



*Technical Report*

2009

## **2007 SWAMP Labor Day Recreational Use Pilot Study**

**July 2009**



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# 2007 SWAMP Labor Day Recreational Use Pilot Study

*July 2009*

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**ACKNOWLEDGEMENTS:**

Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Assistance with site selection and field collection was provided by the Upper Mokelumne River Watershed Council and the Tuolumne County Citizen's Monitoring Group.

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## 1.0 EXECUTIVE SUMMARY

On August 30, September 2, and September 5, 2007, staff from the Central Valley Regional Water Quality Control Board (Central Valley Water Board) conducted a region-wide water quality pilot study of local swimming holes during a period of anticipated elevated recreation use, e.g. over a holiday weekend. The study consisted of sampling before, during, and after the 2007 Labor Day weekend, for general water quality parameters (specific conductivity, pH, DO, and temperature) as well as *E. coli* as a pathogen indicator. The main objectives of this effort were to: 1) gather water quality information in a limited group of local swimming holes; and 2) serve as a pilot study to identify potential logistical constraints when coordinating with local watershed groups during larger scale efforts.

Six stakeholder groups within the Central Valley Region were contacted to determine interest and ability to participate in this pilot study. Two groups in the San Joaquin River Watershed participated in the site selection and sample collection process. Staff provided training, supplies and sample transportation to the stakeholder groups assisting with sample collection. Two field crews from the Central Valley Water Board were required for each sample collection date and all *E. coli* sample analyses were conducted at Central Valley Water Board's in-house laboratory.

Results show that 13 out of a total of 15 sites met the US EPA's recommended full contact recreation limit for *E. coli* (<235 MPN/100mL) on all three collection dates. Two sites had concentrations above the US EPA's recommended limit for Designated Beach *E. coli* concentrations on one of the collection dates. Water quality for the other constituents measured (pH, temperature, dissolved oxygen, and specific conductance) generally met the Basin Plan objectives, in addition to the Bay-Delta Authority and US EPA guidelines used to evaluate them. Temperatures were elevated at several sites, when samples were collected in the afternoon rather than morning.

Based on information collected during this pilot study, a broader scaled effort to evaluate local swimming holes throughout the Central Valley Region during a holiday weekend should consider:

- a. Season may impact level of recreational use (e.g., Memorial Day weekend may be too early in the year for monitoring sites in the upper watersheds since the weather and water temperatures may be too cold)
- b. All samples should be collected in the afternoon to ensure consistency between sample collection times and to increase the likelihood that swimmers will be present.
- c. To insure bacteria analyses within the hold time of 24 hours, sampling runs and collection times must be designed to account for

laboratory transport (e.g. potential overnight shipments to analytical facilities).

- d. Laboratories that receive samples to be analyzed will need to be willing to accept and process samples during the holiday weekend.
- e. Many common carriers do not deliver on holidays which may limit the use of certain laboratories.
- f. Required sample volume and analytical capacity must be factored into the study design when determining how many samples can be analyzed for *Cryptosporidium* and *Giardia*.
- g. Sufficient staff need to be scheduled to ensure sample processors do not become fatigued (Approximately 30 samples per processor).

These recommendations were incorporated into the SWAMP Recreation Use Study - Labor Day 2008, which can be found at:  
[http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies/surface\\_water\\_ambient\\_monitoring/swamp\\_water\\_quality\\_reports/index.shtml#laborday2008](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/swamp_water_quality_reports/index.shtml#laborday2008).

Summary data sheets for this pilot study are provided in Appendix A and also posted at:  
[http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies/surface\\_water\\_ambient\\_monitoring/swamp\\_water\\_quality\\_reports](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/swamp_water_quality_reports).

## 2.0 INTRODUCTION

The purpose of this initial screening study was to provide water quality information on an initial set of local swimming holes as well as identify potential logistical constraints to conducting a broader valley wide survey of *E. coli* concentrations during a holiday weekend when contact recreation use is expected to be elevated. The survey was conducted before, during, and after Labor Day weekend in 2007 (August 30 – September 5, 2007).

Sampling sites consisted of locations throughout the Central Valley Region, including the American, Feather, Cosumnes, Calaveras, Mokelumne, and Tuolumne River Watersheds. The sites included those identified by stakeholder groups as local swimming holes.

Data collected at each site included *E. coli*, specific conductance (SC), pH, dissolved oxygen (DO), and temperature (Temp). Photographs were also taken.

## 3. BACKGROUND

One of the purposes of the Surface Water Ambient Monitoring Program (SWAMP) is to evaluate ambient water quality to determine beneficial use attainment. The Central Valley Regional Water Quality Control Board (Central Valley Water Board) Basin Plan identifies contact recreation as a beneficial use throughout the Region. Although the Basin Plan identifies a water quality objective that utilizes fecal coliform (not to exceed 400 MPN/100mL in a single sample), *E. coli* can also be utilized as an indicator for potential pathogens and is a subset of fecal coliform. The U.S. EPA has developed contact recreation guidelines for *E. coli*, and an Amendment to the Central Valley Basin Plan is pending that would change the bacteria objective to terms of *E. coli* (not to exceed 235 MPN/100mL in a single sample).

This study provides initial information on attainment of contact recreation use in selected Central Valley swimming holes as well as on potential logistical constraints in conducting a broader valley wide survey.

## 4. MONITORING OVERVIEW

This pilot study was developed and conducted within a 3-week period which limited the number of groups contacted and the availability of outside groups to participate.

Six watershed organizations and citizen monitoring groups within the San Joaquin River and lower Sacramento River Watersheds were contacted to determine interest in a swimming hole study, assist in site selection, and determine availability to participate in actual sample collection and transport. These organizations and groups were the Lodi Storm Drain Detectives, the San

Joaquin Stewardship Program, the Sierra Nevada Alliance, the Tuolumne County Citizen's Monitoring Group (TCCMG), the Upper Merced River Watershed Council, and the Upper Mokelumne River Watershed Council (UMRWC). The UMRWC and TCCMG were able to participate in site selection and sample collection.

Citizen monitors and Central Valley Water Board staff were provided sample collection procedures and training, sample collection field sheets, bacteria processing worksheets, and sample collection bottles developed and prepared by SWAMP staff at the Central Valley Water Board.

*E. coli* analysis was conducted by the Central Valley Water Board staff (staff), using in-house Idexx Colilert-18 and Colilert (Standard Method 9223 B) equipment and media. The SC, pH, DO, and Temp data were collected in the field using standard equipment: staff utilized YSI model 650 MDS/600 XLM sonde; and the Upper Mokelumne River Watershed Council utilized YSI model 85 DOCST and YSI 60.

Samples were collected on 8/30/07 and 9/5/07 in the morning, prior to 12 p.m. Samples collected on 9/2/07 were collected after 12 p.m.

Staff picked up samples collected by UMRWC and TCCMG and delivered them to the Central Valley Water Board lab for processing. Samples collected on 8/30/07 and 9/5/07 were picked up and processed the same day they were collected. Samples collected on 9/2/07 were picked up and processed on 9/3/07.

Figure 1 depicts site locations. Table 1 provides a summary of where the sites were located, who collected the samples from each site, and what data was collected at each site.

Figure 1 Sampling Sites: SWAMP Recreation Screening Study, Labor Day 2007

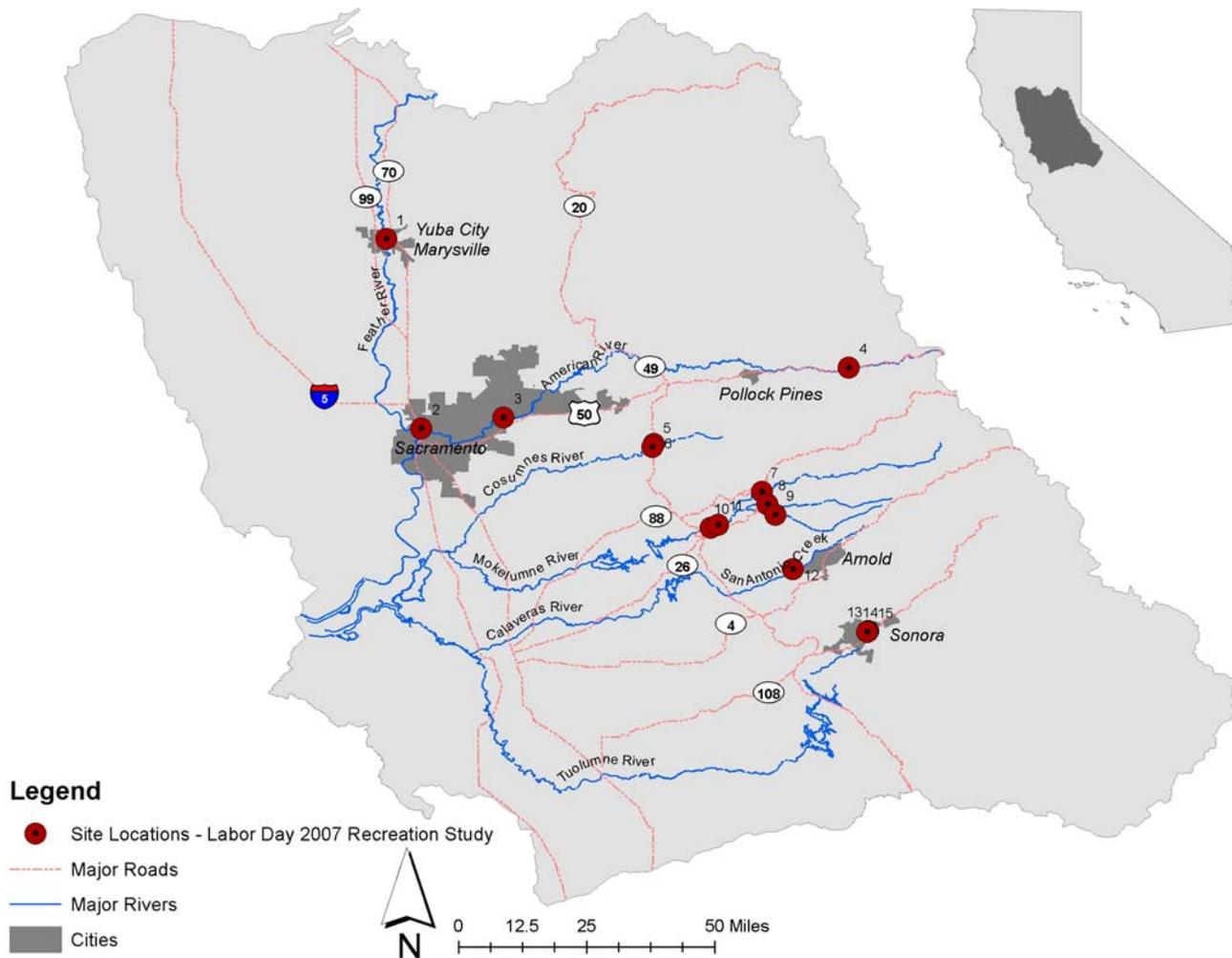


Table 1 Sample Site Summary: SWAMP Recreation Screening Study, Labor Day 2007

Site Number	Watershed	Collected By	Site Code	Site Description	Samples Collected							
					E	SC	pH	DO	T	P1	P2	P3
1	Feather	Water Board -S	SUT001	Feather River at the 5 <sup>th</sup> Street Bridge	X	X	X	X	X	X	X	X
2	American	Water Board -S	SAC007	American River at Discovery Park	X	X	X	X	X	X	X	X
3	American	Water Board -S	SAC008	American River at Sunrise	X	X	X	X	X	X	X	X
4	American	Water Board -S	ELD006	Silver Fork American River at Wildwood	X	X	X		X	X	X	X
5	Cosumnes	Water Board -S	ELD003	Cosumnes River at Gold Beach	X	X	X		X	X	X	X
6	Cosumnes	Water Board -S	ELD004	Cosumnes River at Highway 49	X	X	X		X	X		X
7	Mokelumne	UMRWC	AMA001	N. Fork Mokelumne River at Hwy 26 Bridge	X	X	X	X	X	X		
8	Mokelumne	UMRWC	CAL009	M. Fork Mokelumne at Hwy 26 Bridge	X	X	X	X	X	X		
9	Mokelumne	UMRWC	CAL010	S. Fork Mokelumne at Railroad Flat	X	X	X	X	X	X		
10	Mokelumne	UMRWC	AMA005	Mokelumne below Box Beach	X	X	X	X	X	X		
11	Mokelumne	UMRWC	AMA004	Mokelumne above Powerhouse	X	X	X	X	X	X		
12	Calaveras	UMRWC	CAL001	San Antonio Creek at Sheep Ranch Road	X	X	X	X	X	X		
13	Tuolumne	TCCMG	TUO210	Twain Harte Lake, wading area	X				X	X		
14	Tuolumne	TCCMG	TUO211	Twain Harte Lake, middle beachline	X				X	X		
15	Tuolumne	TCCMG	TUO212	Twain Harte Lake, near the dam	X				X	X		

Water Board -S = Central Valley Regional Water Quality Control Board – SWAMP staff

UMRWC = Upper Mokelumne River Watershed Council

E = E. coli

P1 = Photos taken 8/30/07

SC = Specific Conductivity

P2 = Photos taken 9/2/07

TCCMG. = Tuolumne County Citizen's Monitoring Group

DO = Dissolved Oxygen

P3 = Photos taken 9/5/07

T = Temperature

## 5.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Procedures for bacterial sample preparation, collection and analysis; and field QA/QC were based on the San Joaquin River Basin Bacteria Monitoring Procedures Manual (Central Valley Water Board, 2008a). Collection and analysis of all water samples occurred in compliance with the Quality Assurance Project Plan for this project (Central Valley Water Board, 2008b). Both documents were in draft form at the time of this study and have since been approved.

Samples collected for *E. coli* were analyzed using the IDEXX<sup>®</sup> Colilert-18 method (Analytical methods 9223B in STANDARD METHODS, EDITION 20). Additionally, 5 samples (including lab splits and field replicates) were analyzed using Colilert (24 hour method) to evaluate comparability between methods. Results using the Colilert method are reported in terms of Most Probable Number (MPN). Analyses were conducted in the Central Valley Water Board laboratory in Rancho Cordova. The QA/QC logs for bacteria analysis are maintained in the same laboratory.

Field and handling contamination were evaluated by submitting blind travel blanks (phosphate buffered saline) on each run for bacteria monitoring. Travel blank samples traveled through the sampling run, and were processed with the sample set. Blind laboratory blanks (phosphate buffered saline) were also used in the laboratory on each sampling day. All data sets used for this report had travel and laboratory blank results that fell below the analytical detection limits for the elements of concern.

Sample site homogeneity was evaluated by collecting and analyzing replicate bacteria samples at all sites for each sampling event in the form of a field duplicate.

Lab precision was evaluated using blind split samples. Blind split samples were collected at a 10% frequency for each sampling event by collecting the sample in a container double the normal sample volume and splitting that sample into two equal amounts at the analyzing laboratory.

Field instruments were calibrated the day prior to sampling. Calibration checks were performed before and after samples were collected following methods documented in the Ag Procedures Manual.

Table 2 lists the reporting limits, holding times and acceptable recoveries for the parameters monitored. Only data from sample sets whose QA/QC met these specifications have been included in this report.

**Table 2. Parameters, Acceptable Analytical Recoveries, Reporting Limits, and Holding Times**

Group	Parameter	Accuracy	Precision	Recovery	Target Reporting Limits	Calibration	Calibration Interval	Completeness	Holding Time	Container
Field Testing (YSI 600XLM)	pH	± 0.2 unit	0.01 unit	NA	0 to 14 units	Buffer solutions pH 4, 7, and 10	Each Sampling Event	90%	On Site	In Situ
Field Testing (YSI 600XLM)	Conductivity	± 0.5% of reading + 0.001 mS/cm	0.001 to 0.1 mS/cm (range dependent)	NA	0 to 100 mS/cm	3900 umhos standard	Each Sampling Event	90%	On Site	In Situ
Field Testing (YSI 600XLM)	Temperature	± 0.15°C	0.01°C	NA	-5 to 50°C	Not Required	Not Required	90%	On Site	In Situ
Field Testing (YSI 600XLM)	Dissolved Oxygen	± 0.5 mg/l	0.01 mg/l	NA	0 to 50 mg/l	Saturated Air	Each Sampling Event	90%	On Site	In Situ
Field Testing (YSI 85 DOCST)	Conductivity	± 0.5% full scale	0.1 umhos/cm	NA	0 to 499.9 umhos/cm	1 mS/cm standard	Each Sampling Event	90%	On Site	In Situ
Field Testing (YSI 85 DOCST)	Temperature	± 0.1°C (± 1 lsd)	0.1°C	NA	-5 to 65°C	NA	Each Sampling Event	90%	On Site	In Situ
Field Testing (YSI 85 DOCST)	Dissolved Oxygen	± 0.3 mg/l	0.01 mg/l	NA	0.01 mg/l	Saturated Air	Each Sampling Event	90%	On Site	In Situ
Field Testing (YSI 60)	pH	± 0.1unit	0.01 unit	NA	0 to 14 units	NA	NA	90%	On Site	In Situ

Group	Parameter	Accuracy	Precision	Recovery	Target Reporting Limits	Calibration	Calibration Interval	Completeness	Holding Time	Container
Field Testing (YSI 60)	Conductivity	± 0.5% full scale	0.1 umhos/cm	NA	0 to 499.9 umhos/cm	NA	NA	90%	On Site	In Situ
Field Testing (YSI 60)	Temperature	± 0.1°C (± 1 lsd)	0.1°C	NA	-5 to 75°C	NA	NA	90%	On Site	In Situ
Bacterial Analyses	E. coli	P/A	Lab duplicate, RPD<25%; Field Duplicate, within 95% CI supplied by Idexx (na if native concentration of either sample < or > RL)	Travel blank <1 MPN/100 ml	1 MPN/100 mL	NA	NA	90%	24 Hr	Factory sterilized 100 ml plastic
Bacterial Analyses	Total Coliform	P/A	Lab duplicate, RPD<25%; Field Duplicate, within 95% CI supplied by Idexx (na if native concentration of either sample < or > RL)	Travel blank <1 MPN/100 ml	1 MPN/100 mL	NA	NA	90%	24 Hr	Factory sterilized 100 ml plastic

## 6. RESULTS

### Water Quality Results

Summaries of the results by site can be found in Appendix A and on the internet at [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies/surface\\_water\\_ambient\\_monitoring/swamp\\_recreational\\_use\\_pilot\\_2007/index.shtml](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/swamp_recreational_use_pilot_2007/index.shtml). Results were compared to the quality guidelines and water quality objectives listed in Table 3. The table identifies the most limiting parameter concentration by beneficial use to provide a conservative context for the evaluation of the results since some parameters do not have guidelines identified for recreational use.

**Table 3 Water Quality Objectives and Guidelines used to Evaluate 2007 Rec Study Data**

Constituent	Reference Document	Water Quality Objective/Guideline	Limiting Beneficial Use
Specific Conductance	CVRWQCB Basin Plan (2007)	700 umhos/cm	Irrigation
pH	CVRWQCB Basin Plan (2007)	6.5-8.5	Aquatic Life
DO	CVRWQCB Basin Plan (2007)	7.0 mg/l	Aquatic Life
Temperature	Bay-Delta Authority Guideline	20 -C	Aquatic Life
<i>E. coli</i>	US EPA Maximum Single Sample Density Guideline		Recreation
	Designated Beach Area	<235 MPN/100ml	
	Moderate Full Body Contact	<298 MPN/100ml	
	Light Full Body Contact	<409 MPN/100ml	
	Infrequent Full Body Contact	<575 MPN/100ml	

Flow data for the period of 8/20/07 – 9/10/07 was reviewed to determine if changes in flow might have affected results, and can be found in Appendix B. Data was available from the following stations:

Department of Water Resources  
 Middle Fork Cosumnes River near Somerset (CMF)  
 38.625, -120.701  
 North Fork Cosumnes River near El Dorado (CNF)  
 38.590, -120.843  
 Feather River near Gridley (GRL)  
 39.3667, -121.6475  
 United States Geological Survey  
 American River at Fair Oaks (AFO)  
 38.636, -121.227  
 East Bay Municipal Utilities District  
 Mokelumne River at Highway 49 (MKM)  
 38.313, -120.719

Flow at all stations except MKM remained relatively consistent, in general having a daily variation of less than 50cfs. Flow at MKM spiked to 230 cfs on 8/29, after having been only 100 cfs on 8/27. Then, on 9/2, flow dropped to -5cfs. The flow variations, or lack of variation, were not reflected in the water quality results.

One hundred and twenty seven samples were collected for total coliform and *E. coli* analysis as follows:

<i>Colilert-18</i>	<i>Colilert</i>
Normal Sample: 44	Normal Sample: 2
Field Duplicates: 32	Field Duplicate: 1
Lab Duplicates: 2 sets of 13 +1 sample that was split from the normal (27 total)	Lab Duplicate: 1 set of 2 samples (2 total)
Trip Blanks: 13	
Lab Blanks: 6	

There is no applicable criteria for evaluating total coliform concentrations in ambient streams. Total coliform criteria does exist for drinking water, however, the criteria is mainly used as an indicator of possible failures in the system and is designed to be utilized at the tap.

All samples except five fell within USEPA's most limiting guideline (<235 MPN/100mL) for designated beach areas. The two samples collected at San Antonio Creek at Sheep Ranch Road on 9/5/07 were within criteria for light full body contact (at 365 MPN/100 ml) and infrequent full body contact (at 435 MPN/100ml). One sample collected at Feather River at Beckworth River Front Park on 9/2/07 exceeded all criteria with a result of 816 MPN/100ml. A second sample collected at the same site on the same day and split in the lab the reported concentrations of 365 and 361 MPN/100mL which fall within the

guideline for light full body contact. Duplicate samples at all sites except Feather River at the Beckworth River Front Park swimming hole were within the 95% Confidence Intervals, regardless of the test used (Colilert vs. Colilert-18) .

Insufficient field equipment resulted in missing selected field data (e.g. DO and/or photographs) for some sites.

Twenty six samples were evaluated for SC against irrigation supply criteria, which has as its most protective limit (700 umhos/cm). The highest SC measured during this study was 95 umhos/cm at Feather River at Beckworth Park.

Twenty five samples were evaluated for pH against aquatic life criteria, with an acceptable range of 6.5 – 8.5. Two samples, both at American River at Sunrise, were outside of this range. The sample collected on 9/2/07 was 8.77 pH, and the sample collected on 9/5/07 was 8.81 pH.

Twenty four samples were evaluated for DO against aquatic life criteria for the most protective limit of 7.0 mg/L. All results were above this level indicating adequate dissolved oxygen concentrations.

Twenty nine samples were evaluated for temperature against the Bay Delta target of <20°C. Thirteen samples were within this target. All but one sample collected on 9/2/07, when samples were collected in the afternoon, were above this criterion. The one exception was the sample collected at the Main stem Mokelumne upstream of the Electra Powerhouse site.

## **Logistical Results**

In addition to providing preliminary water quality information, this pilot study allowed evaluation of potential constraints when attempting to expand sampling of local swimming holes throughout the Central Valley in coordination with local watershed groups. Some of the key constraints anticipated included providing appropriate training and materials, meeting analytical holding times while juggling logistics of multiple sampling crews, and maintaining adequate chain of custody of samples. Additional issues surfaced, such as initiating sampling at a time when recreation is anticipated (e.g. not at 7 a. m.), returning to each site at approximately the same time each collection, and reducing fatigue of processing staff. Findings follow.

### Training and Supplies

The short turn around time for this study precluded the involvement of a number of interested watershed groups and limited the availability of supplies for sample collection and analysis. A broader scale study should allow adequate time for

stakeholder contact and training as well as sorting supplies. A minimum of 4-months is recommended.

### Meeting Analytical Holding Times

The vision for a region-wide study includes analysis for *Cryptosporidium* and *Giardia*. Depending on the laboratory, sample volume requirements can range between 10 to 19 liters (2.6 to 5 gallons). In addition, laboratories are typically limited by the number of samples that can be filtered within analytical holding times. Collecting and transporting these large sample volumes would need to be taken into consideration when determining how many sites are sampled for these analytes.

Samples analyzed for *E. coli*, *Cryptosporidium*, and *Giardia* must arrive at the analyzing lab within twenty four hours of sample collection. While it would be preferred that *E. coli* samples be analyzed within six hours of collection, remoteness of the sample collection location may require either local analyses of *E. coli* samples or extending the hold time. Therefore, the 24-hour holding time should be utilized for *E. coli*, which (per SWAMP protocol) allows results to be utilized for assessments. Additionally, the Central Valley Water Board laboratory should be utilized for all *E. coli* analysis to insure that all samples are handled consistently.

To meet the 24-hr holding time for non-local contract laboratories, samples for *Cryptosporidium* and *Giardia* may need to be shipped to the analyzing lab the same day they are collected. Initial planning determined that Federal Express does not guarantee same day courier service, nor do they deliver on certain holidays. Additionally, some laboratories do not analyze samples during a holiday weekend.

Planning for a full basin study would require timely sample transport to all analyzing facilities and insuring that the lab identified to conduct the analysis is staffed during the holiday weekend.

### Timing Sample Collection

Samples collected on 8/30 and 9/5 were generally collected prior to 12pm, while samples collected on 9/2 were generally collected after 11am. After reviewing photos that were taken at some of the sites, it became apparent that samples collected prior to 11am missed the window when contact recreation was likely to be highest. For future holiday recreation studies, all samples should be collected after 11am, when it is more likely that swimmers will be present. In addition, sampling at each site should occur roughly at the same time of day for each of the three days to limit diurnal influences on dissolved oxygen concentrations, temperature, and pH.

Stakeholders also noted that a region wide study would need to take in to account the various environmental differences. For instance, to conduct a study over Memorial Day weekend in May might not be useful to areas higher in elevation since the water would not be warm enough to attract recreational use. However, such a study would be helpful to interested parties in lower elevations. A longer time period to discuss items such as site selection and timing with local stakeholders may help to solidify the best timing.

### Staff Fatigue

Although sufficient staff were available for sample collection, transport and processing during this pilot study, the same person processed all samples in this study. A preferred alternative would be to maintain a reasonable ratio between processing staff and samples to be processed. A ratio of approximately 30-samples/processor would reduce the fatigue of the processor, thus reducing the possibility of error, and reduce processing time between individual samples thereby increasing the quality of the results.

## **7. CONCLUSION**

Water quality observed during this study generally fell within water quality goals, guidelines and targets. Although samples collected in the afternoon generally did not meet the Bay Delta temperature target for aquatic life, most samples did meet the USEPA bacteriological criteria for designated beaches.

Future studies involving staff from all three Central Valley Water Board offices and local stakeholder groups are feasible. However, to ensure groups would be able to participate, coordination would need to begin several months out from the holiday weekend. Also, key items would need to be considered:

- a. Season needs to be considered when determining a monitoring schedule (e.g., Memorial Day weekend may be too early in the year for monitoring sites in the upper watersheds since the weather and water temperatures may be too cold)
- b. All samples should be collected in the afternoon to ensure consistency between sample collection times and to increase the likelihood that swimmers will be present.
- c. To insure bacteria analyses within the hold time of 24 hours, sampling runs and collection times must be designed to account for laboratory transport (e.g. potential overnight shipments to analytical facilities).
- d. Laboratories that receive samples to be analyzed will need to be willing to accept and process samples during the holiday weekend.
- e. Many common carriers do not deliver on holidays which may limit the use of certain laboratories.

- f. Required sample volume and analytical capacity must be factored into the study design when determining how many samples can be analyzed for *Cryptosporidium* and *Giardia*.
- g. A ratio of approximately 1-staff per 30-samples for in house processing of *E. coli* samples should be established to ensure processors do not become fatigued and that there is limited time between individual sample processing.

These items were taken into account in designing the SWAMP Labor Day 2008 Recreation Study which covered 57-sites throughout the Central Valley. A draft of the 2008 study is available at [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies/surface\\_water\\_ambient\\_monitoring/swamp\\_water\\_quality\\_reports/](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/swamp_water_quality_reports/).

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U.S. Environmental Protection Agency. 1986. *Ambient Water Quality Criteria for Bacteria*. 15-16. (<http://www.epa.gov/waterscience/beaches/files/1986crit.pdf>).

YSI Incorporated. *6-Series Multiparameter Water Quality Sondes User Manual, Appendix O*. ([https://www.yei.com/portal/page/portal/YSI\\_Environmental/Products/Product\\_Family/Product?productID=EMS\\_SON08\\_600XLM](https://www.yei.com/portal/page/portal/YSI_Environmental/Products/Product_Family/Product?productID=EMS_SON08_600XLM)).

YSI Incorporated. *YSI Model 60 Handheld pH and Temperature System Operations Manual*. ([https://www.yei.com/portal/page/portal/YSI\\_Environmental/Products/Product\\_Family/Product?productID=WQS\\_60](https://www.yei.com/portal/page/portal/YSI_Environmental/Products/Product_Family/Product?productID=WQS_60))

YSI Incorporated. *YSI Model 85 Handheld Oxygen, Conductivity, Salinity, and Temperature System Operations Manual*. ([https://www.yei.com/portal/page/portal/YSI\\_Environmental/Products/Product\\_Family/Product?productID=WQS\\_85](https://www.yei.com/portal/page/portal/YSI_Environmental/Products/Product_Family/Product?productID=WQS_85))

**APPENDIX A: 2007 SWAMP Labor Day Recreational Use Pilot Study Data  
Sheets**

**Description of Sample Site:** Silver Fork American River at Wildwood  
**SWAMP Site ID:** ELD006  
**Watershed:** American River  
**County:** El Dorado  
**Longitude:** -120.2960  
**Latitude:** 38.7744

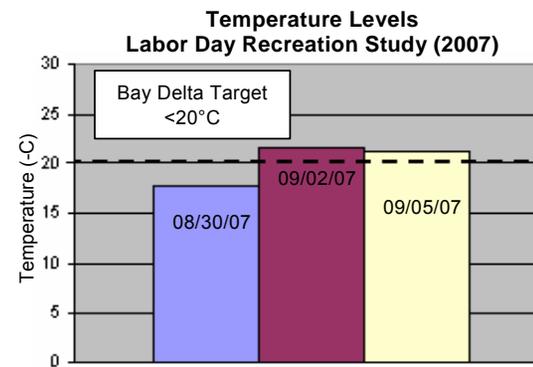
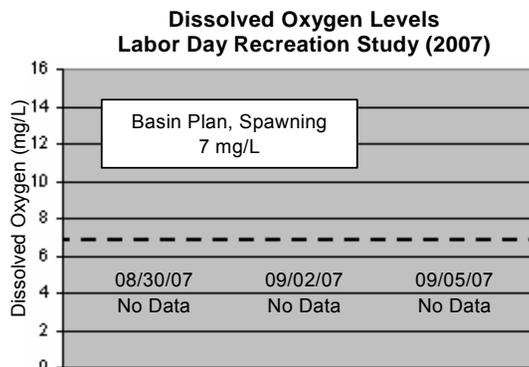
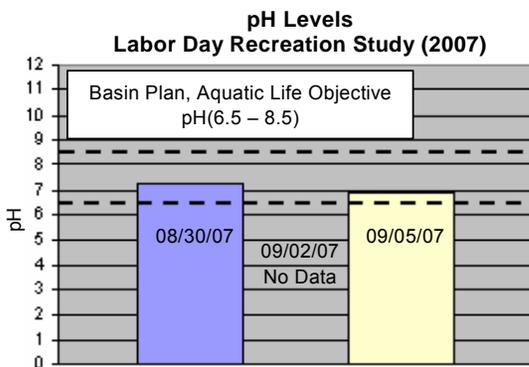
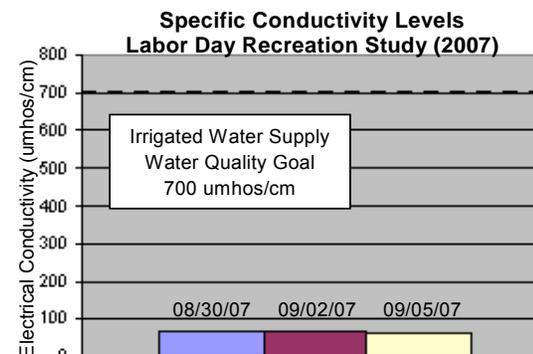
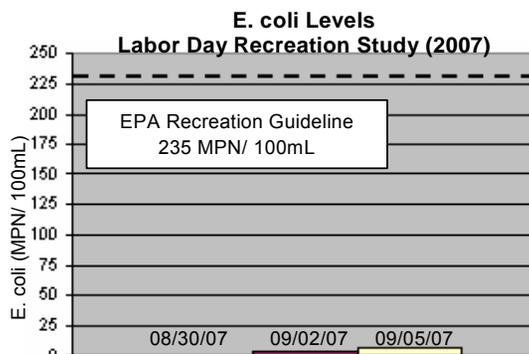
Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	1733	>2420	1300
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	<1.0	4	6.3
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	65.5	65.6	NA
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	7.24	NA	NA
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	17.8	21.6	NA
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	NA	NA	NA

NOTES: Shaded table cells contain values that do not meet the water quality guidelines.  
 SWAMP Staff assisted with field collection at this site.

## Bacteria Screening Survey-Before, During and After Labor Day 2007 Silver Fork American River at Wildwood



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using E. coli as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at:  
[http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

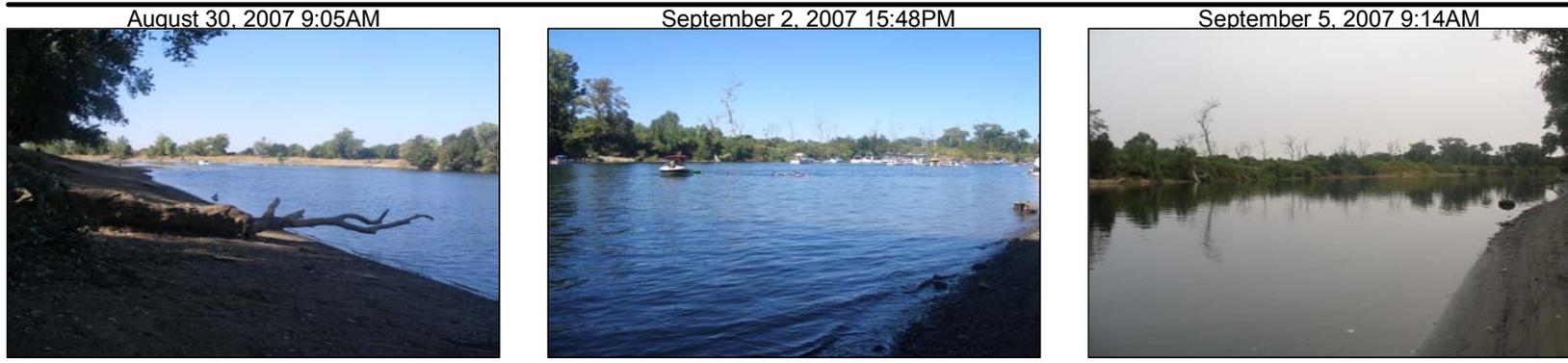


**Description of Sample Site:** American River at Discovery Park  
**SWAMP Site ID:** SAC007  
**Watershed:** American River  
**County:** Sacramento  
**Longitude:** -121.5033  
**Latitude:** 38.6020

Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	>2420	>2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	57	86	62
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	57	57	54
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	7.85	8.07	7.99
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	20.89	22.2	19.31
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	13.3	9.6	9.51

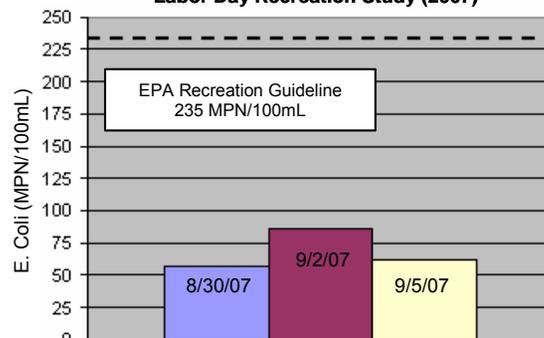
NOTES: Shaded table cells contain values that do not meet the water quality guidelines.  
 SWAMP Staff assisted with field collection at this site.

### Bacteria Screening Survey—Before, During and After Labor Day 2007 American River at Discovery Park

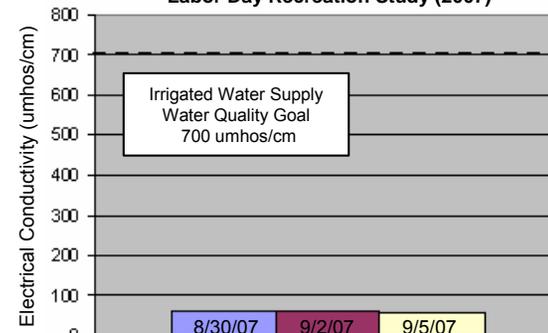


The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

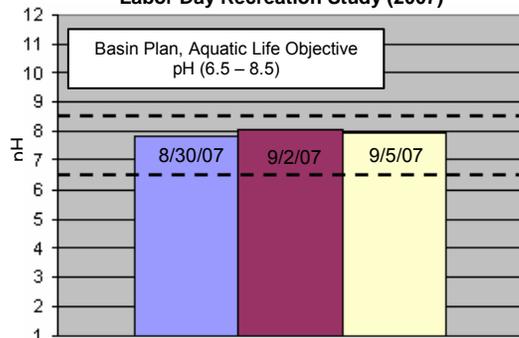
**E. coli Levels  
Labor Day Recreation Study (2007)**



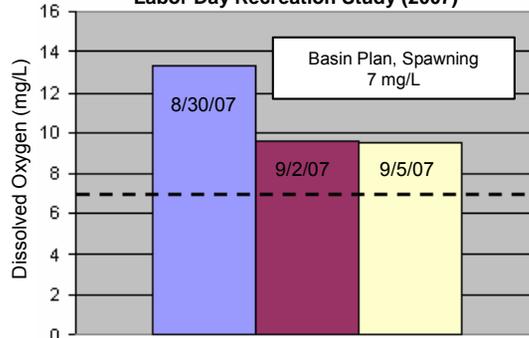
**Specific Conductivity Levels  
Labor Day Recreation Study (2007)**



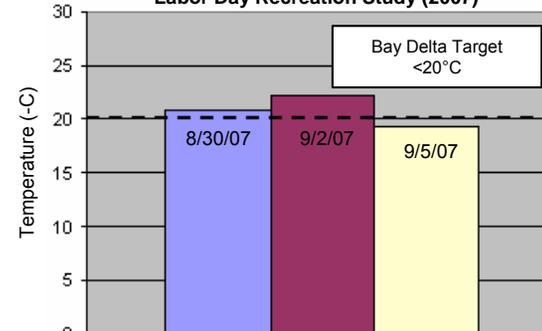
**pH Levels  
Labor Day Recreation Study (2007)**



**Dissolved Oxygen Levels  
Labor Day Recreation Study (2007)**



**Temperature Levels  
Labor Day Recreation Study (2007)**

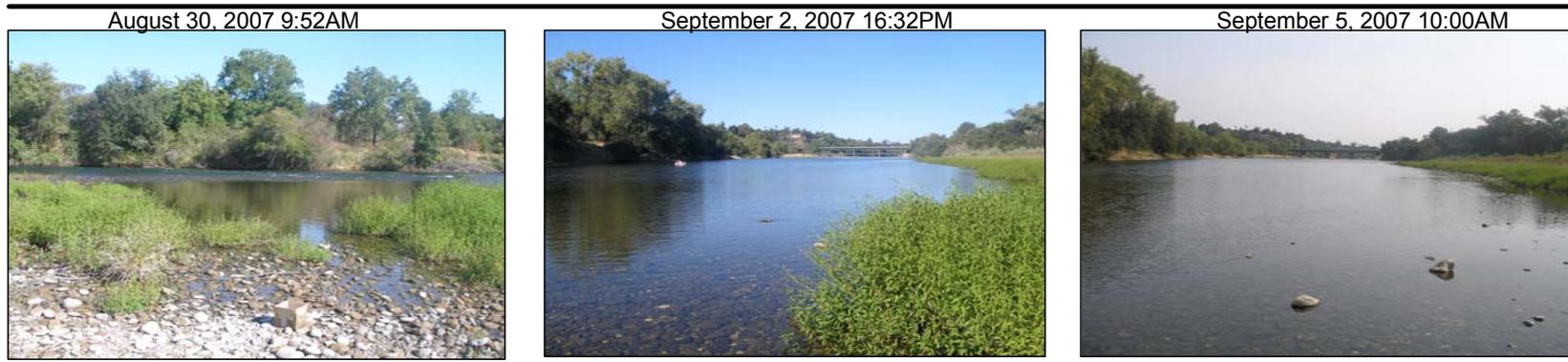


**Description of Sample Site:** American River at Sunrise Blvd.  
**SWAMP Site ID:** SAC008  
**Watershed:** American River  
**County:** Sacramento  
**Longitude:** -121.2710  
**Latitude:** 38.6326

Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	2420	>2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	91	43	35
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	68	67	67
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	7.89	8.77	8.81
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	20.02	24.33	19.53
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	14.9	10.98	13.06

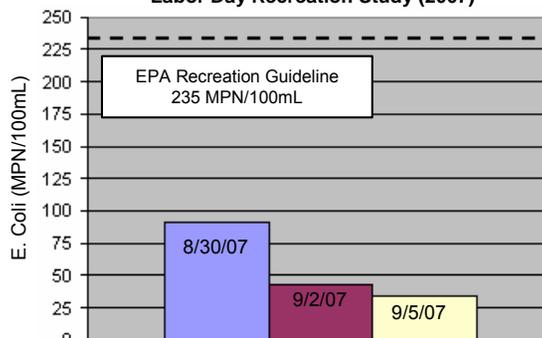
NOTES: Shaded table cells contain values that do not meet the water quality guidelines.  
 SWAMP Staff assisted with field collection at this site.

### Bacteria Screening Survey—Before, During and After Labor Day 2007 American River at Sunrise Blvd.

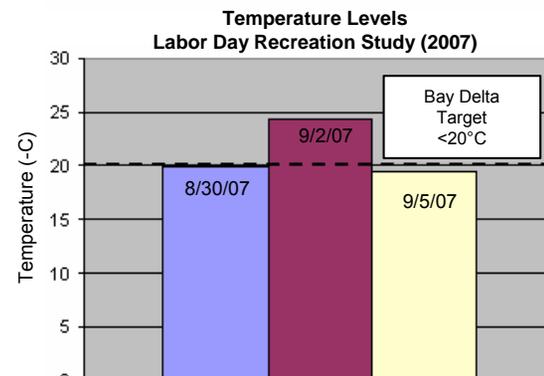
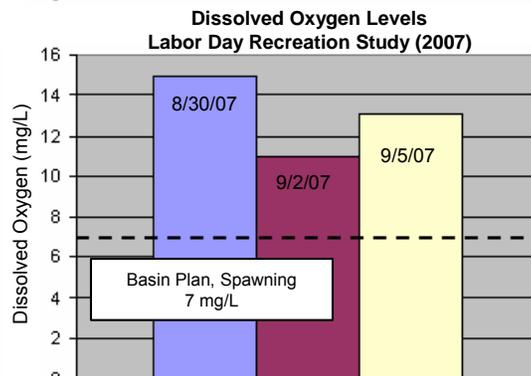
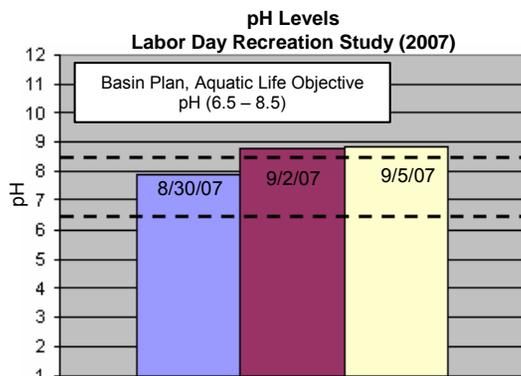
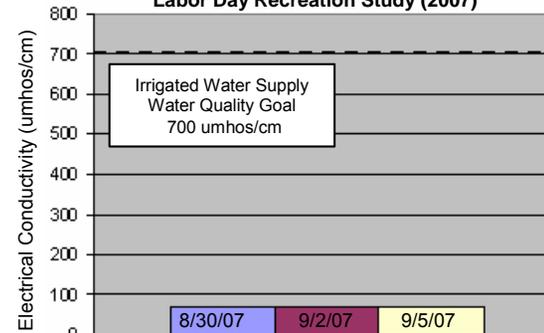


The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

**E. coli Levels  
Labor Day Recreation Study (2007)**



**Specific Conductivity Levels  
Labor Day Recreation Study (2007)**

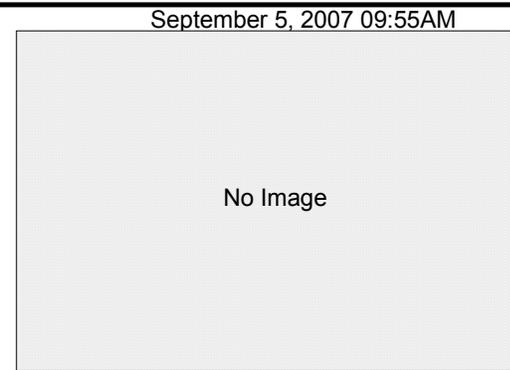
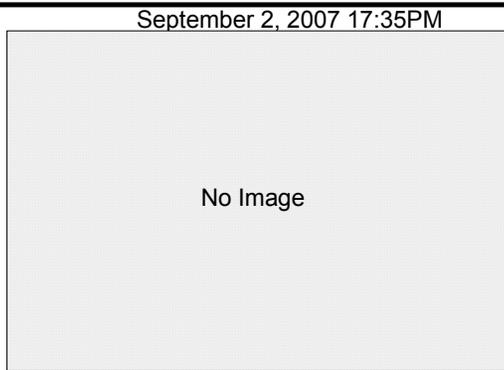


**Description of Sample Site:** San Antonio Creek at Sheep Ranch Road  
 (Calaveras at San Antonio Creek)  
**SWAMP Site ID:** 533CAL001  
**Watershed:** Calaveras River  
**County:** Calaveras  
**Longitude:** -120.4533  
**Latitude:** 38.2047

Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	>2420	>2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	147	34	365
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	74.9	75.6	75.6
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	7.59	7.7	7.53
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	20.8	22.3	15.6
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	7.94	7.73	8.51

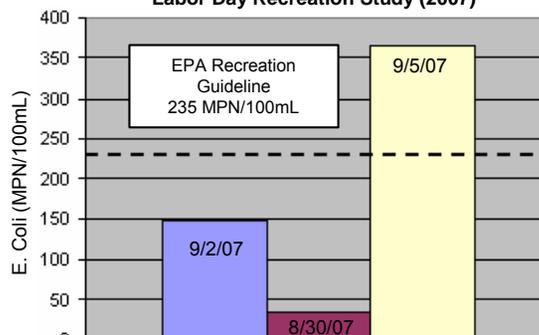
NOTES: Shaded table cells contain values that do not meet the water quality guidelines.  
 Upper Mokelumne River Watershed Council assisted with field collection at this  
 site.

### Bacteria Screening Survey—Before, During and After Labor Day 2007 Calaveras at San Antonio Creek

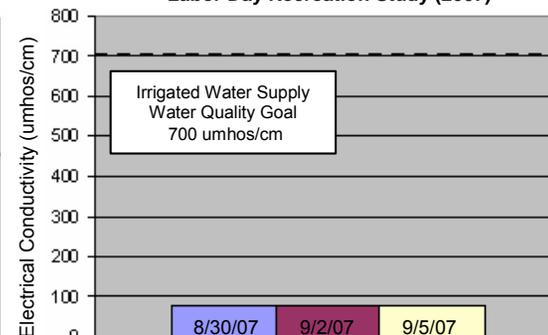


The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

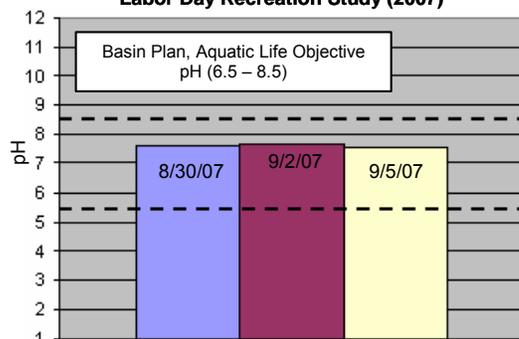
**E. coli Levels  
Labor Day Recreation Study (2007)**



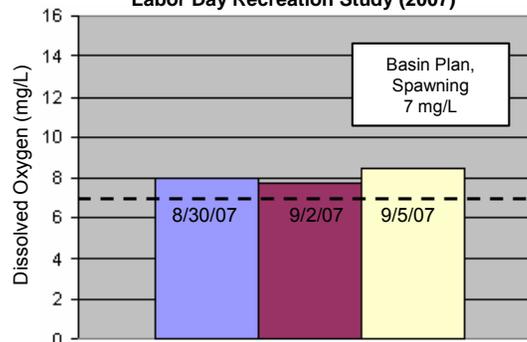
**Specific Conductivity Levels  
Labor Day Recreation Study (2007)**



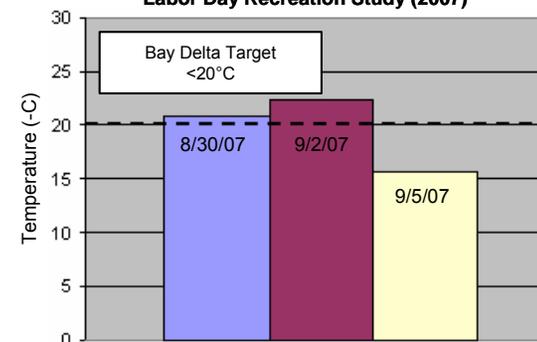
**pH Levels  
Labor Day Recreation Study (2007)**



**Dissolved Oxygen Levels  
Labor Day Recreation Study (2007)**



**Temperature Levels  
Labor Day Recreation Study (2007)**



**Description of Sample Site:** Cosumnes River at Gold Beach  
**SWAMP Site ID:** 532ELD003  
**Watershed:** Cosumnes River  
**County:** El Dorado  
**Longitude:** -120.8464  
**Latitude:** 38.5592

Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	>2420	>2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	81	71	47
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	NA	NA	NA
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	NA	NA	NA
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	NA	NA	NA
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	NA	NA	NA

NOTES: Shaded table cells contain values that do not meet the water quality guidelines.  
 SWAMP Staff assisted with field collection at this site.

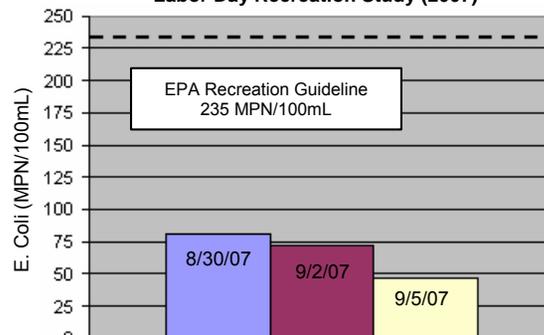
### Bacteria Screening Survey—Before, During and After Labor Day 2007 Consumnes River at Gold Beach



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

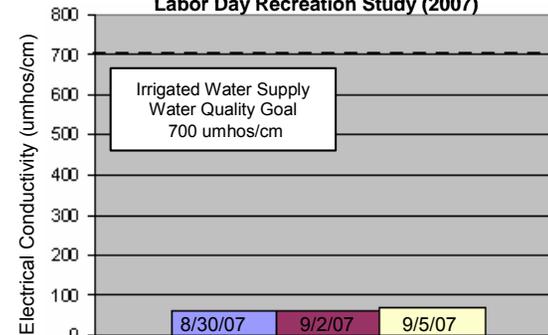
#### E. coli Levels

##### Labor Day Recreation Study (2007)



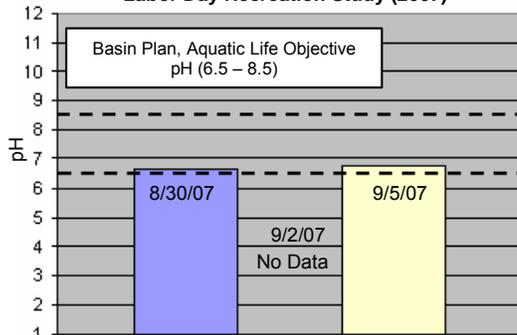
#### Specific Conductivity Levels

##### Labor Day Recreation Study (2007)



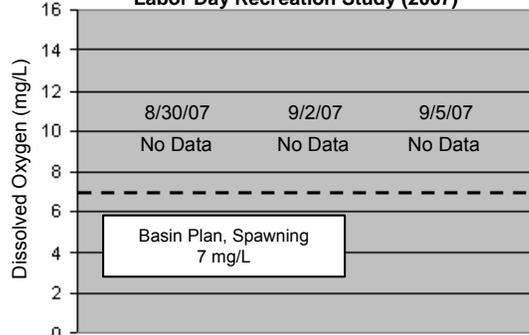
#### pH Levels

##### Labor Day Recreation Study (2007)



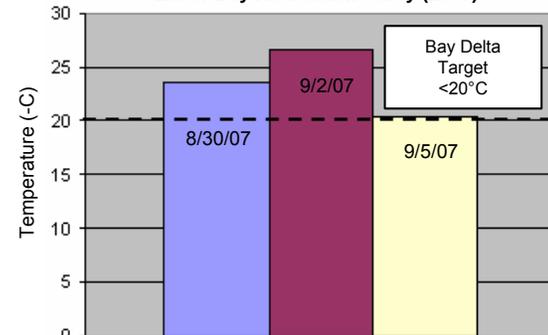
#### Dissolved Oxygen Levels

##### Labor Day Recreation Study (2007)



#### Temperature Levels

##### Labor Day Recreation Study (2007)

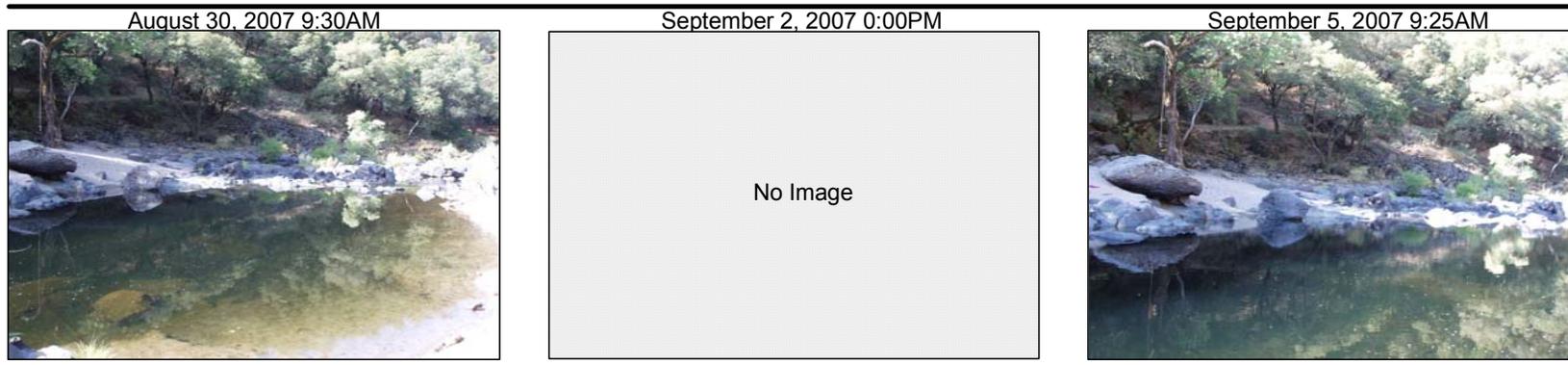


**Description of Sample Site:** Cosumnes River at Highway 49  
**SWAMP Site ID:** 532ELD004  
**Watershed:** Cosumnes River  
**County:** El Dorado  
**Longitude:** -120.8497  
**Latitude:** 38.5508

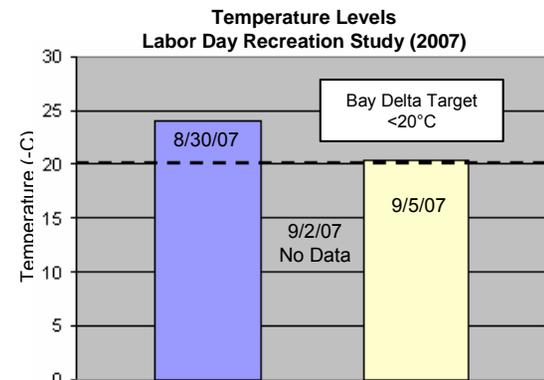
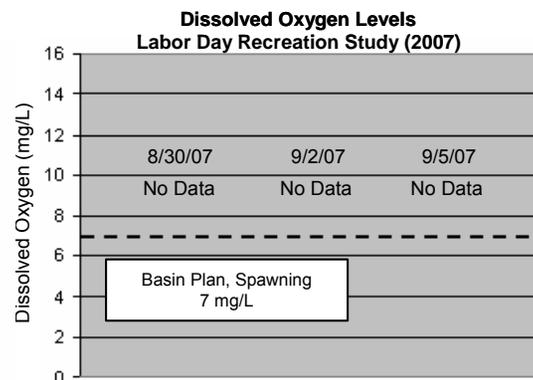
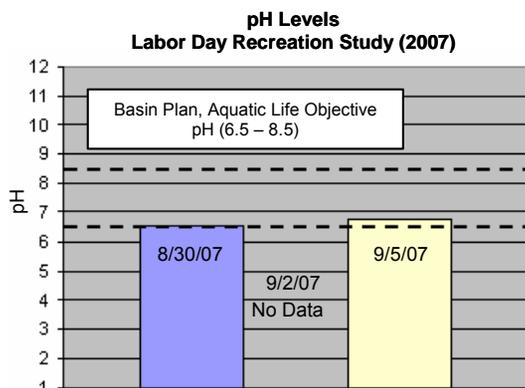
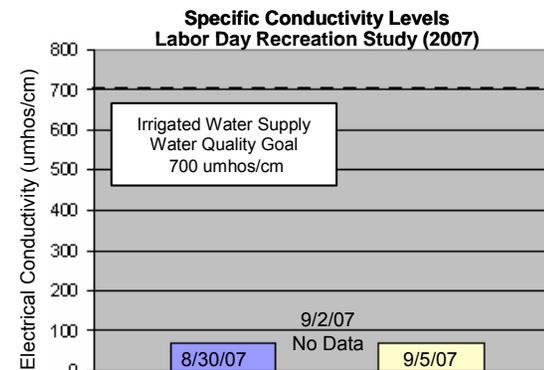
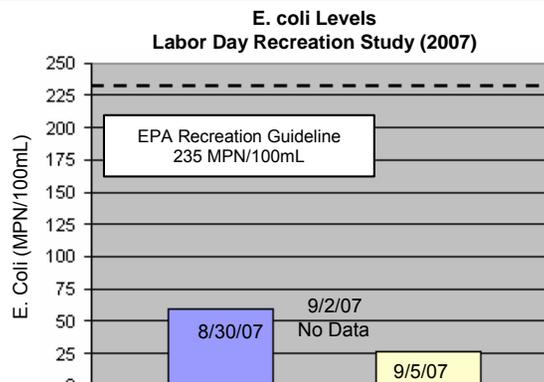
Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	NA	>2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	59	NA	27
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	NA	NA	NA
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	NA	NA	NA
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	NA	NA	NA
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	NA	NA	NA

NOTES: Shaded table cells contain values that do not meet the water quality guidelines.  
 SWAMP Staff assisted with field collection at this site.

### Bacteria Screening Survey—Before, During and After Labor Day 2007 Consumnes River at Highway 49



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).



**Description of Sample Site:** Feather River at Fifth Street Bridge  
**SWAMP Site ID:** SUT001  
**Watershed:** Feather River  
**County:** Sutter  
**Longitude:** -121.6025  
**Latitude:** 39.1368

Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	>2420	2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	31	816	19
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	95	90	91
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	7.67	8.49	7.81
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	19.82	22.51	18.95
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	14.32	14.45	9.14

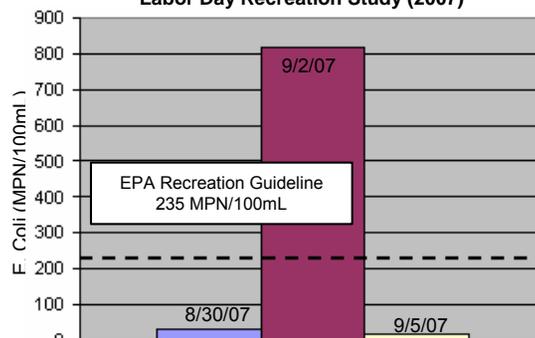
NOTES: Shaded table cells contain values that do not meet the water quality guidelines.  
 SWAMP Staff assisted with field collection at this site.

### Bacteria Screening Survey—Before, During and After Labor Day 2007 Feather River at Fifth Street Bridge

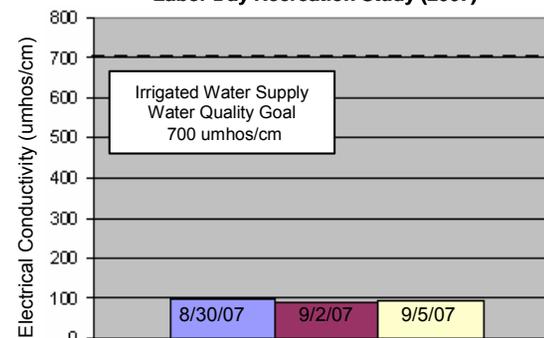


The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

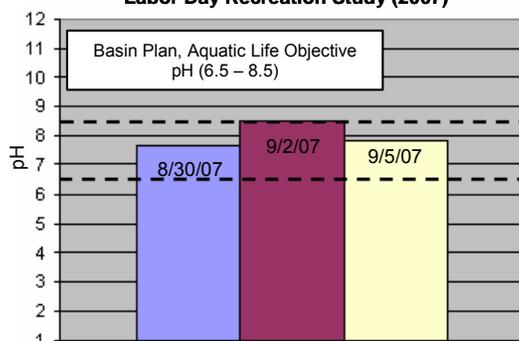
**E. coli Levels  
Labor Day Recreation Study (2007)**



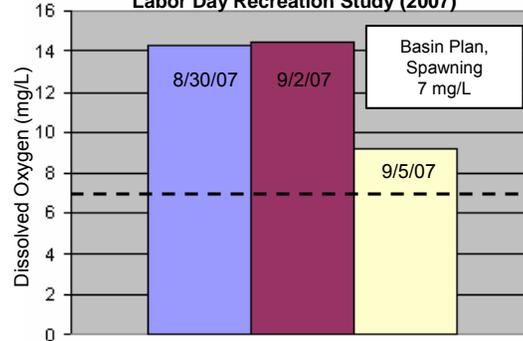
**Specific Conductivity Levels  
Labor Day Recreation Study (2007)**



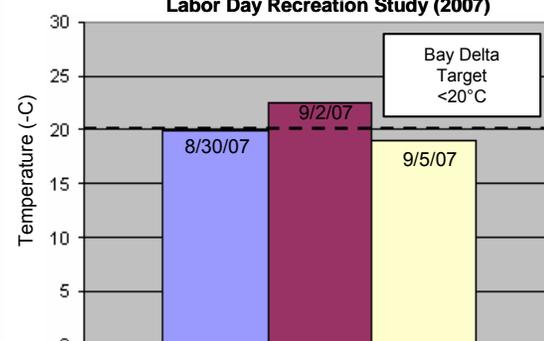
**pH Levels  
Labor Day Recreation Study (2007)**



**Dissolved Oxygen Levels  
Labor Day Recreation Study (2007)**



**Temperature Levels  
Labor Day Recreation Study (2007)**

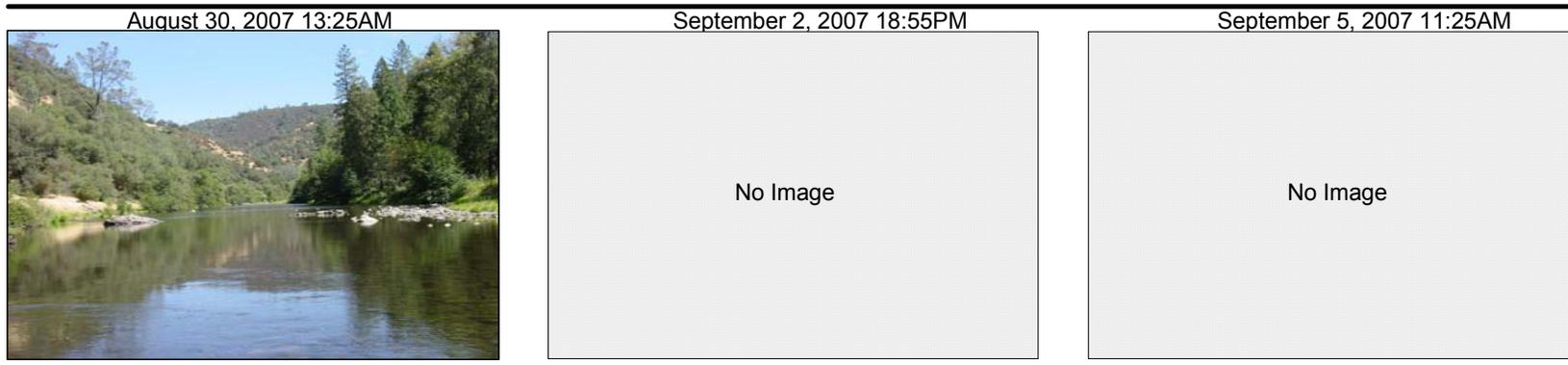


**Description of Sample Site:** Mainstem Mokelumne River Above Powerhouse  
**SWAMP Site ID:** AMA004  
**Watershed:** Mokelumne River  
**County:** Amador  
**Longitude:** -120.6643  
**Latitude:** 38.3299

Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	>2420	>2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	4	2	3
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	27.8	24.8	24.3
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	6.56	7.75	7
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	18.2	16.3	17.2
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	9.48	10.86	9.48

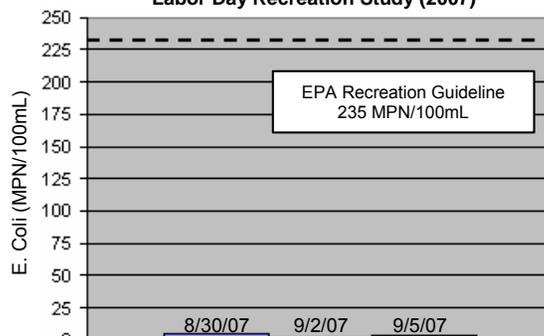
NOTES: Shaded table cells contain values that do not meet the water quality guidelines. Upper Mokelumne River Watershed Council assisted with field collection at this site.

### Bacteria Screening Survey—Before, During and After Labor Day 2007 Mainstem Mokelumne River Above Powerhouse

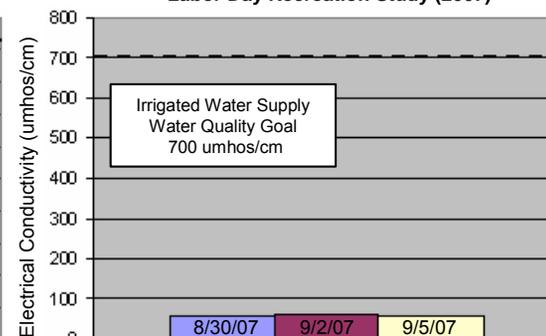


The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

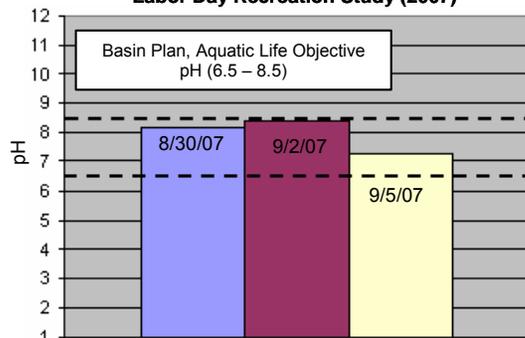
**E. coli Levels  
Labor Day Recreation Study (2007)**



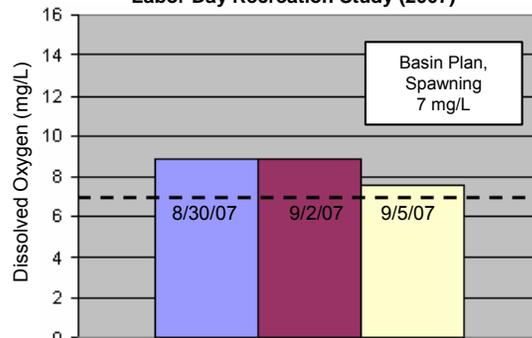
**Specific Conductivity Levels  
Labor Day Recreation Study (2007)**



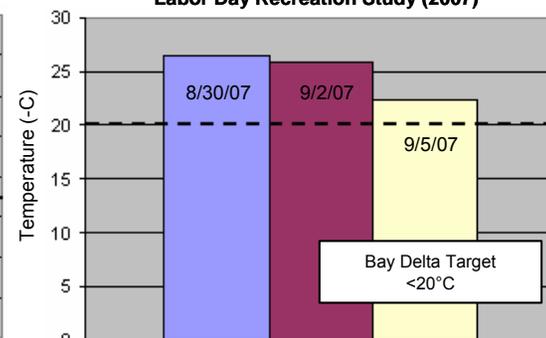
**pH Levels  
Labor Day Recreation Study (2007)**



**Dissolved Oxygen Levels  
Labor Day Recreation Study (2007)**



**Temperature Levels  
Labor Day Recreation Study (2007)**

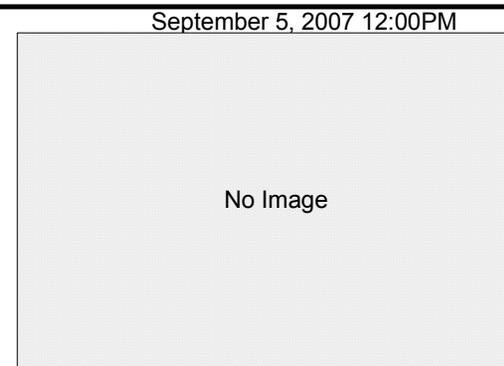
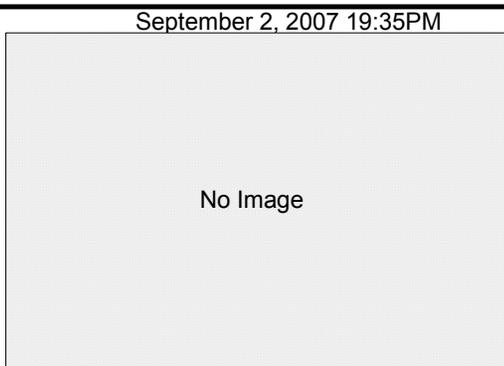
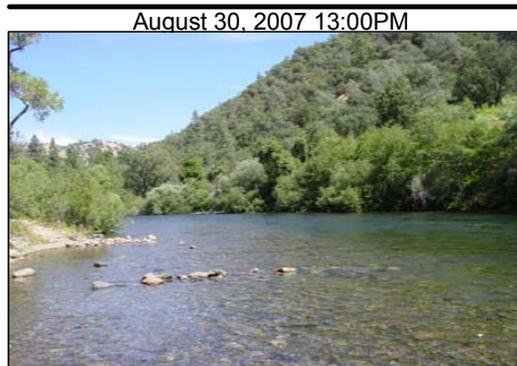


**Description of Sample Site:** Mainstem Mokelumne River Below Box Beach  
**SWAMP Site ID:** AMA005  
**Watershed:** Mokelumne River  
**County:** Amador  
**Longitude:** -120.6855  
**Latitude:** 38.3225

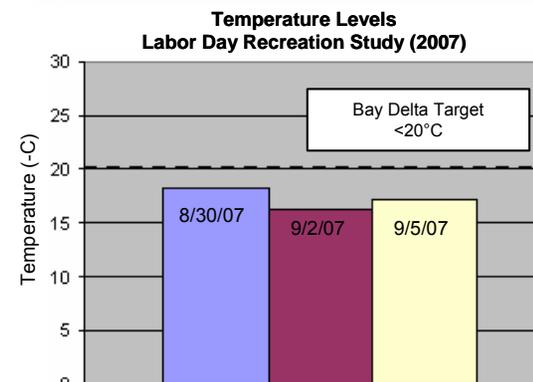
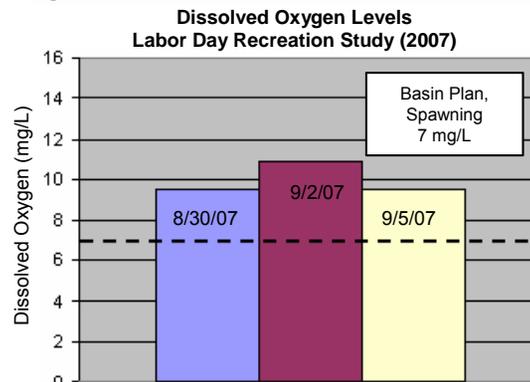
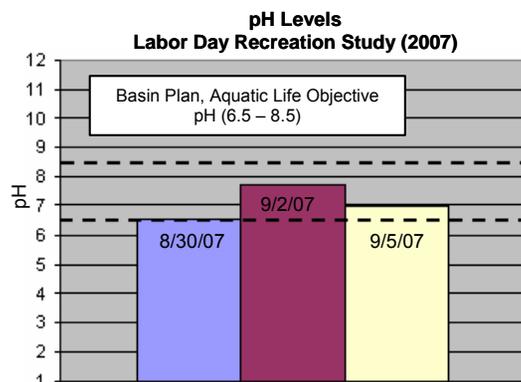
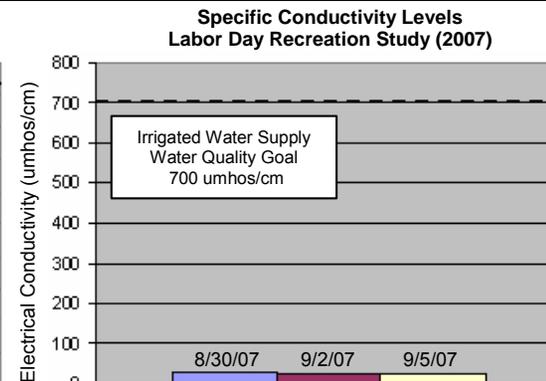
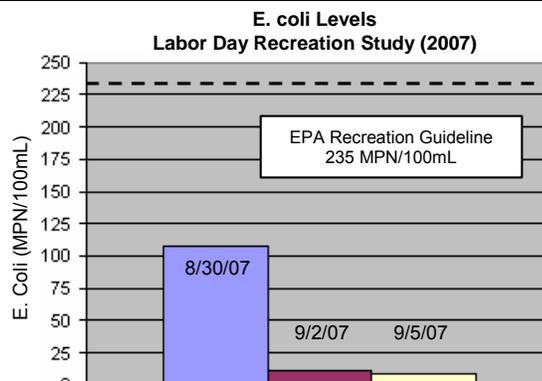
Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	1203	2420	1553
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	108	11	9
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	54.8	56.8	55.5
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	8.16	8.4	7.28
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	26.5	25.9	22.3
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	8.87	8.92	7.62

NOTES: Shaded table cells contain values that do not meet the water quality guidelines. Upper Mokelumne River Watershed Council assisted with field collection at this site.

**Bacteria Screening Survey—Before, During and After Labor Day 2007  
Mainstem Mokelumne River Below Box Beach**



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

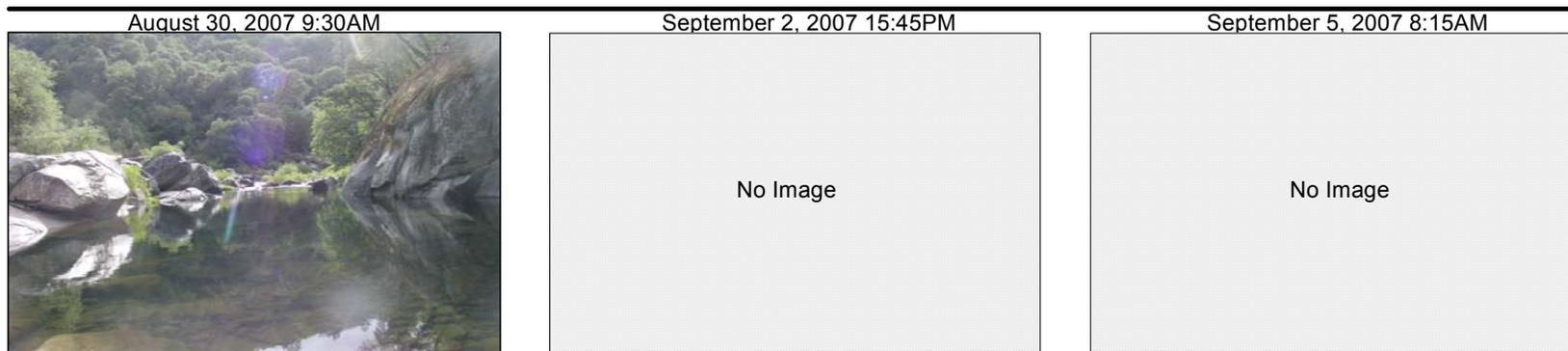


**Description of Sample Site:** Mokelumne River at North Fork Highway 26 Bridge  
**SWAMP Site ID:** 532AMA001  
**Watershed:** Mokelumne River  
**County:** Amador  
**Longitude:** -120.5411  
**Latitude:** 38.4233

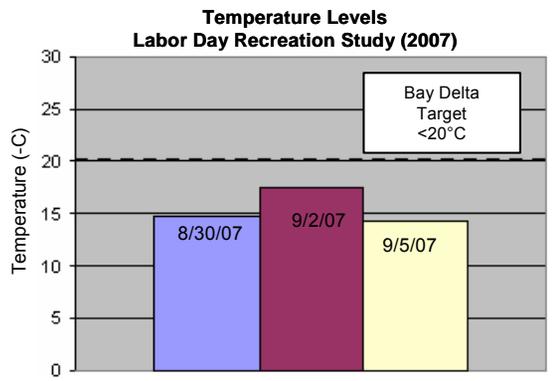
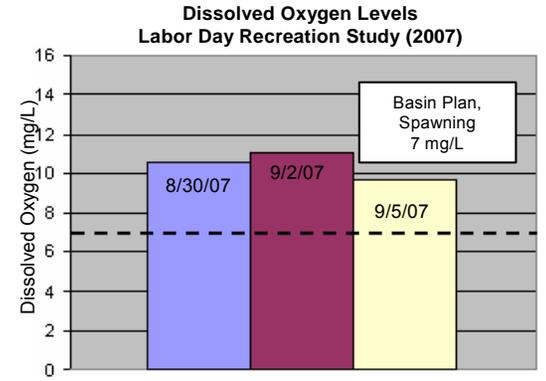
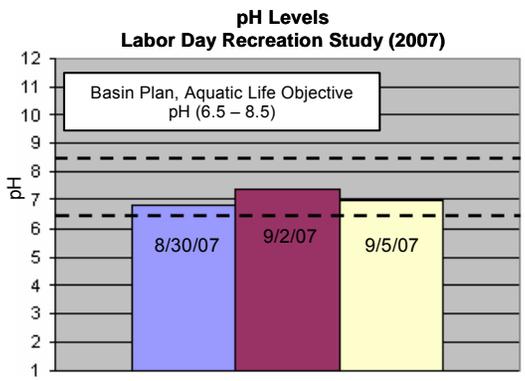
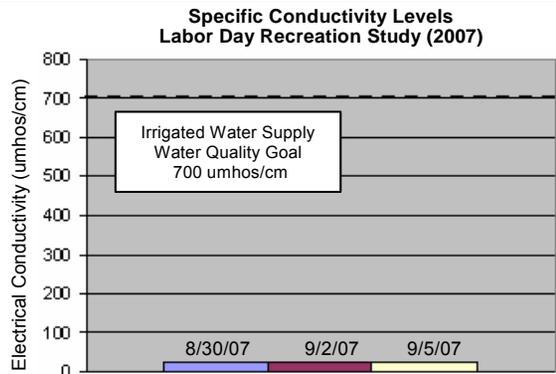
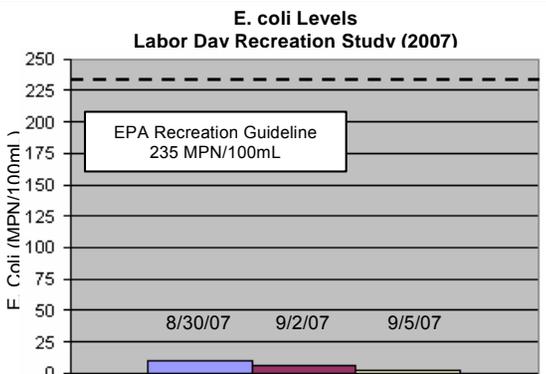
Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	1300	>2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	10	6	2
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	NA	NA	NA
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	NA	NA	NA
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	NA	NA	NA
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	NA	NA	NA

NOTES: Shaded table cells contain values that do not meet the water quality guidelines. Upper Mokelumne River Watershed Council assisted with field collection at this site.

### Bacteria Screening Survey—Before, During and After Labor Day 2007 Mokelumne River at North Fork Highway 26 Bridge



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

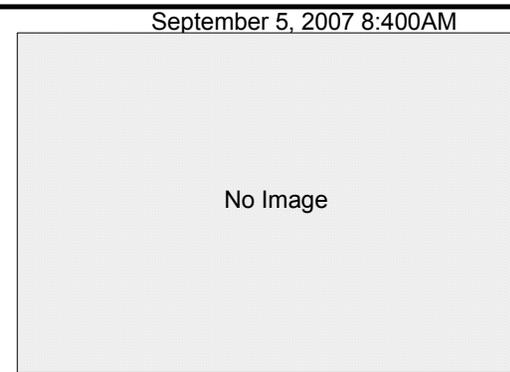
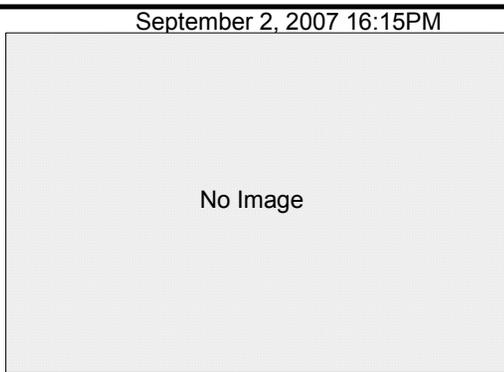


**Description of Sample Site:** Mokelumne River at Middle Fork Highway 26 Bridge  
**SWAMP Site ID:** CAL009  
**Watershed:** Mokelumne River  
**County:** Calaveras  
**Longitude:** -120.5247  
**Latitude:** 38.3877

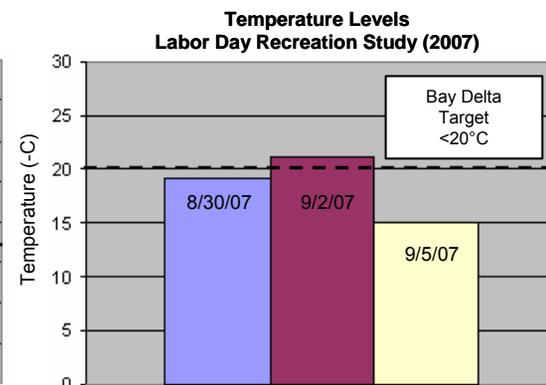
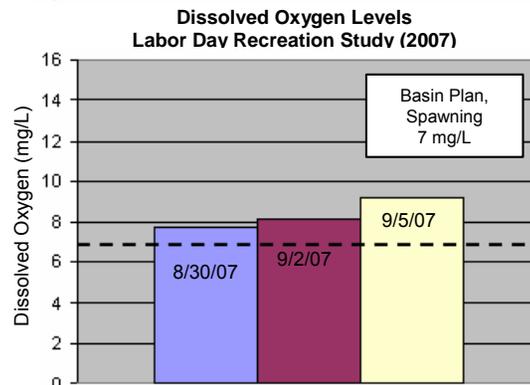
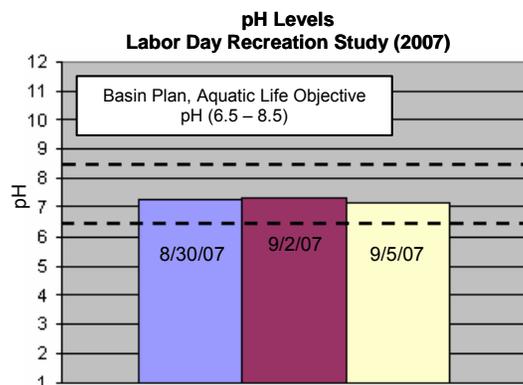
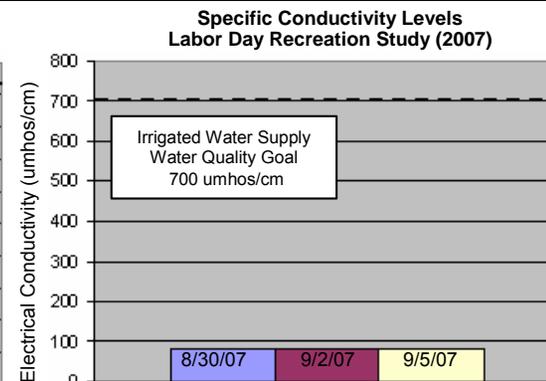
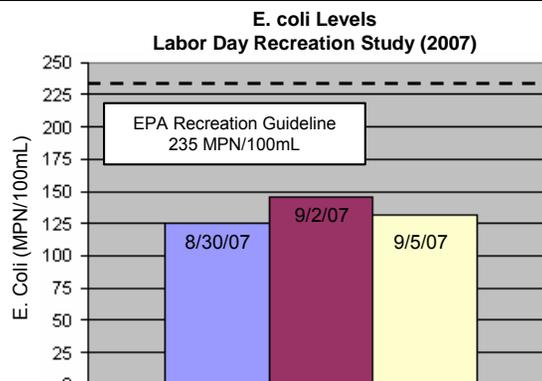
Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	2420	2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	125	146	131
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	80.6	81.9	80.9
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	7.24	7.35	7.16
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	19.1	21.1	15
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	7.74	8.11	9.16

NOTES: Shaded table cells contain values that do not meet the water quality guidelines. Upper Mokelumne River Watershed Council assisted with field collection at this site.

**Bacteria Screening Survey—Before, During and After Labor Day 2007  
Mokelumne River at Middle Fork Highway 26 Bridge**



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

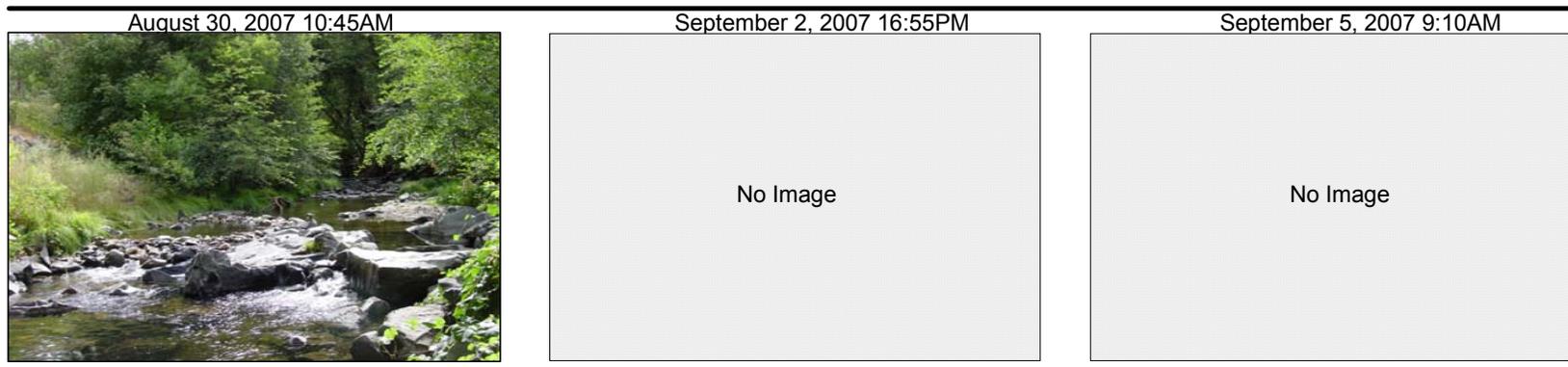


**Description of Sample Site:** South Fork Mokelumne River at Railroad Flat Bridge  
**SWAMP Site ID:** CAL010  
**Watershed:** Mokelumne River  
**County:** Calaveras  
**Longitude:** -120.5025  
**Latitude:** 38.3581

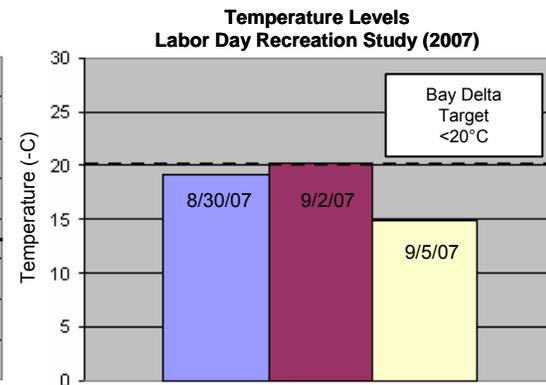
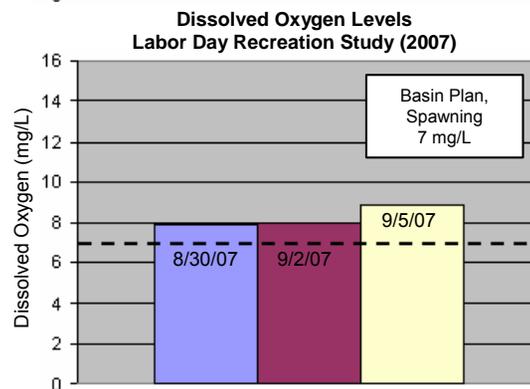
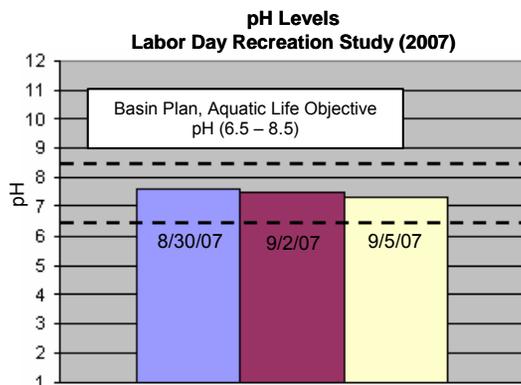
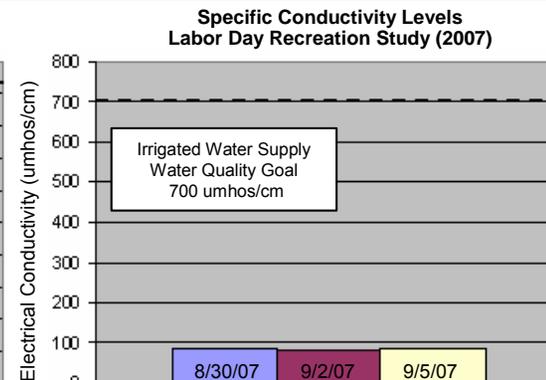
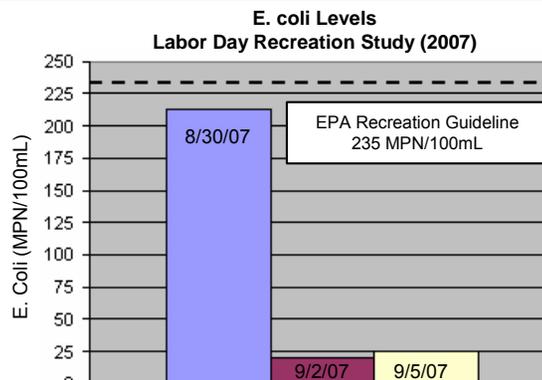
Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	>2420	>2420	>2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	214	20	26
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	84.5	84	86.9
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	7.57	7.5	7.3
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	19.2	20.3	14.9
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	7.86	7.97	8.86

NOTES: Shaded table cells contain values that do not meet the water quality guidelines. Upper Mokelumne River Watershed Council assisted with field collection at this site.

**Bacteria Screening Survey—Before, During and After Labor Day 2007  
South Fork Mokelumne River at Railroad Flat Bridge**



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

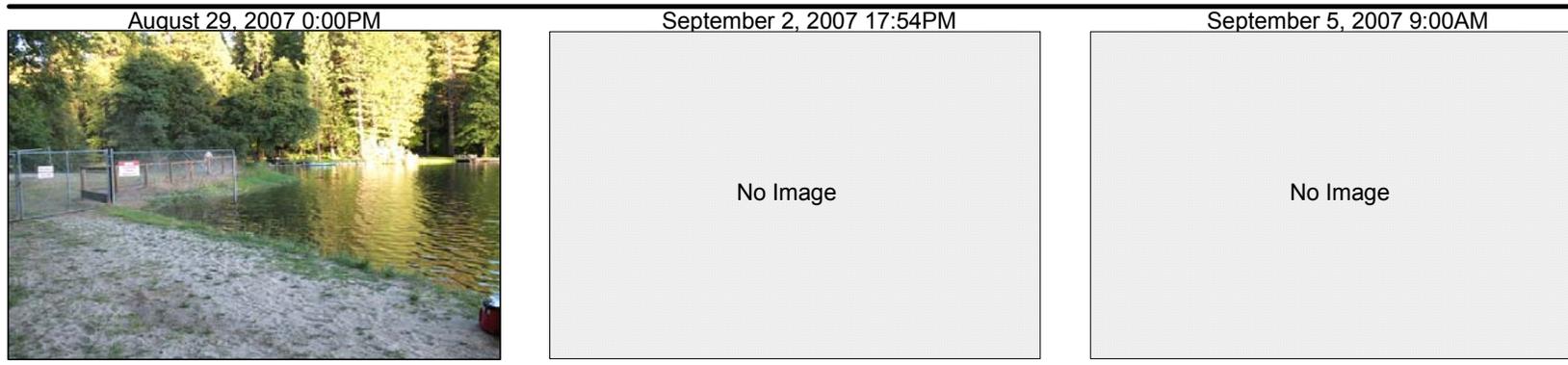


**Description of Sample Site:** Twain Harte Lake (at East End) Northshore, near shallow wading area  
**SWAMP Site ID:** TUO210  
**Watershed:** Tuolumne River  
**County:** Tuolumne  
**Longitude:** -120.2407  
**Latitude:** 38.0300

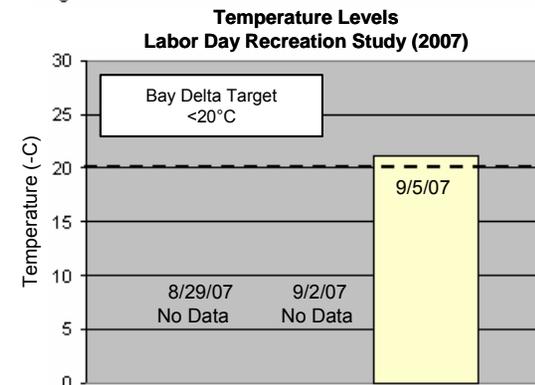
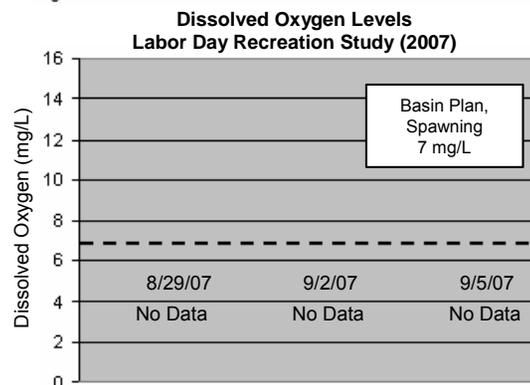
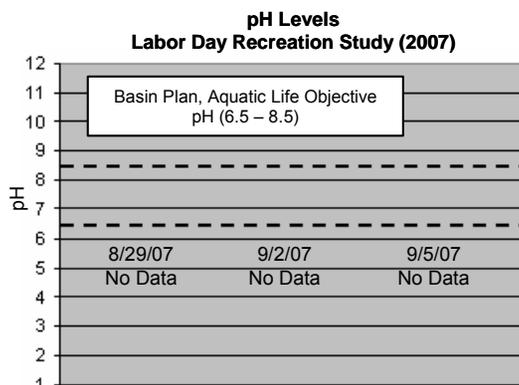
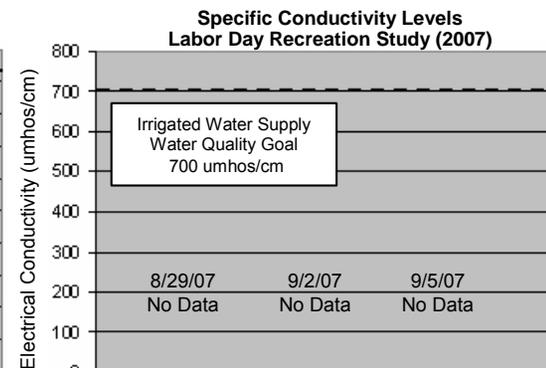
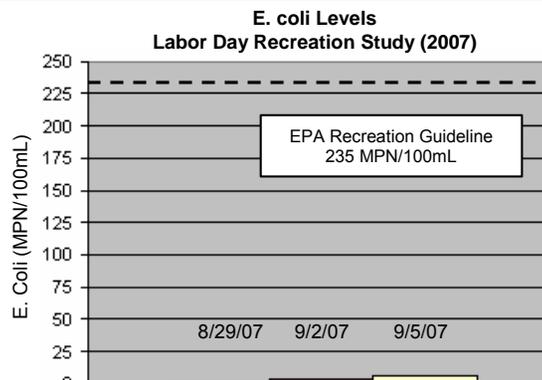
Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	1414	1986	2420
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	1	3	6
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	NA	NA	NA
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	NA	NA	NA
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	NA	NA	NA
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	NA	NA	NA

NOTES: Shaded table cells contain values that do not meet the water quality guidelines. Tuolumne County Citizen's Monitoring Group assisted with field collection at this site.

### Bacteria Screening Survey—Before, During and After Labor Day 2007 Twain Harte Lake at East End



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

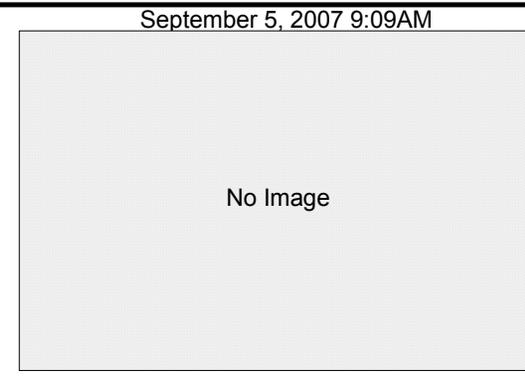
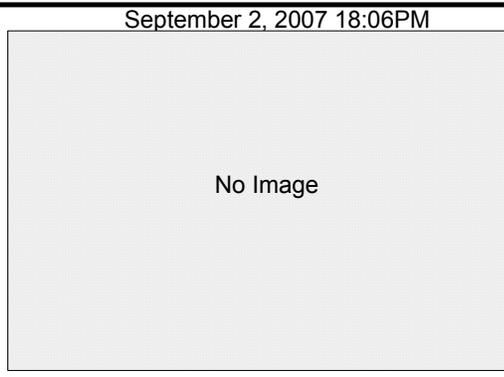


**Description of Sample Site:** Twain Harte Lake Northshore, at Middle Beachline  
**SWAMP Site ID:** TUO211  
**Watershed:** Tuolumne River  
**County:** Tuolumne  
**Longitude:** -120.2419  
**Latitude:** 38.0288

Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	488	921	1733
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	1	16	2
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	NA	NA	NA
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	NA	NA	NA
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	NA	NA	NA
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	NA	NA	NA

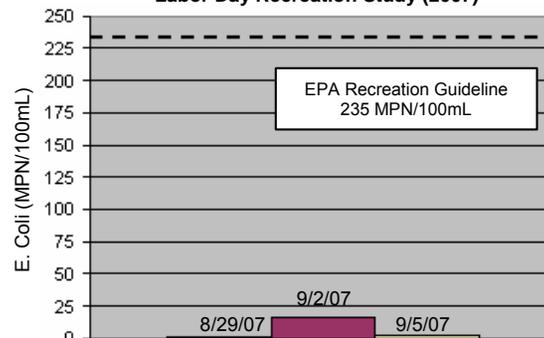
NOTES: Shaded table cells contain values that do not meet the water quality guidelines.  
 Tuolumne County Citizen's Monitoring Group assisted with field collection at this  
 site.

**Bacteria Screening Survey—Before, During and After Labor Day 2007  
Twain Harte Lake at Middle Beachline**

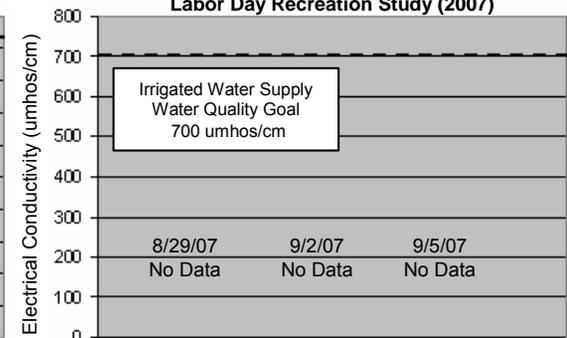


The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

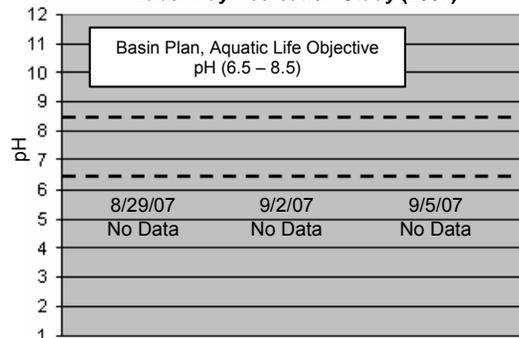
**E. coli Levels  
Labor Day Recreation Study (2007)**



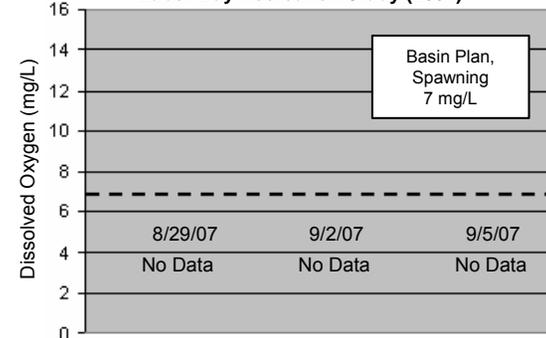
**Specific Conductivity Levels  
Labor Day Recreation Study (2007)**



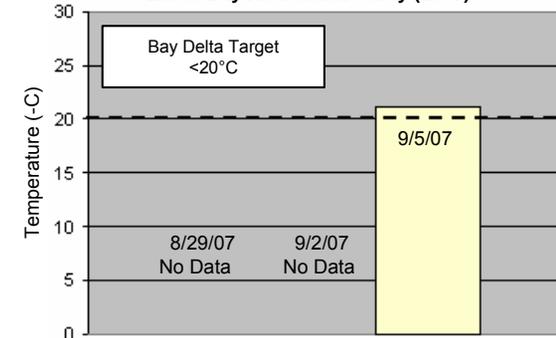
**pH Levels  
Labor Day Recreation Study (2007)**



**Dissolved Oxygen Levels  
Labor Day Recreation Study (2007)**



**Temperature Levels  
Labor Day Recreation Study (2007)**

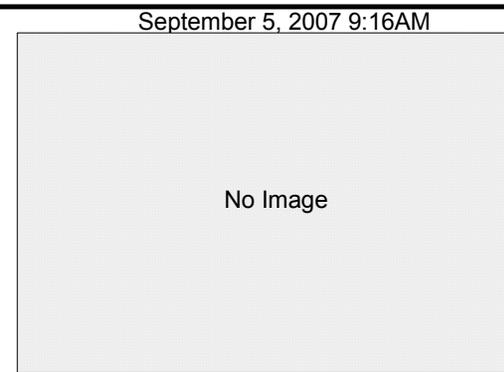
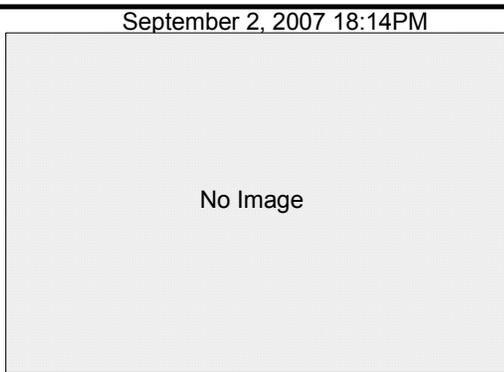
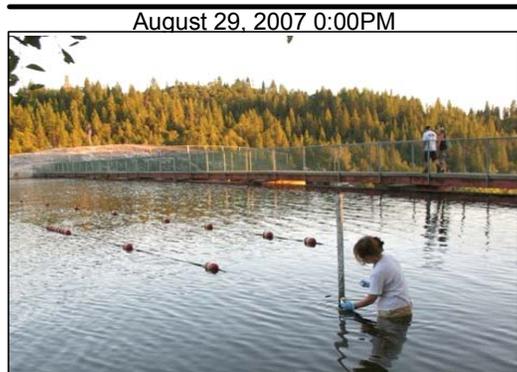


**Description of Sample Site:** Twain Harte Lake Northshore, at West End  
**SWAMP Site ID:** TUO212  
**Watershed:** Tuolumne River  
**County:** Tuolumne  
**Longitude:** -120.2436  
**Latitude:** 38.0285

Constituent	Water Quality Guideline	Thursday August 30, 2007	Sunday September 2, 2007	Wednesday September 5, 2007
<b>Total Coliform</b>	None Applicable	727	1733	1203
<b><i>E. coli</i> (MPN/100 mL)</b>	<235 MPN/100ml (EPA Contact Recreation Guideline)	7	8	6
<b>Specific Conductivity (umhos/cm)</b>	≤700 umhos/cm (Irrigated Water Supply Water Quality Goal)	NA	NA	NA
<b>pH</b>	6.5 - 8.5 (Basin Plan, Aquatic Life)	NA	NA	NA
<b>Temperature (°C)</b>	≤20°C (Bay Delta Target)	NA	NA	NA
<b>Dissolved Oxygen (mg/l)</b>	7 mg/l (Basin Plan, Spawning)	NA	NA	NA

NOTES: Shaded table cells contain values that do not meet the water quality guidelines. Tuolumne County Citizen's Monitoring Group assisted with field collection at this site.

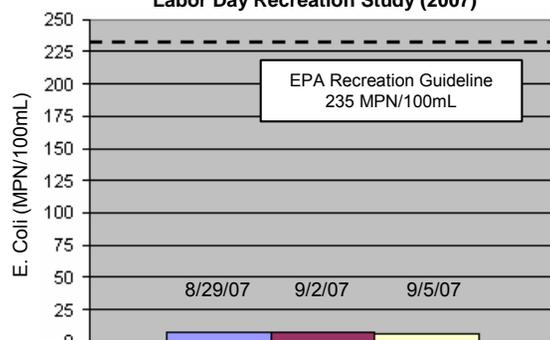
### Bacteria Screening Survey—Before, During and After Labor Day 2007 Twain Harte Lake at West End



The Central Valley Regional Water Quality Control Board (CVRWQCB) conducted an initial screening study in the San Joaquin River Watershed to evaluate logistical needs for a region-wide Recreation Beneficial Use study, using *E. coli* as an indicator, with a guideline 235 MPN/100mL. Funding for this study was made possible through the Surface Water Ambient Monitoring Program (SWAMP). Summary sheets for all sites included in this study can be found at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies).

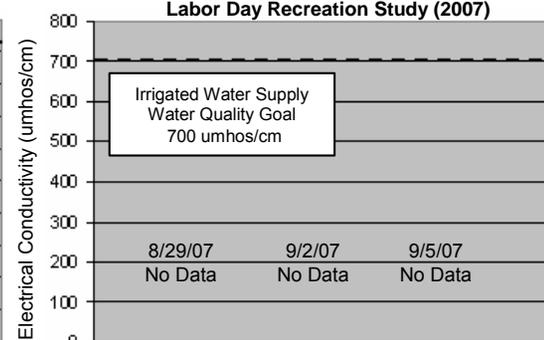
#### E. coli Levels

##### Labor Day Recreation Study (2007)



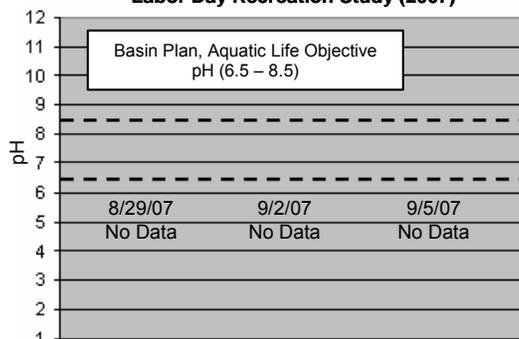
#### Specific Conductivity Levels

##### Labor Day Recreation Study (2007)



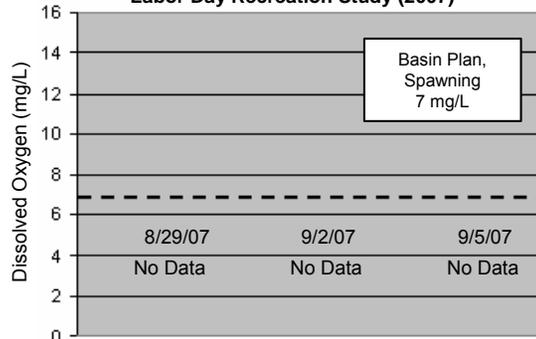
#### pH Levels

##### Labor Day Recreation Study (2007)



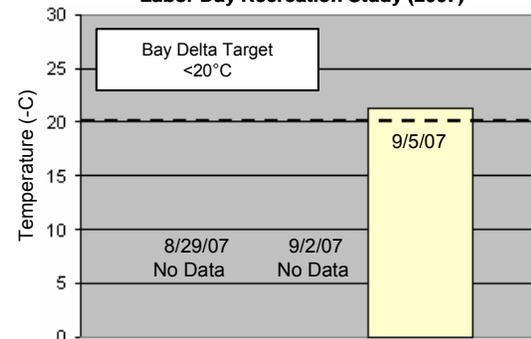
#### Dissolved Oxygen Levels

##### Labor Day Recreation Study (2007)



#### Temperature Levels

##### Labor Day Recreation Study (2007)



**APPENDIX B: Flow Data in Cubic Feet per Second (CFS)**

	Feather River near Gridley GRL*	American River near Fair Oaks AFO*	Middle Fork Cosumnes River near Somerset CMF*	North Fork Cosumnes River near El Dorado CNF*	Mokelumne – Mokelumne Hill MKM**
8/26/2007	5201.49	2582.29	10.39	12.15	50.00
8/27/2007	5196.65	2566.98	10.21	12.21	98.00
8/28/2007	5201.30	2590.10	10.23	12.40	-252.00
8/29/2007	5183.22	2539.79	10.43	11.99	230.00
<b>8/30/2007</b>	<b>5189.73</b>	<b>2552.19</b>	<b>9.98</b>	<b>11.66</b>	<b>244.00</b>
8/31/2007	5191.81	2563.65	9.70	11.27	116.00
9/1/2007	5189.11	2524.48	9.82	11.56	161.00
<b>9/2/2007</b>	<b>5201.00</b>	<b>2571.35</b>	<b>10.19</b>	<b>12.02</b>	<b>-5.00</b>
9/3/2007	5206.72	2378.96	10.48	11.53	126.00
9/4/2007	5203.95	2132.29	9.99	11.52	79.00
<b>9/5/2007</b>	<b>5196.84</b>	<b>2118.23</b>	<b>9.71</b>	<b>11.78</b>	<b>104.00</b>
9/6/2007	5205.66	2127.71	9.62	11.82	3.00
9/7/2007	5206.05	2126.15	9.83	12.73	7.00
Minimum Variation	0.40	1.56	0.02	0.01	4.00
Maximum Variation	18.08	246.67	0.49	0.91	482.00

**Highlighted cells are when samples were collected**

\* - Data collection via satellite

\*\* - Data collection manually