

Dry Creek Habitat Enhancement

- David Manning, Environmental Resources Coordinator
- David Cuneo, Principal Environmental Specialist
- Gregg Horton, Principal Environmental Specialist
- Bob Coey, National Marine Fisheries Service
- Greg Guensch, Water Agency Engineer/Geomorphologist



DRY CREEK HABITAT ENHANCEMENT REACHES

PREPARED BY SONOMA COUNTY WATER AGENCY | FEBRUARY 2012



Complete design phase.
Permitting.
Landowner agreements.
Begin construction

MILESTONE 1
1 mile of habitat in Dry Creek
completed and work on
miles 2 & 3 begins

MILESTONE 2
Complete enhancement
of miles 2 and 3

DECISION POINT
Evaluate the success of
the enhancement projects

MILESTONE 3
Enhance 3 additional miles
of habitat in Dry Creek for
a total of 6 miles

2012

2014

2017

2018

2020



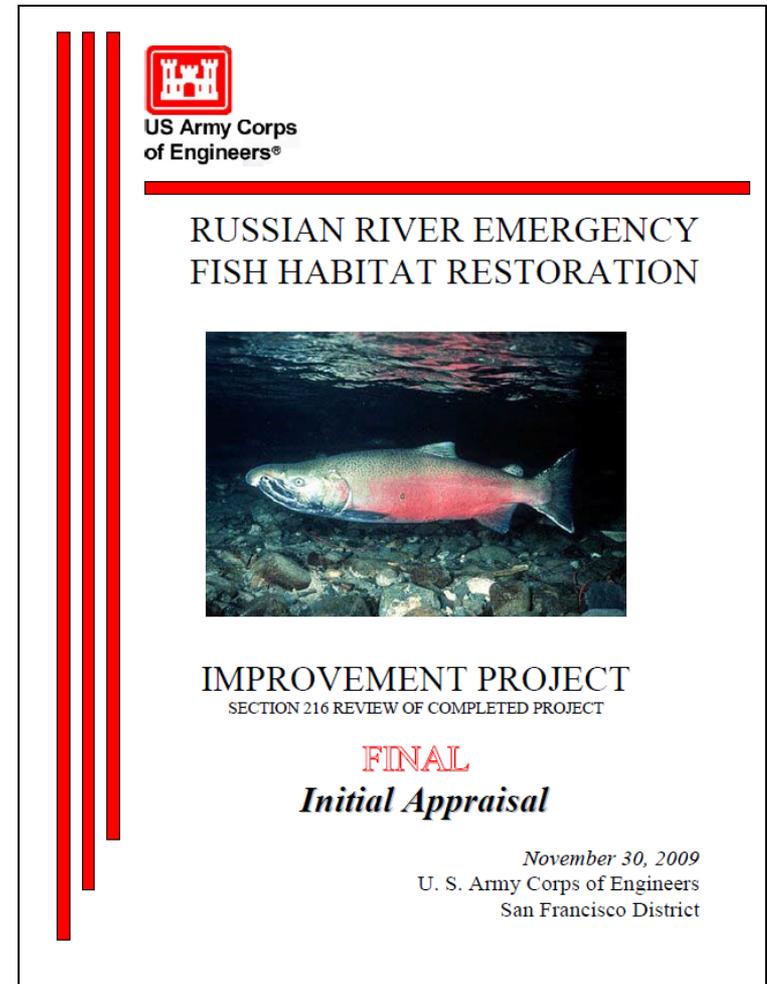
Habitat Feasibility Study Results



- 26 Sub Reaches with Potential project opportunities
- Distributed over 14 miles
- 9 miles of off channel habitat
- Total cost for 6 mile objective = \$36 to \$48 Million

Army Corps Habitat Feasibility Study

- Continuing Authorities Program (CAP) Sec. 1135
- Modifications to structures and operations of water resources projects that will improve the quality of the environment
- 19 Erosion Control Structures in Dry Creek
 - Board Fences, Concrete Weirs, Rock Bank Protection, Concrete Sills
- SF District received funding and SCWA working jointly on study



Dry Creek Habitat Enhancement Milestones and Progress

- Construct 1st Mile by 2014
 - ✓ 1-mile Demonstration Reach in progress completion in October 2014
 - ✓ Army Corps Reach 15 completed
- Adaptive Management Plan by 2013
 - ✓ Completed with SCWA, NMFS, CDFW, USACE
- Engineering Design for Mile 2 and 3 by 2015
 - ✓ Engineering teams selected, survey, landowner outreach

Future Habitat Projects In Dry Creek

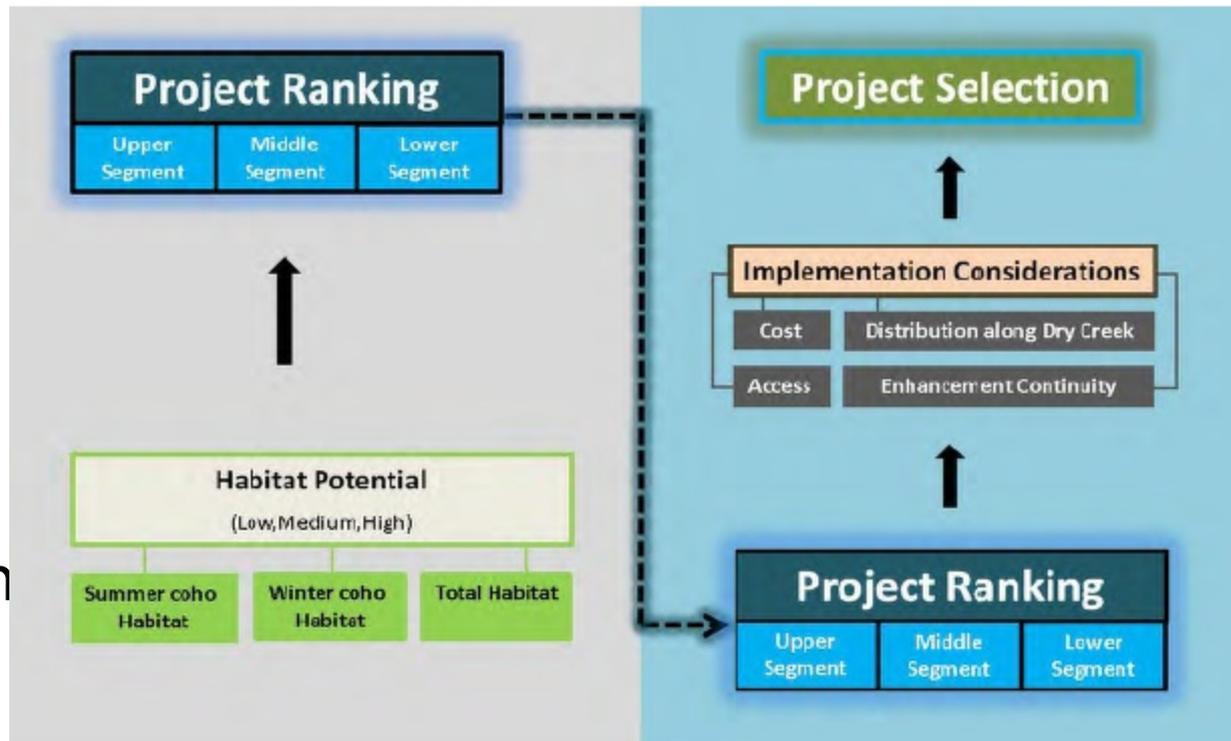
Miles 2-3 - 2015-2017

Miles 4-6 - 2018-2020

✓ Site Evaluation and Ranking

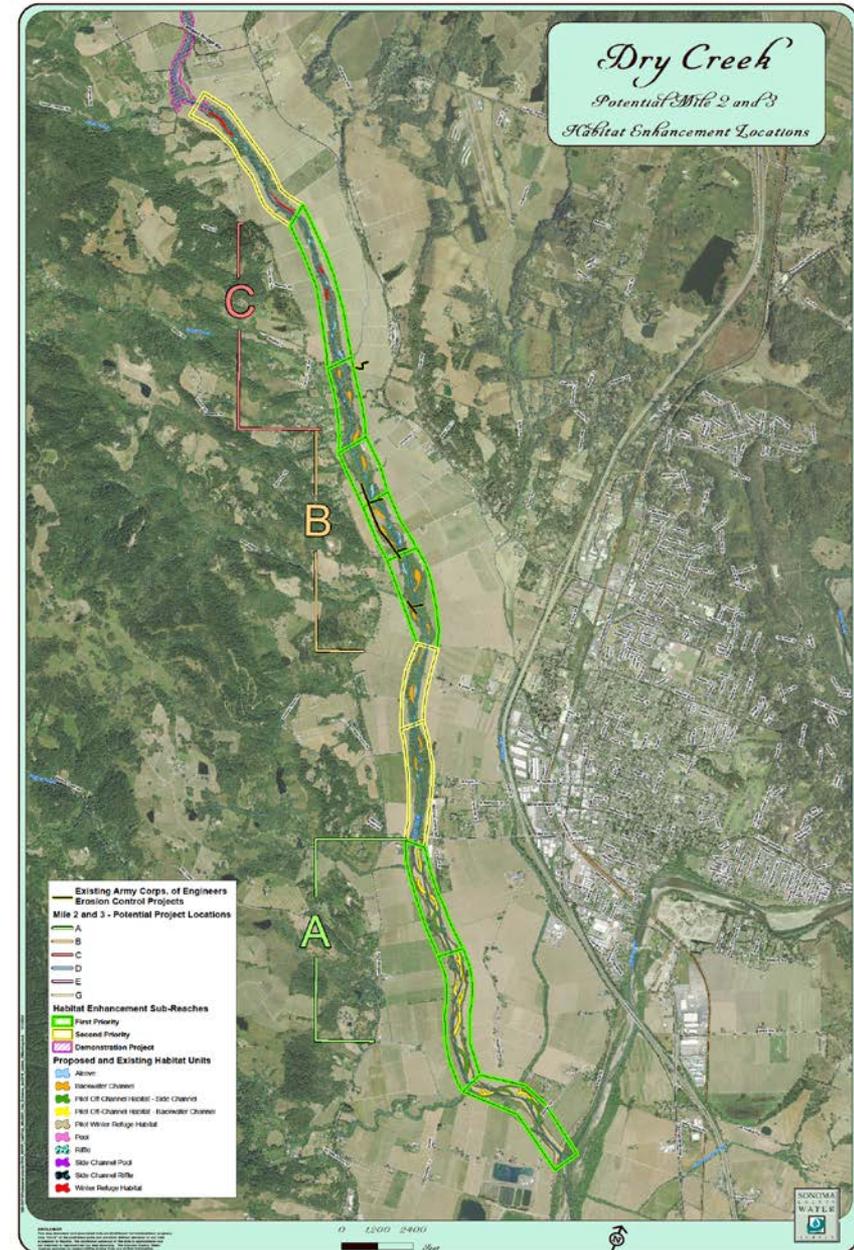
✓ Landowner Outreach

✓ Additional CEQA, Permitting, Right of Way



Mile 2 and 3 Reaches

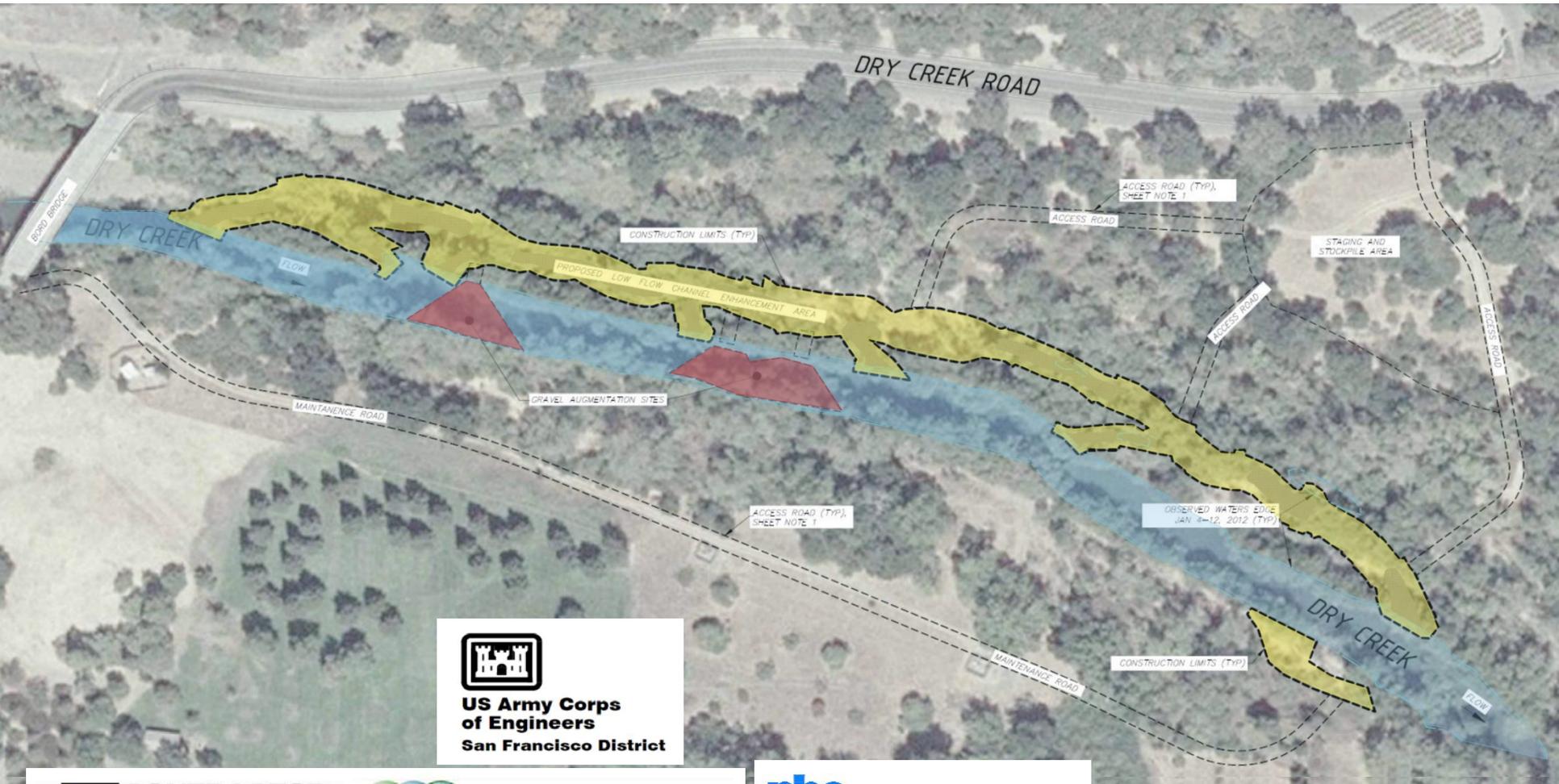
- 6 Focus Areas with High Potential Habitat Quality and Quantity
- 85 Total Parcels
- Positive Responses for Access 50%-85% of Owners
- Two Engineering Teams
 - Upper Reach: Inter-fluve
 - Lower Reach: ESA-PWA / Prunuske Chatham/Cramer Fish Sciences



Current Dry Creek Projects



Army Corps - Reach 15



**US Army Corps
of Engineers
San Francisco District**



**CONTRACTOR
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www.nhcweb.com



August 15, 2013



Sonoma County Water Agency

Dry Creek Habitat Enhancement Demonstration Project

- Van Alyea Family
- Mascherini Family
- Seghesio Family
- Kight Family - Quivira Winery

- Wolmer Family
- Douglas Lipton
- Farrow - Amista Winery
- Wallace - Dry Creek Vineyards, Inc.

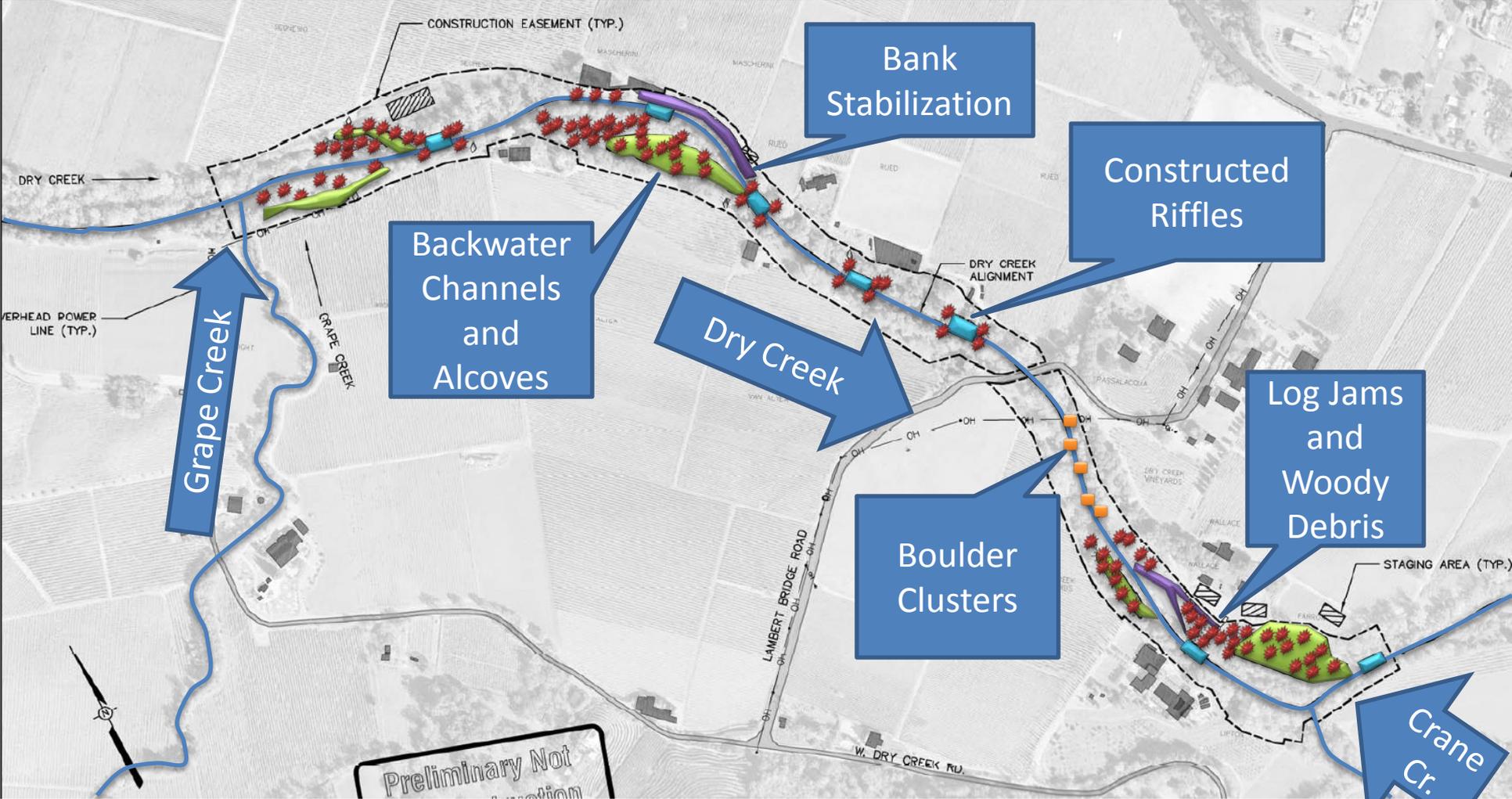
INTER-FLUVE, INC.
1020 WASCO STREET, SUITE I
HOOD RIVER, OR 97031
541.386.9003



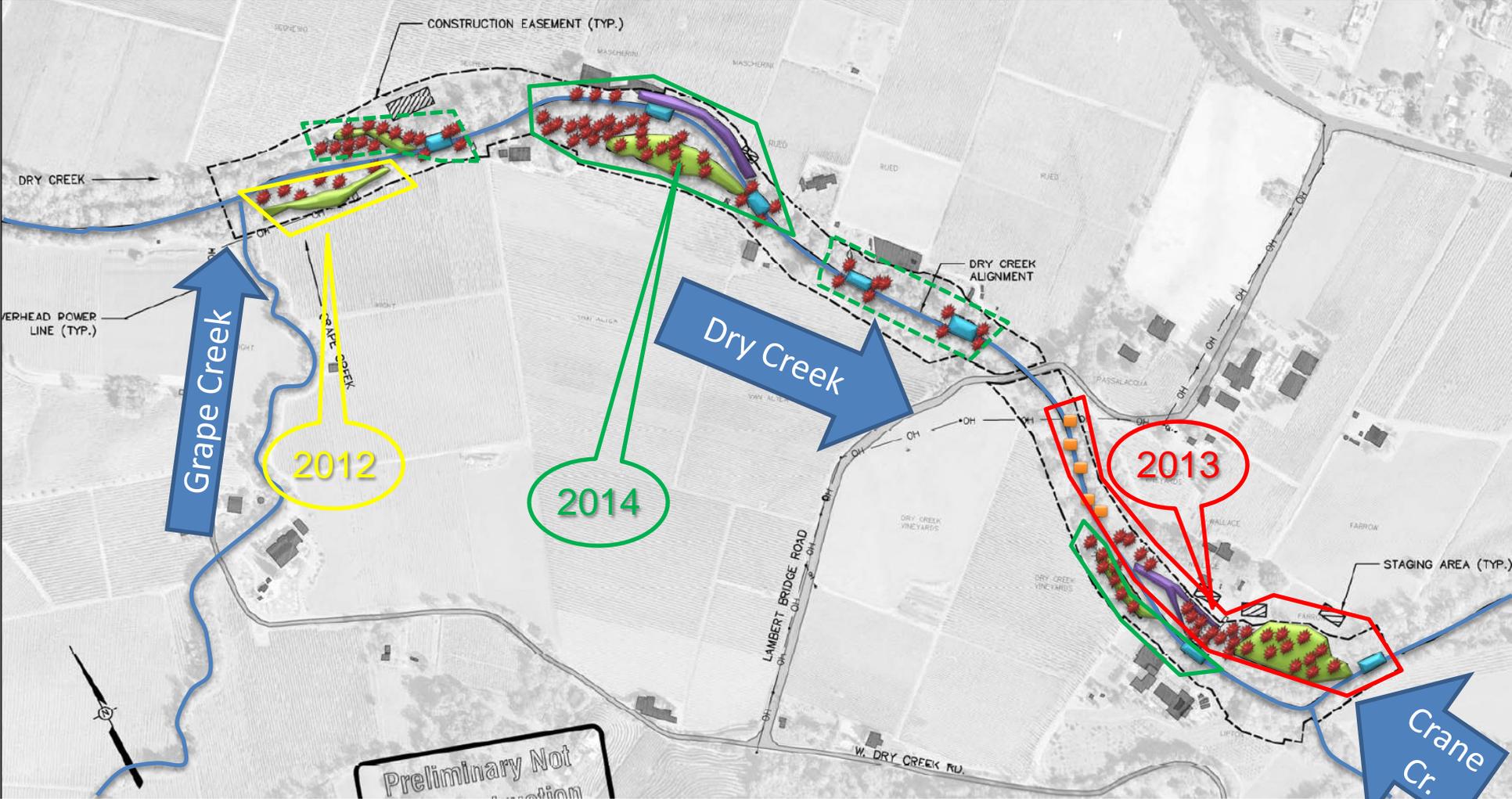
Hanford ARC
23195 Maffei Road
Sonoma, CA 95476
PH (707) 975-3105
FAX (707) 996-6641



Demonstration Project Design Details



Demonstration Project Design Details



December 3, 2012



October 31, 2013



2013 Construction Activities



Isolating Work Area and Fish Rescue



Materials

546 Pieces of large wood

593 Boulders

17,000 cubic yards of material removed



Dewatering



Log Jams



October 17, 2013



Boulder Field in Dry Creek



Bank Stabilization Site



September 16, 2013



2013 - First Dry Creek Juvenile Coho Release



Photo courtesy of Duncan Dwelle

Dry Creek Adaptive Management Plan



Bob Coey

Fisheries Biologist, NOAA Fisheries

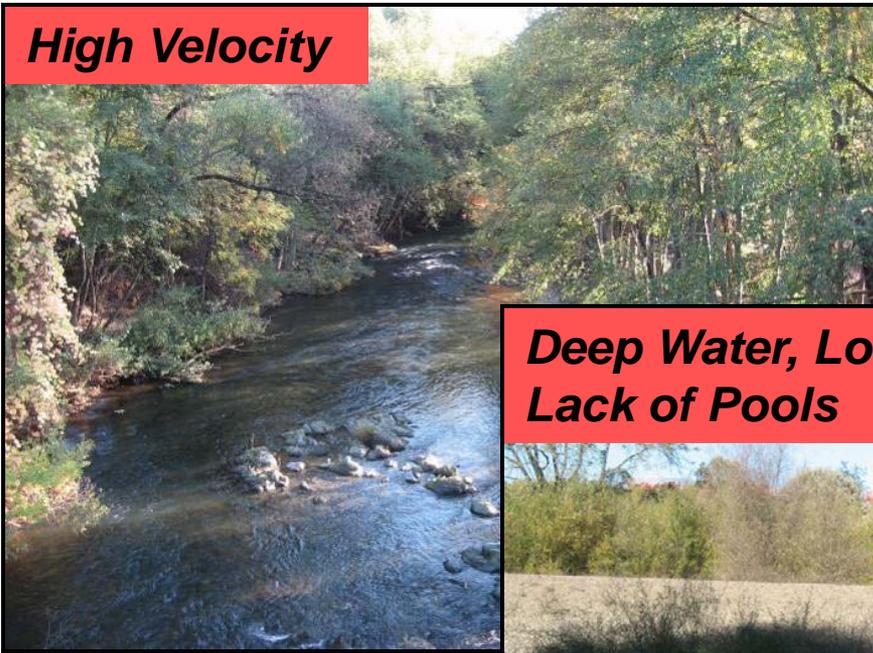
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Gregg Horton

Principal Environmental Specialist

Gregg.Horton@scwa.ca.gov

High Velocity



**Deep Water, Low Cover,
Lack of Pools**

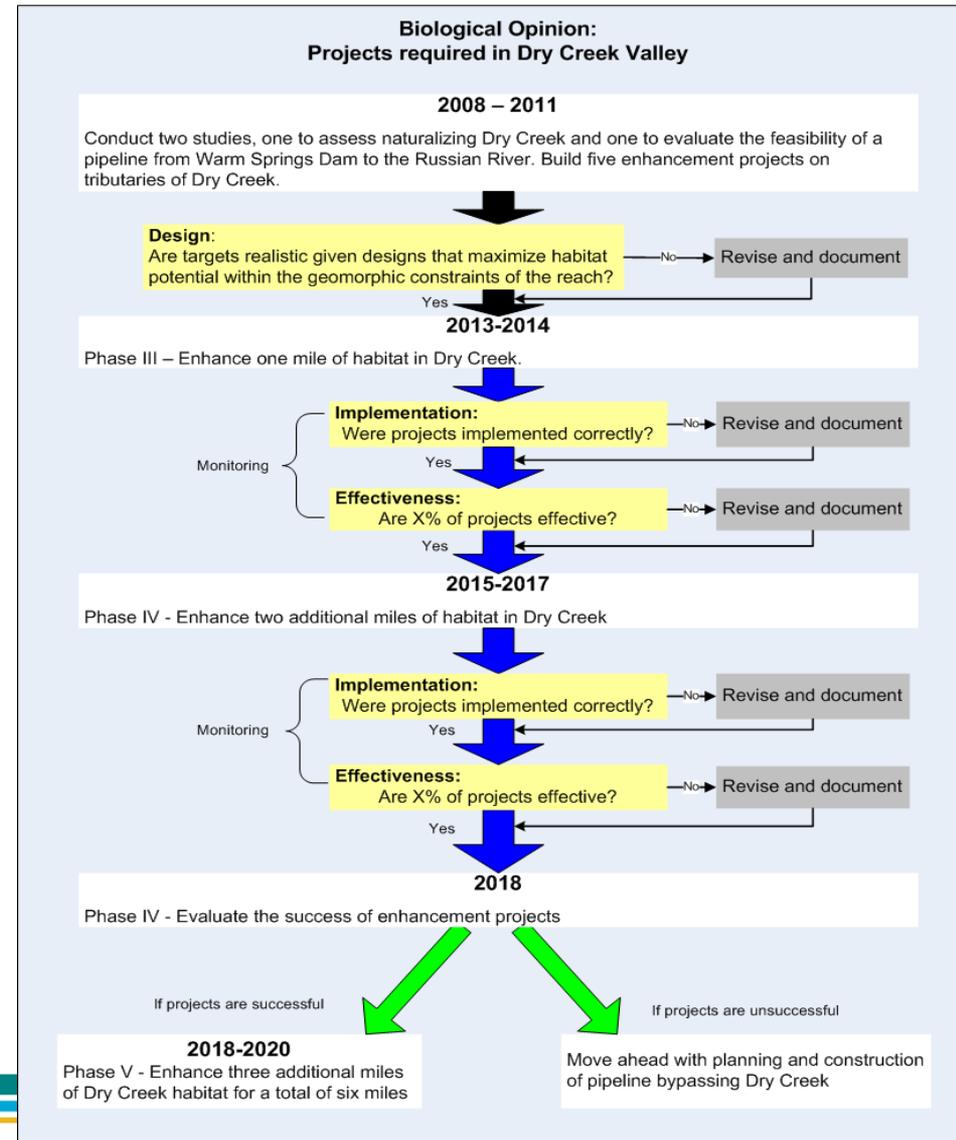


Geomorphic Challenges



Timeline

- 2008 - 2018: Design, construct & monitor 3 miles of habitat enhancements in Dry Creek
- 2018: Decide whether enhancements are sufficiently effective to warrant construction of another 3 miles of habitat (6 miles total)



Workshop 1 (June 23-24, 2010)	Name
Sonoma County Water Agency	Gregg Horton
	David Manning
	Erik Brown
National Marine Fisheries Service	Bob Coey
	Bill Hearn
	Rick Rogers
California Dept. of Fish and Wildlife	Eric Larson
	Adam McKannay
Army Corp of Engineers	Joel Pliskin
Inter-Fluve	Mike Burke
	Greg Koonce
ESSA Technologies Ltd.	David Marmorek
	Darcy Pickard
	Marc Porter
	Katherine Wieckowski

Workshop 3 (July 19, 2011)	Name
Sonoma County Water Agency	Gregg Horton
	David Manning
	Erik Brown
	Dave Cuneo
National Marine Fisheries Service	Bob Coey
	Bill Hearn
	Rick Rogers
	Brian Cluer
California Dept. of Fish and Wildlife	Adam McKannay
	Ryan Wantanabe
Army Corp of Engineers	Peter LaCivita
Inter-Fluve	Mike Burke
	Greg Koonce
ESSA Technologies Ltd.	David Marmorek
	Marc Porter

FINAL AMP - 2013

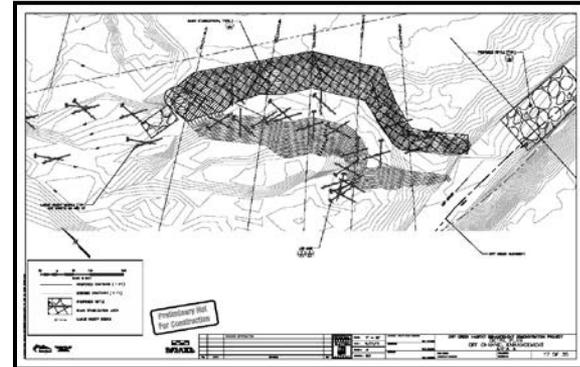
Workshop 2 (Oct 19-21, 2010)	Name
Sonoma County Water Agency	Gregg Horton
	David Manning
	Erik Brown
	Dave Cuneo
	Grant Davis
	Renee Webber
	Pam Jeane
National Marine Fisheries Service	Bob Coey
	Bill Hearn
	Rick Rogers
California Dept. of Fish and Wildlife	Adam McKannay
Army Corp of Engineers	Joel Pliskin
	Daria Mazey
	Merle Griffin
Inter-Fluve	Mike Burke
	Greg Koonce
ESSA Technologies Ltd.	David Marmorek
	Darcy Pickard
	Marc Porter

Workshop 4 (July 19, 2012)	Name
Sonoma County Water Agency	Gregg Horton
	David Manning
	Erik Brown
	Dave Cuneo
National Marine Fisheries Service	Bob Coey
California Dept. of Fish and Wildlife	Rick Rogers
	Adam McKannay
Army Corp of Engineers (USACE)	Peter LaCivita
Inter-Fluve	Mike Burke
	Greg Koonce
ESSA Technologies Ltd.	David Marmorek
	Marc Porter

- Modified CDFW Restoration Project Monitoring Protocols (Harris, 2004)
- Habitat Suitability Curves (USFWS)
- Literature Search (ESSA)

3 Types of Monitoring

- **Implementation (as built)**- Constructed per approved design?
- **Effectiveness (habitat)** - Are desired habitat conditions being created?
- **Validation (biological response)** - Are fish benefiting?



Performance Measures

Type of Performance Measure	Performance Measure	Life Stage	Biologic Function	Spatial Scale	Habitat Type	Evaluation Method	Near-Optimal Ranges (Targets)		
							Spring Flow ¹	Summer Flow ²	Winter Flow ³
PRIMARY	Velocity	fry	Rearing	Feature/HU/Site	Margins	Quant. & Qual.	0-0.5 ft/s	n/a	n/a
	Depth	fry	Rearing	Feature/HU/Site	Margins	Quant. & Qual.	0.5-2.0 ft	n/a	n/a
	Velocity	Summer / winter parr	Rearing	Feature/HU/Site	Pools, off-channel	Quant. & Qual.	0-0.5 ft/s	0-0.5 ft/s	0-0.5ft/s
	Depth	Summer / winter parr	Rearing	Feature/HU/Site	Pools, off-channel	Quant. & Qual.	2-4 ft	2-4 ft	2-4 ft
	Shelter value ⁴	Juvenile	Rearing	Feature/HU	Pools, margins, off-channel	Quant. & Qual.	≥80	≥80	≥80
	Pool:Riffle ratio	Juvenile	Rearing	Project reach	Pools, riffles	Quant. & Qual.	1:2 to 2:1		
SECONDARY	Temperature	Juvenile	Rearing	Site	Off-channel	Quantitative	n/a	8-16° C	n/a
	Diss. oxygen	Juvenile	Rearing	Site	Off-channel	Quantitative	n/a	6-10 mg/l	n/a
	Canopy	Juvenile	Rearing	Site	Off-channel	Quantitative	80 %		
	Quiet water (< 0.5 ft/s)	Juvenile	Rearing	Enhancement reach	Pools off-channel/backwaters (in winter)	Quant. & Qual.	n/a	n/a	≥ 25%
	Off-channel access	Juvenile	Rearing	Project reach	Off-channel/backwaters	Quant. & Qual.	Approx. 1.5 – 1.8 cm/s (ucrit);Approx. 3.3 ft/s (burst speed)		
	Connectivity of habitats	Juvenile	Rearing	Project reach	Pools, riffles, margins, off-channel	Qual. & GIS & Inter-Fluve modeling	Undefined		
	Substrate particle size	Adult	Spawning	Feature/Site	Riffles	Quant. & Qual.	n/a	n/a	0.25-2.5
Depth	Adult	Spawning	Feature/Site	Riffles	Quant. & Qual.	n/a	n/a	0.5-1.6	

¹ Target coho life stage during spring is newly-emerged feeding fry which use shallower depths than would be preferred later in the summer and winter when fish would be larger. Target spring flow (discharge within the enhancement reach) is 200 cfs (approximately double the summer "base" flow).

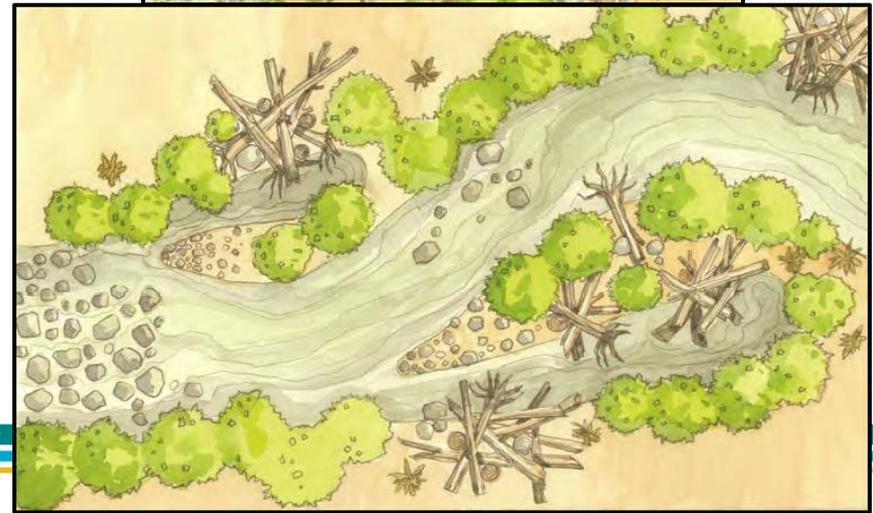
² Target summer flow is 105 cfs

³ Target winter flow is 1000 cfs

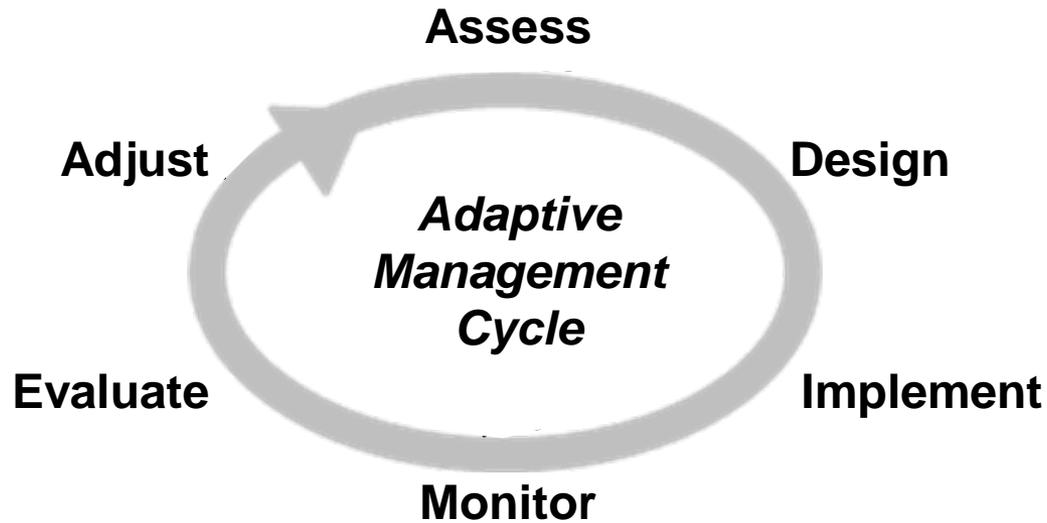
⁴ See Flosi et al. (2003) for a description of how data for shelter value is collected and how shelter values are calculated.

4 Scales of Monitoring

- Feature
 - Site
 - Reach
 - Project
-
- ❖ Quantitative measurements
 - ❖ Qualitative rating
-
- Outcome ~ monitoring, modification, revision



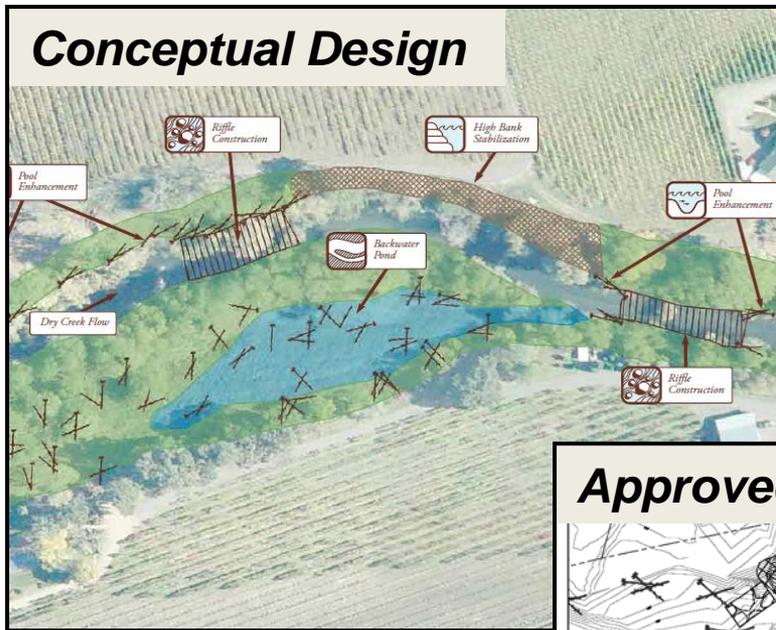
Adaptive Management Plan



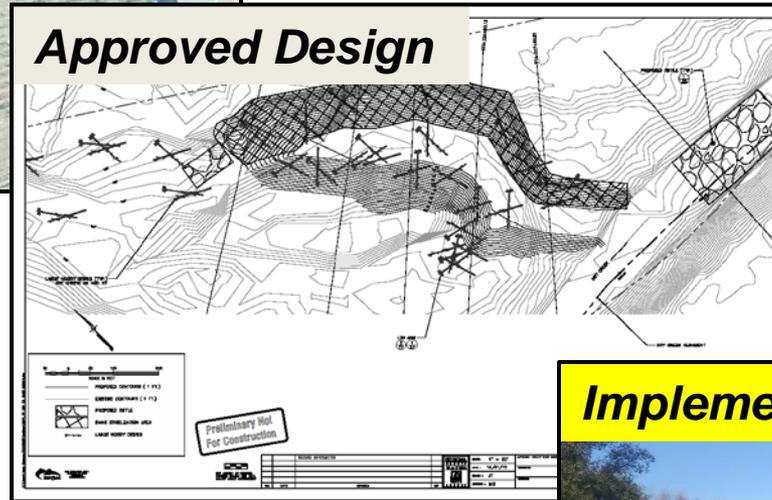
Joint Monitoring Team



Conceptual Design



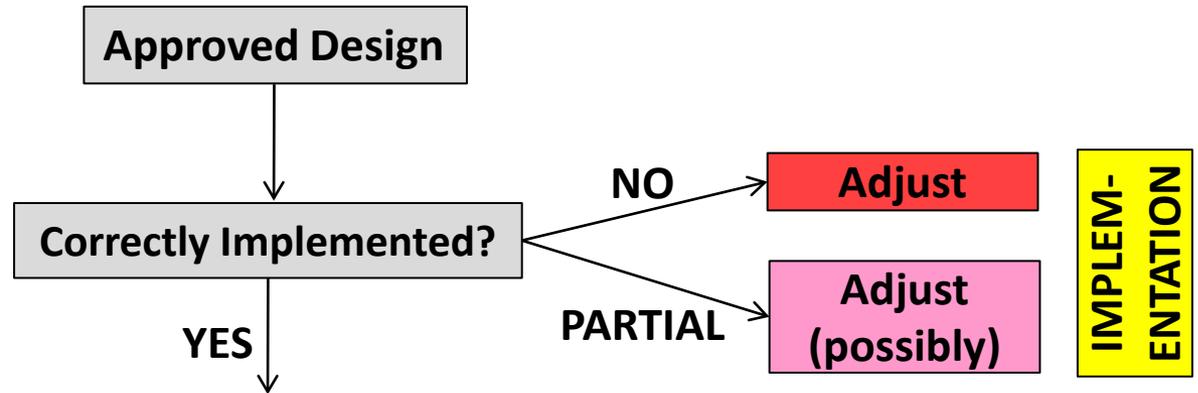
Approved Design



Implementation



Decision Tree



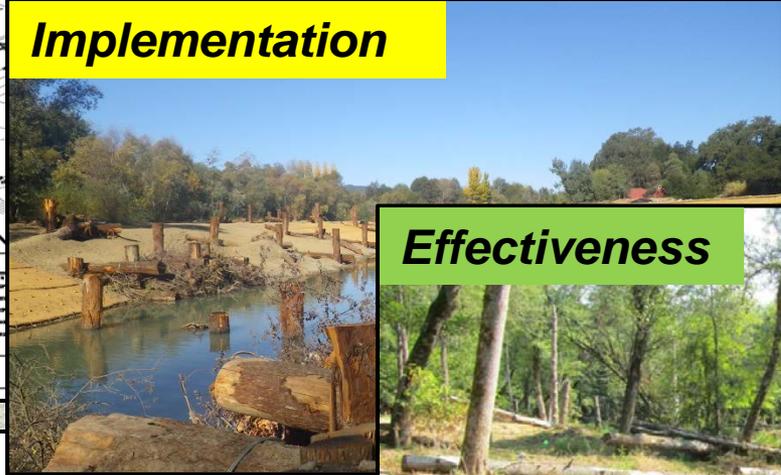
Conceptual Design



Approved Design



Implementation



Effectiveness



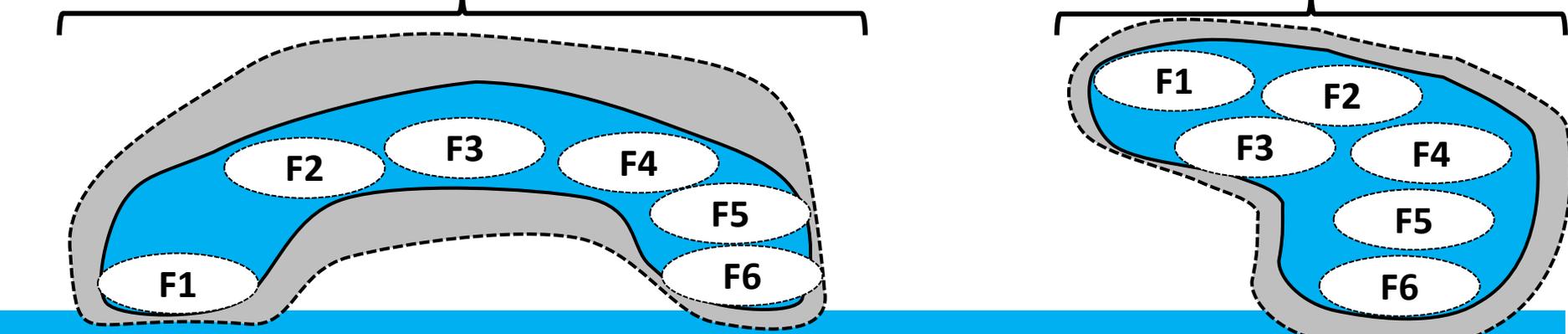
Effectiveness Criteria (Performance Measures)

Type	Life Stage	Performance Measure	Target
PRIMARY	JUVENILE	Velocity	0 – 0.5 feet/second
		Depth	2 – 4 feet
		Shelter	>80
		Pool : Riffle Ratio	1:2 to 2:1
SECONDARY	JUVENILE	Water Temperature	8-16 C
		Dissolved Oxygen	6 – 10 mg/l
		Canopy	80%
		Off-channel Access (“off ramps”)	0.05 feet/second
	ADULT (spawning)	Depth	0.5 – 1.6 feet
		Substrate Size	0.25 – 2.5 inches

PROJECT REACH

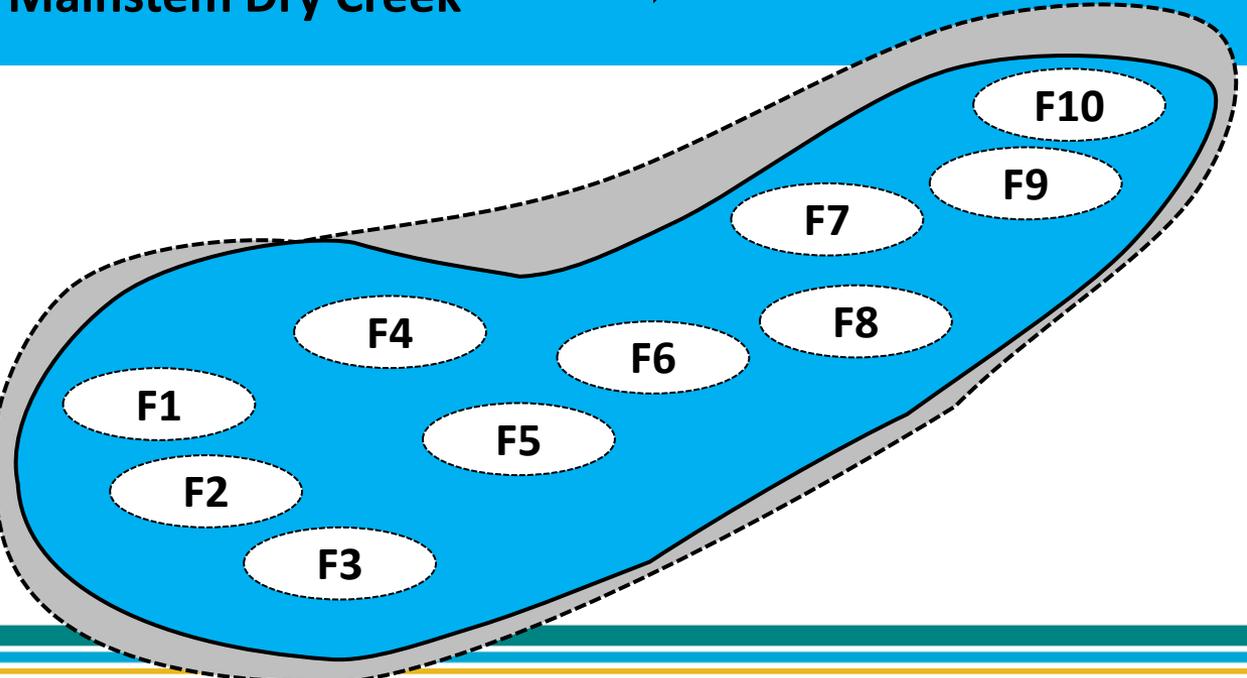
Site 1

Site 2



Mainstem Dry Creek →

Site 3



OFFCHANNEL HABITAT ENHANCEMENT		EFFECTIVENESS (post-treatment)		
Reach #:	Project Title:			page of
Site ID:	Site Name:			
Date&Time:	Evaluator:			
		Project Feature Number		
		Feature Type Code		
Feature	1. Length of targeted treatment: (ft)			
	2. Width of targeted treatment: (ft)			
	3. Area of offchannel habitat improved: ft ²			
	4. Structural condition: <i>Excl, Good, Fair, Poor, Fail</i>			
	5. Are problems with the feature visible? Types: <i>ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH</i>			
Depth / Habitat	6. Is the feature still in its original location, position & orientation?			
	7. Current level II habitat type: <i>FLT, POO, RIF, DRY, ALC, OTH</i>			
	8. If an objective, did the feature create the targeted instream habitat type?			
	9. Were there any unintended effects on the habitat type? If Y, comment.			
	10. Maximum residual water depth in main channel area: <i>ft</i>			
	11. Maximum residual depth associated with the feature: <i>ft</i> <i>a. If an objective, did the feature increase/decrease water depth in the treatment area?</i>			
	12. Measure the targeted depth or range <i>ft</i> <i>a. Estimate area of feature within targeted depth or range ft²:</i>			
Shelter	13. Were there any unintended effects on the water depth? If Y, comment.			
	14. Instream shelter value in the treatment area: <i>0, 1, 2, 3</i>			
	15. Percent of habitat unit covered by shelter: %			
	16. 1st/2nd dominant: <i>BED, BOL, BUB, LWD, RTW, SWD, UCB, VEG, OTH</i>	/	/	/
	17. If an objective, did the feature increase instream shelter rating? <i>a. Calculate the shelter rating: 0-300</i>			
Channel	18. Large woody debris count in treatment area: <i>D >1', L 6-20' / D >1', L >20'</i>	/	/	/
	19. If an objective, did the feature increase LWD count in the treatment area? <i>a. LWD recruitment methods: ANC, EXC, EXH, INT, RPR, UNA, OTH</i>			
	20. Current main channel problems: <i>AGG, BRD, FLO, GRC, HDC, INC, NAR, SCU, STT, WID, NON, OTH</i>			
	21. Did the feature lead to the targeted off channel conditions? <i>a. Overall Offchannel Condition: AGG, FPD, GRC, INC, NAR, SIN, STB, TOG, WID, OTH</i> <i>b. Outlet Conditions: AGG, FPD, GRC, INC, NAR, SIN, STB, TOG, WID, OTH</i> <i>c. Inlet Conditions: AGG, FPD, GRC, INC, NAR, SIN, STB, TOG, WID, OTH</i>			
Velocity	22. Were there any unintended effects on the main channel? If Y, comment.			
	23. If an objective, did the feature decrease/increase velocity in the treatment area? <i>a. Targeted velocity/range: ft/sec</i> <i>b. Did the feature achieve the targeted velocity/range?</i> <i>c. Measure the velocity/range ft/sec:</i> <i>d. Area of habitat unit within targeted velocity: ft²</i>			
	24. Percent of habitat unit within targeted velocity see above: %			
	25. Were there any unintended effects from velocity change? If Y, comment.			
Other	26. 1st/2nd dominant substrate: <i>BED, BOL, COB, GRV, SND, SLC, OTH</i>	/	/	/
	27. % Canopy Measurement:			
	28. Photopoint data collected: <i>yes / no</i>			
	29. Temperature Profile: <i>yes / no</i>			
Rating	30. Dissolved Oxygen Profile: <i>yes / no</i>			
	31. % area where targeted depth, velocity and shelter criteria overlap:			
	32. Does this feature need: <i>DEC, ENH, MNT, REP, NON, OTH</i>			
	33. Are additional restoration treatments recommended at this location?			
Comments	34. Feature Effectiveness Rating: <i>Excl, Good, Fair, Poor, Fail</i>			
	FINAL SITE LEVEL RATING (feature level rollup): <i>Excellent, Good, Fair, Poor, Fail</i>			

For Each Feature:

- Size
- Habitat type created: pool, riffle, backwater, etc.
- Primary metrics: velocity, depth, shelter, pool:riffle ratio
- Secondary metrics: temp., DO, canopy, spawning habitat

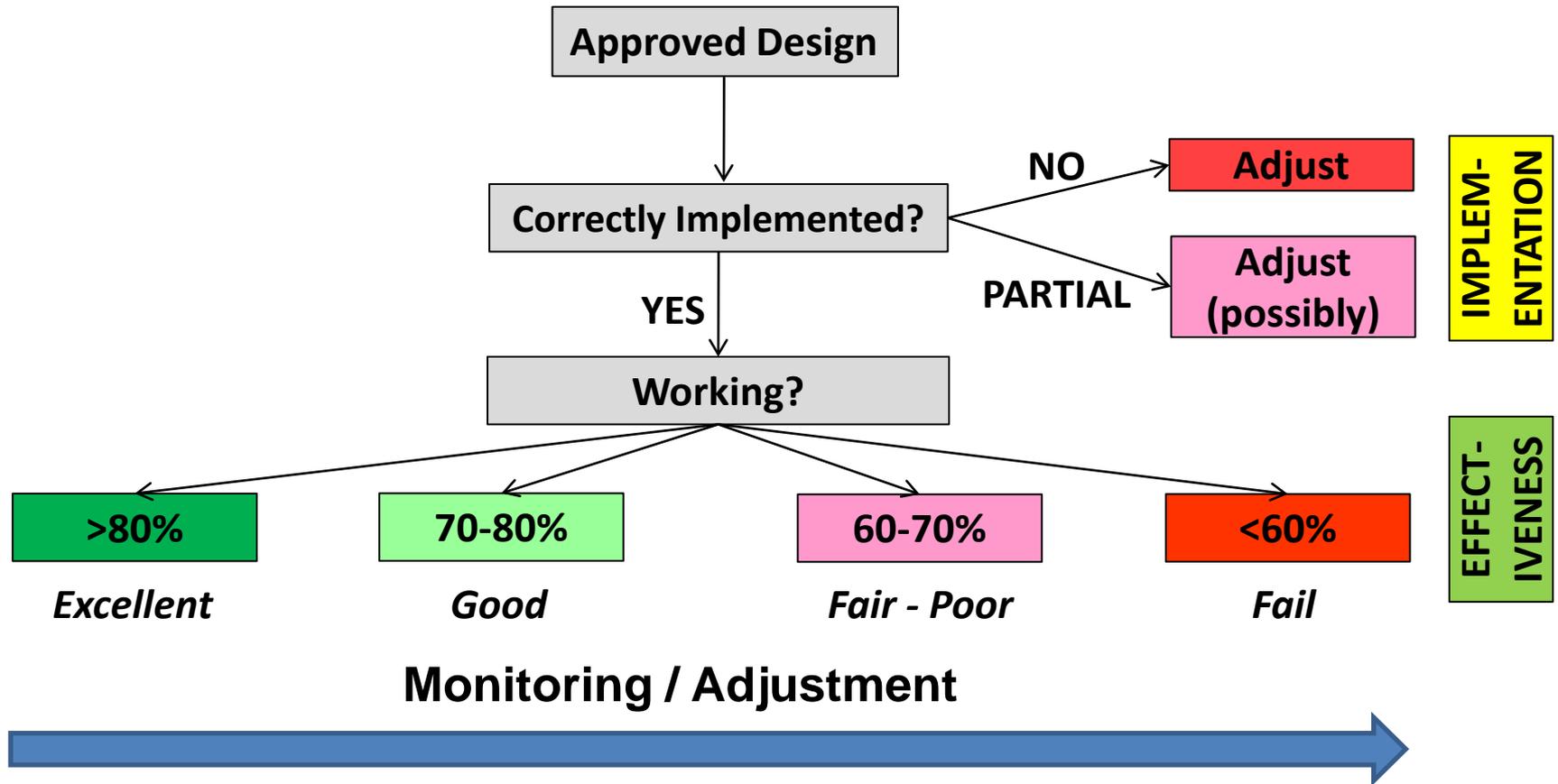
Feature rating

Site rating

Effectiveness Monitoring

Rating	Criteria	Future Outcome
Excellent-Good	All to most features/ habitat units achieve desired habitat response and meet targeted values for primary PMs (where relevant) (>80% of features rated Good or Excellent).	Continue to monitor according to adaptive management plan.
Fair-Poor	Some to many features/ habitat units do not achieve desired habitat response and do not meet -targeted values for primary PMs (where relevant) (60-80% of features rated Good or Excellent).	Step up monitoring on features exhibiting negative performance. Correct site or feature deficiencies as appropriate, including the option of adding sites/features or reducing total project habitat credit.
Fail	Many features/ habitat units did not achieve desired habitat response and did not meet any targeted values for primary PMs (where relevant) (<60% of features rated Good or Excellent).	Reduce site contribution from total project habitat credit. Revisit site potential and feature level design priorities. Redesign or add more sites/features. Alternatively reduce total project habitat credit.

Decision Tree & Rating - *Site Level*



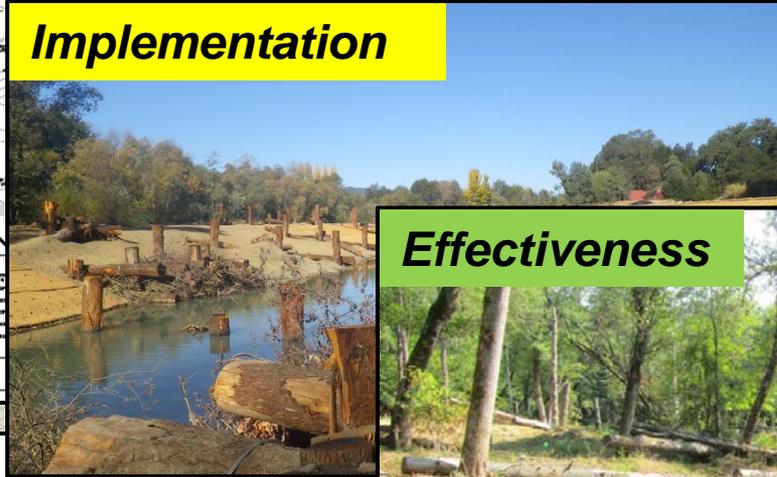
Conceptual Design



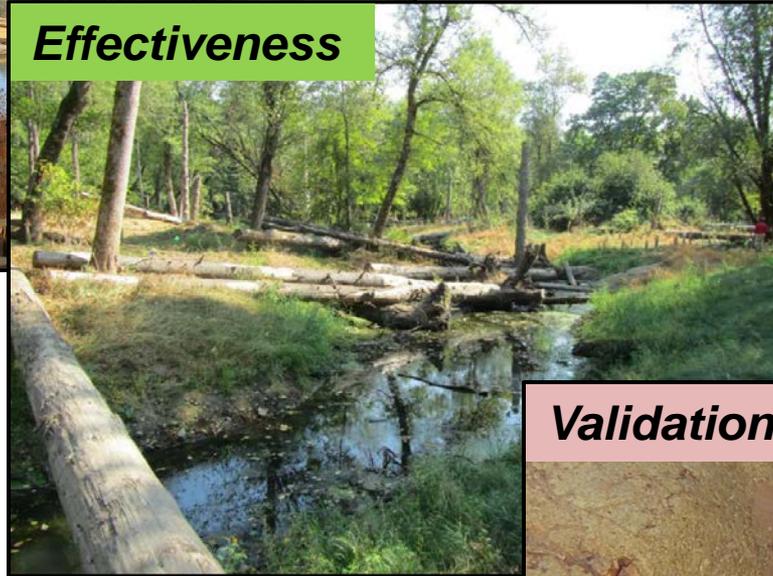
Approved Design



Implementation



Effectiveness



Validation



Validation Criteria (Performance Measures)

Type	Life Stage	Performance Measure	Target
PRIMARY	JUVENILE	Habitat Use	Presence
		Abundance (density)	Coho: 0.3/m ² Sthd: 0.5-1.5 m ²
	SMOLT	Relative Abundance	Increasing Trend
SECONDARY	JUVENILE / SMOLT	Relative Growth	Increase
		Relative Survival	Increase
		Relative Fidelity	Increase
	AQUATIC MACRO-INVERTEBRATES	Community Indices	Beneficial

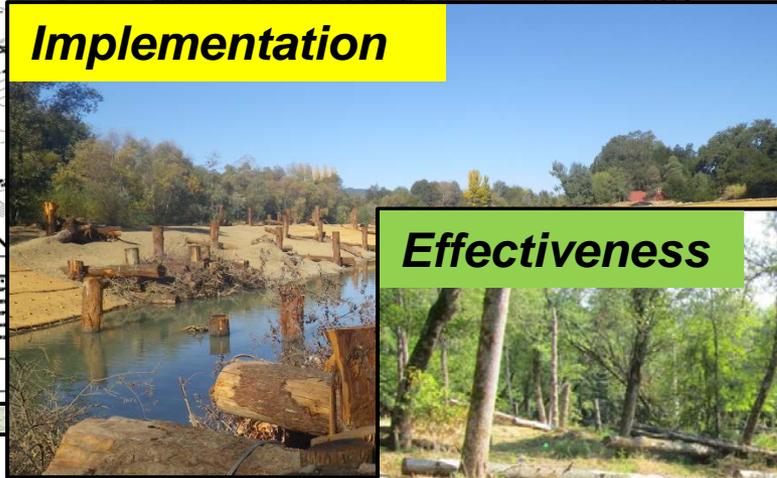
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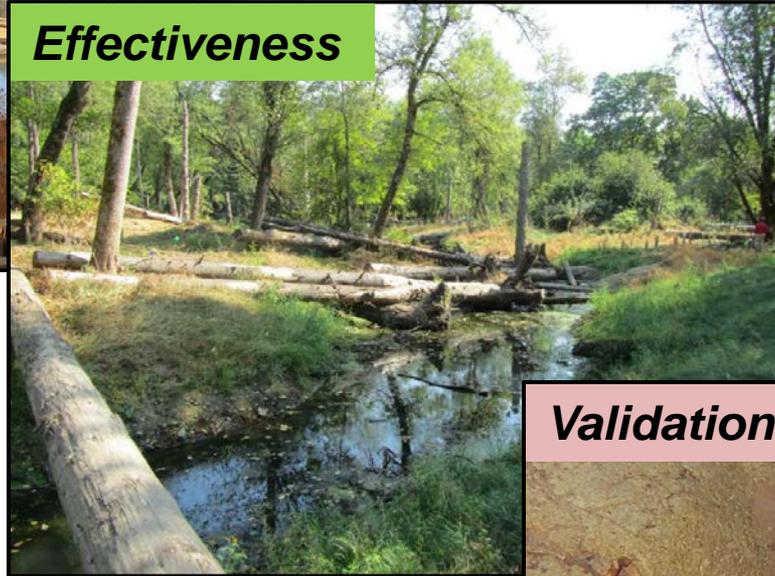
Approved Design



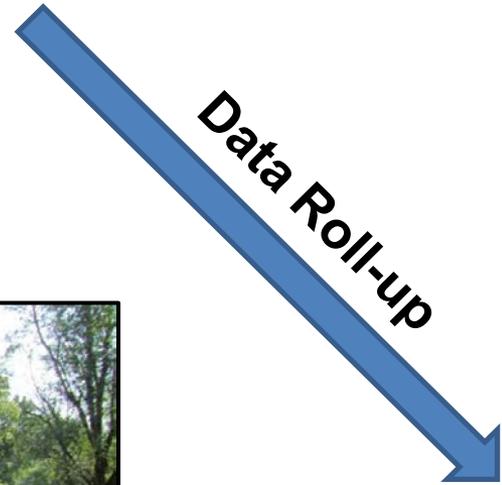
Implementation



Effectiveness



Validation



Project Performance Outcomes



- ***EXCELLENT to GOOD:*** Continue to monitor per AMP and proceed with similar enhancements for miles 4-6
- ***GOOD to FAIR:*** Proceed with enhancing mile 4 with successful performing elements while continuing to monitor/adjust negative performing features
- ***FAIR to POOR:*** Continue monitoring and correct site deficiencies, add features, or accept reduced credit in existing 3 miles. Revisit site potential and conceptual design priorities for miles 4-6.
- ***FAIL:*** Construct bypass pipeline.

Monitoring Schedule

Mile	Year	Implementation	Effectiveness		Validation							
			Feature	Reach	Feature/Site	Enhancement Reach	Watershed					
1	2011	N/A	N/A	N/A	N/A	Yes (pre-project)	Yes					
	2012	N/A	N/A	N/A	N/A	Yes (pre-project)	Yes					
	2013-14 (year 0)	Yes	Yes (baseline)	No	Yes (pre-project)	Yes (pre-project)	Yes					
	2014-15	N/A	Yes (1x within 1-3 years depending on mobility flow)	Yes (1x within 1-3 years depending on mobility flow) ²	Yes (post-project)	Yes (post-project)	Yes					
	2015-16		Yes (post-project)	Yes (post-project)	Yes							
	2016-17		Yes (post-project)	Yes (post-project)	Yes							
	2017-18				Yes (post-project)	Yes						
	2018-19				Yes (post-project)	Yes						
	2019-20				Yes (post-project)	Yes						
	2020-21				Yes (post-project)	Yes						
	2021-22				Yes (post-project)	Yes						
2022-23	Yes (post-project)		Yes (post-project) ³	Yes (post-project)	Yes (post-project)	Yes						
2-3	2011		N/A	N/A	N/A	N/A	As soon as reach is identified	Yes				
	2012	Yes										
	2013	Yes										
	2014	Yes (pre-project)										
	2015	Yes (pre-project)										
	2016-17 (year 0)	Yes	Yes (baseline)	Repeat baseline if necessary (e.g. major changes)	Yes (pre-project)	Yes (pre-project)	Yes					
	2017-18	N/A	Yes (1x within 1-3 years depending on mobility flow)	Yes (1x within 1-3 years depending on mobility flow) ²	Yes (post-project)	Yes (post-project)	Yes					
	2018-19		Yes (post-project)	Yes (post-project)	Yes							
	2019-20		Yes (post-project)	Yes (post-project)	Yes							
	2020-21				Yes (post-project)	Yes						
	2021-22				Yes (post-project)	Yes						
2022-23				Yes (post-project)	Yes							
4-6	2011	N/A	N/A	N/A	N/A	As soon as reach is identified	Yes					
	2012						Yes					
	2013						Yes					
	2014						Yes					
	2015						Yes					
	2016						Yes					
	2017						Yes (pre-project)					
	2018						Yes (pre-project)					
	2019-20 (year 0)						Yes	Yes (baseline)	Repeat baseline if necessary (e.g. major changes)	Yes (pre-project)	Yes (pre-project)	Yes
	2020-21						Yes (1x within 1-3 years depending on mobility flow)	Yes (1x within 1-3 years depending on mobility flow)	Yes (post-project)	Yes (post-project)	Yes	
2021-22	N/A	Yes (post-project)	Yes (post-project)	Yes								
2022-23		Yes (post-project)	Yes (post-project)	Yes								

- **Implementation:**
Immediately following construction
- **Effectiveness:**
 - Pre-enhancement-baseline
 - Post-enhancement-every 3 years
- **Validation:**
 - Pre-enhancement-baseline
 - Post-enhancement-annually

Results to date

- **On schedule:** Agencies are pleased with progress to date (good-excellent implementation rating)
- **Fall 2013:**
First release of juvenile coho in Dry Creek
- **2012, 2013:**
Documented juvenile coho use

Quivira – Winter, 2012



Farrow – Summer, 2013

