FINAL REPORT
Mill Creek Dam Fish Passage Project
Trout Unlimited Final Report to CDFW
February 2020

Project Title: Mill Creek Dam Fish Passage Project
FRGP Grant Number: P1530400
Grantee Name: Trout Unlimited, Inc.
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Overview of Project:

Geographic area: Mill Creek, tributary to Dry Creek, thence Russian River (Sonoma Co.)
Geospatial reference: 38.59591100, -122.90752800 (location of dam)
Project start date: June 1, 2016
Project end date: March 31, 2020

The Mill Creek Dam Fish Passage Project modified a barrier to adult and juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead (*Oncorhynchus mykiss*) and reconnected access to approximately 11.2 miles of spawning and rearing habitat upstream. The barrier, a 5-foot high concrete flashboard dam on Mill Creek, was modified by constructing a roughened channel and a roughened ramp fishway side channel to allow adult and juvenile passage. It was identified as the highest priority barrier within the Russian River population for remediation (NMFS, 2012 Recovery Plan for Central CA Coast Coho Salmon, Task RR-CCC-6.1.2.2).

Trout Unlimited (TU) obtained permits for the project from the Regional Water Quality Control Board, California Department of Fish and Wildlife, County of Sonoma, and Army Corps of Engineers.

Prunuske Chatham, Inc. (PCI) began construction in June 2016. This included mobilization, dewatering, fish relocation, traffic control, landowner water system installation and water deliveries, tree removal, irrigation pipe removal, main and side channel excavation, dam apron removal, main and side channel construction (shotcrete installation, bed installation, boulder inlet weir installation), erosion control fabric installation, and revegetation. Construction of the main channel and side channel was completed in mid-October 2016. Within weeks of completion, steelhead and coho salmon were observed above the dam. Since completion, spawning has been documented throughout much of the newly available 11.2 miles of Mill Creek.

Work from November 2017 to October 2018 included communication with landowners, agency staff, and other project partners; post-project monitoring (described below and in Attachment 5); work within the area of a small landslide (located on the right bank above the entrance to the side channel); and plant irrigation, maintenance and monitoring.

Work from November 2018 to October 2018 included communication with landowners and agency staff; revegetation success monitoring; preparation of the Year 1 post-construction project effectiveness monitoring report (included in Attachment 8); site visits and updates to agencies on site observations and performance; planting of 35 dogwood stakes (*Cornus sericea*) in the landslide face; and irrigation of tree and shrub plantings (driwater and hand watering) during dry season.

Work from November 2018 through February 2020 included communication with landowners and agency staff; revegetation success monitoring; preparation of the Year 2 and Year 3 post-construction project effectiveness monitoring reports (included in Attachments 9 and 11); coordination of an agency and partner field tour in May 2019; irrigation and care of tree and shrub plantings (driwater and hand watering) during the dry season; removal of the irrigation and plant-care-related infrastructure in November 2019; and final grading inspection site visit and permit close out coordination.

The project has received media attention and partner accolades. It was featured in articles by California Sea Grant (CSG), Climate.gov, and the Santa Rosa Press Democrat (Attachment 6). TU produced three blog posts and multiple Facebook posts (Attachment 6). TU and PCI, and CSG delivered poster presentations on the project at the Salmonid Restoration Federation conference in March 2017. In June 2017, the project received an Honorable Mention for the International Conference on Engineering and Ecohydrology for Fish Passage's Distinguished Project Award. The project was recognized at the Fish Passage 2017 Conference and NOAA Engineer David White accepted the award on behalf of the project team (see Attachment 7).

Overview of Biological Monitoring:

In the winters of 2011/12 through 2015/16, the five years preceding dam remediation, CSG documented a total of just four coho salmon redds above the dam site; the remaining 93% of coho redds were confined to the reach below the barrier (Figure 1); no coho salmon redds were documented upstream of the project site in the winter of 2015/16 (Figure 2).

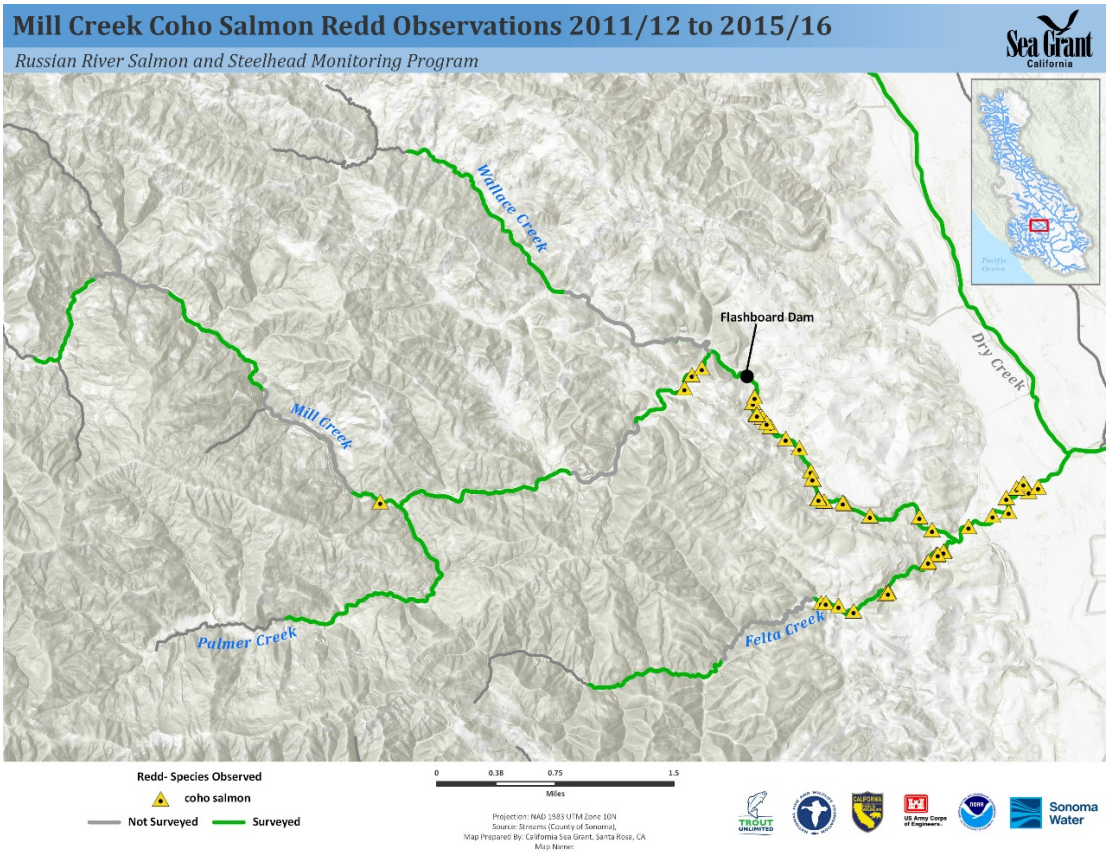

Figure 1. Coho salmon redds observed in Mill Creek from winter 2011/12 through 2015/16.

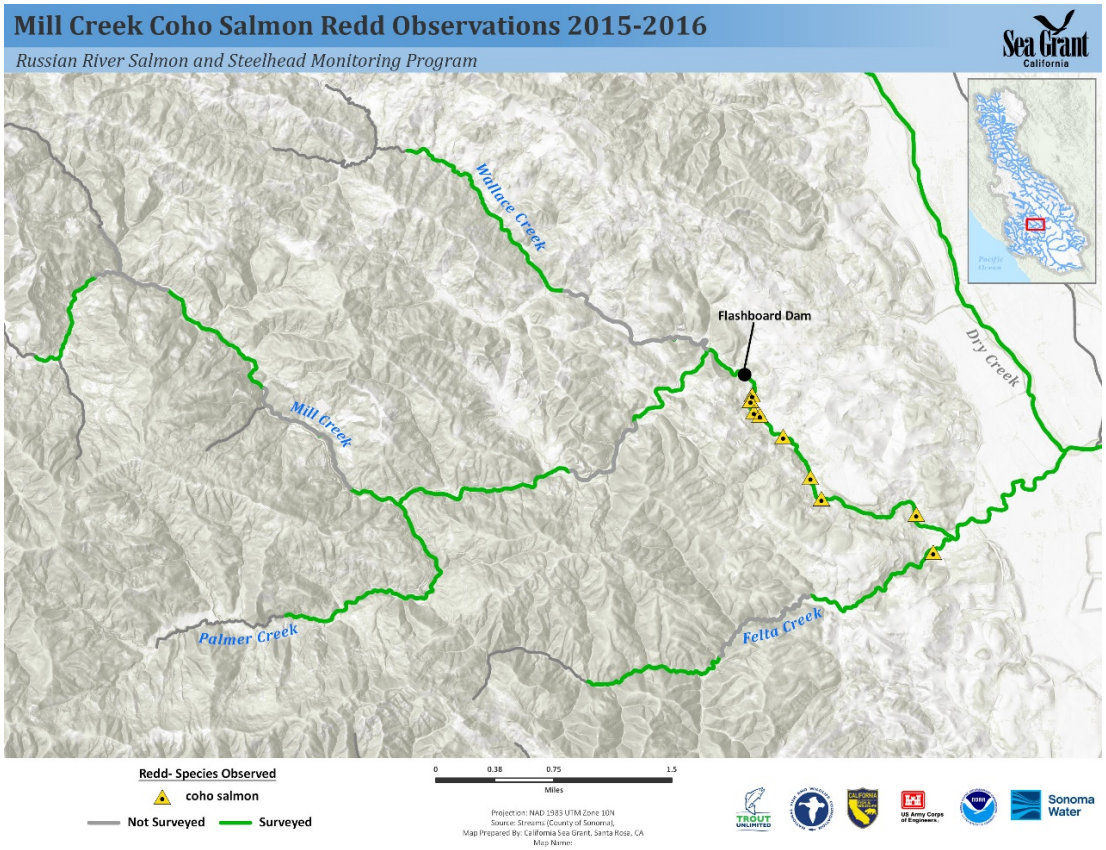

Figure 2. Coho salmon redds observed in Mill Creek during winter 2015/16.

In the two winters following completion of the dam remediation, coho salmon redds have been much more evenly distributed throughout the stream. In the winter of 2016/17, a total of seven redds were observed upstream of the former barrier site (Figure 3), nearly twice as many as were observed in all five years prior to the barrier remediation work. CSG estimates that 19 adult coho salmon passed through the project site in the winter of 2016/17 based on PIT tag detections.

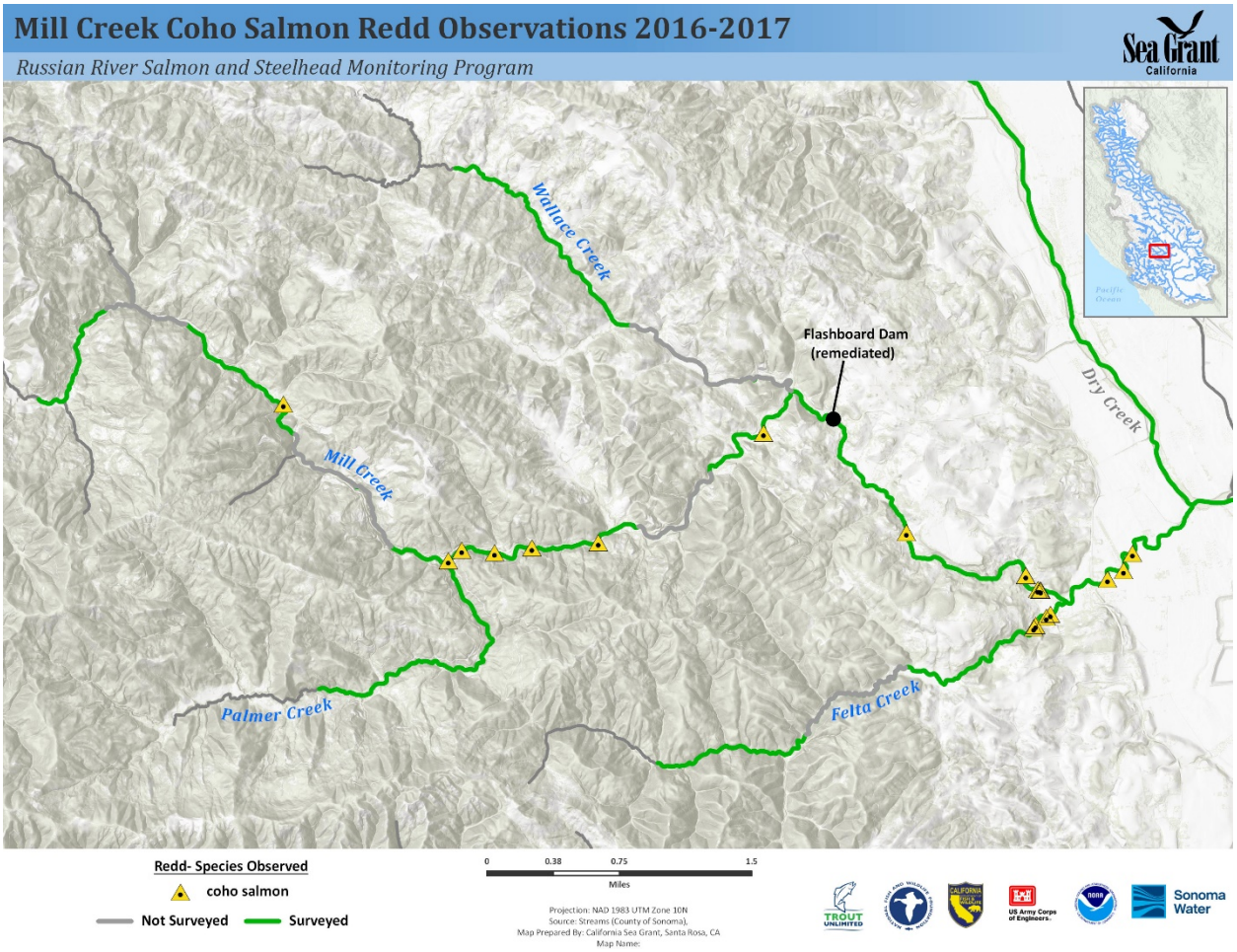

Figure 3. Coho salmon redds observed in Mill Creek during winter 2016/17.

In the winter of 2017/18: three of the seven coho redds observed in the Mill Creek watershed were upstream of the remediated dam site (Figure 4). CSG estimates that 6-17 adult coho salmon passed through the project site based on the season's spawner:redd ratio in Mill Creek.

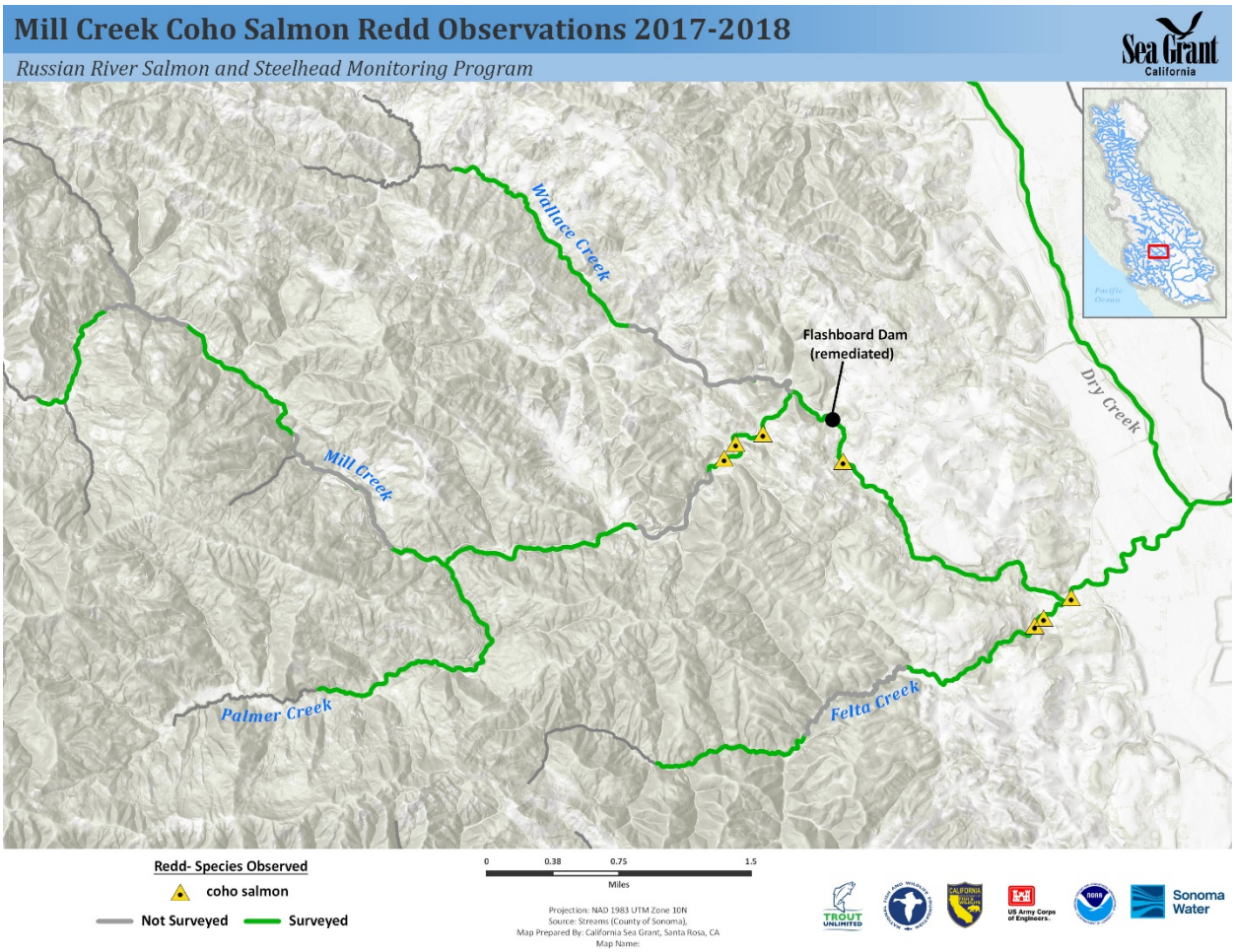

Figure 4. Coho salmon redds observed in Mill Creek during winter 2017/18.

In the winter of 2018/19: five of the fifteen coho salmon redds observed in the Mill Creek Watershed were upstream of the remediated dam site (Figure 5). CSG estimates 7 adult coho salmon passed through the project site based on PIT tag detections.

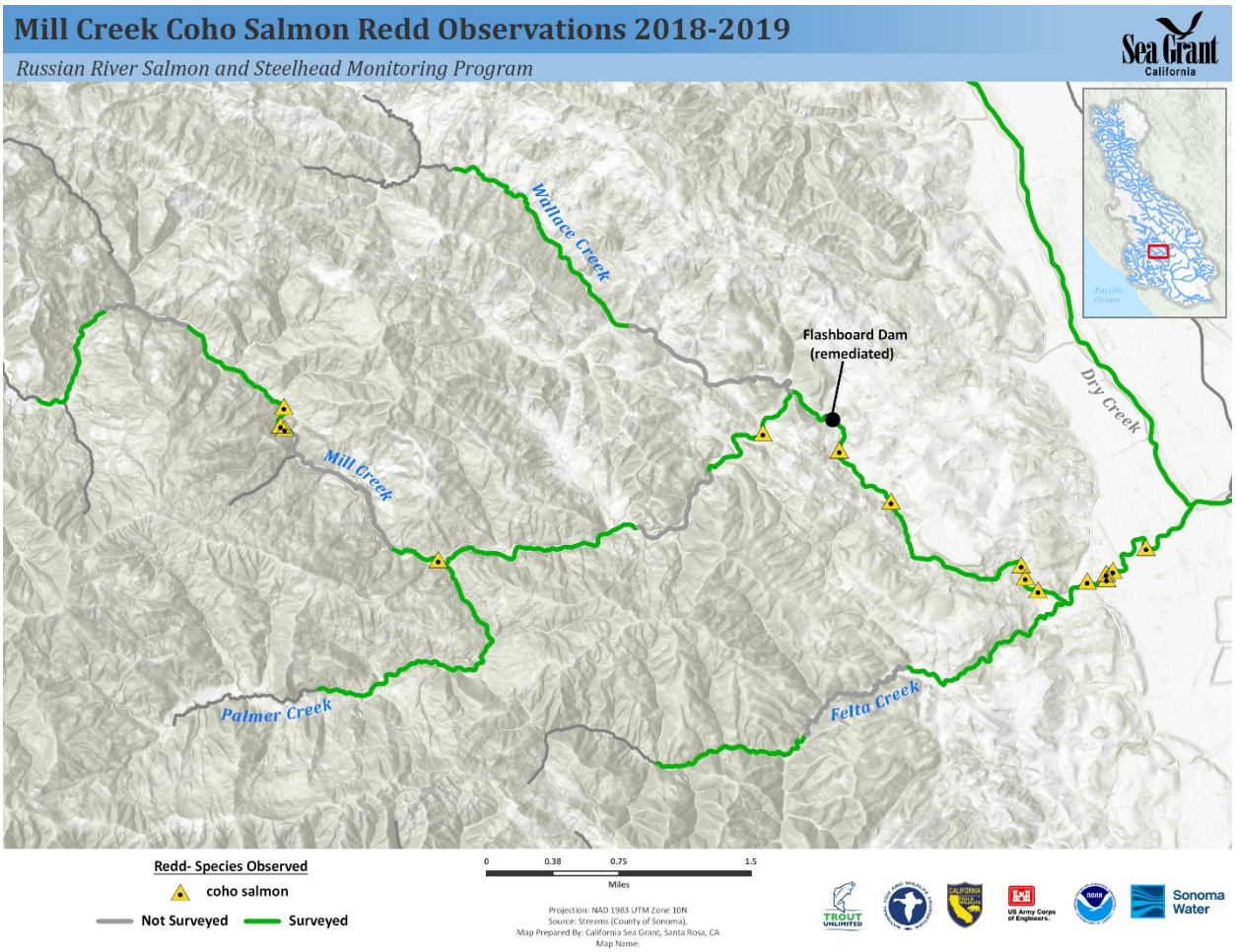

Figure 5. Coho salmon redds observed in Mill Creek during winter 2018/19.

The first PIT-tagged adult coho of winter 2019/20 was documented upstream of the project site in early December 2019.

In the three years after the project was implemented, 12 coho salmon redds were observed upstream of the project site (Figure 6), as compared to only 4 redds in the five years preceding the project.

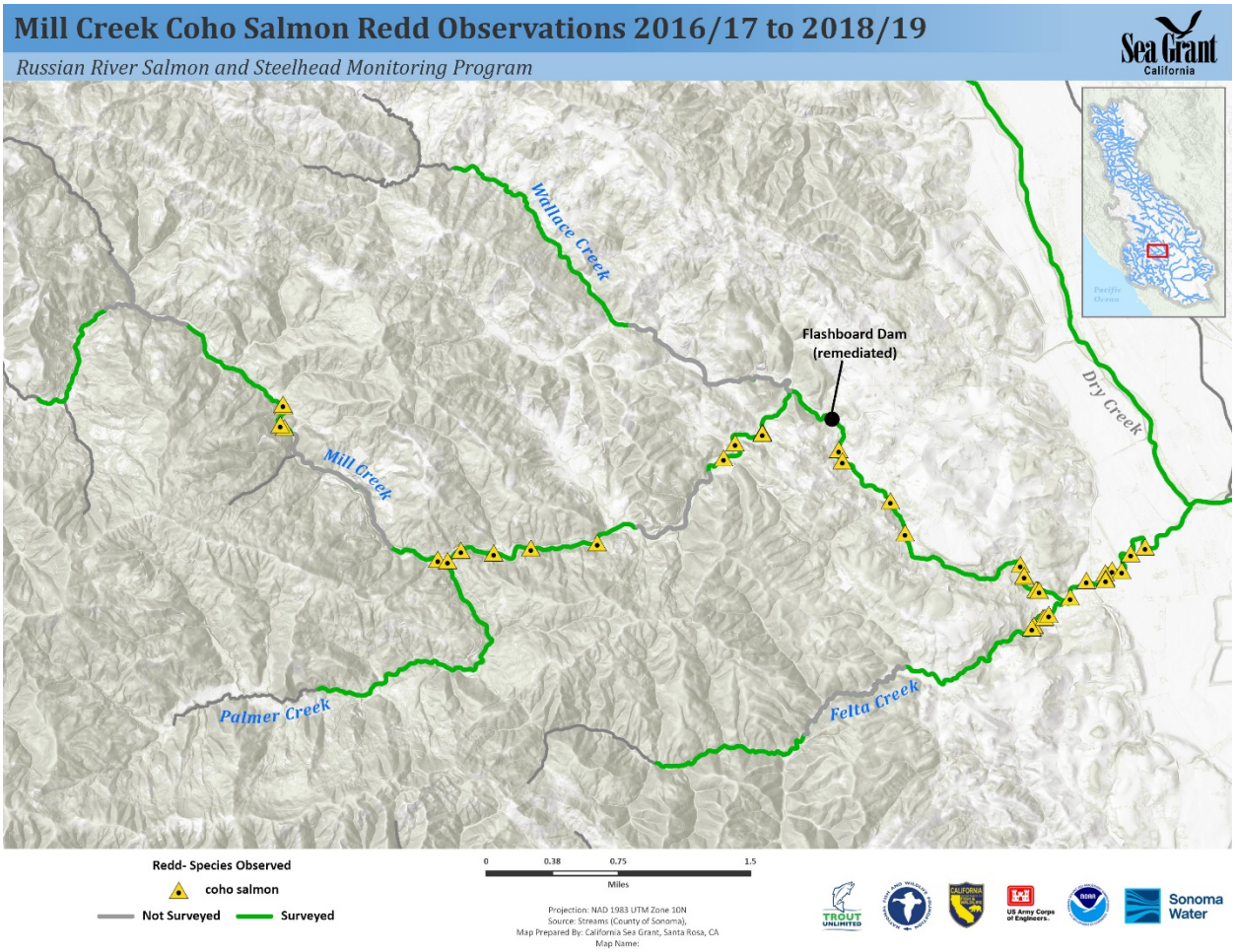

Figure 6. Coho salmon redds observed in Mill Creek 3 years after project implementation, winters 2016/17, 2017/18, 2018/19.

Table 1. Coho salmon redds observed in Mill Creek during CMP Spawner Surveys during the winters of 2015/16 through 2018/19

Season	Coho Redds **Upstream** of Project	Coho Redds **Downstream** of Project
2015/16	0	9
2016/17	7	11
2017/18	3	4
2018/19	5	10

See Attachment 10 for CSG pre- and post-project juvenile counts upstream of the project site.

Project Expenditures:

Mill Creek Dam Fish Passage Project FRGP Expenditures			
	FRGP Budget	**FRGP Expended**	**FRGP Remaining**
Personnel Services			
Stewardship Manager	$5,760.00	$5,760.00	$0.00
Conservation Grants Assistant	$450.00	$450.00	$0.00
Staff Benefits at 28%	$1,739.00	$1,739.00	$0.00
Total Personnel Services	**$7,949.00**	**$7,949.00**	**$0.00**
Operating Expenses			
Subcontractor	$504,188.00	$504,188.00	$0.00
Total Subcontractor	**$504,188.00**	**$504,188.00**	**$0.00**
Mileage at $0.54 per mile	$73.00	$73.00	$0.00
Tolls	$5.00	$5.00	$0.00
Total Operating Expenses	**$504,266.00**	**$504,266.00**	**$0.00**
Administration and Overhead at 14%	$1,124.00	$1,124.00	$0.00
Grand Total	**$513,339.00**	**$513,339.00**	**$0.00**

As Built Description:

The project was constructed substantially as designed. Per the project plans, a 15-foot wide side channel was excavated into the hillside and around the left dam abutment, the dam's concrete apron and cobble fill was removed while leaving the existing concrete cutoff wall, and roughened boulder channels were constructed up the main channel and side channel. The lower 50 feet of the main channel has a slope of 6%. From the confluence with the side channel up to the dam the main channel slope is 8% for another 48 feet. The side channel is 100 feet long and has a slope of 3.2%. The inlet of the side channel was set 6 inches lower than the dam weir so that low fish passage flows will be concentrated in the side channel. Higher flows will be split between the main and side channels. The surface of the roughened channel is gravel and cobbles between a matrix of protruding boulders, which creates multiple flow pathways during low flows. Side channel and main channel weir elevations, as well as the channel bed elevations conform to the plans. Shotcrete and boulder scour protection was placed along the right mainstem bank below an existing residence. Shotcrete scour protection was also used to protect the side channel banks. Sections of the channel with boulder slope protection were planted with willow, dogwood, and alder. Torrent sedge was planted along the channel margins. The reservoir area that was used for construction staging was regraded to meet pre-construction topography and clean gravel was placed on the surface. Compost, grass seed, and erosion control fabric was installed on the right bank of the side channel above the boulder and shotcrete scour protection. The disturbed slope will be revegetated with a pallet of native plants in November 2016.

Minor modifications to the side channel bank grading and weir shape at the dam crest were made; both adjustments were approved by David White (NOAA) and Derek Acomb (CDFW). The adjustments do not affect the function of the channel and fish passage.

In December 2016 a small landslide occurred on the right bank above the side channel and partially blocked the side channel entrance. Agency biologists and the NOAA engineer did not feel that it substantially impacted fish passage conditions or project functioning. PCI planted dogwood stakes (*Cornus sericea*) in the landslide face in December 2017, and the slide is being monitored and allowed to stabilize naturally.

Fish passage conditions through the site were monitored by PCI in early 2017. Monitoring consisted of measuring velocities and depths within the side and main channels. Long profiles and three cross sections were surveyed which captured the range of channel slopes (3%, 6%, and 8%). The site was monitored twice to evaluate fish passage conditions in the roughened channels at a range of flows, including one mid-range fish passage flow (63 cfs) and one low-range fish passage flow (7 cfs). The mid-range flow represents the flows at which adult coho were documented transiting the project reach earlier in the winter. The monitoring indicates that there are favorable velocity and depth conditions for both adult and juvenile upstream migration during low and mid-range flows. The Monitoring Technical Memo is included in Attachment 5.

Photos:

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo 1	6/14/2016	Mill Creek Dam face	Pre-project	On right bank downstream of dam	Upstream - West
Photo 2	9/30/2016	Weir at crest of Mill Creek Dam with roughened ramp	During construction	Mid-channel downstream of original dam	Upstream - West
Photo 3	10/14/2016	Project site	First rain and flow immediately following construction	On right bank upstream of original dam location	North
Photo 4	3/1/2017	Project site during mid-range flow (63 cfs)	PCI post-project monitoring (Credit: PCI)	Downstream of confluence of main and side channels	Upstream - West
Photo 5	12/3/2016	Coho salmon female and jack spawning upstream of project site	Post-project (Credit: CSG)	Upstream of project site	N/A
Photo 6	3/8/2017	Salmonid species upstream of pre-existing dam and new roughened channel	Post-project (Credit: Bob Mattei)	On left bank above new roughened channel	South
Photo 7	10/16/2017	Main channel and side channel	Immediately following construction (Credit: PCI)	On right bank	Downstream - East
Photo 8	12/11/2017	Main channel and side channel	One year after construction	On right bank	Downstream - East
Photo 9	5/24/2018	Main channel and side channel	Second spring after construction	On right bank	Downstream - East
Photo 10	10/3/2018	Main channel and side channel	Two years after construction (Credit: PCI)	On right bank	Downstream - East

Photo 11	5/29/2019	Main channel and side channel	Third spring after construction	On right bank	Downstream - East
Photo 12	11/15/2019	Main channel and side channel	Third fall after construction	On right bank	Downstream - East
Photo 13	10/16/2016	Side channel	Immediately following construction (Credit: PCI)	On right bank	Upstream - West
Photo 14	8/11/2017	Side channel in foreground	One year after construction	On right bank	Upstream - West
Photo 15	5/24/2018	Side channel in foreground	Second spring after construction (Credit: PCI)	On right bank	Upstream - West
Photo 16	10/3/2018	Side channel in foreground	Two years after construction (Credit: PCI)	On right bank	Upstream - West
Photo 17	5/29/2019	Side channel	Third spring after construction	On right bank	Upstream - West

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

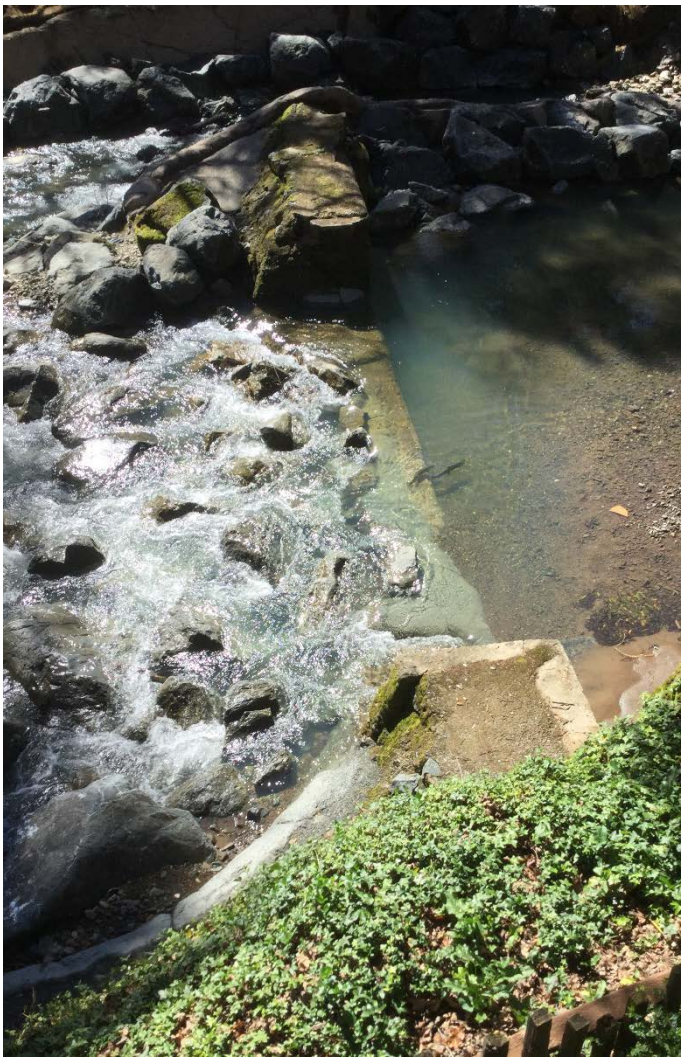

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

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Photo 14

Photo 15

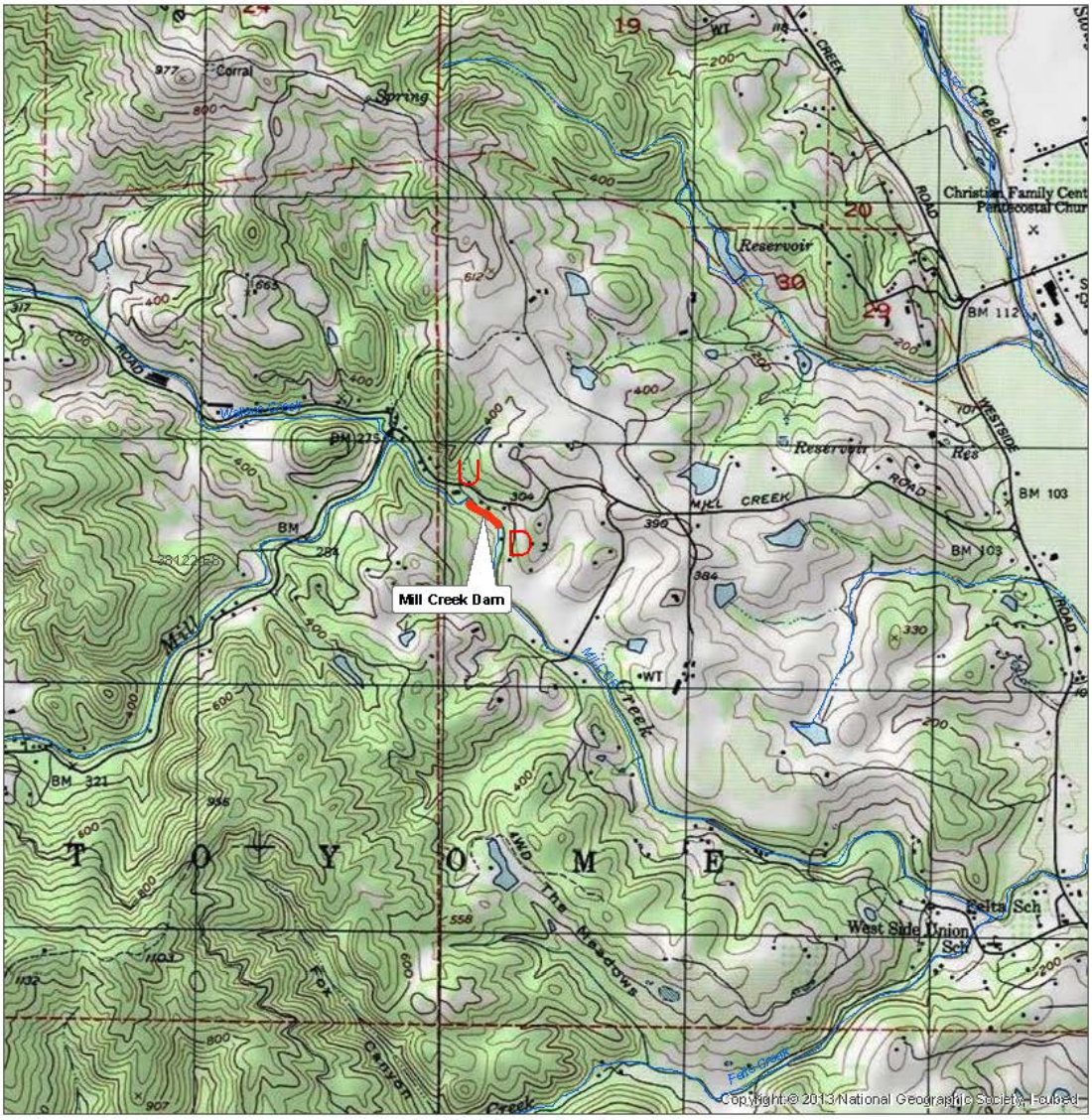
Photo 16

Photo 17

Project Location:

Mill Creek Dam Fish Passage Project - P1530400
Trout Unlimited Inc.

Mill Creek Location Topographic Map



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United States Geological Survey
7.5 Minute Topographic Map. Guemeville Quadrangle

0 0.125 0.25 0.5 0.75 1 Miles

Plans/Data:

- Attachment 1. Mill Creek Dam Fish Passage and Engineering Monitoring Points.
- Attachment 5. Mill Creek Dam Fish Passage Project Monitoring Technical Memo.
- Attachment 8. Mill Creek Dam Project Annual Monitoring Report – Year 1 (2017). December 2017. Prepared by Prunuske Chatham, Inc. for Trout Unlimited, Inc. for submittal to the NCRWQCB and CDFW.

- Attachment 9. Mill Creek Dam Project Annual Monitoring Report – Year 2 (2018). December 2018. Prepared by Prunuske Chatham, Inc. for Trout Unlimited, Inc. for submittal to the NCRWQCB and CDFW.
- Attachment 10. California Sea Grant Juvenile Salmonid Data
- Attachment 11. Mill Creek Dam Project Annual Monitoring Report – Year 3 (2019). December 2019. Prepared by Prunuske Chatham, Inc. for Trout Unlimited, Inc. for submittal to the NCRWQCB and CDFW.

Species Surveys:

- Attachment 2. Biological Resources Evaluation, Mill Creek Dam Fish Passage Project, Healdsburg, Sonoma County, CA. October 2015. Prepared by Prunuske Chatham, Inc. for Trout Unlimited, Inc.
- Attachment 3. HB-148 Mill Creek Dam Fish Passage Project, Sonoma County, CA, Interim Report. June 21, 2016. Prepared by Jennifer Kalt for the California Department of Fish and Wildlife.

Fish Relocation Data / Report:

- Attachment 4. Mill Creek Dam Fish Passage Project, Mill Creek, Healdsburg, Sonoma County, California, Summary of Biological Activities. November 2016. From Jennifer Michaud, Prunuske Chatham, Inc., to Mary Ann King, Trout Unlimited.

Dewatering Data / Report:

- This is included in Attachment 4.

Performance Measures: Instream Barrier Modification for Fish Passage (HB)

Metric	2016	2017	2018	2019	2020	All Yrs.
Overall stream length treated, one side of stream only (miles)	0.04	-	-	-	-	0.04
Length of aquatic habitat disturbed (feet)	460	-	-	-	-	460
Area/footprint of instream features installed within bankfull channel (square feet)	N/A	N/A	N/A	N/A	N/A	N/A
Total length of stream made accessible by removing blockages (miles)	11.2	-	-	-	-	11.2
Total blockages/impediments/barriers removed/altered (number)	1	-	-	-	-	1
Blockages/impediments/barriers impeding passage (number)	1	-	-	-	-	1
Stream length opened for fish passage by improving stream crossings (miles)	N/A	N/A	N/A	N/A	N/A	N/A
Road crossings removed (number)	N/A	N/A	N/A	N/A	N/A	N/A
Species of plants planted in riparian (text)	*Cornus sericea, Salix lasiolepsus, Carex nudata, Alnus rubra*	-	*Cornus serícea**	-	-	See 2016 and 2018
Area planted in riparian (acres)	~0.1	-	0.005	-	-	~0.105
Plants planted (number)	~40	-	35	-	-	~75
Length of riparian stream bank treated, count both sides of stream if applicable (miles)	N/A	N/A	N/A	N/A	N/A	N/A
Total amount of riparian area treated (acres)	~0.1	-	0.005	-		~0.105
Amount of riparian area treated for invasive species (acres)	N/A	N/A	N/A	N/A	N/A	N/A
Total length of instream habitat treated (miles)	N/A	N/A	N/A	N/A	N/A	N/A
Pools created through channel structure placement (number)	N/A	N/A	N/A	N/A	N/A	N/A
Instream features installed/modified (number)	N/A	N/A	N/A	N/A	N/A	N/A
Length of stream treated for channel structure placement (miles)	N/A	N/A	N/A	N/A	N/A	N/A
Dewatering start and stop dates	6/15-10/15	-	-	-	-	See 2016
Dewatering locations (lat-lon)	38.595911, -122.907528	-	-	-	-	See 2016
Relocation dates	6/21, 6/22, 6/23, 6/24, 7/7, 7/8	-	-	-	-	See 2016
Relocation location from (lat-lon)	See Attachment 4	-	-	-	-	See 2016
Relocation location to (lat-lon)	See Attachment 4	-	-	-	-	See 2016
Construction start and end dates	6/15-10/22	-	-	-	-	See 2016

* Annual columns reflect reporting periods (Nov. – Oct.); note *Cornus sericea* planting occurred in Dec. 2017 (2018 reporting period).

Attachments:

- Attachment 1. Mill Creek Dam Fish Passage and Engineering Monitoring Points.
- Attachment 2. Biological Resources Evaluation, Mill Creek Dam Fish Passage Project, Healdsburg, Sonoma County, CA. October 2015. Prepared by Prunuske Chatham, Inc. for Trout Unlimited, Inc.
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- Attachment 5. Mill Creek Dam Fish Passage Project Monitoring Technical Memo.
- Attachment 6. Media and Communications.
- Attachment 7. Distinguished Project Award Honorable Mention Photos and Slides.
- Attachment 8. Mill Creek Dam Project Annual Monitoring Report – Year 1 (2017). December 2017. Prepared by Prunuske Chatham, Inc. for Trout Unlimited, Inc. for submittal to the NCRWQCB and CDFW.
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