2012 Monitoring Report
Scott River Water Trust

Fish use in lower French Creek below lease site - 9/6/12 *photo by Sue Maurer*

Prepared by

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Introduction

During the summer and fall of 2012, the Scott River Water Trust performed its 6th year of forbearance transactions with adjudicated water users in Scott Valley. The purpose of the Water Trust Program is to help improve instream conditions for salmon and steelhead in priority stream reaches by getting landowners to forbear all or part of their decreed water right in exchange for fair financial compensation. Priority reaches were originally identified for the Water Trust in 2007 (Quigley 2007a), with additional reaches added based upon known presence of coho salmon, a priority species due to its threatened status.

2012 Lease Summary

Nine forbearance agreements (water leases) were completed in 2012. Six of those were during the summer juvenile fish rearing period - five on French Creek and one on Shackleford Creek– and three more on the mainstem Scott River for the fall adult salmon migration period (Tables 1 and 2).

Table 1: Summer Leases for 2012: Tributaries

Stream / Tributary / Diversion No.	Date Began	Date Ended	Flow Leased (cfs)	Volume Leased (acre-feet)	Distance of benefit (feet)
French Creek					
FR48 **	July 18	Sept. 30	0.76	113.0	5,050
FR47A **	Sept. 13	Sept. 30	0.4	13.6	1,000
FR36 – Miners Ck*	Aug. 9	Sept. 30	0.25	26.5	2,500 (+3,500 FC)
FR33 – Miners Ck*	Aug. 17	Sept. 30	0.4-0.5	40.0	7,000
FR20	Aug. 31	Sept. 30	0.6	36.0	2,600
Shackleford Creek					
SH14 – Mill Ck	Aug. 6	Oct. 31	0.7	120.4	4,000
TOTAL	**6 leases**	**17-86 days**	**3.1 cfs**	**349.5 acre-feet**	**25,650 ft. (4.9 miles)**

(,** - adjacent diversions)*

Table 2: Fall Leases for 2012: Scott River

Stream / Diversion No.	Date Began	Date Ended	Flow Leased (cfs)	Volume Leased (acre-feet)	Distance of benefit (miles)
SR 223-13-D2 (2 leases)	Oct. 1	Nov. 13	8-12 cfs	800	47
SR 196-13-D2	Sept. 25	Nov. 13	1.3	127.4	4
SR 183-15-D1	Nov. 13	Nov. 23	11.0	220.0	54
TOTAL	**4 leases 3 sites**	**10-43 days**	**~20-24 cfs**	**1,147.4 acre-feet**	**54 miles**

Monitoring Objectives

The main objectives of the monitoring effort for the Scott River Water Trust are to answer the following questions:

1.) Was the amount of water paid for provided?
2.) Was there an instream effect on stream discharge and/or pool volume below the lease site?
3.) What was the extent (distance) of downstream impact on flows?
4.) Was water temperature affected by leases?

Water Year Type

Although the previous year was quite wet, the 2012 water year transformed into a DRY water year type due to significantly below average rainfall and near average snowpack. Precipitation at Fort Jones for October 1, 2011 to April 1, 2012 was 13.92" or 79% of the average for that period, while Callahan's records indicated 76%. Although the average water content of the snowpack for 5 sites was 101% on April 1st, it was reduced to 91% by May 1 and was only 62% at the lower elevation snowfield site above Etna Creek (CDWR 2012; USFS 2012). Runoff into the Scott River dropped below the median average (of 71 years of record) during much of the water year (Figure 1). Snowmelt caused some spikes but by late May, this below median runoff pattern continued through September and into the fall.

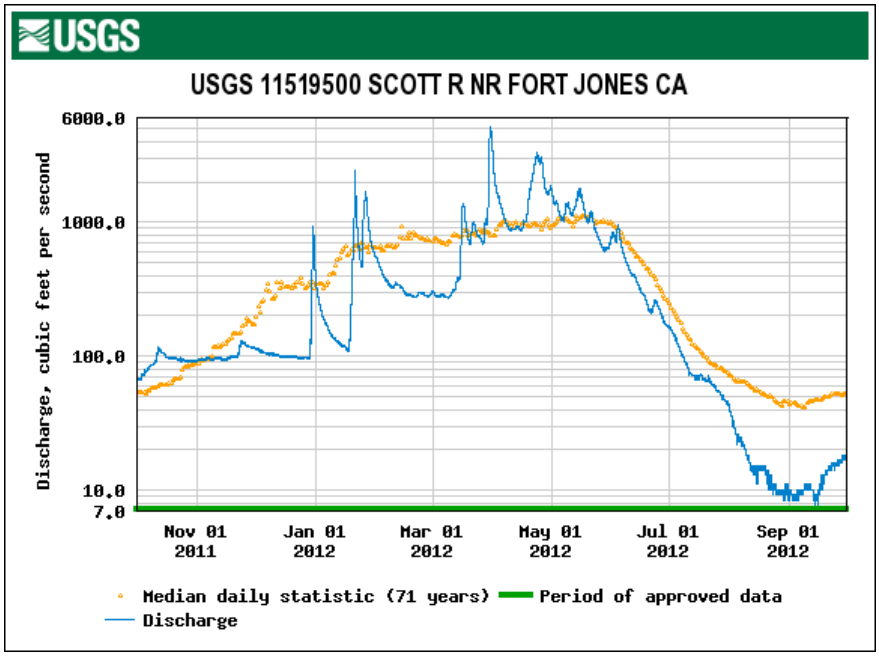


Figure 1. Scott River runoff during 2012 Water Year, Oct. 1, 2011 to Sept. 30, 2012 at USGS gage at river mile 21. (USGS 2012)

Tributary discharges were similarly low throughout the summer and fall season. Fall rains were delayed until late October, with large rain and snow events in late November and mid-December finally bringing runoff to above the median (Figure 2).

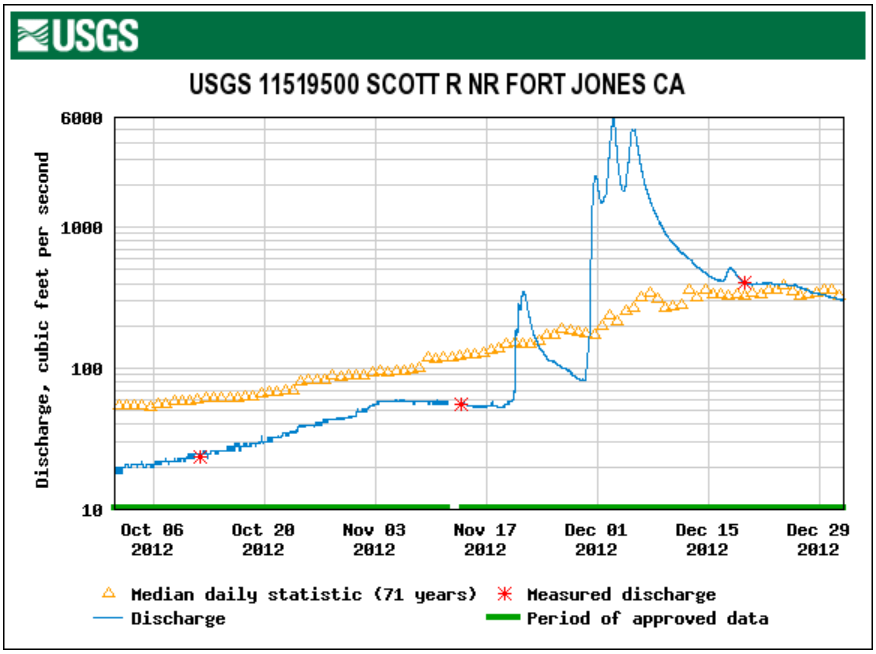
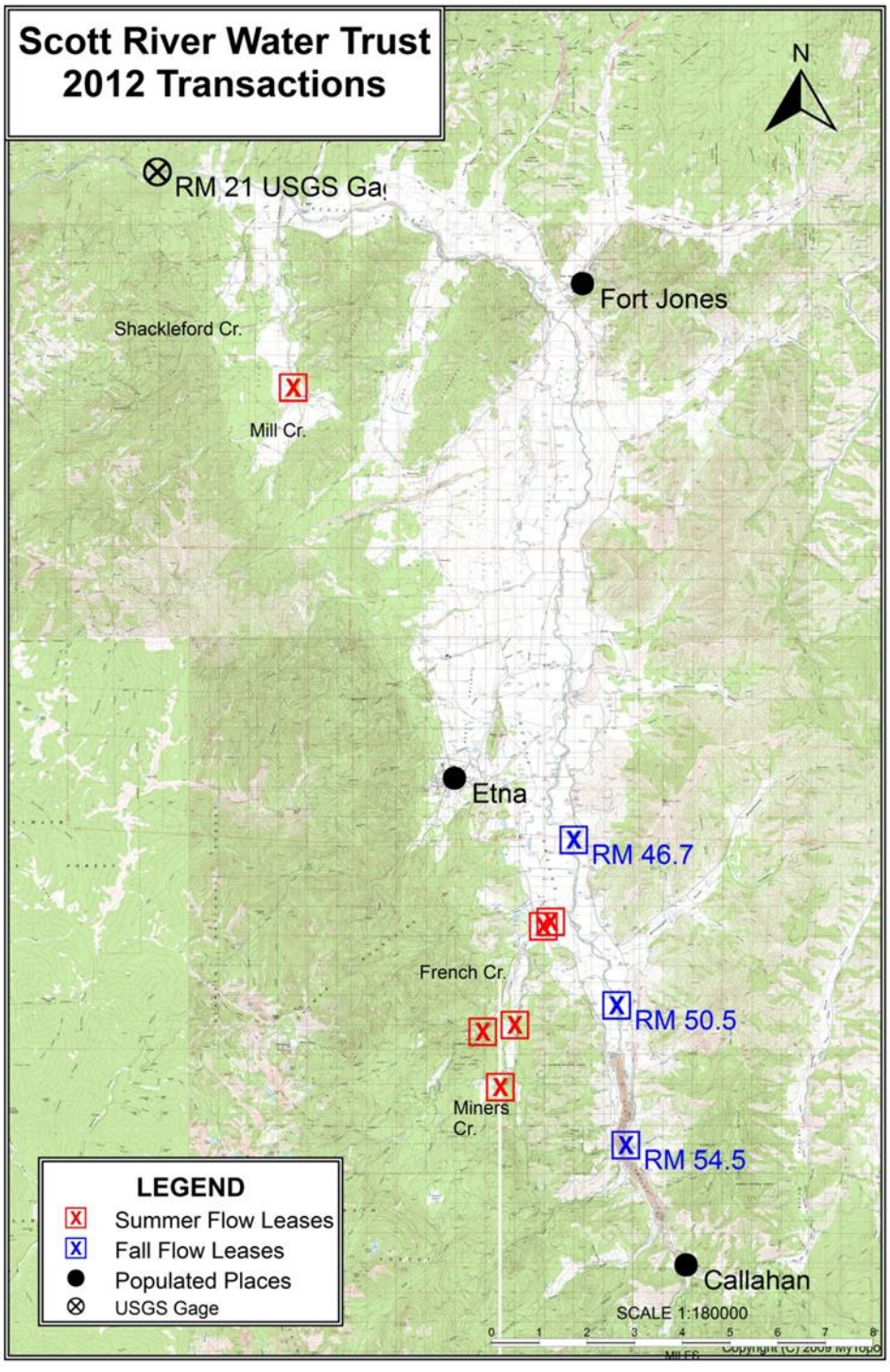


Figure 2. Scott River runoff from Oct. 1, 2012 through Dec. 31, 2012 at USGS gage at river mile 21 (USGS 2012).

Lease Locations

All leases were located within Scott Valley of the Scott River sub-basin of the Klamath River basin (Map 1). Separate maps show the more detailed locations of the summer and fall leases, respectively, later in this report. Summer leases targeted summer rearing habitat for juvenile coho salmon and steelhead trout in priority tributaries, while fall leases targeted adult upstream passage and spawning habitat on the mainstem Scott River, initially for Chinook salmon and later for coho salmon.

Map 1. Locations of Summer & Fall Water Leases



Methods

The Monitoring Program for the Water Trust was first outlined five years ago (Quigley 2007b). Refinements and updates in methods are made each year, as described in the annual monitoring reports prepared for the Water Trust by the Siskiyou Resource Conservation District (RCD) staff (e.g., Yokel 2011). In 2012, independent contractor, Peter Thamer, monitored water temperature and stream flow before and after these transactions, and independent contractor, Sue Maurer, snorkeled and dived reaches to evaluate fish presence. For two specific transactions (FR48 and SR223-13-D2), fish habitat parameters were measured and photopoints were taken by Maurer and Thamer, using field monitoring protocols proposed by consultants to the National Fish and Wildlife Foundation (NFWF) for the second year of a special pilot program (Holmes et al. 2011).

Stream Flow

Instantaneous streamflow was measured before and after each lease using the FlowTracker Handheld-ADV by SonTek/YSI. This flow meter is the same model used by the California Dept. of Water Resources (CDWR) Watermaster and is known for high precision in low flow ranges (down to 0.001 m/s). Flow measurements are performed at hydrologic control points (e.g., pool tail out) with uniform laminar water velocities along a cross-section, following USGS standard methods (Rantz 1982, Yokel 2009.)

For the fall lease at Young's Dam, we relied on the Siskiyou RCD's streamflow gauging system to provide streamflow data. The RCD maintains streamflow gauges throughout the Scott River watershed. One of these gauging stations is immediately below the dam at River Mile 46.5. These stations utilize Onset HOBO Water Level Loggers (U20-001-01) to measure continuous streamflow. The level loggers were placed in vented PVC tubes attached to a T Post and staff gage. The devices were set into the deepest section of a pool. Pressure transducers were used to collect 15 minute water level data at each location. The collected data was converted to river stage using "barometric conversion compensation" in Hobo Water Pro (Onset Computer Corporation). Barometric data is collected at a location on the Scott River mainstem and a location in Kidder Creek. USGS methodology was applied to develop rating curves for each location (Buchanan 1969).

Two streamflow gauging stations were installed for the summer lease in French Creek at FR48 - one just below the POD and one near the end of the reach. These stations were set up following the same protocols as the RCD streamflow gauging system, the only difference being that Solinst Water Level Loggers were used instead of Onset HOBO Water Level Loggers. A Solinst Barometric Logger was deployed near the FR48 POD to ensure that local barometric data would be used to convert the water level logger data for that lease.

Flow data were also available from the DWR gage located on lower French Creek, and preliminary flow data were available for the DWR gages on South and East Fork. The

Watermaster, for the Scott & Shasta Valleys Watermaster District, also provided streamflow and diversion-flow estimates near PODs that were being considered for leasing, to help the Water Trust assess the relative flow benefit during the season.

Diversion Flow

In streams where the Watermaster does not measure diversion amounts, the contracted field technicians validated the amount of flow being diverted before and after the transaction. Flow measurements within the ditch are taken to determine the net diversion amount (if a flow bypass is involved).Often flow measurements were taken in-stream, below where the fish bypass flows entered the stream, before and after the transactions, to evaluate the transaction's effect on stream flow. Ideally, a weir structure is available as the point of most accurate measurement. In 2012, Watermaster John Clements verified diversion flow for SH14, FR20, FR33, FR36, FR47A, and FR48. Whatever method of Diversion Flow evaluation was used is noted in the Results section, under Lease Event Summary.

Stream Temperature

Onset HOBO Water Temp Pro v2 Loggers were utilized to collect 30 minute water temperature data at each location. Data loggers were placed in targeted fish habitat, such as pools, on a site-specific basis. The water temperature loggers were calibrated in both an ice and air bath and the calibration data was analyzed to insure each device's accuracy. We attempted to place the devices instream a minimum of 24 hours prior to the water leases in order to collect one period of diurnal temperature fluctuations, which was not always possible. Excel 2010 spreadsheets were used to develop daily minimum, maximum, and average water temperature data.

Aquatic Habitat

For the summer lease at French #48 and the fall lease at Young's Dam, additional aquatic habit parameters were monitored, following protocols identified in the draft "NFWF Natural Resource Conservation Service Conservation Innovation Grant (CIG) Instream Flow Field Monitoring Protocols"(Holmes et al. 2012). Stream transects (cross-sections) were placed at uniform units along the reach of interest, and in additional habitat units selected using professional judgment. These stream transects were set up to evaluate the changes in pool volumes, and to evaluate the relationship between streamflow and available habitat. Results are described in a separate report by the NFWF consultants (Nichols et al. 2013).

NFWF CIG Project:

NFWF's consultant, Rankin Holmes, assisted in setting up this special project's monitoring equipment for the summer lease at FR48 and the fall lease at Scott River 183-15-D1 (SR183). These two leases were used as case studies for the NFWF CIG project, so additional aquatic habit parameters were monitored, following protocols identified in their

draft Instream Flow Field Monitoring Protocols (Holmes 2012). As these methods were beyond the Water Trust's normal monitoring practices, this report will not provide more than a cursory description below of what this project performed.

Summer Lease FR48 Monitoring Approach:

One day was spent reviewing monitoring protocols, developing site plan, and familiarizing the contracted technicians with monitoring equipment, followed by a day onsite; setting up flow stations, setting up habitat transects, deploying HoboTemps, and developing monitoring schedule. The focus of this lease was to improve summer rearing habitat for coho, which influenced monitoring site selection to include pools.

Habitat: 11 habitat transects - to monitor changes in available habitat relative to flow.
Flow: 2 stations - at top and bottom of reach, to record water level every 30 min.
Temperature: 5 HoboTemps were deployed in:

Targeted Fish Habitat:

- 2 in pool below the POD, to monitor pool temperature stratification,
- 2 more in separate pools created by beaver dams in the lower section of the reach

USGS Protocol:

- 1 in riffle below the POD, to monitor 'well mixed' water temperatures

Fall Lease SR183 – Young's Dam Monitoring Approach:

Rankin Holmes selected monitoring locations and helped field technicians set up the monitoring equipment for this fall lease. The focus of this lease was to improve fish passage for incoming Chinook salmon, so the habitat cross-sections were specifically located on riffle crests or shallow runs that could be a potential barrier to fish passage.

Habitat: 5 habitat transects
Flow: RCD Flow station F1 (Below SVID) and F2 (near end of reach).

- Flow calculation in ditch – post lease, to verify diversion Q.

Temperature: none

Results for this project can be found in the report by NFWF consultants (Nichols et al. 2013)

Results: Summer Leases

French Creek & Miners Creek Leases:

The five summer leases in French Creek and its tributary, Miners Creek, are shown on Map 2. Note that the bright blue lines indicate estimated habitat benefit downstream of the leases, which extend at the minimum to the next unleased diversion.

French Creek – Lower - FR48

Diversion Site: Lower French Creek: Diversion #48
Date Lease Began: July 18th, 2012 Date Lease Ended: September 30, 2012
Water Right: 0.76 cfs, 7th Priority (French Creek Decree)
Diversion Amount at Start of Lease: 1.10cfs (verified by Watermaster)
Leased Amount: 100%
Stream Discharge at Start of Lease: 6.07 cfs After lease: 6.88 cfs
Fish Species Present: Steelhead/rainbow trout, coho salmon, dace. Adult coho spawning redds were observed in lower French Creek in fall 2011 (Franklin 2012). See juvenile fish survey summary below (Maurer 2012c).
Downstream Benefit: To at least the mouth of French Creek (1,300 feet), and next diversion site in the Scott River (5,050 feet downstream) (Yokel 2010.)

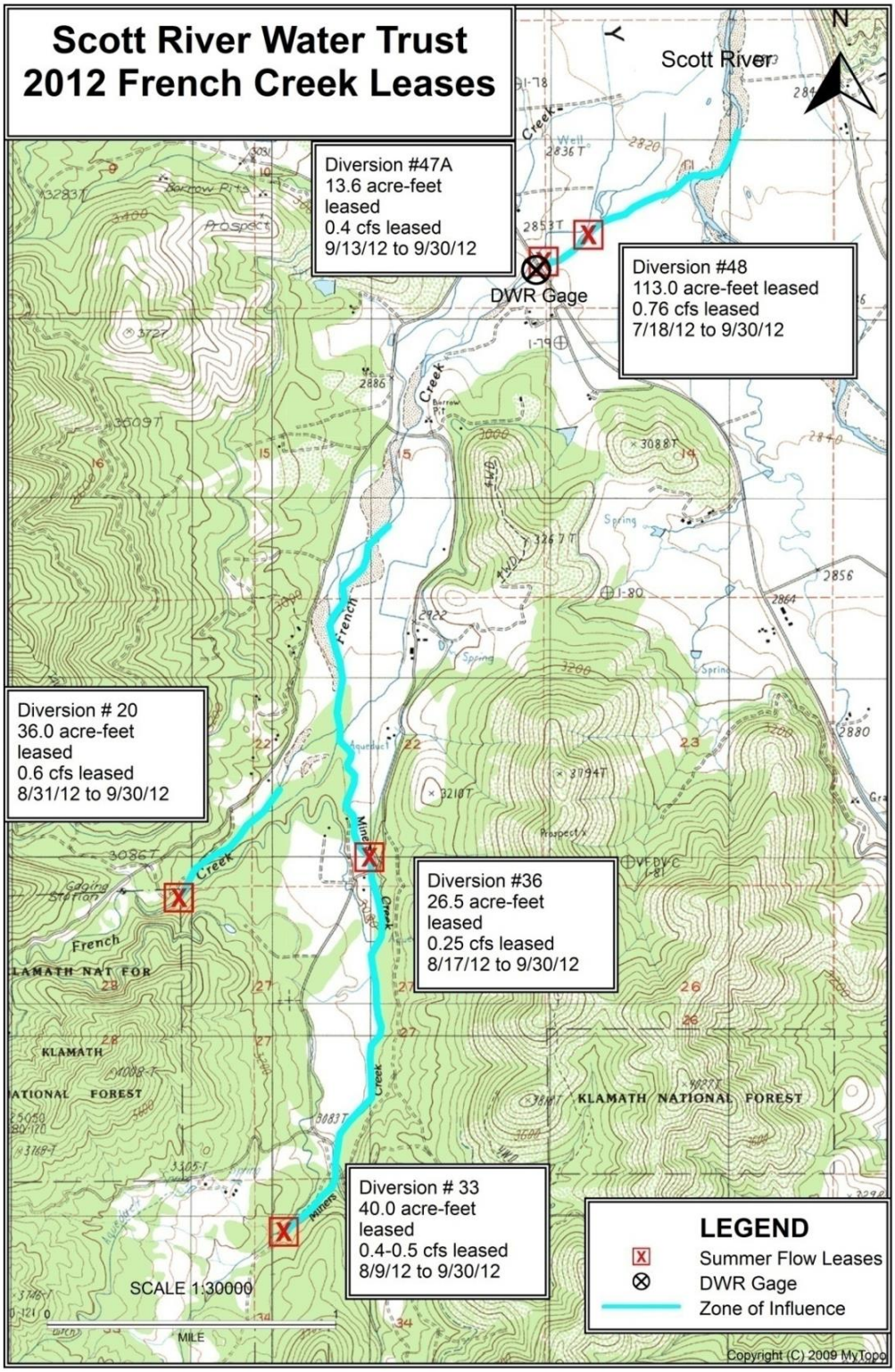
Transaction Event Summary:

On the day of the transaction, 7/18, Watermaster John Clements confirmed diversion rate at fish screen weir to be 1.10 cfs at 9:40 am. At 10:20 am, the second headgate was ratcheted down to slowly reduce flow into ditch, as the first step in fish rescue. Once the headgate was closed, Mary Olswang of CDFW and 2 AmeriCorps interns shocked and rescued fish from the section of ditch between the POD and the fish screen (Table 3). At 12:50 pm, the fish rescue was completed and the upper headgate at the POD was closed and sealed with plastic and rocks so that no water would enter the ditch. From this point on, the headgate remained closed and sealed for the duration of the lease.

Table 3: Fish rescued from section of ditch between POD and fish screen (CDFW data)

Species	Number Rescued (size)	Mortalities
Coho	2 (72 & 65 mm)	0
RT/SH	29	1
Dace	7	1

The water temp in the ditch was 15°C and 17°C in the screen site, CDFW noted.



Map 2. French Creek & Miners Creek Lease Sites

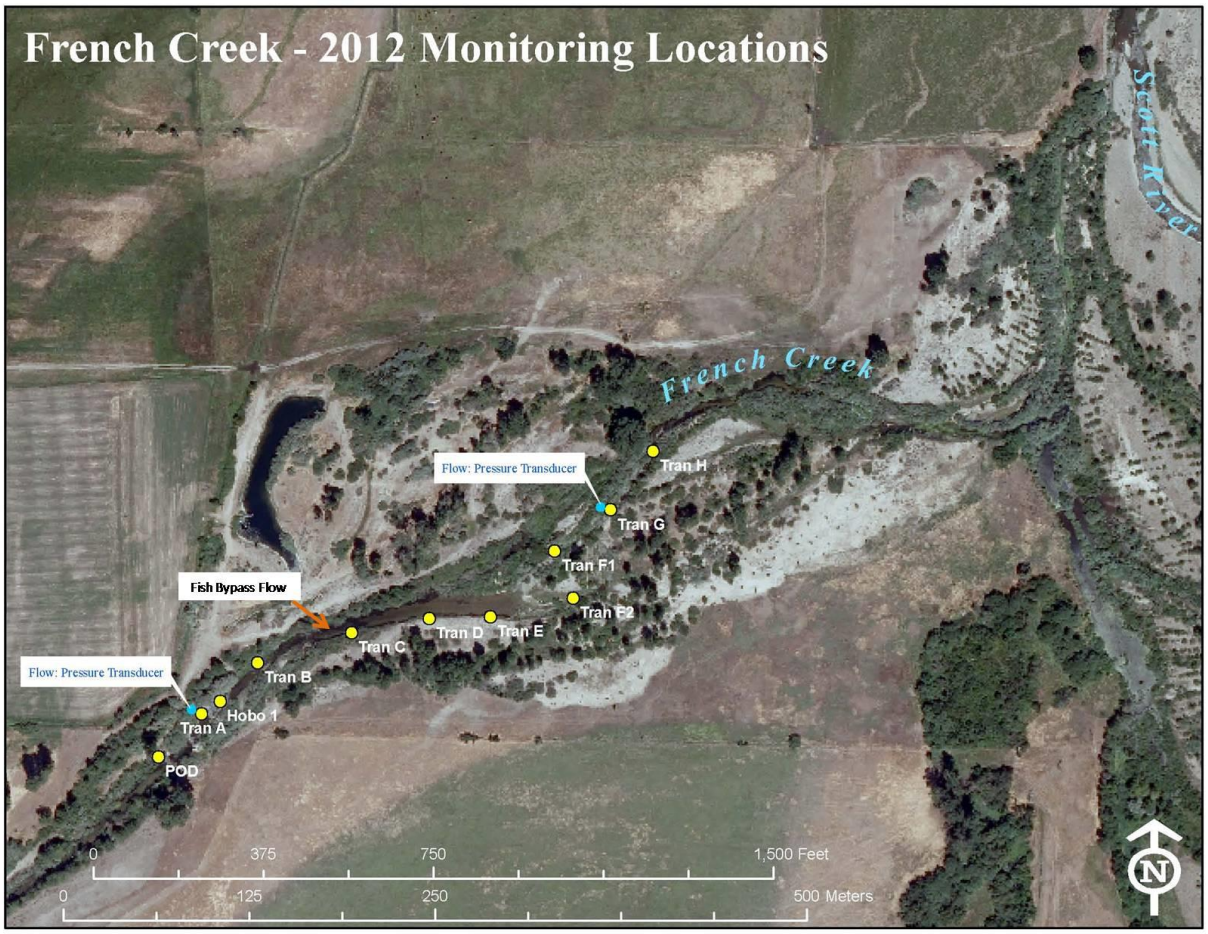


Figure 3. Monitoring locations for FR 48, including CIG project transects (Nichols et al. 2013)

As this lease was part of the NFWF CIG project, additional aquatic habit parameters were monitored at various locations (Fig. 3), following protocols identified in the draft manual by Holmes et al. 2012. Results are reported separately by Nichols et al. 2013.

Issue with Ditch and CIG monitoring:

All CIG monitoring equipment was set up on 7/13, 5 days before the lease. At this point, the ditch had already been closed down by the landowner and all diverted flows were re-entering the stream, 500 ft. below the POD, by way of the fish bypass pipe, which entered the stream beneath the water surface. We did not know that this pipe was transporting the ditch flow into the stream until Sue Maurer noticed fish grouped around the fish bypass pipe during her 'pre-lease' dive the morning of the scheduled transaction. Not knowing that the ditch had been closed down before the scheduled transaction date, we set up monitoring equipment in locations that were already being affected by the incoming ditch flow. For the CIG monitoring project, this oversight, and lack of communication by the landowner, limited our ability to effectively monitor the total instream benefit of the transaction. Flow Station A, Habitat Transects A and B, and HoboTemp 3 (riffle below

POD), were all above the fish-bypass pipe, effectively monitored pre and post lease condition (Nichols et al. 2013).

Flow Monitoring:

Table 4: Flow Measurements with FlowTracker Handheld-ADV

Date, Time	Stream Flow Below POD at FA	Relation to Transaction
7/13, 11:45	8.57cfs	Before transaction
7/19, 13:48	6.38cfs	After transaction
7/25, 14:52	4.06cfs	After transaction
8/1, 10:49	3.11cfs	After transaction
8/15, 13:33	1.72cfs	After transaction
8/29, 9:58	1.29cfs	After transaction
9/5, 11:57	1.10cfs	After transaction

Mean daily discharge at gage FA (immediately below POD) ranged from 7.51 cfs on July 13, 2012 to 0.62 cfs on September 23, 2012. Mean daily discharge at gage FG ranged from 5.85 cfs on July 14, 2012 to 0.18 cfs on September 25, 2012. FG reached baseline flow of ~0.5 cfs on August 10, 2012, and FA reached baseline flow of ~1.2 on August 18th (Fig. 4).

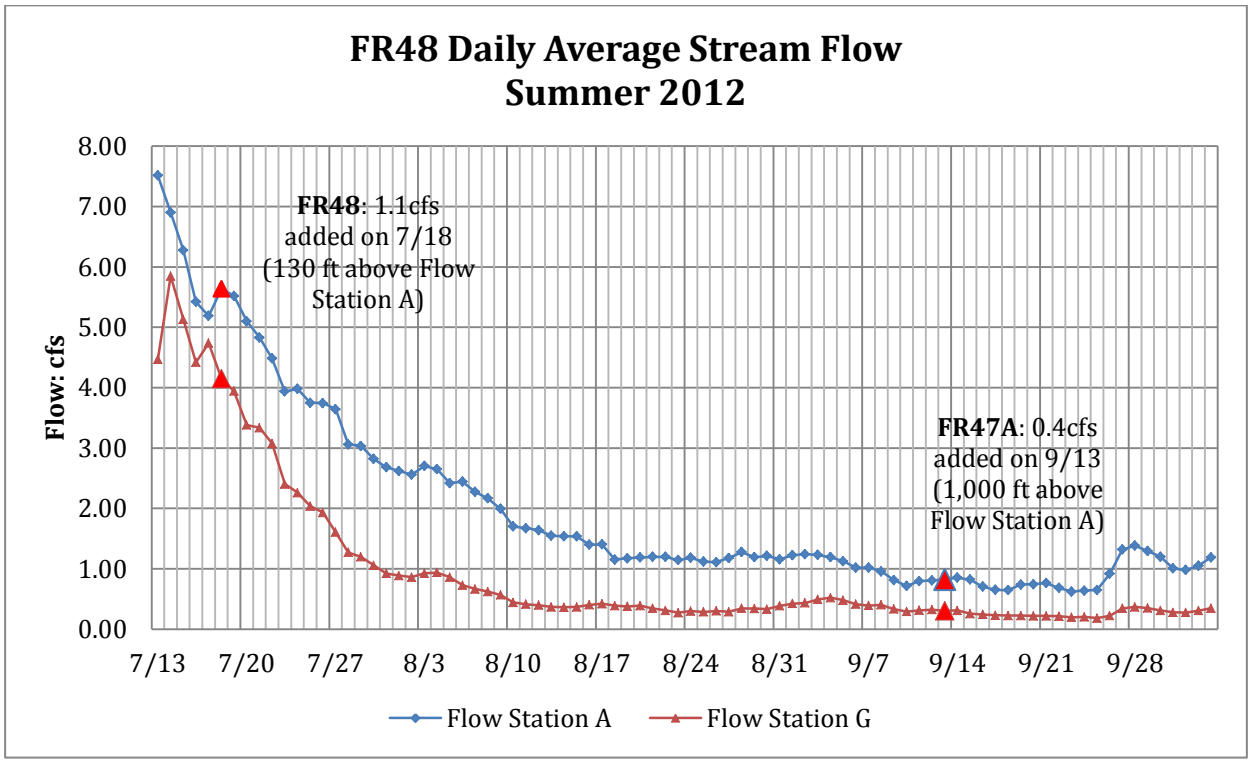


Figure 4: Daily average streamflow for French Creek, FR48. Flow Station A (FA) is 130 ft. below the POD, and Flow Station G (FG) is 1,250 ft. below the POD. Figure also shows upstream lease event at FR47, on 9/13. Lease events are shown as big red triangles.

Streamflow through this section of French Creek is highly variable due to diurnal fluctuations (Figure 4). Peak daily maximum flows, which occurred between 10am and 2pm, were typically 3 cfs greater than daily minimum flow events, which occur between 8 p.m. and 2 a.m. The transaction event took place during daily peak flows, on a day with high fluctuation. If this was the only method used to evaluate how much water was leased, it would be difficult to assess how much water was leased –partly because the water was released in two different portions while efforts were being made to rescue fish from the ditch. Some of the spikes in flow could also be due to adjustments in diversions at upstream POD's by the Watermaster.

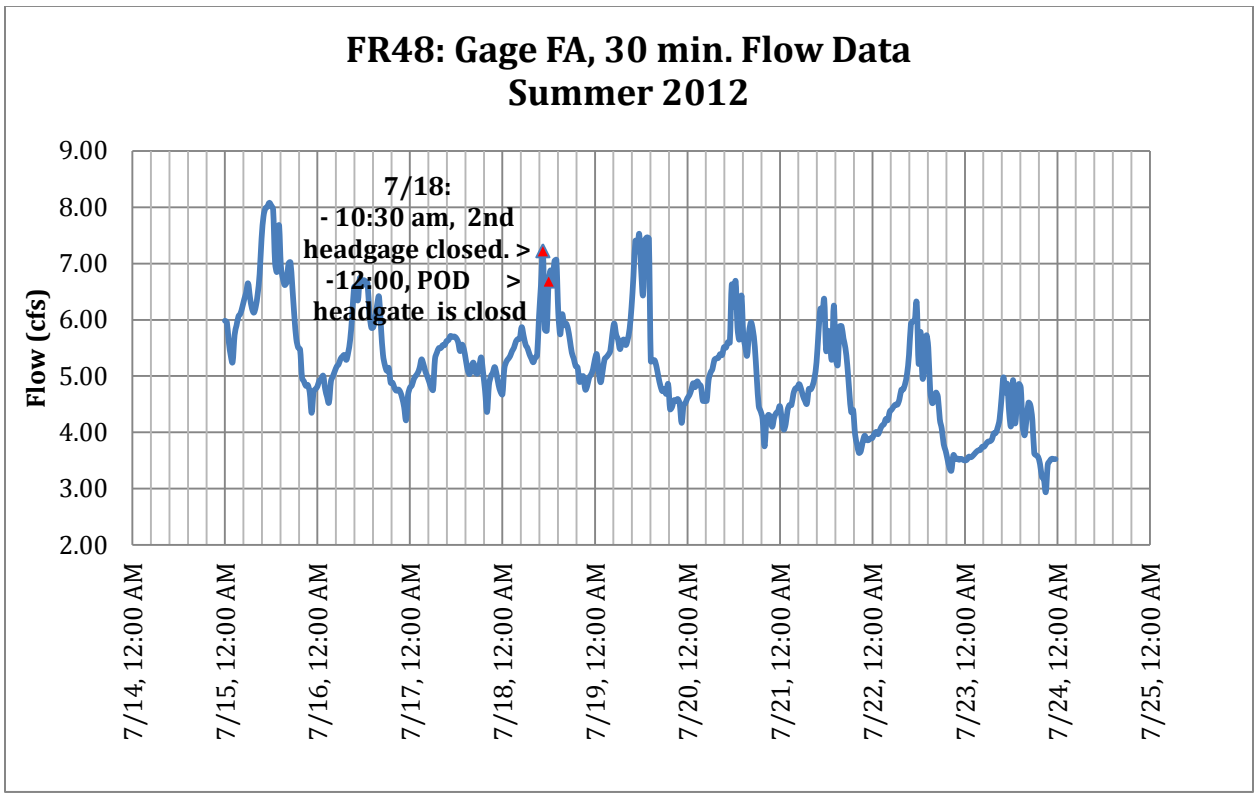


Figure 5: 30min Flow data from gage FA, for a 10 day period around the start of the lease.

Table 5 below shows the same data as the chart above but more clearly shows normal stream fluctuations and flows added by the lease. Sections are highlighted when water was released.

Table 5: 30min flow data from gage FA, for a 12 hour period around the start of the lease.

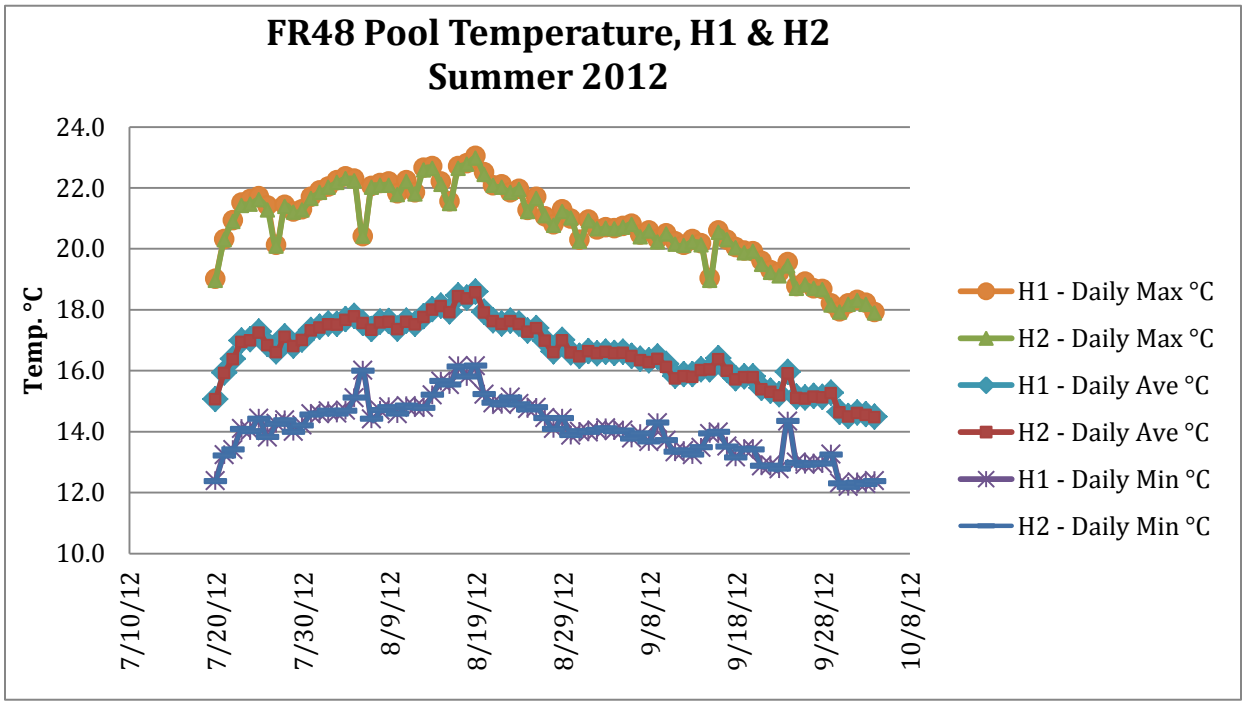
Timestamp	Staff Height	Discharge (cfs)	Lease Events
7/18/2012 5:30	0.3785	5.71	Normal fluctuation
7/18/2012 6:00	0.3768	5.56	Normal fluctuation
7/18/2012 6:30	0.3761	5.50	Normal fluctuation
7/18/2012 7:00	0.3749	5.39	Normal fluctuation
7/18/2012 7:30	0.374	5.31	Normal fluctuation

Timestamp	Staff Height	Discharge (cfs)	Lease Events
7/18/2012 8:00	0.3732	5.25	Normal fluctuation
7/18/2012 8:30	0.3742	5.33	Normal fluctuation
7/18/2012 9:00	0.3746	5.37	Normal fluctuation
7/18/2012 9:30	0.3823	6.07	Watermaster confirms ditch Q = 1.10cfs @ 9:40am.
7/18/2012 10:00	0.3878	**6.62**	
7/18/2012 10:30	0.3935	**7.23**	2nd headgate ratcheted down during fish rescue @ 10:20 (added ~ 0.6cfs)
7/18/2012 11:00	0.3798	5.83	Normal fluctuation
7/18/2012 11:30	0.3795	**5.80**	POD Headgate is closed, and sealed with plastic (added ~0.9cfs)
7/18/2012 12:00	0.3885	**6.69**	
7/18/2012 12:30	0.3903	6.88	Normal fluctuation
7/18/2012 13:00	0.3881	6.65	Normal fluctuation
7/18/2012 13:30	0.3918	7.04	Normal fluctuation
7/18/2012 14:00	0.392	7.06	Normal fluctuation
7/18/2012 14:30	0.3828	6.12	Normal fluctuation

Temperature Monitoring:

Temperature was measured in a pool 20 feet downstream of the POD. This pool was 4.7 ft. deep when the HoboTemps were placed: H1 was placed 1.6 ft. below the water's surface and H2 was placed 2.75 ft. below H1, 0.35 ft. from the bottom. Results are shown in Figure 6.

Figure 6: Daily maximum, minimum, and average water temperature, recorded by H1 and H2 HoboTemps in pool 20 ft. below POD.



The warmest day of the monitoring period was August 18th, when daily max was 23.0 °C. Coldest recorded temperature was September 30th, when the H2's Daily Min was 12.2 °C. Temperatures recorded by H1 and H2 were fundamentally the same – never more than 0.17°C difference - which shows the upper region of the pool is just slightly warmer than the deeper part. The lack of greater pool temperature stratification is likely due to the pool being well mixed.

Fish and Habitat Survey:

Observations of fish and low flow habitat conditions were performed on 9/6 through a snorkel dive in the lowest reach of French Creek to the mouth (Maurer 2012c). Results are summarized below and in Table 6 and representative sites depicted in Figures 7-10. On this date, flow was about 1.0 cfs at Flow Station A and 0.4 cfs at Flow Station G, where the channel becomes braided (Fig. 4). Three active beaver dams altered the channel characteristics.

Highlights of the survey's findings are as follows:

- Observations in French Creek from the confluence with the Scott River at the mouth up to Aquatic Habitat Transect M in the uppermost beaver pond (BD1), between 11:00 AM and 1:00 PM, were accomplished on September 6, 2012 to investigate possible disconnected surface flows and to measure dissolved oxygen and temperature. Snorkel dives took place in some pool habitats and photos were taken of fish presence in these pools.
- Surface flows in French Creek had become disconnected at the mouth for a short distance and then were continuous up to Beaver Dam #3, but riffles were very shallow and not passable by fish. The small scour pool where Hobo Temp #5 is located held ~ 75 0+ Coho salmon.
- Beaver Dam #3 held the largest number of fish, with several hundred 0+ Coho Salmon intermixed with 0+ trout and some 1+ trout. The salmon used what cover and shading was available and were very docile, with nowhere to go. They stayed closer to the bottom, where cooler water was available. Hundreds of dace were present in the upper part of the water column and upper end of the pool. The density was high, as it appears most fish had concentrated in this pool.

Table 6. Habitat observations below FR48 during dive on 9/6/12 by Maurer (2012c)

Location	Dissolved Oxygen mg/l	Water Temperature °C	Comments
Scott River at French Cr.	9.02	18.9	
Mouth of French at Scott River	3.78	18.2	Disconnected at mouth
Hobo #5 Scour Pool	6.09	16.1	Dive-many Coho and trout present
Beaver Dam #3 (BD3)	5.45	15.9-17.1 stratified	Dive-many Coho, few Chinook, some trout present, many dace
Riffle upstream of BD3	2.82	18.2	Little surface flow; algae
Base of Beaver Dam #2 (BD2) at Hobo #4	1.04	17.3	Dive- many dace, few coho and trout-visibility difficult
Beaver Dam #2 Top	7.12	14.7	Dive-most of beaver dam pool is dry-filled with sand. Small remaining pool-many Coho and trout, some dace
Riffle above BD2	7.69	18.9	No fish observed from above
Long Glide below Beaver Dam #1 (BD1)	6.37	17.5	Fish observed from above
Beaver Dam #1 Middle of pool	7.07	17.4	Dive-some Coho and trout and many dace
Beaver Dam #1 Along margin with seeps	6.94	16.5	Dive-some Coho and trout and many dace

- Beaver Dam #2 was almost completely dry, including all of the willows which were flooded in early surveys. Only a small pool near the top held water, but seemed very cold, possibly fed by the Wolford Slough, which is adjacent to the south. Approximately 200 fish were using this covered pool: mostly 0+ Coho and trout, some dace and 2 1+ and 2+ trout.

Figure 7. Lower French Creek: Beaver Dam #3

Figure 8. Lower French Creek: Density of 0+ coho, trout and dace in Beaver Dam #3 Pool

Figure 9. French Creek: Remaining Pool at Top of Beaver Dam #2

Figure 10. French Creek: 0+ Coho and trout in Remaining Pool at top of Beaver Dam #2

FR48 Conclusion:

1.) Was the amount of water paid for provided? – **Yes.**
2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? - **Yes, on stream discharge and pool volume.**
3.) What was the extent (distance) of downstream impact on flows? – **Not certain**.
4.) Was water temperature affected by leases? **– No.**

Lower French Creek - FR47A

Diversion Site: Lower French Creek, diversion #47A
Date Lease Began: September 13, 2012 Date Lease Ended: September 30, 2012
Water Right: 0.9 cfs 7th priority (French Creek Decree)
Diversion Amount on Lease Start Date: 0.20 cfs
Stream Discharge Before Lease Began: 0.34 cfs (10' above POD) 9/18
After Lease Began: not done at site; 2 recording gages below site
Downstream Benefit: no active diversions downstream to mouth of French Creek.
Fish Presence: Coho fry observed in ditch above fish screen; no snorkel dive was performed in this reach. Coho spawning adults were observed in lower French Creek in Fall 2011 (Franklin 2012).

Transaction Event Summary:

A HoboTemp was placed in the deepest part of a pool, 15' below the POD, at 6:21pm on 8/22. A stream flow calculation was completed on 9/18 (0.34 cfs at 1:32pm) 10' above the POD. On 9/13 Watermaster verified diversion Q = 0.20 cfs and closed ditch at fish screen bypass. The POD was not closed or altered because of the problem of chasing juvenile coho out of this very long and overgrown ditch back into the creek. CDFW opted to not assist SRWT in removal of fish and Watermaster was concerned about possible "take" under CESA if ditch was dewatered at the headgate. As the result, the ditch was closed at the fish screen structure, located 1,190 ft. below the POD, and all flow returned to stream by way of fish by-pass. The HoboTemp did not capture any effect of the lease, because it was over 1,000 ft. upstream of where the leased water reentered the stream. The HoboTemp was removed on 10/19.

Flow:

An instream flow measurement was not performed after the lease began as two gages existed downstream. The DWR gage (F25650), located about 500 feet below the POD but above the bypass where the leased water was returned to the stream, recorded 0.8 cfs on 9/13, with flows fluctuating between 0.7-0.9 cfs until 9/26, when flows increased to 1.1-1.5 cfs at the end of the month. The temporary CIG gage at FR48 was located 1,500 feet below

FR47A and 1,020 feet below the bypass. As shown in Fig. 4 above, the added water was not detectable within the range of precision at this lower gage.

Temperature:

The warmest daily maximum water temperature was 21.2°C, on August 23th. The coldest temperature recorded during the lease period was the last day of the lease period, 11.6 °C on September 30th. There was a general cooling trend during the monitoring period, with an average of 4.5 °C difference in daily maximum and daily minimum (Figure 11.)

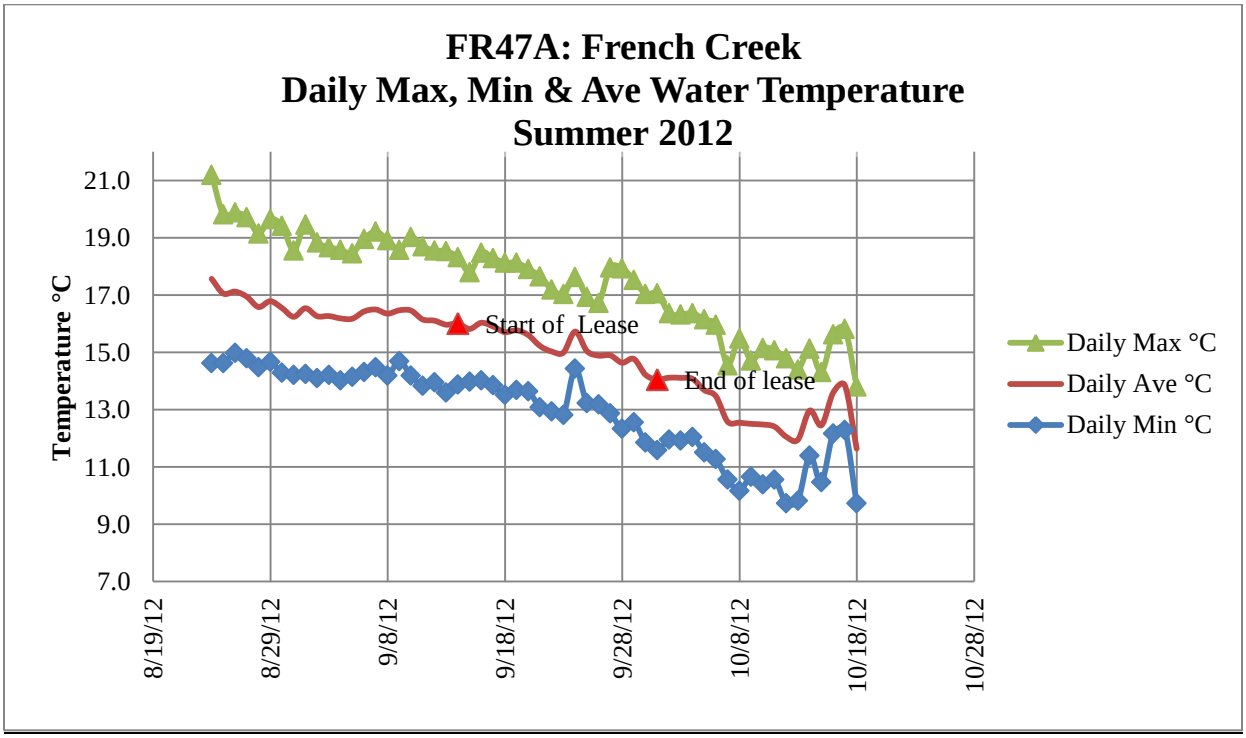


Figure 11. Water temperature at site 1,000 ft. above #47A return flow, so not affected by lease.

Fish and Habitat Survey: Not done

FR47A Conclusion:

1.) Was the amount of water paid for provided? – **Yes.**
2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? - **Yes, stream discharge, (no pools monitored).**
3.) What was the extent (distance) of downstream impact on flows? – Not measurable but no active diversions to mouth of French Creek.
4.) Was water temperature affected by leases? **– Not monitored.**

Lower Miners Creek (French) – FR36

Diversion Site: French Creek – Lower Miners Creek tributary – Diversion #36
Date Lease Began: August 9, 2012 Date Lease Ended: September 30, 2012
Water Right: 0.25 cfs, 1st Priority (French Creek Decree)
Diversion Amount on Lease Start Date: 0.25cfs
Stream Discharge Before Lease Began: 0.68 cfs (measured 8/8, 35' above POD)
After Lease Began: not measured
Downstream Benefit: To next active diversion, estimated to be 2,500 ft. to mouth of Miner's Creek plus 3,500 ft. of French Creek to next active diversion.
Fish Presence: Adult coho spawning redds and carcasses were found near site in fall 2011 (Franklin 2012). Juvenile steelhead/rainbow trout and coho salmon were observed in reach on 8/6 (Maurer 2012b).

Transaction Event Summary:

A HoboTemp was placed in the deepest part of a pool 25 feet below the POD on 8/8 at 9:40 am (same pool as previous year). A stream flow calculation, at 35 feet above the POD, was completed at 11:15am, on 8/8, and measured 0.68 cfs. Watermaster, John Clements, verified ditch Q to be 0.25 cfs on 8/9, before he closed the diversion. Hobo temp was removed on 10/19.

Water Temperature:

The HoboTemp for this lease was placed on August 8th, at 9:40 am, in a pool 25 feet below the POD. As shown in Figure 11, the first daily maximum on August 8th, the day before the lease, was 1.2°C cooler than the daily maximum of the next three days. We cannot be certain that this was due to the lease, and would need more data prior to the start of the lease to make a more confident evaluation of the leases effect on water temperature. There is a 3.5°C difference between the daily minimum and daily maximum temperature for August 9th, 10th, and 11th.

Figure 12 depicts the entire period of temperature recording between 8/8 and 10/19. The warmest daily maximum water temperature was 19.2°C on August 17th. The coldest temperature recorded during the lease period was the last day of the lease period, 9.6°C on September 30th. There was a slight increase in temperature during the first 10 days of the lease, followed by a general cooling trend.

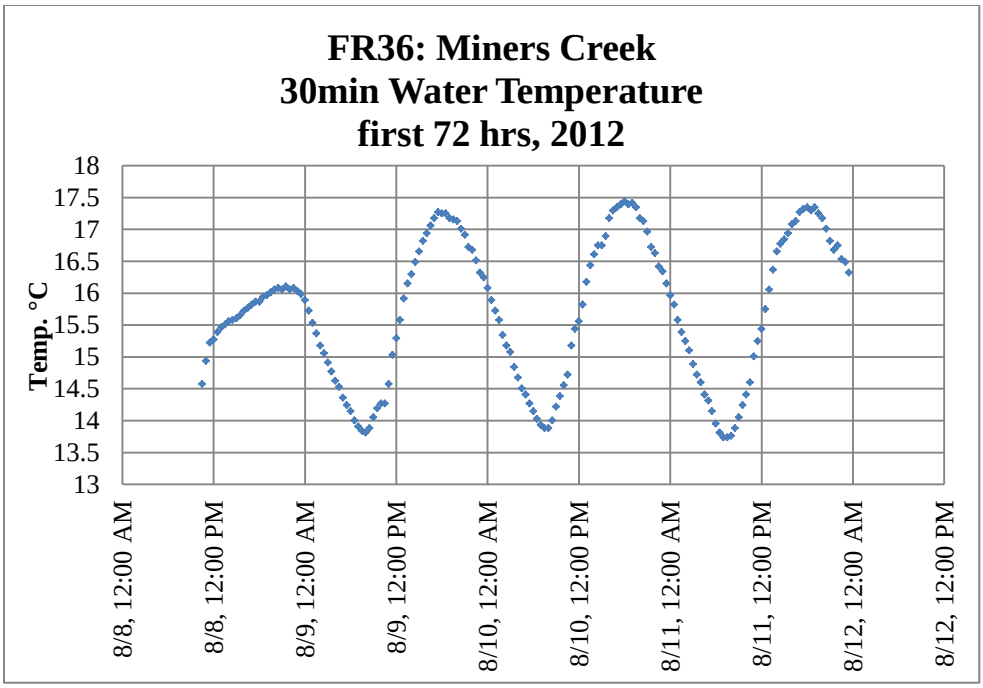


Figure 12: 30 minute water temperature data for 3 days around the start of transaction event on 8/9.

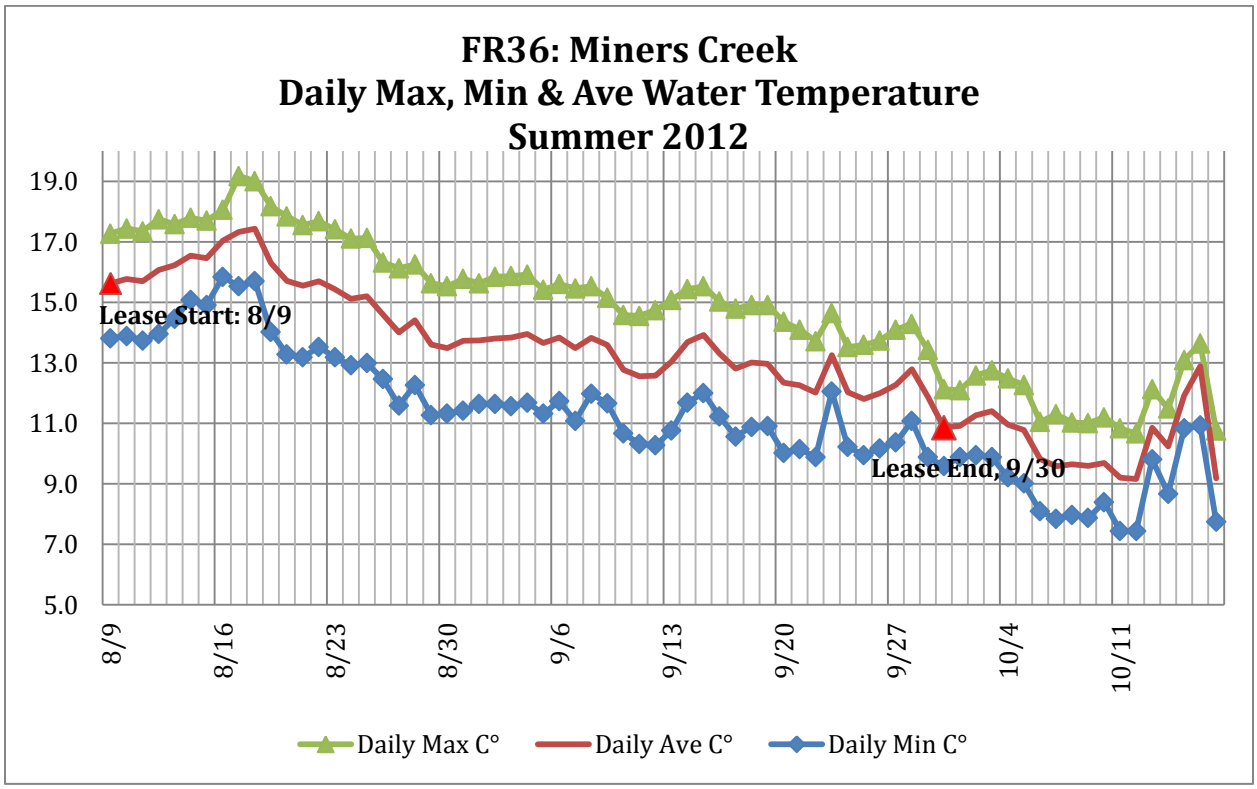


Figure 13: Daily maximum, minimum, and average water temperature of a pool in Miners Creek, 25 ft. below FR36 POD.

Fish and Habitat Survey:

Contractor Sue Maurer performed a dive survey on the day the lease transaction began on August 9th for the purpose of identifying the presence or absence of juvenile salmonids in selected habitats within the beneficial reach of the lease. Following is an excerpt of her full report (Maurer 2012b):

"Two reaches of Miners Creek were snorkeled: 1) the upper reach, just below the POD (point of diversion) on adjacent landowner property, a very short section through the weirs below the POD; and from the confluence of French Cr. to the upper property line, approximately 1/3 mile. Species identification and a cursory estimate of relative numbers by species were attempted. However, the minimal amount of time allotted for this activity limited the ability to fully assess all portions of each of these reaches.

Upper Reach below POD:

9:45 AM Dive
Air Temp = 16.1 °C
Water Temp = 13.9 °C
Weather: clear

"Flows were quite low in Miners Creek at this time. The two artificial pool habitats just below the POD were snorkeled. Below the lower pool (Pool 2), was a shallow riffle. Constructed rock weirs formed the pools, the lower pool having the larger pool volume. Neither pool had much in-stream cover, except for large boulders. The substrate was primarily small granitic sand sized particles and boulders. Overhead canopy cover provided shading to the pools. The fish were very docile and did not try to move from the pools. The following fish were observed:

Pool 2 (lower)	**Est. #**	**Ave. size**
0+ coho salmon	~75	100 mm
	~50	65 mm
0+ trout	~75	50 mm
1+ trout	~40	100+ mm
2+ trout	~15	>180 mm
	1	>250 mm
Pool 1 (upper)		
0+ coho salmon	~20	100 mm
0+ trout	~50	55 mm
1+ trout	~ 3	100+ mm

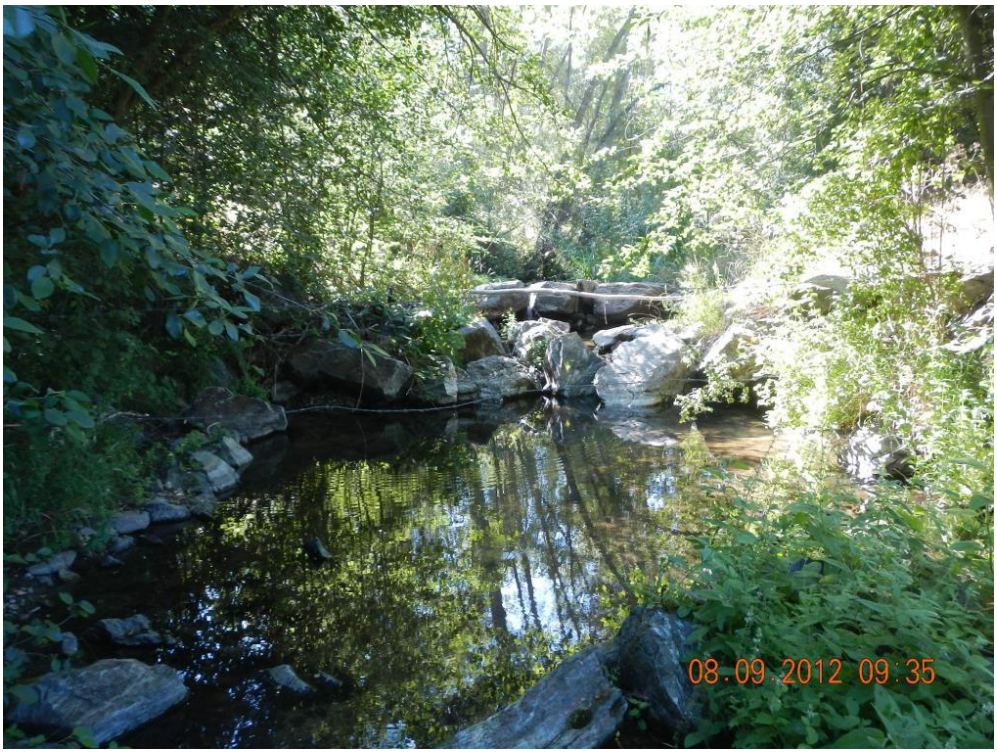


Figure 14: Miners Creek: Upper Reach below POD at Pool 2 (lower)

Figure 15: 0+ Coho salmon and 1+ trout intermixed in Pool 2

Lower Reach:
10:55 AM Dive
Air Temp = 18.4 °C
Water Temp = 14.7 °C Miners Cr.
Water Temp = 14.2 °C French Cr. at confluence
Weather: clear

Confluence Pool in French Creek, just below Miners Creek Confluence

Age / Species	Est. #	Ave. size
0+ coho salmon	~200+	65-105 mm
0+ trout	~100+	45-60 mm
1+ trout	~50	100+ mm
2+ trout	few	>180 mm

Miners Creek -Glide Habitats & Pools-overall

0+ coho salmon	many hundreds	65-105 mm
0+ trout	several hundred	45-60 mm
1+ trout	dozens	100+ mm
2+ trout	few	>180 mm

"0+ coho salmon were the most abundant of the fish species observed. They appeared to be of two size classes, the smaller class ~65 mm and the larger class ~ 100 mm. The smaller 0+ trout resided in the margins and at the tail of the pool/glides. Overall there seemed to be more coho salmon than trout below the sub-surface portion of the reach, with the reverse true above- more trout than coho salmon, but the largest of the coho were at the top of the reach in the bedrock pool where the irrigation pipe crosses overhead."

Figure 15. Confluence Pool in French Creek below Miners Creek confluence, 8/9/12.

FR36 Conclusion:

1.) Was the amount of water paid for provided? – **Yes.**
2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? - **Yes, stream discharge (no pools monitored).**
3.) What was the extent (distance) of downstream impact on flows? – **Not monitored**.
4.) Was water temperature affected by leases? **– No.**

Miners Creek – FR33

Diversion Site: French Creek tributary - Upper Miners Creek Diversion #33
Date Lease Began: August 17, 2012 Date Lease Ended: September 30, 2012
Water Right: 1.22 cfs 2nd priority (French Creek Decree)
Diversion Amount on Lease Start Date: 0.60 cfs (verified by Watermaster)
Stream Discharge Before Lease Began: 0.14 cfs After Lease Began: 0.70 cfs
Downstream Benefit: 7,000 feet downstream to next diversion (#36), which was also leased; total distance is 13,000 feet.
Fish Presence: Water user rescued fish from between POD and fish screen, but no fish species were identified. Juvenile coho and steelhead/trout were observed in lower Miner's Creek in August snorkel dive survey (Maurer 2012 a). Adult coho spawning redds were observed in lower French Creek in fall 2011 (Franklin 2012).

Transaction Event Summary:

A hobo temp was placed at upper Miner's bridge at 7:30 pm, 8/16 - 1,700 ft. below POD, 50' below bridge on Miners Creek Rd. On the day of the transaction, 8/17, a stream flow calculation was completed at 8:35am, 305' below the POD and 165' below the fish bypass, and measured 0.14cfs. Watermaster, John Clements, measured diversion Q = 0.60cfs @ 9:15am. The lower headgate was closed at 9:20, so that all ditch flow re-entered stream by way of fish bypass. The landowners chased fish out from the short section of ditch between the POD and lower headgate and back into the creek through the bypass, and agreed to close upper headgate by end of that day so that no flow would enter the ditch. A post transaction stream flow calculation was completed at 10:51am and measured 0.70 cfs in Miners Creek (same location). Net instream benefit measured = 0.70 – 0.14 = 0.56 cfs. Additional stream flow calculations were completed on 9/5 (0.66cfs at 10:31 am) and 9/18 (0.67cfs at 11:18am) to inform transaction payment schedule. The hobo temp was removed on 10/19; lease ended on 10/1.

Flow Monitoring:

Date (time)	Stream Flow Below POD	Timing
8/17 (8:35am)	0.14 cfs	Before transaction
8/17 (10:51am)	0.70 cfs	After transaction
9/5 (10:31am)	0.66 cfs	After transaction
9/18 (11:18 am)	0.67cfs	After transaction

Temperature Monitoring:

During each day of the first 72 hours of the lease, daily water temperature fluctuated ~5 °C, between a maximum of ~20° C around 6 pm, and minimum of ~14.5° C around 8 am (Figure 16). The lease did not appear to have any effect on water temperature, as there is no visible shift in the smooth curves of normal temperature fluctuation.

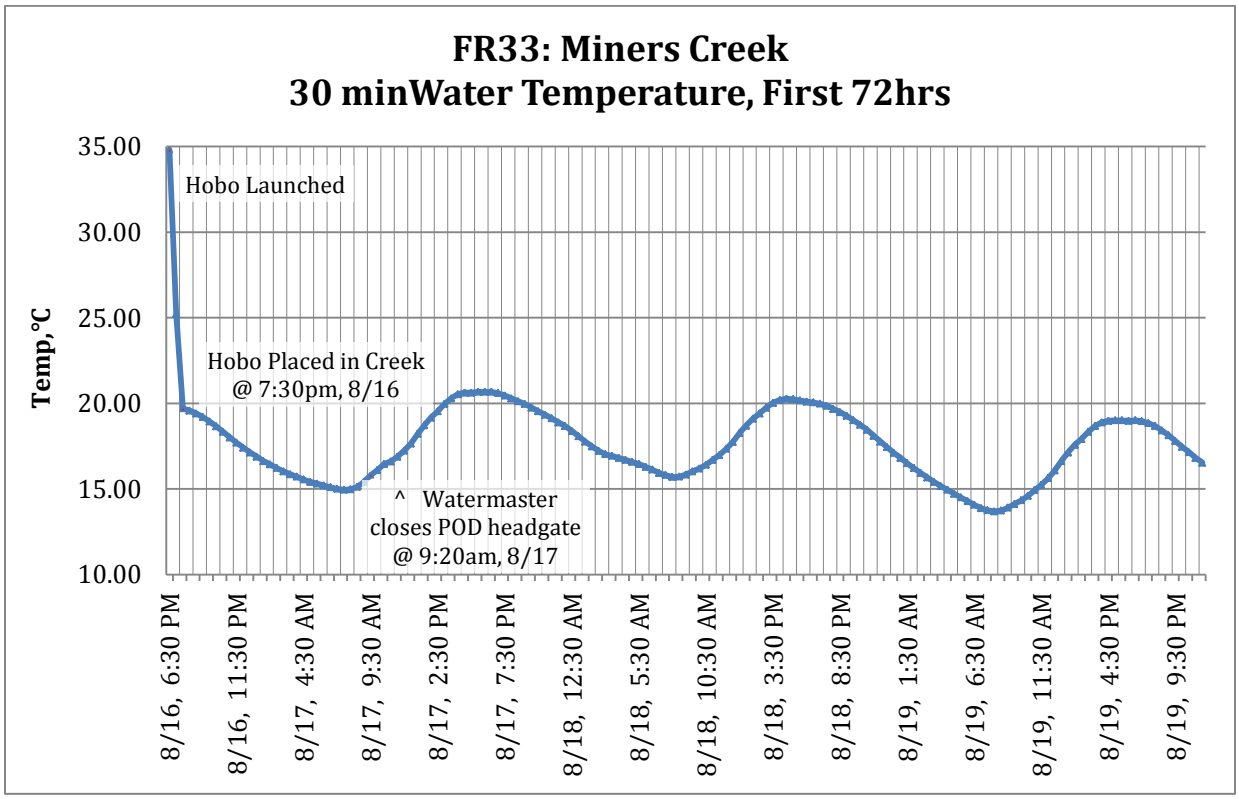


Figure 16: 30 minute water temperature data for3 days around the start of transaction event.

For the period of recorded data, the day of the transaction, August 17th, had the warmest daily maximum water temperature of 20.7°C. The coldest temperature was 8.5°C, recorded on the last day of the transaction, on September 30th. There was a general cooling trend throughout the period, and a constant 5°C difference between daily maximum temperatures and daily minimum temps (Figure 17.)

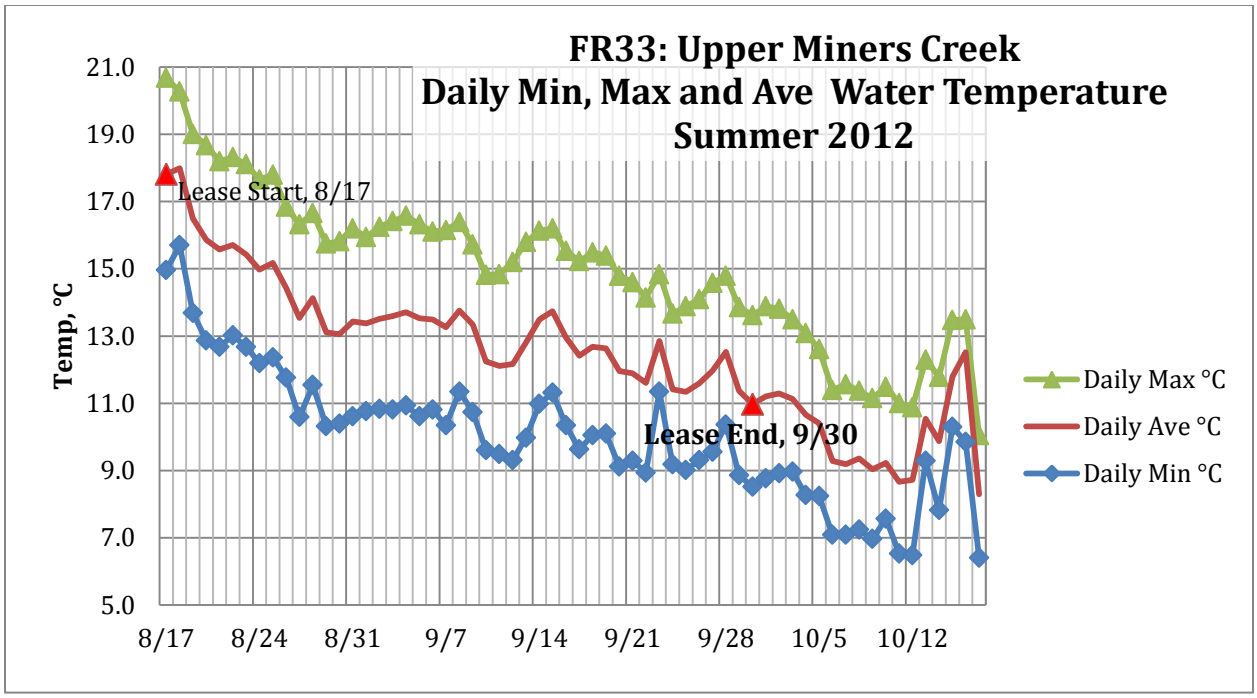


Figure 17: Daily maximum, minimum and average water temperature in upper Miners Creek, 8/17 to 10/18. Lease period ended 9/30.

FR33 Conclusion:

1.) Was the amount of water paid for provided? – **Yes.**
2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? - **Yes, stream discharge, (no pools monitored).**
3.) What was the extent (distance) of downstream impact on flows? – **Not monitored**. (7,000 feet to next diversion, leased on 8/31; 3,000 ft. to next one.)
4.) Was water temperature affected by leases? **– No.**

Figure 18: Miners Creek channel, 37 ft. below POD, 0.14 cfs before transaction

Figure 19: Miners Creek channel, 37 ft. below POD, 0.70 cfs after transaction

Upper French Creek - FR20

Diversion Site: Upper French Creek, Diversion #20
Date Lease Began: August 31, 2012 Date Lease Ended: September 30, 2012
Water Right: 0.58 cfs, 1st priority (French Creek Decree)
Diversion Amount on Lease Start Date: 1.2 cfs
Stream Discharge Before Lease Began: 2.90cfs (+/- 3.3%)
After Lease Began: 3.26 cfs (+/- 3.1%)
Downstream Benefit: 2,800 feet to next active diversion (#23)
Fish Presence: Adult coho spawning redds and carcasses were found near site in fall 2011 (Franklin 2012). Juvenile steelhead/rainbow trout and coho salmon were observed in reach on 9/11 (Maurer 2012a).

Transaction Event Summary:

On 8/31, the Watermaster, John Clements, measured ditch Q at cement weir below fish screen and determined ditch flow at 1.2 cfs. (This amount was double the water right according to John and may be due to diurnal flow fluctuation; previous diversion rates had been 0.6-0.7 cfs.) John dialed back the lower headgate so that ditch was only diverting allowable water right of 0.58 cfs, @ 9:35 am. A stream flow calculation was completed at 11:22 am, 232 ft. below fish bypass: 2.90 cfs. At 12:00 pm, the lower head gate was closed so that all ditch flow re-entered the stream by way of fish bypass. A stream flow calculation was completed at 1:12 pm: 3.26 cfs. Measured net instream benefit = 0.36 cfs added. No Hobo temp was deployed for this transaction.

Flow Monitoring:

Date (time)	Stream Flow Below POD	Timing
8/31, 11:22 am	2.90 cfs (+/- 3.3%).	Before transaction
8/31, 1:12 pm	3.26 cfs (+/- 3.1%)	After transaction

Temperature Monitoring: None performed.

Fish and Habitat Survey:

Contractor Sue Maurer performed a snorkel dive on 8/31, the day of the transaction, for the purpose of identifying the presence or absence of juvenile salmonids in selected habitats within the reach above and below the point of diversion (POD). Following is an excerpt from her full report (Maurer 2012a):

09:46 AM Dive

Air Temp = 13.8 °C
Water Temp = 11.4 °C
Weather: clear

"The stream habitat consists of primarily shallow step pools and glides, with a dominant bedrock substrate and sandy fine sediment deposits. The reach is regularly mined, so it is disturbed. Bedrock and an occasional boulder are the only instream cover components, except for minor bubble curtains at these flows. The riparian canopy is good and the shading creates a dark shadow over the POD pool.

In POD pool:

Age/Species	Est. #	Est. Size
0+ trout	12	~45-60 mm in tail-out and in ditch inlet
1+ trout	6-8	~75-120 mm
0+ coho salmon	15	~85-100 mm intermixed with 1+ trout

Figure 20: POD pool with good shading

"The 0+ coho salmon stayed in a school as I moved about. They utilized what cover there was around a large boulder and made no effort to move either upstream or downstream. Very small 0+ trout (~40mm) were observed in the first 10 m of the ditch, which was very shallow, with a light colored sandy bottom."

Figure 21: School of 0+ coho salmon in POD pool

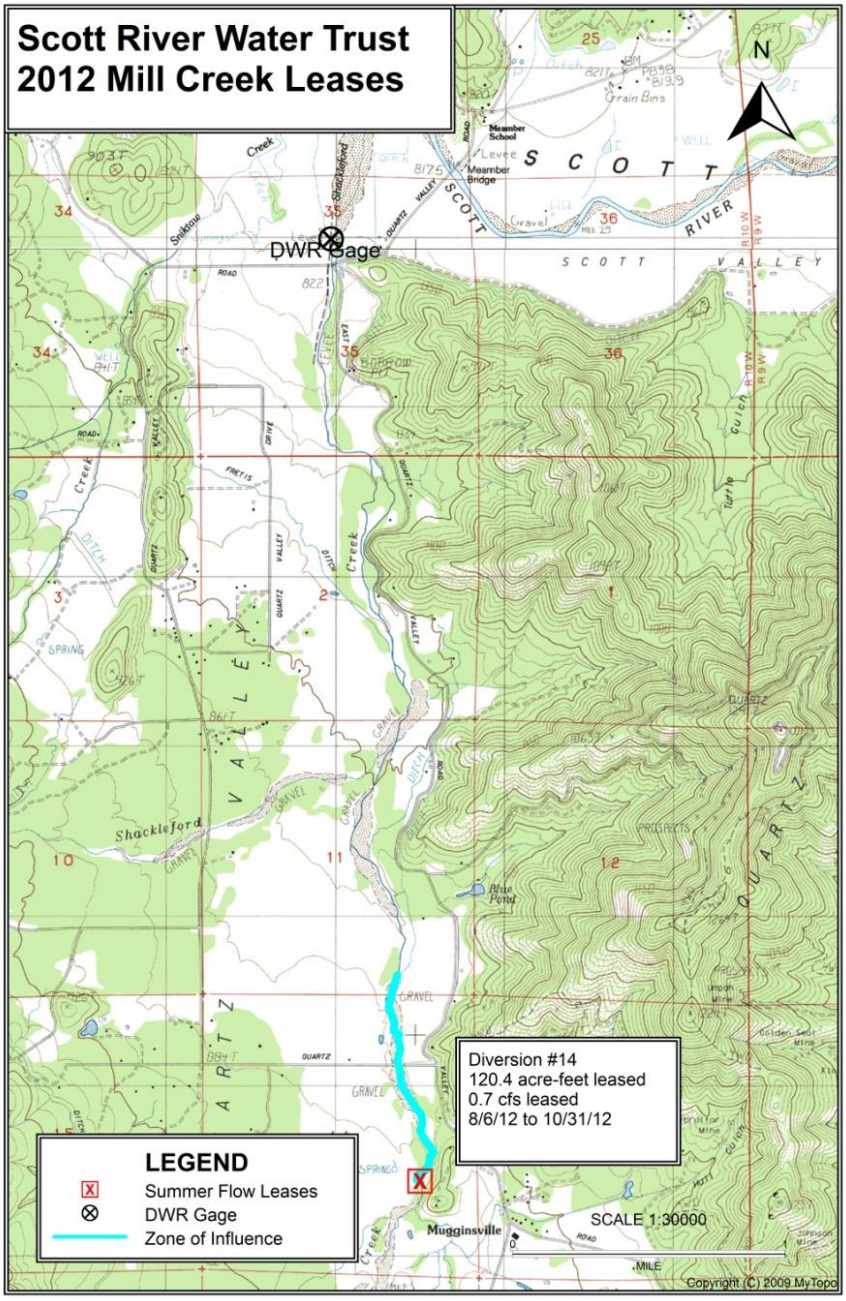
Below POD:

Age/Species	Est. #	Est. Size
0+ trout	6-8	~45-60 mm in most habitats
1+ trout	1-2	~60-120 mm in most shallow pools
2+ trout	few	>120 mm
Possible 0+Chinook	1	~85 mm

FR20 Conclusion:

1.) Was the amount of water paid for provided? – **Yes.**
2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? - **Yes, stream discharge, (no pools monitored).**
3.) What was the extent (distance) of downstream impact on flows? – **Not monitored**. (to next diversion)
4.) Was water temperature affected by leases? **– No.**

Shackleford Creek Lease:



Map 3

SH14 - Shackleford-Mill Creek

Diversion Site: Shackleford Creek Diversion #14, on lower Mill Creek
Date Lease Began: August 6, 2012 Date Lease Ended: October 31, 2012
Water Right: 1.4 cfs, 2nd priority
Diversion Amount on Lease Start Date: 0.7 cfs
Stream Discharge Before Lease Began: 5.71 cfs (below POD) After Lease Began: not done
Downstream Benefit: 4,000 ft.
Fish Presence: Steelhead/rainbow trout, coho salmon

Transaction Event Summary:

A HOBO water temperature logger was placed below the POD in the Mill Creek tributary of Shackleford Creek on 8/6 @ 11:06 a.m. and a stream flow calculation was completed at 12:07 p.m. measuring 5.71 cfs below the POD. Watermaster John Clements measured ditch flow in a cement weir and confirmed that ditch flow was such that no alterations to POD were necessary, due to low streamflow levels at this time. No alterations to POD were made. The Watermaster and landowner also said that streamflow levels fluctuate depending on his upstream neighbors' irrigation schedule, and the landowner agreed that no additional water would be diverted if/when streamflow levels increased. No streamflow was measured after transaction because no water was released. HOBO logger was removed on 11/16.

Temperature Monitoring:

The warmest daily maximum water temperature at this Mill Creek site was 15.5°C, on August 12th. The coldest temperature recorded during the lease period was the last day of the lease period, 9.4°C on October 21st. There was a slight period of warming during the first two weeks of the lease period, followed by a general cooling trend. During the first 3 weeks, the difference between daily maximum and daily minimums was 3°C, and during the last week, the difference was 1°C.

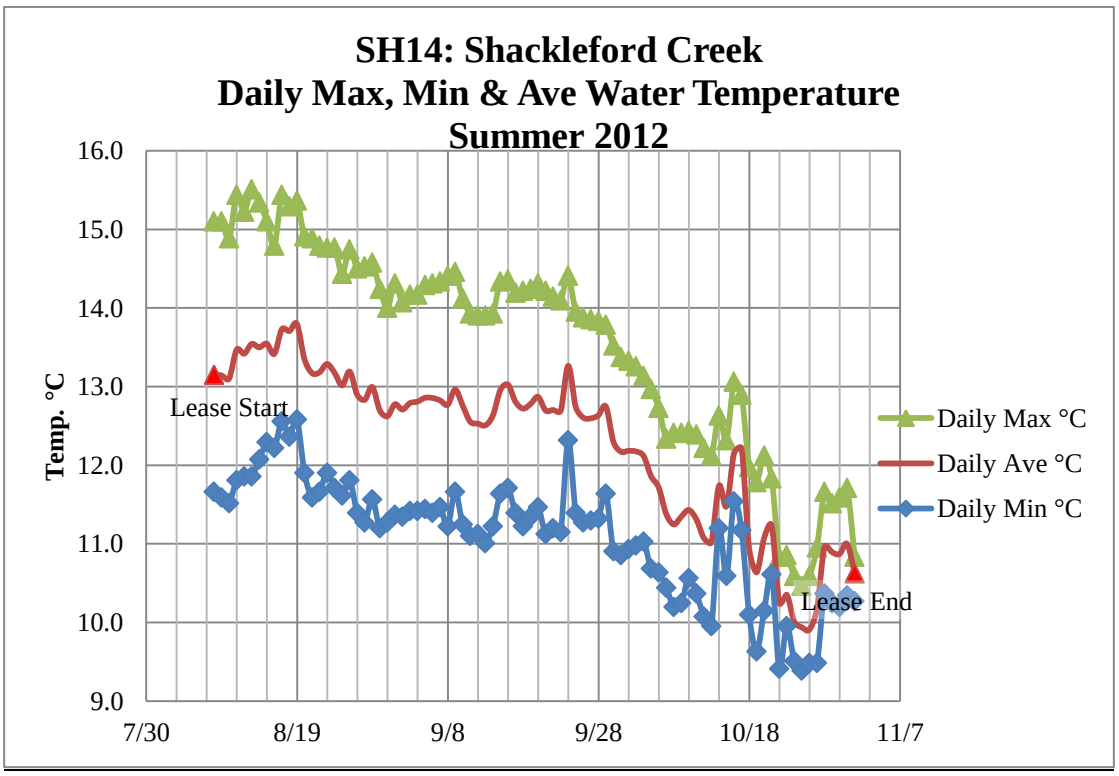


Figure 21. Daily max, min, and average water temperature of Mill Creek, below diversion SH14.

Fish and Habitat:

Sue Maurer surveyed the reach on Aug. 6th, took photos, and wrote a dive report (Maurer 2012d). Her notes reveal the following:

- The upper reach above Quartz Valley Road bridge is well vegetated on both sides, with good canopy cover. Recent beaver activity was noted on cottonwoods.
- Instream habitat consists of shallow riffles and runs with few shallow pools, with small wood and undercut banks providing most of the cover for fish.
- Trout numbered in hundreds for 0+, but also some 1+ and 2+ were seen in deeper habitat with woody cover. Young coho were < 100 but looked robust in the 85-100mm size range.
- In the lower reach about ½ mile below the bridge, one section was shallow and wide with little canopy cover while the upper section had good riparian shade. A partially dismantled beaver dam was seen below the bridge, with the deepest pools found in the old beaver dam pool.
- From hundreds to thousands of 0+ trout were observed in both sections, using mainly shallow riffles and runs. Several hundred 1+ trout (60-160 mm) and 4-5 2+ trout (160-300 mm) were seen near woody cover. Coho salmon were observed intermixed with trout in deeper habitats, with 4-5 per pool in the 100 mm range.

Figure 22. Typical run habitat, with shallow pool at top.

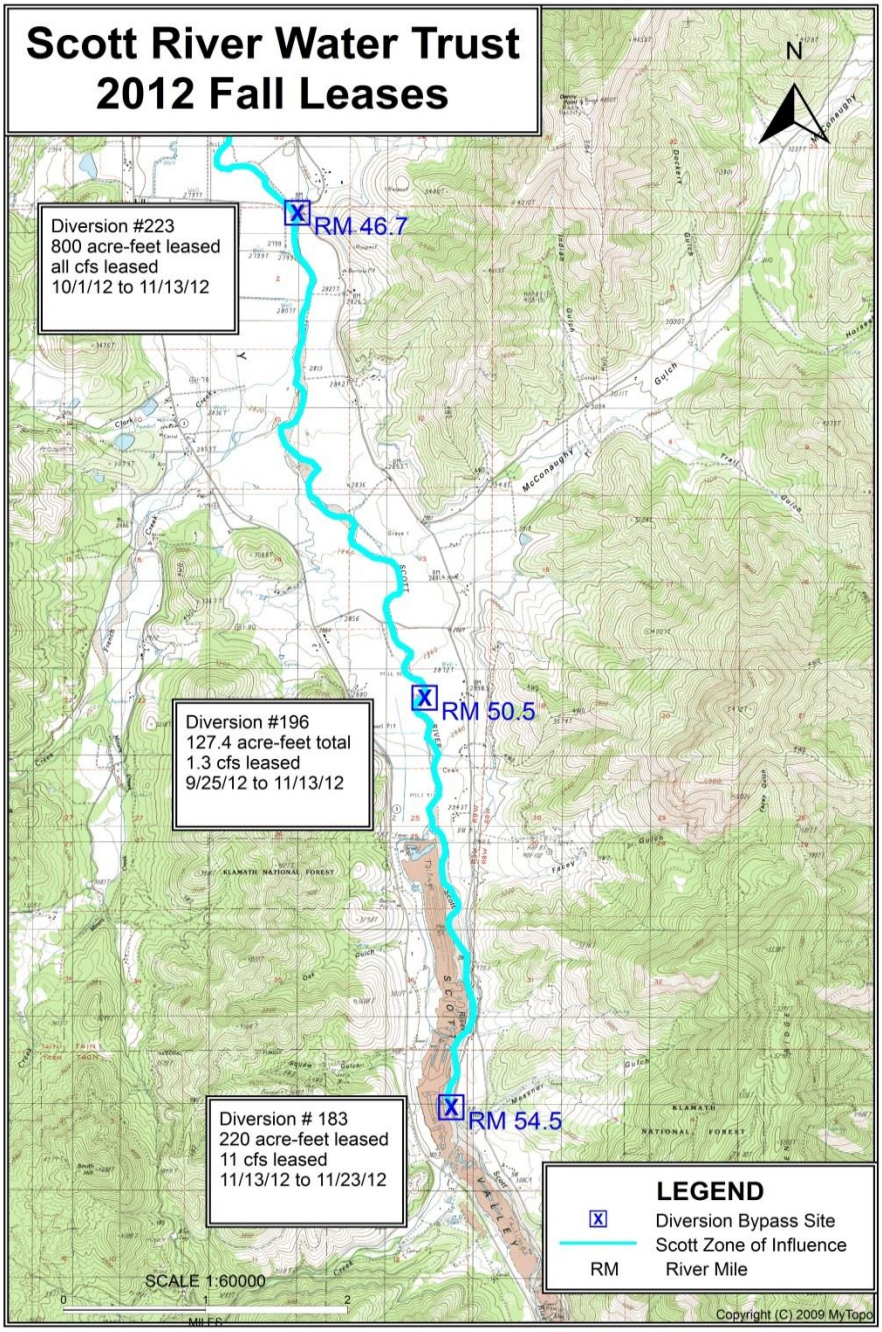
Figure 23. Trout using tree roots for cover.

SH14 Conclusion:

1.) Was the amount of water paid for provided? – **Yes, but before start date.**
2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? - **Not monitored.**
3.) What was the extent (distance) of downstream impact on flows? – **Not monitored**.
4.) Was water temperature affected by leases? **– No.**

Results: Fall Leases on Scott River

Three sites on upper Scott River were leased during stockwater season after Oct. 1.



Map 4. Fall lease locations on upper Scott River.

Scott River - SR223 (Young's Dam)

Diversion Site: Mid-Scott River, mile 46.7 (Young's Dam); Scott River Decree #233-13-D2
Date Lease Began: October 1, 2012 Date Lease Ended: November 13, 2012
Water Right: ~8-12 cfs for stockwater use by ditch users
Diversion Amount on Lease Start Date: 0 cfs (diversion ceased earlier in summer); lease amount was up to 800 acre-feet, if needed.
Stream Discharge Before Lease Began: 3.91 cfs
After Lease Began: 3.91 cfs
Downstream Benefit: 46.7 miles to mouth of Scott River (no downstream surface or groundwater diversions after irrigation season).
Fish Presence: Chinook and coho salmon adults, during fall spawning migration.
Lease Objective: To improve adult fish passage and spawning habitat availability in the mid-Scott River and above Young's Dam.

Monitoring of this lease was also part of the NFWF CIG project. Aquatic habitat results from that study can be found in the report by Nichols et al. 2013.

Transaction Event Summary:

This lease was different than the other leases in that the diversion was taking no water at the start of the lease period due to too little river flow (< 4 cfs at POD). The diversion would have been able to take a stockwater right, starting 10/1/2012, as the river's flow naturally increased in the fall. All water rights were leased and no water was diverted until 11/13, 8:30 am, when the ditch was opened and started diverting 7.4 cfs (+/- 3.9%). RCD's flow monitoring station is located 400 ft. below SR223 POD.

Flow:

As shown in Figure 23, streamflow at the start of the lease period was at baseline flows of less than 4 cfs, and slowly increased during the first 30 days, to 20 cfs on October 29th. A large spike in flow of 64.9 cfs occurred on November 2nd, likely due to rain events, after which, streamflow returned to ~30 cfs until the end of the lease. Once the lease ended on November 13th, the SR223 POD was opened to divert their stockwater right, causing a drop in stream flow from 28.6 to 23.3 cfs.

The large spike in flows that occurred near the SR223 POD on November 2nd is not as dramatic on the USGS Gage at RM 21 (Fig. 24). The USGS gage shows more steady and stable increase in streamflow from October 6th to November 3rd. Streamflow during that period is below the 71 year average, until November 18th and 19th, where rain events caused first major spike in flow - same rain events that helped connect dry section downstream of SR183 lease in the tailings reach.

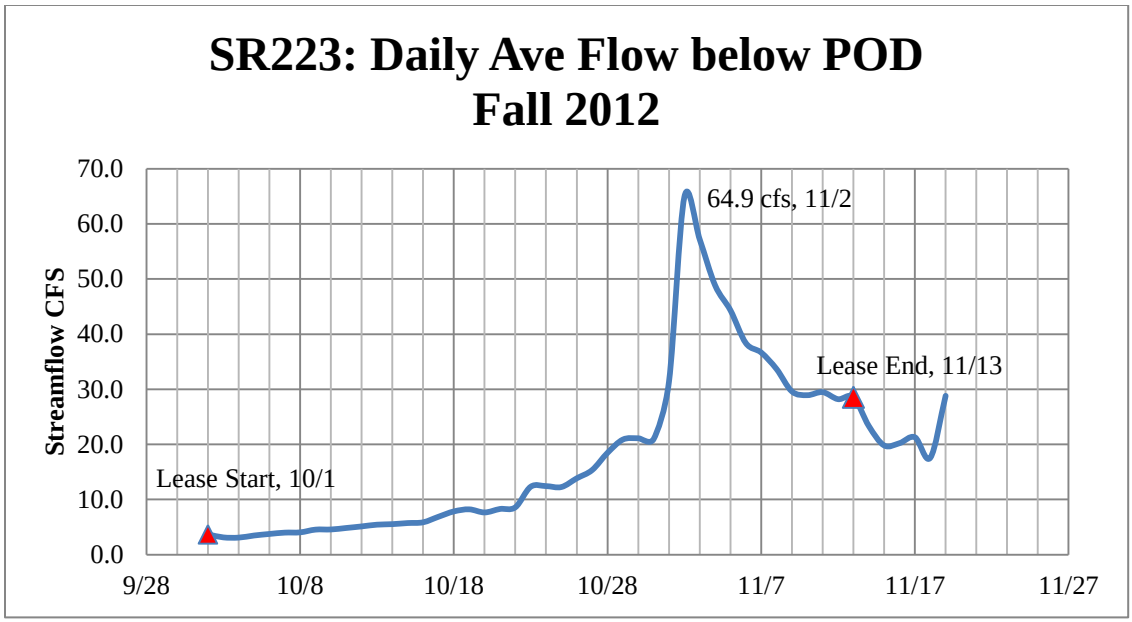


Figure 23. Daily average streamflow of Scott River at RM 47, 10/1- 11/18.

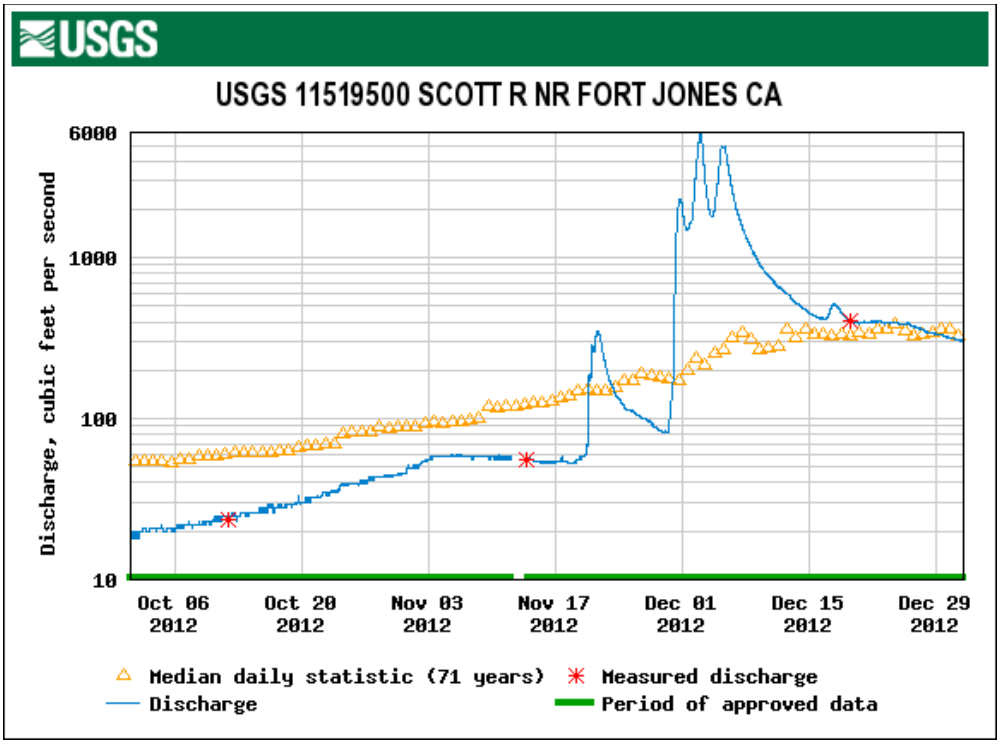


Figure 24. Scott River runoff, 10/1/12 – 12/31/12, at USGS gage at RM 21 (USGS 2012)

The figure below shows Daily Volume Total in acre-feet, where each bar represents total daily volume of water passing over Young's Dam and past the POD, amounted to 1,509.1 acre feet for the lease period.

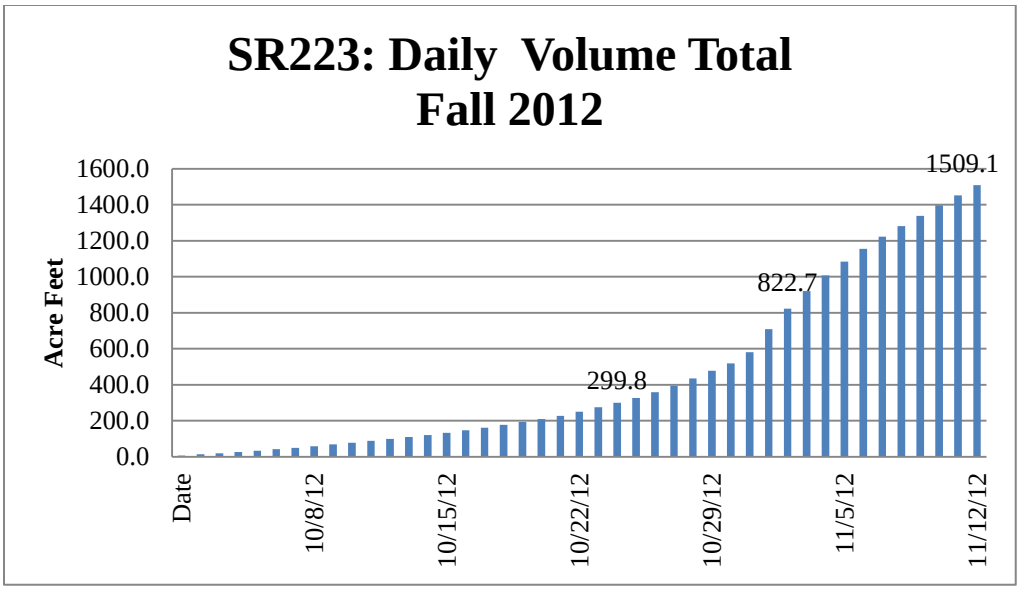


Figure 25. Daily and total volume of water flowing past SR223 at RM 47

Fish Presence:

First Chinook salmon spawners were observed in the Scott River at the CDFW counting facility (video weir) downstream at RM 18 on 10/5 and peaked between 10/12 and 11/6. First coho spawners were seen on 10/27, peaking between 11/13 and 11/25 (Knechtle 2012). Both species were observed, in the mid-Scott reach below and in the upper Scott reach above the lease site at Young's Dam, during the lease period by the RCD salmon spawner survey crew, including the author (Yokel, D. 2013).

Figure 26. Chinook salmon adult observed below POD on 10/23.

Figure 27. Scott River at Young's Dam and fish ladder on 10/1, start of lease.

Figure 28. Scott River at Young's Dam and fish ladder on 11/13, end of lease.

SR223 Conclusion:

1.) Was the amount of water paid for provided? – **Yes.**
2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? – **Yes, stream discharge.**
3.) What was the extent (distance) of downstream impact on flows? – **Not monitored**. (No active surface or groundwater diversions downstream.)

4.) Was water temperature affected by leases? **– Not Monitored.**

Scott River - SR196

Diversion Site: Scott River 196-13-D2 (SR196) – River Mile 50.5
Date Lease Began: September 25, 2012 Date Lease Ended: Nov. 13, 2012
Water Right: 1.3 cfs
Diversion Amount on Lease Start Date: 1.4 cfs (+/- 2.1%)
Stream Discharge Before Lease Began: not done
After Lease Began: not done
Downstream Benefit: 4 miles (to SR 223)
Fish Presence: Chinook and Coho adult salmon, fall spawning migration. During the Chinook Fall Spawning Survey, RCD technicians identified live Chinook and redds, just downstream of the Fay Bridge. Fay Bridge was the upper extent that was surveyed for Chinook Fall Spawning Survey on mainstem Scott River.

Transaction Event Summary:

On 9/25, a ditch flow calculation was taken 30 ft. above the fish screen, which found that ditch flow was 1.4 cfs at 10:47a.m. The ditch was closed at the fish screen and all ditch water re-entered the river by way of the fish bypass pipe, 1,600 ft. bellow the POD. The ditch headgate was sealed with plastic and rocks, and remained closed for the duration of the lease. No temperature device was deployed, as the goal of this lease was to improve fish passage for fall Chinook and Coho migration, unlike the summer leases, which focus on improving summer rearing habitat, where temperature is an important factor.

Figure 29: Scott River #196: Fish bypass outflow pipe, before transaction.

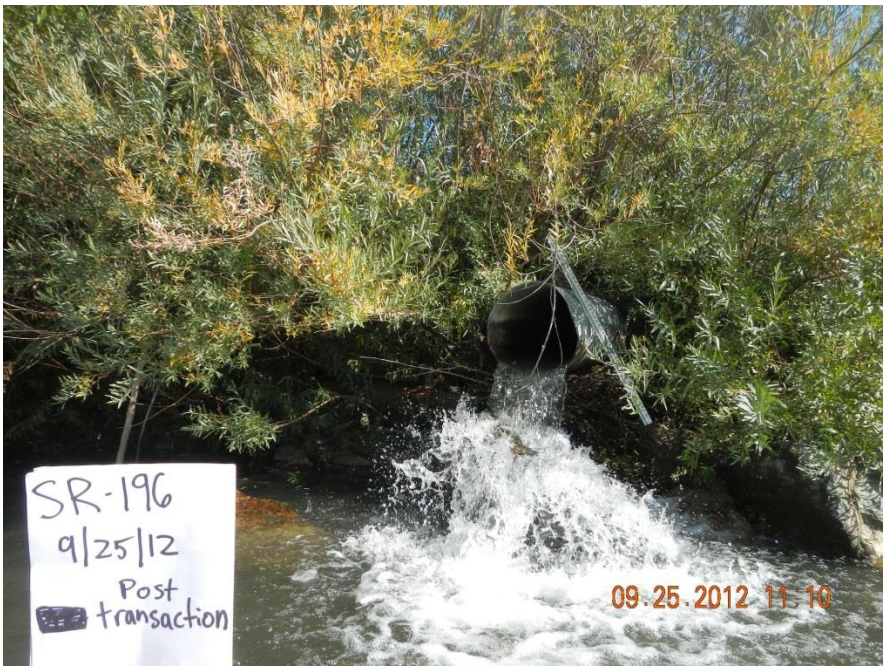


Figure 30: Scott River #196: 1.4 cfs of water released through fish bypass outflow pipe.

SR196 Conclusion:

1.) Was the amount of water paid for provided? – **Yes.**

2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? – **Yes, stream discharge (no pools monitored).**

3.) What was the extent (distance) of downstream impact on flows? – **Not monitored**.

4.) Was water temperature affected by leases? **– Not Monitored.**

Scott River - SR 183

Diversion Site: Scott River Diversion #183-15-D1 – River Mile 54.5 (Farmers Ditch)
Date Lease Began: November 13, 2012 Date Lease Ended: November 23, 2012
Water Right: 11.0 cfs
Diversion Amount on Lease Start Date: 11.0 cfs (+/- 2.1%)
Stream Discharge Before Lease Began: 6.0 cfs (+/- 11.6% - large cobble and velocity variation)
After Lease Began: 6 cfs +11cfs = 17cfs (not measured)
Downstream Benefit: 7.5 miles to diversion #223 at RM 47
Fish Presence: Chinook spawners observed @ RM 50 by RCD crews; coho salmon accessed through reach to South Fork and Sugar Creek, as documented by redds (Yokel, D. 2013).
Lease Objective: To determine if the added water can help reconnect the tailings reach at this time of year for migratory access to important coho spawning tributaries.

Background

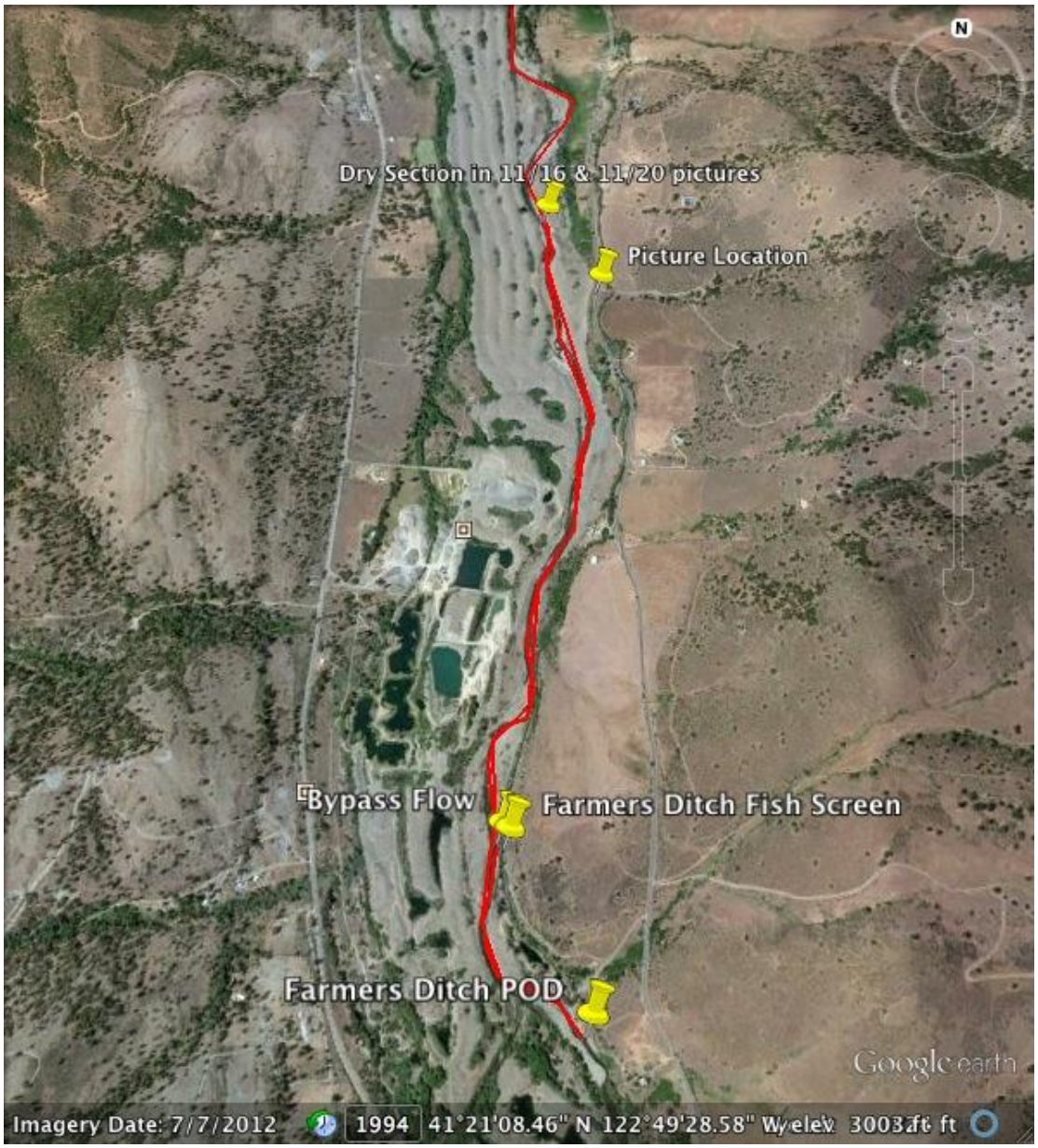
This point of diversion is located in the middle of the 4-mile long dredger tailings reach between RM 52.3 and RM 56.4, a severely disturbed cobble channel that always goes dry each summer and is the last reach to reconnect each fall. Due to the difficulties of ensuring sustained flow through the porous tailings, the Water Trust has been reluctant to lease this site when flow connection potential is low (S. Sommarstrom, SRWT, personal communication). However, in mid-November 2012 coho spawners needed upstream access through this disturbed reach to get into good spawning habitat in Sugar Creek, South Fork Scott, and East Fork Scott. Connection had briefly occurred around Nov. 1st, so the potential appeared high to experiment with this diversion site as no other diversions were active in November. This ditch had been dry since August due to low flows in the Scott and had only recently opened up to divert its stockwater right for the 10-13 users along its 10 mile length.

Transaction Event Summary:

On the day of the transaction, 11/13, a ditch flow measurement was completed at 2:38 pm (ditch Q = 11.0 cfs), and a stream flow measurement was completed at 3:40 pm (stream Q = 6.0 cfs). At 4:26 pm, the fish bypass was opened, as instructed by the ditch tender, which released the majority of the diverted flows back into the stream with a small amount of flow still entering the ditch (~1or 2 cfs). At 4:46 pm, the POD headgate was ratcheted down as much as possible, but could not be closed completely because woody debris obstructed the headgate from closing.

Figure 31. Scott River at Point of Diversion (left) on 11/13/12: BEFORE lease.

The next day (11/14), the contracted field technician, under the direction of the ditch tender, placed rocks and sandbags to stop flows from entering the fish screen, and direct more flows through the fish bypass. Woody debris was removed from the POD headgate and the headgate opening was reduced (though some immovable rocks kept the headgate from closing completely). The POD and fish screen remained in this state for the remainder of the lease period.



Map 5 – Farmers Ditch reach in upper Scott River, below Callahan.

Monitoring of Streamflow Connection/Disconnection:

On 11/16 and 11/20, photos of the disconnected reach below the SR183 POD were taken from the East Callahan Rd at the "Picture Location" (noted above) to monitor stream connectivity for fish passage. This depicted stream section is 1.6 miles below SR183 POD, or about RM 53. Sugar Creek's confluence with the Scott River is at RM 54.4.

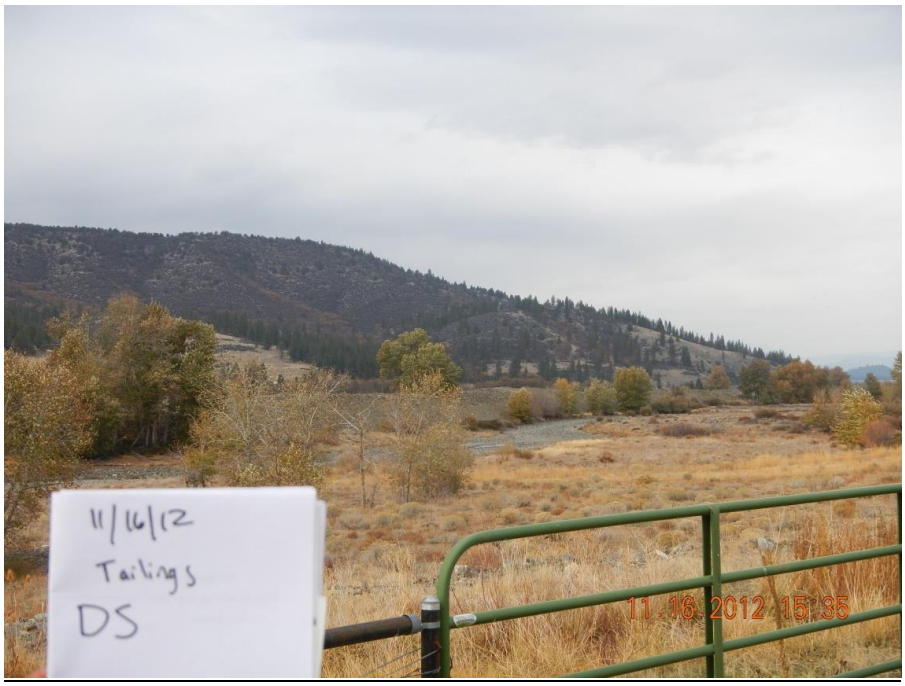


Figure 32: 11/16: 3 days after start of lease, stream is still disconnected @ RM 53.

Figure 33: 11/20: 7 days after start of lease, and recent rain events, stream is connected @ RM 53.

Table 6 was created to evaluate the relationship between streamflow, lease events, and stream connectivity using streamflow data from the upstream DWR gages near Callahan on East Fork (#F26050) and South Fork (#F28100) (CDWR 2013b, 2013c). The column labeled "Scott R (S. + E. Fork)" was created by summing daily average streamflow data from East and South Fork gages, which gives us total incoming flow at RM 57.1, or 2.6 miles above SR183 POD. The column labeled "Lease Contribution" shows when and how much water was added to the Scott River by the lease.

Table 6: Daily Average Stream Flow of Upper Scott River, with Added Lease Flows

	S. Fork	E. Fork	Scott R. (S. + E. Fork)	Lease Contribution	
Date	**Daily Ave cfs**	**Daily Ave cfs**	**Daily Ave cfs**	**Addition of Lease Flow**	**Lease Activity / Notes**
11/06/12	13.0	8.21	21.21	0.0	Pre-lease period
11/07/12	12.4	8.21	20.61	0.0	
11/08/12	13.0	8.21	21.21	0.0	
11/09/12	13.5	8.99	22.49	0.0	
11/10/12	13.5	8.99	22.49	0.0	
11/11/12	13.0	8.99	21.99	0.0	
11/12/12	13.5	9.4	22.90	0.0	
11/13/12	15.4	9.4	24.80	~10.0 cfs released @ 4:26pm	**Ditch = 11.03 CFS** @2:38pm. **Scott = 5.98 CFS** Below Fish Screen bypass @ 3:40pm. (closed headgate @ 4:26pm)
11/14/12	14.8	9.82	24.62	11.0	Sealed fish screen with sandbags, and cleaned fish bypass. (less than 1cfs entering ditch)
11/15/12	14.1	9.4	23.50	11.0	
11/16/12	13.5	9.4	22.90	11.0	river is not connected
11/17/12	17.4	11.6	29.00	11.0	Rain
11/18/12	19.6	16.9	36.50	11.0	Rain
11/19/12	18.1	13.6	31.70	11.0	Rain
11/20/12	55.8	53.7	**109.50**	11.0	**Stream is connected**
11/21/12	64.0	65.4	129.40	11.0	
11/22/12	32.4	31.6	64.00	11.0	
11/23/12	26.4	22.1	48.50	11.0	Lease Ends

	S. Fork	E. Fork	Scott R. (S. + E. Fork)	Lease Contribution	
Date	**Daily Ave cfs**	**Daily Ave cfs**	**Daily Ave cfs**	**Addition of Lease Flow**	**Lease Activity / Notes**
11/24/12	23.7	18.1	41.80	0.0	
11/25/12	22.8	16.3	39.10	0.0	
11/26/12	21.2	15.8	37.00	0.0	
11/27/12	19.6	14.6	34.20	0.0	

Scott River was at baseline flows for 10 days before the lease started: daily average streamflow at confluence of S. and E. Fork was around 20 cfs. The lease added 10 cfs during the first day and 11 cfs for the following 9 days, for a total flow of 17 cfs below the fish screen bypass. The river was disconnected 1.6 mi below the POD before the lease started and still disconnected on 11/16, despite the addition of the 11 cfs (see pictures above). Rain events on November 17th, 18th, and 19th caused an increase in streamflow: November 19th streamflow was 42 cfs and on November 20th, streamflow was 120 cfs. The section of stream that was disconnected on November 16th was connected on November 20th, with the exact time of connection unknown.

Figure 34 below shows incoming flows from E. Fork and S. Fork tributaries, whose confluence is 2.6 mi above SR183 POD. This chart was created using daily average streamflow data from DWR gages on S. Fork and E. Fork, as was Table 6. The line for Scott R. was created by summing S. Fork and E. Fork flows. (S. Fork flow + E. Fork flow = Scott R. No Lease). The large spike in flow, starting on November 19th was due to rain events. This chart cannot depict the actual streamflow conditions near SR183 POD, or disconnected reach 1.6 mi below the POD.

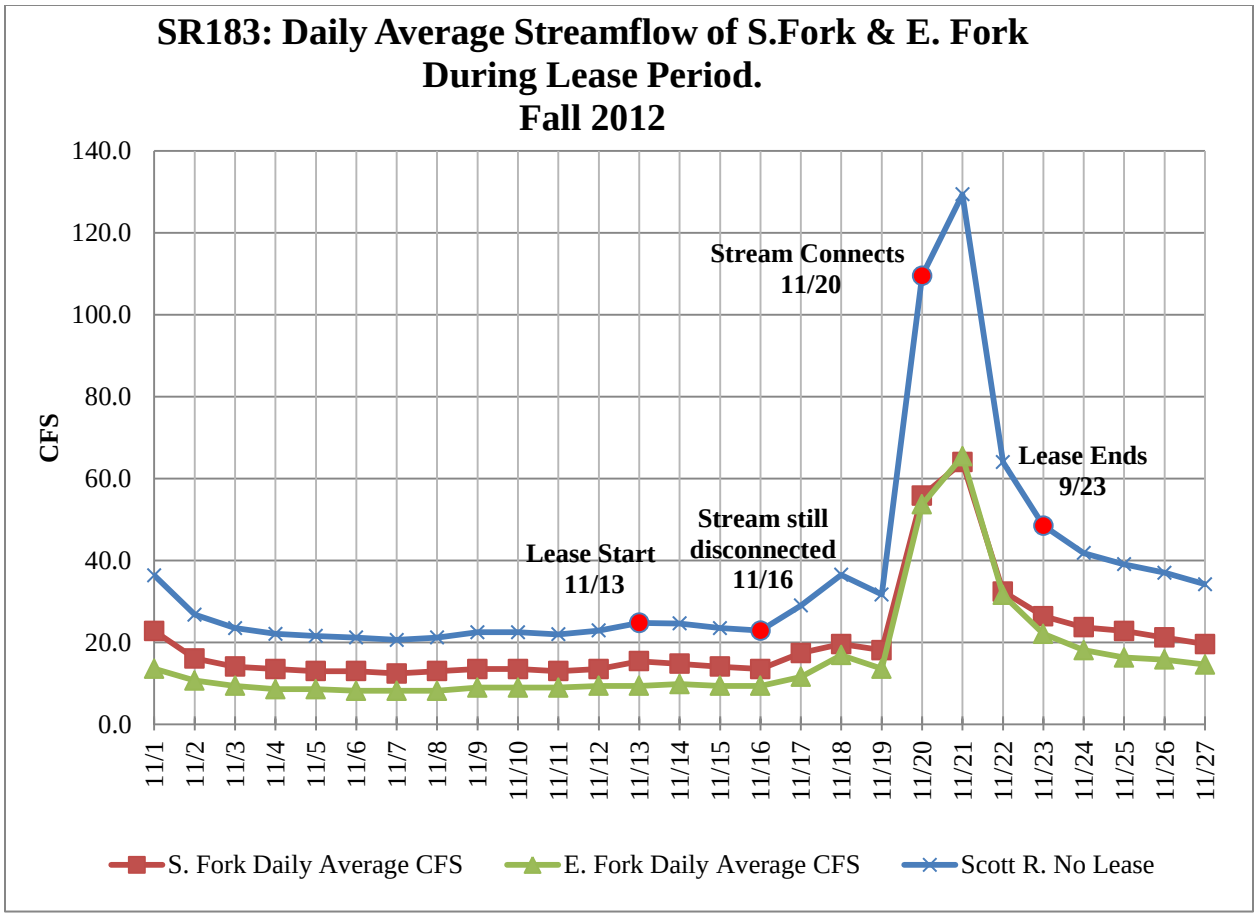


Figure 34: Calculated daily inflow to upper Scott River, 11/1 to 11/27, as measured by DWR gages on East Fork and South Fork near Callahan, upstream of lease site.

Rain Events During Lease Period:

During the lease period, significant precipitation began on 11/17 and ended on 11/21 (Siskiyou RCD 2012). As fairly typical for Scott Valley, rainfall distribution during events is quite variable at different locations (Table 7). The South Fork gage received the most at 2.70" while the East Fork gage was lower at 0.84"; these sites reflect the upstream sources of runoff noted at the DWR gages below.

Table 7: Rain data at 4 gage sites for 11/12 – 11/27 event (in total inches of rain per day) (Siskiyou RCD weather station data).

Date	USFS, Fort Jones	Dockery Gulch (eastside)	Fox Creek (South Fork)	Meadow Gulch (East Fork)	Lease events
12-Nov	--	0	0.02	0	
13-Nov	0.04	0.01	0.03	0.03	Lease starts
14-Nov	0.05	0	0	0	
15-Nov	--	0	0	0	
16-Nov	0	0	0	0	Not Connected
17-Nov	-- **	0.13	0.53	0.24	
18-Nov	-- **	0	0.01	0.01	
19-Nov	0.37 **(sum of weekend too)	0.01	0.23	0.01	
20-Nov	0.17	0.39	1.4	0.45	**Stream is Connected**
21-Nov	0.67	0.08	0.48	0.1	
22-Nov	--	0	0	0	
TOTAL	**1.30"**	**0.62"**	**2.70"**	**0.84"**	
23-Nov	--	0	0	0	Lease Ends

Note on gaining and losing nature of this reach and need for more data analysis:

It is understood that there is a loss in streamflow through the 2.6 miles from the confluence of South Fork and East Fork to SR183 POD, where stream substrate is primarily characterized by mining tailings of cobble size with high porosity. More data analysis is needed to evaluate the gaining and losing nature of this reach, to better estimate what percentatge of confluence flows make it to the SR183 POD and beyond. The RCD took many streamflow measurements in this reach during 2007(?) (personal communication, Danielle Quigley) and that data would likely help us evaluate and model streamflow conditions during this 2012 Fall lease.

SR183 Conclusion:

1.) Was the amount of water paid for provided? – **Yes.**

2.) Was there an instream effect on stream discharge and/or pool volume below the lease site? – **Yes, stream discharge (no pools monitored).**

3.) What was the extent (distance) of downstream impact on flows? – **Not monitored**.

4.) Was water temperature affected by leases? **– Not Monitored.**

Conclusions & Recommendations

Conclusions:

It is certain that the Scott River Water Trust forbearance agreements increased streamflow, which improves instream habitat for fish and the many aquatic and terrestrial species that benefit from healthy stream and riparian habitats. In all locations where stream temperature was monitored, there was no discernable change in water temperature. The downstream impact on flows was not monitored during the 2012 season, and it is assumed that the leased water made it down at least to the next unleased diversion.

The only lease where it was not immediately obvious whether or not the water that was paid for was actually provided was SH14. No water was released from the SH14 POD on the first day of the lease because there was not enough instream flow for the diversion to take the full water right at that time. The Watermaster, the landowner, and the SRWT Director all agreed that streamflow conditions in this part of Shackleford-Mill Creek fluctuate greatly, and are dependent on the irrigation activity of upstream water users. All parties were confident that seasonal streamflow conditions were at a level where this 2nd priority right at SH14 would certainly be able to take water during the lease period, and that leasing the water would achieve the goals of SRWT.

Recommendations:

Recommendations for improved monitoring:

A. Deploy temperature monitoring devices at least a week before each summer lease to establish a *clearer temperature baseline* before leased flows are added to the stream, if possible. The Water Trust is often in the position of obtaining leases with landowners on short-notice and the urgency of adding the leased water instream has outweighed an ideal monitoring schedule.
B. For the snorkel dives that determine fish presence in the reach benefited by the lease, it might be better to have the dives completed days before the lease, or, at minimum, hours before alterations are made to the POD. During one 2012 lease event, alterations to a POD increased turbidity and impaired visibility to a point where the dive could not be completed and had to be rescheduled for a later date. Also, dives are most successful when there is no interference or people potentially scaring fish (Sue Maurer, pers. comm.).
C. The Trust should reconsider if it wants to completely answer its # 2 Objective - *Was there an instream effect on stream discharge and/or pool volume below the lease site?* If pool volume is also expected, then pool depth and width should be measured immediately before and after the lease.
D. Note for participating landowners: please ensure that your diversion is operating correctly and that your maximum legal water right is being diverted into your ditch

before SRWT contractors arrive as this makes for much more clear and accurate monitoring and reporting of the lease event. In some instances during the 2012 season, diversions were taking more than was allowed, were not taking any of the water to be leased, or were returning their diverted water back to the stream by way of the fish screen infrastructure. Those situations make it much more confusing as to how to determine if the water that is paid for is actually being provided.

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