SWAMP
Surface Water Ambient Monitoring Program

Technical Report	**2009**

San Joaquin River Basin: Main Stem and Drainage Basin Sites, October 2000 – September 2005

October 2009

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1.0 EXECUTIVE SUMMARY

The Central Valley Regional Water Quality Control Board's (Central Valley Water Board) San Joaquin River Surface Water Ambient Monitoring Program (SWAMP) was implemented in October 2000 as part of the statewide effort to assess and monitor California's surface water quality. The San Joaquin River (SJR) Basin covers 17,720 square miles (CVRWQCB, 1998) with fresh water flows originating from the Sierra Nevada along the east side and ephemeral streams providing seasonal flows along the west side and within the foothill regions. The hydrology of the basin has been highly modified and regulated since the advent of the Central Valley Project in the late 1940's, and the valley floor is dominated by irrigated agriculture (approximately 2.0 million acres (DWR, 2001)).

The SWAMP within the SJR Basin was designed with a 3-tiered monitoring framework: 1) long-term monitoring in the main stem of the river; 2) long-term monitoring in selected tributaries draining major sub-basins; and 3) more intensive monitoring on a 5-year rotation within the sub-basins themselves. This report focuses on the results for the first two tiers of the SWAMP effort, the main stem of the San Joaquin River and the major inflows from sub-watersheds, between October 2000 and September 2005. Results for the third tier, the Intensive Basin Monitoring Program (IBP), can be found on the following website:

http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/sjr_swamp.shtml

The final sampling design for the first two tiers included eight SJR main stem sites and 30 drainage basin sites, which were sampled monthly or weekly depending on the site, with a total of 39 separate constituents sampled over the course of the sampling period. At a minimum, each site was analyzed for standard field measurements (specific conductance, pH, temperature, turbidity, and dissolved oxygen) as well as total coliform and *E. coli*. Monthly photo documentation was taken at each site. Sampling expanded to include total organic carbon, total suspended sediments, trace elements (arsenic, copper, chromium, lead, nickel, zinc, and mercury), biochemical oxygen demand, mineral data (chloride, sulfate, calcium, magnesium, total dissolved solids, carbonate, bicarbonate, total alkalinity and sodium) and water column toxicity when additional funding was available.

The purpose of this report is to summarize the data gathered over the five year sampling period and attempt to address the SJR SWAMP's main questions within the SJR valley, which include evaluating spatial and temporal trends and providing a preliminary assessment of potential beneficial use concerns.

Constituents monitored displayed distinct spatial and temporal trends within the SJR watershed and some areas were identified for further review of potential impacts to beneficial uses.

Spatial Trend Findings:

Within the river, the majority of constituents, i.e. specific conductance, TSS, turbidity, and most minerals and metals demonstrated increasing concentrations from Sack Dam (essentially the headwaters of the lower SJR) to Hills Ferry (a main stem site just upstream of the first freshwater flow from the Sierra Nevada). Many of the increases corresponded with inflows from the Grassland sub-basin. A pattern of decreasing concentrations from Hills Ferry to Vernalis (the boundary of the Sacramento-San Joaquin Delta) corresponded to dilution from the high volume fresh water flows from the east-side rivers that drain the Sierras. Most constituent concentrations decreased to roughly the same concentrations at Sack Dam after the 110-mile journey to Vernalis.

Comparing tributary sub-basin inflows, those from the western side of the SJR Basin had higher concentrations of most constituents than those on the eastern side. The distribution may in part be due to minimal natural run off from the Coastal Range and replacement supply water from the Delta along the west side and more continuous fresh water flows and captured snowmelt as supply water for the east side.

Temporal Trend Findings:

Strong seasonal trends were found for temperature i.e., temperatures increase in the summer and decrease during the winter. Dissolved oxygen (DO) had the opposite seasonal trend of temperature with a decrease in DO in the summer months and an increase in the winter months. Specific conductivity (SC), total organic carbon (TOC), turbidity, and total suspended solids (TSS) were influenced both by storm events, especially SC during the first storm runoff, and the irrigation season. Concentrations tended to spike during storm events, but remain at a lower but still elevated level during the irrigation season.

Preliminary Assessment of Potential Beneficial Use Concerns:

Potential impacts to key beneficial uses were evaluated by using selected indicators and comparing results against published water quality goals, targets and/or guidelines as follows:

- Drinking Water (SC, TOC, Nitrate, trace elements (arsenic, cadmium, copper, mercury, nickel, lead and zinc) and *E. coli*)
- Aquatic Life (pH, temperature, DO, turbidity, trace elements (cadmium, copper, nickel, arsenic, lead, zinc, and mercury), chloride and water column toxicity)
- Irrigation water supply (SC, and minerals (chloride, sodium and total dissolved solids))
- Recreation (*E. coli*)

In summary:

Drinking Water/Municipal Supply: Total organic carbon was found to be elevated throughout the SJR Basin when compared to the 3.0 mg/L Bay Delta Authority's guideline for water quality in the Sacramento-San Joaquin Delta (Delta). The entire SJR Basin drains into the southern portion of the Delta.

Aquatic Life: Elevated temperatures during the spring and fall were a concern for fish passage along the SJR when compared to the Bay-Delta Authority target for the San Joaquin River at Vernalis of 20ºC from April 1–June 30 and from September 1–November 30. Higher levels of turbidity in the Westside basin were a concern but the current Basin Plan objective is based on background concentrations so it was difficult to evaluate for the existing ephemeral streams. Various levels of water column toxicity were reported sporadically on multiple occasions around the basin. A higher percentage of chronic toxicity was reported as compared to acute toxicity. Samples for acute algae toxicity were collected less frequently but had a higher percentage (50 percent excluding Fremont Ford) of reduction and an increase in growth toxic events. For information on sediment toxicity around the basin see Sediment Toxicity Testing in the San Joaquin River Basin, October 2001 through September 2005 (http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/swamp_water_quality_reports/index.shtml).

Irrigation Water Supply: Specific conductance was found elevated above optimal irrigation water supply concentrations throughout most of the SJR Basin when compared to the Water Quality Goal for Agriculture of 700 umhos/cm. In addition, individual samples were at times elevated above the Basin Plan objective for Vernalis of 700 umhos/cm April through August and 1000 umhos/cm September through March, although it should be noted that the objective is to be applied as a 30-day maximum running

average and was not intended to determine impairment using a single grab sample. The highest SC concentrations were measured within the Grasslands and Westside Basin. High salt concentrations can be attributed to a variety of components not limited to local geology/hydrology, importation and deportation of water from and to different basins, waste products from urban, industrial, and agricultural practices—and is being evaluated separately under the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) project.

Recreation: Occasional spikes of *E. coli* above the USEPA guideline of 235 MPN/100 ml (full contact recreation) were detected sporadically throughout the year, but the summer months were of particular concern due to the potential for recreational use increases for most of the waterways.

Future Activities

By the end of this study (2005), other Central Valley Water Board surface water monitoring efforts had expanded—notably the Irrigated Lands Regulatory Program (ILRP) and monitoring conducted under various grant efforts. The Central Valley Water Board SWAMP efforts became more focused on internal and external monitoring coordination rather than continuing to maintain a separate monitoring strategy with shrinking resources. Some of these efforts are listed below.

- Development of the Central Valley Regional Board SWAMP website that documents monitoring activities supported by SWAMP and provides links to final reports and selected water quality data (http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/index.shtml)
- Continued water quality monitoring support for the multi-agency Grassland Bypass Project (selenium control program)
- Leveraging funds with a separate USEPA project to continue development of a web-based monitoring directory designed to display active monitoring within the entire Central Valley (http://www.centralvalleymonitoring.org)
- Providing resources (staff and contract dollars) to facilitate development of a Regional Monitoring Program for the Sacramento-San Joaquin Delta
- Supporting Department of Water Resources staff to continue long-term trend monitoring at 41-sites in the northern Sacramento River Basin in exchange for the addition of selected constituents of concern identified through Central Valley Regional Board efforts (TOC, nutrients, and toxicity) and realignment of 11-sites to correspond with sites utilized by the state-wide SWAMP sediment toxicity study
- Providing resources to insure ILRP water quality information is captured in the state-wide SWAMP master data base
- Developing a region-wide, long-term trend monitoring framework based on the 30-sites within the Central Valley that are part of the state-wide SWAMP contaminant trend monitoring effort.
- Providing assistance to other monitoring efforts to facilitate SWAMP comparability (e.g. reviewing quality assurance project plans)

Efforts related specifically to the elevated *E. coli* concentrations found within the SJR Basin as well as in other areas of the Central Valley as part of ILRP monitoring, are as follows:

- A survey of *E. coli* concentrations in local swimming holes before during and after a holiday weekend (coordinated with Central Valley watershed groups during both 2007 and 2008)
- A pilot bacteria source identification project with the University of California, Davis, in selected streams demonstrating elevated *E. coli* concentrations
- Continued, seasonal *E. coli* monitoring at 30-major integrator sites throughout the Central Valley.

Recommendations for future monitoring for each sub-basin and river site are summarized in Table 8 within the discussion and conclusion section of this report. Data collected as part of this study has been posted annually on our website since 2003 and was assessed in combination with other available data during the development of the Clean Water Act Sections 305(b) and 303(d) Integrated Report for the Central Valley Region (CVRWQCB, 2009 Draft).