Thursday, January 6, 2022

California Fish Passage Forum

Project Name	Little Case Fish Passage Project
Lead Organization	Eel River Watershed Improvement Group
Name of Project Lead/Point of Contact	Isaac Mikus
Contact Email	isaac@erwig.org
Phone Number	(707) 845-8119
Location of Project	39.68385° N, -123.51815° W
Attach a map of your project	pdf 03070LittleCaseTopoMap.pdf

PROJECT INFORMATION

1. Concisely describe why this project is important, what activities you will undertake to meet your objectives (clearly identify all objectives), resulting outcomes/deliverables to benefit fish passage in California, and why this project should be selected for funding through this RFP. If the funding you are seeking from the Forum is part of a larger project, 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.

Little Case Creek is a tributary to Tenmile Creek, one of the largest tributaries to the South Fork Eel River. The South Fork Eel River is historically the largest producer of Coho salmon in the Eel River basin and is expected to play a key role in repopulating the watershed according to the Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (National Marine Fisheries Service, 2014). Therefore, maximizing habitat available to Coho salmon within the South Fork Eel Watershed is of utmost importance. The available fish habitat in Little Case Creek has been fragmented by two culverts acting as partial barriers to adult salmonids and complete barriers to juveniles, blocking them from accessing one mile of spawning and rearing habitat (PAD ID #764910 and #764911). The engineering firm, Stillwater Sciences, developed design plans to remove the culverts and replace them with bridges. CDFW, ERWIG and the landowners provided input as the designs were developed. Implementation of the 100% designs will result in unimpeded fish passage for all life stages of Coho and steelhead.

ERWIG staff will oversee implementation of the project and obtain all permits for this project. A qualified subcontractor will conduct necessary surveys and a biologist will conduct fish relocation within the project sites. Stillwater Sciences will oversee construction activities. A qualified contractor will remove two culverts and replace them with bridges. The qualified contractor will also construct fish habitat structures and install rock bank protection and grade control structures. The CCC will anchor structures and plant willow. ERWIG will take pre and post project photos. Stillwater will evaluate completed project for fish passage.

Objectives:

- Replace two culverts with bridges that will pass Coho salmon and steelhead at all flows.
- Construct nine fish habitat structures made of 16 logs
- Plant 50 native trees along project reaches

Funding from the Fish Passage Forum will be used to pay for botanical, biological and cultural resource surveys, CDFW LSAA permitting, Mendocino County building permit and 401 certification fees and the staff time necessary to complete these tasks. ERWIG is seeking funding from CDFW for the rest of the project costs.

2. Select all components that apply to your project.

Barrier removal or remediation | Habitat restoration

3. List all partner organizations, and describe their involvement in the project (funder, planning/design, technical assistance, outreach, monitoring/evaluation, etc.)

The CDFW Fisheries Restoration Grant Program funded the planning and design phase of this project (2020-2021). Technical assistance and 100% engineering designs were completed by Stillwater Sciences.

4. If proposed project addresses a barrier to fish passage, does it have a California Passage Assessment Database (PAD) identification number(s)?

YES

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

764910

5. 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

Under average conditions Culvert #1 is a complete barrier to juvenile Coho and steelhead and a temporal barrier to adult

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) for each barrier addressed. Please specify which species you are referring to when describing barrier status.

Coho and steelhead. Under average conditions Culvert #2 is a complete barrier to juvenile Coho and steelhead and a temporal barrier to adult Coho and steelhead.

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

Endorsed by an agency

7. 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.

The California Department of Fish and Game has identified these culverts as a high priority for removal and funded the design phase of the project. They are recommended for replacement in the 2018 CDFW Stream Inventory Report.

8. 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)

1. Remediate barriers to effective fish migration.

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

By removing the two culverts and replacing them with structures that do not impede fish passage, habitat connectivity will be restored for Coho salmon and steelhead trout, listed species under state and federal Endangered Species Acts.

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

Coho Salmon

Steelhead/rainbow trout

11. Describe anticipated outcomes of implementing the proposed project. Include specific numbers when possible. Outreach accomplishments could include workshops/presentations/webinars given, educational materials developed, volunteers engaged, websites developed, social media metrics, etc.

Stream miles restored or enhanced: 0.08 miles

Acres of habitat restored: 0.2 acres

Number of barriers remediated: 2

Number of barriers assessed: 0

Number of watersheds or rivers assessed: 0

Number of stream miles assessed: 0

Number of fish populations assessed: 0

Outreach accomplishments: 0

Other: 1.0 miles of habitat made accessible to all life stages of Coho and steelhead.

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

Approximately 900 feet downstream of culvert #1 is a culvert that was evaluated by Stillwater Sciences and presents an insignificant barrier to fish passage.

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

0.5 miles upstream to Valley Drive bridge that represents an insignificant barrier to fish passage.

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

Spawning habitat

Rearing habitat

15. 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.

Mike Fitch - Supports the project and has signed access agreements, will sign a 25 year access agreement upon project funding.

Tim Huff - Supports the project and has signed access agreements, will sign a 25 year access agreement upon project funding.

Breck Smith - Supports the project and has signed access agreements, will sign a 25 year access agreement upon project funding.

Documentation of consent to proceed may be uploaded here if applicable.

pdf LittleCase_AccessAgreements_2021.pdf

16. Describe how the success of this project will be evaluated, and attach a copy of your monitoring and evaluation plan and indicate the person and/or organization that will be responsible for implementing.**

docx Little Case Creek Monitoring Plan.docx

***For any barrier remediation projects, the Forum recommends, at a 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.*

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

YES

18. Describe below the project's timeline of major tasks and milestones (including permits), as well as implementation and monitoring dates keeping in mind that funding through this RFP will likely be available in Spring/Summer 2023. Please describe any issues that may exist and/or arise that could delay project implementation.

Task 1. Project Management and Administration: 4/1/2023 - 4/1/2025
Task 2. Permitting and Surveys: 4/1/2023 - 7/1/2023
Task 3. Site Preparation: 7/1/2023 - 7/30/2023
Task 4. Aquatic Species Relocation: 7/10/2023 - 7/30/2023
Task 5.1. Dewatering: 8/1/2023 - 10/1/2023
Task 5.2. Site Construction: 8/1/2023 - 10/1/2023
Task 5.3. Erosion Control and Planting: 10/1/2023 - 3/30/2024
Task 6. Post Project Photo & Data Collection: 10/1/2023 - 3/01/2025
Task 7. Reporting: 4/1/2024 - 4/1/2025
If funding from CDFW isn't obtained by Spring 2023, this timeline might be delayed.

19. Attach any project designs, plans, and/or photos.

pdf LCCPhotoLog.pdf

pdf Little Case Creek BOD.pdf

LittleCaseCreek_100_Designs.pdf

PROJECT COSTS & BUDGET

20. Total Project Cost.

640,000

21. Total funding amount being requested from the Forum.

26000

22. List all partner contributions (cash and/or in-kind) and indicate whether match is considered federal, non-federal, or tribal using the table below:

	Name of Partner Organization	Type of Match	Value of Cash Contributions ($)	Cash Contributions Secured?	Value of In-Kind Contributions ($)	In-Kind Contributions Secured?	Total Contribution ($)
1	CDFW	Non-Federal	614,000	No			Total Contribution ($)
2							
3							
4							
5							
6							
7							

23. Will the project be fully funded if funding currently being requested from the Forum through this RFP is awarded?

NO

24. All budgets must include the following information. Please check each box indicating understanding of this requirement and upload a copy of your budget (including budget narrative) below.

Total coast of project

Total funding being requested from the Forum clearly indicating how/on what Forum funds will be spent.

Total match (cash/in-kind) and resulting deliverables. Please include and differentiate federal and non-federal match.

Monitoring/evaluation costs

Accompanying narrative explaining budget categories, amounts listed, what will be accomplished, and what deliverables are expected, etc.

Attach a project budget, including a narrative that describes the overall project budget and a detailed budget breakdown. (Word, .pdf, or .xls) A budget template is available on the Forum's funding page (www.cafishpassageforum.org/funding).

docx Little Case Creek Fish Passage Project Task...

xlsx LittleCase_CFPF_Budget.xlsx

PROJECT TEAM CAPABILITIES

25. Describe the experience and capabilities of up to three of the project leaders relative to their ability to implement this project. Include any work on other Forum-supported projects or efforts project leaders have been involved with.

ERWIG Executive Director Isaac Mikus will manage this project. He has worked for ERWIG for 5 years and has overseen approximately 30 restoration projects during that time. Working for ERWIG, Isaac has successfully completed two culvert replacement projects including the Kenny Creek Fish Passage Improvement Project (CDFW grant agreement #P1510535) and the Buck Gulch Barrier Removal Project (CDFW grant agreement #Q1910516).

Stillwater's lead on this project will be Joel Monschke (M.S., Geotechnical Engineering), a California licensed Civil Engineer (#C79688) with expertise in restoration engineering, hydrology, geology, geotechnical engineering, and geomorphology. He has been engaged in water resource management and restoration activities throughout California, including six years as Director of the Good Roads Clear Creeks Program at the Mattole Restoration Council, and two years as a Restoration Engineer at Questa Engineering. Mr. Monschke has directed and developed projects that upgrade public access infrastructure and enhance fisheries and aquatic habitat focusing on the planning, design and implementation of complex projects, including barrier remediation, fish habitat and riparian restoration, hydrologic planning, groundwater recharge, landslide stabilization, and restoration effectiveness analyses.

OUTREACH

26. Describe how this project conducts outreach and education to the local or regional community? Examples could include, but are not limited to: 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. Include any existing urls, social media handles, etc.

This project will be featured on ERWIG's website at erwig.org and highlights of the project will be disseminated during an ERWIG board meeting and at one other public event.

ALIGNMENT WITH NATIONAL PRIORITIES

27. Which of the National Fish Habitat Partnership's (NFHP) FY23 National Conservation Strategies will be addressed by your project? (select all that apply)

2. Restore hydrologic conditions for fish.

3. Reconnect fragmented fish habitats.

Review the *FY23 NFHP National Conservation Strategies*.

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

3.2 Promote habitat connectivity and integrity.

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

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

This project will provide Coho and steelhead juveniles access to summer habitat and winter refugia that is currently inaccessible. This habitat will help protect juvenile salmonids from increased winter flows caused by climate change enhanced storms. Additionally, climate change is driving the warming of Tenmile Creek, this project will provide access to the colder water available in Little Case Creek, tributary to Tenmile Creek.

30. 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.

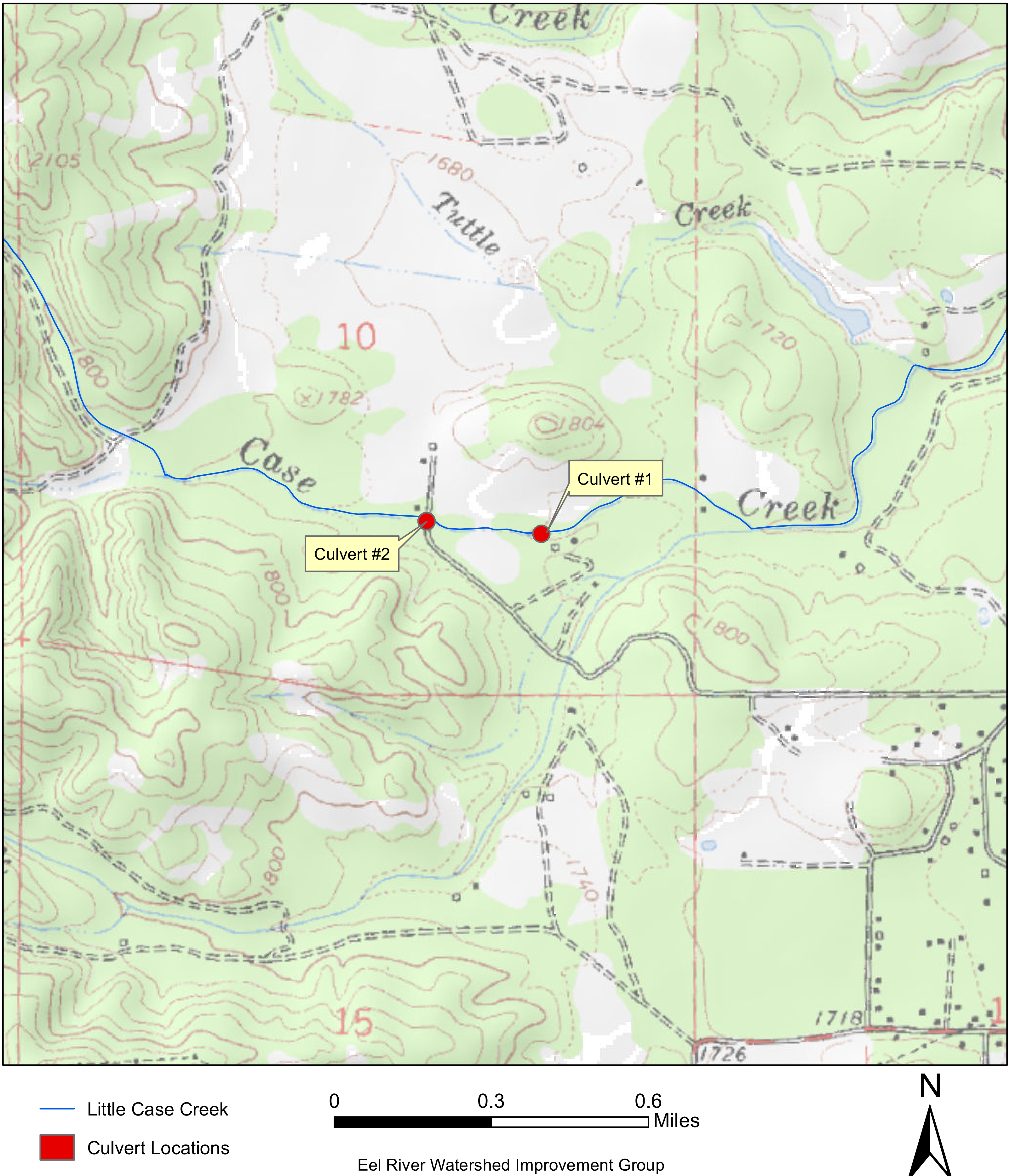
There is no existing tribal or commercial fishery in the Eel River, but this project will provide increased habitat for steelhead which are recreationally caught in the Eel River watershed.

31. Would this project increase public access to land or water resources for fish and wildlife-dependent recreational opportunities? If so, describe.

No

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.

Project Location Topo Map
Little Case Two Barrier Removal Planning Project
Cahto Peak Quad, Mendocino County



Eel River Watershed Improvement Group
March 2019

Little Case Creek – Photos

1 - Upper culvert (#2) inlet, looking downstream from LB

2 - Closer view of upper culvert (#2) inlet, looking downstream from LB

3 - Channel below upper culvert (#2), looking downstream

4 - Culvert (#2) outlet, looking upstream from RB

5 - Upper culvert (#2) outlet and pool, looking upstream from MC

6 – Stream channel downstream of upper culvert (#2), looking downstream from LB

7 - Upper Culvert (#2), 3 foot drop to surface of pool, looking upstream from MC

8 – Stream channel upstream of upper culvert (#2), looking upstream from MC

9 - Lower culvert (#1) inlet, looking downstream from RB

10 - Lower culvert (#1), interior, looking downstream from MC

11 – Stream channel upstream of lower culvert (#1), looking upstream


12 - Lower culvert (#1) and associated pool, looking upstream from MC


13 - Stream channel downstream of lower culvert (#1), looking downstream

MARCH 2021

Final Basis of Design Report – Little Case Creek Restoration Feasibility Study: Barrier Removal and Fish Passage Design Project

PREPARED FOR

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PREPARED BY

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Stillwater Sciences

Suggested citation:
Stillwater Sciences. 2021. Final Basis of Design Report and Feasibility Analyses – Little Case Creek Restoration Feasibility Study: Barrier Removal and Fish Passage Design Project. Prepared by Stillwater Sciences, Arcata, Eel River Watershed Improvement Group, Fortuna, California.

Cover photos: clockwise from top left –Outlet of Upper Culvert Crossing, Inlet of Lower Culvert Crossing, Channel conditions downstream of Lower Crossing.

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1 INTRODUCTION

The Eel River Watershed Improvement Group (ERWIG) retained Stillwater Sciences (Stillwater) to conduct the Little Case Creek Restoration Feasibility Study: Barrier Removal and Fish Passage Design Project (Project). The primary objectives of the Project are improving fish passage, restoring natural stream function, improve riparian conditions, and reducing fine sediment delivery at two road-stream culvert crossings on Little Case Creek in Mendocino County. This basis of design (BOD) report presents the Final 100% designs for the Project.

1.1 Project Location

The project sites are located at private road-stream crossings on Little Case Creek approximately two miles west of Laytonville in Mendocino County, California (Figure 1-1). The two culvert crossings (Culvert 1 – Lower, Culvert 2 – Upper) are located on Little Case Creek. Little Case Creek receives Mill Creek and they both subsequently meet Tenmile Creek, which drain into the upper reaches of the South Fork Eel River. The Little Case Creek, Mill Creek, and the remaining western half of the Tenmile Creek watershed, originate on the eastern slope of the inner most Coast Range mountains. Downstream from the project, Tenmile Creek flows to the northwest and joins the South Fork Eel River at the base of Black and Brush Mountains and the Eastern side of Elk Horn Ridge.

The two project crossing sites are located on two separate private residential properties at the end of Fitch Road. The crossings are located within a quarter mile to each other along the transition of valley plain to hillslope. The crossings are within a half mile of the confluence with Mill Creek; Little Case Creek joins Tenmile Creek approximately one mile downstream.

1.2 Need for the Project

Little Case Creek is a relatively small (832 acres) watershed. Most of the watershed has been impacted by rural residential, ranching, and some small-scale cannabis cultivation. The overall land use is not expected to change in the next 10 years. The watershed is 100% privately owned; however, two of the larger ranches are interested in watershed restoration activities.

Historically, the Little Case Creek watershed was managed for grazing and small timber operations. It has since transitioned towards rural residential properties. Many access roads for grazing, logging, and entrance to rural residences were built before fish passage regulations were in effect and were often not properly located or constructed, resulting in passage issues at many crossings. Nonprofits, community groups and agencies have been working for 20+ years to replace road crossing barriers with crossings that will pass salmonids at all life stages.

The South Fork Eel River is historically the largest producer of coho salmon in the Eel River basin and is expected to play a key role in repopulating the watershed according to the Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (NMFS 2014). Therefore, maximizing habitat available to coho salmon within the South Fork Eel Watershed is of utmost importance.

The South Fork Eel River Watershed Assessment (CDFW 2014) found that salmonid populations in the Eastern Subbasin of the SF Eel Watershed (the location of Little Case Creek) are limited by "Restricted access from culverts at road crossings". The SONCC (NMFS 2014) ranked the threat to SF Eel coho posed by barriers as "high" and ranked the stressor of barriers to SF Eel coho as "high".

The available fish habitat in Little Case Creek has been fragmented by two culverts acting as partial barriers to adult salmonids and complete barriers to juveniles, blocking them from accessing to almost one mile of spawning and rearing habitat. The two culverts on Little Case Creek are both identified as known fish passage barriers in the Passage Assessment Database (PAD), an ongoing inventory of known and potential anadramous fish barriers in the state of California. The Little Case Creek Stream Habitat Inventory Report (CDFW 2018) recommends assessing the two culverts and replace them if they are fish passage barriers. In 2018 CDFW surveyors documented the culverts as potential fish passage barriers and they were entered into the PAD database.

The culverts on Little Case Creek have been reviewed by CDFW and recommended for removal by the agency. The need for the project is also identified in the following plans and assessments:

i. California Department of Fish and Wildlife. 2018. Little Case Creek Stream Habitat Inventory Report. California Department of Fish and Wildlife, Fortuna, California.
ii. California Department of Fish and Wildlife. 2014. South Fork Eel Watershed Assessment. California Department of Fish and Wildlife Coastal Watershed Assessment and Planning Program, Fortuna, California.
iii. California Department of Fish and Wildlife. 2015. California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. California Department of Fish and Wildlife prepared with assistance from Ascent Environmental, Inc., Sacramento, California.

Therefore, the project goal is to develop engineered plans to replace these two culverts, known fish passage barriers, on Little Case Creek, improving passage for coho, Chinook and steelhead and opening access to spawning and rearing habitat upstream of the barriers. The two culverts will be replaced with crossings that allow for fish passage of all life stages at all flows. By developing a plan to remove the two culverts and replace them with structures that do not impede fish passage, habitat connectivity will be restored for coho salmon and steelhead trout, both listed species under state and federal Endangered Species Acts.

Figure 1-1. Location of the project sites near Laytonville, CA. Culvert 1 is the "Lower Crossing" and is downstream of the "Upper Crossing", Culvert 2.

2 EXISTING CONDITIONS

2.1 Geology and Tectonics

The Little Case Creek watershed primarily comprises moderate to steep hillslopes of the Coast range mountains. Three different geologic units are mapped within the watershed: TK, KJf, and Q. The most western and highest elevation portion of the watershed is mapped as overlying unit TK, described as Tertiary-Cretaceous sandstone, shale, and minor conglomerate in the coastal belt. The lower and eastern portion of the watershed is underlain by unit KJf, described as Franciscan Complex, Cretaceous and Jurassic sandstone with smaller amounts of shale, chert, limestone, and conglomerate. The watershed within the immediate vicinity of the project areas and downstream are mapped as containing overlap deposits of unit Q, described as alluvium, lake, playa, and terrace deposits; unconsolidated and semi-consolidated. This is consistent with field observations of cut banks within the project area consisting of moderately consolidated silt, sand, and gravels.

Faults in the project vicinity include numerous southeast-northwest trending splays of the Maacama fault in the north section of the Maacama fault zone. Although recent displacement along these faults is undifferentiated, they are considered Quaternary in age (i.e., active within the last 1.6 million years). At a distance of approximately 2.5 miles to the southeast of the project sites, the Maacama fault is mapped as active within the Holocene, and at 22 miles, in the town of Willits, active within the last 200 years. A geologic map of the project vicinity, including faults, is show in Figure 2-1.

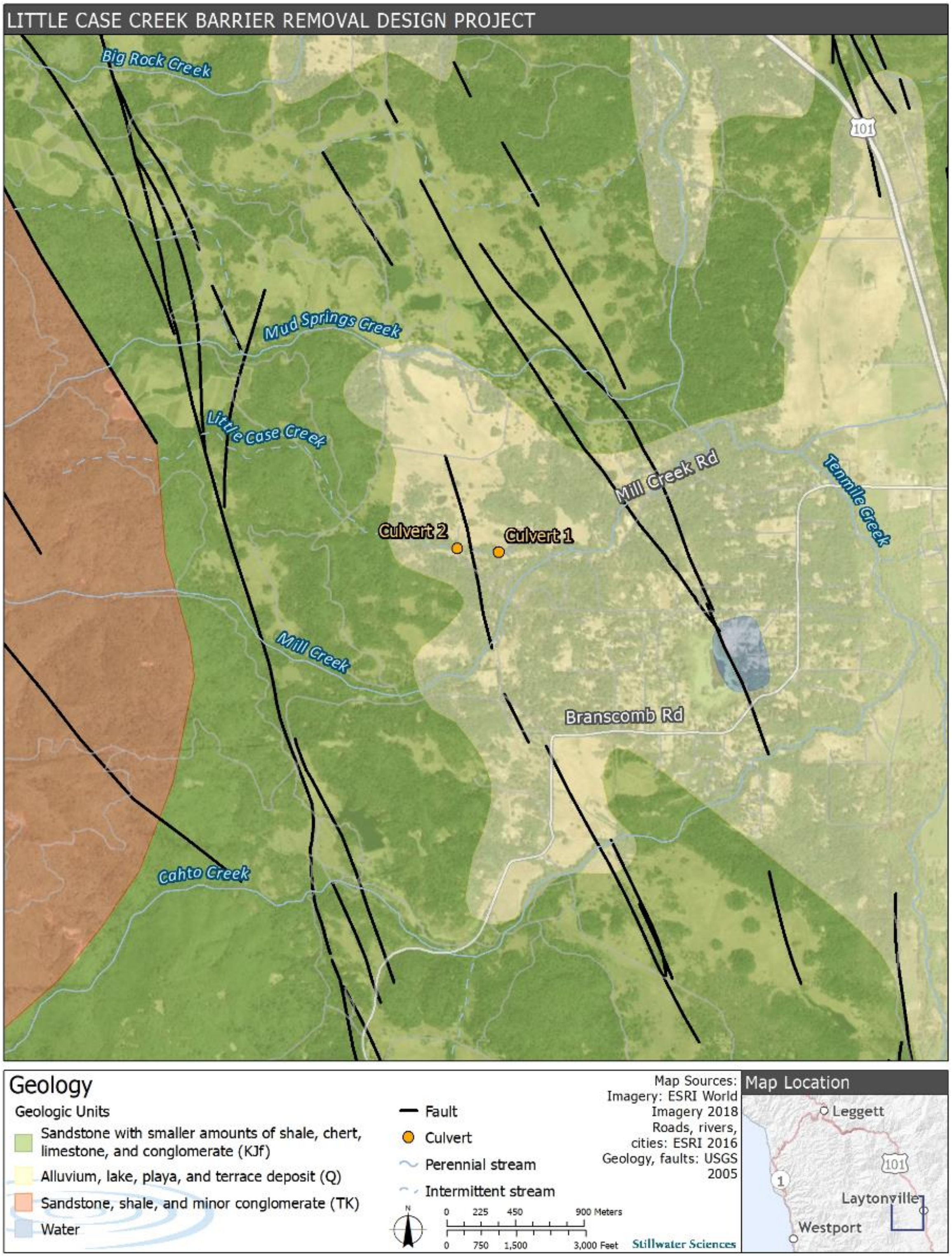

Figure 2-1. Geologic map of the Little Case Creek and surrounding portions of Mendocino County. Culvert 1 is the "Lower Crossing" and is downstream of the "Upper Crossing", Culvert 2.

2.2 Geomorphology

A geomorphic assessment was conducted to characterize the existing geomorphology of the project area, assess risks associated with potential hazards, and inform project designs. Specifically, the geomorphic assessment included a topographic survey of project sites, field measurements and observations, and office review of geomorphic and landslide mapping.

Upper elevations of the Little Case Creek watershed are characterized by steep hillslopes (20–50% slopes), covered primarily with mixed hardwood/conifer forest. Lower elevations within the watershed exhibit moderate hillslopes and low angle, valley bottom, grazed grasslands. The stream channel makes a transition to this low slope (<3%) topography about ½ mile upstream of Culvert 2.

Landslides are common in Franciscan Complex rock, and the California Geological Survey's landslide inventory shows mapped areas of "landslide source or scarp" on the steep headwater hillslopes. No instabilities were mapped in the lower valley within the vicinity of the project.

General channel morphologies at the two project sites are relatively consistent due to their proximity to each other. The stream channel generally exhibits top-of-bank, or bankfull, widths ranging from 20 to 25 feet and active channel widths ranging from 10 to 15 feet. Channel gradients range from approximately 1 to 4 percent and cobble, gravel, and sand are the dominant bed substrate. Riparian condition along the creek channels in the Project areas is generally fair and well vegetated with shrubs and trees including blackberry, Oregon ash, alder, big leaf maple, California bay, and Douglas fir. However, instances of substantial bank erosion along the outside bends in the channel were observed at both sites as shown on Figure 2-2. In those areas, nearly vertical banks of 6 feet in height or greater are actively eroding. Additional details for each crossing are provided below in Section 2.2.3.

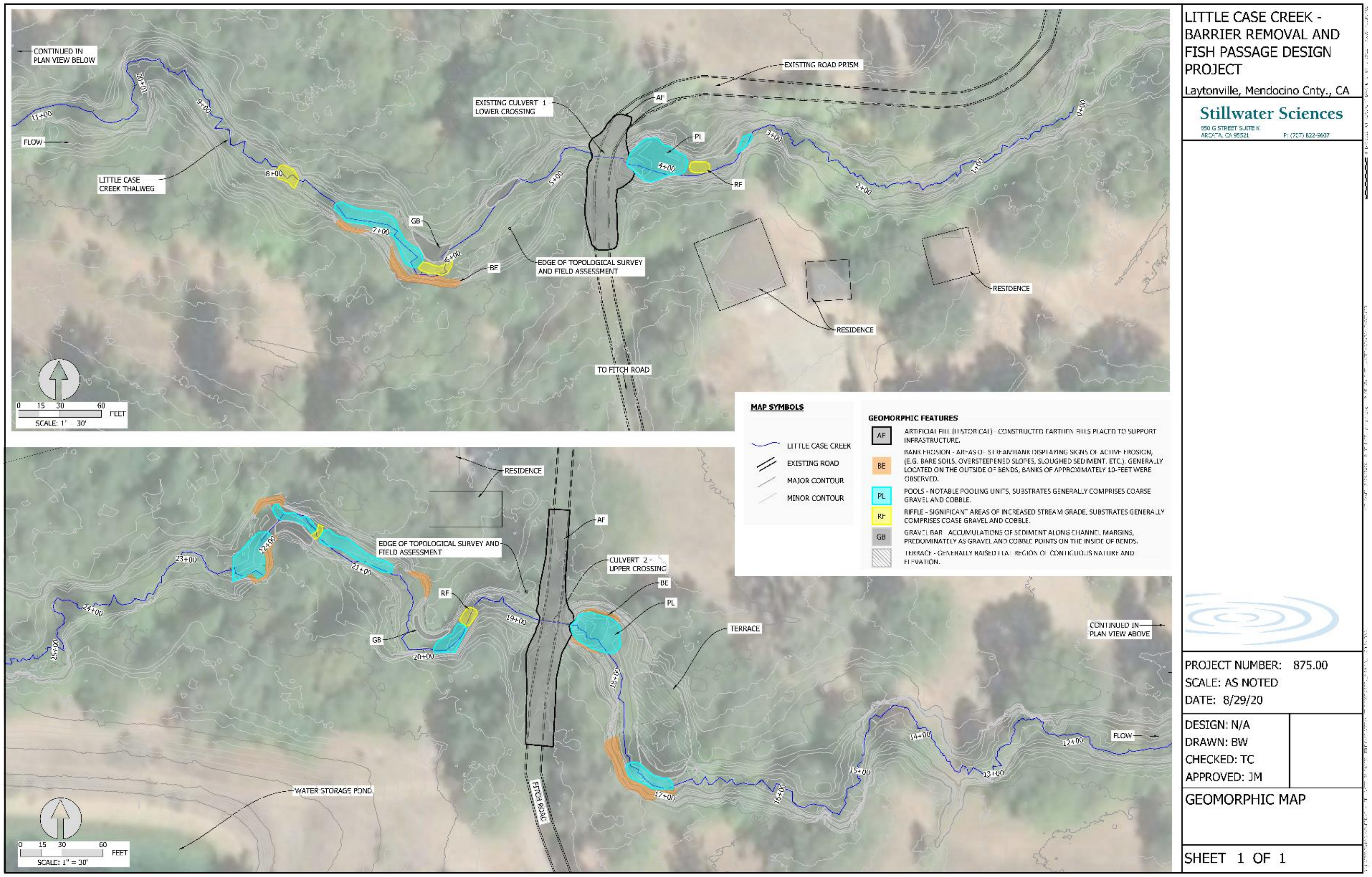

Figure 2-2. Geomorphic map of the Project area.

2.2.1 Aerial photograph interpretation

LiDAR-derived topography and a time-series of historical aerial photographs were reviewed to characterize the longer-term geomorphic and land use changes along the streams and hillslopes within the project area's watershed. Photographs were acquired for the following six years: 1993, 2003, 2005, 2010, 2014, and 2019. Cropped portions of each aerial photograph for the project area are provided in Appendix C.

1993 photograph
The photograph shows thin logging and access roads tracing the upper extents of the watershed, left side, but a largely intact and dense riparian corridor. Regional plains surrounding the project areas, just beyond the vegetative barrier, show signs of agricultural use and production. The vegetative buffers that are present are thinnest through the region between the two crossings of interest. Fitch road, the main access for the crossings had already been constructed by this time, as evidenced by the roads crossing the creek channel at the location of Culvert 2 – Upper Crossing. The private residence and associated access point had also been in existence at the location of Culvert 1 – Lower Crossing.

2003 photograph
A decade after the initial photograph, in the upper-most reaches of the Little Case Watershed, a region of cleared of timber canopy is visible and show signs of agricultural use. Totaling approximately 71 acres the region represents approximately 2.3% of the total watershed area. A water storage pond (~0.7 acres) is also visible in the cleared timber patch. Additionally, a primary access route in and out of this cleared region runs adjacent, and parallel to, Little Case Creek for approximately one-third of a mile. Adjacent regions continue to show signs of agricultural production and disturbance.

2005 and 2010 photographs
Overall, the conditions are very comparable in the previous photographs with the same extent of residential and agricultural development and disturbance. In the next two photos the cleared region visible in the 2003 photo is maintained and three additional water storage ponds (~3 acres) are visible just beyond the riparian buffers between the Upper and Lower Crossings, bringing the total water storage area within the watershed to approximately 3.7 acres.

2014 and 2019 photographs
These final two photographs show the site and condition of the Little Case Watershed within the last 6 years. The cleared region discussed in the previous photographs persists and shows signs of activity and disturbance. All the water storage features appear to be retained and functioning with a ponded surface visible. There are no other signs of new development within the watershed.

2.2.2 Topography

Stillwater and ERWIG staff conducted a field topographic survey in the winter of 2020 using a robotic total station and differential GPS. The primary goals of the topographic survey were to characterize the existing conditions topography to support geomorphic assessment, hydraulic modeling, and engineering designs. The survey focused on complete topography at the crossings and in the channels upstream and downstream of the culverts. The differential GPS was used to establish coordinates for several of the survey control points so that data surveyed with the total station could be aligned approximately with the California State Plane Coordinate System. In the office, GPS data were post-processed using differential position corrections from the three nearest

National Geodetic Survey (NGS) Continuously Operating Reference Stations (CORS). The horizontal accuracy of the differentially corrected GPS coordinates was between 6 and 12 inches.

Field surveyed topographic data of the stream channel were then merged with LiDAR data from the USGS's NoCAL Wildfires B4 2018 dataset to provide both channel and upland topography suitable for hydraulic modeling and engineering design.

2.2.3 Field assessment

The field assessment of the project areas consisted of topographic surveys, evaluation of channel morphology, and examination of existing road-stream crossings. Results and interpretations from the field assessment are summarized below, beginning with Culvert 1.

2.2.3.1 Culvert 1 – Lower Crossing

Culvert 1 – Lower Crossing (PAD ID# 764910) is a metal culvert with a deteriorating concrete lining. The crossing supports a private access road and is approximately 4,100 feet upstream from the confluence with Tenmile Creek. The culvert is approximately 5.9 feet tall and 6.2 feet wide, with an overall length of 19.7 feet. The longitudinal slope of the culvert is 18% based on the survey data. The culvert is hydraulically undersized and under average conditions it is a complete barrier for juvenile coho and steelhead and a partial barrier for adults when flow velocity is high.

As shown in Figures 2-3 through 2-7, the inlet of the culvert is preceded by a strong ~70-degree shift in channel direction with a pool and significant incision and bank erosion visible. A large existing California Bay tree, with approximately 20 feet of associated root ball, appears to be undercut and acting to dissipate and redirect velocities at higher flows. A cattle grate has been erected as an informal debris block.

A large scour pool has developed at the outlet end that is several feet deeper than the surrounding channel. The downstream end of the scour pool contains a high percentage of finer sand and silts with a gravel bar forming the "crest" of the pool. Medium-dense underbrush, small-diameter trees, and exposed roots can be observed growing along the faces of the exposed banks, with limited vegetation in the active channel. A residence is located within approximately 100 feet, near the top of the bank on the outlet end, opposite the most-intense scour regions.

The side-slopes and clearances at the existing crossing are overly steep and armored with RSP. The surrounding road geometry and depth of cover over the existing culvert does not appear to be adequate for long-term use under the indicated potential maximum live load (logging truck).

Figure 2-3. View looking downstream within 100 feet of Culvert 1 inlet. Culvert 1 is visible in underbrush to right; note ~70-degree right turn in thalweg.

Figure 2-4. View looking downstream into the inlet of Culvert 1. Note strong bend in stream geometry immediately above inlet and large bay tree with under-cut roots.

Figure 2-5. View looking over the scour pool, upstream into the outlet of Culvert 1. When the culvert crest elevation is compared to the previous figure, the steep slope is evident.

Figure 2-6. A roughly ~180-degree panoramic view of the downstream channel condition. Flow is from the outlet of Culvert 1, on the right, through the scour pool, and across the gravel bar to the left. Residence visible in background.

Figure 2-7. View looking downstream of the scour pool, exhibiting gravel and cobble substrate typical of the reach.

2.2.3.2 Culvert 2 - Upper Crossing

Culvert 2 – Upper Crossing (PAD ID# 764911) is a smooth-walled metal culvert. The crossing supports a private access road and is approximately 4,980 feet upstream from the confluence with Tenmile Creek. The culvert is approximately 7.9 feet tall and 7.2 feet wide, with an overall length of 23.6 feet. There is an approximately 3-foot-high plunge at the culvert's outlet which is a complete barrier to juvenile salmonids and a low flow barrier to adult coho and steelhead.

As shown in Figures 2-7 through 2-11, the inlet of the culvert is preceded by meandering channel that enters the culvert at a favorable angle. A large existing oak tree exists immediately adjacent to the stream channel and existing roadway; it is within the extent of any sort of improvement and will need to be incorporated or removed. A private residence is visible and sits just beyond the top bank of the channel.

A large scour pool has developed at the culvert outlet that is several feet deeper than the surrounding channel. The culvert outlet is being undercut by several feet. Other signs of continued and active erosion are visible and roots hang from the nearly vertical banks. There is no gravel readily observed in the scour pool, which instead contains fine sands and silts. The large tree visible in Figure 2-10 appears to have once grew along the bank, before being compromised by the expanding scour pool and falling into its current location.

The side-slopes and clearances at the existing crossing are overly steep and armored with RSP and concrete rubble. The surrounding road geometry is simple (e.g., straight), but the depth of cover over the existing culvert crest does not appear to be adequate for long-term use under the indicated potential maximum live load (logging truck).

Figure 2-8. A roughly ~180-degree panoramic view of the upstream channel condition. Flow is from left to right. The banks are visibly steep with exposed roots and underbrush. Vegetation extends into the active channel. A residence is visible within 20-feet of the top of bank.

Figure 2-9. View looking downstream through Culvert 2. Note thin road base cover over culvert crest. Large diameter oak tree (right) is within the extent of disturbance for any alternative.

Figure 2-10. View looking upstream into the outlet of Culvert 2; impassable plunge visible (center). Evidence of scour and increased erosion rates are visible. Base of downed tree indicates historic location of bank.

Figure 2-11. View looking downstream from below Culvert 2. Steep unstable bank and increased rates of erosion are evident.

Channel bed substrate in the downstream reach is dominated by gravel- and small cobble-dominant deposits. Similar to the Crossing 1 downstream reach, the gravel and cobble deposits are well sorted, freshly mobilized, not imbedded, and provide high-quality spawning habitat for salmonids (Figure 2-12). The gravel and cobble deposits form pool tailouts and riffles that establish hydraulic control in this reach. Significant right bank erosion is evident downstream from Crossing 2 as shown in Figure 2-11. Fine-grained sand and silt are evident in the upper portion of the cut bank with coarser gravel interspersed with fine-grained material in the lower portion of the cut bank. There is a large floodplain/bar in the middle of the channel which is occupied by native riparian vegetation and invasive Himalayan blackberries. Lateral migration of flow around this feature as well as ongoing channel incision appear to be driving the current geomorphic instability at this site.

The reach upstream of the crossing is relatively more stable with lower channel slope and banks stabilized by riparian vegetation and tree roots.

Figure 2-12. View looking upstream from below Culvert 2. Typical sand-gravel-cobble deposit with pool and small sand bar visible lower right.

3 HYDROLOGY AND HYDRAULICS

To understand the flow dynamics along the project reaches, flow hydraulics were modeled using the U.S. Army Corps of Engineers' (USACE) *Hydrologic Engineering Center's River Analysis System (*HEC-RAS). HEC-RAS is widely used for floodplain mapping and estimating general flow characteristics. Hydraulic modeling was conducted using a one-dimensional (1-D) approach. The 1-D model assumes uniform flow direction and constant velocity distribution within the channel and floodplain portion of each cross section. Flow is modeled based on topography at a channel cross section without considering the effects of channel topography between cross sections. Therefore, it is important that these limitations are closely considered during hydraulic model setup, calibration, and application.

3.1 Hydrology

A hydrologic analysis is required to determine stream flow data that is the principal input to HEC-RAS. The project streams are ungaged, so relevant discharges were calculated using prorations from nearby gaged streams. Streamflow records from multiple U.S. Geological Survey (USGS) gages were used in the hydrologic analysis (Table 3-1). The gages were selected based on multiple criteria presented in order of importance: (1) similar topography, climate, and underlying geology to the project area; (2) proximity to the project area; (3) adequate duration of record (~20 years minimum; ideally greater than 30 years); and (4) relatively comparable drainage areas.

Peak streamflow and mean daily flow records were analyzed from the USGS gages to produce flood frequency and flow exceedance probability estimates, respectively. Peak flow estimates from the flood frequency analysis have specific recurrence intervals, or frequencies (e.g., a 100-year peak flow has a 1% chance of occurring any year, or once in 100 years, on average). Smaller flood frequency flows with more regular recurrence intervals (i.e., 1.5-year flow) are biologically and geomorphically significant because they occur during most winters and can create high velocities (in undersized crossing and/or in the open channel) capable of flushing juvenile salmonids out of the creek and/or cause mortality if insufficient low-velocity refugia habitat are available. For this analysis, we assume the 1.5-year recurrence interval flow approximates the "bankfull" flow. It is also critical to analyze flows from a 100-year recurrence interval flood event to determine adequate sizing for stream crossings, erosion potential and flooding hazards for adjacent property and infrastructure, as well as the stability of the proposed enhancement features.

The flood frequency analysis used a Log-Pearson III distribution and methods consistent with USGS Bulletin 17B (USGS 1982). For proration calculations, the drainage area at each crossing was used. Peak flow estimates (Table 3-1) were prorated for the project sites following the flow transference equation of Waananen and Crippen (1977):

$$Q_u = Q_g(A_u/A_g)^b$$

Where: b = 0.87 for 100- to 25-year events, b = 0.88 for 10-year events, b = 0.89 for 5-year events, b = 0.9 for 2- and 1.5-year events, and b = 1 for exceedance flows

Q_u = Ungauged discharge
Q_g = Gauged discharge
A_u = Ungauged drainage area
A_g = Gauged drainage area

In addition to peak flow estimates, moderate and low flows were also modeled in HEC-RAS, which correspond to upper fish passage flows, typical winter base flow, and late spring/early summer low flow (Tables 3-1 and 3-2). These relatively smaller flows have biological significance for fish passage objectives. The 2% exceedance flow has been identified in other coastal basins as the highest flow when fish passage is likely to occur. The 20% exceedance flow represents the typical winter base flow when juvenile salmonids will be rearing in the creek. These biologically relevant exceedance flows were calculated from the same regional USGS gage records as used in the peak flow analysis and were prorated based on the drainage area ratio to the project site. An average of the prorated USGS gage flows were used as input in the 1-D hydraulic modeling (described below in Section 3.2 Hydraulic Modeling).

Additionally, both the high and low passage flows for adults and juvenile salmonids were adopted per Table IX-5 of the California Salmonid Stream Habitat Restoration Manual (CDFG 2009). The Manual indicates the high design flows for adults and juvenile salmonids be ~50% and ~10% of the 2-yr design flow respectively. Similarly, the Manual suggests the low design flows for adult and juvenile salmonids be adopted at ~3cfs and ~1cfs respectively.

Table 3-1. Modeled flood frequency and exceedance discharge estimates for Both the Lower and Upper Crossings – Culvert 1 and 2, respectively.[1]

Discharge location and description	Period of record (years)	100-yr peak flow (cfs)	10-yr peak flow (cfs)	2-yr peak flow (cfs)	Adult passage high flow (cfs)[5]	2% exceedance flow (cfs)[2]	Juvenile passage high flow (cfs)[5]	Adult passage low flow (cfs)[5, 6]	Juvenile passage low flow (cfs)[5]
Prorated from USGS Gage No. 11473980 Go Forth Creek near Dos Rios, CA (3.8 sq mi)[3]	11	423	254	120	-	13.5	-	-	-
Prorated from USGS Gage No. 11475560 Elder Creek near Branscomb, CA (6.5 sq mi)[3]	40	595	276	99	-	26.7	-	-	-
Prorated from USGS Gage No. 11475700 Tenmile Creek near Laytonville, CA (50.1sq mi)[3]	21	555	406	240	-	29.9	-	-	-
Prorated from USGS Gage No. 11472200 Outlet Creek near Laytonville, CA (161 sq mi)[3]	39	495	303	133	-	20.9	-	-	-
USGS Streamstats - Little Case Creek Lower Crossing (0.9 sq mi)[4]	N/A	525	298	131	-	-	-	-	-
Average Design Flows for Both Culvert 1 and 2 at the Lower and Upper Crossings (0.9 sq mi)	-	**519**	**307**	**145**	**72**	**23**	**14**	**3**	**1**

Notes:
[1] Values have been calculated using the slightly larger region of the Lower Crossing watershed; therefore, adoption of the tabulated values for design of the slightly smaller Upper Crossing watershed is a conservative assumption.
[2] Exceedance flows calculated using standard flow duration analysis and prorated for drainage area difference.
[3] Log-Pearson Type III distribution based on USGS stream gage prorated for drainage area difference using USGS flow transference formula (Waananen and Crippen 1977).
[4] Steamstats data only used for determination of peak flows only. To account for uncertainty, single-place integers have been rounded off design flows above the 20% exceedance.
[5] Design flows adopted per provided alternative of Table IX-5 of California Salmonid Stream Habitat Restoration Manual, Part IX, Fish Passage Evaluation at Stream Crossings, March 2004, pg IX-40.
[6] For this analysis, the value of the "20% exceedance flow" and the value of the "Adult Passage Low Flow", as determined in Note 5, are essentially equal; therefore those two design flows are represented by the "Adult Passage Low Flow (cfs)" column.

3.2 Hydraulic Modeling

3.2.1 Existing conditions hydraulic modeling

Existing conditions topography used in the HEC-RAS models was taken from the topographic survey data that were described above in Section 2.2.2 Topography. Typically, cross sections are cut perpendicular to the channel thalweg.

Cross-sections of the channel were cut from the Triangular Irregular Network (TIN) surface in AutoCAD and exported to HEC-RAS to create the hydraulic model. The Manning's n roughness value of 0.045 was used for the channel, based on the HEC-RAS Reference Manual conservative recommendation for a "clean and winding natural stream with some pools, shoals, weeds, and stones"; and 0.055 for all banks and floodplains based on a conservative value for "medium brush, in winter". Downstream boundary conditions for completing normal depth equations were assumed to be an average of 2%, and were approximated from field observations and available topological data. Flow was simulated in a subcritical regime with steady flow for each model run.

3.2.2 Existing conditions hydraulic model results

Hydraulic modeling was conducted for the existing conditions at each crossing. Figure 3-1 shows the longitudinal profiles of the channel thalweg and modeled water surface elevations (WSE). Key results from the existing conditions model include:

- Culvert 1 – the Lower Crossing is hydraulically undersized to convey peak flows that have a return period of more than 1.5 years, and during more infrequent events (e.g., 10-yr) the existing culverted road crossing is anticipated to be overtopped by the higher flows. Maximum Velocities within the culvert during a 2% exceedance event are anticipated to reach approximately 5 ft/sec.
- Culvert 2 – the Upper Crossing, like the Lower Crossing, is hydraulically undersized to convey peak flows that have a return period of more than 1.5 years, and during more infrequent events (e.g., 10-yr) the existing culverted road crossing is anticipated to be overtopped by the higher flows. Maximum Velocities within the culvert during a 2% exceedance event are anticipated to reach approximately 5 ft/sec.

The velocities associated with the existing conditions of both crossings are tabulate and compared to the proposed alternatives in Tables 4-1, 4-3, and 4-5. A full tabulation of hydraulic model outputs is included in Appendix B. Proposed conditions hydraulic modeling results for each crossing are discussed below in Sections 4.2.1, and 4.3.1 Proposed conditions hydraulic modeling.

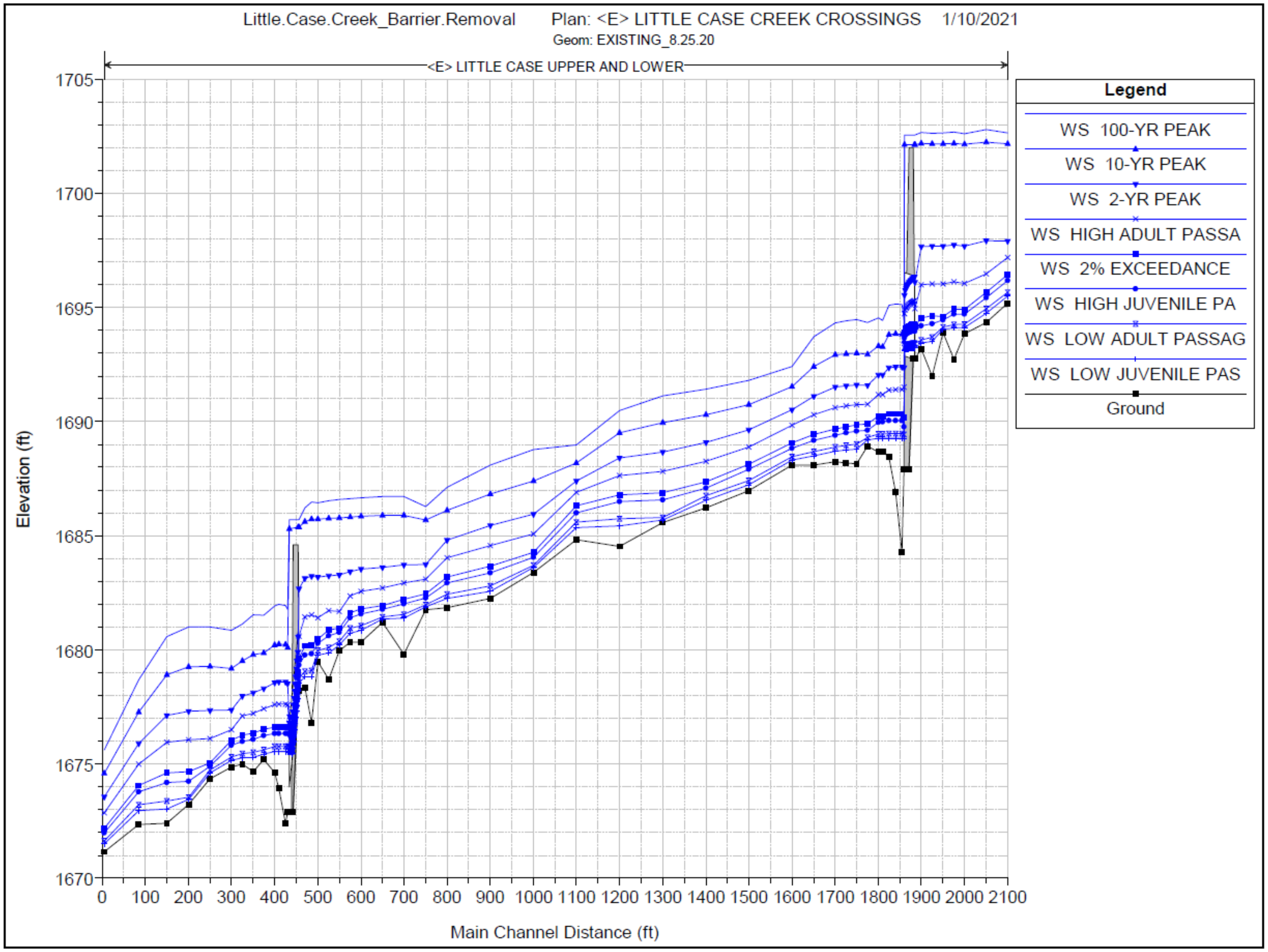

Figure 3-1. Modeled water surface elevations under existing conditions at Culvert 1 and 2—the Lower and Upper Crossings, respectively

4 FINAL 100% DESIGNS

4.1 General Design Objectives

Final 100% designs for the two crossings are provided in Appendix A. The designs focus on several key project goals including:

1. **Improve Fish Passage** – Fish passage is currently a documented impairment at both crossings due to high velocity and excessive jump height, Culvert 1 – Lower Crossing and Culvert 2 – Upper Crossing, respectively. The conceptual design plans include upgrading the crossings with adequately sized fish passage-friendly structures as described below in Sections 4.2 and 4.3. The crossing alternatives were designed following the methods of Part XII of the California Salmonid Stream Habitat Restoration Manual (CDFG 2009) and elements of the stream simulation and Hydraulic Design Approaches (USDA Forest Service 2008).
2. **Restore Natural Stream Function** – The existing undersized and failing culverts also impair natural stream functions including conveying peak flood flows, sediment and debris transport, and passage of large wood. The crossing alternatives were designed to accommodate a 100-year flood at each site with sufficient freeboard (i.e., at least 2 feet) to pass debris and large wood.
3. **Fine Sediment Reduction** – the existing scour pools visible at the outlets of both culvert crossings is contributing fine sediment directly into salmonid spawning reaches of the Eastern Subbasin of the South Fork Eel Watershed.
4. **Riparian and Instream Habitat Enhancement** – In general, the project sites are densely vegetated with multi-story riparian trees and shrubs, including large conifers. However, because the designs call for upgrading the crossings with larger structures, there will be minor incidental riparian impacts, primarily upstream and downstream of the new bridges. Additionally, the design at Culvert 2 includes bank stabilization treatments to reduce erosion on the downstream right bank. Designs will include planting native riparian vegetation in these areas. Also, large wood structures are proposed at both sites to enhance instream habitat.

4.2 Alternatives Analyses

During the conceptual design phase, Stillwater Sciences considered two alternative configurations for the Lower Crossing: a large box culvert and a steel span bridge.

The Lower Crossing needs to maintain the ability to provide access for CalFire or similarly related emergency equipment. For this basis of design, a full-length drop-deck “low-boy” trailer with a D6 type Cat bulldozer was assumed as the “worst-case” foreseeable vehicle combination from a passage geometry and loading perspective. The northern end of the Lower Crossing is approximately 50 feet from the existing easterly road alignment. This existing configuration creates a geometry which presents a geometrically tight radius for passage of long vehicles, the inner-southeast radius. To achieve a channel geometry similar to that presented in the prosed configuration; retain the ability to provide access to necessary emergency vehicles; and minimize alteration to the existing road prism beyond the immediate extent of the crossing; two alternatives were considered.

A box culvert presents the possibility of easily widening the crossing location to adapt to the existing crossing location, and subsequent strong easterly bend and existing road prism. A bridge presents a fixed road width of 16 feet; however, the cross-sectional geometry of the channel beneath a bridge has much more capacity at bankfull flows, and introduces less hydraulic disturbance to higher velocity peak flows, when compared to a box culvert.

In both cases the existing elevation of the road (~1,685-foot) does not provide adequate clearance for the high flows, and therefore both alternatives will need to raise the road approximately 2-foot from its existing elevation and construct ingress and egress aprons from the proposed configurations. While both alternatives require improvement to the approach geometry and aprons, the bridge alternative, as compared to the box culvert alternative, will require more road re-alignment, construction effort, and fill to improve the access for long vehicles.

The two alternatives were presented to project stakeholders and it was determined that the bridge with realignment of the northern road approach was the preferred alternative.

For the Upper Crossing, a bridge was the only feasible alternative analyzed.

4.3 Lower Crossing

The Final 100% design for the Lower Crossing is shown on Appendix A, Sheet 3. The proposed upgrade includes:

- Constructing a new Lower Crossing on the same road alignment with a 16-foot x 40-foot x 2.5-foot prefabricated steel span bridge (e.g., Kernen Construction prefab bridge). The designs include a roughened channel under the bridge, backfilled with engineered streambed material (ESM) with coarse Rock Slope Protection (RSP) protecting the bridge abutments and side slopes on the upstream and downstream approaches, especially the left bank due to the abrupt angle of the creek upstream of the crossing.
- Just downstream, an approximately 20-foot-long by 3-foot-deep pool will dissipate energy and provide resting habitat near the middle of the roughened channel run.
- The construction of ingress/egress aprons from the crossing will allow the proposed crossing to: achieve the desired channel geometry; provide adequate clearance from the lowest chord during high-flow events; and retain the ability to permit access to long and large vehicles (e.g firefighting equipment), by making minor alterations to the northern end of the Lower Crossing and its transition into the existing strong easterly road alignment and prism.
- At least 2.75 feet of freeboard under the low chord of the bridge can be maintained during a 100-year flow event, and the proposed configuration will also substantially reduce the flow velocities compared to existing conditions (further described below). The designs will include stabilization mats (further described below in Section 5.2 In Situ Soil Strength and Bridge/Box Culvert Factor of Safety).
- Riparian plantings at select areas impacted by construction and/or devoid of vegetation.

4.3.1 Proposed conditions hydraulic modeling

Proposed-conditions hydraulic modeling of the design described above was conducted by grading the features in AutoCAD and re-cutting cross sections in HEC-RAS. Results from the proposed conditions modeling are shown in Figure 4-1 for both crossings, with a cropped and enlarged detail of the Crossing location shown in Figure 4-2. The velocity present under proposed conditions (Bridge Alternative) as well as the reductions in flow velocities through the Lower Crossing at fish passage flows are shown in Table 4-1.

Cross sections and tabulated model results for existing and proposed conditions are provided in Appendix B. The proposed conditions modeling focused on evaluating a new crossing structure that could adequately convey flood flows, bedload, debris, and large wood, as described above in Section 4.1 General Design Objectives. The design level shown in the HEC-RAS figures (i.e., 65%) represents the Final 100% level of hydraulic analyses incorporated into the plan set of Appendix A (i.e. no revisions were made to the HEC-RAS model after the 65% design level).

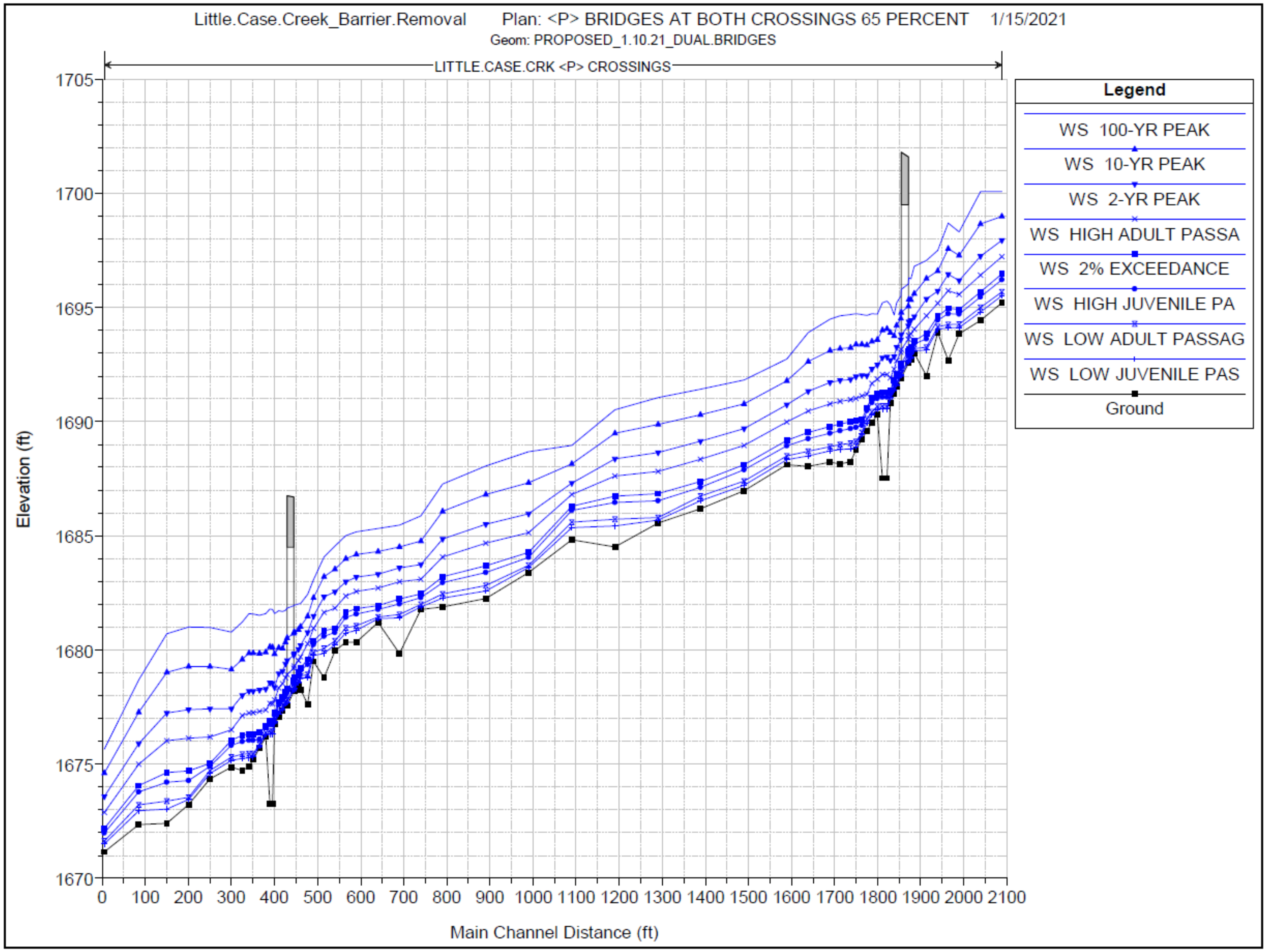

Figure 4-1. Modeled water surface elevations under proposed conditions at both the Upper and Lower Crossings.

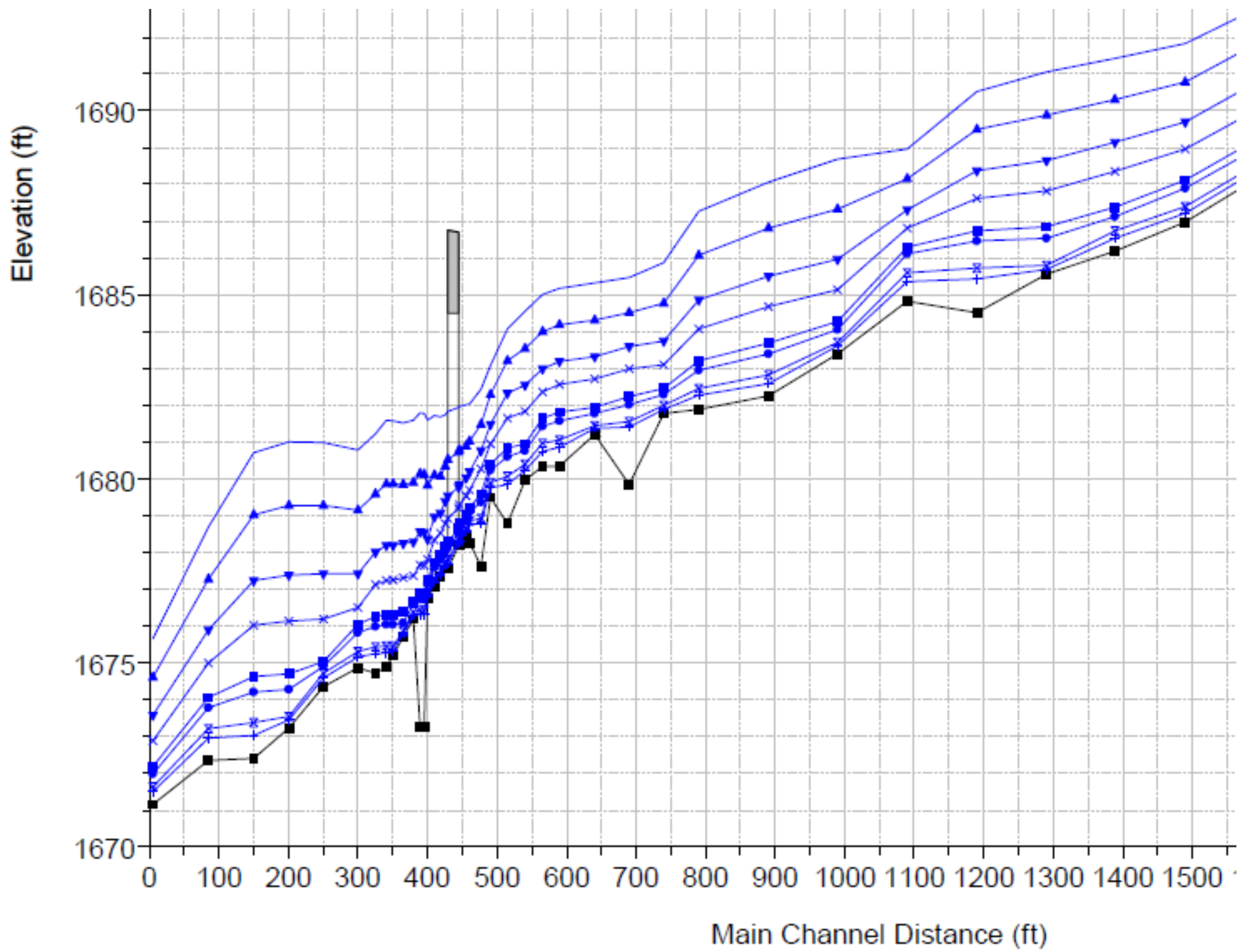

Figure 4-2. Modeled water surface elevations under proposed conditions at the Lower Crossing with the Bridge Alternative (figure is cropped inset from above, see Figure 4-1 for legend).

Table 4-1. Comparison of HEC-RAS modeled velocities at the Lower Crossing with the Bridge Alternative under existing and proposed conditions.

Flow	Existing conditions velocity (ft/s)	Proposed conditions velocity Bridge Alternative (ft/s)	Reduction in velocity (ft/s)
Juvenile Passage Low flow	2.14	1.33	**0.8**
Adult Passage Low Flow	2.85	1.84	**1.0**
High Juvenile Passage	4.31	3.20	**1.1**
2% exceedance	4.98	3.64	**1.3**
High Adult Passage	7.38	5.13	**2.3**
2-yr	11.02	6.28	**4.7**
10-yr	13.20	7.48	**5.7**
100-yr	12.07	7.10	**5.0**

4.3.2 Final 100% construction cost estimate for the Lower Crossing

Table 4-2 provides a Final 100% cost estimate for the Lower Crossing. Figure 4-3 provides the anticipated price escalation of that cost estimate for a five-year period given a ~1.9% average annual inflation rate. The assumed inflation rate is obtained from a Congressional Budget Office July 2020 release, *An Update to the Economic Outlook: 2020 to 2030*. This report presents the baseline economic forecast that the Congressional Budget Office is using as the basis for updating its budget projections for 2020 to 2030.

Table 4-2. Cost estimate for the Lower Crossing with the Bridge Alternative based on Final 100% design.

No.	Item	Unit cost	Quantity	Units	Total cost
1	Mobilization[1]	$15,000	1	LS	$15,000
2	Clearing and grubbing	$10,000	1	LS	$10,000
3	Dewatering	$10,000	1	LS	$10,000
4	Lower Crossing Upgrade—Pre-fabricated Steel Span Bridge, 40’ x 16’ x 2.5’ (LxWxH) (placed)	$100,000	1	LS	$100,000
5	Excavation[2]	$30	300	CY[3]	$9,000
6	Rock slope protection (RSP) and bankline rock (placed)	$150	60	CY[3]	$9,000
7	Engineered streambed material (ESM) (placed)	$100	75	CY[3]	$7,500
8	Large Grade Control Structure material (placed)	$150	100	CY[3]	$15,000
9	Large wood structure—placed and anchored, single log with root wad in pool	$2,500	1	Each	$2,500
10	BioBlock (installed)	$35	120	LF	$4,200
11	Compacted backfill & finished subgrade[4]	$60	300	CY[3]	$18,000
12	Road base	$3	2,500	SF	$7,500
13	Culvert disposal	$1,500	1	LS	$1,500
14	Planting	$2,000	1	LS	$2,000
15	Mulch	$500	1	LS	$500
16	Seeding	$500	1	LS	$500
17	Fence Repair	$2,500	1	LS	$2,500
18	Permits (CDFW 1602)	$5,500	1	LS	$5,500
19	Engineering - bid support, construction oversight, as-builts	$15,000	1	LS	$15,000
Total construction cost:					**$235,200**
Total construction cost plus 5% contingency:					**$246,960**

Notes:
[1] Mobilization cost assumes one mobilization effort for both crossings (i.e., $30,000 total).
[2] Value accounts for volumes required to achieve proposed grades and over-excavations needed to provide room for imported fill materials that create those finished grades.
[3] CY defines “Cubic Yards” and represent the in-situ “tight” volume of the materials in compacted form. These numbers do not account for expansion or handling of these materials.
[4] It is assumed that this material will be sourced from the beneficial onsite reuse of the excavation. Competency of this material source will be assessed and approved in the field by a California licensed civil engineer.

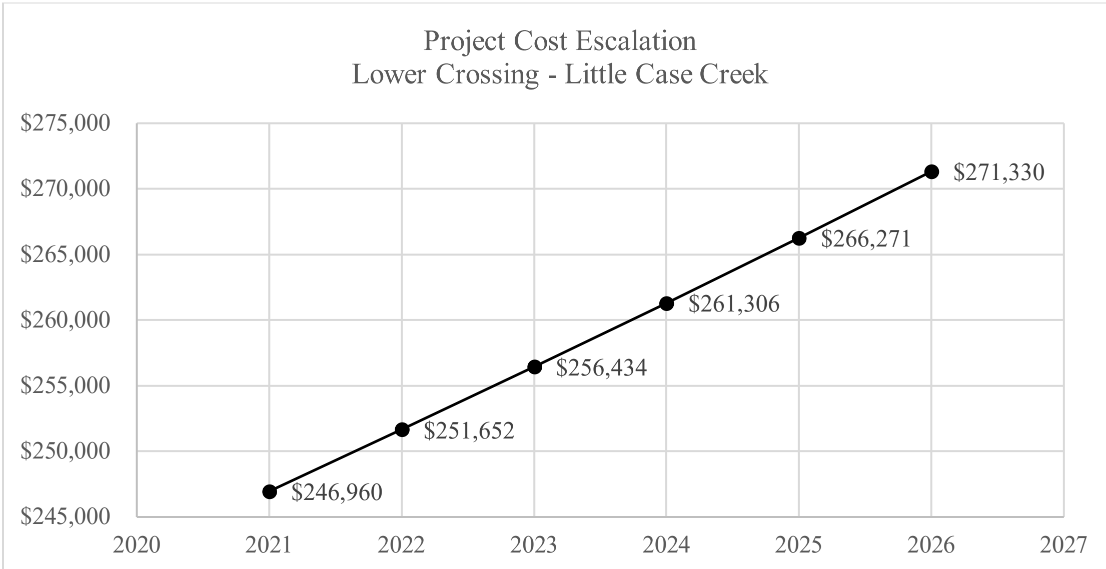

Figure 4-3. Anticipated escalation of project budget for the Lower Crossing for a five-year period assuming average inflation rate of ~1.9%.

4.4 Upper Crossing

The Final 100% design for the Upper Crossing is shown on Appendix A, Sheet 4. The proposed upgrade includes:

- Constructing a new Upper Crossing on the same road alignment with a 16-foot x 40-foot x 2.5-foot prefabricated steel span bridge (e.g., Kernen Construction prefab bridge). The designs include a roughened channel under the bridge backfilled with engineered streambed material (ESM) with coarse Rock Slope Protection (RSP) protecting the bridge abutments. Just downstream, an approximately 30-foot long by 3-foot-deep pool will dissipate energy and provide resting habitat near the middle of the roughened channel run.
- The proposed configuration will also substantially reduce the flow velocities compared to existing conditions (further described below).
- At least 3.5 feet of freeboard under the low chord of the bridge can be maintained during a 100-year flow event. Designs to include stabilization mats (further described below in Section 5.2 In Situ Soil Strength and Bridge/Box Culvert Factor of Safety) to support and protect bridge abutments.
- Bank stabilization, floodplain grading, and large wood placement downstream from the crossing to promote long-term stability and enhance aquatic/riparian habitat.

4.4.1 Proposed conditions hydraulic modeling

Comparable to the Lower Crossing, the proposed-conditions hydraulic modeling of the design described above was conducted by grading the features in AutoCAD and re-cutting cross sections in HEC-RAS. Results from the proposed conditions modeling for the Upper Crossing have already been shown in Figure 4-1. Additionally, Figure 4-4 below provides a detailed view of the Upper Crossing and the predicted water surface elevations. The velocity present under proposed conditions, as well as the reductions in flow velocity through the Upper Crossing at fish passage flows are shown in Table 4-5. Cross sections and tabulated model results for existing and proposed conditions are provided in Appendix B. The proposed conditions modeling focused on evaluating a new crossing structure that could adequately convey flood flows, bedload, debris, and large wood, as described above in Section 4.1 General Design Objectives.

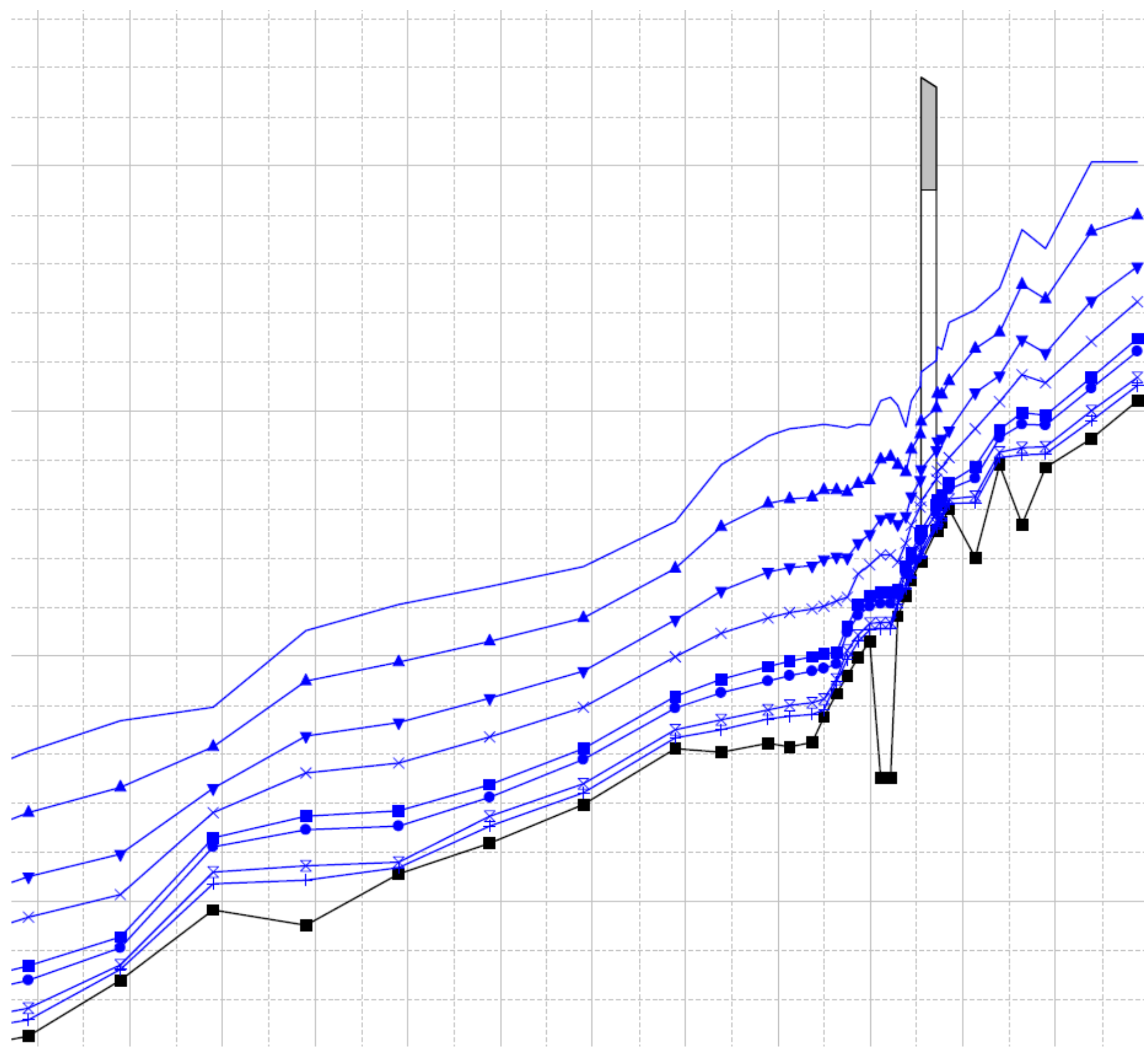

Figure 4-4. Modeled water surface elevations under proposed conditions at the Upper Crossing with a bridge (figure is cropped inset from above, see Figure 4-1 for legend).

Table 4-3. Comparison of HEC-RAS modeled velocities at the Upper Crossing with a bridge under existing and proposed conditions.

Flow	Existing conditions velocity (ft/s)	Proposed conditions velocity-Bridge (ft/s)	Reduction in velocity-Bridge (ft/s)
Juvenile Passage Low flow	2.13	1.49	0.6
Adult Passage Low Flow	2.82	2.07	0.8
High Juvenile Passage	4.23	3.36	0.9
2% exceedance	4.86	3.85	1.0
High Adult Passage	6.86	5.54	1.3
2-yr	8.99	6.62	2.4
10-yr	13.55	8.25	5.3
100-yr	14.13	9.14	5.0

4.4.2 Final 100% construction cost estimate for the Upper Crossing

Table 4-6 provides planning-level cost estimates for the Proposed conditions at the Upper Crossing for a bridge. Figure 4-5 provides the anticipated price escalation of that cost estimate for a five-year period given a ~1.9% average annual inflation rate, refer to Section 4.3.2 for further discussion.

Table 4-4. Cost estimate for the Upper Crossing with a bridge based on Final 100% design.

No.	Item	Unit Cost	Quantity	Units	Total cost
1	Mobilization[1]	$15,000	1	LS	$15,000
2	Clearing and grubbing	$10,000	1	LS	$10,000
3	Dewatering	$10,000	1	LS	$10,000
4	Upper Crossing Upgrade—Pre-fabricated Steel Span Bridge, 40’ x 16’ x 2.5’ (LxWxH) (placed)	$100,000	1	LS	$100,000
5	Excavation[2]	$30	275	CY[3]	$8,250
6	Rock slope protection (RSP) and bankline rock (placed)	$150	60	CY[3]	$9,000
7	Engineered streambed material (ESM) (placed)	$100	100	CY[3]	$10,000
8	Large Grade Control Structure material (placed)	$150	140	CY[3]	$21,000
9	Large wood structures—placed and anchored; single log with root wad in pool, four energy dissipaters with two logs each.	$4,000	7	Each	$28,000
10	Floodplain Grading and Rehabilitation	$2,500	1	LS	$2,500
11	Compacted backfill & finished subgrade[4]	$60	200	CY[3]	$12,000

No.	Item	Unit Cost	Quantity	Units	Total cost
12	BioBlock (installed)	$35	120	LF	$4,200
13	Road base	$3	500	SF	$1,500
14	Culvert disposal	$1,500	1	LS	$1,500
15	Planting	$3,000	1	LS	$3,000
16	Mulch	$500	1	LS	$500
17	Seeding	$500	1	LS	$500
18	Permits (CDFW 1602)	$5,500	1	LS	$5,500
19	Engineering - bid support, construction oversight, as-builts	$15,000	1	LS	$15,000
Total construction cost:					**$257,450**
Total construction cost plus 5% contingency:					**$270,323**

Notes:
1 Mobilization cost assumes one mobilization effort for both crossings (i.e., $30,000 total).
2 Value accounts for volumes required to achieve proposed grades and over-excavations needed to provide room for imported fill materials that create those finished grades.
3 CY defines "Cubic Yards" and represent the in-situ "tight" volume of the materials in compacted form. These numbers do not account for expansion or handling of these materials.
4 It is assumed that this material will be sourced from the beneficial onsite reuse of the excavation. Competency of this material source will be assessed and approved in the field by a California licensed civil engineer.

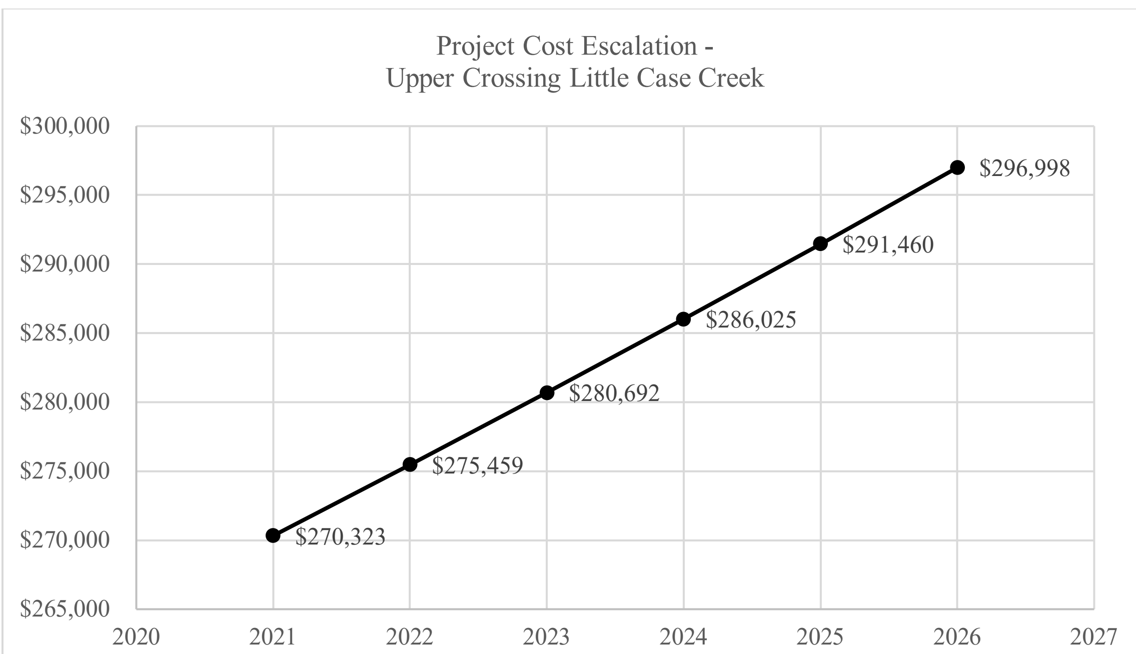

Figure 4-5. Anticipated escalation of project budget for the Upper Crossing for a five-year period assuming average inflation rate of ~1.9%.

5 FEASIBILITY, STABILITY AND RISK ASSESSMENTS

Feasibility and risk assessments were conducted to identify opportunities and constraints at the project sites, characterize existing conditions and potential risks, and to support design development consistent with project goals and appropriate risk management. The assessments were discussed with project stakeholders during the first round of review and design modifications were included in the 65% and 90% plans to address risk. The assessments focused on access and construction logistics, subsoil bearing capacity to support proposed crossing upgrade structures, and depth to bedrock. Additional revisions have been made to the 100% design plans included in Appendix A to address additional stakeholder comments.

5.1 Access and Construction Logistics

In general, there is good access and staging areas at both crossings. The primary staging area will be southwest of the Upper Crossing as shown on the Final 100% design plans.

5.2 *In Situ* Soil Strength and Bridge Factor of Safety

The *in situ* silty sand and silty gravel shallow subsoils at Crossing 2 have a presumptive vertical foundation bearing capacity of 2,500 pounds per square foot (psf), per Table 1806.2 in Chapter 18 (*Soils and Foundations*) of the 2019 California Building Code. Subsoils were characterized from onsite observations in channel cutbanks and are consistent with the geologic setting within an area of alluvial terrace deposits. Using this soil bearing capacity, factors of safety were computed for the bridge alternative at both crossings.

The prefabricated bridges would be supported by two precast concrete abutments. The bridge abutments bear 842 pounds per square foot (psf) under a dead load and 1,368 psf under a live load of an 18-wheel tractor-trailer partially supported by the bridge. This size truck is 70 to 80 feet long and only a portion of the vehicle weight would be supported by the bridge at a given time. The factor of safety calculations assumes a maximum of approximately 63% of the vehicle weight would be supported by the bridge at a given time. These dead and live loads correspond to a factor of safety of 2.54 and 1.66, respectively. The bridge abutments will be supported by relatively shallow soils, which are susceptible to settlement. To increase the factor of safety and reduce the potential for settlement, the bridge abutments are designed to be supported on stabilization mats, which consist of a multi-layered bed of well-graded crushed aggregate and two layers of geogrid (Mirafi BXG12 or equivalent), one at the base of the crushed rock and one at mid-height. The entire mat is wrapped in filter fabric to create a laterally constrained structure that will maintain its integrity while undergoing anticipated minor differential settlement. Design details are included in the Final 100% submittal. Additional bridge abutment protection measures include constructing rock slope protection (RSP) on the channel banks around the abutments.

5.3 Depth to Bedrock

There are no bedrock outcrops at the project sites and based on the underlying geology no bedrock is expected to be evident or encountered within the project vicinity. Depth to bedrock is likely greater than 20 feet, so will not be a factor during construction.

5.4 Large Wood Stability

Incorporating large wood structures into the project will expand habitat variability and increase flow dynamics that promote localized sediment mobilization and sorting. Quantitative wood stability analyses were conducted as part of this Final 100% design for all the proposed wood structures shown on the design plan set of Appendix A.

The wood stability analysis is based on the methodology presented in Castro and Sampson (2001). The constants, freebody diagram, and equations from Castro and Sampson are included in Appendix D. In summary, the analyses use a basic force balance approach in the vertical and horizontal directions to ensure that each wood structure will be stable during a specific flow regime. The calculation process begins with a sum of vertical forces to determine the boulder weight that is necessary to give each structure a factor of safety of 1.5 for buoyancy. Then based on these boulder weights, the factor of safety for momentum is calculated and more boulders are either added or enlarged as necessary to give each structure a momentum (sliding) factor of safety of 1.5 or greater.

The following is a list of assumptions that provide the basis of these calculations:

- Analysis based on 100-year flow velocity outputs from HEC-RAS existing conditions 2-D model. Velocities used are from the location of the proposed structure and range from ~4 to ~8 feet/second.
- All boulders and logs are fully submerged.
- Rootwad dimensions: 4-foot diameter x 3.5-foot length with porosity = 0.3.
- Channel bed and banks composed of medium gravel: Friction angle = 40 degrees, which results in coefficient of friction for bed of 0.84 (Castro and Sampson 2001).
- All wood is calculated as dry Douglas Fir: density = 33.7 lb/ft^3 (Castro and Sampson 2001).

There are several areas of uncertainty associated with this stability analysis; however, risks associated with log instability are minimized due to the factors of safety built into the calculations and the on-site engineering and geomorphic expertise that will guide the final layout and construction of the structures.

The structures are built along the creek banks with strong anchor points to new boulders. It is recommended that anchor boulders be keyed deeply into the channel bed and bank and that the engineer and/or geologist is onsite for construction to ensure proper installation. To further ensure the quality of anchoring, we strongly recommend that a contractor is selected that has previous experience with implementing large wood projects.

Long-term stability will be achieved by proper installation, guided by technical field oversight and the final design plans and specifications. However, large wood structures typically have a design life of approximately 20 years due to declining strength related to wood decay, so it is critical to design the project to account for this reality. There is also the possibility of faulty materials (wood or rock with insufficient strength) leading to failure of one or more of the anchoring connections. It is possible that the position of the wood structures may adjust due to scour or racking of significant new wood and debris. A minimum of ~2-feet of freeboard is anticipated below both proposed bridges.

5.5 Rock slope protection (RSP)

The bridge abutments and channel slopes at the crossings will be protected from scour with rock slope protection (RSP). The RSP will be placed at a thickness of ~2.5 feet minimum from the top edge of the stabilization mats (see Section 6.4.3 *In situ soil strength and factor of safety*) at a 1.5:1 slope down to the active channel. The RSP will extend into keyed toe trenches a minimum of 4.5 feet below the channel bed. Sizing the RSP uses the methods of USACE (1994). The channel slopes will use ¼ to ½ -ton rock and ½ to 1-ton rock in the toe trenches. The RSP will be placed in lifts with care taken to lock the angular boulders together. Void spaces will be filled with smaller rock (e.g., 6-inch) and soil with willow stakes at the upstream and downstream margins. RSP will be placed at a minimum of 2 feet thick.

5.6 Rock sizing analysis

For determining both the immobile rock size at a stable bed design flow (i.e., 100-year flow), and determining the appropriate size and depth distributions of the Engineered Streambed Material (ESM); the methods from USACE (1994), Bates et al. (2003), and CDFG (2009) were applied (Table 5-1).

Active channel margins along the extent of restored active channel will be established using stable bankline rocks from the D_{84} to D_{100} size classes. The largest rock size should consist of angular boulders approximately 18 to 44 inches in diameter, with smaller rock packed into interstitial void spaces. Additional immobile rocks from the D_{84} to D_{100} size classes can also be placed partially buried as dispersed keystone rocks within the bed to increase hydraulic variability, create micro low velocity refugia for aquatic species, and provide bank toe stability, see the plan view depictions of the crossings in Appendix A.

Similarly, applying the methods cited above, produces the size distribution of rocks appropriate for creating the Engineered Streambed Material (ESM) that fills majority of the bed substrate between the large grade control structures. The ESM should include a matrix of coarse sand and silt that composes up to 10% of the final mixture. This smaller material should be tamped, jetted, and/or flooded into place to minimize hyporheic flow. Ensuring interstitial void spaces are adequately packed with finer material is essential to maintain surface flow through the crossings. The ESM should attain an overall depth of ~2.5 feet and be placed in lifts between 0.5 and 1 feet in thickness. A small pilot low-flow channel will be constructed through the restored lengths of channel.

Table 5-1. Engineered streambed material (ESM) particle size distribution.

Size class	Size (ft)	Size (in)	Size (mm)
D_8	-	-	3
D_{16}	-	0.5	13
D_{50}	0.6	7	178
D_{84}	1.53	18.3	-
D_{100}	3.7	44	-

6 REFERENCES

Bates, K., B. Barnard, B. Heiner, J. P. Klavas, and P. D. Powers. 2003. Design of Road Culverts for Fish Passage. Washington Department of Fish and Wildlife, Olympia, Washington. http://wdfw.wa.gov/hab/engineer/cm/culvert_manual_final.pdf.

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USDA Forest Service. 2008. Stream simulation: an ecological approach to providing passage for aquatic organisms at road-stream crossings. National Technology and Development Program.

USGS (U.S. Geological Survey). 1982. Guidelines for determining flood flow frequency. Bulletin 17B of the Hydrology Subcommittee. U.S. Department of the Interior.

Waananen, A. O., and J. R. Crippen. 1977. Magnitude and frequency of floods in California. U.S. Geological Survey. Water Resources Investigation 77-21.

Appendices

Little Case Creek Fish Passage Project Tasks

Task 1: Project Management and Administration
Grant oversight including invoicing and reporting will be conducted by Grantee Executive Director and Project Manager (Staff). Upon final execution of the Grant and prior to receiving a Notice to Proceed, Grantee shall deliver the following items to the CDFW Grant Manager:
1. Request to spend project funds in order to prepare for implementation. Requests shall be sent by email or telephone.
2. Subcontractor Agreements. A written copy of the sub agreement that conforms to grant agreement requirements shall be submitted to the CDFW Grant Manager.
Deliverables: Subcontractor agreements, invoices, and invoice progress reports

Task 2. Permitting and Surveys
Archeological, biological and botanical surveys will be conducted within the project reach. Interim survey reports will be delivered to CDFW Grant Manager prior to receiving a Notice to Proceed. ERWIG will obtain building permit, 1600 permit, 401 certification and 404 permit.
Deliverables: Interim and Final Survey Reports, Mendocino County building permit, 1600 permit, 401 certification and 404 permit.

Task 3. Site Preparation
Stillwater staff and ERWIG staff will flag and stake sites for material delivery and installation, clear brush for equipment as needed, and designate staging areas for equipment, rock and wood. Excavator will be delivered by a lowboy to the staging area. Bridges will be delivered by truck. Boulders will be delivered by a dump truck along the project reach and/or staging areas. Pre-project photos and metrics will be collected. Project materials will be procured, including erosion control materials, anchoring materials, high strength epoxy, boulders and logs. To address concerns over invasive species, this project will follow the ERWIG Aquatic Invasive Species Decontamination Protocol which is in line with the CDFW Aquatic Invasive Species Decontamination Protocol.
Deliverables: Flagged Equipment Access Routes, Pre-project metrics and photos.

Task 4. Aquatic Species Relocation
Block nets will be set up and fish will be removed from the section of stream that is to be de-watered using an efisher, operated by a qualified professional. Relocated fish will be placed in suitable habitat upstream and/or downstream of the project site. Amphibians will be caught with a dip net and relocated upstream and/or downstream of the section of stream to be dewatered.
Deliverables: Fish relocation data sheet and summary report.

Task 5.1: Dewatering
General Engineering Construction contractor shall construct coffer dams upstream and downstream of each excavation site (within the fish exclusion zone) and divert all flow from upstream of the upstream dam to downstream of the downstream dam. The coffer dams may be constructed with clean river gravel or sand bags, and may be sealed with sheet plastic. The suction end of the intake pipe shall be fitted with fish screens meeting DFG and NOAA criteria to prevent entrainment or impingement of small fish. Any turbid water pumped from the work site itself to maintain it in a dewatered state shall be disposed of in an upland location where it will not drain directly into any stream channel. Sand bags and any sheet plastic shall be removed

from the stream upon project completion. Clean river gravel may be left in the stream, but the coffer dams must be breached to return the stream flow to its natural channel.
Deliverables: Dewatering data and summary report.

Task 5.2. Site Construction
With guidance from Stillwater Engineer and ERWIG staff, General Engineering Construction Contractor (TBD) will remove the existing culverts. Removal of the existing culverts and fill prism will involve excavation of approximately 575 cubic yards of material which will be used for backfill or disposed of at a legal dumpsite. Construction contractor will further excavate the stream channel to design specifications in order to prepare for bridge installation. Pre-cast concrete abutments will be set on stabilization mats and the bridge will be anchored to the abutments. Purchase rock will be used to stabilize the stream banks and will be incorporated into log and boulder structures. On-site rock and some additional imported cobble may be used for streamed material. Logs will be sourced locally and used by the construction contractor to build LW structures. A special inspections subcontractor will inspect soil compaction, welds and abutments. California Conservation Corps (CCC) will anchor log and boulder structures into place. ERWIG staff will monitor water quality as needed.
Deliverables: Two installed bridges and wood and rock structures installed as designed. Water quality monitoring data sheets.

Task 5.3: Erosion Control and Planting
Erosion control materials will be installed and mulching with rice straw and locally available native materials will take place as features are completed to avoid unforeseen surface erosion. Mulching will take place on all exposed soils which may deliver sediment to a stream. Bare soil will be seeded with native grasses. Native trees will be planted to stabilize banks and replace trees removed during project activities. See Erosion Control (Section 6.5) in the Basis of Designs for more detail.
Deliverables: At least 50 native trees (Pseudotsuga menziesii, Quercus sp. and Alnus rubra) will be planted along the project area. Native trees will be planted from December 1 to March 31.

Task 6. Post Project Photo & Data Collection
Following implementation ERWIG and Stillwater Sciences will take post-project photos and quantitative implementation metrics will be collected which satisfy the Project Annual Progress Reports and Final Report. Fish passage surveys will be conducted at low and high flows to assess passage through the bridges. A post-project longitudinal profile survey will be conducted.
Deliverables: Post-project metrics and photos, longitudinal profile, fish passage assessment.

Task 7. Reporting
ERWIG Staff will write and deliver Annual Progress Reports, and a Draft and Final Report to CDFW Grant Manager and CFPF
Deliverables: Annual reports, draft final report, final report.

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Little Case Creek Fish Passage

Monitoring and Evaluation Plan

Project Title: Little Case Fish Passage Project

Organization: Eel River Watershed Improvement Group

Prepared by: Isaac Mikus

Date: 01/04/2022

Monitoring Plan

In the winter following construction, Stillwater Sciences will evaluate both stream crossings for fish passage. Following construction, ERWIG staff will conduct a large wood count along both project sites and measure the length of habitat restored. ERWIG will also confirm that at least 50 native trees were planted. ERWIG staff will establish a permanent photo point at each site and will take pre-project and post project photos. ERWIG will complete the CFPF Fish Passage Barrier Removal Monitoring Worksheet.

Evaluation

Success of the project will be evaluated by a fish passage assessment and by habitat restored in the project reaches. See Table 1 and Table 2 for desired project outcomes and outcome indicators.

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TABLE 1. PRIMARY BENEFIT

Desired Outcome Proposed improvements to baseline/pre-implementation conditions	Restore anadromous access to one mile of Little Case Creek
Output Indicators Actions taken to achieve desired outcome	Replacement of two culverted fish passage barriers with bridges.
Outcome Indicators Target measurement that indicates the desired outcome has been achieved	Two stream crossings that pass Coho salmon at all life stages and flows.
Measurement Tools & Methods Quantitative means of measuring Outcome Indicators	Fish passage assessment
Baseline Conditions* Pre-project conditions of Outcome Indicators	Two culverts that are fish passage barriers to juvenile salmonids at all flows and adult salmonids at some flows.
Monitoring Frequency Description of how often each Outcome Indicator will be measured	Once
Monitoring Locations	Measured at the two existing crossing sites on Little Case Creek.

TABLE 2. SECONDARY BENEFIT

Desired Outcome Proposed improvements to baseline/pre-implementation conditions	Habitat restoration
Output Indicators Actions taken to achieve desired outcome	Instream placement of 9 LWD structures (logs and logs with rootwads), planting of 50 native trees
Outcome Indicators Target measurement that indicates the desired outcome has been achieved	0.2 acres of improved habitat affecting a 400-foot stream reach, 16 pieces of large wood, and 50 trees planted
Measurement Tools & Methods Quantitative means of measuring Outcome Indicators	Photographic documentation, large wood survey, planted tree count
Baseline Conditions* Pre-project conditions of Outcome Indicators	Habitat for salmonids lacks shelter and velocity refugia. An LWD survey conducted by ERWIG found 0 pieces of LWD within the Culvert #1 project reach and 1 piece of LWD within the Culvert #2 project reach.
Monitoring Frequency Description of how often each Outcome Indicator will be measured	Once
Monitoring Locations	Measured along the restored section of the project sites.

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Performance Measures and Metrics

Project Objective	Performance Measure	Monitoring Metrics
Objective 1. Remove two barriers to salmonid migration.	Two culverts will be removed and replaced by bridges which will restore fish passage at all life stages to one mile of habitat.	Fish passage assessment
Objective 2. Improve salmonid habitat by installing fish habitat structures.	Nine fish habitat structures will be built with 16 logs, restoring at least 400 feet and 0.2 acres of stream channel.	Pre and post photos, length of channel restored, habitat structure count.

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I ... ...MENT GROUP

LANDOWNER ACCESS AGREEMENT

Little Case Creek Fish Passage Project

I. PURPOSE

The following agreement details requirements of both the landowner and Eel River Watershed Improvement Group (ERWIG) regarding establishment of a stream habitat improvement project on real property controlled by the landowner named below. Said property is located on Little Case Creek, on Parcel APN #01439079.

Mike Fitch, hereinafter called "landowner", is aware that a stream habitat restoration project has been proposed through the CDFW Fisheries Restoration Grants Program. The project has been explained to the landowner by the grantee and the landowner understands the objectives of the project and supports the goals of the project. If funded, the landowner will enter into a project specific access agreement that will include access for CDFW to conduct oversight and project visitation.

II. ACCESS PERMISSION

Landowner hereby grants Eel River Watershed Improvement Group, California Department of Fish and Wildlife representatives, National Oceanic and Atmospheric Administration fisheries staff and ERWIG subcontractors permission to enter onto real property owned by the landowner to perform pre-project evaluations. Access shall be limited to those portions of landowner's real property where actual stream restoration work is to be performed and those additional portions of the real property which must be traversed to gain access to the work site. ERWIG, CDFW, NOAA and ERWIG subcontractors will follow all conditions set forth by the property owner.

III. DURATION OF NOTICE

The term of this agreement shall be April 15, 2021 – April 15, 2022. This is provided that Eel River Watershed Improvement Group or the California Department of Fish and Wildlife shall give landowner reasonable actual notice and any necessary arrangements are made prior to each needed access. Reasonable and actual notice may be given by mail, in person, email, or by telephone.

This agreement can be amended only by prior written agreement of both parties executing this permit.

IV. LIABILITIES

Reasonable precautions will be exercised by Eel River Watershed Improvement Group to avoid damage to persons and property. Eel River Watershed Improvement Group agrees to indemnify and hold harmless the landowner and agrees to pay for reasonable damages proximately caused by reason of the uses authorized by this permit, except those caused by the gross negligence or intentional conduct of the landowner. Eel River Watershed Improvement Group will shall maintain general liability insurance with limits of not less than $1,000,000 per occurrence and $1,000,000 in aggregate.

Michael E. Fitch   Michael E. Fitch   3/31/21

Landowner Signature   Print Name
Date

Isaac Mi

Isaac Mikus   3/30/21

Grantee (ERWIG) Signature   Print Name
Date

EEL RIVER WATERSHED
IMPROVEMENT GROUP

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LANDOWNER ACCESS AGREEMENT

Little Case Creek Fish Passage Project

I. PURPOSE

The following agreement details requirements of both the landowner and Eel River Watershed Improvement Group (ERWIG) regarding establishment of a stream habitat improvement project on real property controlled by the landowner named below. Said property is located on Little Case Creek, on Parcel APN #01439073.

Timothy Huff, hereinafter called "landowner", is aware that a stream habitat restoration project has been proposed through the CDFW Fisheries Restoration Grants Program. The project has been explained to the landowner by the grantee and the landowner understands the objectives of the project and supports the goals of the project. If funded, the landowner will enter into a project specific access agreement that will include access for CDFW to conduct oversight and project visitation.

II. ACCESS PERMISSION

Landowner hereby grants Eel River Watershed Improvement Group, California Department of Fish and Wildlife representatives, National Oceanic and Atmospheric Administration fisheries staff and ERWIG subcontractors permission to enter onto real property owned by the landowner to perform pre-project evaluations. Access shall be limited to those portions of landowner's real property where actual stream restoration work is to be performed and those additional portions of the real property which must be traversed to gain access to the work site. ERWIG, CDFW, NOAA and ERWIG subcontractors will follow all conditions set forth by the property owner.

III. DURATION OF NOTICE

The term of this agreement shall be April 15, 2021 – April 15, 2022 for project evaluation. This is provided that Eel River Watershed Improvement Group or the California Department of Fish and Wildlife shall give landowner reasonable actual notice and any necessary arrangements are made prior to each needed access. Reasonable and actual notice may be given in person, or by telephone (707) 984-6140.

This agreement can be amended only by prior written agreement of both parties executing this permit.

IV. LIABILITIES

Reasonable precautions will be exercised by Eel River Watershed Improvement Group to avoid damage to persons and property. Eel River Watershed Improvement Group agrees to indemnify and hold harmless the landowner and agrees to pay for reasonable damages proximately caused by reason of the uses authorized by this permit, except those caused by the gross negligence or intentional conduct of the landowner. Eel River Watershed Improvement Group will shall maintain general liability insurance with limits of not less than $1,000,000 per occurrence and $1,000,000 in aggregate.

Timothy G. Huff 4/1/2021
Landowner Signature

3/30/2021
Eel River Watershed Improvement Group

EEL RIVER WATERSHED
IMPROVEMENT GROUP

1500 Alamar Way
Fortuna, CA 95540
(707) 845-8119
isaac@erwig.org

LANDOWNER ACCESS AGREEMENT

Little Case Two Barrier Removal Project

I. PURPOSE

The following agreement details requirements of both the landowner and Eel River Watershed Improvement Group (ERWIG) regarding establishment of a stream habitat improvement project on real property controlled by the landowner named below. Said property is located on Little Case Creek, on Parcel APN #01439074

Breck Smith, hereinafter called "landowner", is aware that a stream habitat restoration project has been funded through the CDFW Fisheries Restoration Grants Program. The project has been explained to the landowner by the grantee and the landowner understands the objectives of the project and supports the goals of the project.

II. ACCESS PERMISSION

Landowner hereby grants Eel River Watershed Improvement Group, California Department of Fish and Wildlife representatives, and ERWIG subcontractors permission to enter onto real property owned by the landowner to perform pre-project evaluations, project implementation, and conduct project inspections. Access shall be limited to those portions of landowner's real property where actual stream restoration work is to be performed and those additional portions of the real property which must be traversed to gain access to the work site. ERWIG, CDFW and ERWIG subcontractors will follow all conditions set forth by the property owner. Data collected for this project can be shared with the grantor (CDFW).

III. DURATION OF NOTICE

The term of this agreement shall be May 1, 2020 – March 31, 2022 for project preparation and project implementation. This is provided that Eel River Watershed Improvement Group or the California Department of Fish and Wildlife shall give landowner reasonable actual notice and any necessary arrangements are made prior to each needed access. Reasonable and actual notice may be given by mail, in person, email, or by telephone.

This agreement can be amended only by prior written agreement of both parties executing this permit.

IV. LIABILITIES

Reasonable precautions will be exercised by Eel River Watershed Improvement Group to avoid damage to persons and property. Eel River Watershed Improvement Group agrees to indemnify and hold harmless the landowner and agrees to pay for reasonable damages proximately caused by reason of the uses authorized by this permit, except those caused by the gross negligence or intentional conduct of the landowner. Eel River Watershed Improvement Group will shall maintain general liability insurance with limits of not less than $1,000,000 per occurrence and $1,000,000 in aggregate.

[signature]	Wm. Breck. Smith	4/10/2020
Landowner Signature	Print Name and Phone #	Date
[signature]	Isaac Mikus	4/10/20
Grantee (ERWIG) Signature	Print Name	Date

LITTLE CASE CREEK BARRIER REMOVAL AND FISH PASSAGE DESIGN PROJECT - 100% FINAL DESIGN
MENDOCINO COUNTY, CA

PROJECT PROPONENT:
EEL RIVER WATERSHED IMPROVEMENT GROUP (ERWIG)
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AGENT:
JOEL MONSCHKE PE
STILLWATER SCIENCES
850 G STREET, SUITE K
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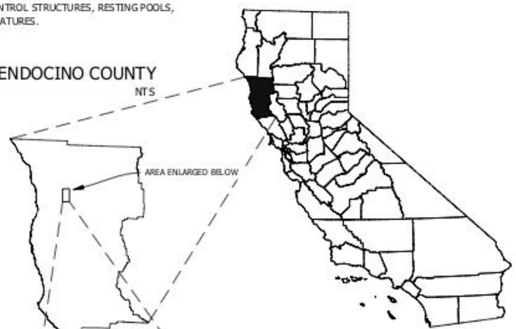
PROJECT FUNDED BY:
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE'S FISHERIES RESTORATION GRANTS PROGRAM

LITTLE CASE GRANT AGREEMENT
#Q1910526

PROJECT DESCRIPTION:

REPLACEMENT OF TWO CROSSINGS ON LITTLE CASE CREEK. CURRENTLY BOTH EXISTING CULVERTED CROSSINGS PRESENT A BARRIER TO SALMONIDS. PROPOSED CROSSING UPGRADES INCLUDE TWO PREFABRICATED CONCRETE AND STEEL SPAN BRIDGES (40Lx16Wx2.5D). STREAM CONVEYANCE CHANNELS BENEATH THE BRIDGES IS PROPOSED TO BE RESTORED AND REBUILT TO INCLUDE ROUGHENED CHANNELS, LARGE GRADE CONTROL STRUCTURES, RESTING POOLS, AND LARGE WOODY DEBRIS HABITAT ENHANCEMENT FEATURES.

MENDOCINO COUNTY
NTS



CALIFORNIA MAP
NTS

SYMBOL AND ABBREVIATION KEY:

1 / 12 — DETAIL NUMBER / SHEET NUMBER

<P> = PROPOSED
<E> = EXISTING

EARTHWORK ESTIMATES:

CUT/FILL:
575 CY BALANCED ONSITE

IMPORT:
175 CY ENGINEERED STREAMBED MATERIAL
40 CY ROAD BASE GRAVEL
360 ½ TO 2 TON BOULDER FOR RSP AND GRADE CONTROL
240 LF BIOBLOCK

LARGE WOOD:
16 PIECES OF LARGE WOOD UTILIZED IN DESIGN

CROSSING UPGRADE:
2 PRE-FABRICATED STEEL SPAN BRIDGES (40'x16'x2.5' LxWxH)

SHEET LIST TABLE

SHEET NUMBER	SHEET TITLE
1	TITLE SHEET
2	PROJECT OVERVIEW
3	LOWER CROSSING - PLAN & PROFILE
4	UPPER CROSSING - PLAN AND PROFILE
5	TYPICAL CROSS SECTIONS
6	VEHICLE CLEARANCES - LOWER CROSSING
7	DEWATERING & MATERIAL HANDLING
8	CIVIL & DEWATERING DETAILS
9	CIVIL & DEWATERING DETAILS
10	PLANTING PLAN & LWD TABLE

GENERAL PROJECT AND GRADING NOTES:

1. **DESIGN INTENT.** THESE DRAWINGS REPRESENT THE GENERAL DESIGN INTENT TO BE IMPLEMENTED AND CONTRACTOR IS RESPONSIBLE FOR ALL ITEMS SHOWN ON THESE PLANS. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE ENGINEER FOR ANY CLARIFICATIONS OR FURTHER DETAILS NECESSARY TO ACCOMMODATE ACTUAL SITE CONDITIONS. ANY DEVIATION FROM THESE PLANS WITHOUT THE LANDOWNER AND ENGINEER'S APPROVAL ARE AT THE CONTRACTOR'S OWN RISK AND EXPENSE. NOTIFY ENGINEER IMMEDIATELY OF ANY UNEXPECTED AND CHANGED CONDITIONS, SAFETY HAZARDS, AND ENVIRONMENTAL PROBLEMS ENCOUNTERED.
2. **JOB SITE CONDITIONS AND CONTRACTOR RESPONSIBILITY.** CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR SITE CONDITIONS DURING THE COURSE OF THE CONSTRUCTION OF THIS PROJECT, INCLUDING THE SAFETY OF ALL PERSONS AND PROPERTY, AND ALL ENVIRONMENTAL PROTECTION ELEMENTS, WHETHER SHOWN ON THESE DRAWINGS OR NOT. CONTRACTOR SHALL FOLLOW ALL APPLICABLE CONSTRUCTION AND SAFETY REGULATIONS. THESE REQUIREMENTS SHALL APPLY CONTINUOUSLY AND WILL NOT BE LIMITED TO NORMAL WORKING HOURS. THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE LANDOWNER AND ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPT FROM LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE LANDOWNER OR ENGINEER.
3. **DAMAGE.** CONTRACTOR SHALL EXERCISE CARE TO AVOID DAMAGE TO EXISTING PUBLIC AND PRIVATE PROPERTY, INCLUDING NATIVE TREES AND SHRUBS, AND OTHER PROPERTY IMPROVEMENTS. IF CONTRACTOR CAUSES DAMAGES TO SUCH ITEMS, HE SHALL BE RESPONSIBLE FOR REPAIR OR REPLACEMENT IN LIKE NUMBER, KIND, CONDITION, AND SIZE. ANY SUCH COST MAY BE DEDUCTED BY OWNER FROM MONIES DUE CONTRACTOR UNDER THIS CONTRACT.
4. **SOILS REPORT.** ALL CONSTRUCTION ACTIVITIES SHALL BE CONDUCTED IN ACCORDANCE WITH THE SOILS REPORT PREPARED FOR THIS PROPERTY.
5. **LIMITS OF WORK, ACCESS, STAGING AND MOBILIZATION AREAS.** EXACT LIMITS OF WORK, POINTS OF INGRESS-EGRESS, MOBILIZATION, STAGING, AND WORK AREAS WILL BE IDENTIFIED IN THE FIELD BY THE LANDOWNER AND/OR ENGINEER.
6. **EARTHWORK QUANTITIES.** CONTRACTOR IS RESPONSIBLE FOR ALL EARTHWORK, INCLUDING GRADING, PROVISION AND PLACEMENT OF ROCK MEETING SIZE LIMITS, AS SHOWN ON DRAWINGS, AND DISPOSAL OF ALL EXCESS SOIL AND RUBBLE. EARTHWORK QUANTITIES, INCLUDING GRADING, PLACED ROCK RIP-RAP QUANTITY ESTIMATES PROVIDED BY THE ENGINEER ARE ESTIMATES ONLY. LANDOWNER AND ENGINEER DO NOT, EXPRESSLY OR OTHERWISE BY IMPLICATION, EXTEND ANY WARRANTY TO EARTHWORK CALCULATIONS.
7. AREAS TO BE GRADED SHALL BE CLEARED OF ALL VEGETATION INCLUDING ROOTS AND OTHER UNSUITABLE MATERIAL FOR A STRUCTURAL FILL, THEN SCARIFIED TO A DEPTH OF 6 INCHES PRIOR TO PLACING OF ANY FILL.
8. AREAS WITH EXISTING SLOPES WHICH ARE TO RECEIVE FILL MATERIAL SHALL BE KEYED AND BENCHED.
9. FILL MATERIAL SHALL BE SPREAD IN LIFTS NOT EXCEEDING 12 INCHES IN COMPACTED THICKNESS, MOISTENED OR DRIED AS NECESSARY TO NEAR OPTIMUM MOISTURE CONTENT AND COMPACTED BY AN APPROVED METHOD. FILL MATERIAL SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DENSITY AS DETERMINED BY 1957 ASTM D - 1557 - 91 MODIFIED PROCTOR (AASHO) TEST OR SIMILAR APPROVED METHODS.
10. CUT AND FILL SLOPES SHALL NOT EXCEED A GRADE OF 2 HORIZONTAL TO 1 VERTICAL EXCEPT WHEN SHOWN ON PLANS. ALL DISTURBED GROUND SHALL BE PLANTED WITH NATIVE GRASS SEED AND MULCHED.
11. BEST MANAGEMENT PRACTICES FOR CONSTRUCTION ACTIVITIES: ERODED SEDIMENTS AND OTHER POLLUTANTS MUST BE RETAINED ONSITE AND MAY NOT BE TRANSPORTED FROM THE SITE VIA SHEET FLOW, SWALES, AREA DRAINS, NATURAL DRAINAGE COURSES, OR WIND. STOCKPILES OF EARTH AND OTHER CONSTRUCTION RELATED MATERIALS MUST BE PROTECTED FROM BEING TRANSPORTED FROM THE SITE BY THE FORCES OF WIND OR WATER. FUELS, OILS, SOLVENTS, AND OTHER TOXIC MATERIALS MUST BE STORED IN ACCORDANCE WITH THEIR LISTING AND ARE NOT TO CONTAMINATE THE SOIL AND SURFACE WATERS. ALL APPROVED STORAGE CONTAINERS ARE TO BE PROTECTED FROM THE WEATHER. SPILLS MAY NOT BE WASHED INTO THE DRAINAGE SYSTEM. EXCESS OR WASTE CONCRETE MAY NOT BE WASHED INTO PUBLIC WAY OR ANY OTHER DRAINAGE SYSTEM. TRASH AND CONSTRUCTION RELATED SOLID WASTE MUST BE DEPOSITED INTO A COVERED WASTE RECEPTACLE TO PREVENT CONTAMINATION OF RAINWATER AND DISPERSAL BY WIND. SEDIMENTS AND OTHER MATERIAL MAY NOT BE TRACKED FROM TO THE SITE BY VEHICLE TRAFFIC.

LITTLE CASE CREEK BARRIER REMOVAL AND FISH PASSAGE DESIGN PROJECT
Laytonville, Mendocino Cnty., CA

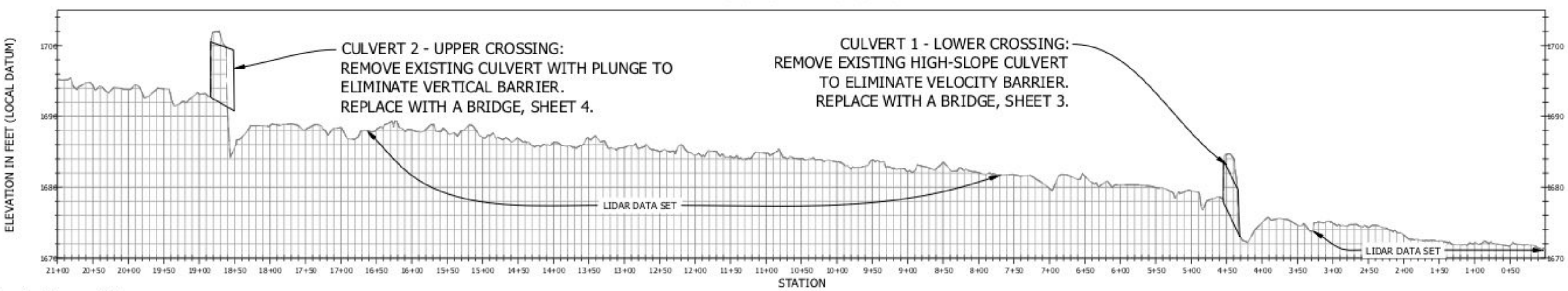
Stillwater Sciences
850 G STREET SUITE K
ARCATA, CA 95521 P: (707) 822-9607

PROJECT NUMBER: 875.00
SCALE: AS NOTED
DATE: 3/31/21

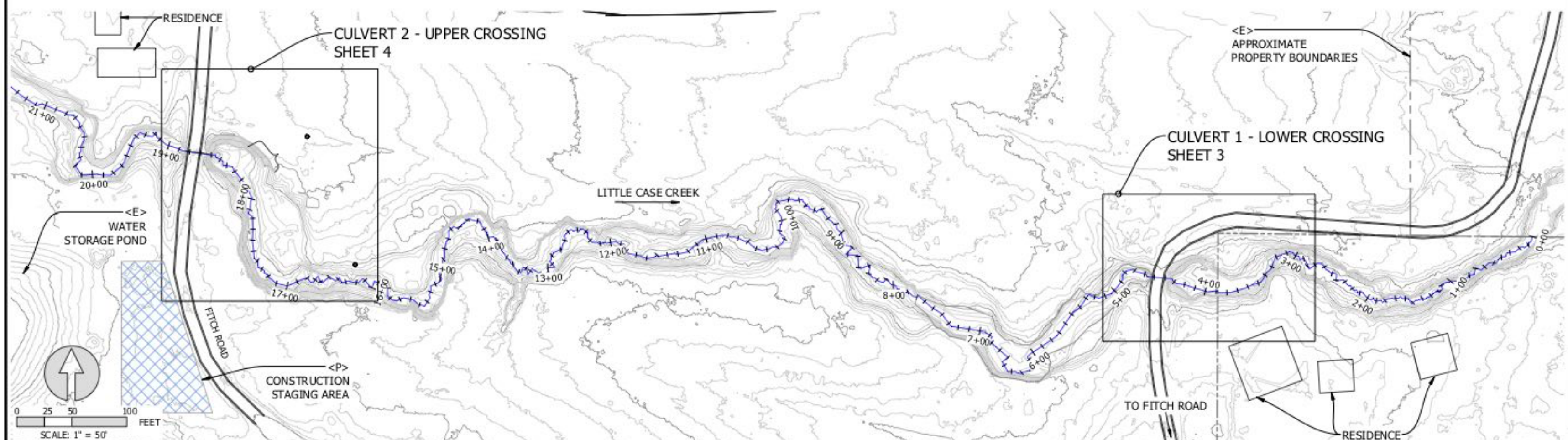
DESIGN: JM/BW
DRAWN: BW/HG
CHECKED: JM
APPROVED: JM

TITLE SHEET

LITTLE CASE CREEK - LONG PROFILE



0 40 80 160 FEET
SCALE: 1" = 80'
VERTICAL EXAGGERATION OF 10.



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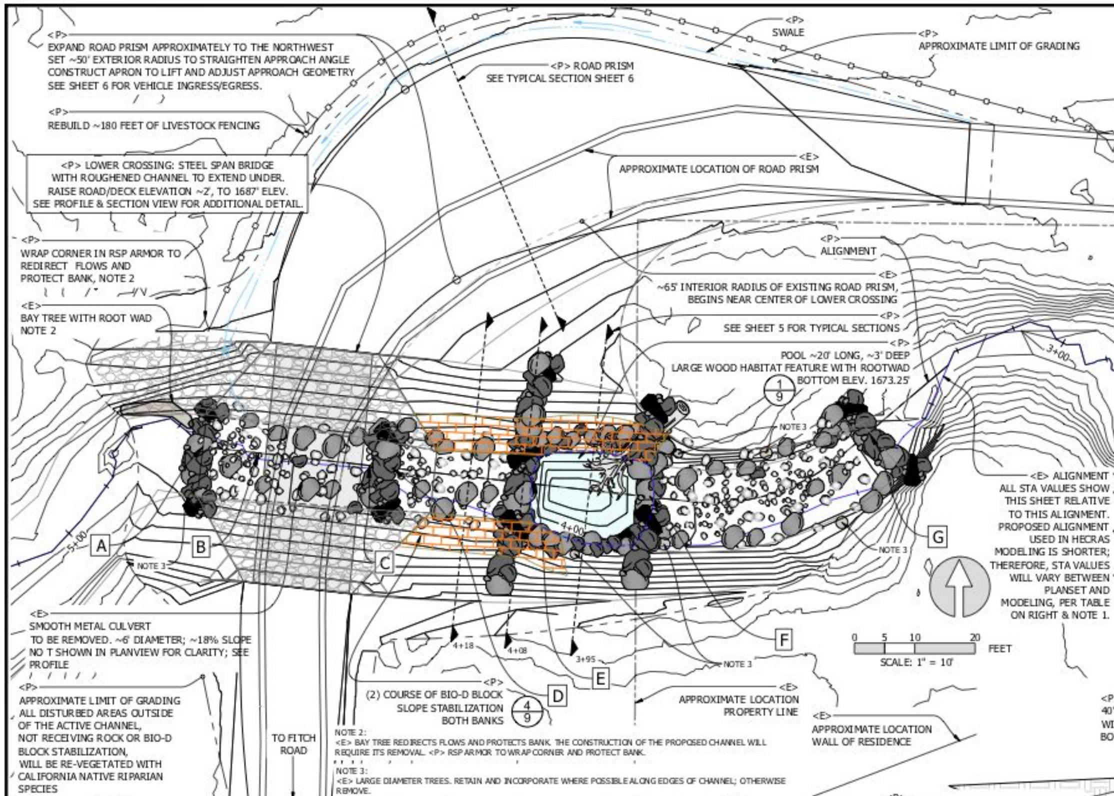
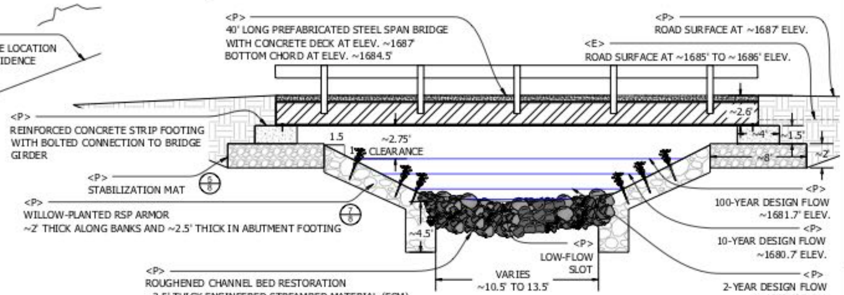
OVERVIEW SHEET

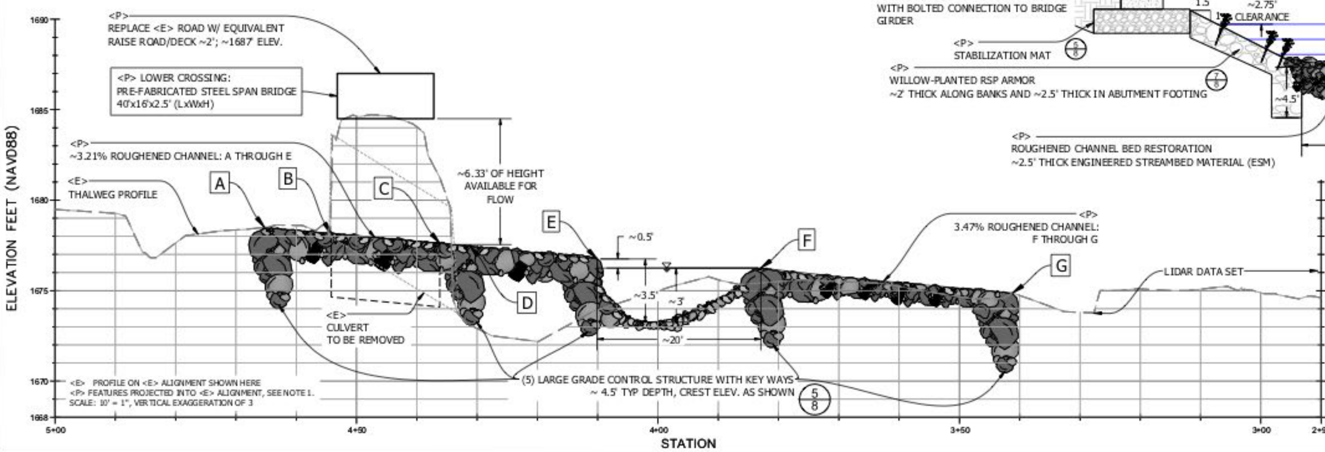
SHEET 2 OF 10



SYMBOL	FEATURE	<P> ELEVATION (NAVD88 FEET)	STA VALUE ON <E> ALIGNMENT	STA VALUE ON <P> ALIGNMENT	<P> SLOPE PRESENT AFTER CONSTRUCTION
A	GRADE CONTROL CREST - UPSTREAM MATCH EXISTING	1,678.50	4+65.25	4+55	N/A - EXISTING UPSTREAM CHANNEL SLOPE
B	CULVERT INLET/CHANNEL BED BELOW UPSTREAM BRIDGE DECK EDGE	1,678.19	4+55.32	4+48	
C	CULVERT OUTLET/CHANNEL BED BELOW DOWNSTREAM BRIDGE DECK EDGE	1,677.62	4+37.05	4+30	3.21%
D	GRADE CONTROL CREST - ~5' DOWNSTREAM OF OUTLET/BRIDGE DECK	1,677.47	4+32.63	4+25	
E	GRADE CONTROL CREST - POOL INLET	1,676.75	4+07.08	4+00	
F	GRADE CONTROL CREST - POOL OUTLET	1,676.25	3+86.14	3+80	2.38%
G	GRADE CONTROL CREST - DOWNSTREAM MATCH EXISTING	1,674.90	3+41.00	3+41	3.47%

NOTE 1:
THE <P> ALIGNMENT IS SHORTER THAN THE <E> ALIGNMENT. FEATURES ARE PROJECTED INTO <E> THALWEG ALIGNMENT IN PROFILE VIEW. SLOPES AND HORIZONTAL POSITION OF <P> FEATURES MAY NOT SCALE CORRECTLY.
ANNOTATION OF <P> FEATURES SUPERSEDE ANY DEPICTION OF <P> FEATURES.





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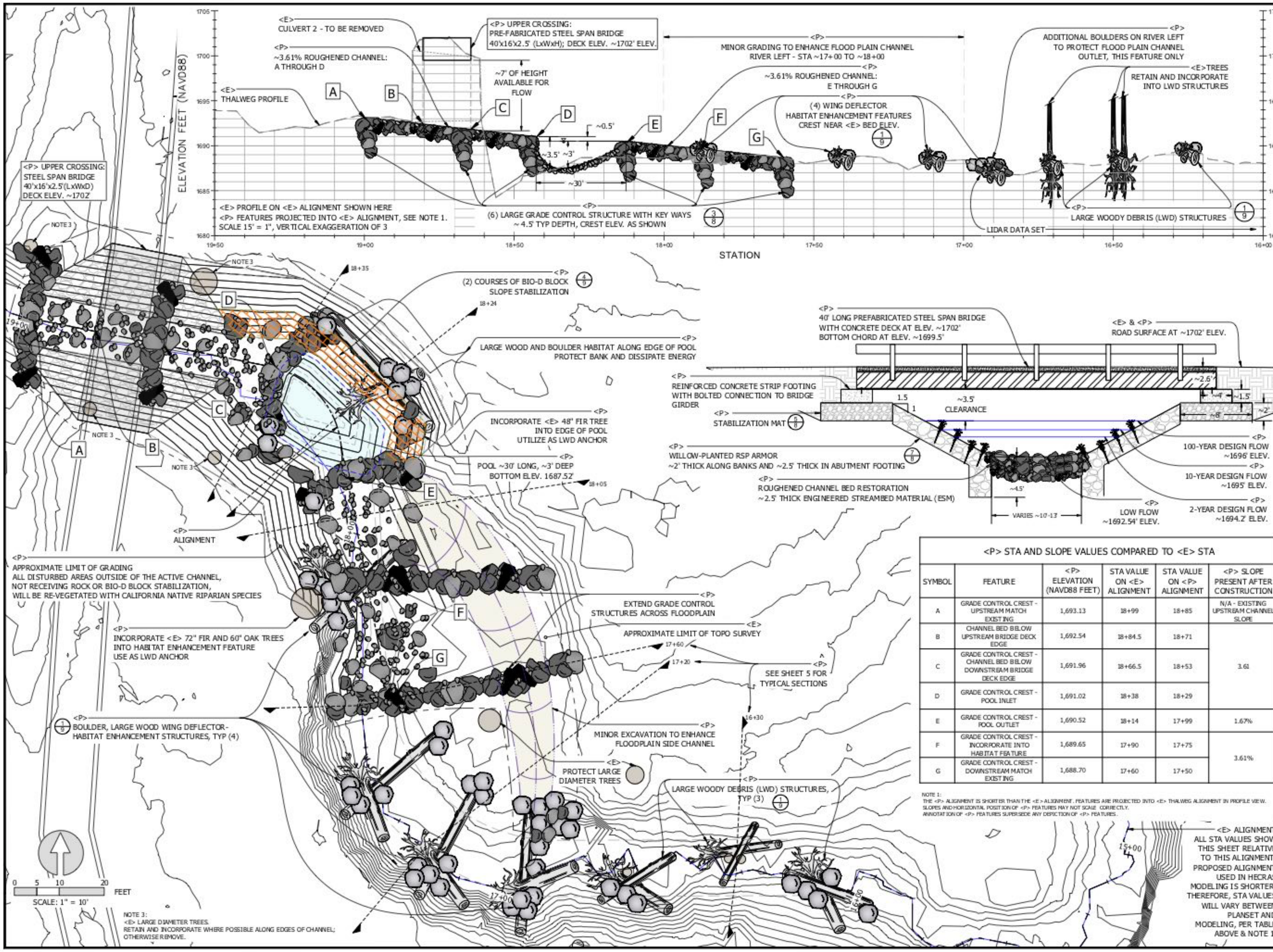
LOWER CROSSING PLAN AND PROFILE

SHEET 3 OF 10



<P> STA AND SLOPE VALUES COMPARED TO <E> STA

SYMBOL	FEATURE	<P> ELEVATION (NAVD88 FEET)	STA VALUE ON <E> ALIGNMENT	STA VALUE ON <P> ALIGNMENT	<P> SLOPE PRESENT AFTER CONSTRUCTION
A	GRADE CONTROL CREST - UPSTREAM MATCH EXISTING	1,693.13	18+99	18+85	N/A - EXISTING UPSTREAM CHANNEL SLOPE
B	CHANNEL BED BELOW UPSTREAM BRIDGE DECK EDGE	1,692.54	18+84.5	18+71	3.61
C	GRADE CONTROL CREST - CHANNEL BED BELOW DOWNSTREAM BRIDGE DECK EDGE	1,691.96	18+66.5	18+53	
D	GRADE CONTROL CREST - POOL INLET	1,691.02	18+38	18+29	
E	GRADE CONTROL CREST - POOL OUTLET	1,690.52	18+14	17+99	1.67%
F	GRADE CONTROL CREST - INCORPORATE INTO HABITAT FEATURE	1,689.65	17+90	17+75	3.61%
G	GRADE CONTROL CREST - DOWNSTREAM MATCH EXISTING	1,688.70	17+60	17+50	

NOTE 1:
THE <P> ALIGNMENT IS SHORTER THAN THE <E> ALIGNMENT. FEATURES ARE PROJECTED INTO <E> THALWEG ALIGNMENT IN PROFILE VIEW. SLOPES AND HORIZONTAL POSITION OF <P> FEATURES MAY NOT SCALE CORRECTLY. ANNOTATION OF <P> FEATURES SUPERSEDE ANY DEPICTION OF <P> FEATURES.

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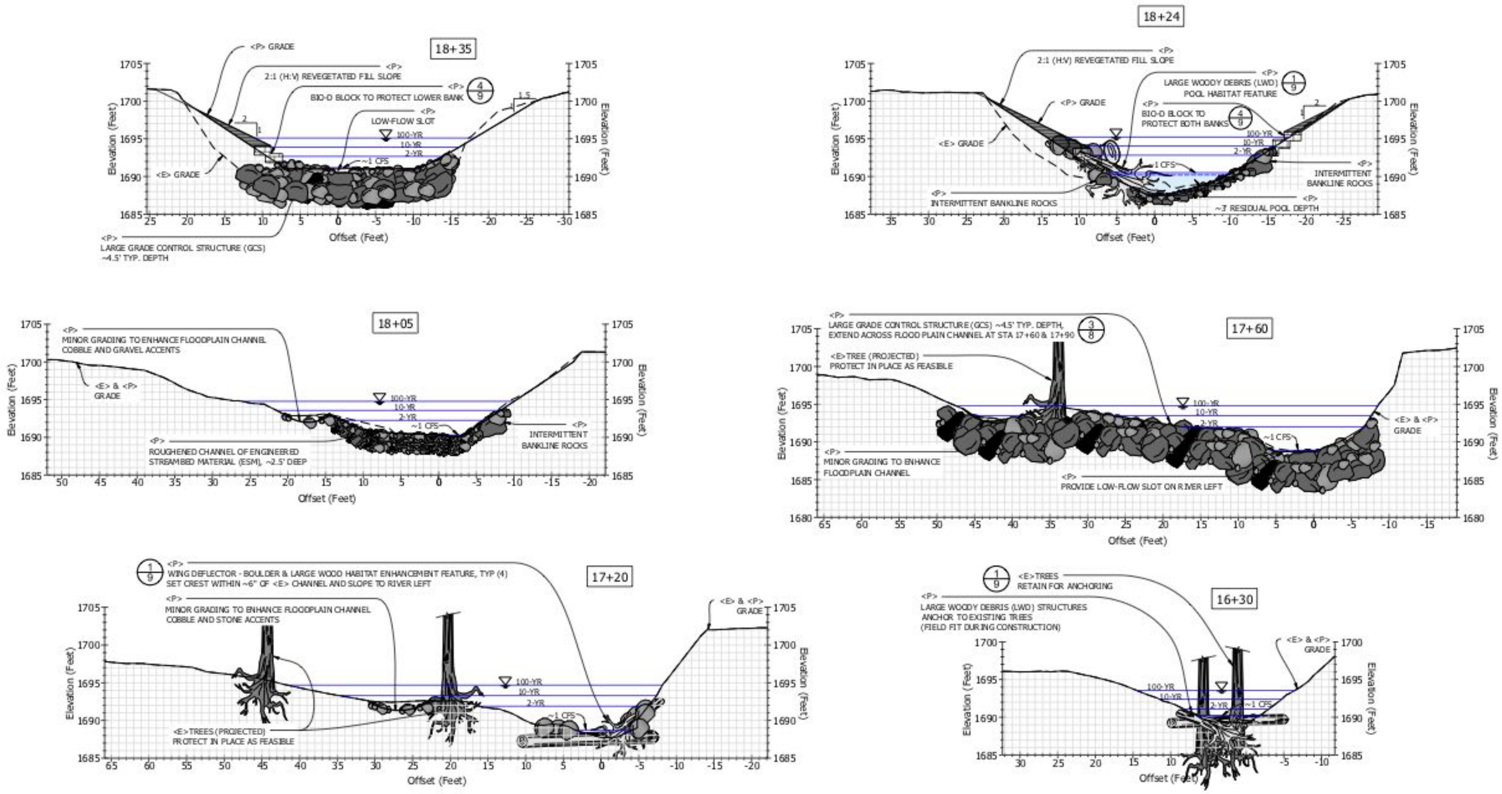
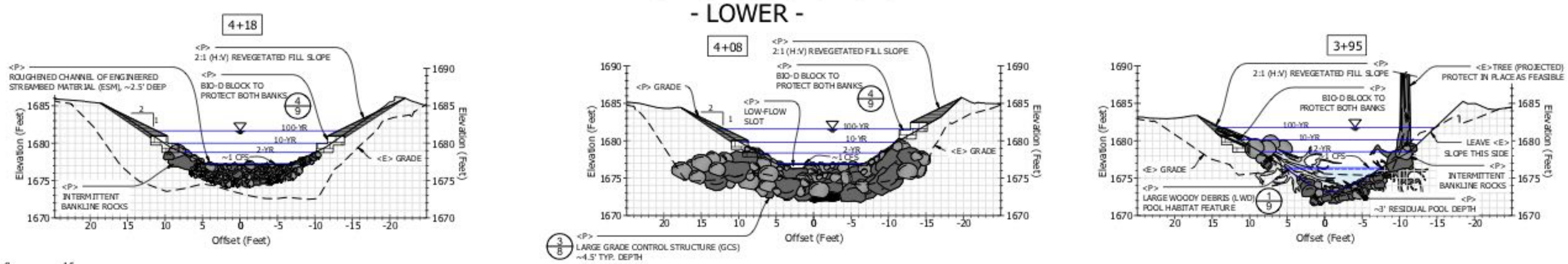
UPPER CROSSING PLAN AND PROFILE

TYPICAL CROSS-SECTIONS
- UPPER -



TYPICAL CROSS-SECTIONS
- LOWER -



0 4 8 16 FEET
SCALE: 1" = 8'

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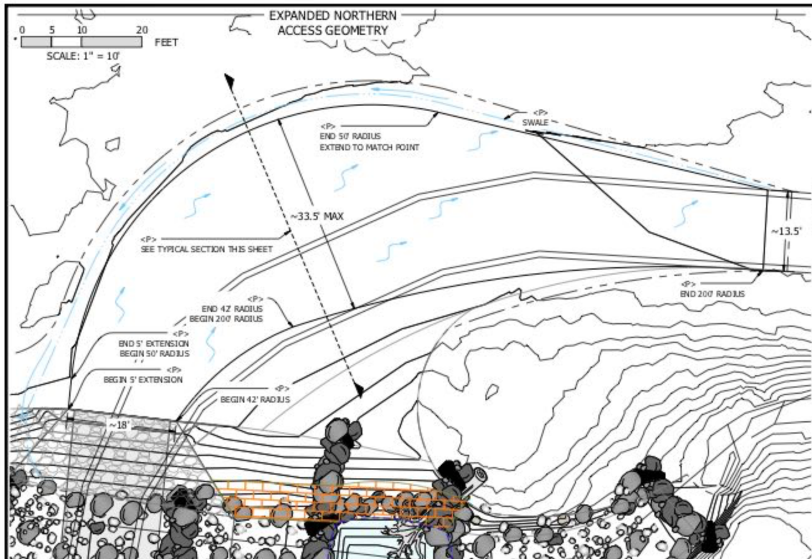
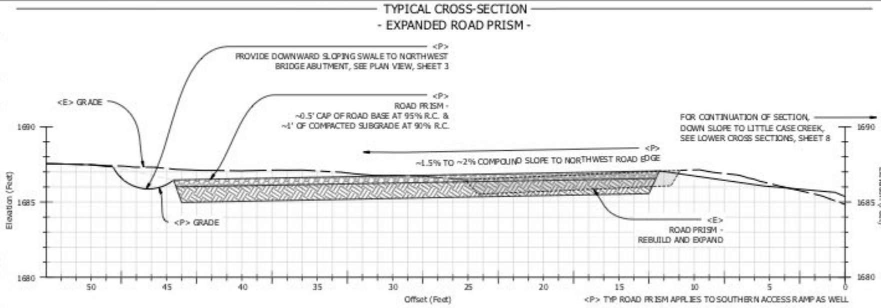
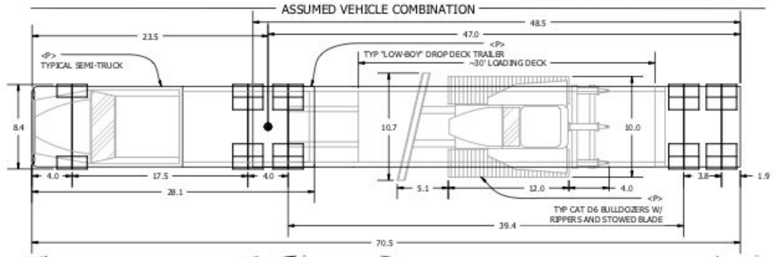
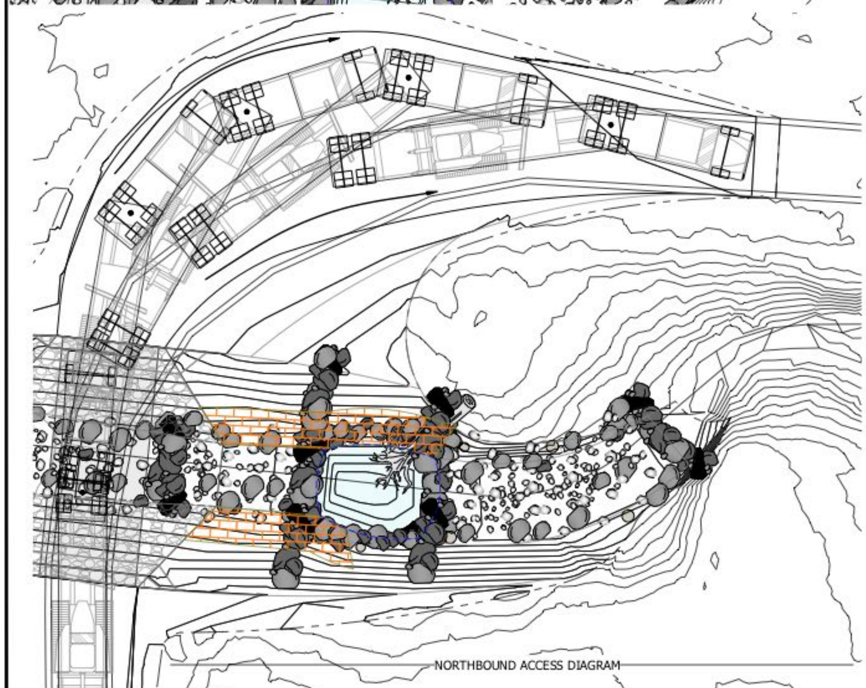
TYPICAL CROSS SECTIONS

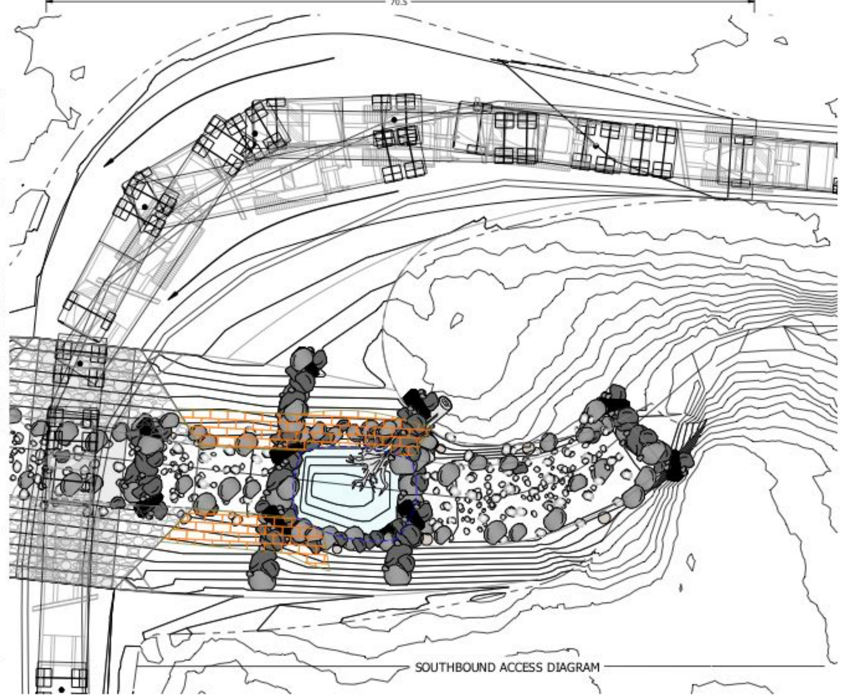
SHEET 5 OF 10











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VEHICLE CLEARANCES

DEWATERING NOTES:

THE DEPICTIONS OF PUMP POINTS AND TRANSFER LINES ON THIS SHEET ARE SCHEMATIC AND NOT INTENDED TO BE PRESCRIPTIVE. PUMP INLET AND OUTLET LOCATIONS WILL VARY AS WORK PROGRESSES; HOWEVER, ALL CONFIGURATIONS DESCRIBED TO BE WITNESSED AND APPROVED BY THE FIELD ENGINEER PRIOR TO IMPLEMENTATION.

1 SUMP/PUMP INTAKE FOR DEWATERING EXCAVATIONS WILL BE RELOCATED AS NEEDED TO SUIT FIELD CONDITIONS AND PROGRESSION OF WORK. IT IS PRESENTED HERE AT THE LOW POINT FOR EACH PROJECT AREA. THIS IS A SCHEMATIC REPRESENTION, CONFIGURE TO SUIT.

2 DEPICTION OF HOSE CONFIGURATIONS ARE SCHEMATIC AND NOT A PRESCRIBED ROUTE; ALL DEWATERING ELEMENTS WILL BE RELOCATED TO SUIT FIELD CONDITIONS AND PROGRESSION OF WORK.

3 PROVIDE PROTECTION TO PIPING THAT IS REQUIRED TO TRAVERSE VEHICLE PATHS.

4 INTERCEPT ALL INCOMING CREEK FLOWS, AS PRESENT, BY IMPOUNDING BEHIND TEMPORARY DAM. PLACE AN ADEQUATELY FINE MESH SCREEN OVER THE CULVERT INLET UPSTREAM TO PROTECT AQUATIC SPECIES FROM THE TRANSFER PUMP; LEAVE IN PLACE FOR DURATION OF DIVERSION ACTIVITIES (SEE DEWATERING DETAIL 1, SHEET 8).

5 CLEAN CREEK WATER IMPOUNDED AND INTERCEPTED BEHIND TEMPORARY BLOCKAGE TO BE PUMPED AROUND THE PROJECT EXTENT AND RELEASED BACK INTO LITTLE CASE CREEK DOWNSTREAM OF WORK. PUMP SIZE TO BE DETERMINED BASED ON QUANTITY OF FLOW PRESENT AT TIME OF WORK. ANTICIPATE ~0.25 CFS (~100GPM) FOR PLANNING PURPOSES. LOCATE PUMP OUTSIDE CHANNEL.

6 ENSURE ADEQUATE DIFFUSION AND VELOCITY DISSIPATION EXIST AT OUTLET TO MINIMIZE SCOUR UPON RELEASING CLEAN WATER BACK INTO CREEK.

7 EXCAVATIONS WILL BE DEWATERED FROM LOW PUMP POINTS AND SUMPS WITHIN THE REGION OF WORK AS GROUNDWATER (GW) IS ENCOUNTERED. ANTICIPATE GW INFLOWS DURING ALL EXCAVATIONS WITH INCREASED FLOWS DURING THE DEEPEST PORTIONS OF WORK (E.G. RSP/BRIDGE FOOTINGS, LOG WEIRS, AND LOWERING OF THALWEG ELEVATIONS). ANTICIPATE HIGHLY TURBID FLOWS FROM THESE SUMPS; DEWATER ONLY AS NEEDED TO FACILITATE CONSTRUCTION AND CONFIRM CONSTRUCTION SPECIFICATIONS ARE MET.

8 TURBID WATER WILL BE DRAWN FROM IN-EXCAVATIONS SUMPS BY AN ADEQUATELY SIZED PUMP LOCATED OUTSIDE THE CHANNEL.

9 TURBID WATER WILL BE RELEASED ONTO NEARBY PASTURES AND UPLANDS, AS FAR DOWNSTREAM AS FEASIBLE. BMPs FOCUSED ON REDUCTION OF VELOCITY AND TURBIDITY WILL BE USED TO SLOW AND FILTER THE WATER AT THE OUTLET OF THE DISCHARGE LINE. TO ENCOURAGE SHEET FLOW AND INFILTRATION, A SERIES OF WATTLE TYPE SEDIMENT BARRIERS DEPLOYED IN SERIES ON THE GROUND WILL SPREAD AND SLOW THE WATER WHILE ENTRAPPING THE MOBILIZED SEDIMENTS. WATER WILL PASSIVELY AND SLOWLY FLOW THROUGH AND OVER THESE BMPs AS IT NATURALLY FLOWS BACK DOWN TO LITTLE CASE CREEK ALONG THE GENTLE SLOPE THAT EXISTS. BASED ON THE QUANTITY OF GROUNDWATER ENCOUNTERED THE DISCHARGE LOCATION CAN BE RELOCATED TO SUIT. ALL ATTEMPTS SHOULD BE MADE TO AVOID CONCENTRATED FLOWS DOWN THE BANKS OF THE CREEK; SHEET FLOWS SHALL BE MAINTAINED.

10 INSTALLATION OF THE LARGE WOOD FEATURES ARE ANTICIPATED TO INCUR MINOR GW QUANTITIES. THE RETURN POINT FOR THE RELEASE OF THE DIVERTED WATER BACK INTO LITTLE CASE CREEK SHOULD BE AS NEAR TO THE INTERCEPTION POINT AS FEASIBLE, IDEALLY UPSTREAM OF THE CONFLUENCE AND LARGE WOOD FEATURES. SHOULD THIS PRODUCE UNWORKABLE CONDITIONS WHEN INSTALLING THE LARGE WOOD FEATURES, THE REINTRODUCTION OF THE DIVERTED STREAM FLOWS SHOULD BE MOVED DOWNSTREAM OF ALL THE <P> WORK.

11 ENSURE DISCHARGE FLOWS DO NOT CONCENTRATE DOWN SIDE SLOPES. REDIRECT AND SLOW WATER AS NECESSARY WITH LINEAR BMP, SEE SHEET 8.

TABLE 1. PRELIMINARY INFORMATION NEEDED FOR WATER QUALITY MONITORING PLAN.

PARAMETER [REQUIRED ANALYTICAL TEST METHOD][1]	UNIT	TYPE OF SAMPLE	MINIMUM SAMPLING FREQUENCY LIVE STREAM	MINIMUM SAMPLING FREQUENCY DIVERSIONS
TURBIDITY[2,4]	NTU	IN SITU	EVERY 4 HOURS DURING IN-WATER WORK	DURING CONSTRUCTION/DEWATERING AND REMOVAL/REWATERING A MINIMUM OF 3 SAMPLES MUST BE TAKEN EACH DAY ACTIVITIES OCCUR (BEGINNING, MIDDLE, AND END OF THE ACTIVITY OR DAY)
VISIBLE CONSTRUCTION RELATED POLLUTANTS[3]	OBSERVATIONS	VISUAL INSPECTIONS	CONTINUOUS THROUGHOUT THE CONSTRUCTION PERIOD	CONTINUOUS THROUGHOUT THE CONSTRUCTION PERIOD
PH[2,4]	STANDARD UNITS	IN SITU	EVERY 4 HOURS	DURING CONSTRUCTION/DEWATERING AND REMOVAL/REWATERING A MINIMUM OF 3 SAMPLES MUST BE TAKEN EACH DAY ACTIVITIES OCCUR (BEGINNING, MIDDLE, AND END OF THE ACTIVITY OR DAY)
TEMPERATURE[2,4]	°C	IN SITU	EVERY 4 HOURS	DURING CONSTRUCTION/DEWATERING AND REMOVAL/REWATERING A MINIMUM OF 3 SAMPLES MUST BE TAKEN EACH DAY ACTIVITIES OCCUR (BEGINNING, MIDDLE, AND END OF THE ACTIVITY OR DAY)
DISSOLVED OXYGEN[2,4]	MG/L & % SATURATION	IN SITU	EVERY 4 HOURS	DURING CONSTRUCTION/DEWATERING AND REMOVAL/REWATERING A MINIMUM OF 3 SAMPLES MUST BE TAKEN EACH DAY ACTIVITIES OCCUR (BEGINNING, MIDDLE, AND END OF THE ACTIVITY OR DAY)

[2]POLLUTANTS SHALL BE ANALYZED USING THE ANALYTICAL METHODS DESCRIBED IN 40 CODE OF FEDERAL REGULATIONS PART 136; WHERE NO METHODS ARE SPECIFIED FOR A GIVEN POLLUTANT, THE METHOD SHALL BE APPROVED BY THE WATER BOARD STAFF PERSON OVERSEEING THE PROJECT.

[3]VISIBLE CONSTRUCTION-RELATED POLLUTANTS INCLUDE FOAM, PETROLEUM PRODUCTS, AND CONSTRUCTION-RELATED, EXCAVATED, ORGANIC OR EARTHEN MATERIALS.

[4]A HAND-HELD FIELD METER MAY BE USED (I.E. YSI OR SIMILAR), PROVIDED THE METER UTILIZES A USEPA-APPROVED ALGORITHM/METHOD AND IS CALIBRATED AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. A CALIBRATION AND MAINTENANCE LOG FOR EACH METER USED FOR MONITORING SHALL BE MAINTAINED ONSITE.

WATER QUALITY MONITORING PLAN

THE GRANTEE SHALL PERFORM SURFACE WATER QUALITY MONITORING: WHEN:

A) PERFORMING ANY IN-WATER WORK;
B) PROJECT ACTIVITIES RESULT, OR MAY RESULT, IN DISCHARGE TO SURFACE WATERS; OR
C) PROJECT ACTIVITIES RESULT IN THE CREATION OF A VISIBLE TURBIDITY IN SURFACE WATERS.

THE SAMPLING AS DESCRIBED IN TABLE 1 SHALL OCCUR UPSTREAM AND OUT OF THE INFLUENCE OF THE PROJECT, AND 300 FEET DOWNSTREAM OF THE WORK AREA. THE SAMPLING FREQUENCY MAY BE MODIFIED WITH WRITTEN APPROVAL FROM THE WATER BOARD STAFF PERSON OVERSEEING THE PROJECT.

A SURFACE WATER MONITORING REPORT SHALL BE SUBMITTED WITHIN ONE WEEK OF INITIATION OF IN-WATER CONSTRUCTION, AND EVERY WEEK THEREAFTER.

THE GRANTEE SHALL FILL OUT THE SUPPLIED WATER QUALITY SAMPLING FORM AND RETURN IT TO THEIR GRANT MANAGER. THE REPORT SHALL INCLUDE SURFACE WATER SAMPLING RESULTS FOR EACH SAMPLING SITE, PARAMETER, AND VISUAL OBSERVATIONS MADE AT THE TIME OF SAMPLING.

THE GRANTEE SHALL COORDINATE WITH THE GRANT MANAGER IF THEY BELIEVE THERE IS NO SAMPLING REQUIRED. IF IT IS DETERMINED THERE IS NO SAMPLING REQUIRED, THE GRANTEE SHALL SUBMIT A WRITTEN STATEMENT EXPLAINING THE RATIONAL TO THE GRANT MANAGER.

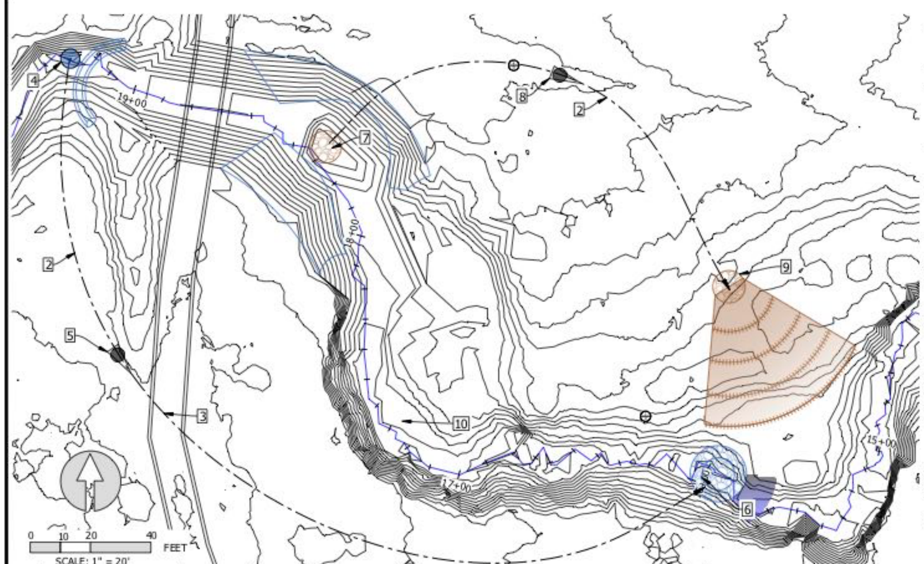
GRANTEES SHALL FOLLOW ANY ADDITIONAL MONITORING REQUIREMENTS AND LIMITS IN THE APPLICABLE REGIONAL WATER QUALITY CONTROL BOARD'S BASIN PLAN.

THE GRANTEE SHALL NOTIFY THEIR GRANT MANAGER IMMEDIATELY IF THE CRITERIA SET FORTH IN THEIR PROJECTS APPROPRIATE REGIONAL WATER QUALITY CONTROL BOARD'S BASIN PLAN FOR TURBIDITY, SETTLEABLE MATTER, OR OTHER WATER QUALITY OBJECTIVES ARE EXCEEDED.

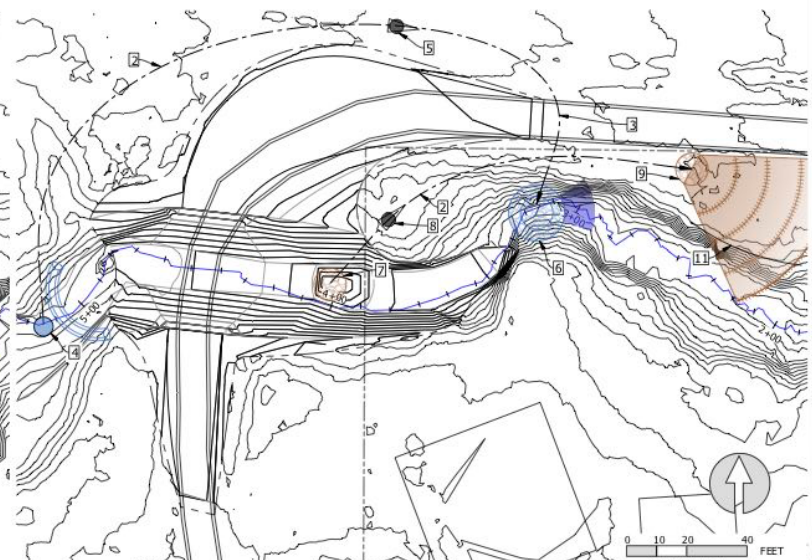
MAP SYMBOLS THIS SHEET

- <P> TEMPORARY COFFER DAM
- <P> DIVERSION PUMP INTAKE POINT (CLEAN WATER)
- <P> DIVERTED WATER DISCHARGE POINT (CLEAN WATER)
- <P> EXCAVATION SUMP/PUMP INTAKE POINT (TURBID WATER)
- <P> EXCAVATION DEWATERING DISCHARGE POINT (TURBID WATER)
- <P> HOSE ROUTE (ALL)
- <P> PUMP LOCATION
- <E> EDGES OF ROAD
- <P> EQUIPMENT AND MATERIAL STAGING AREAS
- <P> EQUIPMENT TRAVEL ROUTE

1&2
8



UPPER CROSSING DEWATERING CONFIGURATION



LOWER CROSSING DEWATERING CONFIGURATION

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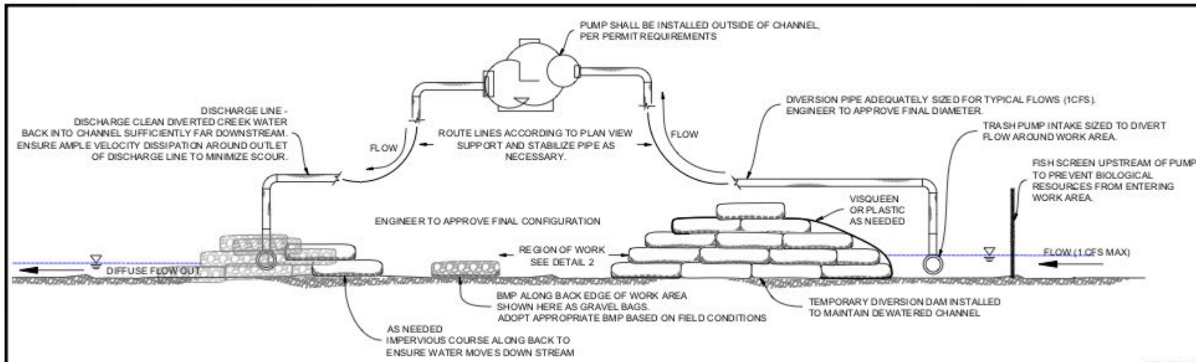
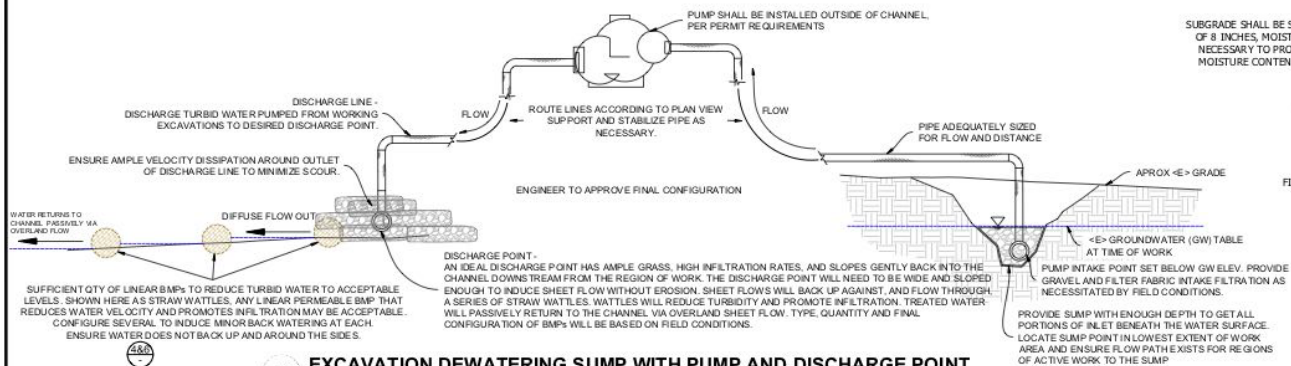
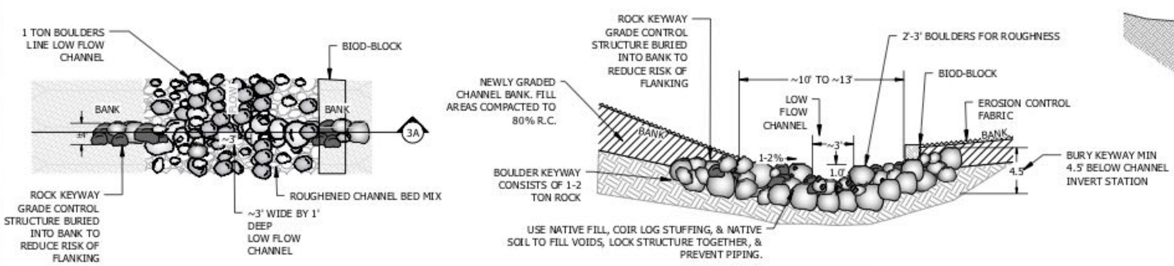
DEWATERING & MATERIAL HANDLING



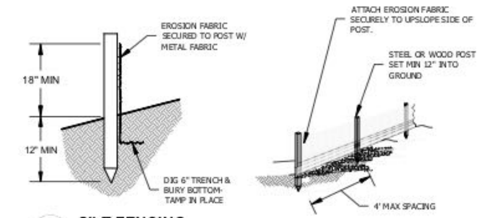
1 **COFFER DAM WITH PUMP DIVERSION AND DISCHARGE POINT**
NTS



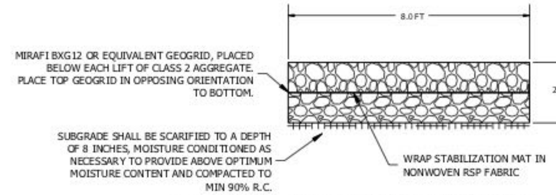
2 **EXCAVATION DEWATERING SUMP WITH PUMP AND DISCHARGE POINT**
NTS



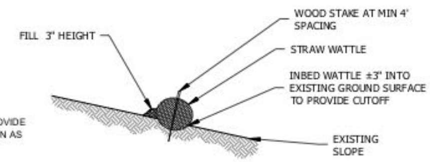
3 **CONSTRUCTED RIFFLE AND GRADE CONTROL STRUCTURE PLAN AND SECTIONS**
NTS



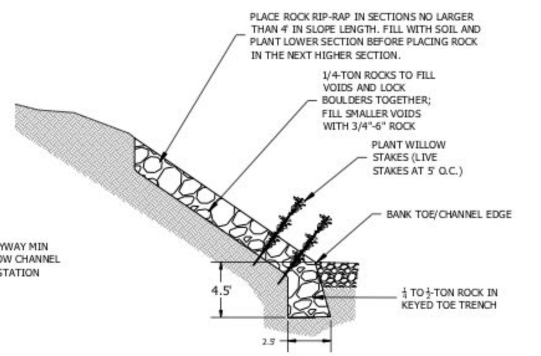
4 **SILT FENCING**
NTS



5 **MULTILAYER STABILIZATION MAT**
NTS



6 **STRAW WATTLE**
NTS



7 **WILLOW PLANTED ROCK SLOPE PROTECTION (RSP)**
NTS

LITTLE CASE CREEK BARRIER REMOVAL AND FISH PASSAGE DESIGN PROJECT

Laytonville, Mendocino Cnty., CA

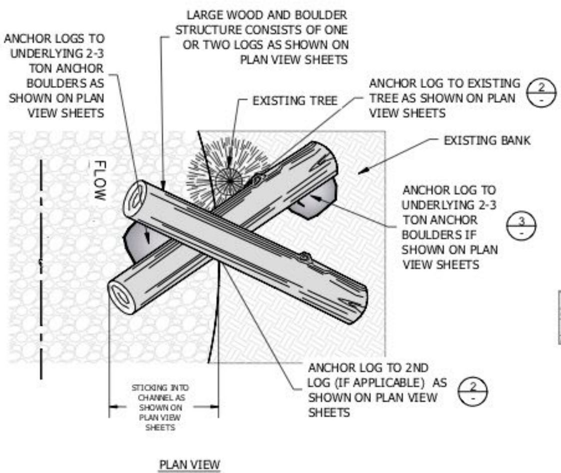
Stillwater Sciences
850 G STREET SUITE K
ARCATA, CA 95521
P: (707) 822-9607

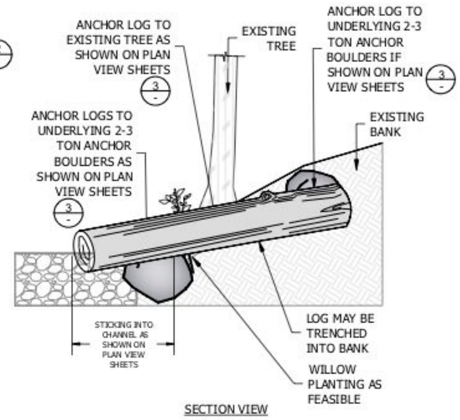
PROJECT NUMBER: 875.00
SCALE: AS NOTED
DATE: 3/31/21

DESIGN: JM/BW
DRAWN: BW/HG
CHECKED: BW
APPROVED: JM

CIVIL & DEWATERING DETAILS

SHEET 8 OF 10





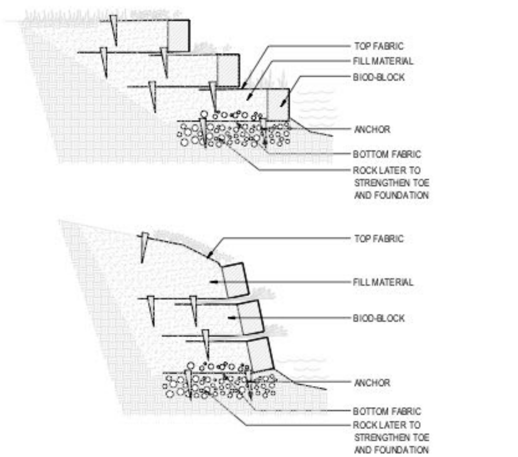
NOTES:

1. LOG STRUCTURES SHALL BE INSTALLED AS SHOWN ON PLAN VIEW SHEETS
2. WHERE BANKS ARE STEEP, LOG STRUCTURES MAY BE TRENCHED INTO THE BANK TO ALLOW FOR A LOWER ANGLE AND PROVIDE MORE WOOD VOLUME IN THE ACTIVE CHANNEL
3. LOG STRUCTURE CONSTRUCTION DETAILS MAY BE MODIFIED IN THE FIELD AS APPROVED BY THE PROJECT MANAGER AND ENGINEER

1 1- AND 2-PIECE WOOD STRUCTURE DETAILS

NTS

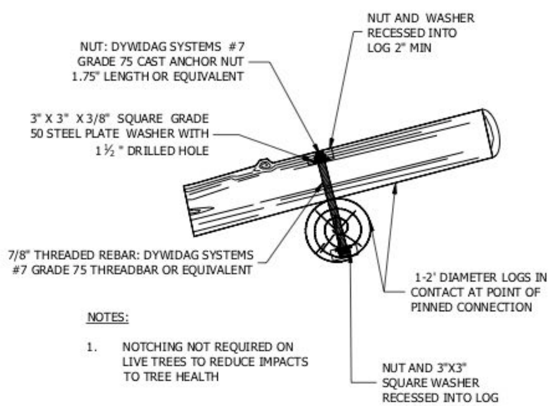
ROLANKA INTERNATIONAL INC.
155 ANDREW DRIVE
STOCKBRIDGE, GA 30281
TOLL FREE: 1-800-760-3215
PHONE: (770) 506-8211
FAX: (770) 506-0391
www.rolanka.com



NOTES:
1. LIVE PLANTS AND CUTTINGS SHOULD BE USED IN EITHER SITUATION.
2. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
3. DO NOT SCALE DRAWING.
4. THIS DRAWING IS INTENDED FOR USE BY ARCHITECTS, ENGINEERS, CONTRACTORS, CONSULTANTS AND DESIGN PROFESSIONALS FOR PLANNING PURPOSES ONLY. THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION.
5. ALL INFORMATION CONTAINED HEREIN WAS CURRENT AT THE TIME OF DEVELOPMENT BUT MUST BE REVIEWED AND APPROVED BY THE PRODUCT MANUFACTURER TO BE CONSIDERED ACCURATE.
6. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info AND ENTER REFERENCE NUMBER 084-010.

4 BIOD-BLOCK COIR BLOCK SYSTEM TERRACED APPLICATION

WITH LIVE PLANTS AND CUTTINGS

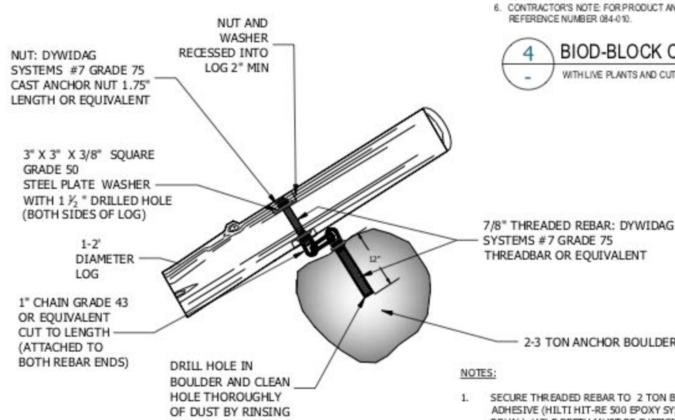


NOTES:

1. NOTCHING NOT REQUIRED ON LIVE TREES TO REDUCE IMPACTS TO TREE HEALTH

2 LOG-LOG OR LOG-TREE ANCHORING

NTS



NOTES:

1. SECURE THREADED REBAR TO 2 TON BOULDER USING EPOXY ADHESIVE (HILTI HIT-RE 500 EPOXY SYSTEM, OR APPROVED EQUAL). HOLE DEPTH MUST BE SUFFICIENT TO REACH COMPETENT, UN-FRACTURED ROCK IN ORDER TO OBTAIN MAXIMUM BONDING STRENGTH. A MINIMUM OF 12 INCHES IS RECOMMENDED; 1" DIAMOND-TIPPED DRILL (TIGHT FIT).

3 LOG-BOULDER ANCHORING

NTS

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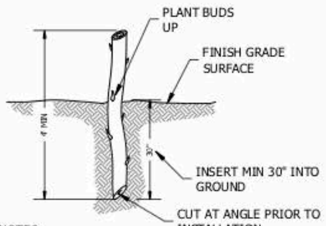
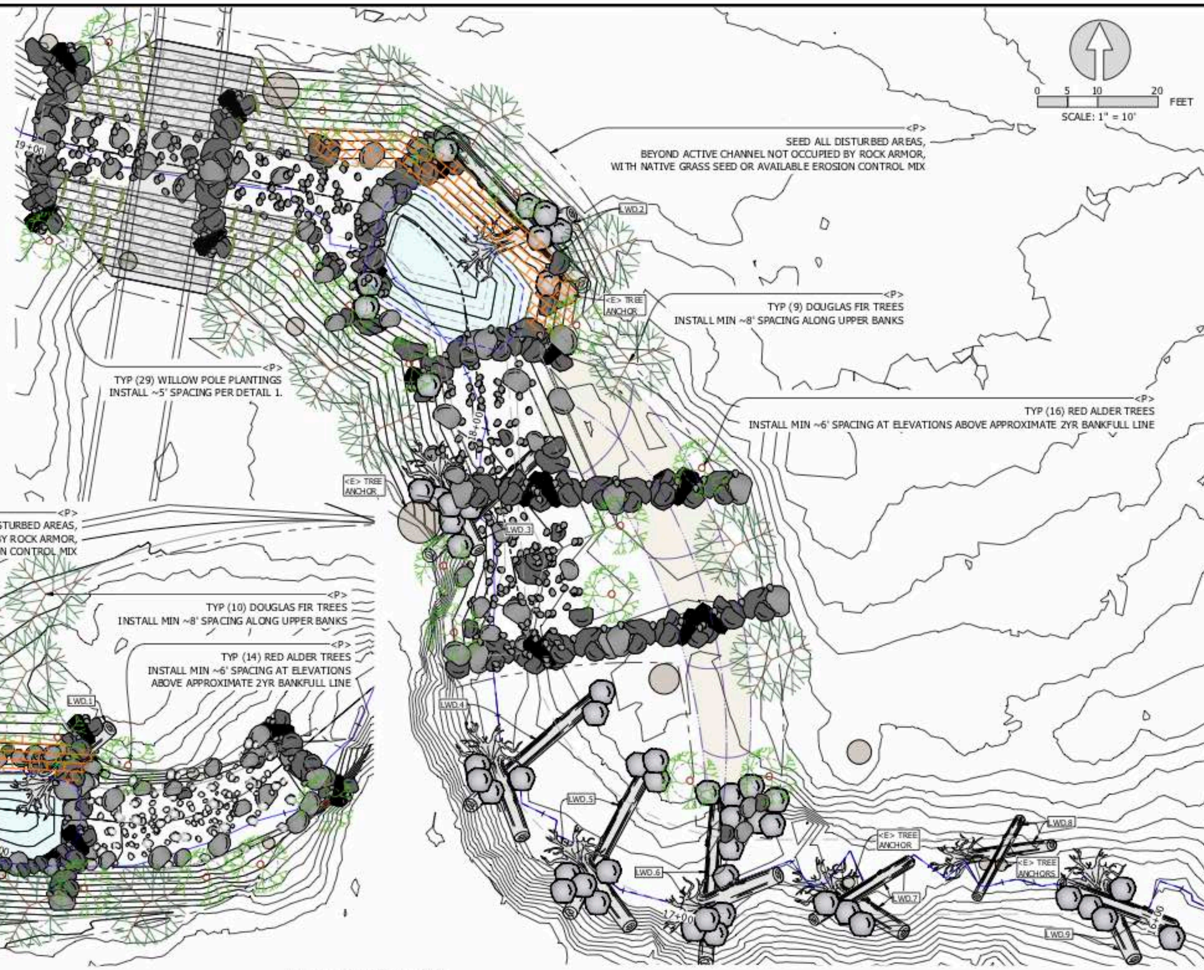


NOTES:

1. WILLOW STAKE SPECIES SHALL BE A MIX OF SPECIES PRESENT AT AND ADJACENT TO THE WORK SITE
2. EACH STAKE SHALL BE 1.5" - 3" THICK AT THE BOTTOM TO FACILITATE ROOT GROWTH AFTER TREATMENT WITH ROOTING HORMONE
3. INSERT MIN 30" INTO GROUND

1 **WILLOW POLE STAKE PLANTING**
NTS



Large Wood Stability Analysis

Feature number	Station	Feature component number	Total pieces of wood (#)	Log length (ft)	Log width (ft)	Tree with rootwad	Rootwad length (ft)	Rootwad width (ft)	Tree volume (ft³)	Rootwad volume (ft³)	Total volume (ft³)	% submerged	Force gravity (lbs)	Force boyancy (lbs)	Ballast from live tree anchor (lbs)	Log flow acting area (ft²)	Rootwad flow acting area (ft²)	Channel velocity for force of lift calculation	Force of lift from flow (lbs)	Force of flow (lbs)	Weight of boulder required to counteract buoyancy & lift (tons) FS_b=1.5	Normal force (without live tree ballast) (lbs)	Resistance force from live tree ballast (lbs)	Factor of safety for momentum (FS_m=2 min)	Governing factor of safety	Final weight of boulder required for FS_b=1.5 min & FS_{m} min (tons)	Final rock weight (tons)	Total number of boulders with average weigth of ~2.5 tons
LWD.1	3+95	A	1	16	2.5	Yes	3.5	4	79	30	108	100%	3641	6741	0	31	9.8	4.5	382	415	5.7	-1141.2	0.0	-2.3	Momentum	3.6	3.6	1.4
LWD.2	18+24	A	2	15	2.5	Yes	3.5	4	74	30	103	100%	3475	6435	4000	29	9.8	3.6	233	256	7.6	-70	4000	10.4	Bouyancy/ Lift	7.6	7.6	3.0
		B		35	2.5	No	0	0	172	0	172	100%	5787	10715	4000	88	0	3.6	388	330		-2194	4000					
LWD.3	17+90	A	2	15	2.5	Yes	3.5	4	74	30	103	100%	3475	6435	4000	29	9.8	5.8	605	664	7.4	-508	4000	4.2	Bouyancy/ Lift	7.4	7.4	3.0
		B		30	2.5	No	0	0	147	0	147	100%	4960	9185	4000	75	0	5.8	864	733		-2031	4000					
LWD.4	17+40	A	2	15	2.5	Yes	3.5	4	74	30	103	100%	3475	6435	0	29	9.8	4.1	302	332	12.9	2087	0	3.3	Bouyancy/ Lift	12.9	12.9	5.2
		B		30	2.5	No	0	0	147	0	147	100%	4960	9185	0	75	0	4.1	432	366		693	0					
LWD.5	17+10	A	2	15	2.5	Yes	3.5	4	74	30	103	100%	3475	6435	0	29	9.8	3.9	274	300	12.9	2081	0	3.7	Bouyancy/ Lift	12.9	12.9	5.1
		B		30	2.5	No	0	0	147	0	147	100%	4960	9185	0	75	0	3.9	390	332		700	0					
LWD.6	16+90	A	2	15	2.5	Yes	3.5	4	74	30	103	100%	3475	6435	0	29	9.8	4.3	333	365	13.0	2093	0	3.0	Bouyancy/ Lift	13.0	13.0	5.2
		B		30	2.5	No	0	0	147	0	147	100%	4960	9185	0	75	0	4.3	475	403		687	0					
LWD.7	16+70	A	2	15	2.5	Yes	3.5	4	74	30	103	100%	3475	6435	4000	29	9.8	6.5	760	835	6.4	-1054	4000	3.5	Bouyancy/ Lift	6.4	6.4	2.6
		B		25	2.5	No	0	0	123	0	123	100%	4134	7654	4000	63	0	6.5	904	768		-1758	4000					
LWD.8	16+45	A	2	15	2.5	Yes	3.5	4	74	30	103	100%	3475	6435	8000	29	9.8	7.3	959	1053	0.0	-3918	8000	7.4	Bouyancy/ Lift	0.0	0.0	0.0
		B		15	2	No	0	0	47	0	47	100%	1587	2939	8000	30	0	7.3	438	465		-1790	8000					
LWD.9	16+25	A	2	15	2.5	Yes	3.5	4	74	30	103	100%	3475	6435	0	29	9.8	8.1	1180	1296	14.0	1643	0	0.8	Momentum	12.1	12.1	4.8
		B		25	2.5	No	0	0	123	0	123	100%	4134	7654	0	63	0	8.1	1404	1192		859	0					

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REGISTERED PROFESSIONAL ENGINEER
JOEL MONSCHKE
C 79688
EXP
CIVIL
STATE OF CALIFORNIA

PLANTING PLAN & LWD TABLE

SHEET 10 OF 10

Project Budget

Name of Project: Little Case Creek Fish Passage Project

Category	CFPF Funding Requested	Partner Contributions (non-federal cash)	Partner Contributions (in-kind)	Total	Comments
Salaries and Wages	$2,000.00	$13,000.00	$0.00	$15,000.00	ERWIG costs include grant management, reporting and construction oversight. This includes $1000 in Monitoring and Evaluation costs. Tasks 1, 3, 5.2, 6, & 7 CFPF funds will be spent on staff time needed to obtain project permits (1600, 401, 404)
Employee Benefits	$500.00	$3,250.00	$0.00	$3,750.00	Benefits are calculated at 25% of ERWIG staff wages.
Supplies	$0.00	$257,840.00	$0.00	$257,840.00	Supplies include two bridges, abutments, habitat anchoring materials, building permit, logs, rock, erosion control and native trees.
Professional Services	$23,500.00	$44,659.00	$0.00	$68,159.00	CFPF Funds will be spent on obtaining the necessary permits for this project and carrying out the botanical, biological and archeological surveys necessary for project work. Partner contributions will pay for an engineering company, bridge inspector and biologist. Tasks 2, 3, 4, 5.2
Administrative Overhead	$0.00	$16,500.00	$0.00	$16,500.00	Indirect costs includes workers compensation, accounting services, telephone/communications, utilities, liability insurance, banking fees, administrative salaries and other misc costs directly related to the project. Admin overhead will not be charged on subcontracts over $25,000 and equipment or rentals.
Contracted Services	$0.00	$277,070.00	$0.00	$277,070.00	This includes the contruction contractor and the CCCs. They will construct the bridge crossings and associated habitat. Tasks 5.1, 5.2 & 5.3
Travel	$0.00	$1,672.00	$0.00	$1,672.00	This inludes ERWIG mileage reimburements and per diem for overnight stays.
Total	**$26,000.00**	**$613,991.00**	**$0.00**	**$639,991.00**	