

Research Update

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Bottom Line

This research project enhances understanding of the changing flows and salinity conditions in the San Joaquin River and how they affect salt loads. Real-time salinity management requires real-time access to this information.

Better, Faster, Cheaper

Providing salinity information for stakeholders is the first step towards complete San Joaquin Basin water quality management. Improved coordination will promote water storage in New Melones Reservoir and optimize salt export from the San Joaquin River Basin, while meeting water quality objectives at the Vernalis compliance monitoring station.

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Visualizing Salinity in the San Joaquin River

Decision support tool summarizing San Joaquin River salinity conditions for the past 30 days

Problem

Salinity management of the lower San Joaquin River is required to ensure compliance with State water quality objectives set for salinity. Before 2000, salinity objectives at the Vernalis compliance monitoring station on the San Joaquin River were routinely violated. A salinity Total Maximum Daily Load (TMDL) was adopted as the customary approach to water quality regulation.

Reclamation and San Joaquin Basin stakeholders embraced a novel concept of real-time salinity management to achieve the goals of the TMDL while maximizing salt export from the basin. Under real-time salinity management, strict salt load-based limits set monthly for each of seven sub-basins within the San Joaquin River Basin are replaced by a single concentration objective at Vernalis. Monitoring, modeling, and model-based forecasting provide relevant salt load assimilative capacity information to stakeholders to improve cooperation, coordination, and scheduling of San Joaquin River salt loading needed to stay within the 30-day-running average salinity objectives. Real-time management in the Basin Water Quality Plan provides a more equitable and resource-efficient way to use river resources.

Solution

This Reclamation Science and Technology Program research project was a first attempt at building some of the needed visualization capability to develop real time salinity management. It provides a prototype visualization tool to calculate and display San Joaquin River salt loading to allow assessment of salt load assimilative capacity for real-time management by:

- Using ArcGIS software to develop a line segment map that shows the approximate length of river channel associated with each monitoring station along the San Joaquin River for major east-side and west-side drainages and the major points of diversion.
- Developing a data parser to download the raw data from the California data exchange for each monitored site and then separate time series parameters for flow and electrical conductivity (EC).
- Summarizing these raw data as daily mean values.



*New Melones Dam and Reservoir,
California*

This novel approach to real-time salinity management requires that significant changes be made to allow coordination between west-side agricultural and wetland return flows to the San Joaquin River and releases from east-side reservoirs and operational spills of high-quality water that supply mostly east-side irrigation districts. New decision support tools with state-of-the-art visualization capabilities are required to develop this needed collaboration. This new initiative will be called “WARMF-Online” and will provide access to all continuous, telemetered flow and EC monitoring data measured within the basin to calculate salt load (EC times flow). Participants will use the same visualization framework to access model output and model-based forecasts of flow, EC, and salt assimilative capacity.

Application

Time series data at several monitoring sites had different averaging periods, and the data at these sites had to be processed separately. After interviewing several stakeholder decisionmakers, daily mean flow and EC were determined most critical. Calculating the salt load at all river, drainage, and diversion monitoring stations allowed estimation of salt assimilative capacity at the Vernalis and Maze Road sites. The parsed flow, EC, and salt load data were then associated with each river, drainage channel, and diversion arc using the ArcGIS attribute file for each monitoring station. Using the “MapObjects” toolbox, a map was created with a time series data slide bar to display the last 30 days of flow, EC, and salt load data as colored line segments. In addition, a data table was added below each monitoring station label to show current daily parameter values.

Results

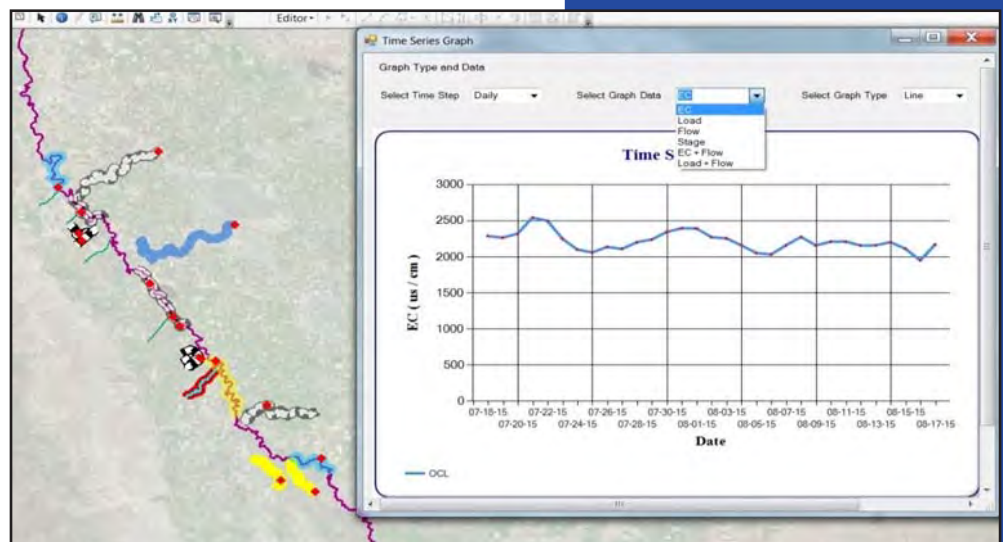
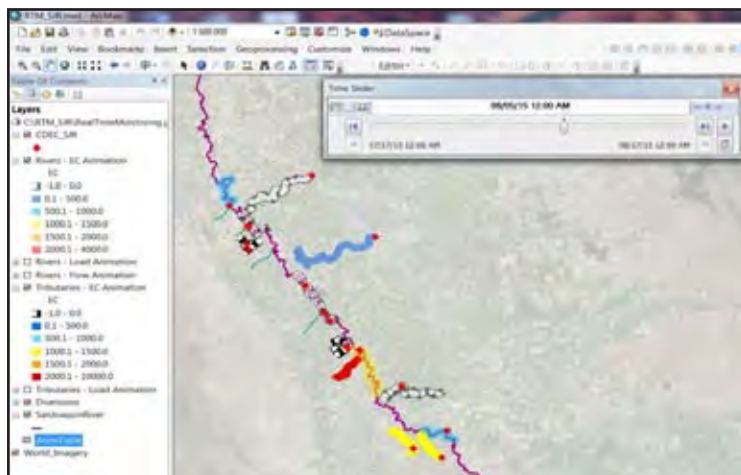
The parser and visualization tool worked very well for sites that currently provide raw data to the WARMF-Online website. (Although all of the eight west-side stations are operational, only two of them provide data that can be visualized using this tool.)

This method allowed a swift, easy to interpret visual depiction of salinity concentration and load trends in the San Joaquin River and its tributaries, which become the basis for flow, EC, salt load, and salt load assimilative capacity forecasting.

Future Plans

A Reclamation consultant is developing a very similar visualization interface using a public domain, Geographic Information System (GIS)-based tool called “Open-NRM,” which will build upon the current project. This is the first step in building the WARMF-Online web portal as a central hub for salt managers in the San Joaquin Basin. The tool can provide animation of flow, EC, and salt load of San Joaquin River and its tributaries.

Further long-term research and ongoing analysis are needed to guide ongoing development of WARMF-Online and improve monitoring station design placement in the basin to overcome current flow and salinity forecasting impediments. Data and information dashboards are being developed for individual stakeholders, and stakeholder groups, to enable a better understanding of those data necessary for decisionmaking. These dashboards are being shared with all stakeholders on the WARMF-Online web portal. Feedback from these dashboards is helping to guide the next generation of flow and salinity visualization tools.



“We continue to experiment with visual aids to track and improve our understanding of salt load assimilative capacity in the San Joaquin River Basin. Stakeholders can use a single dashboard and come away with new knowledge of a system they have known for decades and, perhaps, insights into becoming more effective and responsible resource stewards.”

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More information

www.usbr.gov/research/projects/detail.cfm?id=3942

Top figure: EC animation of San Joaquin River and its tributaries.

Bottom figure: Daily time series EC at OCL.