CALIFORNIA FISH PASSAGE ADVISORY COMMITTEE

Connectivity Case Studies

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PRESENTERS

Salsipuedes Creek

Sarah Sandstrom

Acting Senior Fish Biologist, Caltrans Office of Biological Science and Innovation

Aquatic Resource Biologist, Caltrans District 5

Little Lost Man Creek

Susan Leroy

Caltrans District 1 Natural Resources Environmental Planner

Salsipuedes Creek Bridge Scour Mitigation Project

Sarah Sandstrom

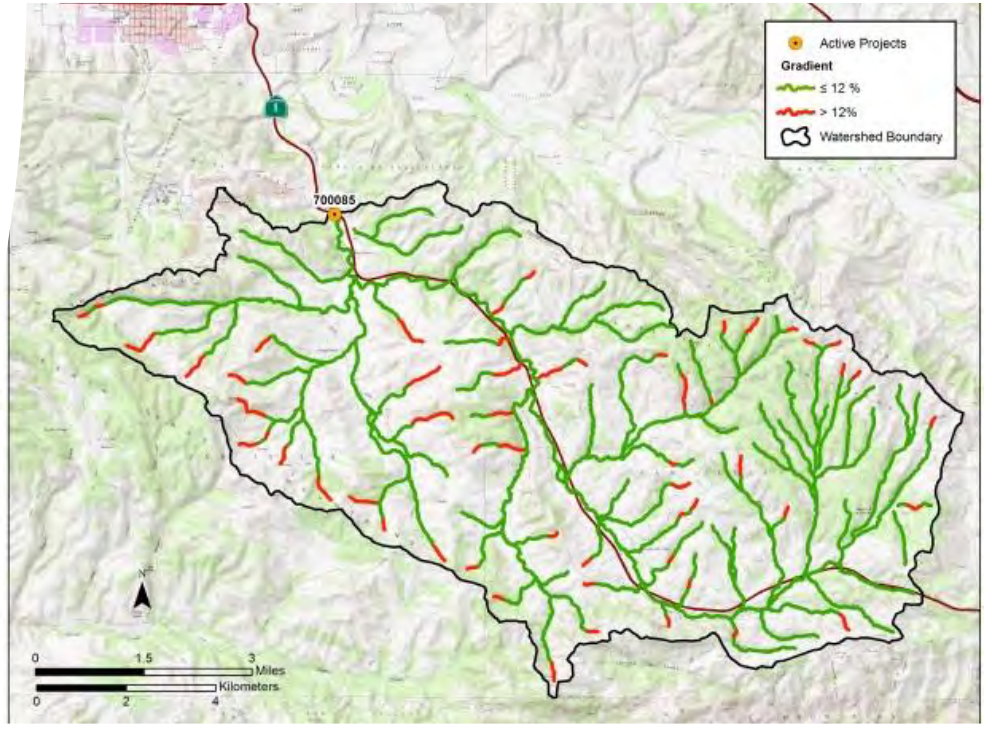
Acting Senior Fish Biologist, Caltrans Office of Biological Science and Innovation

Aquatic Resource Biologist, Caltrans District 5

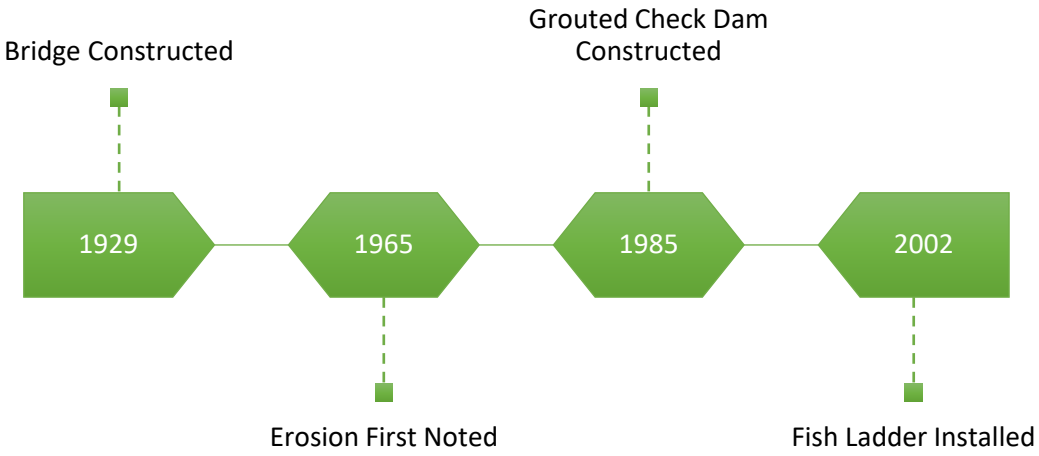
Santa Barbara County

Tributary to Santa Ynez River

~100 miles of upstream habitat



Scour Threatening Roadway



Replace three-span bridge with single-span bridge

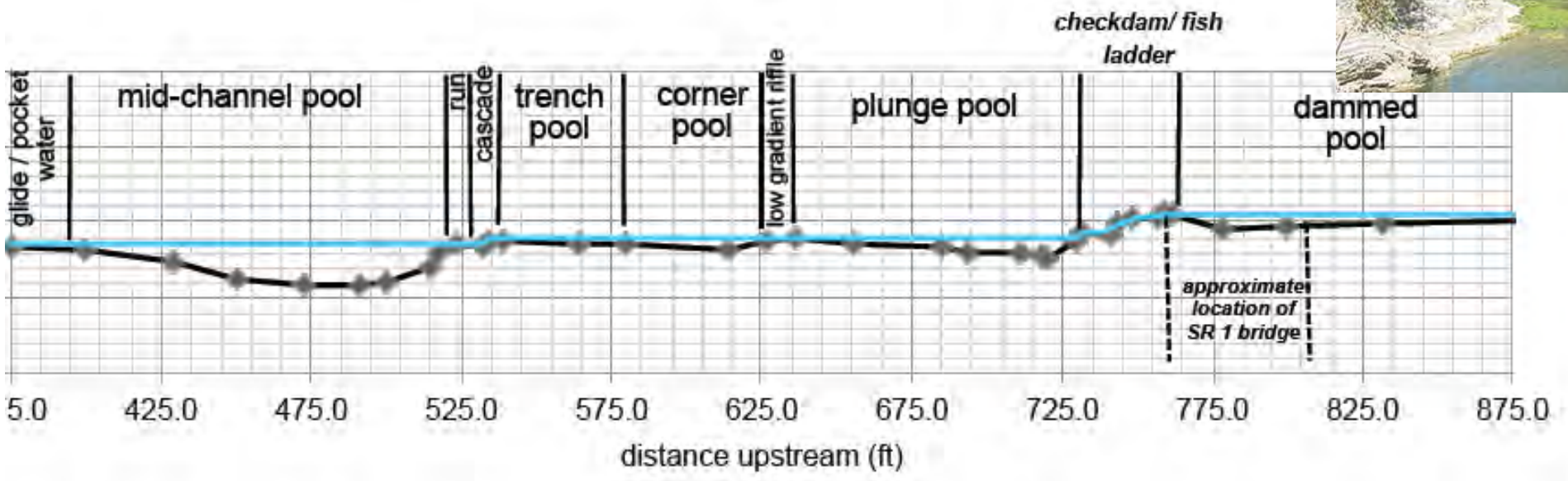
Remove man-made elements constructed to reduce scour and erosion and restore full fish passage

Caltrans District 5 (Central Region)

- Long History- Begin Environmental 2008, Project Completed in 2020
- Consultants- ICF, SWCA, Balance Hydraulics
- Cachuma Operations and Maintenance Board (fish ladder)

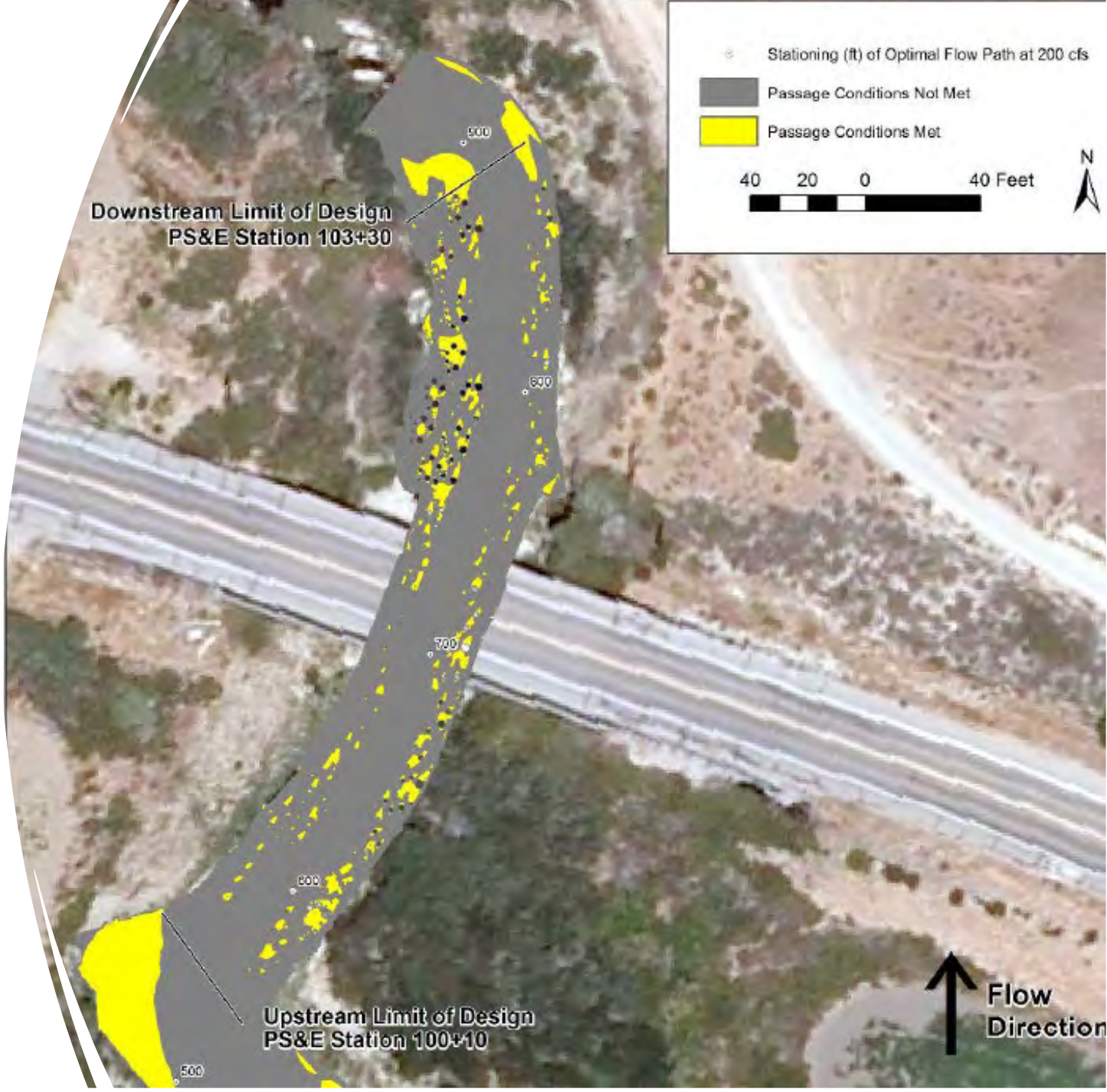
Species and Habitat

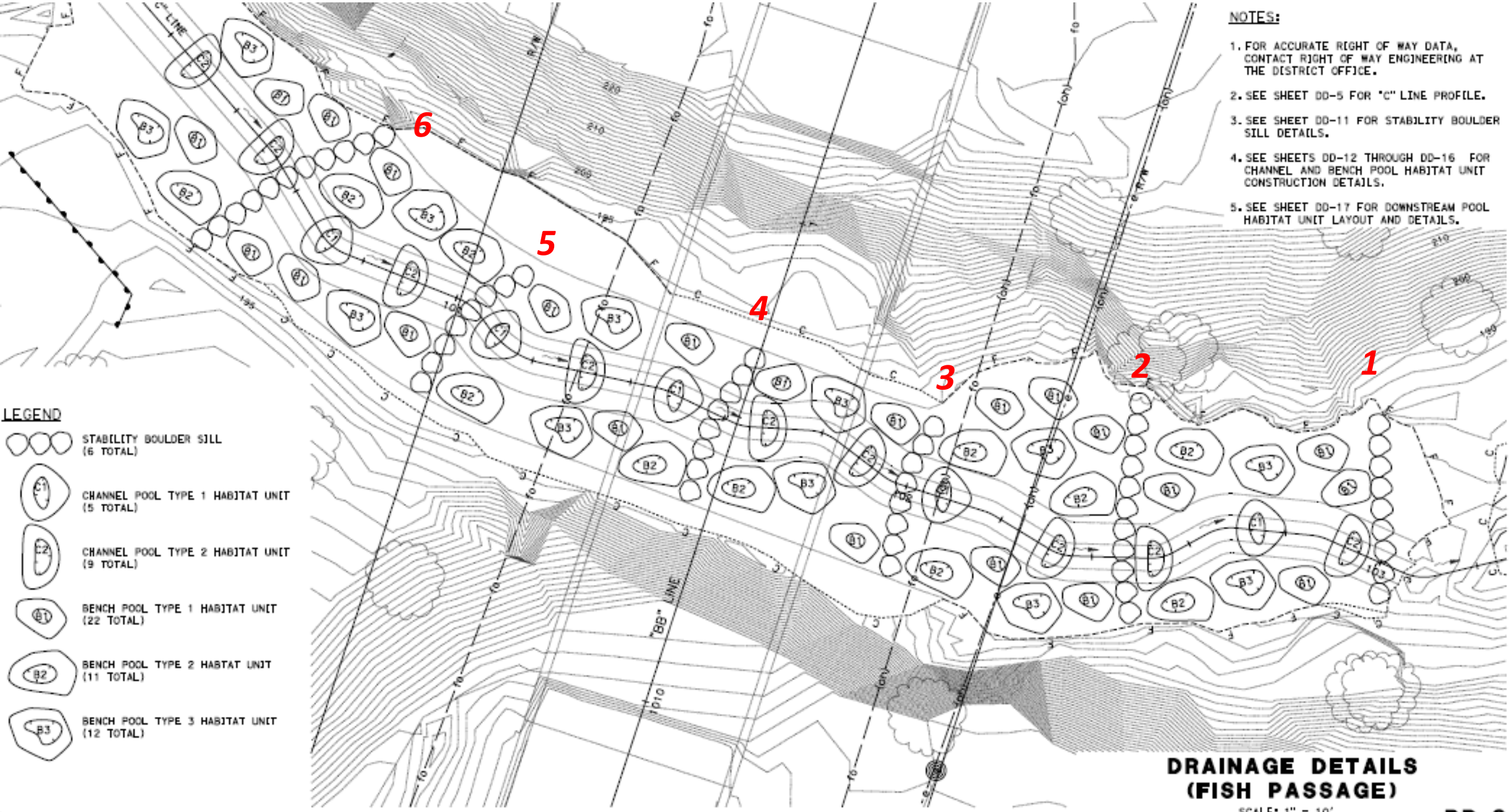
- Southern CA Steelhead (FE), California Red-Legged Frog (FT), Western Pond Turtle (SSC), Two-striped Garter Snake (SSC)
- Existing fishway exceeded juvenile passage criteria for steelhead
- Large ponded areas upstream and downstream supported quality habitat for steelhead, Red-legged Frog and Pond Turtle



Planning and Project Delivery

- Full-span pre-cast bridge, new abutments pushed back 30 feet (150-ft span)
- Early agency coordination for fish passage (NMFS, USFWS, and CDFW)
- Initially considered concrete fishway with partial passage, eventually landed on a roughened ramp
- Geomorphological study (x2)
- 2D modelling for depths and velocities





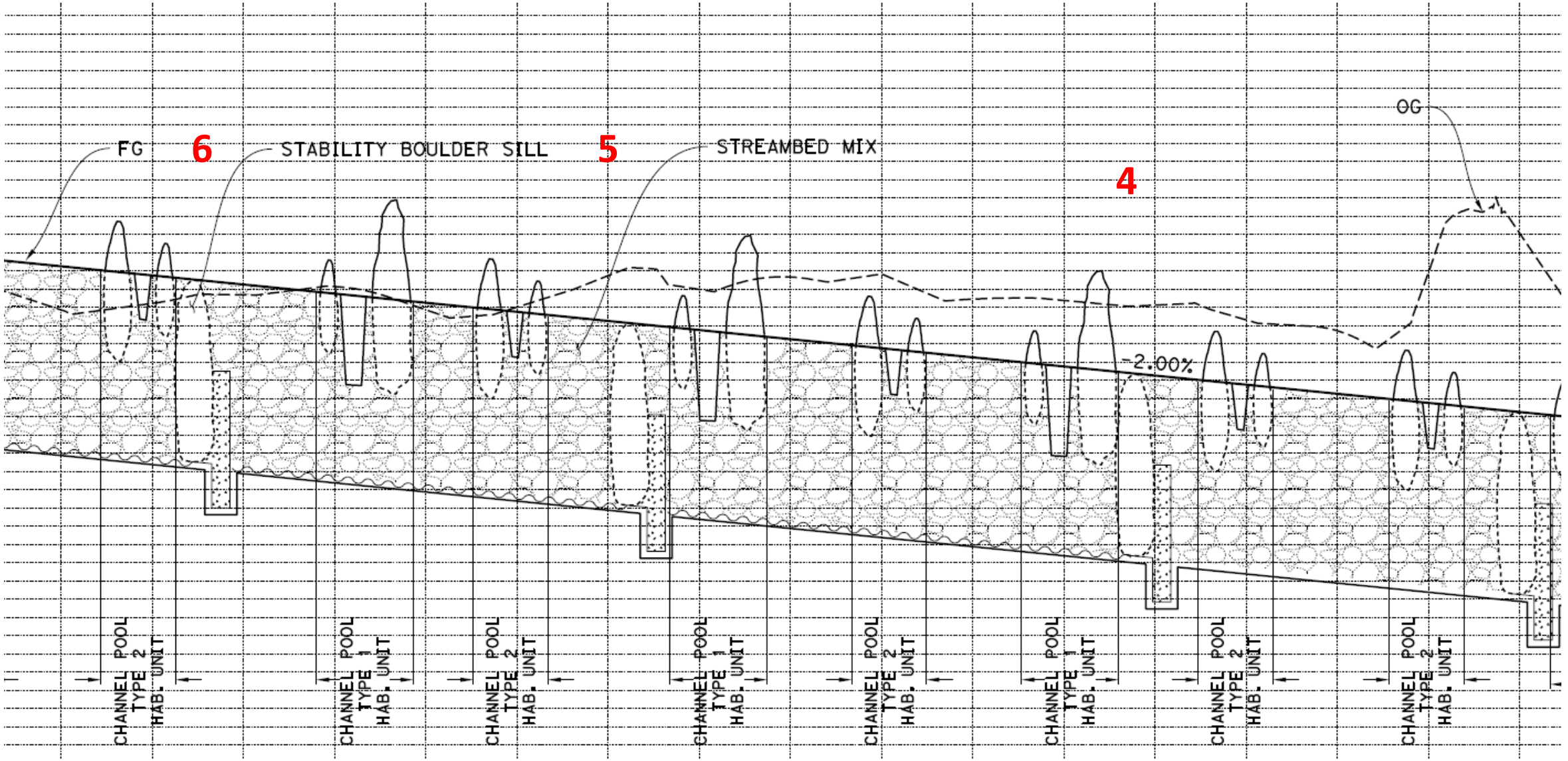
DRAINAGE DETAILS (FISH PASSAGE)

SCALE: 1" = 10'

DD-3

APPROVED FOR DRAINAGE WORK ONLY

Fish Passage Design



Permitting

- 404, 401 Certification, 1600 Agreement, Biological Opinion (NMFS), Programmatic BO (USFWS)
- Extended review and negotiations with permitting agencies
- Balance of fish passage with pool habitat
- Added basking habitat in downstream pool for Western Pond Turtle

Funding

Right of Way	132,000
PID support (k phase)	109,000
PA&ED support (0 phase)	2,115,000
PS&E (1 phase)	2,730,000
Construction	2,697,000
Construction Capital	5,776,000
Post-Construction Monitoring	500,000
Total	**14,059,000**

Construction- Year 1

Construction-Year 2

Construction- Year 2

Stability Boulder Sill

Low Flow Channel

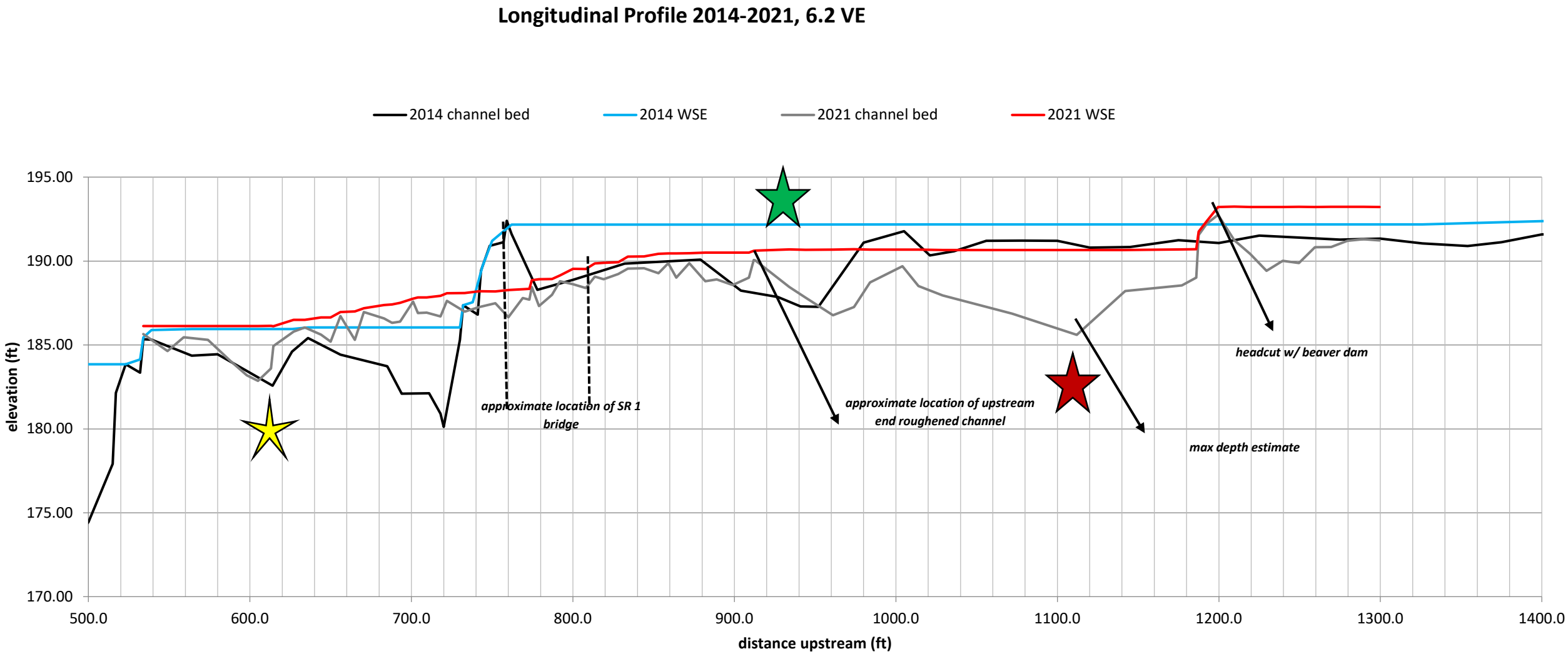
Habitat Pools

Post-Construction (November 2020)

Post-Construction (November 2020)

Post-Construction (March 2021)

Post-project Monitoring



Post-project Monitoring

Success Criteria	Year 1	Progress toward Criteria
Native Riparian Cover 	Native herbaceous cover 4.6%	Cover low. Reseeding and invasive control will improve herbaceous cover.
Riparian survival	96% survival of container plants	Meets criterion
Riparian Species Diversity	7 native woody species and 5 native herbaceous species	Meets criterion
Willow cover	31% native cover at Year-1	On track to meet criterion
Native Emergent Cover	10% native cover at Year-1	On track to meet criterion
Emergent Species Diversity 	8 native emergent species	Meets criterion
Invasive Plant Cover	No woody invasive species. Herbaceous invasive vegetation 5% in riparian and 1% in wetland.	Meets criterion, maintenance will help progress in future years
Contiguous surface water low-flow channel	Surface water connection maintained	Meets criterion
Bankfull depth allows fish passage	Bankfull depth of 1.32 m (4.33 ft)	Meets criterion
No hydraulic drops 	No channel spanning hydraulic drops	Meets criterion
Total pool area	3,541 SF pool area	Meets criterion
Erosion	16% bank erosion	Meets criterion
Deep pool habitat 	Bankfull pool area >3,000 SF with >4 ft depth	On track to meet criterion
Basking habitat present all years	Basking habitat present	Meets criterion

Multispecies benefits

Lessons Learned

- NSSP for Engineered Stream Mix (ESM) placement
  - What is entailed in washing in fines? Jetting vs soaking
  - What does it mean to have surface flow? Through one cell vs through entire channel
  - Careful oversight needed of first cell (contractors not familiar with technique or objectives- requires close coordination between RE, Inspector, and Hydraulics expert)
- Fines are critical
  - ESM spec did not account for enough fines, additional fines were added

Lessons Learned

- Rocks will move
  - Mix large rocks through ESM instead of strategically placing individual rocks at surface
  - This will help lock smaller rocks in place thoughout the material
  - Design weirs to ensure function if uncovered (embed rocks into concrete)
- Willow fascines may be better than live siltation fencing where high flows are possible.

Special Thanks

ICF- Jeff Peters

Mindy Trask

Lilian Bennetzen

Mitch Doucette

Ben Erchul

Sarah Sandstrom

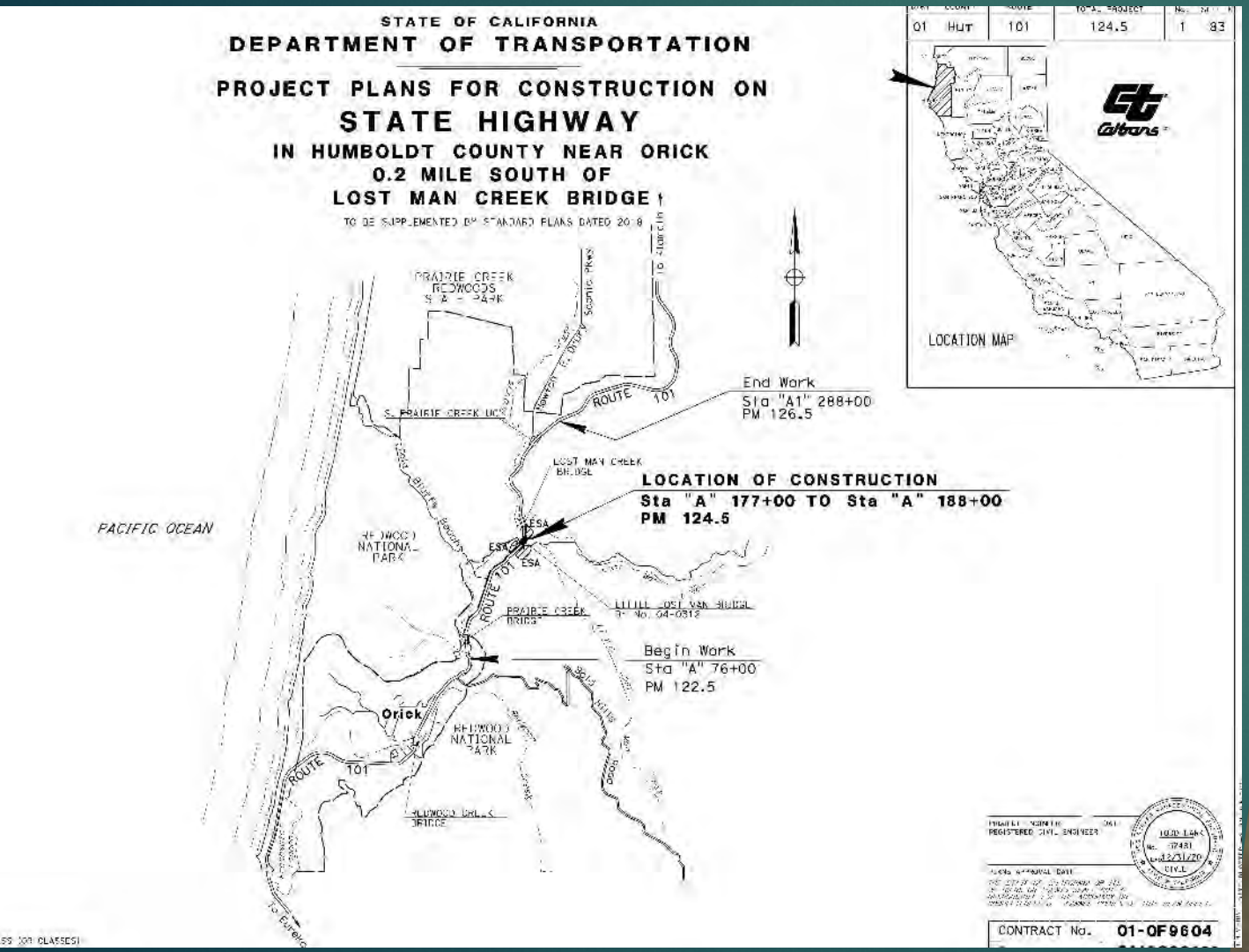
sarah.sandstrom@dot.ca.gov

Little Lost Man Creek Fish Passage Project

HUMBOLDT COUNTY ROUTE 101, POST MILE 124.49
APPROXIMATELY THREE MILES NORTH OF ORICK, ADJACENT TO REDWOOD NATIONAL PARK.

01-0K690 **SUSAN LEROY, CALTRANS DISTRICT 1 BIOLOGIST**

Little Lost Man Creek is tributary to Prairie Creek. The Hwy 101 crossing is about 450' upstream of the confluence with Prairie Creek. Approximately 3 miles downstream, Prairie Creek drains into Redwood Creek, which is about six miles away from the Pacific Ocean. The watershed is within Redwood National Park and ancestral territory of the Yurok Tribal People.

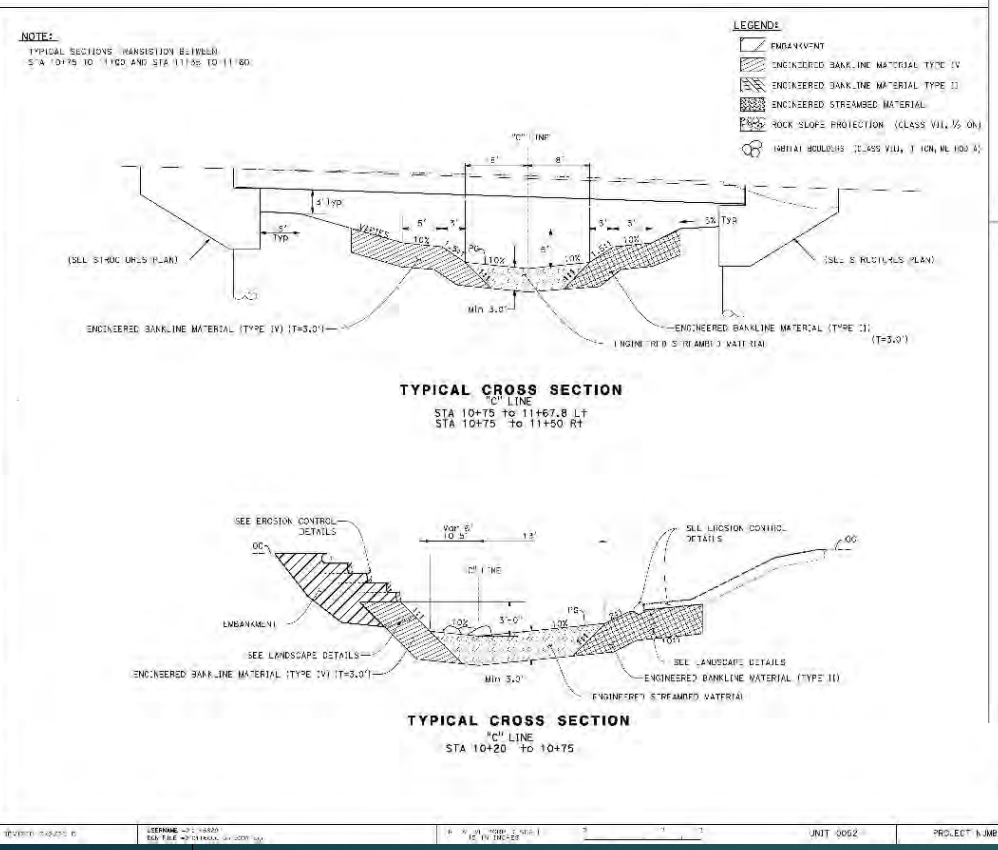


Built for fish!

- Purpose and need was to restore fish passage under Route 101 in northern Humboldt County
- Listed species present:
  - Coho Salmon (*Oncorhynchus kisutch*), Southern Oregon/Northern California Coast ESU
  - Steelhead (Oncorhynchus mykiss irideus), Northern California DPS
  - Chinook Salmon (*Oncorhynchus tshawytscha*), California Coastal ESU
- Identified in the 2015 SB 857 Fish Passage Annual Legislative Report and programmed and moved to the active list in 2016.
  - Ranked in the top 20 priorities in the Caltrans District 1 pilot Fish Passage Assessment Study by Dr. Margaret Lang P.E., Environmental Resources Engineering, Humboldt State university, 2005 (Lang study)
- Restored passage to 1.21 miles of spawning and rearing habitat for anadromous fish (and other fish, amphibians), and also expands passage for terrestrial wildlife

Bonus: Project also serves to reduce our maintenance needs at this location

Replaced an 8 x 8-foot reinforced concrete double box culvert with a full span 70-foot long bridge



TYPICAL CROSS SECTION
"C" LINE
STA 10+75 to 11+67.8 Lt
STA 10+75 to 11+50 Rt

TYPICAL CROSS SECTION
"C" LINE
STA 10+20 to 10+75

DRAINAGE DETAILS
NO SCALE
DD-1

UNIT 0052 | PROJECT NUMBER & PHASE 0116000109

INDEX TO PLANS

SHEET NO.	TITLE
1.	GENERAL PLAN
2.	INDEX TO PLANS
3.	DECK CONTOURS
4.	FOUNDATION PLAN
5.	ABUTMENT 1 LAYOUT
6.	ABUTMENT 2 LAYOUT
7.	ABUTMENT DETAILS NO. 1
8.	ABUTMENT DETAILS NO. 2
9.	TYPICAL SECTION
10.	SLAB LAYOUT
11.	PRECAST PRESTRESSED SLAB DETAILS NO. 1
12.	PRECAST PRESTRESSED SLAB DETAILS NO. 2
13.	ARCHITECTURAL TREATMENT
14.	LOG OF TEST BORINGS 1 OF 2
15.	LOG OF TEST BORINGS 2 OF 2

STANDARD PLANS DATED MAY 2018

A10C	LINES AND SYMBOLS (SHEET 1 OF 3)
A10D	LINES AND SYMBOLS (SHEET 2 OF 3)
A10E	LINES AND SYMBOLS (SHEET 3 OF 3)
A10F	LEGEND - SOIL (SHEET 1 OF 2)
A10G	LEGEND - SOIL (SHEET 2 OF 2)
A10H	LEGEND - ROCK
A62C	LIMITS OF PAYMENT FOR EXCAVATION AND BACKFILL BRIDGE
RSP B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-5	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B6-21	JOINT SEALS (MAXIMUM MOVEMENT RATING = 2")
RSP B7-10	UTILITY OPENING BOX GIRDER
B11-47	CABLE RAILING
RSP B11-81	CONCRETE BARRIER TYPE 842 DETAILS NO. 1
RSP B11-82	CONCRETE BARRIER TYPE 842 DETAILS NO. 2

STANDARD PLAN SHEET NO.
DETAIL NO.

GENERAL NOTES
LOAD AND RESISTANCE FACTOR DESIGN

DESIGN:
AASHTO LRFD Bridge Design Specifications, 2012 edition with California Amendments, preface dated January 2014

SEISMIC DESIGN:
California Seismic Design Criteria (SDC), version 1.7 dated April 2013

DEAD LOAD:
Includes 35 psf for future wearing surface

LIVE LOADING:
HL93 and permit design load

SEISMIC LOADING:
V_{S30} = 890 ft/sec
Moment Magnitude: M = 8.85 Max
Peak Ground Acceleration 0.62 g (see "ARS CURVE")

REINFORCED CONCRETE:
f'_c = 3.6 ksi & 5.0 ksi
n = 8

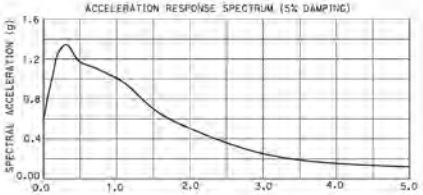
PRESTRESSED CONCRETE:
See "PRECAST PRESTRESSED SLAB DETAILS" sheet

STEEL PIPE PILES:
fy = 45 ksi

Dist	County	Route	Post Mile's Total Project	Sheet No.	Total Sheets
01	Hum	101	124.5	70	83

5-24-2019
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

CONCRETE STRENGTH AND TYPE LIMITS
NO SCALE



ARS CURVE
NO SCALE

PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips) Compression	Nominal Resistance (kips) Tension	Design Tip Elev (ft)	Specified Tip Elev (ft)	Required Nominal Driving Resistance (kips)
Abut 1	CISS 36 X 1.0	630	0	-16 (a) 2 (b)	-16	1160
Abut 2	CISS 36 X 1.0	630	0	-7 (a) 0 (b)	-7	1550

NOTES:
1. Design tip elevations for Abutments are controlled by: (a) Compression, (b) Lateral.
2. The Specified Tip Elevations shall not be raised above the design tip elevation for Lateral.

QUANTITIES

STRUCTURE EXCAVATION (BRIDGE)	245 CY
STRUCTURE BACKFILL (BRIDGE)	89 CY
FURNISH 36" CAST-IN-STEEL SHELL CONCRETE PILING	528 LF
DRIVE 36" CAST-IN-STEEL SHELL CONCRETE PILE	8 EA
STRUCTURAL CONCRETE, BRIDGE	155 CY
STRUCTURAL CONCRETE, BRIDGE (POLYMER FIBER)	86 CY
FURNISH PRECAST PRESTRESSED CONCRETE SLAB (TYPE BJV MODIFIED)	2,604 SQFT
ERECT PRECAST PRESTRESSED CONCRETE DECK UNIT	14 EA
JOINT SEAL (MR 1")	83 LF
BAR REINFORCING STEEL (BRIDGE)	45,229 LB
BRIDGE REMOVAL	LUMP SUM
PREPARE AND STAIN CONCRETE	25 SQFT
CABLE RAILING	44 LF
CONCRETE BARRIER (TYPE 842 MODIFIED)	139 LF
CONCRETE BARRIER (TYPE 842B)	64 LF

DESIGN	BY Karen C Keam	CHECKED Rakesh Sao
DETAILS	BY J. Shoufu Dickerson	CHECKED Rakesh Sao
QUANTITIES	BY K	CHECKED K

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

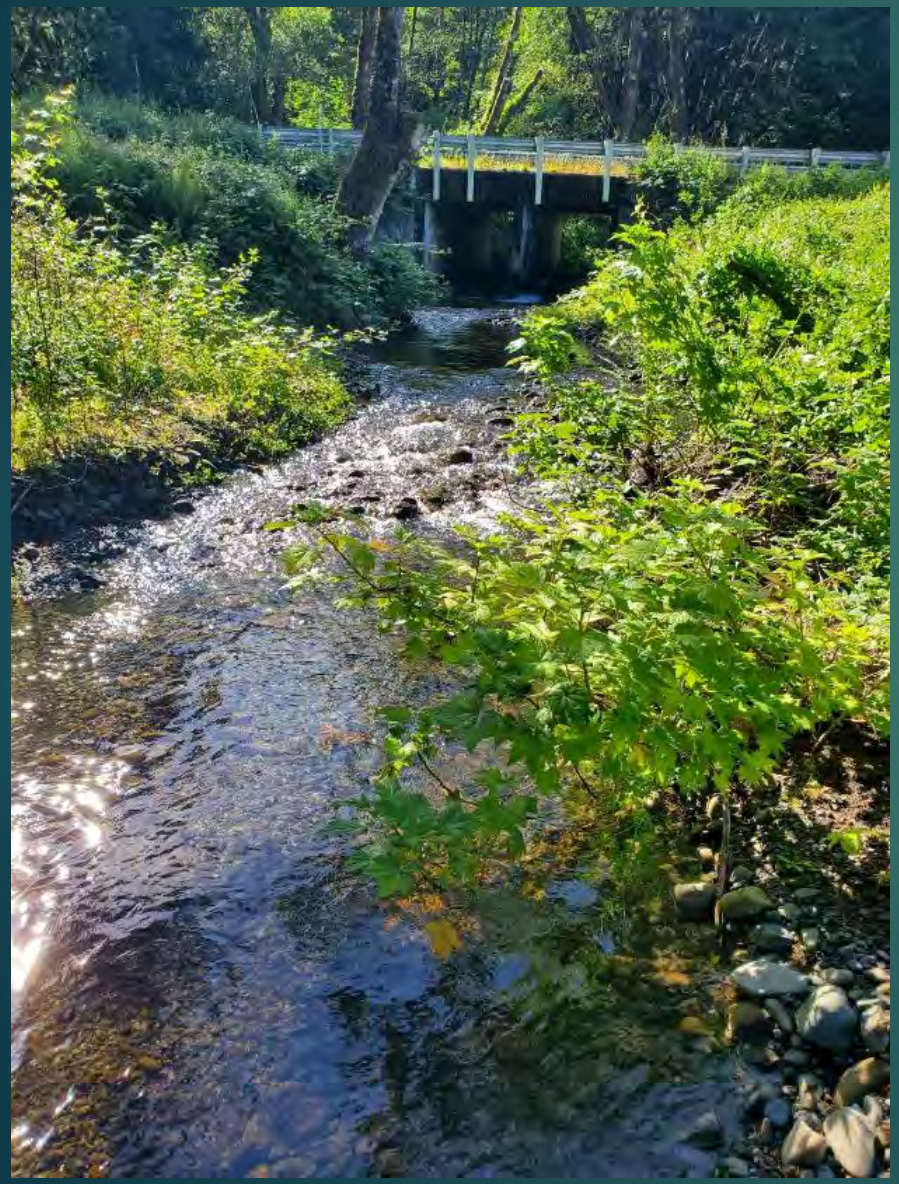
DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 1

ORIGINAL PROJ. 04-03T2
POST MILE 124.5

LITTLE LOST MAN CREEK BRIDGE
INDEX TO PLANS

UNIT: 5516
PROJECT NUMBER & PHASE: 0116000109
CONTRACT No.: 01-0F9604
STANDARD PRINTS SEARCH/EARLIER REVISION DATES:
REVISION DATES
SHEET 2 OF 15

Before

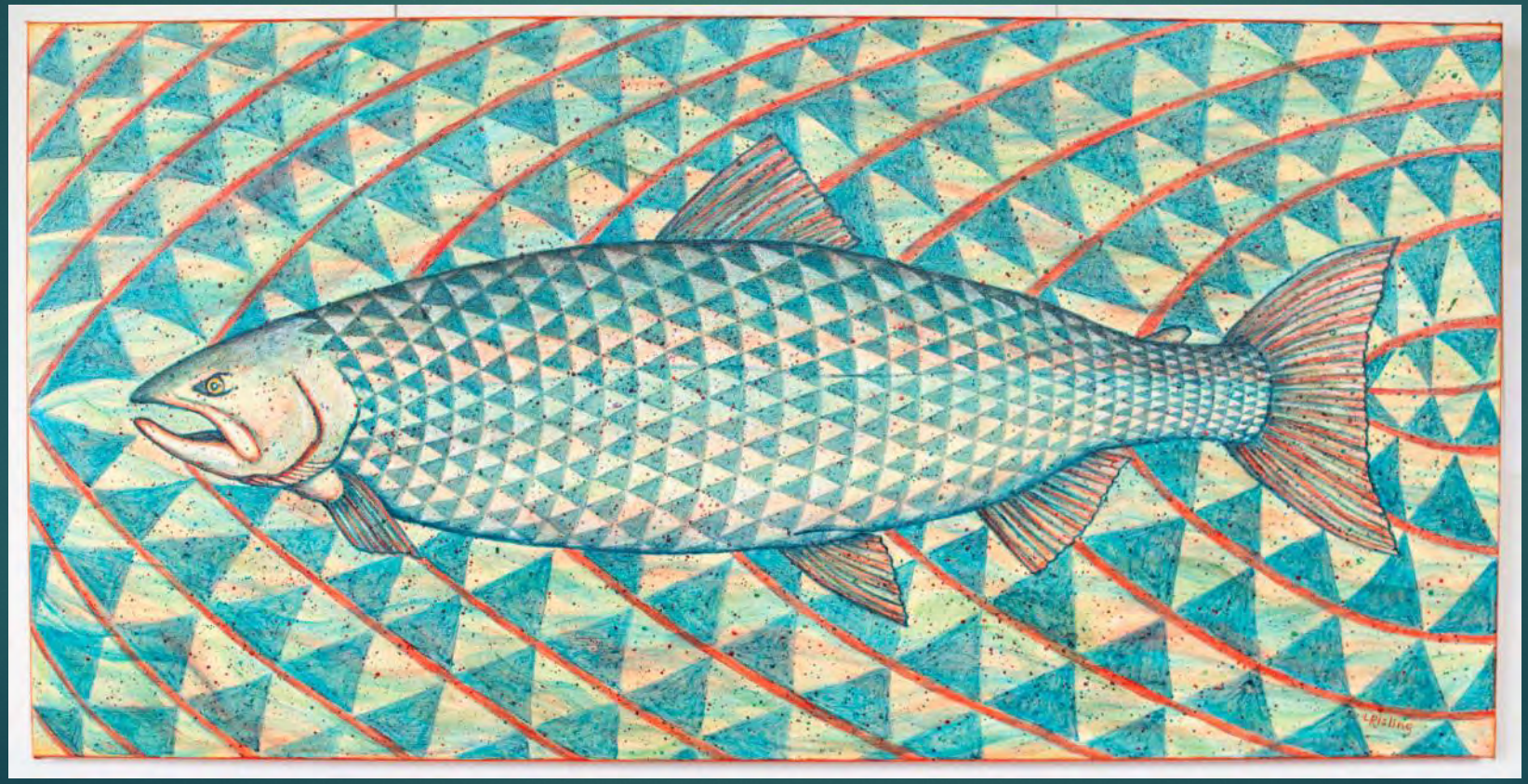


After

Project Funding

100% Department of Transportation funding

Caltrans Bridge Rehabilitation and Replacement State Highway Operation and Protection Program (SHOPP) almost $2 million for project development
Construction phase: First fish passage project funded by Senate Bill 1- approximately $5.4 million for construction



Artist: Mateo Hinojosa

The **Project Development Team (PDT)** collaborated closely in order to design and implement the project and to get all the information together for the internal and external approvals. PDT members include:

- Project Engineer
- Hydraulics Engineer
- Traffic Safety
- Right of Way
- Structures Engineers
- Structures Construction
- Geotechnical Engineering
- Environmental Management
- Landscape Architecture
- Revegetation/Stewardship
- Roadway Construction
- Environmental Construction Liaison

Fish Passage Analysis

Adults

- Fish X-ing software showed that adults were only able to pass the culvert during 5% of the passable flows due to water velocity constraints
  - shallow water depths during the winter also limited adult passage

Juveniles

- it was a complete *velocity barrier* to juvenile salmonids and resident fish
- complete *depth* barrier during the summer also inhibited juvenile and resident passage
- in addition, a leap at the outlet prevented most juvenile and resident fish from entering the culvert.

Multiple species benefits -

In addition to three listed salmonids Little Lost Man creek provides habitat for a diversity of aquatic and terrestrial species.

- Pacific lamprey
- Western brook lamprey
- Coastal cutthroat trout
- Northern red legged frog
- Tailed frog
- Chorus frog
- Coastal giant salamander
- Southern torrent salamander
- Gray fox
- Raccoon
- River otter
- Pacific fisher
- Humboldt marten
- Roosevelt elk and black tailed deer
- Black bear

Federal and State consultations and permits

- Federal
  - Section 7 ESA consultations from **National Marine Fisheries Service** (NMFS) and **United States Fish and Wildlife Service** (USFWS)
  - **US Army Corps of Engineers** Nationwide Permits:
    - #14 for *Linear Transportation Projects* and Nationwide Permit
    - #27 for *Aquatic Habitat Restoration, Enhancement and Establishment Activities*
- State

  Because the project was programmed based on its merits to improve access to fish habitat, it qualified for **Habitat Restoration Enhancement Act (HREA)** permitting process
  - Coverage under HREA
    - California Endangered Species Act (CESA) consultation
    - 1600 agreement
    - General 401 Water Quality Certification Order for Small Habitat Restoration Projects

Installation and Maintenance of fish exclusion netting

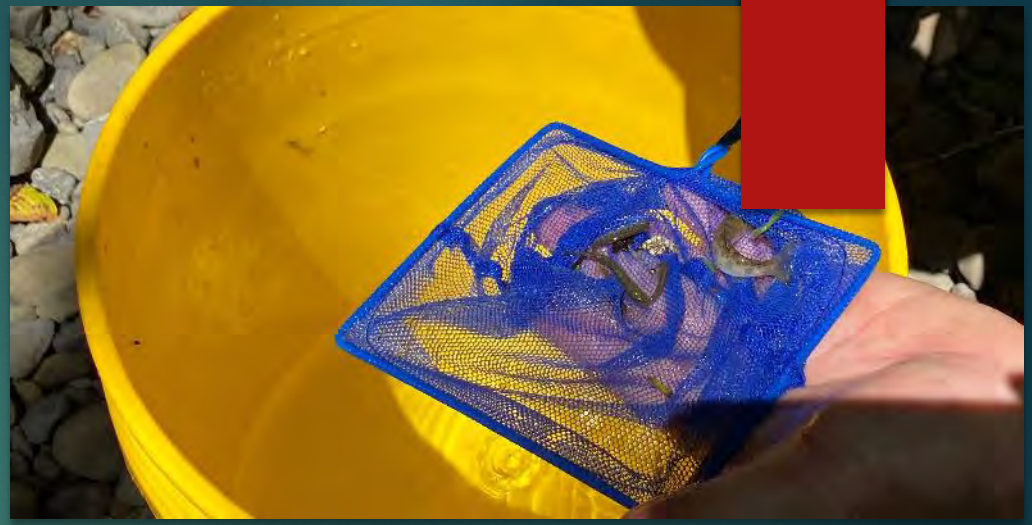
- Assurances were made that the fish exclusion netting measured 0.5” diagonally, that it spanned the entire width of the wetted channel, and was sealed with the bottom of the channel.
- Fish exclusion netting was maintained daily to avoid debris buildup that could lead to failure.

Fish Relocation

- Contractor was required to submit an aquatic species relocation plan
- Fish relocation was conducted by a contractor supplied biologist (CSB).
- Two backpack electrofishers were utilized to capture and relocate fish. Shallow water depths required cautious placement of the anode ring for the recently emerged steelhead/coastal cutthroat fry.
- Removal by hand dipping with aquaria nets was used to relocate the remainder of aquatic species in the relocation reach as the dewatering began and the water receded.

Altogether, more than1000 fish!

- About 800 steelhead/rainbow, mostly young of the year (18- 1+). No coho or Chinook although coho spawning was noted in years previous.
- Other fish species included:
  - coastal cutthroat trout, sculpin, brook lamprey, pacific lamprey, and stickleback
- Amphibians: coastal giant salamander, tailed frog, northern red legged frog.
- More than anticipated, needed to reinitiate consultation with NMFS



Fyke trap and Water diversion

A fyke trap was used to capture out-migrating fish so they could be moved downstream.

The contractor installed sheet piles to isolate the work area from the water, and then installed a five pump gallery to capture the surface flow

Clear Water Diversion

Pump gallery

Outlet sump pump

Outlet of the clearwater diversion

Inlet sump pump

- The clearwater diversion was about 200 feet long.
- Contractor required to submit a clear water diversion plan (according to Caltrans' Field Guide to Construction Site Dewatering (2014).
- The plan included measures to slowly ramp down flows to allow for aquatic species to voluntarily relocate and also re-water the site slowly to avoid a release of sediment.
- A five pump gallery was used to get the water up and over the highway to a point downstream of the work area.
- Sump pumps at the inlet and outlet collected subsurface water to further dry work area.

Construction **22.5’ active channel width---70 foot long single span precast slab. (No piers or columns in the channel)**

Half width construction

Stream Restoration

- Channel restoration
- Bank restoration
- Revegetation efforts

Channel Restoration

Boulder clusters were added to create channel diversity and localized scour

Installation of Root Wad Structures

Biostabilization of the vertical bank (downstream right bank)

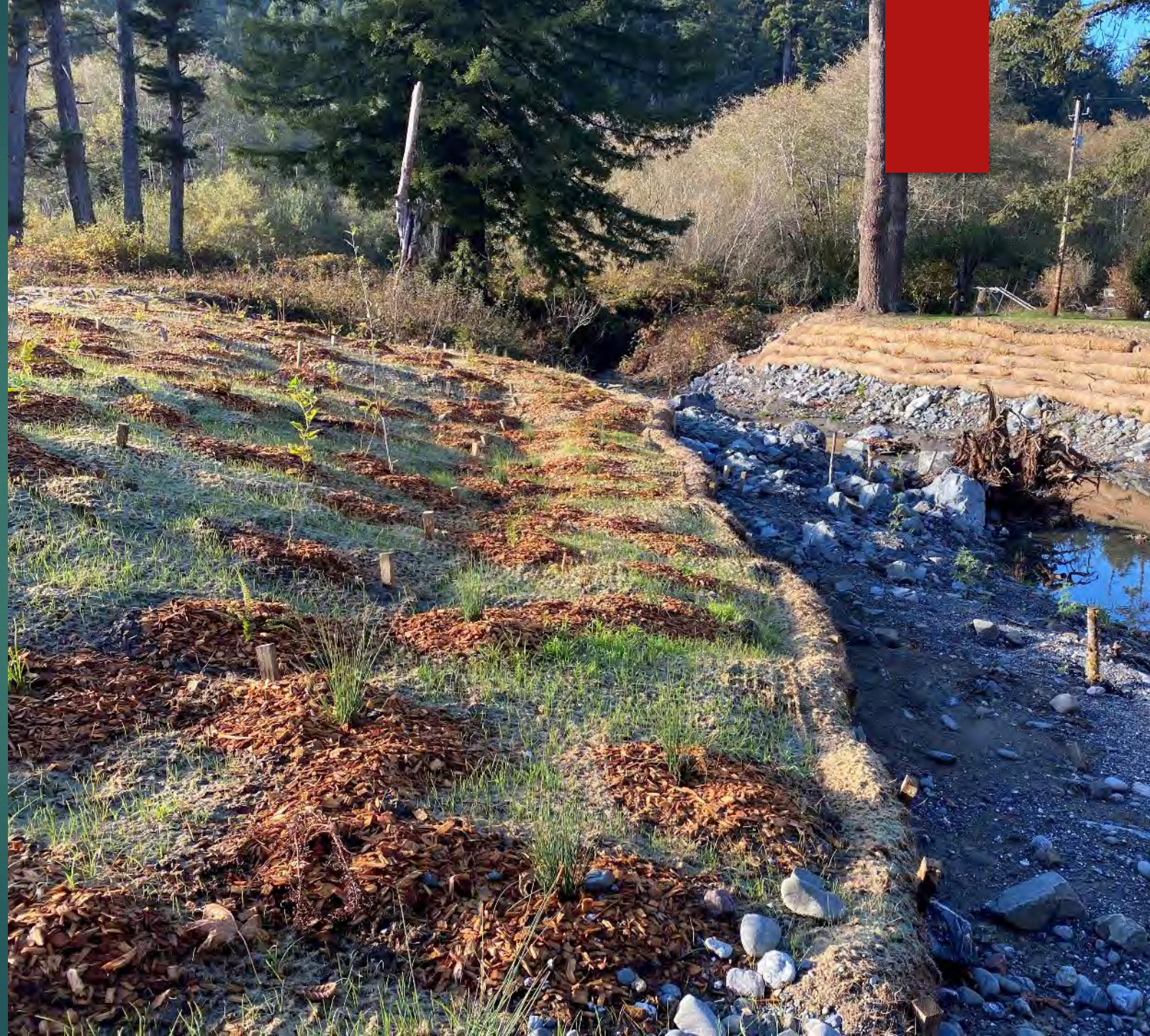
Willow Blanket (upstream left bank)

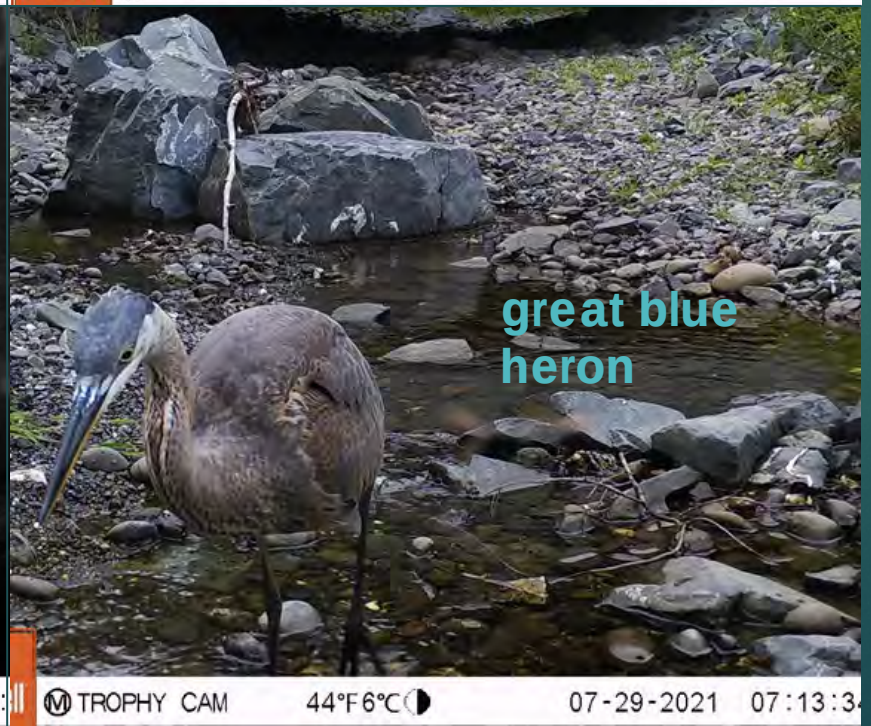
Cultural Consideration

Artist: Mateo Hinojosa

Revegetation

Botanical Name	Common Name	Notes
Alnus rubra	red alder	nursery container stock
Athyrium filix-femina var. cyclosorum	lady fern	nursery container stock
Frangula purshiana	cascara	nursery container stock
Heracleum maximum	cow parsnip	nursery container stock
Iris douglasiana	Douglas iris	nursery container stock
Marah oregana	coastal wild cucumber	salvage from site
Polystichum munitum	sword fern	salvage from site
Rubus parviflorus	thimbleberry	nursery container stock
Rubus spectabilis	salmonberry	nursery container stock
Salix sitchensis	Sitka willow	salvage from site
Sambucus racemosa var. racemosa	red elderberry	nursery container stock





Wildlife camera footage of multi-species use

Fox family

-

Some have just as much interest in us as we have in them.


Bushnell
TROPHY CAM
44°F 6°C
06-26-2021
08:13:12


8/14/2021
6:24 AM
ID:2
Cuddeback


9/16/2021
9:12 PM
ID:2
Cuddeback


9/12/2021
8:55 AM
ID:2
Cuddeback


6/28/2021 9:17 AM ID:2
Cuddeback Digital

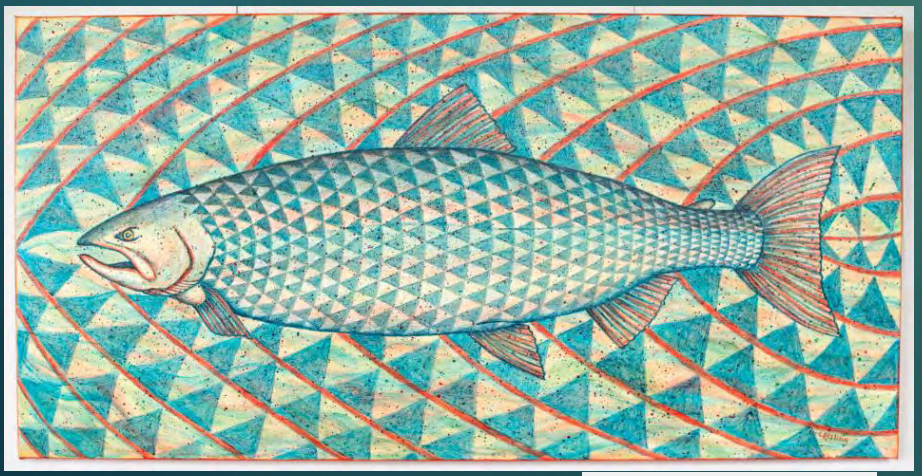

10/1/2021 7:23 AM ID:2
Cuddeback Digital

Top predators

HUGE SUCCESS

Summary of Benefits

Permitting success
Construction success
Fish and wildlife success



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