

Feather River Coordinated Resource Management Watershed Monitoring Program

2007 Report



Clarks Creek Project: view from upper meadow groundwater monitoring well looking downstream, March 8, 2008

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Quincy, CA
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Introduction to FRCRM Monitoring Program

About the Feather River CRM

The Feather River Coordinated Resource Management (FR-CRM) group, a proactive consortium of 21 public agencies, private sector groups, and local landowners, was established in 1985 in response to widespread erosion and channel degradation in the Feather River watershed. One hundred and forty years of intensive resource use, including mining, grazing, timber harvesting, wildlife, railroad and road construction, have all contributed to a watershed-wide stream channel entrenchment process. FR-CRM was able to initiate systematized monitoring in the Feather River watershed in 1999 to establish baseline data for assessing long-term trends in watershed condition, and the potentially significant effects of restoration projects on watershed function. Most of the monitoring effort is concentrated in the Indian Creek subwatershed because of its highly degraded upper watershed condition, and high potential for benefit from restoration with many linear miles of alluvial channels. Monitoring site locations follow a nested approach.

Watershed Monitoring Program Background

Background information such as an overview of the watershed, monitoring program objectives, and protocols can be found in the FR-CRM Watershed Monitoring Reports from 2001, 2004, and 2005. The last three reports (2004-06) can be found on the monitoring page of the FR-CRM website at www.feather-river-crm.org. The monitoring network was installed in 1999 and data have been collected from 2000-2007.

Initial funding for FR-CRM's monitoring program was provided by a Clean Water Act 319(h) grant (Aug 1998 to Dec 2000). Subsequent funding sources were: the California Surface Water Ambient Monitoring Program (SWAMP) from Oct 2000 to Dec 2003 and the Plumas Watershed Forum (2004 to 2006). Physical and biological surveys of FR-CRM's 20 Monitoring Reaches have not been conducted since 2003.

Monitoring Program Description

As the fifth FR-CRM Watershed Monitoring Report, this report documents on-going monitoring data from the 2007 water year (October 1, 2006-September 30, 2007). Continuous Recording Station maintenance was a significant activity for the monitoring program in the 2007 Water Year (WY). Low flows provided the opportunity to maintain and/or replace components of 6 stations. Funding from the UC Davis Indian Creek Watershed Modeling project helped pay for the maintenance/replacement of 4 stations in the Indian Creek Watershed: Wolf Creek @ Main Street Br., Lights Cr. @ Deadfall Lane Br., Indian Creek @ Taylorsville Br., and Indian Creek @ Flourney Br. Deteriorated gage plates were replaced at the station on Wolf Creek & Indian Creek @ Flourney Bridge stations.

Three main subwatersheds of the Feather River are covered under this monitoring program:

- Indian Creek
 - Spanish Creek
 - Middle Fork Feather River
 - North Fork Feather River
- } East Branch North Fork Feather River

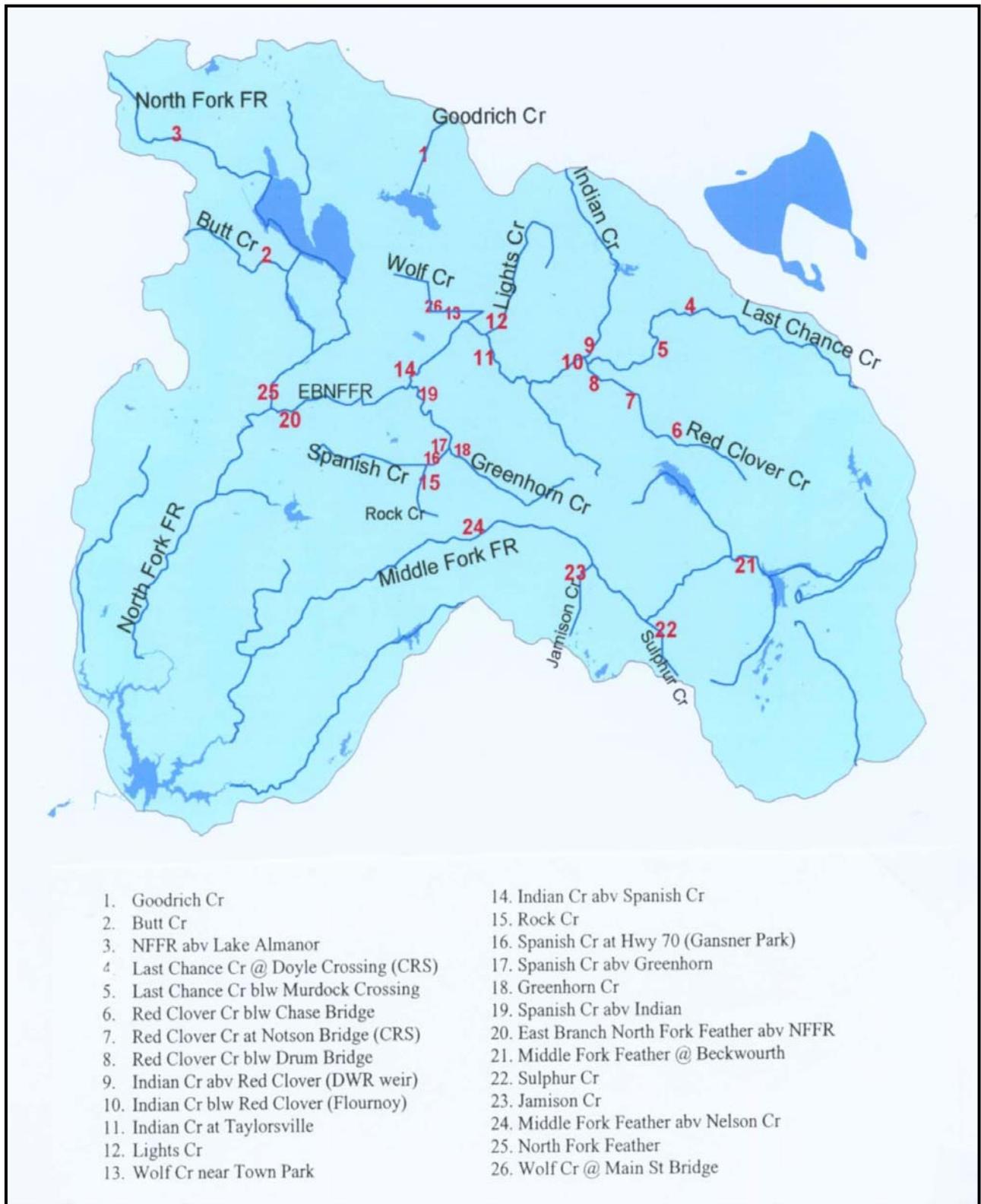


Figure 1. Feather River CRM Continuous Recording & Monitoring Reach Locations

Table 1. Upper Feather River Watershed Monitoring Sites and Parameters Recorded by FR-CRM, the California Department of Water Resources (DWR) and the U.S. Geological Survey (USGS)

Map #	Monitoring Site by Subwatershed	Monitoring Type
	North Fork Feather River (NFFR) watershed	
3	NFFR @ Domingo Springs (abv Lake Almanor)	MR [∞]
25	NFFR @ acw [†] East Branch NFFR	MR
2	Butt Cr (abv 307 Br)	MR
1	Goodrich Cr	MR discontinued
20	East Branch mouth (acw NFFR)	MR
19	Spanish mouth (acw Indian)	MR
	Spanish Creek @ Keddie abv Blackhawk Cr.	CRS (USGS)
17	Spanish Cr acw Greenhorn	MR
18	Greenhorn Cr mouth	MR
16	Spanish @ Gansner Park (Hwy 70)	CRS [‡]
15	Rock Cr mouth	MR
14	Indian Cr blw Indian Falls (acw Spanish Cr)	CRS (DWR)
13	Wolf Cr @ Town Park	MR
26	Wolf Cr @ Main St Bridge	CRS
12	Lights Cr @ Deadfall Lane Br	MR & CRS
11	Indian Cr @ Taylorsville (TAY)	MR & CRS & Weather Station (DWR)
10	Indian Cr @ Flournoy (bcw [§] Red Clover)	MR & CRS
9	Indian Cr @ DWR weir (acw Red Clover)	MR & CRS
6	Red Clover Cr @ Chase Bridge	MR
	Thompson Valley (TVL)	Weather Station (DWR)
8	Red Clover Cr @ Drum Bridge	MR
7	Red Clover @ Notson Bridge	CRS
5	Last Chance (LC) Cr @ Murdock	MR
4	Last Chance (LC) Cr @ Doyle Crossing (DOY)	CRS & Weather Station (DWR)
	McClellan Cr	MR (DWR)
	Cottonwood Cr @ Big Flat	CRS abv & blw Big Flat
	Little Stoney Cr	MR (DWR)
	Willow Cr	MR (DWR)
	LC @ Alkali Flat low water crossing	MR (DWR)
	Ferris Cr	MR (DWR)
	LC @ Bird-Jordan Neck	staff gage & MR (DWR)
	Jordan Peak (JDP)	Weather Station (DWR)
	Middle Fork Feather River (MFFR) watershed	
24	MFFR abv Nelson Cr	MR
	MFFR @ Sloat	staff gage
23	Jamison Cr @ 23N37 Br	MR
22	Sulphur Cr @ Hwy 89 (Clio)	MR & CRS
	Boulder Cr	staff gage
	Barry Cr	staff gage
	Sulphur @ Lower Loop Bridge	staff gage
	Sulphur @ Upper Loop Bridge	staff gage
21	MFFR blw A23 Br (Beckwourth)	MR
	MFFR near Portola (MFP)	CRS (DWR)

[∞] Monitoring Reaches (MR) refers to those surveyed by FR-CRM unless otherwise noted in parentheses. Long term monitoring of these sites is expected to give watershed managers a better understanding of processes and long term trends in these subwatersheds. Data collected at Monitoring Reach sites can be found in the SWAMP final report, with details on protocols in Appendix A.

[†] “acw” means “above confluence with”

[‡] Continuous Recording Stations (CRS) are maintained and operated by FR-CRM unless otherwise noted in parentheses.

[§] “bcw” means “below confluence with”

Data Collected at the Continuous Recording Stations (CRS):

- **Stage** (calibrated to flow)
- **Water Temperature**
- **Air Temperature** (except at Wolf Creek)
- **Turbidity** (NTU's) (currently Indian Cr. at Taylorsville & Spanish Cr. 2001-06)

Much of the FR-CRM restoration efforts are concentrated on restoring the function to the meadow floodplains of the watershed to store winter and spring precipitation, and release it later in the year. The two metrics which would reliably indicate restored floodplain function are summer baseflow levels and summer water temperatures. Increases in summer baseflow with concurrent decreases in summer water temperatures would indicate that winter and spring runoff stored in the meadow soils was being released as late season flow. Stream flow stage, air and water temperature are recorded every 15 minutes by Campbell CR10X data loggers at the following monitoring sites: Red Clover Creek on Notson Bridge; Last Chance Creek at Doyle Crossing and Million Dollar Bridge; Cottonwood Creek above and below Big Flat (not on map); Indian Creek at the DWR weir (abv Red Clover), at the Fournoy Bridge (blw Red Clover), and at the Taylorsville Bridge; Lights Creek at Deadfall Lane Br.; Wolf Creek at the Main Street Bridge in Greenville; Spanish Creek at Hwy 70 Br. near Gansner Park in Quincy; and on Sulphur Creek at the Highway 89 Bridge near Clio (temporarily disconnected). The locations of the Continuous Recording Stations in relation to FR-CRM restoration projects is shown in the diagram in Appendix B.

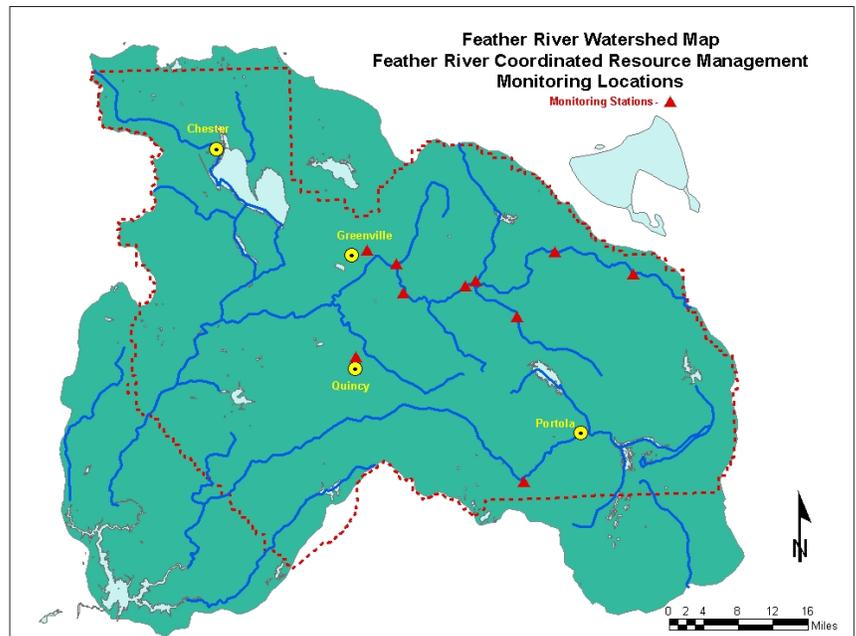


Figure 2. Location of FR-CRM Continuous Recording Stations (CRS)

The stage, air and water temperature readings are stored as hourly averages and then summarized into daily files at the end of each water year. To continuously record turbidity, an Analite 195 laser sensor (a nephelometric (NTU) probe) was installed on Indian Creek at Taylorsville Br. in 2001 and on Spanish Creek (2001-06). The data loggers are capable of storing up to six months of data. FRCRM staff and contract technicians download data bi-monthly to ensure reliable station operation. Because of periodic channel shifts at most of the stations monthly calibration measurements are required. FRCRM staff are also responsible for capturing discharge measurements over the range of flows experienced at each station in order to maintain/update the rating tables. Rating tables are reviewed and/or updated annually by Tim Sagraves.

The California Department of Water Resources (DWR) Flow & Weather Stations

DWR maintains 4 Weather Stations and 2 continuous recording flow stations in the Feather River watershed to assist in managing the water resources. The two recently-installed DWR flow stations are on Indian Creek below Indian Falls (ICR) and on the Middle Fork Feather River near Portola (MFP). Four weather stations installed by DWR in the Indian Creek watershed include Doyle Crossing (DOY) in 2000, Jordan Peak (JDP) in 2005, Thompson Valley (TVL) in 2006 and Taylorsville (TAY) in 2007. All of the weather and flow stations are accessible on the California Data Exchange Center (CDEC) website at cdec.water.ca.gov. Stream discharge and stage height are recorded at the DWR flow stations, while the DWR weather stations record rainfall, temperature, relative humidity, wind speed, wind direction, solar radiation and atmospheric pressure.

2007 Monitoring Program Findings

FR-CRM is continuously collecting data throughout the Upper Feather River Watershed. Annual hydrographs of six Continuous Recording Stations (CRS) maintained by FR-CRM in the Indian Creek Watershed can be found in Appendix A, including Wolf Creek @ Main St. Br., Lights Cr. @ Deadfall Ln. Br., Red Clover Cr. @ Notson Br., Indian Cr. @ DWR weir, Indian Cr. @ Flourney Br., Last Chance Cr. @ Doyle Crossing and Last Chance Cr. @ Million Dollar Br. (Note that the transducers of the CRS on Lights Creek and Indian Creek at Flourney Bridge were out of the water during low flows resulting in missing data.) Annual hydrographs from FR-CRM's CRS on Indian Creek @ Taylorsville Bridge and Spanish Creek @ Gansner Park are not included in this monitoring report. All monitoring data collected at these stations is considered invalid since the transducers were buried at both locations for an unknown period of time prior to the start of the 2007 water year.

The 2007 Water Year experienced the second lowest annual precipitation in the last decade with 60% of historic average annual precipitation for the Feather River Basin (see Table 2).

Table 2. Precipitation averages

Water Year (10/1-9/30)	Percent of Historic Average annual precip for the entire Feather River Basin from CDEC*	Water Year (7/1-6/30)	Total annual precip (inches) at Indian Cr in Genesee (Wilcox data)
		1996	54.55
		1997	58.9
1998	144%	1998	60.70
1999	99%	1999	47.8
2000	101%	2000	43.65
2001	56%	2001	23.6
2002	77%	2002	33.6
2003	111%	2003	49.6
2004	83%	2004	42.8
2005	109%	2005	45.6
2006	154%	2006	68.2
2007	59.8%	2007	27.7
			46.4 = Avg

* calculated by averaging the percent average of all reporting stations in the watershed. For 2004 there were 6/10 stations with averages (Sierraville, Vinton, Portola, Chester, Strawberry Valley, Brush Cr). For 2005, 9/10 stations were reporting (all of the above, plus Greenville, Quincy, and DeSabra). For 2006 data, 10 out of 10 stations were reporting. For 2007 8/10 stations were reporting averages (Plumas Eureka State Park, Sierraville, Vinton, Portola, Strawberry Valley, Greenville, Quincy, and DeSabra).

Most important findings in this monitoring report:

- Decrease in lethal water temperatures (exceeding 75°F) for coldwater fisheries on Red Clover Creek @ Notson Bridge with corresponding water temperature improvements on Indian Creek @ Flourney Bridge.
- Improvements in water temperature for coldwater fisheries also recorded on Last Chance Creek @ Doyle Crossing, but more work remains for trout habitat suitability.
- Lights Creek & Last Chance Creek are still the least suitable creeks to coldwater fish species that FR-CRM monitors, with Wolf Creek following close behind in 3rd place.

Watershed Temperature

Introduction

The Central Valley Regional Water Quality Control Board has identified water temperature as a water quality concern in the Feather River Watershed. In this section of the report, a variety of water temperature parameters were used to compare between sites and between years. Water temperature parameters were analyzed for six continuous recording stations with usable low flow data (all of which are in the Indian Creek subwatershed). The temperature sensor at Wolf Creek was buried underneath sediment in 2005 & 2006, thus the data are inaccurate and not included in these analyses. On Lights Creek and Indian Creek at Flournoy Bridge, transducers of the Continuous Recording Stations (CRS) were out of the water during low flows, so water temperature data was supplemented with data from HOBO temperature loggers placed in the stream near the CRS.

Maximum daily water temperature

Figure 3 graphs the highest 1 hour-long temperature that was recorded during the annual sampling period, which is a function of air temperature, volume of water, and surface interval for insolation. Above the confluence with Red Clover, at the DWR weir, Indian Creek is primarily fed by cold water from the bottom of Antelope Lake. Red Clover has a visible warming influence on Indian Creek below the confluence (at Flournoy Br.) from 2000-07. Even though 2007 was a low flow year, the maximum water temperature coming out of Red Clover at Notson Br. was lower than that of the previous eight recorded years. The decreased maximum daily water temperature was recorded on Indian Creek at Flournoy Bridge. In 2007 when Red Clover Creek is about 7 degrees cooler, Indian Creek at Flournoy is also about 7 degrees cooler. The Red Clover-McReynolds Creeks Restoration Project was completed in Fall 2006, contributing to increased groundwater infiltration and hyporheic exchange between the surface water and cool groundwater.

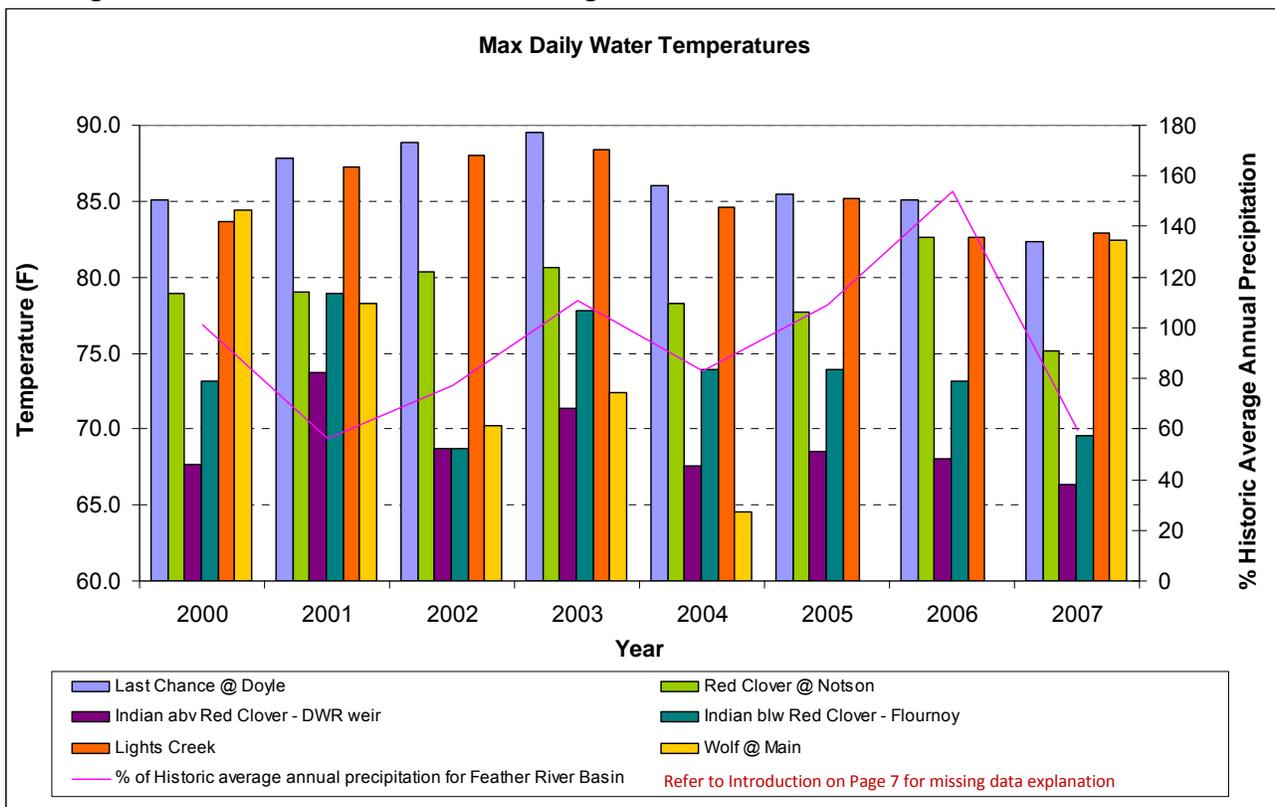


Figure 3. Maximum Daily Water Temperatures recorded 2000-07

Most of the stations have reported a downward trend in the maximum daily water temperature over the past few years. In 2007, one of the lowest precipitation years during the monitored period, one would expect to find warmer water temperatures due to the low flow conditions with increased

insolation effects. This temperature increase is most dramatic on Wolf Creek with an 18 degrees Fahrenheit increase in maximum average daily water temperature from 2004 to 2007 (missing data in '05-'06 due to buried sensor). The increased temperatures on Wolf Creek may be due to the continued expansion of the entrenchment due to the deposition of material from upstream sources, creating a wider, shallower channel exposed to solar radiation. Another possible explanation for the increase in maximum water temperatures on Wolf Creek from 2004 to 2007 is the lower base flow on Wolf Creek in 2007, due to a historically low precipitation year (60% versus 83% of the historic average annual precipitation for the Feather River Basin experienced in 2007 and 2004 respectively). Lights Creek experienced a slight increase in maximum average daily water temperature from the high precipitation WY2006 to the low precipitation WY2007. On the other hand a dramatic decrease in maximum daily water temperature was recorded at the two stations below Red Clover Creek (Red Clover Creek at Notson Bridge and Indian Creek at Flornoy Bridge) from high flow WY2006 to low flow WY2007. The maximum daily water temperatures recorded on Last Chance Creek at Doyle Crossing are the lowest since 2003, despite the low precipitation year experienced in 2007. This drop in temperature may be attributed to the effects of 10 miles of channel restoration on Last Chance Creek upstream of Doyle Crossing since 1995. Indian Creek at DWR weir maintained the lowest recorded maximum daily temperature in 2007, due to its cold water source from the bottom of Antelope Lake.

Maximum weekly average water temperature

The graph of maximum weekly average water temperatures (Figure 4) shows that Lights and Last Chance Creeks are consistently the two warmest channels, based on the highest of the running seven-day averages calculated throughout the sampling period from 2000-07. Despite low precipitation in WY07 the max weekly average water temperatures are the lowest they have been in the eight year recording period, except for Wolf Creek. Last Chance Creek at Doyle Crossing also experienced max weekly average water temperatures in WY2007 that were much lower than in the high flow 2006 water year. During the low precipitation years of 2007 and 2001, Wolf Creek reported similar max weekly average water temperatures.

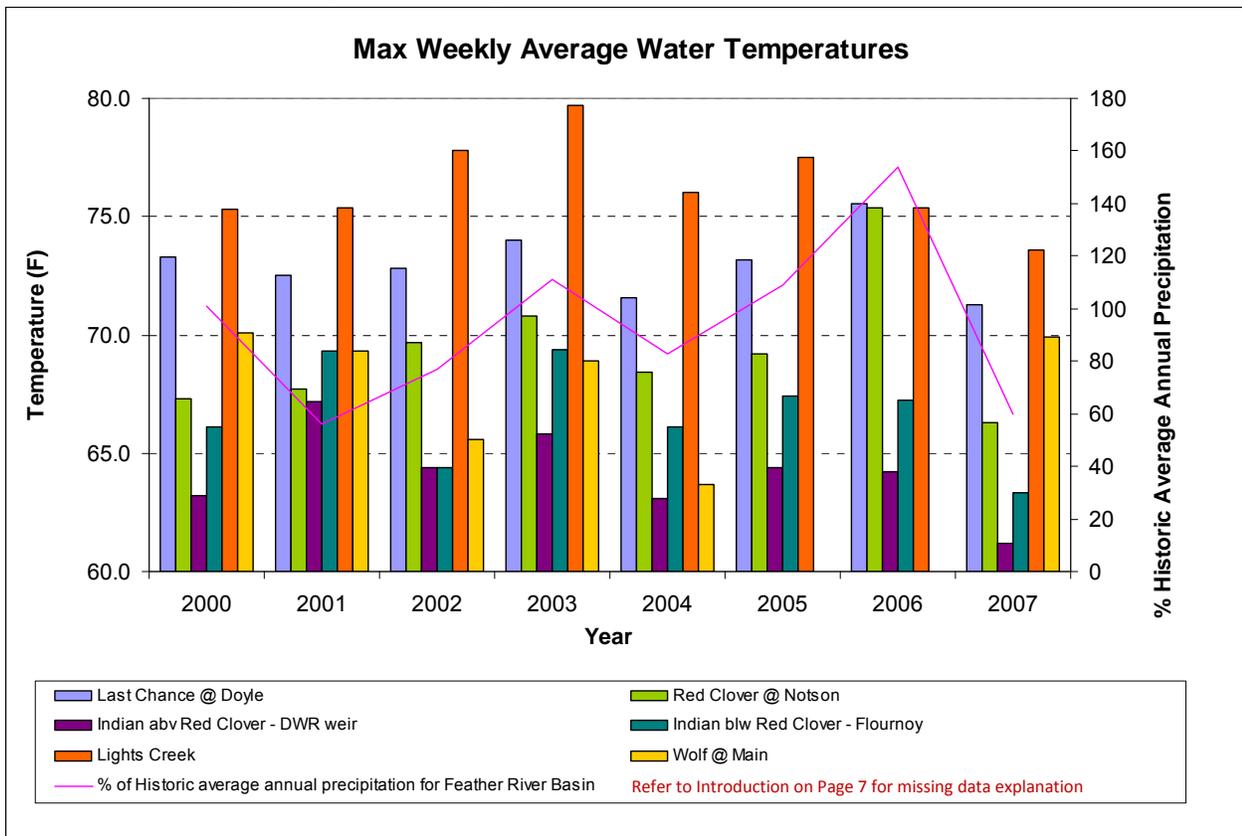


Figure 4. Maximum Weekly Average Water Temperatures 2000-07 at Continuous Recording Stations

A dramatic decrease in max weekly average water temperature was recorded on Red Clover Creek at Notson Bridge from WY2006 to WY2007, perhaps attributable to the completion of the Red Clover-McReynolds Creeks Restoration project in Fall 2006. The effect of decreased water temperatures out of Red Clover Creek was felt on Indian Creek at Flournoy Bridge. At DWR weir, the station recorded the cooling influence from water released out of Antelope Lake into Indian Creek. Indian Creek above and below the Red Clover-McReynolds Creeks Restoration project saw dramatically lower max weekly average water temperatures in 2007, after the restoration project, than in the 2001 water year with similar percent historic average annual precipitation.

Weekly Average Water Temperatures >66°F

Figure 5 displays the number of running seven day averages that were greater than 66 degrees Fahrenheit. This water temperature parameter is of biological importance since water that has an average temperature greater than 66°F for seven days is considered impaired habitat for coldwater fish species. Following 2 years of missing data, Wolf Creek recorded over 40 weekly average water temperatures greater than 66°F in WY2007. Figure 5 shows Lights Creek, Last Chance Creek, and Wolf Creek as the least hospitable streams to cold water fisheries that Feather River CRM monitors in the Feather River Watershed. The two stations downstream of the Red Clover-McReynolds Creeks Restoration Project completed Fall 2006 – Red Clover Cr @ Notson Br. & Indian Cr. @ Flournoy Br., barely experienced any weekly water temperatures above 66°F. An important caveat is that the temperature data recorded by the CRS on Lights Creek and Indian Creek @ Flournoy Bridge were supplemented with HOBO temperature logger data, but some low flow data is still missing.

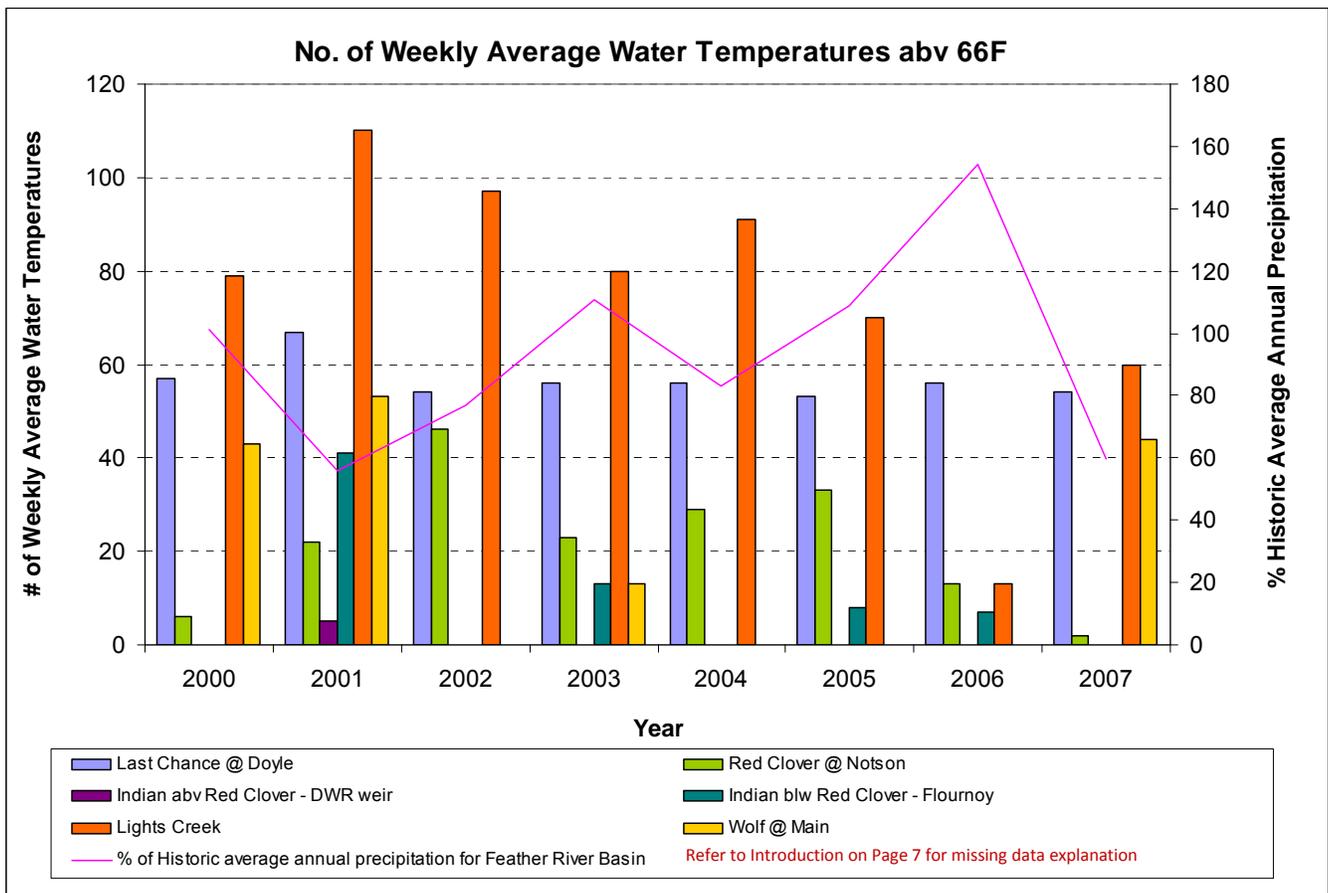


Figure 5. Number of Weekly Average Water Temperatures above 66F from 2000-07

Daily Maximum Water Temperature >75°F

Figure 6 displays the number of days that had an absolute 1-hour long temperature greater than 75°F among the six continuous recording stations with usable low flow data from 2000-07. A temperature reading greater than 75°F can be lethal to coldwater fish species, even if it is just a short-term maximum temperature reading. Last Chance and Lights creeks are the most impaired creeks monitored in the Indian Creek watershed over the last 8 years based on maximum water temperatures exceeding 75°F and maximum weekly average water temperatures greater than 66°F. Even though 43 days were recorded on Last Chance Cr @ Doyle Crossing with maximum temperatures exceeding 75°F, the numbers have continued to decline since 2001, when most of the restoration projects on Last Chance Creek were started (see Table 3). The low precipitation 2007 water year saw the least amount of days with max temperatures exceeding 75°F than in the past 8 recorded years. On Red Clover Creek at Notson Bridge, 2007 is the first year in 8 years that there are no recorded days that the water temperature was above 75°F.

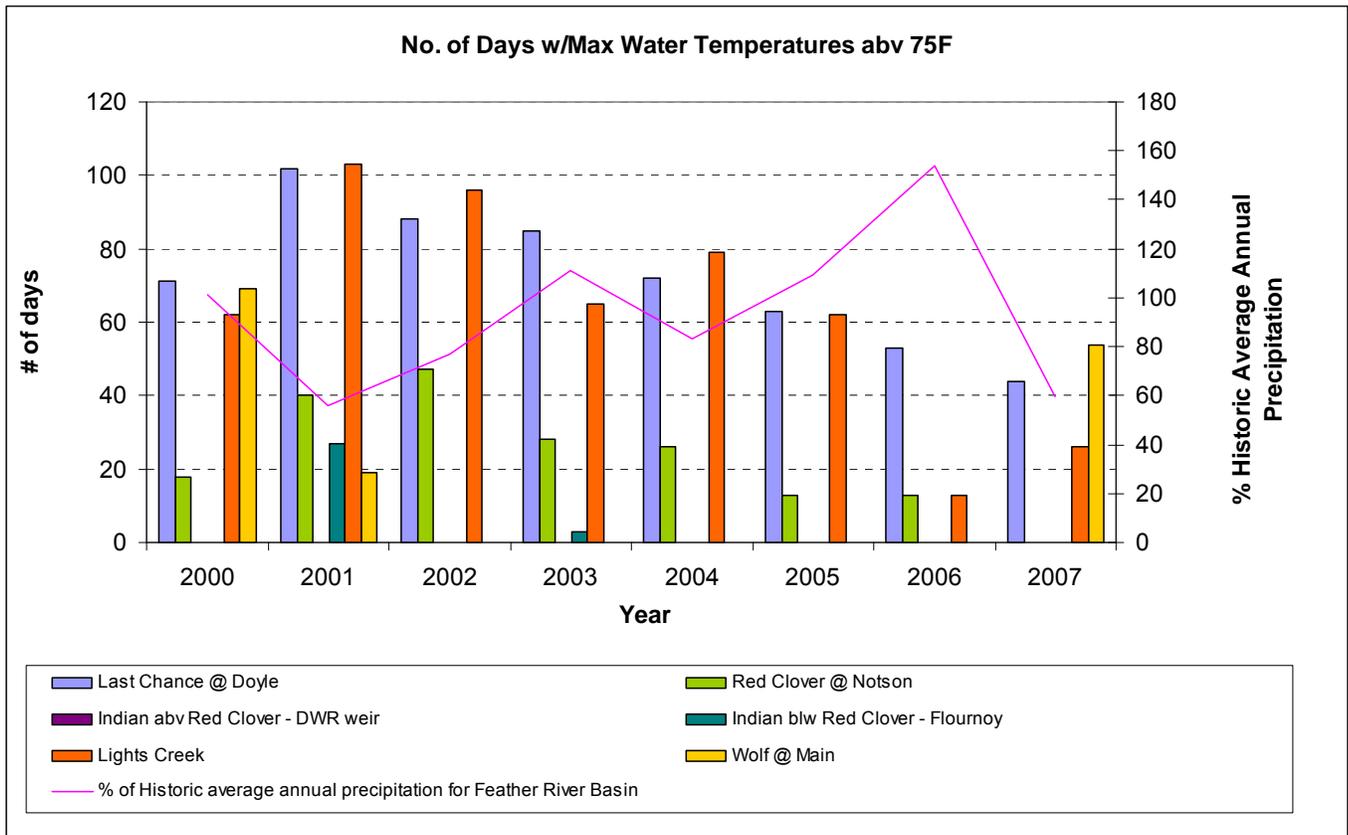


Figure 6. Number of days with maximum water temperature above 75F recorded from 2000-07

Maximum summer diurnal water temperature fluctuation

Figure 7 displays the greatest fluctuation of water temperature in a 24-hour period during the sampling period. Since this parameter is heavily dependent on volume of water and elevation, a comparison between years at the same site is most appropriate. The cooling influence of the Red Clover Creek restoration project was apparent in the decrease from WY 2006 to WY2007 of maximum summer water temperature diurnal fluctuation recorded on Red Clover Creek at Notson and on Indian Creek at Flournoy. However, the decrease in summer water temperature fluctuation in Indian Creek below Red Clover was moderated by Indian Creek from Antelope Lake. This temperature moderation is apparent in the slight increase in Indian Creek temperature at DWR weir and the slight decrease recorded at Flournoy, from WY2006 to WY2007.

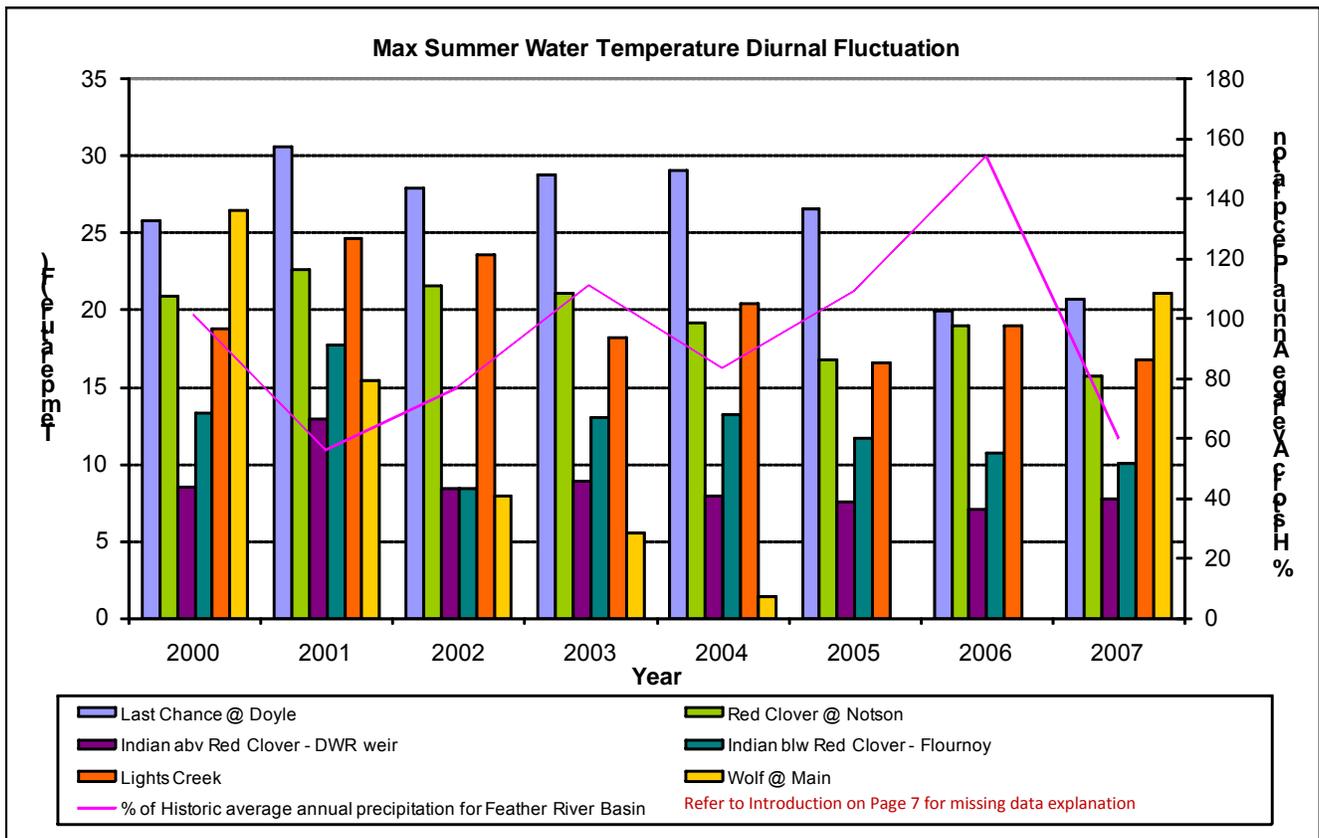


Figure 7. Maximum summer water temperature diurnal fluctuation recorded from 2000-07

Watershed Temperature Summary

Last Chance Creek at Doyle Crossing and Lights Creek are consistently found to be the most heavily temperature impaired channels, followed by Wolf Creek and Red Clover Creek. The temperature impairment of Red Clover and Lights Creeks are assumed to be from channel degradation. Locally high temperature readings at Doyle Crossing on Last Chance Creek can be attributed to enhanced solar collection from water sheeting over bedrock and a 400-foot long open pool above the recording station. Wolf Creek, whose sensor was uncovered at the beginning of the 2007 water year, has some of the highest maximum temperatures recorded during the summer in the Feather River watershed. One possible explanation for higher maximum temperatures on Wolf Creek in 2007 than 2004 is that the channel is being increasingly destabilized due to accelerated bar development within the entrenched system, which exposes the water surface to more solar radiation. Another possible explanation is the lower baseflow experienced in 2007 than in 2004. Even though riparian vegetation on Wolf Creek has increased due to FRCRM channel restoration, the riparian recovery is still not adequately shading the stream to moderate summer water temperatures. Though some phases of restoration have been completed on Wolf Creek, more degraded and altered channel reaches remain to be treated upstream of Greenville, CA. During the year following the Red Clover-McReynolds Creeks Restoration project, water temperatures in Red Clover Creek have noticeably declined during the low flow summer periods that can be most lethal to coldwater fish species. The decrease in water temperatures out of Red Clover Creek was also recorded on Indian Creek below their confluence.

Stream Flows

Weekly Average Minimum Flow

Figure 8 shows weekly average of minimum flows across the six continuous recording sites in the Indian Creek watershed from 2000-07, with discharge recorded in cubic feet per second (cfs). The 2007 water year saw the lowest flows recorded over the eight year monitoring record on Red Clover Creek @ Notson Br. and Last Chance Creek @ Doyle Crossing. The weekly average minimum flow recorded on Indian Creek below Red Clover at Flournoy Bridge continues to increase over the past four years despite decreased precipitation levels from 2006. While weekly average minimum flows on Red Clover at Notson Bridge stayed fairly stable through precipitation changes over the past seven monitoring years, the weekly average minimum flows were considerably lower in WY2007, at 1.12 cfs. This temporary decrease in flows is expected since the Red Clover meadow is being recharged following the completion of the Red Clover-McReynolds Creeks restoration project in Fall 2006.

Since 2007 was the first water year following the completion of the Red Clover-McReynolds Creeks restoration project, the low flows recorded on Red Clover Creek @ Notson Bridge can be attributed to the following three factors:

- 1) The 2007 water year experienced historically low precipitation with 60 percent of historic average precipitation in the Feather River Watershed.
- 2) Four miles of degraded meadows were being recharged in Red Clover Valley following the meadow restoration project.
- 3) The 2007 water year saw extensive beaver activity throughout the restored meadow area, with over 20 constructed dams ponding up most of the flowing water.

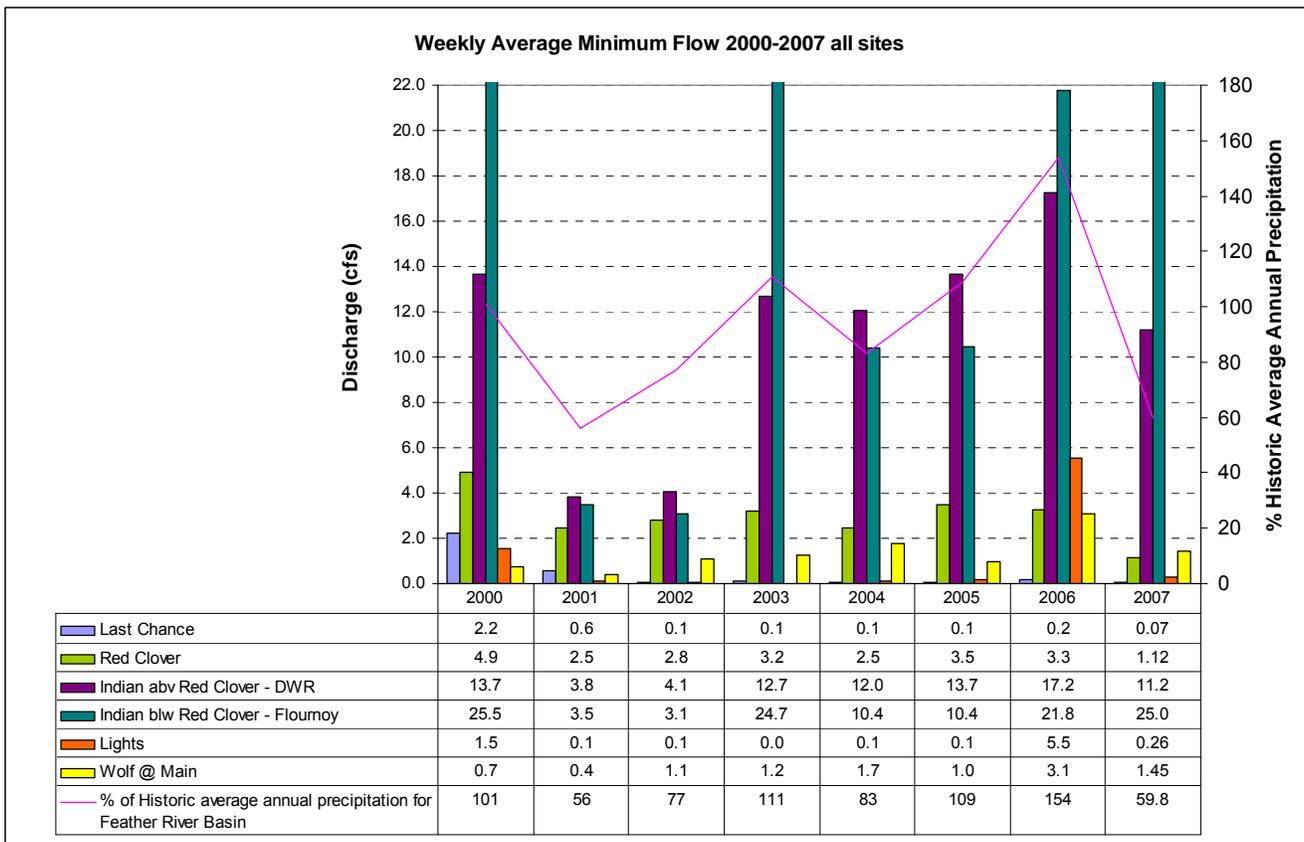


Figure 8. Weekly Average Minimum Flow from 2000-07 across CRS sites in Indian Creek Watershed

Refer to Page 6 first paragraph for missing data explanation

Spring Recession Comparison of Last Chance Creek @ Doyle Crossing during the low precipitation water years of 2001 & 2007.

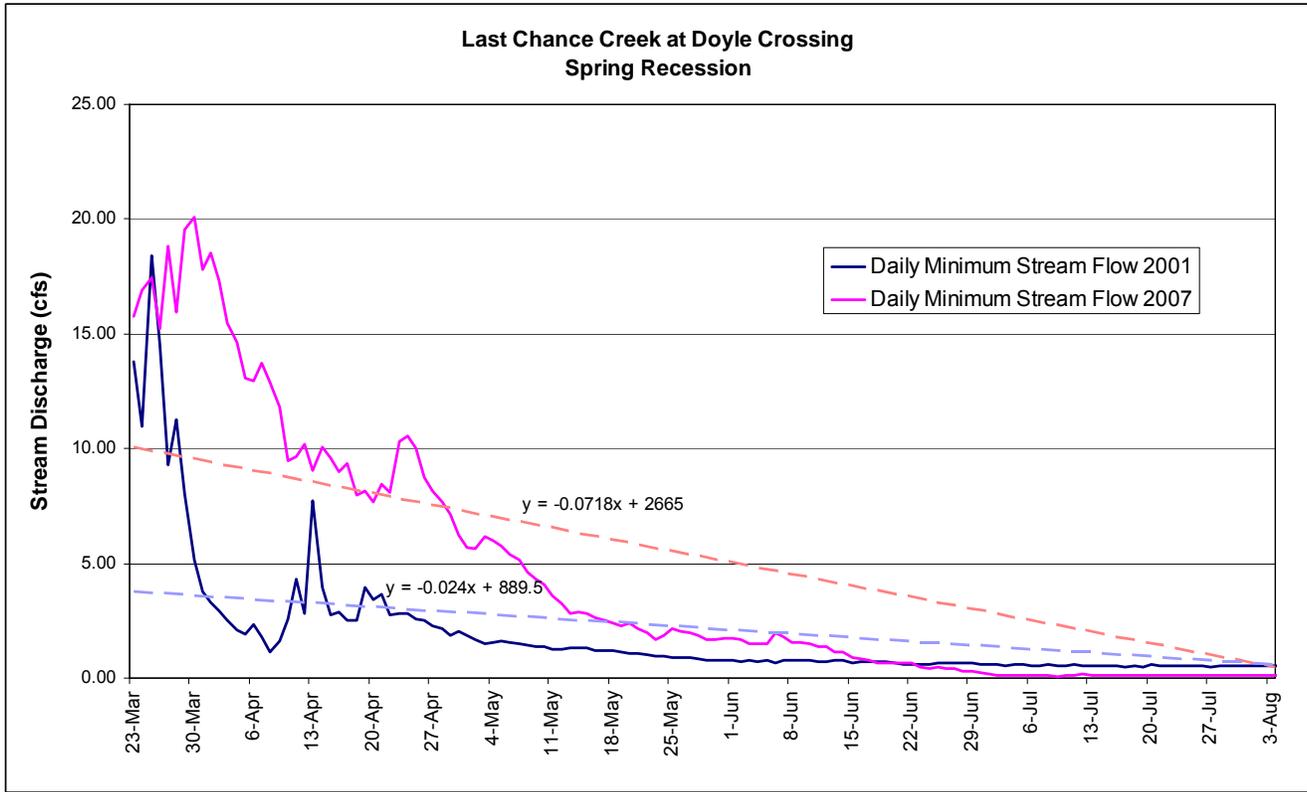


Figure 9. Spring recession stream flows in 2001WY and 2007WY at Doyle Crossing

Figure 9 compares the spring hydrograph of Last Chance Creek at Doyle Crossing from March 23-August 3 for 2001 and 2007. The baseflows recorded on Last Chance Creek at Doyle Crossing in 2007 are greater than that of 2001 from late March to June 19. The higher sustained baseflows out of Last Chance Creek in 2007 can be partially attributed to saturation from the previous water year of 2006, with the highest recorded precipitation over the monitoring period. Trendlines have been added to the Spring Recession hydrographs for 2001 and 2007. The steeper trendline from 2007WY has a slope of -0.07 ($R^2= 0.6$) versus lower slope trendline from 2001WY of -0.024 ($R^2= 0.3$), indicating more water being released out of the Last Chance watershed into early summer. More water being held in the watershed, and released over a longer period of time, with higher sustained base flows into June could be a result of the work that the CRM has completed in the Last Chance watershed from 2001 to 2007. Table 3 shows all of the projects that have been completed in the Last Chance watershed from 1995-2007. Due to potential differences in precipitation type and distribution and/or evapotranspiration rates, there is no indication of a significant change in summer baseflow after late June from 2007 to 2001.

Table 3. Completion of project work in the Last Chance Creek watershed upstream of Doyle Crossing.

Year	Reach Name	Miles of Channel	Affected Acreage
1995	Big Flat on Cottonwood Cr	0.78	47
2001	Stone Dairy	0.43	20
2002	Meadowview & Artray	1.6	300
2003-4	Ferris Field I, Alkali Flat, Bird, Bird-Jordan, Ferris Cr, Jordan Flat I	4.1	800
2004	Above Charles	0.38	80
	Big Flat Modification	0.57	34
2005	Jordan Flat Supplemental	0.34	50
	Dooley Cr	1	80
2007	Ferris Field II	0.85	85
	TOTAL	10.05 miles	1,496 acres

Conclusion

Monitoring Results

The 2007 water year was quite the opposite of the previous 2006 water year high flows. With 60% of average historic precipitation falling in 2007, this was a good water year for FRCRM to analyze the response of the Feather River Watershed to low flows and summer temperatures. While Last Chance and Lights Creeks continued to be the most impaired streams for cold water fisheries that FRCRM monitors, improvement in water temperatures were seen on Last Chance Creek at Doyle Crossing over the last 8 years of watershed monitoring data. Such water temperature improvements may be attributed to over 10 miles of channel and almost 1,500 acres of affected meadows that have been restored by FRCRM on Last Chance Creek above Doyle Crossing. Eight more miles of restoration on Last Chance Creek above Doyle Crossing is planned for construction in 2009-2010 with Proposition 50 funds, and we hope to see more improvements in summer water temperatures and baseflow on Last Chance Creek at Doyle Crossing.

Unlike the improvements on Last Chance Creek, we foresee little improvement in summer water quality on Lights Creek, particularly with sediment contribution from the burned areas and subsequent rehabilitation activities following the Moonlight fire in 2007. Wolf Creek water quality has improved since the first three phases of restoration, yet coldwater fisheries would benefit from more channel restoration upstream of Main Street between Setzer Road Bridge and the Greenville Campground.

Maintenance Completed in 2007:

Necessary maintenance was completed in October 2007 on six Continuous Recording Stations. Due to the amount of maintenance that was required in 2007, FR-CRM staff deemed that moving the Wolf Creek CRS downstream to the Ball Field Bridge was unnecessary, as long as the transducer box is unburied every summer after the cessation of high flows. Rusted staff gage plates were replaced on Wolf Creek @ Main Street Br. and Indian Creek @ Flournoy Br.

After being buried by sediment, the monitoring station transducers on Indian Creek @ Taylorsville Br. and Spanish Creek near Gansner Park were moved to more stable locations. The Spanish Creek CRS (logger, transducer, and staff gage) was moved upstream of the Highway 70 bridge to a pool created by bank restoration work (with the construction of boulder vanes). This location is considered more stable than the previous location downstream of Highway 70 bridge, under the Gansner Pedestrian bridge, where the transducer was buried for an unknown period of time (though probably since the high flows during New Years Eve 2006).

After Plumas County finished replacing the guard rail on the Taylorsville Bridge crossing Indian Creek, FR-CRM was able to relocate the transducer box from its temporary installation on the left bank to its original location on the nearby bridge abutment, closer to the center of the channel. With the current transducer relocation, the Taylorsville CRS will continue to be a high flow only station.

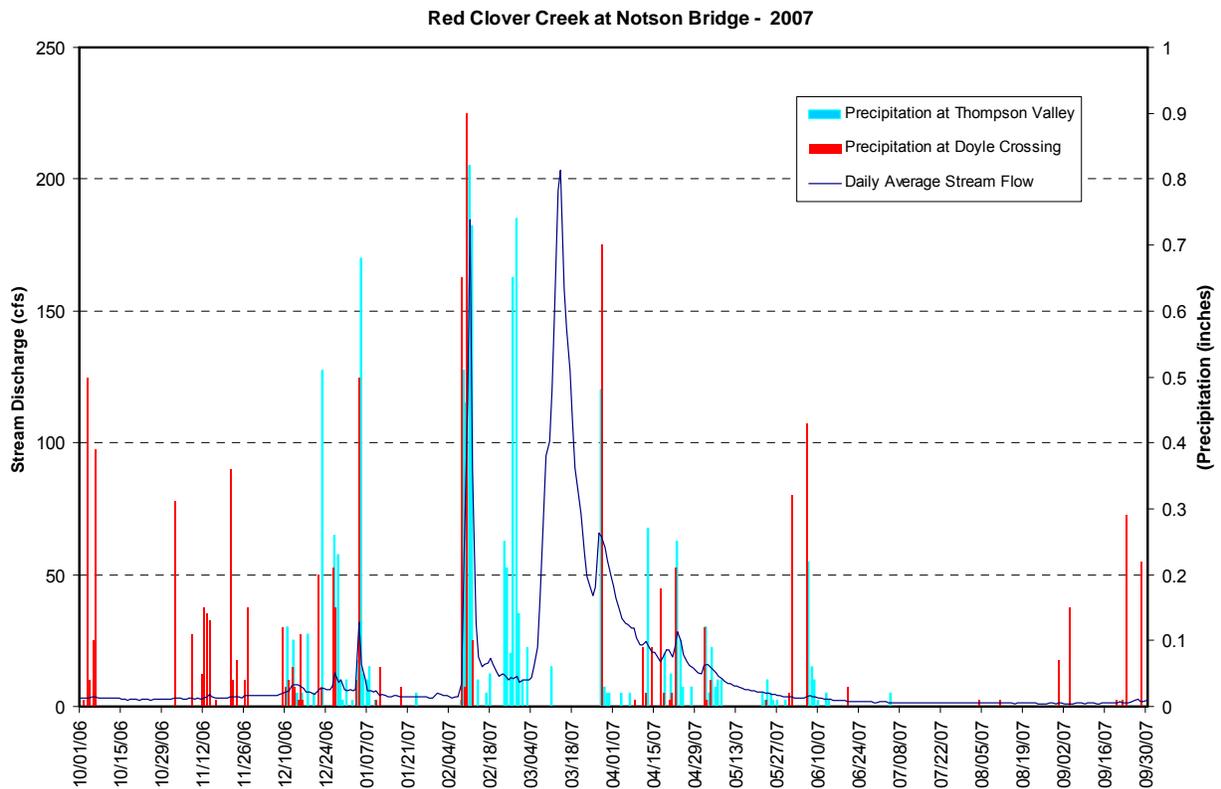
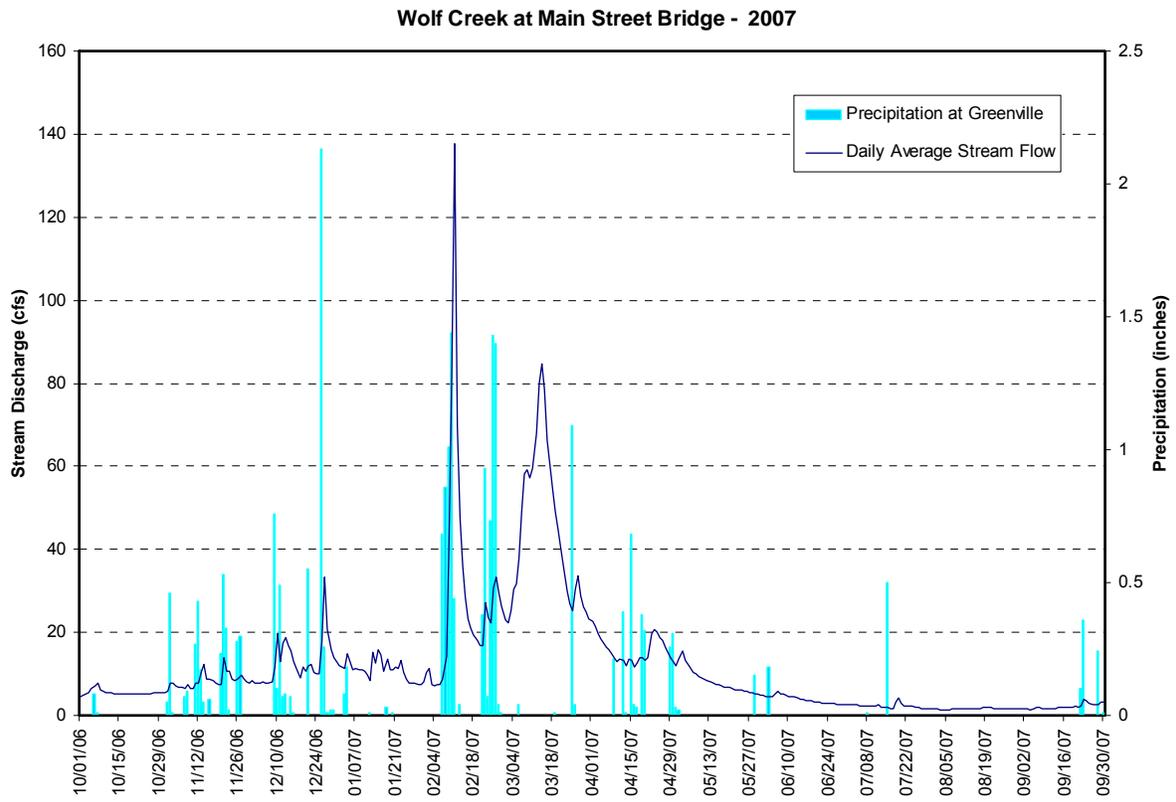
Finally, on Lights Creek @ Deadfall Lane Br. and Indian Creek @ Flournoy Br., the transducers were lowered to compensate for changes in the hydraulic control. Previously, the transducers were out of the water during low flows and were unable to collect valuable summer temperature and flow data.

In February 2008, FRCRM installed 13 feet of staff gage plates on the northern pier (#2) of the Highway 70 bridge in Quincy with an encroachment permit from the California Department of Transportation (CalTrans). The new gage plates are able to be read with binoculars from the right river bank or the pedestrian bridge. Maintenance and relocation of the Spanish Creek station was funded by the Quincy Community Services District as part of a contract to monitor Spanish Creek flows for their discharge permit. Cross-section measurements and flow-stage calibration measurements for the new CRS location will be completed in the 2008 water year.

Future Maintenance Needs:

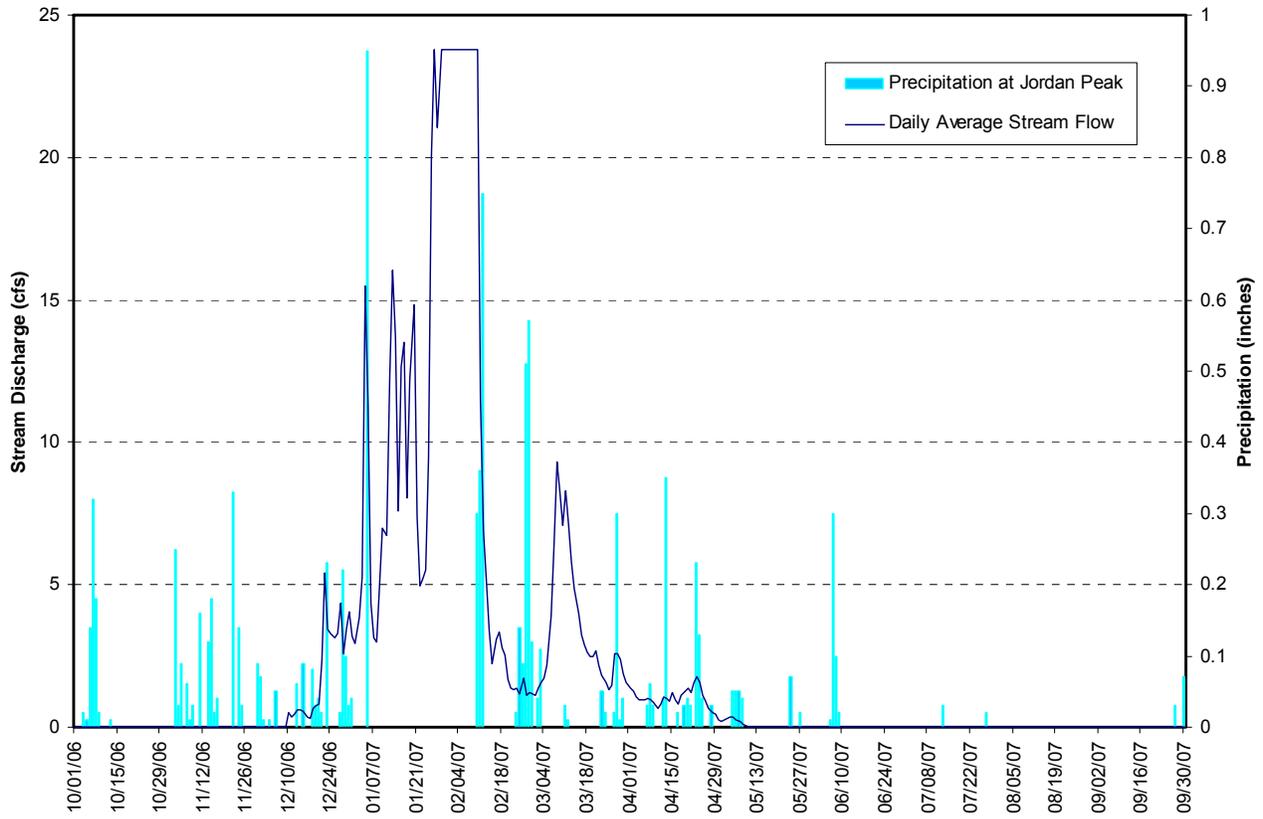
The data collected by the CRS on Indian Creek at the DWR weir indicates that the transducer may have failed and needs to be replaced after flows have receded in 2008. Wolf Creek at Main Street Bridge will require yearly maintenance by FR-CRM staff to excavate the transducer housing after the cessation of high flows. Finally, FR-CRM is considering installing the turbidity sensor from the Spanish Creek CRS on the data logger on Last Chance Creek @ Doyle Crossing. This will enable FR-CRM to collect better pre-project turbidity monitoring data on Last Chance Creek for the eight miles of Phase II construction in 2009-2010.

Appendix A. Annual hydrographs for continuous recording stations WY2007 (precipitation data taken at nearby weather stations)

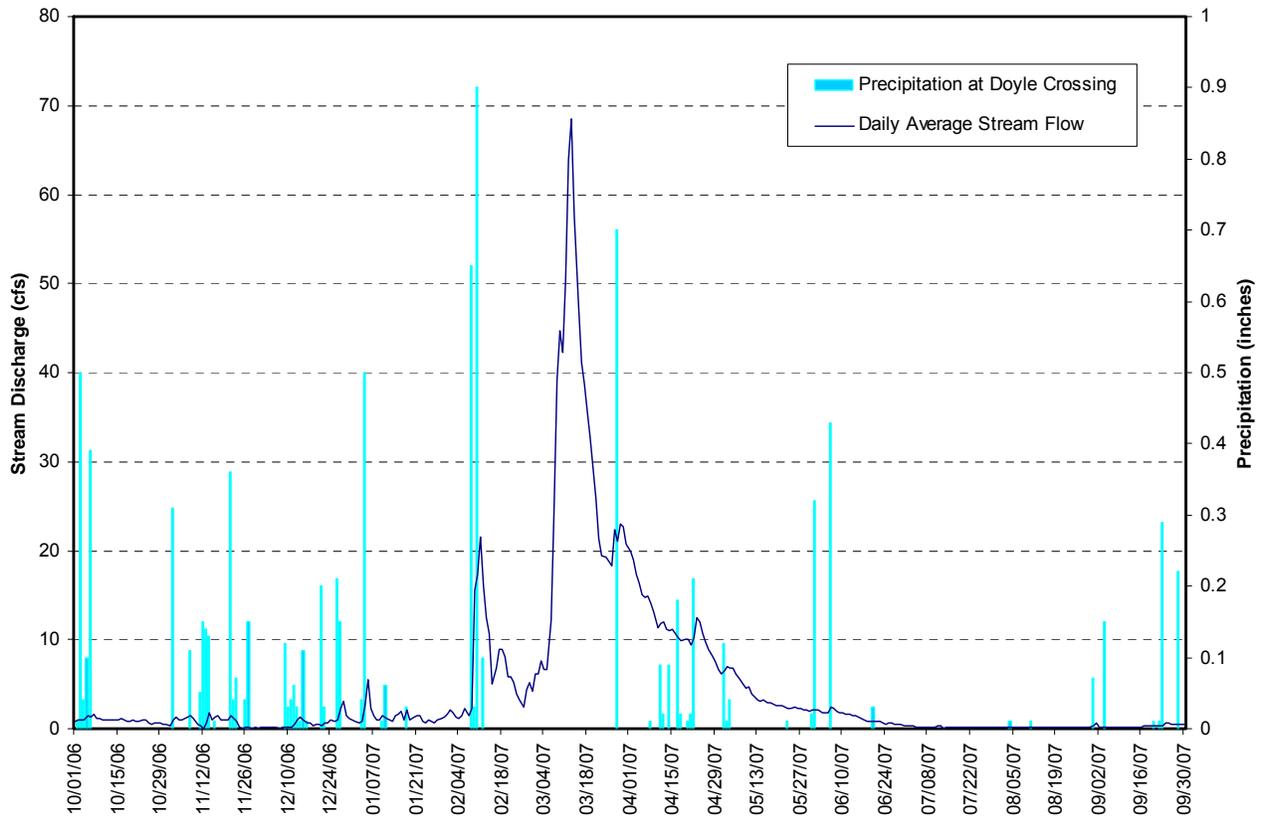


Note: Data from DWR weather station at Thompson Valley (TVL) came online 11/29/2006.

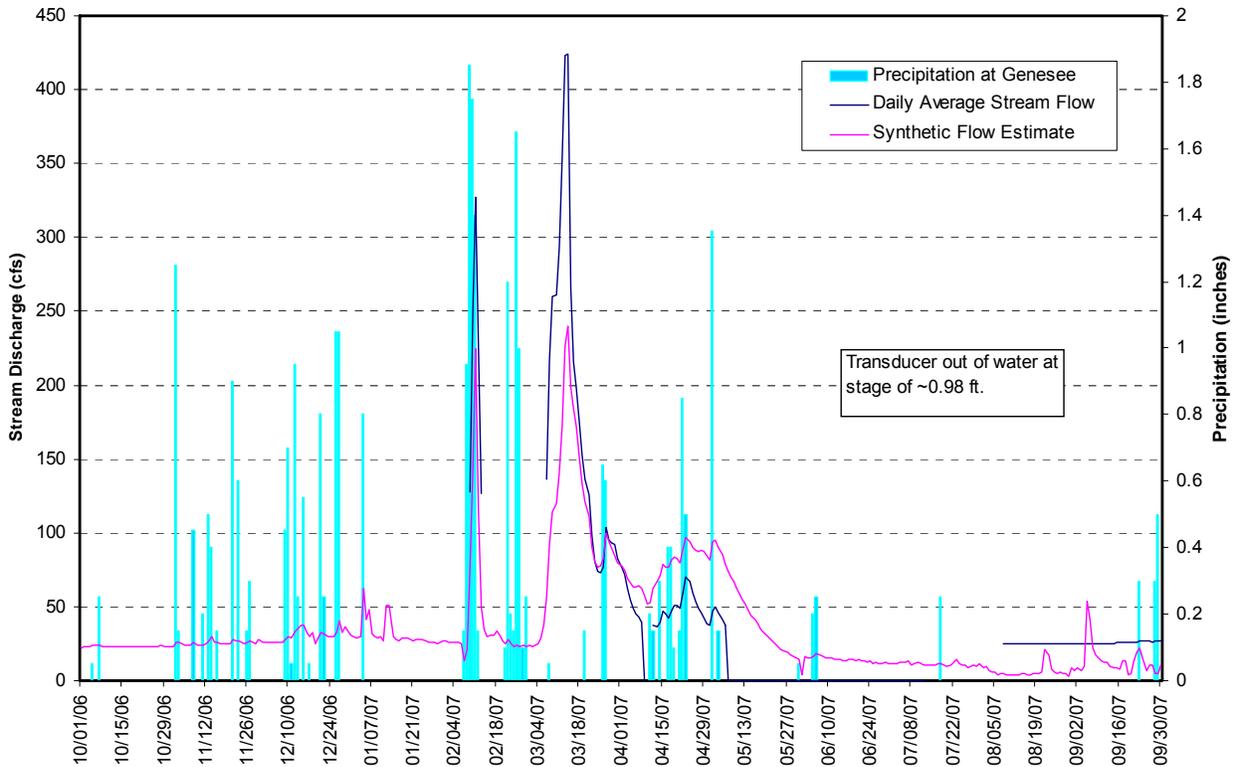
Last Chance Creek at Million Dollar Bridge - 2007



Last Chance Creek at Doyle Crossing - 2007

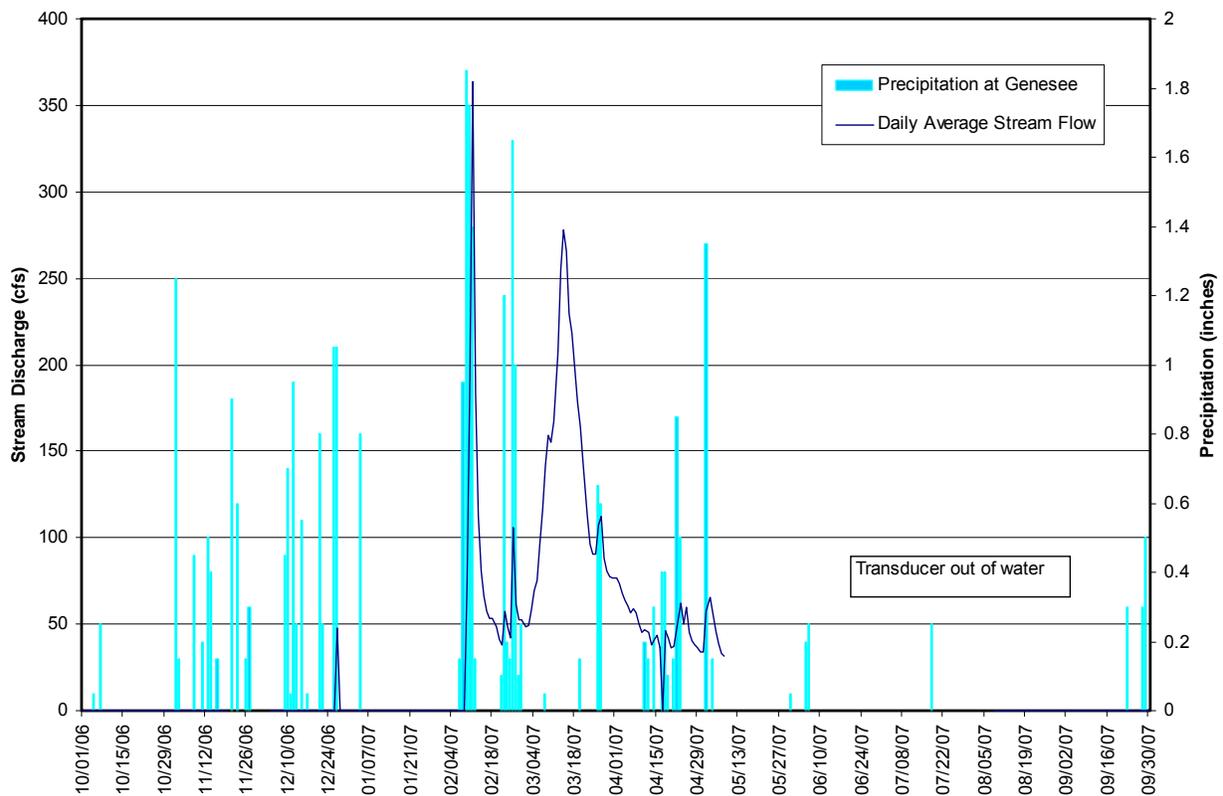


Indian Creek at Flournoy below Red Clover* - 2007



NOTE: Synthetic Flow Estimate = discharge recorded on Indian Creek @ DWR weir + Red Clover Creek @ Notson Bridge; transducer out of water during low flows resulting in missing data

Lights Creek at Deadfall Lane Bridge - 2007



NOTE: Transducer out of water from May-February resulting in missing data

Appendix B. Locations of FR-CRM restoration projects & Continuous Recording Stations in the Upper Feather River Watershed

