SACR NAWQA Home

What is NAWQA?

Study Unit Description

Cycle I
Surface Water
Aquatic Ecology
Ground Water

Cycle II
Surface Water
Ground Water

NAWQA Personnel

SACR Publications

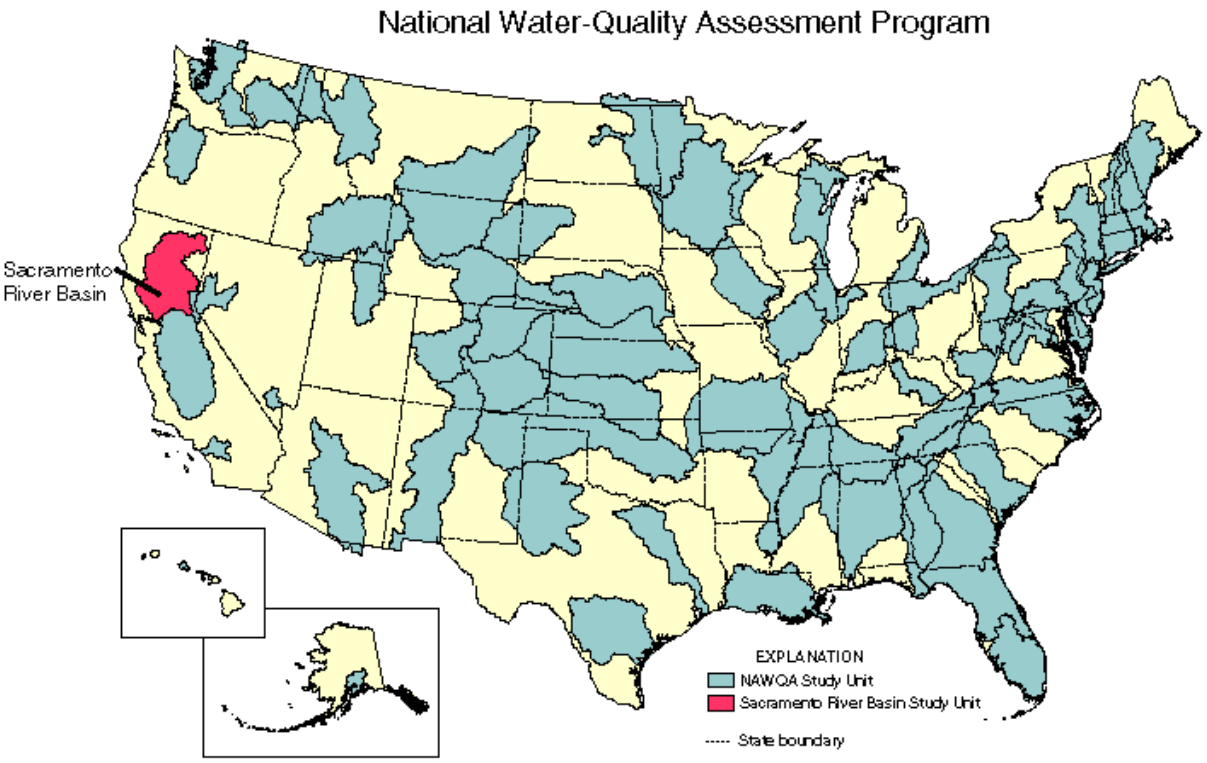
Liaison Committee

Presentations

Water-Quality Assessment of the Sacramento River Basin, California: Water-Quality, Sediment and Tissue Chemistry, and Biological Data, 1995-1998 (Open-File Report 2000-391)

Introduction

The U.S. Geological Survey (USGS) implemented the National Water-Quality Assessment (NAWQA) Program to describe the status of and trends in the quality of the nation's surface water and ground water and to provide scientific understanding of the natural and human-induced factors that affect water quality. In 1991, twenty study units were started. Additional study units began in 1994 and 1997.



Data collection and analysis in each study unit follows national guidelines for the NAWQA Program, but they may also address the local or regional issues most important to that study unit. NAWQA is designed to produce a wealth of water-quality information to assist policy makers and managers at the national, state, and local levels in making more informed decisions with regard to the concentrations of specific analytes.

In 1994, the Sacramento River Basin study unit team began planning assessment activities. The basin was subdivided into six physiographic subunits and nine ecological subunits that were determined to be the most influential natural factors affecting water quality. Stream sampling began in 1995 and lasted until April 1998. Much of the data collection focused on the Sacramento Valley and Klamath Mountain subunits, but ecological sampling also included the Cascade Mountains and Sierra Nevada subunits. Hundreds of water-quality characteristics were measured in different media during this time, including ground water, stream water, streambed sediments, and aquatic biological tissues. Fish, invertebrate, and algal communities and stream habitat also were sampled or assessed. In addition, spatial data such as geology, land use, hydrography, and other watershed characteristics were compiled into a geographic information system (GIS) to support the assessment. After April 1998, the project entered a period of less frequent sampling called the low-intensity phase.

Purpose and Scope

This report presents data collected and compiled during the first high-intensity phase of the Sacramento River Basin NAWQA study unit. The data are presented in a convenient electronic format suitable for downloading into spreadsheet applications. Data are presented from 78 ground-water wells and 55 stream sites. Ground-water measurements compiled in this report include chemical, physical, and water-level data. Stream water measurements compiled include chemical, physical, streamflow, bed-sediment contaminants, aquatic-tissue contaminants, fish community, invertebrate community, and periphyton algae assemblages. Quality-control chemical data are also presented. All data were collected between 1995 and 1998.

Study Design and Sampling Methods

The study design and sampling methods developed for the Sacramento River Basin NAWQA study unit are consistent with the national NAWQA guidelines (Gilliom and others, 1995, Sheton, 1994). The design permits an integrated assessment of conditions at local, regional, and national scales. A detailed description of the design of the Sacramento River Basin NAWQA study is given in the report, "Water Quality Assessment of the Sacramento River Basin, California–Environmental Setting and Study Design" (Domagalski and others, 1998).

Sampling methods and protocols for the NAWQA Program are documented in a series of guidance documents. Citations for these can be found in the Selected references section of this report. The primary reference for streamwater sample collection methodology is given by Shelton (1994). Streamwater samples are collected using the equal-width-increment (EWI) technique and using a 3-liter Teflon bottle fitted with an isokinetic nozzle. This technique allows for a representative sample to be collected along the stream cross section, both horizontally and vertically. The method has limitations in large rivers, such as the Sacramento River, because of the depth of the water column. For example, the method is valid for sampling the upper 4.6 meters of water columnn, but the Sacramento River is of greater depth at some sampling locations. Sampling to greater depths can result in a biased sample, especially for suspended sediment. As a result, only the upper 4.6 meters of water were sampled, if the overall water depth was greater, on any given sampling event. Samples of streambed sediment were collected according to the methods of Shelton and Capel (1994), Methodology for the collection of ground-water samples is provided by Koterba and others, (1995). Methods for the collection of biological samples are provided by Meador and others (19993a, 1993b), Cuffney and others (1993a, 1993b), and Porter and others, (1993).

Data are also included for the Sacramento River Trace Metals Project. Trace metal occurrence, distribution, and transport were cited as important water quality issues early in the design phase of this project. Because the NAWQA Program only supported limited sampling for trace metals, a separate project was designed in cooperation with the Sacramento County Regional Sanitation District to assess these issues. Water quality and hydrologic data from the Sacramento River Trace Metals Project are included in this report. Interpretative reports from that project are listed in the Selected References.

Note: Use of trade names in this report is strictly for informational purposes and does not constitute endorsement by the U.S. Geological Survey.

Using This Report

The data presented in this report are organized according to the Sacramento River Basin study unit's design. Most of the data can be accessed two ways, viewing the data on screen, in the format of HTML tables, or downloading the data in a tab-delimited format. Most of the downloadable files are in a tab-delimited format. The data can be read into any spreadsheet software application by choosing the tab-delimited option of the chosen software. Some data files are stored in compressed format (zip-format) because of size. The de-compressed files are Microsoft Excel workbooks.

For More Information

This report is being distributed by CD-ROM and on the World Wide Web.
Requests for information or data related to this report should be directed to:

Sacramento River Basin NAWQA Chief
U.S. Geological Survey
Placer Hall, 6000 J Street
Sacramento, California 95819-6129

Sac NAWQA

SACR NAWQA Home
What is NAWQA?
Study Unit Description

Cycle I
Surface Water
Aquatic Ecology
Ground Water

Cycle II
Surface Water
Ground Water

NAWQA Personnel
SACR Publications

Study Unit Description

The Sacramento River Basin covers nearly 27,000 square miles. The study unit includes all or parts of five physiographic provinces: the Sacramento Valley, the Sierra Nevada, the Coast Ranges, the Cascade Range, and the Modoc Plateau. The Sacramento River is the largest river in California, with an average annual runoff of 22,000,000 acre-feet. This is approximately one third of the total runoff in the state. The length of the Sacramento River is 327 miles. The river is vital to the State's economy and is a major source of drinking water for residents of northern and southern California. The Sacramento River is a principal source of irrigation water for Sacramento and San Joaquin Valley farmers and fresh-water flow to the San Francisco Bay. Click here for more on the environmental setting of the Sacramento River Basin.


Shasta Dam on the Sacramento River

Water use in the study unit was 11.6 million acre-feet in 1990, and this amount is expected to rise to 12.4 million acre-feet by the year 2020. Water use in 1990 was 58-percent agricultural, 32-percent environmental, 6-percent urban, and 4-percent other. Up to about 6 million acre-feet per year of water also is exported from the basin, principally to areas in southern California, by local, state, and Federal conveyance facilities. The flows of the Sacramento River are controlled mainly by Shasta Dam and, to a lesser extent, by dams on the Feather, Yuba, and American Rivers. Part Part of the runoff from winter rains and spring snow melt is stored in reservoirs and released during the normally dry summer months. Most of the water supplies are derived from these reservoirs.

The Sacramento Valley is a major ground-water basin and can be considered a single-aquifer system. The storage capacity of the Sacramento Valley ground-water basin is about 114 million acre-feet at depths of 20 to 600 feet below land surface. Ground water provides about 22 percent of the water supply and is used extensively as a source of drinking and irrigation water, particularly in areas removed from surface-water supplies.


Rice fields and silos in the Sacramento valley

The Sacramento Valley supports a diverse agricultural economy, much of which depends on the availability of irrigation water. More than 2 million acres are irrigated. Major crops include rice, fruits and nuts, tomatoes, sugar beets, corn, alfalfa, and wheat. Dairy products are also an important agricultural commodity. In the study unit, the Sacramento Valley has the largest cities, including Chico, Red Bluff, Redding, and Sacramento. The Sacramento metropolitan area is home to more than 1 million people, which is nearly half of the total population of 2,208,900 people, in the study unit. The population in the study unit increased by more than a one-half million people between 1980 and 1990. Land cover within the Sierra Nevada and Cascade Range is principally forest. Forest and range land are mixed throughout the Coast Ranges and Modoc Plateau.


McCloud river

The Sacramento River Basin contains a number of species, subspecies, and genetically distinct populations of fish that are presently listed as Federal or State threatened/endangered species or species that appear to be approaching that status. The winter-run race of chinook salmon (oncorhynchus tschawytscha) that spawn below Keswick Dam in the main stem Sacramento River is on the Federal list of endangered species. The spring-run chinook salmon the spend the summer in deep, cool pools of streams tributary to the Sacramento River before spawning in the early fall are presently a species of special concern, and efforts are being made to increase its population before the species becomes endangered. The Sacramento splittail, Pogonichthys macrolepidotus, a large minnow native to the Sacramento-San Joaquin drainage and the only remaining representative of the genus in the world, has been officially proposed as a threatened species by the U.S. Fish and Wildlife Service.

Major Water-Quality Issues

The NAWQA study will focus on the quality of ground-water and surface-water resources in the Sacramento Valley, because most of the population, agriculture, and water use are in that part of the study unit. Information for the other physiographic provinces will be used primarily to establish background water-quality conditions or to establish loadings of key water-quality constituents.

The major water-quality issues of concern in the Sacramento River Basin study unit are:

- **Elevated concentrations of trace metals, especially from abandoned mines**--A number of abandoned mines, especially those near Lake Shasta have the potential to denegrade the quality of much of the Sacramento River.

- **Pesticide contamination of surface water and potential contamination of ground water**--Pesticide use within the Sacramento Valley is high and occurs during as much as 75 percent of each calendar year. Pesticides can be transported from the fields to surface water by irrigation and storm runoff or to ground water by percolation of rain or irrigation water.

- **Nitrate contamination of ground water**--Ground water in localized areas, particularly those with highly permeable soils, is susceptible to contamination by nitrate from fertilizers and other sources.

- **Urban runoff and volatile-organic-chemical contamination**--Urban runoff from the metropolitan area of Sacramento is a potential source of contaminants that enter the lower Sacramento River. Contamination by volatile organic compounds, especially contamination of ground water, can occur in any large urban setting.

Aquatic Issues:

Issues considered important for aquatic species include the operation of dams and diversions of all sizes and their effects on stream flow, aquatic habitat, fish migration, and stream temperature. Other issues affecting aquatic species include acidic mine discharge, agricultural return flows, reductions in fish populations by commercial and sport fishing, and introduction of non-native species.

U.S. Department of the Interior | U.S. Geological Survey
URL: http://ca.water.usgs.gov/user_projects/sac_nawqa/study_description.html
For Page Information: Send Us a Message
Page Last Modified: Tuesday, 14-Jun-2011 13:53:03 EDT

Sac NAWQA

SACR NAWQA Home
What is NAWQA?
Study Unit Description

Cycle I
Surface Water
Aquatic Ecology
Ground Water

Cycle II
Surface Water
Ground Water

NAWQA Personnel
SACR Publications

Surface Water: Cycle I Activities (1994 - 2004)

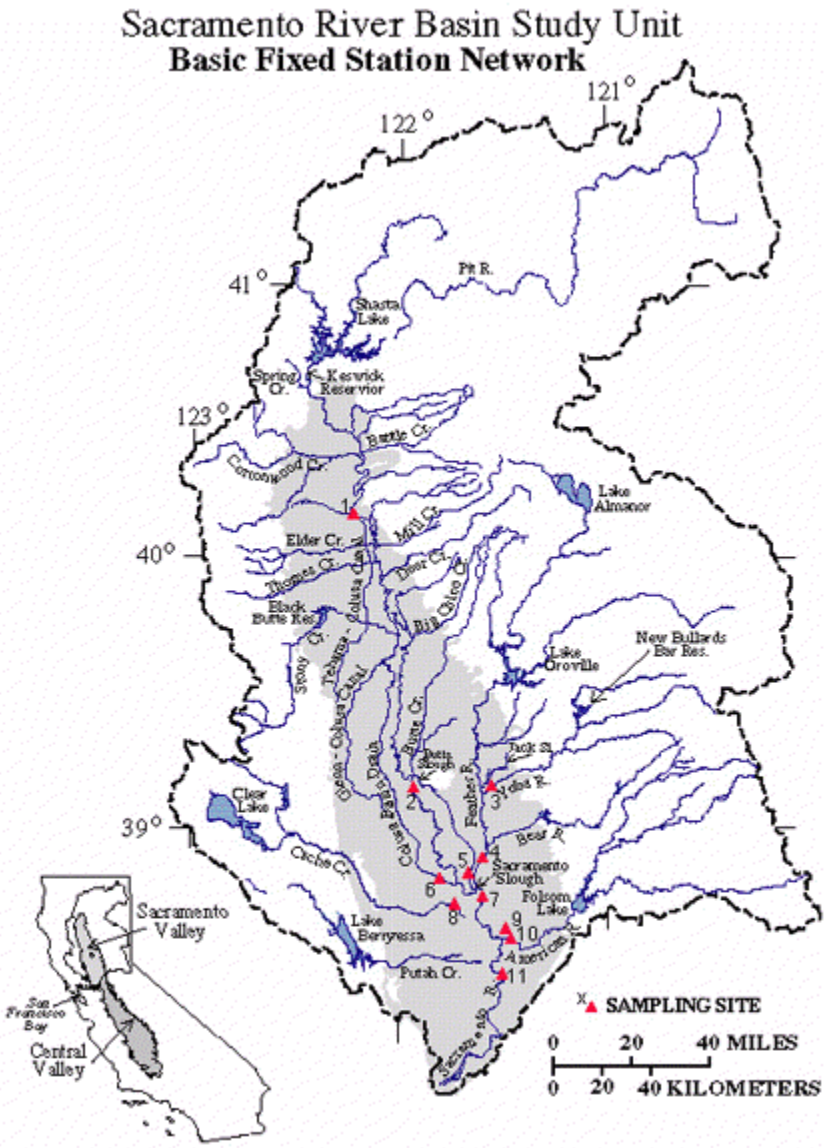
Surface Water Study Design

The approach taken by NAWQA to assess the water quality of streams is based on three interrelated components: Water Column, Bed Sediment and Tissue, and Ecological Studies. The Water Column and Bed Sediment and Tissue Studies are described here and the Ecological Studies are described under Aquatic Ecology Activities. The Water Column Studies are made up of the Basic-Fixed Site Assessment, the Intensive-Fixed Site Assessment, Synoptic Studies, and Low-Intensity Phase Sampling. The sampling strategy of these studies is based on the general concept of initial intensive sampling of few sites for all water-quality characteristics, and progressively adding more sites for more specific and less frequent sampling. For instance, fewer constituents are measured during a shorter time frame for the Synoptic Studies than for the Intensive Fixed-Site Assessment, but the spatial coverage is broader. The Bed Sediment and Tissue Study was designed to provide an initial identification of important constituents and their occurrence in the Study Unit. Concentrations and their areal distribution are assessed to identify occurrence and potential needs for more detailed study.

Gilliom , R.J., Alley, W.M., and Gurtz, M.E., 1995, Design of the National Water-Quality Assessment Program--Occurrence and distribution of water-quality conditions: U.S. Geological Survey Circular 1112, 33 p.

Basic-Fixed and Intensive-Fixed Site Assessments

The primary objective of the Basic-Fixed Site Assessment was to characterize the spatial and temporal distribution of general water-quality conditions and the transport of major inorganic constituents in stream water in relation to hydrologic conditions and sources.



Data collected:
A network of 12 sites were sampled for stream flow, nutrients, major ions, organic carbon, suspended sediment, water temperature, specific conductance, pH, and dissolved oxygen during 1995 through 1998, following procedures described by Shelton (1994). Four of these Basic-Fixed Sites are also Intensive-Fixed Sites. The purpose of the Intensive-Fixed Site Assessment was to assess the seasonal and short-term temporal variability of pesticides.

Domagalski, J.L., Dileanis, P.D., Knifong, D.L., Munday, C.M., May, J.T., Dawson, B.J., Shelton, J.L., Alpers, C.N., 2000, Water-quality assessment of the Sacramento River Basin, California, water-quality, sediment and tissue chemistry, and biological data, 1995-1998: U.S. Geological Survey Open-File Report 2000-391.

Bed Sediment and Tissue Occurrence Study

The primary objective of this study is to determine which trace elements and hydrophobic organic compounds occur at elevated levels relative to background conditions or at levels potentially toxic to humans or aquatic life. The occurrence survey for contaminants in bed sediment and tissues in the Sacramento River Basin study unit focused on the perennial reach of the

main stem of the Sacramento River and tributaries to this reach within the Sacramento Valley.

Data Collected:

Bed sediment data was collected from 17 sites between October and November 1995. These samples were analyzed for polychlorinated biphenyls (PCBs), organochlorine pesticides, semivolatile organic compounds, and trace elements. Clams and fish were collected at 18 sites in October-November 1992. The tissues from these samples were analyzed for PCBs, organochlorine pesticides, and trace elements.

References:

MacCoy, D.E., Domagalski, J.L., 1999, Trace Elements and Organic Compounds in streambed Sediment and Aquatic Biota from the Sacramento River Basin, California, October and November 1995: U.S. Geological Survey Water Resources Investigations Report 99-4151

Low-Intensity Phase Sampling

The Low-Intensity Phase Sampling is intended to meet the objectives of trend assessment, which are to analyze past changes in water quality and to identify, describe, and explain (as possible) current and future changes and trends in water quality.

Data collected:

The Sacramento River at Freeport, and Arcade Creek near Del Paso Heights sites are currently being sampled at least once a month during the low-intensity phase (2005-2008). During the time period of October 1, 2006 through September 30, 2007, only the Sacramento River site will be monitored. That site will be sampled a total of 17 times during this period and will include analyses of nutrients, pesticides, suspended sediment, pH, alkalinity, dissolved oxygen, specific conductance, chloride, and sulfate.

Sac NAWQA

SACR NAWQA Home
What is NAWQA?
Study Unit Description

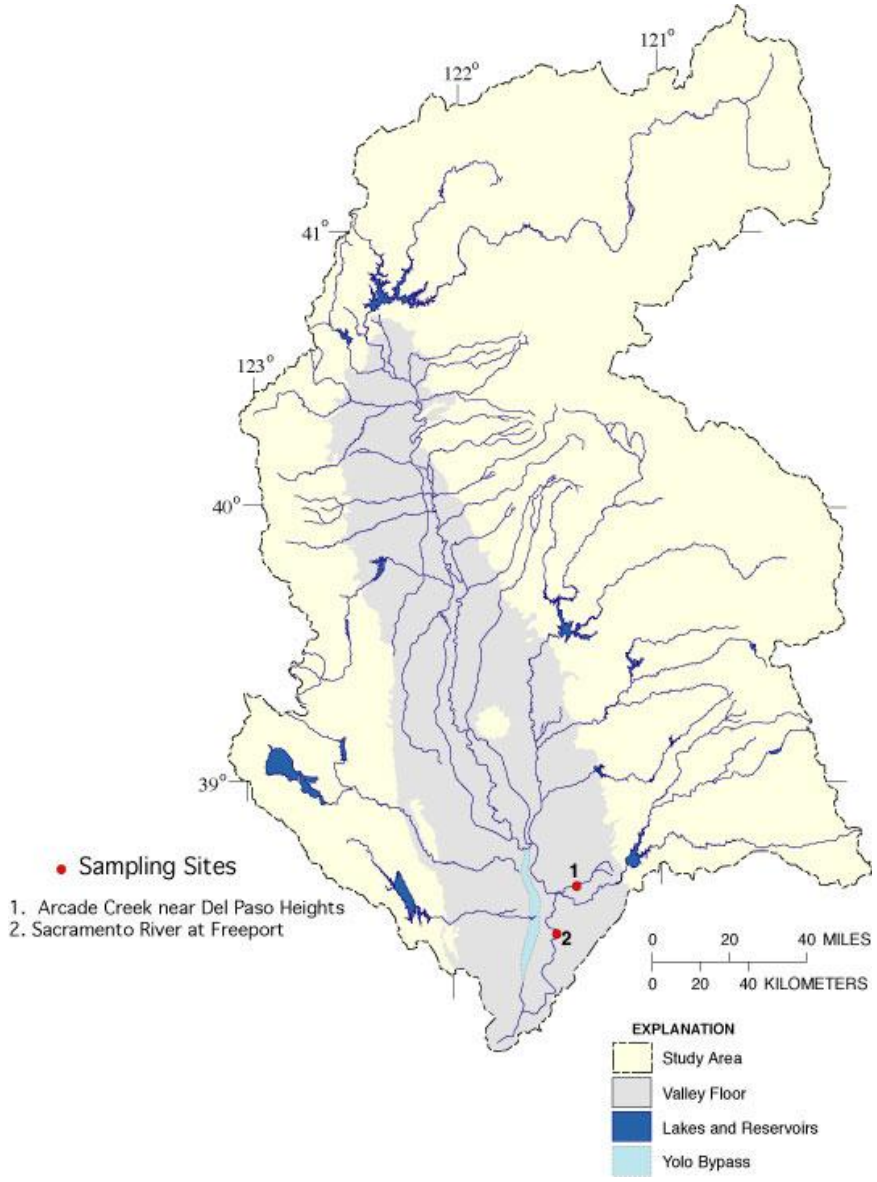
Cycle I
Surface Water
Aquatic Ecology
Ground Water

Cycle II
Surface Water
Ground Water

NAWQA Personnel
SACR Publications

Surface Water: Cycle II Activities (2004 - 2014)

Cycle 2 of the U.S. Geological Survey NAWQA Program, which began in 2001, builds on the previous decade's investigations with some major changes in the number of surface water sites monitored for status of and trends in water quality. Two surface water sites in the Sacramento River Basin were chosen for ongoing monitoring as part of the Status and Trends portion of the NAWQA Program. The Status and Trends Program is intended to provide continuing information on water quality parameters of interest at a select number of sites and at variable sampling frequency. The two sites chosen for the Sacramento River Basin are the Sacramento River at Freeport and Arcade Creek near Del Paso Heights (see map for locations). During the time period of October 1, 2006 through September 30, 2007, only the Sacramento River site will be monitored. That site will be sampled a total of 17 times during this period and will include analyses of nutrients, pesticides, suspended sediment, pH, alkalinity, dissolved oxygen, specific conductance, chloride, and sulfate.



U.S. Department of the Interior | U.S. Geological Survey
URL: http://ca.water.usgs.gov/user_projects/sac_nawqa/sw_cycle2.html
For Page Information: Send Us a Message
Page Last Modified: Tuesday, 14-Jun-2011 13:53:48 EDT