Appendix H
Proposed Restoration Concepts

1 EXISTING INFORMATION FOR RESTORATION

The Applicant intends to restore and revegetate all areas cleared for construction staging and access that are not part of the permanent Flood Retention Expandable (FRE) facility, including quarries. This includes approximately 56.6 acres of stream buffer, approximately 90 acres of upland habitat, and 7,803 linear feet (1.48 miles) of temporary gravel access roads that would be built on the active construction site. Temporary roads would also provide access to the selected quarry site and material processing and production areas.

1.1 Upland Habitat in Construction Disturbance Area

The temporary construction area outside of the inundation area includes 90 acres of vegetated land. The temporarily disturbed vegetation communities would be graded, topsoiled, and planted following construction, and then monitored over time. More than 90 percent of the vegetated land cover types consist of commercial timberlands although small areas of herbaceous/grass and deciduous scrub-shrub habitats are present. These areas are expected to be restored to their current structure or scrub-shrub within a couple of years after native vegetation planting. The disturbance to forested cover would temporarily reduce the amount of forest habitat, converting it to scrub-shrub that would persist for several years after restoration until natural forest conditions develop.

1.2 Bypass Channel Excavation

Following Phase 2 of construction, as described in Appendix K of the Revised Project Description Report (RPDR), once the Chehalis River and Crim Creek are permanently rerouted through the final engineered stream channel, the temporary bypass channel would be backfilled to form the right bank of the engineered stream channel and graded to drain freely into the engineered channel to eliminate the potential for future fish stranding. Materials used to fill the temporary bypass would include native materials excavated during bypass excavation, or native materials excavated for the FRE foundations. Following the placement of native fill material, the temporary bypass would be recontoured and restored with appropriate flood-tolerant native riparian plants. Along portions of the temporary bypass footprint adjacent to the Chehalis River, streambanks would be formed using a mix of native rock removed during bypass and FRE foundation excavation. Willow fascines would be in-planted within the bank armoring, as feasible and appropriate. Streambank rocks would be sized to maintain hydraulic preference and to withstand design flows to ensure the river remains within the engineered channel downstream of the bypass entrance during design flow events.

Downstream of the spillway, the riverbank would be filled to grade and planted with suitable native vegetation to prevent erosion and sedimentation of the Chehalis River. This area will not be maintained as a channel after FRE construction because allowing flow through the area could attract fish during FRE operations. During operations, fish must be attracted to the left bank flood fish passage facility to facilitate entry into the various fish ladders and minimize passage delay.

Following fill placement, restored areas would be covered with a layer of topsoil placed at a depth suitable for the establishment and maintenance of riparian vegetation over the long term. The topsoil depths would be determined during later design phases but would consider flooding events and the need to accommodate rooting systems for a variety of species. Drawings within Appendix A of the RPDR illustrate both the temporary grading and final grading of the project site.

Riparian plantings would occur in the fall or spring immediately following bypass channel restoration, during Phase 3 of the construction schedule (see RPDR for construction schedule). This timing will allow a minimum of two years for plant establishment before construction is complete and before the first possible operation of the FRE. Thus, the timing of bypass channel restoration and plant establishment will allow sufficient growth of plantings to minimize erosion potential and sediment entry into the river before the FRE becomes operational.

Plant species selected for restoration of the temporary bypass channel, and for restoration of the riverbank downstream of the proposed FRE spillway, will be the same as those detailed in the riparian planting palette presented in the Vegetation Management Plan (VMP, Appendix D). As discussed in the VMP, faster growing flood-tolerant species such as willow (*Salix* spp.) and red alder (*Alnus rubra*) will be planted first, and slower-growing riparian species such as redosier dogwood (*Cornus stolonifera*) will be planted in succession. Over time, this species combination will become established and provide a multi-layered, complex canopy of woody, deciduous species within the riparian zone.

1.3 Road Decomissioning/ Roadway Abandonment

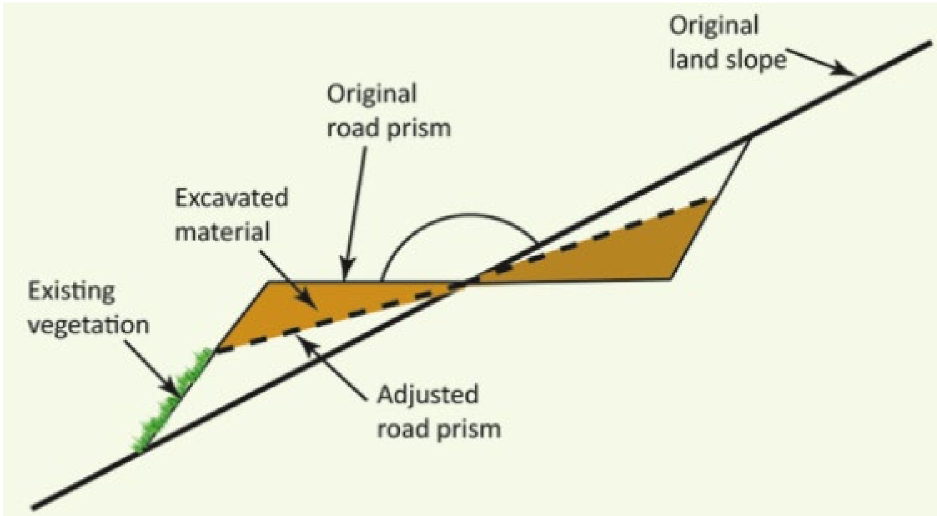
Currently, the Applicant proposes to decommission all temporary roads after construction and restore habitats to pre-construction conditions. All roads (including existing roads) that are not required for permanent operations and maintenance will be returned to pre-construction condition, graded and scarified, covered with topsoil, and planted with native species. The Applicant also proposes to revegetate approximately 49 acres of stream buffer around the active construction site. In all temporarily impacted areas located within the modeled temporary inundation pool, native flood-tolerant species will be used for replanting.

Decommissioning of roads outside of the modeled temporary inundation pool will include the following steps (note: specifications will be refined during future design phases):

1. Excavate and grade road surface to mimic adjacent topography and drain runoff from upslope areas. In roadway areas that cross drainages or streams, areas will be graded to remove fill

within the channels and provide stable side slopes (e.g., approximately 2:1) as shown in Figure 1.

Figure 1
Compared to Gates or Barriers, a More Permanent Closure Method Is to Radically Outslope the First 100 Feet of the Closed Road So That the Road Is Too Steep to Drive (Figure 291 in Weaver et al. 2014).



2. Scarify road surface to reduce surface runoff and allow for placement and infill of topsoil or other surface amendments at depths sufficient to promote the establishment and long-term sustainability of native plantings.
3. Place biodegradable fabric coir in areas adjacent and sloping to perennial or intermittent drainages.
4. Apply a mix of suitable, native hydroseed and native plantings.
5. In areas adjacent to or along hillsides, add materials for roughness (e.g., downed logs or similar) to slow erosion and facilitate roadway stabilization, an example is shown in Figure 2.

Figure 2
After Decommissioning, All of the Potentially Unstable Fill Material Has Been Excavated and Endhauled Offsite. Some Excavated Material Has Been Placed Along Dry Portions of the Cutbank, But Seeps and Springs Have Been Left Uncovered to Freely Drain Down the Slope. The Excavated Fill Slope and Road Bench Has Been Covered with Alder Trees That Were Growing on the Slope, and the Remaining Bare Soil Areas Were Seeded and Mulched with Straw. The Threat to the Stream at the Base of the Slope Has Been Eliminated (Figure 271b in Weaver et al. 2014).

Restoration of ground disturbed areas to control the input of sediment to waterways includes two primary objectives. These objectives are i) returning soils to the pre-disturbed context; and ii) vegetation establishment. Access roads and clearings encompass the majority of disturbances where restoration is needed. The pre-disturbed soil context includes the assessment of drainage and temporary soils or fill. Vegetation establishment shall be of native species and must reflect the pre-disturbance plant community. Best practices for revegetation include seed collection and propagation of species from the ecoregion where land disturbing activities are proposed.

Drainage on the landscape over large, cleared areas occurs as overland flow, and if left in a disturbed condition will result in nonpoint-source runoff. Clearings are examples of areas where overland flow must be mitigated. In flat or gently sloped areas where flows are not concentrated, treatment includes decompaction, scarification, and construction of swales and berms from slash or compost. Swales and berms contour slopes to catch and slow down overland flow. They provide a filter function and capture the fine material entrained in overland flow. Best practices during clearing activities include salvage and staging of slash for use later in site restoration. Sourcing materials from on-site clearing activities prevents the introduction of invasive species and reduces greenhouse gas emissions related to material transportation. Cleared material that is not merchantable would be chipped or flailed and composted before staging for later use in restoration efforts.

Temporary soils and fill typically occur coincident with steeper drainage through gullies or streams where road crossings have been constructed. Revegetation alone is insufficient for the restoration of stream crossings as culverts can become blocked and unstable slopes can fail. Decommissioning a stream crossing includes the removal of the culvert as well as the removal of all temporary unstable fill or side-cast sediments that could deliver sediment to a stream through slope failure. The excavation of gully and stream crossing fills should be sized to pass a 100-year storm event, and bank slopes should not exceed a 2:1 (50 percent) gradient as shown in Figures 3 through 5.

Figure 3
On Roads That Are to Be Closed (Decommissioned), All Stream Crossing Culverts and Fills Should Be Removed. Stream Crossing Excavations Are Best Performed Using an Excavator. The Original Channel Should Be Excavated and Exhumed Down to the Former Streambed, with a Channel Width Equal or Greater Than the Natural Channel Above and Below the Crossing. Sideslopes Should Be Laid Back to a Stable Angle, Typically a 2:1 (50%) Gradient or Less. Spoil Can Be Endhauled Off-Site or Stored on the Road Bench Adjacent the Crossing, Provided It Is Placed and Stabilized Where It Will Not Erode or Fail and Enter the Stream (Figure 263 in Weaver et al. 2014).

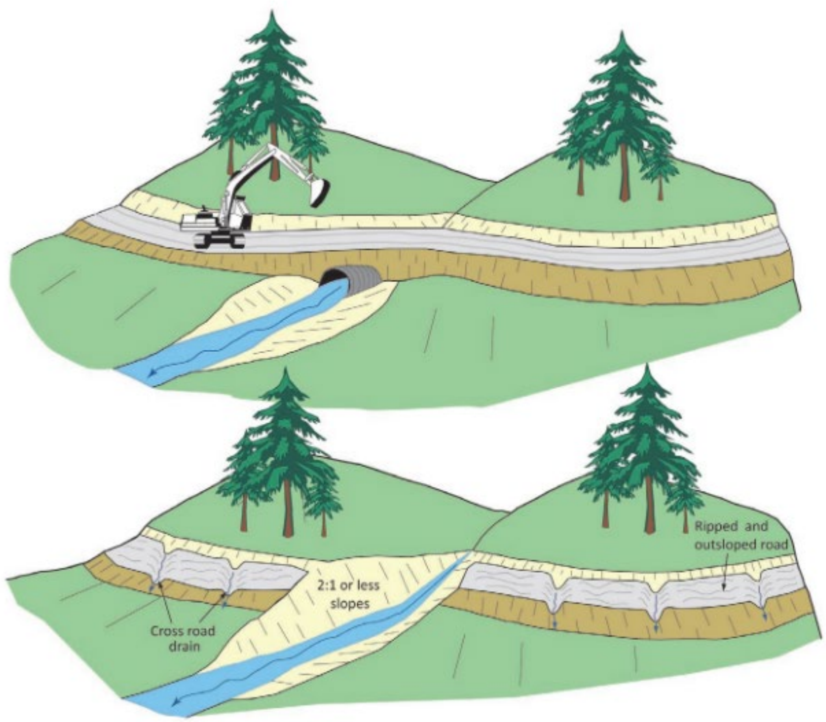


Figure 4
Plan View of Road Crossing Abandonment Showing Excavation of Road Fill and Placement of Large Wood When It Is Available on Site and Non-merchantable (Figure 19 in Washington Department of Natural Resources [WA DNR] 2013).

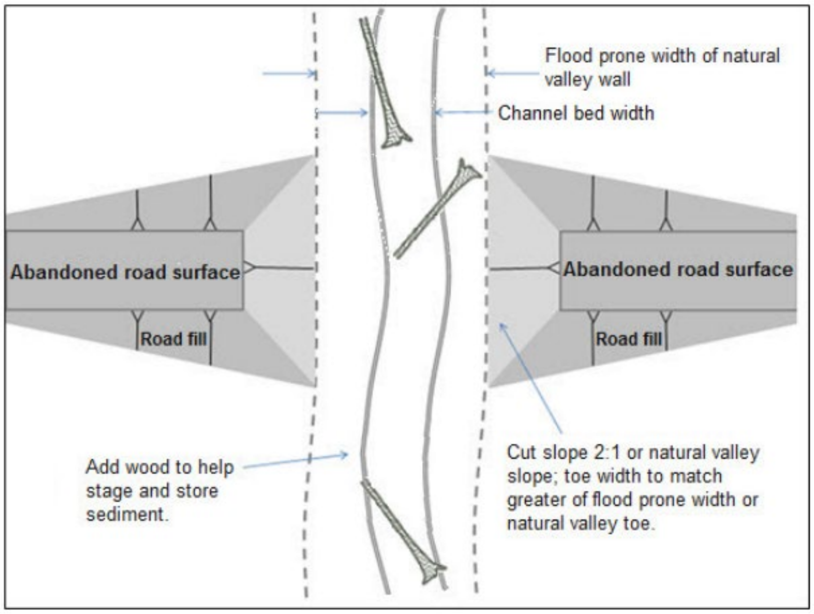
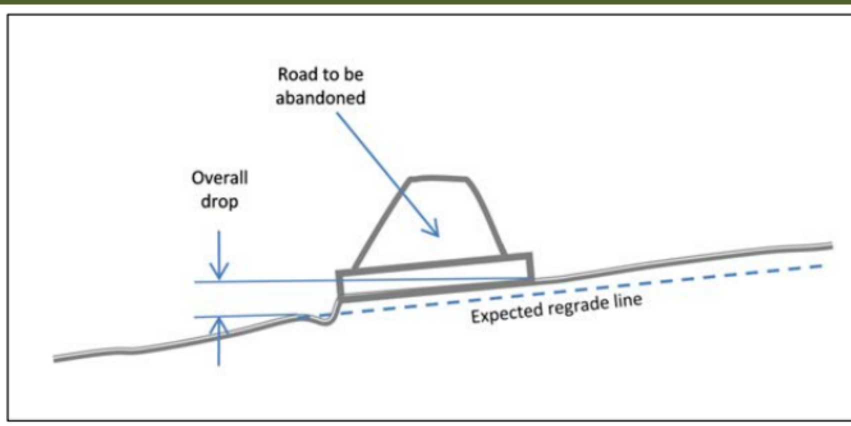


Figure 5
Profile View of Road Crossing Abandonment Showing the Overall Drop in Water Surface (Figure 20 in WA DNR 2013).



The banks of all excavated stream crossings as well as all bare soil areas immediately adjacent or near a watercourse should be seeded and mulched with straw before revegetation with native species. Beyond the immediate proximity of the crossing, access shall be regraded so that the road is outsloped and soils do not become saturated as shown in Figure 6.

Figure 6
Top Panel: Poorly “Decommissioned” Stream Crossing with Excavated Spoil Piled Next to the Trench (Arrow) That Could Easily Erode into the Stream.
Lower Panel: Properly Decommissioned Stream Crossing, with 2:1 (Stable) Sideslopes, Adequate Channel Width for Flood Flows, a Uniform Channel Grade, and Sideslopes Treated with Erosion Control Measures (Figures 264 and 265 in Weaver et al. 2014).

Best practices for planning land disturbing activities include site surveys to inform where access and staging would be optimally located, cataloging vegetation communities, and development of seed collection strategies for material germination and revegetation planning.

Consistent with re-grading the disturbed areas within up to two quarry sites (the second site will be disturbed only if the rock at the first site is insufficient), the Applicant will assess the extent to which habitats can be created at these sites to help offset potential wetland, wetland and riparian buffer, and wildlife impacts from construction. The quarry sites, each about 65 acres, are in steeply sloping terrain where the current vegetation is dominated by coniferous forest. After gravel extraction is complete, each site is expected to consist of a relatively level central area (pit floor) surrounded by steep slopes. Reclamation planning will follow the best management practices for surface mining for Oregon and Washington (Norman et al. 1997), including stockpiling overburden and topsoil. The rehabilitation approach will focus on promoting the development of the following three habitat types.

Depressional Wetlands − The reclamation objective for the pit floor areas will be to create depressional wetland habitats. Shallow basins will be excavated if needed, and impervious material available on site will be used to restrict drainage. This material will be capped with topsoil to provide suitable conditions for the growth of wetland plants. A variety of suitable native herbaceous and woody plants will be planted to promote the development of a wetland plant community and appropriate buffer habitat. If springs are present at any of the sites, it may be possible to create slope wetlands using a similar approach.

Coniferous Forest − On slopes where soil moisture appears likely to be adequate to support tree growth, the reclamation objective will be to promote the development of coniferous forest. The growth of mature trees in this environment can require several centuries, so treatments will focus on establishing a healthy early-successional community that has the potential to eventually develop into old-growth forest.

Shrubland − At one or more sites, there may be steep slopes that lack sufficient soil moisture to support tree growth, due to substrate properties, slope angle, and/or aspect. For these areas, the reclamation objective will be to promote the development of shrubby and/or herbaceous vegetation that will help stabilize the slopes and reduce opportunities for the spread of invasive species. Treatments will focus on seed and/or transplanting native plants that are adapted to these conditions.

2 REFERENCES

Norman D.K., P.J. Wampler, A.H. Throop, E.F. Schnitzer, and J.M. Roloff, 1997. Best management practices for reclaiming surface mines in Washington and Oregon. Washington Division of Geology and Earth Resources. Open File Report 96-2. 130p.

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Weaver, W.E., E.M. Weppner, and D.K. Hagans, 2014. Handbook for Forest, Ranch and Rural Roads: A Guide for Planning, Designing, Constructing, Reconstructing, Upgrading, Maintaining and Closing Wildland Roads, Mendocino County Resource Conservation District, Ukiah, California, 416 p.