



# The CDFW Instream Flow Program: Flow Studies in Sacramento River Delta Tributaries

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## Introduction

The CDFW Water Branch Instream Flow Program (IFP) mission is to determine stream flows that maintain healthy conditions for the long-term protection, maintenance and stewardship of fish and wildlife resources in California streams. The IFP selects streams, conducts studies, and transmits flow recommendations pursuant to Public Resources Code §10000-10005. Instream flow recommendations, based on scientifically defensible assessments, are needed to inform regulatory processes that must balance protection of fish and wildlife resources with other beneficial water uses. Consistent with the intent of the Delta Reform Act (SBX7 1), the IFP is conducting instream flow studies on tributary streams to the Sacramento-San Joaquin River Delta. Results of these studies will be submitted to the State Water Resources Control Board as flow criteria. Studies are underway on lower Butte, Deer and Mill Creeks. These Delta tributary streams are of particular interest for flow studies because they support the largest natural spawning populations of listed spring-run Chinook salmon (SRCS; *Oncorhynchus tshawytscha*) in the Central Valley. With the help of CDFW Regional staff, the Fisheries Branch, and the Engineering Group, IFP staff are evaluating factors that affect passage of adult fish migrating upstream in each of these streams.

## Goals

Determine streamflow requirements in Sacramento-San Joaquin Delta tributaries and produce instream flow recommendations for the State Water Resources Control Board.

## Butte Creek

**Issues:** Adult SRCS upstream migration. Factors affecting passage are flow, temperature, and physical barriers. Stranding occurs in the Valley section of lower Butte Creek downstream of Durham Mutual Diversion Dam near Highway 99 just south of Chico, California.

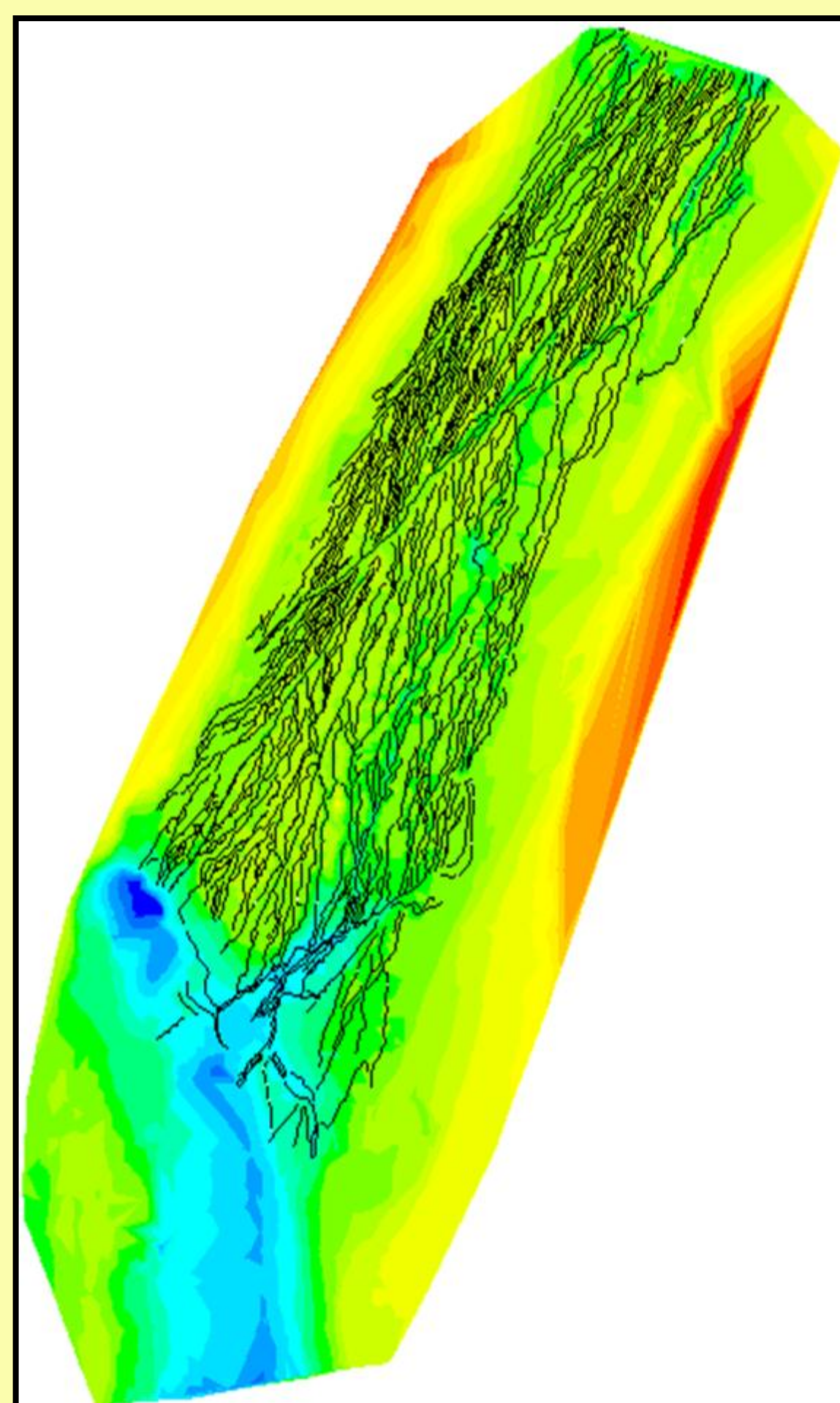
**Objectives:** 1) Identify locations upstream of stranding site where migrating fish passage may be impeded. 2) Identify conditions at selected sites meeting CDFW passage criteria for SRCS.

**Methods:** Develop model that considers stream stage, discharge, depth and velocity within the study sites. Monitor temperature in conjunction with stage and discharge. Conduct terrain surveys of study sites to identify migration pathways. Construct two-dimensional model to evaluate depth and velocity for passage over a range of flow regimes. Evaluate depth criteria for adult SRCS passage under modeled flow regimes.

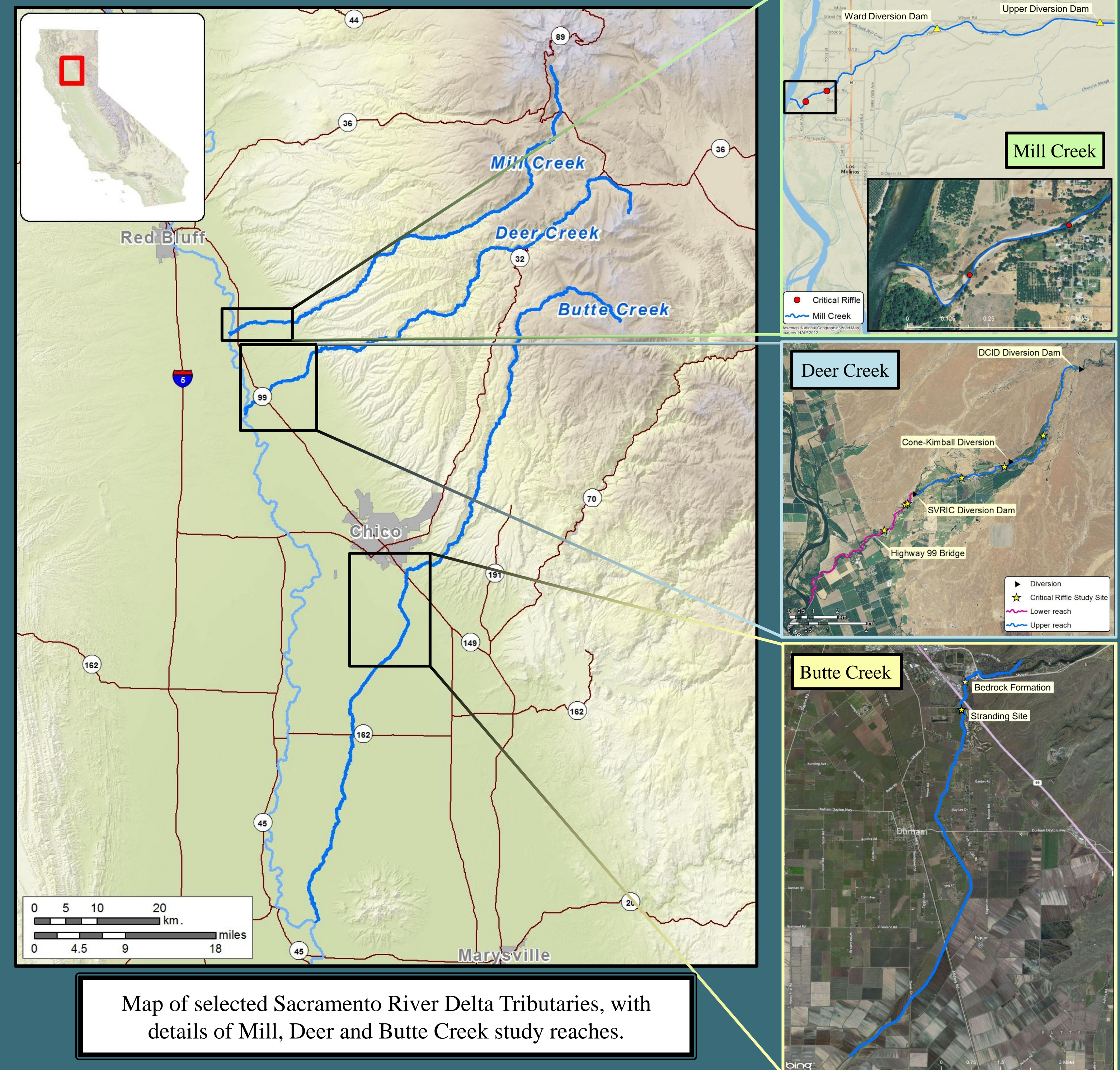
**Status:** Contract in place with U.S. Fish and Wildlife Service to conduct passage study with assistance from CDFW staff. Site selection and terrain surveys completed. Stream stage and temperature monitoring field data collection expected to be completed by Summer 2014.



Eroded bedrock formation upstream of where stranding previously occurred. Taken September 2013 at 43 cfs. Left: Looking downstream. Right: CDFW staff collecting terrain data. Looking upstream.



Aerial views of eroded bedrock formation. Left: Satellite image (Google Earth). Right: River 2D terrain model image. Lines depict flow channels in bedrock.



Map of selected Sacramento River Delta Tributaries, with details of Mill, Deer and Butte Creek study reaches.

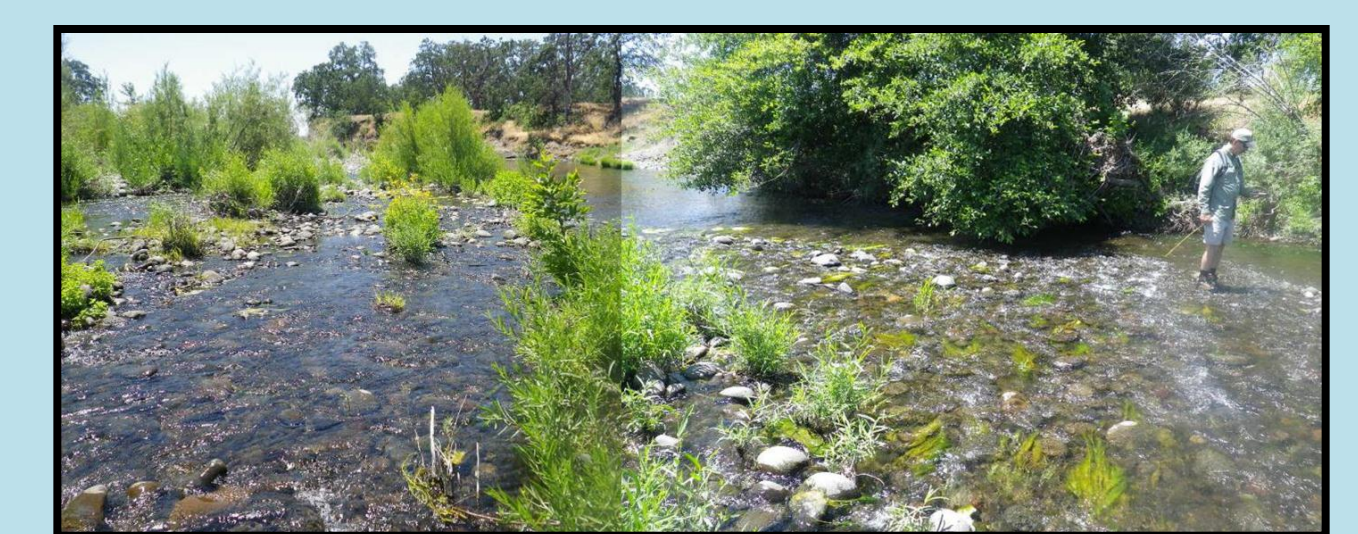
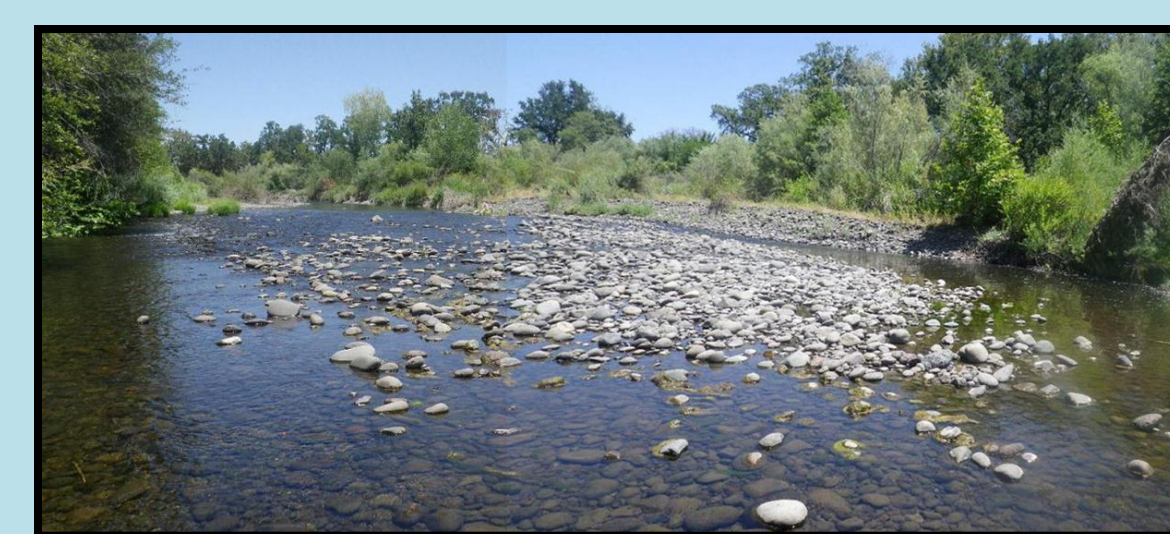
## Deer Creek

**Issues:** Passage barriers, elevated water temperatures, and diminished peak flow magnitudes affecting attraction cues pose threats to adult and juvenile salmonids in lower Deer Creek.

**Objectives:** 1) Identify critical passage sites and assess physical factors. 2) Monitor and model water temperature to identify possible thermal barriers.

**Methods:** Conduct critical riffle assessment using the CDFW Standard Operating Procedure (SOP) for Critical Riffle Analysis at sites below each diversion. Install temperature loggers to monitor water temperature, and model temperature throughout lower Deer Creek using SNTemp.

**Status:** Preliminary site survey conducted in spring 2013. Field work to begin spring 2014.



Critical riffle sites on lower Deer Creek taken June 2013 at ~48 cfs. Left: #32 looking upstream. Right: #31 looking downstream.

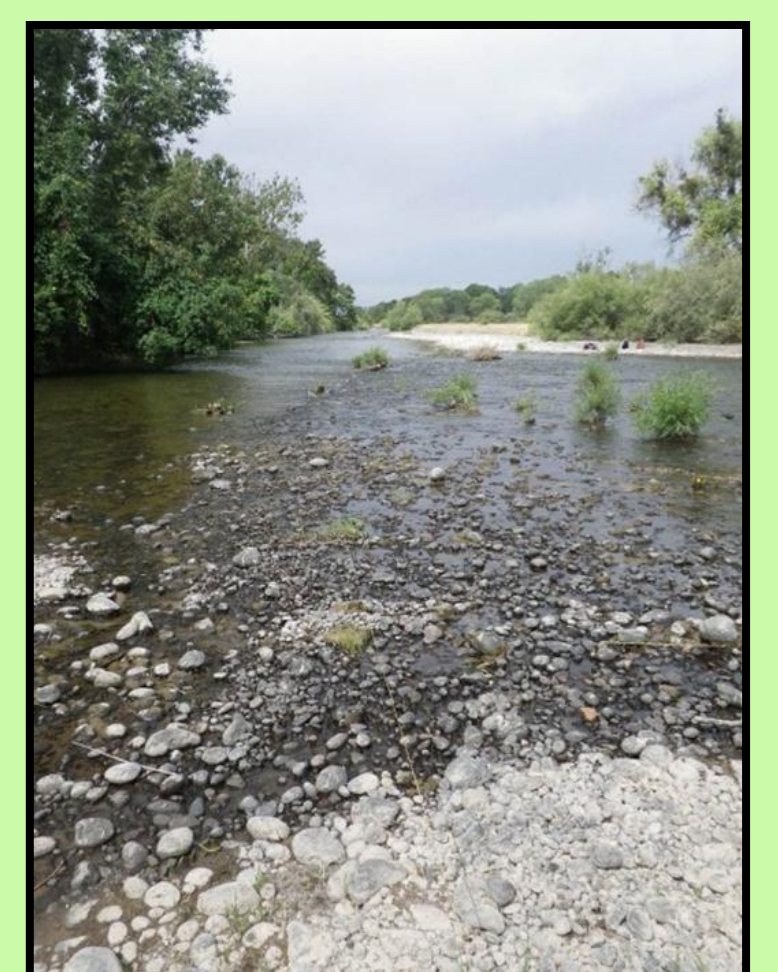
## Mill Creek

**Issues:** Passage barriers at two critical riffles in lower Mill Creek and thermal barriers caused by elevated water temperatures may have negative impacts to migrating SRCS.

**Objectives:** 1) Quantify stream flows required for adult and juvenile SRCS passage over critical riffles. 2) Monitor stream temperature for possible thermal barrier.

**Methods:** Conduct critical riffle assessment using the CDFW SOP for Critical Riffle Analysis. Deploy temperature loggers in lower Mill Creek to define upper temperature thresholds and use SNTemp to model daily average temperature at different flows.

**Status:** Field work to begin late winter/early spring 2014.



Critical riffle (CR2). Taken June 2012 at 42 cfs.

## Next steps

- Develop outreach plans to keep stakeholders informed
- Continue collaborations with regional and USFWS staff to complete field work
- Submit flow recommendations to State Water Resources Control Board
- Set new priorities for future streamflow studies



Butte Creek SRCS

## Acknowledgements

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