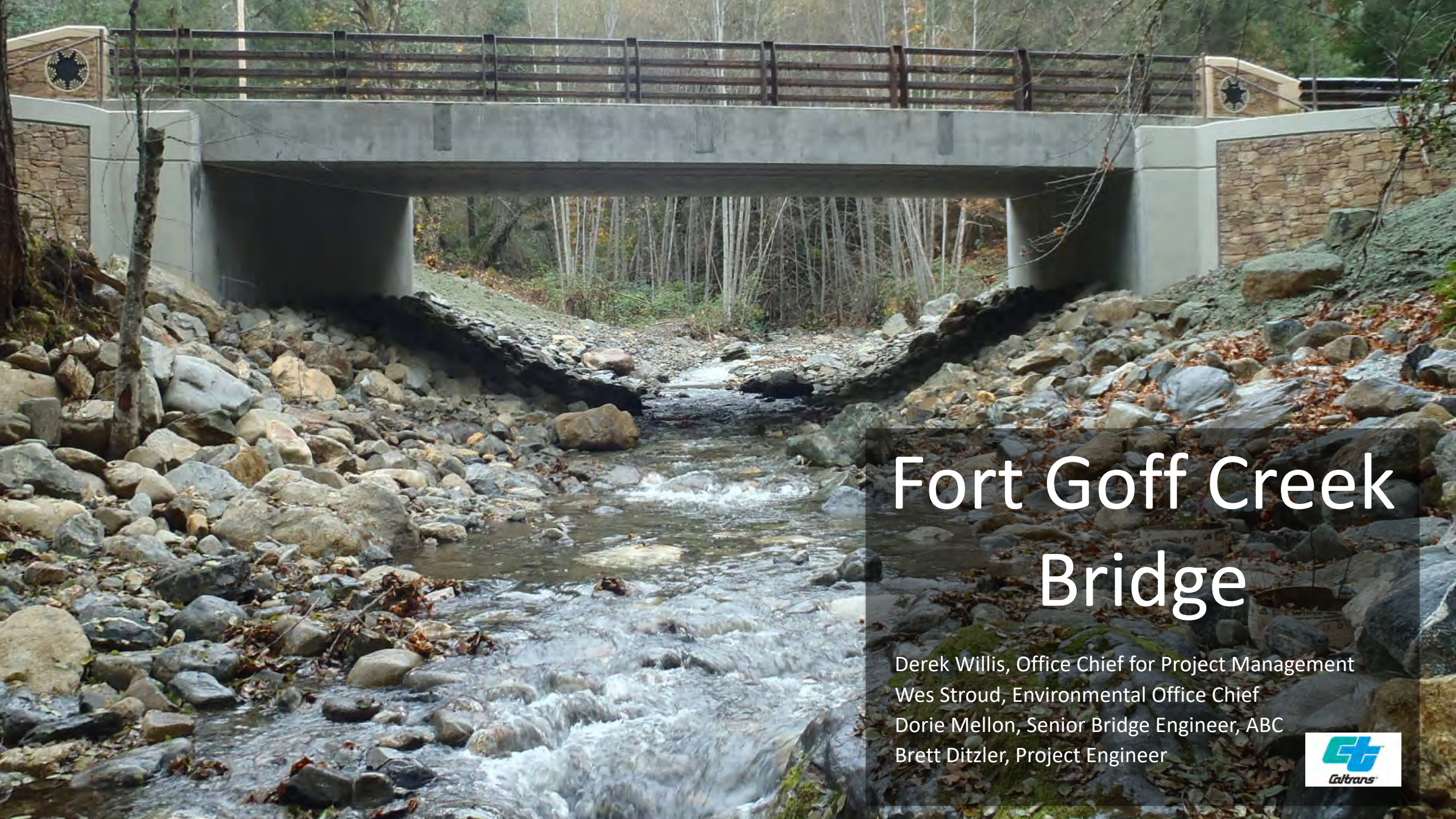


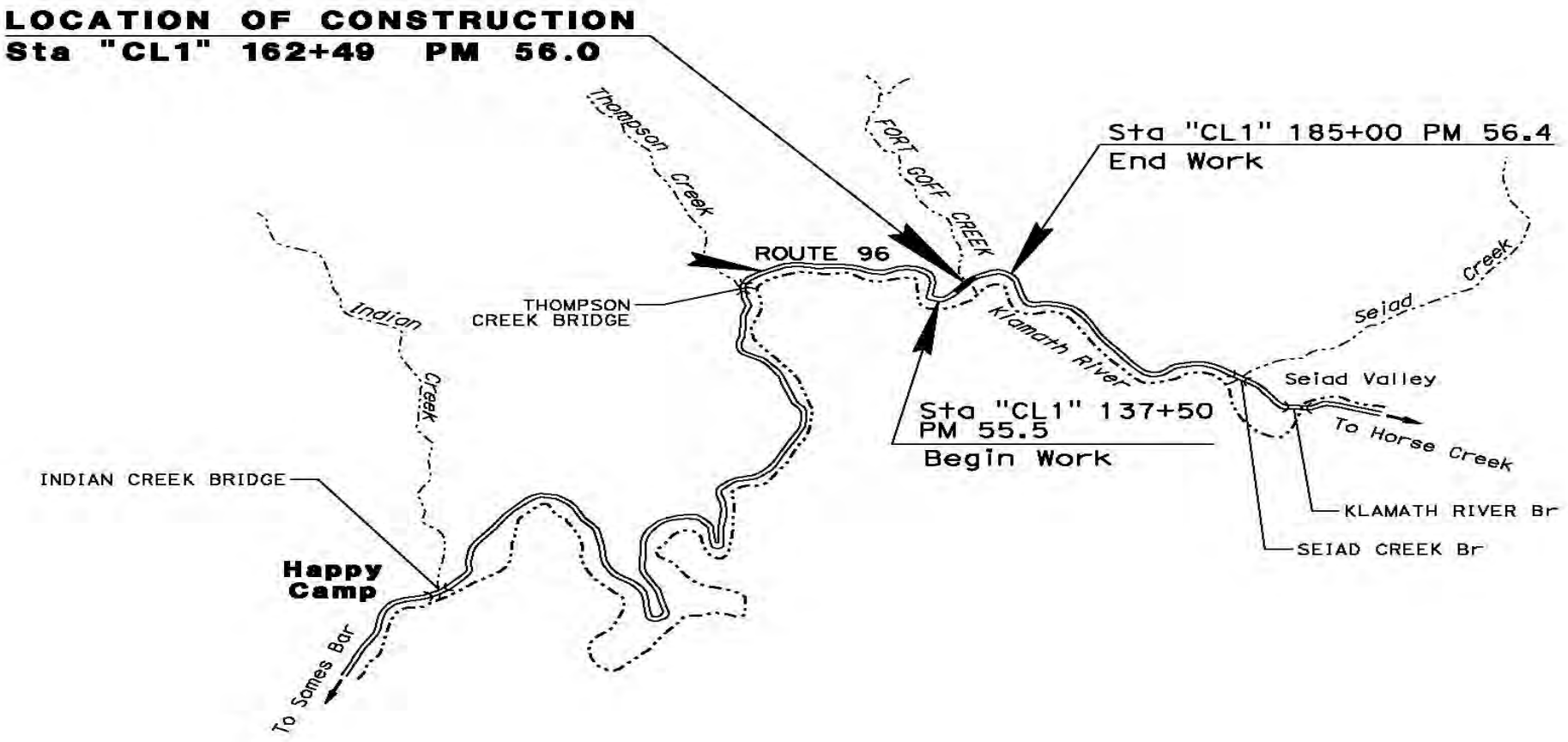
Fort Goff Creek Bridge

Derek Willis, Office Chief for Project Management
Wes Stroud, Environmental Office Chief
Dorie Mellon, Senior Bridge Engineer, ABC
Brett Ditzler, Project Engineer

Caltrans

Project Location

Fort Goff Creek flows under State Route 96, at PM 55.5 approximately 4 miles west of Seiad in Siskiyou County



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NEED

PURPOSE

Caltrans

LONG-TERM OUTCOME

PARTNERS

FISHPAC Partners:

- California Department of Fish & Wildlife (CDFW)
- US Fish & Wildlife Service (USFWS)
- National Oceanic Atmosphere Administration (NOAA)
- California Department of Transportation (Caltrans)

Supporting Partners:

- Mid-Klamath Watershed Council - MKWC
- Karuk Tribe
- Pacificorp Coho Enhancement Fund (CEF)
  - National Fish and Wildlife Foundation (NFWF)
  - USFWS
- Federal Highway Administration - FHWA
- American Association of State Highway Transportation Officials - AASHTO
- US Forest Service - USFS

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GRANTS/FUNDING SOURCES & PLANNED AMOUNTS

• CDFW/NOAA – FRGP Grant -	$1,620,000
• Caltrans (SHOPP Minor program) -	$1,005,000
• Office of Traffic Safety (Caltrans) -	$1,000,000
• FHWA/AASHTO – SHRP2 Grant -	$ 500,000
• USFWS -	$ 350,000
• CEF – (USFWS & NFWF assisted) -	$ 150,000
	$4,625,000

Caltrans

BIDS OPEN / CONTRACT AWARDED

- BID RANK BID TOTAL BIDDER ID BIDDER INFORMATION
- ------- ---------- -------- --
- 1 $1,963,233.50 HAYES AND SONS INC. ~13% over EE
- 2 $2,312,605.00 SHASTA CONSTRUCTORS, INC. ~33% over EE
- 3 $2,389,390.00 STEWART ENGINEERING INC. ~37% over EE
- 4 $2,404,943.99 SHASTA SERVICES, INC.
- 5 $2,614,121.00 R. BROWN CONSTRUCTION COMPANY
- 6 $2,778,790.00 J. F. SHEA CONSTRUCTION, INC.
- 7 $3,215,042.70 GOLDEN STATE BRIDGE, INC.

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SUPPORT	Caltrans share			USFWS share		[6]Pacificorp CEF share through NFWF and USFWS		[6]CDFW & NMFS share - FRGP		[1]AASHTO & FHWA share - SHRP2		**COMBINED SUPPORT**		
-	[5]SHOPP (Minor) Programmed	[2] OTS Programmed	Expended as of 01-12-16	Programmed	Expended as of 01-12-16	Programmed	Expended as of 01-12-16	Programmed	Expended as of 01-12-16	Programmed	Expended as of 01-12-16	**PLANNED PROGRAMMED FUNDING**	**Expended as of 01-12-16**	**Support to Capital Ratios**
Prelim Design	$245,000		$455,900	$100,000	$100,000							$345,000	$555,900	18.7%
Final Design	$523,000		$611,595									$523,000	$611,595	20.5%
R/W Support	$30,000		$60,616	$65,000	$59,547							$95,000	$120,163	4.0%
Const Support	$200,000		$355,749	$185,000	$185,000					$300,000	$300,000	$685,000	$840,749	28.2%
Subtotal	**$998,000**		**$1,483,860**	**$350,000**	**$344,547**	**$0**	**$0**	**$0**	**$0**	**$300,000**	**$300,000**	**$1,648,000**	**$2,128,407**	71.5%
CAPITAL														
R/W Capital	$7,000		$8,662							$30,000	$26,184	$37,000	$34,846	
[3]Const Capital		$1,000,000	$614,812			$150,000	$150,000	$1,620,000	$1,619,958	$170,000	$170,000	$2,940,000	$2,554,770	
Subtotal	**$7,000**		**$623,474**	**$0**	**$0**	**$150,000**	**$150,000**	**$1,620,000**	**$1,619,958**	**$200,000**	**$196,184**	**$2,977,000**	**$2,589,616**	
Total	**$1,005,000**	**$1,000,000**	**$2,107,334**	**$350,000**	**$344,547**	**$150,000**	**$150,000**	**$1,620,000**	**$1,619,958**	**$500,000**	**$496,184**	**$4,625,000**	**$4,718,023**	

Caltrans

A barrier to fish passage was removed through a concerted team effort of many state and federal agencies and the Karuk Tribe. The Fort Goff Creek Fish Passage Restoration project has demonstrated that when a group of people come together for a single cause many barriers can be removed and bridges built, opening up new territory for others to follow. This was true in this project as nearly four miles of anadromous Steelhead habitat and 1.6 miles of Coho and Chinook salmon habitat were opened for spawning, refuge and rearing.

Caltrans

Senate Bill - 857

- Only relates to barriers that effect Anadromous Fish
- The Existing law requires that the California Department of Transportation (Caltrans) provide unimpaired passage for all anadromous fish at stream crossings.
- Consistent with SB 857, all projects within current or historically populated streams shall be constructed so that they do not present a barrier to anadromous fish passage at any life stage.
- The definition of “projects” includes any action regardless of funding source or level and includes any rehabilitation, new construction or maintenance action that extend the life of the existing culvert or crossing.
- A “barrier” can be a physical, thermal, or hydrologic impediment to fish passage that is partial or complete barrier to any life stage as defined by NMFS and CDFW assessment protocol.

Caltrans

Fish PAC's Fish Passage Prioritization Ranking Criteria

Species Diversity

- Number of fish species currently or historically present within stream reach
- State/Federal Status (endangered, threatened, or species of concern)

Suitable Habitat

- Quality of stream habitat upstream of potential barrier
- Quantity of stream habitat upstream of potential barrier

Professional Knowledge

- Information known to fisheries or hydraulic professionals (fish presence, additional barriers on stream, roadway fill, replacement cost, etc.)

Caltrans

Project Goals Specific to Fort Goff Creek

- Improve fish Passage for state and federally threatened Coho Salmonids, local fish species, amphibians and terrestrial wildlife.
- Remove a significant Barrier (15’ diam. By 65’, worn out CSP) under State Route 96 and construct a bridge
- Restore 200’ of streambed & habitat connectivity

Caltrans

Fort Goff Creek Studies

Fish Habitat Assessment Report (2011)

- Prepared by Karuk Tribe, funded by US Fish and Wildlife Service
- Assessed habitat value upstream of State Route 96 on Fort Goff Creek, Portuguese Creek, and Cade Creek.
- Approximately 1.6 miles of coho salmon habitat and 4 miles of steelhead habitat exists upstream of State Route 96 on Fort Goff Creek.

Fish Passage Evaluation Report (2008)

- Karuk Tribe funded fish passage evaluations on 3 State Route 96 culverts (Fort Goff Creek, Portuguese Creek, and Cade Creek).
- Fort Goff Creek culvert was determined to be a partial barrier. Due to lack of depth during low flows (<6.2 cfs) and excessive velocities for high flow events (>98.9 cfs).

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Pre Project

Post Project

Caltrans

Water Temperature Monitoring Results for Fort Goff Creek 2005 – 2014

Year	Maximum Water Temperature	Maximum Weekly Temperature
2005	68.4	67.1
2006	70.2	69.8
2007	68.7	67.8
2008	66.2	64.9
2009	69.8	68.9
2010	66.2	65.5
2011	64.6	64.0
2012	65.8	64.9
2013	68.4	67.1
2014	68.9	67.6

Caltrans

Additional Fort Goff Information

State Route 96 crosses Fort Goff Creek approximately 300 feet from the confluence with Klamath River.

99 % of the total Fort Goff Creek watershed is owned by U.S. Forest Service and almost entirely roadless with the exception of State Route 96.

Caltrans

Project Success Information Upstream of SR 96 Crossing

Survey Information Pre-Project

- 2014 – 2 Coho / 167 Trout

Survey Information Post Project

- 2016 – 174 Coho / 197 Trout

Project Target Species
Coho Salmon-S Oregon / N California ESU (*Oncorhynchus kisutch*)
Federally and State Listed as Threatened

Coho salmon. Photo credit: David Berman, Sonoma Water.

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Some Environmental Challenges

- Stream Diversion - Fish Exclusion/Relocation requirements
- Risks associated with “Streambed Restoration” and general adherence to all Environmental and Storm Water Permits

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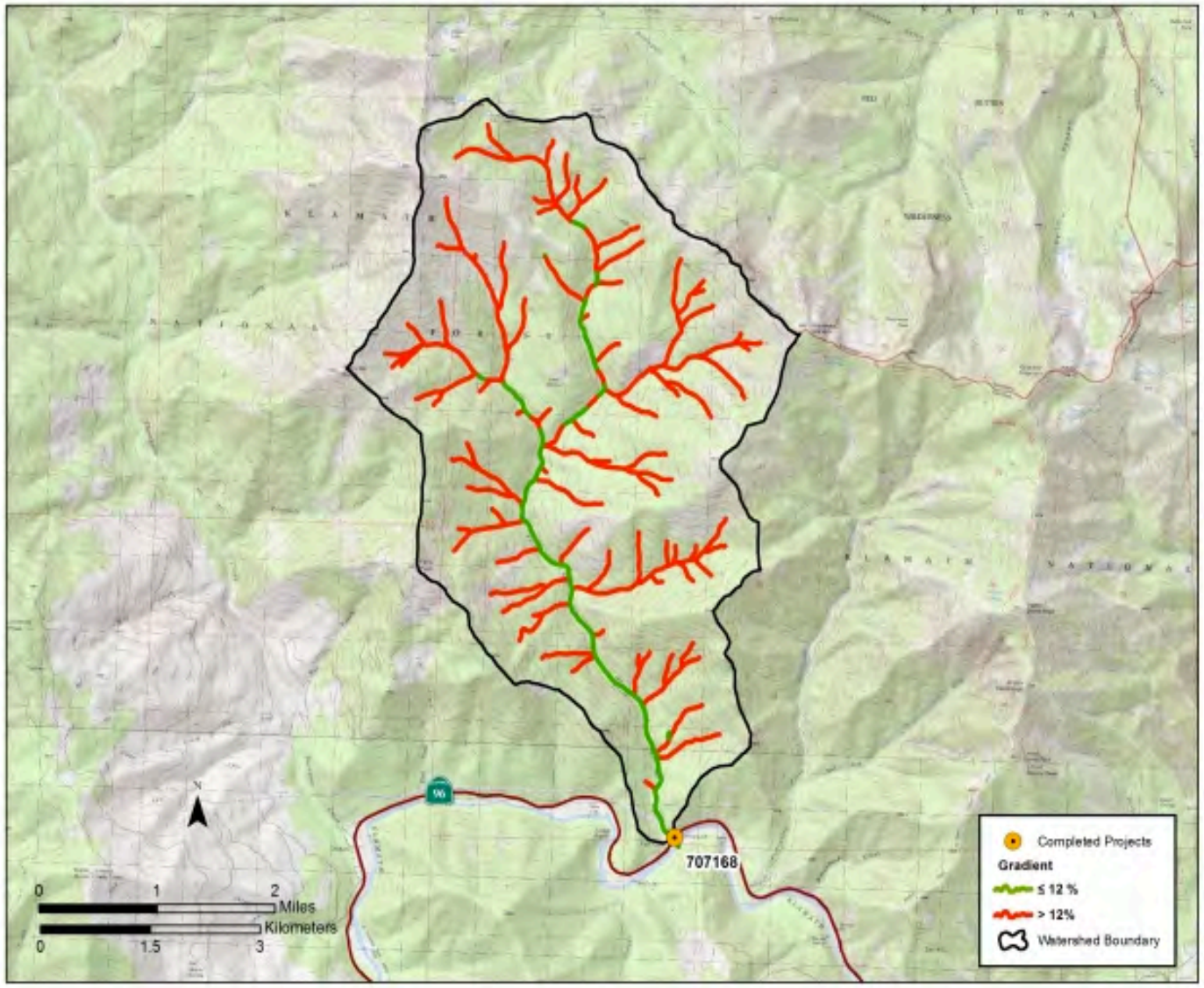

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Coho salmon	• 1.6 miles of suitable habitat • State and Federally Threatened
Chinook salmon	• 1.6 miles of suitable habitat
Steelhead	• 4 miles of suitable habitat
Pacific lamprey	
Klamath River lamprey	

Grants

- U.S. Fish and Wildlife Service
- National Fish and Wildlife Foundation
- California Dept. of Fish and Wildlife
  Fisheries Restoration Grant Program (FRGP)

Caltrans

CDFW FRGP Environmental Responsibilities

CDFW Provides

CEQA Environmental Document	•Mitigated Negative Declaration •Does not cover roadway widening or realignment
Biology Studies	•ESA Section 7 consultation •Plant and wildlife surveys
Cultural Studies	
U.S. Army Corps of Engineers Sect. 404 permit	•Regional General Permit
Regional Water Quality Control Board	•Section 401 Certification

Caltrans

CEQA Environmental Document	•Use DFW and Caltrans studies to prepare own Mitigated Negative Declaration •Cover entire project
Cultural Studies	•Prepare studies to Caltrans and FHWA standards •Cover entire project
Hazardous Waste Studies	•Adjacent potential hazardous waste site adjacent to project.
Wild & Scenic Concurrence	
DFW 1602 Streambed Alteration Agreement	

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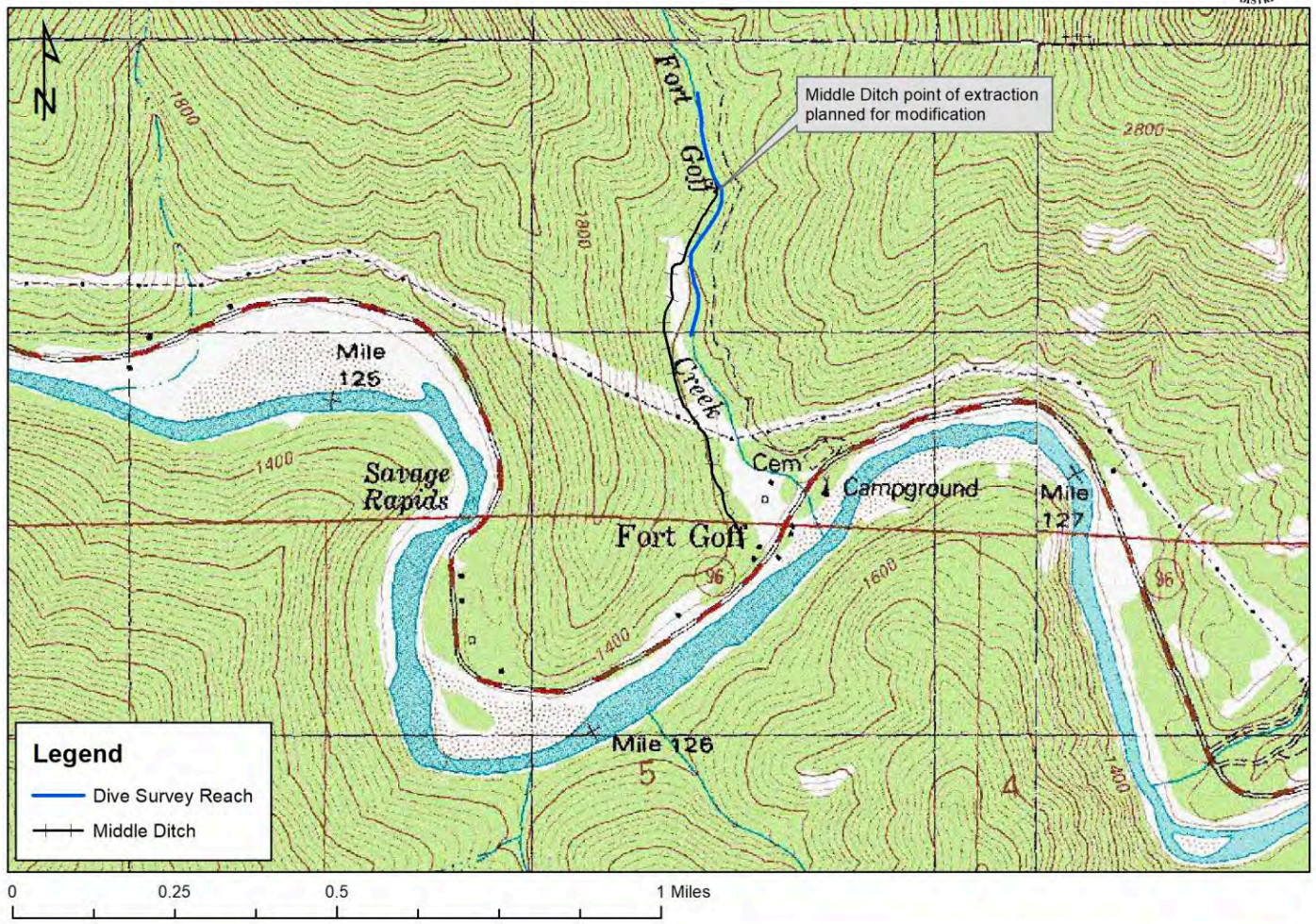
Some Lessons Learned

Any Upstream Water Diversions? - A unscreened water diversion a few hundred meters upstream of the Fort Goff bridge crossing. The diversion is considered a partial barrier. Scheduled for remediation this year.

Future projects should endeavor to have fish relocation completed earlier in the season. Those 800+ fish relocated showed up at the outlet pool as the Klamath started to warm up (They weren't there two weeks prior). Might even be a reason to request or require an earlier environmental start window from the agencies for similar projects (less impact on the environment, let's us get started earlier – weather permitting). This would be advantageous in other constructability aspects related to time lines and completing the project, with paving, before temperature drops in the fall.

Fort Goff Fish Passage and Diversion Improvement Project

Siskiyou Resource Conservation District



Partnering With Agencies

Caltrans

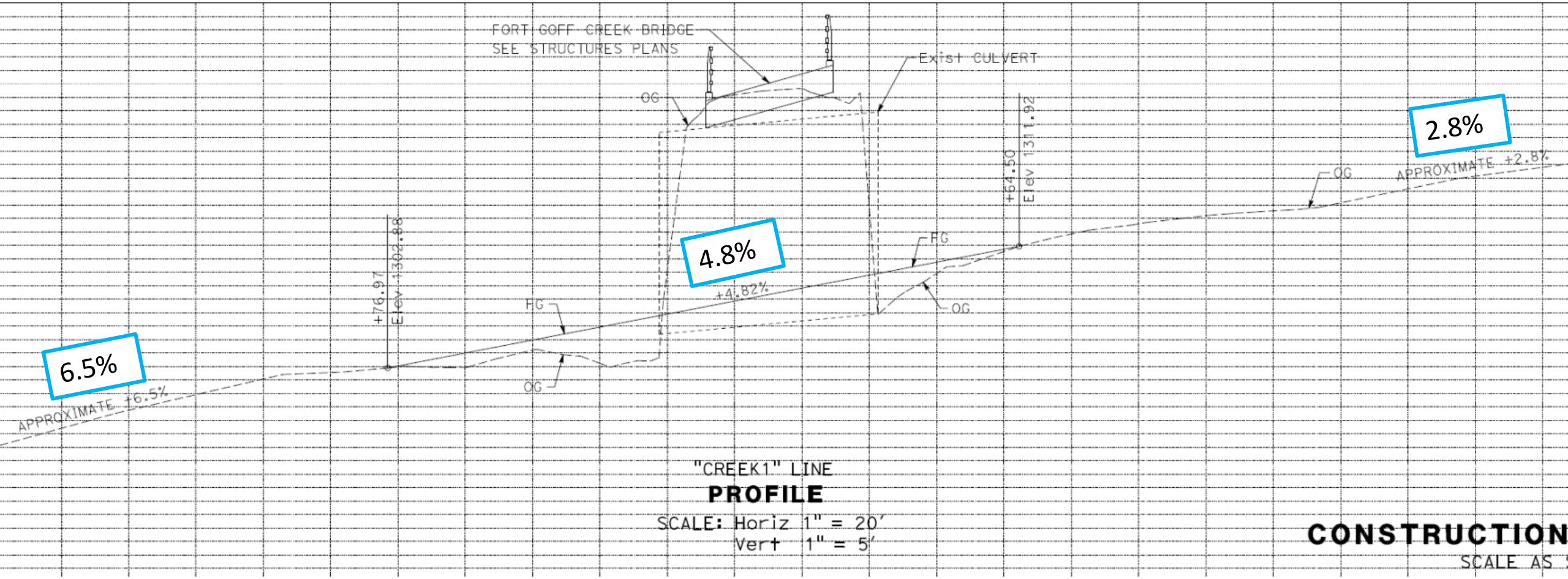
Benefits of working with partners

- Leverage knowledge and funding
- Establish priorities across jurisdictions
- Identify and explore highest priority research needs
- Enhance communication and cooperation
- Achieve Caltrans and Partners goals

Channel Conditions

Channel Surveys

- Long Profile (850’)
- Cross sections and topographic survey
- Bankfull Width = 48’



Stream Design Approach

- Hybrid Stream Simulation/Roughened Channel
- Bankfull width met with 60’ span bridge
- Rock sizes calculated using CDFW Roughened Channel guidance, but adjusted to fit observations in reference reach
- Bed built in plane with keystone rocks scattered, no weirs constructed
- Modeled fish passage flows in HEC-RAS with depth-dependent roughness, checked hydraulic fish passage criteria

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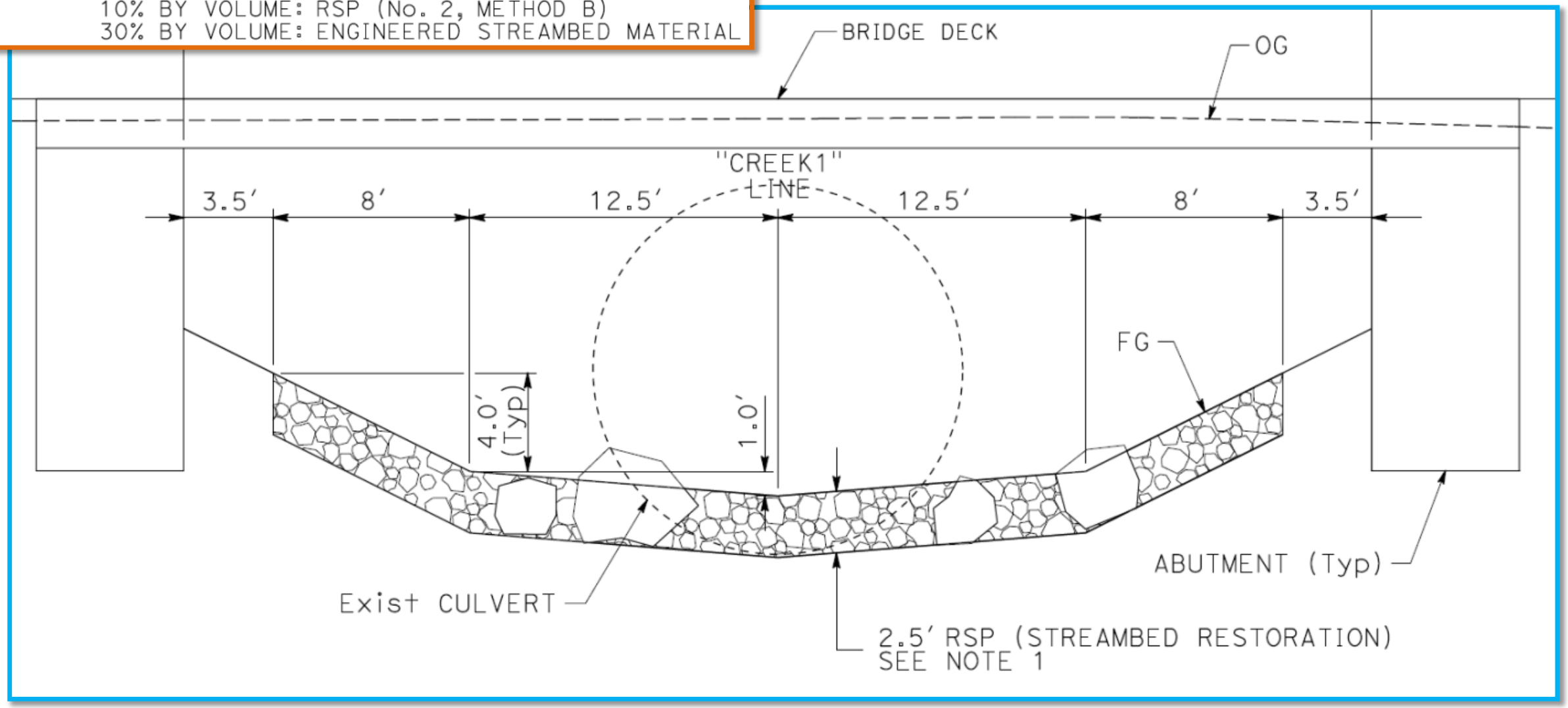
1. RSP (STREAMBED RESTORATION) CONSISTS OF:

5% BY VOLUME: RSP (4T, METHOD A)
5% BY VOLUME: RSP (2T, METHOD A)
10% BY VOLUME: RSP (1T, METHOD A)
30% BY VOLUME: RSP (1/4 T, METHOD B)
10% BY VOLUME: RSP (No. 1, METHOD B)
10% BY VOLUME: RSP (No. 2, METHOD B)
30% BY VOLUME: ENGINEERED STREAMBED MATERIAL



Roadway Design

Feature	Pre-Project	Constructed
Alignment	Multiple curves/kink points	Single curve
Shoulders	<1’	4’ (Design Exception required for bridge shoulder width)
Superelevation	Flat or sloped wrong way	7% superelevation
Clear recovery zone	Drop off at creek, trees close to roadway	Creek shielded by guardrail and bridge rail, trees too close to road were removed
Driveways	3 dirt driveways plus gravel campground parking area	Paved driveways and campground parking area

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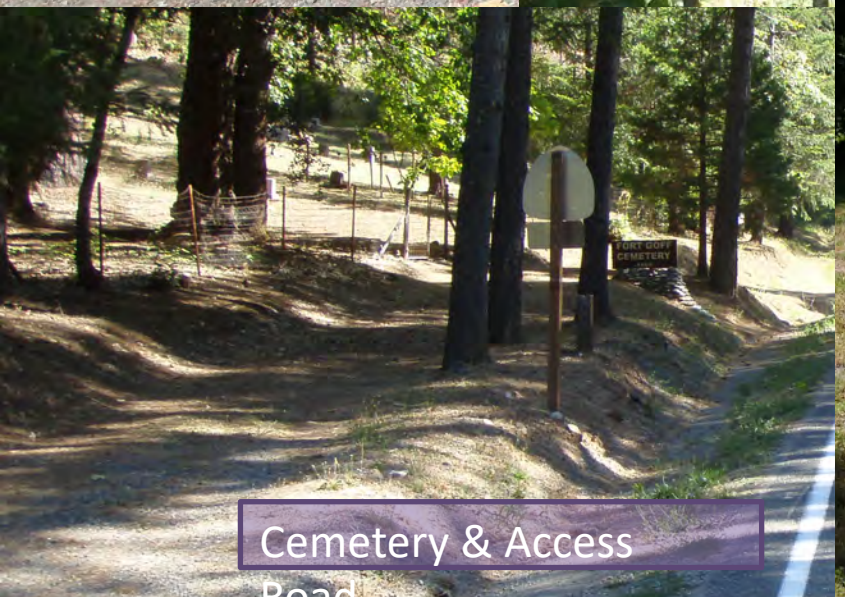
Site Constraints

Campground

Driveways & Adjacent Buildings



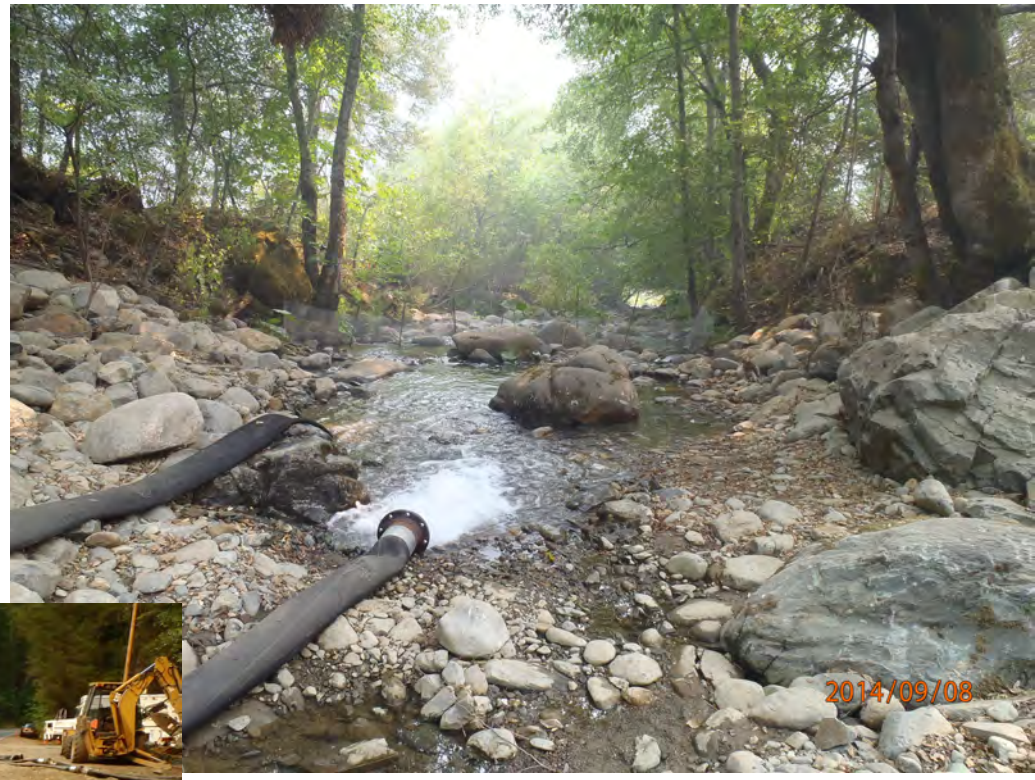
Cemetery & Access Road

Utilities

Fences and Prescriptive Right-of-Way

Construction - Detour

Construction – Culvert Removal/Diversion



Construction - Channel Reconstruction


Before


After

Fort Goff Creek Bridge - Design & Construction

Project Goals

- Restore Fish Passage
- Single Season Construction
- Reduce Environmental Impacts
- Quality Concrete
- Minimize Traffic Disruption
- Address Stakeholder Interests

Caltrans

Fort Goff Creek Bridge

Location Challenges

- Project in severe climate area
- Freeze-thaw cycles and heavy salting
- Nearest batch plant located 90 minutes away from site

Caltrans

Accelerated Bridge Construction (ABC)
Prefabricated Bridge Elements & Systems (PBES)

PBES
Bridge elements are manufactured at an off-site facility and assembled at the project location

- Single season construction
- Minimal traffic disruption
- Quality control of concrete elements
- Well suited to streambed restoration

Caltrans

ABC Advantage - **Environment**

Reduced Environmental Impact

Reduced construction time allows scheduling around crucial times for plant growth and animal life.

Eliminating falsework keeps construction activities out of the

Conduct construction activities offsite

Reduce wetland mitigation

Advance Planning Study Alternatives

- Cast-in-place

  $1,043,000*

- Precast Superstructure

  $937,000*

- All Prefabricated Elements (PBES)

  $928,000* (ABC Alternative)

Prefabricated Advantages

- Rapid assembly
- Reduce MOT
- Ensure concrete quality
- Reduce creek impacts
- Reduce risk of extending to second season
- Most cost-effective alternative

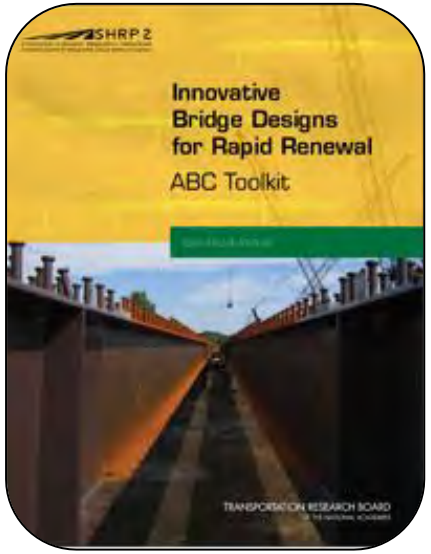
*Preliminary Design Cost Estimate

What Supported the Solution?

- Temporary culvert
- One way signalized traffic control
- Fish relocation
- Permits
- Coordination with environmental partners
- Collaborative funding
- Route for the precast element delivery

Temporary culvert for detour

SHPR2 Lead Adopter Grant - $500,000
Innovative Bridge Designs for Rapid Renewal



SHRP2 (Strategic Highway Research Program #2)

- American Association of State Highway & Transportation Officials (AASHTO)
- Federal Highway Association (FHWA)

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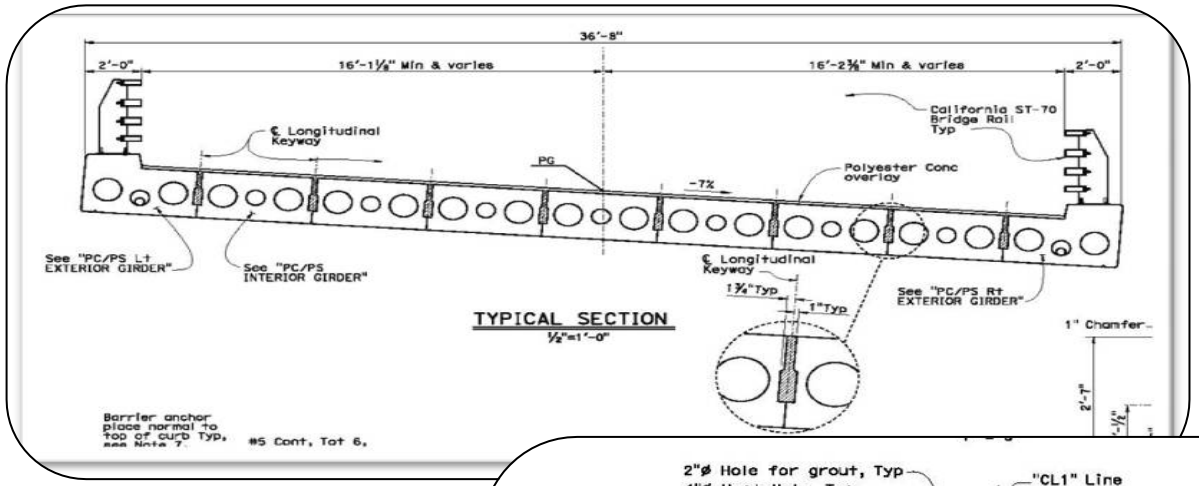
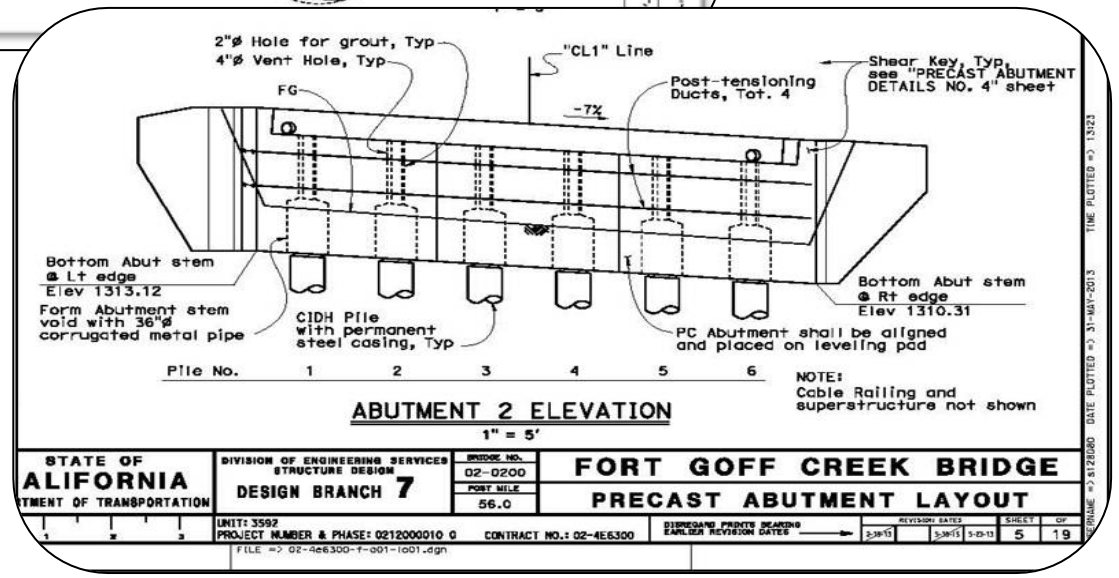
Prefabricated Bridge Design





- PC Voided Deck Slabs
- PC Abutment Elements
- PC Wingwalls
- Prefabricated Rail

Bridge Design Engineer
Mario Guadamuz

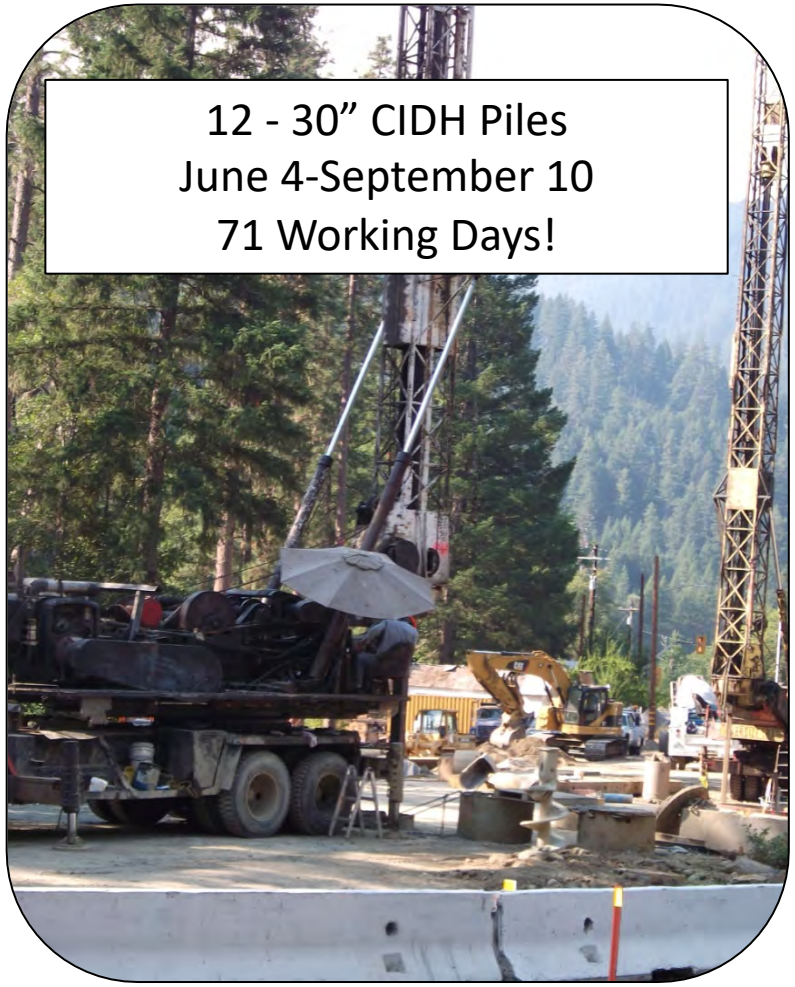
Construction: Detour

One way signalized traffic

Temporary culvert for detour

Caltrans

Construction: Foundation



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Construction: Foundation

4 sac slurry for abutment bearing pad proved an effective leveling pad.

Construction: Abutments

85 kip precast abutment elements

(1 kip = 1,000 pounds)

Voids formed with 36” diameter corrugated metal pipe

Post-tensioning ducts ran through abutment elements

Abutment elements preassembled at precast yard

Construction: Abutments

Sept 16 & 17, 2014

Construction: Abutments

Caltrans

Construction: Voided Slabs and Wingwalls Delivered

Construction: Voided Slabs

Caltrans

September 23, 2014

Construction: Wingwalls

Caltrans

September 23, 2014

Construction: Connections & Overlay

Caltrans

Construction: Rail & Aesthetics

California ST-70 Bridge Rail

Architectural treatment achieved by the use of form liners and on-site staining.

Completed Project

Foundation
71 days

Structure
23 days

Road
21 days

Caltrans

Lessons Learned: Foundation

Take foundation risk into account when developing schedule

Explore foundations options to control schedule and long term benefits.

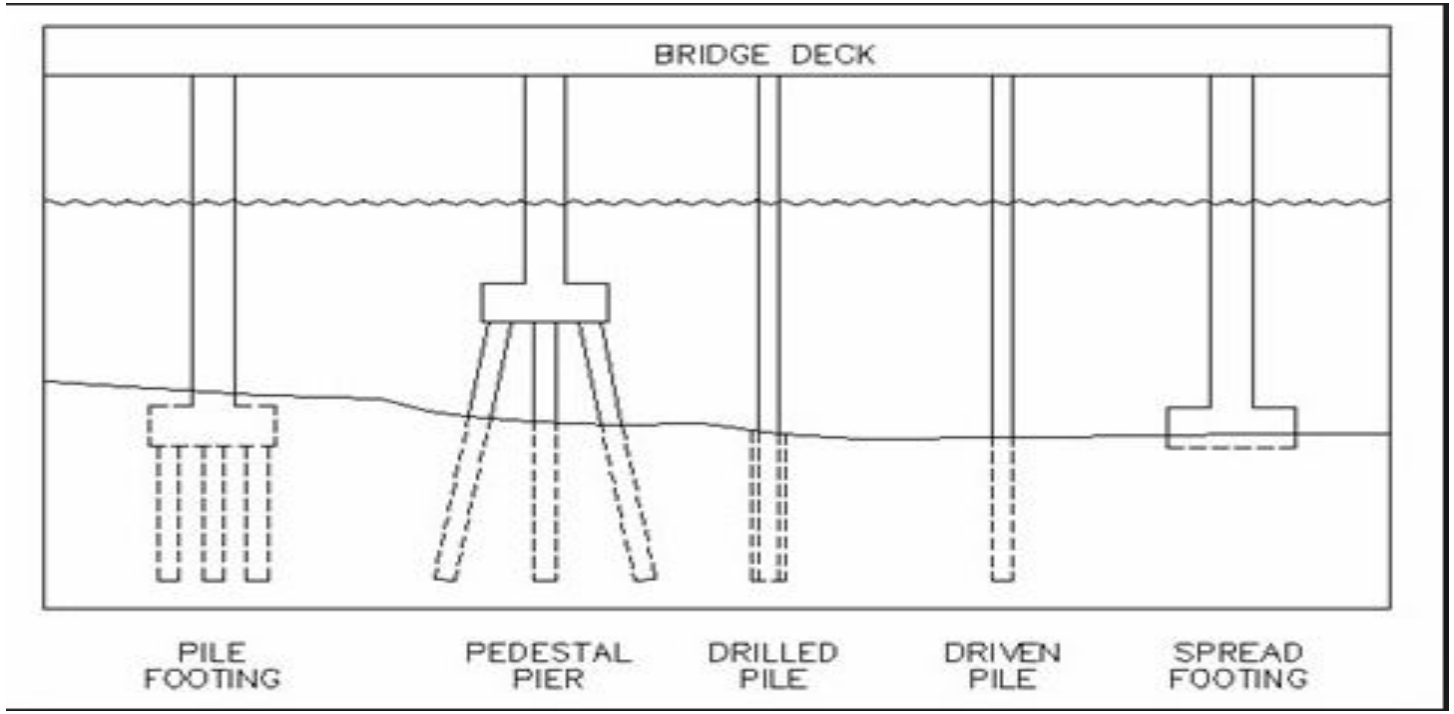
- Type
- Location
- Timing

Foundation Selection

- Geology
- Cost
- Schedule
- Short term impacts
- Long term impacts

Explore foundation options to address project goals.

- Type
- Location
- Timing



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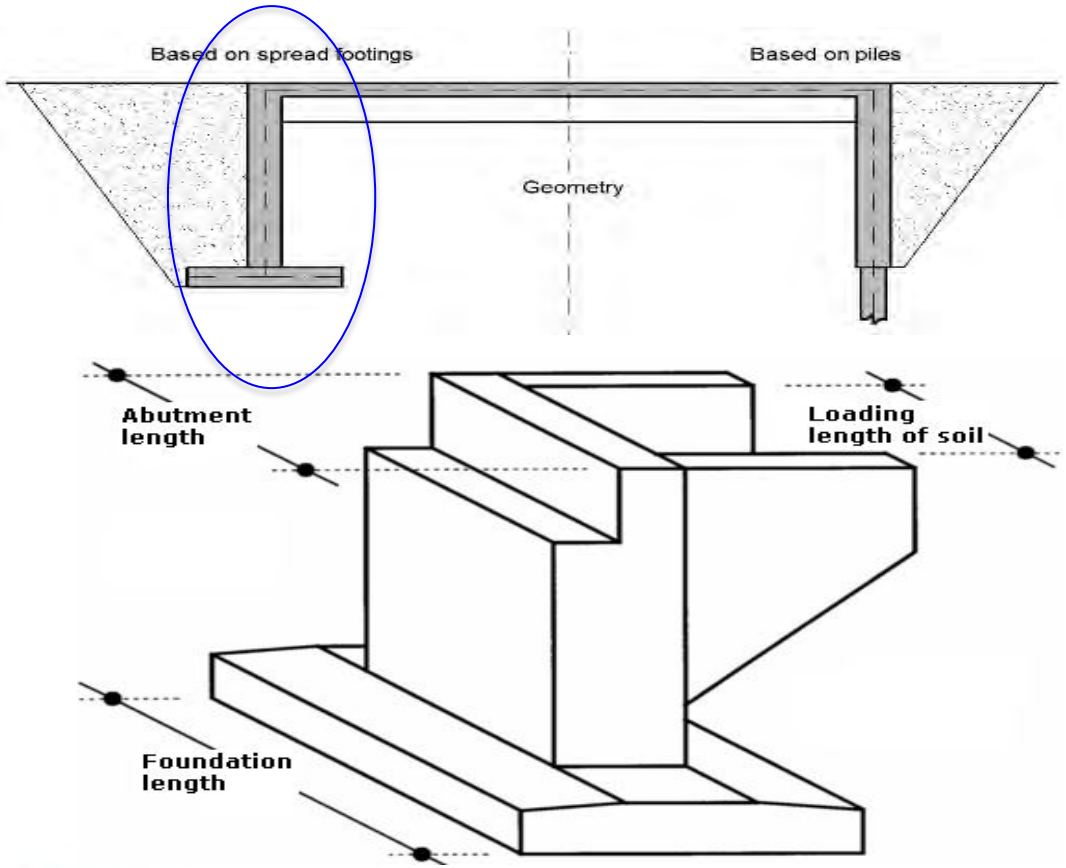
Shallow Foundation - Spread Footing



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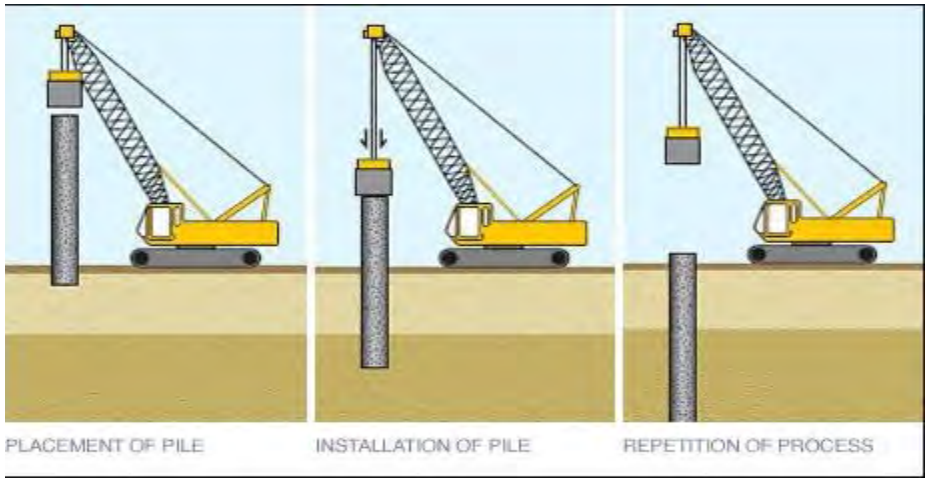
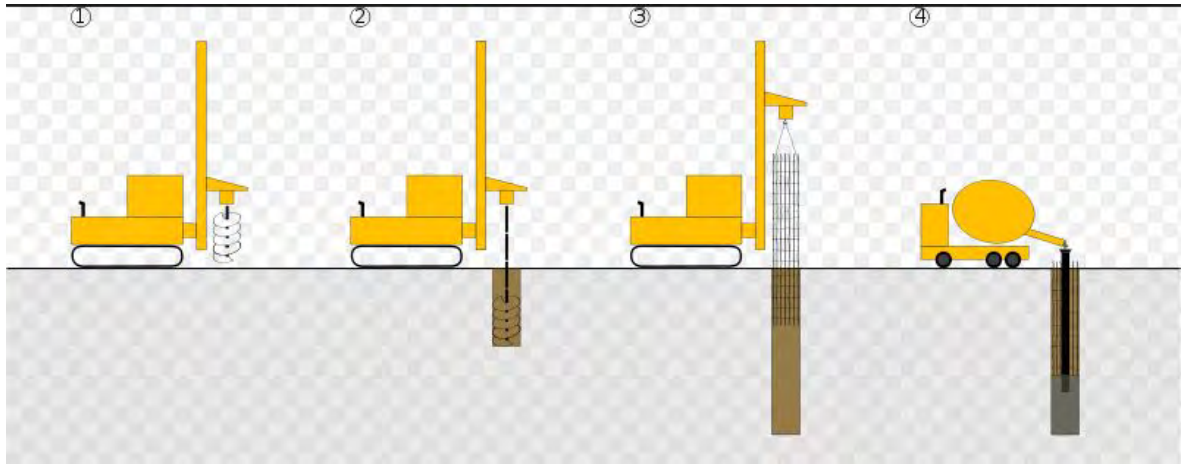
Deep Foundations – Piles & Shafts

Short term impacts yield long term benefits.

DRIVEN PILES



DRILLED PILES & SHAFTS



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Lessons Learned Continued

- Simplify abutment segment connection detailing
- Avoid rebar congestion in precast elements
- Watch out for conflicts at connections areas
- Require concurrent submittals of shop drawings
- Provide more time for shop drawing review

Caltrans

Lessons Learned - Cost

STRUCTURE COST INFORMATION

- Preliminary Estimate: $928,000
- Estimate at Bid: $978,572
- Bid Award $1,309,843
- Final Structure Cost $1,400,303 ($660/SQFT)

LESSONS LEARNED

- Clarify Aesthetics on Plans
- Do not underestimate the impact of remote locations on price
- Precast industry in California charges a high premium for elements beyond girders.

Caltrans

Best Practices

PROACTIVELY ADDRESS FIT-UP AND TOLERANCES

- Fabrication tolerances on the plans and in the specifications
- Pre-assemble substructure elements prior to shipping
- Polyester concrete deck overlay thickness to accommodates tolerances

Caltrans

Best Practices Continued

- Single row of piles
- Slurry pad for setting abutment
- Repeatable elements
- Pick weight under 95K
- Construction sequence on the plans
- Include rail curb in the precast exterior slab elements
- Prefabricated rail
- Strong communication of project delivery team

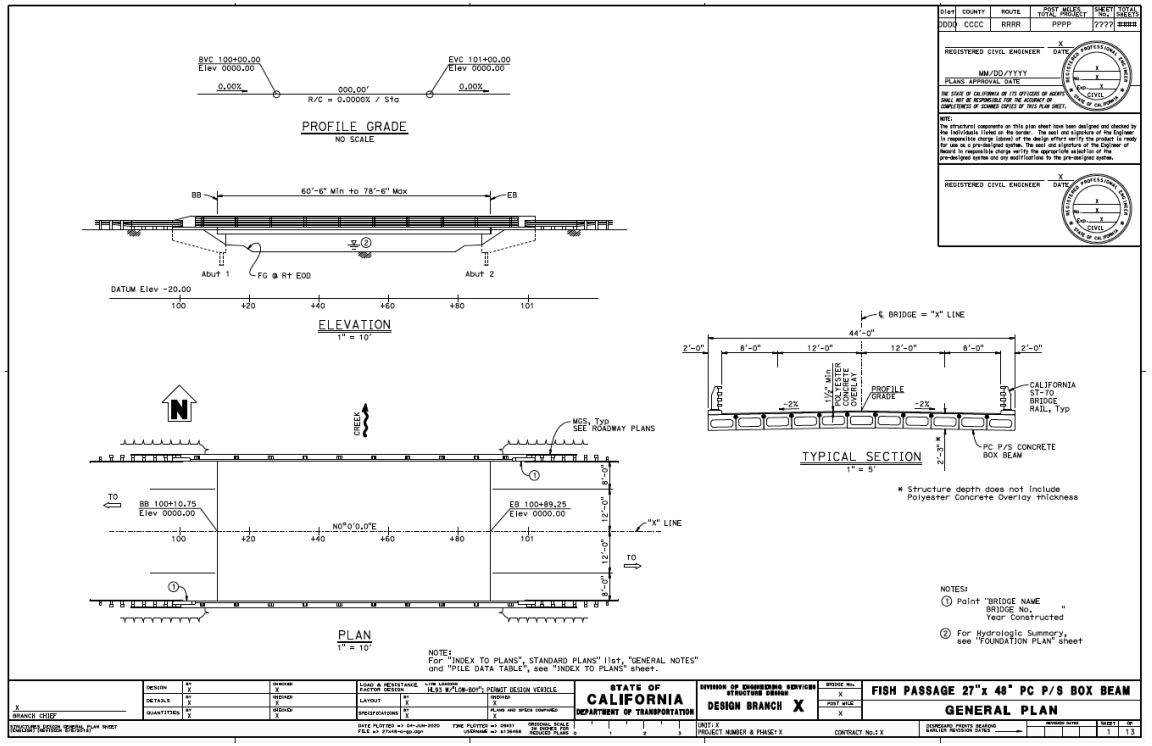
Caltrans

Project Outcomes

- Gathered Lessons Learned and Best Practices to improve ABC going forward
- Since the Fort Goff Creek Bridge Caltrans has pursued ABC on a larger scale
- Incentive to pursue programmatic permitting process to reduce permit procurement time.
- Standardized single span bridge designs to improve efficiency

Pre-designed Fish Passage Bridges

- Simple spans ranging from 20 ft to 110 ft
- Pre-cast superstructure & Abutments
  - PC PS Slab 18’ to 60’
  - PC PS Box Beam: 60’ to 116’
- Skews up to 45 degrees
- Roadway Typical Section:
  - 2-12 ft lanes
  - 2-8 ft shoulders
  - Barriers



Project Accomplishments

- Reconnected miles of upstream salmonid habitat
- Demonstrated the need and effectiveness of FishPAC
- Innovative approach to bridge construction

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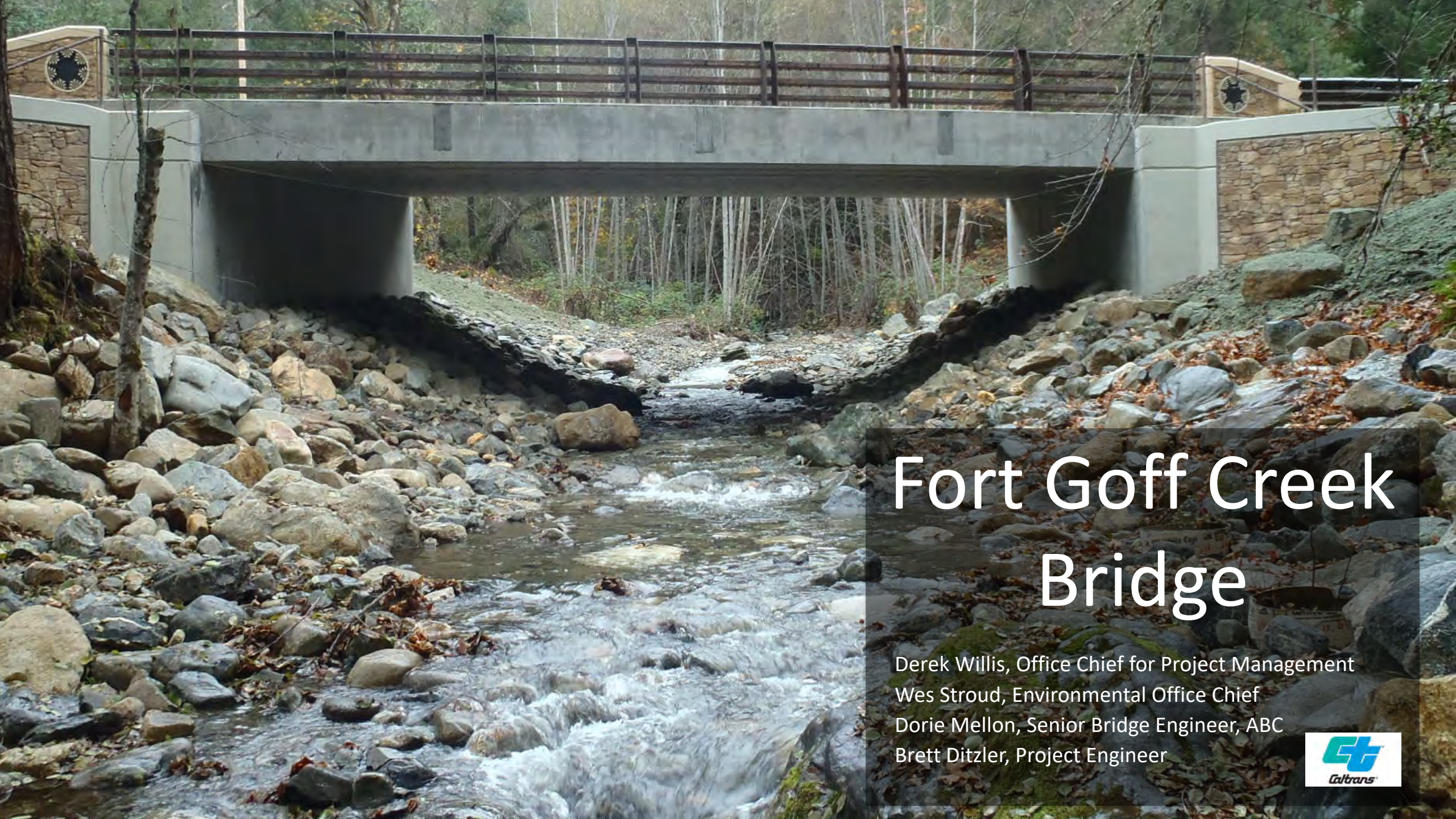

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