Friday, October 16, 2020

California Fish Passage Forum

Project Name	Lawrence Creek Off-Channel Habitat Connectivity Project, Phase III
Contact Name	Elise Ferrarese
Lead Organization	Trout Unlimited, Inc.
Contact Email	elise.ferrarese@tu.org
Phone Number	(541) 829-1250
Date	Thursday, October 15, 2020

PROJECT INFORMATION

1. Location of Project

40.598833, -123.978571 DD

2. Attach a map of your project

pdf Lawrence Creek_3.0_Site Map.pdf

3. Description of project, including, deliverables and outcomes you seek to achieve. Please clearly describe which portion of the project Forum funding would be applied to, and the specific deliverables and outcomes expected to result from this funding.

This
project will occur on Humboldt Redwood Company property within Lawrence Creek, a high priority, core recovery salmon and steelhead stream in Humboldt County. Lawrence Creek is a tributary to Yager Creek, which is located 11.0 miles upstream of the confluence with the Van Duzen River. Yager Creek and its tributaries are among the most important Coho and Chinook salmon streams in the Van Duzen River basin (CDFW, 2017 draft). The Lawrence Creek watershed covers a total area of 42.0 mi2. The watershed contains 22.2 miles of anadromous streams and contains important salmonid habitat for Coho salmon, Chinook salmon, and steelhead trout (CDFG 2006; Palco, 2002).

Historically,
Coho salmon occupied much of the Lower Eel and Van Duzen River sub-basin. However, information on historic Coho salmon distribution and abundance is limited. Coho salmon have been observed intermittently over the past few decades, but Coho salmon are absent in many historically occupied tributaries (NOAA, 2014). The Lower Eel/Van Duzen
River Coho population is at high risk of extinction (NOAA, 2014). The Lower

Eel/Van Duzen River population is a core, Functionally Independent population within the Southern Coastal diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, and with population dynamics or extinction risk over a 100-year time period that are not substantially altered by exchanges of individuals with other populations. Within the Van Duzen River Basin, the Yager Creek Subbasin most likely maintains the highest salmonid fisheries value, particularly concerning the presence and viability of Coho salmon within the Lawrence Creek drainage (CDFW, 2017).

Anadromous
salmonids found in the Van Duzen River basin include Southern Oregon/Northern California Coast (SONCC) Coho salmon- status: threatened (federal and state listing); California Coastal (CC) Chinook Salmon – status threatened (federal listing); and Northern California (NC) Steelhead trout-status: threatened (federal listing); as well as coastal cut-throat trout. Historically, thousands of Coho salmon (*Oncorhynchus kisutch*) returned annually to spawn in the rivers and streams of Northern California and Southern Oregon. The watersheds that supported this fishery supported robust and resilient populations of Coho salmon that could persist under a range of environmental conditions. Habitat alterations caused by land management led to declines in these populations. Current population estimates state that steelhead are distributed in mainstem Yager Creek in all its forks and tributaries (approximately 53 miles). At least 19 of the available stream miles are potentially used by Coho salmon and approximately 30 miles are utilized by Chinook salmon. The proposed project intends to benefit multiple species but focuses on addressing high priority SONCC Coho recovery actions: “Construct off channel habitats alcoves, backwater habitat and old stream oxbows.” The proposed project will reconnect and enhance off-channel floodplain habitat features by restoring hydrologic connectivity and adding large wood. Large wood will be added to the project site to provide shelter habitat, control grade, and to enhance the duration and inundation of surface water.

This is the third off-channel
habitat restoration project in the Lawrence Creek Sub-basin since 2015. The first project (Lawrence 1.0) was a ¼ acre pond (150’x 45’) collaboratively designed and constructed by NOAA and Humboldt Redwood Company (HRC). Approximately 2,000 cubic yards of sediment were removed to create two separate deep-water pools, with shallow edge-water habitat to provide a diversity of habitat types and conditions to maximize potential food resources and other ecosystem benefits. This project provided a valuable opportunity to learn more about off-channel pond design, construction and physical monitoring, fish utilization and overall project performance. After one-year post-construction, Coho salmon and steelhead were found utilizing the habitat. The complex wood structures and willow plantings provided habitat diversity in the pond that allowed for increased macroinvertebrate production and utilization by northwestern salamanders and Pacific tree and red-legged frogs, as evidenced by egg masses observed on small wood and submerged willow plantings.

In 2017, TU was awarded funds from
the NOAA Restoration Center to expand on the work that occurred in 2015, and to complete two additional off-channel habitat restoration projects. In 2018, construction was completed on a second off channel pond on Lawrence Creek (2.0),

which consisted of restoring hydrologic connectivity to 260' of an unnamed (Class II) watercourse and enhancing the habitat through excavation of pond and alcove features and placement of large wood.. Coho salmon and steelhead trout have also been observed utilizing the pond feature year-round. Although the pond became hydrologically disconnected during the 2019 and 2020 summers, water quality conditions did not impact salmonid summer growth or survival.

This project, Lawrence Creek Off Channel Habitat Connectivity, Phase III (3.0), is the final deliverable under the NOAA Restoration Center grant. The scope of this project is focused on enhancing and restoring hydrologic connectivity to an existing side channel habitat feature connected to Lawrence Creek. The project was developed and designed following a collaborative public-private partnership between Trout Unlimited, Humboldt Redwood Company, Pacific Watershed Associates, and the Western Region NOAA/NMFS staff to capitalize on shared expertise, experience, and resources.

The project will provide ESA species access to historic floodplain habitats by enhancing hydrologic connectivity to a side channel feature and creating a new connected alcove-pond feature that will provide shelter during intense storm events. Low-velocity refugia are important for reducing juvenile salmonid mortality during high-flow events. The project will create low-velocity winter refugia off-stream of Lawrence Creek and add shelter and complexity to the available aquatic habitat in the reach. The project will hydrologically reconnect the side channel habitat by constructing large wood structures to increase inundation frequency to the existing side-channel and off-channel alcove. Large bar apex and deflector jams constructed in Lawrence Creek will raise the water surface upstream and induce more flow into the side channel to achieve hydrologic connection at 15% exceedance flows and greater (~55 days per year). Construction of the alcove will include excavation to achieve engineered grades and addition of large wood for habitat. The project approach will provide sustainable and lasting ecological benefits to core populations of SONCC Coho and CC Salmon as well as NC Steelhead trout.

Habitat wood will be placed throughout the alcove and project reach to improve the aquatic habitat to optimize conditions for all life stages of fish and macroinvertebrates. These elements will be configured in a manner to allow access at varying depths and promote habitat complexity. Log spanners will provide sediment flushing velocities within the side channel by forcing flow under the log during the receding limb of the flood flow. These features will be embedded into the channel banks and be elevated above the alcove invert a maximum 1- ft. The log spanners will utilize soil ballast on both ends of the log to withstand buoyancy and lift forces up to 100-yr flood events. A total of approximately 68 pieces of large wood (some with attached rootwads) will be added to the alcove, stream channel and banks as part of this project.

This project is fully permitted (401 NOA, 404 Nationwide 27, HREA, NOAA Programmatic Approach) and was originally scheduled for implementation during the 2020 low flow season, however, several unforeseen circumstances culminated in postponing the project until 2021. Humboldt Redwood Company was originally identified as the entity to provide equipment and operators for project construction. However, due to the Covid-19 pandemic HRC was

forced to eliminate the equipment operator staff. Following its procurement policy, TU sought three cost estimates from local qualified subcontractors to conduct the work. Most of the estimates provided exceeded the total construction budget previously secured by TU, except one provided by LTO Kyle Roscoe. Mr. Roscoe comes highly recommended by PWA, so based on his experience and estimated costs TU and the Project Team selected Mr. Roscoe as the preferred construction subcontractor. The project was scheduled to occur in mid-October, however during late September, the August Complex fire entered the Van Duzen basin, leading to further uncertainty about whether construction was feasible during the 2020 construction season, so a decision was made to postpone until 2021. Construction is scheduled to occur at any point between August 1, 2021and October 31, 2021, and will take approximately 2 weeks.

This request intends to provide additional support to the project during the 2021 season. The original project budget included funds awarded by the NOAA RC and HRC in-kind cost. In addition to providing monitoring support and materials, HRC agreed to provide construction services, which afforded the project a certain amount of financial flexibility if construction costs exceeded the original award. When HRC was no longer able to provide construction services, the remaining award balance for construction became highly constrained. This request will allow TU staff to remain actively involved throughout construction and will allow for more construction oversight provided by PWA. The request will also address potential cost increases that are likely to occur in 2021.

The estimate provided by Mr. Roscoe took into consideration the conditions onsite during 2020. One of the benefits related to constructing in 2020 was that the drought conditions and low streamflow were going to reduce construction and oversight costs. Higher stream flow will require additional water management (i.e. clear water diversion, nuisance pumping, etc.) which will extend the total construction window and require additional PWA oversight. The request will ensure that construction can occur as designed in the 2021 season. Without these funds this otherwise shovel ready project project may suffer from further delay.

Project Tasks

Task A- Project Administration

Trout Unlimited personnel will provide all contract oversight and grant administration as pursuant to funding and regulatory guidelines. This includes but is not limited to securing contracts, project scheduling, implementation support, invoicing, reporting, and agency and landowner communications. This task will occur throughout the life of this project.

Task B- Implementation

Pacific
Watershed Associates (PWA) were the design engineers for this project and will also serve as the technical lead for project implementation. PWA will conduct a pre-construction conference with the Heavy Equipment contractor (Kyle Roscoe), and provide construction oversight. PWA will also provide as-built drawings after project completion.

Kyle
Roscoe will be the Heavy Equipment contractor, and will be responsible for water management, grading according to the engineered drawings, and construction of the large wood structures. Kyle Roscoe will also be responsible for erosion control and access road decommissioning following completion of project construction.

Please see
the attached Basis of Design Report (90%) for details on project implementation.

Task C
Monitoring

Humboldt
Redwood Company will supply wood and rock for the large wood structures and is responsible for project monitoring. HRC will collect information that is consistent with the NOAA Restoration Center's Habitat Restoration Performance Measures and Monitoring Worksheet and the requirements of the project permitting agencies. Data that will be collected will address the amount of habitat made available as a result of the project, land elevations, water levels, and biological monitoring. Please see attached monitoring plan for details. Humboldt Redwood Company's work is being used as match for NOAA grant NA17NMF4630189 and thus cannot be used as match for this funding opportunity. Please see attached monitoring plan for more detail.

Deliverables will include a Final Report, As-built Drawings, Photographs, and Monitoring Report.

4. Select all components that apply to your project.

Habitat restoration

Fish passage monitoring

Education/outreach

If you answered "yes" to question 6, please provide the PAD ID number(s).

18. Attach a copy of your monitoring plan, (if available) and indicate the person and/or organization that will be responsible for implementing.**

docx Lawrence Creek_ MONITORING PLAN.docx

If you would like to also upload a document to help illustrate the project's timeline (as described above) please do so here.

5. List all partner organizations.

Trout Unlimited-project management, grant administration; Humboldt Redwood Company-landowner, monitoring lead; PWA-engineering and construction oversight; NOAA Restoration Center-engineering review, monitoring, funder; Kyle Roscoe, LTO- Licensed Timber Operator and construction contractor.

6. Does the barrier(s) being addressed through this project have a Passage Assessment Database (PAD) identification number(s)?

NO

7. Describe the barrier(s) under "average" conditions, if it is a complete, temporal, or partial barrier, how often passage is provided for both adult and juvenile anadromous fish, and if the information is available (e.g., meets fish passage criteria for adults 45% of the time and 0% of the time for juveniles). Please specify which species you are referring to when describing barrier status.

Although this project does not address a specific impediment to fish migration, it does address habitat connectivity. This project will provide access to important low-velocity winter refugia for juvenile salmonids during the largest annual storm events. Water surface profiles, included in the Basis of Design Report (Figure 4), compared existing conditions and proposed model conditions to indicate that improvements occur under proposed conditions with a rise of water surface elevation above the proposed wood structures. Through increased roughness and reducing channel cross sectional area, proposed water surface elevations will rise to increase frequency of flow that enters the side channel and improve access to the proposed off-channel pond feature. Under proposed conditions the 15% exceedance flow has access to the side channel whereas the existing conditions model demonstrates that there isn't access. Under existing conditions, the hydraulic model shows that 5-10% exceedance flow accesses the side channel. A 5-percent exceedance probability represents a high flow that has been exceeded only 5-percent of all days of the flow record. This project has been designed to result in the connection of important off-channel habitat at the 15% exceedance flow and higher, which will lead to inundation of the project area for an average of 55 days per year. This project will benefit multiple listed species, including SONCC Coho Salmon, CC Salmon, and NC steelhead trout.

8. Indicate how you determined that this barrier is a high priority project and/or addresses a high priority barrier. (Please check all that apply.)

Barrier is listed in a key restoration plan for the region (see question 9 below)

Endorsed by an agency

Local knowledge/conversation with local representatives

9. List the name(s) of the recovery plans and the specific task that name this barrier/project as a high priority, the agency that endorsed this project, or the local representative that names this project as a priority.

Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (Onchorhynchus kisutch), National Marine Fisheries Service, Arcata, CA. 2014:

SONCC-LEVR.2.1.36.2 Implement restoration projects that improve off channel habitats to create refugia habitat, as guided by assessment results in Yager and Lawrence Creeks.

SONCC-LEVR.2.2.47 Reconnect old oxbows, side channels, and off channel habitats to Lawrence Creek.

CDFW, Recovery Strategy for California Coho Salmon, 2004:
ER-VD-02 Implement the plan to restore and maintain tributary and mainstem habitat connectivity where low flow or sediment aggradation is restricting coho salmon passage.

ER-VD-04 Supplement ongoing efforts to provide short-term and long-term benefits to coho salmon by restoring LWD and shade through LWD placement.

10. The California Fish Passage Forum (Forum) has seven (7) overall objectives. Please check each objective your project will help to address. (check all that apply)

- [x] 1. Remediate barriers to effective fish migration.
- [x] 2. Facilitate coordination and communication among agencies, agency staff, and other entities that may propose, review, or promulgate fish passage criterial within California.
- [x] 4. Promote state and federal permit coordination and streamlining.
- [x] 7. Implement education and outreach activities, targeting both the general public and fish passage practitioners.

11. Provide a brief explanation of how your project addresses all of the checked boxes in question 10.

1) This project will provide important winter refugia habitat for juvenile salmonids by restoring access to side channel habitat that ishydrologically disconnected from Lawrence Creek most of the year, and enhancing the newly reconnected habitat with the excavation of an off-channel alcove enhanced with large wood structures.

2) The project includes a diverse stakeholder team including federal agencies (NOAA), nonprofit organizations (TU), private landowners (HRC), and consultants and contractors (PWA and Kyle Roscoe, LTO). The total costs of this project will be leveraged between the current funding request, an existing grant award between TU and NOAA (award number NA17NMF4630189), and in-kind leveraging from the landowner (Humboldt Redwood Company) in the form of materials (e.g. wood and rock) and effectiveness monitoring.

4) The project permits were secured under coordinator state and federal permit programs for small habitat restoration. A secondary objective of the overall NOAA funded effort is to quickly design, permit, and implement the projects. Both the 2nd and 3rd phases of off channel restoration on HRC land were designed and permitted within a year. This was largely feasible due to the 30-day review periods associated with the State Water Board SHRP 401 Water Quality Certification and the CDFW HREA Authorization process. Furthermore, the project was included in the NOAA RC Arcata Office Programmatic Biological Opinion as it relates to the US Army Corps of Engineers 404 permit. The project is also considered CEQA exempt, under categorical exemption 15333.

7) Previous phases of the project have already been featured in multiple outreach efforts. The National Fish and Wildlife featured Phase I and II projects in a short video as part of Saving Species together website (https://wildlife.ca.gov/Saving-Species-Together#55656857-species-videos). It is anticipated that Phase III of the project will be featured in other TU outreach (e.g. blog posts, website content, social media, and reports), and that a project-specific presentation may be provided to the Fish Passage Forum.

12. Select each anadromous fish species that will benefit from your project (select multiple if applicable).

Coho salmon | Chinook salmon | Steelhead/rainbow trout

13. Provide all relevant data on anticipated outcomes of implementing this project. *

- **0.09** Stream miles restored or enhanced
- **1.1** Acres of habitat restored
- **0** Number of barriers removed/remediated
- **1 Website Project Feature (www.northcoastcohoproject.org)**

Outreach accomplishments (number of presentations given, materials produced, individuals reached etc.)

14. Provide the location and distance in stream miles to downstream river structures, and whether each structure represents an insignificant, partial, or total barrier to fish passage.

There are no known barriers downstream of the project site.

15. Provide the location and distance in stream miles to upstream river structures, and whether each structure represents an insignificant, partial, or total barrier to fish passage.

There are no known barriers upstream of the project site.

16. Indicate which of the Forum's priority habitats that will be enhanced or restored as a result of this project (choose all that apply).

Rearing habitat

17. Has the owner and/or responsible organization/agency of the barrier(s) proposed for removal and/or remediation been identified, notified, and given permission for this project to proceed as proposed?

YES

If YES, please provide the name of the entity that owns/is responsible, and describe how consent to proceed was obtained/documented, and their role (if any) in any monitoring.

Humboldt Redwood Company (HRC) is the landowner at the project site. HRC partnered with TU and NOAA for the first two phases of this project (Lawrence 1.0 and Lawrence 2.0) and will be providing in-kind cost share for this project. The in-kind cost share (already committed to NOAA) is sourced from HRC staff time spent reviewing designs and conducting monitoring as well as contributing the large wood and rock that are specified in the designs.TU and HRC have a landowner access agreement established that provides access through September 30, 2021. TU expects to request a one-year extension to that term in order to complete construction and post- project monitoring.

***The Forum recommends, as a bare minimum, applicants use the California Fish Passage Forum's Fish Passage Barrier Removal Performance Measures and Monitoring Worksheet, and one year minimum pre- and post-project monitoring.*

19. Will your project be implemented within 12-18 months?

YES

20. Describe below the project's timeline (including permits), as well as implementation and monitoring dates. Please describe any issues that exist, if any, that could delay project implementation.

Fish Passage Forum Proposal
Trout Unlimited
Lawrence Creek Off-Channel Habitat Improvement Project,Phase III Timeline

Grant Term: August 1, 2021-October 31, 2022 (14 months)

Task A Project Administration – August 1 2021 – October 31, 2022
TU will lead all project coordination and grant administration, and this includes construction scheduling, landowner coordination, invoicing, and reporting. All subcontracts will be developed with the subcontractors prior to construction, and all permits are secured. Project administration will occur throughout the life of the project.

Task B Implementation August 01, 2021-October 31, 2021 (2.5 months)
Construction activities are scheduled to occur during the low flow, dry season of 2021, after bird nesting season. Construction activities are expected to take 12 to 14 workdays. PWA, the design engineers for this project, will provide project coordination and construction oversight. Kyle Roscoe, LTO, will provide all equipment and labor necessary for project completion. Clear water diversion, fish screens, and nuisance water management systems will be installed by Kyle Roscoe according to permit condition specifications and best management practices prior to construction, if necessary. Mr. Roscoe's team will excavate a 0.28 acre alcove to the elevations indicated in the engineered designs. A bar apex jam, deflector jam, and venturi-style jam will be installed, along with 8 additional pieces habitat wood within the alcove, for a total of about 68 total pieces of wood (some including rootwads) and 10 cubic yards of boulders. After project completion, the contractor shall remove any water management structures and fish screens. Upon completion of construction, the contractor will be required to implement best management practices (BMPs) for erosion control.

Task C Monitoring
The monitoring for this project is being led by the landowner, Humboldt Redwood Company. Some pre-project monitoring equipment (i.e. stream gage) were deployed during the project design phase. This equipment will continue to operate after construction occurs. All pre- and post- project data will be compared to evaluate project effectiveness. This includes, comparing topographic conditions, surface water levels, photographic monitoring, and fish sampling data. All reporting requirements will be finalized prior to the end of the grant term, but will include at a minimum a project description, specific as-builts metrics, validation monitoring results, and a discussion of potential maintenance costs. Project monitoring results will be characterized in a brief memo and/or the NOAA Tier 1 Monitoring Report Form and reported to other project partners and regulatory agencies. Please see attached monitoring plan for more information.

Potential Issues that Could Delay Construction
At this time the project team does not foresee any potential issues that could delay construction. If awarded funds, this project will be fully funded. All permits are secured, and the construction contractor has been selected.

21. Attach any designs of your project as well as any photos.

pdf Lawrence Creek 3.0 Photos.pdf

pdf Lawrence Creek 3.0 Basis of Design Report_...

PROJECT COSTS & BUDGET

22. Total Project Cost. $198,129

23. Total funding amount being requested from the Forum. 48029

24. Total matching contributions (cash and in-kind) that will be included in your project. Include all matching contributions that have been secured and that are anticipated/requested. 0

25. Total matching funds or in-kind support secured at time of application. 0

26. List all partner contributions (cash and/or in-kind) using the table below:

	Match Source	Cash Contribution	In-Kind Contribution	Total Contribution
Partner 1		0		

	Match Source	Cash Contribution	In-Kind Contribution	Total Contribution
Partner 2				
Partner 3				
Partner 4				
Partner 5				
Partner 6				
Partner 7				

27. Will the project be fully funded if funding being requested from the Forum is awarded?

YES

28. Attach a project budget sheet below that describes the overal project budget. Budgets MUST include:

- Total cost of project
- Total funding request from the Forum clearly indicating how/on what those funds will be spent.
- Monitoring costs
- Accompanying narrative explaining budget categories, amounts listed, what will be accomplished, and what deliverables are expected, etc. as needed.

If you do not have a detailed budget for your project, you can find a template and other resources on the Funding page of the Forum's website.

Attach a project budget, including a narrative that describes the overall project budget and a detailed budget breakdown. (Word, .pdf, or .xls)

xlsx 2021 TU FPF Application Budget Spreadshe...

PROJECT TEAM CAPABILITIES

29. Describe the experience and capabilities of up to three of the project leaders relative to their ability to implement this project. Please also describe any other Forum-supported projects project leaders have been involved with.

TU's North Coast Coho Project has a 20+year history of completing successful anadromous fisheries restoration projects. To date, TU and its partners have improved or eliminated over 884 miles of logging roads, removed 15 major fish migration barriers, reconnected over 130 miles of stream habitat, and improved instream habitat in over 100 miles of stream. The Trout Unlimited Project Manager, Anna Halligan, will obtain permits; secure contracts (grantors, subcontractors, landowner, etc.); coordinate the project schedule; process invoices and develop reports; as well as facilitate agency and landowner communications. Ms. Halligan has a bachelor's in environmental science from Warren Wilson College and over fourteen years of experience in restoration project management. The Project Manager will be available on a full-time basis to manage this project. Elizabeth Mackey and Elise Ferrarese may also assist with some aspects of grant management, administration, and project coordination. In addition to the TU Project Manager, the TU Grants Accountant will assist in processing invoices and vendor payments, grant tracking, and reporting. TU's North Coast Coho Project has been awarded four Forum-funded projects in recent years: Strawberry Creek at Clam Beach Fish Passage (21-020G); M1 Road Fish Passage Improvement Project (20-86G); Upper Noyo River Fish Passage Improvement and Sediment Reduction Project (20-87G); and Neefus Gulch Barrier Removal (19-25G).

Pacific Watershed Associates, Inc. (PWA) will be subcontracted by TU and function as a professional engineering subcontractor. Greg Orum and Ryan Seng are the project engineers. PWA Senior Engineering Geologist Thomas Leroy (CEG #2593) will provide a pre-project walkthrough with the heavy equipment subcontractor, project inspection and technical oversight, and post-construction stream surveys. Elektra Mathews-Novelli, PWA Forest Hydrologist, will assist with project coordination and construction oversight activities.
Kyle Roscoe, Licensed Timber Operator (LTO), will be the heavy equipment subcontractor for this project. Kyle Roscoe will provide all heavy equipment, operators, and labor necessary to complete the project, including Hydraulic Excavator, D7 Dozer, Dump Truck, Skip loader, Lowboy, Pilot car, Truck/Trailer. Kyle Roscoe will be responsible for clearing and grubbing, earthwork, erosion control, and water management/dewatering.

OUTREACH

30. Does your project have a public and/or community outreach component? If so, please describe (e.g., public workshops, tours, signs, scientific journal articles, scientific conference presentations, educational forums, professional photo/video development, website, press release, newsletter, social media outreach, volunteers, schools, etc.)

It is anticipated that TU will prepare outreach media materials as a part of this Project, which may include, but are not limited to: features in TU-related programmatic reports, blog posts on the TU website (www.tu.org), social media posts, and special features on the North Coast Coho Project website (www.northcoastcohoproject.org). TU staff will also be available to give a presentation about the project to the Fish Passage Forum.

ALIGNMENT WITH NATIONAL PRIORITIES

31. Which National Fish Habitat Partnership (NFHP) National Conservation Strategies will be addressed by your project? (select all that apply)

1. Protect intact and healthy waters.
2. Restore hydrologic conditions for fish.
3. Reconnect fragmented fish habitats.

Review the *NFHP National Conservation Strategies*.

32. What U.S. Fish & Wildlife Service (USFWS) Climate Change Strategies will be addressed by your project? (select all that apply)

3.1 Take conservation action for climate-vulnerable species.

3.2 Promote habitat connectivity and integrity.

3.3 Reduce non-climate change ecosystem stressors.

Review the *USFWS: Rising to the Urgent Challenge – Strategic Plan for Responding to Accelerating Climate Change*.

33. Provide specific information about how your project addresses the climate change strategy you checked in question 32.

3.1- The proposed project will implement conservation measures for coastal cutthroat trout, steelhead trout, Chinook Salmon and Coho Salmon, the latter three species are listed under the California and Federal Endangered Species Acts. Anadromous fish populations are highly vulnerable to climate change,

particularly during flood and drought events which are predicted to increase in frequency and intensity over time. This project attempts to increase the amount and quality of winter refugia habitat available in the Lawrence Creek watershed, a regionally significant watershed for these species.

3.2 This project will reconnect a hydrologically disconnected off-channel feature along Lawrence Creek, while concurrently improving the quality of the habitat available in the off-channel alcove. The intent of this project is to provide high-quality winter refugia habitat for overwintering juvenile salmonids. This project type has been identified as a priority restoration action within this watershed in the CDFW Coho Recovery Plan and the SONCC Coho Recovery Plan (NOAA 2014). Juvenile salmon seek slow velocity areas as rivers rise during storm events. Studies have shown significant increase in juvenile Coho salmon growth and survival when they have access to slow water refuge in off-channel ponds during storms.

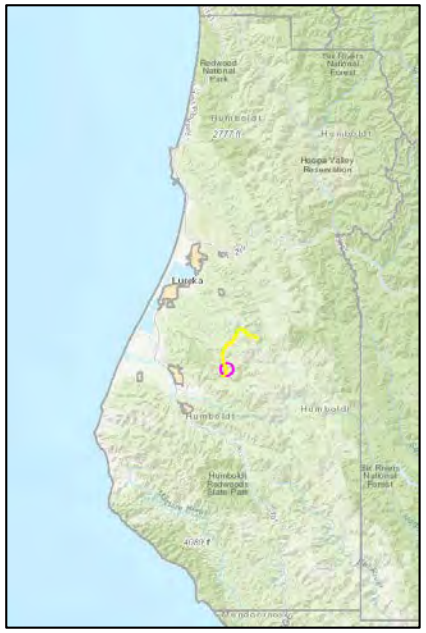
3.3 This project is addressing a non-climate change anthropogenic stressor, lack of stream channel complexity, which has led to the loss of critical habitat. Lack of channel complexity has resulted from historic timber practices including clear-cutting and tractor yarding, road building, sedimentation and lack of instream wood. Providing hydrologic reconnection with off-channel habitat and the floodplain, along with placement of large wood habitat features will provide anadromous fishes with additional winter refugia habitat during peak storm flows.

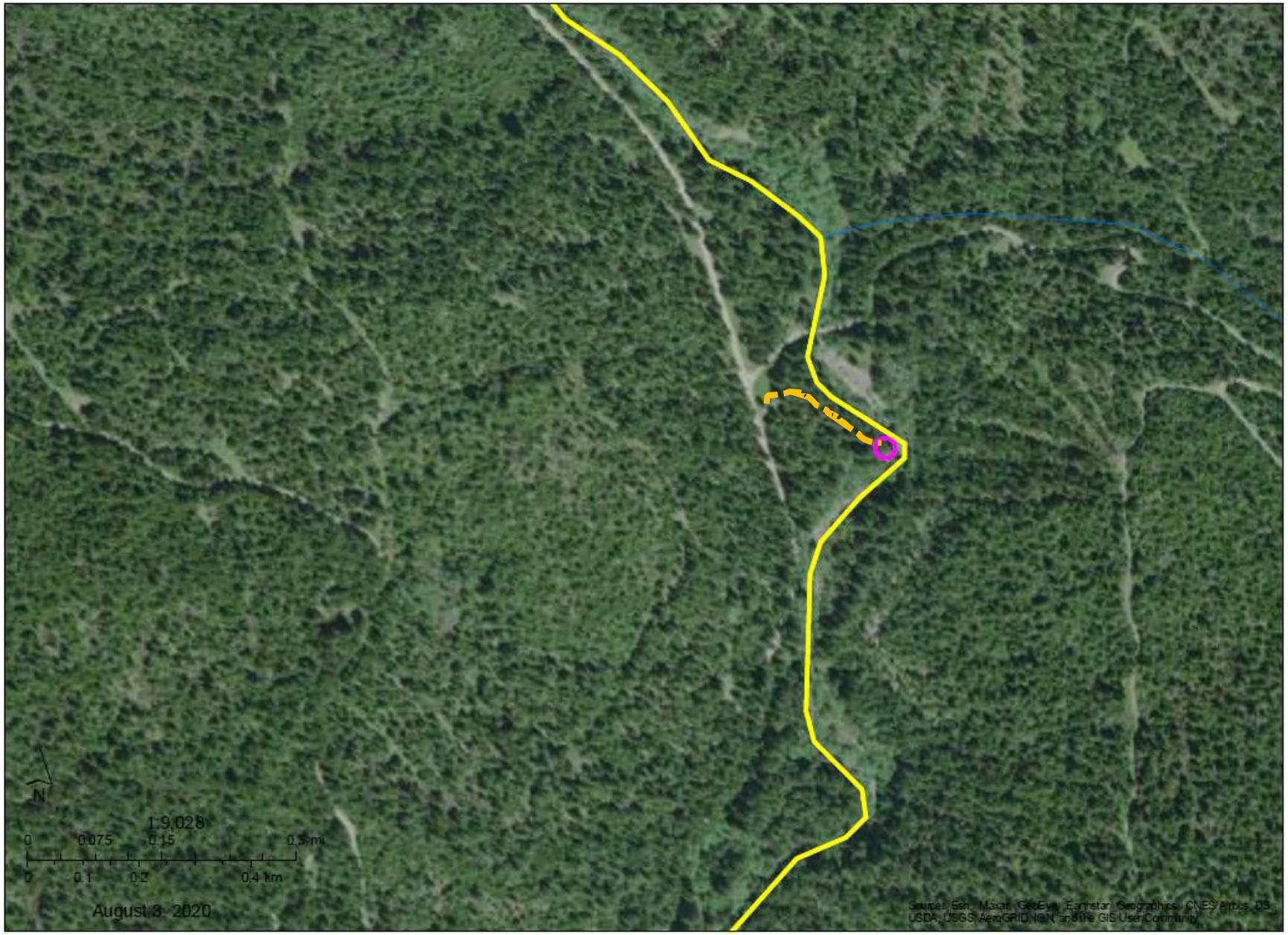
34. Would an existing tribal, commercial, recreational, or subsistence fishery be enhanced as a result of the project? If yes, please describe. If not, is there a future fishery that would potentially be restored through increased habitat as a result of this project? If so, describe.

Historically, the Eel River, the third largest watershed in California, was one of the state's most productive rivers for anadromous salmonids. These days, the Eel River supports a year-round recreational sport fishery, and while it is especially known for winter steelhead fishing, there is also a recreational fall Chinook fishery. Sport fishing in the Eel River is subject to a low flow fishing closure each year beginning on October 1. Adult Chinook salmon and lamprey are an important cultural and nutritional food source for local Tribes. Despite historical landscape alterations, the Yager Creek subbasin contains some of the best potential for high quality salmonid habitat in the Van Duzen River Basin (CDFW 2017). The overall goal of the recovery plans that helped guide this restoration is to have self-sustaining populations of salmon and steelhead trout. Restoring access to off channel habitat in Lawrence Creek will help increase the survival rates of juvenile salmonids, increasing their likelihood to return to the sport fishery and Tribal harvests.

Thank you for your interest in the Forum, and for taking the time to submit this proposal. You will be contacted by the Forum to discuss the outcome of this funding process.

Lawrence Creek Off Channel Site 3.0





Legend:

- Temporary Access
- Project Area
- Lawrence Creek
- NHD Flowlines

Author: Trout Unlimited
Printed from http://bios.dfg.ca.gov

TROUT UNLIMITED
LAWRENCE CREEK HYDROLOGIC RECONNECTION OF CRITICAL OFF CHANNEL SALMONID HABITAT
MONITORING PLAN

Tier I Hydrologic Reconnection data will be reported in standard progress reports as required by NOAA, the Fish Passage Forum, and as determined by the project permits. Submittals will include project site descriptions as well as specific project metrics. The reports will include the following information at a minimum, or as determined by the grantee, permit agencies, and NOAA RC staff:

LAND ELEVATIONS: The Project Team will use restoration designs and post-construction as-built surveys or drawings to determine whether the restoration effort met its target elevations. Restoration designs will show all relevant existing and proposed and final elevations and cross sections of structures, channels, wetlands, and floodplains. As-built drawings will be surveyed into a known elevation benchmark and referenced to a standard geodetic datum. Additionally, the pond outlet elevations and configurations will be monitored monthly and will include:

- measurements at the elevation of the outlet
- measurements the pond water level and Lawrence Creek water level

Frequency/Duration of Sampling: One post-restoration survey will be conducted per project site locations. The survey may occur immediately post-restoration, and will be compared to engineered designs.

WATER LEVELS: Data loggers will be deployed during periods of off channel pond inundation. When data loggers can't be deployed effectively, photographs and measurements at staff gages may be used to document basic project effectiveness. Loggers will be checked/downloaded once per month.

Equipment: HOBO Water Temperature Pro v2 Data logger; HOBO Water Level (13ft) Data Logger; HOBO Dissolved Oxygen Data Data Logger; as well as Capacitance rods and piezometer.

Techniques:

Hydrographs- Pre-restoration and post-restoration hydrographs from both downstream and upstream of the project site may be obtained using data loggers. Pre- and post-restoration hydrographs may be generated by collecting water elevations using at least three data loggers (upstream and downstream of water restrictions, and one to correct for atmospheric pressure) that are surveyed into the same elevation benchmark and datum as the as-built drawings and project plans. All loggers or gages will be surveyed into the same elevation benchmark as the as-built drawings and restoration designs. Data loggers will correlate the off/side channel feature inundation periods with the adjacent stream flow levels, and correct for atmospheric pressure, rather than measuring either side of a particular restriction.

Photographs- Pre- and post-restoration photographs combined with measurements at multiple staff gages may be used to show floodplain inundation extent throughout the project area during peak flows. Staff gages and corresponding photo points along one or more transects may be surveyed. Flood elevations within the project area will be measured in tandem with existing gages on an adjacent river.

Frequency/Duration of Sampling

Hydrographs-The post-project monitoring period may occur during the rainy season and should capture peak flows during the greatest extent of inundation, and may cover up to 8 months. The Project Team intends to discuss whether there are benefits to conducting monitoring during a biologically relevant season for target fish species with NOAA RC staff.

Photographs- The post project monitoring period may occur during peak flows or during the greatest extent of inundation, and may cover up to 8 months in order to capture high flow periods. We intend to discuss the benefits of conducting monitoring during a biologically relevant season for target fish species with your NOAA RC staff.

Targets

Hydrographs- Changes that indicates progress towards the project's overall goals; particularly focused at the pond outlet configuration.

Photographs- There is no set target for comparing the pre- and post-restoration photographs. Instead, the RC is looking for evidence that the new flooding regime is in line with the project's overall goals.

Biological Validation Monitoring

The biological monitoring could consist of deploying minnow traps in the ponds once per month.

Public Safety and Community Enhancement

There are no monitoring objectives for this category because the project will not directly result in an effect on public safety or community enhancement.

Monitoring Report

1. **A project description which will include the following:**
    - A project problem statement.
    - The project goals and objectives (including target species), *etc.*
    - The watershed context.
    - A description of the type of project and restoration techniques implemented
    - The project dimensions, including as builts and stream channel dimensions.
    - A description of construction activities (types of equipment, timing, staging areas or access roads required).
    - The construction time period.
    - The materials that were used as part of the restoration action.

2. **Specific As-Built Project Metrics:**
    - Land Elevations:
    - Water Levels: using hydrographs or photographs
    - Annual Operating and Maintenance Costs: estimated for the next five-year period *
3. **Validation Monitoring**
    - Description of water quality and fishery data results

* *The proposed project follows an ecosystem based approach, and as such intends to be self-sustaining. However, TU staff will work with Humboldt Redwood Company to determine if there are any costs associated with restoration maintenance costs pre- and post- implementation.*

Figure 1. Location of future bar apex jam, which will split flood flows at the side channel, and promote scour at the side channel inlet.

Figure 2. Upstream end of side channel, and location of deflector jam

Figure 3. Deflector jam site; the deflector jam will focus flow towards the side channel and bar apex jam.

Figure 4. Deflector jam site and side channel inlet.

Figures 5-8. Clockwise from top left: Fig. 5 Alcove location, area will be excavated to engineered elevations and habitat wood will be placed throughout the alcove. Fig. 6 Location of Venturi-Style Jam, which will provide a hydraulic control downstream of the mouth of the alcove. Fig. 7 Side-channel looking downstream. Fig. 8 Side-channel looking upstream.

Lawrence Creek Off-Channel 3.0
Coho Habitat Improvement Design

DRAFT 90% Basis of Design Memorandum

Van Duzen River,
Humboldt County, California

PWA Project No. 10135
June 4, 2020

Project Proponent:
Humboldt Redwood Company
Trout Unlimited, Inc.
NOAA Fisheries

Authored by:
Greg Orum, Civil Engineer
Elektra Mathews-Novelli, Forest Hydrologist
Ryan Seng, Staff Engineer
Pacific Watershed Associates Inc.
PO Box 4433, Arcata, CA 95518
gregо@pacificwatershed.com / (707) 839 -5130

CONTENTS

1 PROJECT SUMMARY 1
2 WATERSHED SETTING 1
2.1 Fish Habitat 2
2.2 Regional and Local Geology 2
3 WATER LEVEL MONITORING 2
4 HYDROLOGY 3
4.1 Flow Transference 4
4.2 Daily Average Exceedance Flows 4
4.3 Peak Floods 6
5 HYDRAULIC MODELING 6
5.1 Model Calibration 7
6 SITE RISK ASSESSMENT 8
6.1 Avulsion 8
6.2 Flooding 8
6.3 Predation 8
6.4 Sedimentation 8
6.5 Fish stranding 8
6.6 Rising sea level 9
6.7 Invasive plants & animals 9
7 PROJECT CONSTRAINTS 9
7.1 Water quality 9
7.2 Water supply 9
7.3 Floodplain functions 9
7.4 Existing infrastructure (structures, pipelines, over-head utilities) 9
7.5 Biological limitations 9
7.6 Large Woody Material Decay 9
8 PROPOSED DESIGN 10
8.1 Alcove/Pond 10
8.2 Large Woody Material 11
8.2.1 Bar Apex Jam 12
8.2.2 Deflector Log Jam 12
8.2.3 Venturi Style Jam 13
8.2.4 Habitat Wood 13
8.2.5 Log Spanners 13
8.3 Hydraulic Model Results 14
9 CONSTRUCTION PLANS AND SEQUENCING 15
10 REFERENCES 16

LIST OF FIGURES

Figure 1. Lawrence Creek water surface elevations measured from 9/27/19 to 3/3/20. 3
Figure 2. Flow Duration Curve for Van Duzen River at USGS gage #11478500..... 5
Figure 3. HEC-RAS cross-sections shown in plan view 7
Figure 4. Lawrence Creek HEC-RAS model longitudinal profile existing and proposed conditions. 14

LIST OF TABLES

Table 1. Basin Characteristic from StreamStats for Van Duzen River Gage and Lawrence Creek 4
Table 2. Percent average daily exceedance flows used in hydraulic modeling. 5
Table 3. Flood quantiles at the project site. 6
Table 4. Bar apex jam wood material 12
Table 5. Deflector log jam wood and ballast material 13
Table 6. Venturi style jam wood material..... 13
Table 7. Habitat wood material..... 13
Table 8. Log spanner wood material..... 13

LIST OF APPENDICES

Appendix A. 90% Design Plans
Appendix B. Opinion of Probable Construction Costs
Appendix C. Wood Design Calculations

1 PROJECT SUMMARY

The Lawrence Creek Off-Channel Coho Habitat Improvement Project 3.0 (hereinafter the Project) is being designed to increase the quality and quantity of winter rearing habitat for Coho Salmon by expanding and enhancing off-channel riparian area in the Yager Creek / lower Van Duzen River basin. The intended results of the Project are to create low-velocity refugia off-stream of Lawrence Creek and add complexity to the available aquatic habitat in this reach of Lawrence Creek.

Monitoring of an enhanced off-stream pond (referred to as Lawrence 1.0 and 2.0) imply that relatively low water temperatures and good water quality conditions are likely to prevail during the wet months. Also monitoring efforts have shown significant growth rates from salmonids rearing in the off-channel features.

The project site currently has a significant amount of coniferous vegetation and the project design will seek to conserve all mature trees. Additional plantings of riparian vegetation will ensure good cover and limit insolation onto the wetted channel. With appropriate planting and channel design it is unlikely that additional open water will result in significant increased insolation on the channel or significant increase in water temperatures. Finally, the fine grain sediment that will be deposited in the quiescent conditions in the project reach will provide much better habitat for macroinvertebrates that typically serve as prey for juvenile fish.

The site can be accessed from Fortuna, California, by travelling about 4 miles south on State Highway 101 and turning east onto California State Route 36. Then travel east on Highway 36 for approximately 5.5 miles and turn left (north) onto Mantova Lane. After about 1.3 miles Mantova Lane becomes Yager Creek / Yager-Lawrence Mainline Road. Travel north on Yager-Lawrence Mainline Road for approximately ## miles. The project site is immediately adjacent to Yager-Lawrence Mainline Road.

2 WATERSHED SETTING

The project site is located on the right floodplain and includes the high-flow side-channel of Lawrence Creek, thence Yager Creek, thence the Van Duzen River, and thence the Eel River, which drains to the Pacific Ocean southwest of the town of Loleta, CA. The watershed ground cover is comprised primarily of mixed conifer forest.

The climate of north-coastal California in the area is characterized by dry, warm summers and cool winters with periods of intense rainfall and minor snow accumulation during cold storms. The Van Duzen River is recognized as one of the more significant coastal salmon and steelhead producing systems in the North Coast region. Chinook and Coho Salmon, as well as Steelhead and Cutthroat Trout, utilize the mainstem and lower reaches of the major tributaries.

Lawrence Creek adjacent to the project site has an average active channel width of 48-ft and an average channel slope of 0.004 ft/ft. The project site incorporates an existing side channel of Lawrence Creek that receives flow from the main stem during an estimated 10% exceedance

flow or greater. The side channel has an average active channel width of 16-ft and approximately 3-ft high channel banks. Average slope of the side channel is 0.0045 ft/ft.

2.1 Fish Habitat

The Lawrence Creek watershed hosts populations of Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*O. kisutch*), and Steelhead Trout (*O. mykiss*). Coastal Cutthroat Trout (*O. clarki clarki*) may be present. The watershed has been classified as critical habitat for Chinook Salmon, Coho Salmon, Steelhead Trout, and Cutthroat Trout.

Lawrence Creek is one of two tributaries in the Lower Eel/Van Duzen population that consistently has stream type Chinook that rear in the stream for the first year after emergence rather than heading out to the ocean.

2.2 Regional and Local Geology

The project area lies within the greater regional geomorphic Coast Ranges province (CGS, 2002). The Coast Ranges lie between the Pacific Ocean and the Great Valley, west to east, and the from the Oregon/California border to the Transverse Ranges near Point Conception, north to south. The northern Coast Ranges are characterized by northwest trending valleys, mountain ranges and fault complexes associated with the on-land portion of the accretionary prism of the Cascadia subduction zone (Clark and Carver, 1992).

The geology of the Yager Creek subbasin contains diverse rocks groups ranging from recent alluvial and colluvial deposits to rocks of the Central Belt Franciscan Complex (Mesozoic), including both mélange and meta-sedimentary units. Most of the watershed is underlain by a sheared matrix of argillite with blocks of sandstone, greywacke, argillite, limestone, chert, basalt, blueschist, greenstone, and metachert. The geology is susceptible to mass wasting, large earthflows, and subsequent debris torrents that tend to be triggered by ground saturation following extended precipitation events.

The project site lies entirely within the floodplain of Lawrence Creek. The subsurface stratigraphy is comprised of well-graded relatively course alluvium.

3 WATER LEVEL MONITORING

Water-level monitoring equipment was installed adjacent to the project site within Lawrence Creek to inform the proposed designs. Sheet C-2 in Appendix A depicts the water monitoring locations as staff plates. Water level data collection began in late September, 2019 and continued into late February, 2020.

Staff plates (SP) were installed within the project area to measure surface water surface elevations of Lawrence Creek. The location of the staff plates are illustrated in the CAD generated Drawings (Appendix A). The staff plates consisted T-posts installed in locations where they were protected and not likely to be impacted by woody debris in transport and not subjected to supercritical flow. The water surface elevations at the T-posts staff plates were measured manually with a tape measure intermittently throughout the data collection process.

An in-stream pressure transducer (PT) gage was set up in order to capture a better record of stream surface water elevations through the winter higher flow eve/nts. Because the instream PT monitoring data time frame was so short, the data was only used to a limited extent for the larger hydrologic analysis. It was useful for checking results derived from stream flow modeling and exceedance values based on the hydrologic analysis. The PT gage results demonstrated the frequency and duration during the sample time of how often and for how long the side channel was receiving active flow (Figure 1).

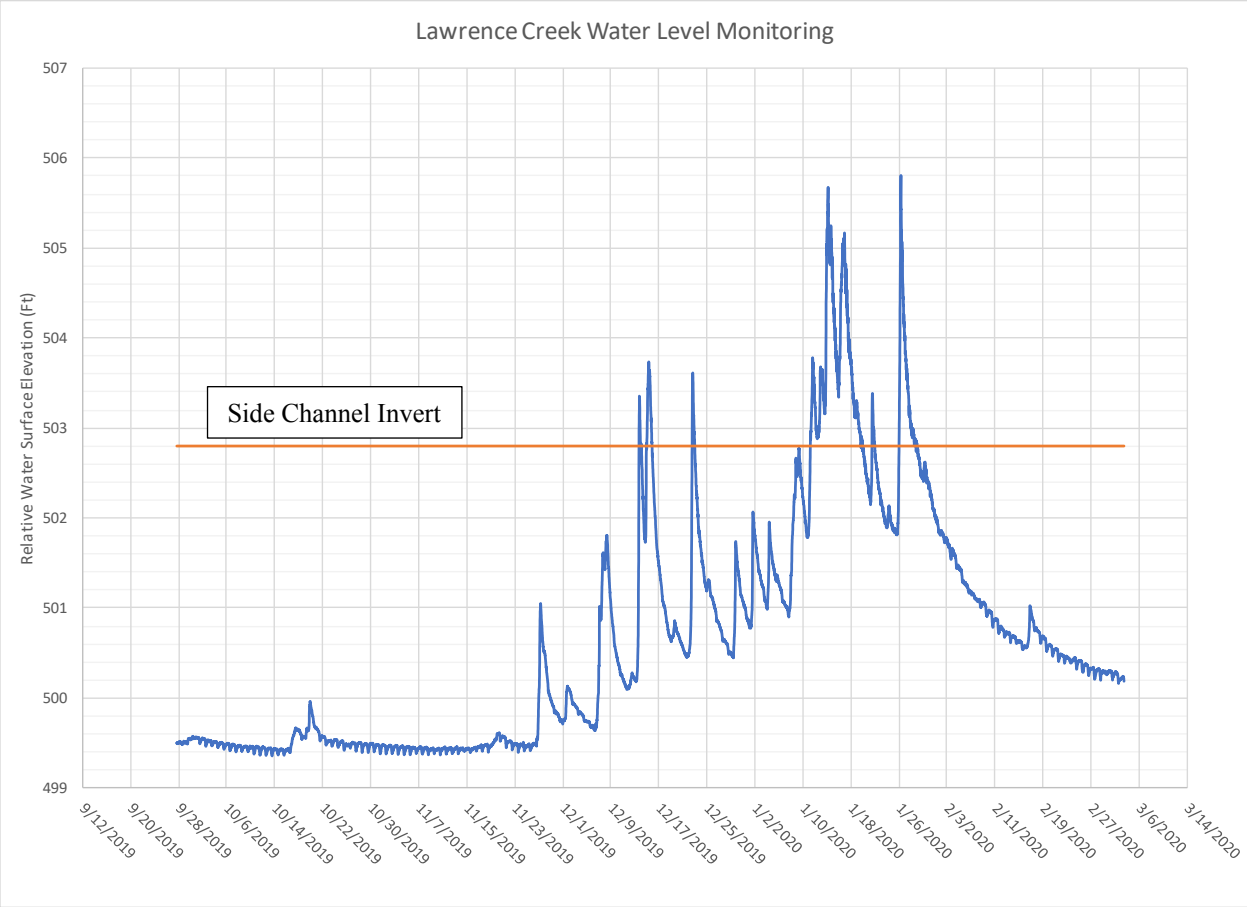


Figure 1. Lawrence Creek water surface elevations measured from 9/27/19 to 3/3/20.

4 HYDROLOGY

To determine the appropriate range of flows to consider in the fish passage analysis, the stream hydrology was assessed using historical gage data and flood regression equations. USGS maintained a stream flow and stage monitoring station (USGS Station #11478500) for Van Duzen River near Bridgeville, CA from October 1950 to December 2019 with a 69 year period of record. Because there is no flow monitoring gage on Lawrence Creek a combination of flood regression equations and flow transference methods were used to determine flood flows and daily average exceedance flows for hydraulic assessment.

The data from the USGS gage was used to develop exceedance flows for Lawrence Creek. The

flow transference method was used to scale the measured flows to a smaller drainage area. Based on the gage data, flood flows typically occur between late December and mid-April.

4.1 Flow Transference

Average daily flow data from the USGS gage was used as the baseline data from which scaled flows for the project site were calculated. The drainage area for the Lawrence Creek project site was obtained from StreamStats. Lawrence Creek has a drainage area of 40.6 sq. mi. and Van Duzen River at the USGS gage has a drainage area of 222 sq. mi. (Table 1). The results in drainage area ratios of *C*. The gage flows were multiplied by this ratio to obtain the estimated project flows, as shown below.

$$Estimated\ Flow\ (cfs) = Gage\ Flow(cfs) * C$$

Table 1. Basin Characteristic from StreamStats for Van Duzen River Gage and Lawrence Creek

	Drainage Area (Sq. Mi.)	**Mean Annual Precipitation (in)**	**DA Ratio, *C***
Van Duzen River USGS 11479000	222	73.8	--
Lawrence Creek	40.6	68.8	0.18

4.2 Daily Average Exceedance Flows

A flow duration curve was developed using the measured flows from 1950 to 2019 for Van Duzen River. Flow values were sorted in order from highest to lowest and assigned a rank (M) starting with 1 for the highest flow. The probability of exceedance for each flow was calculated using the rank and the total number of days in the flow record (n). The equation below shows how the probabilities were calculated.

$$Probability\ of\ Exceedance = 100 * \frac{M}{n+1}$$

Where,

P = the probability that a given flow will be equaled or exceeded (% of time)

M = the ranked position on the listing (dimensionless)

n = the number of events for period of record (dimensionless)

The flow duration curve for Van Duzen River at USGS gage 11478500 is shown in Figure 2. The flows used to construct this curve are average daily flows, therefore a 1.0% exceedance flow may occur on average 3.7 times per year (1% of the time).

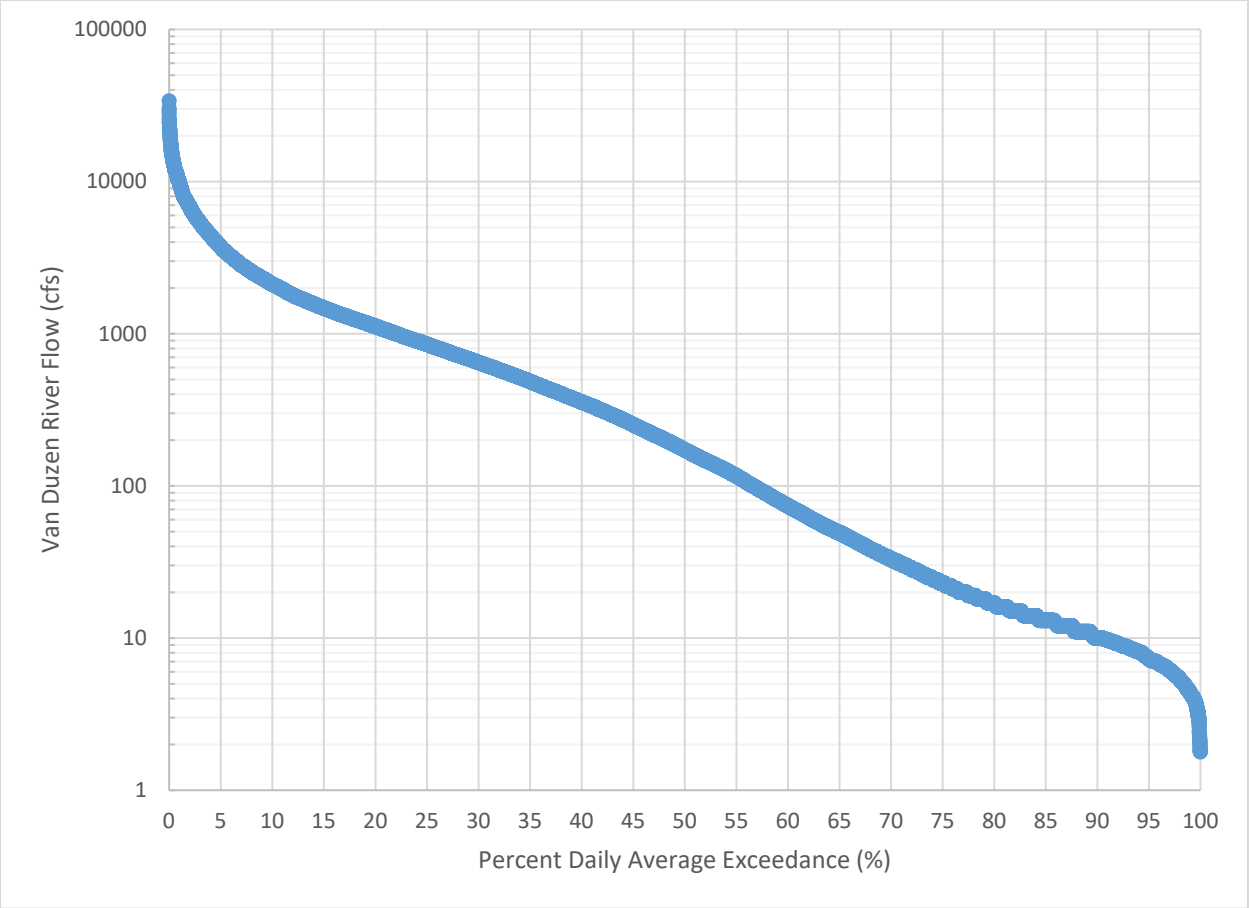


Figure 2. Flow Duration Curve for Van Duzen River at USGS gage #11478500

To evaluate when the project area may get inundated exceedance flows from the Van Duzen River gage daily average flow and flow transference were used for this assessment. Percent average daily exceedance flows were inputted into the hydraulic model to assess the frequency the existing side channel will became active with flow and at what approximate depth.

Table 2. Percent average daily exceedance flows used in hydraulic modeling.

Recurrence interval (days)	Percent Average Daily Exceedance	Lawrence Creek Flow (cfs)
328	90%	1.8
146	40%	65
55	15%	270
18	5%	677
7	2%	1253
3	1%	1805

4.3 Peak Floods

Flood quantiles were required to understand the forces exerted on the channel boundaries for design purposes and to better understand floodplain connectivity. To estimate peak floods, we applied the online the USGS StreamStats[1] program which is a map-based internet application that allows users to easily obtain streamflow statistics, basin characteristics, and other information for user-selected locations. The application relies on the data collected at U.S. Geological Survey streamflow-gauging stations; computer-aided computations of drainage-basin characteristics; and published regression equations (Gotvald et al. 2012) for specific geographic regions comprising the United States. StreamStats provides peak flow statistics and annual exceedance probabilities. The program provided peak flows having recurrence intervals of 2, 5, 10, 25, 50, 100, 200, and 500 year. StreamStats also automatically computes and reports selected drainage basin characteristics that influence peak flow frequency statistics. This analysis was applied to Lawrence Creek at the project site (Table 3).

Table 3. Flood quantiles at the project site.

Recurrence interval (years)	Lawrence Creek ($ft.^3/s$)
2	3320
5	5680
10	7320
25	9440
50	11000
100	12600
500	16100

5 HYDRAULIC MODELING

Survey data were combined with the flow estimates developed from the hydrologic analysis to develop a one-dimensional, steady-state hydraulic model using the U.S. Army Corps of Engineers' HEC-RAS program Version 5.0.6[2]. The program calculates average hydraulic characteristics in each cross section.

Geometric data for the model were first established in AutoCAD Civil 3D and then exported to HEC-RAS. An alignment representing both the thalweg of Lawrence Creek and the thalweg of Lawrence Creek side channel were drawn through the TIN model to define the downstream reach lengths between cross sections. Hydraulic cross sections were overlaid onto the surveyed cross sections. Model was setup as a steady-state split flow simulation with a total of 16 cross sections were used for Lawrence Creek and 7 cross sections were used for the Lawrence Creek side channel. Figure 3 provides an overview of the channel and cross-section geometry from HEC-RAS demonstrating the surface sampled cross sections (dark green), bank station locations (red dot), levees (pink square), and ineffective flow stations (green triangle).

[1] https://www.usgs.gov/mission-areas/water-resources/science/streamstats-streamflow-statistics-and-spatial-analysis-tools?qt-science_center_objects=0#qt-science_center_objects
[2] https://www.hec.usace.army.mil/software/hec-ras/downloads.aspx

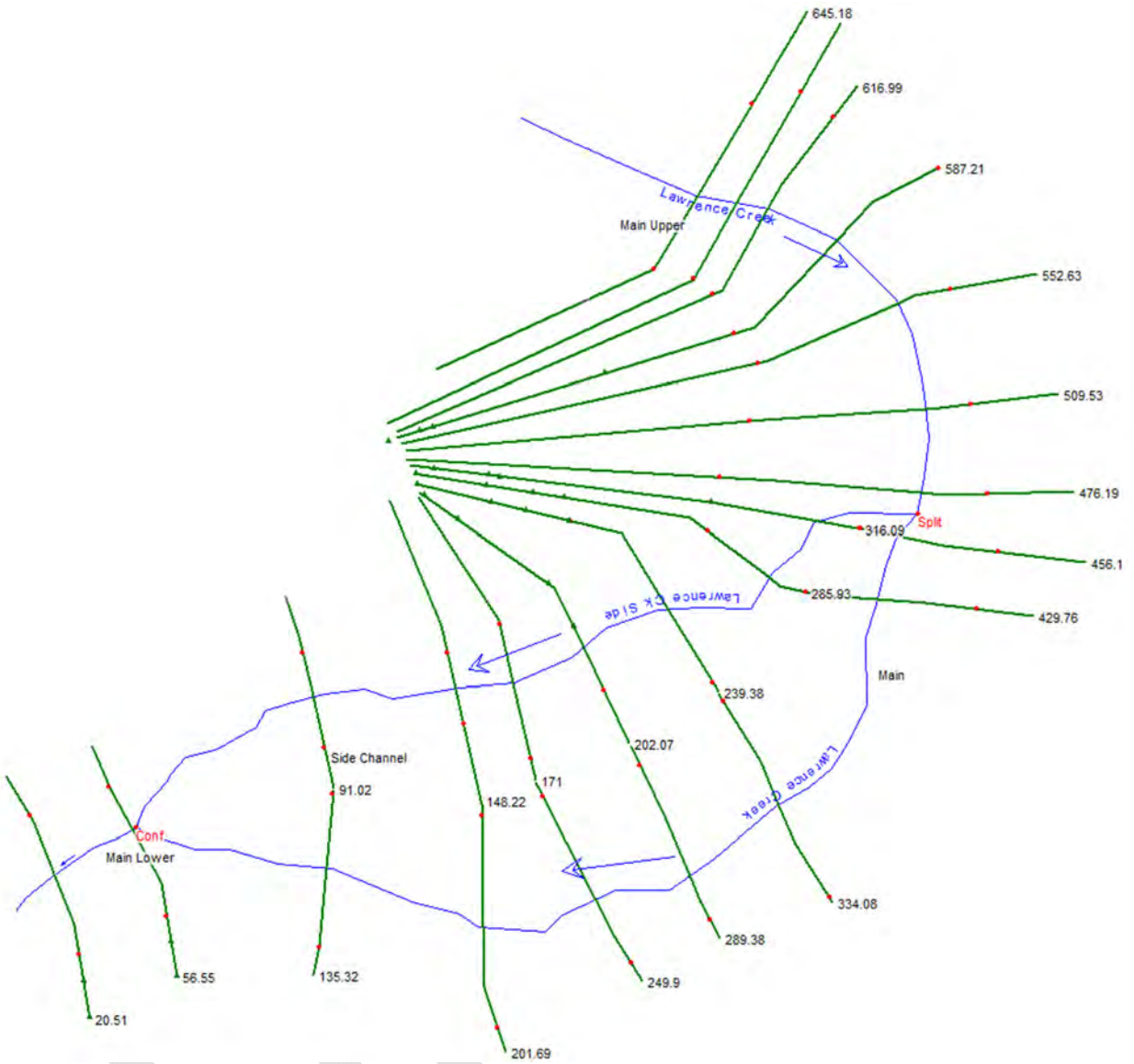


Figure 3. HEC-RAS cross-sections shown in plan view

Initial roughness values (Manning's n) and loss coefficients were adjusted within the hydraulic model. Flow obstructions were present throughout the Lawrence Ck project reach in the form of large wood; however these features were not explicitly incorporated into the model. Roughness values were estimated in every cross section using the method of Arcement and Schneider (1989) which accounts for hydraulic roughness, vegetation, variations in cross sections, and flow obstructions. The roughness values used for the main channel was 0.055. In the floodplain, we specified a value of 0.1. The normal depth of the channel was set as the upstream and downstream boundary condition based on the measured water surface general slope of 0.0044 ft/ft.

5.1 Model Calibration

Initial calibration was conducted using discharge measurements and surveyed water surface

elevations sampled on 11/18/19. The discharge measured was 2.3 cfs equivalent to 88% exceedance flow. Validation of the model was done using the video footage, high water marks observed, PT measurements at that time, along with Van Duzen River gage measurement and the exceedance flow relationship. During the video footage taken the afternoon of 01/14/20 the water surface was estimated to be around 505-ft elevation, PT measurement indicated 504.8-ft at 1:00 pm, which is equivalent to an estimated 5% daily average exceedance flow based on the existing conditions model. For comparison, at the same time the Van Duzen River gage was measured to be 2,570 cfs, equivalent to an 8% daily average exceedance flow. The January 14th flow elevation roughly matched the elevation of the high flow observed and staked off by Humboldt Redwood Company (HRC) the year prior.

6 SITE RISK ASSESSMENT

6.1 Avulsion

There is relatively little risk of avulsion at this site mainly due to the location of the project being on the inside bend of the stream. Moreover, the relatively mature forest stand that lies to the north of the project site should resist migration of the mainstem Lawrence Creek into the Project reach.

6.2 Flooding

This site is at relatively high risk of flooding because of the elevation relative to the mainstem Lawrence Creek. The proximity to Lawrence Creek and potential for backwatering is one of the primary benefits of this location. This site will provide low velocity refugia to juveniles when the mainstem Lawrence Creek is at flood stage.

6.3 Predation

It is anticipated that the project site will have no more potential for colonization of the area by predatory fish than the rest of the sub-basin. By conserving mature trees and planting new riparian vegetation, there will be significant vegetation cover at the project site for juvenile salmonids. The large wood features will increase the available in-channel cover, thus increasing habitat complexity while reducing predation potential. The project site is located upstream the Yager Roughs, which are considered to be a barrier to the invasive and predatory Sacramento pike minnow.

6.4 Sedimentation

A qualitative assessment of sedimentation resulting from flooding in mainstem Lawrence Creek indicates that very limited accumulations of fine grain sediment might occur at the site, such deposits are unlikely to bury the features constructed at the site.

6.5 Fish stranding

Fish passage through the project reach will be assured by maintaining a low, virtually flat channel gradient throughout the project reach.

6.6 Rising sea level

This site is not subject to sea level rise within the foreseeable planning horizon for this project.

6.7 Invasive plants & animals

The site will be inspected for the presence of invasive plants and animals as part of the operations and maintenance program. Minor occurrences of invasive plants or animals will be eradicated as quickly as possible. Major occurrences of invasive plants or animals will be brought to the attention of the relevant government agencies to assist in developing a plan to prevent the spread and/or eradicate of the invasion.

7 PROJECT CONSTRAINTS

7.1 Water quality

Water quality poses a potential limiting factor during the summer rearing window due to the project off-channel feature not being associated with a wetland or tributary.

7.2 Water supply

There is no indication that, aside from natural climate variability, water supply will be a limiting factor at this site. There are no envisioned changes in the sub-basin that might affect the availability of water at the site.

7.3 Floodplain functions

While the Van Duzen River is water quality impaired by sediment, there is no evidence of recent unnaturally excessive sedimentation at the Lawrence Creek site.

7.4 Existing infrastructure (structures, pipelines, over-head utilities)

The Yager-Lawrence Mainline road is a geologic control on the unnamed tributary upstream of the current project site. However, the road does not affect the Project as it is currently envisioned. There is no other infrastructure proximate to the Project site.

7.5 Biological limitations

There are no identified biological limitations at the current project site.

7.6 Large Woody Material Decay

Typical decay rates for the coniferous species (Douglas fir and redwood) likely to be used for proposed large woody material structures range from 25-50 years for mature Douglas fir and redwood logs (Johnson and Stypula 1993; Hyatt and Naiman 2001).

8 PROPOSED DESIGN

Many studies throughout the Pacific Northwest document juvenile salmonids, in particular Coho Salmon, utilizing off-channel habitats as low-velocity refugia to avoid mainstem high flows and to take advantage of high-quality cover components. Channel modifications, transportation systems, and bank armoring have significantly reduced channel complexity and habitat available for the Coho Salmon population which was already stressed by a number of other factors. The Final SONCC Coho Recovery Plan (2014) lists the lack of floodplain and channel structure as one of the key limiting stresses and lists "Construct off channel habitats, alcoves, backwater habitat, and old stream oxbows" as one of the highest priority actions in connection associated with the overall treatment strategy to reconnect the channel to the floodplain.

As off channel features become inaccessible and disconnected to the main channel, juvenile fish can be displaced and encounter mortality during high flow events. Juvenile fish can also be impacted from decreases in prey resources, slow water rearing and holding areas when off channel features become disconnected. This project aims to provide off channel winter flow refugia through implementing large wood structures to increase frequency to the existing side channel and an off channel pond to provide slow water holding areas while high velocities are occurring in the main channel.

The draft proposed design plan set can be found in Appendix A.

8.1 Alcove/Pond

Alcoves and off-channel ponds are areas off to the side of the stream that connect to the main stream only at their downstream end. During this time, water backs into these areas, and has very low or no current. In addition to still water, logs that protrude into or float on the water, floating and submerged vegetation, and surrounding tall vegetation make these areas very attractive to juvenile fish. They use these areas to search for food, rest and to avoid predators. During winter periods these areas will continue to have quiet water despite occasional high flows moving through them. This type of habitat provides the greatest opportunity to meet low velocity criteria. Construction of alcove will include excavation to achieve grades demonstrated in the plans and include placement of logs at locations shown in plans, planting of aquatic vegetation and management of surrounding vegetation. Grading of the alcove invert elevation is relative to the side channel thalweg elevation. With the proposed large bar apex and deflector wood structures located in Lawrence Creek raising the water surface upstream and inducing more flow into the side channel, it is anticipated that the off-channel pond would be hydraulically connected during 15% exceedance flows and greater, or on average 55 days out of the year.

The primary challenges to the longevity of constructed backwater habitats are any sedimentation and downstream changes in the main channel affecting the hydraulic control for the backwater habitat. Various design elements such as large wood structure configurations will promote the longevity of the alcove by providing scouring velocities in appropriate places. Nevertheless, some degree of sedimentation in these areas will be unavoidable, and this issue should be tracked through an adaptive management program.

Large wood habitat structures will be added to the alcove habitat. These habitat structures will be overtopped by a full range of flood flows. To ensure the habitat structures will remain in the alcove over a prolonged period to continue to provide habitat value, the habitat wood must either be large enough that it cannot be transported by the stream or be ballasted to prevent mobilization. It will not be feasible to utilize old growth logs that would be self-stable in the project area the large wood elements installed will need to be ballasted through a range of techniques such as driving the large wood stems into the banks to provide ballast and cover.

8.2 Large Woody Material

Large wood (logs and logs with rootwads) will be installed throughout the Lawrence Creek project reach. The purpose of the large wood is to mimic old-growth forest conditions where wood was an important component of salmonid habitat including: creating overhead cover, maintaining scour pools and shallow water habitat, and providing flow refugia. Given that the forests in the Lawrence Creek watershed are largely second-growth, the current density and sizes of instream large wood pieces is relatively low compared with old growth forests. The project reach appears to have some natural occurring and previously placed large wood; however, most of the large wood is relatively small and natural recruitment is limited. Thus, most of the large wood in the reach is ineffective for providing the hydraulic control promoting access to the side channel and backwatering the proposed alcove/pond optimizing access and producing better salmonid habitat. HRC will source and provide the logs necessary to implement the design wood structures.

The purpose of this wood is to provide better habitat, shade, hiding, scour conditions to maintain depth, food and to promote access to the proposed alcove/pond. The stabilizing function of the wood is necessary as large flows will impacts channel banks directly. Vertical log piles will be placed to mimic a mature floodplain forest where anchoring is needed. The pieces will be placed within proximity of each other and other existing trees as natural recruitment large wood pieces floating down during floods will get caught in the piles.

Large wood will be installed in jams along the channel banks, within the existing side channel and within the alcove/pond. These log jams will be placed in a variety of configurations designed to mimic natural large wood jams, improve habitat conditions, and remain stable through flood events. Stability of the logs will be provided by soil, rock or stump ballast, existing trees, or log piles. Soil ballast will be provided by excavating trenches into the stream banks and floodplain, placing log(s) in the trench, and backfilling. Additional logs may be anchored to the soil-ballasted logs depending on the length of the buried log and the amount of soil on top.

Logs may also be anchored from existing mature trees on top of the banks or to vertically-driven log piles that behave like existing trees. It will be assumed that the existing trees are stable during floods while the log piles will be tested for their pull-out resistance. Thus, the stability of the attached logs will be reliant on the anchor rigging. The estimated dislodging forces acting on each anchor contact point will be smaller than the rigging capacity and include a factor of safety of at least 1.5. The built-in redundancy is preferred to prevent log movement and downstream transport. Movement of logs diminishes their ability to provide habitat, and downstream transport may result in logs jamming at bridge crossings inducing failure.

Stability of the soil ballasted logs will be estimated at the time of construction assuming a

saturated unit weight of soil of 120 lbs/ft^3 for sandy clay soils (Budhu, 2015). The vertical log pile resistance will be estimated using a crane scale until incipient pull-out. This pull-out strength is important as it will be the maximum buoyancy force that the attached logs can have before the structure fails.

Dislodging forces include buoyancy, lift and drag on the logs. The net vertical forces, however, will only be accounted for in design. D'Aoust and Millar (2000) state that large wood jams with factors of safety of at least 1.5 remained laterally stable when designed to prevent vertical dislodgement. Although horizontal forces are not directly related to the vertical forces, the buoyancy and lift forces are much larger than the lateral drag forces so that the vertical stability usually means logs will also not move laterally. Buoyancy will be estimated by measuring log lengths and diameters coupled with published unit weights of the wood species given saturated conditions. Vertical lift forces will be estimated using the standard force balance approach adapted from D'Aoust and Millar (2000) and NRCS (2007).

The large woody material (LWM) anticipated for project use will likely consist of coastal redwood (*Sequoia sempervirens*) and Douglas fir (*Pseudotsuga menziesii*). LWM will be placed in different configurations and positioned in a manner that different sections of the log will interact with the site at different water depths. This is important because of seasonal flow and varying water levels throughout the year. Although large wood installation typically involves a fit-in-the-field approach to optimize the morphology and hydraulics at each location, the following list contains the typical configurations proposed for the project. Design calculations can be found in Appendix C.

8.2.1 Bar Apex Jam

The bar apex jam was designed to replicate mid channel bar features. Designed for splitting flood flows at the side channel location to enhancement of side channel activation and scour at side channel access thalweg. The bar apex jam is designed to withstand buoyancy and lift forces up to 100-yr flood events. Design of the bar apex jam is made up of the following wood elements shown in Table 4.

Table 4. Bar apex jam wood material

Type	Quantity	Length	Diameter	Rootwad Percent
Key Piece	12	40-ft	24-in	100%
Staked/Racked	10	30-ft	20-in	50%
Piles	9	30-ft	20-in	0%

8.2.2 Deflector Log Jam

The design uses a deflector log jam on the opposite bank of Lawrence Creek to focus flow towards the side channel and bar apex jam. The deflector jam was designed to replicate wood jams located on outside bends and is designed to withstand buoyancy and lift forces up to 100-yr flood events. The deflector jam is designed to be made up of wood and ballast material shown in Table 5.

Table 5. Deflector log jam wood and ballast material

Type	Quantity	Length	Diameter	Rootwad Percent
Key Piece	6	40-ft	24-in	100%
Staked/Racked	9	30-ft	20-in	50%
Piles	5	30-ft	20-in	0%
Boulder Ballast	12	--	42-in	--

8.2.3 Venturi Style Jam

The venturi style jam was developed to provide a hydraulic pinch point downstream the mouth of the alcove. These particular jams will confine the wetted width of the channel increasing the water surface elevation on the upstream end under larger flood flow events and transport fine sediments leaving coarser material exposed during the receding limb of the flood flow. The venturi style jam is designed to withstand buoyancy and lift forces up to 100-yr flood events. Design of the venturi style jam is made up of wood pieces shown in Table 6.

Table 6. Venturi style jam wood material

Type	Quantity	Length	Diameter	Rootwad Percent
Key Piece	5	40-ft	20-in	100%
Piles	2	30-ft	20-in	0%

8.2.4 Habitat Wood

Habitat wood will be placed throughout the proposed alcove to improve the aquatic habitat to optimize conditions for all life stages of fish and macroinvertebrates. These elements will be configured in a manner to accessed at varying depths and promote habitat complexity. The habitat wood is designed to withstand buoyancy and lift forces up to 100-yr flood events. Material type description is shown in Table 7.

Table 7. Habitat wood material

Type	Quantity	Length	Diameter	Rootwad Percent
Habitat Piece	8	40-ft	20-in	100%

8.2.5 Log Spanners

Log spanners were developed to provide sediment flushing velocities within the alcove access channel by forcing flow under the log during the receding limb of the flood flow. These features will be embedded into the channel banks and be elevated above the alcove invert a maximum 1-ft. The log spanners will utilize soil ballast on both ends of the log to withstand buoyancy and lift forces up to 100-yr flood events. The design for the log spanner configuration calls for 2 logs with the dimensions shown in Table 8.

Table 8. Log spanner wood material

Type	Quantity	Length	Diameter	Rootwad Percent
Log	2	30-ft	20-in	0%

8.3 Hydraulic Model Results

Water surface profiles compared existing conditions and proposed model conditions output to indicate that improvements occur under proposed conditions with a rise of water surface elevation above the proposed bar apex and deflector jam wood structures. Through increased roughness and reducing channel cross sectional area, proposed water surface elevations rose to increase frequency of flow that enters the side channel and improving access to the proposed off-channel pond feature. Figure 4 demonstrates the proposed (solid line) and existing (dashed line) conditions model longitudinal profile output of daily average exceedance flows of 1% (dark blue), 5% (light blue), and 15% (red) with 0.5-ft vertical gridlines. Under proposed conditions the 15% exceedance flow has access to the side channel whereas the existing conditions model demonstrates that there isn't access.

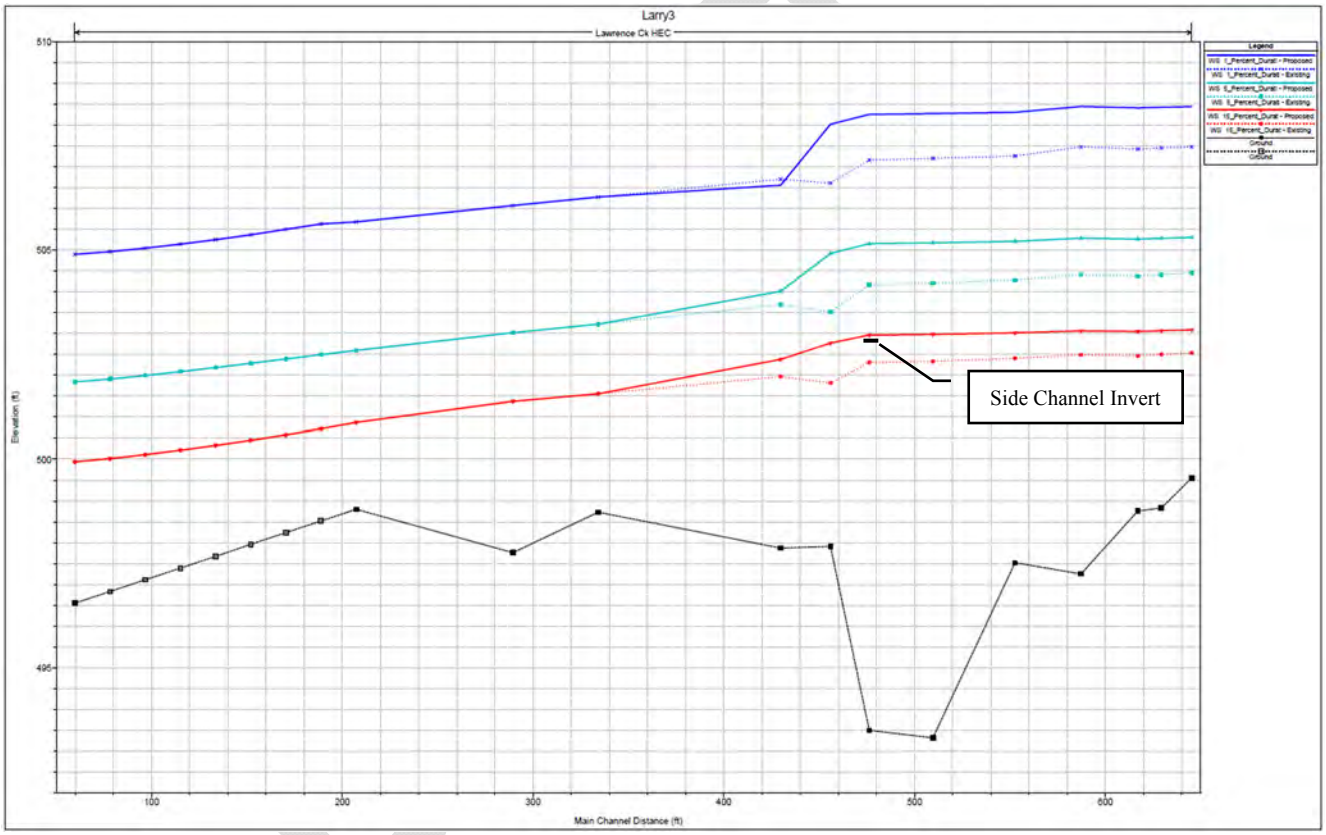


Figure 4. Lawrence Creek HEC-RAS model longitudinal profile existing and proposed conditions.

Utilizing split flow model conditions for simulating flows at and larger than the 15% exceedance flow, the side channel water surface elevations were estimated for analyzing the venturi jam influence. Existing and proposed modeled water surface elevations are demonstrated on sheet C-4 of Appendix A.

9 CONSTRUCTION PLANS AND SEQUENCING

General sequence of construction:

1. Verify ingress and egress and construction access routes with owner and engineer
2. Install erosion and sediment control measures prior to any earth moving activity.
3. Clear areas only as needed to meet design requirements.
4. Source wood and mobilize to site for temporary stockpiling.
5. Implement water control measures and dewatering as needed prior to wood structure implementation.
6. Construct deflector log jam on opposite bank of Lawrence Ck and bar apex jam using sourced wood and reusing existing instream wood as needed.
7. Excavate project reach from upstream to downstream. The downstream extent of the project will only be breached after the rest of the project construction is substantially complete to prevent impacts to water quality or resident fish.
8. Construct the remaining large woody material structures in the general locations shown on the plans.
9. Plant riparian vegetation.
10. Place slash and weed-free straw on disturbed surfaces for erosion control.
11. Decommission or water-bar access routes to the construction sites.
12. Establish photo-points.
13. PWA to perform as-built survey.

10 REFERENCES

Arcement, G.J., and V.R. Schneider. 1989. Guide for selecting Manning's roughness coefficients for natural channels and flood plains. USGS Water-Supply Paper 2239.

Budhu, M. 2015. Soil Mechanics Fundamentals – Imperial Version. Wiley Blackwell, West Sussex, UK.

California Department of Fish and Game. 2004. Recovery Strategy for California Coho Salmon., California Department of Fish and Game, Sacramento, CA.

California Department of Fish and Game. 2013. Van Duzen River Watershed Assessment. Coastal Watershed Planning and Assessment Program. Department of Fish and Game.

California Geological Survey. 2002. California Geomorphic Provinces.

Clarke, S.H., and G.A. Carver. 1992. Late Holocene tectonics and paleoseimicity, Southern Cascadia subduction zone. Science 255: 188-192.

D'Aoust, S., and R.G. Millar. 2000. Stability of ballasted wood debris habitat structures. Journal of Hydraulic Engineering, 126(11): 810-817.

Gotvald, A.J., N.A. Barth, A.G. Veilleux, and C. Parrett. 2012. Methods for determining magnitude and frequency of floods in California, based on data through water year 2006. U.S. Geological Survey Scientific Investigations Report 2012-5113.

Hyatt, T.L., and R.J. Naiman. 2001. The residence time of large woody debris in Queets River, Washington. Ecological Applications 11: 191-202.

Johnson, A.W., and J.M. Stypula, eds. 1993. Guidelines for bank stabilization projects in riverine environments of King County. King County Department of Public Works. Surface Water Management Division. Seattle, WA.

NRCS. 2007. Use of Large Woody Material for Habitat and Bank Protection. Technical Supplement 14J.

NOAA, 2014, Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionary Significant Unit of Coho Salmon (Oncorhynchus kisutch)-Ch. 25-Humboldt Bay Tribs, NOAA Fisheries, Arcata, CA

Stillwater Sciences, 2010, Van Duzen River watershed assessment. 2010. Final report. https://www.waterboards.ca.gov/northcoast/.../mad_river/pdf/.../PDF_MRWA.PDF

USGS, 1991, Lawrence Creek, California [map]: Washington, D.C., U.S. Geological Survey, 7.5 Minute Map 40123B8, scale 1:24,000

Appendix A

90% Design Plans

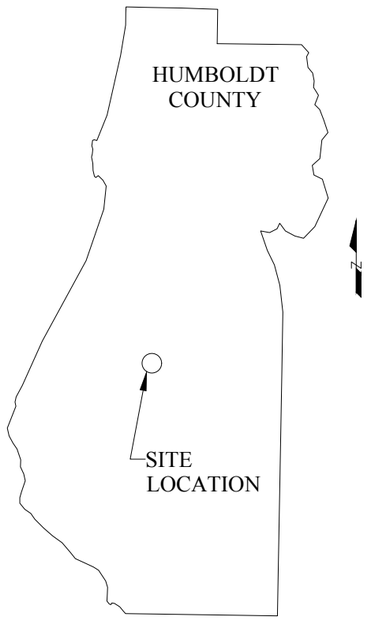
LAWRENCE CREEK OFF CHANNEL HABITAT IMPROVEMENT 3.0

PROJECT LOCATION: HYDESVILLE, CA

PREPARED FOR:
TROUT UNLIMITED

Humboldt Redwood™

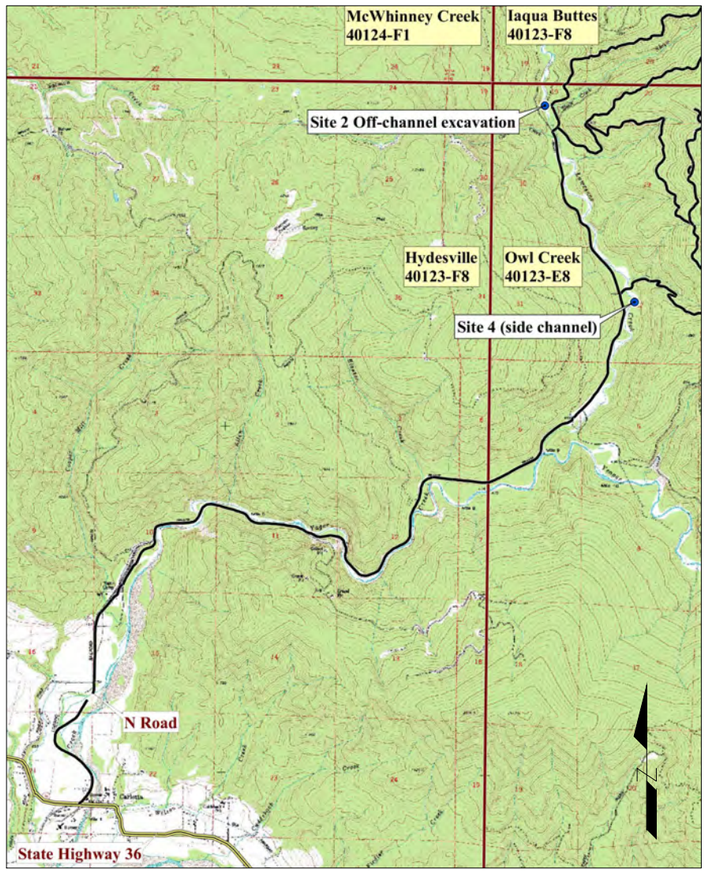
DRAFT
90% DESIGN SUBMITTAL



VICINITY MAP
NOT TO SCALE

SHEET INDEX

SHEET NO.	DESCRIPTION
G-1	COVER AND SHEET INDEX
C-1	GENERAL NOTES AND ESTIMATED QUANTITIES
C-2	EXISTING CONDITIONS PLAN VIEW
C-3	PROPOSED CONDITIONS PLAN VIEW
C-4	HYDRAULIC MODEL WATER SURFACE PROFILES
C-5	PROPOSED POND PROFILE AND CROSS SECTIONS
C-6	BAR APEX JAM DETAILS
C-7	DEFLECTOR JAM DETAILS
C-8	VENTURI JAM AND HABITAT STRUCTURE DETAILS
C-9	WOOD ANCHORING DETAILS
C-10	WATER CONTROL PLAN



LOCATION MAP
USGS 7.5 MINUTE QUADRANGLE
NOT TO SCALE

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

DATE
6/4/2020
NOTES PREPARED BY
PWA
FIGURES CREATED BY
GSO
SHEET 1 OF 11

PACIFIC WATERSHED ASSOCIATES

DRAWING DESCRIPTION:
COVER AND SHEET INDEX

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

G-1

C:\Users\PWACADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_V2 - Standard\Larry3_05_07_2020_90_V2.dwg

GENERAL NOTES

1. THE CONTRACTOR SHALL HAVE SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY.
2. THE CONTRACTOR IS RESPONSIBLE FOR ASSURING THAT EXCAVATION, GRADING, AND FILL WORK IS CONSISTENT WITH ALL APPLICABLE PERMITS, THE CALIFORNIA BUILDING CODE, CALIFORNIA FISH AND GAME CODE, CALIFORNIA WATER CODE, AND OTHER LOCAL CODES AND REQUIREMENTS.
3. A COPY OF THE PLANS, SPECIFICATIONS, AND ALL PERMITS SHALL BE KEPT ON-SITE AT ALL TIMES WHEN EXCAVATION AND CONSTRUCTION WORK ARE ONGOING.
4. IF GROUND DISTURBANCE WILL OCCUR BETWEEN OCTOBER 15 AND MAY 15, THE MATERIALS CALLED OUT IN THE EROSION CONTROL PLAN SHALL BE PRESENT ON SITE BEFORE EXCAVATION COMMENCES. THE CONTRACTOR IS RESPONSIBLE FOR MONITORING WEATHER AND IMPLEMENTING THE BEST MANAGEMENT PRACTICES (BMPS) SPECIFIED IN THE EROSION CONTROL PLAN. BMPS SHALL BE IN PLACE NO LESS THAN 24 HOURS OF A PREDICTED RUNOFF GENERATING STORM (>0.1 INCHES OF PRECIPITATION). THE CONTRACTOR SHALL BE SOLELY LIABLE FOR VIOLATIONS OF ENVIRONMENTAL PERMITS AND CODES RESULTING FROM FAILURE TO IMPLEMENT BMPS IN A TIMELY MANNER.
5. THE CONTRACTOR SHALL IDENTIFY THE EXCAVATION BOUNDARIES AND DIRECTIONS TO THE EXCAVATION AREA USING WHITE PAINT IN ACCORDANCE WITH THE REQUIREMENTS OF USA NORTH 811. NOTIFICATION TO USA NORTH 811 SHALL BE MADE NOT LESS THAN 2 WORKING DAYS AND NOT MORE THAN 14 CALENDAR DAYS BEFORE DIGGING COMMENCES. USA NORTH 811 MEMBERS WILL IDENTIFY THE LOCATIONS OF UNDERGROUND UTILITIES ONCE THE CONTRACTOR RECEIVES A USA TICKET NUMBER BY CALLING 811 OR APPLYING ONLINE AT HTTP://USANORTH811.ORG/. IF THERE IS UNCERTAINTY REGARDING THE LOCATION OF UNDERGROUND UTILITIES WITHIN THE PERIMETER OF THE EXCAVATION AREA, THE CONTRACTOR SHALL HIRE A QUALIFIED PRIVATE UTILITY LOCATING SERVICE.
6. IF OVERHEAD UTILITIES ARE PRESENT, THE CONTRACTOR SHALL DETERMINE IF THE UTILITIES WILL INTERFERE WITH EQUIPMENT OPERATIONS. IF OVERHEAD UTILITIES COULD POTENTIALLY INTERFERE WITH EQUIPMENT OPERATIONS, THE CONTRACTOR SHALL PROVIDE A SPOTTER WHO SHALL BE CAPABLE OF COMMUNICATING CLEARANCE DISTANCES AND UNSAFE CONDITIONS TO THE EQUIPMENT OPERATOR.
7. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR ALL DAMAGE TO OVERHEAD AND UNDERGROUND UTILITIES. IN THE EVENT OVERHEAD OR UNDERGROUND UTILITIES ARE DAMAGED THE CONTRACTOR SHALL CEASE EXCAVATION AND CALL 911 IMMEDIATELY.
8. IN THE EVENT THAT ARCHAEOLOGICAL RESOURCES ARE ENCOUNTERED DURING EXCAVATION, ALL EXCAVATION WORK SHALL CEASE UNTIL A QUALIFIED ARCHAEOLOGICAL OR TRIBAL MONITOR IS CONSULTED. EXCAVATION WORK SHALL RESTART ONLY UPON THE APPROVAL OF THE QUALIFIED ARCHAEOLOGIST OR TRIBAL MONITOR. IF HUMAN REMAINS OR EVIDENCE OF HUMAN BURIAL ARE ENCOUNTERED THE CONTRACTOR SHALL ALSO CONTACT THE COUNTY CORONER.
9. IF HAZARDOUS MATERIALS, DRUMS, OILY LIQUIDS, UNUSUAL ODORS, OR EVIDENCE OF NATURALLY OCCURRING ASBESTOS IS ENCOUNTERED DURING EXCAVATION, WORK SHALL CEASE AND THE CONTRACTOR SHALL CONTACT THE ENGINEER AS SOON AS POSSIBLE. EXCAVATION SHALL RESUME ONLY UPON THE APPROVAL OF THE ENGINEER.
10. MATERIAL STORAGE AND HANDLING PROCEDURES SHALL CONFORM WITH THE MANUFACTURER'S RECOMMENDATIONS AND/OR THE INDUSTRY'S GENERALLY ACCEPTED BEST MANAGEMENT PRACTICES.
11. DETAILS AND NOTES ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES OR TYPICAL DETAILS.
12. DRAWINGS SHALL NOT BE SCALED. DRAWINGS ARE GENERALLY TO SCALE AND NOT TO SCALE IS SHOWN ONLY WHERE DRAWING IS OBVIOUSLY OUT OF SCALE. WRITTEN DIMENSIONS ON THE DRAWINGS SHALL TAKE PRECEDENCE OVER GRAPHICAL SCALES SHOWN ON DRAWINGS.
13. THE GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK. THE ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCIES BEFORE WORK COMMENCES.
14. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING A CLEAN, SAFE, AND ORDERLY JOB SITE.
15. THE GENERAL CONTRACTOR SHALL THOROUGHLY INVESTIGATE THE SITE AFTER CLEARING AND GRUBBING IS COMPLETE AND BEFORE CONSTRUCTION COMMENCES. IF BURIED STRUCTURES SUCH AS CULVERTS, WOODY DEBRIS, FOUNDATIONS, CESSPOOLS, OR LARGE ROCKS ARE ENCOUNTERED, CONSTRUCTION SHALL CEASE AND THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY.
16. THE ENGINEER SHALL NOT BE HELD LIABLE FOR CONSTRUCTION SITE SAFETY MATTERS, THE CONTRACTOR'S AND THEIR SUBCONTRACTORS ERRORS AND OMISSIONS, NOR FOR FAILURE OF THE CONTRACTOR AND THEIR SUBCONTRACTOR'S FAILURE TO ADHERE TO THE CONSTRUCTION CONTRACT, SPECIFICATIONS, AND DRAWINGS.
17. ELEVATIONS SHOWN ON THE DRAWINGS ARE RELATIVE TO THE LOCAL GROUND CONDITIONS AND TEMPORARY BENCHMARKS PLACED FOR THE PURPOSE OF CONSTRUCTION.
18. THE CLIENT SHALL BE RESPONSIBLE FOR SECURING ALL REQUIRED PERMITS FOR CONSTRUCTION. PACIFIC WATERSHED ASSOCIATES SHALL NOT BE LIABLE FOR ANY FINES, FEES, OR VIOLATIONS DUE TO CONSTRUCTION COMPLETED WITHOUT THE REQUIRED PERMITS.
19. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MINIMIZE EROSION AND PREVENT THE DELIVERY OF SEDIMENT OR OTHER POLLUTANTS TO SURFACE WATERS OR OTHER SENSITIVE AREAS.
20. WORK WILL BE CONDUCTED DURING DRY WEATHER PERIODS WHEN ALL GRADING, EROSION CONTROL, AND SITE STABILIZATION MEASURES CAN BE IMPLEMENTED PRIOR TO RAINFALL.
21. CONTRACTOR SHALL KEEP PROJECT AREAS GENERATING DUST WATERED DURING THE TERM OF CONSTRUCTION.
22. SOLID WASTE, SUCH AS TRASH, DEBRIS, AND SANITARY WASTE SHALL BE PLACED IN CONTAINERS AND REMOVED FROM THE SITE PERIODICALLY OR DISPOSED OF AS DIRECTED BY THE LANDOWNER.
23. IF RAINFALL GREATER THAN 1 INCH IN A 24 HOUR PERIOD IS FORECAST PRIOR TO THE COMPLETION OF GRADING, OR IF ACCUMULATED PRECIPITATION HAS MADE FILL MATERIALS UNSUITABLE FOR COMPACTION AND STABLE CONSTRUCTION, THE SITE WILL BE STABILIZED AND PROTECTED FROM SURFACE EROSION. PLASTIC SHEETING WILL BE USED TO COVER ALL FILL STOCKPILES AND UNFINISHED SLOPES AND SECURED BY PLACEMENT OF MULTIPLE HEAVY OBJECTS..

INSPECTIONS:

1. EXCAVATION
2. FINISHED GRADE
3. LARGE WOOD
4. PLACEMENT OF SPOILS AND EROSION CONTROL MEASURES

LEGEND

- 1+00 — ALIGNMENT STATIONING (FEET)
- 10 — EXISTING CONTOUR WITH ELEVATION
- 10 — PROPOSED CONTOUR WITH ELEVATION
- FENCE LINE
- LIMIT OF GRADING
- LIMIT OF DISTURBANCE
- SURVEY CONTROL POINT
- STAFF PLATE / T-POST
- FLOW DIRECTION
- TREE
- 2 / C7 — SECTION LABEL (DETAIL #, SHEET #)
- WATER SURFACE

PROFILE/SECTION LABELS

2 / C7 — DETAIL IDENTIFIER; SHEET IDENTIFIER

ABBREVIATIONS

APPROX, ~	APPROXIMATELY
CA	CALIFORNIA
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CP	CONTROL POINT (SURVEY)
CY	CUBIC YARDS
DIA	DIAMETER
EG	EXISTING GRADE
EL	ELEVATION
(E)	EXISTING
FG	FINISHED GRADE
FT	FOOT OR FEET
LOD	LIMIT OF DISTURBANCE
LWM	LARGE WOODY MATERIAL
MAX/MIN	MAXIMUM/MINIMUM
NTS	NOT TO SCALE
PT#	POINT NUMBER
(P)	PROPOSED
RD	ROAD
STA	STATION
SF	SQUARE FEET
TYP	TYPICAL
(3 : 1)	SLOPE (HORIZONTAL : VERTICAL)

PROJECT DESCRIPTION: PROJECT ELEMENTS INCLUDE EXCAVATING A POND, CONSTRUCTING A CONNECTOR CHANNEL BELOW THE POND, AND ENHANCED WITH LARGE WOODY MATERIAL WHICH WILL SERVE AS HABITAT, GRADE CONTROL, AND SCOUR/DEPOSITION MECHANISMS. THE POND WILL FUNCTION AS VELOCITY REFUGIA DURING HIGH-FLOW EVENTS.

WATER POLLUTION CONTROL: THE CONTRACTOR SHALL DEVELOP THE DEWATERING PLAN. INFRASTRUCTURE AND EXTENTS SHALL BE DEFINED BY CONTRACTOR AND REVIEWED AND APPROVED BY ENGINEER PRIOR TO CONSTRUCTION.

ESTIMATED QUANTITIES FOR INFORMATIONAL PURPOSES ONLY

CATEGORY	UNIT	ESTIMATED QUANTITY
LARGE WOODY MATERIAL	EACH	68
EARTHWORK	CY	1600
STRAW BALE	EACH	20
SILT FENCE	LF	500

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 2 OF 11

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

DRAWING DESCRIPTION:
GENERAL NOTES AND ESTIMATED QUANTITIES

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

C-1

STAFF PLATE

SURVEY CONTROL

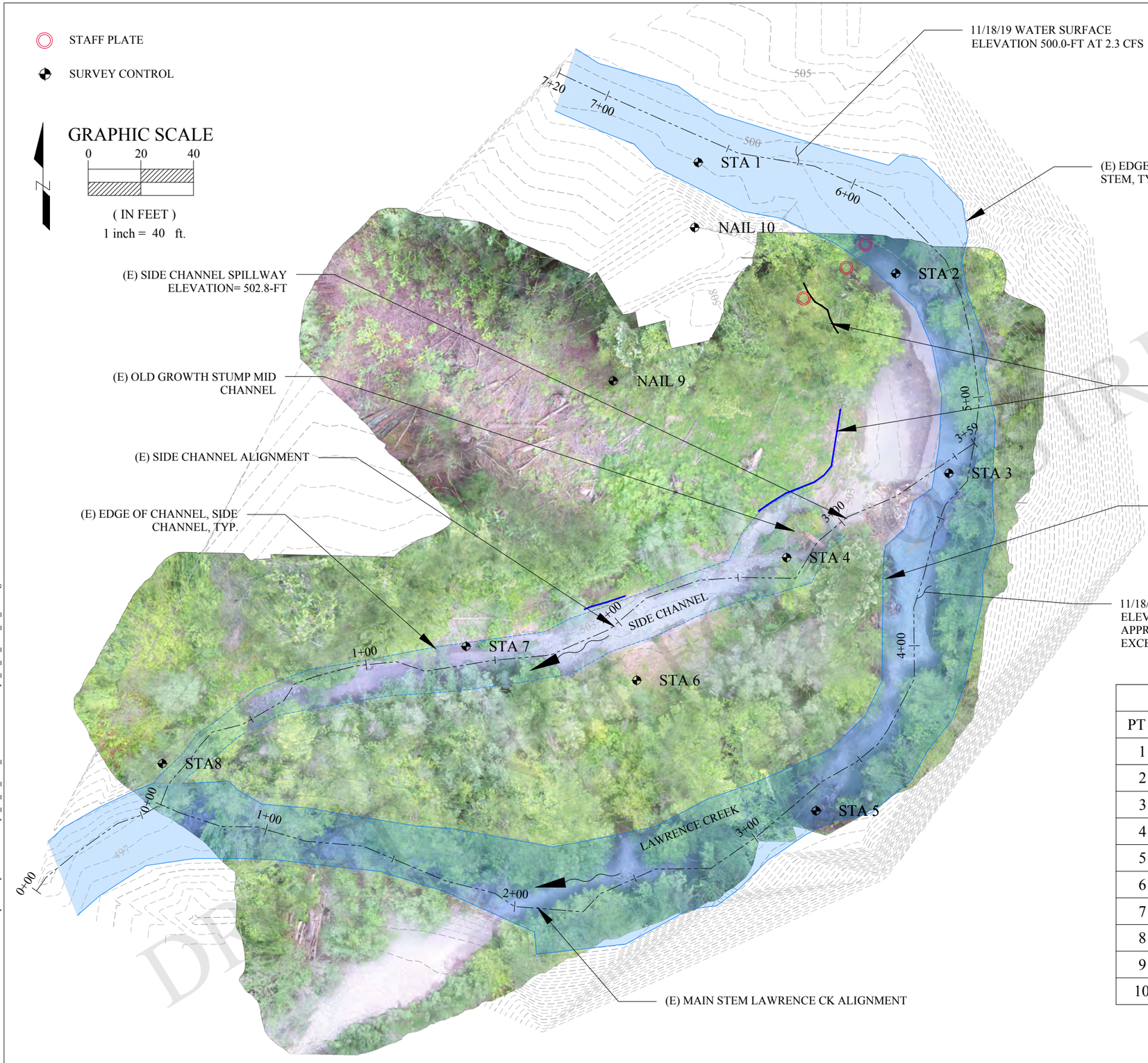
GRAPHIC SCALE

0 20 40

(IN FEET)

1 inch = 40 ft.

N



SURVEY NOTES:

1. TOPOGRPAHIC DATA COLLECTED USING LEICA TCRA 1101 PLUS TOTAL STATION.
2. DATES OF SURVEY 9/4/19, 9/5/19, 9/27/19 & 11/18/19.
3. SURVEY PERSONNEL: RS, HF, GD.
4. CONTOUR INTERVAL = 1 FT. ALL ELEVATIONS RELATIVE TO APPROXIMATE NAVD88 DATUM.
5. THIS IS NOT A BOUNDARY SURVEY AND DOES NOT MEET THE LEGAL REQUIREMENTS OF A BOUNDARY SURVEY AS DESCRIBED IN PROFESSIONAL LAND SURVEYORS' ACT.

Control Point Table

PT #	Description	Northing	Easting	Elevation
1	Nail in Ground	2107741.32'	6012312.13'	500.00'
2	Nail in Ground	2107699.08'	6012387.26'	499.64'
3	Nail in Ground	2107623.12'	6012407.42'	499.52'
4	Nail in Ground	2107591.07'	6012345.77'	503.35'
5	Nail in Ground	2107494.83'	6012356.92'	499.55'
6	Nail in Ground	2107544.41'	6012288.76'	507.29'
7	Nail in Ground	2107557.37'	6012223.91'	502.96'
8	Nail in Ground	2107512.79'	6012108.44'	500.55'
9	Nail in Tree	2107658.25'	6012279.82'	510.92'
10	Nail in Tree	2107716.56'	6012310.79'	512.51'

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 3 OF 11

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

DRAWING DESCRIPTION:
EXISTING CONDITIONS PLAN VIEW

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

C-2

C:\Users\PWACADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_V2 - Standard\Larry3_05_07_2020_90_V2.dwg

(P) EXTENTS OF GRADING

CONSTRUCTION ACCESS

(P) POND WITH UNDULATING TOE TO VARY EDGE HABITAT SLOPE AND DEPTHS, CONNECTOR SLOPING TO MOUTH AT 0.005FT/FT

LIMITS OF DISTURBANCE

(P) SPANNER LOGS 1-FT ABOVE CHANNEL GRADE

(P) VENTURI STYLE WOOD JAM, SEE DETAILS 1&2 ON SHEET C-8

(P) HABITAT WOOD, TYP

(P) OFF-CHANNEL FEATURE ALIGNMENT, SEE SHEET C-5

(E) OLD GROWTH STUMP TO BE RETAINED

(P) LOG EMBEDDED SLIGHTLY ABOVE SIDE CHANNEL THALWEG GRADE

(P) ALCOVE MOUTH MATCH EXISTING SIDE CHANNEL THALWEG ELEVATION

(P) DEFLECTOR LOG JAM, SEE SHEET C-7

(E) ROOTWAD STUMP

(P) BAR APEX WOOD JAM, SEE SHEET C-6

SIDE CHANNEL

ISLAND

LAWRENCE CREEK

GRAPHIC SCALE

0 15 30

(IN FEET)

1 inch = 30 ft.

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 5 OF 11

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

DRAWING DESCRIPTION:
PROPOSED CONDITIONS PLAN VIEW

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

C-3

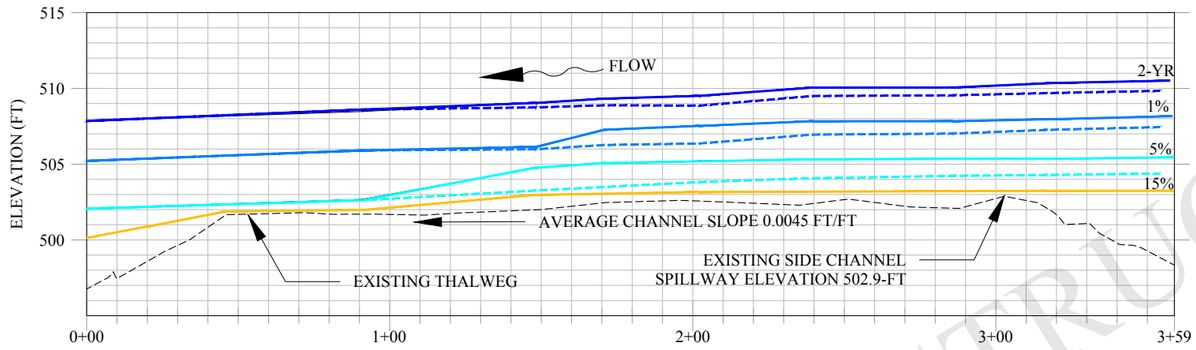
C:\Users\PWACADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_V2 - Standard\Larry3_05_07_2020_90_V2.dwg

LEGEND:

2-YR EXISTING PROPOSED
1% EXISTING PROPOSED
5% EXISTING PROPOSED
15% EXISTING PROPOSED
90% EXISTING/PROPOSED

NOTES:

1. PROFILE VIEWS ARE 5X VERTICALLY EXAGGERATED
2. WATER SURFACE ELEVATIONS ARE FROM EXISTING AND PROPOSED CONDITIONS HEC RAS MODEL FLOWS REPRESENTING THE 90%, 15%, 5%, AND 1% DAILY AVERAGE EXCEEDANCE, AND THE 2-YR RECURRENCE FLOOD FLOW



PROFILE SIDE CHANNEL

PROFILE MAIN STEM LAWRENCE CK

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 4 OF 11

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

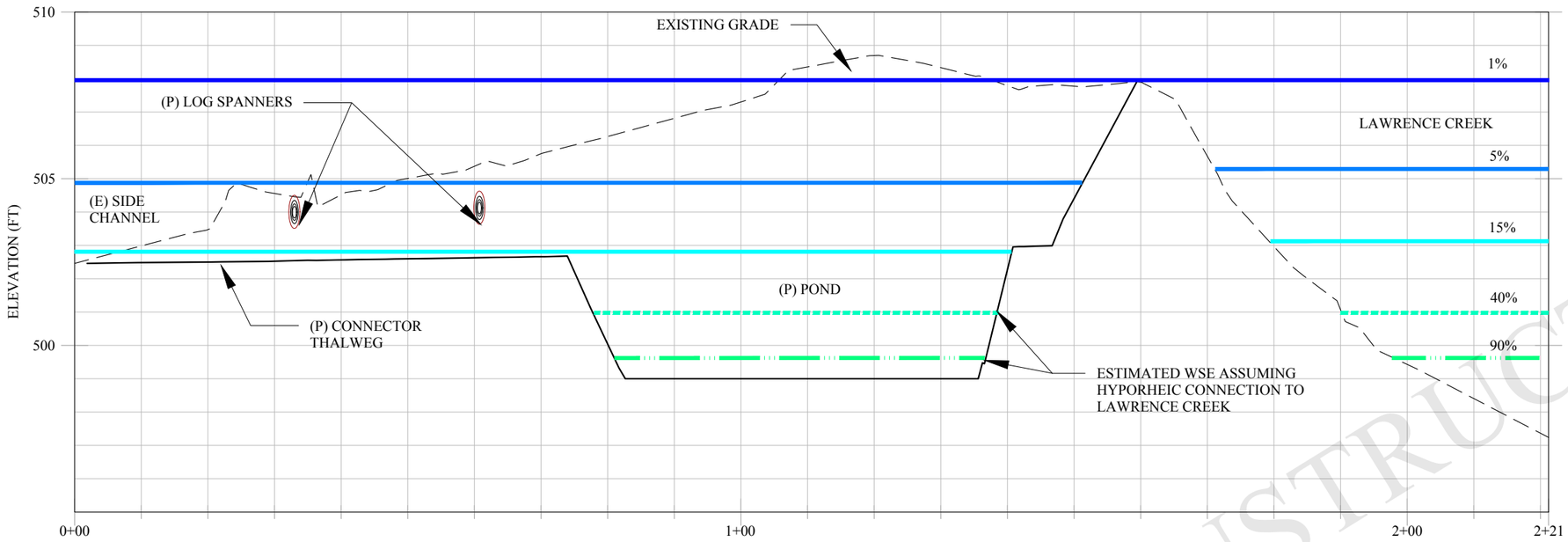
DRAWING DESCRIPTION:
HYDRAULIC MODEL WATER SURFACE PROFILES

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

C-4

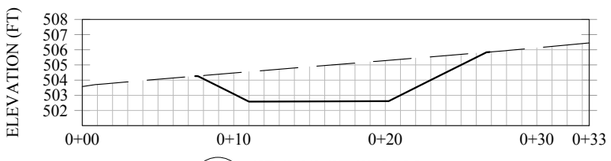
C:\Users\PWACADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_V2 - Standard\Larry3_05_07_2020_90_V2.dwg



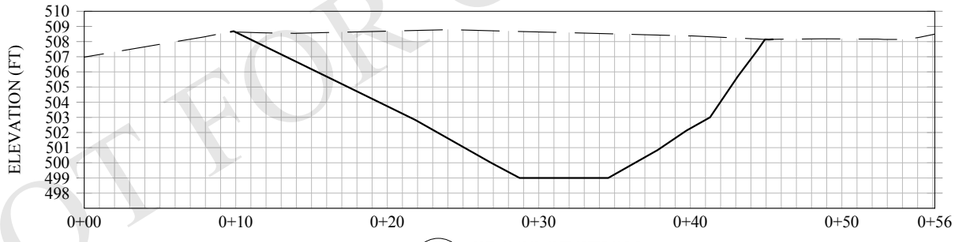
PROPOSED POND PROFILE

NOTES:

1. PROFILE VIEW ARE 5X VERTICALLY EXAGGERATED
2. WATER SURFACE ELEVATIONS ARE FROM PROPOSED CONDITIONS HEC-RAS MODEL FLOWS REPRESENTING THE 90%, 40%, 15%, 5%, AND 1% DAILY AVERAGE EXCEEDANCE FLOW



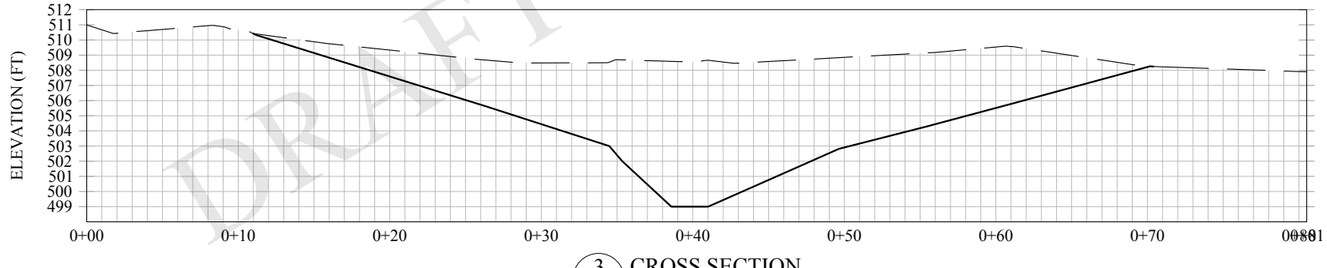
1 / C5 CROSS SECTION CONNECTOR
SCALE: 1" = 10'



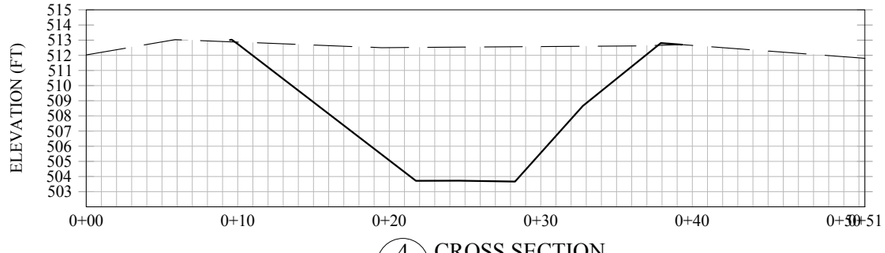
2 / C5 CROSS SECTION POND
SCALE: 1" = 10'

NOTES:

1. CROSS SECTIONS ORIENTED LOOKING DOWNSTREAM
2. CROSS SECTIONS SHOULD BE USED FOR GENERAL GRADING; POND AND CONNECTOR GEOMETRY WILL BE MODIFIED IN THE FIELD TO OBTAIN VARYING SLOPES AND UNDULATING BANKS.



3 / C5 CROSS SECTION POND
SCALE: 1" = 10'



4 / C5 CROSS SECTION POND
SCALE: 1" = 10'

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 6 OF 11

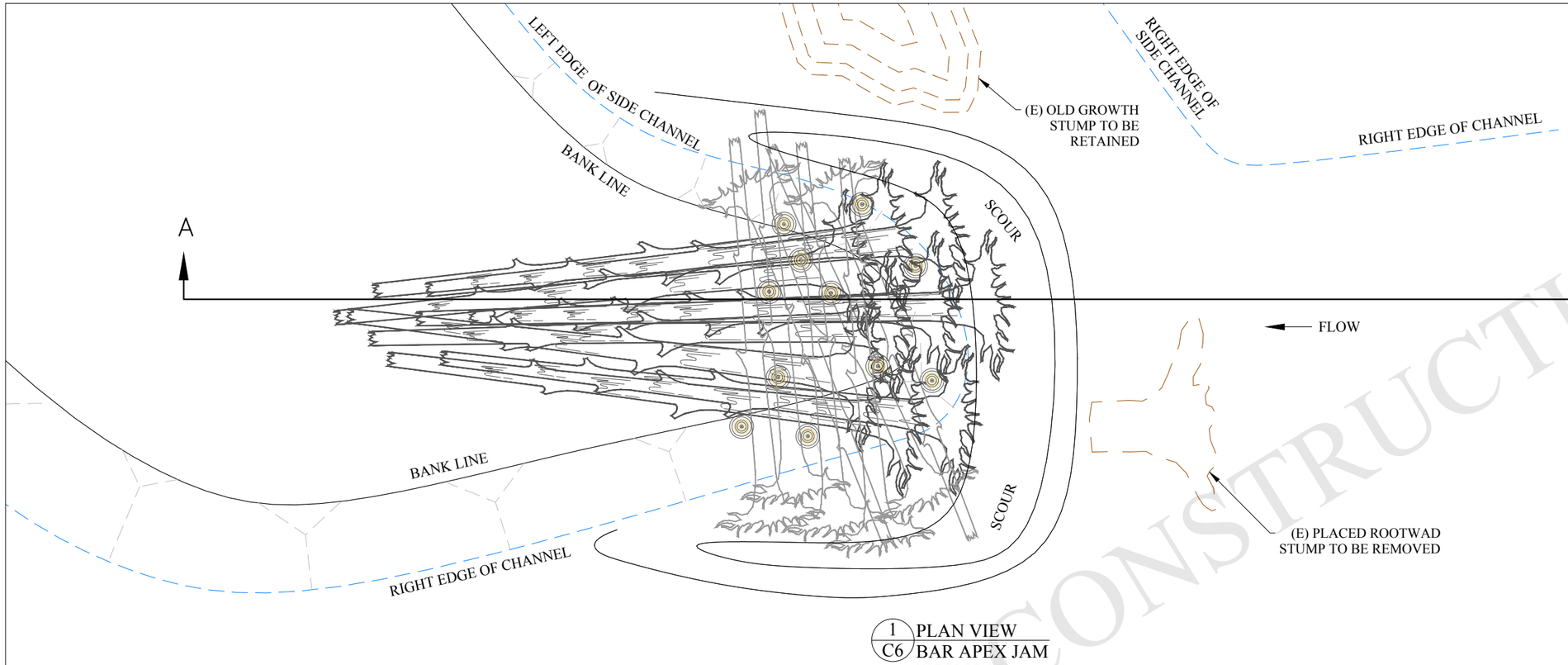
DRAWING DESCRIPTION:
PROPOSED POND PROFILE AND CROSS SECTIONS

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

C-5

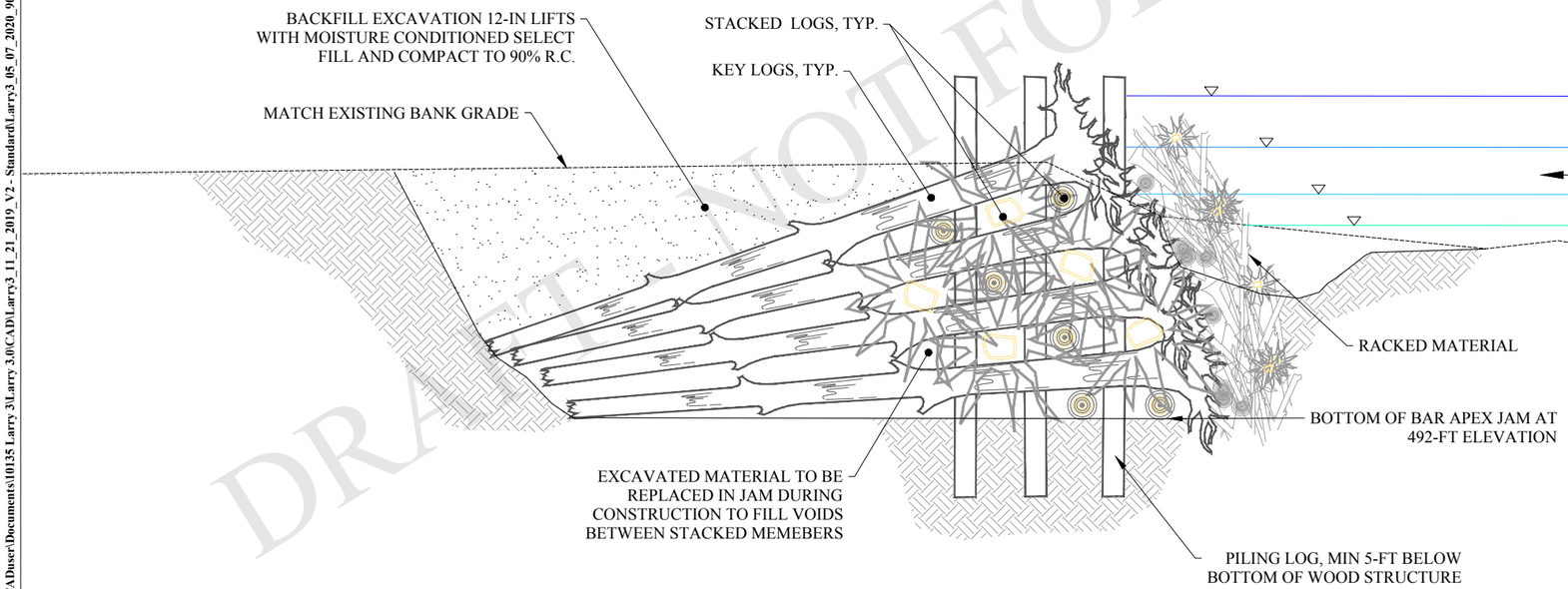
C:\Users\PWA\CADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_V2 - Standard\Larry3_05_07_2020_90_V2.dwg



1 C6 PLAN VIEW
BAR APEX JAM
NOT TO SCALE

NOTES:

1. EXCAVATED MATERIAL REPLACED IN JAM DURING CONSTRUCTION TO FILL VOIDS BETWEEN STACKED MEMBERS AND TO INCREASE STRUCTURAL MASS.
2. EXCAVATE CHANNEL BED TO PREDICTED GENERAL SCOUR DEPTH.
3. KEY LOGS TO BE ANCHORED TO EACH OTHER AND TO PILINGS.
4. LOGS TO BE CONIFEROUS SPECIES.



2 C6 SECTION A-A'
BAR APEX JAM
NOT TO SCALE

WOOD MATERIAL ESTIMATES

KEY PIECES
- QUANTITY = 12
- LENGTH = 40-FT
- MIN. DIAMETER = 2-FT DBH
- WITH ROOTWADS

STACKED/RACKED
- QUANTITY = 10
- LENGTH = 30-FT
- MIN. DIAMTER = 1.7-FT DBH
- MIN 50% WITH ROOTWADS

PILES
- QUANTITY = 9
- LENGTH = 30-FT
- MIN. DIAMTER = 1.7-FT DBH

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 7 OF 11

PACIFIC WATERSHED ASSOCIATES

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

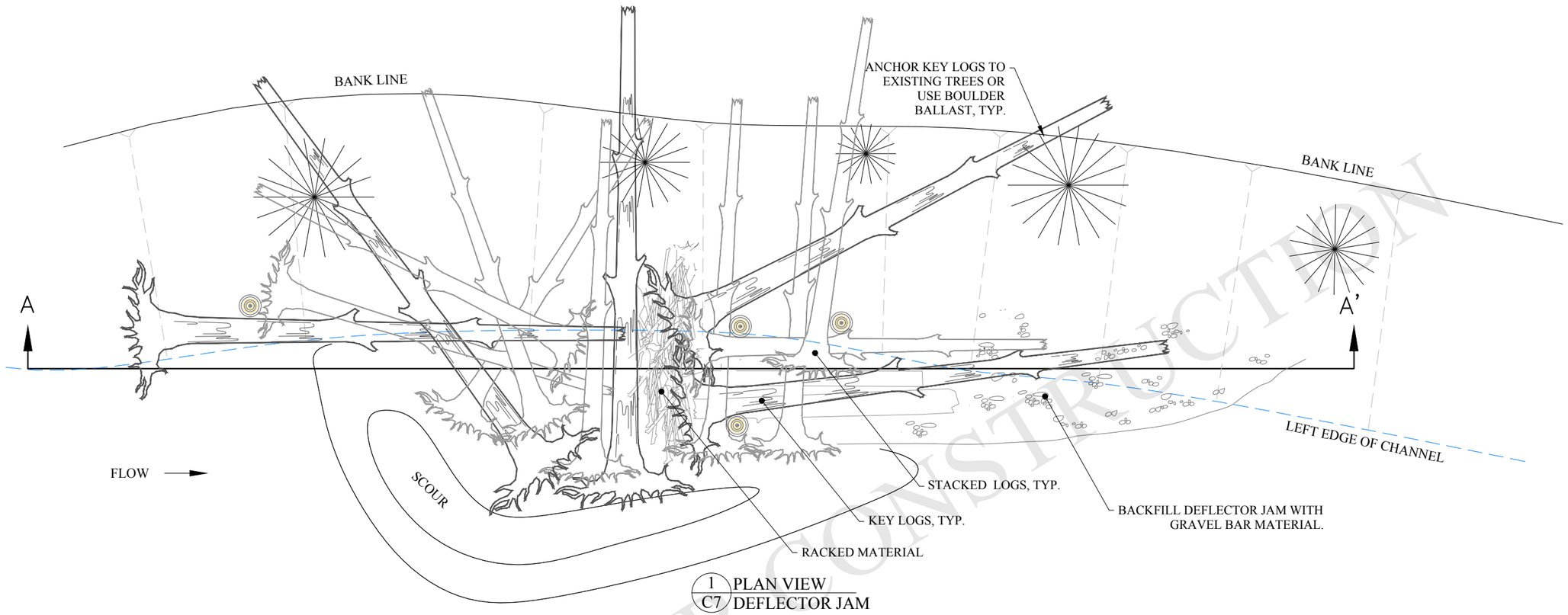
DRAWING DESCRIPTION:
BAR APEX JAM DETAILS

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

C-6

C:\Users\PWA\CADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_V2 - Standard\Larry3_05_07_2020_90_V2.dwg



1/C7 PLAN VIEW
DEFLECTOR JAM
NOT TO SCALE

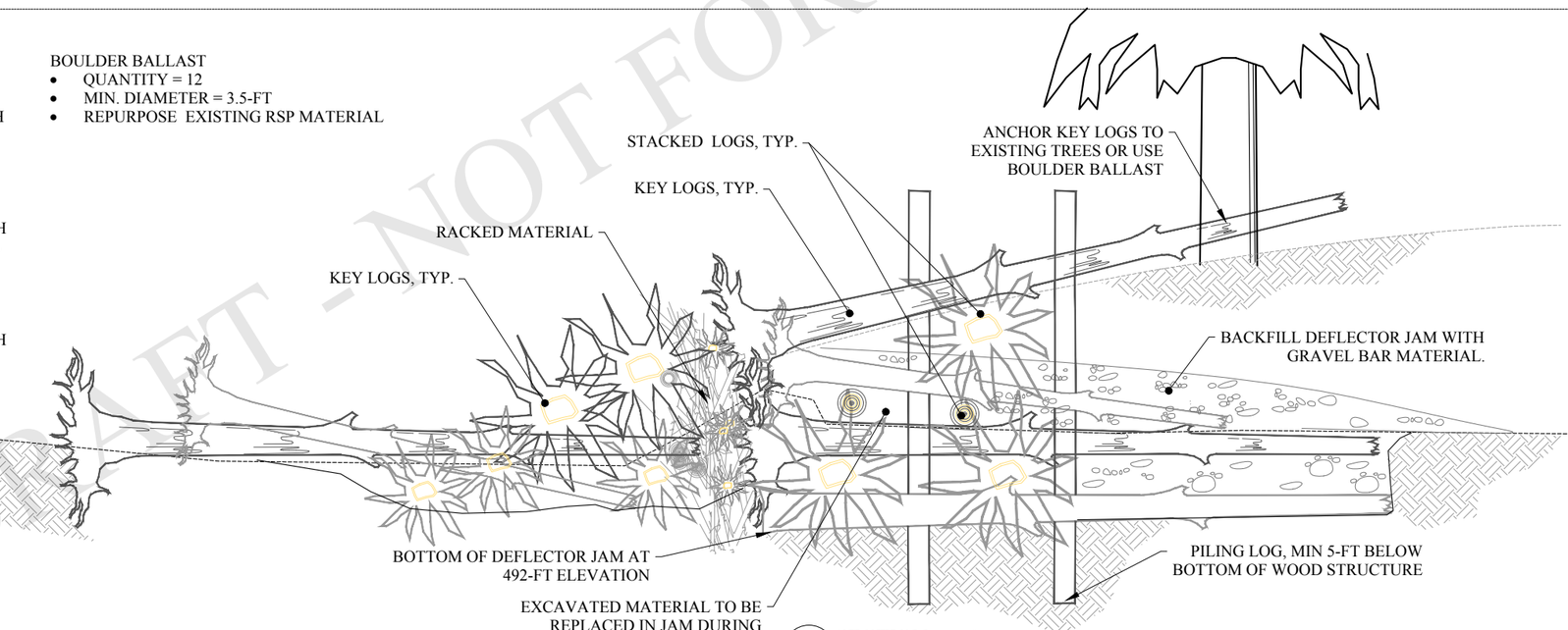
WOOD MATERIAL ESTIMATES

KEY PIECES
- QUANTITY = 6
- LENGTH = 40-FT
- MIN. DIAMETER = 2-FT DBH
- WITH ROOTWADS

STACKED/RACKED
- QUANTITY = 9
- LENGTH = 30-FT
- MIN. DIAMTER = 1.7-FT DBH
- MIN 50% WITH ROOTWADS

PILES
- QUANTITY = 5
- LENGTH = 30-FT
- MIN. DIAMTER = 1.7-FT DBH

BOULDER BALLAST
- QUANTITY = 12
- MIN. DIAMETER = 3.5-FT
- REPURPOSE EXISTING RSP MATERIAL



2/C7 SECTION A-A'
DEFLECTOR JAM
NOT TO SCALE

NOTES:

1. EXCAVATED MATERIAL REPLACED IN JAM DURING CONSTRUCTION TO FILL VOIDS BETWEEN STACKED MEMBERS AND TO INCREASE STRUCTURAL MASS.
2. EXCAVATE CHANNEL BED TO PREDICTED GENERAL SCOUR DEPTH.
3. KEY LOGS TO BE ANCHORED TO EACH OTHER AND TO PILINGS.
4. KEY LOGS TO BE BALLASTED USING ROD ANCHORING, SOIL OR BOULDER BALLAST.
5. LOGS TO BE CONIFEROUS SPECIES.

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 8 OF 11

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

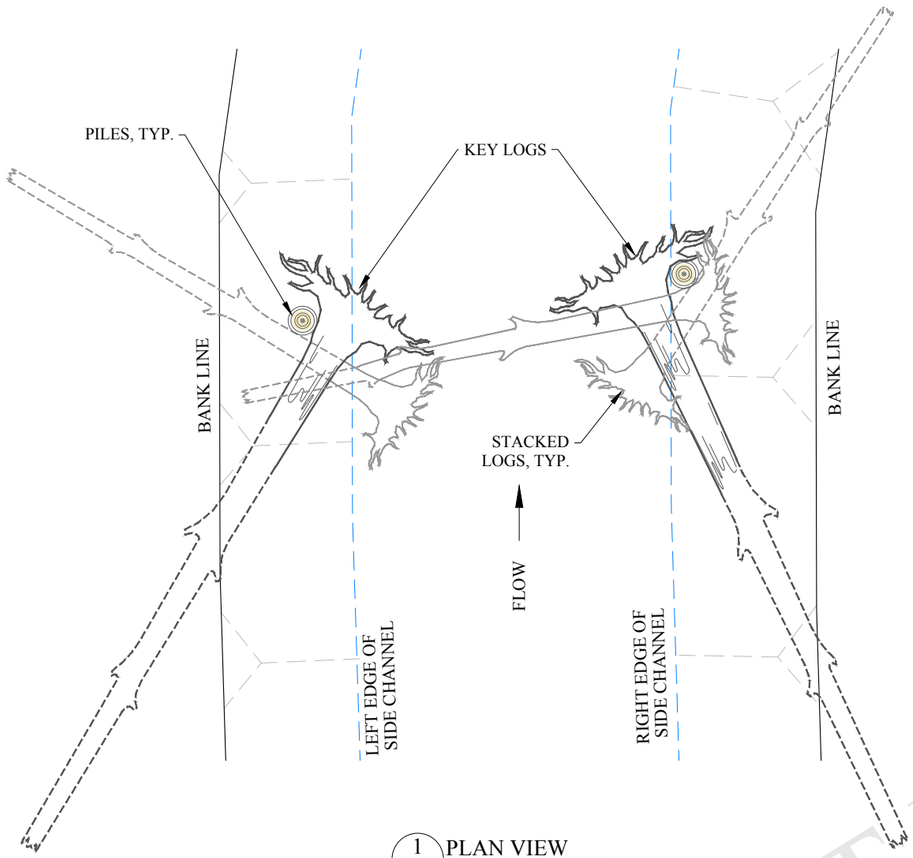
DRAWING DESCRIPTION:
DEFLECTOR JAM DETAILS

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

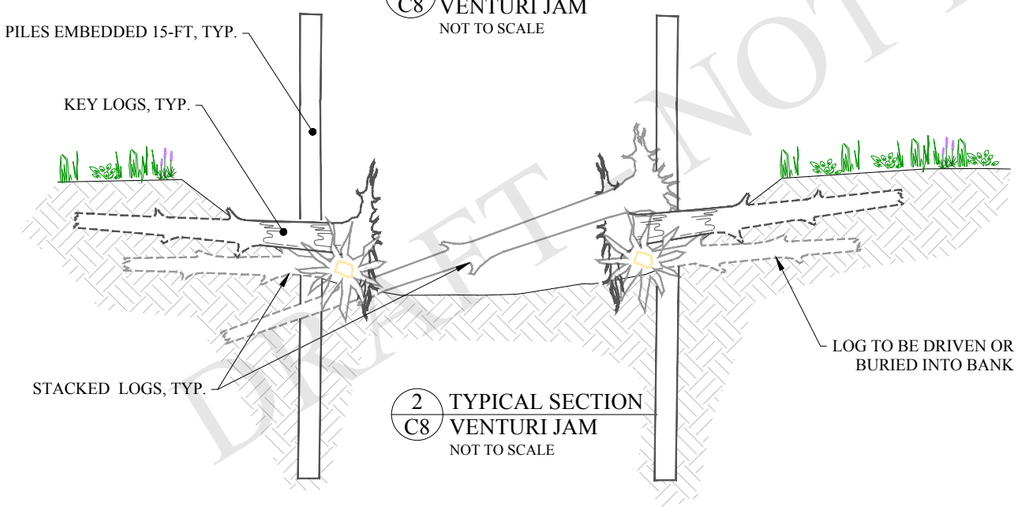
PWA JOB NO.: 10135

C-7

C:\Users\PWACADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_Y2 - Standard\Larry3_05_07_2020_90_Y2.dwg



1 C8 PLAN VIEW
VENTURI JAM
NOT TO SCALE

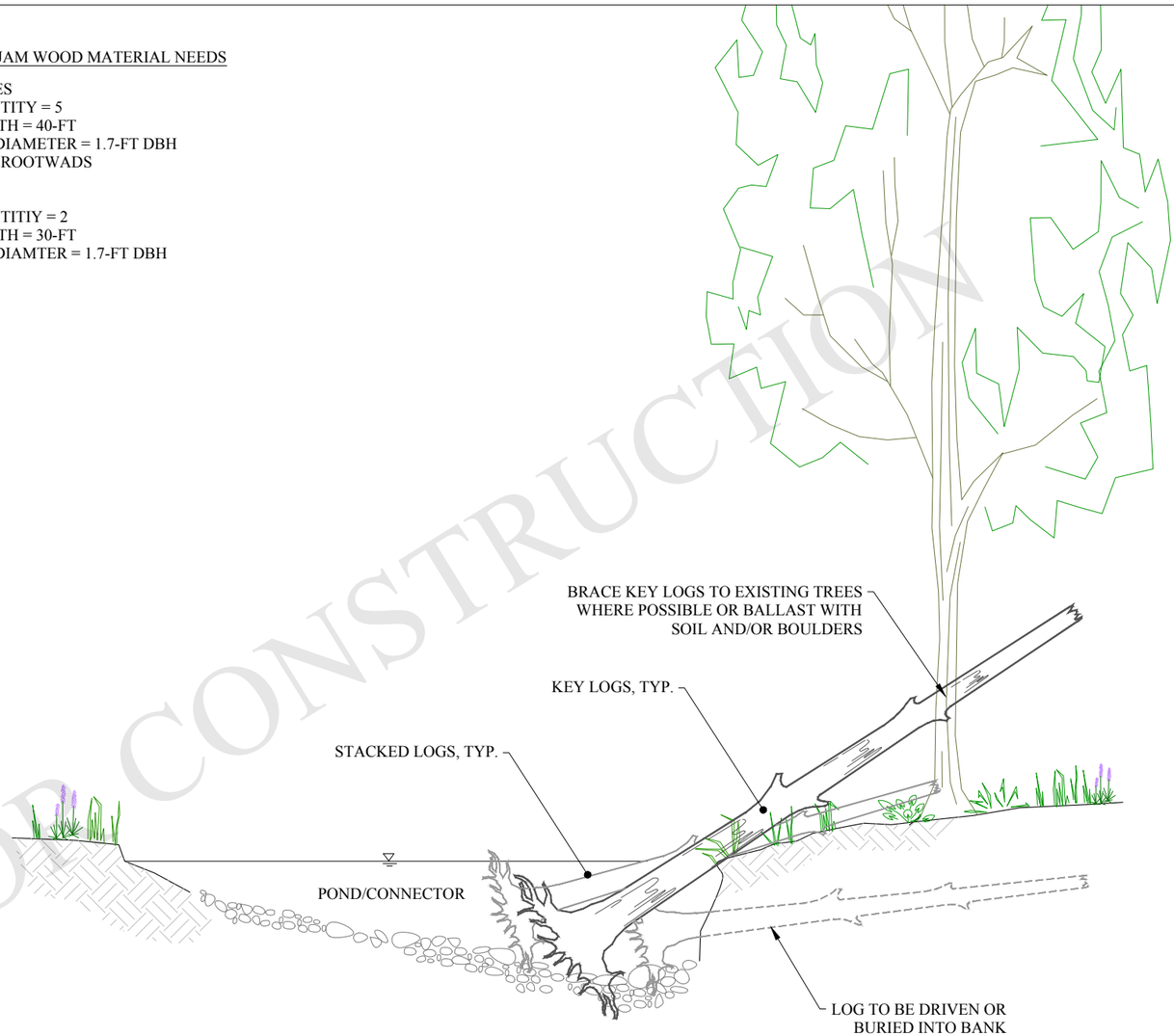


2 C8 TYPICAL SECTION
VENTURI JAM
NOT TO SCALE

VENTURI JAM WOOD MATERIAL NEEDS

KEY PIECES
- QUANTITY = 5
- LENGTH = 40-FT
- MIN. DIAMETER = 1.7-FT DBH
- WITH ROOTWADS

PILES
- QUANTITIY = 2
- LENGTH = 30-FT
- MIN. DIAMTER = 1.7-FT DBH



3 C8 TYPICAL SECTION
HABITAT WOOD STRUCTURE
NOT TO SCALE

POND AND CONNECTOR WOOD MATERIAL NEEDS

HABITAT PIECES
- QUANTITY = 8
- LENGTH = 40-FT
- MIN. DIAMETER = 1.7-FT DBH
- WITH ROOTWADS
- WITH LIMBS

CONNECTOR LOGS
- QUANTITY = 2
- LENGTH = 30-FT
- MIN. DIAMTER = 1.7-FT DBH

DATE
6/4/2020
NOTES PREPARED BY
PWA
FIGURES CREATED BY
GSO
SHEET 9 OF 11

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

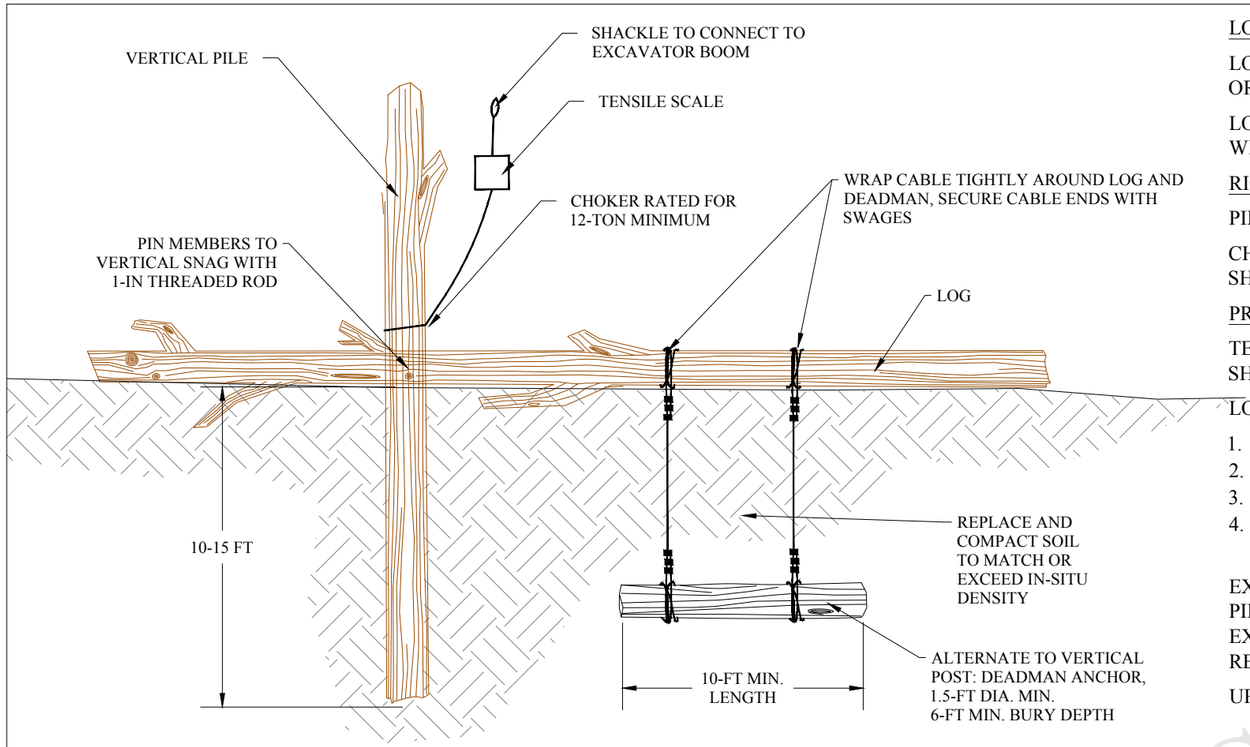
DRAWING DESCRIPTION:
VENTURI JAM AND HABITAT
STRUCTURE DETAILS

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

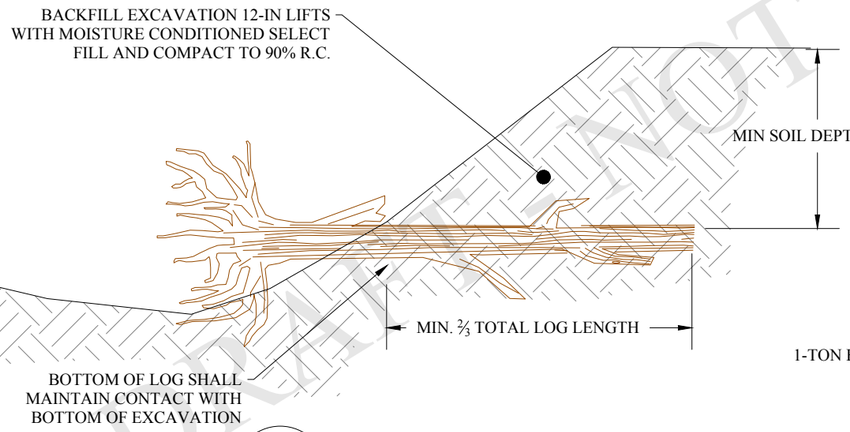
PWA JOB NO.: 10135

C-8

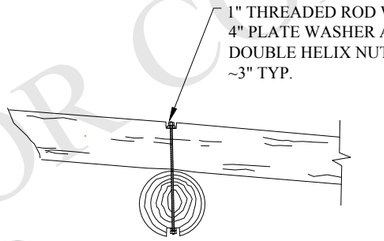
C:\Users\PWACADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_V2 - Standard\Larry3_05_07_2020_90_V2.dwg



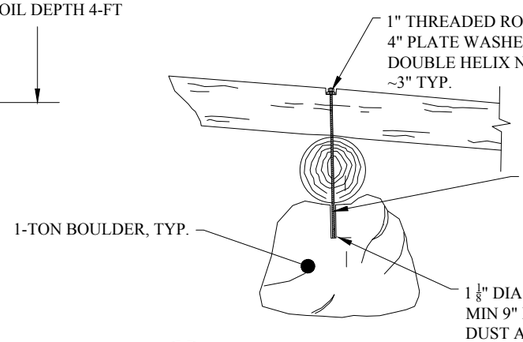
1 / C9 TYPICAL ANCHORING DETAIL
VERTICAL PILES OR DEADMAN
NOT TO SCALE



2 / C9 TYPICAL ANCHORING DETAIL
BURIED LOG BALLAST
NOT TO SCALE



3 / C9 TYPICAL ANCHORING DETAIL
LOG TO LOG
NOT TO SCALE



4 / C9 TYPICAL ANCHORING DETAIL
LOG TO LOG TO BOULDER
NOT TO SCALE

LOG PILES

LOG PILES SHALL BE INSTALLED USING VIBRATORY PILE DRIVING EQUIPMENT. INSTALLATION BY EXCAVATOR OR HAMMERING WILL NOT BE ALLOWED.

LOG PILES SHALL BE MINIMUM 10-INCH DIAMETER AT SCALED END. DIAMETER OF LOG AT GRIP POINT SHALL BE WITHIN THE RANGE OF 12-14-INCH.

RIGGING

PILE TESTING RIGGING SHALL CONFORM TO THE TENSION SCALE MANUFACTURER'S RECOMMENDATIONS.

CHOKERS, CABLES, AND SHACKLES SHALL HAVE MINIMUM WORKING LOAD RATING OF 12 TONS. FITTINGS SHALL BE SIZED ACCORDINGLY.

PROOF TESTING

TESTING OF PILES SHALL BE PERFORMED IN THE PRESENCE OF THE ENGINEER. EACH VERIFCATION TEST PILE SHALL BE TENSION LOAD TESTED TO 20,000 POUNDS, OR PULL OUT, WHICHEVER IS LESS.

LOAD TEST REQUIREMENTS:

1. 5,000 LB LOAD, 1 MIN HOLD TIME, 6-INCH MAX DEFLECTION
2. 10,000 LB LOAD, 1 MIN HOLD TIME, 6-INCH MAX DEFLECTION
3. 15,000 LB LOAD, 1 MIN HOLD TIME, 6-INCH MAX DEFLECTION
4. 20,000 LB LOAD, 2 MIN HOLD TIME, 6-INCH MAX DEFLECTION

EXCAVATOR CONDUCTING PULL OUT LOADING SHALL BE POSITIONED NO CLOSER THAN EMBEDMENT DEPTH OF PILE, IF POSSIBLE. LIMIT COMPRESSIVE LOADING OF THE TRACKS ON THE GROUND BY DRIVING THE EXCAVATOR ONTO LOGS LAID ON THE GROUND TO DISTRIBUTE THE WEIGHT OVER A LARGER AREA. PULL OUT RESISTANCE READING SHALL BE COMPARED AGAINST EXCAVATOR MAX LIFT OFFSET TABLE.

UP TO 10% OF INSTALLED PILINGS SHALL BE PROOF TESTED.

LOG BUOYANCY FORCE (LBS)			
ASSUMES WOOD SPECIFIC GRAVITY = 0.43			
DBH X LOG LENGTH (FT)	F_b	SAFETY FACTOR 1.25	SAFETY FACTOR 1.5
1.5 X 40	2,490	3,113	3,735
2 X 40	4,420	5,525	6,630
2.5 X 40	6,910	8,638	10,365
3 X 40	9,950	12,438	14,925
1.5 X 50	3,110	3,888	4,665
2 X 50	5,530	6,913	8,295
2.5 X 50	8,630	10,788	12,945
3 X 50	12,430	15,538	18,645
1.5 X 60	3,730	4,663	5,595
2 X 60	6,630	8,288	9,945
2.5 X 60	10,360	12,950	15,540
3 X 60	14,920	18,650	22,380
ADDITIONAL ROOT WAD BUOYANCY FORCE (LBS)			
ESTIMATED BASED ON 35% VOID SPACE			
DIAMETER ROOT WAD	F_b	SAFETY FACTOR 1.25	SAFETY FACTOR 1.5
4	575	719	863
6	1,300	1,625	1,950
8	2,300	2,875	3,450
10	5,400	6,750	8,100
12	7,800	9,750	11,700

WOOD PHYSICAL PROPERTIES REFERENCE TABLE		
SPECIES	DENSITY (LB/FT3)	SPECIFIC GRAVITY
REDWOOD	27.2	0.43
DOUGLAS FIR	32.0	0.50
SITKA SPRUCE	26.8	0.42

NOTE

ANCHORING METHODS AND OR ALTERNATIVE OPTIONS TO BE REVIEWED AND APPROVED BY ENGINEER

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 10 OF 11

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

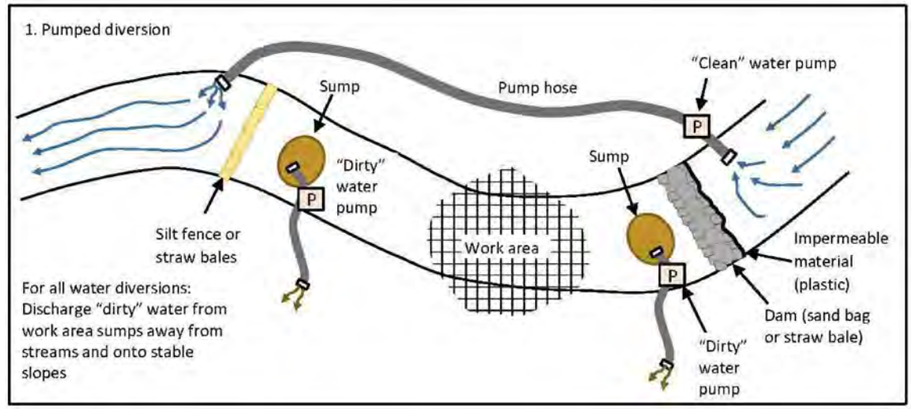
DRAWING DESCRIPTION:
WOOD ANCHORING DETAILS

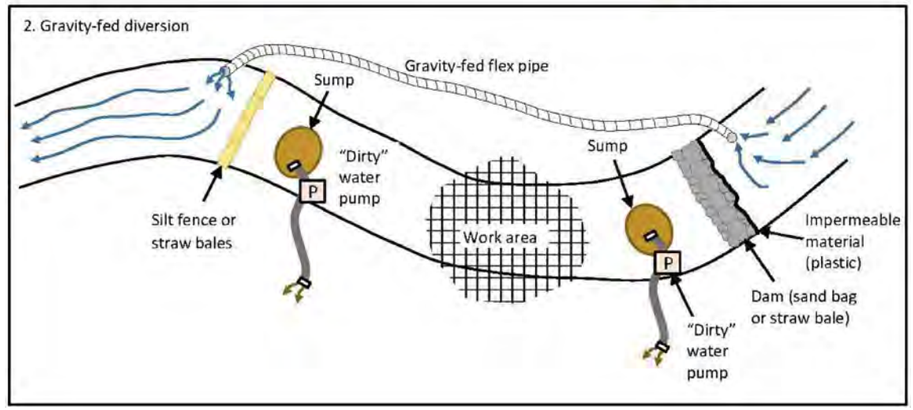
PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

C-9

STREAM DEWATERING AND FISH EXCLUSION DETAILS:





GENERAL WATER POLLUTION CONTROL, FISH EXCLUSION AND WATER MANAGEMENT NOTES:

1) THE CONTRACTOR IS RESPONSIBLE TO IMPLEMENT THE PROJECT IN A MANNER THAT ELIMINATES THE DISCHARGE OF POLLUTANTS TO WATERS OF THE STATE OR SENSITIVE BIOLOGICAL AREAS. THE CONTRACTOR WILL BE RESPONSIBLE FOR ALL CLEAN-UP ASSOCIATED WITH WATER POLLUTION VIOLATIONS.

2) THE CONTRACTOR SHALL AT A MINIMUM IMPLEMENT THE PROJECT SPECIFIC WATER POLLUTION CONTROL BMPS DESCRIBED.

3) IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO IMPLEMENT ADDITIONAL BMPS AS NECESSARY TO PREVENT THE DISCHARGE OF POLLUTANTS TO WATERS OF THE STATE OR SENSITIVE BIOLOGICAL AREAS.

4) DEPENDING ON BASE STREAM FLOW CONDITIONS WITHIN LAWRENCE CREEK, THE PROJECT WILL LIKELY REQUIRE A CLEAR WATER DIVERSION AND FISH EXCLUSION FROM THE WORK SITE. THE CONTRACTOR WILL PROVIDE A QUALIFIED BIOLOGIST TO SET UP THE EXCLUSIONARY FENCING AND CONDUCT THE FISH EXCLUSION. HOWEVER, 2 WEEKS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION THE CONTRACTOR SHALL SUBMIT NOTICE OF INTENT TO BEGIN CONSTRUCTION TO THE LANDOWNER, AND SHALL NOT BEGIN ANY EARTHWORK UNTIL FISH EXCLUSION ACTIVITIES HAVE BEEN COMPLETED.

5) THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING ALL SUPPLIES AND MECHANICAL DEVICES (PUMPS, ETC.) NECESSARY TO EFFECTIVELY DEWATER THE WORK SITE DURING CONSTRUCTION ACTIVITIES.

6) BMPS SHALL BE APPLIED WHERE SHOWN ON THE MAP AND AT OTHER APPLICABLE LOCATIONS AS NECESSARY AT THE DISCRETION OF THE CONSTRUCTION MANAGER OR PROJECT ENGINEER/GEOLOGIST.

7) ALL SPOILS GENERATED BY THE PROJECT WILL EITHER BE HAULED OFF-SITE AND DISPOSED OF AT A LEGAL LOCATION OR WILL BE PLACED IN LIFTS ALONG FLOODPLAIN TERRACE SURFACES (<5% GRADE) WITH NO CHANCE FOR SEDIMENT DELIVERY AND WILL BE CONTOURED IN A MANNER TO DISPERSE RUNOFF. ALL SPOILS PLACED ON-SITE WILL BE MULCHED ACCORDING TO PROJECT SPECIFIC BMP REQUIREMENTS.

STREAM DEWATERING NOTES:

PRIOR TO WORKING IN AND AROUND THE ACTIVE STREAM CHANNEL, PROPER STREAM DEWATERING AND AVOIDANCE OF INCREASING DOWNSTREAM TURBIDITY SHOULD BE EMPLOYED. STREAM FLOWS WILL BE ISOLATED UPSTREAM OF THE WORK AREA USING COFFERDAMS AND CONVEYED DOWNSTREAM AROUND THE WORK SITE THROUGH EITHER A PUMPED DIVERSION (TYPE 1) AND/OR BY GRAVITY DIVERSION (TYPE 2) TO KEEP THE STREAM "LIVE" (FLOWING) BELOW THE WORK AREA. AN ADDITIONAL DAM WILL BE INSTALLED DOWNSTREAM OF THE WORK AREAS TO CAPTURE ANY SUBSURFACE FLOW THAT MIGHT TRAVEL THROUGH THE CONSTRUCTION AREA. ANY "DIRTY" WATER WILL BE COLLECTED AT THIS LOCATION AND PUMPED AWAY FROM THE SITE WHERE IT CAN INFILTRATE INTO THE GROUND WITHOUT THE POTENTIAL FOR CONNECTIVITY AND DELIVERY TO THE STREAM SYSTEM.

PROJECT SPECIFIC WATER POLLUTION AND EROSION CONTROL BMPS:

PROJECT SPECIFIC WATER POLLUTION CONTROL BMPS ARE DESCRIBED IN THE CALIFORNIA STORMWATER QUALITY ASSOCIATION (CASQA) BMP HANDBOOK FACT SHEETS. CASQA BMPS CHOSEN FOR THIS PROJECT INCLUDE AT A MINIMUM THE FOLLOWING:

EC-1, SCHEDULING WILL BE UTILIZED THROUGHOUT PROJECT PHASES TO ENSURE MAJOR EARTH DISTURBING ACTIVITIES OCCUR ONLY DURING NON-RAINY WEATHER.

EC-2, PRESERVATION OF EXISTING VEGETATION WILL BE IMPLEMENTED BY CLEARLY DELINEATING THE PROJECT BOUNDARIES.

EC-6, STRAW MULCH AND/OR **EC-8** WOOD MULCH MAY BE USED AS NECESSARY TO PROTECT BARE SOIL AREAS INCLUDING CUT/FILL AREAS, STOCKPILES AND DISTURBED GROUND AS A RESULT OF CONSTRUCTION. ALL DISTURBED SOIL AREAS WITH THE POTENTIAL TO DELIVER SEDIMENT TO A WATERCOURSE VIA SURFACE EROSION PROCESSES WILL BE TREATED BY THE APPLICATION OF NATIVE EROSION CONTROL SEED AT A RATE OF 35#/ACRE, STRAW MULCH AT A RATE OF 4,000#/ACRE, AND WITH THE REMAINING SLASH MATERIALS PRODUCED FROM THE CLEARING AND GRUBBING ACTIVITIES.

EC-9, EARTH DIKES AND COFFER DAMS WILL BE USED AS NECESSARY TO DIVERT ACTIVE STREAMFLOW AROUND THE CONSTRUCTION AREA AT SPECIFIED LOCATIONS OR AS DIRECTED BY THE PROJECT ENGINEER OR GEOLOGIST.

EC-10, VELOCITY DISSIPATION DEVICES MAY BE USED AS NECESSARY AT STREAM DISCHARGE BYPASS OUTFALLS.

EC-12, STREAMBANK STABILIZATION MEASURES MAY BE USED ALONG ALL STREAMBANK DISTURBANCE ZONES AT SPECIFIED LOCATIONS OR AS DIRECTED BY THE PROJECT ENGINEER OR GEOLOGIST. STREAMBANK STABILIZATION MAY INCLUDE MATS, RSP OR BIOTECHNICAL MEASURES AS NECESSARY TO PROTECT THE FRESHLY DISTURBED STREAMBANKS FROM EROSION.

NS-2, DEWATERING OPERATIONS AND **NS-5**, CLEAR WATER DIVERSIONS MAY BE IMPLEMENTED AT SPECIFIED LOCATIONS OR AS DIRECTED BY THE CONSTRUCTION MANAGER IN ORDER TO DEWATER THE CONSTRUCTION AREA WHILE EXCAVATION ACTIVITIES ARE TAKING PLACE.

NS-6, ILLICIT CONNECTION/ILLEGAL DISCHARGE DETECTION AND REPORTING WILL BE COMPLETED BY THE CONTRACTOR THROUGHOUT THE DURATION OF THE PROJECT.

NS-9, VEHICLE AND EQUIPMENT FUELING WILL BE CONDUCTED AT LEAST 100 FT FROM ANY STREAM, AND NS-10, VEHICLE AND EQUIPMENT MAINTENANCE WILL BE IMPLEMENTED IN A MANNER TO AVOID ANY RELEASE OF POTENTIAL POLLUTANTS.

WM-1, MATERIAL DELIVERY AND STORAGE, **WM-2**, MATERIAL USE AND **WM-6**, HAZARDOUS WASTE MANAGEMENT WILL BE IMPLEMENTED TO PREVENT DISCHARGES OF CONSTRUCTION MATERIALS AND WASTES DURING DELIVERY, STORAGE AND USE.

WM-3, STOCKPILE MANAGEMENT BMPS WILL BE IMPLEMENTED TO REDUCE OR ELIMINATE STORMWATER POLLUTION RUNOFF FROM STOCKPILES OF SOIL, MULCH, AGGREGATES OR OTHER MATERIALS. **SE-1**, **SE-5** AND **SE-9** BMPS WILL BE APPLIED AS NECESSARY AT THE DISCRETION OF THE CONSTRUCTION MANAGER.

WM-4, SPILL PREVENTION AND CONTROL WILL BE IMPLEMENTED TO CONTAIN AND CLEAN UP SPILLS AND PREVENT MATERIAL DISCHARGES TO ANY STREAM OR WETLAND.

WM-5, SOLID WASTE MANAGEMENT BMPS REQUIRE THAT ANY SOLID WASTE BE CONTAINED IN A WATER TIGHT CONTAINER AND WILL BE LOADED DIRECTLY INTO TRUCKS FOR OFF-SITE DISPOSAL AT LEAST ON A WEEKLY BASIS.

WM-9, SANITARY/SEPTIC WASTE MANAGEMENT. IF SANITARY FACILITIES ARE NOT AVAILABLE ONSITE, PORTABLE TOILETS WILL BE BROUGHT IN AND WILL BE EMPTIED AT LEAST ON A WEEKLY BASIS.

DATE 6/4/2020
NOTES PREPARED BY PWA
FIGURES CREATED BY GSO
SHEET 11 OF 11

PACIFIC WATERSHED ASSOCIATES, INC.
P.O. BOX 4433
ARCATA, CALIFORNIA 95518
PH: (707) 839-5130 FX: (707) 839-8168
www.pacificwatershed.com

DRAWING DESCRIPTION:
WATER CONTROL PLAN

PROJECT LOCATION:
HUMBOLDT REDWOOD CO.
LAWRENCE CREEK
HUMBOLDT COUNTY, CA

PWA JOB NO.: 10135

C-10

C:\Users\PWACADuser\Documents\10135 Larry 3\Larry 3.0\CAD\Larry3_11_21_2019_V2 - Standard\Larry3_05_07_2020_90_V2.dwg

LAWRENCE CREEK OFF-CHANNEL COHO HABITAT IMPROVEMENT PROJECT – PHASE 3.0

DIVISION SP – SPECIAL PROVISIONS

1. REFERENCE DOCUMENTATION

1.1. Reference Documentation shall be the latest edition, including amendments and published updates, issued prior to the date of advertisement for bids or the date of request for quotations, of the following:

1.1.1. 2009 California Stormwater BMP Handbook issued by the California Stormwater Quality Association (CASQA).

1.1.2. California State Transportation Agency (Caltrans) Standard Specifications 2018. Within these special provisions, reference to Caltrans specifications is given as Caltrans followed by the section number. In conflicts between Caltrans Specifications and these Special Provisions, the Special Provisions shall govern.

2. OWNER AND EASEMENTS

2.1. Humboldt Redwood Company is designated as the Owner. All work shall be located on public land or on easements to be provided by the Owner. The contractor shall confine operations at all times within the limits of the easements. Any repairs or restoration outside the easement limits, required due to the contractor's carelessness, shall be made with no compensation allowed.

2.2. The Contractor shall coordinate any staging, parking and access to the work sites with the Owner.

3. CONFLICTS IN DIMENSIONING

3.1. In case of conflict between dimensions shown on the plans or detail drawing and those in the specifications, the dimensions on the Plans shall govern. If the conflict is other than dimensions, the specifications shall govern.

4. PRE-CONSTRUCTION CONFERENCE

4.1. A pre-construction conference will be scheduled after the Engineer's receipt of the Contractor's schedule. The Contractor shall submit to the Engineer a schedule including the following:

4.1.1. A schedule illustrating in bar chart form the anticipated commencement date and duration of each of the major work tasks prior to the pre-construction conference.

4.1.2. The schedule should address the phasing of construction in a manner that will provide good project coordination. The Contractor will be required to update or modify the written construction schedule as necessary to accurately reflect the rate and progress on the project.

4.1.3. A list of planned equipment and any extraordinary measures (haul road construction, mats etc.) planned to ensure efficient dewatering and construction given the soils and soil moisture conditions anticipated.

4.2. The conference will be held with the Contractor, Owner Representatives, Engineer and other parties involved in the project. Materials, material sources, construction methods, and scheduling will be reviewed and any questions or procedures will be clarified.

5. INCIDENTAL WORK

5.1. Items of work for which no pay items are included in the bid proposal shall be considered as incidental expense and no separate payment will be made therefore. Incidental items include, but are not limited to the following:

5.1.1. Maintaining access to private property

5.1.2. Temporary Rock Construction Entrance

5.1.3. Street and trail sweeping

5.1.4. Protection of trees and utilities during construction

5.1.5. Off-site disposal of excess construction materials

5.1.6. Billboards for display of permits, posters and other required documents

5.1.7. Removal and restoration of signs

5.1.8. Dust and noise control

5.1.9. Construction safety fence

5.1.10. Traffic Control fencing, barriers, and signage

5.1.11. Maintenance, protection, replacement and/or restoration of poles and utilities

5.1.12. Removal of aggregate from haul routes prior to planting

6. MOBILIZATION

6.1. Mobilization shall be performed in accordance with the provisions of Caltrans Section 8, and the following:

6.1.1. Mobilization shall be measured and paid for under item Mobilization at the contract lump sum price, which shall be compensation in full for all labors, materials, and equipment necessary to complete the work as specified

7. CLEARING AND GRUBBING

7.1. The Contractor shall follow general clearing and grubbing guidelines set forth in Caltrans Section 17-2.

7.2. The Contractor shall employ measures to ensure that all clearing and grubbing activities are limited to the area of construction as follows:

7.2.1. Within the footprint of the engineered embankment the depth of grubbing shall be minimized, but sufficient to remove all organic soils, woody debris, and roots in excess of 1/2 inch in diameter.

7.2.2. All materials resulting from clearing and grubbing shall become the property of the contractor or timberland owner as directed by the owner.

7.2.3. Trees not within the area of construction, limits of disturbance, and area of conversion shall be protected.

7.2.4. All trees to be removed within the area to be converted will be removed by a licensed timber operator and disposed of as required under the relevant less than 3 acre conversion exemption if required to be filed for the project.

7.2.5. Salvaged trees shall be large wood pieces removed from within the project footprint that is deemed acceptable for reuse in project construction by the owner's representative.

7.3. Clearing and Grubbing shall be measured and paid for under item Clearing/Grubbing at the contract lump sum price, which shall be compensation in full for all labors, materials, and equipment necessary to complete the work as specified

8. EARTHWORK

8.1. All earthwork work shall be performed in accordance with the provisions of Caltrans Section 19 and these provisions.

8.2. Items *12. Off-Channel Restoration* include earthwork that shall be measured and paid per this item.

8.3. The Contractor shall attempt to utilize on-site soil disposal. Any necessary permits needed to dispose of excess off-site shall be secured by the Contractor at his expense. The Contractor shall submit a disposal plan at the pre-construction meeting which specifies how he will dispose of soil, concrete rubble, bituminous rubble, solid rock, tree/shrub debris and any other displaced/disposed items to be removed off-site.

8.4. No separate classification shall exist for muck excavation. Soft or saturated soils to be reused shall be stockpiled on site for drying in such a manner to minimize drying time. Erosion control measures must be implemented to prevent soil loss from stockpiles. The contractor is advised of the following:

8.4.1. The contractor shall use extraordinary measures and specialized equipment necessary to work efficiently given the soils and moisture conditions.

8.4.2. Prevention of invasive species infestation: Prior to planting or seeding, all personnel must ensure that equipment, clothing and footwear is clean and free of seeds. Equipment and personnel may be subject to inspection prior to site entry.

8.5. Earthwork shall be measured and paid for under item Earthwork at the contract lump sum price, which shall be compensation in full for all labors, materials, and equipment necessary to complete the work as specified.

9. EROSION CONTROL

9.1. Description

9.1.1. Erosion Control shall be performed in accordance with these provisions and the provisions of THP, HCP, MATO, and CASQA EC-6 and SE-5 except as modified below:

a. The Contractor is advised that payment for furnishing and installing temporary erosion control set forth in the foregoing area is for the initial installation and removal only. Any replacement components as may be necessary to maintain the temporary erosion control devices in a functional condition, to the satisfaction of the Engineer, during the tenure of

this Contract shall be furnished, installed, maintained, and removed at the Contractor's expense.

b. The Contractor shall be responsible for the removal of temporary erosion control devices once the project is completed as directed by the Engineer.

c. Erosion Control shall conform to all applicable requirements of the project permits. The price bid for erosion control shall include compensation for all maintenance required to conform to permits.

9.2. Materials

9.2.1. Material specifications for seed shall follow those in Section 12 of these Special Provisions.

9.2.2. Mulch shall be seedless straw mulch.

9.3. Construction requirements

9.3.1. Installation of seed shall follow Section 12 of these Special Provisions.

9.3.2. The straw mulch shall be applied at 2 tons (4000lb) per acre. Mulch shall be disc anchored on all upland slopes 3:1 and flatter the same date it is applied.

9.4. Measurement and Payment

9.4.1. *Erosion Control* – Work for this item shall include site prep, layout, trenching and securing as shown according to permits, the Plans and Special Provisions. This item includes supplying all materials, equipment, labor and incidentals to complete this work. Measurement and payment at the contract lump sum price.

10. DEWATERING

10.1. Description

10.1.1. Dewatering will be required for parts of this project. All dewatering shall follow these special provisions and the provisions of Caltrans Sections 13 and 19. The contractor is advised of the following:

a. The entire area is subject to constant groundwater flow.

b. As part of the base bid, the Contractor is responsible for diverting streamflow into constructed dewatering channels and for maintaining that diversion.

10.1.2. Streamflow will be diverted into a single dewatering channel. This channel must be maintained and monitored to prevent sedimentation caused by bank erosion. Any bank erosion areas must be immediately repaired with erosion control fabric.

10.1.3. Pumping: It may be necessary to provide damming and pumping of streamflow during integration of new and existing flow areas (eg. connecting new stream sections). Temporary damming should be accomplished through installation of sandbags, wrapped jersey barriers or other approved method.

10.1.4. In situ dewatering: It may be necessary to provide dewatering of localized construction areas where the work area must be kept relatively dry.

10.1.5. Fish rescue: Fish shall be rescued from residual pools following any diversion of streamflow that will dewater the main channel. Fish must be collected by a Qualified Biologist.

10.2. Construction requirements

10.2.1. The Contractor shall complete dewatering to the satisfaction of the Engineer.

10.2.2. Provide and remove all equipment necessary for dewatering including, but not limited to, wells, well points, sumps, temporary pipelines for water disposal, rock or gravel placement, barrier placement or any combination. Provide dewatering systems with sufficient pumping equipment and machinery in good working condition and provide at all times, competent workmen for the operation of the systems. Keep adequate standby equipment available at all times to insure continuous and efficient dewatering and maintenance of dewatering operation.

10.2.3. Contractor shall not discharge groundwater directly to existing drainageways, culverts or sanitary without permission from the Owner and project engineer. The Contractor will be responsible for installation, operation, and maintenance of a flow measurement device, subject to approval of the Owner.

10.2.4. Contractor shall not drain water into Work built.

10.2.5. Contractor shall filter water using an approved method (suitable holding basins and bale check systems etc.) to remove sand and fine-sized soil particles before disposal into any drainage system.

10.2.6. Provide drainage for the site grading at all times. Divert surface runoff from excavations and trenches

10.2.7. Contractor shall provide and maintain standby pumping equipment on the job site.

10.2.8. Contractor is responsible for controlling discharge rate and effect of the dewatering system.

10.2.9. Diversion of the main channel stream will be required. Any diversion structure shall be constructed and maintained in such a manner as to not allow erosion in accordance with these Special Provisions.

10.2.10. If needed, provide a mat system or clean coarse granular working mat as required to provide a stable working base for construction equipment and to facilitate construction. Any other granular material needed for drainage shall be in addition to the working base provided.

10.2.11. Prevent flotation by maintaining a positive and continuous removal of water. Contractor is responsible and liable for all damages which may result from failure to adequately keep excavations and trenches dewatered.

10.2.12. Adequately space well points or wells (if used) to provide the necessary dewatering. Sand-pack or by other means to prevent pumping of fine sands or silts from the subsurface. Continuously check to ensure that the subsurface soil is not being removed by the dewatering operation.

10.3. Measurement and payment

10.3.1. Dewatering: Work for this item shall include, but not be limited to, site prep, dewatering channel integration, in-situ dewatering, maintenance, diversion, pumping, damming and sediment control as shown within the Plans and Special Provisions. This item includes supplying all materials, equipment, labor and incidentals to complete this work. Measurement and payment shall be for Dewatering at the contract lump sum price.

11. OFF-CHANNEL RESTORATION

11.1. Description

11.1.1. *Common excavation for off-channel restoration* – Work under this section includes earthwork such as grading, excavation and fill for channel and wetland restoration. The work includes all operations in connection with grading, channel excavation, haul road construction and common fill placement for construction of the off-channel.

11.1.2. *Installation of Large Woody Material (LWM)* - Work under this section includes the installation of logs and logs with roots, any of which may be also noted in the plans and specification as LWM. Work shall require excavating, placing LWM on streambanks, partially burying logs, and backfilling, all using a "fit in the field" approach as directed by the Engineer.

11.2. Materials

11.2.1. Large Woody Material (LWM)

a. Logs and rootwads *not already supplied by the Owner* shall be redwood or Douglas fir at least 40 feet in length measured from base to top and the diameter at breast height shall be a minimum of 20 inches. Any deviation in size, species or quality must be pre-approved by the Engineer. Logs and rootwads should be cleaned of secondary branches and include only the main trunk and any associated forks. LWM should be recently harvested or in a 100% rot free condition, free of fungus, disease, or pests that could contaminate site or infect existing or planted live trees.

b. The total number of logs and rootwads to be installed is estimated in the bid item list.

11.2.2. Fully Threaded Rod Anchoring: Threaded rod used in securing woody material shall be 1-inch diameter galvanized steel threaded rod with square washers and double heavy hex nuts.

11.2.3. Cable and Clamps: Cable used in securing woody material shall be 1/2 inch galvanized steel core cable with a minimum nominal tensile capacity of 12 tons. Cable clamps shall be galvanized steel and shall meet the performance requirements of federal specification FF-c-450 Type 1 Class 1. Cable clamps shall be Crosby Clips, "G-450" or approved equivalent.

11.2.4. Salvaged Topsoil: Salvaged topsoil may be any silty loam excavated from the area and stockpiled within the project limits, sufficiently dried, free from vegetation and all rocks 2 inches or greater in diameter and other deleterious material not suitable for use in backfill applications. Material shall be approved by Owner prior to use in backfilling.

11.3. Submittals

11.3.1. Large Woody Material: The contractor shall submit tree species, type (rootwad or log) length and diameter information to the Engineer prior to delivery.

11.4. Construction Requirements

11.4.1. *Common excavation for channel restoration* - Supply all materials, labor, tools, and equipment to perform channel and wetland restoration excavation as shown in the plans and described in these specifications. Excavation shall be in accordance with the provisions of Caltrans Section 19 and the requirements listed below.

a. Excavate to the lines and elevations indicated on the plans. Excavation beyond the lines and elevations indicated on the plans is considered incidental.

b. Common fill material shall be sorted such that the best material for native backfill is stockpiled for drying (determined by Engineer). Salvaged material must be approved by the Engineer.

c. If the quantity or quality of excavated common fill from on-site is unsuitable for use as backfill in the embankments, imported backfill will be required.

d. Care should be taken to avoid damage to existing trees and structures on-site during earthwork.

e. Material not stockpiled or used elsewhere on-site shall be disposed of off site by the contractor.

f. Protection of structures: Prevent new and existing structures from becoming damaged due to construction operations or other reasons.

g. Shoring: Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.

h. Drainage: Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water. Provide pumping required to keep excavated spaces clear of water during construction. Should any water be encountered in the excavation, notify Engineer and Soils Engineer. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.

i. Perform all shaping of the sub grade to the elevations, lines and grades, as shown in the plans. Shape, trim, and finish slopes of channels to conform with the sub grade lines, grades, and cross sections as shown. The finished sub grade shall be approved by the Engineer prior to placement of any new material.

j. Do not carry the excavation for the sub grade deeper than the elevation shown. The Contractor shall bear all costs for correcting over excavated areas.

k. Fill shall be compacted in 8-12 inch layers using the Quality Compaction (Visual Inspection) Method

l. Any abandoned infrastructure uncovered in excavation must be removed as directed by the Engineer.

11.4.2. *Installation of Large Woody Material (LWM)*

a. Installation of LWM shall require placing logs on streambanks or partially burying logs using a “fit in the field” approach as directed by the Engineer. Logs will be installed individually or in groups. Buried logs shall be buried into the streambank and aligned so that part of the log protrudes from the bank into the stream. Burial shall be through excavating trenches, overexcavating streambank, or pushing the woody material directly into the soil. Unburied logs shall be ballasted by anchoring and/or bracing against buried logs according to the direction of the Engineer. Disturbed ground shall be seeded and mulched.

b. To facilitate efficient movement of logs, the contractor shall provide a track excavator with a *hydraulic thumb* attachment.

11.4.3. *Layout and Grades*

a. Benchmarks: The Contractor shall maintain and/or reestablish benchmarks and survey monuments necessary for the work and as shown in the Contract Documents or found to exist on the site to provide a base reference for the construction. Replace any which may become destroyed or disturbed.

b. The Contractor shall provide necessary detailed surveying of channel cross sections and grading elevations during construction. General staking of channel stationing, channel centerline and disturbance limits shall be provided by the Owner. All detailed elevation and location surveying and staking shall be considered incidental.

11.4.4. *Microtopography*

a. The intent of final grading shall not be to create a uniformly flat surface. Final grading of the bog surfaces will include the creation of humps and depressions of varying size and depth, deviating no more than +/- 1.0 feet from the grades shown in the plans. These variations will be directed in the field and are not depicted in the plans.

11.5. Measurement and Payment

11.5.1. *Common Excavation for Off-Channel Restoration* - Work for this item shall include, but is not necessarily limited to surveying, excavation, construction of channel banks, transport and disposal of excess material, backfill, and compaction as shown within the Plans and Special Provisions. This item includes supplying all materials, equipment, labor and incidentals to complete this work. Measurement and payment under item Earthwork at the contract lump sum price. Salvaged material placement, reworking, erosion control and stabilization shall be considered incidental to the work.

11.5.2. *Layout and grades* – All work for detailed layout and grades including detailed surveying shall be considered incidental to the work. This does not include any staking to be performed by the Owner.

11.5.3. *Large Woody Material* (installed) – All work under large woody material shall be measured and paid for at the contract lump sum price. All materials, equipment, labor and supplies shall be incidental to this work. Excavation, backfilling, grading, mulching, and hauling and disposal of surplus soils associated with placement of LWM shall be incidental to this work.

11.6. Quality Control and Assurance

11.6.1. Quality Control

a. The Contractor shall verify that all grades have been met to the elevations shown in the plans and specifications.

b. The Contractor shall verify that imported materials meet the Specifications for their intended use.

c. The Contractor shall verify that compacted in-place materials are compacted to the satisfaction of the Engineer.

d. The Contractor shall verify that sub grade of areas to be filled are free of soft spots or debris.

11.6.2. Quality Assurance

a. The engineer will inspect final conditions with the contractor to grading is complete to plans and specifications.

b. The engineer may inspect channel restoration prior to and after installation to assure proper fabrication, alignment, and quality. Work that does not meet Specifications shall be redone at no cost to the Owner.

c. The Contractor shall be responsible for the stability of embankments prior to acceptance and shall repair any portions that have failed.

12. RIPARIAN REVEGETATION

12.1. Description

12.1.1. Work includes, but is not limited to the following activities: purchasing, storage, revegetation and monitoring of seed native stock. The work shall be performed according to requirements contained in these Plans, or as directed by the Qualified Biologist. This work will consist of supplying and sourcing all materials, labor, tools, and equipment to reestablish a riparian and wetland community within bare and disturbed areas.

12.1.2. All planting and seeding activities shall be in accordance with the special provisions below and with Caltrans Sections 5, 17, and 20.

12.1.3. Referenced Standards:

a. California Riparian Habitat Restoration Handbook.

b. Disinfection Protocols for Field Activities.

c. American Standard for Nursery Stock (ASNS).

d. Natural Resource Conservation Service California eVegGuide.

e. California Natural Diversity Database (CNDDB).

12.2. Materials

12.2.1. All plant species sourced will be native in origin and sourced when appropriate from an ecologically similar site.

12.2.2. Native Seed Mixes

a. The listed seed mixes are pre-approved and available through Le Ballister's Seed and Fertilizer 1250 Sebastopol Road, Santa Rosa CA 95407, (7070) 526-6733 or leballisters@gmail.com. A product of equal properties may be used if pre-approved by the Qualified Biologist. For pre-approval, the Contractor shall submit specifications for an alternative product.

b. All seed mixes must follow these requirements for inspection and acceptance. All mixes must be approved by the Qualified Biologist and each bag of seed delivered shall be clearly labeled, and include the following information:

- The common name genus, species and variety/subspecies (when applicable).
- The amount of Pure Live Seed (PLS) pounds of each species in each seed mix.
- The total delivered weight, in pounds, of each seed mix.
- The state and county of origin of each species of seed used in mixes.
- The name and address of the seed supplier.

c. The Riparian Seed Mix shall include the species shown below, in Table 1. This mix can be sourced from LeBallisters as the "Little Three Native Perennial Blend".

Table 1. Riparian Seed Mix	
Common Name	**Scientific Name**
Red Fescue	*Festuca rubra*
Idaho Fescue	*Festuca idahoensis*
Western Fescue	*Festuca occidentalis*
California Brome grass	*Bromus carinatus*

d. Upland Seed Mix shall include the species shown below, in Table 2. This mix can be sourced from LeBallisters, as the "Holdfast Native Blend".

Table 2. Upland Seed Mix	
Common Name	**Scientific Name**
California Brome (annual)	*Festuca rubra*
California Brome (perennial)	*Festuca idahoensis*
Blue Wildrye	*Elymus glaucus*
Small Fescue	*Festuca microstachys*
California Poppy	*Eschscholzia californica*

e. The specified seed mixes shall be healthy and vigorous and free of non-native and invasive species. Seeds that have become wet, moldy, or otherwise non-viable, or do not meet the specifications will be rejected by the Qualified Biologist at no cost to the Owner.

f. Seed will be broadcast mechanically or by hand where/when appropriate.

12.2.3. Live stakes:

a. Live stake plant material general specifications shall be in accordance with the special provisions below, the reference standards as stated in section 12.1.3.

b. Live stake materials must be sourced from native species and should be obtained in or around the project area in coordination with the Qualified Biologist.

c. Any adjustments or substitutions in live stake species, sizes, or quantities shall be pre-approved in writing by the Qualified Biologist.

d. The following live stake cuttings in Table 4 are to be harvested and planted where directed:

Table 4. Live Stake Cuttings			
Common Name	**Scientific name**	**Size**	**Zone**
Coastal willow	Salix hookeriana	2-4 ft Live Stake Cutting (1 ½ + inch diameter)	Riparian
Pacific willow	Salix lasiandra	2-4 ft Live Stake Cutting (1 ½ + inch diameter)	Riparian
Scouler willow	Salix scouleriana	2-4 ft Live Stake Cutting (1	Riparian

		½ + inch diameter)	
Coulter willow	Salix sitchensis	2-4 ft Live Stake Cutting (1 ½ + inch diameter)	Riparian

12.3. Revegetation Parameters

12.3.1. Seed:

a. The Riparian, Upland, and Custom Seed Mixes will be mixed 1:1 with sterile U.S. #1 Grade Rice Hulls to facilitate uniform distribution and seeding rate. After mixing, the seed will be spread at a density of 40 lbs/acre over all bare soil.

12.3.2. Native Stock

a. Live stakes will be planted by driving them into the soil until approximately 2/3 of each cutting is buried below the ground surface or until only two bud scales are visible above the soil line. The soil will be tamped around the cutting and each exposed stake tip will be painted with a 50:50 mix of latex paint and water to reduce transpiration.

b. Immediately prior to, and following the planting of all species, all soil that contacts the plants shall be thoroughly watered with 0.15 gallons per square foot. Irrigation of plants shall otherwise be in accordance with Caltrans July 2019 Construction Manual Section 5-1.36E.

12.4. Protection Requirements

12.4.1. Seed:

a. Care of Seeded Areas: All seeded areas shall be protected and maintained throughout the construction of the project and until the work is accepted. No construction traffic will be allowed over seeded or planted areas once the seeding and erosion control measures have been implemented. Foot traffic shall be minimized; workers shall travel along completed banks only in designated areas. Any damage to seeded areas caused by construction traffic or construction activities shall be re-seeded.

12.4.2. Plants:

a. Plants shall be protected from animal damage including rodents, deer browsing and antler damage.

b. Protection shall be thick wire deer cages or other pre-approved material sufficient to prevent browse. Cages must be secured with stakes sufficient to prevent deer antler damage.

c. Protection must be held in place for the duration of the three years unless directed in writing by the Qualified Biologist. Upon final acceptance of the project by the Qualified Biologist, all plant protection shall be removed.

d. Prevention of invasive species establishment: Prior to planting or seeding, all personnel must ensure that equipment, clothing and footwear is clean and free of seeds following the California Department of Fish and Wildlife (CDFW) Disinfection Protocols for Planting Activities.

12.5. Measurement and Payment

12.5.1. All revegetation efforts: Work for this item shall include, but is not limited to: site preparation, hole excavation, planting, stabilizing, animal protection, irrigation and other maintenance as shown in the Plans and Special Provisions. This item includes supplying all materials, equipment, labor and incidentals to complete this work. Measurement and payment shall be for planting at the contract lump sum price.

Appendix B

Opinion of Probable Construction Costs

LAWRENCE CREEK 3.0

90% Design - Opinion of Probable Construction Cost

PERSONNEL SERVICES (Heavy Equipment and Labor Subcontractor)			
Staff Title	**Hours**	**Hourly Pay ($)**	**Amount**
Excavator and operator	100	$ 215.00	$ 21,500
D-7 Dozer and operator	40	$ 207.00	$ 8,280
Dump truck and operator	60	$ 110.00	$ 6,600
Skip Loader and operator	50	$ 165.00	$ 8,250
Laborer	280	$ 80.00	$ 22,400
Lowbed Move in/Move out equipment	15	$ 150.00	$ 2,250
Pilot car	15	$ 70.00	$ 1,050
Truck, trailer and driver	60	$ 110.00	$ 6,600
		Total Personnel Services	**$ 76,930**
OPERATING EXPENSES			
Equipment/Electronics/Rental	**Unit(s)**	**Unit Cost ($)**	Amount
Small equipment rental (water pumps)	15	$ 75.00	$ 1,125
hole hawg (drill for anchoring LWD)	3	$ 75.00	$ 225
Laser level/transit rental	3	$ 50.00	$ 150
		$ -	$ -
Operating Expenses: Other			
Wood Furnishing	68	$ 932.00	$ 63,376
		Total Operating Expenses	**$ 64,876**
		PERSONNEL SERVICES AND OPERATING EXPENSES SUBTOTAL	**$ 64,876**
		GRAND TOTAL	**$ 141,806**

Appendix C

Wood Design Calculations

BAR APEX JAM DESIGN

BUOYANCY CALCS FOR SOIL BALLAST ONLY

KEY PIECES (ROOTWAD TREES)

Number of Logs with Rootwads	N_L =	12	
Density of Large Wood for Redwood	ρ =	27.22	lb/ft³
Average Rootwad Fan Diameter	D_{RW} =	8	feet
Average Rootwad Length	L_{RW} =	2	feet
Proportion of Voids in Rootwad	p =	0.35	decimal %
Rootwad Tree Stem Average Diameter	D_{TS} =	2	feet
Rootwad Tree Stem Average Length	L_{TS} =	40	feet

$$Vwood = [\{\pi * (\frac{Drw}{2})^2 * Lrw * (1-p)\} + \{\pi * (\frac{Dts}{2})^2 * Lts\}] * N_L$$

Fbl = Vwood*(pwood - ρwater)

$$F_{BL} = \left(\frac{\pi \bar{X}_{TS} L_{TS}}{4} + \frac{\pi \bar{X}_{RW} L_{RW}}{4} \cdot (1-p)\right) \cdot \rho_w g (1 - S_L) \cdot N_L$$

Wood Volume = 2,292 total cubic feet of Key pieces

F_{BL} = 80,638 pounds

STACKED and RACKED MEMBERS

Number of Logs	N_L =	10	
Density of Large Wood for Redwood	ρ =	27.22	lb/ft³
Tree Stem Average Diameter	D_{TS} =	1.7	feet
Tree Stem Average Length	L_{TS} =	30	feet

$$Vwood = \pi * (\frac{Dts}{2})^2 * Lts * N_L$$

Fbl = Vwood*(pwood - ρwater)

Wood Volume = 681 Total cubic feet for face and racking logs

F_{BL} = 23,956 pounds

SOIL BALLAST

Specific Gravity of Soil Particles	S_{soil} =	2.65	well-graded, small silt content GM 119-134
Minimum Soil Dry Density	$\gamma_{d\ min}$=	119	lbs/ft³
Maximum Soil Dry Density	$\gamma_{d\ max}$=	134	lbs/ft³
Very Dense	Dr =	90%	Percent Relative Density
Unit Weight of Dry Soil Backfill	γ_d=	132	lbs/ft³
Void Ratio	e=	0.25	
Porosity	n=	0.20	
Degree of Saturation Below Water Level	S=	100.0	%
Weight of Pore Water	w=	9.54	lbs/ft³
Saturated Unit Weight of Soil Backfill	γ_{sat}=	141.54	lbs/ft³
Buoyant Unit Weight of Soil Backfill	γ'_b	79.14	lbs/ft³
Nominal Area of Soil Backfill for Embeded Logs	A_{BF}=	430	ft²
Depth of Soil Backfill Submerged	Z_B =	6	feet
Depth of Soil Backfill above Water Level	Z_{BU} =	0	feet

Accounts for soil ballast only on back 30-ft of key pieces

W' = 34,029 (pounds effective weight for 430 cubic feet of 1-ft thick Soil Ballast

W = 56,760 (pounds) weight for 430 cubic feet of 1-ft thick Soil Ballast

Total Effective Weight for all soil ballast = 204,173 pounds

FACTOR OF SAFETY: BUOYANCY

$$FS_B = \frac{\sum (W + W')}{\sum F_{BL}}$$

FS_B = 1.95

MOMENT BASED CALCS

$$M_{d-buoy} = F_{BL} C_{log} \qquad M_{r-log} = W_{log} C_{log}$$

$F_{BL\text{-}Key}$ = 80,638 W_{log} = 62,392 lbs

$F_{BL\text{-}Racked}$ = 23,956 C_{log} = 26.3 ft

C_{log} = 26.3

$M_{d\text{-}buoy}$ 2,752,481 foot lbs **$M_{r\text{-}log}$** 1,641,917 foot lbs

$$M_{r-soil} = W_{soil} C_{soil}$$

W_{soil} = 204,173 lbs

C_{soil} = 15 ft

$M_{r\text{-}soil}$ = 3,062,597 foot lbs

$$FS_M = \frac{M_{r-log} + M_{r-soil}}{M_{d-buoy}}$$

FS_M = 1.71

DEFLECTOR JAM DESIGN

BUOYANCY CALCS

KEY PIECES (ROOTWAD TREES)

Number of Logs with Rootwads	N_L =	6	
Density of Large Wood for Redwood	ρ =	27.22	lb/ft^3
Average Rootwad Fan Diameter	D_{RW} =	8	feet
Average Rootwad Length	L_{RW} =	2	feet
Proportion of Voids in Rootwad	p =	0.35	decimal %
Rootwad Tree Stem Average Diameter	D_{TS} =	2	feet
Rootwad Tree Stem Average Length	L_{TS} =	40	feet

$$Vwood = [\{\pi * (\tfrac{Drw}{2})^2 * Lrw * (1-p)\} + \{\pi * (\tfrac{Dts}{2})^2 * Lts\}] * N_L$$

$$F_{BL} = \left(\frac{\pi \bar{D}_{TS}^2 L_{TS}}{4} + \frac{\pi \bar{D}_{RW}^2 L_{RW}}{4} \cdot (1-p)\right) \cdot \rho_w g (1 - S_s) \cdot N_L$$

Fbl = Vwood*(pwood - pwater)

Wood Volume = 1,146 total cubic feet of Key pieces

F_{BL} = 40,319 pounds

FACE and RACKED MEMBERS

Number of Logs	N_L =	9	
Density of Large Wood for Redwood	ρ =	27.22	lb/ft^3
Tree Stem Average Diameter	D_{TS} =	1.7	feet
Tree Stem Average Length	L_{TS} =	30	feet

$$Vwood = \pi * (\tfrac{Dts}{2})^2 * Lts * N_L$$

Fbl = Vwood*(pwood - pwater)

Wood Volume = 613 Total cubic feet for face and racking logs

F_{BL} = 21,560 pounds

PILE ANALYSIS

Number of Piles	N_P =	5	
Length below bed	L_e =	7	feet
Pile diameter	d_p =	1.5	feet
Distance above scoured bed anchoring occurs	h_{load} =	10	feet
Rankine coefficient for passive earth pressure	K_p =	2.77	

$$F_{gh(piles)} = N\left(\frac{\frac{1}{2} L_{em}^3 d_p K_p (\gamma_s - \gamma_w)}{(h_{load} + L_{em})}\right)$$

Fgh(piles) 9,958 pounds

BOULDER BALLAST

Specific Gravity of Boulders	S_S =	2.65	
equivalent Diameter of Boulder	D_B =	3.5	feet
Number of Boulders Submerged	N_B =	12	
Number of Boulders above water level	N_{BU} =	0	

$$W' = \frac{\pi D_B^3}{6} \cdot \rho_w g (S_S - 1)$$

W' = 2,312 (pounds) effective weight per submerged boulder

W = 3,713 (pounds) weight per boulder

Total Effective Weight for all Boulders = 27,744 pounds

SOIL BALLAST

Specific Gravity of Soil Particles	S_{soil} =	2.65	
Minimum Soil Dry Density	$\gamma_{d\ min}$=	119	lbs/ft^3
Maximum Soil Dry Density	$\gamma_{d\ max}$=	134	lbs/ft^3
Very Dense	Dr =	90%	Percent Relative Density
Unit Weight of Dry Soil Backfill	γ_d=	132	lbs/ft^3
Void Ratio	e=	0.25	
Porosity	n=	0.20	
Degree of Saturation Below Water Level	S=	100.0	%
Weight of Pore Water	w=	9.54	lbs/ft^3
Saturated Unit Weight of Soil Backfill	γ_{sat}=	141.54	lbs/ft^3
Buoyant Unit Weight of Soil Backfill	γ'_b	79.14	lbs/ft^3
Nominal Area of Soil Backfill for Embeded Logs	A_{BF}=	418	ft^2
Depth of Soil Backfill Submerged	Z_B =	2	feet
Depth of Soil Backfill above Water Level	Z_{BU} =	0	feet

well-graded, small silt content	GM	119-134	
key pieces	3	30	180
stacked pieces	7	20	238

W' = 33,079 (pounds effective weight for 418 cubic feet of 1-ft thick Soil Ballast

W = 55,176 (pounds) weight for 418 cubic feet of 1-ft thick Soil Ballast

Total Effective Weight for all soil ballast = 66,158 pounds

FACTOR OF SAFETY: BUOYANCY

$$FS_B = \frac{\sum (W + W')}{\sum F_{BL}}$$

FS_B = 1.68

VENTURI JAM DESIGN

BUOYANCY CALCS

KEY PIECES (ROOTWAD TREES)

Number of Logs with Rootwads	N_L =	5	
Density of Large Wood for Redwood	ρ =	27.22	lb/ft³
Average Rootwad Fan Diameter	D_{RW} =	8	feet
Average Rootwad Length	L_{RW} =	2	feet
Proportion of Voids in Rootwad	p =	0.35	decimal %
Rootwad Tree Stem Average Diameter	D_{TS} =	1.7	feet
Rootwad Tree Stem Average Length	L_{TS} =	40	feet

$$Vwood = [\{\pi * (\tfrac{Drw}{2})^2 * Lrw * (1-p)\} + \{\pi * (\tfrac{Dts}{2})^2 * Lts\}] * N_L$$

Fbl = Vwood*(pwood - pwater)

Wood Volume = 781 total cubic feet of Key pieces

$$F_{BL} = \left(\frac{\pi D_{RW}^2 L_{RW}}{4} + \frac{\pi D_{TS}^2 L_{RW}}{4} \cdot (1-p)\right) \cdot \rho_w g (1 - S_L) \cdot N_L$$

F_{BL} = 27,465 pounds

FACE and RACKED MEMBERS

Number of Logs	N_L =	0	
Density of Large Wood for Redwood	ρ =	27.22	lb/ft³
Tree Stem Average Diameter	D_{TS} =	1.7	feet
Tree Stem Average Length	L_{TS} =	40	feet

$$Vwood = \pi * (\tfrac{Dts}{2})^2 * Lts * N_L$$

Fbl = Vwood*(pwood - pwater)

Wood Volume = 0 Total cubic feet for face and racking logs

F_{BL} = 0 pounds

PILE ANALYSIS

Number of Piles	N_P =	2	
Length below bed	L_e =	8	feet
Pile diameter	d_p =	1.5	feet
Distance above scoured bed anchoring occurs	h_{load} =	3	feet
Rankine coefficient for passive earth pressure	K_p =	2.77	

$$F_{gh(piles)} = N\left(\frac{\frac{1}{2}L_{em}^3 d_p K_p (\gamma_s - \gamma_w)}{(h_{load} + L_{em})}\right)$$

Fgh(piles) 11,140 pounds

SOIL BALLAST

Specific Gravity of Soil Particles	S_{soil} =	2.65	
Minimum Soil Dry Density	$\gamma_{d\ min}$=	94	lbs/ft³
Maximum Soil Dry Density	$\gamma_{d\ max}$=	119	lbs/ft³
Very Dense	Dr =	90%	Percent Relative Density
Unit Weight of Dry Soil Backfill	γ_d=	115	lbs/ft³
Void Ratio	e=	0.44	
Porosity	n=	0.30	
Degree of Saturation Below Water Level	S=	100.0	%
Weight of Pore Water	*w*=	16.53	lbs/ft³
Saturated Unit Weight of Soil Backfill	γ_{sat}=	131.53	lbs/ft³
Buoyant Unit Weight of Soil Backfill	γ'_b	69.13	lbs/ft³
Nominal Area of Soil Backfill for Embeded Logs	A_{BF}=	204	ft²
Depth of Soil Backfill Submerged	Z_B =	3	feet
Depth of Soil Backfill above Water Level	Z_{BU} =	0	feet

poorly-graded, small silt content | SP | 94-119

W' = 14,102 (pounds effective weight for 204 cubic feet of 1-ft thick Soil Ballast

W = 23,460 (pounds) weight for 204 cubic feet of 1-ft thick Soil Ballast

Total Effective Weight for all soil ballast = 42,305 pounds

FACTOR OF SAFETY: BUOYANCY

$$FS_B = \frac{\sum(W + W')}{\sum F_{BL}}$$

FS_B = 1.95

APPLICANT NAME: Trout Unlimited

Indirect Charge Rate 13.74%

PROJECT BUDGET

PERSONNEL SERVICES

Staff Title	Hours: CA Fish Passage Forum	Hours: Applicant Cost Share	Hours: Partner Cost Share	Hourly Pay ($)	Amount Requested from CA Fish Passage Forum	HRC Amount	NOAA Amount	Total Project Cost
Project Director	150			$ 40.00	$ 6,000	$ -	$ -	$ 6,000
Project Manager	115			$ 35.00	$ 4,025	$ -	$ -	$ 4,025
Grants Accountant	25			$ 48.00	$ 1,200	$ -	$ -	$ 1,200
				$ -	$ -	$ -	$ -	$ -
				Personnel Services Subtotal	**$ 11,225**	**$ -**	**$ -**	**$ 11,225**
Staff Benefits				**(%)**				
Project Director				47.00%	$ 2,820	$ -	$ -	$ 2,820.00
Project Manager				47.00%	$ 1,892	$ -	$ -	$ 1,892.00
Grants Accountant				47.00%	$ 564	$ -	$ -	$ 564.00
				0.00%	$ -	$ -	$ -	$ -
				Staff Benefit Subtotal	**$ 5,276**	**$ -**	**$ -**	**$ 5,276**
				[1] **Total Personnel Services**	**$ 16,501**	**$ -**	**$ -**	**$ 16,501**

OPERATING EXPENSES

Subcontractor(s)	Hours or Units: CA Fish Passage Forum	Hours or Units: Applicant Cost Share	Hours or Units: Partner Cost Share	Hourly Rate or Unit Cost ($)	Amount Requested from CA Fish Passage Forum	HRC Amount	NOAA Amount	Total Project Cost
Pacific Watershed Associates (Oversight)	1			$ 18,000.00	$ 5,000	$ -	$ 8,000	$ 13,000
Kyle Roscoe, LTO (Construction)	1			$ 133,316.00	$ 20,000	$ 63,376	$ 42,440	$ 125,816
HRC (Fish relocation and Monitoring)			1	$ 36,284.00	$ -	$ 36,284	$ -	$ 36,284
				$ -	$ -	$ -	$ -	$ -
				Subcontractor Subtotal	**$ 25,000**	**$ 99,660**	**$ 50,440**	**$ 175,100**
Operating Expenses: Other								
[1]				$ -	$ -	$ -	$ -	$ -
[1] Lodging				$ 90.00	$ -	$ -	$ -	$ -
[1] TU Supplies	1			$ 50.00	$ 50	$ -	$ -	$ 50
[1] Mileage (Miles)	1,175			$ 0.58	$ 676	$ -	$ -	$ 676
[1] Per Diem				$ 46.00	$ -	$ -	$ -	$ -
				Total Operating Expenses	**$ 25,726**	**$ 99,660**	**$ 50,440**	**$ 175,826**
				PERSONNEL SERVICES AND OPERATING EXPENSES SUBTOTAL	**$ 42,227**	**$ 99,660**	**$ 50,440**	**$ 192,327**
Administrative Overhead	**13.74%**	**0.00%**	**0.00%**		$ 5,802			$ 5,802
				GRAND TOTAL	**$ 48,029**	**$ 99,660**	**$ 50,440**	**$ 198,129**