8th Spring-run Chinook Symposium

July 26-28, 2016 in Chico, CA

Overview

- Sponsors:
  - PG&E
  - Northern California Water Association
  - Friends of Butte Creek
  - California Conservation Corps

The year's Symposium will highlight regional status reports on Spring-run Chinook populations, instream flow studies and fish passage assessments, water conservation and transactions, and how to translate research and genetics into implementation and recovery actions.

Field tours will include visits to the legendary spawning grounds in Upper Butte Creek and PG&E's hydroelectric retrofit projects; salmon and steelhead fish passage in Lower, Deer, Mill and Antelope Creek that have been prioritized for instream flow enhancement and fish passage projects; a Clear Creek Spring Chinook Restoration tour; and a tour of Lower Butte Creek Water Diversions.

Presentations

Enhancing Instream Flows for Spring-run Chinook

(Slide 4) *Evaluating Passage Conditions and Instream Flows for Salmonids in Lower Deer and Mill Creeks*
Diane Haas, Instream Flow Program, California Department of Fish & Wildlife

(Slide 39) *Management of Storage and Instream Flow for Holding Spring-run Chinook Salmon (Oncorhynchus tshawytscha) in Butte Creek, Butte County, CA*
Catalina Reyes, Pacific Gas & Electric

(Slide 57) *Managing Water for Instream Flow Enhancement*
Matt Clifford, California Water Project, Trout Unlimited

(Slide 85) *Mill Creek Instream Flow Tools*
Gregg Werner, The Nature Conservancy

Evaluating Passage Conditions and Instream Flows for Salmonids in Lower Deer and Mill Creeks

Diane Haas
Instream Flow Program
California Department of Fish and Wildlife

SRF Spring-run Chinook Symposium
Chico, CA
July 26, 2016

Overview

- CDFW Instream Flow Program
- Study design considerations for evaluating instream flows
- Deer Creek study
- Mill Creek study
- Next steps

CDFW Instream Flow Program (IFP)

- Provides instream flow criteria and recommendations
- Oversees study design and implementation
- Collects field data
- Technical oversight and review
- Coordinates with CDFW Regions, SWRCB, USFWS, and others
- Develops guidelines and SOPs for quality assurance

Policies and Mandates

- Public Resources Code §10000-10005 [Stream Flow Protection Standards]
- Fish and Game Code §5937
- CA Senate Bill X7-1/Delta Reform Act (2009)
- CA Proposition 1 Water Bond/Water Action Plan (2014)

Methods to Support Flow Regimes

- Many proven and acceptable methods available to quantify flow criteria
- Credible, consistent, and defensible
- No single best method or flow (*think flow regimes*)

Study Design

- What are the questions?
  - Salmonid passage, spawning, or rearing flows
  - Ecological riffle productivity flows
  - Low-flow threshold flows
  - Subsistence flows (water quality)
  - Channel maintenance flows

Study Design

- What is the intended use of the data?
  - Permit compliance (water right, LSA)
  - Develop flow criteria/flow objectives (PRC, WAP)
  - Identify bypass flows
  - Monitoring and assessment
  - Research and development

Study Design

- Select representative sample sites
  - What spatial scale is needed?
  - Is a habitat inventory needed?
  - What is the temporal scale of sampling appropriate flows?
  - Targeted sites (salmonid passage) vs. stratified random sites (salmonid rearing)
  - Intended data use – i.e., desktop methods may not need site-specific physical habitat data

Study Design

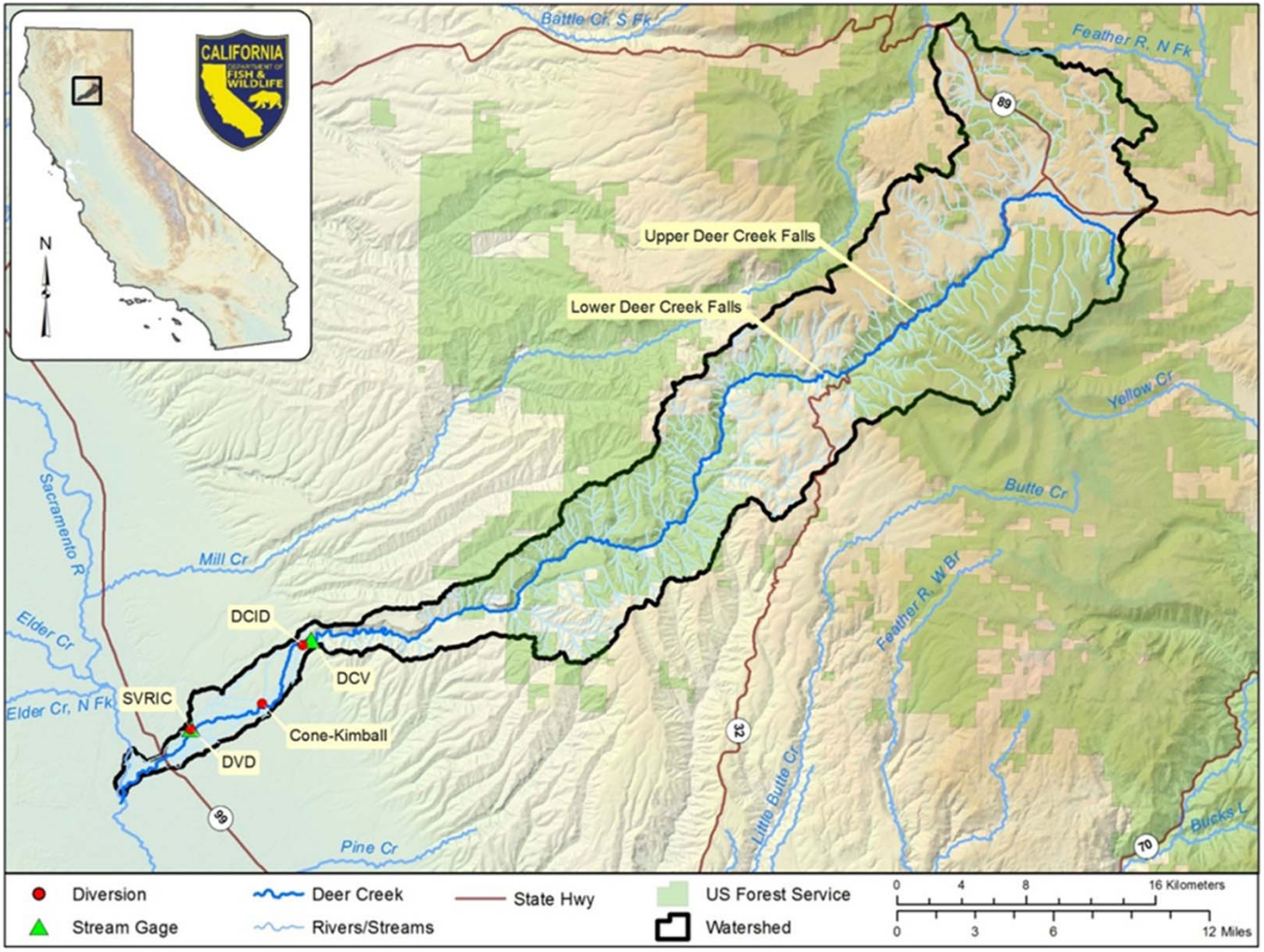
- Match appropriate methods to questions

Methods	Salmonid Rearing	Salmonid Passage	Salmonid Spawning	Ecological Riffle Productivity	Low-Flow Threshold	Survival Flows	Subsistence Flows	Channel Maintenance	Drought Flows
Habitat Retention Method		X		X	X	X			
Wetted Perimeter Method				X	X				
Q_{fp}		X							
Hatfield-Bruce Equations	X		X						
Critical Riffle Analysis		X							
Flow Duration Analysis									X
Percentile-based Flow Criteria					X			X	X
Channel Maintenance Flows								X	
7Q10									
Hydraulic Habitat Modeling	X	X	X						

Deer and Mill Creeks (Tehama County)

- Self-sustaining, genetically distinct populations of CV Spring-run Chinook salmon
- CV steelhead
- Fall-run and late-fall run Chinook salmon

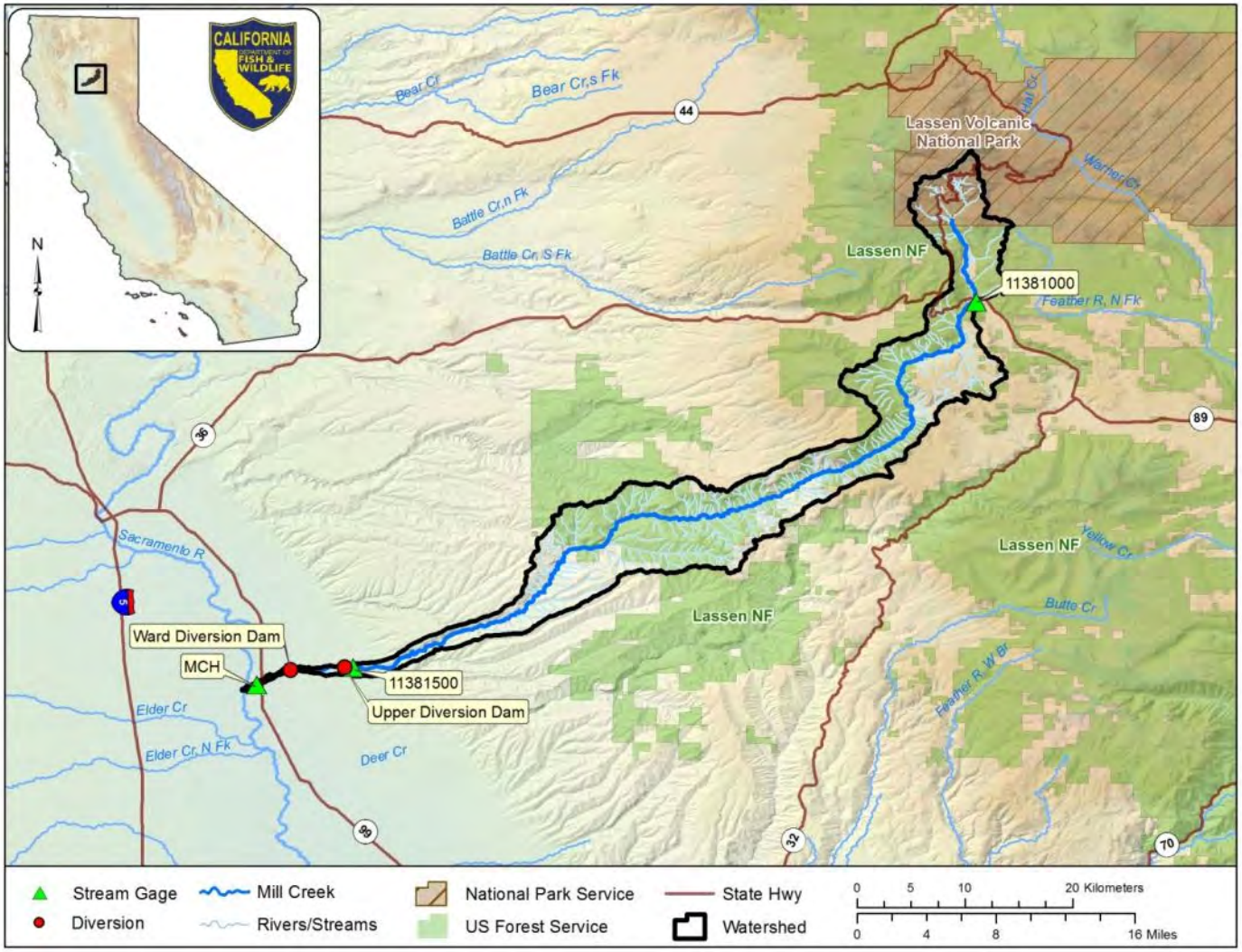
Deer Creek Watershed



Upper Deer Creek, August 2012

Lower Deer Creek, September 2014

Mill Creek Watershed



Upper Mill Creek, June 2012

Lower Mill Creek, June 2012

Lower Mill Creek, June 2015

Mill Creek Migration Timing

Species and Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spring-run Chinook Salmon												
Adult												
Juvenile												
Fall-run Chinook Salmon												
Adult												
Juvenile												
Steelhead												
Adult												
Juvenile												

Source: USFWS 2000; M. Johnson pers. comm. 2015

Migration Peak

Deer and Mill Creeks

- What is the question?
  - Identify salmonid passage flows
- What is the intended use of the data?
  - Develop flow criteria
- Selecting representative sample sites
  - Targeted sites for salmonid passage
- What methods were chosen?
  - Critical riffle analysis
  - 2-D hydraulic model

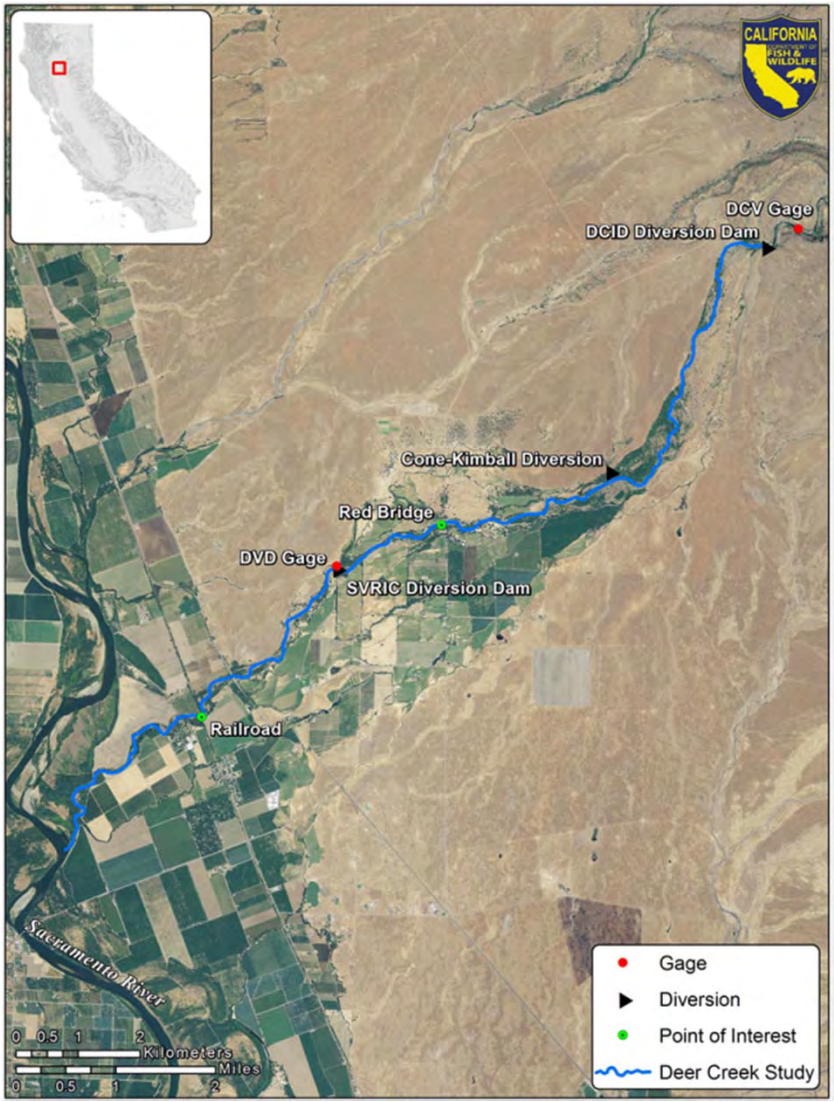
Critical Riffle Analysis (CRA)

- Depth and velocity criteria

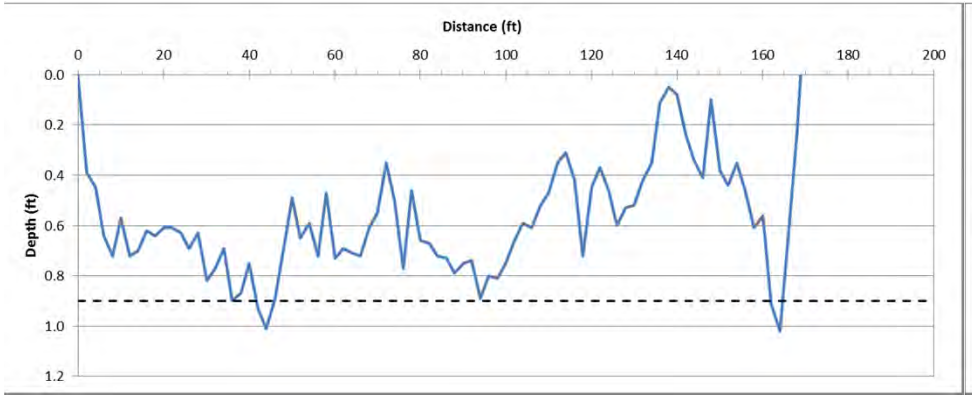
Species (life stage)	Minimum depth (ft)	Maximum Velocity (ft/s)
Chinook Salmon (adult)	0.9	8.0
Steelhead (adult)	0.7	8.0
Salmonid (young-of-year/juvenile)	0.3	-

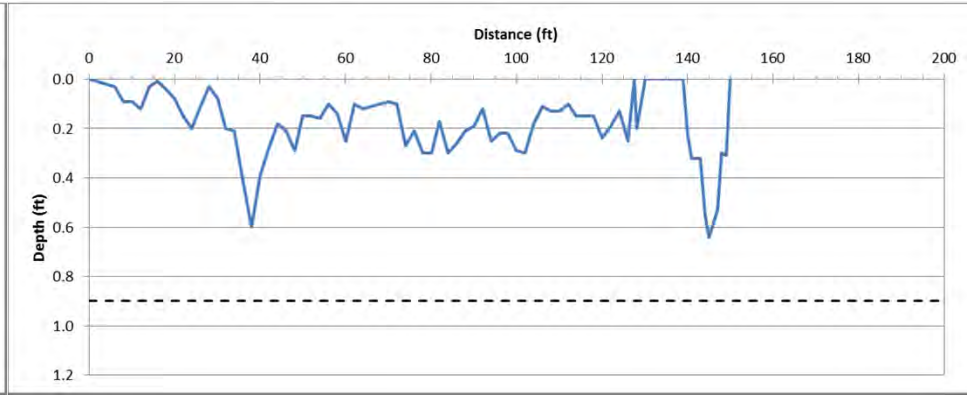
Deer Creek Study Reach

- Surveyed lower 12 miles, from DCID to confluence (2014)
- 21 critical riffles identified
- Two most depth limited riffles selected



CR31



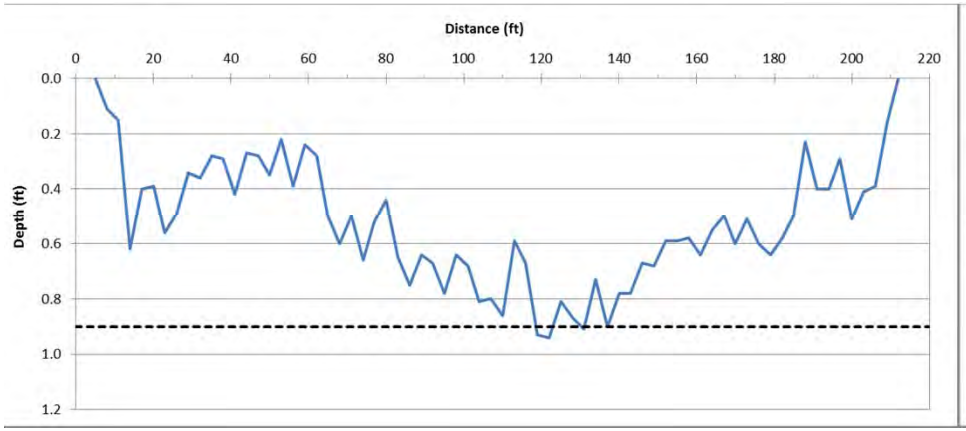


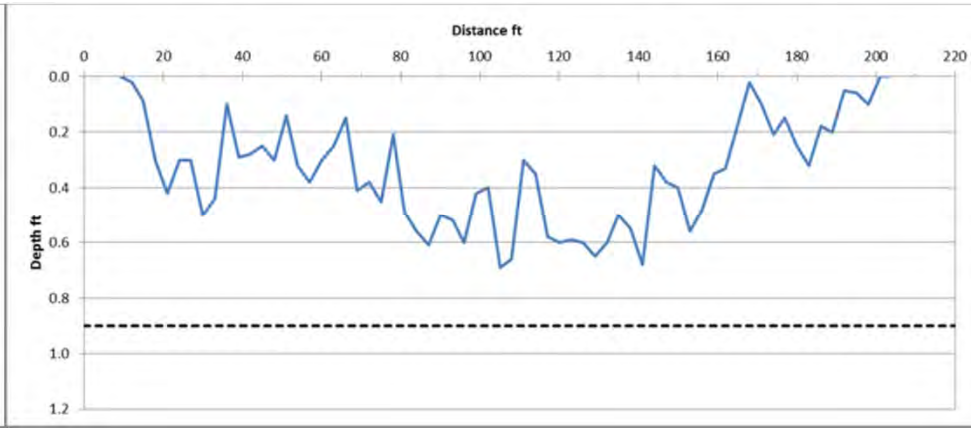
193 cfs

12 cfs

Mill Creek Study Reach

CR7





153 cfs

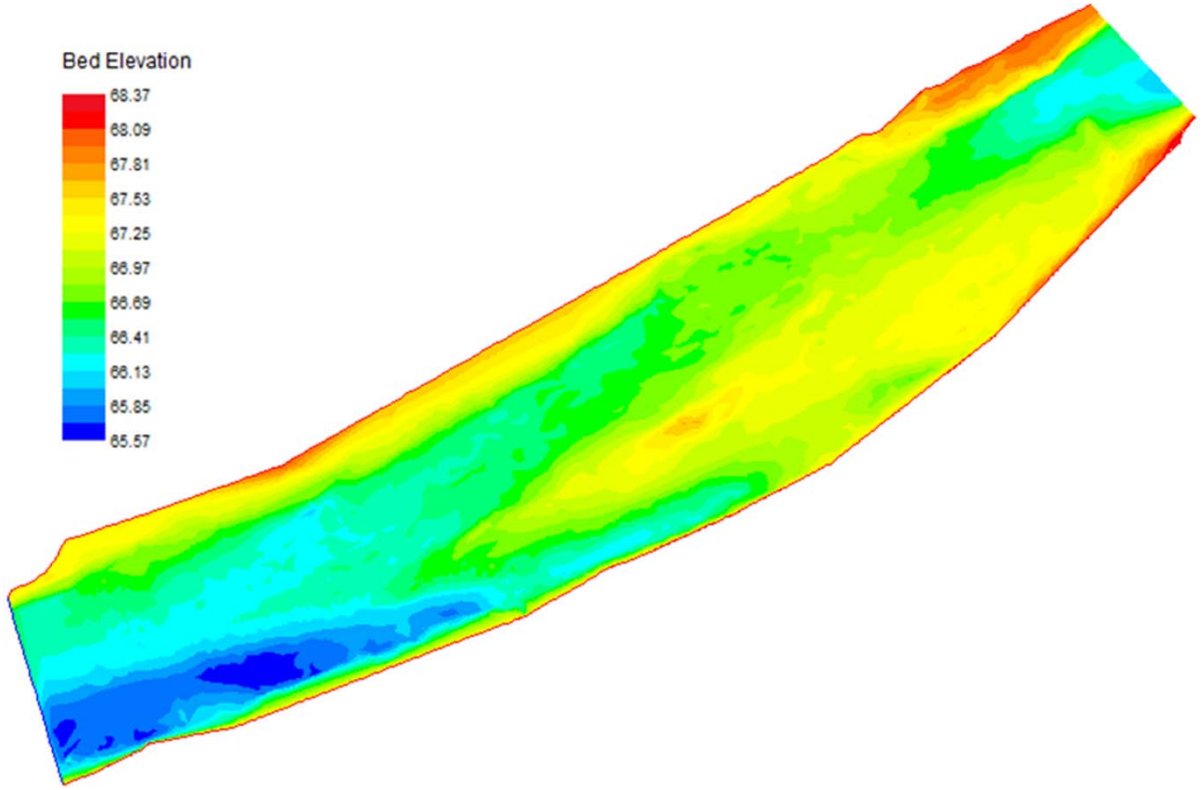
67 cfs

Mill Creek 2-D Site (CR2)

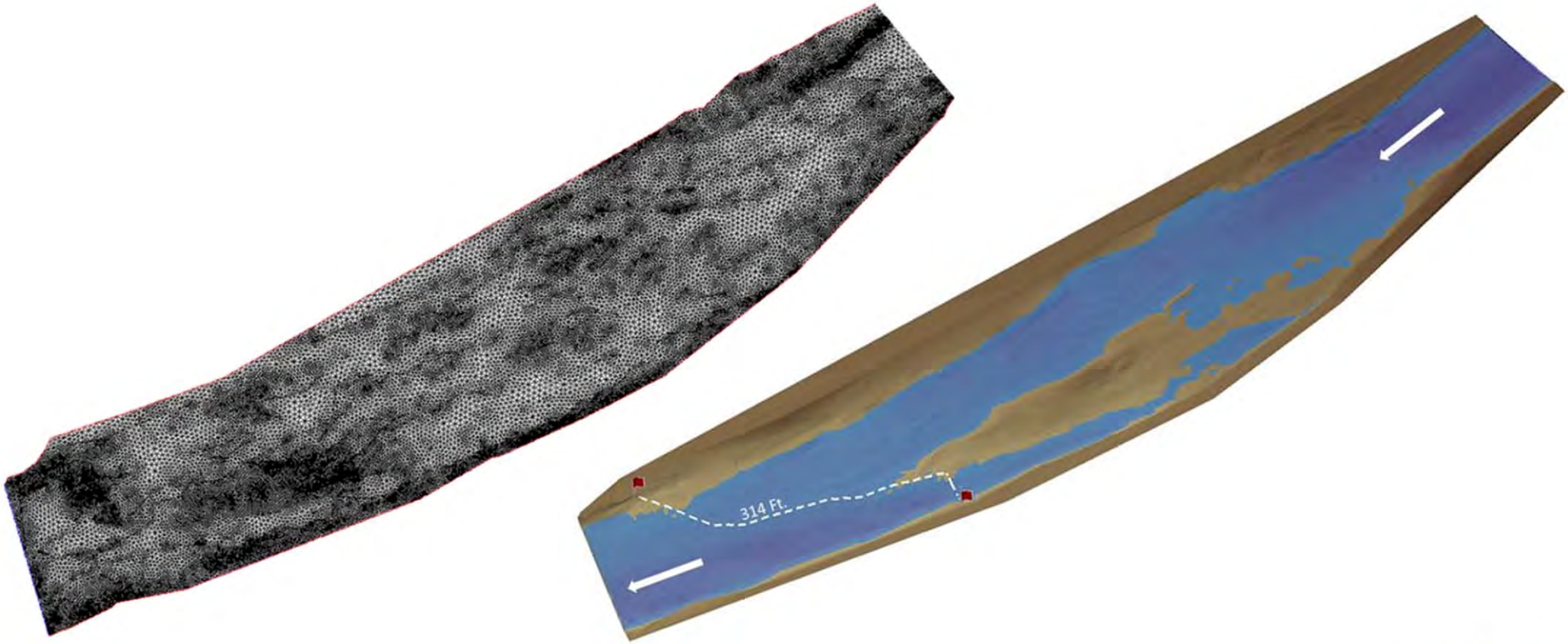
Mill Creek 2-D Model

- Bed topography
- Water surface elevations
- Water depths
- Water velocities
- Substrate and cover composition

Mill Creek 2-D Model



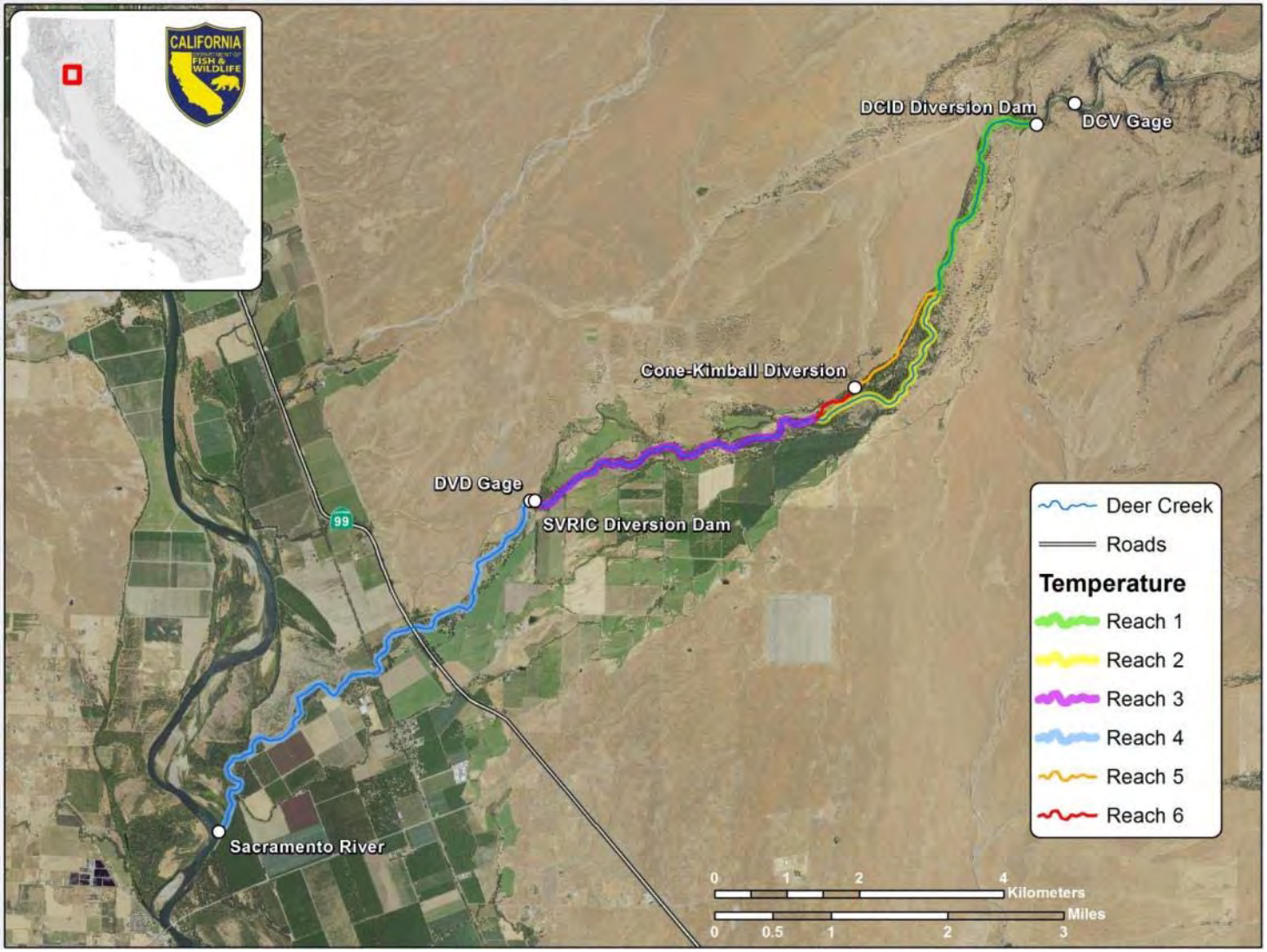
Mill Creek 2-D Model



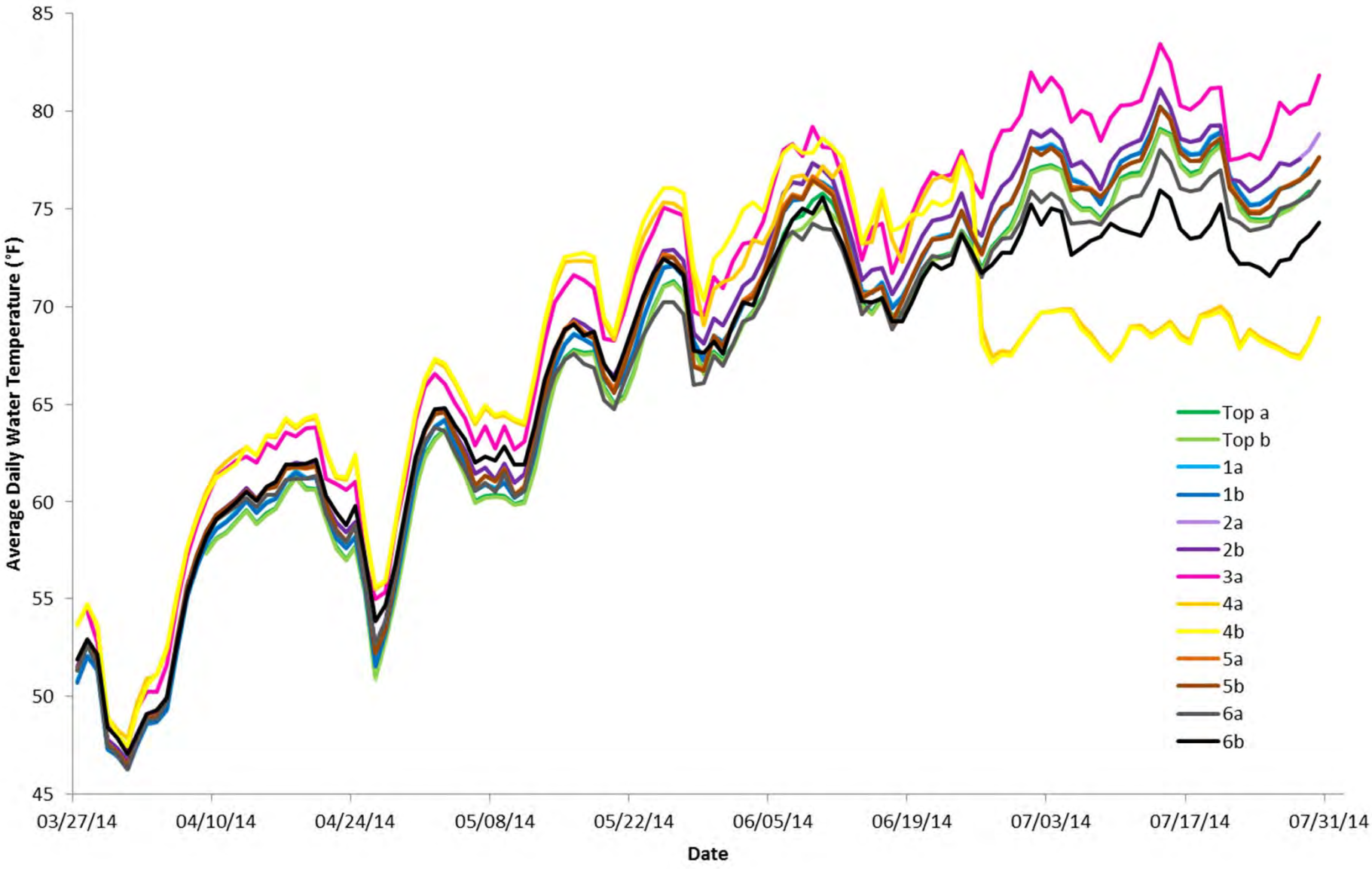
Water Temperature Models

- SNTEMP and W3T models
- Model calibration data collected in 2014
- Validation data collected in 2015
- Streams divided in reaches based on diversions and returns

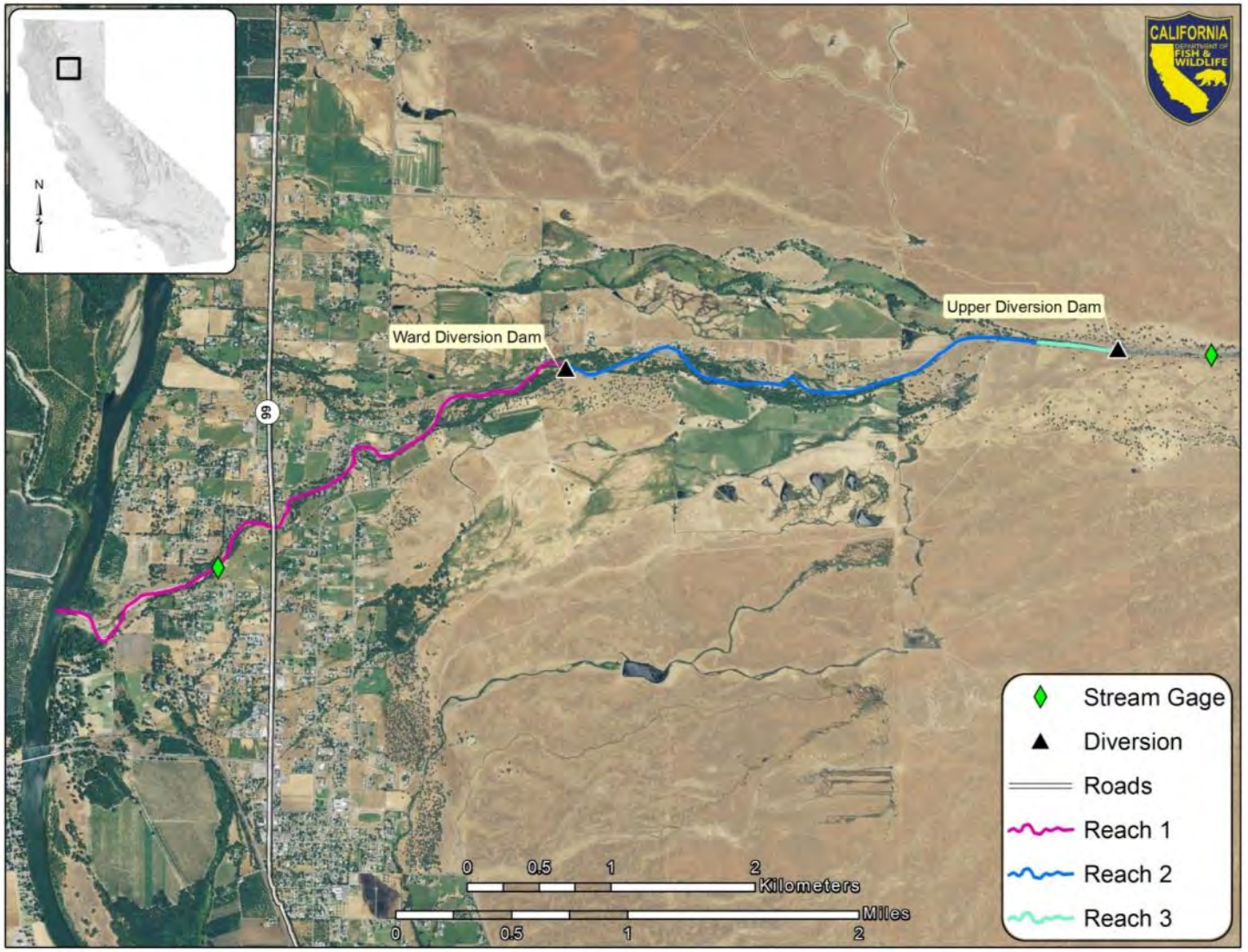
Deer Creek Temperature Study Reaches



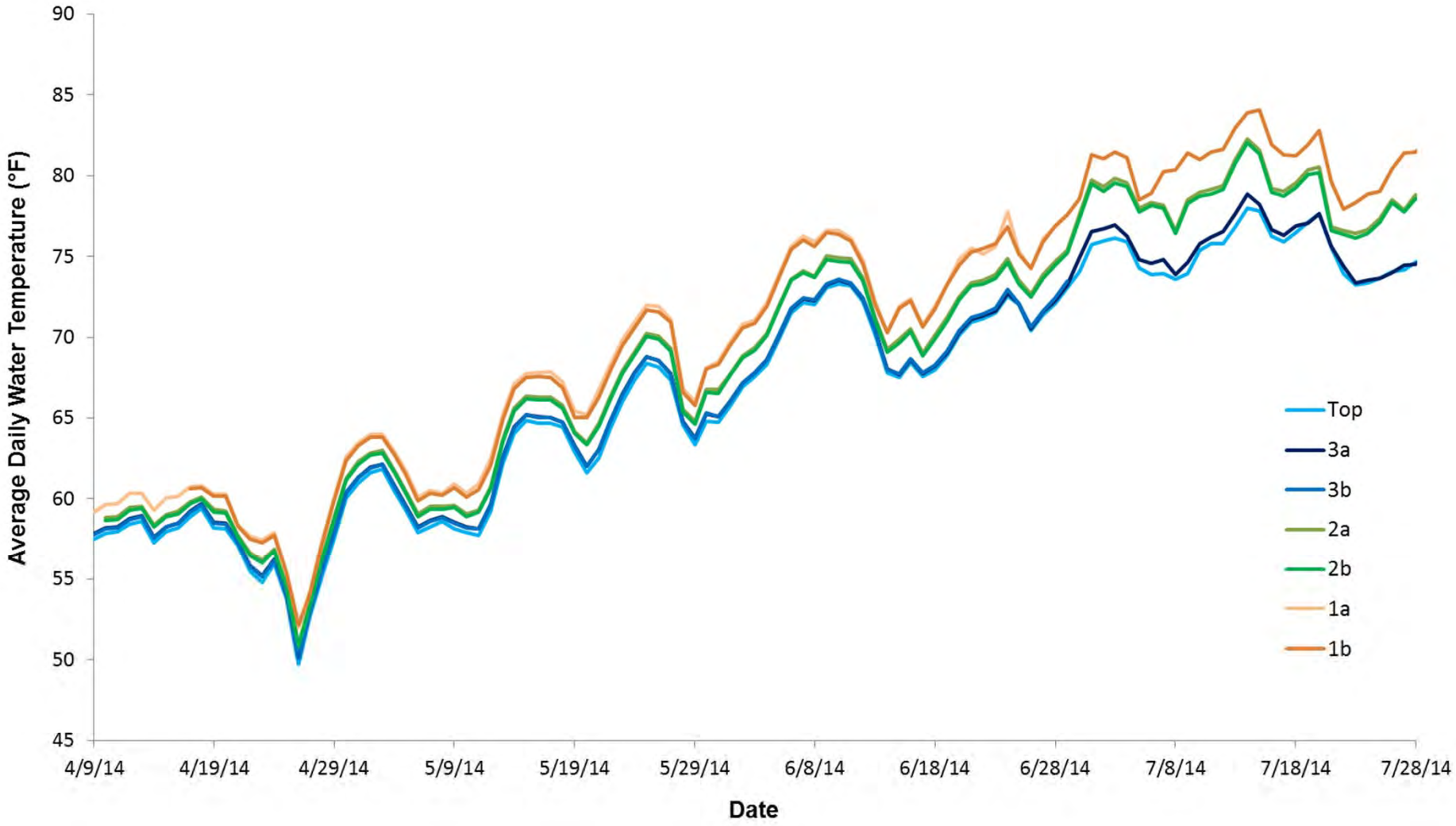
Deer Creek Water Temperatures



Mill Creek Temperature Study Reaches



Mill Creek Water Temperatures

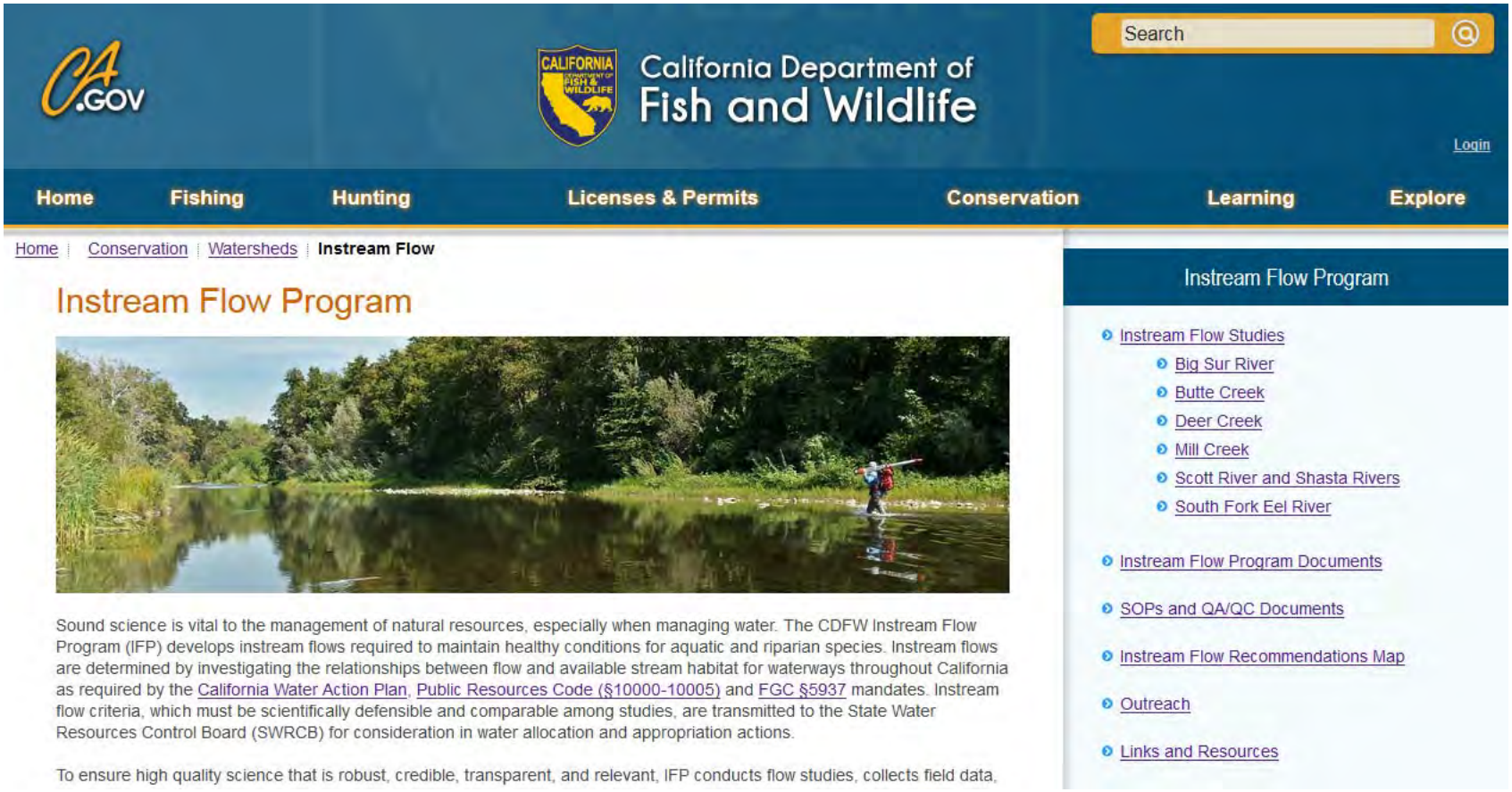


Next Steps

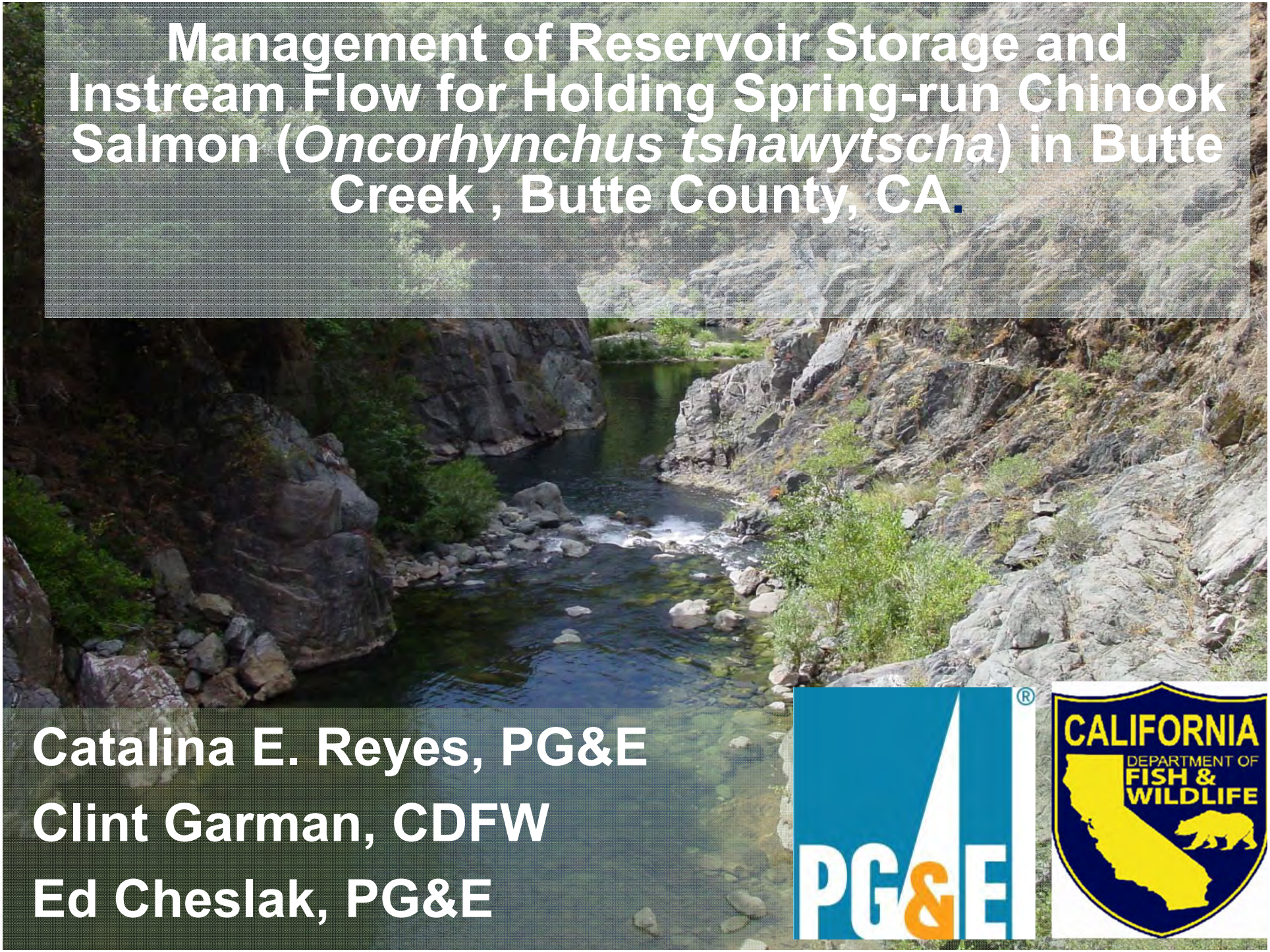
- Compete internal review
- Flow criteria report
- Stakeholder meetings and input
- Flow recommendations submitted to State Water Board

Available resources

https://www.wildlife.ca.gov/Conservation/Watersheds/Instream-Flow



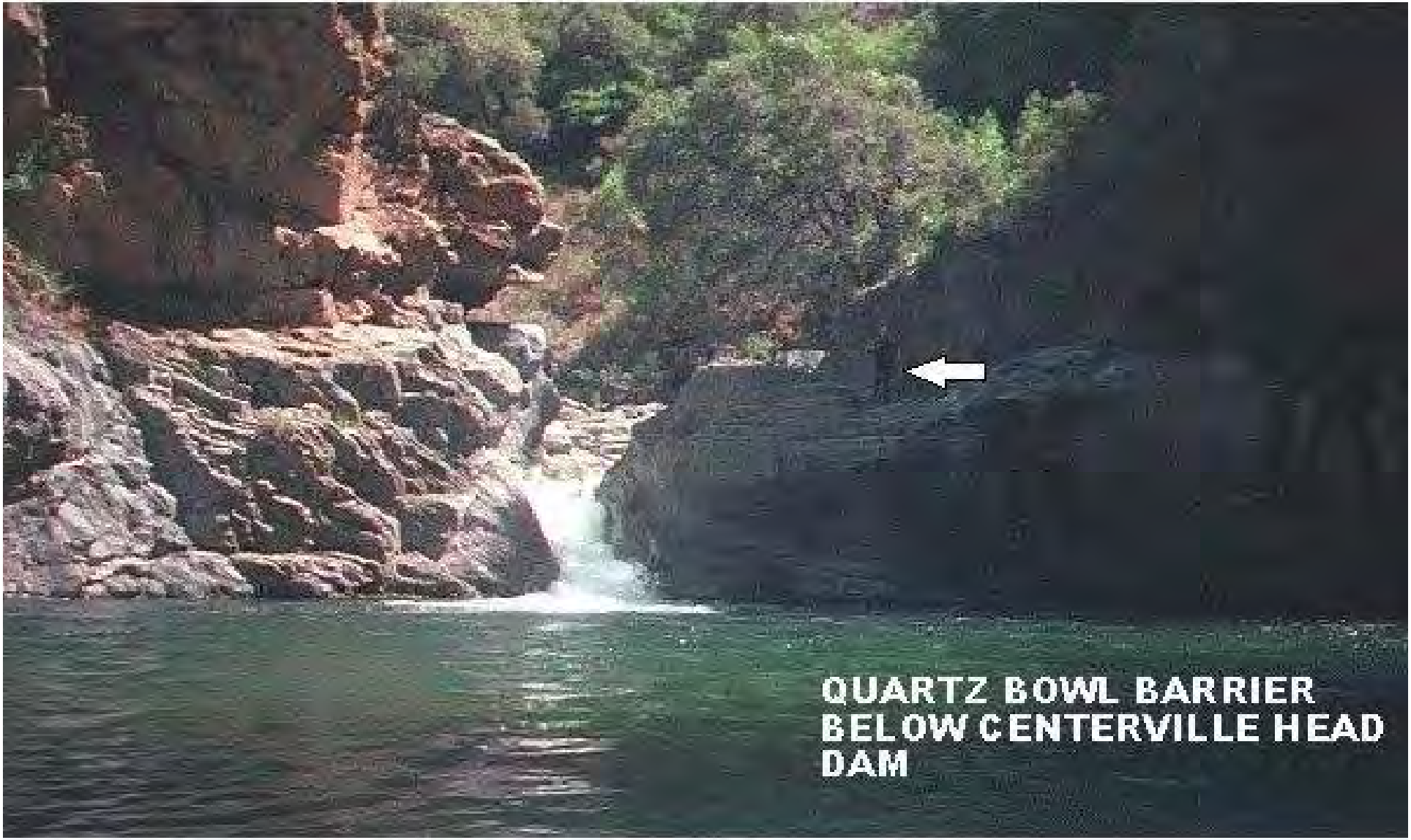
Management of Reservoir Storage and Instream Flow for Holding Spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) in Butte Creek , Butte County, CA.

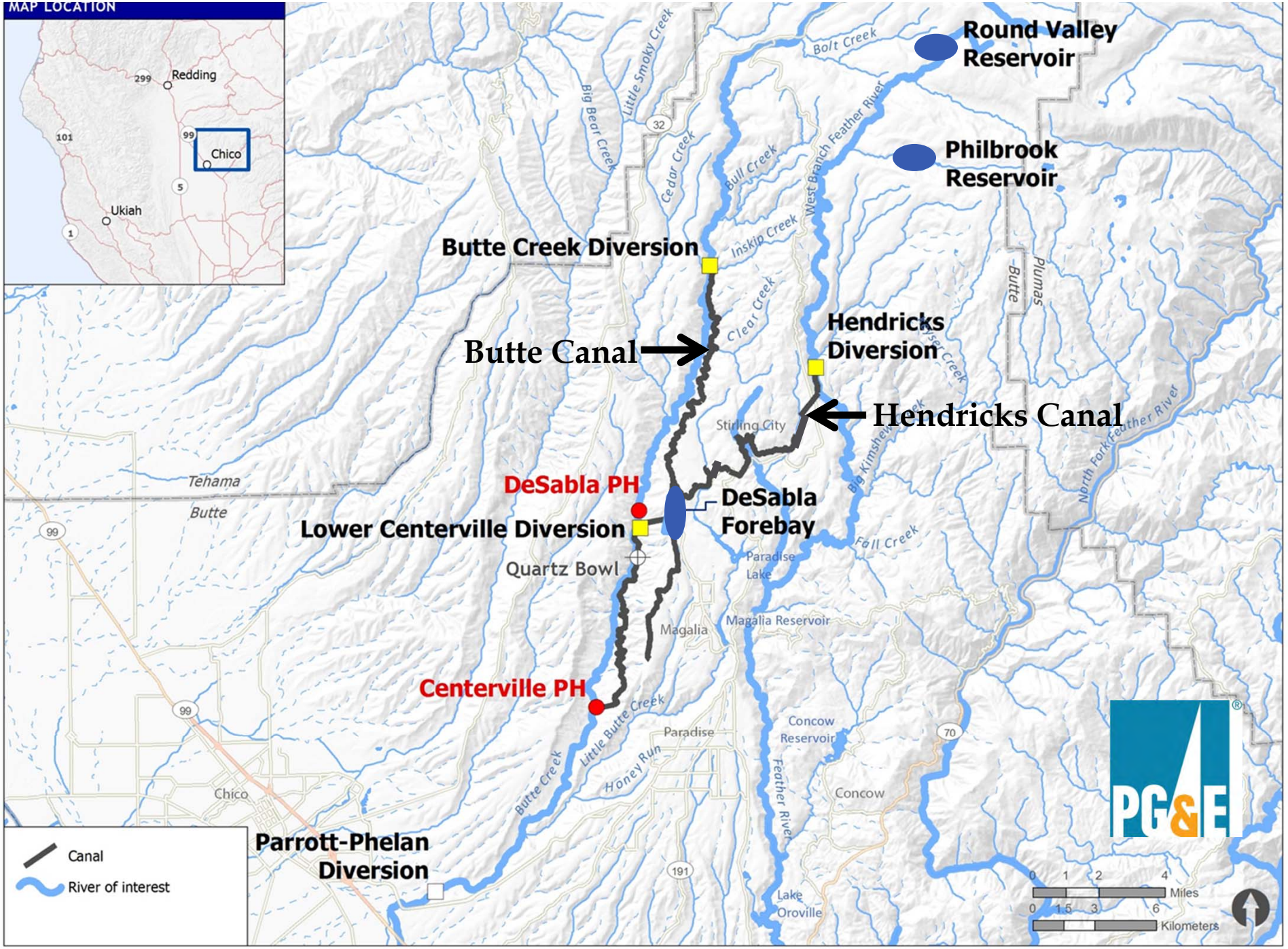


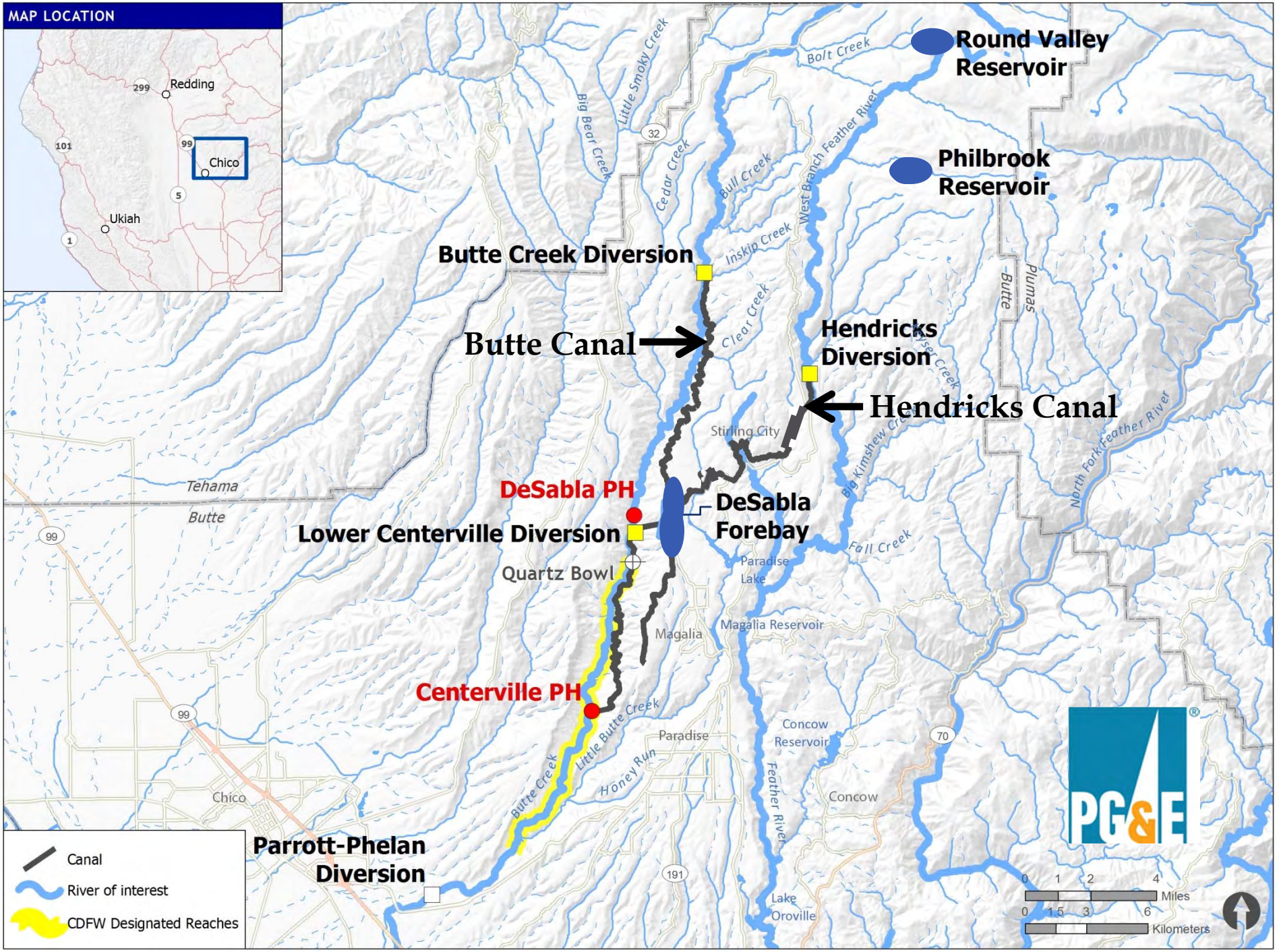
Catalina E. Reyes, PG&E

Clint Garman, CDFW

Ed Cheslak, PG&E


QUARTZ BOWL BARRIER
BELOW CENTERVILLE HEAD
DAM

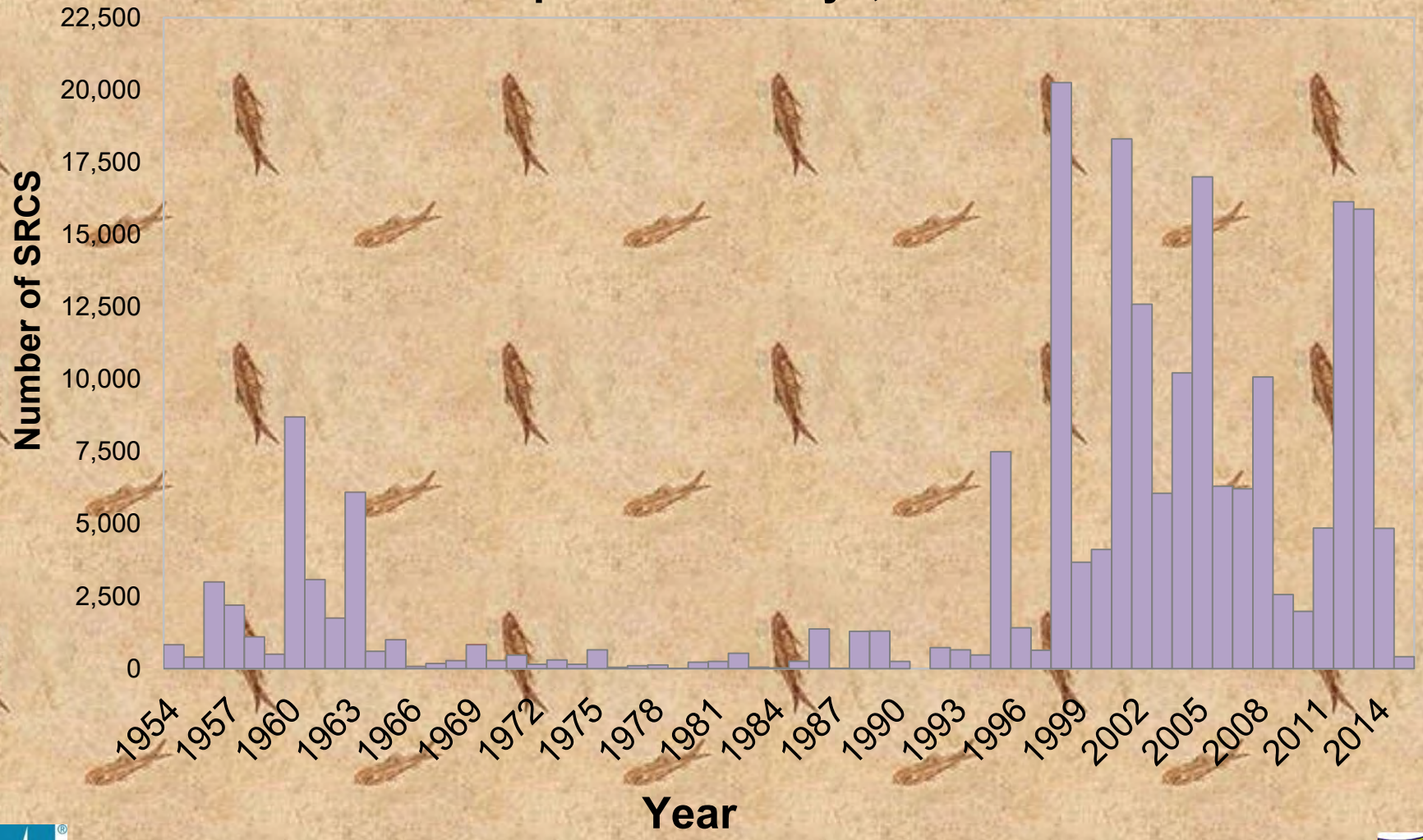

MAP LOCATION
Redding
299
Chico
101
99
5
Ukiah
1
Round Valley Reservoir
Philbrook Reservoir
Butte Creek Diversion
Butte Canal
Hendricks Diversion
Hendricks Canal
DeSabla PH
DeSabla Forebay
Lower Centerville Diversion
Quartz Bowl
Centerville PH
Parrott-Phelan Diversion
Stirling City
Paradise Lake
Magalia
Magalia Reservoir
Paradise
Concow Reservoir
Concow
Chico
Oroville
Lake Oroville
Tehama
Butte
Bolt Creek
Big Bear Creek
Little Smoky Creek
Cedar Creek
Bull Creek
Inskip Creek
West Branch Feather River
Clear Creek
Butte
Plumas
North Fork Feather River
Big Kimshew Creek
Fall Creek
Little Butte Creek
Honey Run
Butte Creek
Feather River
32
70
191
99
Canal
River of interest
0 1 2 4 Miles
0 1.5 3 6 Kilometers
PG&E


MAP LOCATION
Redding
Chico
Ukiah
299
101
99
5
1
Round Valley Reservoir
Philbrook Reservoir
Butte Creek Diversion
Butte Canal
Hendricks Diversion
Hendricks Canal
DeSabla PH
DeSabla Forebay
Lower Centerville Diversion
Quartz Bowl
Centerville PH
Parrott-Phelan Diversion
Stirling City
Paradise
Paradise Lake
Magalia
Magalia Reservoir
Concow
Concow Reservoir
Lake Oroville
Tehama
Butte
Bolt Creek
Little Smoky Creek
Big Bear Creek
Cedar Creek
Bull Creek
Inskip Creek
Clear Creek
West Branch Feather River
Butte
Plumas
Big Kimshew Creek
North Fork Feather River
Fall Creek
Little Butte Creek
Butte Creek
Honey Run
Feather River
32
70
191
Canal
River of interest
CDFW Designated Reaches
PG&E
0 1 2 4 Miles
0 1.5 3 6 Kilometers

Releases from Philbrook Reservoir

- Provides approximately 4,000 acre feet of water to supplement Butte Creek Flows for holding period.
- Minimum release of 2.0 cfs for protection of aquatic resources.
- Typically, maximum release of 35 cfs during the holding period.
- LIMITED supply of water

CDFW Butte Creek Adult CV Spring-run Chinook Salmon Escapement Surveys, 1954-2015

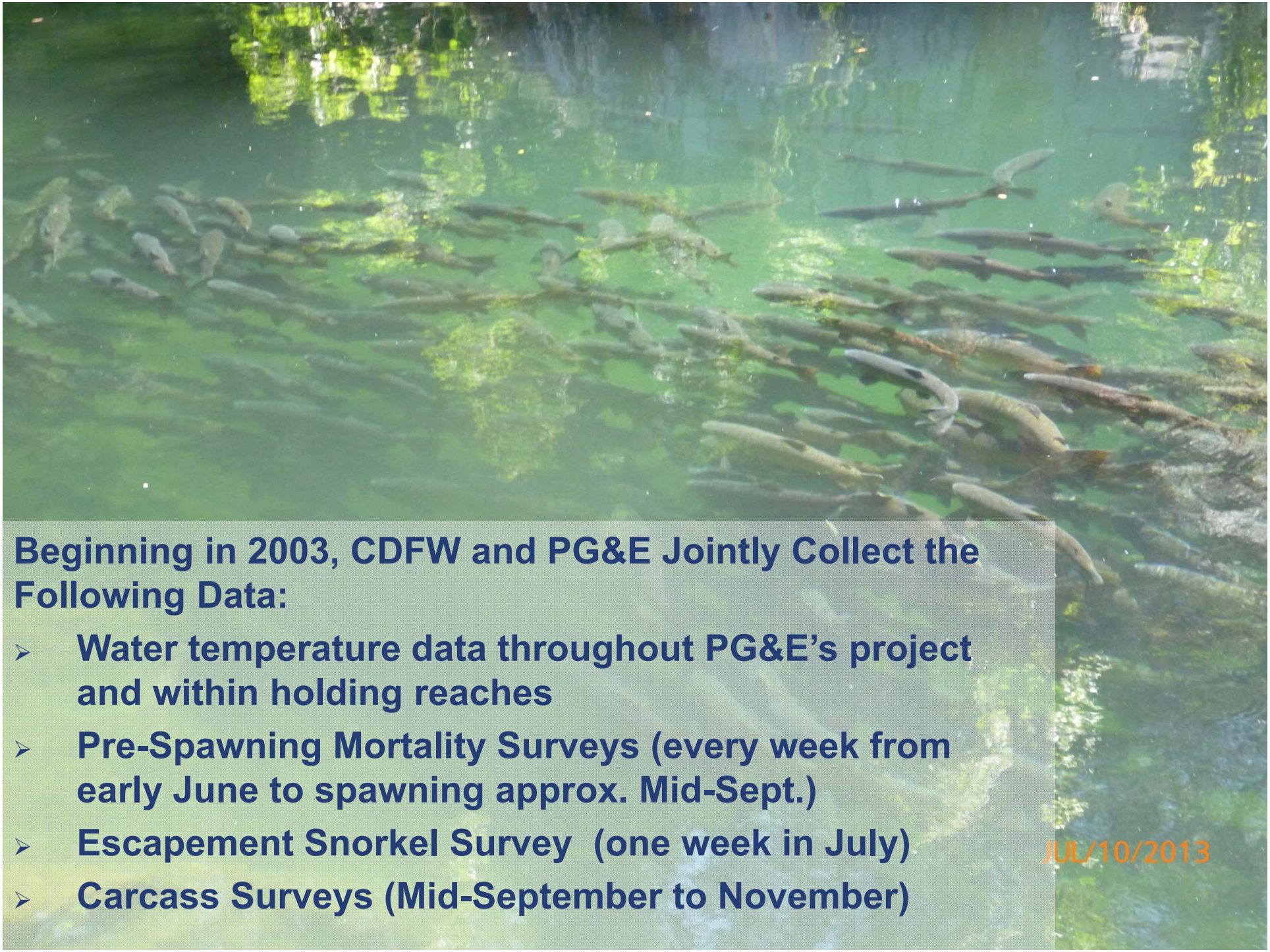


Pre-spawning Mortality

- In 2002 – Run size 16,328; partially documented mortality of 3,431; 21% pre-spawn mortality of the run
- In 2003 – Run size 17,297; pre-spawn mortality of 11,231; 65% pre-spawn mortality of the run

Changes to Operations and Management Post 2003

- PG&E began providing meteorological forecast 2 X's per week to adapt operations to weather conditions .
- Operations Group to proactively manage releases from Philbrook Reservoir.
- PG&E operations now actively engaged in discussions and decision making.
- No scheduled outages from mid-June to September.



Beginning in 2003, CDFW and PG&E Jointly Collect the Following Data:

- **Water temperature data throughout PG&E's project and within holding reaches**
- **Pre-Spawning Mortality Surveys (every week from early June to spawning approx. Mid-Sept.)**
- **Escapement Snorkel Survey (one week in July)**
- **Carcass Surveys (Mid-September to November)**

Extreme Temperature/Downslope Wind Probability Forecast : Cohasset/Chester

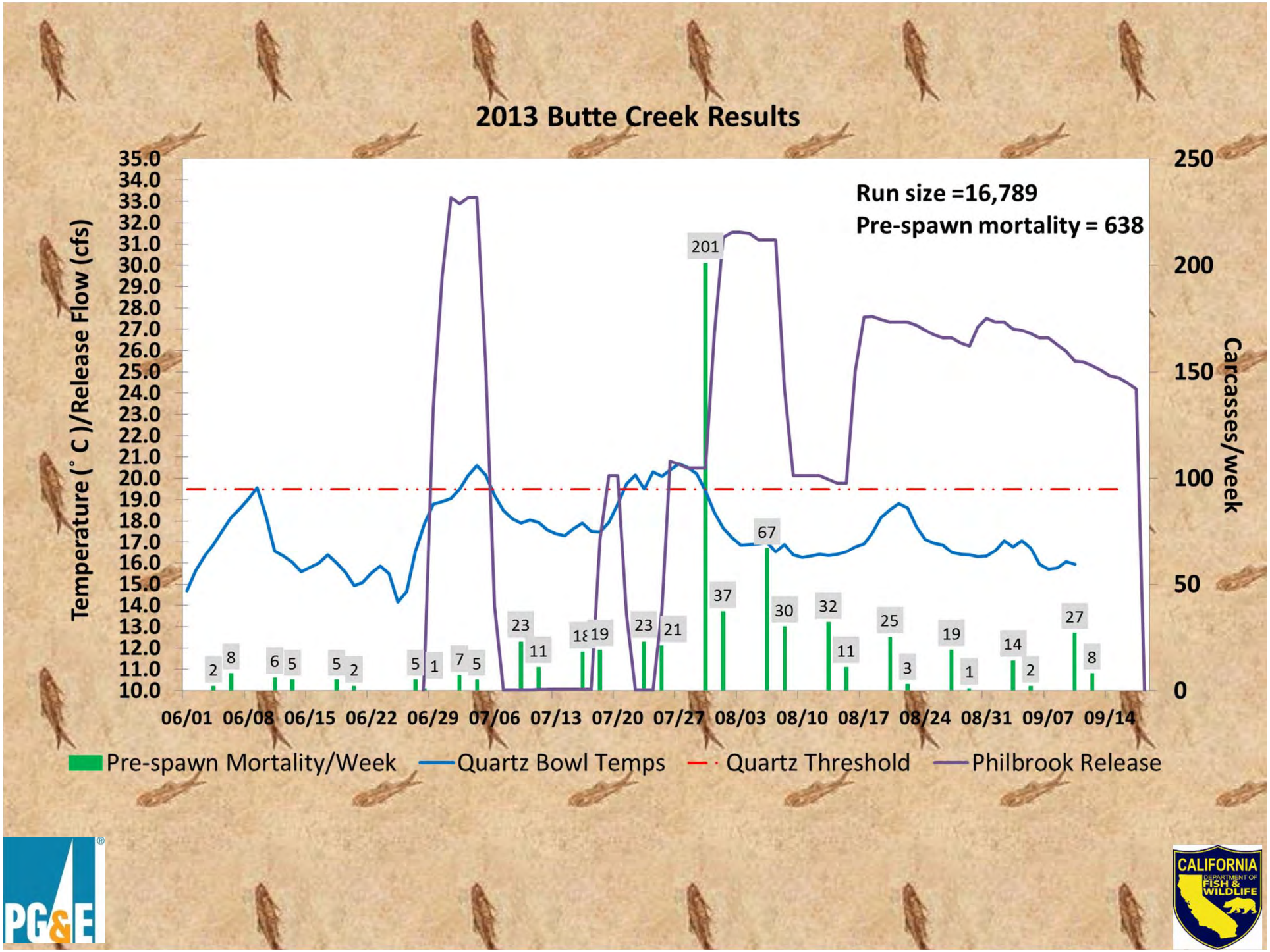
Forecast Period: June 24, 2013 - July 3, 2013

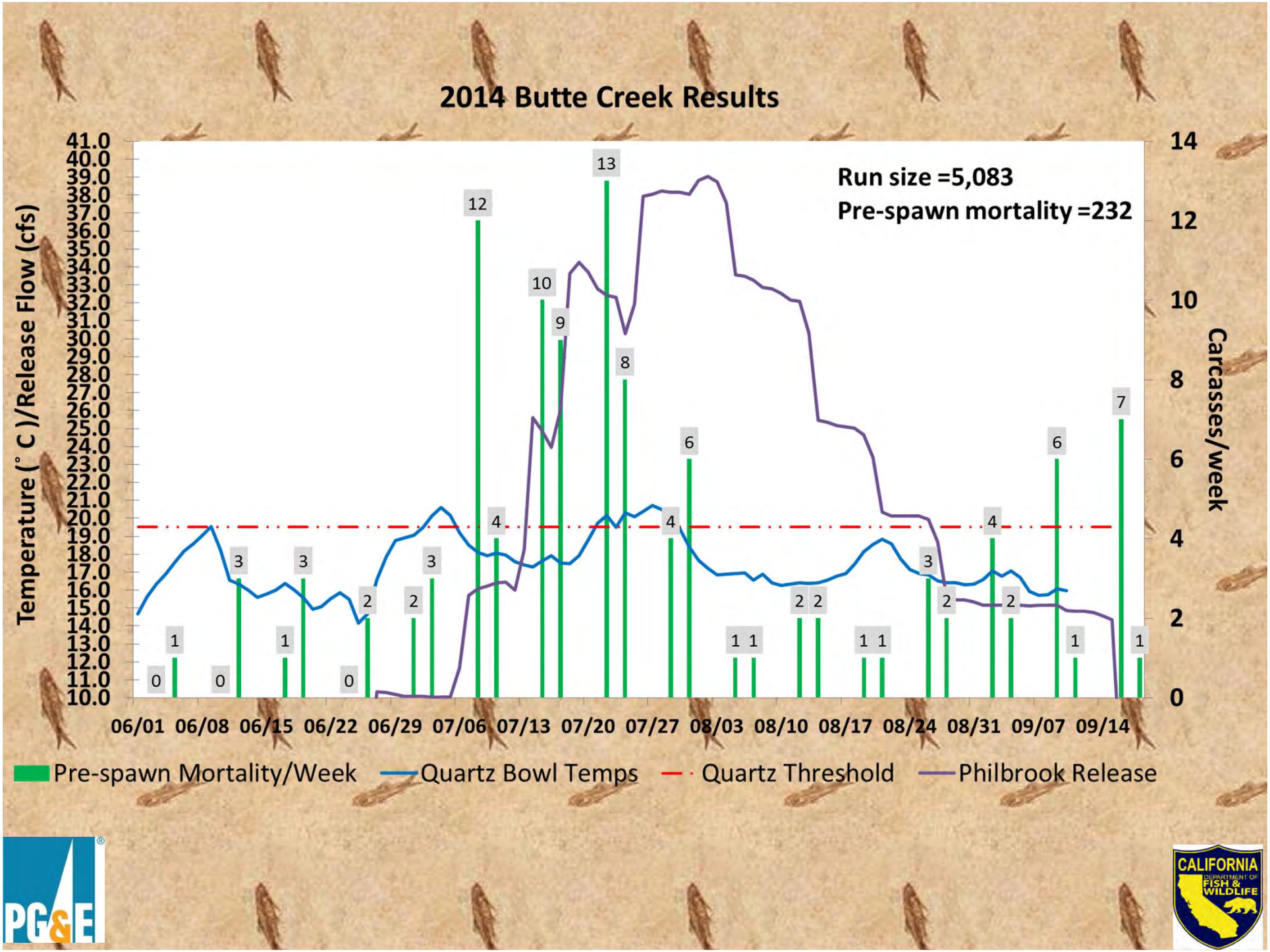
Issued: June 24, 2013

Site	Maximum Temperature	Mon 6/24	Tue 6/25	Wed 6/26	Thu 6/27	Fri 6/28	Sat 6/29	Sun 6/30	Mon 7/1	Tue 7/2	Wed 7/3
Cohasset	Tmax>=100										
Elev @ 1750 ft.	Tmax>=105										
Chester	Tmax>=95										
Elev 4500 ft.	Tmax>=100										
Foothill Winds	N/NE > 20 mph										

Probable
Possible
Slight Chance
Not Expected

Forecast Summary:	Cool today and Tuesday for the end of June with rain showers today followed by moderate to heavy rain at times on Tuesday. Dry and warmer weather return on Wednesday after some lingering morning showers followed by fair and warmer weather for the rest of the week, through the weekend, and into the middle part of next week. Temperatures will approach the criteria on Saturday and Sunday with temperatures likely exceeding the temperatures thresholds early next week when the high pressure ridge peaks in strength. Cooler weather may develop by the middle/end of next week with long range models hinting that hot weather could return again over the following week or second week of July.


2013 Butte Creek Results
Run size =16,789
Pre-spawn mortality = 638
Temperature (° C)/Release Flow (cfs)
Carcasses/week
35.0
34.0
33.0
32.0
31.0
30.0
29.0
28.0
27.0
26.0
25.0
24.0
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
250
200
150
100
50
0
2
8
6
5
5
2
5
1
7
5
23
11
19
23
21
201
37
67
30
32
11
25
3
19
1
14
2
27
8
06/01
06/08
06/15
06/22
06/29
07/06
07/13
07/20
07/27
08/03
08/10
08/17
08/24
08/31
09/07
09/14
Pre-spawn Mortality/Week
Quartz Bowl Temps
Quartz Threshold
Philbrook Release


2014 Butte Creek Results
Run size =5,083
Pre-spawn mortality =232
Temperature (° C)/Release Flow (cfs)
Carcasses/week
41.0
40.0
39.0
38.0
37.0
36.0
35.0
34.0
33.0
32.0
31.0
30.0
29.0
28.0
27.0
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24.0
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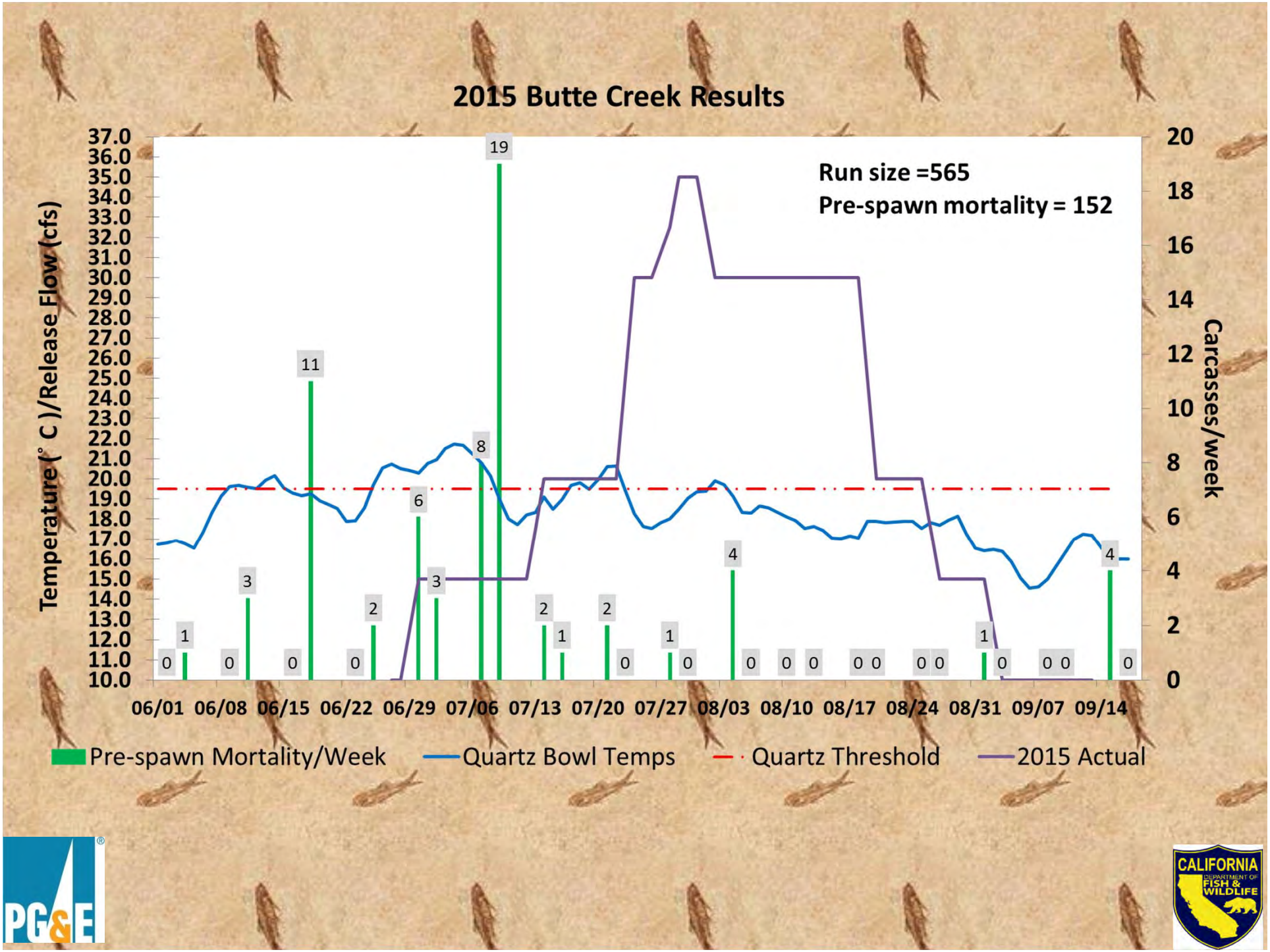
0 1 0 3 1 3 0 2 2 3 12 4 10 9 13 8 4 6 1 1 2 2 1 1 3 2 4 2 6 1 7 1
06/01 06/08 06/15 06/22 06/29 07/06 07/13 07/20 07/27 08/03 08/10 08/17 08/24 08/31 09/07 09/14
Pre-spawn Mortality/Week
Quartz Bowl Temps
Quartz Threshold
Philbrook Release


2015 Butte Creek Results
Run size =565
Pre-spawn mortality = 152
Temperature(˚ C)/Release Flow (cfs)
Carcasses/week
37.0
36.0
35.0
34.0
33.0
32.0
31.0
30.0
29.0
28.0
27.0
26.0
25.0
24.0
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
20
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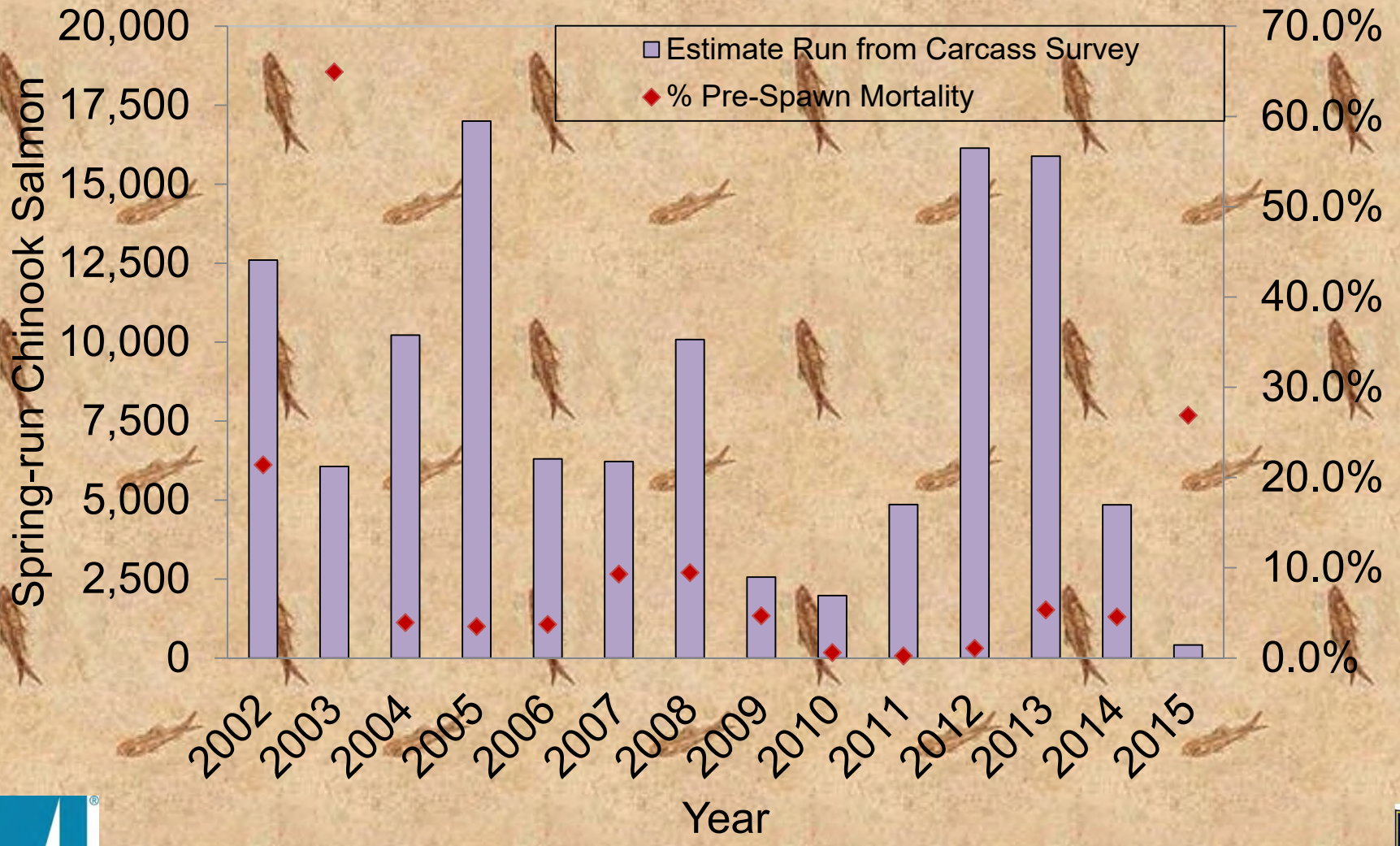
16
14
12
10
8
6
4
2
0
06/01 06/08 06/15 06/22 06/29 07/06 07/13 07/20 07/27 08/03 08/10 08/17 08/24 08/31 09/07 09/14
Pre-spawn Mortality/Week
Quartz Bowl Temps
Quartz Threshold
2015 Actual

CDFW Butte Creek Adult Spring-run Chinook Salmon Escapement Surveys, 2002-2015



Conclusion

- PG&E and Agencies work collaboratively to manage limited storage in Philbrook Reservoir to get salmon through the heat storms.
- Meteorological forecasting, temperature monitoring, pre-spawning mortality surveys.

- Currently the management and operation process is very fluid and adaptive.

Acknowledgements

- Chico CDFW office for field work, data analysis, and reports.
- Federal Aid in Sport Fish Restoration Act for funding CDFW.
- Tim Sagraves of Sagraves Environmental for his historical and technical knowledge of the project.
- PG&E's Generation Supervisor, Kyle Ingvoldsen, and Water Crew Staff.

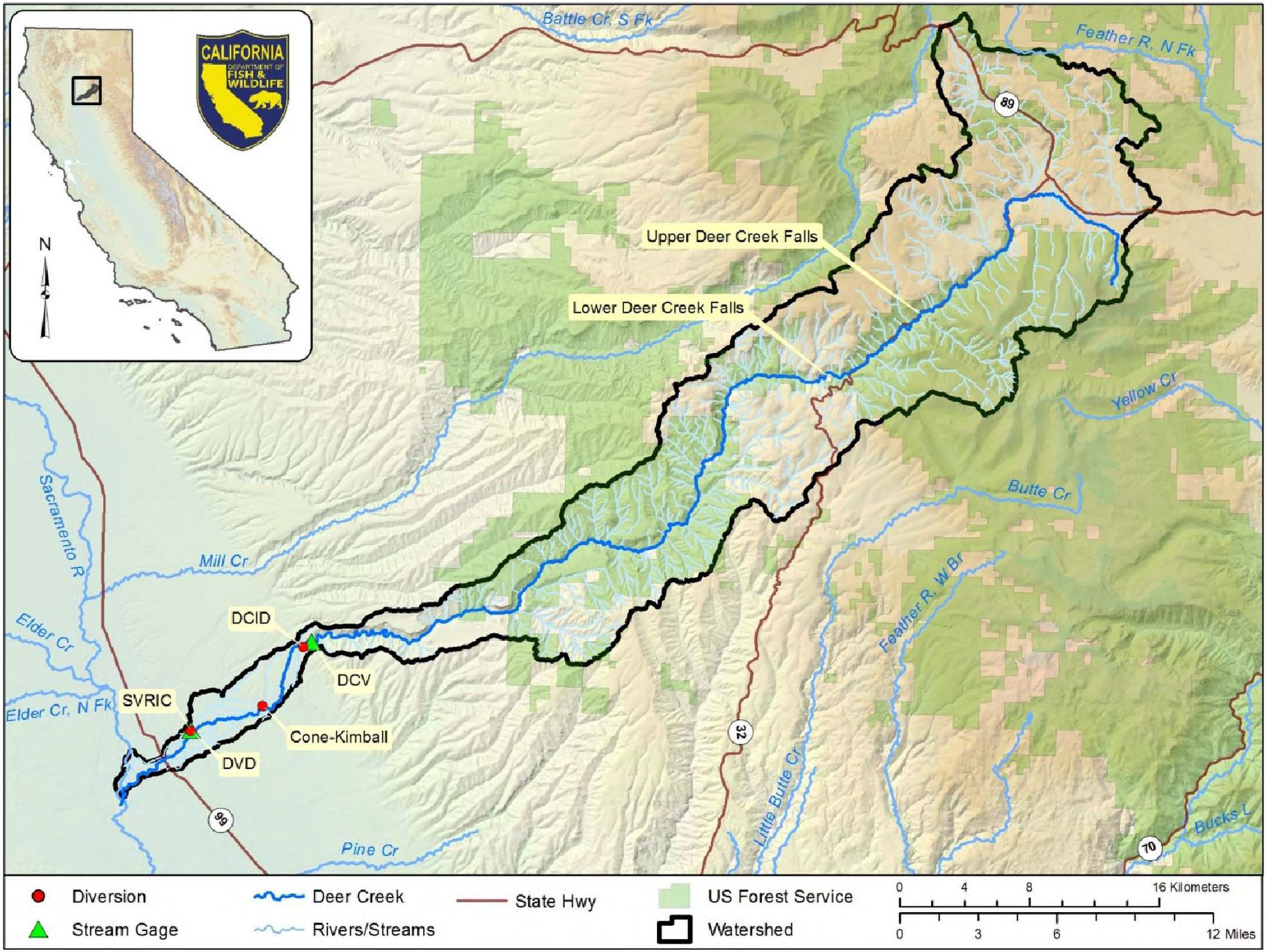

Questions?
JUL/10/2013

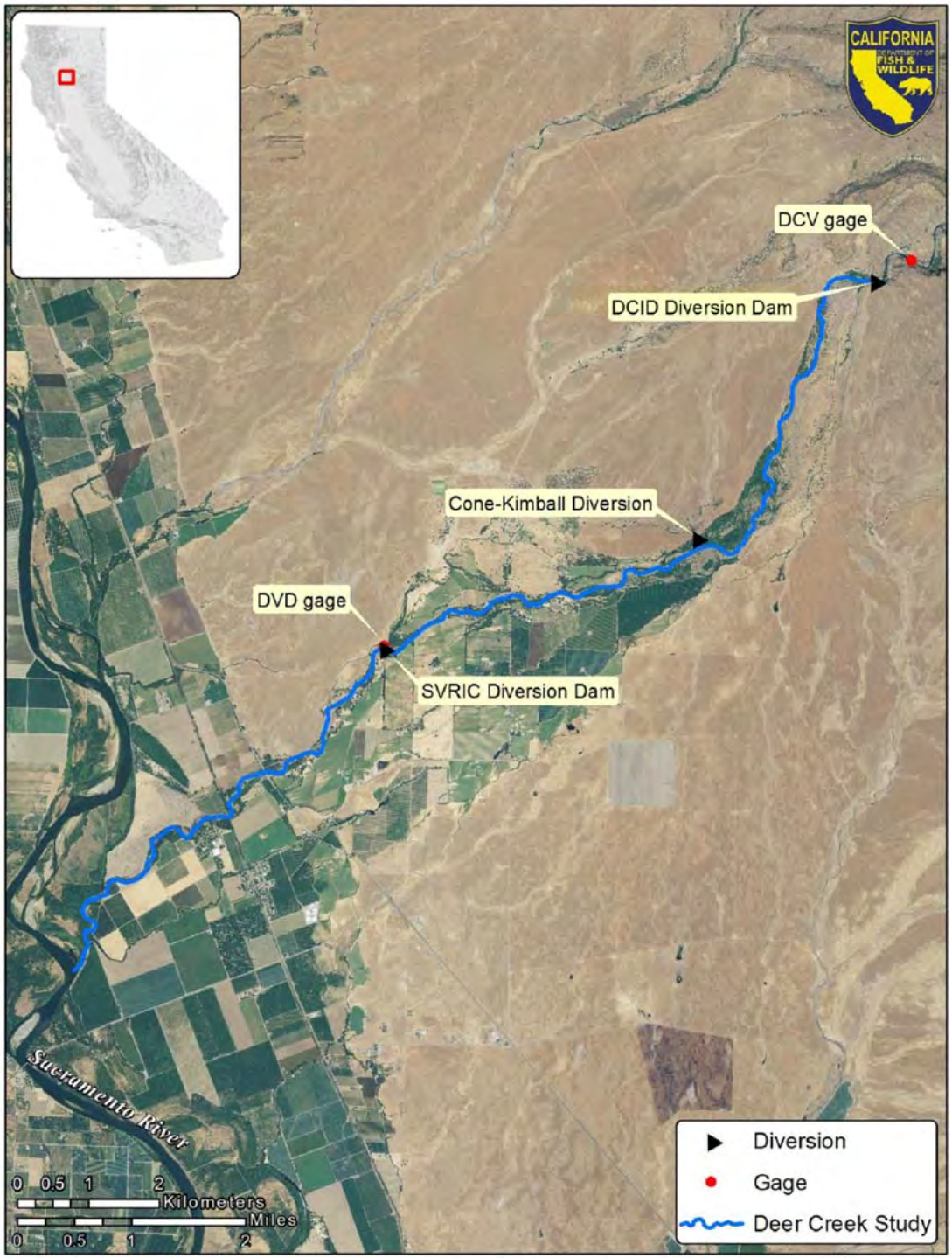
Background on Deer Creek

How much water we need

Possible ways to get it

- Voluntary
- Regulatory


CALIFORNIA
DEPARTMENT OF FISH & WILDLIFE
N
Battle Cr, S Fk
Feather R, N Fk
89
Upper Deer Creek Falls
Lower Deer Creek Falls
Yellow Cr
Butte Cr
Sacramento R
Mill Cr
Elder Cr
Elder Cr, N Fk
DCID
DCV
SVRIC
Cone-Kimball
DVD
Feather R, W Br
32
Little Butte Cr
99
Pine Cr
70
Bucks L
Diversion
Stream Gage
Deer Creek
Rivers/Streams
State Hwy
US Forest Service
Watershed
0 4 8 16 Kilometers
0 3 6 12 Miles


CALIFORNIA
DEPARTMENT OF
FISH & WILDLIFE
DCV gage
DCID Diversion Dam
Cone-Kimball Diversion
DVD gage
SVRIC Diversion Dam
Sacramento River
0 0.5 1 2
Kilometers
0 0.5 1 2
Miles
Diversion
Gage
Deer Creek Study

Water Allocation in Lower Deer Creek

Water Allocation in Lower Deer Creek

Deer Creek Irrigation District	33%
Stanford-Vina Ranch Irrigation Co.	66%

How much flow?

For migration, two concerns:

(1) Depth @ critical riffles (.9’/ .7’)
(2) Temperature (< ~67^{o})

CriticalThresholds

(Curtailment levels)

50 cfs (adult)
25 cfs (juvenile)

Plus pulse flows based on presence of fish

Species and Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SRCS												
Adult												
Juvenile												
FRCS												
Adult												
Juvenile												
Steelhead												
Adult												
Juvenile												

Source: Johnson and Merrick 2012; USFWS 1999.

Ways to reduce diversions

(i.e., increase instream flows)

(1) Voluntary

(2) Regulatory

Voluntary Approach:
Deer Creek Flow Enhancement Program

Use groundwater to replace diversions bypassed during pulse flow events

DCID wells developed/ permitted 2003 – 2011

Funding from 4 Pumps Fish Protection Agreement

Agreement currently under negotiation w/ DCID

Regulatory Approaches

- Curtailment
- Criteria/ Objectives (Phase 4)

Both have roots in the **public trust doctrine**

Curtailment

Invoked by Water Board in times of shortage, upon determination
Of insufficient water to meet needs of all uses

Public trust is “senior”

But**, minimum flow thresholds** (i.e., 50/ 25 cfs plus pulse flows)

Invoked in 2014 & 2015 drought years by Water Board rules

Allowance for voluntary agreements **if** they cover all diverters

Phase 4 Process (under Bay-Delta Plan)

Water Board sets enforceable flow thresholds for public trust uses

Two-step process:

- Determine “criteria” (“what the fish need”) (DFW)
- Balance criteria against other rights to develop “objective” (SWRCWB)

Objectives are enforceable – (incorporated into water rights)

DFW Water Branch is in midst of study to propose criteria for Deer Creek

Voluntary Approach – DCID System Improvements

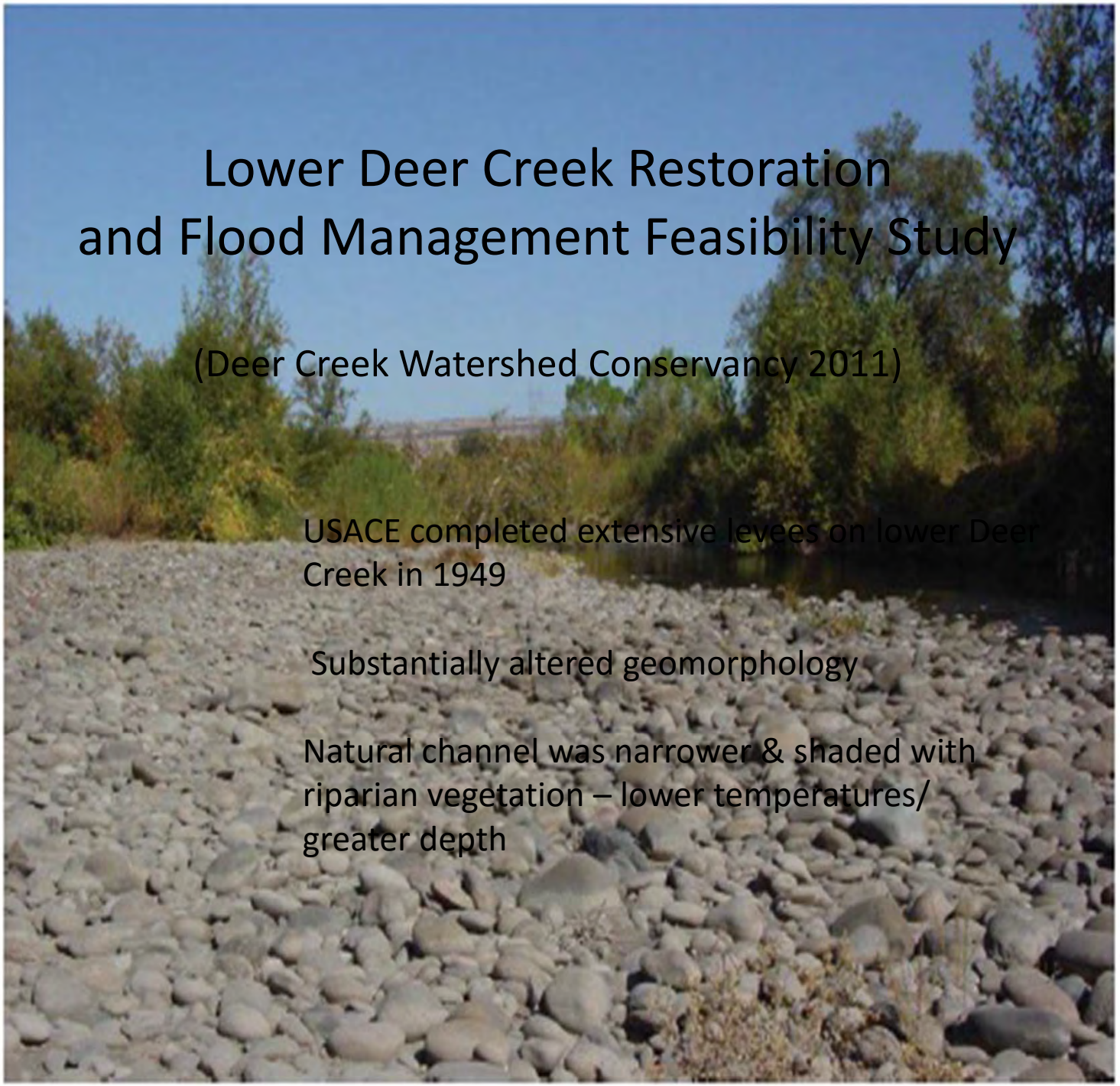
Concept:

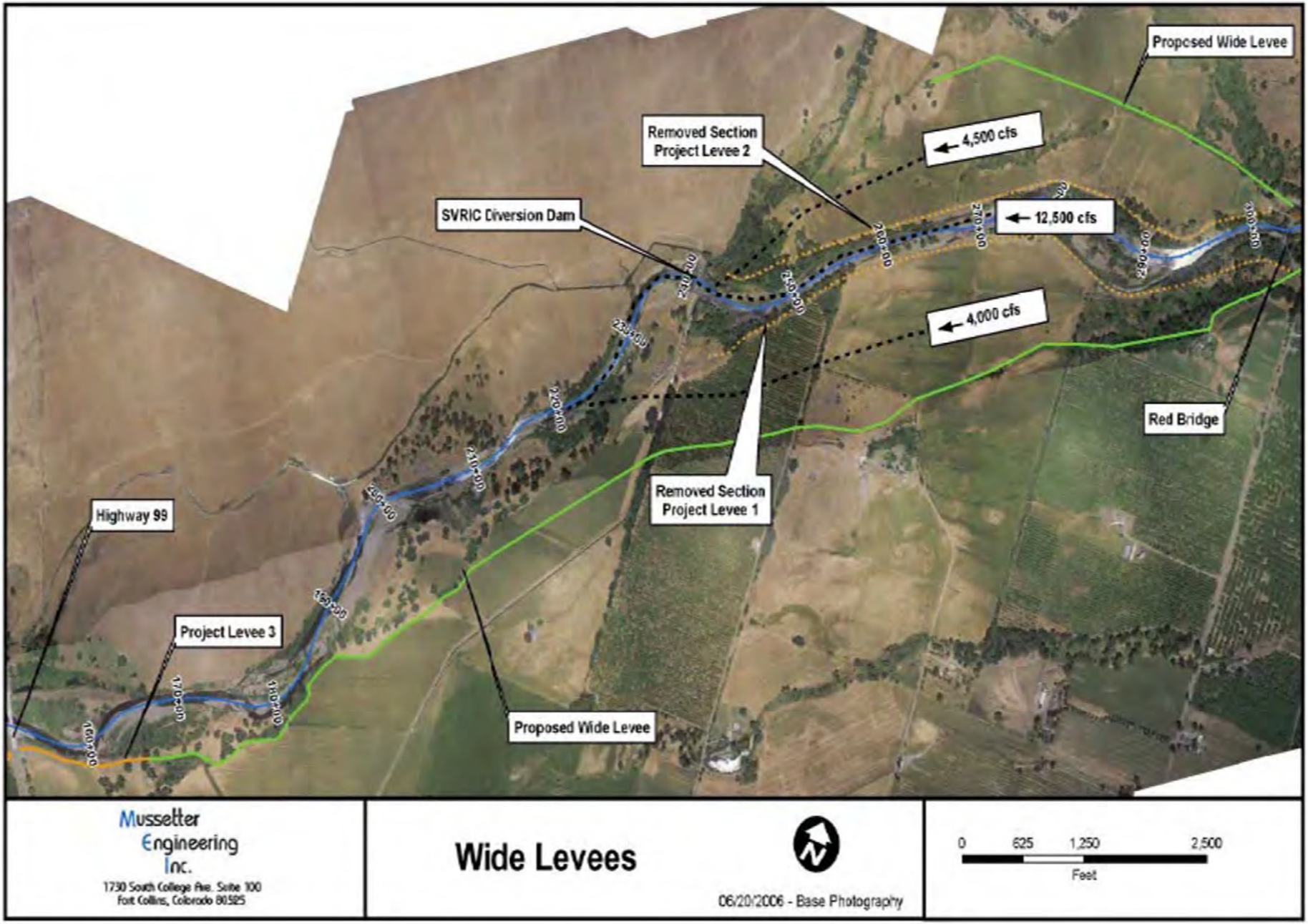
- Partner with DCID to improve efficiency
- Dedicate conserved water to instream flow under WC §1707

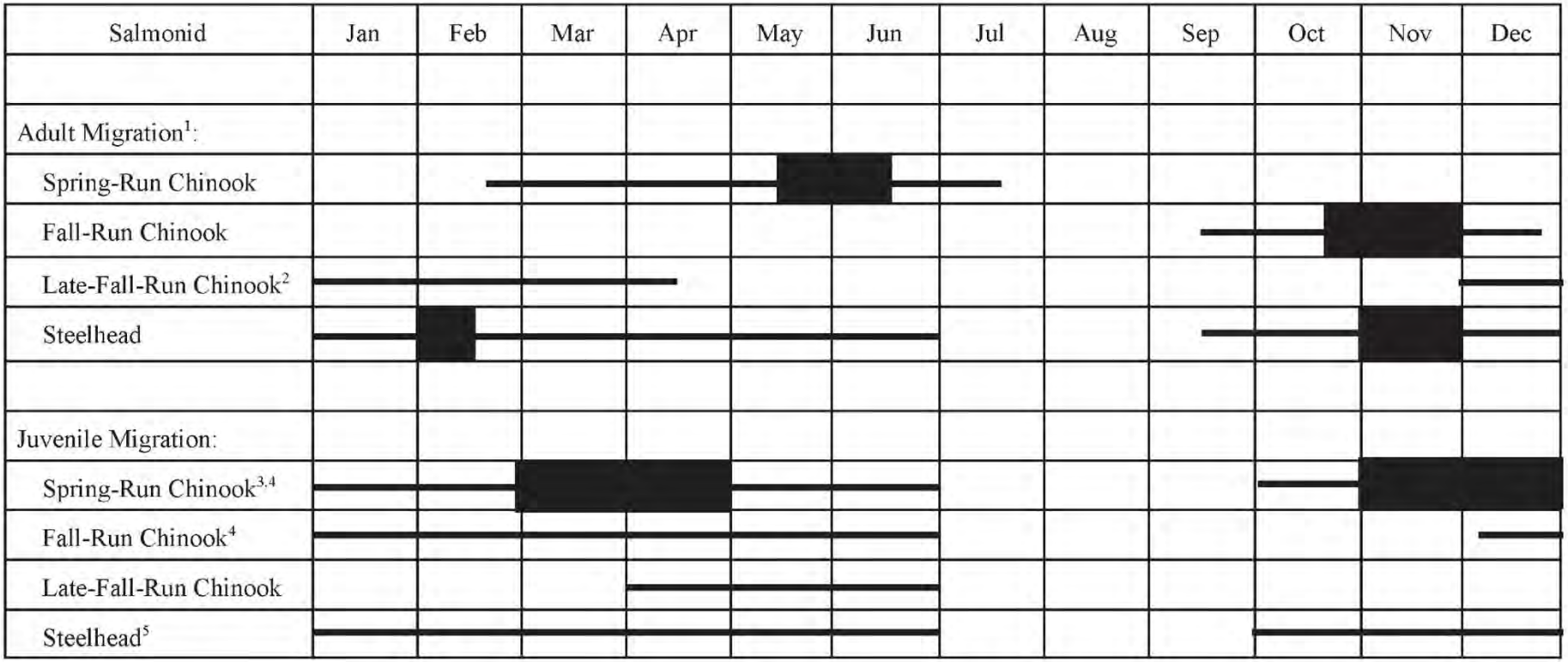
Voluntary Approach – DCID System Improvements

Benefits:

- DCID gets help meeting minimum flow requirements
- Public trust flows increased at non-critical times


Lower Deer Creek Restoration
and Flood Management Feasibility Study
(Deer Creek Watershed Conservancy 2011)
USACE completed extensive levees on lower Deer Creek in 1949
Substantially altered geomorphology
Natural channel was narrower & shaded with riparian vegetation – lower temperatures/ greater depth


Proposed Wide Levee
Removed Section Project Levee 2
4,500 cfs
SVRIC Diversion Dam
12,500 cfs
4,000 cfs
Red Bridge
Removed Section Project Levee 1
Highway 99
Project Levee 3
Proposed Wide Levee
Musselter Engineering Inc.
1730 South College Ave. Suite 100
Fort Collins, Colorado 80525
Wide Levees
06/20/2006 - Base Photography
0
625
1,250
2,500
Feet



[1] Adult migration timing data from Mill Creek Counting station, in operation 1953-1963.

[2] No data available for late-fall in Deer Creek, but this generalized migration table is correct.

[3] This includes both fry and yearling outmigration.

[4] Spring-Run and Fall-Run outmigrants cannot be identified separately during the spring outmigration time period. Therefore, the fry migration periods are considered the same.

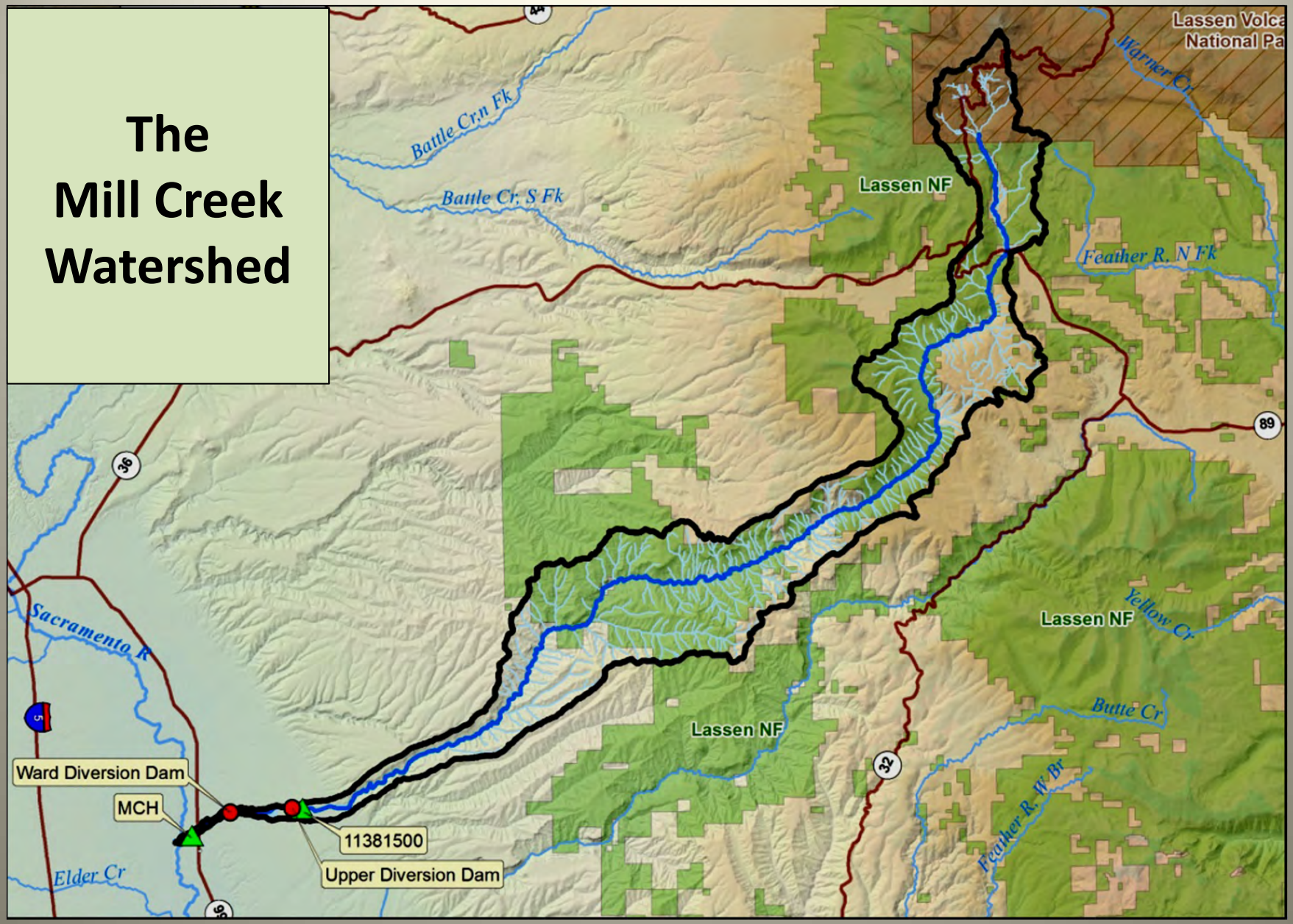
[5] Rainbow/Steelhead trout have been captured in outmigrant traps from October to June. Peak period not documented.

Figure 5-1. Deer Creek Anadromous Salmonid Migration Calendar.[14]

The Mill Creek Instream Flows Toolbox

Gregg Werner
The Nature Conservancy

The Mill Creek Watershed



Salmonids in Mill Creek

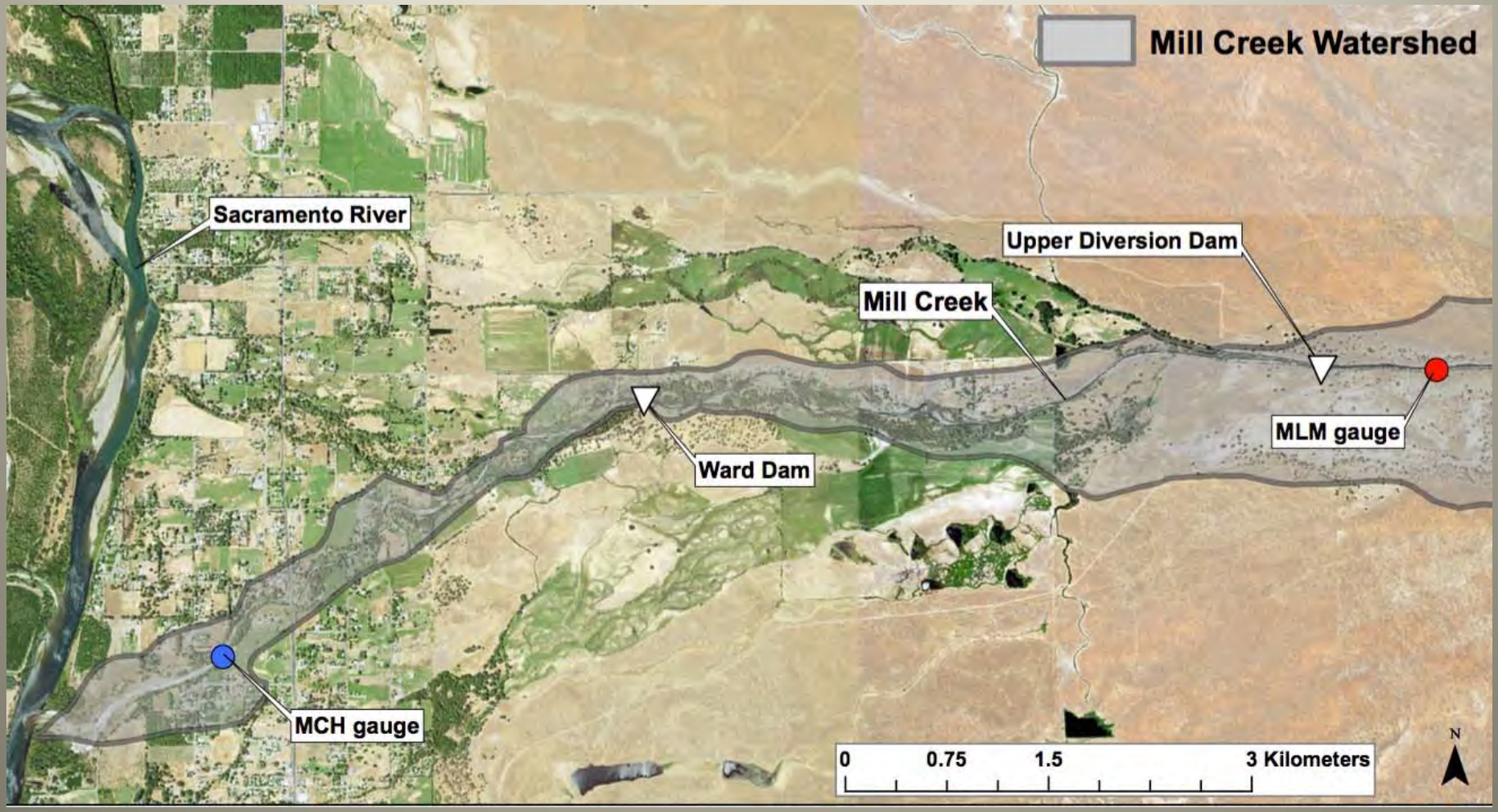
- Spring-run Chinook
- Fall-run Chinook
- Late Fall-run Chinook
- Steelhead Trout

The Mountains *(10 miles)*

The Canyon *(40 miles)*

The Valley *(6 miles)*

The Valley Segment



Mill Creek Water Rights

- Pre-1914 water rights
- Governed by a 1920 Decree, interpreted to allow instream use *(no 1707 required!)*
- 203 cfs allocated
- Every year the flow falls below 203 cfs in the summer and historically the entire flow was diverted in most years

Salmonid Passage Needs

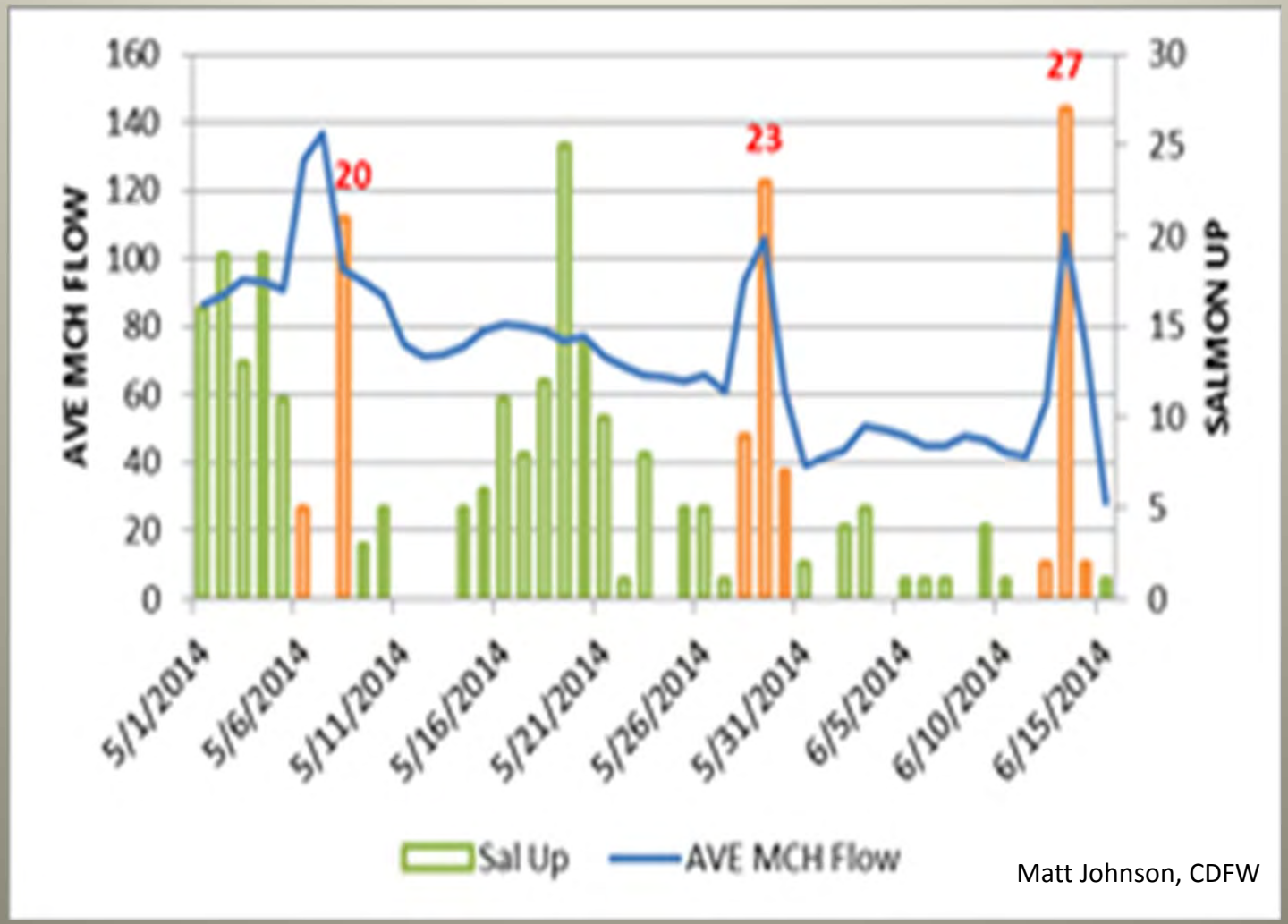
	January - April	May	June	July	August	September	October	November - December
Traditional Water Use	No irrigation until April Substantial flow from rain and snow melt	Irrigation use requires most or all of the flow Lowest flow of the year						No Irrigation Substantial flow from fall rains
Salmonid Needs	Salmon and steelhead smolts out Spring-run adults in			No salmonid needs Water is too warm				Fall-run and steelhead in
Instream Flow Needs	Adequate flow *No Problem*	Need increased flow in dry years *PROBLEM*		Water is too warm for salmonids in the valley segment *No Problem*		Need flow *PROBLEM*		Adequate flow *No Problem*

Flow Solutions

- **Pulse Flows in the spring -** Replicate natural pulses of flow resulting from spring rainfall or snowmelt events and attract spring-run Chinook.
  - As needed to supplement undiverted flow in dryer years
  - Triggered by DFW "Flow Call"

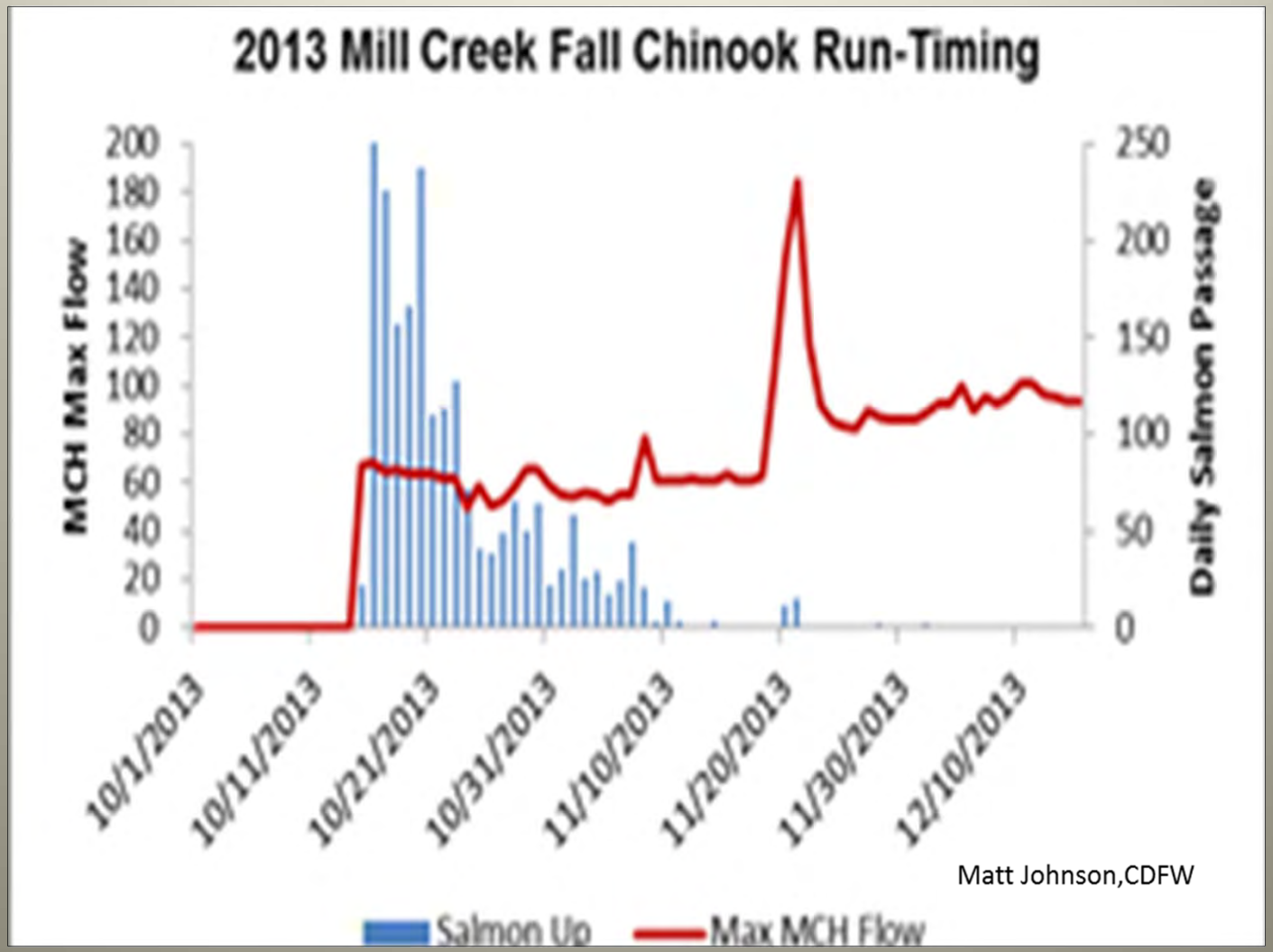
- **Continuous Flows in the fall** – Replicate unimpaired fall flows when the stream cools to acceptable passage temperature to attract fall-run Chinook and steelhead.
  - Needed every year
  - Triggered by DFW "Flow Call"

Spring Pulse Flow Response



Matt Johnson, CDFW

Fall Continuous Flow Response



History of Instream Flow Management

- 1980's - Flow Releases for salmonid passage
- 1990 - Conjunctive Use Wells Agreement
- 1994 - Jones Water Right Lease Agreement
- 2007 - Long-term Cooperative Management
- 2015 - Mill Creek Water Exchange Agreement

Mill Creek Flows Group

- **Formed:** August of 2013

- **Representation:**

CA Dept. of Fish and Wildlife
US Fish and Wildlife Service
Los Molinos Mutual Water Co.
The Nature Conservancy
CA Dept. of Water Resources
CA Water Resources Control Board
NOAA Fisheries
Mill Creek Conservancy

- **Mission:**

To develop and Implement a program to improve Mill Creek flows for salmonids that will have a positive impact on their viability in the Mill Creek watershed and will be compatible with continued irrigated agricultural operations.

Mill Creek Instream Flows Strategy:

The "TOOL BOX"

The Mill Creek Flows Group adopted in 2015 a four-part strategy to increase instream flows that are targeted to salmonid needs.

1. **Conjunctive Use Wells**
2. **Water Rights Acquisition**
3. **Water Use Efficiency Improvements**
4. **Offstream Storage**

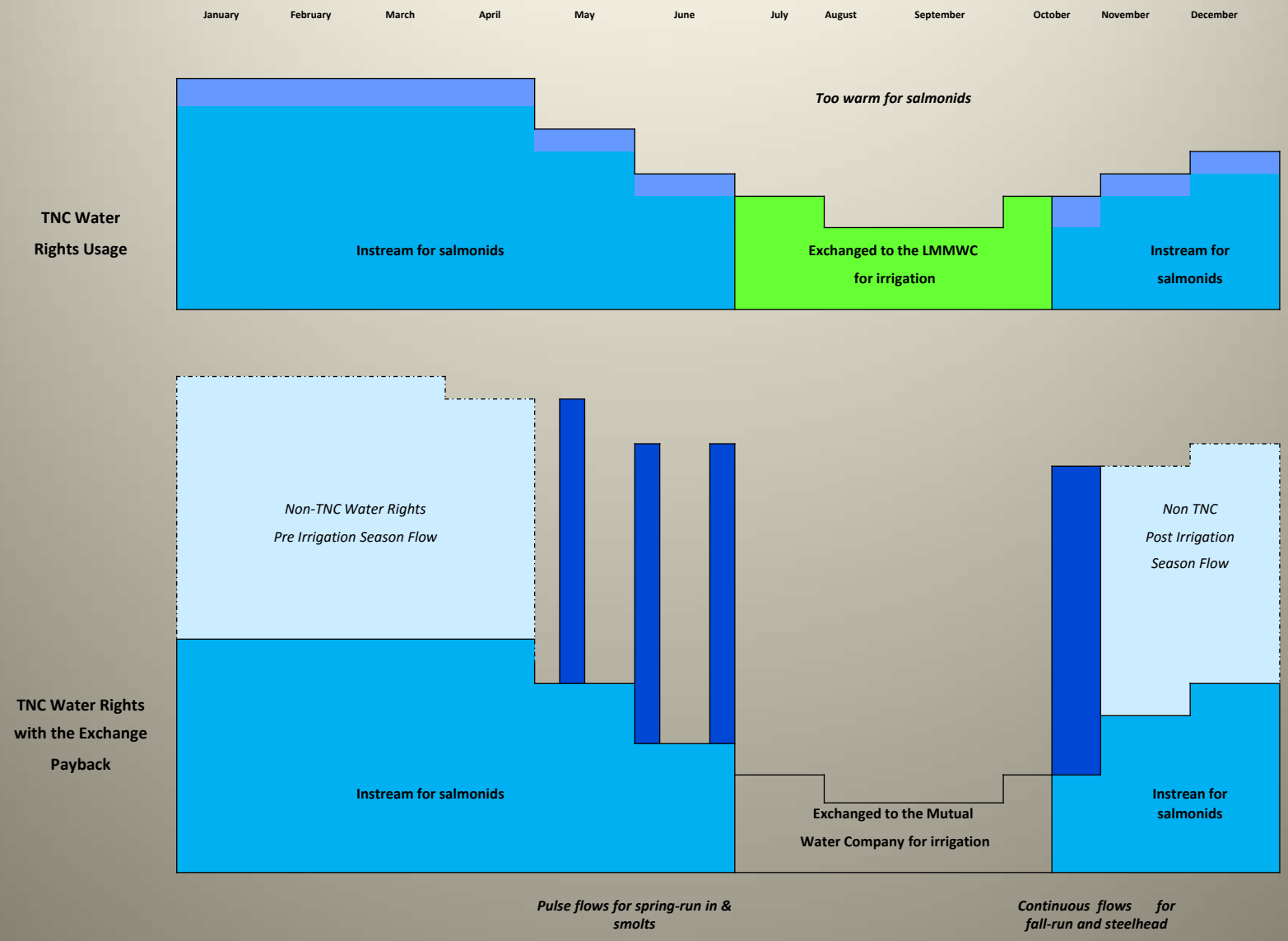
Conjunctive Use Wells

- Two wells (10 cfs capacity) used exclusively to replace diversions for increase instream flow
- Development and operations funding from Delta “Four Pumps”
- 10 cfs of required instream flow with credit incentive to provide more instream flow
- LMMWC may use replacement water then or bank well credits for use later in the year
- Wells only operate a limited time
- Additional wells proposed

Water Rights Acquisition

- TNC purchased two water rights, 17.9 cfs at full flow
- Leveraged through a Water Exchange Agreement with LMMWC
- LMMWC uses TNC water for irrigation from 7/1 to 10/15 with payback for passage flows
- Additional water rights are being pursued

Mill Creek Water Exchange Agreement



Water Use Efficiency Improvements

- Mill Creek water is commonly used for relatively low value crops and it has been very inexpensive
- Little economic incentive to improve efficiency and reduce water demand
- LMMWC has initiated improvements with an SCADA system and improved measuring and distribution devices
- FRGP and NFWF are funding the Water Efficiency Masterplan
- Identify specific projects and develop cost and water savings estimates to support funding applications

Offstream Storage

- 3 day pulse flows disrupt irrigation cycles and make life difficult for LMMWC customers
- Pond(s) proposed to store higher spring flows for use to even out rotations during pulse flows
- Reducing the negative impact will increase LMMWC ability to provide pulse flows
- Initial engineering analysis commissioned to evaluate the potential benefits and cost

Typical Instream Flows Achieved

Water Exchange Agreement

24 cfs
payback water

8 to 18 cfs
TNC water

Conjunctive Use Wells
(for credits)

20 to 30 cfs

Conjunctive Use Wells
(required)

10 cfs

Typical Instream Flows Achieved

Water Exchange Agreement	**24 cfs** payback water
	8 to 18 cfs TNC water
Conjunctive Use Wells (for credits)	**20 to 30 cfs**
Conjunctive Use Wells (required)	**10 cfs**
Total Instream Flow	**62 to 72 cfs**

The Bottom Line

Good science, innovation, funding, cooperation and a little sacrifice =

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Good science, innovation, funding, cooperation and a little sacrifice =