Welcome attendees of the Lower Mattole River Tour for the 2023 Salmonid Restoration Conference

This package of documents and links provides some background for tour. The package includes the following:

- Directions to the Mattole Beach, our first stop on the tour
- An itinerary for the tour (Note the offer of a paella dinner following the tour at our last stop!)
- A brief historical perspective on restoration actions in the lower Mattole River and Estuary
- A link to drone footage of the lower Mattole River with some of the projects pointed out: https://vimeo.com/818603359
- A package describing the Lower Bear Creek Project including some interesting figures of the proposed project and project area
- Background, photos, and graphs from the McGinnis Creek Habitat Enhancement Project

Please be prepared for walking on uneven wet ground. Muck boots or hiking boots are suggested.

We look forward to showing you some of our work in the Lower Mattole River.

Your tour hosts,

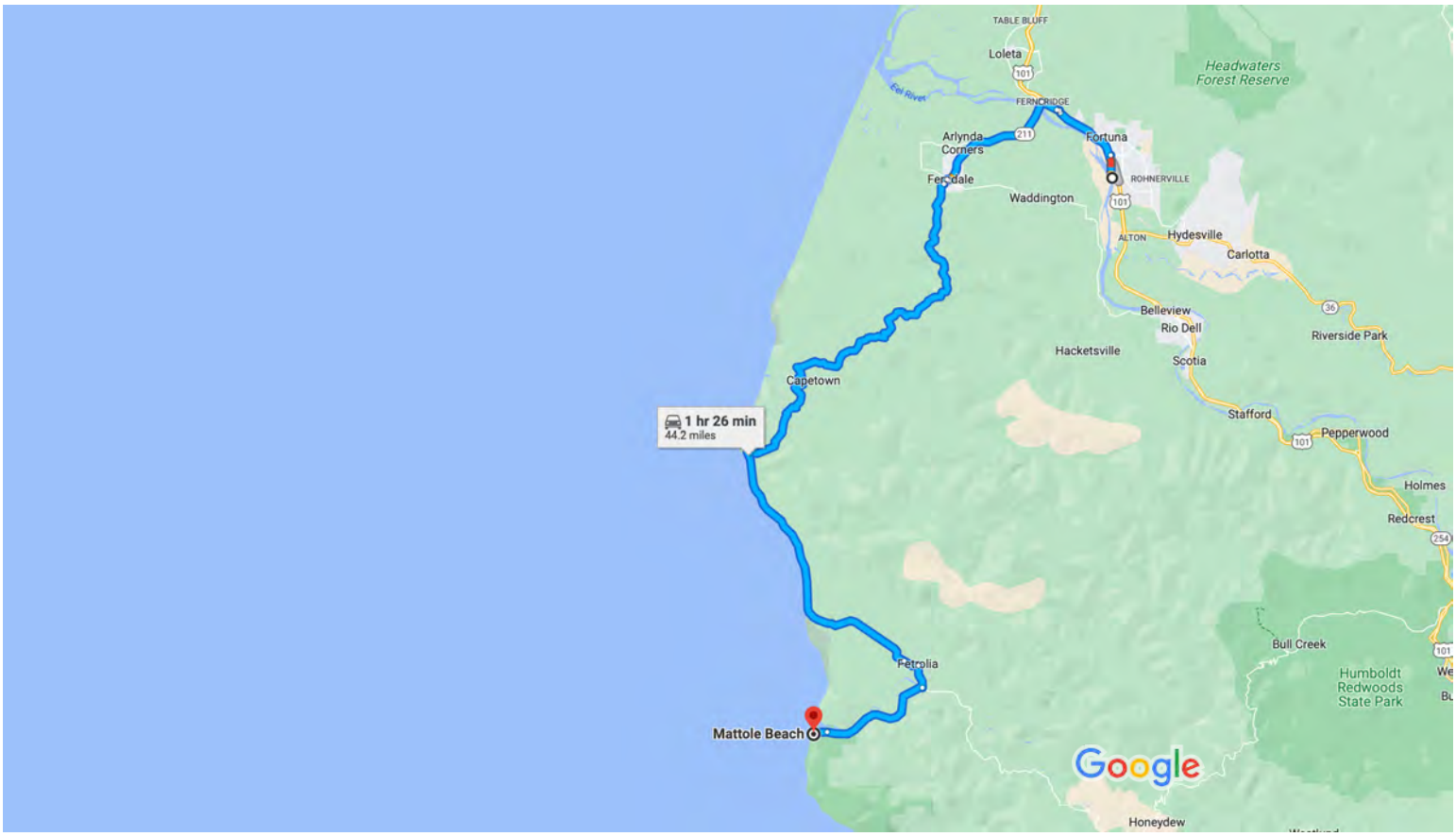
Mattole Salmon Group
Mattole Restoration Council
US Bureau of Land Management
Michael Love and Associates

Google Maps

1800 Riverwalk Dr, Fortuna, CA 95540 to Mattole Beach, California 95558

Drive 43.7 miles, 1 hr 27 min

You can Google Mattole Beach for directions. But note that cell service will be lost shortly after you leave Ferndale. Park near the restrooms at Mattole Beach parking lot which is just before the entrance to the BLM Campground.



Map data ©2023 Google 2 mi

1800 Riverwalk Dr
Fortuna, CA 95540

1. Head east toward S 12th St/Riverwalk Dr
   25 sec (354 ft)

Take CA-211 S and Mattole Rd to Lighthouse Rd
1 hr 21 min (38.8 mi)

2. Turn left onto S 12th St/Riverwalk Dr
   Continue to follow Riverwalk Dr
   0.8 mi
3. Turn left to merge onto US-101 N
   2.4 mi
4. Take exit 691 toward Fernbridge/Ferndale
   0.1 mi

5. Continue onto Fernbridge Dr

0.1 mi

6. Turn right to stay on Fernbridge Dr

0.6 mi

7. Turn left onto CA-211 S

4.8 mi

8. Turn right onto Bluff St/Ocean Ave

Continue to follow Ocean Ave

476 ft

9. Turn left onto Wildcat Ave

0.2 mi

10. Keep right to continue on Mattole Rd

28.1 mi

11. Continue onto Front St

0.6 mi

12. Turn right onto Mattole Rd

0.8 mi

Drive to Lighthouse Rd

12 min (4.9 mi)

13. Turn right onto Lighthouse Rd

4.4 mi

14. Slight right to stay on Lighthouse Rd

0.4 mi

Mattole Beach

California 95558

SRF Conference 2023 – Field Tour

Habitat Restoration Projects in the Lower Mattole River

April 25, 2023

Itinerary

09:15 Leave Fortuna (two vans, and a few cars)

11:00 Arrive Mattole Estuary Overlook
- Restroom stop for Mattole Beach then drive to turnout just below road up Prosper Ridge
- Welcome, Introductions and Overview of Field Tour
- BLM Overview of KRNCA

11:30 Arrive at Dog-Leg Pool Turnout/Trail
- Walking tour of Middle Slough Restoration along all sections including views of alcoves, shelfs, riparian re-vegetation
- Continue walking tour of stream barbs, mid-elevation terrace planting, and observation of Heliwood 1 and 2 structures on north side of river
- Walk through floodplain treatment areas and return to vans

1:00 Arrive at Bear River Band (BRB) Flat for lunch, project tour
- Lunch 30 minutes
- BRB introduction
- Discussion of Lower Bear Creek Project
    - Purpose
    - Design Process
    - Recommended Project

2:15 Arrive 3030 Ranch Parking Area
- Bathroom stop
- Walking tour of McGinnis Creek FRGP Work
- Brief discussion of upcoming heliwood project

3:15 Vans leave for Fortuna (Note: those wishing to join in a late afternoon paella dinner at 3030 ranch following the tour of McGinnis are welcome)

A Brief History of Cooperative Restoration Actions in the Mattole River Estuary 1990 – 2016

Michael Evenson, Mattole Salmon Group

Humboldt State University's Cooperative Fisheries Research Unit studied the estuary in 1986 and 1987 (Natural Resources of the Mattole River Estuary, California, Busby et al., 1988 – https://www.krisweb.com/biblio/mattole_blm_busbyetal_1988_estinv.pdf). Prior to these studies, the South Slough was teeming with juvenile Chinook. HSU found that the estuary/lagoon was extremely shallow in depth (from a minimum of 0.1m to a maximum of 4m – with much of it merely ankle deep and temperatures lethal to juvenile salmonids, with maximum temperatures ranging from 17 to 23 degrees C. From the work of Reimers [1978] which found that juvenile Chinook that over-summered in the estuary/lagoon were far more likely to return as spawning adults, it was clear that the Mattole estuary was inhospitable for Chinook and a serious bottleneck to recovering the population.

The Mattole Salmon Group (MSG), working with the US Bureau of Land Management (BLM) which manages the lower river and Estuary, implemented a two pronged approach: 1) place massive rock/wood structures to increase scour and depth throughout the lower mile of the river and 2) address the loss of slough habitat which had become filled with sediment and became perched above the mainstem channel following the April 1992 earthquake which created a 1meter uplift.

MSG proposed dredging the South Slough, then located along the ocean berm, in the early 1980s. But at that time, the project was considered too radical an alteration of the natural environment and was not pursued. What followed were various projects to mitigate for the lack of suitable habitat for the over-summering fish.

In 1989, MSG pioneered the Estuary Floating Shade and Cover Structures which the juvenile fish flocked to immediately upon placement. These temporary wood and willow structures provided both shade and shelter for juvenile salmonids.

In 1990, MSG built two log revetment structures on the south bank of the Estuary and, in 1991, another six along the north bank. These structures provided scour and habitat complexity in the hostile aquatic environment. The South Bank structures were still in place as late as 2010 (photo) and most of the North Bank structures are in place today. Along with structure installation, MSG conducted riparian plantings from 1986 through 1994.

1991 Revetment structures south bank

During the early 1990's, MSG convened a meeting with the California Department of Fish and Game, Coastal Conservancy and the USDA Redwood Sciences Laboratory to propose studying the Mattole estuary and developing a plan to restore aquatic function to remedy the hostile conditions for Chinook and Coho salmon. Funding was provided to the Mattole Restoration Council to complete the study titled, Dynamics of Recovery:
https://www.krisweb.com/biblio/mattole_mrc_xxxx_1985_dynamicsrecov.pdf
This study recommended placing more large log and rock anchored structures in the estuary in proximity to the high-energy flows so that they would scour deeper and provide better habitat.

The first massive structure was a wood and rock assemblage called “Woodzilla” at the mouth of Collins Creek – a source of cold water. When the river channel migrated away from the structure to the center of the floodplain, this structure functioned in the Collins delta, sometimes in the water, sometimes high and dry.

“Woodzilla” as built, 2002

MSG built another four massive boulder/large wood assemblages in successive years. Each one created scour and, over time, buried themselves, sinking into the deep gravels. They continue to function by creating turbulence and scour, aiding the transport of sediment out of the system into the Pacific Ocean and creating temporary fish habitat between high flows. They have become “permanent” hard points in the lagoon/estuary, the tops of which are visible from time to time.

Gary Flossi (CDFW) on field tour of structure #3 built in 2003

2007 structure as built

As built - 7th LWD structure completed, August 2011

Beginning in about 2012, MSG pioneered the use of the helicopter transport of whole, large trees into the wetted channel. The project had mutual benefit of removing Douglas-fir which was encroaching into historic grasslands for use in the river. These trees were excavated from sidehill rangeland and carefully placed in the lower 2 miles of the river.

Heliwood 2013

The Mattole Salmon Group, working with a BLM chartered Estuary Technical Advisory Committee, pursued the use of a helicopter for wood placement of whole trees in the estuary. With seven large wood structures downstream in the estuary, whole trees might hang up and or create their own jams and island building structures. The idea is to give the river the materials it needs to build structures and let the rivers dynamics do the work.

The first placement of 100 whole trees took place between September and November 2013. A helicopter lowered the trees to conserve as much branch and root wad complexity as possible. All areas disturbed in the process of tree removal were planted and restored to deep rooted perennial grasses and clovers. A monitoring program was set up in which each trees has an individual identifying scannable tag. These tags are scanned and each tree's location is mapped. Locations and movement of the trees are tracked.

In order to promote longer term residency, the second heliwood placement was conducted in 2016. This effort incorporated constructing triangles of whole trees which were hen pinned with 1" diameter iron rod. Most of the trees were placed along the North Bank, and some were used to create the massive Twin Towers rock and wood structure placed mid-channel. Several stream barb structures were placed mid-channel but did not survive high flows.

Apex jams in construction 2014

Note that this history describes projects that preceded the work to be viewed in detail on the 4/25/2023 SRF field tour. This background aims to provide some perspective of the restoration efforts in the estuary.

Construction in progress of the 7th LWD structure, August 2011

Slough excavation #1 in 2014

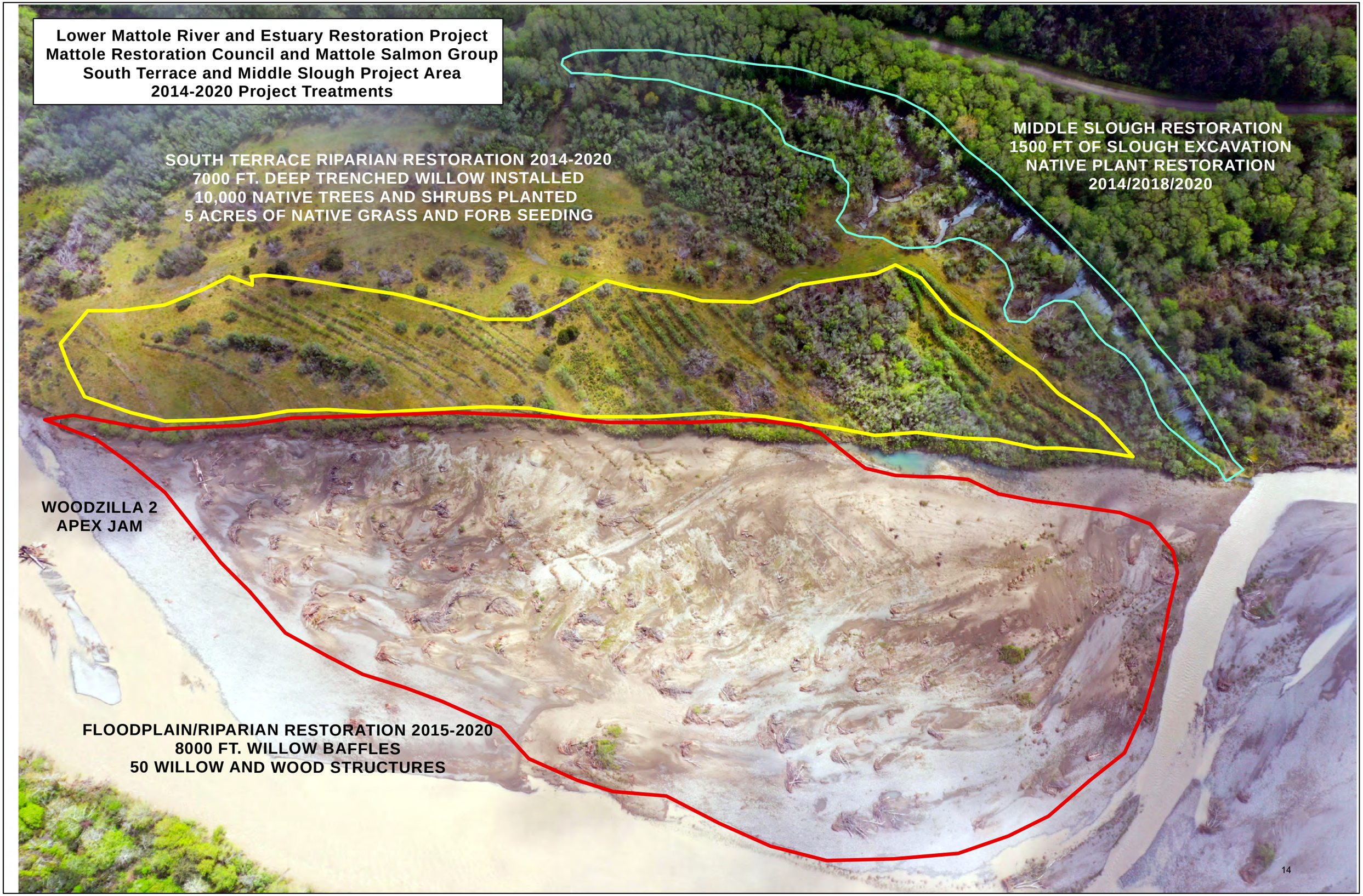
Mattole River Estuary Project Time-Line

1990 - LWD #1 Log revetment structure south bank
1991 - LWD #2 Log and rock revetment structures north bank
1999 - LWD #3 “Woodzilla” at mouth of Collins Gulch, North bank
2003 - LWD #4 North bank near “Woodzilla”
2004 - LWD #5 edge of gravel island
2007 - LWD #6 and #6 edge of gravel island
2010 - LWD #7 at mouth of slough
2011 - LWD #8 structure and 3 Apex jams
2013 - Heliwood #1 - 246 whole trees placed with willow planting
2014 - 300' slough excavation "C-zero" and apex jams #1
2016 - Heliwood #2 - 253 whole trees placed, Woodzilla 2 anchored structure installed
2018 - 500' slough excavation "C1" completed, and 5000' trenched willow and 18 willow/wood clusters near Monadnock
2019 - 1500' willow planted along Lighthouse Rd emergency repair
2020 - 800' slough excavation "C2" plus 701' of alcove
2014-2020 - **South terrace and floodplain, north of slough:** 15,000' trenched willow, 17 stream barbs, 10,000 native trees and shrubs planted, 50 willow and wood structures
2021 - 2 anchored LWD structures and 75 willow/wood clusters near Monadnock and on North Bank

Photo by Hugh McGee, April 2023, looking east and upstream from near upper tidal extent of the Mattole estuary

1. Mouth of Collins Gulch
2. Mouth of excavated slough
3. Upstream end of slough, and Dogleg Pool
4. South terrace and floodplain, planted 2014-2020
5. Bear Creek channel realignment
6. North Bank, 2021 planting and wood
7. Lighthouse Rd emergency repair, Stansberry Ck mouth immediately upstream
8. Monadnock, planting and wood 2018-2021

Lower Mattole River and Estuary Restoration Project
Mattole Restoration Council and Mattole Salmon Group
South Terrace and Middle Slough Project Area
2014-2020 Project Treatments



Lower Mattole River and Estuary Restoration Project
Mattole Restoration Council and Mattole Salmon Group
North Bank Project Area
2021 Project Treatments

Lower Mattole River and Estuary Restoration Project
Mattole Restoration Council and Mattole Salmon Group
Mandonok Project Area
2018-2021 Project Treatments

Michael Love & Associates
Hydrologic Solutions
PO Box 4477 • Arcata, CA 95518 • (707) 822 -2411

Lower Bear Creek at Lighthouse Road Realignment and Restoration Project

Antonio Llanos, P.E and Mike Love, P.E. *Michael Love and Associates, Inc*

Lower Bear Creek (LBC) emerges from its steep inner-gorges draining Prosper Ridge onto the unconfined lower Mattole River floodplain, where it has formed an alluvial fan before draining across the County maintained Lighthouse Road (LHR) and into the adjacent river. Channelized and aggraded with sediment the reduced channel capacity causes flooding across LHR and loss of contributing flow into the Middle Slough, which was recently enlarged and enhanced to provide habitat for rearing juvenile salmonids.

This project reconnects LBC to the slough network and is intended to work with, and expand upon, the recently completed restoration activities in the estuary and Middle Slough.

Specific goals developed with the Technical Advisory Committee:

- Enhance off-channel habitat for over-wintering salmonids in the upper ecotone of the Mattole River Estuary.
- Improve public safety and access along LHR in the vicinity of LBC.

Specific measurable objectives of this project:

- Deliver surface and subsurface flows from LBC into the Middle Slough to improve water quality in the slough and fish access to the Dogleg Pool
- Minimize delivery of sediment to the Middle Slough from LBC and western tributaries
- Reduce frequency of flooding on LHR and private driveway
- Reduce need for County maintenance of LBC at LHR
- Minimize maintenance obligations for landowners
- Minimize flooding of the existing grassy field west of the driveway.
- Install road-stream crossings sized for flow, sediment, and debris from upstream

Each alternative followed the same LBC channel alignment, placing the channel to the west of its current alignment and connecting to the Middle Slough at the upstream end of the Dogleg Pool.

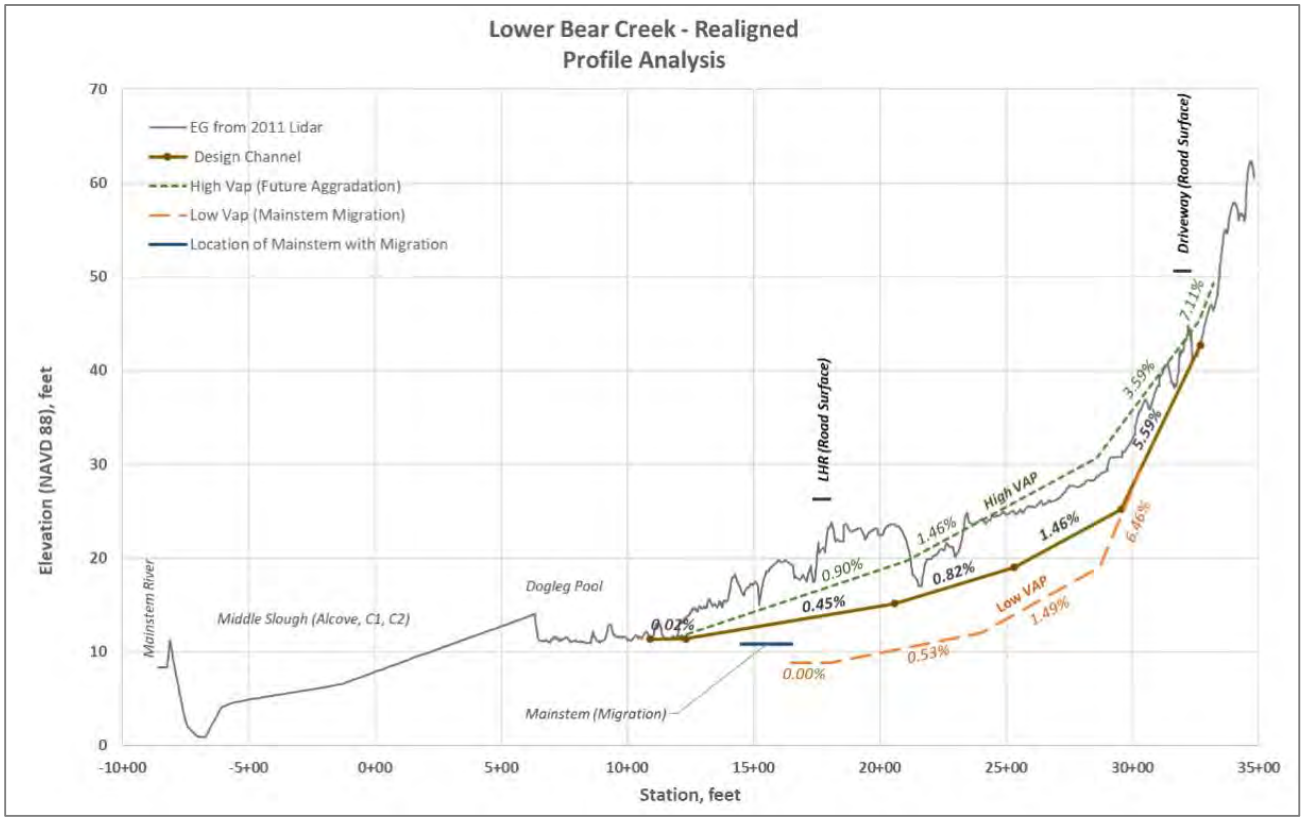
Options and alternatives developed during the project scoping period and alternatives analyzed and presented to the TAC and landowners for LBC.

Option	Alternative	Description	Selected for Development	Selected for Design
0		No Project	No	No
1		Dual Sediment Capture Basin	No	No
2	**A**	**Single Sediment Capture Basin**	**Yes**	No
3	**B**	**Reset Alluvial Fan**	**Yes**	No
4		Natural Fan Growth Confined by Berms	No	No
5	**C**	**Realign Lighthouse Road.**	**Yes**	No
	D	**Raise Lighthouse Road and Driveway**	**Yes**	**Yes**

Channel Project Description

The project will realign approximately 2,000 feet of Lower Bear Creek (LBC) from its present alignment to the west, where it historically flowed. This allows unconstrained flow across the western half of the alluvial fan, allowing sediment to deposit in-channel and across the fan. Over time the channel will aggrade and likely change course across the surface of the fan. Downstream of the depositional zone, flow will be conveyed through a newly excavated slough channel that connects to the existing Dogleg Pool. And into the Mattole River. Capture channels and side channels will be constructed downstream of the alluvial fan to pick-up and guide overland flows into this slough channel.

- Enhance salmonid habitat by including alcoves, backwater channels, and large wood cover structures in the LBC slough channel downstream of the alluvial fan.
- Design the realigned upper delivery channel based on an upstream natural reference reach.
- Establish the service life of the project based on aggradation extending from the head of the Dogleg Pool to the apex of the alluvial fan (referred to as the fully aggraded condition).

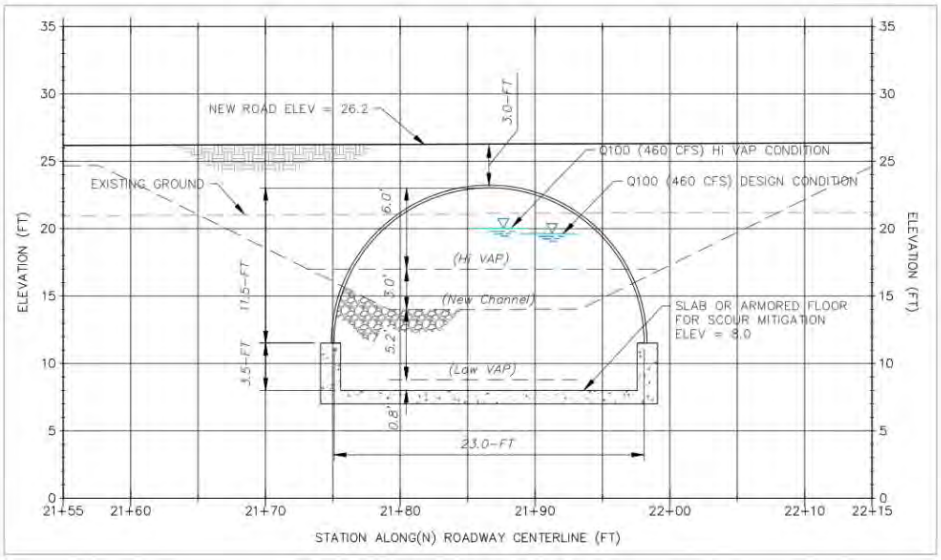


Vertical adjustment potential (VAP) profiles and existing ground (EG). The vertical adjustment potential of the channel is represented by the High VAP (Aggradation) and the Low VAP (scour from lateral mainstem river migration).

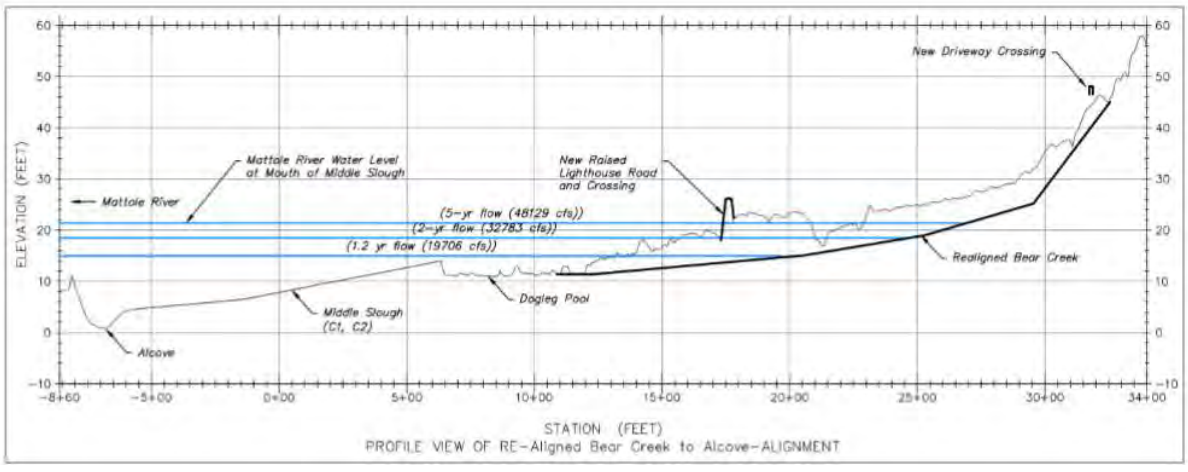
Road and Crossing Project Description

This new channel alignment crosses under both the driveway and LHR, which will both be raised. These roadway and stream crossing improvements will greatly reduce the frequency of roadway flooding on LHR and the private driveway.

- Raise the roadway of LHR and driveway above the peak water level of LBC 10-year flood for the fully aggraded condition.
- Meet County and CalFire road geometry requirements
- Convey LBC 100-yr flow with freeboard at the fully aggraded condition.
- Accommodate lowest estimated potential elevation of the channel bed at culvert and future aggraded condition at Bridge
- Passage of aquatic organisms based on stream simulation design approach (CDFW, 2009)



Design cross section for Lower Bear Creek crossing at Lighthouse Road.



Water level in the Lower Mattole River projected on the realigned Lower Bear Creek profile.

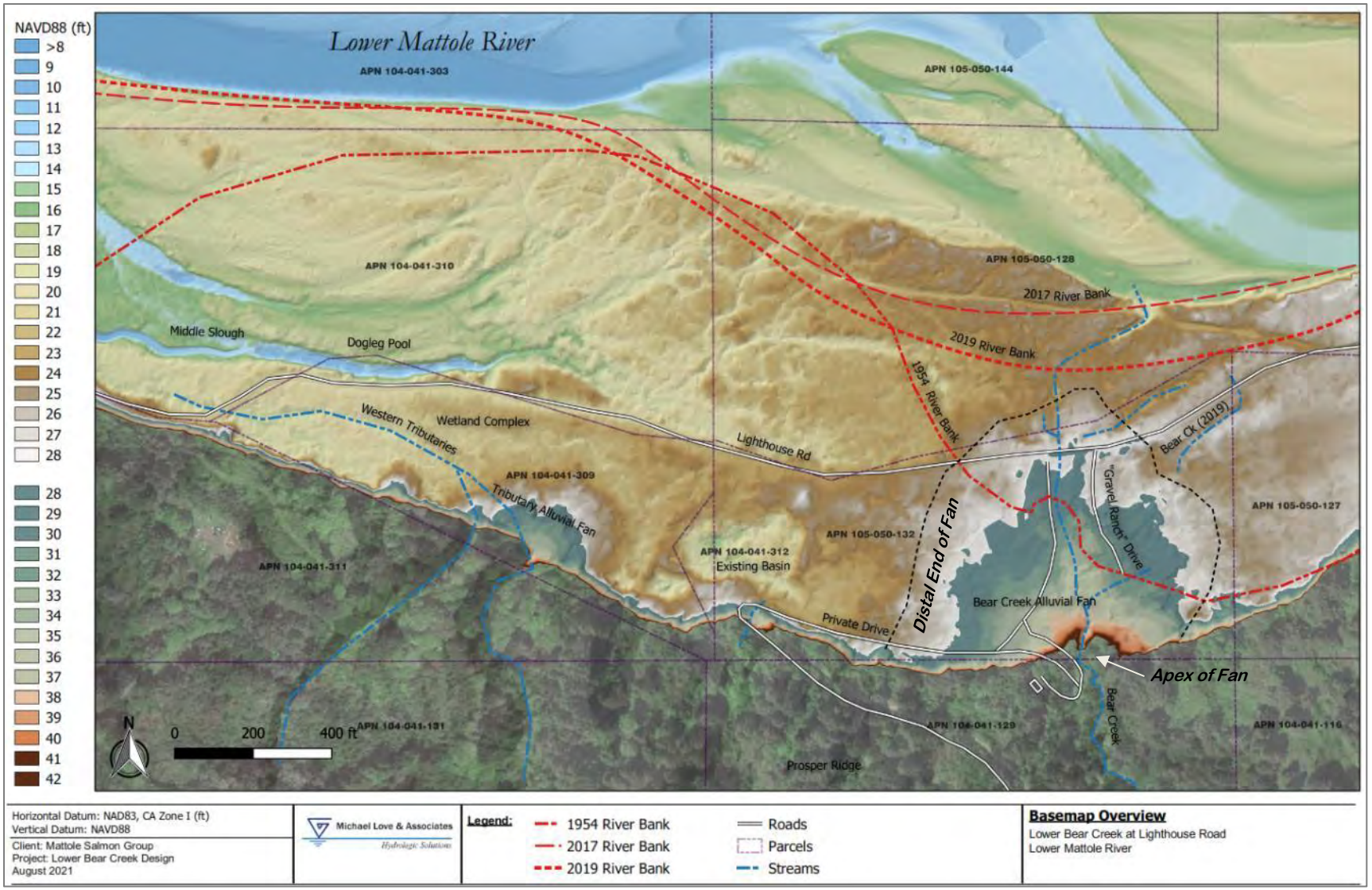


Figure 1-2. Basemap of the existing Lower Bear Creek channel and project area. Topography was derived from the 2009-2011 Coastal Lidar database. Property lines are approximate from Humboldt County Planning Department's GIS portal. Riverbank locations were traced from aerial photographs.

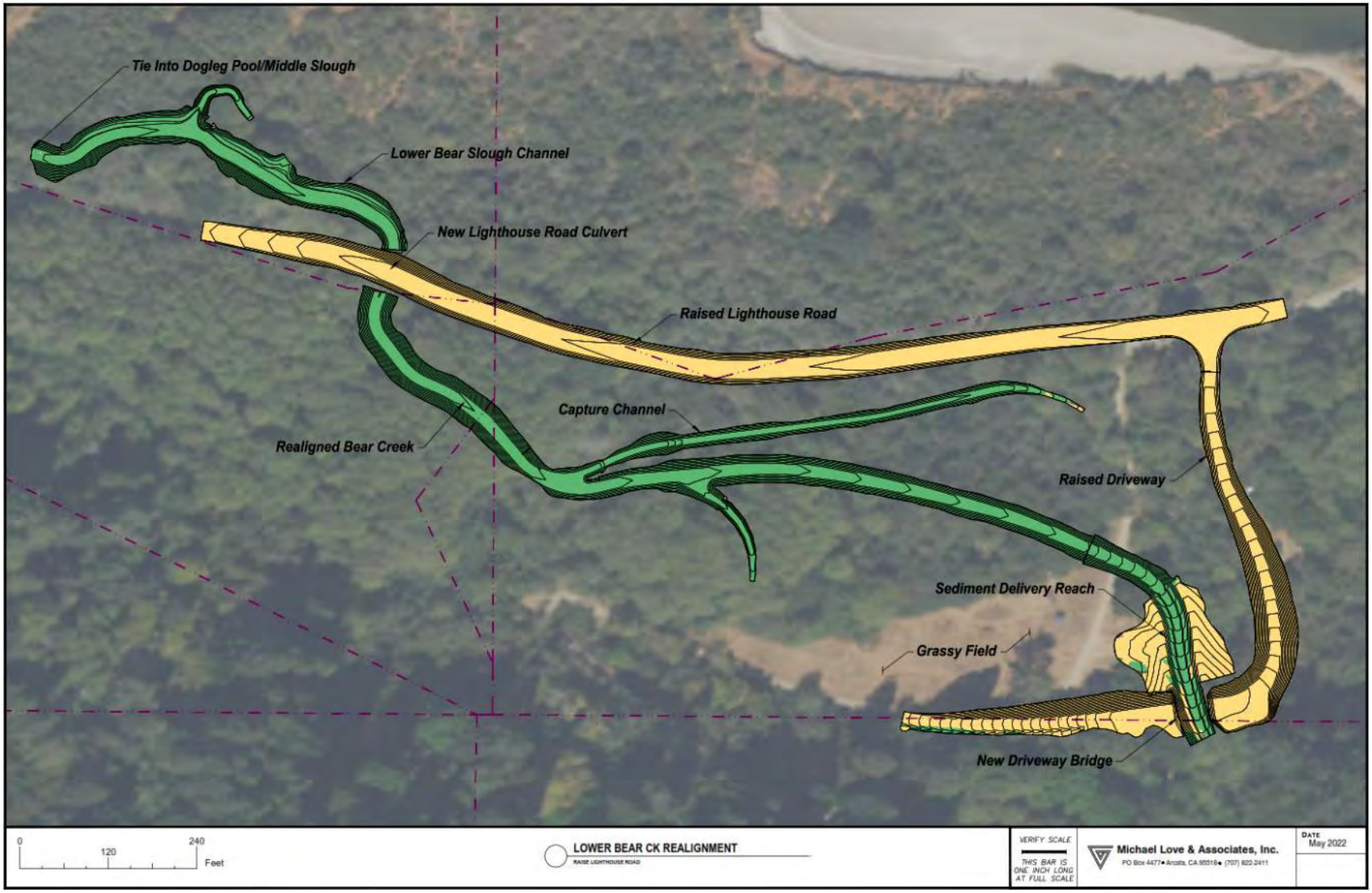
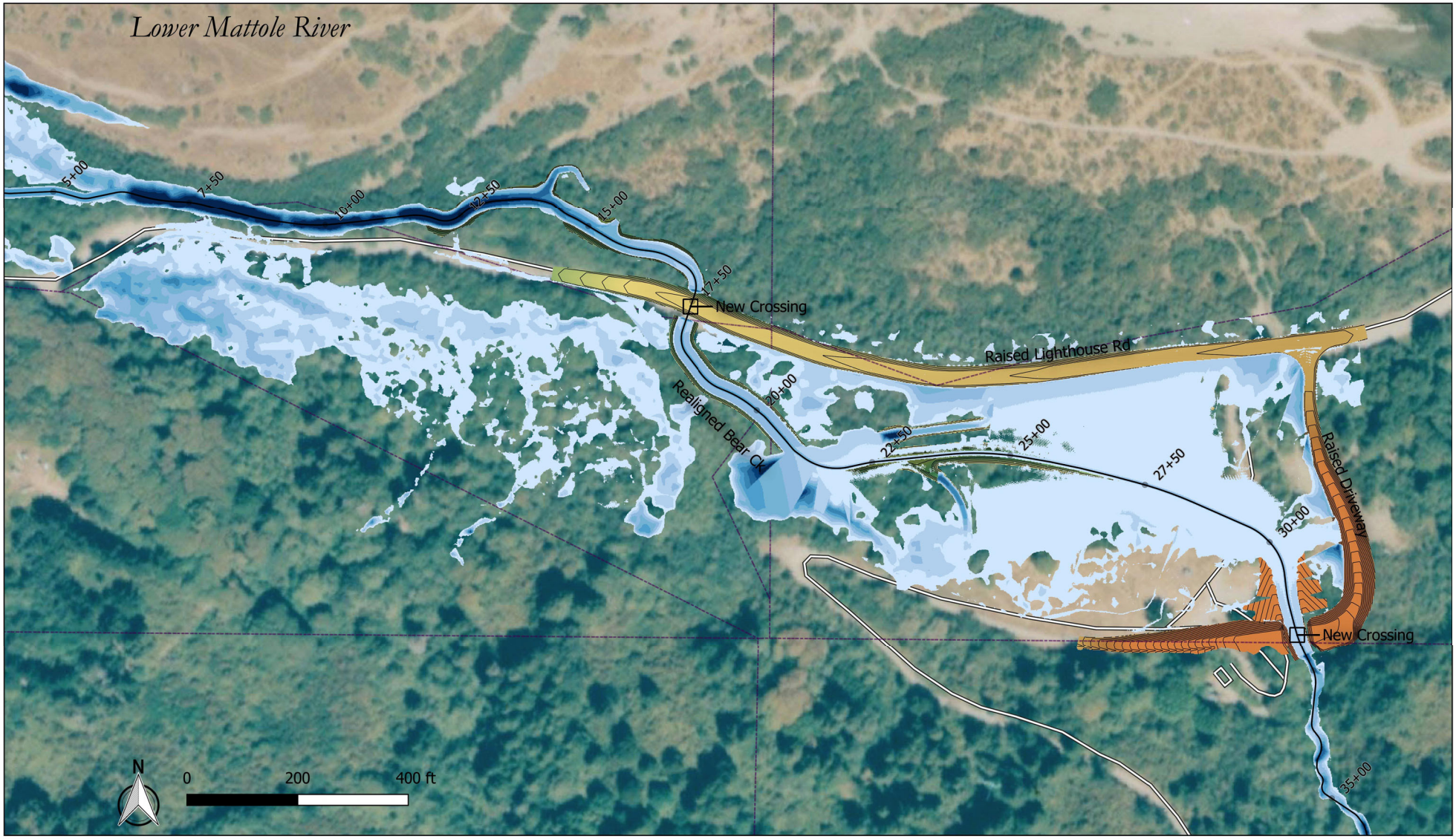


Figure 4-1. Layout for the proposed realignment of Lower Bear Creek and the raised Lighthouse Road and Driveway. Green indicates channel excavation, yellow indicates road embankment fill. Contours represent 1-foot elevations. Approximate parcels lines are shown as dashed lines.



Horizontal Datum: NAD83, CA Zone I (ft)
Vertical Datum: NAVD88

Client: Mattole Salmon Group
Project: Lower Bear Creek Design
May 2022

Michael Love & Associates
Hydrologic Solutions

Mattole Salmon Group

Legend:

- New LBC Alignment
- Parcels
- Roads
- Streams

Depth (ft)

<= 0.5	1.5 - 2	3 - 3.5
0.5 - 1	2 - 2.5	3.5 - 4
1 - 1.5	2.5 - 3	

Realinged Lower Bear Creek and Raised Lighthouse Road

Lower Bear Creek at Lighthouse Road
Lower Mattole River
10-Year Flow, Aggraded Condition

Filepath: Q:\Lower Bear Creek - Mattole\7_CAD-GIS\QGIS\Working\FINAL DESIGN.qgz

Michael Love & Associates, Inc. P.O. Box 4477, Arcata, CA 95521 (707) 822-2411

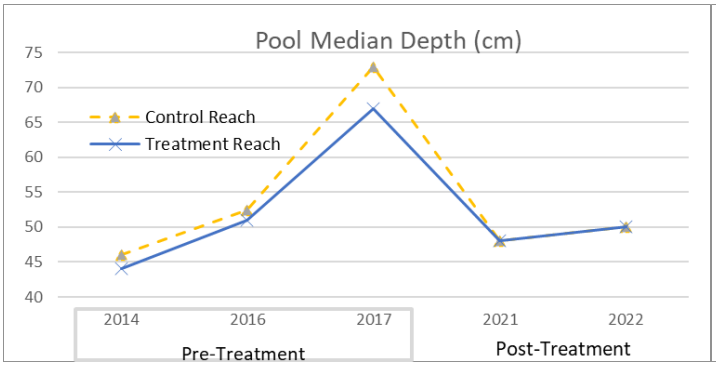
McGinnis Creek Habitat Enhancement Project – Mattole Salmon Group

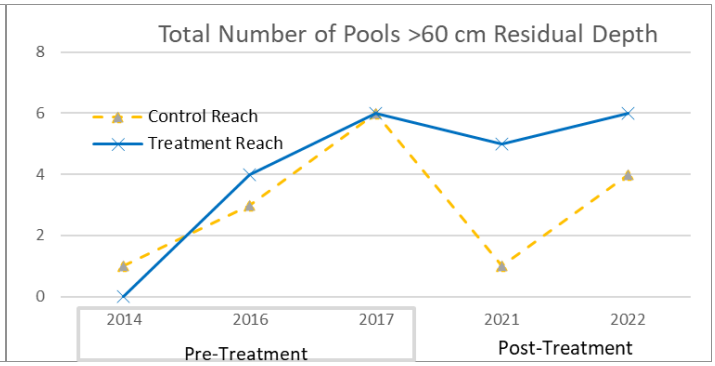
The McGinnis Creek Habitat Enhancement Project installed 148 logs at 16 sites over 0.75 miles in McGinnis Creek in 2020 and 2021. Funding was provided by CDFW's FRGP, and in-kind donations (primarily logs/trees) from Humboldt Redwood Company and the 3030 Ranch.

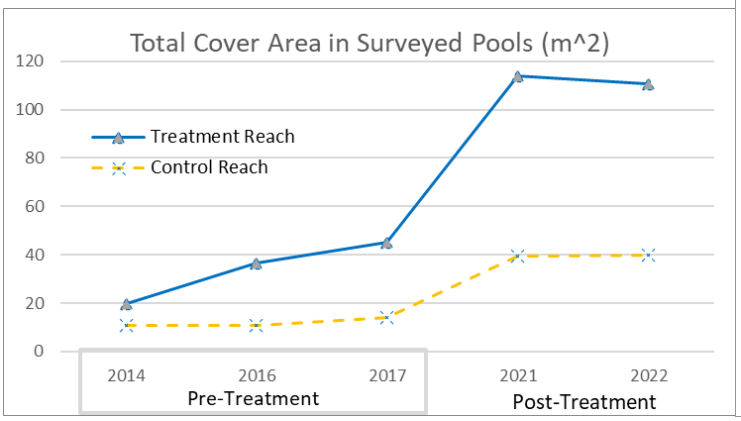
McGinnis Creek is one of the few Mattole tributary streams in the lower river with both extensive low-gradient habitat (nearly two miles) and cool-summer water temperatures (MWATs<18 C). The intent of this project was to enhance spawning and rearing habitat for steelhead, coho, and Chinook salmon by increasing pool depth and cover, and gravel aggradation upstream of structures.

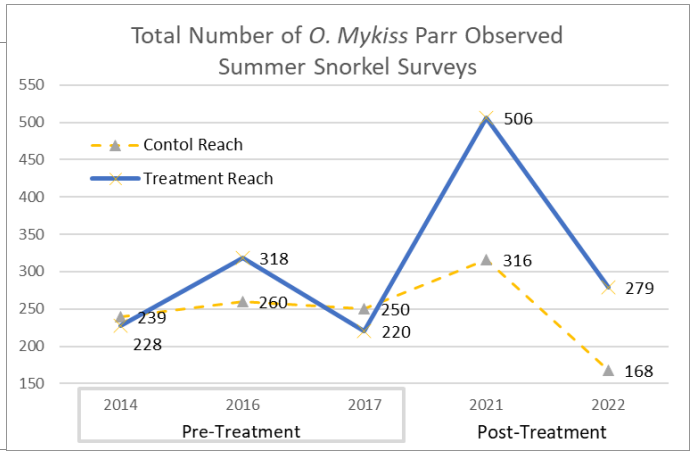
Pre-project, the treatment reach was a classic "bowling alley", with relatively few, shallow pools, and a lack of large wood and cover. Surveys in 2014 found only a single pool over 60 cm deep in 2500m surveyed. The stream was heavily impacted by timber harvest and road-building in the 1960s (see aerial photos below). Recovery has been notable in the last several decades, with the development of a closed alder canopy and the channel down-cutting as coarse sediment loads have decreased, but with a continued lack of instream large wood (and no mature streamside forest for recruitment) there was little prospect for the creation of complex instream habitat and re-engagement of the floodplain without significant wood additions.

Pre and post-project habitat surveys and snorkel surveys (sampling every other qualifying pool) were conducted in the treatment reach, and in the 1500m reach immediately upstream. Post-project data showed modest increases in pool depth relative to the control reach, and much more substantial increase in the amount of pool cover, which nearly tripled in the treatment reach. Perhaps the most notable result was the increase in the number of *O. mykiss* parr observed in the treatment reach relative to the control reach post-project, likely due to the much more complex habitat and cover created by the wood placement. These results also highlight the variability of instream habitat conditions year-to-year, and the importance of a control reach in evaluating the impact of instream projects.





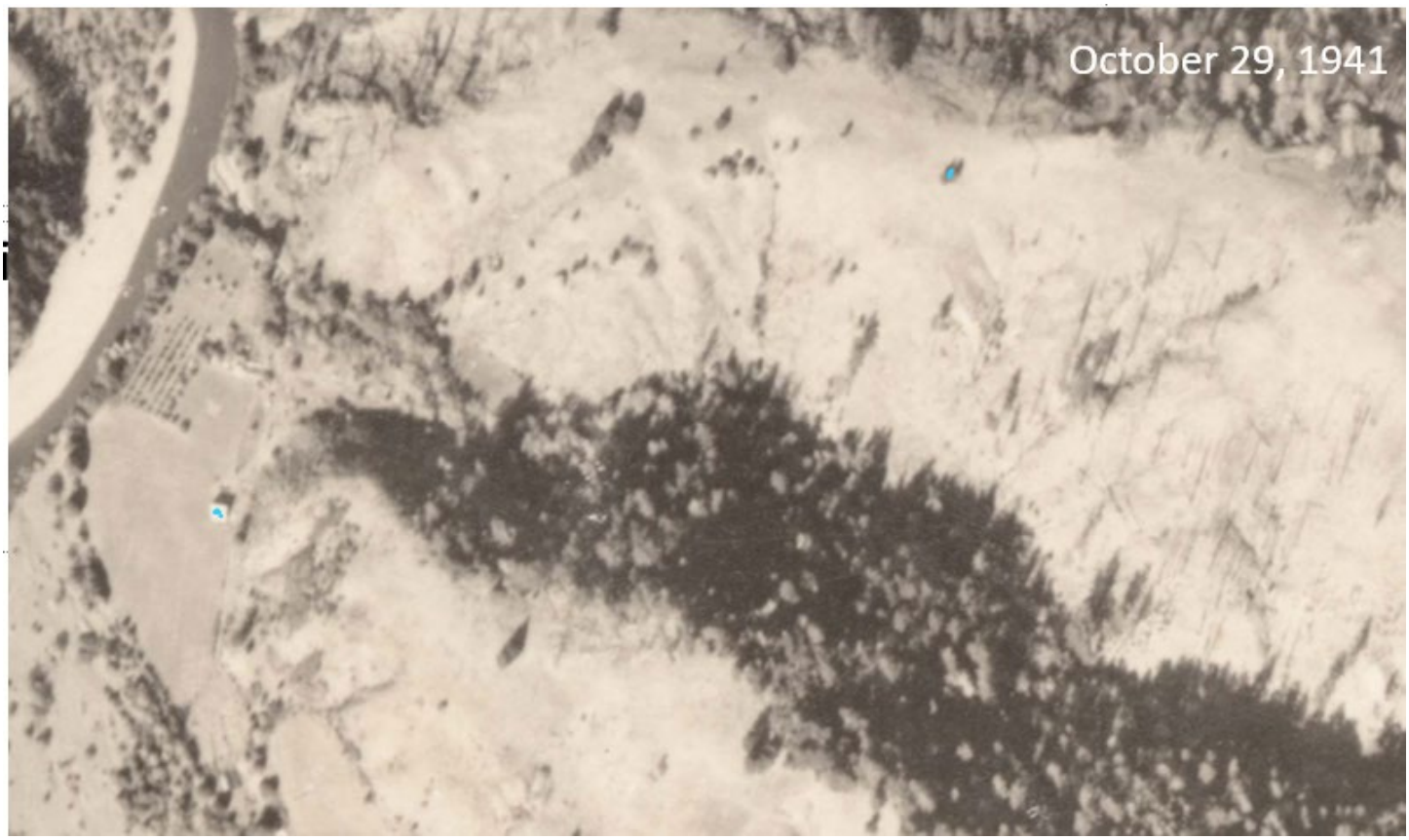


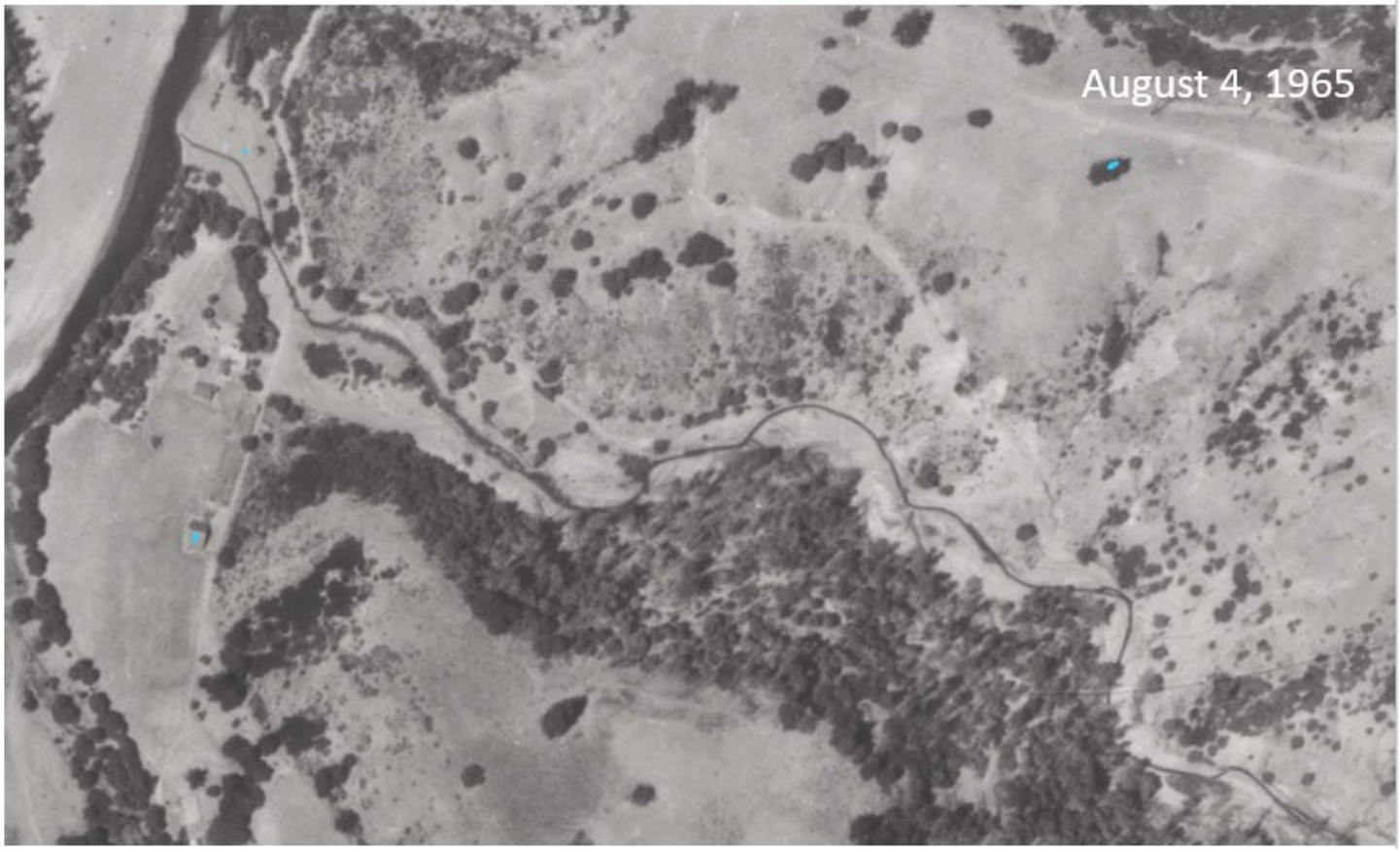


Site #8 Pre-project 2018 above, post-project 2022 below

Site #10 Pre-project 2018 above, post-project 2022 below

Note presence of large trees casting long shadows, especially conifers, in valley bottom in 1941 compared with gravel-land in 1965





By 1998 vigorous forest recovery is evident, and riparian alders are beginning to shade the stream channel. By 2019 alder now provides almost complete canopy coverage, and hillslope forest is very dense, growing, but still relatively small trees with low potential for near-term wood recruitment.