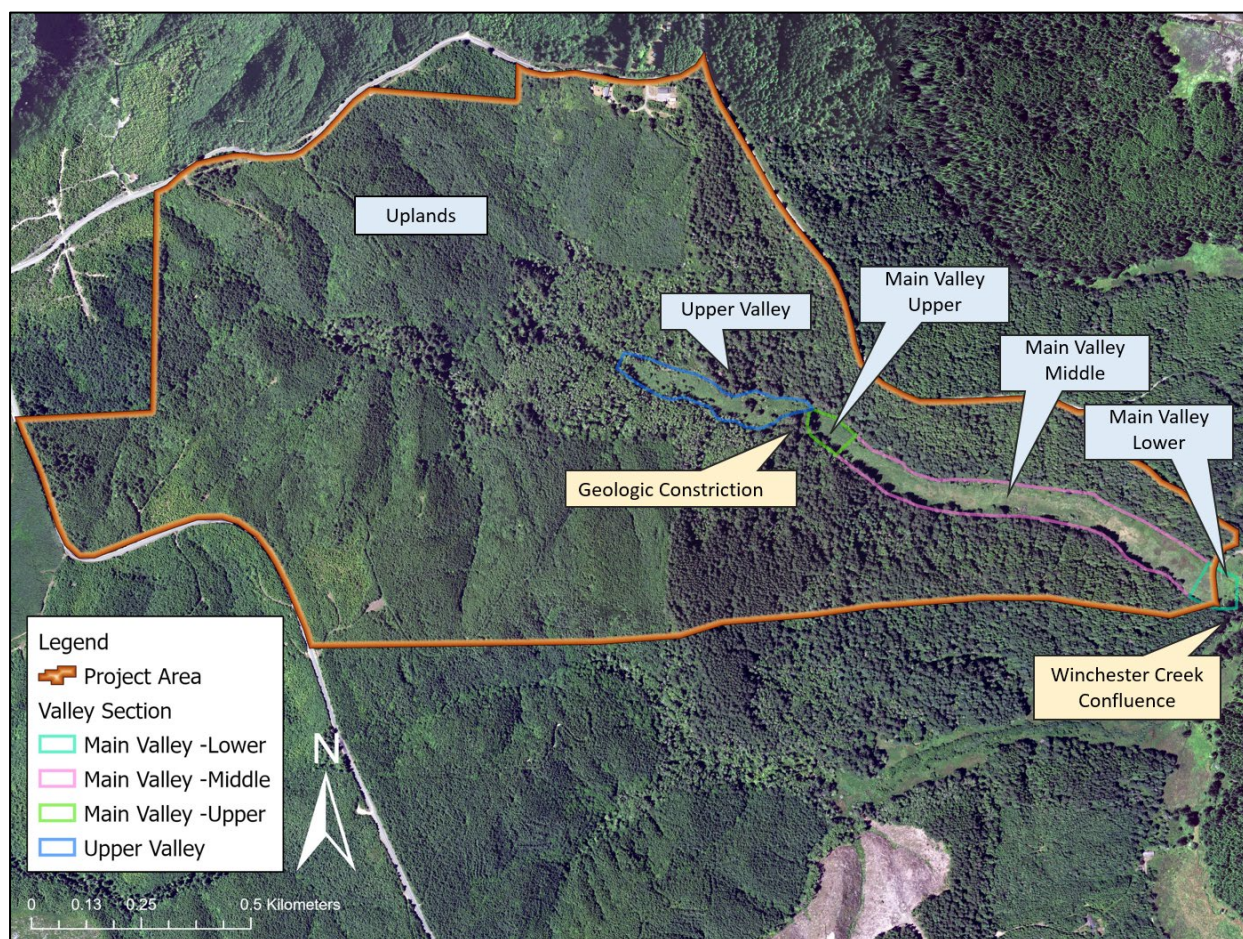


Figure 2: Wasson Creek watershed restoration project area with the floodplains defined by  $>1\%$  slope to the west and Winchester Creek to the east. A geologic constriction separates the Upper from the Main Valley. The Main Valley includes three management areas; Lower, Middle, and Upper.

## **Current Conditions and Problems**

The Wasson Creek watershed supports populations of several estuarine- dependent fish species, two of which are targeted evolutionarily significant anadromous fish; coho salmon (*Oncorhynchus kisutch*), winter steelhead (*Oncorhynchus mykiss*) and sea-run and resident cutthroat trout (*Oncorhynchus clarki clarki*), a federally listed species of concern. Several species with cultural importance to local Tribal Nations utilize Wasson Creek, in addition to coho salmon, these include both Pacific and western brook lamprey (*Entosphenus tridentatus* and *Lampetra richarsonii* respectively).

The basin is within the nesting zone and forest type of the endangered marbled murrelet (*Brachyramphus marmoratus*); however, current forest conditions do not support this species. Prior to SSNERR establishment in 1974, and acquisition of the western portion in 2012, the Wasson Creek subbasin's timber was harvested multiple times and its floodplain converted to pasture and crop lands. The constructed ditches in the floodplain, established to support

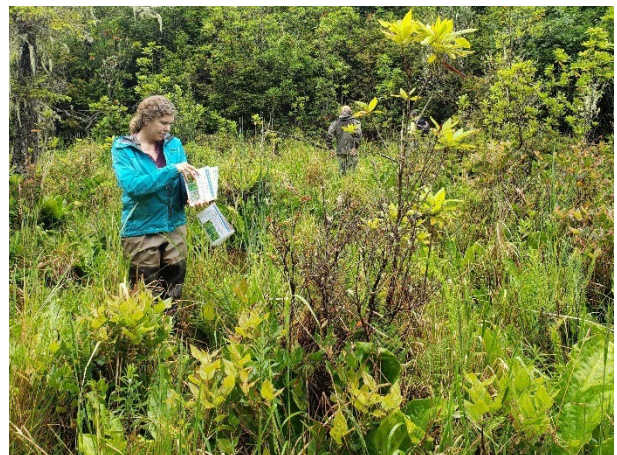


agricultural activities in the floodplain, resulted in fractured stream and floodplain connectivity, and resulted in diminished fish habitat. Also, the remnants of high-density tree planting without the recommended thinning in the uplands and simplified floodplain plant community resulted in degraded bird and wildlife habitats (Figure 3 & Attachment 1).

a) Wasson Creek



b) Reference



c)



d)



Figure 3: Simplified habitats and in the Wasson Creek watershed. Images show a disconnected floodplain dominated by the invasive plant, reed canary grass (*Phalaris arundinacea*) (a), and a dense forest stand with poor branch development and sparse understory (c). Complex habitats at the Tom's Creek reference site in SSNERR (b) and Cummins Creek reference site (d) provide reference conditions.

There are eight fundamental “problems” that the Wasson Creek Watershed Restoration Project is designed to address:

- 1) **Constructed ditches.** Wasson Creek currently flows through an incised, historically constructed ditch that borders the south side of the valley, with a seasonally active ditch bordering the north side of the valley. The incised ditches still drain the floodplain, severely limiting wetland function and habitat complexity for fish and other aquatic species.
- 2) **Dense forests and few riparian zone trees.** The Wasson Creek subbasin includes

- around 500-acres of forested upland, a majority of which has been harvested multiple times since the early 20<sup>th</sup> century. As a result, upland forest communities in the subbasin feature stands with overly crowded tree densities and repressed understory habitats. These conditions result in slow growing forests that are structurally simple, exhibiting few later successional or old growth characteristics. The absence of riparian zone trees or shrubs means limited opportunities for the natural recruitment of large woody debris to enhance the habitat complexity of the Wasson Creek floodplain.
- 3) **Limited large wood.** As part of the 2010-2011 aquatic habitat inventory (AQI) of South Slough basin, the CoosWA assessed the aquatic habitat of Wasson Creek (OWEB #210-2023; Cornu *et al.*, 2012). The AQI results indicated that the frequency and volume of large wood debris (LWD) in Wasson Creek does not meet habitat benchmarks (Moore *et al.*, 2006; Watershed Professionals Network, 1999). These deficits can be attributed to the lack of adjacent late successional forest and riparian plant communities that supply key wood pieces to Wasson Creek.
  - 4) **Poor soils.** The same AQI also revealed that the percent of sand, silt, and organics exceeds values considered to be optimal for fish habitat (Cornu *et al.*, 2012).
  - 5) **Invasive plant dominance.** Floodplain wetlands in the lower Wasson Creek drainage, that were once dominated with native sedge/bulrush/twinberry/crab apple plant communities, are now hydrologically disconnected from Wasson Creek and dominated by invasive reed canary grass (*Phalaris arundinacea*). The upland edge plant community is dominated by other non-native, invasive species including Himalayan blackberry (*Rubus armeniacus*), Scotch broom (*Cytisus scoparius*), Canadian thistle (*Cirsium arvense*), and cotoneaster (*Cotoneaster spp.*).
  - 6) **Fractured habitat.** Habitat connectivity in the Wasson Creek drainage is fragmented for aquatic, wetland, and upland species alike. Due to fractured hydrology from wetland ditching, the presence of invasive species, and simplified upland communities, salmonid and wildlife habitat availability and connectivity is a problem in the Wasson Creek watershed.
  - 7) **Limited cultural resources.** Simplified plant communities, dominated by invasive species, provide few opportunities for the cultural connections that are abundant in healthy wetland systems. Many culturally important wetland and forest plant species were lost or reduced in abundance in the Wasson Creek watershed.
  - 8) **Loss of forested tidal swamps.** As with many freshwater tidal areas in Oregon, forested tidal swamps were lost in the tidal portion of Wasson Creek. Approximately 2-acres of forested tidal swamp fringes Winchester Creek and the lower 100-ft reach of Wasson Creek's southern ditch.

### **Restoration Project Design**

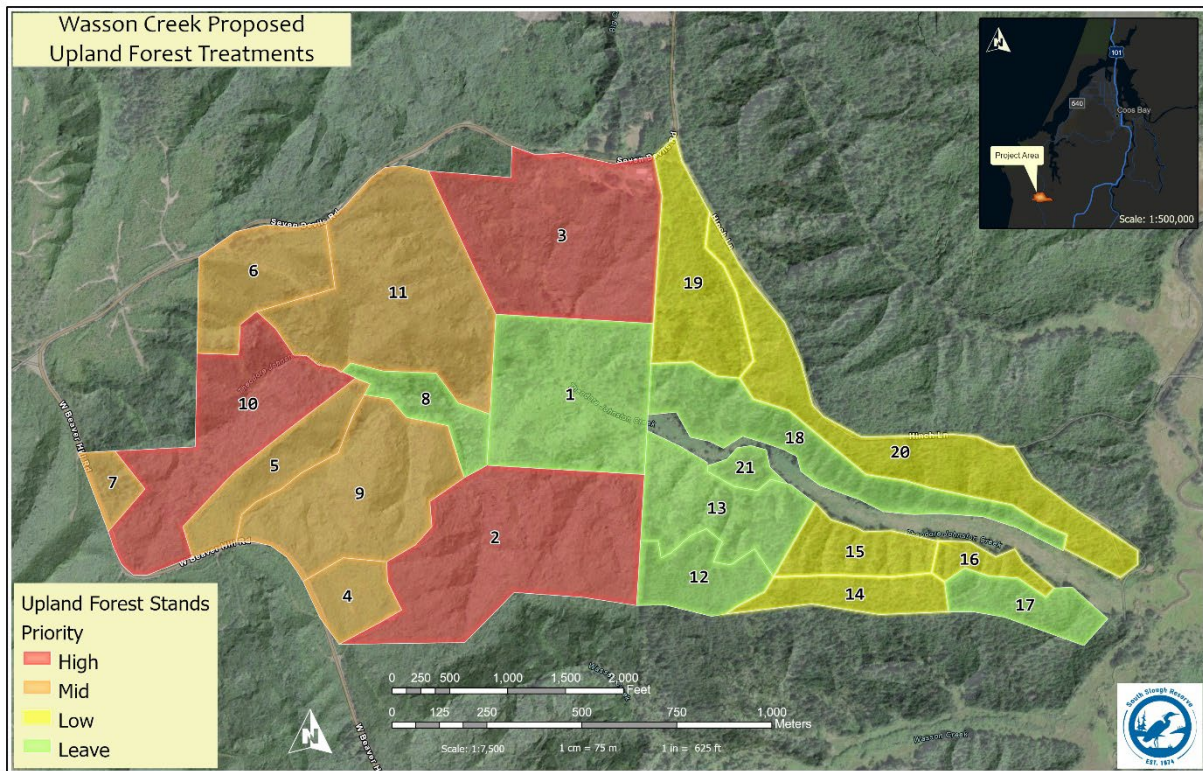
The Wasson Creek Watershed Restoration Plan is a ridgetop-to-estuary project that includes variable density thinning in the uplands and Stage 0 restoration principles in the lowlands (Powers *et al.* 2018; Behan *et al.* 2021). Variable density thinning is an emerging forest practice that

restores heterogeneity in dense second growth stands by creating “skips and gaps” within a thinned stand. By creating more availability to resources such as light, water, nutrients and space to understory vegetation, this thinning method reintroduces the variability associated with old-growth forests into a regenerating stand (Carey, 2003; Carey and Johnson, 1995; Carey et al., 1999a; Comfort et al., 2010). Stage 0 restoration is a restoration method that establishes site conditions to allow natural processes (the power of surface water hydrology, sediment deposition, large wood recruitment, and beaver activity) to do virtually all the work establishing self-forming wetland-stream complexes (Powers et al. 2018). To achieve these restoration elements, multiple restoration techniques are used in this project allowing for the varied conditions and restoration objectives throughout the watershed. This section gives an overview of restoration methods and objectives for each management area, where management areas are delineated as Uplands, Upper Valley, Main Valley Upper, Main Valley Middle, and Main Valley Lower (Figure 2). Detailed descriptions of methodologies and maps can be found in Appendices B-D.

## **Uplands**

The Wasson Creek upland (503-ac) contains stands that have been assessed as high (148-ac), mid (139-ac) and low (88-ac) priority areas and stands that will be left unmanaged (128-ac) (Figure 4). Variable density thinning restores heterogeneity in dense second growth stands by creating “skips and gaps” within a stand (Harrington 2009). “Skips” are patches that receive no treatment; “gaps” are areas that are cleared of overstory trees. A matrix of lightly thinned forest is left between skips and gaps that comprises much of the remainder of the stand. Variable density thinning allows for the natural recruitment of species already within the system. It also provides an opportunity to facilitate recruitment of species that are underrepresented, have been disproportionately impacted (e.g. by disease) and/or that are culturally important. Several species, including recently developed disease resistant varieties of Port-Orford-cedar and a variety of culturally important species, are recommended for planting in both thinned areas and gaps following treatment. See Figure 4 for map of Uplands management area and Appendix D for further details.





*Figure 4: Wasson Creek Restoration Uplands Management Area. Prioritization for restoration is based on number of trees per acre, tree size, and age of stand, where the densest stands with smallest and youngest trees have the highest priority. Leave areas are due to sensitive site conditions or are relatively old and healthy forests.*

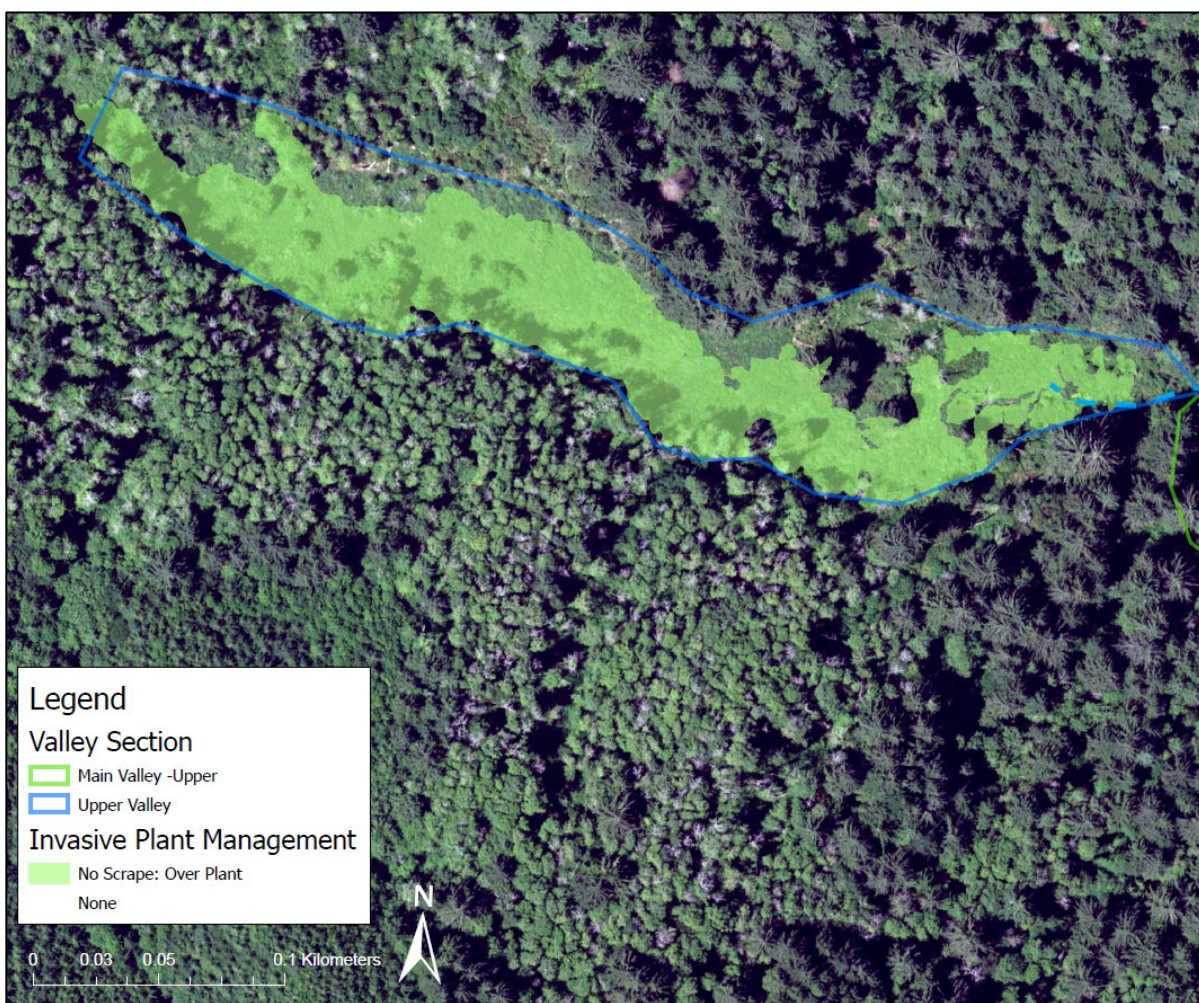
The uplands management plan (Appendix D) was approved by the SSNERR Commission on April 30<sup>th</sup>, 2021, and work was completed in stands 4, 5, and 6 in Spring 2021.



## Upper Valley

In the Upper Valley management area (5-acres; Figure 5) the channel has not been diverted into sidewall ditches and has retained a dynamic wetland-stream complex. The core problems in this area are the dominance of reed canary grass and below optimal large wood densities. Although beaver activity has been documented in this area populations are likely restricted due to loss of riparian and wetlands trees and shrubs. Due to access restrictions, we cannot utilize heavy machinery in this area. The management strategy in this area includes planting Sitka spruce for long term establishment of large wood and dense plantings of willow and other native shrubs to both increase hydrologic complexity by encouraging beaver activity and to shade out reed canary grass.

See Appendix C Planting Plan for further details.

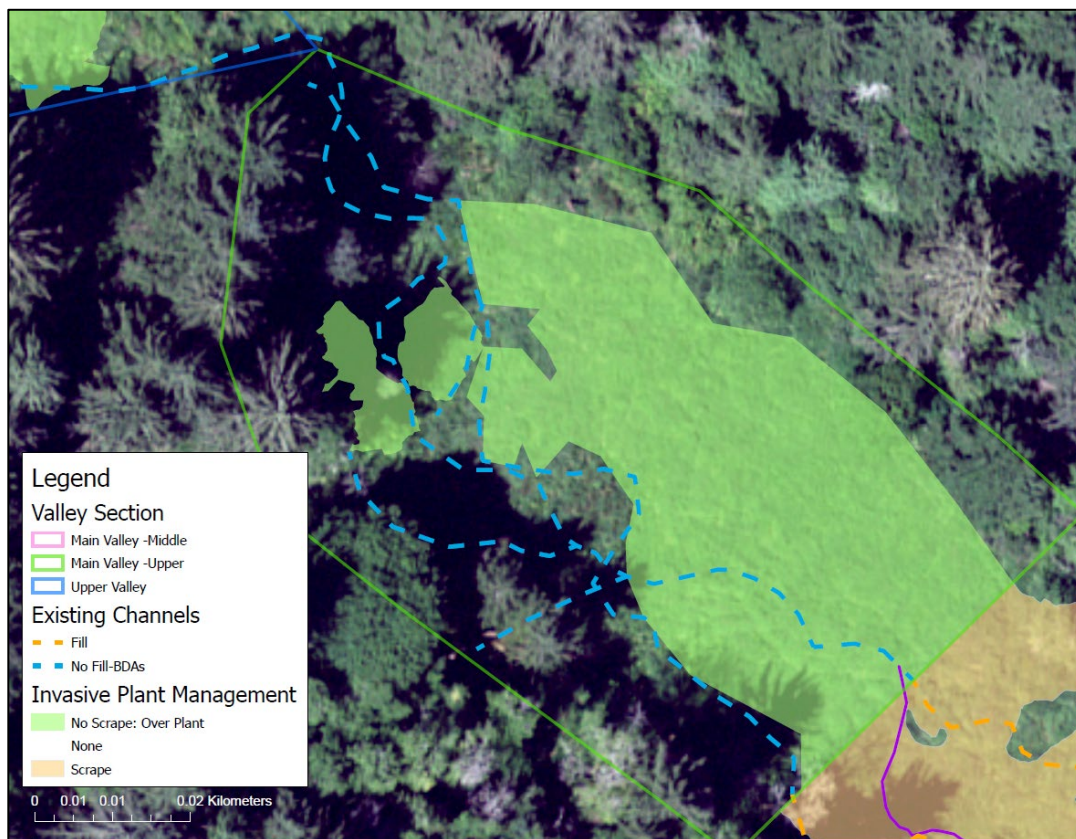


*Figure 5: Upper Valley management area showing reed canary grass dominated areas shaded green. Invasive plant management in this area will be through shading, by planting dense stands of willows and native shrubs.*

## Main Valley Upper

The Main Valley Upper management area (1.4-ac) is characterized by a relatively intact Wasson Creek stream channel network and floodplain soils that are saturated virtually year-round (Figure 6). The objective for this area is to transition flow from within existing natural stream channels entering the management area out onto the floodplain instead of flowing into the historically constructed south ditch as it does now. Beaver Dam Analogs (BDAs) will be installed in the stream channels to slow the movement of water and increase sediment deposition, which will then reduce channel depth and thus ultimately encourage the stream to overflow its banks. In addition to BDAs, high densities of wood (>30 pieces/acre) will be distributed across the floodplain to slow flow and encourage development of complex flow pathways. Reed canary grass will be managed by overplanting with dense willow stakes and other native shrubs.

See Appendix B and C for further details.



*Figure 6: Main Valley Upper management area showing reed canary grass dominated areas shaded green and existing channels. Invasive plant management in this area will be through shading, by planting dense stands of willows and native shrubs. Hydrological alterations in this area will be created by installing beaver dam analogs (BDAs) and encourage beaver activity.*



## Main Valley Middle

The Main Valley Middle management area (14-acres) is characterized by a simplified incised stream channel network in the far upper portion and a deeply down-cut constructed ditch which crosses the floodplain to become the site's southern ditch (Figure 7). This southern ditch carries most of the Wasson Creek streamflow to its confluence with Winchester Creek. A second constructed ditch begins on the north side of the floodplain around one-third down this management area. Floodplain soils in this area are seasonally saturated during winter months (though often not entirely) and dry during summer and early fall months. Reed canary grass dominates the plant community in this area and, along with other invasive species, will be removed by mechanically scraping those areas to maximum root depth (approx. 1-1.5-ft). The resulting surface will be graded to a 1% grade line slope from the upstream end to confluence. Scraped materials will be used to fill ditches and direct flow away from the valley edges. A small fish passage channel, excavated with target dimensions of 6-in. depth and 3-5-ft width, will meander through the management area. Large wood will be placed and partially buried throughout the floodplain (20 pieces/acre). For the valley floor, a slough sedge "straw" mix will be used for erosion control and seeding. This material will be augmented with plugs from existing patches and a diverse seed mix of native wetland forbs, grasses, and rushes. The riparian buffer and forested wetlands will be planted with a mix of hardwoods, shrubs, and Sitka spruce. The public access trail, that crosses the floodplain about 800-ft from confluence, will be replaced by a boardwalk. See Appendix B, C, and E for further details.

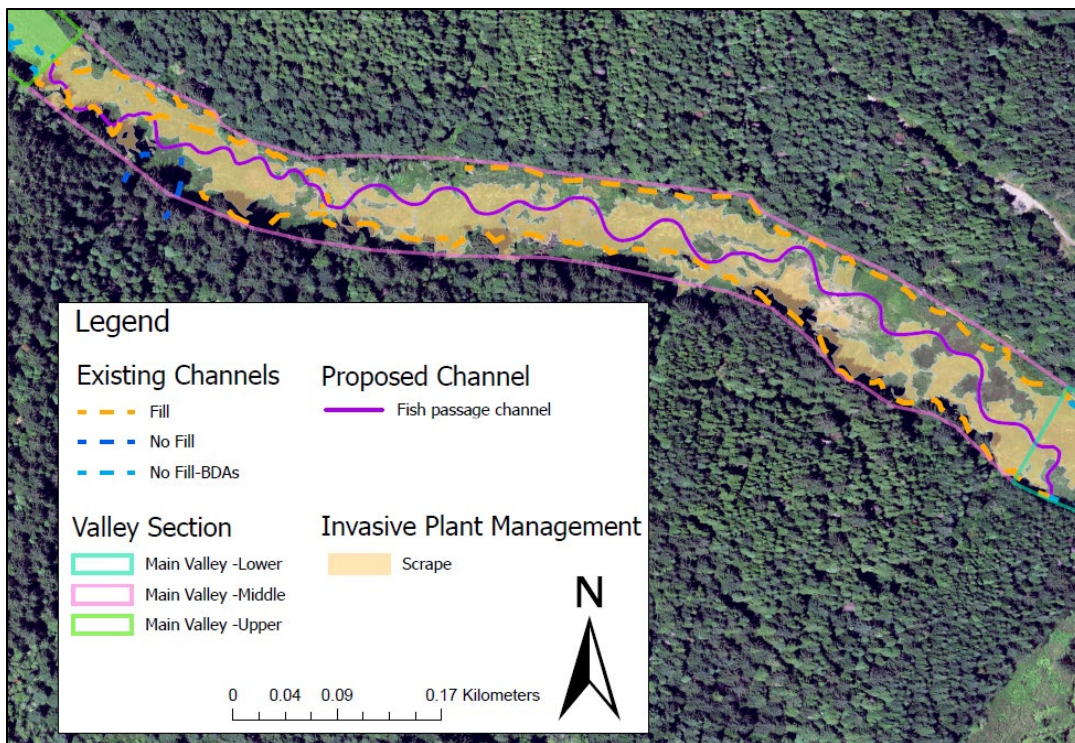
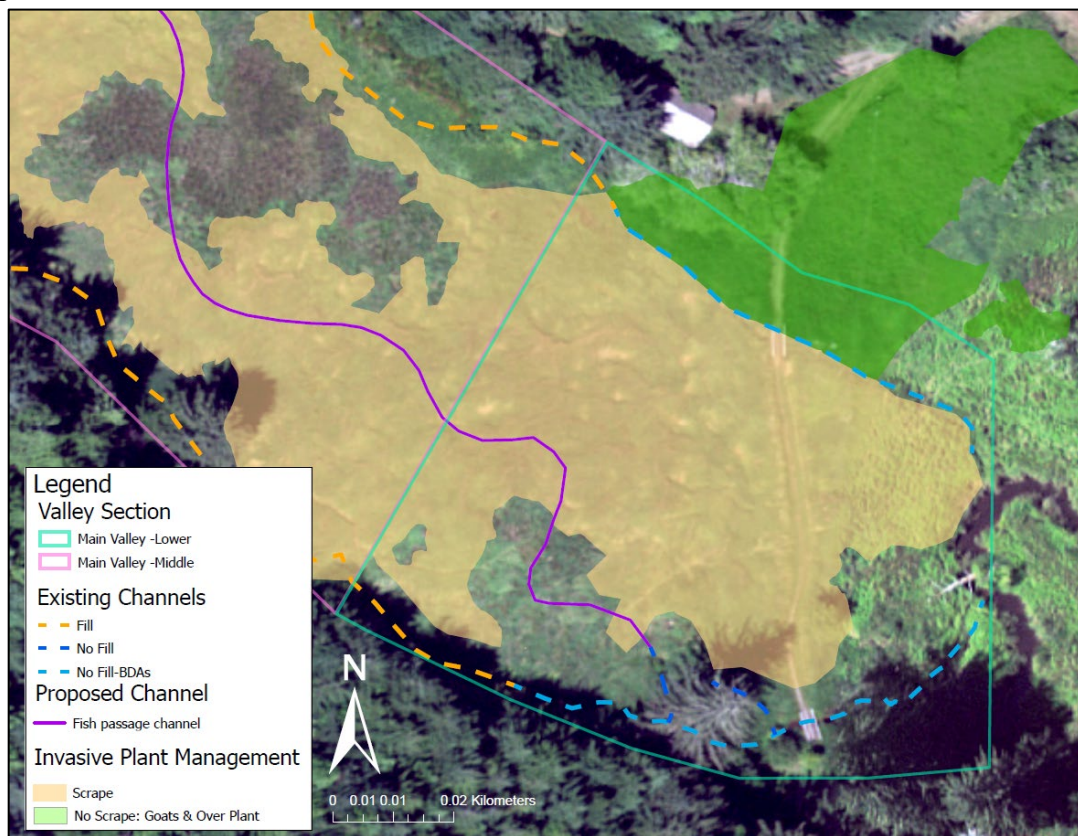


Figure 7: Main Valley Middle management area showing reed canary grass dominated areas (shaded yellow), existing channels (dashed lines) and proposed fish passage channel (solid line). Invasive plants in this area will be scraped to below root level and over planted with native wetland species. Existing channels in this area will be filled using scraped materials.

## Main Valley Lower

The Main Valley Lower management area (1.6-acres; Figure 8) is characterized by semi-regular fresh water tidal flooding and seasonally and tidally influenced soil saturation. Both constructed ditches connect to Winchester Creek at the lower end of this management area. Restoration design elements that continue in this area from the upstream management area include scraping of reed canary grass, surface grading, excavation of fish passage channel and large wood placement (approx. 25 pieces/acre). Due to sensitivities in this management section some areas in the lower floodplain will not be scraped, and all ground disturbance will be closely monitored. The lowest reaches of the existing constructed ditches will not be filled all the way to their confluence with Winchester Creek to create a gradual ditch to maintain creek transition. Transition areas will be approx. 200-ft on the southern ditch and 600-ft on the northern ditch. BDAs will be used to reduce channel depth and encourage floodplain connections and beaver activity. The fish passage channel will connect to the southern ditch via an existing drainage depression. This management area will be planted with Sitka spruce forested tidal swamp associated species, using log cribs, and partially buried large wood. The public trail that crosses the floodplain and extends into the existing spruce swamp will be replaced by a boardwalk.

See Appendix B, C, and E for further details.



*Figure 8: Main Valley Lower management area showing reed canary grass (yellow), Himalayan blackberry (green), existing channels (dashed lines) and proposed fish passage channel (solid line). Invasive plant management includes scraping (reed canary grass), goat browsing (blackberry) and overplanting with native species. Existing ditches will either have beaver dam analogs (BDAs) installed (light blue), left untouched (dark blue), or filled (orange). The fish passage channel will connect to an existing drainage that flows into the southern ditch.*



### **Public Awareness and Educational Activities**

Although the SSNERR has implemented several wetland restoration projects, this will be the most accessible for public and formal education programs. The existing Wasson Creek Loop Trail is a popular hiking trail and provides a significant opportunity for increasing the accessibility to trails in the Reserve. Appendix E proposes changes to the existing trail, outlines interpretive objectives, and details restoration plans for protection and use of a historic structure. An outreach and communication plan, from pre-restoration through implementation, has been developed but is not included in this document. Improvement to the trail section that extends from Wasson Creek to the mouth of Anderson Creek, restored in 2002, will provide access to a good comparison with an older restoration project which used different restoration techniques. This trail can be used as an interpretive hike where the public can learn about the project's history, goals, and its benefit to water, people, and wildlife. The Coquille Indian Tribe and the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians have agreed to develop interpretive information on cultural connections (past and present) in the Wasson watershed and coastal area. The Wasson Creek project site would also be a great place for an outdoor classroom where local students could learn about a wide range of ecology topics such as native plant identification, pollinators, wildlife, restoration methods, and much more! Students and/or volunteers can also partake in wildlife surveys (macroinvertebrate, bird, beaver, and fish) and vegetation monitoring, either to teach them ecological monitoring methods or as part of official post-project effectiveness monitoring.

## **Timeline**

Table 1 provides a projected timeline for completing different elements of the Wasson Creek Restoration Project. This timeline is dependent on successful acquisition of funds in 2022/2023 and is subject to change. Detailed timelines for individual tasks can be found in Attachment 2.

*Table 1: Estimated Wasson Creek Watershed Restoration Project timeline from 2021-2026*

| <b>Year/Month</b> | <b>Project Component</b>                                                   |
|-------------------|----------------------------------------------------------------------------|
| <b>2021</b>       |                                                                            |
| Apr. 30           | SSNERR Commission approved Appendix D: Wasson Uplands Restoration Plan     |
| May               | USFWS funds awarded to Friends of South Slough Reserve for forest thinning |
| Dec.              | Coquille Tribal Community Fund awarded to Coos WA for willow planting      |
| <b>2022</b>       |                                                                            |
| Apr.-May          | Completed 45-acres of forest thinning                                      |
| July              | Present full plan to SSNERR Commission for approval (sans Appendix E)      |
| Jul.-Dec.         | Apply for funding                                                          |
| Aug.-Dec.         | Update permits                                                             |
| Sep.-Dec.         | Preparation for and planting in Upper Valley management area (Appendix C)  |
| <b>2023</b>       |                                                                            |
| Jan.-Apr.         | Contracting services for uplands work                                      |
| May-Dec.          | Forest thinning (Appendix D)                                               |
| Jul.-Sept.        | Install beaver dam analogs                                                 |
| <b>2024</b>       |                                                                            |
| Jan.-Dec.         | Continue forest thinning as needed (Appendix D)                            |
| Jan.-Mar.         | Contracting services for lowlands Main Valley management area              |
| Jun.-Dec.         | Main Valley restoration work (Appendix B and C)                            |
| <b>2025</b>       |                                                                            |
| Jan.-Dec.         | Monitoring and adaptive management                                         |
| Aug.-Dec.         | Report writing                                                             |
| Nov.-Dec.         | Preparation for and planting in Upper Valley management area (Appendix C)  |
| <b>2026</b>       |                                                                            |
| Jan.-Jul.         | Monitoring and adaptive management                                         |
| Aug.-Dec.         | Report writing                                                             |



## **Budget**

Table 2 provides estimated project costs for upland forest restoration, stream and floodplain restoration, trails and public access, and restoration of historic shed separately. This budget may change due to fluctuating costs and additional information. SSNERR will apply for grant funding for operational costs, listed below, and Reserve staff will provide in-kind supervision and monitoring support. This does not include money already received from the USFWS administered by Friends of South Slough (\$64,203), and Coquille Tribal Community Grant administered by Coos WA (\$5,000). Detailed budget available upon request.

*Table 2: Estimated grant funding request for the Wasson Creek Watershed Restoration Project. Does not include in-kind provided by SSNERR or partners, nor funding received from other entities.*

| <b>Restoration Component</b>                     | <b>Estimated Grant Funding</b> |
|--------------------------------------------------|--------------------------------|
| Upland forests restoration                       | \$1,932,519                    |
| Stream and floodplain restoration and monitoring | \$1,217,802                    |
| Public access                                    | \$268,332                      |
| Historic shed restoration                        | \$50,000                       |
| <b>Grand Total</b>                               | <b>\$3,485,654</b>             |

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Powers, P.D., M. Helstab & S. L. Niezoda, 2018. A process-based approach to restoring depositional river valleys to Stage 0, an anastomosing channel network. River Research and Applications. <https://doi.org/10.1002/rra.3378>

Watershed Professionals Network (WPN), 1999. Oregon Watershed Assessment Manual. June 1999. Prepared for the Governor's Watershed Enhancement Board, Salem, Oregon.



**Attachment 1.** Photoset 1. Photos of the ditched Wasson Creek. Photos 1 & 2 are at the lower end of the valley looking upstream and downstream respectively. Photos 3 & 4 are about a third up the valley, again looking upstream and downstream respectively.





Photoset 2. Photos of the vast monoculture of reed canary grass within the Wasson valley with Photo 3 showing a section with a mix of native species and reed canary grass. Photo 4 is the more historic plant community just upstream of the geologic constriction.





Photoset 3. Photos showing the overstocked, planted stands of Wasson's upland forests that are in dire need of restoration thinning to introduce heterogeneity, conserve biodiversity, and increase the overall ecological function of the basin.





## Attachment 2: Timeline

*Table 1: Restoration timeline assuming successful funding. Management areas are designated as Uplands, Upper Valley (UV), and Main Valley (MV) Upper (MVU), Middle (MVM), and Lower (MVL). Although South Slough Reserve (SSNERR) will oversee the entire project, different entities (teams) are listed for implementation of specific tasks. Teams include SSNERR, Coos Watershed Association (Coos WA), Friends of South Slough (FOSS), and Contractors (TBP via public bid).*

| Date       | Task                                                                                          | Management Area          | Team                                       |
|------------|-----------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------|
| 2021       |                                                                                               |                          |                                            |
| Apr. 30    | SSNERR Commission approved Appendix D: Wasson Uplands Restoration Plan                        | Uplands                  | SSNERR                                     |
| May        | USFWS funds awarded to FOSS for forest thinning (\$64,203)                                    | Uplands                  | FOSS                                       |
| Dec.       | Coquille Tribal Community Fund awarded to Coos WA for willow planting (\$5,000)               | UV                       | Coos WA                                    |
| 2022       |                                                                                               |                          |                                            |
| Apr.-May   | Completed 45-acres of forest thinning                                                         | Uplands                  | Contractor                                 |
| Jul.       | Fuel reduction work and fuelbreak                                                             | Uplands                  | SSNERR                                     |
| Jul. 21    | Present full plan to SSNERR commission                                                        | Excl. Appendix E         | SSNERR                                     |
| Jul.-Sept. | Apply for NERRS IJA funds                                                                     | All remaining            | SSNERR                                     |
| Aug.-Dec.  | Update permits                                                                                | MV & UV                  | Coos WA                                    |
| Sep./Oct.  | Willow planting preparation                                                                   | UV                       | Coos WA                                    |
| Nov./Dec.  | Plant willows and native shrubs                                                               | UV                       | Coos WA/SSNERR                             |
| 2023       | Year 1 (if awarded IJA funds in 2022)                                                         |                          |                                            |
| Jan.-Apr.  | Contract preparation                                                                          | Uplands                  | SSNERR                                     |
| May.-Dec.  | Forest thinning & tree placement                                                              | Uplands & UV             | Contractor                                 |
| Jun.       | Willow maintenance & protection                                                               | UV                       | Coos WA                                    |
| Jul./Aug.  | Install BDAs<br>Mow RCG                                                                       | MVL<br>MVL               | Contractor/SSNERR                          |
| 2024       | Year 2                                                                                        |                          |                                            |
| Jan.-Mar.  | Contract preparation<br>Forest thinning cont. as needed                                       | MV<br>Uplands            | SSNERR<br>Contractor                       |
| Apr./May.  | Beaver dam surveys                                                                            | MV & UV                  | SSNERR                                     |
| Jun./July  | Earth moving, tree placement                                                                  | MVM & MVU                | Contractor                                 |
| Jul.       | Install BDAs<br>Mow RCG<br>Vegetation monitoring                                              | MVL & MVU<br>MVL<br>UV   | Contractor/SSNERR<br>Contractor<br>SSNERR  |
| Aug.       | Earth moving<br>Cultural resource monitoring<br>Construct log cribs<br>Boardwalk installation | MVL<br>MVL<br>MVL<br>MVL | Contractor<br>CIT<br>Coos WA<br>Contractor |
| <Sept. 15  | Fish salvage<br>Earth moving fill channels                                                    | MV<br>MV                 | Coos WA<br>Contractor                      |
| Oct.-Dec.  | Planting and erosion control                                                                  | MV                       | Coos WA                                    |
| 2025       | Year 3                                                                                        |                          |                                            |
| Jan.-Dec.  | Post-restoration monitoring & adaptive management                                             | All                      | SSNERR                                     |
| Jul.       | Install BDAs as needed                                                                        | MVU&MVL                  | Coos WA/SSNERR                             |
| Aug./Dec.  | Report writing                                                                                | All                      | SSNERR                                     |
| Sept./Oct. | Willow planting prep                                                                          | UV                       | Coos WA                                    |
| Nov./Dec.  | Plant willows                                                                                 | UV                       | Coos WA                                    |
| 2026       | Year 4                                                                                        |                          |                                            |
| Jan./Feb.  | Plant willows                                                                                 | UV                       | Coos WA                                    |
| Jan.-Jul.  | Post-restoration monitoring & adaptive management                                             | All                      | SSNERR                                     |
| Jun.       | Willow maintenance and protection                                                             | UV                       | Coos WA                                    |
| Aug.-Dec.  | Report writing                                                                                | All                      | SSNERR                                     |

## Appendix A

# Wasson Creek Watershed Restoration Project

## Original Permits and Renewal Status

Compiled by Coos Watershed Association

Updates by Alice Yeates (Stewardship Coordinator, SSNERR)

### Overview

The original 2018 plan applied for a received several permits for completing the Wasson Creek restoration project. This Appendix includes all original permits, and associated documentation, along with an update on their status and required actions (Table 1). Changes in project designs (e.g. reducing channel dimensions, adding beaver dam analogs, reducing/eliminating the use of chemicals, using goats for weed management) and time lapse since approval has meant that some permits require reverification and modification.



*Table 1: List of original permits (included in this Appendix) and information on permit office and type, application number, status and actions required.*

| <b>Permit</b>                                                                                                                  | <b>Number</b>                      | <b>Status and Required Action</b>                                                                         | <b>Page</b> |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------|
| Coos County Planning Department                                                                                                |                                    | Signed off, no expiration date                                                                            | 3           |
| OR Department of State Lands (DSL) – Removal/Fill                                                                              | 61277-RF                           | Modify with updated design plans (reduced removal/fill)                                                   | 4           |
| US Army Corps of Engineers (USACE)                                                                                             | NWP-2018-303                       | Need to reverify and modify with updated design plans (reduced removal/fill)                              | 11          |
| National Marine Fisheries Service (NMFS)                                                                                       | NWP-2018-303                       | USACE will communicate with NMFS during reverification process                                            | 16          |
| OR Department of Environmental Quality (DEQ) - 401 Water Quality Certification Approval                                        | NWP-2018-00303                     | USACE reverification will trigger a resubmit through newer 401 WQC program which now includes fee (\$985) | 17          |
| DEQ -1200C                                                                                                                     |                                    | Uncertain if needed. Apply if necessary and pay fee (\$2,193)                                             | 26          |
| Coquille Indian Tribe with consultations from the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians (CTCLUSI) |                                    | Coquille Indian Tribe THPO to re-submit updated letter of “no adverse effects”                            | 27          |
| State Historic Preservation Office (SHPO)                                                                                      | 18-1234 (old)<br>22-0221 (current) | New case number created, modify with updated design plans                                                 | 28          |

**(10) CITY/COUNTY PLANNING DEPARTMENT LAND USE AFFIDAVIT  
(TO BE COMPLETED BY LOCAL PLANNING OFFICIAL)**

I have reviewed the project described in this application and have determined that:

- ☐ This project is not regulated by the comprehensive plan and land use regulations.
- ☒ This project is consistent with the comprehensive plan and land use regulations.
- ☐ This project will be consistent with the comprehensive plan and land use regulations when the following local approval(s) are obtained:
- ☐ Conditional Use Approval
  - ☐ Development Permit
  - ☐ Other Permit (see comment section)
- ☐ This project is not consistent with the comprehensive plan. Consistency requires:
- ☐ Plan Amendment
  - ☐ Zone Change
  - ☐ Other Approval or Review (see comment section)

An application ☐ has ☐ has not been filed for local approvals checked above.

Local planning official name (print) Title City / County (circle one)

Crystal Orr

Planning Specialist

Coos

Signature

Crystal Orr

Date

6/21/18

Comments:

allowed pursuant to 4.6.200.1.g

**(11) COASTAL ZONE CERTIFICATION**

If the proposed activity described in your permit application is within the [Oregon coastal zone](#), the following certification is required before your application can be processed. A public notice will be issued with the certification statement, which will be forwarded to the Oregon Department of Land Conservation and Development (DLCD) for its concurrence or objection. For additional information on the Oregon Coastal Zone Management Program, contact DLCD at 635 Capitol Street NE, Suite 150, Salem, Oregon 97301 or call 503-373-0050.

**CERTIFICATION STATEMENT**

I certify that, to the best of my knowledge and belief, the proposed activity described in this application complies with the approved Oregon Coastal Zone Management Program and will be completed in a manner consistent with the program.

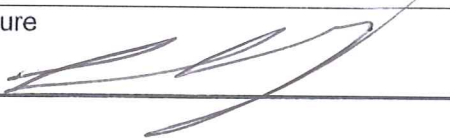
Print /Type Name

Anne Donnelly

Title

Coos Watershed Association Interim Executive Director

Signature



Date

6/5/2018



Department of State Lands  
775 Summer Street, Suite 100  
Salem, OR 97301-1279  
☎ 503-986-5200

|                        |                           |
|------------------------|---------------------------|
| Appendix A Permit No.: | <u>61277-RF</u>           |
| Permit Type:           | <u>Removal/Fill</u>       |
| Waterway:              | <u>Wasson Creek</u>       |
| County:                | <u>Coos</u>               |
| Expiration Date:       | <u>September 20, 2019</u> |

**COOS WATERSHED ASSOCIATION**

**IS AUTHORIZED IN ACCORDANCE WITH ORS 196.800 TO 196.990 TO PERFORM THE OPERATIONS DESCRIBED IN THE ATTACHED COPY OF THE APPLICATION, SUBJECT TO THE SPECIAL CONDITIONS LISTED ON ATTACHMENT A AND TO THE FOLLOWING GENERAL CONDITIONS:**

1. This permit does not authorize trespass on the lands of others. The permit holder must obtain all necessary access permits or rights-of-way before entering lands owned by another.
2. This permit does not authorize any work that is not in compliance with local zoning or other local, state, or federal regulation pertaining to the operations authorized by this permit. The permit holder is responsible for obtaining the necessary approvals and permits before proceeding under this permit.
3. All work done under this permit must comply with Oregon Administrative Rules, Chapter 340; Standards of Quality for Public Waters of Oregon. Specific water quality provisions for this project are set forth on Attachment A.
4. Violations of the terms and conditions of this permit are subject to administrative and/or legal action, which may result in revocation of the permit or damages. The permit holder is responsible for the activities of all contractors or other operators involved in work done at the site or under this permit.
5. Employees of the Department of State Lands (DSL) and all duly authorized representatives of the Director must be permitted access to the project area at all reasonable times for the purpose of inspecting work performed under this permit.
6. Any permit holder who objects to the conditions of this permit may request a hearing from the Director, in writing, within twenty-one (21) calendar days of the date this permit was issued.
7. In issuing this permit, DSL makes no representation regarding the quality or adequacy of the permitted project design, materials, construction, or maintenance, except to approve the project's design and materials, as set forth in the permit application, as satisfying the resource protection, scenic, safety, recreation, and public access requirements of ORS Chapters 196, 390, and related administrative rules.
8. Permittee must defend and hold harmless the State of Oregon, and its officers, agents and employees from any claim, suit, or action for property damage or personal injury or death arising out of the design, material, construction, or maintenance of the permitted improvements.
9. Authorization from the U.S. Army Corps of Engineers may also be required.

**NOTICE:** If removal is from state-owned submerged and submersible land, the permittee must comply with leasing and royalty provisions of ORS 274.530. If the project involves creation of new lands by filling on state-owned submerged or submersible lands, you must comply with ORS 274.905 to 274.940 if you want a transfer of title; public rights to such filled lands are not extinguished by issuance of this permit. This permit does not relieve the permittee of an obligation to secure appropriate leases from DSL, to conduct activities on state-owned submerged or submersible lands. Failure to comply with these requirements may result in civil or criminal liability. For more information about these requirements, please contact Department of State Lands, 503-986-5200.

Kirk Jarvie, Southern Region Manager  
Aquatic Resource Management  
Oregon Department of State Lands

  
**Authorized Signature**

September 20, 2018  
**Date Issued**



## **ATTACHMENT A**

**Permit Holder: Coos Watershed Association**

**Project Name: Wasson Creek Restoration Project**

**Special Conditions for Removal/Fill Permit No. 61277-RF**

### **READ AND BECOME FAMILIAR WITH CONDITIONS OF YOUR PERMIT.**

**The project site may be inspected by the Department of State Lands (DSL) as part of our monitoring program. A copy of this permit must be available at the work site whenever authorized operations are being conducted.**

1. **Responsible Party:** By signature on the application, Allison Tarbox is acting as the representative of Coos Watershed Association. By proceeding under this permit, Coos Watershed Association agrees to comply with and fulfill all terms and conditions of this permit, unless the permit is officially transferred to another party as approved by DSL.
2. **Authorization to Conduct Removal and/or Fill:** This permit authorizes removal of up to 21,250 cubic yards and the fill of 21,500 cubic yards of material in T26S R14W Section 35, Tax Lots 300, 600, 700, 800, 900 and 1200, in Coos County, as described in the attached permit application, map and drawings (See Attachment B for project locations), with a receipt date of June 7, 2018.
3. **Work Period in Jurisdictional Areas:** Fill or removal activities below the ordinary high water elevation of Wasson Creek must be conducted between July 1 and September 15, unless otherwise coordinated with Oregon Department of Fish and Wildlife and approved in writing by DSL. If fish eggs are observed within the project area, work must cease and DSL contacted immediately.
4. **Changes to the Project or Inconsistent Requirements from Other Permits:** It is the permittee's responsibility to ensure that all state, federal and local permits are consistent and compatible with the final approved project plans and the project as executed. Any changes made in project design, implementation or operating conditions to comply with conditions imposed by other permits resulting in removal-fill activity must be approved by DSL prior to implementation.
5. **DSL May Halt or Modify:** DSL retains the authority to temporarily halt or modify the project or require rectification in case of unforeseen adverse effects to aquatic resources or permit non-compliance.
6. **DSL May Modify Conditions Upon Permit Renewal:** DSL retains the authority to modify conditions upon renewal, as appropriate, pursuant to the applicable rules in effect at the time of the request for renewal or to protect waters of this state.
7. **DSL Proprietary Authorization Required Before Beginning Work:** Prior to the start of work within state-owned submerged and submersible lands, the permittee must apply for the following proprietary authorizations: Short-Term Access Agreement; Waterway Registration for large woody debris placement in Wasson Creek channel.



### **General Construction Conditions**

8. **Water Quality Certification:** The Department of Environmental Quality (DEQ) may evaluate this project for a Clean Water Act Section 401 Water Quality Certification (WQC). If the evaluation results in issuance of a Section 401 WQC, that turbidity condition will govern any allowable turbidity exceedance and monitoring requirements.
9. **Erosion Control Methods:** The following erosion control measures (and others as appropriate) must be installed prior to construction and maintained during and after construction as appropriate, to prevent erosion and minimize movement of soil into waters of this state.
  - a. All exposed soils must be stabilized during and after construction to prevent erosion and sedimentation.
  - b. Filter bags, sediment fences, sediment traps or catch basins, leave strips or berms, or other measures must be used to prevent movement of soil into waterways and wetlands.
  - c. To prevent erosion, use of compost berms, impervious materials or other equally effective methods, must be used to protect soil stockpiled during rain events or when the stockpile site is not moved or reshaped for more than 48 hours.
  - d. Unless part of the authorized permanent fill, all construction access points through, and staging areas in, riparian and wetland areas must use removable pads or mats to prevent soil compaction. However, in some wetland areas under dry summer conditions, this requirement may be waived upon approval by DSL. At project completion, disturbed areas with soil exposed by construction activities must be stabilized by mulching and native vegetative plantings/seeding. Sterile grass may be used instead of native vegetation for temporary sediment control. If soils are to remain exposed more than seven days after completion of the work, they must be covered with erosion control pads, mats or similar erosion control devices until vegetative stabilization is installed.
  - e. Where vegetation is used for erosion control on slopes steeper than 2:1, a tackified seed mulch must be used so the seed does not wash away before germination and rooting.
  - f. Dredged or other excavated material must be placed on upland areas having stable slopes and must be prevented from eroding back into waterways and wetlands.
  - g. Erosion control measures must be inspected and maintained as necessary to ensure their continued effectiveness until soils become stabilized.
  - h. All erosion control structures must be removed when the project is complete and soils are stabilized and vegetated.
10. **Hazardous, Toxic, and Waste Material Handling:** Petroleum products, chemicals, fresh cement, sandblasted material and chipped paint, wood treated with leachable preservatives or other deleterious waste materials must not be allowed to enter waters of this state. Machinery refueling is to occur at least 150 feet from waters of this state and confined in a designated area to prevent spillage into waters of this state. Barges must have containment system to effectively prevent petroleum products or other deleterious material from entering waters of this state. Project-related spills into waters of this state or onto land with a potential to enter waters of this state must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311.
11. **Archaeological Resources:** If any archaeological resources, artifacts or human remains are encountered during construction, all construction activity must immediately cease. The State Historic Preservation Office must be contacted at 503-986-0674. You may be contacted by a



Tribal representative if it is determined by an affected Tribe that the project could affect Tribal cultural or archeological resources.

12. **Hazards to Recreation, Navigation or Fishing:** The activity must be timed so as not to unreasonably interfere with or create a hazard to recreational or commercial navigation or fishing.
13. **Operation of Equipment in the Water:** Heavy equipment may be positioned on or traverse the area below ordinary high water or highest measured tide only when the area is free of flowing or standing water. All machinery operated below ordinary high water (OHW) elevation must use vegetable-based hydraulic fluids, be steam cleaned and inspected for leaks prior to each use, and be diapered to prevent leakage of fuels, oils, or other fluids below OHW elevation. Any equipment found to be leaking fluids must be immediately removed from and kept out of OHW until repaired. Equipment staging, cleaning, maintenance, refueling, and fuel storage must be at least 150 feet from OHW and wetlands to prevent contaminants from entering waters of the state.
14. **Work Area Isolation:** The work area must be isolated from the water during construction by using a coffer dam or similar structure. All structures and materials used to isolate the work area must be removed immediately following construction and water flow returned to pre-construction conditions.
15. **Fish Salvage Required:** Fish must be salvaged from the isolation area. Permits from NOAA Fisheries and Oregon Department of Fish and Wildlife, Fish Research are required to salvage fish. Fish salvage permit information may be obtained by contacting ODFW Fish Research at 503-947-6254 or [Fish.Research@state.or.us](mailto:Fish.Research@state.or.us).
16. **Fish Passage Required:** The project must meet Oregon Department of Fish and Wildlife requirements for fish passage.
17. **Channel Relocation:** The new channel must be constructed under these conditions:
  - a. There must be no operation of equipment in the active flowing stream except to connect the newly dug channel in to the existing stream.
  - b. The new channel must be completely constructed and stabilized before diverting the stream flow.
  - c. The old channel must be permanently blocked with impervious material protected by suitable bank protection.
  - d. Spoils from the excavation of the new channel must be stockpiled, and after the diversion has been accomplished, the material may be used to fill the abandoned channel.

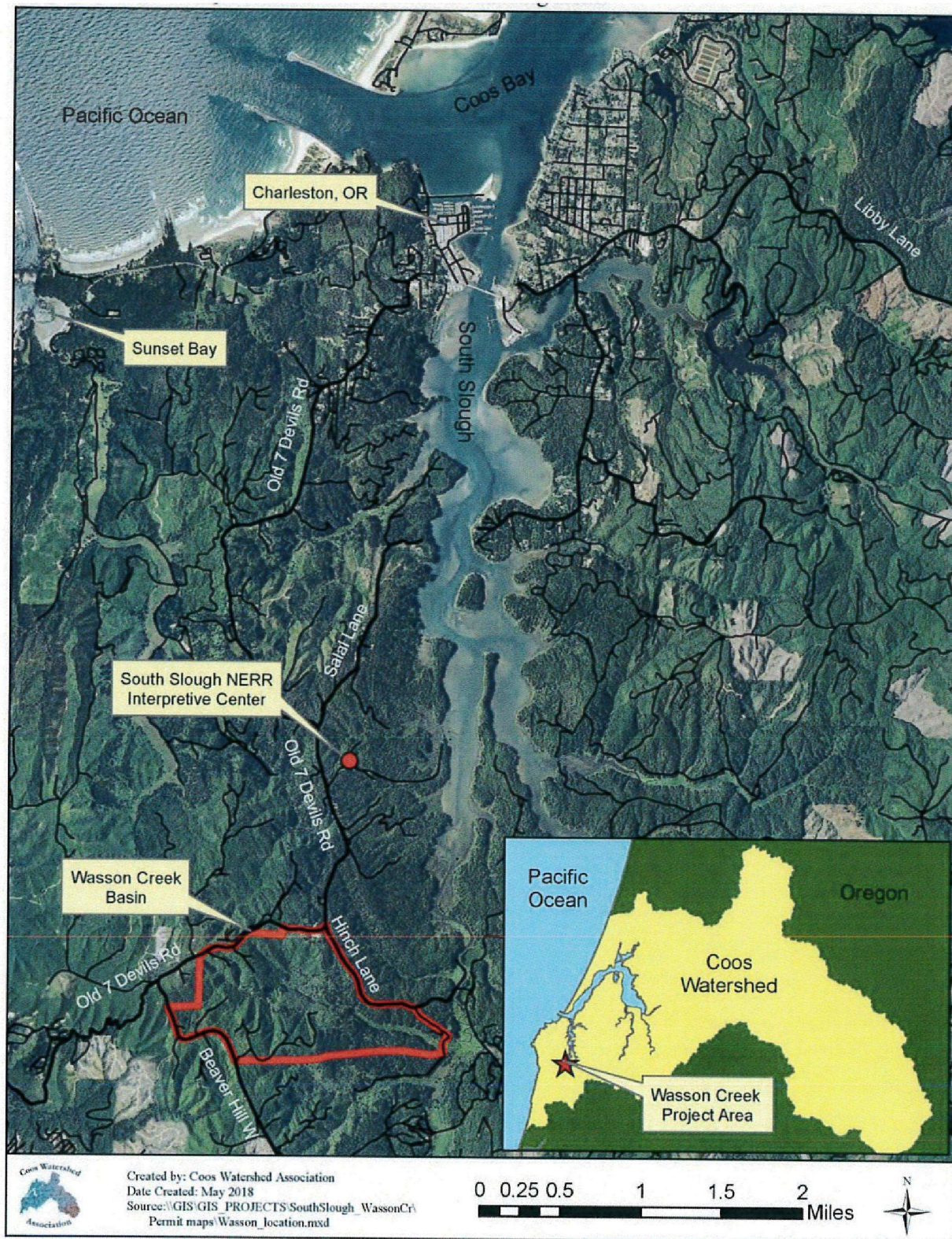


## ATTACHMENT B

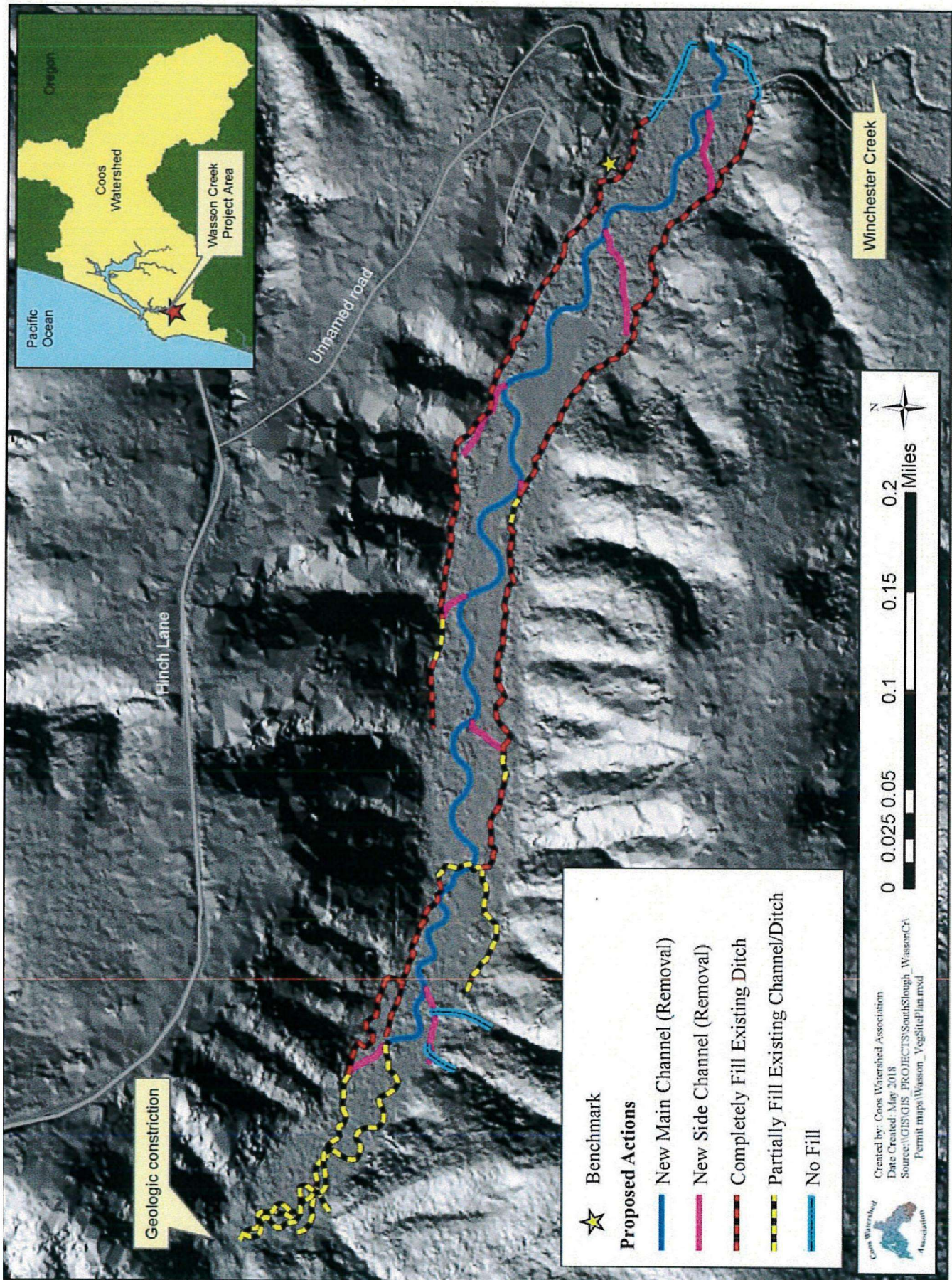
Permit Holder: Coos Watershed Association

Project Name: Wasson Creek Restoration Project

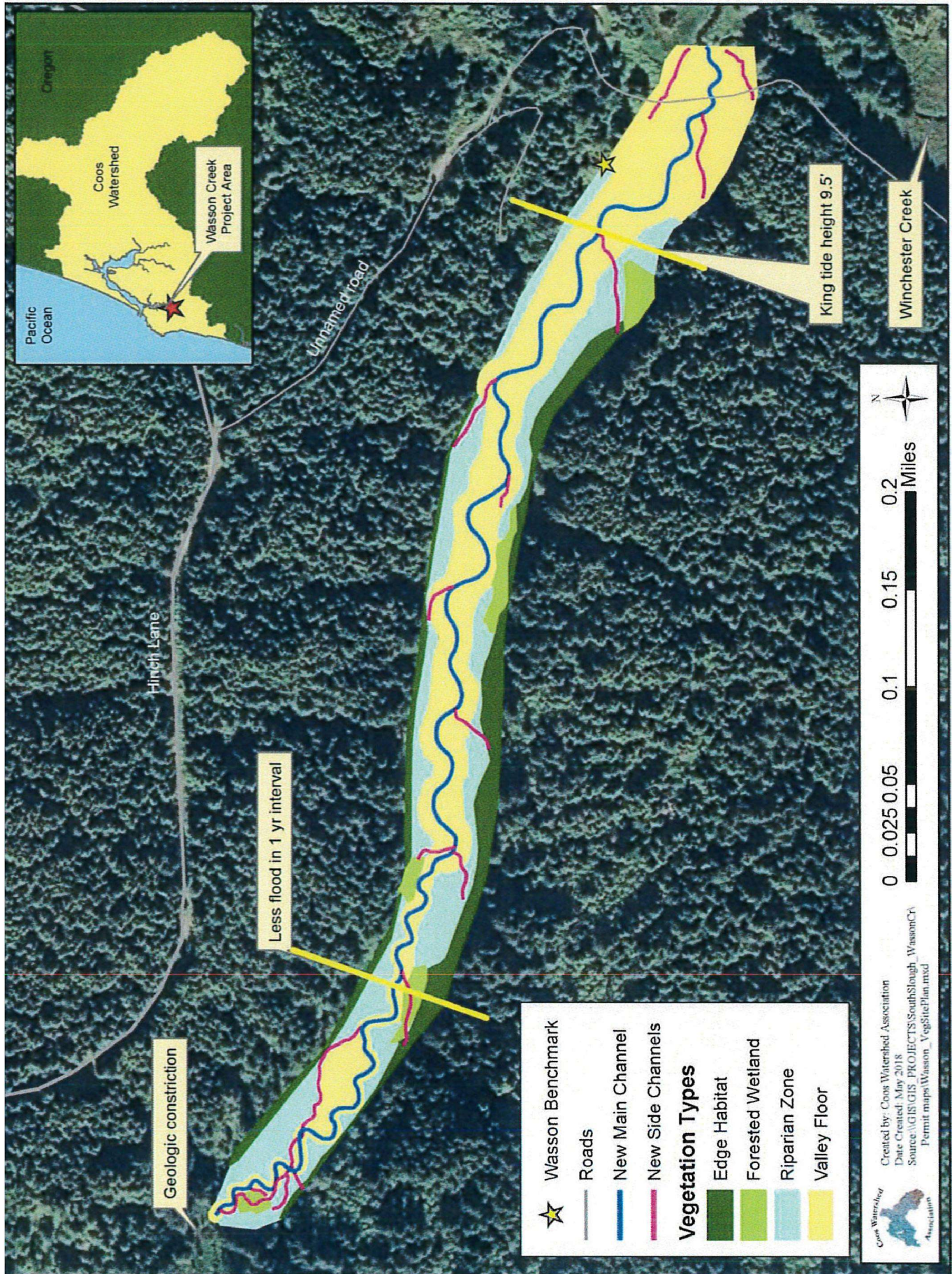
Maps and Drawings for Removal/Fill Permit No. 61277-RF















**DEPARTMENT OF THE ARMY**  
CORPS OF ENGINEERS, PORTLAND DISTRICT  
NORTH BEND FIELD OFFICE  
2201 N. BROADWAY, SUITE C  
NORTH BEND, OREGON 97459-2372

August 27, 2018

Regulatory Branch  
Corps No. NWP-2018-303

Ms. Allison Tarbox  
Coos Watershed Association  
P.O. Box 388  
Coos Bay, Oregon 97420  
atarbox@cooswatershed.org

Dear Mr. Tarbox:

The U.S. Army Corps of Engineers (Corps) received the Coos Watershed Association's (CoosWA) request for Department of the Army (DA) authorization to restore aquatic habitat in Wasson Creek, near Charleston, Coos County, Oregon. The site is located at Latitude/Longitude: 43.272122°, -124.3247°.

This letter verifies CoosWA's project as depicted on the enclosed drawings (Enclosure 1) is authorized by Nationwide Permit (NWP) No. 27, Aquatic Habitat Restoration, Establishment, and Enhancement Activities (*Federal Register, January 6, 2017, Vol. 82, No. 4*) provided the CoosWA obtains a 401 Water Quality Certification (WQC) decision from the Oregon Department of Environmental Quality (DEQ). CoosWA is not authorized to begin work in waters of the U.S. until you obtain and submit to our office a 401 WQC decision or waiver.

The CoosWA will restore aquatic habitat by conducting work and discharging dredged and fill material below the high tide line of Wasson Creek and tidally influenced wetlands. Permanent impacts include reconstructing and elongating approximately 5,897-feet of stream channel to 1.7-miles, filling previously ditched channels, placing approximately 272 pieces of large wood, and planting approximately 22 acres of wetland with native vegetation. The CoosWA will conduct work with excavator to reconstruct stream channels and floodplain sinuosity to reflect historic conditions and will place large wood in configurations of one to five pieces extending 1.5 times bankfull width of the stream.

In order for this authorization to be valid, CoosWA must ensure the work is performed in accordance with the enclosed Nationwide Permit 27 Terms and Conditions (Enclosure 2); the Oregon Department of Land Conservation and Development (DLCD) Coastal Zone Management Conditions (Enclosure 3); any 401 Water Quality Certification conditions and Coastal Zone Management Act conditions, as applicable (see below); and the following special conditions:



- a. All in-water work shall be performed during the in-water work period of July 1 to September 15, to minimize impacts to aquatic species. **Exceptions to this time period requires specific approval from the Corps and National Marine Fisheries Service.**
- b. Permittee shall provide a copy of the permit transmittal letter, permit form, and permit drawings to all contractors performing any work authorized by Corps No. NWP-2018-303.
- c. Permittee shall complete and sign the enclosed *Compliance Certification* (Enclosure 4). Permittee shall submit the completed certification to the U.S. Army Corps of Engineers, Portland District, Regulatory Branch within 30 days of completion of the authorized activity.
- d. Permittee shall fully implement all applicable Proposed Design Criteria (PDC) of the Tidal Area Restoration Authorized, Funded, or Implemented by the Corps of Engineers, Federal Emergency Management Agency, and Federal Highways Administration in Oregon and the Lower Columbia River programmatic opinion (TARP). A detailed list of the PDC's are enclosed (Enclosure 5). The PDC's included with the TARP notification for the project include numbers: 8-23, 27, 28, 32, 34-36 and 40.
- e. Permittee shall implement the Inadvertent Discovery Plan (Enclosure 6) and immediately notify the U.S. Army Corps of Engineers, Portland District, Regulatory Branch if human remains or cultural resources are discovered during the performance of the authorized work. We also draw the CoosWA's attention to Regional Condition 3.

The requirements of the Endangered Species Act were met through a programmatic biological opinion as listed in the special condition above. The complete text of the biological opinion is available for your review at <http://www.nwp.usace.army.mil/Missions/Environmental-Stewardship/SLOPES/>. Please note, CoosWA must submit a *TARP Action Completion Report and Fish Salvage Report* form which are provided in Enclosure 5. Please submit the TARP reports and any other reports associated with this permit to either the letterhead address above or by email to [cenwp.notify@usace.army.mil](mailto:cenwp.notify@usace.army.mil). For submittals by email, the email subject line shall include the Corps project number listed above and the name of the county where the project is located.

We have reviewed your project pursuant to the requirements of the Endangered Species Act, the Magnuson-Stevens Fishery Conservation and Management Act and the National Historic Preservation Act. We have determined the project complies with the requirements of these laws provided CoosWA complies with all of the permit general and special conditions.

At this time, the DEQ has not completed a 401 WQC decision for this project. Before proceeding with the work authorized by this NWP, you must obtain a 401 WQC or certification waiver from the DEQ. Please contact the DEQ regarding this requirement at: 401 Water Quality Certification Coordinator, Oregon Department of Environmental Quality, 700 NE Multnomah Street, Suite 600, Portland, Oregon, 97232, by telephone at (503) 229-6414, or visit <http://www.oregon.gov/deq/pages/index.aspx>. After obtaining a 401 WQC or a waiver for certification, you must submit a copy of the 401 WQC or waiver to our office. The conditions of the 401 WQC will become conditions of this NWP verification. This NWP verification will become effective upon our receipt of the 401 WQC. You may then proceed with construction.

The proposed work is not authorized by this NWP if the DEQ denies the 401 WQC. Please contact us if the 401 WQC is denied.

If the DEQ has not provided you with a 401 WQC decision within twelve (12) months of the date of this letter, your requirement to obtain a 401 WQC becomes waived. You may then proceed with construction.

The project appears to comply with the DLCD Coastal Zone Management Act concurrence for this NWP. No further coordination with DLCD is required provided the work is performed in accordance with all of the enclosed conditions.

Please note, Portland District NWP Regional General Condition 3, Cultural Resources and Human Burials Inadvertent Discovery Plan, details procedures should an inadvertent discovery occur. CoosWA must ensure that you comply with this condition during the construction of your project.

As part of our permit application review process, we notified Native American tribes that have an interest in this area. The Coquille Indian Tribe requested their archeology staff be present to observe construction. Based on our coordination, CoosWA agreed to allow Tribal Staff access. Please contact Ms. Cassandra Rippee, Tribal Historic Preservation Officer, Coquille Indian Tribe at (541) 808-5554 at least 72 hours prior to commencing construction.



We have determined the aquatic resources identified on the enclosed Preliminary Jurisdictional Determination (PJD) form “may be” waters of the U.S. (Enclosure 7). The aquatic resources shown on the enclosed drawings are considered “potential jurisdictional waters” and the boundaries are approximate. These waters have been treated as jurisdictional waters of the U.S. for purposes of computation of impacts and compensatory mitigation requirements. Please see the enclosed PJD form for additional information on the applicability of a PJD. If you concur with the PJD, please sign and return the PJD form to either the letterhead address above or the email address below within 30 days of the date of this letter.

The enclosed PJD is advisory in nature and may not be appealed. However, you have the option to request an Approved Jurisdictional Determination (AJD). An AJD is an official determination regarding the presence or absence of waters of the U.S. and is an appealable action. The enclosed *Notification of Administrative Appeal Options and Process and Request for Appeal* form describes options regarding PJDs and AJDs (Enclosure 8). If an AJD is requested, please be aware that we may require the submittal of additional information to complete the AJD and work authorized in this letter may not occur until the AJD has been finalized.

The enclosed PJD finds there “may be” waters of the U.S. in the subject review area and the determination does not have an expiration date. However, the Corps may re-evaluate this determination at any time if new information warrants revisions.

NWP General Condition 29 requires the CoosWA to obtain the signatures(s) of the new owner(s) if you sell the property associated with this permit in order to transfer the permit to the new owner. For your convenience, the enclosed *Permit Transfer* form (Enclosure 9) can be prepared and submitted to document the permit transfer.

The verification of this NWP is valid until March 18, 2022, unless the NWP is modified, reissued, or revoked prior to that date. If the authorized work has not been completed by that date and you have commenced or are under contract to commence this activity before March 18, 2022, CoosWA will have until March 18, 2023, to complete the activity under the enclosed terms and conditions of this NWP. If the work cannot be completed by March 18, 2023, CoosWA will need to obtain a new NWP verification or authorization by another type of DA permit.

- 5 -

Our verification of this NWP is based on the project description and construction methods provided in your permit application. If CoosWA proposes changes to the project, you must submit revised plans to this office and receive our approval of the revisions prior to performing the work. Failure to comply with all terms and conditions of this NWP verification invalidates this authorization and could result in a violation of Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act. CoosWA must also obtain all local, state, and other federal permits that apply to this project.

Upon completing the authorized work, CoosWA must fill out and return the enclosed *Compliance Certification* form (Enclosure 4). We would like to hear about CoosWA's experience working with the Portland District, Regulatory Branch. Please complete a customer service survey form at the following address:  
[http://corpsmapu.usace.army.mil/cm\\_apex/f?p=regulatory\\_survey](http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey).

If CoosWA has any questions regarding this NWP verification, please contact Mr. Tyler J. Krug at the letterhead address, by telephone at (541) 756-2097, or email [Tyler.J.Krug@usace.army.mil](mailto:Tyler.J.Krug@usace.army.mil).

FOR THE COMMANDER, AARON L. DORF, COLONEL, CORPS OF ENGINEERS,  
DISTRICT COMMANDER:

For:   
William D. Abadie  
Chief, Regulatory Branch

Enclosures

cc:

Oregon Department of State Lands (Lobdell)  
Oregon Department of Environmental Quality ([401applications@deq.state.or.us](mailto:401applications@deq.state.or.us))  
Oregon Department of Land Conservation and Development (Snow and Ruther)  
Coquille Indian Tribe (Rippee)



Appendix A.

To: Tyler Krug (Tyler.J.Krug@usace.army.mil), USACE (Corps)  
From: Ken Phippen ([Ken.Phippen@noaa.gov](mailto:Ken.Phippen@noaa.gov)), National Marine Fisheries Service (NMFS)  
Cc: Jim Muck ([Jim.B.Muck@noaa.gov](mailto:Jim.B.Muck@noaa.gov)), Sandra Schoof ([sandra.schoof@noaa.gov](mailto:sandra.schoof@noaa.gov)), Sandra Forester ([sandra.forrester@noaa.gov](mailto:sandra.forrester@noaa.gov)), Allison Tarbox (atarbox@cooswatershed.org)

Date: 7/10/2018

Re: **Verified:** Corps Permit #NWP-2018-303 Coos Watershed Association, Wasson Creek Project (6<sup>th</sup> field HUC 171003040305) TARP

Corps Permit #NWP-2018-303. I verified the Wasson Creek restoration project from the applicant Coos Watershed Association as consistent with the Tidal Area Restoration Programmatic (TARP) biological opinion, issued May 15, 2018. This is based on my review of that action under project criteria #4 (Review and Verification), #20 (In-Water Work Timing), #22 (Fish Capture and release), #28 (Revegetation), and #34 (Channel Reconstruction/Relocation) using information received from pre-consultation meetings with the applicant and the TARP Form and application from the Corps dated July 2, 2018.

Reinitiation of consultation on this action is required and shall be requested by the Corps where discretionary Federal involvement or control over the action has been retained or is authorized by law and (a) the amount or extent of taking specified in the Incidental Take Statement is exceeded, (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (c) the identified action is subsequently modified in a manner that has an effect to the listed species or critical habitat that was not considered in the biological opinion, or (d) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

Please direct questions regarding this email to Jim Muck, Fisheries Biologist in the Oregon Coast Branch of the Oregon/Washington Coastal Area Office, at 541-957-3394.

Ken Phippen  
Oregon Coast Branch Chief  
Oregon/Washington Area Office  
National Marine Fisheries Service



# Oregon

Kate Brown, Governor

Appendix A.

Department of Environmental Quality  
Northwest Region Portland Office/Water Quality  
700 NE Multnomah Street, Suite 600  
Portland, OR 97232-4100  
(503) 229-5263  
FAX (503) 229-6957  
TTY 711

August 29, 2018

Allison Tarbox  
Coos Watershed Assn.  
P.O. Box 388  
Coos Bay, OR 97420

RE: Nationwide 401 Water Quality Certification Approval for NWP # 2018-00303, Wasson Creek Restoration Project

The US Army Corps of Engineers (USACE) has determined that your project will be authorized under Nationwide Permit (NWP) category #27. As described in the application package received and reviewed by the Oregon Department of Environmental Quality (DEQ), the project qualifies for the Nationwide Section 401 Water Quality Certification (WQC), subject to the conditions outlined below. If you cannot meet all conditions of this 401 WQC, you may apply for a standard individual certification. A standard individual certification will require additional information and higher fees will apply.

**Certification Decision:** Based on information provided by USACE and the Applicant, DEQ is reasonably assured that implementation-eligible activities under the proposed NWP will be consistent with applicable provisions of Sections 301, 302, 303, 306, and 307 of the federal Clean Water Act, state water-quality standards set forth in Oregon Administrative Rules Chapter 340 Division 41, and other appropriate requirements of state law, provided the following conditions are incorporated into the federal permit and strictly adhered to by the Applicant.

**In addition to all USACE national and regional permit conditions, the following 401 WQC conditions apply to all NWP categories that qualify for the Nationwide 401 WQC.**

#### **401 GENERAL CERTIFICATION CONDITIONS**

- 1) **Responsible parties:** This 401 WQC applies to the Applicant. The Applicant is responsible for the work of its contractors and sub-contractors, as well as any other entity that performs work related to this WQC.
- 2) **Work Authorized:** Work authorized by this 401 WQC is limited to the work described in the Application or Pre-Construction Notification submitted to the USACE and additional application materials (hereafter "the permit application materials"), unless otherwise authorized by DEQ. If the project is operated in a manner not consistent with the project description contained in the permit application materials, the Applicant is not in compliance with this 401 WQC and may be subject to enforcement.
- 3) A copy of this 401 WQC must be kept on the job site and readily available for reference by Applicant and its contractors, as well as by DEQ, USACE, National Marine Fisheries Service (NMFS), Oregon Department of Fish and Wildlife (ODFW), and other appropriate state and local government officials.



- 4) In accordance with OAR 340-048-0050, DEQ may modify or revoke this 401 WQC if project activities are having an adverse impact on state water quality or beneficial uses, or if the Applicant is otherwise in violation of the conditions of this certification.
- 5) The Applicant and its contractors must allow DEQ access to the project site, staging areas, and mitigation sites to monitor compliance with these 401 WQC conditions, including:
  - a. Access to any records, logs, and reports that must be kept under the conditions of this 401 WQC;
  - b. To inspect best management practices (BMPs), monitoring or operational equipment or methods; and
  - c. To collect samples or monitor any discharge of pollutants.
- 6) Failure of any person or entity to comply with this Order may result in the issuance of civil penalties or other actions, whether administrative or judicial, to enforce its terms.
- 7) **Land Use Compatibility Statement:** In accordance with OAR 340-048-0020(2) (i), each Applicant must submit findings prepared by the local land use jurisdiction that demonstrates the activity's compliance with the local comprehensive plan. Such findings can be submitted using the appropriate section of the USACE & DSL Joint Permit Application, signed by the appropriate local official and indicating:
  - a. "This project is consistent with the comprehensive plan and land use regulations;" or,
  - b. "This project will be consistent with the comprehensive plan and land use regulations when the following local approvals are obtained," accompanied by the obtained local approvals.
  - c. Rarely, such as for federal projects on federal land, "this project is not regulated by the comprehensive plan" will be acceptable.

In lieu of submitting the appropriate section of the USACE & DSL Joint Permit Application, the Applicant may use DEQ's Land Use Compatibility Statement form found at:

<http://www.oregon.gov/deq/FilterDocs/lucs.pdf>

**FOR PROJECTS THAT PROPOSE CONSTRUCTION, THE FOLLOWING GENERAL  
CONDITIONS APPLY**

- 8) **Erosion and Sediment Control:** During construction, erosion and sediment control measures must be implemented to prevent or control movement of sediment, soil or pollutants into waters of the state. The Applicant is required to develop and implement an effective erosion and sediment control plan. **Any project that disturbs more than one acre is required to obtain an NPDES 1200-C construction stormwater permit from DEQ.** In addition, the Applicant (or responsible party) must:
  - a. Where practicable, use removable pads or mats to prevent soil compaction at all construction access points through, and staging areas in, riparian or wetland areas to prevent soil compaction.
  - b. Demarcate wetlands not specifically authorized to be impacted to protect from disturbance and/or erosion.

- c. Place dredged or other excavated material on upland areas with stable slopes to prevent materials from eroding back into waterways or wetlands. Place BMPs as necessary to stabilize and prevent erosion.
- 9) **Spill Prevention:** The Applicant must fuel, operate, maintain and store vehicles, and must store construction materials, in areas that will not impact water quality either directly or due to potential discharges.
- 10) **Spill & Incident Reporting:**
  - a. In the event that petroleum products, chemicals, or any other deleterious materials are discharged into state waters, the discharge must be promptly reported to the Oregon Emergency Response Service (OERS, 1-800-452-0311). Containment and cleanup must begin immediately and be completed as soon as practicable.
  - b. If the project operations result in distressed or dying fish, the operator must immediately: cease operations; take appropriate corrective measures to prevent further environmental damage; and immediately notify DEQ and ODFW.
- 11) **Vegetation Protection and Site Restoration:**
  - a. The Applicant must protect riparian, wetland, and shoreline vegetation in the authorized project area from disturbance through one or more of the following:
    - i. Minimization of project and impact footprint;
    - ii. Designation of staging areas and access points in open, upland areas;
    - iii. Fencing and other barriers demarking construction areas; and
    - iv. Use of alternative equipment (e.g., spider hoe or crane).
  - b. If authorized work results in any vegetative disturbance and the disturbance has not been accounted for in planned mitigation actions, the Applicant must successfully reestablish vegetation to a degree of function equivalent or better than before the disturbance.
- 12) The Applicant shall avoid and protect from harm, all wetlands and riparian areas located within 50 feet of USACE jurisdictional waters, unless proposed, necessary, and approved as part of the project. If a local jurisdiction has a more stringent buffer requirement, that requirement will override this certification requirement.

**FOR PROJECTS THAT PROPOSE IN-STREAM WORK IN JURISDICTIONAL WATERS**

- 13) **Fish protection/Oregon Department of Fish and Wildlife timing:** The Applicant must perform in-water work only within the Oregon Department of Fish and Wildlife preferred time window as specified in the *Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources*, or as authorized otherwise under a USACE permit and/or Department of State Lands removal/fill permit. Exceptions to the timing window must be recommended by Oregon Department of Fish and Wildlife, the National Marine Fisheries Services and/or the US Fish and Wildlife as appropriate.
- 14) **Aquatic life movements:** Any activity that may disrupt the movement of aquatic life living in the water body, including those species that normally migrate through the area, is prohibited. The Applicant must provide unobstructed fish passage at all times during any authorized activity, unless otherwise approved in the approved application.



- 15) **Turbidity:** The Applicant must implement appropriate Best Management Practices (BMPs) to minimize turbidity during in-water work. Any activity that causes turbidity to exceed 10% above natural stream turbidity is prohibited except as specifically provided below:
- a. **Monitoring:** Turbidity monitoring must be conducted and recorded as described below. Monitoring must occur at two hour intervals each day during daylight hours when in-water work is being conducted. A properly calibrated turbidimeter is required **unless another monitoring method is proposed and authorized by DEQ.**
    - i. Representative Background Point: The Applicant must take and record a turbidity measurement every two hours during in-water work at an undisturbed area. A background location shall be established at a representative location approximately 100 feet upcurrent of the in water activity unless otherwise authorized by DEQ. The background turbidity, location, date, tidal stage (if applicable) and time must be recorded immediately prior to monitoring downcurrent at the compliance point described below.
    - ii. Compliance Point: The must monitor every two hours. A compliance location shall be established at a representative location approximately 100 feet downcurrent from the disturbance at approximately mid-depth of the waterbody and within any visible plume. The turbidity, location, date, tidal stage (if applicable) and time must be recorded for each measurement.
  - b. **Compliance:** The Applicant must compare turbidity monitoring results from the compliance points to the representative background levels taken during each two – hour monitoring interval. Pursuant to OAR 340-041-0036, short term exceedances of the turbidity water quality standard are allowed as follows:

| <b>MONITORING WITH A TURBIDIMETER EVERY 2 HOURS</b> |                                                                                                                                                                     |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>TURBIDITY LEVEL</i></b>                       | <b><i>Restrictions to Duration of Activity</i></b>                                                                                                                  |
| 0 to 4 NTU above background                         | No Restrictions                                                                                                                                                     |
| 5 to 29 NTU above background                        | Work may continue maximum of 4 hours. If turbidity remains 5-29 NTU above background, stop work and modify BMPs. Work may resume when NTU is 0-5 above background.  |
| 30 to 49 NTU above background                       | Work may continue maximum of 2 hours. If turbidity remains 30-49 NTU above background, stop work and modify BMPs. Work may resume when NTU is 0-5 above background. |
| 50 NTU or more above background                     | Stop work immediately and inform DEQ                                                                                                                                |

- c. **Reporting:** The Applicant must record all turbidity monitoring required by subsections (a) and (b) above in daily logs. The daily logs must include calibration documentation; background NTUs; compliance point NTUs; comparison of the points in NTUs; location; date; time; and tidal stage (if applicable) for each reading. Additionally, a narrative must be prepared discussing all exceedances with subsequent monitoring, actions taken, and the effectiveness of the actions. Applicant must make available copies of daily logs for turbidity monitoring to DEQ, USACE, NMFS, USFWS, and ODFW upon request.

- d. **BMPs to Minimize In-stream Turbidity:** The Applicant must implement the following BMPs, unless otherwise accepted by DEQ:
- i. Sequence/Phasing of Work – The Applicant must schedule work activities so as to minimize in-water disturbance and duration of in-water disturbances;
  - ii. Bucket control - All in-stream digging passes by excavation machinery and placement of fill in-stream using a bucket must be completed so as to minimize turbidity. All practicable techniques such as employing an experienced equipment operator, not dumping partial or full buckets of material back into the wetted stream, adjusting the volume, speed, or both of the load, or using a closed-lipped environmental bucket must be implemented;
  - iii. The Applicant must limit the number and location of stream-crossing events. Establish temporary crossing sites as necessary in the least sensitive areas and amend these crossing sites with clean gravel or other temporary methods as appropriate;
  - iv. Machinery may not be driven into the flowing channel, unless authorized by DEQ; and
  - v. Excavated material must be placed so that it is isolated from the water edge or wetlands, and not placed where it could re-enter waters of the state uncontrolled.

**FOR PROJECTS THAT INCLUDE NEW IMPERVIOUS SURFACES OR REDEVELOPMENT  
OF EXISTING SURFACES, THE FOLLOWING CONDITIONS APPLY**

- 16) **Post-Construction Stormwater Management:** For projects which propose new impervious surfaces or the redevelopment of existing surfaces, the Applicant must submit a post-construction stormwater management plan to DEQ for review and approval prior to construction, in order to ensure compliance with water quality standards. The Applicant must implement BMPs as proposed in the stormwater management plan, including operation and maintenance. If proposed stormwater facilities change due to site conditions, the Applicant must notify DEQ.

In lieu of a complete stormwater management plan, the Applicant may submit documentation of acceptance of the stormwater into a DEQ permitted National Pollutant Discharge Elimination System (NPDES) Phase I Municipal Separate Storm Sewer System (MS4).

- 17) **Stormwater Management & System Maintenance:** The Applicant is required to implement effective operation and maintenance practices for the lifetime of the proposed facility.

**CATEGORY-SPECIFIC CONDITIONS**

**In addition to all national and regional conditions of the USACE permit and the 401 Water Quality Certification general conditions above, the following conditions apply to the noted specific categories of authorized activities.**

**NWP 7 – Outfall Structures and Associated Intake Structures:**

- 7.1) The following actions are denied certification:
- a. Discharge outfalls that are not subject to an NPDES permit; and



- b. Outfalls that discharge stormwater without pollutant removal demonstrated to meet water-quality standards prior to discharge to waters of the state.
- 7.2) If an Applicant cannot obtain an NPDES permit or submit an approvable stormwater management plan per DEQ's Guidelines found at:  
<http://www.oregon.gov/deq/FilterDocs/401wqcertPostCon.pdf> the Applicant must submit complete project information and water quality impacts analysis directly to DEQ in order to undergo individual 401 WQC evaluation and fulfill public participation requirements.

#### **NWP 12 – Utility Lines:**

- 12.1) For proposals that include directionally-bored stream or wetland crossings:
- a. All drilling equipment, drill recovery and recycling pits, and any waste or spoil produced, must be completely isolated, recovered, then recycled or disposed of to prevent entry into waters of the state.
  - b. In the event that drilling fluids enter a water of the state, the equipment operator must stop work, immediately initiate containment measures and report the spill to the Oregon Emergency Response System (OERS) at 800-452-0311.
  - c. An adequate supply of materials needed to control erosion and to contain drilling fluids must be maintained at the project construction site and deployed as necessary.
  - d. The Applicant must have a contingency plan in place prior to construction for the inadvertent return of drilling lubricant.
- 12.2) For proposals that include utility lines through wetlands, include anti-seep collars or equivalent technology to prevent draining the wetlands.

#### **NWP 13 – Bank Stabilization:**

- 13.1) Projects that do not include bioengineering are denied certification, unless a registered professional engineer provides a written statement that non-bioengineered solutions are the only means of protection.
- 13.2) To apply for certification for a project without bioengineering, the Applicant must submit complete project information and water quality impacts analysis directly to DEQ in order to undergo individual 401 WQC evaluation and fulfill public participation requirements.

#### **NWP 14 – Linear Transportation:**

- 14.1) For projects that include bank stabilization, bioengineering must be a component of the project, unless a registered professional engineer provides a written statement that non-bioengineered solutions are the only means to protect an existing structure.
- 14.2) To apply for certification for a project without bioengineering, the Applicant must submit complete project information and water quality impacts analysis directly to DEQ in order to undergo individual 401 WQC evaluation and fulfill public participation requirements.

**NWP 16 - Return Water from Contained Upland Disposal Areas:** Water-quality criteria and guidance values for toxics, per OAR 340-041-0033, are available in Tables 30, 31, and 40 at:  
<http://www.oregon.gov/deq/Rulemaking%20Docs/tables303140.pdf>.

- 16.1) Discharge of return water from contaminated dredged material that exceeds a chronic or acute toxicity water quality standard is prohibited.
- 16.2) Water removed with contaminated dredged material that could or does exceed chronic water-quality criteria must be contained and disposed of at an appropriately sized and sealed upland facility by evaporation or infiltration.
- 16.3) If a Modified Elutriate Test (MET) is performed for the known contaminants of concern (CoCs) and CoC concentrations are below DEQ chronic water-quality criteria, return water discharge is not limited.
  - a. The MET must be performed before dredging.
  - b. DEQ must approve the list of CoCs and analytical method prior to the Applicant performing the MET.
  - c. DEQ must review the results and provide approval of discharge from return water, in writing, prior to dredging.

**NWP 20 – Response Operations for Oil and Hazardous Waste:**

- 20.1) Coordination with DEQ's Emergency Response program is required. See:  
<http://www.oregon.gov/deq/Hazards-and-Cleanup/env-cleanup/Pages/Emergency-Response.aspx>.

**NWP 22 – Removal of Vessels:**

- 22.1) Coordination with DEQ's Emergency Response program is required. See:  
<http://www.oregon.gov/deq/Hazards-and-Cleanup/env-cleanup/Pages/Emergency-Response.aspx>.

**NWP 31 – Maintenance of Existing Flood Control Facilities:**

- 31.1) Projects in streams with temperature TMDLs which result in a net reduction of riparian shade are prohibited.

**NWP 38 – Cleanup of Hazardous and Toxic Waste:**

- 38.1) For removal of contaminated material from waters, dredging method is limited to diver assisted hydraulic suction, hydraulic suction, closed-lipped environmental bucket, or excavation in the dry, unless otherwise authorized by DEQ.
  - a. For in-water isolation measures, the Applicant is referred to Appendix D of DEQ's Oregon Erosion and Sediment Control Manual, April 2005 (or most current version), at:  
<http://www.deq.state.or.us/wq/stormwater/docs/escmanual/appxd.pdf>.
- 38.2) Discharge to waters of the state resulting from dewatering during dredging or release of return



water from an upland facility is prohibited except as provided below.

- a. All water removed with sediment must be contained and disposed of at an appropriately sized and sealed upland facility by evaporation or infiltration; or,
- b. A Modified Elutriate Test (MET) may be performed for the known Contaminants of Concern (CoCs) and if CoC concentrations are below DEQ chronic water-quality criteria; return water discharge is not limited.
  - i. The MET must be performed before dredging.
  - ii. DEQ must approve the list of CoCs and analytical method prior to the Applicant performing the MET.
  - iii. DEQ must review the results and provide approval of discharge from dewatering and return water in writing prior to dredging.

38.3) Dredged material must be disposed of in compliance with DEQ Rules governing Hazardous Waste (see: <http://www.oregon.gov/deq/Hazards-and-Cleanup/hw/Pages/default.aspx>) or Solid Waste (see: <http://www.oregon.gov/deq/mm/swpermits/Pages/Solid-Waste-Disposal-Sites-and-Landfill.aspx>).

38.4) The new in-water surface must be managed to prevent exposure or mobilization of contaminants.

#### **NWP 41 - Reshaping Existing Drainage Ditches:**

- 41.1) To the extent practicable, the Applicant must work from only one bank in order to minimize disturbance to existing vegetation, preferably the bank with the least existing vegetation;
- 41.2) Following authorized work, the Applicant must establish in-stream and riparian vegetation on reshaped channels and side-channels using native plant species wherever practicable. Plantings must be targeted to address water-quality improvement (e.g., provide shade to water to reduce temperature or provide bank stability through root systems to limit sediment inputs). Planting options may include clustering or vegetating only one side of a channel, preferably the side which provides maximum shade.

#### **NWP 42 – Recreational Facilities:**

- 42.1) For facilities that include turf maintenance actions, the Applicant must develop and implement an Integrated Pest Management Plan (IPM) that describes pest prevention, monitoring and control techniques with a focus on prevention of chemical and nutrient inputs to waters of the state, including maintenance of adequate buffers for pesticide application near salmonid streams, or coverage under an NPDES permit, if required (information is available at: <http://www.oregon.gov/deq/wq/wqpermits/Pages/Pesticide.aspx>).

#### **NWP 43 – Stormwater Management Facilities:**

- 43.1) Projects that propose the following elements are denied certification:
  - a. In-stream or wetland stormwater facilities;
  - b. Discharge outfalls not subject to an NPDES permit; and,
  - c. Proposals that do not demonstrate pollutant removal to meet water-quality standards prior to discharge to waters of the state.

- 43.2) To apply for certification for a project with in-stream stormwater facilities, without an NPDES permit, or without submittal of an approvable stormwater management plan per DEQ's Guidelines (at: <http://www.oregon.gov/deq/FilterDocs/401wqcertPostCon.pdf>), the Applicant must submit complete project information and water quality impacts analysis directly to DEQ in order to undergo individual 401 WQC evaluation and fulfill public participation requirements.

**NWP 44 – Mining Activities:**

- 44.1) Projects that do not obtain an NPDES 700-PM or Individual permit are denied certification.
- 44.2) To apply for certification for a project without an NPDES permit, the Applicant must submit complete project information and water quality impacts analysis directly to DEQ in order to undergo individual 401 WQC evaluation and fulfill public participation requirements.

**NWP 51 – Land-Based Renewable Energy Generation Facilities:**

- 51.1) For associated utility lines with directionally-bored stream or wetland crossings proposed, condition 12.1 must be applied.

**NWP 54 – Living Shorelines**

- 54.1) Projects that do not include bioengineering are denied certification, unless a registered professional engineer provides a written statement that non-bioengineered solutions are the only means of protection.

If the Applicant is dissatisfied with the conditions contained in this certification, a hearing may be requested. Such request must be made in writing to DEQ's Office of Compliance and Enforcement at 700 NE Multnomah St, Suite 600, Portland Oregon 97232, within 20 days of the mailing of this certification.

The DEQ hereby certifies that this project complies with the Clean Water Act and state rules, with the above conditions. If you have any questions, please contact Dan Defehr at 503-229-5395, by email at [defehr.daniel@deq.state.or.us](mailto:defehr.daniel@deq.state.or.us), or at the address on this letterhead.

Sincerely,



Steve Mrazik,  
Water Quality Manager  
Northwest Region

ec: Tyler Krug, USACE ([Tyler.J.Krug@usace.army.mil](mailto:Tyler.J.Krug@usace.army.mil))





**Oregon**  
Kate Brown, Governor

**Parks and Recreation Department**  
State Historic Preservation Office  
725 Summer St NE Ste C  
Salem, OR 97301-1266  
Phone (503) 986-0690  
Fax (503) 986-0793  
[www.oregonheritage.org](http://www.oregonheritage.org)



November 13, 2018

Mr. Winston Zack  
US Army Corp of Engineers  
Policy and Compliance Section  
PO Box 2946  
Portland, OR 97208

RE: SHPO Case No. 18-1234  
NWP-2018-303, Coos Watershed Association, Wasson Creek Restoration Project  
Channel filling, grading, and ground disturbance  
26S 14W 35, Charlston, Coos County

Dear Mr. Zack:

We have reviewed the materials submitted on the project referenced above, and we concur with the determination that the property is eligible for listing in the National Register of Historic Places. We also concur with the finding of no adverse effect for the proposed project. This letter refers to above-ground historic resources only. Comments pursuant to a review for archaeological resources, if applicable, will be sent separately.

Unless there are changes to the project, this concludes the requirement for consultation with our office under Section 106 of the National Historic Preservation Act (per 36 CFR Part 800) for above-ground historic resources. Local regulations, if any, still apply and review under local ordinances may be required. Please feel free to contact me if you have any questions, comments or need additional assistance.

Sincerely,

Robert Olguin  
National Register Program Coordinator  
(503) 986-0668  
[Robert.Olguin@oregon.gov](mailto:Robert.Olguin@oregon.gov)

cc: Tyler Krug, USACOE NBFO



## COQUILLE INDIAN TRIBE

3050 Tremont Street, North Bend, OR 97549  
Telephone: (541) 756-0904 ~ Fax: (541) 756-0847  
[www.coquilletribe.org](http://www.coquilletribe.org)

Department of State Lands  
South Slough National Estuarine Research Reserve  
63466 Boat Basin Road  
Charleston, OR 97420

To Whom It May Concern

The Coquille Indian Tribe has completed a Cultural Resources Review of the Wasson Creek Drainage. The report has been submitted to the State Historic Preservation Office for review.

Wasson Creek contains the remnants of at least three historic occupations since the mid-1800s, including two historic cemeteries. Only one structure from the most recent occupation still stands.

We expect that the Wasson Creek Restoration Project will have No Adverse Effect to known cultural resources or historic properties. Projects and activities occurring within the drainage should undergo consultation with the appropriate Tribes (CTCLUSI, Coquille, and Siletz) and the State Historic Preservation Office. An archaeological monitor will be required for all ground disturbing activities occurring within close proximity to the identified cultural sites and an Inadvertent Discovery Plan must be in place for the entire Area of Potential Effect.

Shuenhalni,

A handwritten signature in black ink, appearing to read 'K. Rippee'.

Kassandra Rippee, MA  
Tribal Historic Preservation Officer



Appendix A.  
Wasson Creek Stream Restoration

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PORIOR ENGINEERING , 69262 WILDWOOD ROAD, NORTH BEND, OREGON, 541-290-1693

## Wasson Creek Stream Restoration

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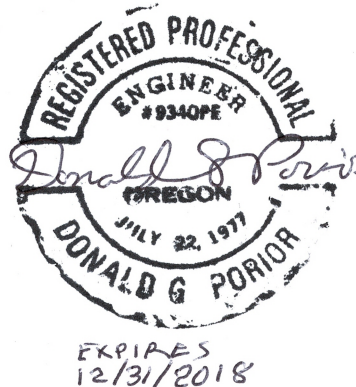
### Flood Plain Certification

**D.PORIOR**

Prepared For:

Coos Watershed Association

Allison Tarbox  
Uplands Project Manager  
Coos Watershed Association  
P.O. Box 388  
Coos Bay, OR 97420  
541-888-5922 (office)  
832-693-9159 (cell)  
[atarbox@cooswatershed.org](mailto:atarbox@cooswatershed.org)  
[www.cooswatershed.org](http://www.cooswatershed.org)



#### Abstract

This analysis documents a flood plain analysis of a proposed stream restoration project on Wasson Creek. Analysis noted there would not be a rise in stream elevations or at all flow levels in the channel from the proposed improvements. The project was designed to keep any rise in 100-year flood levels as close to zero as practically possible given the goals of the project; and No structures will be impacted by any potential rise in flood elevation; and that an agreement to monitor the project, correct problems, and ensure that flood carrying capacity remains unchanged is included as part of the local approval.

## Contents

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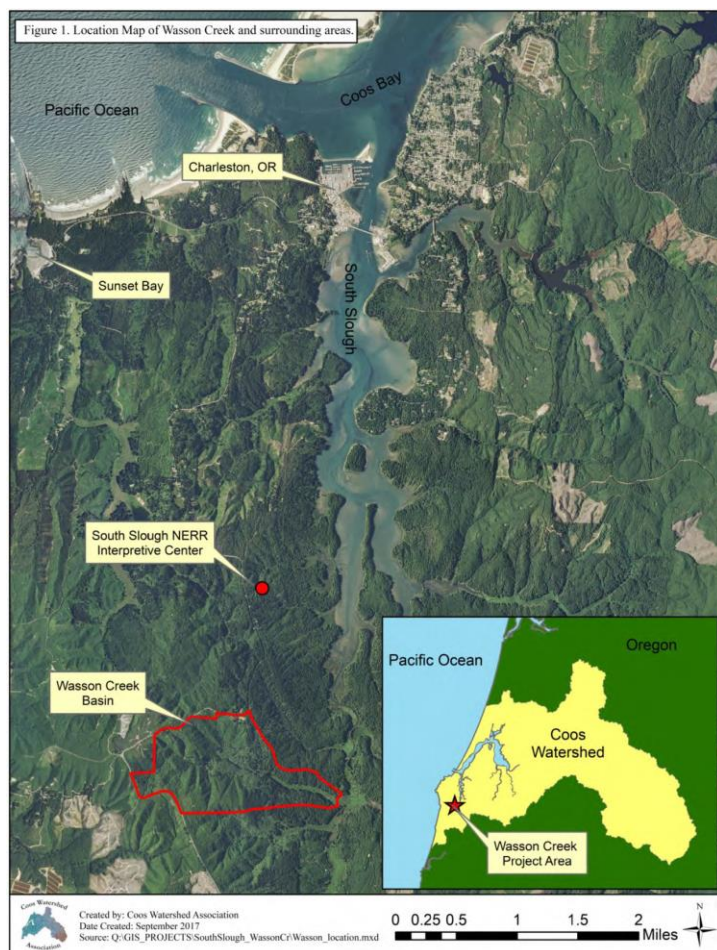
## Purpose and Scope

The Purpose and scope of this report is to document a flood Plain Analysis for stream habitat restoration work on Wasson Creek in Coos County. This analysis and a certification are prepared as attachments for a Coos County Planning Department Floodplain Application.

A portion of the Certification analysis was taken from permit application data and design data prepared by the Coos Watershed Association. That information is attached in Appendix C to this report and quoted as needed.

Support photos maps and ordinances are included as appendices to this report the table below summarizes those attachment.

1. Appendix A - Coos County Floodplain Ordinances
2. Appendix B- Photos and maps to include Fema Maps of area and Project maps. Maps taken from Permit applications
3. Appendix C- Wasson Creek Design prepared by Coos Watershed Association.



## Appendix A.

## Project Data

Applicant

Allison Tarbox

Coos Watershed Association

P.O Box 388, Coos Bay, Oregon, 97420

Business Phone: 541-888-5922 X 307

Property Owner

South Slough National Estuarine Research Reserve, Oregon

## Project Information

Project Name: Wasson Creek Restoration

Tax Lot # 1200, 900, 800, 700, 600, 300

Address: Unnamed road off of Hinch Lane

Township 26S Range 14W Section 35

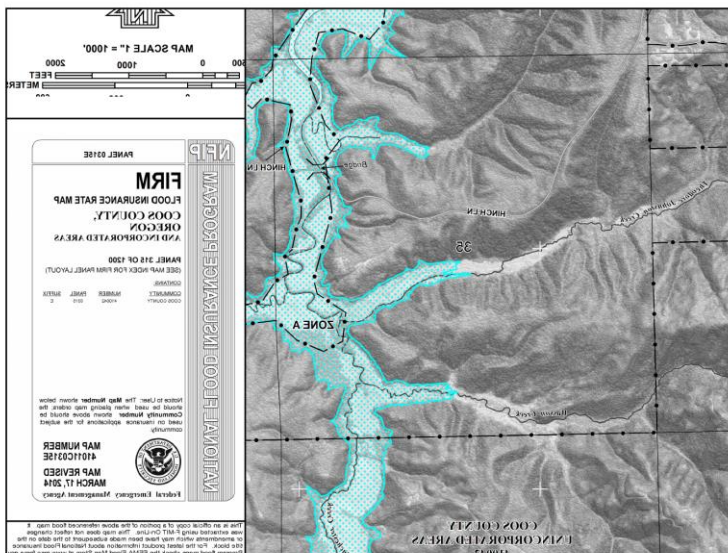
Brief Directions to Site: From Charleston, OR, head west on Cape Arago Hwy and turn left on Seven Devils Rd. Follow Seven Devils Rd for 5 miles and veer left on Hinch Lane. After one mile, turn right and follow gravel road to locked gate. Follow path beyond gate by foot to reach the Wasson Creek valley.

Type of waterbody: River, estuary

Waterbody Name: Wasson Creek, River mile: 0

FEMA Map

Wasson Creek is in FEMA FLOOD ZONE A – See map appendix B





## Project Purpose and Need

### **I. Background**

The Wasson Creek Watershed Restoration Project is located in the South Slough National Estuarine Research Reserve (South Slough NERR), a 5,000 acre protected area in the Coos estuary on the southern Oregon coast (Figure 1). Wasson Creek is a tributary of Winchester Creek, the largest freshwater source to the South Slough estuary. The Wasson Creek watershed supports populations of several estuarine-dependent fish species, two of which are targeted evolutionarily significant anadromous fish; coho salmon (*Oncorhynchus kisutch*) and winter steelhead (*Oncorhynchus mykiss*). The Wasson Creek watershed also supports a small population of sea-run and resident cutthroat trout (*Oncorhynchus clarki clarki*), a federally listed species of concern. Although reproducing populations of Chinook (*Oncorhynchus tshawytscha*) and chum salmon (*Oncorhynchus keta*) have not been observed in Wasson Creek, these species may use the watershed for rearing in the future.

The Wasson Creek watershed has a long land use history of timber extraction and the creek, itself, was altered by filling in the main channel and constructing two parallel ditches, one on each side of the valley, in order to use the valley for agricultural pursuits. This resulted in a network of constructed ditches in the watershed's floodplain wetlands that intercepted all of the side channels, diverting that flow into the ditches. When the ditches were excavated, the excavated material was used to form berms adjacent to the ditches; functionally disconnecting the floodplain from the streams. With gradual down-cutting during runoff events, the ditches now have a significantly lower elevation than the valley floor, resulting in a channel that is much larger and deeper than would naturally occur. This further exacerbates the disconnection of the stream channel from its floodplain.

South Slough NERR has implemented several restoration projects within the reserve and the opportunity to implement a whole watershed restoration project in Wasson Creek presented itself as this watershed was listed as high priority in in South Slough's 2009 Restoration Action Plan. This following plan details the lowland channel remeander portion of the Wasson Creek Watershed Restoration Project in the effort to restore three main issues:

1. Stream flow is directed away from the valley and confined in a ditch
2. Formerly overbank flows that would have deposited sediment and detritus on the flood plain now deposit this material in the ditches or in the South Slough.
3. The channel is incised, straightened, and lacking fish habitat (e.g., spawning gravel, large wood).

## Appendix A.

approach. While still designed, the pilot channel will be underdeveloped to re-establish key physical elements at the site to give it a jump start, but still allow for natural processes to finish the restoration work and create a complex channel within the valley (Mitsch, 2000; Cornu, 2005).

### Specific Design Criteria:

- 1) Construct a channel in the historic channel location (where identifiable) within the valley, that reconnects the channel to the valley (including all side channels), and allows frequent flooding of the valley.
  - a) The main channel should have a capacity to hold at most a 1-year recurrence interval flood. The floodplain will hold the any flows above a 1-year recurrence interval.
  - b) The channel design stream power should be sufficient to transport sand and small gravel (at least 10 mm).
  - c) Channel geometry should be variable, increasing capacity with drainage area and input from side channels.
  - d) The channel should occupy relict channels, where they are identifiable.
  - e) Meander radii, wavelength, and amplitude should all increase as the channel progresses down-valley; mimicking channel planform in slough channels in adjacent drainages.
- 2) The channel should be allowed to laterally migrate within the valley floodplain, but not reoccupy the ditches, except where the ditches will be used for side channels.
  - a) Fill in the ditches, preventing flow from recapturing them.
- 3) The lower end of the valley, where it joins South Slough, will be the interchange between riverine and estuarine environments such that:
  - a) The lower floodplain is periodically inundated during high tide cycles, and
  - b) The water table is retained high enough to support marsh or wetland habitat.
- 4) Perennial, tributary channels are directly connected to the new channel.
- 5) Ephemeral, tributary channels are connected to the new channel only if the main channel meander is on the side of the valley where the channel enters the valley.
  - a) Ditches intercepting and diverting ephemeral tributaries will be filled.
  - b) Ephemeral flow will be allowed to pond in existing wetlands, disperse overland on the floodplain (likely extending existing wetlands), and/or infiltrate into the floodplain. The desire is to create additional wetland habitat in the valley margins where these ephemeral channels dramatically decrease in gradient. Additionally, by allowing the flow to pond or slowly disperse (rather than be quickly diverted as is the existing condition), water will move through the valley slower, thereby retaining a higher water table longer into the dry, summer season.

## II. Design Criteria

With the disconnected ditched network, a more active approach is needed when it comes reconnecting Wasson Creek to its floodplain. The deeply entrenched ditches currently present are not likely to remeander to a more natural state and reconnect to the floodplain on its own in any reasonable amount of time. Even with the option of filling the current ditches and allowing the stream to create itself, the size and power of Wasson creek and the soil type present (silt loam) in the valley will not allow the channel to develop and establish itself in a reasonable timeframe. There are other pressing factors that need to be remedied in the basin that require a faster timeframe, such as increasing coho habitat and reed canary grass removal/conversion; therefore, a constructed pilot channel design was determined to be the best



approach. While still designed, the pilot channel will be underdeveloped to re-establish key physical elements at the site to give it a jump start, but still allow for natural processes to finish the restoration work and create a complex channel within the valley (Mitsch, 2000; Cornu, 2005).

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### Analysis of Flow changes from Stream Restoration work

The following procedures were used to evaluate the effects of flooding from stream restoration to include placement of logs in streams. The flow analysis and its documentation is in Appendix C to this report in the Coos Watershed Association Channel Design. That report was reviewed in detail and provides excellent hydrology and hydraulic documentation.

### Hydrology Summary

Table 1. Wasson Creek basin parameters for channel locations.

| Parameter                                    | Upstream | Downstream |
|----------------------------------------------|----------|------------|
| Drainage area in square miles                | 0.77     | 0.98       |
| Mean Basin Elevation, in feet                | 362      | 315        |
| Basin Relief in feet.                        | 529      | 565        |
| Mean basin slope measured in degrees.        | 12.8     | 12.9       |
| Total stream length in miles                 | 0.99     | 1.67       |
| 24 Hour 2 Year Precipitation (inches)        | 2.95     | 2.94       |
| Average Soil Permeability (inches per hour)  | 1.47     | 2.02       |
| Mean Maximum January Temperature (degrees F) | 51.5     | 51.6       |

Table 2. StreamStats calculated discharge for recurrence intervals at Wasson Creek upstream and downstream locations.

| Recurrence Interval (yrs) | Annual Maximum Discharge (cfs) |            |
|---------------------------|--------------------------------|------------|
|                           | Upstream                       | Downstream |
| 2                         | 51.4                           | 62.4       |
| 5                         | 80.5                           | 95.9       |
| 10                        | 101.0                          | 120.0      |
| 25                        | 130.0                          | 151.0      |
| 50                        | 152.0                          | 176.0      |
| 100                       | 176.0                          | 202.0      |
| 500                       | 233.0                          | 263.0      |

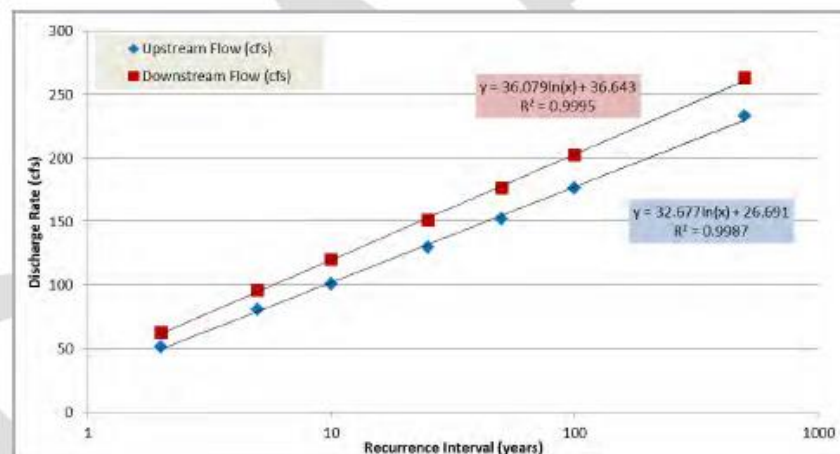


Figure 3. Flood frequency flow rates for upstream and downstream locations on Wasson Creek.

## Evaluation of Channel Design

The proposed new channel will have a gradient and depth that will transport sand and small gravel at a bankfull flow event and will carry the sand out of the channel at flows greater than bankfull flow events. The effects of this design is to lower the elevations of flows throughout the reaches.

As noted the proposed channel design will have a better conveyance for flows. The result will be that all flows will be at a lower elevation than the existing flows in the channel during low tide events. During high tide events Tidal heights will backwater the channel particularly in the lower reach. The proposed design effects on backwatered elevation will range from no change to slightly lower flow elevations.

## Structures downstream of Reach

There are no structures downstream of the reach. See vicinity map below. In addition all log structures placed in restoration areas are sized to resist movement at Q100 year flow events. See Design report.





## Appendix A.

### Review of Analysis

During a 100 year flood event the stream restoration work on Wasson Creek will not impact any structures. There are no structures within the reaches or immediately downstream. Logs placed in streams are sized to resist movement.

### Summary of Analysis

Per this analysis, I certify that The stream Restoration work on Wasson Creek was designed in accordance with county ordinances to keep any rise in 100-year flood levels as close to zero as practically possible given the goals of the project; and no structures will be impacted by any potential rise in flood elevation; and an agreement to monitor the project, correct problems, and ensure that flood carrying capacity remains unchanged is included as part of the local approval.

Proposed work does not alter the FEMA Flood Map which is included as an attachment to this No Rise Certification report. A letter of map revision is not required.

As a result of this work there will not be any effects on downstream properties as the flow elevations will remain the same at both ends of projects and under the bridge structure. Flows are neither modulated nor enhanced.

Flood carrying capacity is not changed in that the stream adjustment do not diminish the available storage capacity of the property for flood controls.

## Appendix A: COOS COUNTY OREGON ORDINANCES

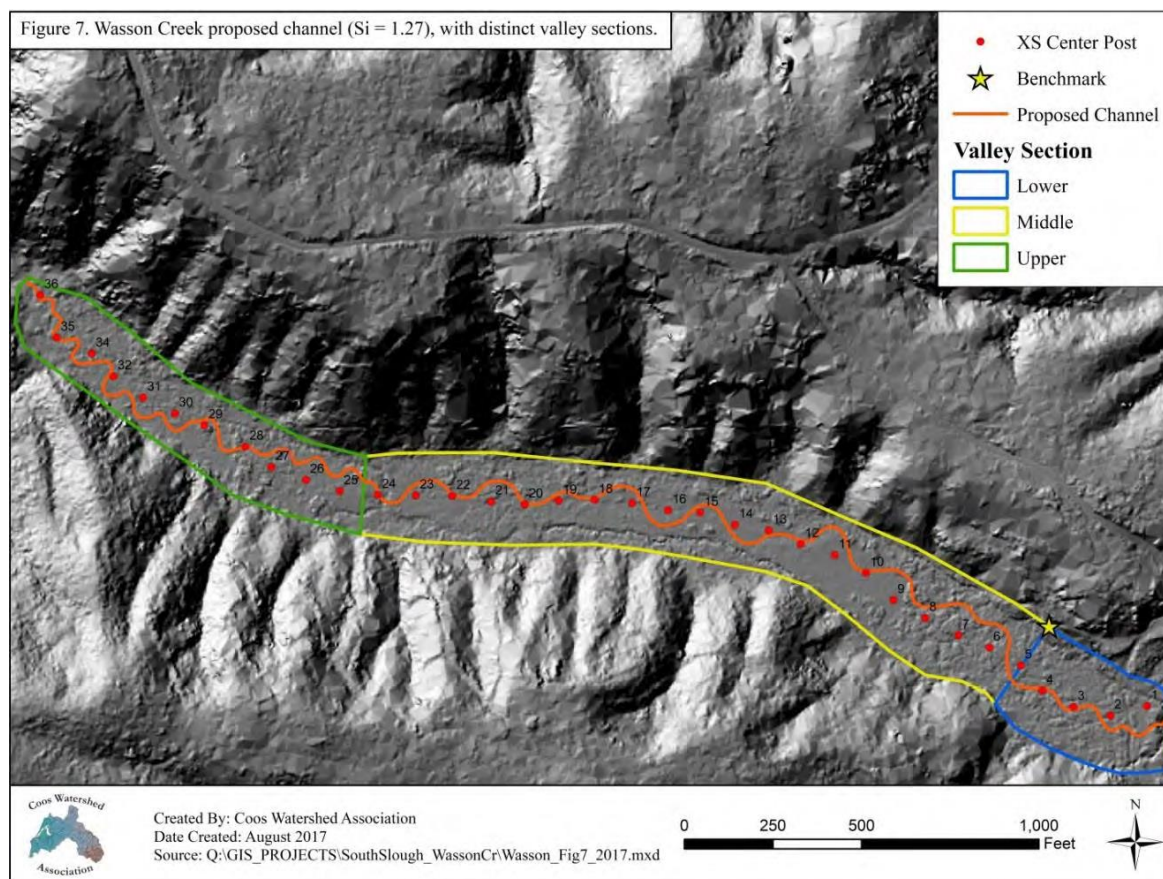
### SECTION 4.6.219 SITES WITHIN SPECIAL FLOOD HAZARD AREAS:

### SECTION 4.6.229 FLOODWAYS:

Located within special flood hazard areas established in Section 4.6.205 are areas designated as “floodway s”. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles, and erosion potential, the following provisions apply:

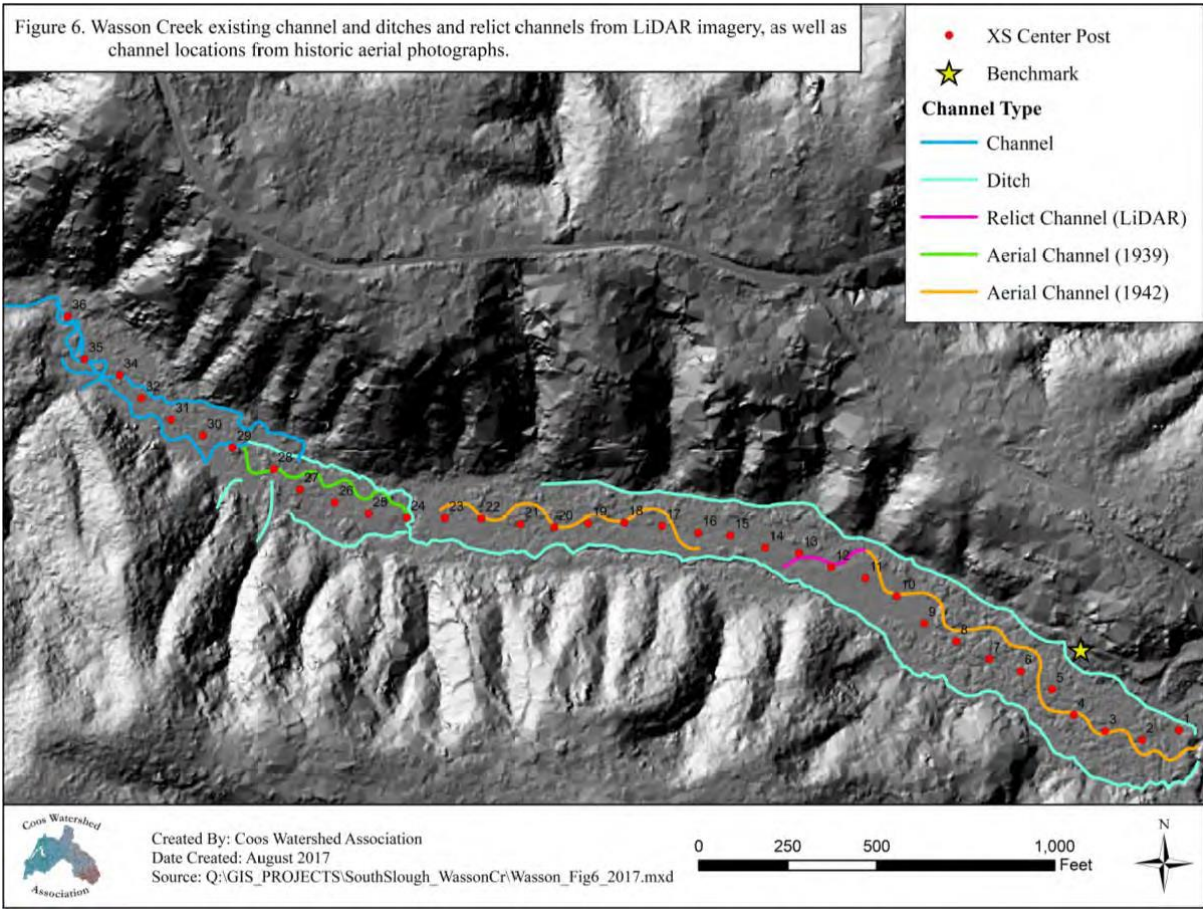
1. Encroachment, including fill, new construction, substantial improvements and other developments shall be prohibited, unless certification by a registered professional civil engineer is provided demonstrating through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.
2. If (1) above is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of this Article (Article 4.6).
3. Projects for stream habitat restoration may be permitted in the floodway provided:
  - a. The project qualifies for a Department of the Army, Portland District Regional General Permit for Stream Habitat Restoration (NWP-2007-1023); and
  - b. A qualified professional (a Registered Professional Engineer; or staff of NRCS; the county; or fisheries, natural resources, or water resources agencies) has provided a feasibility analysis and certification that the project was designed to keep any rise in 100-year flood levels as close to zero as practically possible given the goals of the project; and
  - c. No structures would be impacted by any potential rise in flood elevation; and
  - d. An agreement to monitor the project, correct problems, and ensure that flood carrying capacity remains unchanged is included as part of the local approval.

## Appendix B- Maps, Photos and memos





Appendix A.



# Appendix A.

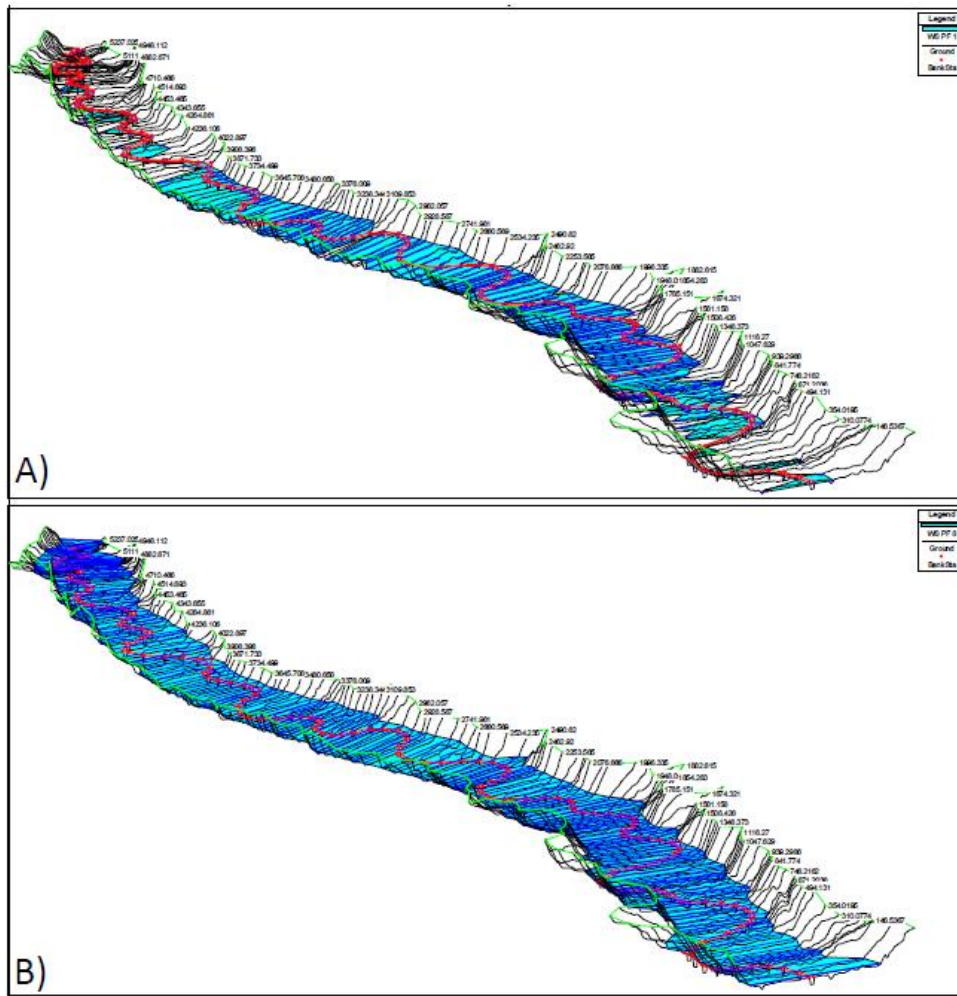
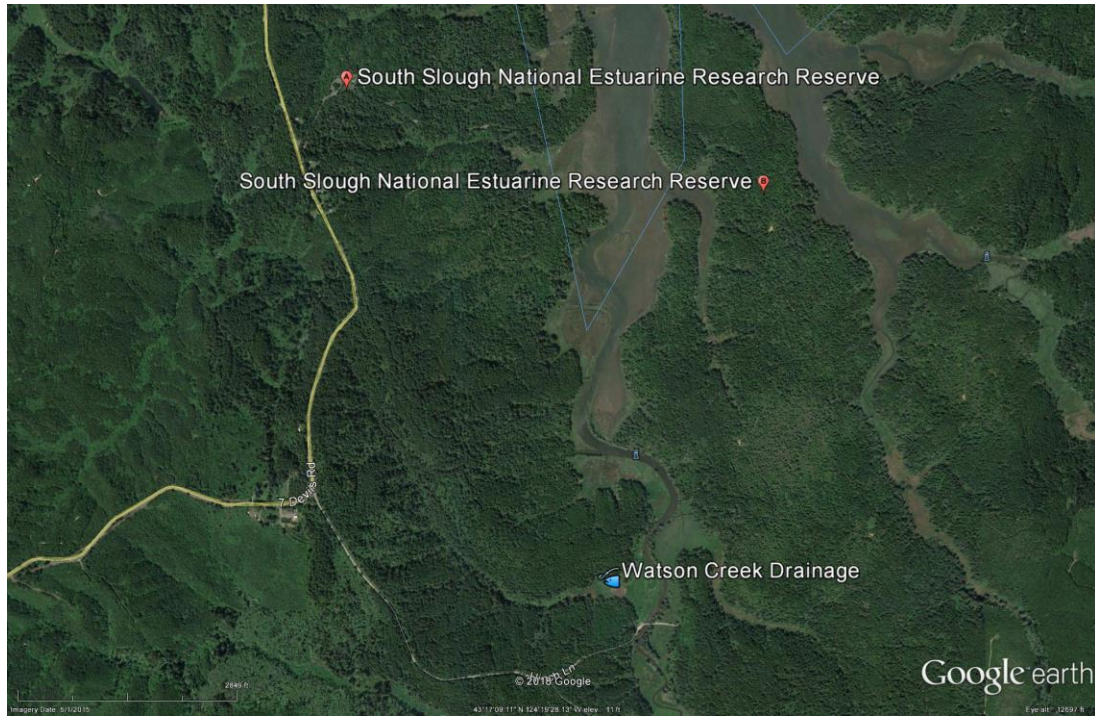
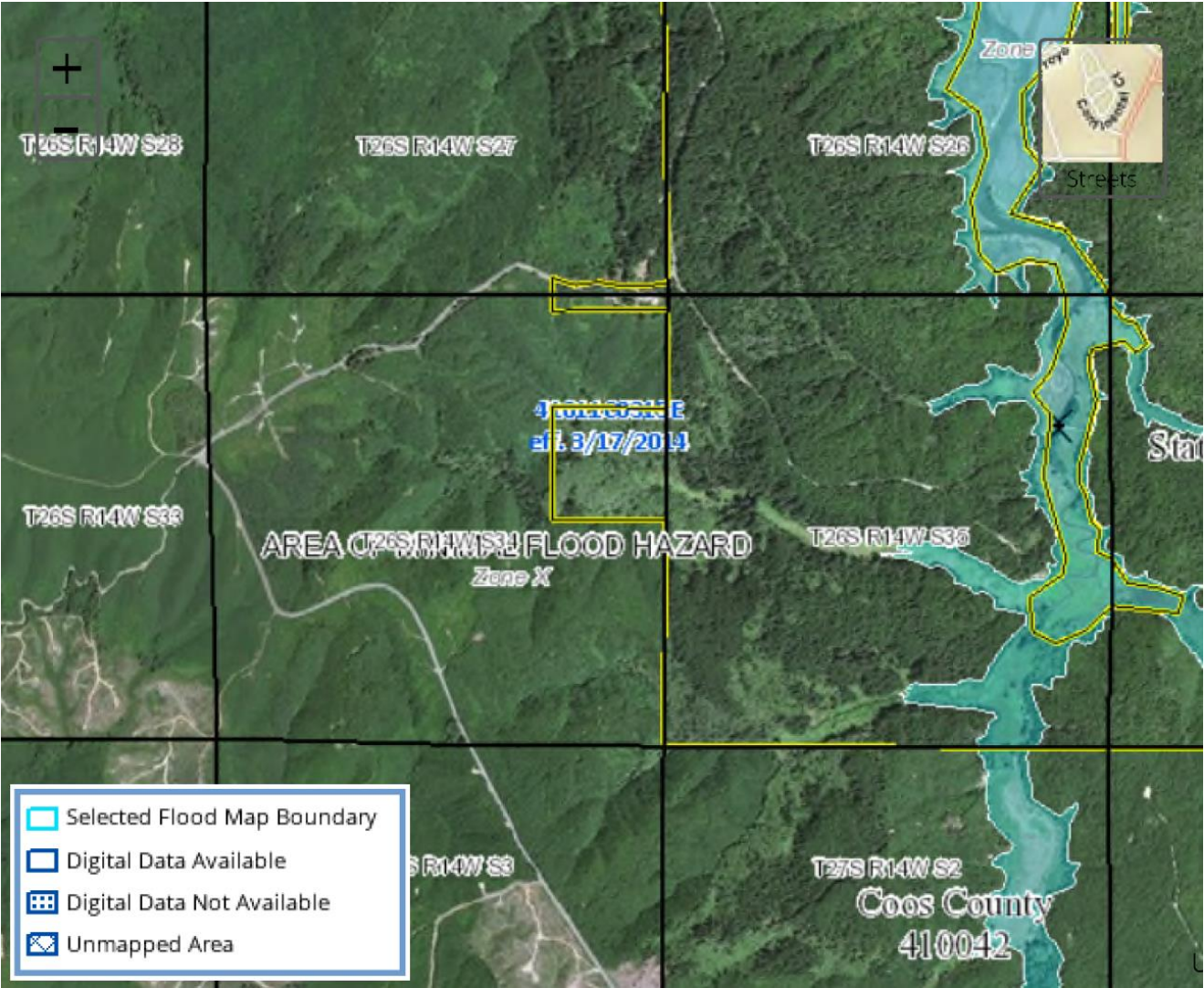


Figure 10. Wason Creek HEC-RAS flow modeling results using the proposed channel configuration for A) a 1-year recurrence interval flow, and B) a 500-year recurrence interval flow using the proposed channel configuration.

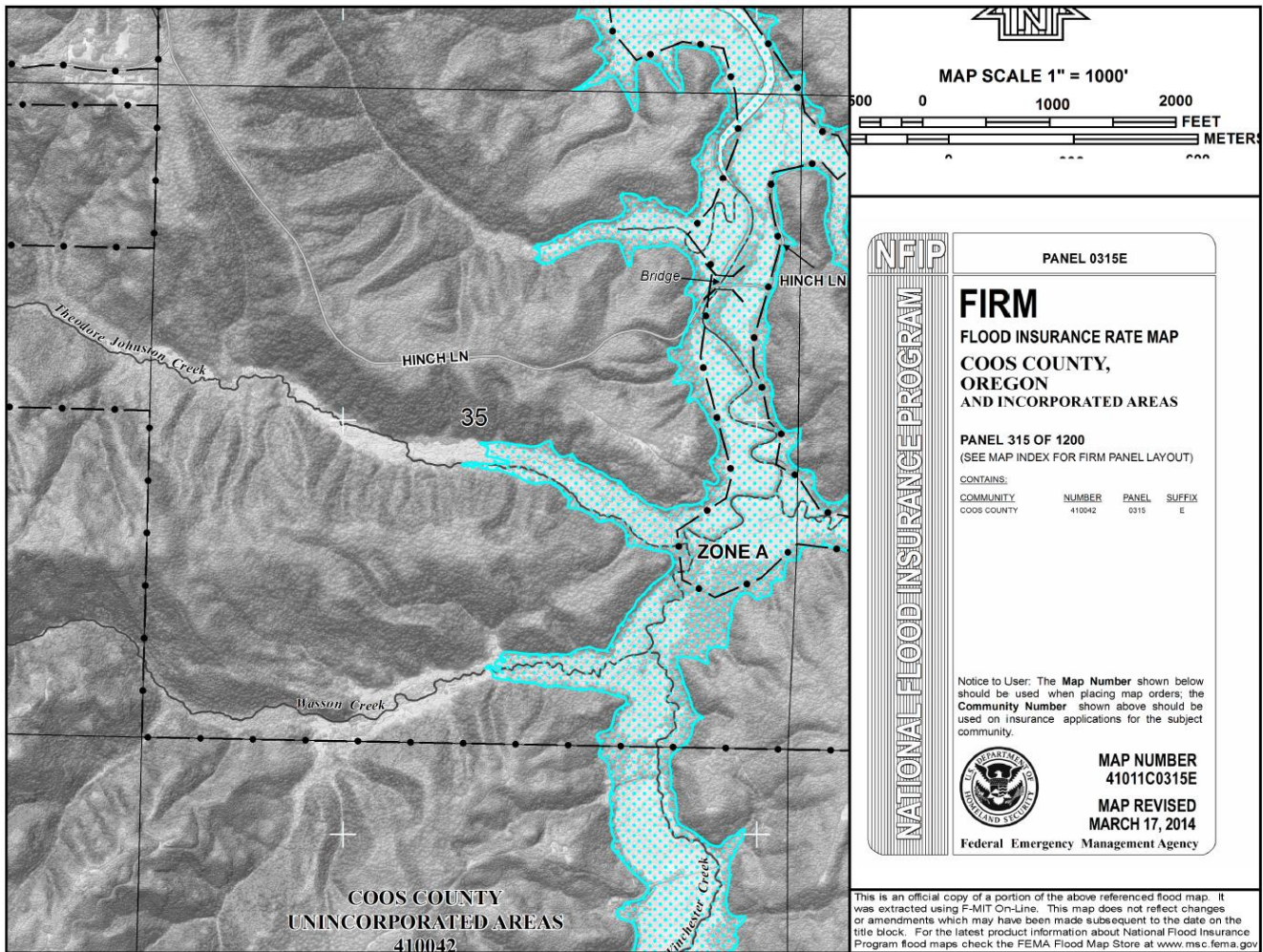
## Appendix A.







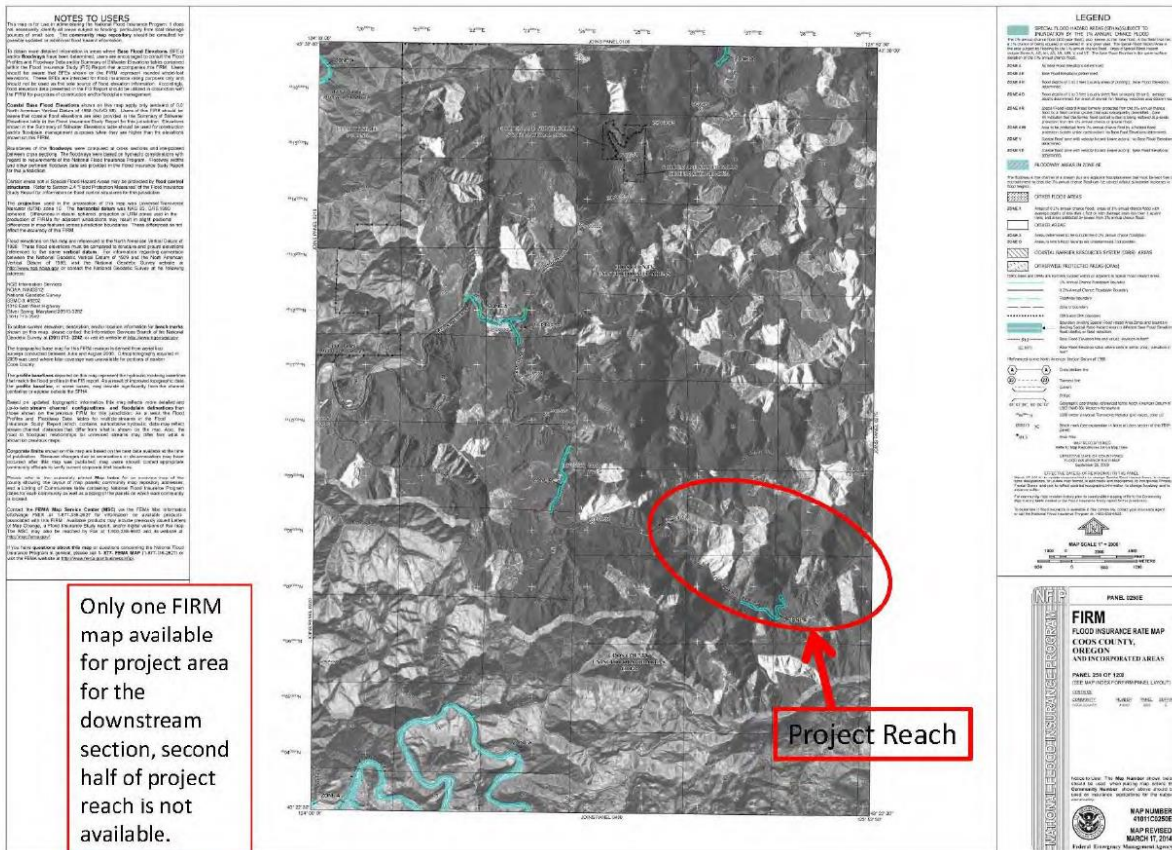
# Appendix A.





## Appendix A.

Attachment 8. FEMA Flood Insurance Rate Map





Appendix A.

Appendix C: Coos Watershed Association Design Report Wasson Creek

Attached separately as Appendix B

# Wasson Creek Restoration

## Appendix B: Floodplain Hydrology Restoration Plan



2018 Original Plan Prepared by:

Allison Tarbox (Restoration Program Leader; Coos Watershed Association) and Bill Conroy  
(Former member of Coos Watershed Association)

2022 Revised Plan Prepared by:

Alice Yeates; Stewardship Coordinator; South Slough National Estuarine Research Reserve

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## **Floodplain Hydrology Restoration Objectives**

The Wasson Creek watershed has a long land use history of both timber extraction in the uplands and agricultural activities in the floodplain, the latter resulted in significant alterations to site hydrology and the former in limited large wood recruitment. Floodplain alterations included draining existing wetland soils through the construction of parallel ditches at the toe of the slopes on either side of the floodplain, diverting Wasson Creek streamflow to the southern ditch, and filling Wasson Creek's main channel and associated overflow channels. Alterations also presumably included removing the formerly beneficial influence of beaver activity (elimination of dams/ponds), removal of vegetation used by beaver and the continued suppression of beaver activities in the floodplain. While the results of these alterations enabled landowners to benefit from agricultural production, the ecological trade-offs, unrecognized at the time and for many years afterwards, were significant, as has been repeatedly documented elsewhere (Brophy 2005, Meli et al. 2014). The constructed ditches intercepted any surface water flows from adjacent uplands. When the ditches were excavated, the excavated material was used to form linear sidecast berms adjacent to the ditches which functionally disconnected the floodplain from the streams. This disconnection was further exacerbated by the gradual down-cutting of the ditches over time, especially during heavy precipitation events.

This component of the Wasson Creek Watershed Restoration Plan details proposed methods to re-establish fully functional floodplain hydrology in the Wasson Creek floodplain including the re-establishment of self-sustaining:

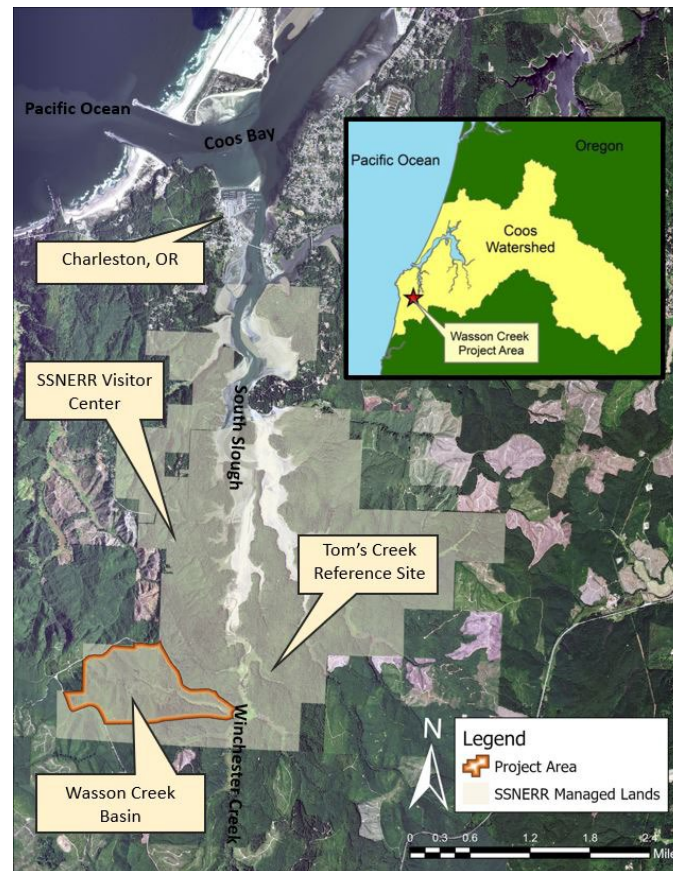
1. Tidal and non-tidal wetland-stream complex, in the Wasson Creek floodplain, that provides rearing habitat for juvenile salmonids among other functions and ecosystem services formerly provided by the site.
2. Tidal and non-tidal groundwater regimes that support native forested, scrub-shrub, and emergent marsh, tidal and non-tidal wetland plant communities, and suppress non-native plants, as applicable (see Appendix C: Vegetation Plan).
3. Frequent sediment and organic detritus deposition throughout the Wasson Creek floodplain that helps form a wetlands-stream complex and deliver nutrients to floodplain plant communities and allows for surface accretion to mitigate effects of rising sea levels.
4. Naturally recruited beaver populations free to add ecological complexity to the floodplain by engineering floodplain hydrology as they see fit.

Our approach to achieving these objectives is focused on addressing four main floodplain hydrology issues in the Wasson Creek floodplain:

1. Surface water flow which is almost entirely confined to constructed ditches.
2. The infrequent overbank flows that would have previously deposited beneficial sediments and detritus on the Wasson Creek floodplain.
3. Constructed ditches that are largely lacking in complexity and woody debris, deeply incised, and lacking fish habitat (e.g., hydrologic, and foraging refuge and protection from predators).
4. Minimal beaver activity in the floodplain.

## **Project Area and Existing Hydrology**

The Wasson Creek basin lies on the Oregon Coast in the Coos Watershed (Figure 1). The basin consists of several soil types in the upland areas and Nestucca silt loam in the floodplain.



*Figure 1: Wasson Creek Project Area (orange polygon) within the South Slough NERR and Coos Watershed.*

The 22-acre Wasson Creek floodplain is divided, about 3,500 feet up the valley (along the central axis), by a geologic constriction (~90 feet wide; Figure 2a). Above the constriction a 5-acre floodplain is defined as the Upper Valley, while the 17-acre Main Valley management area extends below the constriction to the confluence with Winchester Creek at the downstream end. Based on hydrologic conditions, the Main Valley is further assigned three management sections, Main Valley Upper, Main Valley Middle, and Main Valley Lower (Figure 2b).



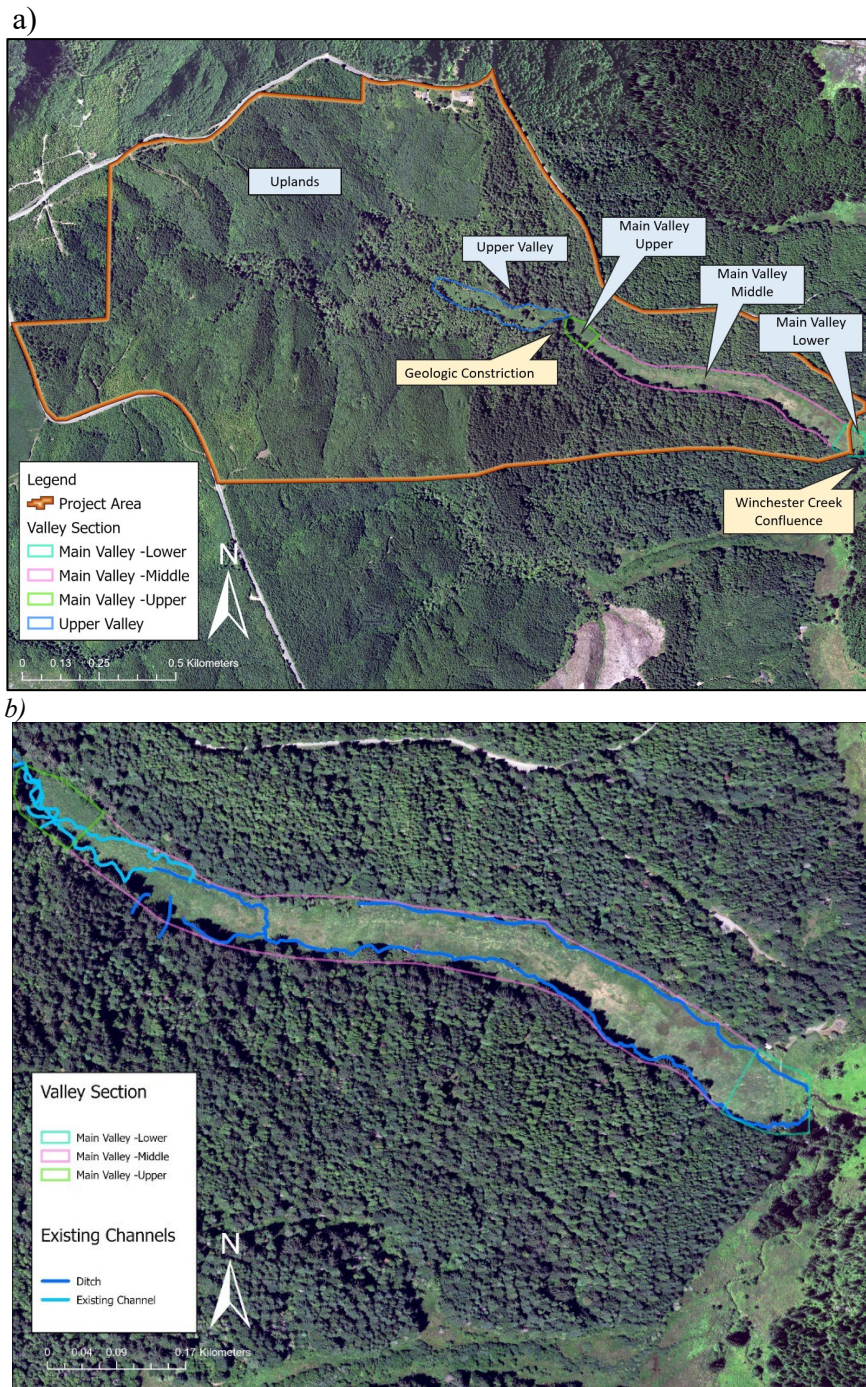


Figure 2: a) Wasson Creek watershed restoration project area with the floodplains defined by  $>1\%$  slope to the west and Winchester Creek to the east. A geologic constriction separates the Upper from the Main Valley. The Main Valley is further divided into Lower, Middle and Upper Sections based on hydrologic conditions (tidal, dry, and saturated respectively). b) Existing channels and ditches shown in light and dark blue (respectively) for the Main Valley.



In the **Upper Valley** management area (5-acres) the channel has not been diverted into sidewall ditches and has retained a dynamic wetland-stream complex. Beaver activity has been documented, however, is currently minimal.

The **Main Valley Upper** management area (1.4-acres) is characterized by a relatively intact Wasson Creek stream channel network and floodplain soils that are saturated virtually year-round (Figure 2b).

The **Main Valley Middle** management area (14-acres), by far the largest of the four management areas, is characterized by an incised stream channel network in the far upper portion of the area, which quickly connect to a deeply downcut constructed ditch which crosses the floodplain to become the site's south ditch (Figure 2b). This southern ditch carries the majority of the Wasson Creek streamflow to its confluence with Winchester Creek. A second constructed ditch begins on the north side of the floodplain almost halfway down this management area. This north ditch connects with Winchester Creek separately from where the south ditch connects. Floodplain soils in this management area are seasonally saturated during winter months (though often not entirely) and dry during summer and early fall months.

The **Main Valley Lower** management area (1.6-acres) is characterized by semi-regular tidal flooding and seasonally and tidally-influenced soil saturation (Figure 3). As mentioned, both constructed ditches connect to Winchester Creek at the bottom end of this management area. Tidal waters flooding this part of the estuary and this management area are mostly fresh.

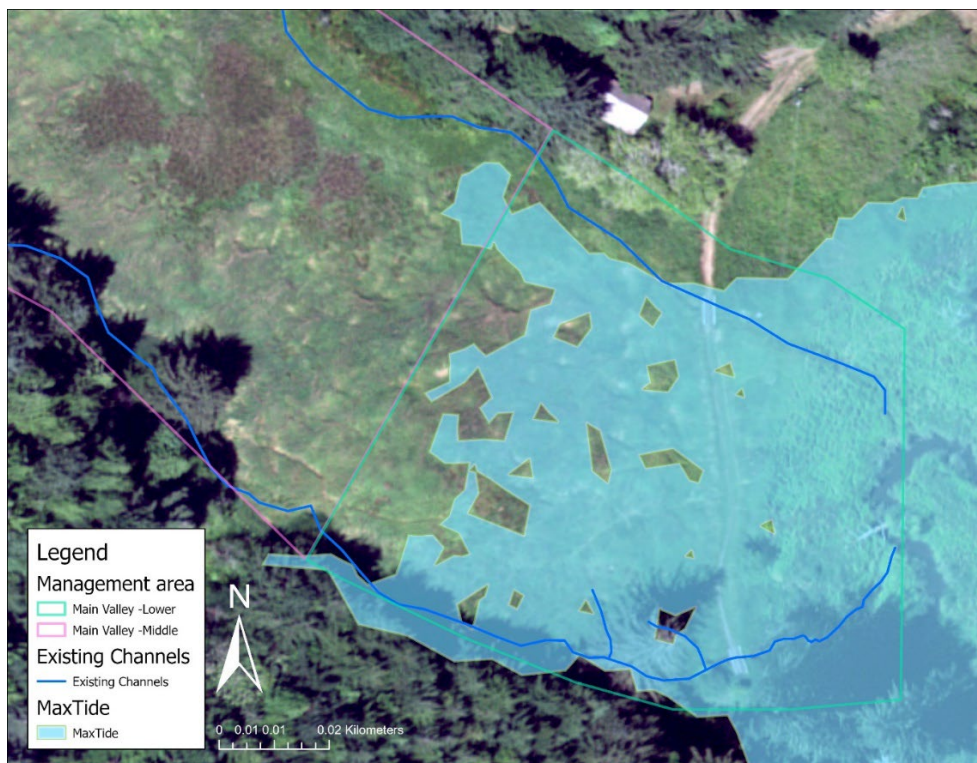


Figure 3: Main valley Lower management area showing maximum tide extent.

## **Restoration Plan Overview**

Similar to the South Slough NERR’s active stream channel restoration approach used at their Anderson Creek site (Cornu 2005), the restoration of the Wasson Creek floodplain hydrology will also require an active restoration approach. The site’s deeply downcut linear ditches will remain simplified channel structures unlikely to re-meander to a more natural state and reconnect to the floodplain on their own in any reasonable amount of time using less active restoration or habitat enhancement methods.

Rather than repeat the pilot channel restoration approach demonstrated in the Anderson Creek floodplain, the Wasson Restoration Project presents the Reserve and partners with the opportunity to test and demonstrate, as others have begun to locally (e.g., Fivemile-Bell Creek project in Powers et al. 2018), a floodplain hydrology restoration approach using “Stage 0” methods. Stage 0 restoration is a restoration method that establishes site conditions to allow natural processes (the power of surface water hydrology, sediment deposition, large wood recruitment, and beaver activity) to do virtually all the work establishing self-forming wetland-stream complexes, similar to the Reserve’s least disturbed Tom’s Creek floodplain (Figure 4). Stage 0 methods are designed to ensure dynamic and self-sustaining floodplain channel networks are formed over time, leading to the development of complex aquatic habitat for anadromous and other fishes, and other tidal and non-tidal wetland-dependent species.



*Figure 4: Drone image of the relatively unimpacted Tom’s Creek reference site, showing multiple flow pathways. Tom’s creek drains into Winchester Creek approximately one mile downstream from Wasson Creek. Photo credit: Jack Waddington June 22<sup>nd</sup>, 2021).*

Although recent Stage 0 restoration projects (e.g., Powers et al. 2018) have shown relatively fast or immediate development of stream networks, there are some concerns that the power and the smaller size of Wasson Creek may not establish and maintain fish passage on a timescale needed for sustaining current and anadromous populations. Consequently, the design plan, a “modified” Stage 0 approach, includes the establishment of a narrow and shallow fish passage channel which, coupled with large wood placement, will encourage the natural development of multi-channel stream complexes in the floodplain over time.

The key to restoring floodplain hydrology using Stage 0 methods is using the power of stream hydrology to initiate and maintain a suite of natural hydrologic and ecological processes that result over time in fully restored and self-sustaining floodplain hydrology at the site. In essence, the project will be phased in such a manner that once ditches are eliminated and the fish passage channel is constructed, all mainstem and tributary streamflow entering the floodplain at the top of the valley (Main Valley Upper) will be spread out across the entire floodplain area and allowed to enter the fish passage channel, but not be constrained by it. This will result in stream flow haphazardly and continuously coursing down the floodplain (larger flows in winter and smaller in the summer), depositing and redistributing sediments though the floodplain and creating networks of first nascent, then established stream channel networks and associated aquatic habitat over time. Ultimately, the wetland-stream complex developed in response to retained sediments, large wood placed (Appendix D) and naturally recruited, the continuously developing floodplain plant community (Appendix C) and beaver activity, will result in a new dynamic equilibrium providing a self-sustaining suite of aquatic habitats throughout the floodplain.

Finally, Stage 0 methods are also designed to facilitate the relatively rapid recovery of healthy soils to the Wasson Creek floodplain. Degradation of Wasson Valley soils, resulting from a long period of agricultural production, summertime soil drying, and suppression of wintertime flooding and associated sedimentation deposition, has resulted in lower soil organic content, lower nitrogen levels and higher pH than observed in the relatively unimpacted Tom’s Creek floodplain (Brophy, 2005; Figures 4). Additional removal of organic material is expected during restoration implementation, where floodplain grading for reed canary grass management will remove the topsoil layer over a considerable area. Reestablishment of healthy soils can take decades following restoration (De et al. 2019), where little improvement was observed at the adjacent Anderson Creek 20 years after restoration (2021 SSNERR research project). The Stage 0 approach creates multiple stream channels through deposited sediments (Figure 5), rather than downcutting, and thereby suggests the potential for a greater rate of soil recovery following restoration, as has been seen at local Stage 0 projects such as Fivemile-Bell Creek (Paul Burns pers. comm. January 2022).





*Figure 5: Deposition in the first year following restoration at the Fivemile-Bell Stage 0 restoration project, implemented by Siuslaw National Forest Service and Siuslaw Watershed Council.*

### **Floodplain Hydrology Restoration Tasks**

As mentioned, the project's modified Stage 0 floodplain restoration design proposes to direct all mainstem and tributary streamflow entering the floodplain across the valley, resulting in stream flow haphazardly and continuously coursing down the floodplain. Larger flows in winter and smaller in the summer will deposit and redistribute sediments and creating wetland-stream complex networks and associated aquatic habitat over time. To make this work, a suite of phased hydrology-focused restoration actions need to be staged and implemented, carefully coordinated with actions related to invasive species removal and implementation of the project's planting plan (Appendix C).

Here we focus on restoration actions related to floodplain hydrology. Because sometimes different restoration actions are required for the Upper Valley and Main Valley Upper, Middle and Lower management areas, we outline actions for each management area.

#### *Upper Valley*

Due to restricted access in this management area the objective is to increase hydrologic complexity by re-establishing healthy beaver activity and increasing large wood recruitment.

Restoration actions include:

- 1) Densely planting willow and other native shrubs. See Appendix C Planting Plant for further details.
- 2) Placing large wood where possible and planting Sitka spruce for long term wood recruitment.

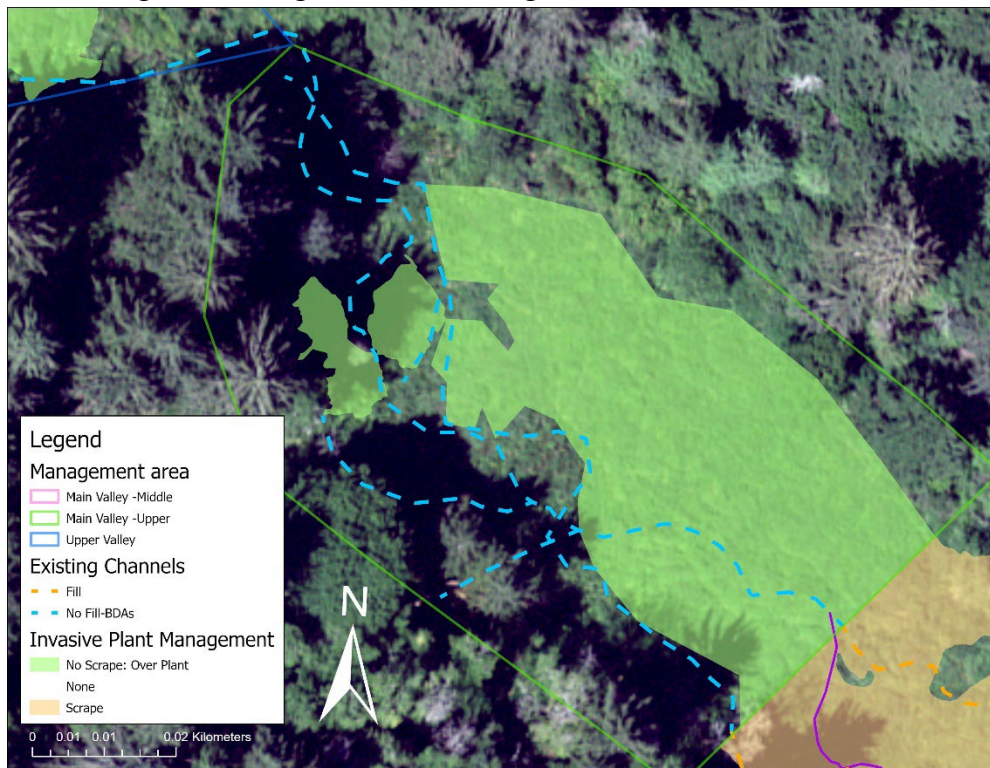
#### *Main Valley Upper*

Due to saturated soils in this area, use of heavy machinery is unavailable. The objective of this management area is to slow flow, spread flow across the floodplain and connect flow to the temporary fish passage channel. Restoration actions include:

- 1) Install beaver dam analogs (BDAs) to the existing Wasson Creek channel to slow stream flow, encourage sediment deposition and channel shallowing key to making a transition between the Wasson Creek and the newly graded floodplain and constructed shallow fish passage channel (described in the Main Valley Middle section below)(Figure 6). Such transitions between channels of different depths need to be designed so they don't result in

head-cutting/downcutting of the newly constructed channel. These additions to the Wasson Creek stream channel will also create complex aquatic habitat. BDAs placed in the Wasson Creek channel are planned as artificial enhancements to mimic the ecosystem engineering functions of beavers whose natural recruitment of greater numbers to the site could take some time.

- 2) Introduce large wood at high densities (>30 pieces/acre) to slow and disperse flow entering the newly graded floodplain. This area, where the stream enters the project area, has high flow velocity. Consequently, large quantities of wood will be distributed across the floodplain, increasing surface roughness, and slowing water flow. Once connected, Wasson Creek stream flow is anticipated to not only provide fish passage in the temporary fish passage channel, but also initiate significant surface flow even during summer low flows throughout the floodplain, promoting the development of additional channels that spread water across the entire valley floor.
- 3) Connect the existing Wasson Creek channel to the floodplain and the newly constructed fish passage channel (described in the Main Valley Middle section). The above-mentioned BDAs and large wood are designed to encourage flow out of the existing channels and onto the floodplain. The transition between the Main Valley Upper and Middle sections will encourage flow on the floodplain through gentle grading and will inhibit channel flow by blocking the existing channel with large wood.



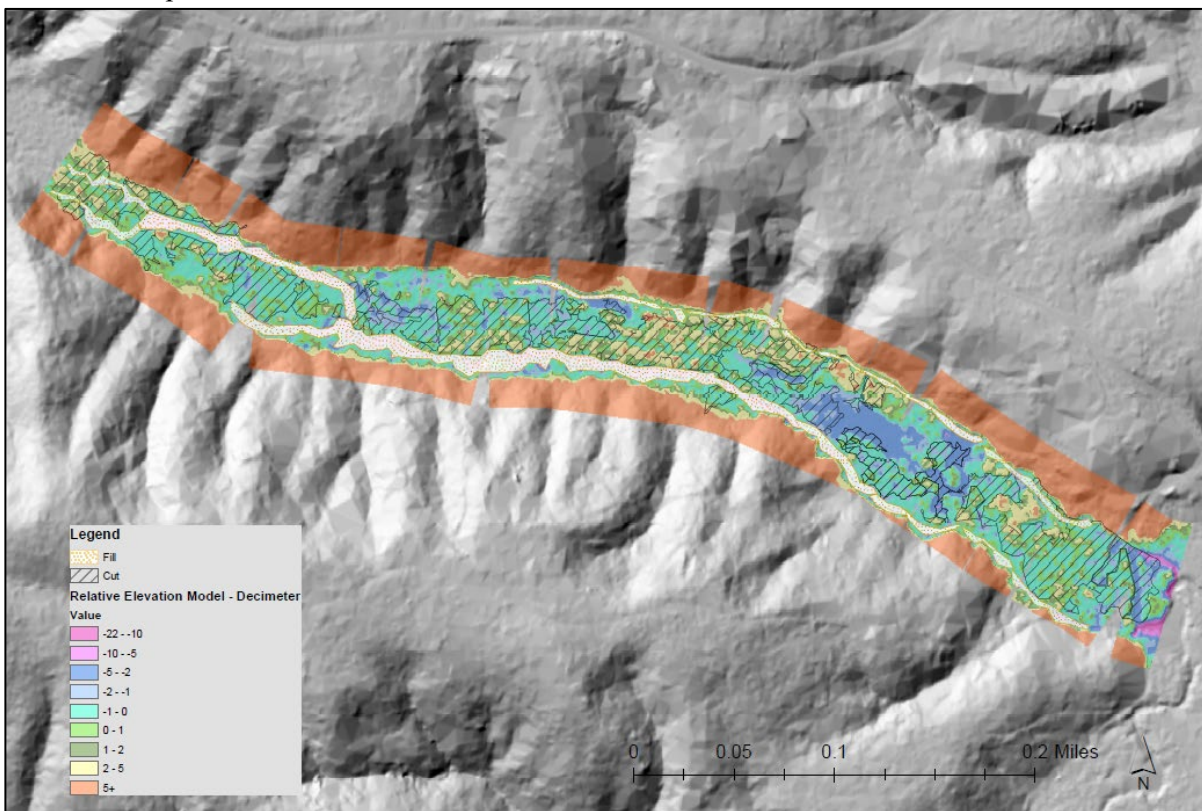
*Figure 6: Main Valley Upper management area showing existing channels where beaver dam analogs will be installed to reduce channel depth and encourage surface flow. The floodplain, dominated by reed canary grass (green shade), will be scattered with high densities of wood to slow surface flow.*

Note: Because soils in this part of the floodplain are saturated virtually year-round, work in the Main Valley Upper area will be carefully planned/staged and completed with care. Some construction impacts will be unavoidable but construction-related damage to the area will be kept to a minimum.

### *Main Valley Middle*

The objectives for this management area are to grade the floodplain, fill existing ditches, create a temporary fish passage channel, and place large wood.

- 1) Grade valley along a 1% grade line slope. Large areas of reed canary grass will be scraped, and the valley surface will be graded to direct flow down the valley and away from upland edges (Figure 7). Areas dominated by native vegetation will be left to create fish refugia, local seed source and increased surface complexity and roughness.
  - a) Much of the valley will be scraped to remove reed canary grass, leaving extant native plant patches mostly intact (see invasive species management in Appendix C). Scrape depth will be just below reed canary grass root zone, approximately 12-in.
  - b) Extended toe slopes will direct tributary flow away from the edges of the floodplain and limit reoccupation of filled ditches.



*Figure 7: Relative elevation model with grade-line analysis in Main Valley management area. High areas and reed canary grass scrape areas are indicated as “cut” (diagonal lines) and existing depressions, ditches and channels which require increased elevation are indicated as “fill” (dots). Analysis performed by and map created by Kacey Largent at USFS.*

- 2) Construct a shallow temporary channel that provides fish passage and is sized to encourage maximum surface flow and placing large wood to encourage multiple flow pathways and avoid deep channel



formation.

- a) A highly sinuous initial fish passage pathway will be dug with the expectation that the additional stream channels will spread across the valley as the water moves downstream (Figure 8). The fish passage channel should have the capacity to hold only enough water to allow fish use (6-in. deep and approx. 4-ft. wide) and discourage downcutting. As native vegetation develops and beaver re-occupy the floodplain, stream flow paths are anticipated to change in response to dam numbers, size, relative stability, and permanence.
  - b) Where the fish passage channel transitions from graded areas and passes through native vegetation patches, channel depth will be excavated to depths needed to maintain consistent stream gradient and stream flows through these relatively higher marsh areas (approx. 18-in). These sections will provide fish refugia, through shading and deeper channel segments. Native plant roots and rhizomes will be carefully “borrowed” from native plant stands and transplanted into adjacent scraped floodplain areas or on extended toe slopes (Appendix C).
  - c) Large wood will be placed in the shallow fish passage channel and across the floodplain at moderate densities (approx. 20 pieces/acre) to promote development of multiple stream channels and intercept stream energy, which will encourage the development of aquatic habitat structures such as pools and bank overhangs.
- 3) Phased appropriately with valley grading and excavation of the shallow fish passage channel, fill existing ditches with the use of material generated during grading. As mentioned, the fish passage channel will be sized to encourage overbank flow to initiate natural hydrologic processes to create additional channel networks throughout the floodplain, but conditions will be established on site to prevent surface flow from potentially reoccupying the filled ditches over time.
- a) Ditches will be filled taking care to neither underfill and allow ponding nor overfill to the degree that berms restrict water entry from tributaries onto the floodplain. Roughness in the form of large wood and high density plantings (see planting plan, Appendix C) will also be emphasized in filled ditch areas, to help prevent ditch reoccupation.
  - b) There are shallow remnant channel features in the valley that may or may not be historical channels. Those channels with sinuous plan form will be retained where they meet the needs of the initial fish passage pathway. More linear remnant channels will be filled since they have the potential to focus flows and discourage water retention on the valley floor. Large wood will also be partially buried in remnant channels to encourage water to spread out of the channel and to reduce stream power.
  - c) To further discourage filled ditches from being reoccupied, floodplain surface flows will be directed generally away from floodplain margins using extended toe slopes made from clean fill generated from floodplain grading (Appendix C). The extension of toe slopes along the valley edge across ditch locations will push surface flow energy out across the valley, away from filled ditches.

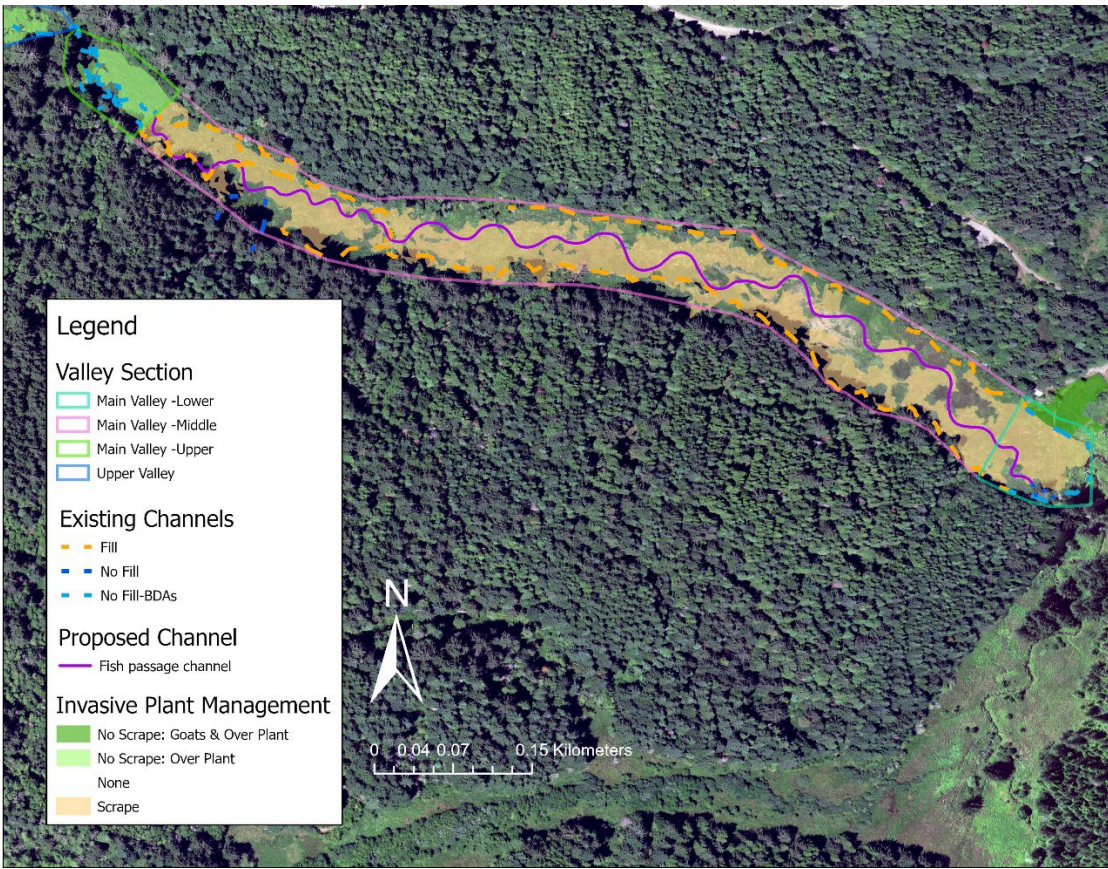


Figure 8: Wasson Creek Main Valley showing maximum extent surface scraping, proposed new excavated fish passage channel and existing channels to be filled, beaver dam analogs installed or left untouched

- 4) Water from seasonal, tributary channels will be encouraged to enter the floodplain and prevented from re-occupying filled ditches.
  - a) Ditches intercepting and diverting ephemeral tributaries will be filled, slight mounding or large wood placement on the downstream side to prevent flow from entering old ditch segments or re-occupying filled ditch areas.
  - b) Seasonal and ephemeral surface water flows will be allowed to pond in existing wetlands, disperse overland on the floodplain (likely extending existing wetlands), and/or infiltrate into floodplain soils. The desire is to create additional wetland habitat in the valley margins where these ephemeral channels dramatically decrease in gradient, but without re-occupying the old ditches. Additionally, by allowing the flow to pond or slowly disperse (rather than be quickly diverted as is the existing condition), water will move through the valley slower, thereby helping maintain a higher water table longer into the dry, summer season.
  - c) Tributary channels that intersect with Wasson Creek Marsh trails will be re-connected with the floodplain, and boardwalks will be installed to maintain trail access.

#### *Main Valley Lower*

The objectives of this management area are to connect the Wasson Creek, it's newly graded floodplain and the temporary fish passage channel to Winchester Creek. This area experiences

tidal flooding and has some sensitive areas that cannot be graded. All ground disturbance work in this area will be closely monitored.

- 1) Continue grading and construction of the shallow fish passage channel in this management area (Figure 9). Fish passage channel will again be scaled as appropriate to encourage overbank flow, consistent with the project's modified Stage 0 approach.
  - a) The natural development of a floodplain stream network consistent with the modified Stage 0 approach will be encouraged across the entire Main Valley Lower area. Grading will continue and large wood placed at moderately high densities (approx. 25 pieces/acre) in conjunction with nurse cribs (see Appendix C for forested tidal swap planting plan) will increase surface roughness.
  - b) The shallow fish passage channel will be connected to the original south ditch approximately 80 m from its confluence with Winchester Creek via an existing shallow depression which runs through established native vegetation (Figure 9). Connecting to the south ditch in an area where no floodplain grading will take place will reduce the scale of naturally formed channel head cutting.
  - c) All earth moving in this area will be monitored by Tribal Historic Preservation Officers, or their approved representatives, from the Coquille Indian Tribe and the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians. If cultural resources are discovered, work will stop within a 300-ft buffer of the discovery and the inadvertent discovery plan will be followed. If grading extent is limited, the allowable grading will avoid linear pathways to reduce the chance of deep channelization.
- 2) Continue ditch filling in the Main Valley Lower area, again, phased as appropriately with fish passage channel construction. Create a gradual transition from filled ditches, and floodplain, to Winchester Creek by installing Beaver Dam Analogs (BDAs) in areas where ditches are not filled (Figure 9).
  - a) Filling of the southern ditch will continue down valley to its confluence with the newly excavated shallow fish passage channel, approximately 80 m from Winchester Creek (Figure 9).
  - b) North ditch filling will continue to maximum tidal extent (Figure 3).
  - c) In both ditches, a series of BDAs will be used to slow water flow and promote sediment deposition, resulting in increasing elevation of stream base and facilitating an improved transition with Winchester Creek. As noted above, BDAs are used here as an artificial stand-in for desired beaver structures which, due to low beaver numbers, would not be constructed on a timeline suitable to meet the project objectives.
  - d) Large woody debris will be placed in the shallower north ditch to encourage lateral flow of stream and tidal flows onto the floodplain and to initiate the development of complex aquatic habitat features.



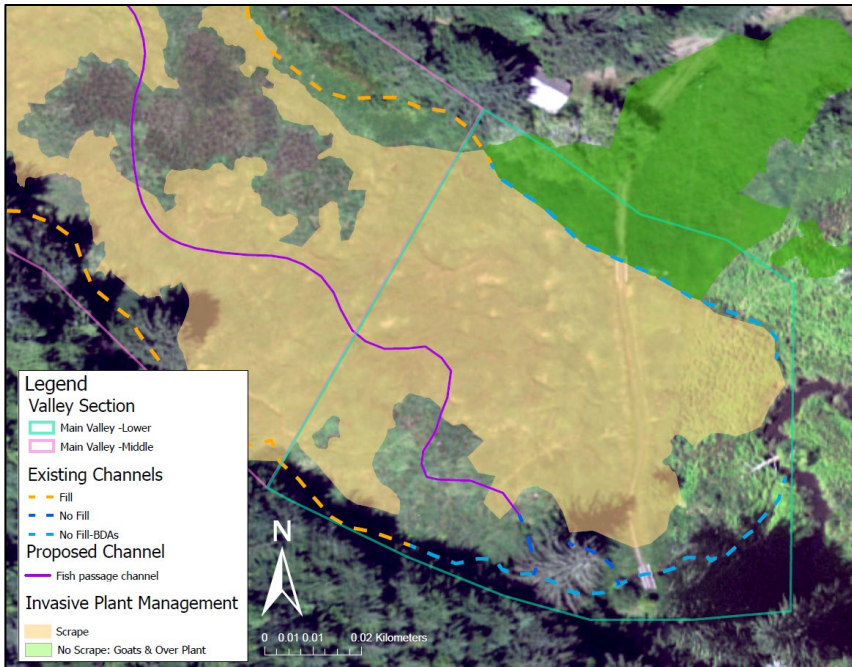


Figure 9: Main Valley Lower management area showing maximum grading (yellow shading), existing channels (dashed lines) that will be either filled (orange), installed with beaver dam analogs (light blue) or left untouched (dark blue), and proposed fish passage channel (purple solid line).

## **Methodology Details**

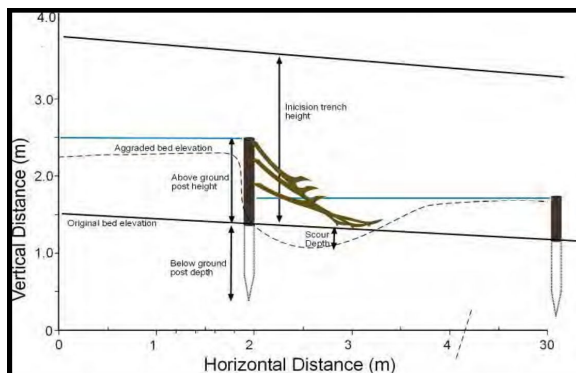
This section gives additional information on the methodologies used to install beaver dam analogs and specifics on large wood placement. We also provide details on avoiding impacts in areas adjacent to potential Marbled Murrelet habitat, which will be confirmed prior to commencement of work.

### **Beaver Dam Analog**

Channel spanning BDAs are structures that mimic the function of beaver dams, are biodegradable, and allow movement of water, fish and some materials and sediments to pass through, while trapping others (Pollock *et al.* 2017). To construct BDAs install a line of vertical conifer posts, approximately 0.5m apart using a hydraulic or pneumatic post pounder, weave fresh branches between posts and deposit a layer of coarse gravel, native slough sedge and fine sediments on the upstream face to prevent under scouring and increase roughness. Detailed instructions can be found in the Beaver Restoration Handbook (Figure 10; Pollock *et al.* 2017). Post materials will be stockpiled from uplands forest restoration thinning, will be Sitka spruce or Douglas fir, have a DBH of 3 to 5-in and length between 6-14-ft. Posts should be straight, branches removed and not split. Shorter poles will be used at upstream end where the channel is shallower. The drive end will be shaped into a square, with diameter around 3.5-in, and the opposite end will be cut to a point. A score at the halfway mark will guide drive depth. Weaving

materials will include fresh conifer boughs from thinning project, this has been shown to increase the longevity from the commonly used willow branches in areas where beavers are present. Once woven, additional branches running through the dam will be placed, to mimic natural beaver dams (Figure 10). Order of installation will be from downstream to upstream and the distance between BDAs will be at the extent to which water is backed up behind the below stream BDA. This spacing helps prevent overtopping scour bellow the upstream BDA (Pollock et al. 2017). Once sediment has accumulated and the upstream bed has increased in elevation, expected after a single high flow season, additional BDAs will be installed on the upstream side of the original BDAs (Figure 10b). Downstream scouring from these new BDAs will move sediment against the original BDAs, which reinforces them. This iterative process is continued until the original channel is reconnected to the floodplain. These stream sections will provide additional stream habitat, promote beaver activity, and increase stream bed elevation to reconnect with the Stage 0 style restoration of the remaining valley. The initial BDAs will be installed before valley restoration in the Main Valley Lower management area and the phase 2 installation, along with initial installation in Main Valley Upper management area, will coincide with the ditch filling stage of valley restoration. By installing BDAs in the lower reach prior to stream diversion we expect to see greater accumulation of materials, resulting from higher flows and sediment movement, and an increase in stream bed elevation. The pre-restoration BDAs will use shorter posts, below incised ditch heights, to reduce soil saturation which may inhibit machinery access. The installation of BDAs in the upper reaches should be in conjunction with downstream channel filling to reduce stream energy and encourage bank overflow.

Phase 1: Year 1 placement



Phase 2: After sedimentation upstream of BDA

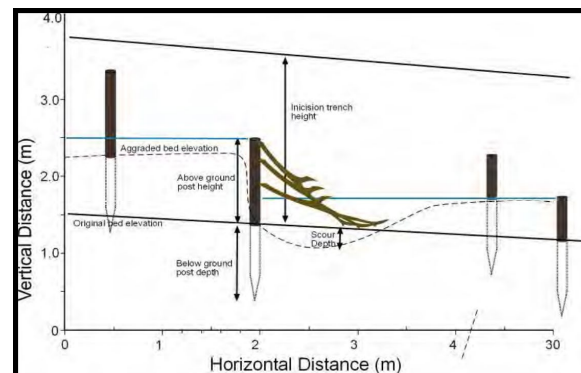


Figure 10: Diagrams copied from *The Beaver Restoration Guidebook* (Pollock 2017, Fig. 28 p. 90), showing placement of BDAs in a) phase 1, year 1 installation and b) phase 2, after sedimentation upstream of original BDAs.

## Large Wood Habitat Structures

Adding large wood to the floodplain and fish passage pathway will promote deposition (Figure 5 & 11a) and the development of a wetland-stream complex, while also creating and maintaining

rearing habitat and possibly spawning habitat. High densities of large wood (e.g., >25/acre) are essential for Stage 0 restoration, as these increase roughness until vegetation and depositional mounds establish (Powers et al. 2018; Figure 11). The presence and abundance of large wood has also been found to be critical for the survival of trout and salmon in river systems (ODFW, 2010). Large wood structures catch native gravels to create suitable spawning ground, promote pool formation, to increase channel and hydraulic diversity, and provide cover habitat for visual and physical refuge within the stream. Wood placement designs and numbers are based on recent Stage 0 projects, such as Fivemile-Bell (Figure 11), which exceed recommendations in the *Oregon Guide to Placement of Wood, Boulder and Gravel for Habitat Restoration* (ODFW et al., 2010). Designs also include key pieces based on ODFW recommendations (ODFW et al., 2010). The size, type, orientation, and location of wood, as well as depth and velocities of design flows, are the main factors that dictate the size and number of trees and logs necessary to stabilize wood placements. As Stage 0 restoration methods dissipate flow over the entire valley surface, velocities are much lower than experienced in single channel designs (Powers et al. 2018). In higher velocity areas, such as incoming flow in the upper section and tidal flow in the lower section, stability will be added through bracing logs with inverted logs driven vertically into the floodplain or through interlocking structures (Figure 11b). In areas around boardwalks wood will be embedded to minimize movement and damage to structures. Although we have smaller trees available for our large wood structures (i.e., height less than 60-ft and breast-height diameter less than 18-in.), it will not be necessary to use boulders to ballast the structures and ensure long-term stability because flow depths within the fish passage pathway and in the wetland-stream complex will be insufficient to transport whole logs and trees more than one-half of a meander wavelength. To increase stability, around half of the wood will be embedded into the floodplain. For key pieces we will prefer whole trees with rootward over single cut logs and larger in diameter and length (Table 1; Figure 11b).



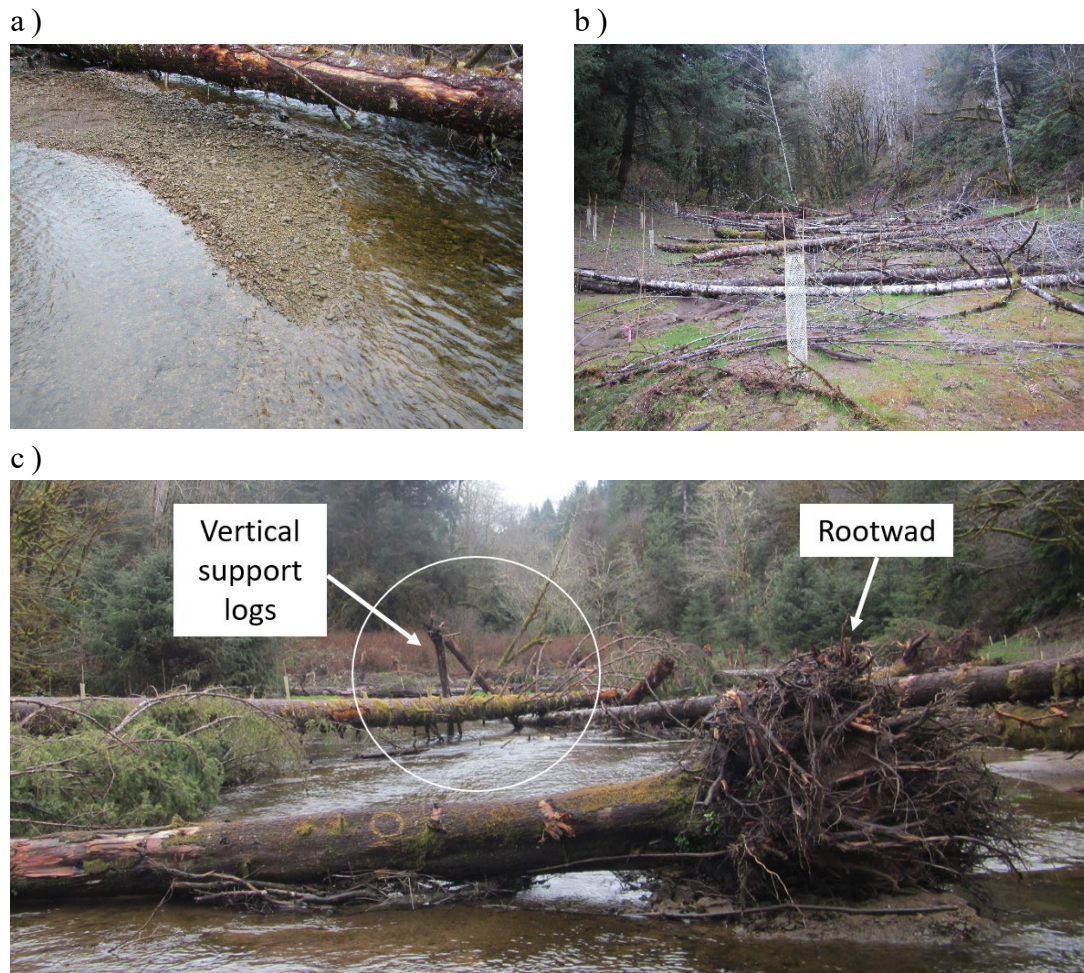


Figure 11: Wood placement in the Stage 0 phase of the Fivemile-Bell restoration project (implemented by Siuslaw National Forest Service and Siuslaw Watershed Council) showing a) accumulated sediment and gravels, b) high densities in upper reach, where velocity is high, and c) rootwad and vertical support log structures.

Table 1: Recommended wood metrics for large wood placement in Wasson Creek floodplain. Stage 0 restoration projects use all sizes of wood and recommended size of non-key pieces here is based on availability from forest restoration thinning in adjacent uplands (Appendix D)

| Parameter                       | Wood Pieces | Key Pieces |
|---------------------------------|-------------|------------|
| Diameter at breast height (DBH) | <16"        | 16-20"     |
| Length                          | <60'        | 60-80'     |

The locations for proposed large wood placement were determined by analysis of the aquatic habitat inventory (AHI) surveys conducted by the Coos Watershed Association in 2010. The 2010 surveys found Upper Valley had 3.4 large wood pieces per 100m, with no key wood pieces, and no large wood pieces in the Main Valley. The survey divided reaches by type (e.g.,

pool, riffle, etc.), and collected physiographic and habitat data for each reach (e.g., channel geometry, substrate type and size, large wood type and volume). Using these data, combined with the Oregon Department of Fish and Wildlife's instream habitat benchmarks (Attachment A – Moore et al., 2006), we computed the minimum volume and number of large wood pieces that would be needed to restore in stream habitat complexity and combined this with the number of pieces needed to dissipate stream energy and discourage linear flow paths that can concentrate flows and increase stream power (Table 2). In order to reduce stream energy as the incoming stream enters the restoration area, there should be greater large wood densities scattered throughout the Upper Section of the main valley (approx. 30/acre). Although observations in years following the 2010 survey have noted that a few large riparian trees have fallen onto the floodplain, these numbers are still well below desired benchmark.

*Table 2. Large wood quantities for Wasson Creek. Calculations for minimum ODFW desired large wood and key pieces is based on 20 and 3 pieces per 100-m respectively. Additional Stage 0 requirements for Main Valley Upper, Middle, and Lower management areas are based on 30, 20, 25 pieces per acre respectively.*

| Stream Reach                       | Reach Length (m) | Area (acres) | ODFW Desired Wood Pieces | ODFW Desired Key Pieces | Additional Stage 0 desired pieces | Total pieces |
|------------------------------------|------------------|--------------|--------------------------|-------------------------|-----------------------------------|--------------|
| Upper Valley (Total)               | 1121             | 5            | 186                      | 34                      | 0                                 | 186          |
| Main Valley Upper (Si=1.34)        | 201              | 1.57         | 40                       | 6                       | 1                                 | 47           |
| Main Valley Middle (Si=1.22)       | 1000             | 12.63        | 199                      | 31                      | 53                                | 253          |
| Main Valley Lower (Si=1.20)        | 160              | 2.8          | 32                       | 5                       | 38                                | 70           |
| <b>Total Main Valley (Si=1.27)</b> | <b>1361</b>      | <b>17</b>    | <b>272</b>               | <b>42</b>               | <b>98</b>                         | <b>370</b>   |

Using the above computations, the following design criteria should be used in log selection and placement:

1. Minimum size for single logs placed in channel in the upper valley should be: 12-in DBH and 35-ft long.
2. Once key piece requirements are met, wood dimensions can vary. To be considered a key piece *Oregon Guide to Placement of Wood, Boulder and Gravel for Habitat Restoration* (2010) recommends:
  - a. A log with a rootwad still attached should be at least one and one-half times (1.5X) the bankfull or a log without a rootwad should be twice (2X) the length of the stream's bankfull width.
  - b. A log must also have a minimum diameter of 16 inches to be considered a key piece in a stream with a bankfull width of 10-20 feet (found in Upper Valley and Main Valley Upper management areas).
3. Use higher densities of logs where there is a chance that flows are more concentrated (Main Valley Upper) and areas transitioning into tidal channels (Main Valley Lower). All other pieces should be scattered across the valley with higher densities of logs in scaped area than remnant vegetation patches, where established plants provide surface roughness.
4. Use wood pieces available in the adjacent uplands thinning areas while still meeting the stability standards (Table 1).

5. Wood pieces will be placed both in the fish passage pathway to encourage dispersion and across the floodplain to increase surface roughness.
6. Large wood will be used in conjunction with fill material to plug the current ditched channel as ditch obstructions when needed to block flow from re-entering the ditched channel (Figure 12).
7. Wood pieces will be partially buried placed as nurse logs on the floodplain for the general enhancement of floodplain and wetland features (Figure 12)

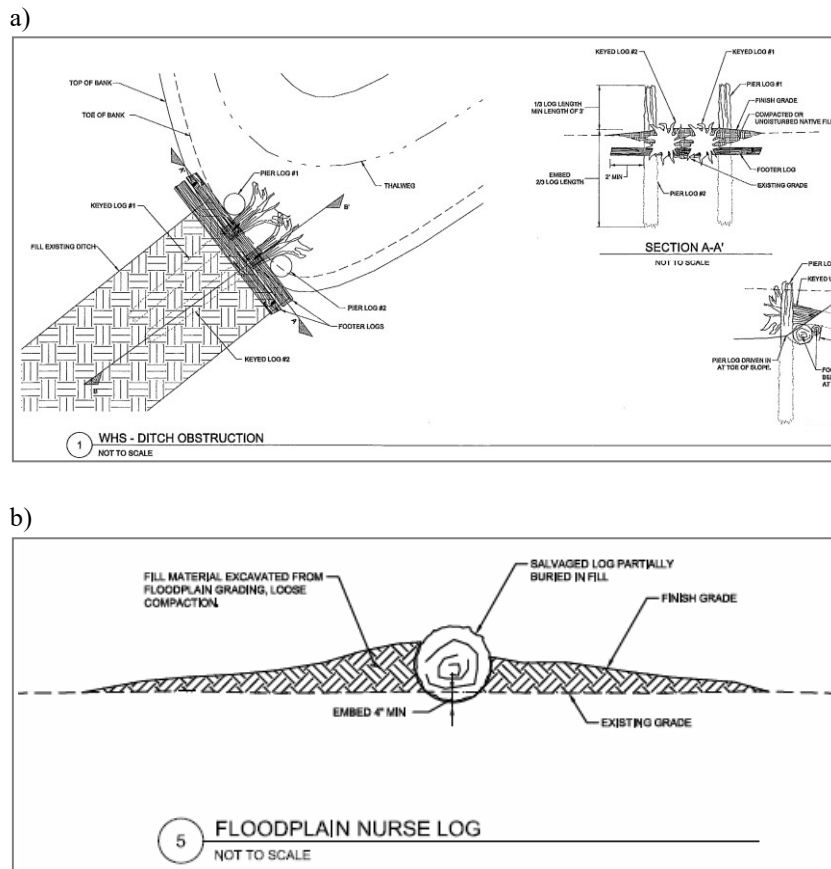


Figure 12. Diagrams copied from CBNB Water Board (2015) showing a) Typical ditch obstruction configuration to be used in Wasson Creek to block flow from re-entering the old, ditched channels and b) Typical floodplain nurse log configuration to add complexity to the floodplain and surrounding wetland

## Marbled Murrelet Considerations

The following details are copied from the “Stream Restoration Projects in or near Marbled Murrelet Management Areas” (MMA) section, P. 40-42, of Guidelines for Implementing Marbled Murrelet Policies and Procedures (ODF, 2016). No known nesting trees are present within the project area, however, surveys for potential nesting habitat will be conducted prior to commencement of work. If suitable habitat trees are documented within the project area, irrespective of occupancy, the following criteria will be observed.



1. The following trees will not be selected for removal:
  - a. Trees with potential nest platforms and immediately surrounding trees that provide cover to potential nest platforms;
  - b. Known nest trees;
  - c. The largest trees in areas where the number of large trees is limited;
  - d. Minor tree species (not commonly found in the stand)
2. Trees may be felled or pushed/pulled directly into a stream or floodplain. Trees may be removed/repositioned by cable, ground-based equipment, horses or helicopters.
4. Trees may be stockpiled for future in-stream restoration projects.
5. Wildlife biologists with experience in murrelet habitat will select trees for removal. If trees are selected by someone other than a wildlife biologist, an experienced wildlife biologist will be required to approve selected trees.
6. To protect interior forest habitat, existing or potential nesting structure, and neighboring trees with nesting structure from incidental damage, the following specific criteria will be used to select trees for placement in streams:
  - a. Selected trees will be dispersed within the first two lines of trees along the periphery of permanent openings (e.g., road right-of-ways, powerlines, etc.) or along the periphery of non-permanent openings (e.g., plantation edges or along clear-cut edges less than 40 years old);
  - b. Selected trees will be less than or equal to 36 inches in dbh and lack existing or potential nesting structure (i.e., for murrelets, limbs or other platforms greater than or equal to four inches in diameter);
  - c. When within 300 ft. of murrelet habitat, individual trees will be selected; however, on rare occasions small groups of no more than four trees may be selected, if appropriate;
  - d. Selected trees (or small groups of trees defined above) will not create a gap greater than  $\frac{1}{4}$  acre and will be spaced a minimum distance of one potential tree height apart;
  - e. Trees will be selected to avoid any damage to existing or potential nesting structure in the stand during felling and removal operations.
7. The implementation of projects within the disruption distances of occupied or potential murrelet habitat will be scheduled outside of the critical breeding period of April 1 – August 5th.
8. Where activities are permitted between August 6th and September 15th, projects would not begin until 2 hours after sunrise and would end 2 hours before sunset.
9. Tree felling shall not create excessive stream bank erosion or increase the likelihood of channel avulsion during high flows.
10. Garbage containing food and food trash generated by workers in project areas is to be secured or removed daily to minimize attraction of corvids.

### **Fill and Removal Estimated Volumes**

Since the proposed fish passage channel is designed to be much shallower than the current incised ditches on the sides of the valley and there are multiple ditches that need to be filled, the amount of material needed to fill the current ditches is projected to be much larger than the volume of material that will be removed during channel excavation (Figure 7). A rough estimated volume for the needed fill material was calculated using the data from the elevation surveys, and the volume of removal material was determined from the proposed channel dimensions (Table 3). As part of the Wasson Creek Vegetation Plan, large areas of the main

valley will be scraped to remove reed canary grass (Appendix C, Section II), and that material will be used in addition to the excavated channel material to fill the current ditch locations. The material scraped from the valley floor will contain invasive vegetation (predominantly reed canary grass) and its seedbank. To help prevent these invasive species from spreading back into the valley, the contaminated material will be overturned and compacted into the ditches. Soil removed from the fish passage channel will contain less contaminated seedbank, as this will be excavated following valley scraping, and will be used to top drier edge fill areas. Plugs of native wetland vegetation (e.g., slough sedge, small fruited bullrush) will also be removed along the fish passage pathway and these materials will be placed on top of wetter fill areas. Any additional clean fill will be used to direct flow from side drainages into the valley and prevent them from re-entering side ditches.

*Table 3. Removal and fill volumes for Wasson Creek restoration. Required fill of existing ditches and channels was calculated from elevation surveys, with average dimensions listed in table. Scraping valley floor and above ground biomass refers to reed canary grass removal (Appendix C), values for minimum and maximum extent are listed.*

|                                            | Length<br>(ft) | Width (ft) | Depth (ft) | Area (ft <sup>2</sup> ) | Volume (yd <sup>3</sup> ) |
|--------------------------------------------|----------------|------------|------------|-------------------------|---------------------------|
| <b>Source of Fill</b>                      |                |            |            |                         |                           |
| Excavating fish passage pathway            | 3,760          | 4          | 0.5        | 15,038                  | 278                       |
| Scraping valley floor (min.-max.)          |                |            | 1          | 333,160-369,683         | 12,339-13,692             |
| Compacted above ground biomass (min.-max.) |                |            | 0.5        | 166,580-184,841         | 6,170-6,846               |
| <b>Total Removal Estimate:</b>             |                |            |            |                         | <b>18,787-20,816</b>      |
| <b>Fill Requirements</b>                   |                |            |            |                         |                           |
| Existing ditches and channels              | 6,412          | 15         | 4          | 97,521                  | 13,627                    |
| <b>Total Estimated Fill Requirement:</b>   |                |            |            |                         | <b>13,627</b>             |
| <b>Extra Estimated Fill:</b>               |                |            |            |                         | <b>5,161-7,190</b>        |

## **Timeline**

The timeline for earthmoving work in the Wasson Main Valley is dependent on In-Water Work Period (July 1- Sept 15), soil saturation, distance to marbled murrelet habitat trees (where applicable), and the Wasson Creek Vegetation Plan (Appendix C) and associated timeline (Brickner, 2016). If potential habitat trees are recorded in the minimum disruption distance from machine work (100-yards) then work will be restricted to Aug. 6 - Sept. 15<sup>th</sup>, based on ODF guidelines (ODF, 2016). In June, the valley will be scraped of reed canary grass in preparation for the channel construction. Channel construction may begin before the start of the In-Water Work Period but only work that is not connected to the existing channels. All connections or fill activities will occur during the In-Water Work Period (Table 4).

*Table 4. Wasson Creek timeline for heavy machinery work.*

| Year 1 (2023)                                    |                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| July 1 <sup>st</sup> -September 15 <sup>th</sup> | Install BDAs in lower reaches<br>Repeatedly mow reed canary grass in lower valley section                                                                                                                                                                                                                                       |
| Year 2 (2024)                                    |                                                                                                                                                                                                                                                                                                                                 |
| June-July                                        | Scrape valley in preparation for channel work (starting in lower valley), dig the new fish passage pathway (do not connect new channels to the stream), place wood across the valley and in fish passage pathway. Construct log cribs in Lower Valley.                                                                          |
| July 1 <sup>st</sup> -September 15 <sup>th</sup> | Install BDAs in lower reach (second phase) and upper reach (initial). Connect new channel to streamflow, use scraped reed canary grass as fill for existing channel, use removed material from new channel to finish fill of existing channels, place additional wood as needed. Construct log cribs in Lower Valley as needed. |
| September-October                                | Once channel work is complete, spread seed and straw for erosion control (more information in Appendix C Wasson Creek Vegetation Plan)                                                                                                                                                                                          |
| October-January                                  | Plantings (See Wasson Creek Vegetation Plan)                                                                                                                                                                                                                                                                                    |
| Year 3 (2025)                                    |                                                                                                                                                                                                                                                                                                                                 |
| July 1 <sup>st</sup> -September 15 <sup>th</sup> | Install BDAs in lower reach (third phase) and upper reach (second phase) if needed.                                                                                                                                                                                                                                             |
| October-January                                  | Log crib plantings (See Wasson Creek Vegetation Plan)                                                                                                                                                                                                                                                                           |

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# Wasson Creek Restoration

## Appendix C. Vegetation Plan



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Alexis Brickner, former Riparian Project Manager, Coos Watershed Association

2022 Revised Plan Prepared by:

Alice Yeates, Stewardship Coordinator, South Slough National Estuarine Research Reserve

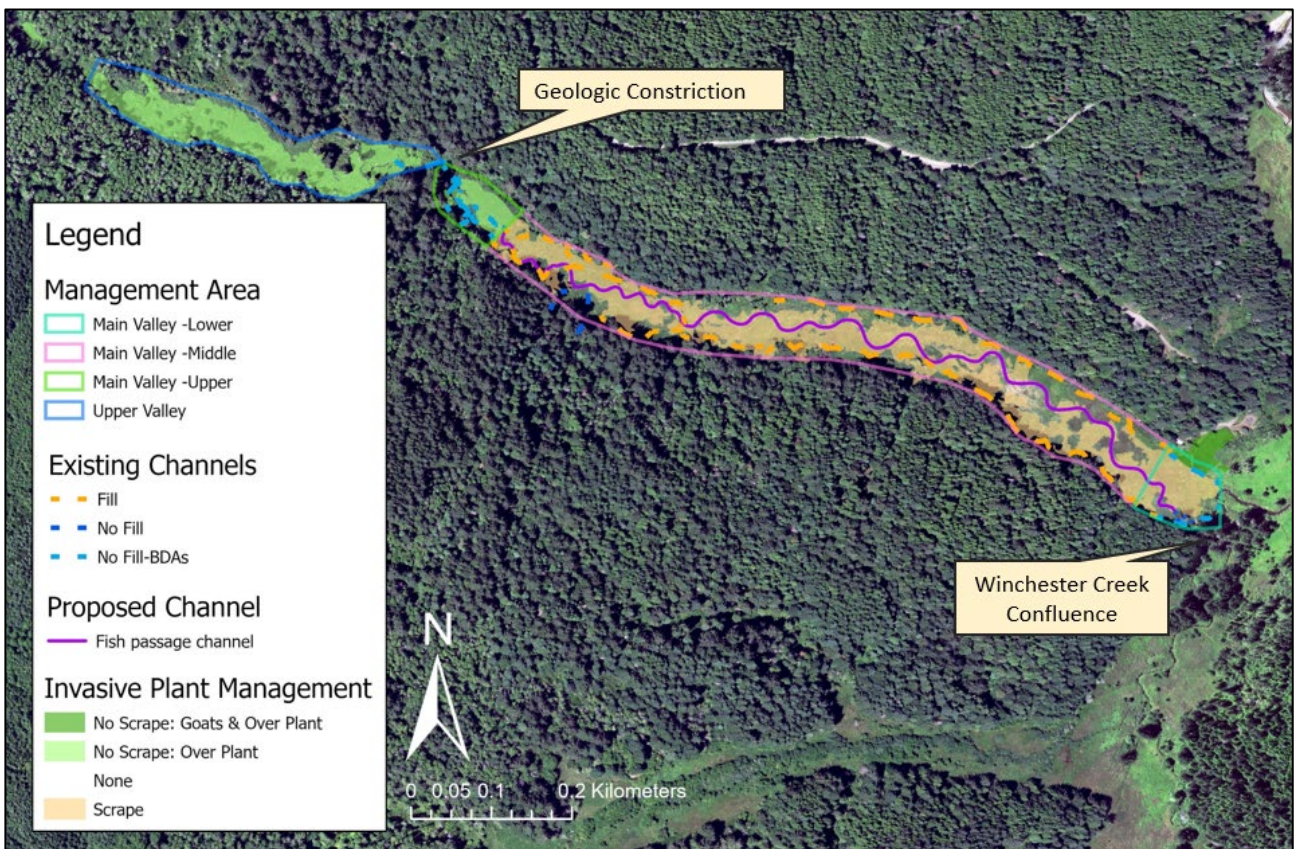
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## **Background and current conditions**

Wasson Creek in the South Slough National Estuarine Research Reserve has been heavily impacted by historic land uses including stream channelization, grazing, and logging in the 1900s through 1970s (Brophy 2005), resulting in a simplified drainage network, lack of in-stream habitat, minimal floodplain connectivity, and simplified vegetation community dominated by invasive species (Figure 1). The goal of restoration actions, outline in this plan, is to reestablish diverse native plant communities to the Wasson Creek floodplain, tidal and riparian areas. The revegetation plan aims to restore the following attributes to the Wasson Creek valley: reduce cover and impact of invasive species, provide off-channel habitat for several ESA-listed fish species (e.g. coho salmon and winter steelhead, cutthroat trout), restore forested tidal swamps, support a robust beaver population, and provide harvest materials for cultural use and future restoration plantings.



*Figure 1: Wasson Creek lowlands management areas (Upper Valley and Main Valley Upper, Middle, and Lower) showing reed canary grass management (scraping, over planting and goats), and both existing and proposed channels (dashed and solid lines respectively).*



## Current plant communities

Current vegetation composition in the Main Valley consists of large patches of reed canary grass (*Phalaris arundinacea*), an extremely invasive grass, mixed with pasture grasses, non-native forbs, and native species including slough sedge (*Carex obnupta*), small-fruited bulrush (*Scirpus microcarpus*), soft rush (*Juncus effusus*), and cattail (*Typhus latifolia*) (Figure 2). There is some Himalayan blackberry (*Rubus bifrons*) onsite, which is generally constrained to isolated patches amongst the fields of reed canary grass.

a)



b)



Figure 2: Main Valley a) dominated by reed canary grass and b) patches of native vegetation such as slough sedge and sword fern (foreground).

The upper valley of Wasson Creek also consists mainly of reed canary grass, however, is intermixed with skunk cabbage and has more shrubs, mainly red elderberry, than the Main Valley (Figure 3). Around the geologic constriction that separates the valleys, there is a plant community that is reminiscent of what the historic vegetation composition would have been. The area consists of three levels of vegetation: groundcover, shrub layer, and tree layer. Native groundcovers include American skunk cabbage (*Lysichiton americanus*), Pacific water parsley

(*Oenanthe sarmentosa*), slough sedge (*Carex obnupta*), and small-fruited bulrush (*Scirpus microcarpus*). The shrub layer consists of salmonberry (*Rubus spectabilis*), thimbleberry (*Rubus parviflorus*), red elderberry (*Sambucus racemosa*), and stink currant (*Ribes bracteosum*). Trees include red alder (*Alnus rubra*), cascara (*Rhamnus purshiana*), big leaf maple (*Acer macrophylla*), Sitka spruce (*Picea sitchensis*), and western hemlock (*Tsuga heterophylla*). This species composition provides an excellent example of what to strive for with revegetating the main valley of Wasson Creek and provides a seed collection and cuttings source.



Figure 3: Upper Valley showing 75% reed canary grass mixed with skunk cabbage and red elderberry.

### **Invasive Plant Management**

Reed canary grass (*Phalaris arundinacea*), the dominant invasive species, is a sod-forming, perennial grass and is found in abundance in the Wasson Creek basin. Reed canary grass creates monocultures that displace native plant species, alter hydrology, and reduce biodiversity and habitat for wildlife. Reed canary grass also creates unstable stream banks which contribute to erosion and sediment in streams. This species can be particularly difficult to control due to multiple growth periods within a year, once in the spring and again in late summer, as well as its ability to reproduce by multiple methods (WRCGMWG 2009). These characteristics present a challenge to restoration practitioners and successful control methods vary by site. Because of this, several options for reed canary grass control in the main valley and the upper valley are detailed here. Mechanical, manual, and overplanting methods will be used with a potential for isolated chemical control in the event that other methods do not meet project needs. Due to expected use of plant materials and other Reserve objectives (e.g. pollinator habitat) chemical use will be avoided as much as possible and limited to localized application only when necessary (e.g. no broad over spraying). Aquatic approved glyphosate (AquaMaster, AquaNeat, AquaPro) is the recommended herbicide. Glyphosate is a broad-spectrum herbicide and should be used in monocultures. The herbicide will be mixed with a surfactant (Agri-Dex, LI-700). Herbicide application procedures will follow the Project Design Criteria outlined in SLOPES V Restoration Programmatic (Attachment A).

### **Upper Valley (5 acres)**

The upper valley of Wasson Creek is approximately 5 acres and consists of about 75% reed canary grass (Figure 2). At the eastern end of the valley, the vegetation is mixed with native



species but quickly turns to a monoculture of reed canary grass. Due to access issues, heavy equipment cannot be used in the upper valley. Therefore, reed canary grass management will consist of hand held brush cutters and over planting with shrubs at high densities. The shrub planting will be done in two phases, 1) initial shrub plantings will follow an experimental design approach and 2) follow up planting will cover the remainder of the management area and use cuttings from initial planting. Based on management recommendation from restoration practitioners (e.g. Lummi Nation Wetland and Habitat Mitigation Bank, Fivemile-Bell Restoration) planting sites will be cleared of reed canary grass using brush cutters in Sept./Oct. and planted with willow and other shrub species at high densities (11,00 on 10-ft centers).

Phase 1: Four experimental methods will be applied at permanent vegetation plots in year 1, including 1) brush cutting + willow, 2) brush cutting + mix of willow and other native shrubs, 3) no site prep + willow, and 4) no site prep + mix of willow and other native shrubs. Native shrubs may include red elderberry (*Sambucus racemosa*), spirea (*Spiraea douglasii*) and twinberry (*Lonicera involucrate*). Each planting site will center around an existing 6m (19 ft) diameter vegetation monitoring plot, where possible, and be replicated in a randomized design with 3 replicates per treatment (total of 12 plots). Site prep treatments will receive follow-up brush cutting management in June the following year and all plantings will be sprayed with PlantSkydd, a natural herbivore repellent. This initial planting design is intended to both guide future plantings and provide harvest material for the remainder of the Upper Valley. Consequently, it is important that species and genetic representation is as diverse as possible in these first plantings.

Phase 2: Once initial shrub plantings have grown for three years cutting will be taken to plant in the remainder of the valley (see Willow Planting Prescription section p. 16). Cuttings from initial plantings will be supplemented with cuttings from outside the valley as need. Results from the phase 1 experiment will guide the planting plan for the remainder of the Upper Valley.

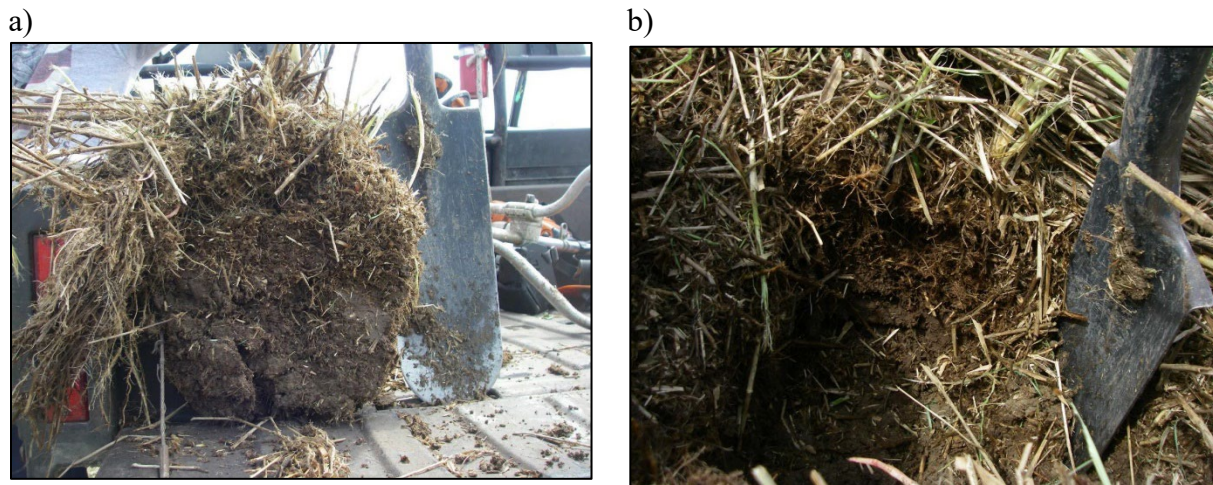
This staggered method will allow for a multi-aged population, reduce transportation of cuttings into the remote location and allow for a manageable population size to be protected during early establishment.

### **Main Valley (17 acres)**

The main Wasson Creek valley is approximately 17 acres, of which about 75% is reed canary grass (Figure 2.a.). Some patches of reed canary grass are mixed with native sedges and rushes while in most places it forms a dense monoculture. Care will be taken not to harm native species as these populations may be used as plant plug and seed source for revegetation efforts following control. The Main Valley Upper management area has year-round saturated soils and a braided stream, making it impossible for heavy machinery to be used. Management of reed canary grass in this area follows the Upper Valley planting plan, described above.

In the Main Valley Middle and Lower management areas reed canary grass will be mowed then scraped, as part of the valley grading outlined in Appendix B, Floodplain Hydrological

Restoration Plan. Reed canary grass stands will be mowed in early spring using a brush-hog or large industrial mowers before the grass reaches over 2-ft tall. Once the site is cleared for earthwork, the valley will be scraped down to the base of the reed canary grass roots (approx. 12-18-in; Figure 4) in preparation for planting. This will remove much of the remaining reed canary grass material as well as a significant portion of the seedbank. Consequently, the amount of regrowth will be reduced which will lessen the need for and amount of localized spot spraying applied to the site. The removed material will be stockpiled near the existing channel and ditches to be used as fill. This fill will be placed upside down and covered with material removed from the new channel which should have little to no reed canary grass in it. Any excess fill will be trucked out of the project site and disposed of at a designated dump location. Fill areas will be monitored for five years post-restoration to eliminate reed canary grass reestablishment. Follow up management may include additional shrub plantings, brush cutting to allow competing vegetation to establish, or if no other management is successful then a chemical application (see Attachment A: Slopes V Restoration Programmatic).



*Figure 4: a) Reed canary grass sod removed from a wetland on Larson Slough by Coos Watershed Association staff; this sod ball is about 18-in. deep and b) ground where previous reed canary grass sod ball was removed.*

There are isolated, but dense patches, of Himalayan blackberry in the sloped areas on the northeastern corner of the valley (Figure 1). Mechanical removal in this area is challenging and the project will utilize goat browsing as an alternative management strategy. Goat services will be contracted out and emphasis on containing them in target areas is the highest priority. Cleared areas will then be planted with competing native vegetation, including willow and other shrubs, that will shade out reed canary grass. See revegetation section below.

## **Revegetation**

### **Desired plant communities**

This restoration project aims to re-establish three general types of plant communities, 1) freshwater wetland, 2) riparian forest edge, and 3) forested tidal swamp. Reference sites in the South Slough watershed include Tom's Creek freshwater wetland and Winchester Creek Spruce forested tidal swamp (Figure 5). This planting plan is modified from several local restoration

projects including the Anderson Creek Restoration Project completed in 2002-03 by South Slough NERR and the Coos Watershed Association, the Matson Creek Restoration Project implemented in 2015 by the Coos Bay North Bend Water Board and Sol Coast Consulting & Design, the Fivemile-Bell Restoration Project implementation by the Siuslaw National Forest Service and Siuslaw Watershed Council, and the Ross Slough Restoration Project which will be implemented in 2016-17 by the Coos Watershed Association. All these projects are within the Coos watershed, except for the Fivemile-Bell project in the Siuslaw watershed and have similarities to the Wasson Creek restoration plan. This revegetation plan will establish native riparian, freshwater wetland, and Sitka spruce forested tidal swamp species which will provide several benefits to the Wasson Creek sub-basin including riparian vegetation structure, species diversity, vegetative ground cover, sediment accumulation, nutrient cycling, large wood recruitment, shade to cool stream temperatures, blue carbon storage, ongoing invasive species management, and beaver resources. This plan is designed to provide native vegetation with a significant head start on the potential recolonization of the site by non-native grasses and forbs during and after restoration activities. Plant establishment activities will need to take place for five years after the initial planting. Where necessary plant survival rate will be increased by using weed-whackers to release individual trees and shrubs from competing vegetation and protected with PlantSkydd, a natural herbivore repellent.



a)



b)



*Figure 5: Reference sites within the South Slough Reserve for the a) freshwater wetland, Tom's Creek, and b) spruce forested swamp plant community types.*

Table 1 details the species selected for revegetation due to their historic presence in the valley, their success in similar restoration projects, plant associations described by Christy (2004), and their cultural value. Planting material type, location, size, and spacing was determined by success in similar projects as well as the recommendations described in the *Oregon Coast Riparian Silviculture Guide* (Massingill 2003) and *Propagation of Pacific Northwest Native Plants* (Rose et. al. 1998).

*Table 1: Native species that may be planted in the Wasson Creek Main Valley, including information on planting material (seeds, plant plugs, tubers, bareroot, cutting), planting locations, plant or plug size, and spacing or seeding rate.*

| Species                                                                | Planting Material | Planting Locations           | Size                           | Spacing/Seeding Rate                          |
|------------------------------------------------------------------------|-------------------|------------------------------|--------------------------------|-----------------------------------------------|
| <b>Forbs</b>                                                           |                   |                              |                                |                                               |
| Common camas ( <i>Camassia quamash</i> )                               | Bulb/plug         | Valley floor                 | N/A                            | 2'x2'                                         |
| Gumweed ( <i>Grindelia integrifolia</i> )                              | Seed              | Valley floor                 | N/A                            | 0.25lb/acre                                   |
| Pacific silverweed ( <i>Potentilla anserina</i> ssp. <i>pacifica</i> ) | Plug              | Valley floor                 | Plug                           | 2'x2'                                         |
| Tiger lily ( <i>Lilium columbianum</i> )                               | Plug              | Edge habitat                 | N/A                            | Depends on planting location                  |
| Wapato ( <i>Sagittaria latifolia</i> )                                 | Tuber             | In-stream - low flowsites    | N/A                            | Depends on planting location                  |
| <b>Monocots</b>                                                        |                   |                              |                                |                                               |
| Common threesquare ( <i>Schoenoplectus pungens</i> )                   | Plug              | Valley floor                 | Plug                           | 2'x2'                                         |
| Slough sedge ( <i>Carex obnupta</i> )                                  | Plug/seed         | Valley floor                 | 6"x6", if wild collected       | 2'x2'/Seed introduced in "slough sedge straw" |
| Small-fruited bulrush ( <i>Scirpus microcarpus</i> )                   | Plug/seed         | Valley floor                 | 6"x6", if wild collected       | 2'x2'/0.5lb/acre                              |
| Soft rush ( <i>Juncus effusus</i> )                                    | Plug/seed         | Valley floor                 | plug, 6"x6", if wild collected | 2'x2'/0.5lb/acre                              |
| Tufted hairgrass ( <i>Deschampsia cespitosa</i> )                      | Plug/seed         | Valley floor                 | Plug                           | 2'x2'/1lb/acre                                |
| <b>Shrubs/Trees</b>                                                    |                   |                              |                                |                                               |
| Beaked hazel ( <i>Corylus cornuta</i> )                                | Plug              | Edge habitat/stream bank     | 3-4'                           | 8'x8'                                         |
| Big leaf maple ( <i>Acer macrophyllum</i> )                            | Plug              | Edge habitat                 | 3-4'                           | 8'x8'                                         |
| Red osier dogwood ( <i>Cornus sericea</i> )                            | Cutting           | Stream bank/forested wetland | 4-6'                           | 3'x3'                                         |
| Red elderberry ( <i>Sambucus racemosa</i> )                            | Bareroot          | Riparian                     | 3-4'                           | 3'x3'                                         |
| Indian plum ( <i>Oemleria cerasiformis</i> )                           | Bareroot          | Riparian                     | 3-4'                           | 3'x3'                                         |
| Nootka rose ( <i>Rosa nutkana</i> )                                    | Bareroot          | Forested wetland             | 2-3'                           | 3'x3'                                         |
| Oceanspray ( <i>Holodiscus discolor</i> )                              | Bareroot          | Edge habitat                 | 3-4'                           | 8'x8'                                         |
| Pacific crabapple ( <i>Malus/Pyrus fusca</i> )                         | Bareroot          | Riparian/forested wetland    | 3-4'                           | 8'x8'                                         |
| Twinberry ( <i>Lonicera involucrata</i> )                              | Cutting           | Valley floor                 | 4-6'                           | 3'x3'                                         |
| Sitka spruce ( <i>Picea sitchensis</i> )                               | Bareroot          | Riparian/forested wetland    | 3-4'                           | 8'x8'                                         |
| Vine maple ( <i>Acer circinatum</i> )                                  | Plug              | Riparian/forested wetland    | 3-4'                           | 8'x8'                                         |
| Willow ( <i>Salix</i> sp.)                                             | Cutting           | Stream bank                  | 4-6'                           | 1'x1'                                         |
| Western red cedar ( <i>Thuja plicata</i> )                             | Bareroot          | Edge habitat                 | 3-4'                           | 8'x8'                                         |
| Western hemlock ( <i>Tsuga menziesii</i> )                             | Bareroot          | Edge habitat                 | 3-4'                           | 8'x8'                                         |

The species outlined in Table 2 were selected for their cultural value and were recommended by the Coquille Tribe and the Confederated Tribe of the Coos, Lower Umpqua, and Siuslaw Indians and described in *Ethnobotany of the Coos, Lower Umpqua, and Siuslaw Indians* (Phillips 2016).

*Table 2: Cultural plants for Wasson Creek revegetation*

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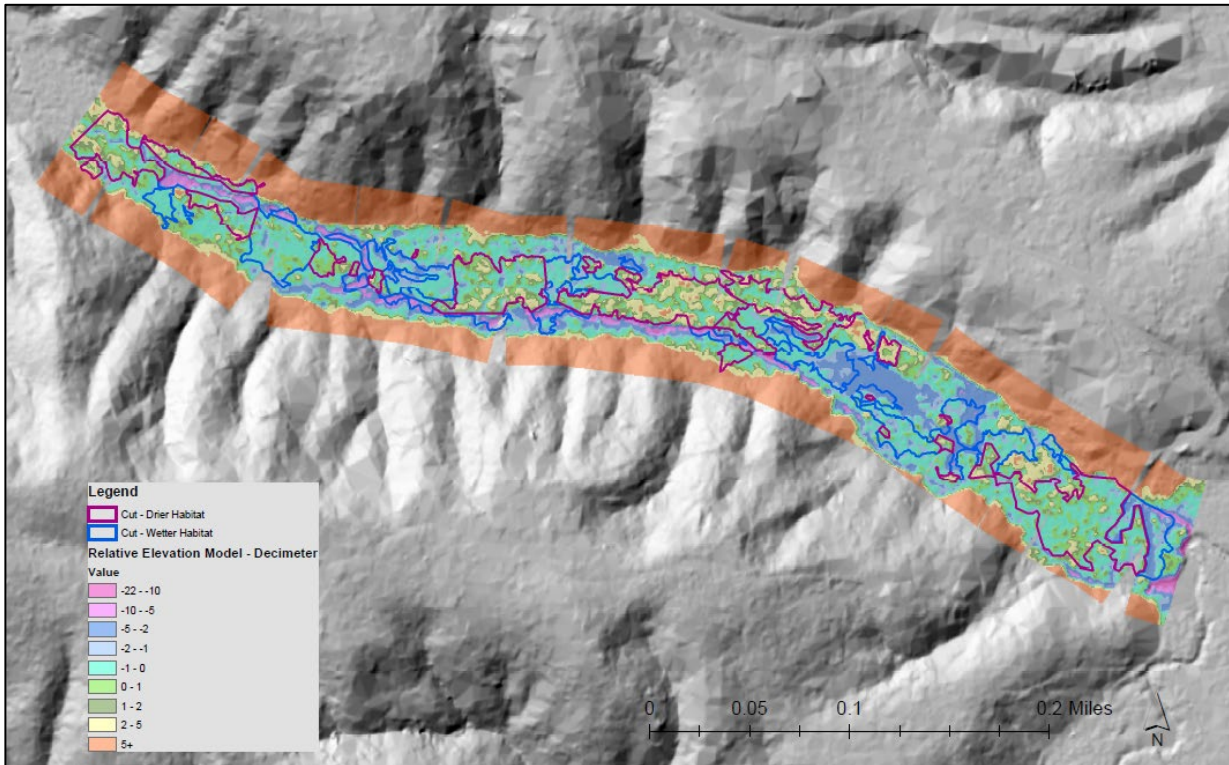
|                                                      |
|------------------------------------------------------|
| Big leaf maple ( <i>Acer macrophyllum</i> )          |
| Common camas ( <i>Camassia quamash</i> )             |
| Gumweed ( <i>Grindelia integrifolia</i> )            |
| Oceanspray ( <i>Holodiscus discolor</i> )            |
| Oregon ash ( <i>Fraxinus latifolia</i> )             |
| Pacific crabapple ( <i>Malus/Pyrus fusca</i> )       |
| Sitka spruce ( <i>Picea sitchensis</i> )             |
| Small-fruited bulrush ( <i>Scirpus microcarpus</i> ) |
| 3-square bulrush ( <i>Schoenoplectus pungens</i> )   |
| Tiger lily ( <i>Lilium columbianum</i> )             |
| Wapato ( <i>Sagittaria latifolia</i> )               |
| Western hemlock ( <i>Tsuga menziesii</i> )           |
| Western red cedar ( <i>Thuja plicata</i> )           |
| Willow ( <i>Salix</i> sp.)                           |

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### **Planting zones**

Different hydrological conditions, invasive plant management needs and habitat types will drive native species plantings in the Wasson Main Valley. Diverse wetlands will be reestablished throughout the valley floor, forested swamps will be expanded in tidal areas and coastal fens, riparian vegetation will provide a transition between wetlands and upland forests, and willows will be used for reed canary grass management as needed. A relative elevation model, created by the US Forest Service, will guide finer scale planting plans (Figure 6). Where reed canary grass is excavated and the valley floor graded, existing topography may result in wetter and dryer areas (Figure 6); for example, willow galleries may be planted in drier areas, while wetter areas with pooling may be suitable for wapato.





*Figure 6: Relative elevation model delineating scraped areas for reed canary grass management (cut) that will have a slightly higher elevation (light greens and yellows, drier habitat) and lower elevation (darker blues, wetter habitat). Current incised areas (pinks, constructed ditches) will be filled, except for in lower reaches (eastern edge) where beaver dam analogs will be installed. Modeling and map created by Kacey Largent (USFS).*

### **Wetlands on the valley floor (Main Valley Middle)**

The goal for the valley floor revegetation is to reestablish a wetlands-stream complex similar to the Reserve's freshwater wetland reference site, Tom's Creek (Figure 5). Reference conditions include a diverse mix of native monocots (e.g. Slough sedge, broadleaf cattail, soft rush), forbs (e.g. skunk cabbage, Pacific silverweed etc.), and shrubs (e.g. Pacific rhododendron, wax myrtle, huckleberry species). The valley floor revegetation approach will therefore include a diverse species mix using seed, plugs and live stakes. Shrubs will be planted on mounds against semi-buried large wood pieces. A seed mix will be prepared with small-fruited bulrush, soft rush, and tufted hairgrass, spread using a hand spreader or a hydroseeding machine. The seed mix may need to be bulked up with a carrier (e.g. sawdust, clean sand, peat moss) to carry further. Seeds can be purchased through the Native Seed Network or collected within the Coos watershed. Small-fruited bulrush, slough sedge, soft rush, tufted hairgrass, gumweed, and Pacific aster are found within the South Slough reserve and bulrush, sedge, and soft rush are found within the Matson Creek Wetland Preserve. Both sites would provide adequate sources for seed collection. No more than 10% of seeds from a large vegetation patch should be collected. Seeds should be collected and spread in the fall after channel work is completed (see timeline section, p. 22).

Slough sedge seeds should also be introduced in the form of straw. Slough sedge plants with ripe seed heads should be cut at the base and the seeds and leaves spread over the bare floodplain to aid in establishment of this species and reduce erosion.

Two types of plant plugs are available for the valley floor species: purchased from a native plant

nursery or collected in South Slough. If plugs are wild collected, they should be dug from large patches of the selected species with no more than 10% of the patch collected. For example, a 40x40-ft or 1600 ft<sup>2</sup> patch would provide 640 6x6-in. plugs. Live transplants can also be collected in 2 ft<sup>2</sup> patches and cut into 8-16 plugs with a spade. A depth of 6-in. should be sufficient to obtain adequate root mass for planting. Leaves can be clipped back to 6-10-in. before planting to allow the plant to allocate more energy into root production. Plugs should be planted as soon as possible after they are collected or can be stored in a cool, moist location prior to planting. Targeted locations for slough sedge live transplant collection will be the forested wetland areas to clear space to plant other species. Other species to be live collected include small-fruited bulrush and soft rush from locations in the Wasson and Anderson Creek floodplains. All other plug species should be purchased from a native plant nursery.

Some areas will have higher anticipated reed canary grass re-establishment, such as drier and high elevation edges and extended toe slopes. In these areas greater densities and diversity of seed mixes will be applied and will include a concentration of dense shrubs. This will increase competition and success of one or more native species. Species to be planted where reed canary grass cannot be otherwise managed (e.g. upper valley and main valley upper) include willow, red osier dogwood, red elderberry etc. These species should be planted as cuttings. Protocol for collecting and planting cuttings is described in the Willow Planting Prescription, Section IV and will also apply to other species. Most willow cuttings will come from within South Slough, although added genetic and species diversity will require cuttings from other populations in the Coos watershed. Suggested source for dogwood cuttings is Matson Creek Native Plant Nursery, if enough can't be sourced in South Slough.

Spacing for wapato (*Sagittaria latifolia*) will be determined once the channel work is completed to find appropriate locations in the channel. Wapato is most successfully transplanted by tuber. The species grows on the edges of ponds and lakes and follows curves in rivers. It prefers full sun to flower and shallow water. Wapato will most likely be planted in the wet areas at and above stream from the geologic constriction (shallow, muddy areas with some water flow). Specific sites will be determined as channel work occurs and at the time of planting based on these habitat characteristics. The quantity of wapato tubers to be planted will be based on availability from sources at time of planting.

### **Riparian edge (Upper and Main Valleys)**

The goal of the riparian edge is to create an ecotone between the wetland-stream complex and the upland forest that provides food, resources and habitat for birds, beaver, and fish, increases shade, and provides long term sources of large wood. The wetter area will be planted with a mix of hardwoods, shrubs, and Sitka spruce. Hardwood species, including Pacific crabapple, are great for revegetating wet areas and providing food and habitat for birds. Shrub species include Indian plum, red elderberry, and Nootka rose are commonly found in lowland wet meadows and riparian areas in the Coos watershed, establish quickly, and provide habitat for wildlife. Sitka spruce can withstand wet areas and will be a source for large wood recruitment in the years following restoration. All species will be planted as bareroot stock. Due to expected mortality

(e.g. beaver and elk browsing) trees and shrubs will be planted at high densities where required for reed canary grass management and assessed at three years for follow up planting or thinning as needed. Trees will be planted at 12x12-ft spacing and shrubs will be planted at 3x3-ft spacing. Trees and shrubs should be staggered to mimic the mosaic structure of a riparian buffer.

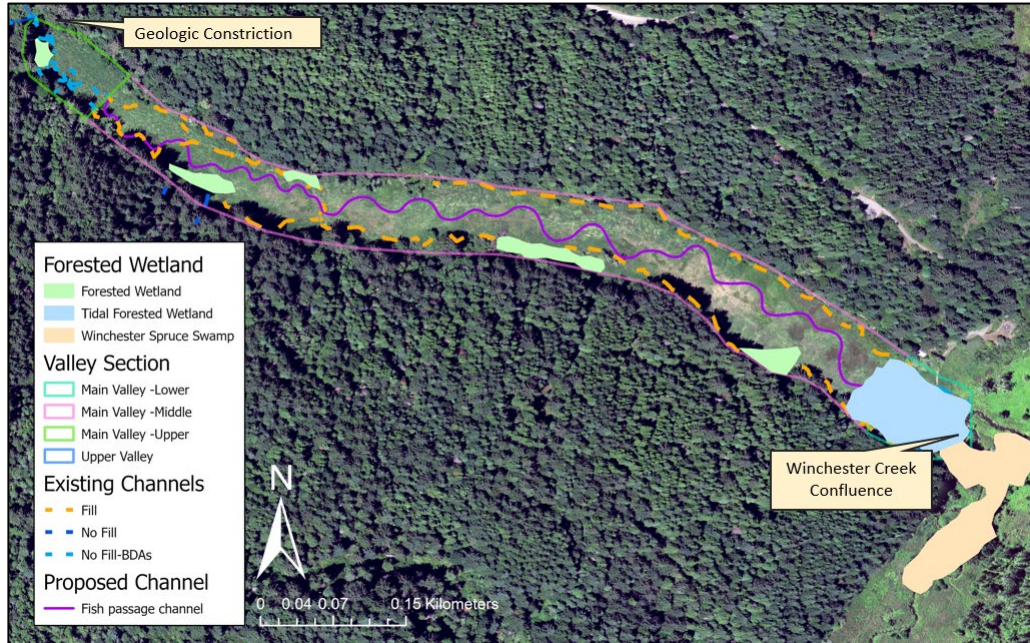
Nearest the existing forest edge Sitka spruce, western red cedar, western hemlock, oceanspray, big leaf maple, and tiger lily will be planted. Trees and shrubs will be planted as in wetter areas (as described above). Tiger lily location and spacing will be determined after valley grading. Sites with full to part sun and relatively higher elevation on the edge of the existing forest will be targeted for lily plugs. Giant chain fern (*Woodwardia fimbriata*) will be planted in suitable forested ravines on the valley edge, where they will be protected from frost. Live transplants will be donated by the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians.

### **Forested swamps (Main Valley Lower)**

Two types of forested wetlands, or spruce swamps, exist on the Oregon coast: tidal freshwater and coastal fen. Tidal freshwater swamps are found on large coastal rivers and floodplains within the zone of tidal inundation (Christy 2004). Coastal fens are found in nutrient rich lags adjacent to uplands (Christy 2004). This type of habitat is late-successional with Sitka spruce (*Picea sitchensis*) as the dominant tree and a dense shrub and herb understory. Key understory species include skunk cabbage (*Lysichiton americanus*), slough sedge (*Carex obnupta*), and salmonberry (*Rubus spectabilis*). The largest extant patch of spruce swamp in South Slough Reserve is located at the Wasson Creek confluence with Winchester Creek, just outside the project area (Figure 7a & 5b). The revegetation plan for the Main Valley Lower management area, which is within the current tidal range, is to expand the existing tidal forested swamp to high tide extent. Other areas suitable for revegetation of non-tidal forested wetlands were identified by existing old growth elderberries and slough sedge (Figure 7). Caution not to crowd out old growth elderberry will be taken, and plantings will focus on expanding existing patches.



a)



b)



Figure 7: Suitable planting areas for forested tidal swamp. a) Wasson Main Valley showing the existing Winchester spruce swamp (yellow) and tidal (blue) and non-tidal (green) potential planting areas for forested wetland revegetation. b) Old growth elderberries with slough sedge understory - an ideal site for enhancing a forested wetland by planting Sitka spruce, Pacific crabapple, and other shrubs at low densities.

Existing Sitka spruce forested swamp areas (Figure 5b) within the South Slough watershed were used for reference in this vegetation plan, as well as plant associations described in *Native*

*Freshwater Wetland Plant Associations of Northwestern Oregon* (Christy 2004) and personal communication with Laura Brophy of the Estuary Technical Group. Species to be planted include Sitka spruce (*Picea sitchensis*), Pacific crabapple (*Malus fusca*), red osier dogwood (*Cornus sericea*), Nootka rose (*Rosa nutkana*), twinberry (*Lonicera involucrata*). Several associated species will be expected to colonize naturally including skunk cabbage (*Lysichiton americanus*), red alder (*Alnus rubra*), salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccinium ovatum*), and salmonberry (*Rubus spectabilis*). In the project area, several large areas of established slough sedge exist. These areas will be the source of slough sedge transplants, seed, and straw. Spruce and other woody species will be planted on nurse cribs and large wood will be placed for future recruitment opportunities.

When planted, Sitka spruce trees will be planted at 15-ft feet apart and thinned to 30-ft at 5-10 years. Pacific crabapple trees will be placed 5' apart. Shrubs (red osier dogwood and Nootka rose) will be placed 3-ft apart. This spacing is to mimic natural spruce swamps which are found to have spruce spaced far enough apart to allow for dense understory growth. Shrubs will be planted more densely to aid in more rapid establishment of understory and shade out reed canary grass regrowth.

### **Log Crib Design**

To aid in establishment of forested wetland species, log cribs will be constructed and planted within the forested wetland zones (Main Valley Lower and Upper)(Figure 8). This style of log crib has been installed in a neighboring watershed in the Coquille Basin by the Coquille Watershed Association and Yankee Creek Forestry through funding provided by the Oregon Watershed Enhancement Board (*Leslie Wetland Wood Crib Placement*, OWEB 04-14-004, 2015). These cribs will serve as a base for planting Sitka spruce, Pacific crabapple and Nootka rose. The cribs will be constructed from conifer logs that have been removed from the forest surrounding the Wasson Creek valley, as part of the upland restoration plan (Appendix D). Six posts will be pounded into the ground and the logs will be placed within the posts to form a crib and tied together with large fiber rope. The cribs will be filled with composted wood chips which will help wick moisture to the plants. Wood chip will be from Sitka spruce removed during the upland thinning project where possible (Appendix D). Selected plants will be planted within the crib and red osier dogwood cuttings will line the outside edge of the crib to maintain location in case of flooding. Logs used for crib construction will be approx. 10-ft long and <5-in. diameter. Cribs will be haphazardly located, to mimic natural patterns, and at a density of 5-15/acre (total of 15-45 cribs).



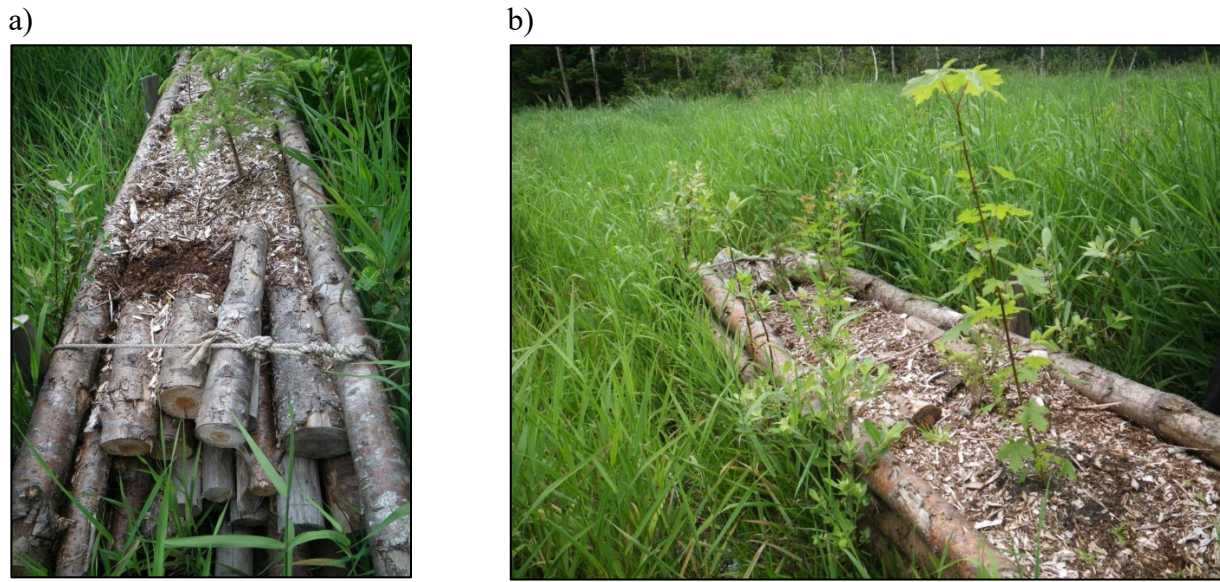


Figure 8: Log crib developed by Yankee Creek Forestry at Leslie Wetland with a) Sitka spruce and b) big leaf maple planted

### **Willow Planting Prescription**

Dense willow plantings will be essential for reed canary grass management, stream shading and beaver recruitable to aid in the restoration of the Wasson Creek sub-basin. Several willow species grow in the area including *Salix hookeriana* (Hooker's willow), *Salix lasiandra* (Pacific willow), and *Salix scouleriana* (Scouler's willow). These species will be planted at three locations: within the reed canary grass of the Upper Valley and the Main Valley Upper management areas and scattered at lower densities throughout the floodplain, focusing on areas most likely to suit reed canary grass regrowth.

Willow planting specifications follow recommendations by Hartema (2015), Kim (2006), and Massingill (2003), as well as institutional knowledge from the Coos Watershed Association and the Wasson Creek Advisory Team. Willows will be planted as live stakes or cuttings. Cuttings will be taken from locations within the lowlands of the Coos watershed with emphasis on cuttings found within the South Slough reserve to maintain local adaptations. Willow cuttings will be taken once the plants are dormant, usually between November and February. In selecting whips for cutting, stems should be between ½-2-in. in diameter and 4-6-ft long (Figure 9). Cuttings should be taken at the base of the whip or just above a node with a diagonal cut. Cuttings should be healthy, relatively straight, and have smooth bark. Willow cuttings can be placed in water for up to one week before cutting to accelerate root formation. When planted, at least 1/3 of the cutting length should be planted with preference of 1/2 of the length to be inserted (e.g., a 6-ft cutting should be planted at least 2-ft in the ground but ideally up to 3-ft, if possible). Willow cuttings should be easy to plant by pushing cuttings into the ground to desired length by hand or gently tapping with a mallet. If necessary, a pilot hole can be created using a piece of rebar and a mallet. The diagonally cut end should be placed into the ground. If tops of the cuttings have been damaged, trim off damaged portion of stem. Fill in around cuttings as necessary.





*Figure 9: Willow and red osier dogwood cuttings soaking before planting at Matson Creek Native PlantNursery (CoosWA)*

In areas of high flow willow cuttings planted along the streambank should be planted at 1' intervals. Stems should be planted at an angle with the bottom end (diagonal cut) facing upstream and the top facing downstream at about a 75° angle. This will help newly planted cuttings remain in place during high flows. If there is no water flow, cuttings can be placed straight into the ground.

### **Plant Protection**

For protection from herbivory targeted seedlings will be either sprayed with a natural herbivore repellent (e.g. PlantSkydd) or planted with a tree guard. Where possible plants will be sprayed with PlantSkydd, a natural herbivore repellent that protects plants for deer, elk and beaver for 6-months following spray. Spraying plants at Coos WA nursery 2-4 weeks ahead of planting will increase efficiency, while giving maximum protection (approx. 6 months post planting). This will improve the survival and growth of the species while limiting the number of tree guards. Where tree guards are needed, biodegradable natural products (e.g. Vigilis Tree Shelters) will be prioritized, to limit post restoration removal of plastic materials. The tubes should include the entire plant and bamboo stakes should be secured in place with zip ties at the top and bottom of the tube. Tubes will be placed around the following species: red elderberry (*Sambucus racemose*), Oregon ash (*Fraxinus latifolia*), Nootkarose (*Rosa nutkana*), oceanspray (*Holodiscus discolor*), western red cedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*).

### **Plant Material Sources and Pathogen Prevention**

Increasingly, restoration professionals are becoming aware of the risk of introduced exotic and invasive Phytophthora species. Examples of exotic Phytophthoras inadvertently introduced to Oregon's south coast include *Phytophthora ramorum* and *Phytophthora lateralis*, the pathogens that cause Sudden Oak Death and Port-Orford-cedar root disease, respectively. *Phytophthora cinnamomi* is also causing significant mortality in lone manzanita (*Arctostaphylos myrtifolia*), a rare and threatened species in California. Shipping and planting is considered the main route that exotic Phytophthoras are moved into new landscapes around the world. Recent discovery of the introduction of *Phytophthora tentaculata* into restoration plantings in California via restoration planting projects have highlighted the need to ensure that planting stock is clean and that restoration professionals use sanitation Best Management Practices (BMPs).

The following are recommendations to help reduce the introduction of exotic Phytophthoras and other pathogens into restoration sites:

- Detailed prevention guidelines regarding nursery and restoration BMPs can be found in *Preventing Phytophthora Infestations in Restoration Nurseries, A Key to Protecting Wildland Plant Communities*. <https://catalog.extension.oregonstate.edu/em9330>
- Procure plants from nurseries that follow best management practices (see OSU Extension publication, em9330).
- Consider direct seeding as an option in restoration sites with rare and threatened plants.
- Follow sanitation BMPs during restoration activities that include boot and equipment sanitation.

Table 3 shows suggested sources to obtain plant materials, although these have not yet been assessed for best management practices. Protocol to collect wild plant material (seeds and plant plugs) is described in the revegetation plan (Section III).

*Table 3: Plant material sources*

| <b>Name</b>                       | <b>Location</b>  | <b>Contact Information</b>                                               | <b>Species</b>                                                                                                                               |
|-----------------------------------|------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Anderson Creek/<br>South Slough   | Charleston,OR    |                                                                          | Cuttings - Willow, red osier dogwood. Seeds & plugs - small-fruited bulrush, soft rush, slough sedge, common threesquare. Slough sedge straw |
| Balance Restoration Nursery       | Lorane, OR       | 541-942-5530                                                             | Wetland species plugs, wapato, camas bulbs                                                                                                   |
| Brooks Tree Farm                  | Brooks, OR       | 503-393-6300                                                             | Conifers, hardwoods, shrubs                                                                                                                  |
| Champoeg Nursery                  | Aurora, OR       | 503-678-6348                                                             | Conifers, hardwoods, shrubs                                                                                                                  |
| Coquille Tribe & CTCLUSI          | Coos Bay,OR      | 541-888-9577                                                             | Wapato, camas, common threesquare, giant chain fern                                                                                          |
| L&H Seed                          | Connell,WA       | 509-234-4433                                                             | Slough sedge, tufted hairgrass, soft rush, small-fruited bulrush, Pacific aster                                                              |
| Seven Oaks Nursery                | Albany, OR       | 541-757-6520                                                             | Conifers, hardwoods, shrubs, tiger lily, camas, Douglas aster plugs, wetland plugs                                                           |
| Stillwater Natives                | Bandon, OR       | 541-260-2182                                                             | Shrubs, forbs                                                                                                                                |
| Matson Creek Native Plant Nursery | Coos Bay,OR      | 541-888-5922                                                             | Cuttings - Willow, red osier dogwood. Seeds & plugs - small-fruited bulrush, soft rush, slough sedge, common threesquare.                    |
| Native Seed Network               | Varies           | <a href="http://www.nativeseednetwork.org">www.nativeseednetwork.org</a> | Potentially all seed species, use database as needed                                                                                         |
| River Refuge Seed                 | Brownsville,OR   | 541-466-5309                                                             | Gumweed, wapato, slough sedge, tufted hairgrass, soft rush, small-fruited bulrush                                                            |
| Scholls Valley Native Nursery     | Forest Grove, OR | 503-516-9129                                                             | Conifers, hardwoods, shrubs                                                                                                                  |
| Willamette Gardens                | Corvallis,OR     | Esther 541-990-0948                                                      | Tiger lily, camas                                                                                                                            |



## **Quantities and Densities**

The quantity of each species was determined by recommendations in the *Coastal Oregon Riparian Silviculture Guide*, the Anderson Creek Restoration Project, the Fivemile-Bell Restoration Project, the Matson Creek Restoration Project, and the ODFW Aquatic Inventory and Analysis Project Habitat Benchmarks (ODFW) (Attachment B). These numbers were then boosted, particularly for the floodplain and riparian species in order to compete with any returning reed canary grass and to accelerate establishment.

*Table 4: Estimated quantity of each species for revegetation*

| <b>Species</b>                                                         | <b>Quantity</b> |
|------------------------------------------------------------------------|-----------------|
| Small-fruited bulrush ( <i>Scirpus microcarpus</i> )                   | 3800            |
| Slough sedge ( <i>Carex obnupta</i> )                                  | 3800            |
| Soft rush ( <i>Juncus effusus</i> )                                    | 3800            |
| Tufted hairgrass ( <i>Deschampsia cespitosa</i> )                      | 3800            |
| Common threesquare ( <i>Schoenoplectuspungens</i> )                    | As available    |
| Gumweed ( <i>Grindelia integrifolia</i> )                              | 3 lbs.          |
| Pacific silverweed ( <i>Potentilla anserina</i> ssp. <i>Pacifica</i> ) | 3700            |
| Common camas ( <i>Camassia quamash</i> )                               | 600             |
| Wapato ( <i>Sagittaria latifolia</i> )                                 | As available    |
| Willow ( <i>Salix</i> sp.)                                             | 5200            |
| Red osier dogwood ( <i>Cornus sericea</i> )                            | 2800            |
| Red elderberry ( <i>Sambucus racemosa</i> )                            | 2550            |
| Indian plum ( <i>Oemleria cerasiformis</i> )                           | 2550            |
| Pacific crabapple ( <i>Malus/Pyrus fusca</i> )                         | 2650            |
| Nootka rose ( <i>Rosa nutkana</i> )                                    | 100             |
| Oceanspray ( <i>Holodiscus discolor</i> )                              | 800             |
| Tiger lily ( <i>Lilium columbianum</i> )                               | 200             |
| Sitka spruce ( <i>Picea sitchensis</i> )                               | 700             |
| Western red cedar ( <i>Thuja plicata</i> )                             | 600             |
| Western hemlock ( <i>Tsuga menziesii</i> )                             | 600             |
| <b>Total</b>                                                           | <b>40,800</b>   |

## **Timeline**

*Table 5: Timeline for implementing reed canary grass control and native vegetation planting in Upper Valley (UV), Main Valley (MV) and Main Valley Lower (MVL)*

| <b>Timing</b> | <b>Management technique</b>                                                                                                                                                                                                             | <b>Management Area</b> |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>2022</b>   |                                                                                                                                                                                                                                         |                        |
| Sep./Oct.     | Site prep (i.e. brush cut RCG)                                                                                                                                                                                                          | UV                     |
| Nov./Dec.     | Willow and shrub planting in experiment and parent tree areas                                                                                                                                                                           | UV                     |
| <b>2023</b>   |                                                                                                                                                                                                                                         |                        |
| Mar.-Jul.     | Site prep (i.e. Mow RCG)                                                                                                                                                                                                                | MV                     |
| Jun.          | Willow maintenance and protection                                                                                                                                                                                                       | UV                     |
| <b>2024</b>   |                                                                                                                                                                                                                                         |                        |
| Mar.-Jul.     | Site prep (i.e. Mow RCG)                                                                                                                                                                                                                | MV                     |
| Jun.          | Willow maintenance and protection (as needed)                                                                                                                                                                                           | UV                     |
| Jun.-Sept.    | Earthwork (i.e. scrape valley and fill existing channels)                                                                                                                                                                               | MV                     |
| Sept.         | Flag populations of small-fruited bulrush, soft rush and slough sedge for plugs; collect seeds from selected species; order additional seeds as needed; once channel work is complete, spread seed and straw; spread slough sedge straw | All                    |
| Aug./Sept.    | Install log cribs                                                                                                                                                                                                                       | MV L                   |
| Oct.          | Collect and plant plugs; spread seed and straw; spread slough sedge straw; plant wapato, camas and lily bulbs                                                                                                                           |                        |
| Nov.-Dec.     | Cut willows & dogwood; plant and protect trees and shrubs                                                                                                                                                                               | MV                     |
| <b>2025</b>   |                                                                                                                                                                                                                                         |                        |
| May           | Monitor and manage RCG regrowth, as needed                                                                                                                                                                                              | MV                     |
| Sep./Oct.     | Site prep (i.e. brush cutting)                                                                                                                                                                                                          | UV                     |
| Nov./Dec.     | Willow and shrub planting in entire Upper Valley                                                                                                                                                                                        | UV                     |

### **Attachment A: SLOPES V Restoration Programmatic**

This attachment includes a copy of the SLOPES V Restoration programmatic, sections 25. Site restoration, 26. Revegetation and 27. Invasive and non-native plant control (p. 14-19).

#### **25. Site restoration.**

- a. Restore any significant disturbance of riparian vegetation, soils, stream banks or stream channel.
- b. Remove all project related waste; e.g., pick up trash, sweep roadways in the project area to avoid runoff-containing sediment, etc.
- c. Obliterate all temporary access roads, crossings, and staging areas.
- d. Loosen compacted areas of soil when necessary for revegetation or infiltration.
- e. Although no single criterion is sufficient to measure restoration success, the intent is that the following features should be present in the upland parts of the project area, within reasonable limits of natural and management variation:
  - i. Human and livestock disturbance, if any, are confined to small areas necessary for access or other special management situations.
  - ii. Areas with signs of significant past erosion are completely stabilized and healed, bare soil spaces are small and well-dispersed.
  - iii. Soil movement, such as active rills and soil deposition around plants or in small basins, is absent or slight and local.
  - iv. Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site; invasive plants are absent.
  - v. Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
  - vi. Plant litter is well distributed and effective in protecting the soil with little or no litter accumulated against vegetation as a result of active sheet erosion (“litter dams”).
  - vii. A continuous corridor of shrubs and trees appropriate to the site are present to provide shade and other habitat functions for the entire streambank.

#### **26. Revegetation.**

- a. Plant and seed disturbed areas before or at the beginning of the first growing season after construction.
- b. Use species that will achieve shade and erosion control objectives, including forb, grass, shrub, or tree species that are appropriate for the site and native to the project area or region.
- c. Short-term stabilization measures may include use of non-native sterile seed mix if native seeds are not available, weed-free certified straw, jute matting, and similar methods.
- d. When feasible, use vegetation salvaged from local areas scheduled for clearing due to development.
- e. Do not apply surface fertilizer within 50 feet of any wetland or water body.
- f. Install fencing as necessary to prevent access to revegetated sites by livestock or



- unauthorized persons.
- g. Do not use invasive or non-native species for site restoration.
  - h. Remove or control invasive plants until native plant species are well-established.
27. Invasive and non-native plant control.
- i. ***Non-herbicide methods.*** Limit vegetation removal and soil disturbance within the riparian zone by limiting the number of workers there to the minimum necessary to complete manual and mechanical plant control (*e.g.*, hand pulling, clipping, stabbing, digging, brush-cutting, mulching or heating with radiant heat, pressurized hot water, or heated foam).
  - j. ***Herbicide Label.*** Herbicide applicators must comply with all label instructions.
  - k. ***Power equipment.*** Refuel gas-powered equipment with tanks larger than 5 gallons in a vehicle staging area placed 150 feet or more from any natural waterbody, or in an isolated hazard zone such as a paved parking lot.
  - l. ***Maximum herbicide treatment area.*** For the total area treated with herbicides within riparian areas, do not exceed 10-acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6-mile reach of a stream, per year.
  - m. ***Herbicide applicator qualifications.*** Herbicides may only be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species that will cause the least impact. The applicator will be responsible for preparing and carrying out and the herbicide transportation and safely plan, as follows.
  - n. ***Herbicide transportation and safety plan.*** The applicator will prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, to take remedial actions in the event of spills, and to fully report the event.
  - o. ***Herbicides.*** The only herbicides proposed for use under this opinion are (some common trade names are shown in parentheses):<sup>10</sup>
    - i. aquatic imazapyr (*e.g.*, Habitat)
    - ii. aquatic glyphosate (*e.g.*, AquaMaster, AquaPro, Rodeo)
    - iii. aquatic triclopyr-TEA (*e.g.*, Renovate 3)
    - iv. chlorsulfuron (*e.g.*, Telar, Glean, Corsair)
    - v. clopyralid (*e.g.*, Transline)
    - vi. imazapic (*e.g.*, Plateau)
    - vii. imazapyr (*e.g.*, Arsenal, Chopper)
    - viii. metsulfuron-methyl (*e.g.*, Escort)
    - ix. picloram (*e.g.*, Tordon)
    - x. sethoxydim (*e.g.*, Poast, Vantage)
    - xi. sulfometuron-methyl (*e.g.*, Oust, Oust XP)

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<sup>10</sup> The use of trade, firm, or corporation names in this opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any product or service to the exclusion of others that may be suitable.

- p. ***Herbicide adjuvants.*** The only adjuvants proposed for use under this opinion are as follows, with mixing rates described in label instructions (Table 3). Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (*e.g.*, Roundup) will not be used.

**Table 3.** Herbicide adjuvants, trade names, and application areas.

| Adjuvant Type    | Trade Name | Application Areas |
|------------------|------------|-------------------|
| Surfactants      | Agri-Dex   | Riparian          |
|                  | LI 700     | Riparian          |
| Drift Retardants | 41-A       | Riparian          |
|                  | Vale       | Upland            |

- i. ***Herbicide carriers.*** Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil. Use of diesel oil as an herbicide carrier is prohibited.
- j. ***Herbicide mixing.*** Mix herbicides more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge.
- k. ***Dyes.*** Use a non-hazardous indicator dye (*e.g.*, Hi-Light or Dynamark™) with herbicides within 100 feet of live water. The presence of dye makes it easier to see where the herbicide has been applied and where or whether it has dripped, spilled, or leaked. Dye also makes it easier to detect missed spots, avoid spraying a plant or area more than once, and minimize over-spraying (SERA 1997).
- l. ***Spill Cleanup Kit.*** Provide a spill cleanup kit whenever herbicides are used, transported, or stored. At a minimum, cleanup kits will include, Material Safety Data Sheets, the herbicide label, emergency phone numbers, and absorbent material such as cat litter to contain spills.
- m. ***Herbicide application rates.*** Apply herbicides will be applied at the lowest effective label rates.
- n. ***Herbicide application methods.*** Apply liquid or granular forms of herbicides as follows:
- Broadcast spraying – hand held nozzles attached to back pack tanks or vehicles, or by using vehicle mounted booms.
  - Spot spraying – hand held nozzles attached to back pack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants using.
  - Hand/selective – wicking and wiping, basal bark, fill (“hack and squirt”), stem injection, cut-stump.
  - Triclopyr – will not be applied by broadcast spraying.
  - Keep the spray nozzle within 4 feet of the ground; 6 feet for spot or patch spraying more than 15 feet of the high water mark (HWM) if needed to

- treat tall vegetation.
- vi. Apply spray in swaths parallel towards the project area, away from the creek and desirable vegetation, *i.e.*, the person applying the spray will generally have their back to the creek or other sensitive resource.
- vii. Avoid unnecessary run off during cut surface, basal bark, and hack-squirt/injection applications.
- o. ***Washing spray tanks.*** Wash spray tanks 300 feet or more away from any surface water.
- p. ***Minimization of herbicide drift and leaching.*** Minimize herbicide drift and leaching will as follows:
  - i. Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour.
  - ii. Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind.
  - iii. Keep boom or spray as low as possible to reduce wind effects.
  - iv. Increase spray droplet size whenever possible by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents.
  - v. Do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit.
  - vi. Wind and other weather data will be monitored and reported for all broadcast applications.
- q. ***Rain.*** Do not apply herbicides when the soil is saturated or when a precipitation event likely to produce direct runoff to salmon bearing waters from the treated area is forecasted by the NOAA National Weather Service or other similar forecasting service within 48 hours following application. Soil-activated herbicides may follow label instructions. Do not conduct hack-squirt/injection applications during periods of heavy rainfall.
- r. ***Herbicide buffer distances.*** Observe the following no-application buffers, measured in feet and are based on herbicide formula, stream type, and application method, during herbicide applications (Table 4). Use the most conservative buffer for any herbicide included in a combination of approved herbicides. Buffer widths are in feet, measured as map distance perpendicular to the bankfull elevation for streams, the upland boundary for wetlands, or the upper bank for roadside ditches. Before herbicide application begins, flag or mark the upland boundary of each applicable herbicide buffer to ensure that all buffers are in place and functional during treatment.



**Table 4.** Herbicide buffer distances by herbicide formula, stream type, and application method.

| Herbicide                          | No Application Buffer Width (feet)                                               |               |                    |                                             |               |                    |
|------------------------------------|----------------------------------------------------------------------------------|---------------|--------------------|---------------------------------------------|---------------|--------------------|
|                                    | Streams and Roadside Ditches with flowing or standing water present and Wetlands |               |                    | Dry Streams, Roadside Ditches, and Wetlands |               |                    |
|                                    | Broadcast Spraying                                                               | Spot Spraying | Hand Selective     | Broadcast Spraying                          | Spot Spraying | Hand Selective     |
| Labeled for Aquatic Use            |                                                                                  |               |                    |                                             |               |                    |
| Aquatic Glyphosate                 | 100                                                                              | waterline     | waterline          | 50                                          | None          | none               |
| Aquatic Imazapyr                   | 100                                                                              | 15            | waterline          | 50                                          | None          | none               |
| Aquatic Triclopyr-TEA              | <b>Not Allowed</b>                                                               | 15            | waterline          | <b>Not Allowed</b>                          | None          | none               |
| Low Risk to Aquatic Organisms      |                                                                                  |               |                    |                                             |               |                    |
| Imazapic                           | 100                                                                              | 15            | bankfull elevation | 50                                          | None          | none               |
| Clopyralid                         | 100                                                                              | 15            | bankfull elevation | 50                                          | None          | none               |
| Metsulfuron-methyl                 | 100                                                                              | 15            | bankfull elevation | 50                                          | None          | none               |
| Moderate Risk to Aquatic Organisms |                                                                                  |               |                    |                                             |               |                    |
| Imazapyr                           | 100                                                                              | 50            | bankfull elevation | 50                                          | 15            | bankfull elevation |
| Sulfometuron-methyl                | 100                                                                              | 50            | 5                  | 50                                          | 15            | bankfull elevation |
| Chlorsulfuron                      | 100                                                                              | 50            | bankfull elevation | 50                                          | 15            | bankfull elevation |
| High Risk to Aquatic Organisms     |                                                                                  |               |                    |                                             |               |                    |
| Picloram                           | 100                                                                              | 50            | 50                 | 100                                         | 50            | 50                 |
| Sethoxydim                         | 100                                                                              | 50            | 50                 | 100                                         | 50            | 50                 |

### **Attachment B: Riparian Conifer Benchmarks**

Attachment C includes a copy of ODFW Aquatic Inventory and Analysis Project: Habitat Benchmarks (Table 3), highlighting riparian conifer benchmarks.

| <u>POOLS</u>                                              | <u>UNDESIRABLE</u> | <u>DESIRABLE</u> |
|-----------------------------------------------------------|--------------------|------------------|
| POOL AREA (% Total Stream Area)                           | <10                | >35              |
| POOL FREQUENCY (Channel Widths Between Pools)             | >20                | 5-8              |
| RESIDUAL POOL DEPTH (m)                                   |                    |                  |
| SMALL STREAMS (<7m width)                                 | <0.2               | >0.5             |
| MEDIUM STREAMS (≥ 7m and < 15m width)                     |                    |                  |
| LOW GRADIENT (slope <3%)                                  | <0.3               | >0.6             |
| HIGH GRADIENT (slope >3%)                                 | <0.5               | >1.0             |
| LARGE STREAMS (≥15m width)                                | <0.8               | >1.5             |
| COMPLEX POOLS (Pools w/ LWD pieces ≥3) / km               | <1.0               | >2.5             |
| <u>RIFFLES</u>                                            |                    |                  |
| WIDTH / DEPTH RATIO (Active Channel Based)                |                    |                  |
| EAST SIDE                                                 | >30                | <10              |
| WEST SIDE                                                 | >30                | <15              |
| GRAVEL (% AREA)                                           | <15                | ≥35              |
| SILT-SAND-ORGANICS (% AREA)                               |                    |                  |
| VOLCANIC PARENT MATERIAL                                  | >15                | <8               |
| SEDIMENTARY PARENT MATERIAL                               | >20                | <10              |
| CHANNEL GRADIENT <1.5%                                    | >25                | <12              |
| <u>SHADE</u> (Reach Average, Percent)                     |                    |                  |
| STREAM WIDTH <12 meters                                   |                    |                  |
| WEST SIDE                                                 | <60                | >70              |
| NORTHEAST                                                 | <50                | >60              |
| CENTRAL - SOUTHEAST                                       | <40                | >50              |
| STREAM WIDTH >12 meters                                   |                    |                  |
| WEST SIDE                                                 | <50                | >60              |
| NORTHEAST                                                 | <40                | >50              |
| CENTRAL - SOUTHEAST                                       | <30                | >40              |
| <u>LARGE WOODY DEBRIS* (15cm x 3m minimum piece size)</u> |                    |                  |
| PIECES / 100 m STREAM LENGTH                              | <10                | >20              |
| VOLUME / 100 m STREAM LENGTH                              | <20                | >30              |
| "KEY" PIECES (>60cm dia. & ≥10m long)/100m                | <1                 | >3               |
| <u>RIPARIAN CONIFERS (30m FROM BOTH SIDES CHANNEL)</u>    |                    |                  |
| NUMBER >20in dbh/ 1000ft STREAM LENGTH                    | <150               | >300             |
| NUMBER >35in dbh/ 1000ft STREAM LENGTH                    | <75                | >200             |

\* Values for Streams in Forested Basins

# **South Slough National Estuarine Research Reserve Wasson Uplands Restoration Plan**



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Stewardship Coordinator  
September 2018

Updated by Alice Yeates  
Stewardship Coordinator  
April 2021

**Charleston, Oregon**





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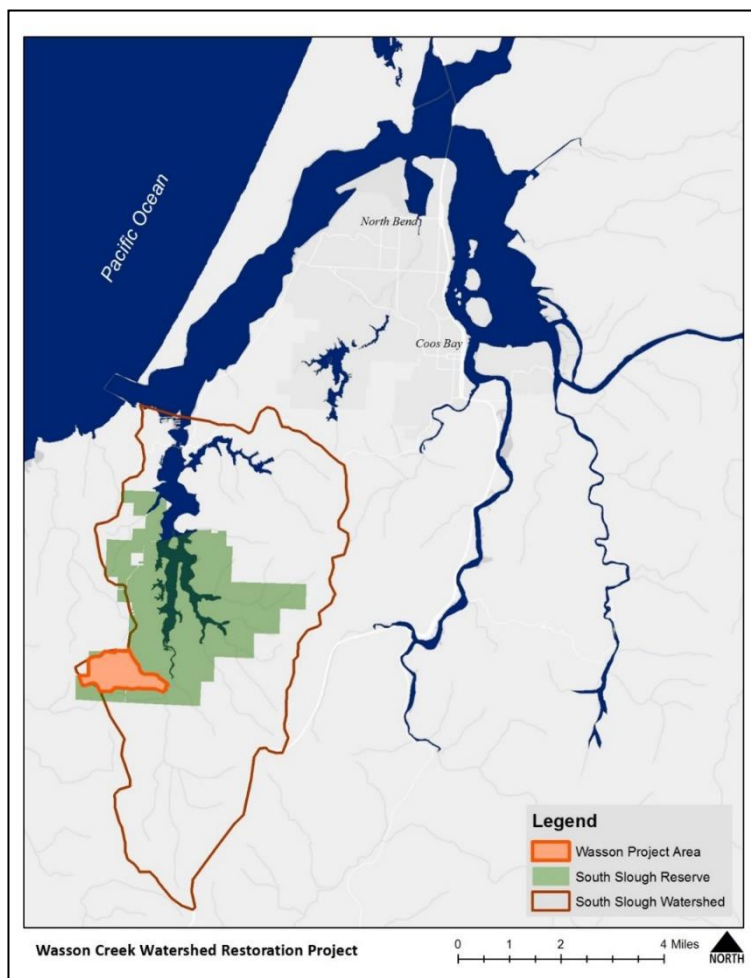
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# 1 Introduction

The Wasson Creek Watershed Project Area (PA) is 530 acres of forested uplands, palustrine wetlands, and remnant pasturelands within the South Slough of the Coos Estuary (Figure 1). The eastern half of the PA has been part of the South Slough National Estuarine Research Reserve (Reserve) since 1974, while the western portion of the PA was acquired by the Reserve in 2011. The entire Wasson PA is managed under the same management directives as all Reserve lands (ORS 273.553 through 273.558 and OAR 142-001 through 142-015); which are to maintain the integrity of the estuary, protect its natural dynamic processes, and preserve the area for long-term scientific and education uses.



*Figure 1: Wasson project area location in the South Slough Watershed*

This plan details upland ecological conditions and restoration activities for habitat restoration implementation in the PA. Restoration actions described here will be implemented to achieve site-specific restoration needs as well as Reserve-wide goals for landscape management. To inform this plan, an upland ecological inventory was conducted by collecting field data in 2015. The restoration actions detailed in this plan are based on an analysis of the site data and current restoration and ecological research.



### **Site-Specific Upland Goals Addressed in this Plan**

- Conduct an inventory of upland ecological attributes in the Wasson PA, including tree species and general size, understory, and dead wood characteristics
- Prioritize upland stands in need of active restoration
- Develop stand-specific treatments to improve forest health and heterogeneity
- Incorporate the Wasson watershed into ongoing Port-Orford-cedar (*Chamaecyparis lawsoniana*) conservation actions
- Determine road/access needs for upper watershed restoration prescriptions and evaluate the potential for eliminating remnant logging roads
- Incorporate wildfire risk planning and identify strategies to support resilient ecosystems in the case of a fire disturbance
- Determine the potential for improving spawning habitat in Wasson Creek headwater tributaries

### **Reserve-Wide Goals & Objectives Addressed in this Plan**

- Continue to build the ridgetop to estuary habitat restoration program at the Reserve
- Develop a ridgetop to estuary restoration plan for the Wasson Creek Watershed
- Assess and monitor habitats in the Coos Estuary in order to characterize conditions and changes in habitat use and availability
- Increase public awareness of Reserve stewardship practices, habitat-related research, and habitat protection
- Contribute to the scientific community in habitat restoration techniques
- Evaluate, manage, and restore habitats and ecosystem processes

In addition to these site-specific and Reserve-wide goals, this plan will augment regional restoration and planning efforts such as the 2009 Upper Watershed Restoration Action Plan, the 2017-2022 Reserve Management Plan, and the 2010 Oregon Watershed Enhancement Board's Strategic Plan.

The Wasson Uplands Restoration Plan is part of a larger planning effort to provide for holistic ridgetop to estuary restoration in the Wasson Creek Watershed. Together with the Wasson Creek Channel Design and the Wasson Creek Vegetation Restoration Plan, this plan functions to compose the ridgetop to estuary ecological restoration plan for the Wasson Creek Watershed.

## 2 Description of the Wasson Creek Project Area

### Location

The Wasson Creek Watershed is located on the South Slough inlet of the Coos Estuary on the southern Oregon coast; near the fishing port of Charleston, Oregon. The watershed drains into Winchester Creek, the largest of the two main tributaries of the South Slough (Figure 2). The Wasson Project Area (PA) is approximately 530 acres and comprised primarily of upland forest (Table 1). Within Township 26S Range 14W, Sections 34 and 35; the center of the parcel is at approximately 43.16°N, 124.20°W.

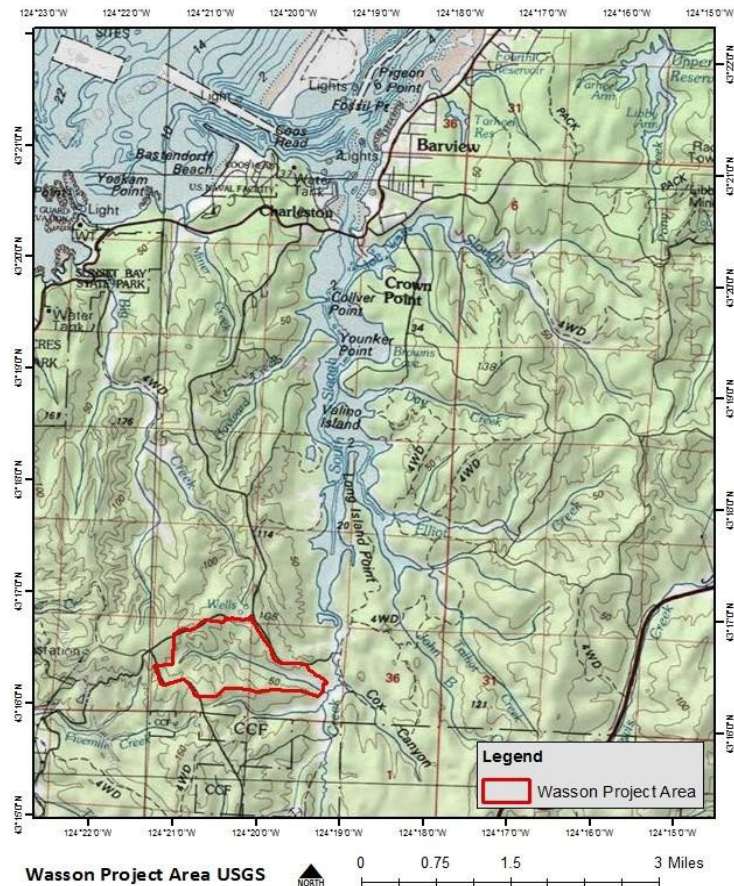


Figure 2: U.S. Geological Survey map with Wasson Project Area

Table 1: Location, size, and zoning determination of Wasson Project Area

|                                           |                         |
|-------------------------------------------|-------------------------|
| <b>Township, Range and Section</b>        | T 26S, R 14W, S 34 & 35 |
| <b>Parcel Center Latitude / Longitude</b> | 43.16° N, 124.20° W     |
| <b>Total Acres</b>                        | 530                     |
| <b>Acres of Forested Uplands</b>          | 507                     |
| <b>Zoning</b>                             | Forest                  |

## Access and Use

The PA is in the southwestern corner of the South Slough Reserve and is bounded by Seven Devils Road and Hinch Road to the north, West Beaver Hill Road to the west, Winchester Creek to the east, and a forested ridgeline to the south (Figure 3). Remnant roads from previous timber harvests provide access into the PA from these established roads, but they are in varied states of functionality. Beginning near the confluence of Wasson Creek with Winchester Creek there is a 0.5-mile loop trail that receives moderate human use. The entire watershed is open to hunting.

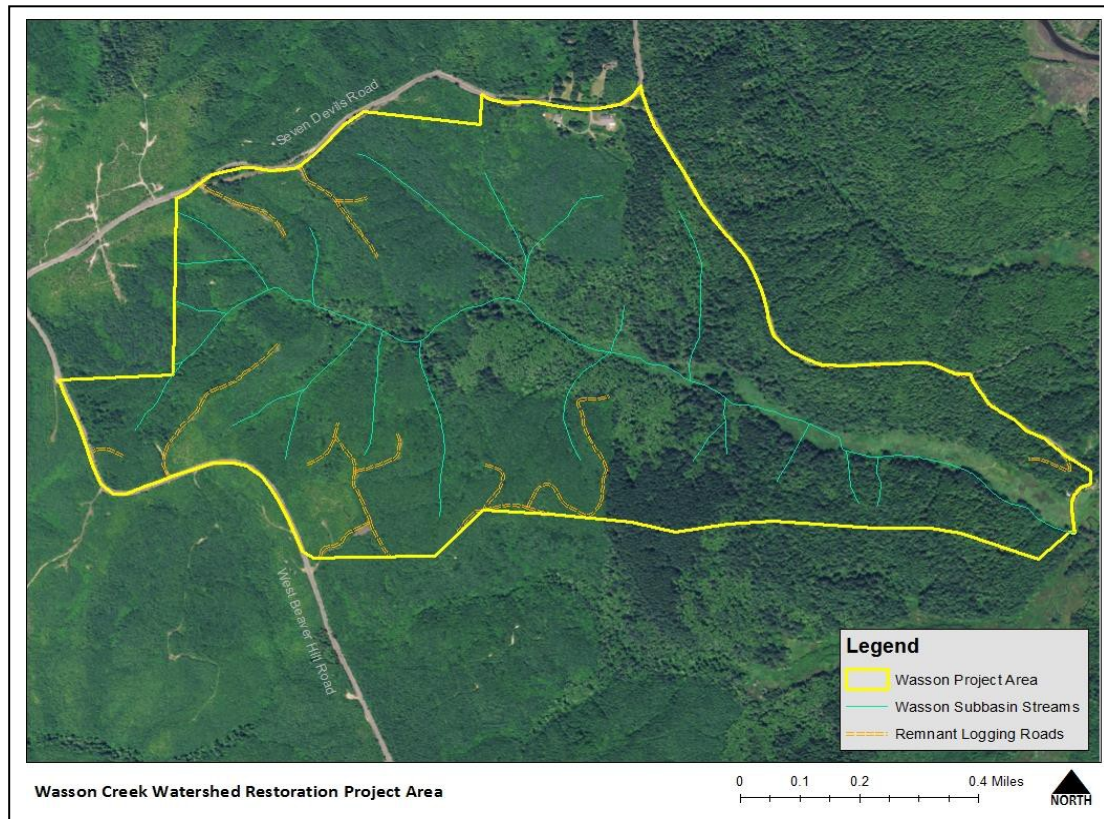


Figure 3: Road access to the Wasson Project Area

## Forest Conditions

Historically, the floodplain was composed of tidal and forested wetlands before conversion to pasture in the early 1900s. The uplands were once dominated by Sitka spruce, Port-Orford-cedar, and western hemlock, with heterogeneous stand structure and diverse understories. Successive timber harvests over the last century, without follow-up forest management (e.g. thinning), have caused the upland forests of the PA to become overly dense, closed canopy forests with few large trees and sparse understories.



## Streams

The upland reaches of the Wasson Creek Watershed include numerous fish and non-fish bearing streams. Fish bearing streams support populations of several estuarine-dependent fish species such as sea-run cutthroat trout (*Oncorhynchus clarki clarki*), Pacific Lamprey (*Entosphenus tridentatus*) and Western book lamprey (*Lampetra planeri*) (Figure 4). This watershed has the potential of supporting coho salmon (*Oncorhynchus kisutch*) and winter steelhead (*Oncorhynchus mykiss*), which are both present in Winchester Creek.

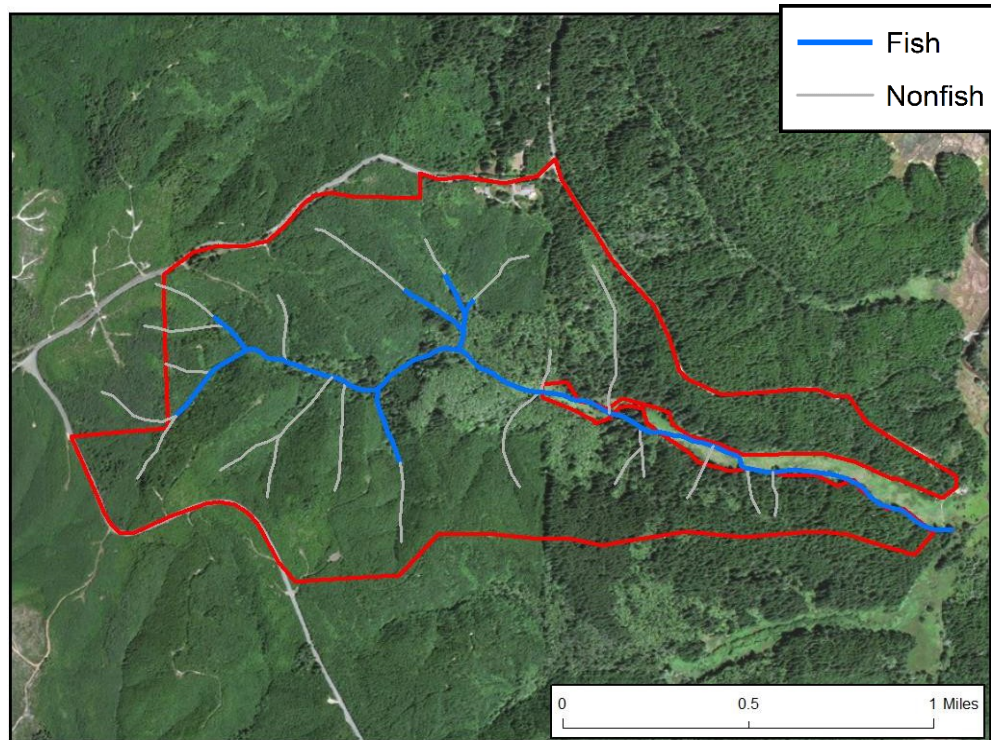


Figure 4: Fish bearing and non-fish bearing streams in the Wasson Project Area (red outline)

## Soils and Slope

Soils in the project area are comprised predominately of Templeton silt loam (Figure 5). These are deep, well drained soils present at benches, broad ridgetops and side slopes of mountains. These soils are characteristic of the western slopes of the Coast Range in the region. Slopes in the Wasson uplands range from flat to 75% or greater in some headwater regions. Information derived from digital elevation models shows there are several areas in the upper watershed of the PA that have a high likelihood of shallow landslides (Figure 6).

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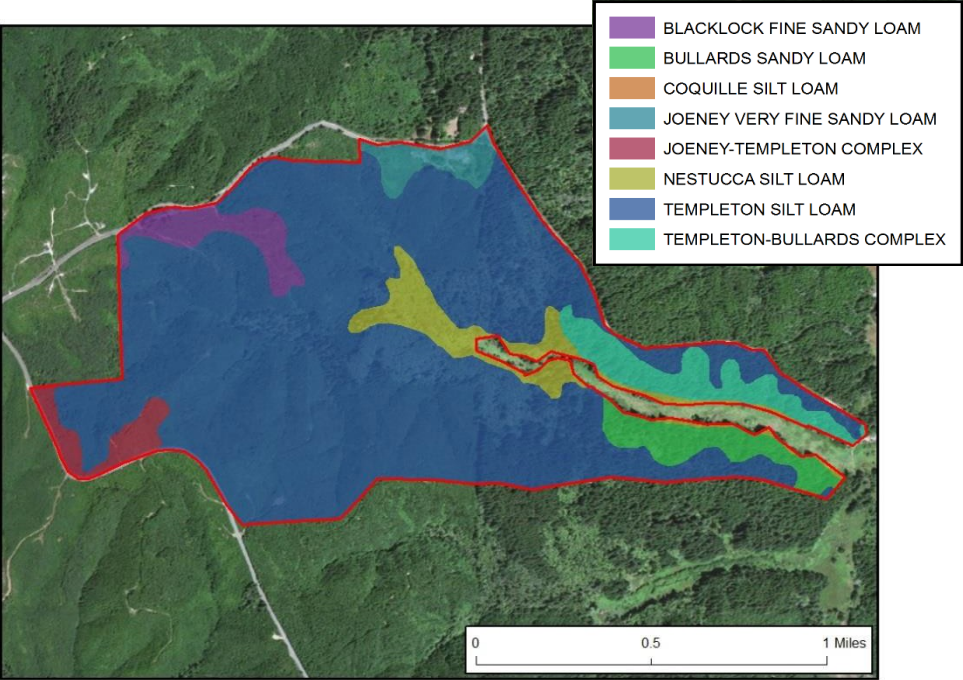


Figure 5: Soils in the Wasson Project Area

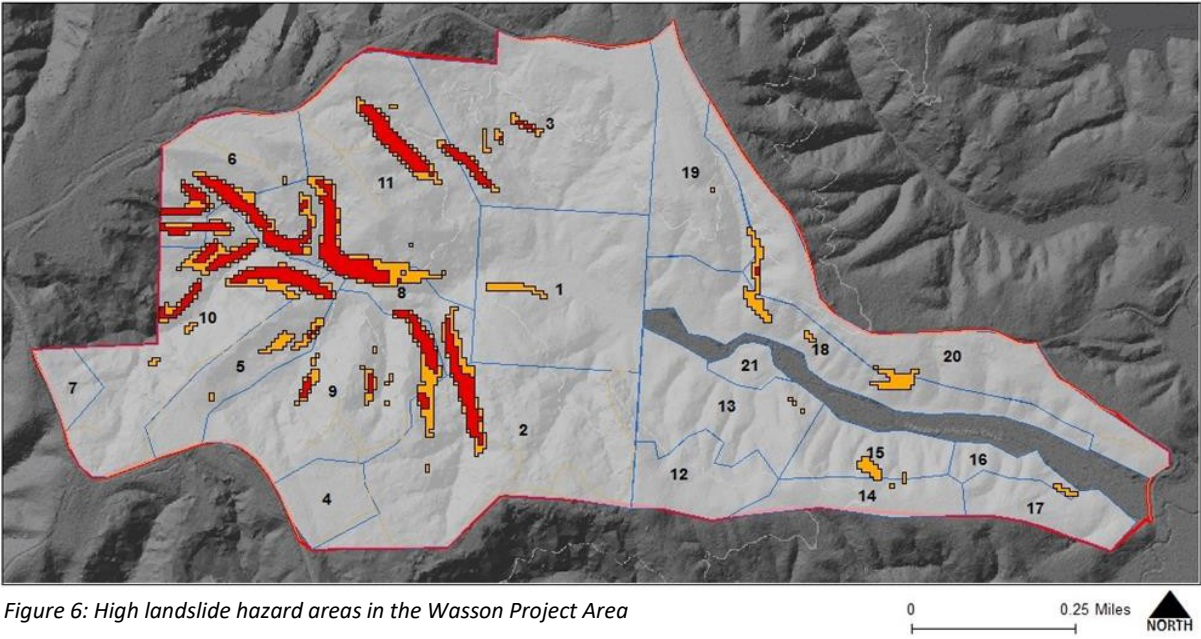


Figure 6: High landslide hazard areas in the Wasson Project Area

### 3 Overview of Reserve Uplands

The Wasson Project Area (PA) is in the *Sitka spruce zone*; a variant of the Western hemlock coastal forest type (Franklin and Dyrness, 1973). The Sitka spruce zone is characterized by its proximity to the ocean, with significant moisture delivered to uplands in the form of summer fog. Plant communities are typical of nutrient-poor, well-drained soils (Franklin and Dyrness, 1973; Schultz, 1990). Disturbance regimes in the Sitka spruce zone are characterized by infrequent stand replacing fires on intervals ranging from 200-1,000 years (Agee, 1993) and patch mortality caused by windthrow (Harcombe, 1986).

The environmental setting of the South Slough Reserve and its uplands is well summarized in other documents, namely the Site Profile of the South Slough National Estuarine Research Reserve (Rumrill, 2006) and the Upper Watershed Restoration Action Plan (Robinson, 2009). While the Reserve has acquired over 1,000 acres (including part of the PA) since these plans were completed, the overall upland assessments are still applicable and now augmented by this plan.

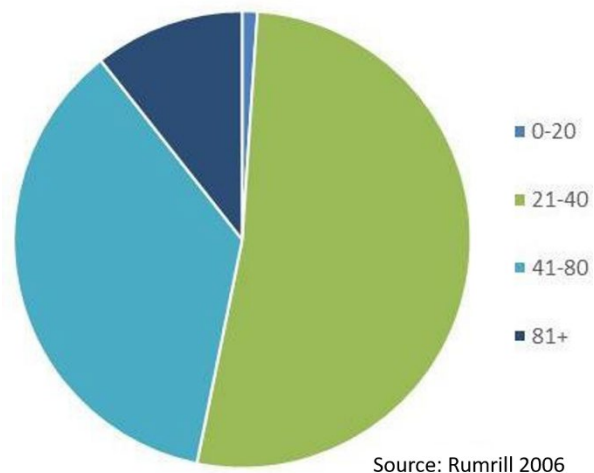


Figure 7: General forest age classes at the Reserve

Upland forests comprise ~77% of the Reserve and have not been actively

managed since the inception of the Reserve in 1974 (Cornu *et al.*, 2012; Graybill, 2006). Prior to 1974, the uplands experienced significant overstory removal (Carey *et al.*, 1991), with virtually all areas having been harvested at least once and up to three times in the past 100 years. Most uplands acquired since 2011 are less than 30 years old. Many stands were homogenously replanted, especially those acquired since 2011, and are consequently densely stocked. Overall, the uplands in the Reserve are dominated by 15-40-year-old mixed conifer trees with brushy slopes, and there are relatively few isolated stands greater than 80 years old (Figure 7). No unmanaged old growth stands remain (Graybill, 2006; Rumrill, 2006). Much of the upland forests in the Reserve need restoration thinning due to the density of remnant plantations (Sheridan, 2001).

The management directive of the Reserve is to develop late-seral stage forest habitat in the uplands (Robinson, 2009). In the Sitka spruce zone, late-seral habitats have several key components: high numbers of large trees, elevated levels of horizontal and vertical heterogeneity, foliage distributed along the boles of large trees, well-developed understory shrub and herb communities, one or more codominant tree layers, mortality caused gaps in the canopy and substantial amounts of snags and downed woody debris (Deal, 2002; Franklin *et al.*, 2002; Muir *et al.*, 2002; Peet and Christensen, 1987). This plan is focused on prioritizing stands for restoration actions that will promote the development of these desired forest conditions.



## 4 Methods

### Stand Delineation

An initial stand delineation was done using LiDAR data, Google Earth aerial imagery, and data from field assessments in the PA conducted in 2008 and preliminary data collected in early 2015 as a pilot study for this project. The imagery and LiDAR were used to characterize canopy height and age of last harvest, resulting in the delineation of 21 forest stands (Figure 8).

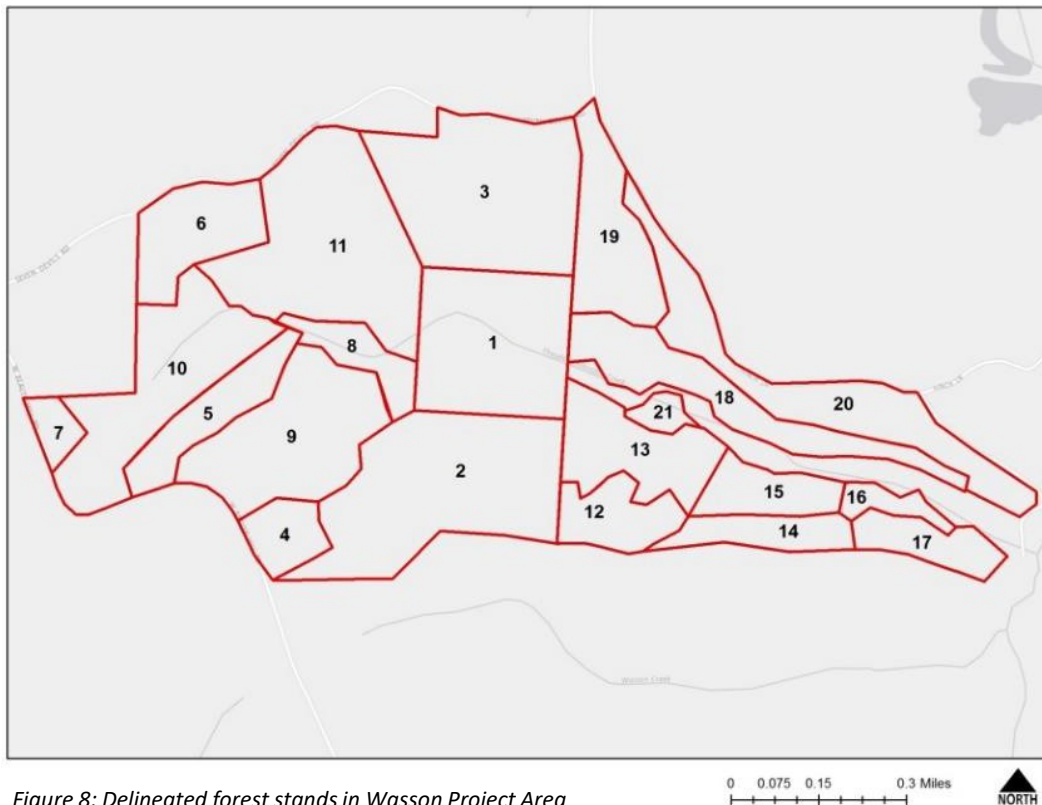


Figure 8: Delineated forest stands in Wasson Project Area

### Forest Inventory and Baseline Data Collection

A forest inventory was conducted in the PA from May through September 2015. Data were collected in 207 plots (Figure 9). Each plot was 0.05 acre with a fixed radius of 26.3 feet. Plots were spaced evenly across the PA, with one plot per 2.5 acres. In each plot, trees were recorded by species, diameter at breast height (down to 1 inch), height, position in canopy, and percent live crown.

Snag data (diameter, height, decay) was collected in each plot, along with percent cover of the top three dominating understory species. Downed woody debris was noted along a 100' transect from plot center, directionally to the next plot. Downed woody debris diameter, length and decay class were noted.

## Appendix D.

The total number of trees per acre (TPA) was calculated for each stand as follows:

*(0.05 acre) x number of plots in stand = total area sampled*

*Number of trees in area sampled/total area sampled = Trees Per Acre (TPA)*

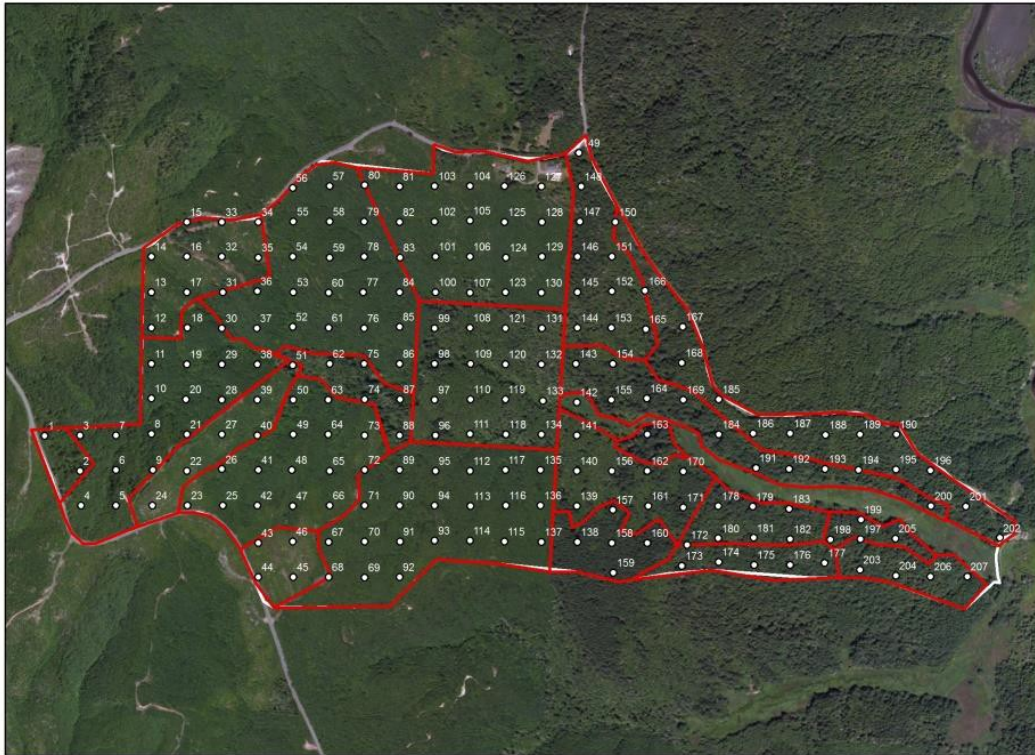
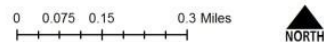


Figure 9: Forest inventory plots in the Wasson Project Area



### Restoration Prioritization

Data from the forest inventory were used to characterize the overall diversity and composition of each upland forest stand in the PA. Stands were then ranked by TPA (descending), average DBH (ascending), and maximum DBH (ascending). Land use history and aerial imagery were used to estimate the age of each stand. These parameters were then used to rank the priority level (high, mid, low) for each stand. Stands in riparian areas were classified as Riparian Management Areas and therefore excluded from prioritization. In general, young, densely stocked stands with a high TPA and relatively small DBH were classified as high priority.

## Upland Forest Modeling

The United States Forest Service Forest Vegetation Simulator (FVS) was used to model forest thinning scenarios to evaluate different thinning prescriptions (Figure 10). Data from the forest inventory were used to inform the model of current average trees per acre, species composition, and size of stand (acreage). General constraints were placed on the model to not cut big leaf maple or all of one species and to reduce levels of cascara.

Three scenarios were modeled:

1. No Action
2. Thin from below to 250 trees per acre, no species constraints (out to the year 2050)
3. Thin to 100 trees per acres, focusing on Douglas-fir removal (out to the year 2050)

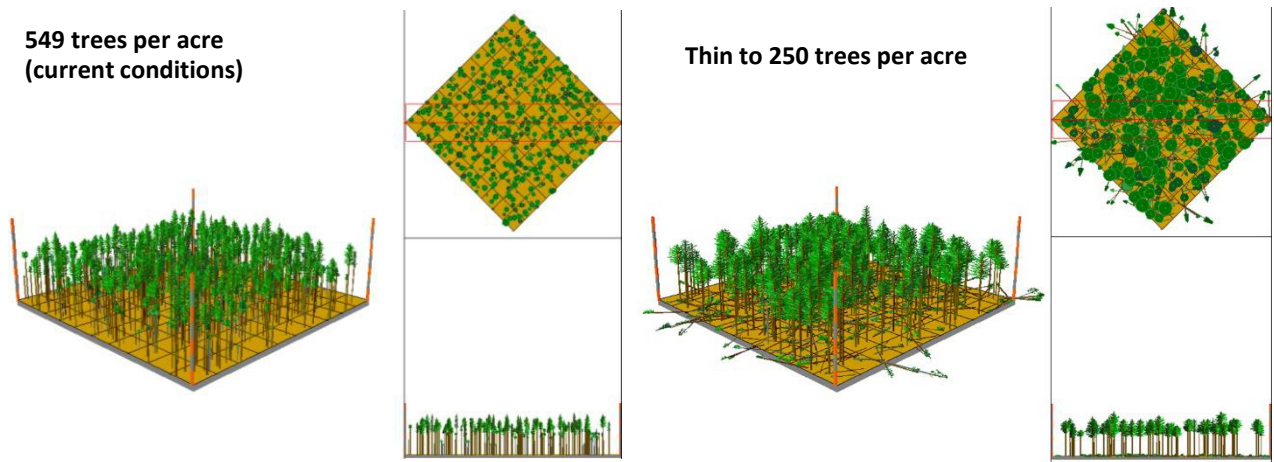


Figure 10: Example of Forest Vegetation Simulator modeling for Stand 2



## 5 Current Ecological Conditions of Wasson Project Area

### Dominant Overstory and Understory Species

The overstory plant community, across the Wasson Project Area (PA), is largely occupied by Sitka spruce and Douglas-fir. The remaining overstory community consists largely of cascara, Port-Orford-cedar and western hemlock, with very little representation of western red cedar and willow (Figure 11). The dominant understory species (incl. salmonberry, red elderberry, salal, evergreen huckleberry and sword fern) on average cover around 30% of the survey area (Figure 12).

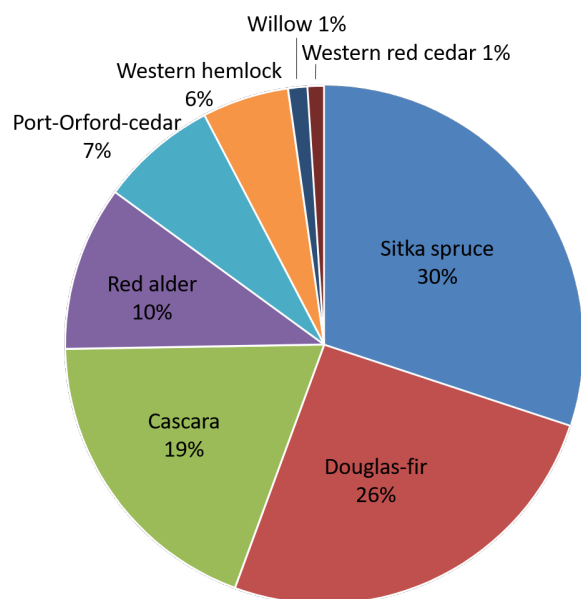


Figure 11: Percentage of overstory by individual species for the Wasson Project Area

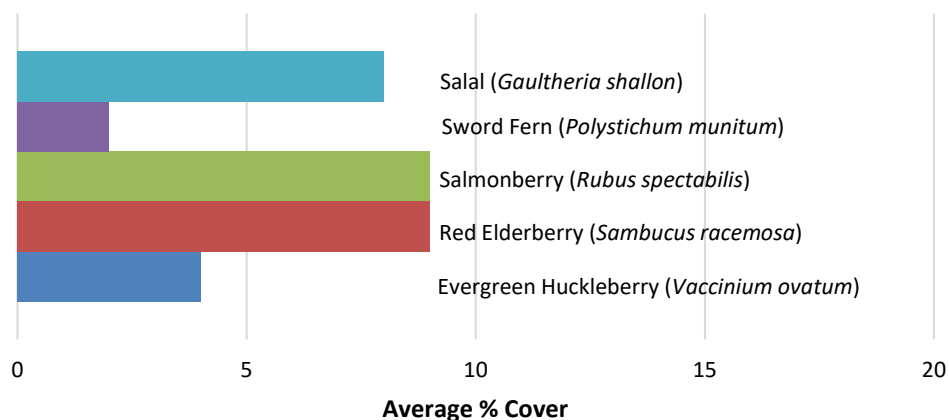


Figure 12: Average percent cover of all common understory species in the Wasson Project Area

### Stand Canopy Characteristics

One indicator of tree vigor is the percentage of tree height occupied by live crown (percent live crown). Greater percent live crown values indicate greater vigor. Average percent live crown in the PA ranged from 17-65% per stand, with over half of the stands averaging <30% (Figure 13).

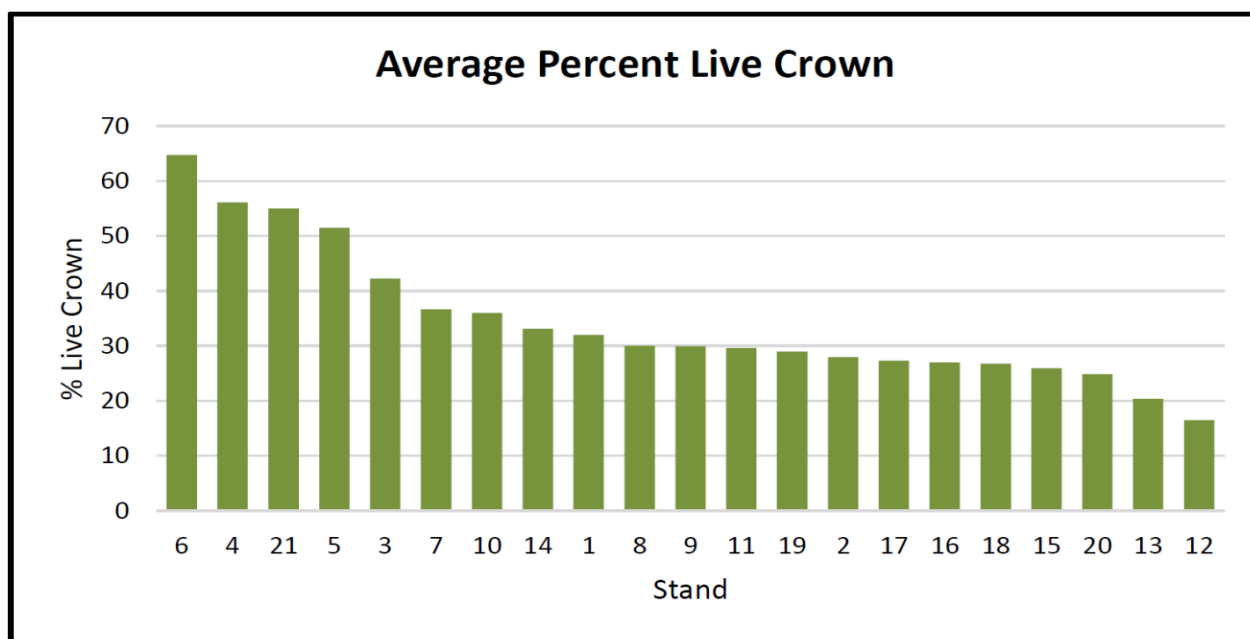


Figure 13: Average percent live crown by stand in the Wasson Project Area

### Tree Size: Diameter at Breast Height (DBH)

One measure of tree size is the stem diameter at 4.5-feet (diameter at breast height or DBH). Maximum DBH per stand ranged from 6.5-in (Stand 4) to 72.1-in (stand 18), with 51% of the plots in the 12.1-24-in range (Figure 14). For 50% of the plots average DBH was in the 5.1-10-in range (Figure 15 & 16).

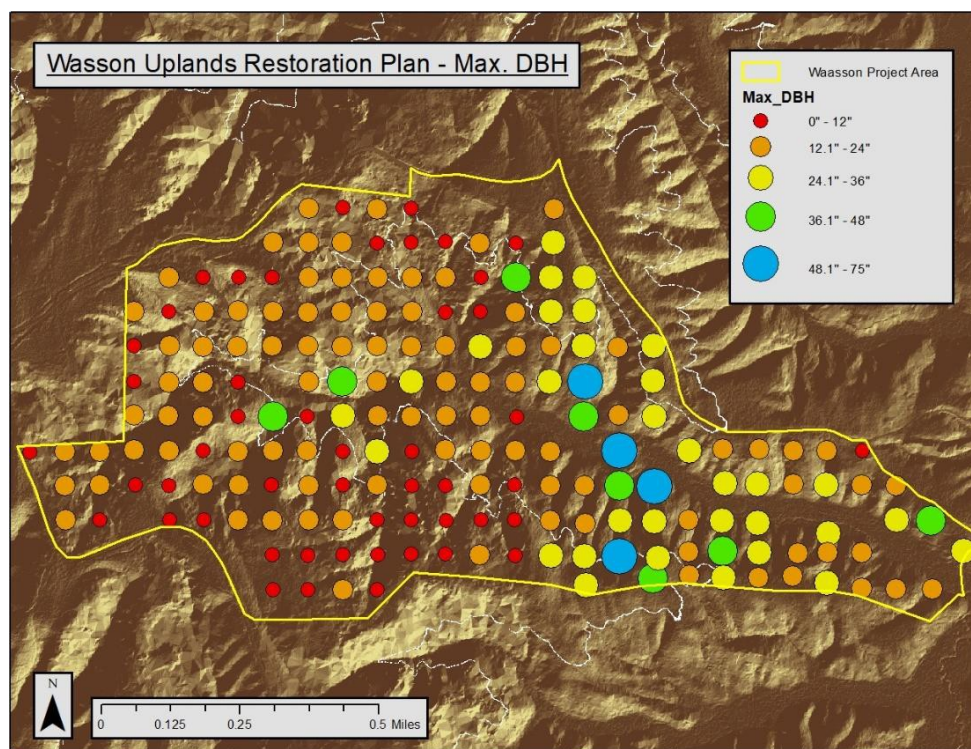


Figure 14: Maximum tree DBH at each survey plot in the Wasson Project Area

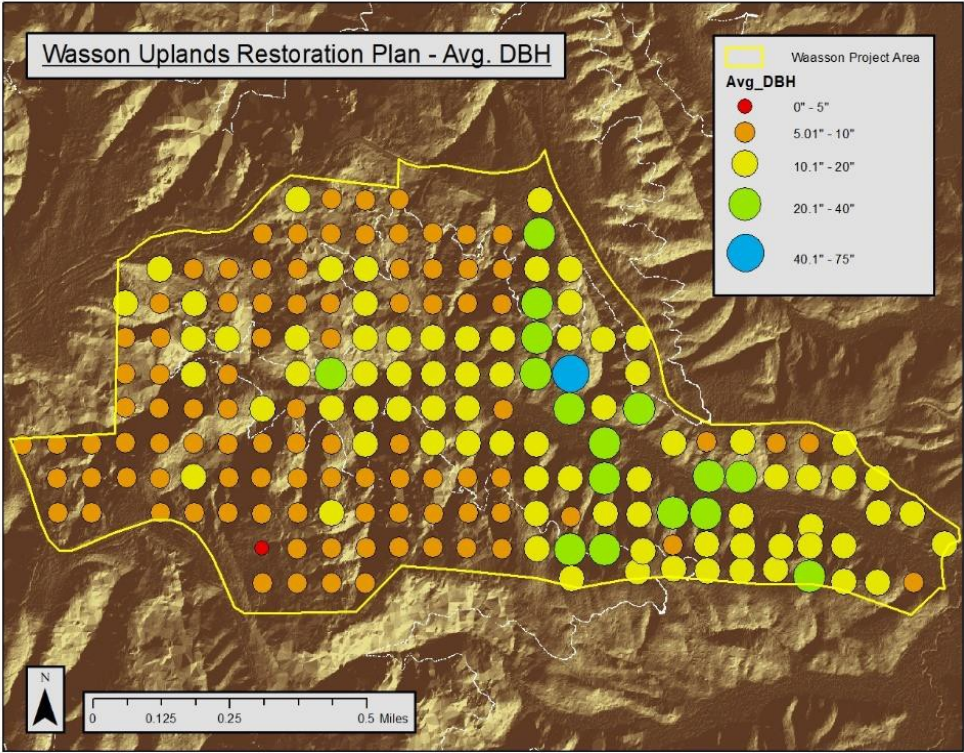


Figure 15: Average tree DBH at each survey plot in the Wasson Project Area

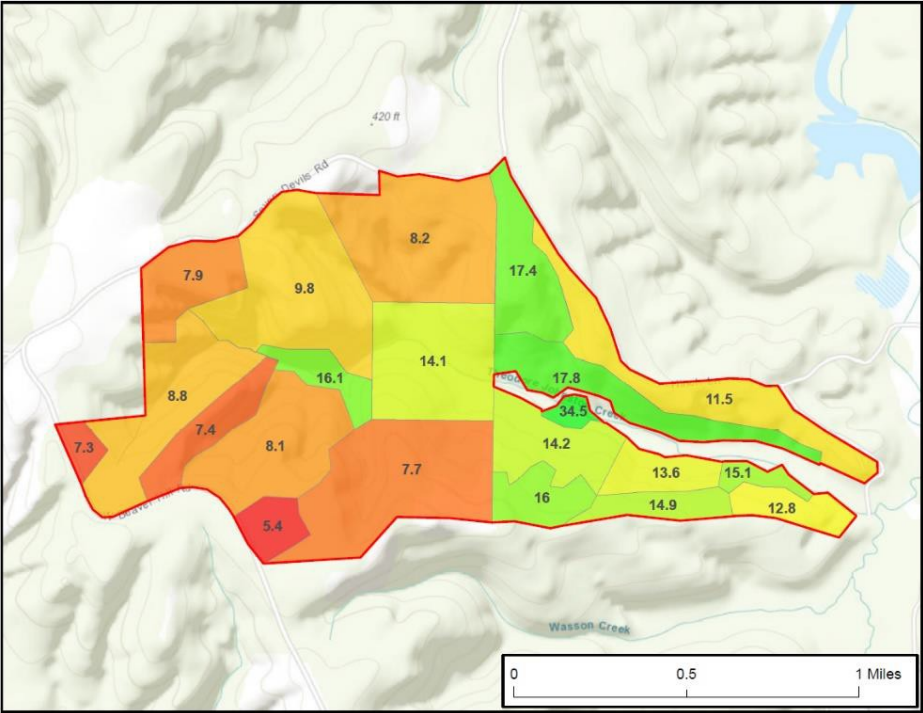


Figure 16: Average DBH in inches of stands in the Wasson Project Area



### Age of Stand

Approximate age of stands ranged from 15 to over 50 years (Figure 17). Older stands occupy the eastern portion of the PA, which has been under Reserve management since its inception.

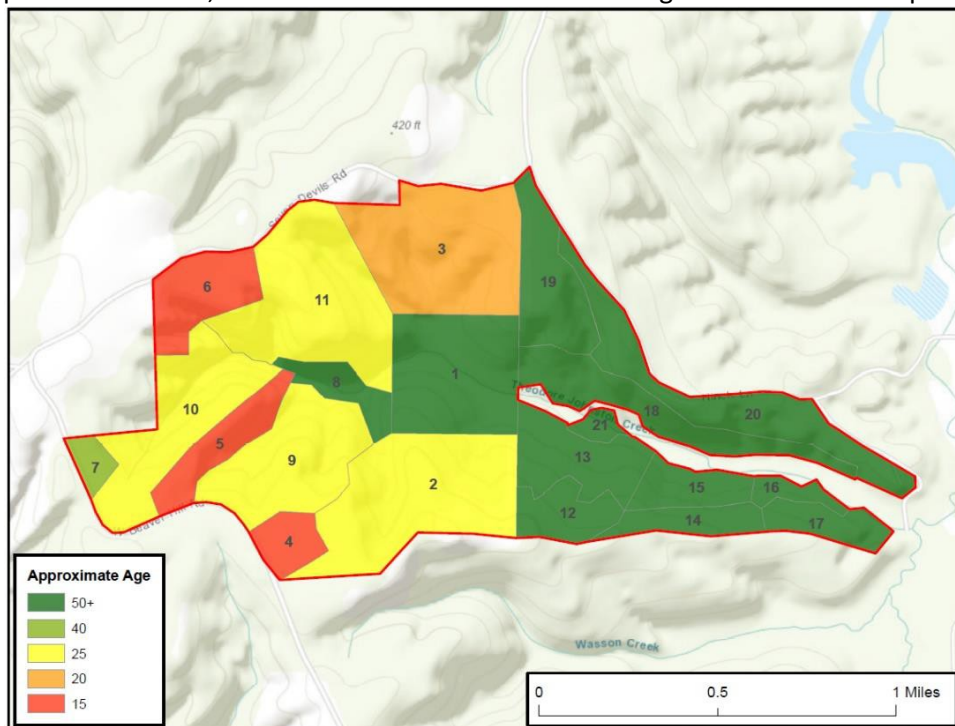


Figure 17: Estimated age of stands in the Wasson Project Area

### Density: Trees Per Acre (TPA)

High tree density dominate the western portion of the PA, with stand averages up to 395 TPA (Figure 18&19). As stem diameters <4-in DBH were excluded from analysis some stands may have much greater densities.

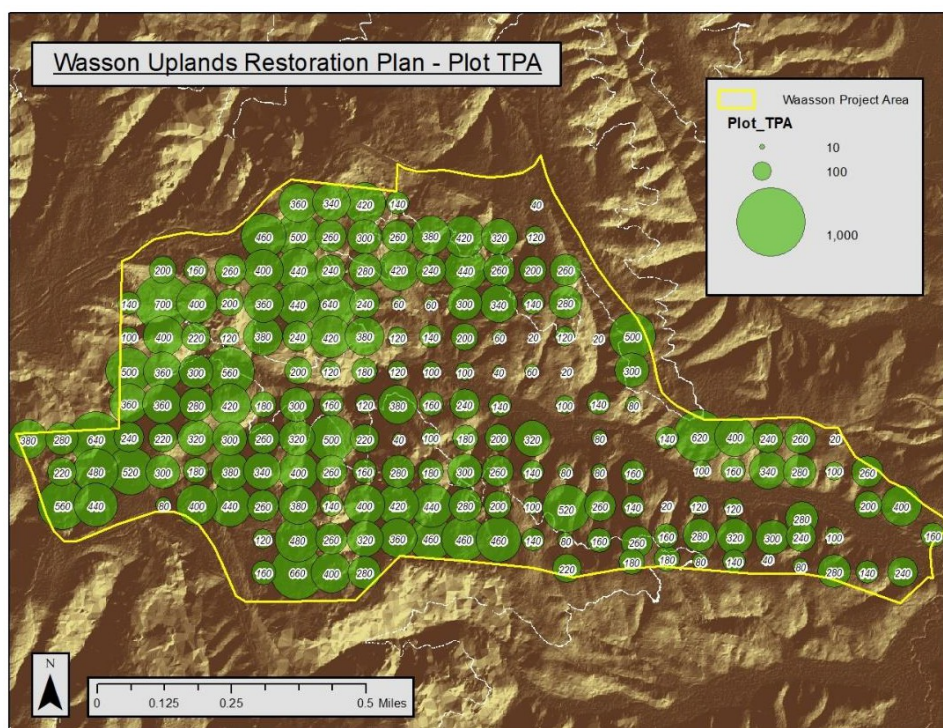


Figure 18: Trees per acre at each survey plot in the Wasson Project Area

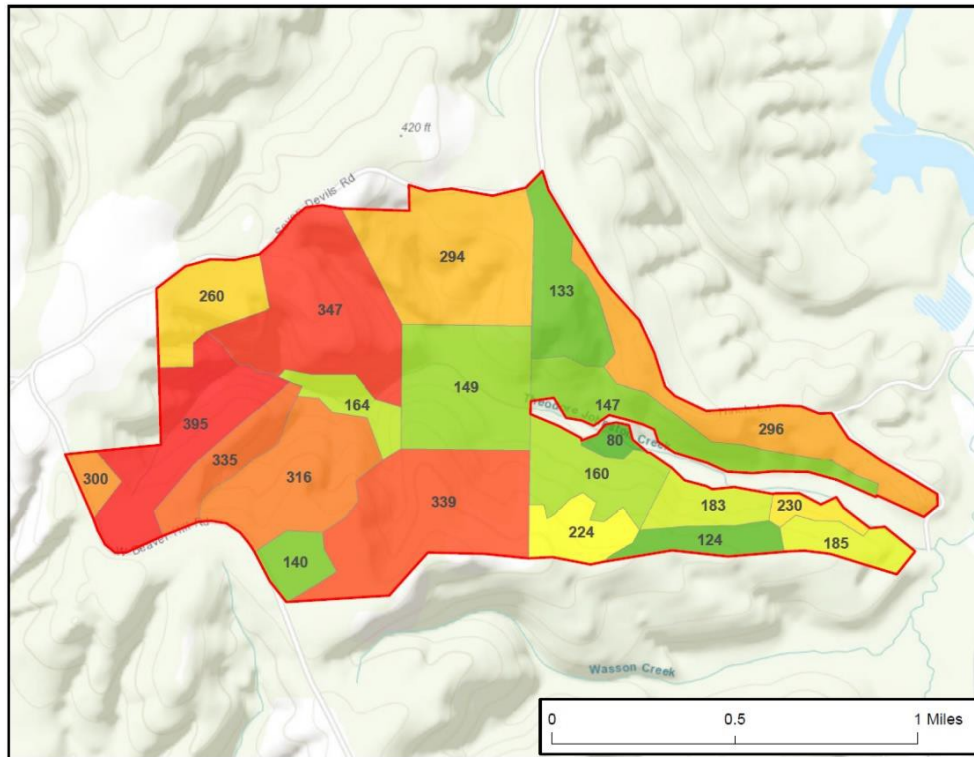


Figure 19: Average trees per acre of stands in the Wasson Project Area

## 6 Case for Variable Density Thinning (Drop and Leave)

The stands targeted for restoration actions in the Wasson Watershed were planted for timber production - with high densities of merchantable conifer species. These stands were planted densely with the assumption that thinning would take place before the stand was harvested. It is clear based on field surveys that thinning is needed not only to release the planted trees from being overstocked, but to reintroduce heterogeneity, promote biodiversity and increase the overall ecological function of the landscape.

Timber management in the Pacific Northwest has simplified forest ecosystems since the arrival of Europeans (Franklin, 1993a, 1993b; Carey *et al.*, 1999a, b). This shift has led to the rise in exotic species (Hobbs and Humphries, 1995; Halpern *et al.*, 1999; Thysell and Carey, 2001), an imbalance in biotic communities (Aubry, 2000; Carey, 2000; Haveri and Carey 2000; Wilson and Carey 2000; Carey and Harrington, 2001), reduced prey availability for predators (Carey *et al.*, 1992) and poorly functioning food webs (Carey *et al.*, 1996, 1999a, 2002; Colgan *et al.*, 1999). Forest stands managed exclusively for timber production have also been shown to lack various structural attributes associated with late-seral forests such as large canopy trees, a diversity of tree size-classes, a lack of coarse woody debris such as snags and downed wood, variation in crown structure and a shade-tolerant mid story (Franklin and Spies, 1991; Spies, 2004; Zenner, 2004; Bauhus *et al.*, 2009).

The management direction of the South Slough Reserve is to develop late-successional forest ecosystems (Robinson, 2009). To this end, forest management can promote the biocomplexity associated with these ecosystems (Carey *et al.*, 1999a, b) and promote biodiversity on the landscape, the fundamental guiding principle of ecologically sound forest practices (Larsson and Danell, 2001; Lindenmayer and Franklin, 2002). Generally, forest management practices that restore structural

heterogeneity and species diversity will help the Reserve meet its objectives for the development of late-seral forests on the Reserve.

Variable density thinning is an emerging forest practice that restores heterogeneity in dense second growth stands by creating “skips and gaps” within a stand. By creating more availability to resources such as light, water, nutrients and space to understory vegetation, this thinning method reintroduces the variability associated with old-growth forests into a regenerating stand (Carey, 2003; Carey and Johnson, 1995; Carey *et al.*, 1999a; Comfort *et al.*, 2010). “Skips” are patches that receive no treatment; “gaps” are areas that are cleared of overstory trees. Generally, a matrix of lightly thinned forest is left between skips and gaps that comprises much of the remainder of the stand (Figure 20).

This thinning practice has been applied in a wide variety of applications in the Olympic Peninsula since the 1990s. The US Forest Service has found that the practice was easy to apply, resulted in insignificant damage to residual trees, induced a positive response in tree growth rates of all size classes in as little as five years and increased the variation in plant cover and tree regeneration (Harrington, 2009). To mitigate risk to upland forests from wind damage, it is recommended that gaps not be created in wind-prone areas such as ridgetops. Additionally, created gaps should be smaller than the height of the tree canopy to avoid wind funneling.

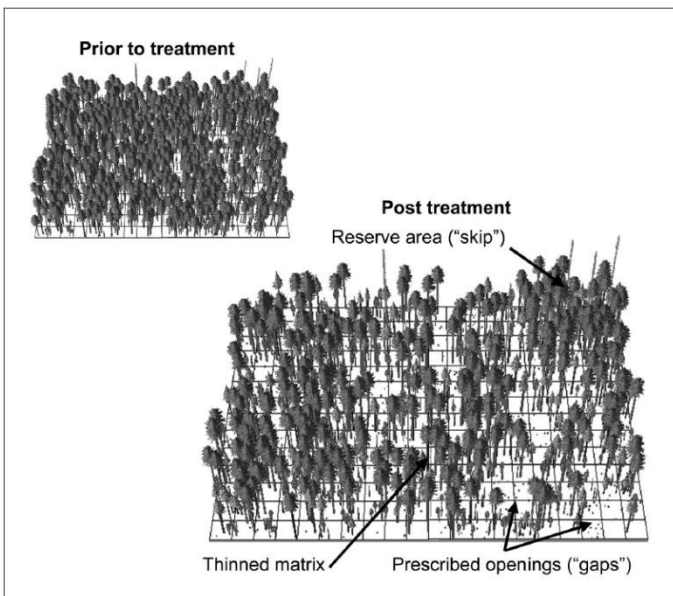


Figure 20: Example of variable density thin. Source: Leslie Brody, USFS

## 7 Restoration Actions for the Wasson Uplands by Stand

### Stand Prioritization and Prescriptions

Stands were prioritized for restoration based on the number trees per acre (TPA), tree size, and age of stand (Table 2 & Figure 21). The densest stands (i.e. highest TPA) and smallest trees (i.e. lowest DBH) were identified as the highest priority stands for thinning. Stands in riparian areas were not ranked and left as Riparian Management Areas (RMAs).



# Appendix D.

Table 2: Ranking and prioritization of forest stands in the Wasson Project Area. TPA=Trees Per Acre, DBH = Diameter at Breast Height and RMA = Riparian Management Area.

| Stand Rankings - Priority Stands with Values |     |         |         |     |       |             |
|----------------------------------------------|-----|---------|---------|-----|-------|-------------|
| Rank                                         | TPA | Avg DBH | Max DBH | Age | Stand | Priority    |
| 1                                            | 339 | 7.7     | 14.1    | ~25 | 2     | High        |
| 2                                            | 294 | 8.2     | 42      | ~20 | 3     | High        |
| 3                                            | 395 | 8.8     | 18.2    | ~25 | 10    | High        |
| 4                                            | 300 | 7.3     | 23.5    | ~40 | 7     | Mid         |
| 5                                            | 260 | 7.9     | 18.5    | ~15 | 6     | Mid         |
| 6                                            | 164 | 16.1    | 38.6    | 50+ | 8     | Leave - RMA |
| 7                                            | 347 | 9.8     | 23.6    | ~25 | 11    | Mid         |
| 8                                            | 335 | 7.4     | 19      | ~15 | 5     | Mid         |
| 9                                            | 149 | 14.1    | 35.2    | 50+ | 1     | Leave - RMA |
| 10                                           | 230 | 15.1    | 33.5    | 50+ | 16    | Low         |
| 11                                           | 147 | 17.8    | 72.1    | 50+ | 18    | Leave - RMA |
| 12                                           | 140 | 5.4     | 6.5     | ~15 | 4     | Mid         |
| 13                                           | 316 | 8.1     | 43      | ~25 | 9     | Mid         |
| 14                                           | 160 | 14.2    | 50.2    | 50+ | 13    | Leave       |
| 15                                           | 296 | 11.5    | 37.4    | 50+ | 20    | Low         |
| 16                                           | 183 | 13.6    | 48      | 50+ | 15    | Low         |
| 17                                           | 124 | 14.9    | 43.5    | 50+ | 14    | Low         |
| 18                                           | 133 | 17.4    | 30.5    | 50+ | 19    | Low         |
| 19                                           | 185 | 12.8    | 29.8    | 50+ | 17    | Leave       |
| 20                                           | 224 | 16.0    | 75      | 50+ | 12    | Leave       |
| 21                                           | 80  | 34.5    | 48.7    | 50+ | 21    | Leave - RMA |

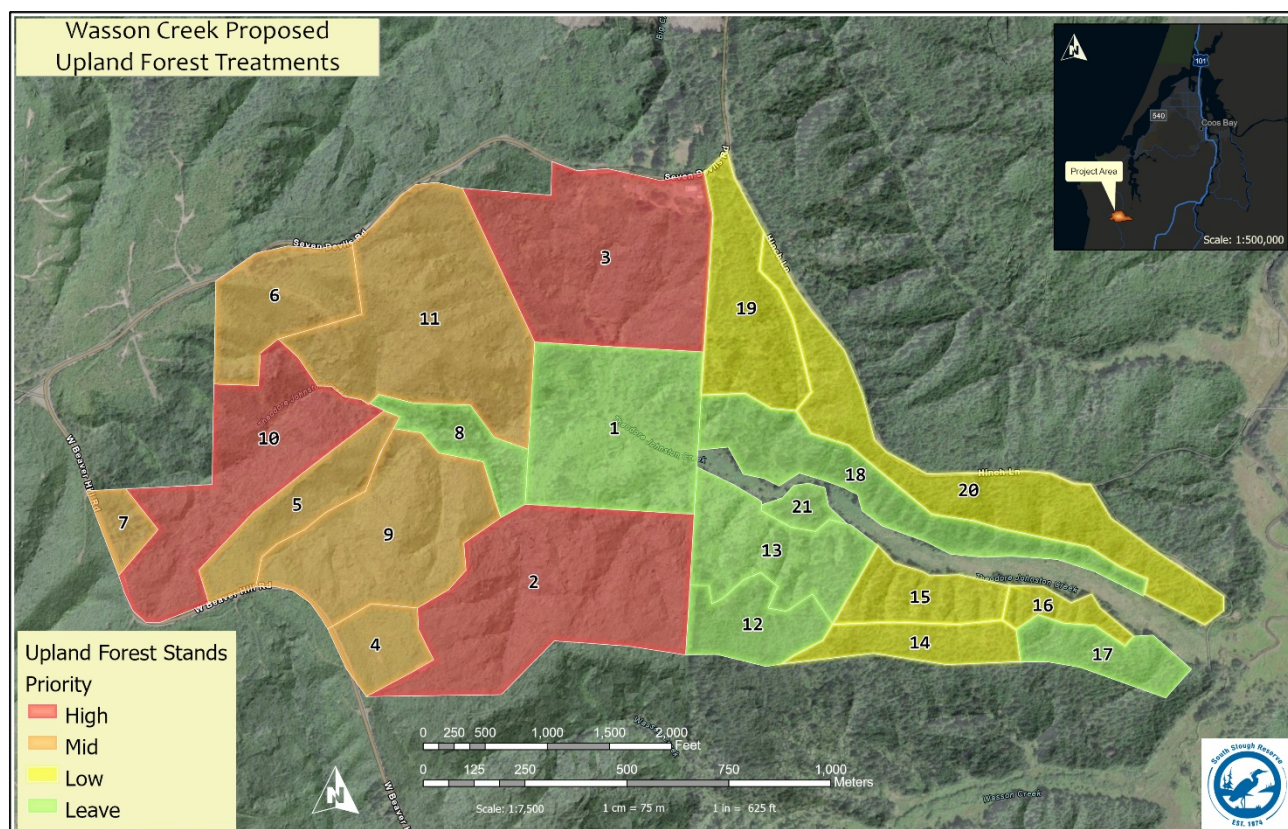


Figure 21: Prioritization of numbered forest stands in the Wasson Project Area

Restoration prescriptions for the high and mid priority stands were determined based on existing TPA, species diversity, and composition. Modeling results indicated most high and mid priority stands should be initially thinned to 150 TPA, with some stands requiring a secondary thinning 20-25 years later. Stand descriptions and detailed prescriptions are included in subsequent pages.

### Planting and regeneration

Variable density thinning allows for the natural recruitment of species already within the system, it also provides an opportunity to facilitate recruitment of species that are underrepresented, have been disproportionately impacted (e.g. by disease) or that are culturally important. Several species, including the disease resistant Port-Orford-cedar, are recommended for planting in thinned areas and gaps following treatment (Table 3).

Table 3: Potential species to be planted following forest thinning and gap creation

| Common name            | Scientific name                 | Habitat                                       |
|------------------------|---------------------------------|-----------------------------------------------|
| Port-Orford-cedar      | <i>Chaemecyparis lawsoniana</i> | Drier sites                                   |
| Western red cedar      | <i>Thuja plicata</i>            | Moist to wet seepage and alluvial             |
| Big leaf maple         | <i>Acer macrophyllum</i>        | Dry to moist gaps at lower elevations         |
| Vine maple             | <i>A. circinatum</i>            | Moist to wet forest gaps                      |
| Beargrass              | <i>Xerophyllum tenax</i>        | Well drained, sunny hillside, dappled light   |
| Giant chain fern       | <i>Woodwardia fimbriata</i>     | Moist areas, springs                          |
| Beaked hazelnut        | <i>Corylus cornuta</i>          | Moist but well drained gaps and stream edges  |
| Black gooseberry       | <i>Ribes lacustre</i>           | Stream banks or forested slopes, rotting wood |
| Trailing black current | <i>Ribes laxiflorum</i>         | Moist forest gaps at low to mid elevations    |

### Wood and slash management

The Oregon Administrative Rules, that govern the South Slough Reserve, prohibit commercial timber harvesting; therefore, trees felled during restoration thinning are unable to be sold. Several factors are considered when determining the fate of materials from the thinning prescriptions, including fuel and wildfire risk, habitat value, nutrient cycling, carbon sequestration and output, and use within the stream restoration component. Materials from the thinning will be processed in the following ways:

**Lop and scatter:** trees limbed, to accelerate decay, and left in place. Due to fuel loading any material left on site will be spaced to avoid continuous high fuel areas

**Habitat piles:** trees limbed and piled within gaps

**Biochar:** use biochar kilns to lock up carbon, products can be scattered on site or used in wetland restoration plantings

**Used in stream restoration:** medium-large trees (>12" DBH and >40' length) can be use as large wood structures, while smaller trees (<8" DBH) can be used for nurse cribs and beaver dam analogs

**Mulching and chipping:** Where on ground machinery is accessible smaller trees and limbs can be chipped and scattered on site. To reduce fire risk chip lays will not exceed 2" depth

**Burn piles:** Burn piles will be used only when necessary and limited to fine fuels

**Stewardship contracting:** offset costs by trading wood for services. This will be limited by availability of merchantable trees and will depend on regulatory allowances.

## Mid and high priority stands

### Stand 2 – 56.8 Acres, High Priority (Figure 22)

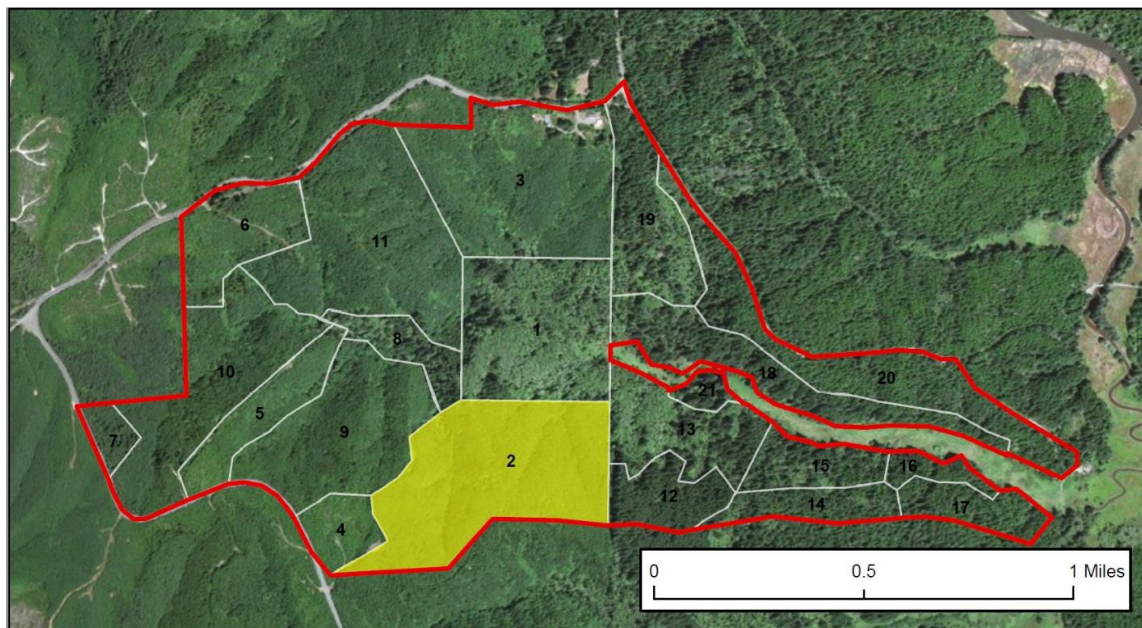


Figure 22: Location of stand 2 within Wasson project area

### Stand 2 – Description

This stand was clear cut in approximately 1994. The stand of replanted Douglas-fir and likely naturally regenerated Sitka spruce (Figure 23) is now 20-25 years old, with an average DBH of 8" and 339 TPA. There is a predominantly northern and western aspect, with a northeastern aspect on the east side of the stand. A narrow, steep drainage is on the west of the stand, which will need to be considered during thinning (Figure 6). Further buffering of the two narrow drainages on the east side of the stand is also recommended. Remnant logging roads exist along the southern and eastern boundaries with one remnant spur into the center of the stand which may be reopened temporarily for operational use (Figure 3). Stewardship contracting may be an option due to the ease of access and merchantability of trees but a stand exam to establish volume estimates in treatment areas would be needed to determine the viability of the project.

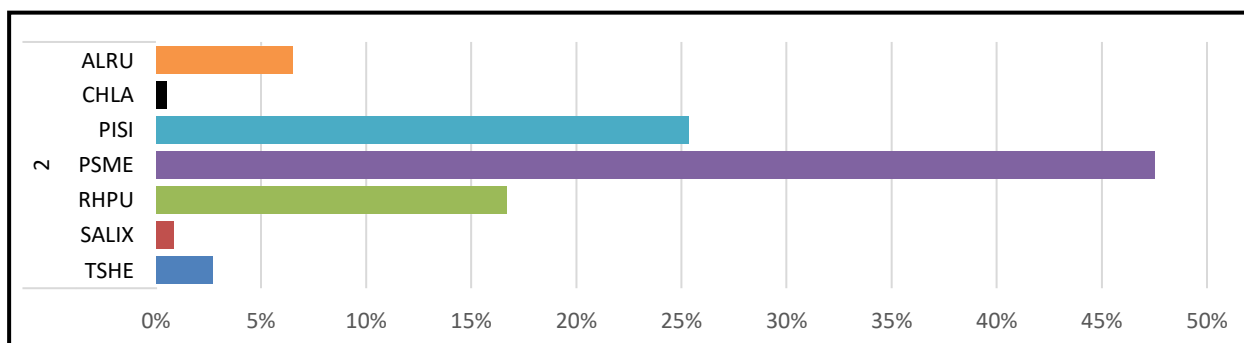


Figure 23: Species composition of trees in Stand 2. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, SALIX = willow, TSHE = western hemlock



## Stand 2 – Prescription

On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing ½-acre to 1-acre skips (up to 6 acres total), ½-acre to ¼-acre gaps (up to 9 acres total) and a thinning matrix between the skips and gaps. Gaps should be located strategically to minimize wind damage (i.e. not on ridgetops) where possible and skips could include areas within the steep ravine. Treatments will preferentially remove Douglas-fir, leave trees over 12" DBH and leave allsnags over 12" DBH. Underplanting of disease-resistant Port-Orford-cedar seedlings in thinned areas and gaps following treatment is encouraged, especially in relatively flat areas or in higher elevations. In areas of higher moisture, underplanting of western red cedar is recommended. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 15-20 years. Re-entry will likely involve commercially viable thinning.

## Stand 3 – 52.4 Acres, High Priority (Figure 24)

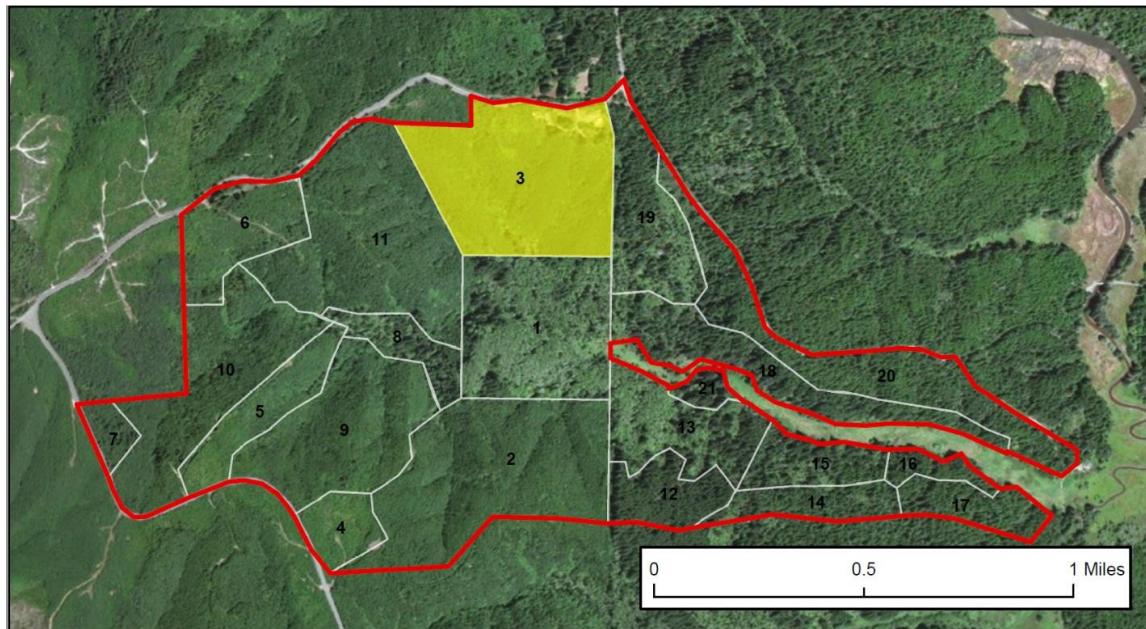


Figure 24: Location of stand 3 within Wasson project area

## Stand 3 – Description

This stand was clear cut in approximately 2000. The stand of replanted Douglas fir and likely naturally regenerated Sitka spruce is now 17-20 years old, with an average DBH of 8" and 294 trees per acre. There are many small (<4" DBH) Cascara (*Rhamnus purshiana*) in the stand which are not expected to persist following treatment (Figure 25). There is a predominantly southern aspect. Two narrow steep drainages in the center of the stand and one creek on the west side of the stand will need to be buffered to mitigate debris flow risk following thinning (Figure 6). There are no remnant roads into this stand, access will be by foot. This stand is adjacent to the Spruce Ranch and shop buildings, making it an attractive option for recreation or education development such as an interpretive trail to demonstrate restoration forestry practices at the South Slough Reserve. Based on soil type, aspect, and accessibility this stand may be suitable for establishing a population of beargrass (*Xerophyllum tenax*).

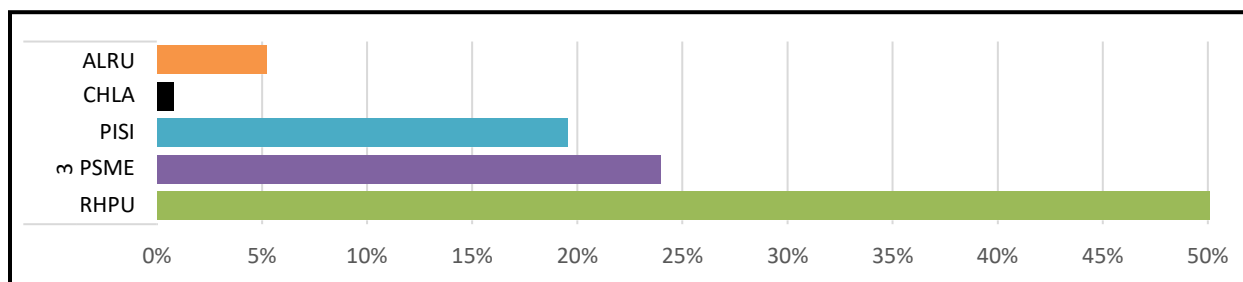


Figure 25: Species composition of trees in Stand 3. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara

### Stand 3 – Prescription

On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing ½-acre to 1-acre skips (up to 6 acres total), ½-acre to ¼-acre gaps (up to 9 acres total) and a thinning matrix between the skips and gaps. Gaps should be located strategically to minimize wind damage (i.e. not on ridgetops) where possible. Treatments will preferentially remove Douglas fir, leave trees over 12" DBH and leave all snags over 10" DBH. Underplanting of disease-resistant Port-Orford-cedar seedlings in thinned areas and gaps following treatment is encouraged. This stand should be assessed for planting beargrass in a gap with dappled sunlight, potentially amongst sparse cascara trees. Fire breaks and education trails should be considered for this site. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 15-20 years. Re-entry will likely involve commercially viable thinning.

### Stand 10 – 39.2 Acres, High Priority (Figure 26)

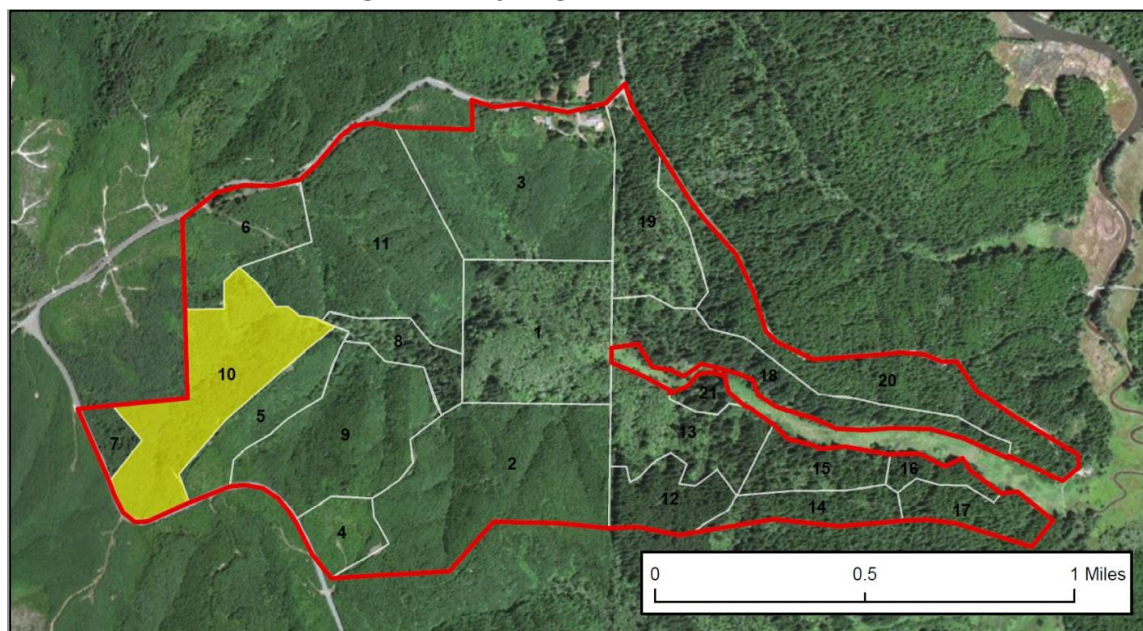


Figure 26: Location of stand 10 within Wasson project area

## Stand 10 – Description

This stand was clear cut in approximately 1994. The stand of replanted Douglas fir with lesser amounts of native tree regeneration mixed throughout is now 20-25 years old, with an average DBH of 9" and 395 trees per acre. There are many small (<4" DBH) Cascara in the stand which are not expected to persist following treatment (Figure 27). There is a predominantly northwestern aspect, with a small portion of southeast segment on the northern end of the stand. There is a small stream running through the middle of the unit that may need to be buffered to mitigate debris flow risk following thinning, as well as most of the northern section of the unit (Figure 6). There is a remnant logging road running down the ridge on the southern boundary of this unit which may be temporarily reopened for operational access (Figure 3). Stewardship contracting may be an option due to the ease of access and merchantability of trees but a stand exam to establish volume estimates in treatment areas would be needed to determine the viability of the project. Re-entry will likely involve commercially viable thinning.

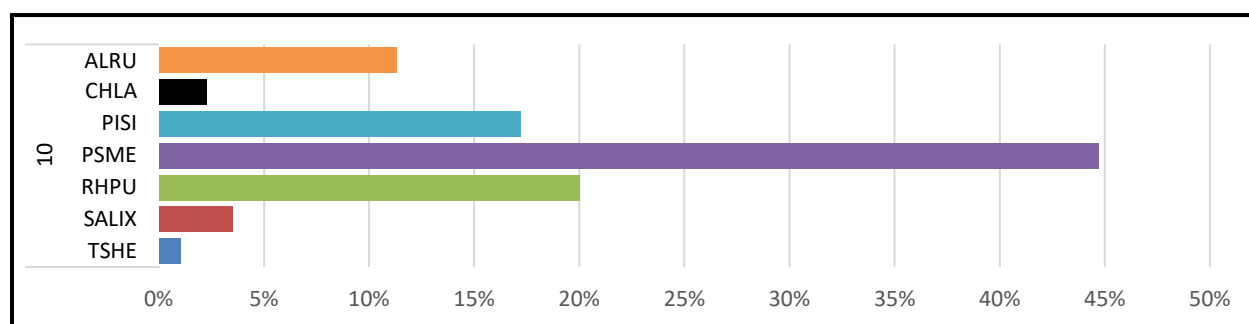


Figure 27: Species composition of trees in Stand 10. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, SALIX = willow, TSHE = western hemlock

## Stand 10 – Prescription

On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing ½-acre to 1-acre skips (up to 5 acres total), ½-acre to ¼-acre gaps (up to 6 acres total) and a thinning matrix between the skips and gaps. Gaps should be located strategically to minimize wind damage (i.e. not on ridgetops) where possible. Treatments will preferentially remove Douglas fir, leave trees over 12" DBH and leave all snags over 10" DBH. Underplanting of disease-resistant Port-Orford-cedar in drier areas and western red cedar in wetter areas is recommended. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 15-20 years.



### Stand 7 – 4.83 Acres, Mid Priority (Figure 28)

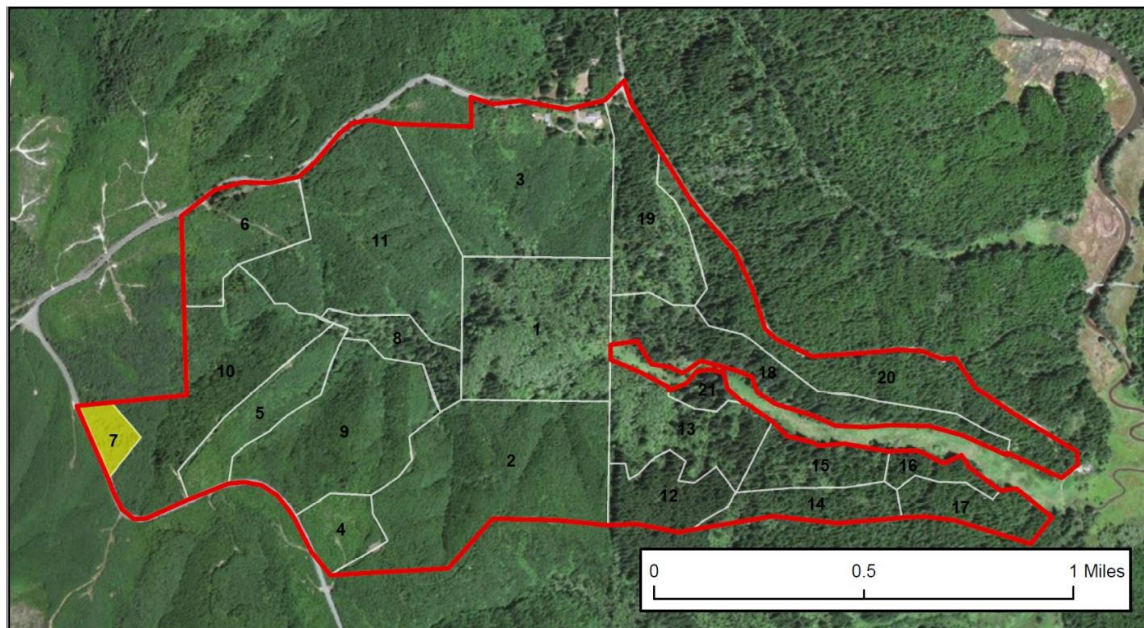


Figure 28: Location of stand 7 within Wasson project area

### Stand 7 - Description

This stand was clear cut in approximately 1994. The stand is mixed with replanted Douglas fir and native tree regeneration ranging from 20-60 years old, with an average DBH of 7" and 300 trees per acre. There are many small (<4" DBH) Cascara in the stand which are not expected to persist following treatment (Figure 29). There is a very slight northeastern aspect on the eastern edge of the stand, but otherwise it is relatively flat. There is a short remnant spur road into southern boundary of this unit which may be temporarily reopened for operational access (Figure 3). Stewardship contracting may be an option due to the ease of access and merchantability of trees but a stand exam to establish volume estimates in treatment areas would be needed to determine the viability of the project. Re-entry will likely involve commercially viable thinning.

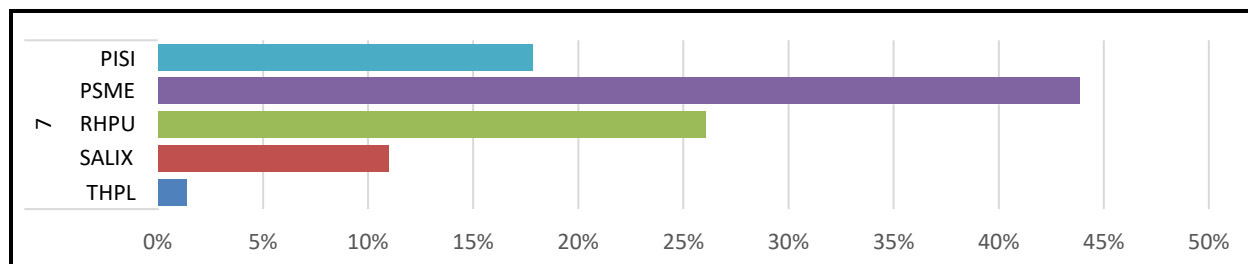


Figure 29: Species composition of trees in Stand 7. PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, SALIX = willow, TSHE = western hemlock

## Stand 7 – Prescription

On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing one ½-acre skip, two ¼-acre gaps and a thinning matrix between the skips and gaps. Due to the proximity to West Beaver Hill Road, a 100 ft buffer strip may be placed along the road instead of creating skips within the stand itself. Treatments will preferentially remove Douglas fir, leave trees over 12" DBH and leave all snags over 10" DBH. Underplanting of disease-resistant Port-Orford-cedar is encouraged. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 15-20 years.

## Stand 6 – 20.0 Acres, Mid Priority (Figure 30)

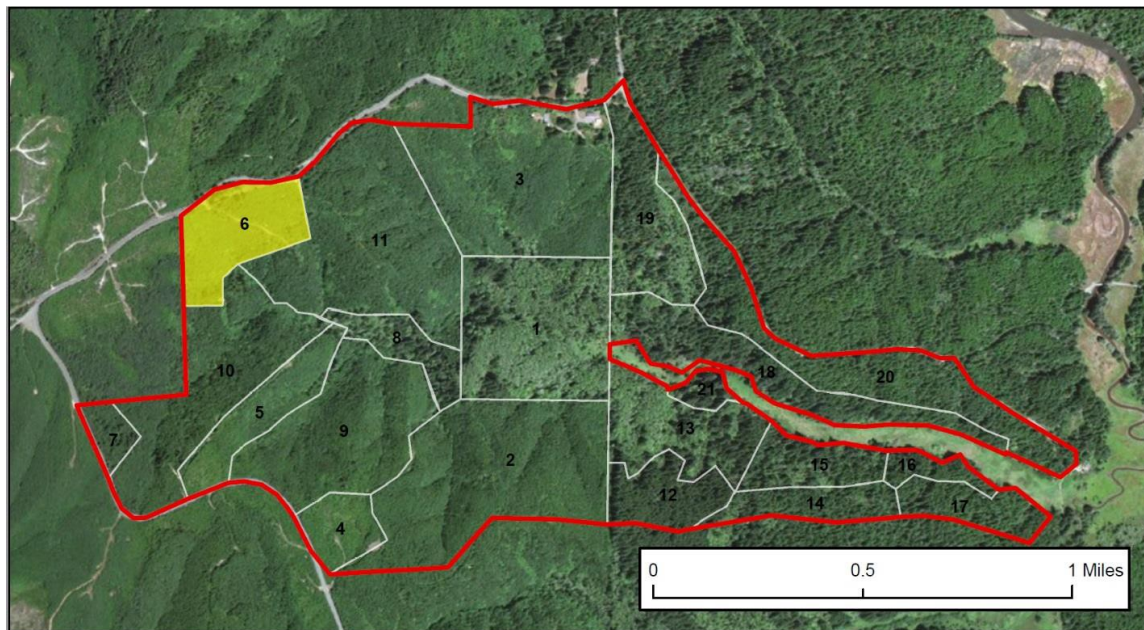


Figure 30: Location of stand 6 within Wasson project area

## Stand 6 – Description

This stand was clear cut in approximately 2003. This 15-year-old stand is mixed with replanted Sitka spruce and diverse native tree regeneration (Figure 31), with an average DBH of 8" and 260 trees per acre. Our analysis excluded saplings under 4" in calculations of trees per acre – but due to the age of this stand there will likely need to be thinning of the many young trees to accelerate development of late seral conditions and avoid the stand developing into a dense plantation. The southwestern portion of the stand contains steep slopes along the headwaters of two small streams (Figure 3) and may need to be buffered to mitigate debris flow risk following thinning (Figure 6). There is a remnant logging road through the middle of the unit which may be temporarily reopened for operational access (Figure 3).



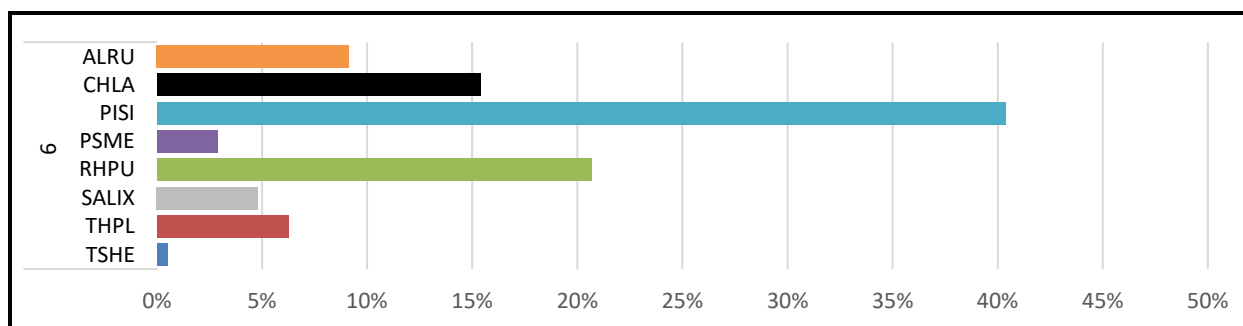


Figure 31: Species composition of trees in Stand 6. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, SALIX = willow, THPL = western red cedar, TSHE = western hemlock

### Stand 6 – Prescription

Due to age of stand and ease of access, this will be one of the first stands to implement forest management. On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing ½-acre to 1-acre skips (up to 2 acres total), ½-acre to ¼-acre gaps (up to 3 acres total) and a thinning matrix between the skips and gaps. Due to the proximity to West Beaver Hill Road, a 100 ft buffer strip may be placed along the road instead of or in addition to creating skips within the stand itself. Treatments will preferentially remove Sitka spruce, leave trees over 12" DBH and leave all snags over 10" DBH. Underplanting of disease-resistant Port-Orford-cedar is encouraged. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 20-25 years.

### Stand 11 – 54.8 Acres, Mid Priority (Figure 32)

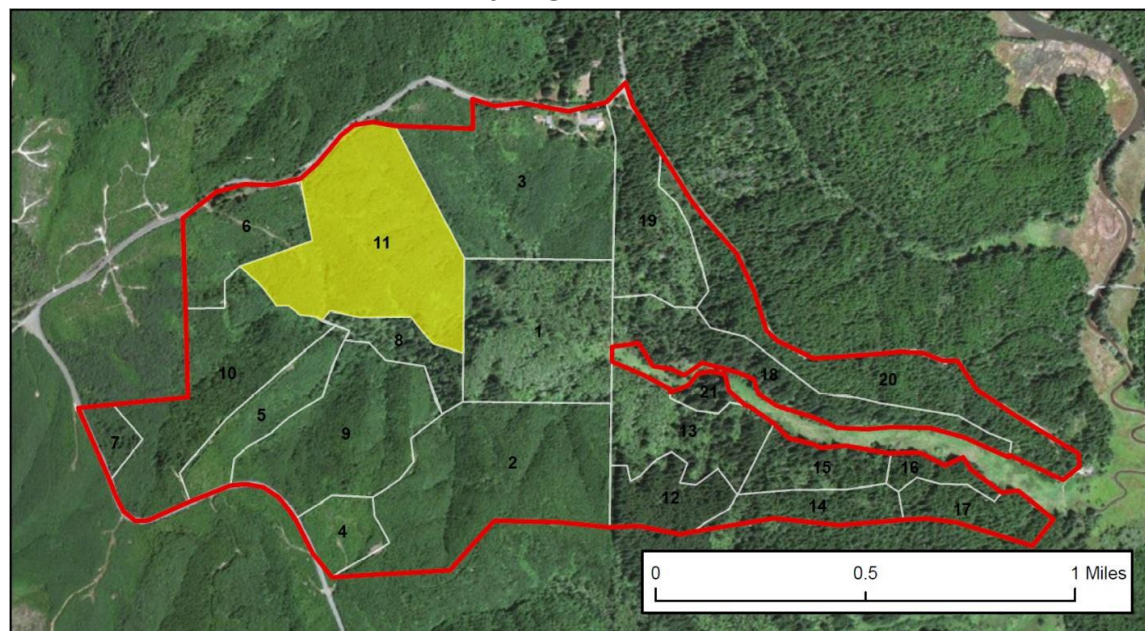


Figure 32: Location of stand 11 within Wasson project area



## Stand 11 – Description

This stand was clear cut in approximately 1994. This 20 to 25-year-old stand is mixed with replanted Sitka spruce and Douglas fir and limited native tree regeneration (Figure 33), with an average DBH of 10" and 347 trees per acre. The center of the stand is on a bench, with steep slopes falling off to the west, south and east sides of the stand. The southwestern portion of the stand and the drainage in the northeastern portion of the stands may need to be buffered to mitigate debris flow risk following thinning (Figure 6). There is a remnant logging road through the middle of the unit which may be temporarily reopened for operational access (Figure 3). Stewardship contracting may be an option due to the ease of access and merchantability of trees but a stand exam to establish volume estimates in treatment areas would be needed to determine the viability of the project. Re-entry will likely involve commercially viable thinning.

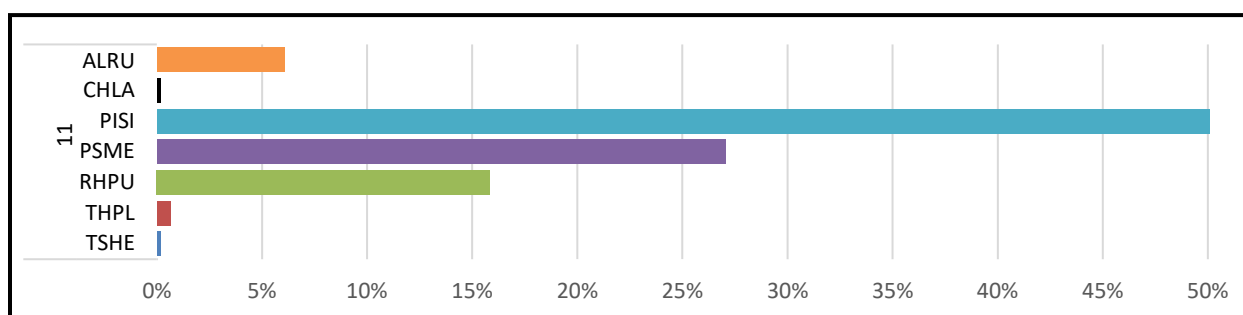


Figure 33: Species composition of trees in Stand 11. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, THPL = western red cedar, TSHE = western hemlock

## Stand 11 – Prescription

On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing ½-acre to 1-acre skips (up to 6 acres total), ½-acre to ¼-acre gaps (up to 8 acres total) and a thinning matrix between the skips and gaps. Due to the proximity to West Beaver Hill Road, a 100 ft buffer strip may be placed along the road instead of or in addition to creating skips within the stand itself. Treatments will preferentially remove Sitka spruce, leave trees over 12" DBH and leave all snags over 10" DBH. Underplanting of disease-resistant Port-Orford-cedar in drier areas and western red cedar in wetter areas is recommended. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 20-25 years.

### Stand 5 – 15.8 Acres, Mid Priority (Figure 34)

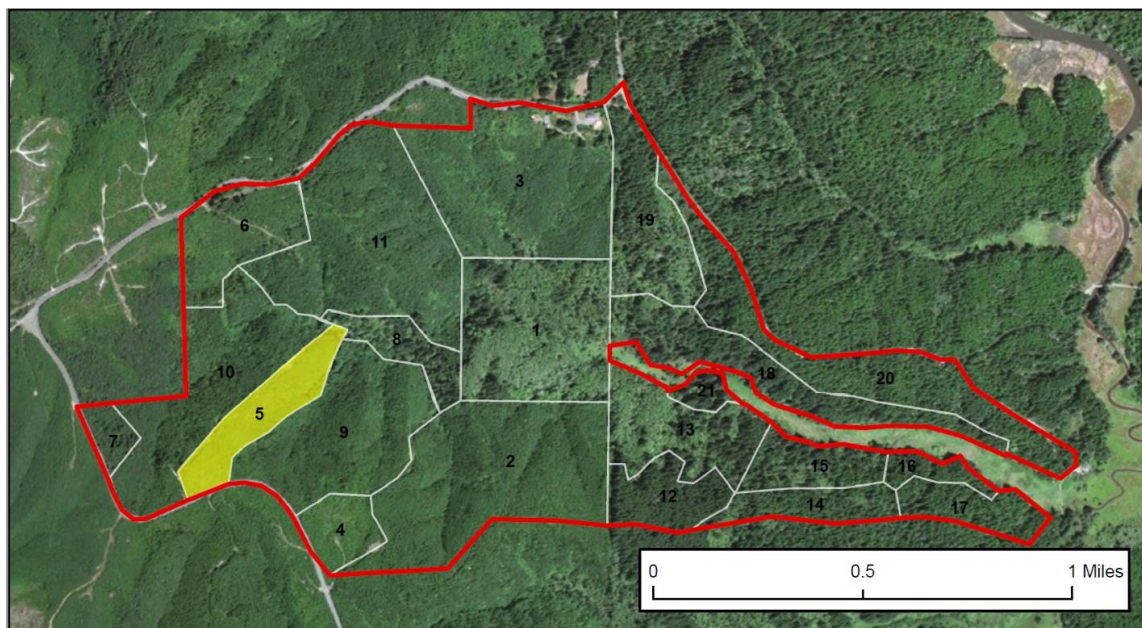


Figure 34: Location of stand 5 within Wasson project area

### Stand 5 – Description

This stand was clear cut in approximately 2003. This 15-year-old stand is mixed with replanted Sitka spruce and diverse native tree regeneration (Figure 35), with an average DBH of 7.5" and 335 trees per acre. Our analysis excluded saplings under 4" in calculations of trees per acre – but due to the age of this stand there will likely need to be thinning of the many young trees to accelerate development of late seral conditions and avoid the stand developing into a dense plantation. The seasonal stream along the eastern boundary of the stand and the steep slopes in the northeastern area of the stand will need to be considered during thinning (Figure 6). Most of the stand has a southeastern aspect. There is a remnant logging road along the western boundary of the unit which may be temporarily reopened for operational access (Figure 3).

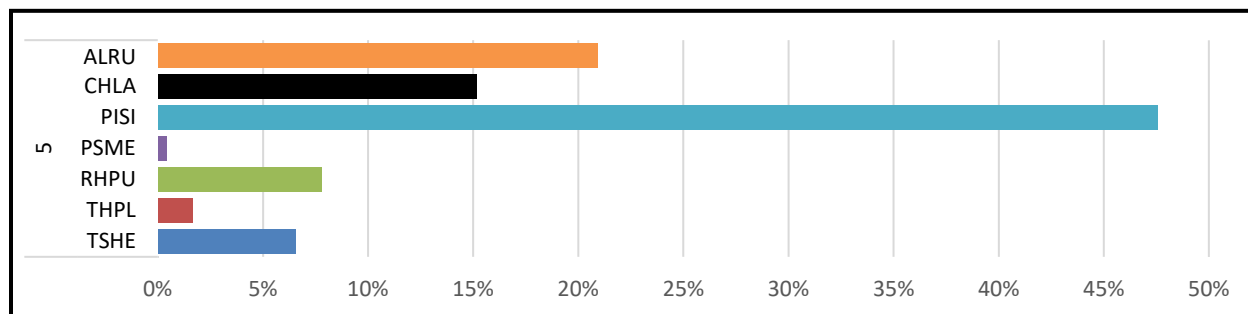


Figure 35: Species composition of trees in Stand 5. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, THPL = western red cedar, TSHE = western hemlock

## Stand 5 – Prescription

Due to age of stand and ease of access, this will be one of the first stands to implement forest management. On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing ½-acre to 1-acre skips (up to 2 acres total), ½-acre to ¼-acre gaps (up to 3 acres total) and a thinning matrix between the skips and gaps. Due to the proximity to West Beaver Hill Road, a 100 ft buffer strip may be placed along the road instead of or in addition to creating skips within the stand itself. Treatments will preferentially remove Sitka spruce, leave trees over 12" DBH and leave all snags over 10" DBH. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 20-25 years.

## Stand 4 – 9.2 Acres, Mid Priority (Figure 36)

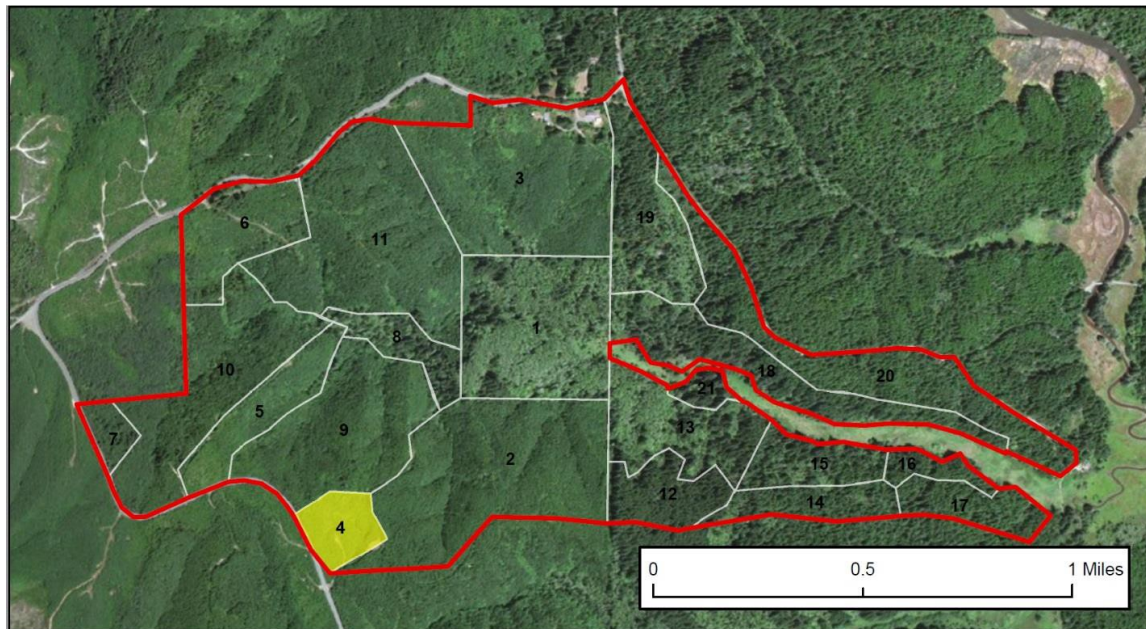


Figure 36: Location of stand 4 within Wasson project area

## Stand 4 – Description

This stand was clear cut in approximately 2003. This 15-year-old stand is mixed with replanted Sitka spruce and diverse native tree regeneration (Figure 37), with an average DBH of 5" and 140 trees per acre. Our analysis excluded saplings under 4" in calculations of trees per acre – but due to the age of this stand there will likely need to be thinning of the many young trees to accelerate development of late seral conditions and avoid the stand developing into a dense plantation. The stand is flat and has very low risk of debris flow following treatment (Figure 6). There is a remnant logging road along the eastern boundary of the unit which may be temporarily reopened for operational access (Figure 3). This stand has easy access and would make a good location to develop recreational or educational resources such as interpretive signs and trails to demonstrate restoration forestry practices at South Slough.



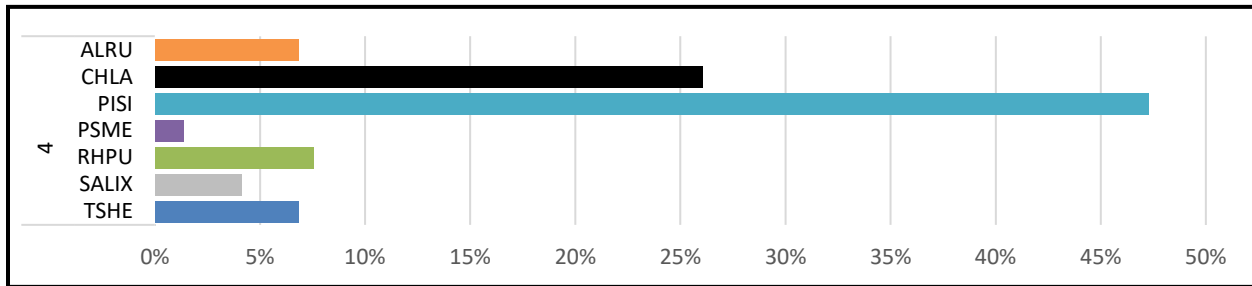


Figure 37: Species composition of trees in Stand 4. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, SALIX = willow, TSHE = western hemlock

### Stand 4 – Prescription

Due to age of stand and ease of access, this will be one of the first stands to implement forest management. On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing a 1-acre skip, two  $\frac{3}{4}$ -acre gaps and a thinning matrix between the skips and gaps. Due to the proximity to West Beaver Hill Road, a 100 ft buffer strip may be placed along the road instead of or in addition to creating skips within the stand itself. Treatments will preferentially remove Sitka spruce, leave trees over 12" DBH and leave all snags over 10" DBH. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 20-25 years.

### Stand 9 – 34.8 Acres, Mid Priority (Figure 38)

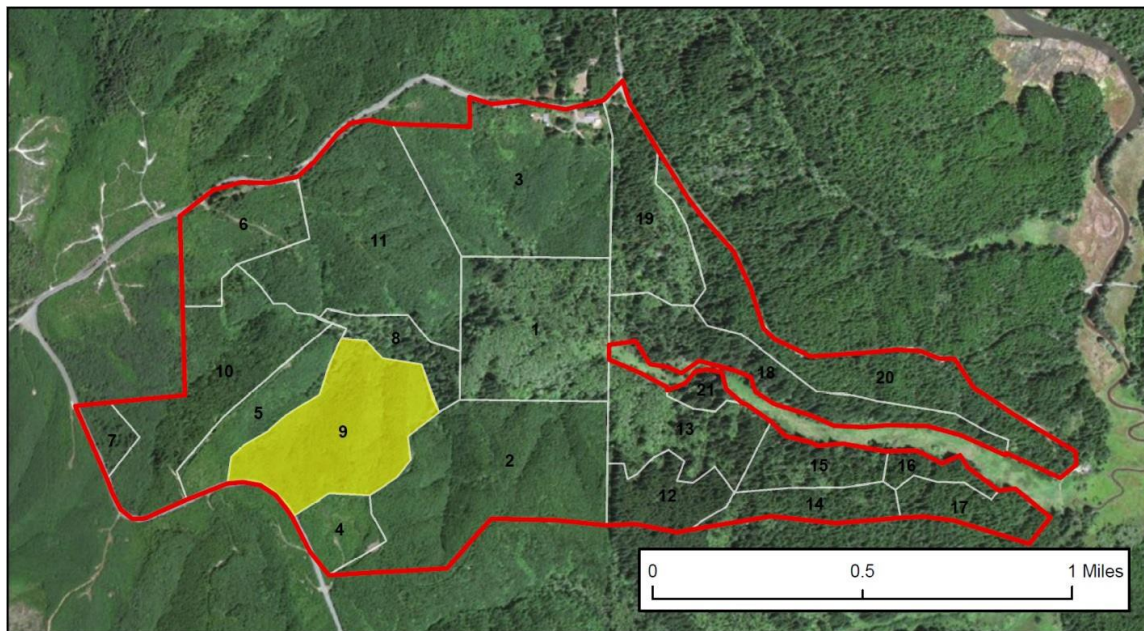


Figure 38: Stand 9 within Wasson project area

### Stand 9 – Description

This stand was clear cut in approximately 1994. This 20 to 25-year-old stand is mixed with replanted Sitka spruce and Douglas fir and limited but diverse native tree regeneration (Figure 39), with an average DBH of 8" and 316 trees per acre. The aspect is northern with two steep drainages making up the middle of the stand (Figure 3), parts of which will need to be buffered to mitigate debris flow risk following thinning (Figure 6). There are three short spur roads reaching to the top of the ridge in the middle of the stand which may be temporarily reopened for operational access (Figure 3). Stewardship

contracting may be an option due to the ease of access and merchantability of trees but a stand exam to establish volume estimates in treatment areas would be needed to determine the viability of the project. Re-entry will likely involve commercially viable thinning.

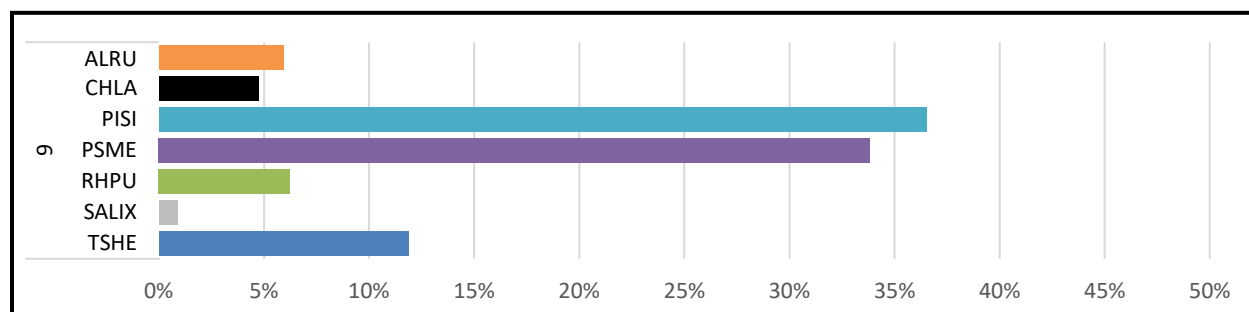


Figure 39: Species composition of trees in Stand 9. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, SALIX = willow, TSHE = western hemlock

### Stand 9 – Prescription

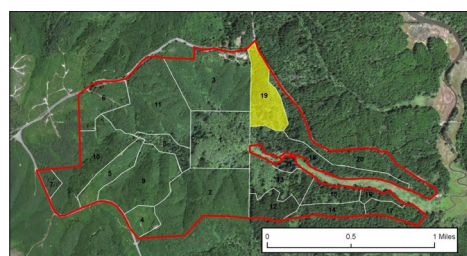
On the initial entry, thin to 150 trees per acre (17 ft spacing between leave trees), utilizing ½-acre to 1-acre skips (up to 4 acres total), ½-acre to ¼-acre gaps (up to 6 acres total) and a thinning matrix between the skips and gaps. Due to the proximity to West Beaver Hill Road, a 100 ft buffer strip may be placed along the road instead of or in addition to creating skips within the stand itself. Treatments will preferentially remove Sitka spruce, leave trees over 12" DBH and leave all snags over 10" DBH. Underplanting of disease-resistant Port-Orford-cedar in drier areas and western red cedar in wetter areas is recommended. Restoration actions and timing for a second entry should be determined with follow-up monitoring, but further thinning to roughly 70 TPA (25 ft spacing) and creation of snags and downed woody debris will likely be needed in 20-25 years.

### Low priority stands

#### Stand 19 – 23.9 Acres, Low Priority

Stand 19 was harvested prior to 1974 and is currently mixed conifer with 133 TPA which (Figure 40). Survey data is based on 11 plots of data. Comprises a flatter area above drainage on the north side of the Wasson Watershed, while the main component of the stand is predominantly an eastern aspect and sloped. The northeastern tip of the stand joins up with Hinch Road, which provides good access to the stand.

a)



b)

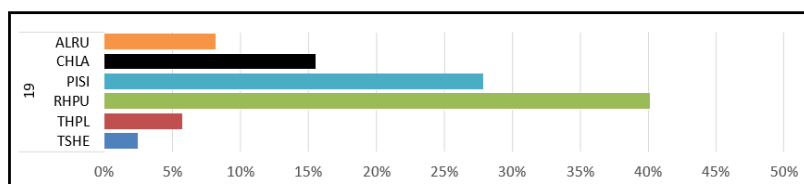


Figure 40: a) Stand 19 location and b) species composition. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, TSHE = western hemlock

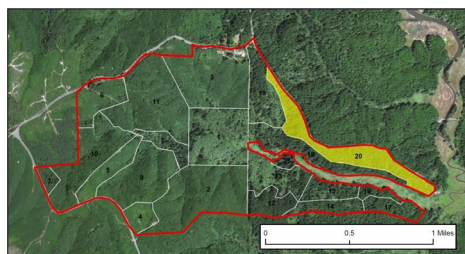
### Stand 19 – Prescription

Stand could be thinned for demonstration purposes. Remove up to 20% of conifer trees (down to ~150/acre, considering cascara component). Leave all trees over 20" DBH and all snags over 10" DBH. Cable operation likely needed in steep drainages; creation of 12' corridors needed for extraction, with minimum spacing of 150'. Merchantable wood could be used for stewardship contracting. Skips in patches of larger trees (3 acres remain untouched) and gaps in densest areas (total not to exceed 3.5 acres).

### Stand 20 – 35.9 Acres, Low Priority

Stand 20 was harvested prior to 1974 and is currently mixed conifer with 296 TPA which (Figure 41). Survey data is based on 12 plots of data. This stand is relatively flat and includes the head of multiple smaller creeks that drain into the northern part of the Wasson drainage. Hinch Road borders the stand to the north and provides good access. Generally, a southern aspect.

a)



b)

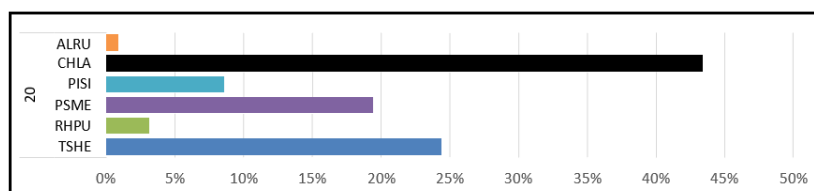


Figure 41: a) Stand 20 location and b) species composition. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, TSHE = western hemlock

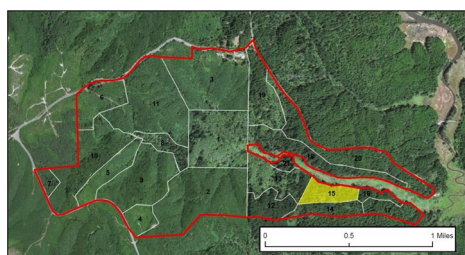
### Stand 20 – Prescription

Stand could be thinned for demonstration purposes. Remove up to 45% of trees (down to ~200/acre), half in the 5-12" DBH class, half in the 12-24" DBH class. Leave all snags over 10" DBH. Cable operation likely needed in steep drainages; creation of corridors needed for extraction. Merchantable wood may be used for stewardship contracting. Skips should be located in patches of larger trees (4 acres remain untouched) and gaps in densest areas (total not to exceed 5.5 acres). Port-Orford-cedar thickets are present.

### Stand 15 – 12.1 Acres, Low Priority

Stand 15 was harvested prior to 1974 and is currently mixed conifer with 183 TPA which (Figure 42). Survey data is based on 7 plots of data.

a)



b)

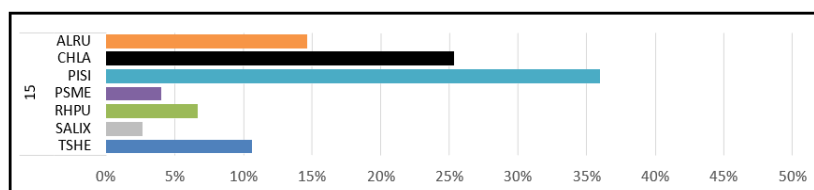


Figure 42: a) Stand 15 location and b) species composition. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, SALIX = Willow, TSHE = western hemlock



### Stand 15 – Prescription

Stands 15 and 16, will supply large wood to the stream restoration component of the project (Appendix B). Approximately 300 pieces of large wood (12-16" DBH and 40-60' long) will be extracted across both stands. Small corridors, maximum width 12' with minimum spacing of 150', will be used to extract trees with minimal impact using a yarder and cable system. Seeps and wet drainages will be considered for planting giant chain fern.

### Stand 16 – 5.0 Acres, Low Priority

Stand 16 was harvested prior to 1974 and is currently mixed conifer with 230 TPA which (Figure 43). Survey data is based on 4 plots of data.

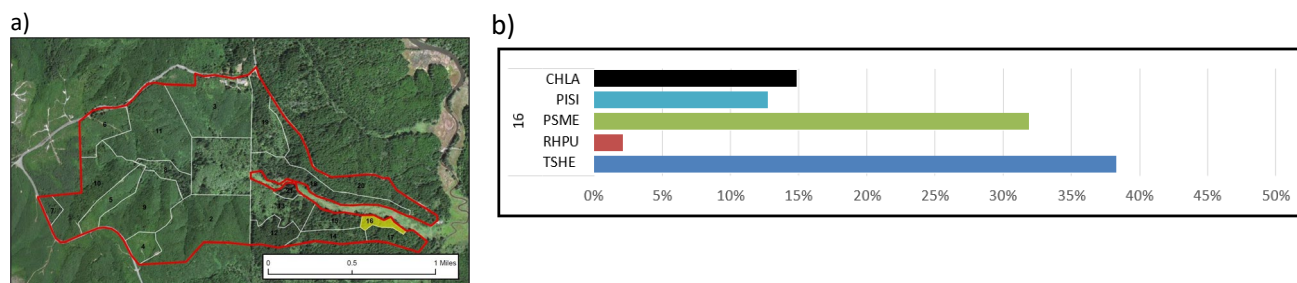


Figure 43: a) Stand 16 location and b) species composition. CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, TSHE = western hemlock

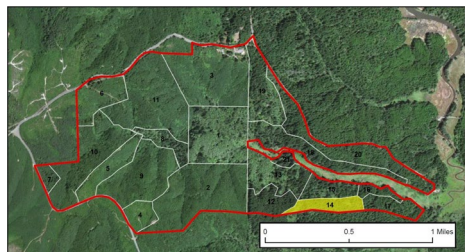
### Stand 16 – Prescription

Stands 15 and 16, will supply large wood to the stream restoration component of the project (Appendix B). Approximately 300 pieces of large wood (12-16" DBH and 40-60' long) will be extracted across both stands. Small corridors, maximum width 12' and minimum spacing of 150', will be used to extract trees with minimal impact using a yarder and cable system. Seeps and wet drainages will be considered for planting giant chain fern.

### Stand 14 – 11.1 Acres, Low Priority

Stand 14 was harvested prior to 1974 and is currently mixed conifer with 124 TPA which (Figure 45). Survey data is based on 5 plots of data.

a)



b)

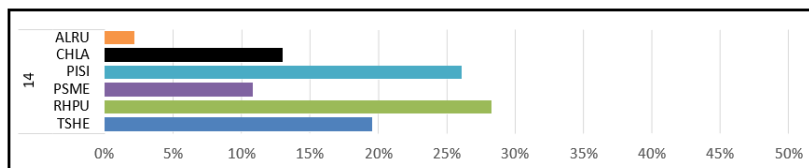


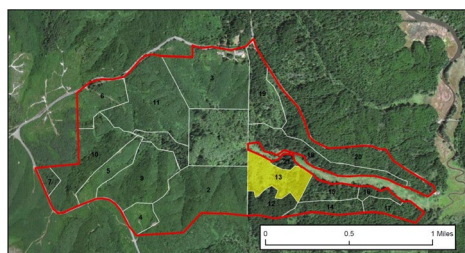
Figure 45: a) Stand 14 location and b) species composition. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, TSHE = western hemlock

### Leave stands

#### Stand 13 – 22.5 Acres, Leave

Stand 13 was harvested prior to 1974 and is currently mixed conifer with 160 TPA which (Figure 44). Survey data is based on 8 plots of data.

a)



b)

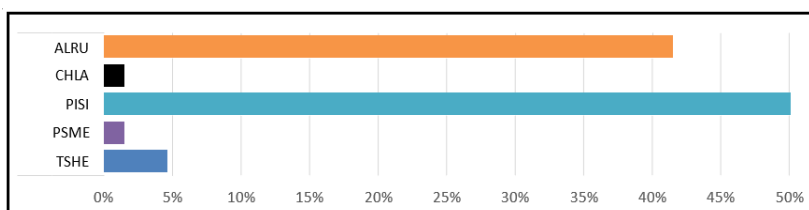
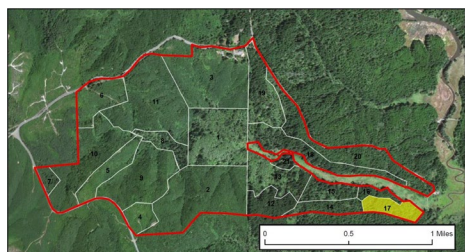


Figure 44: a) Stand 13 location and b) species composition. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, TSHE = western hemlock

#### Stand 17 – 10.9 Acres, Leave

Stand 17 was harvested prior to 1974 and is currently mixed conifer with 185 TPA which (Figure 46). Survey data is based on 4 plots of data.

a)



b)

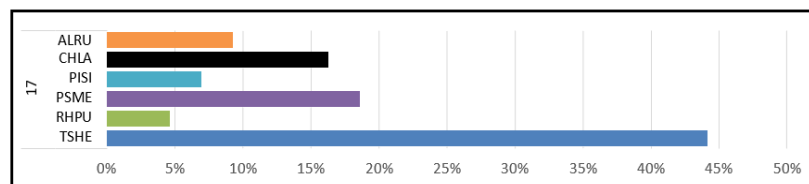


Figure 46: a) Stand 17 location and b) species composition. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, TSHE = western hemlock

#### Stand 12 – 13.2 Acres, Leave

Stand 12 was harvested prior to 1974 and is currently mixed conifer with 224 TPA which (Figure 47). Survey

Appendix D.

data is based on 5 plots of data.

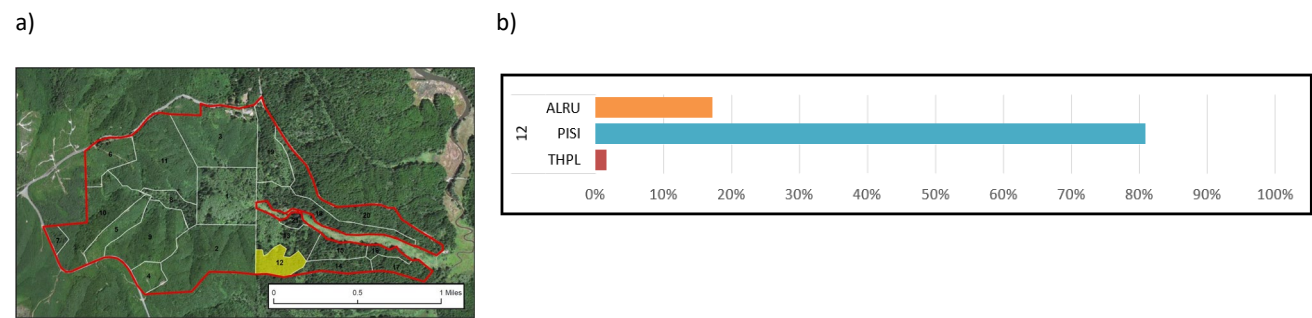


Figure 47: a) Stand 12 location and b) species composition. ALRU = red alder, PISI = Sitka spruce, THPL = western red cedar



### Stand 8 – 10.0 Acres, Leave – Riparian Management Area

Stand 8 was harvested prior to 1994, likely left as buffer for ~1994 harvests, and currently has 164 TPA (Figure 48). Located deep in the lower parts of the upper watershed this stand buffers Wasson creek on both the north and the south (dual aspect based on side of creek). Not likely to need or be accessed for active management. Five plots were surveyed in this stand.

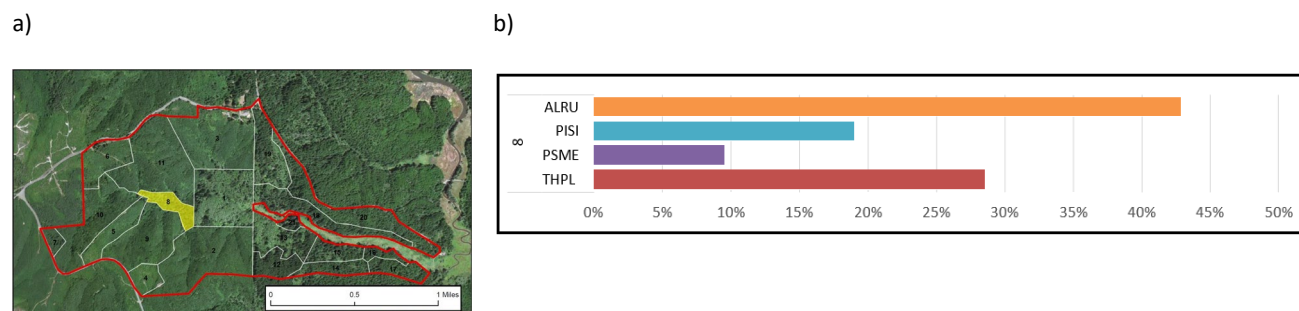


Figure 48: a) Stand 8 location and b) species composition. ALRU = red alder, PISI = Sitka spruce, PSME = Douglas-fir, THPL = western red cedar

### Stand 1 – 40.9 Acres, Leave – Riparian Management Area

Stand 1 was harvested prior to 1994, probably older than 1974 and consists of a relatively flat square stand of hardwoods (149 TPA; Figure 49) that borders Wasson Creek on both sides. Crosses Wasson Creek and consequently includes both northern and southern aspects. The remnant logging road, runs from the ridgeline through stand 2 accesses the southeast corner of the stand. Sixteen plots were surveyed in this stand.

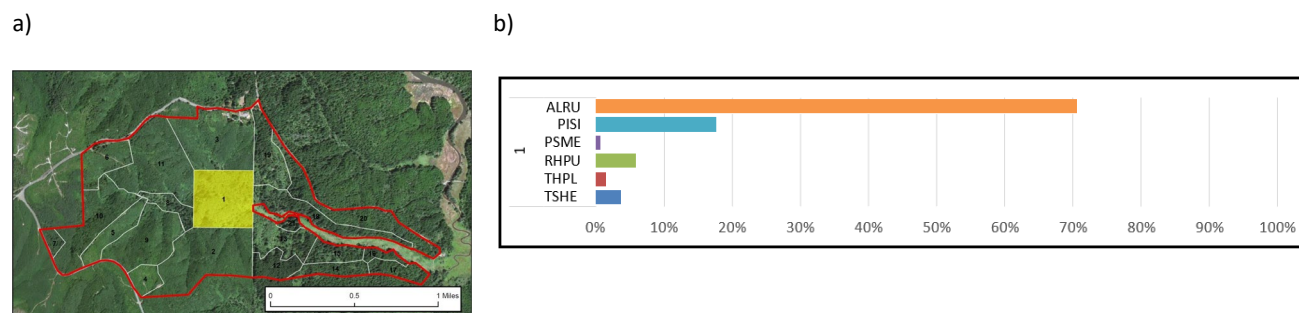


Figure 49: a) Stand 1 location and b) species composition. ALRU = red alder, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, TSHE = western hemlock

### Stand 18 – 27.0 Acres, Leave – Riparian Management Area

Stand 18 was harvested prior to 1974 and is currently mixed conifer with 147 TPA which (Figure 50). Survey data is based on 11 plots of data.

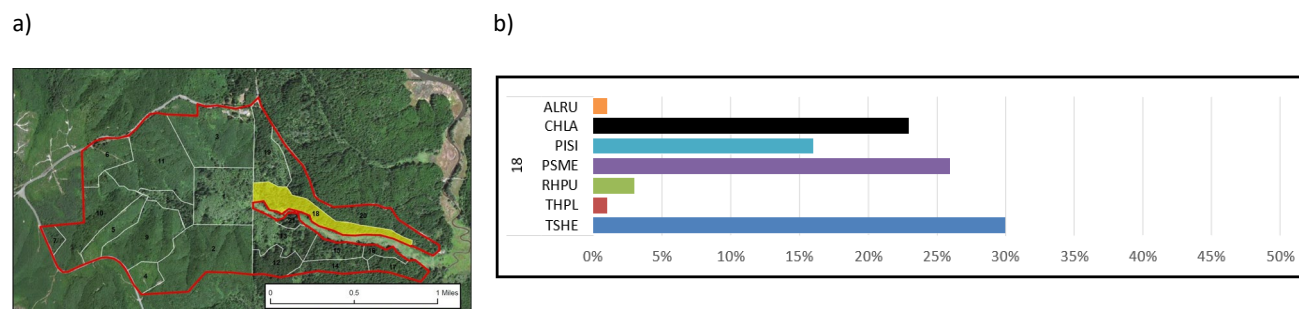
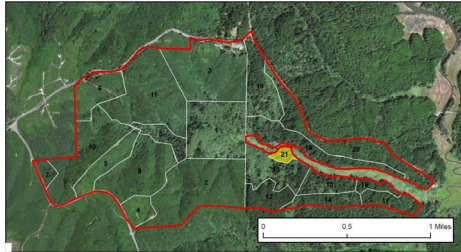


Figure 50: a) Stand 18 location and b) species composition. ALRU = red alder, CHLA = Port-Orford-cedar, PISI = Sitka spruce, PSME = Douglas-fir, RHPU = Cascara, THPL = western red cedar, TSHE = western hemlock

### Stand 21 – 3.4 Acres, Leave – Riparian Management Area

This small stand was harvested prior to 1974 and is currently dominated by Sitka spruce with 80 TPA which (Figure 51). Survey data is based on a single plot of data.

a)



b)

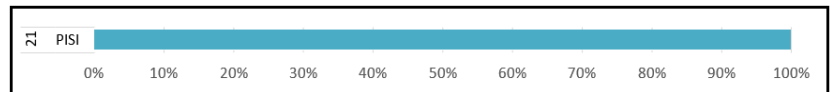


Figure 51: a) Stand 21 location and b) species composition. PISI = Sitka spruce

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## 9 Supplementary Information A – Species List

| Common Name                     | Latin Name                       | Abbreviated Latin      | 4-Letter Code |
|---------------------------------|----------------------------------|------------------------|---------------|
| <b>Trees (coniferous)</b>       |                                  |                        |               |
| Grand fir                       | <i>Abies grandis</i>             | <i>A. grandis</i>      | ABGR          |
| Port-Orford-cedar               | <i>Chamaecyparis lawsoniana</i>  | <i>C. lawsoniana</i>   | CHLA          |
| Shore (Lodgepole) pine          | <i>Pinus contorta</i>            | <i>P. contorta</i>     | PICO          |
| Sitka spruce                    | <i>Picea sitchensis</i>          | <i>P. sitchensis</i>   | PISI          |
| Douglas fir                     | <i>Pseudotsuga menzeseii</i>     | <i>P. menzeseii</i>    | PSME          |
| Coastal redwood                 | <i>Sequoia sempervirens</i>      | <i>S. sempervirens</i> | SESE          |
| Western red cedar               | <i>Thuja plicata</i>             | <i>T. plicata</i>      | THPL          |
| Western hemlock                 | <i>Tsuga heterophylla</i>        | <i>T. heterophylla</i> | TSHE          |
| <b>Trees (deciduous)</b>        |                                  |                        |               |
| Big leaf maple                  | <i>Acer macrophyllum</i>         | <i>A. macrophyllum</i> | ACMA          |
| Red alder                       | <i>Alnus rubra</i>               | <i>A. rubra</i>        | ALRU          |
| Cascara                         | <i>Rhamnus purshiana</i>         | <i>R. purshiana</i>    | RHPU          |
| Willow                          | <i>Salix, spp.</i>               | <i>S. spp.</i>         | SALI          |
| <b>Understory (native)</b>      |                                  |                        |               |
| Slough sedge                    | <i>Carex obnupta</i>             | <i>C. obnupta</i>      | CAOB          |
| Salal                           | <i>Gaultheria shallon</i>        | <i>G. shallon</i>      | GASH          |
| Horsetail                       | <i>Equisetum</i>                 | <i>E. spp.</i>         | EQUI          |
| Oregon grape                    | <i>Mahonia aquifolium</i>        | <i>M. aquifolium</i>   | MAAQ          |
| Pacific waxmyrtle               | <i>Myrica californica</i>        | <i>M. californica</i>  | MYCA          |
| Sorrel                          | <i>Oxalis oregana</i>            | <i>O. oregana</i>      | OXOR          |
| Sword fern                      | <i>Polystichum munitum</i>       | <i>P. munitum</i>      | POMU          |
| Deer fern                       | <i>Pteridium aquifolium</i>      | <i>P. aquifolium</i>   | PTAQ          |
| Pacific rhododendron            | <i>Rhododendron macrophyllum</i> | <i>R. macrophyllum</i> | RHMA          |
| Salmonberry                     | <i>Rubus spectabilis</i>         | <i>R. spectabilis</i>  | RUSP          |
| Willow                          | <i>Salix, spp.</i>               | <i>S. spp.</i>         | SALI          |
| Red elderberry                  | <i>Sambucus racemosa</i>         | <i>S. racemosa</i>     | SARA          |
| Thimbleberry                    | <i>Rubus parviflorus</i>         | <i>R. parviflorus</i>  | RUPA          |
| Inside-out flower               | <i>Vanvouveria hexandra</i>      | <i>V. hexandra</i>     | VAHE          |
| Evergreen huckleberry           | <i>Vaccinium ovatum</i>          | <i>V. ovatum</i>       | VAOV          |
| Red huckleberry                 | <i>Vaccinium parvifolium</i>     | <i>V. parvifolium</i>  | VAPA          |
| <b>Shrubs (non-native)</b>      |                                  |                        |               |
| Scotch broom                    | <i>Cytisus scoparius</i>         | <i>C. scoparius</i>    | CYSC          |
| English holly                   | <i>Ilex aquifolium</i>           | <i>I. aquifolium</i>   | ILAQ          |
| Cotoneaster                     | <i>Cotoneaster, spp.</i>         | <i>C. spp.</i>         | COTO          |
| English ivy                     | <i>Hedera helix</i>              | <i>H. helix</i>        | HEHE          |
| Himalayan (Armenian) blackberry | <i>Rubus armeniacus</i>          | <i>R. armeniacus</i>   | RUAR          |



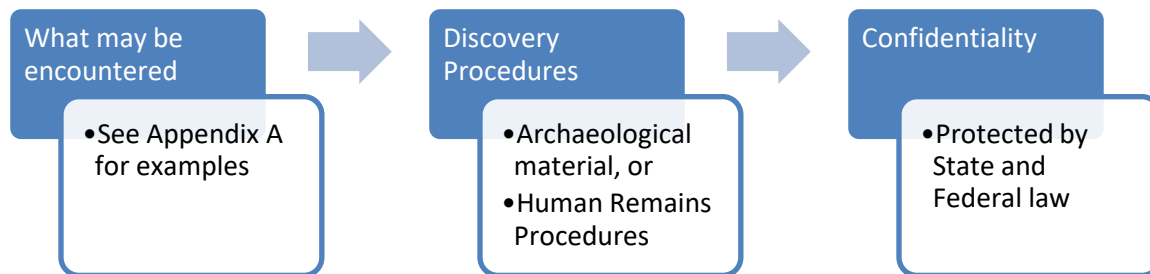
## APPENDIX F

# ARCHAEOLOGICAL INADVERTENT DISCOVERY PLAN (IDP)

## Wasson Creek Watershed Restoration Project

Project Manager: Alice Yeates; July 2022; SHPO case number: 22-0221

## HOW TO USE THIS DOCUMENT



Archaeology consists of the physical remains of the activities of people in the past. This IDP should be followed should any archaeological sites, objects, or human remains are found. These are protected under Federal and State laws and their disturbance can result in criminal penalties.

This document pertains to the work of the Contractor, including any and all individuals, organizations, or companies associated with the Wasson Creek Watershed Restoration Project.

### WHAT MAY BE ENCOUNTERED

Archaeology can be found during any ground-disturbing activity. If encountered all excavation and work in the area **MUST STOP**. Archaeological objects vary and can include evidence or remnants of historic-era and precontact activities by humans. Archaeological objects can include but are not limited to:

- **Stone flakes, arrowheads, stone tools, bone or wooden tools, baskets, beads.**
- Historic building materials such as **nails, glass, metal** such as cans, barrel rings, farm implements, **ceramics, bottles, marbles, beads.**
- Layers of **discolored earth** resulting from hearth fire
- Structural remains such as **foundations**
- **Shell** Middens
- **Human skeletal remains** and/or **bone fragments** which may be whole or fragmented.

*For photographic examples of artifacts, please see Appendix A. (Human remains not included)*

**If there is an inadvertent discovery of any archaeological objects see procedures below.**

**If in doubt call it in.**

### DISCOVERY PROCEDURES: WHAT TO DO IF YOU FIND SOMETHING

1. Stop ALL work in the vicinity of the find

2. Secure and protect area of inadvertent discovery with 30 meter/100 foot buffer—work may continue outside of this buffer
3. Notify Project Manager and Agency Official
4. Project Manager will need to contact a professional archaeologist to assess the find.
5. If archaeologist determines the find is an archaeological site or object, contact SHPO. If it is determined to *not* be archaeological, you may continue work.

### HUMAN REMAINS PROCEDURES

1. If it is believed the find may be human remains, stop ALL work.
2. Secure and protect area of inadvertent discovery with 30 meter/100 foot buffer, then work may continue outside of this buffer with caution.
3. Cover remains from view and protect them from damage or exposure, restrict access, and leave in place until directed otherwise. **Do not take photographs. Do not speak to the media.**
4. Notify:
  - Project Manager
  - Agency Official
  - Oregon State Police **DO NOT CALL 911**
  - SHPO
  - LCIS
  - Appropriate Native American Tribes
5. If the site is determined not to be a crime scene by the Oregon State Police, do not move anything! The remains will continue to be *secured in place* along with any associated funerary objects, and protected from weather, water runoff, and shielded from view.
6. Do not resume any work in the buffered area until a plan is developed and carried out between the State Police, SHPO, LCIS, and appropriate Native American Tribes and you are directed that work may proceed.

### CONTACT INFORMATION

- Project Manager, Alice Yeates: 541-888-8270 x314 (office)
- Reserve Manager, [Bree Yednock]: 541-888-8270 x302 (office), 971-720-0897 (cell)
- Contracted Archaeologist: *To be entered if applicable*
- Oregon State Police, Lt. Craig Heuberger: 503-508-0779 cheuber@osp.oregon.gov
- Oregon State Historic Preservation Office (SHPO),
  - SHPO archaeologist: *To be entered if applicable*
  - State Archaeologist, John Pouley: 503-480-9164
  - Ass. State Archaeologist, Jamie French: 503-979-7580
- LCIS, Patrick Flanagan: 503-986-1067
- Appropriate Tribes
  - Coquille Indian Tribe, THPO, Kassandra Rippee: 541-808-5554
  - Confederated Tribes of Coos Lower Umpqua and Siuslaw, THPO and State IDP: Courtney Krossman: [(541)808-5085] and Jesse Beers [(541)297-0748]
  - Confederated Tribes of Siletz Indians, Cultural Director, Robert Kentta: 541-351-0148

### CONFIDENTIALITY

The Wasson Creek Watershed Restoration Project and employees shall make their best efforts, in accordance with federal and state law, to ensure that its personnel and contractors keep the discovery confidential. The media, or any third-party member or members of the public are not to

be contacted or have information regarding the discovery, and any public or media inquiry is to be reported to South Slough National Estuarine Research Reserve. Prior to any release, the responsible agencies and Tribes shall concur on the amount of information, if any, to be released to the public.

*To protect fragile, vulnerable, or threatened sites, the National Historic Preservation Act, as amended (Section 304 [16 U.S.C. 470s-3]), and Oregon State law (ORS 192.501(11)) establishes that the location of archaeological sites, both on land and underwater, shall be confidential.*

## APPENDICES AND SUPPLEMENTARY MATERIALS

### A. Visual reference and examples of archaeology



## APPENDIX A

### VISUAL REFERENCE GUIDE TO ENCOUNTERING ARCHAEOLOGY



**Figure 1: Stone flakes**



**Figure 2: Stone tool fragments**



**Figure 3: Cordage**



**Figure 4: Shell midden**





Figure 5: Historic glass artifacts



Figure 6: Historic metal artifacts





**Figure 7: Historic building foundations**



**Figure 8: 18th Century ship**



**Figure 9: Fish weirs**