# WARMF Output Description

## *Time Series Output*

WARMF produces outputs of flow and each water quality parameter it simulates for each daily time step in every river segment in the simulated model domain. Time series output is the classic output showing the flow or concentration on the y-axis and time on the x-axis (Figure 1, Figure 2, Figure 3). The simulated values are shown in solid lines and the measured values are in black circles. Multiple scenarios can be compared against each other with different colored lines. The simulation results can be exported to a text file for further analysis.
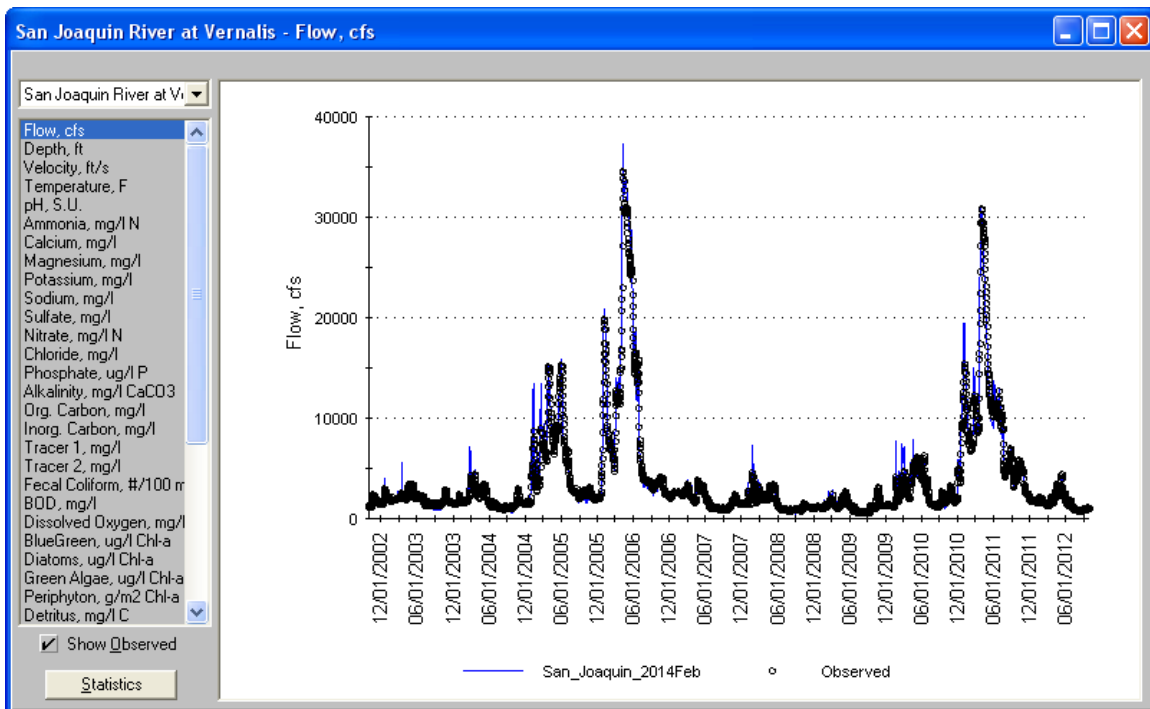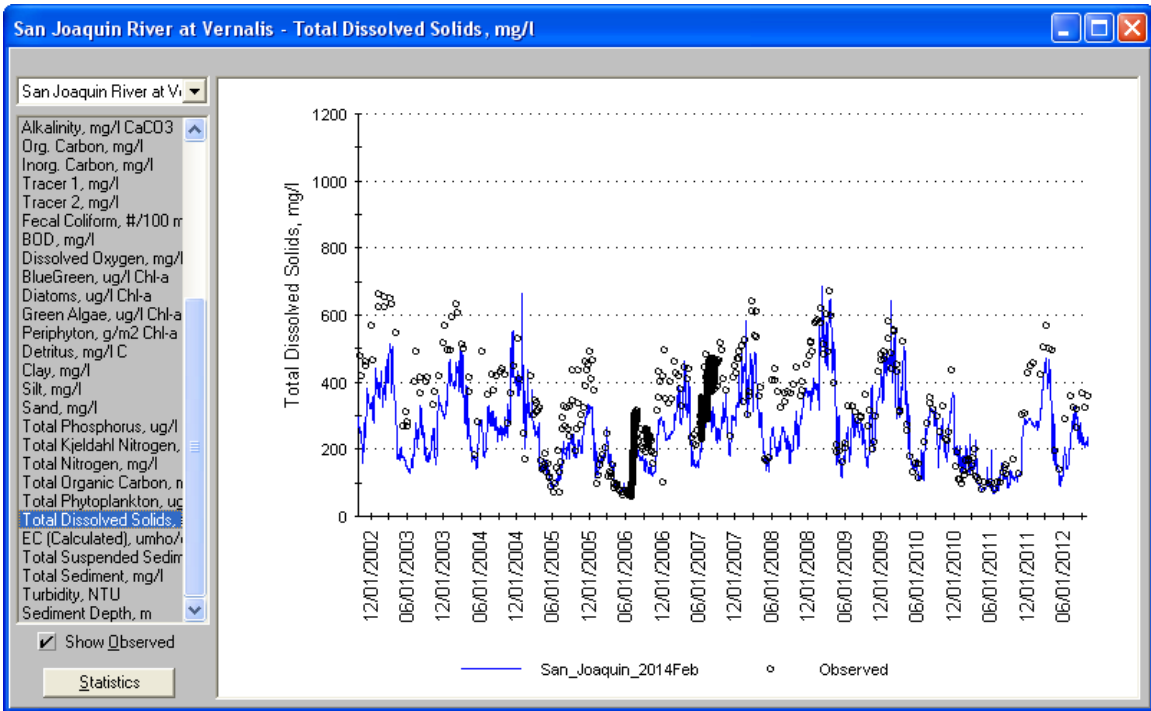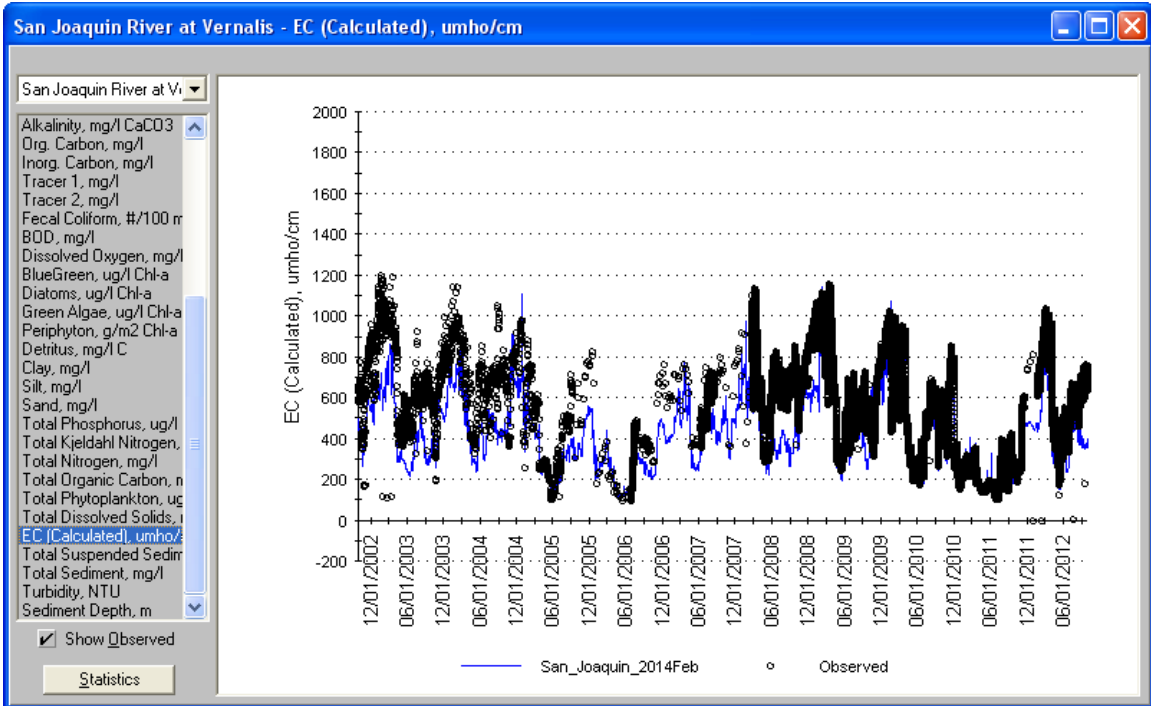


**Figure 1 Time series plot of simulated vs observed flow, San Joaquin River at Vernalis**

**Figure 2  Time series plot of simulated vs observed total dissolved solids, San Joaquin River at Vernalis**



**Figure 3 Time series plot of simulated vs observed electrical conductivity, San Joaquin River at Vernalis**

## *Loading Output*

Loading output provides loading rates averaged over the whole simulation period.
WARMF tracks the transport and transformations of constituents to examine the original
sources of chemical constituents within regions and land uses. Loading output takes two
forms. Direct loading (Figure 4) shows the loading from the land and point sources to the
surface waters within colored regions on the map. Source contributions loading (Figure
5) shows the loading within a section of river. The difference between them is transport
and transformations which occur while the loading proceeds downstream, such as
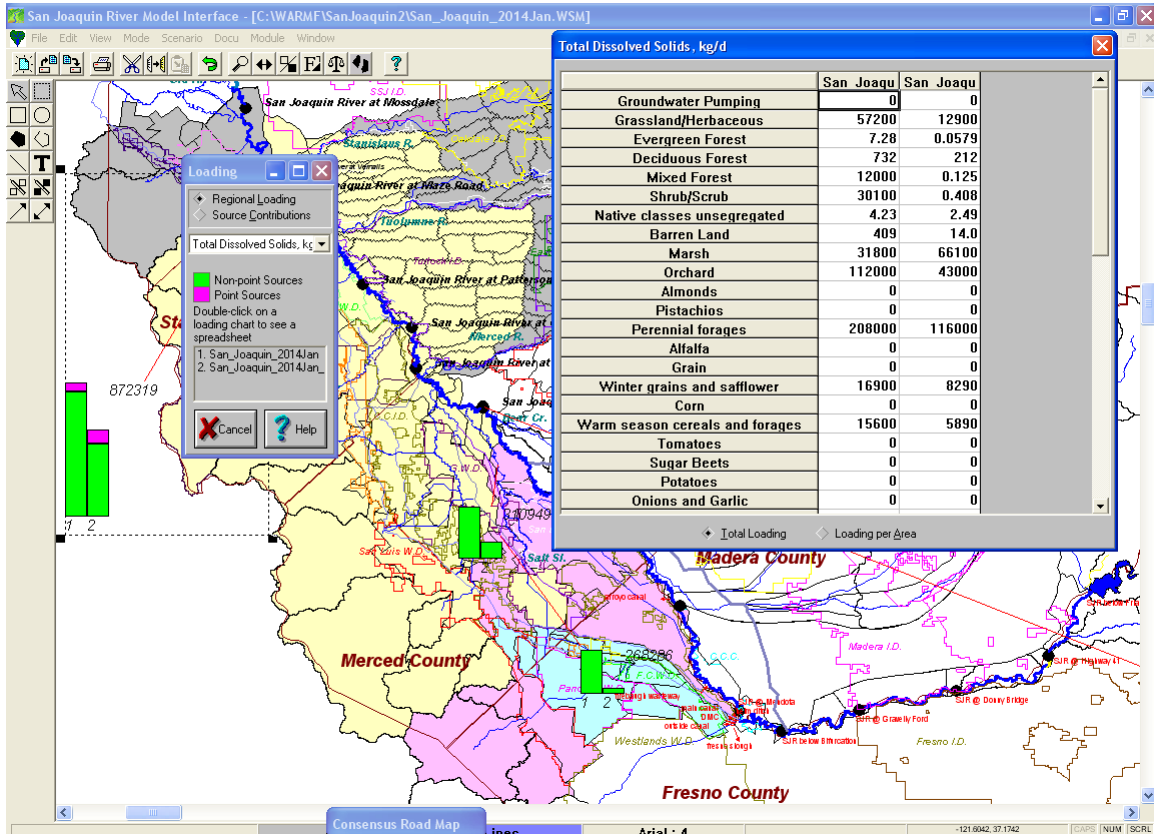settling, chemical reactions, and diversions.



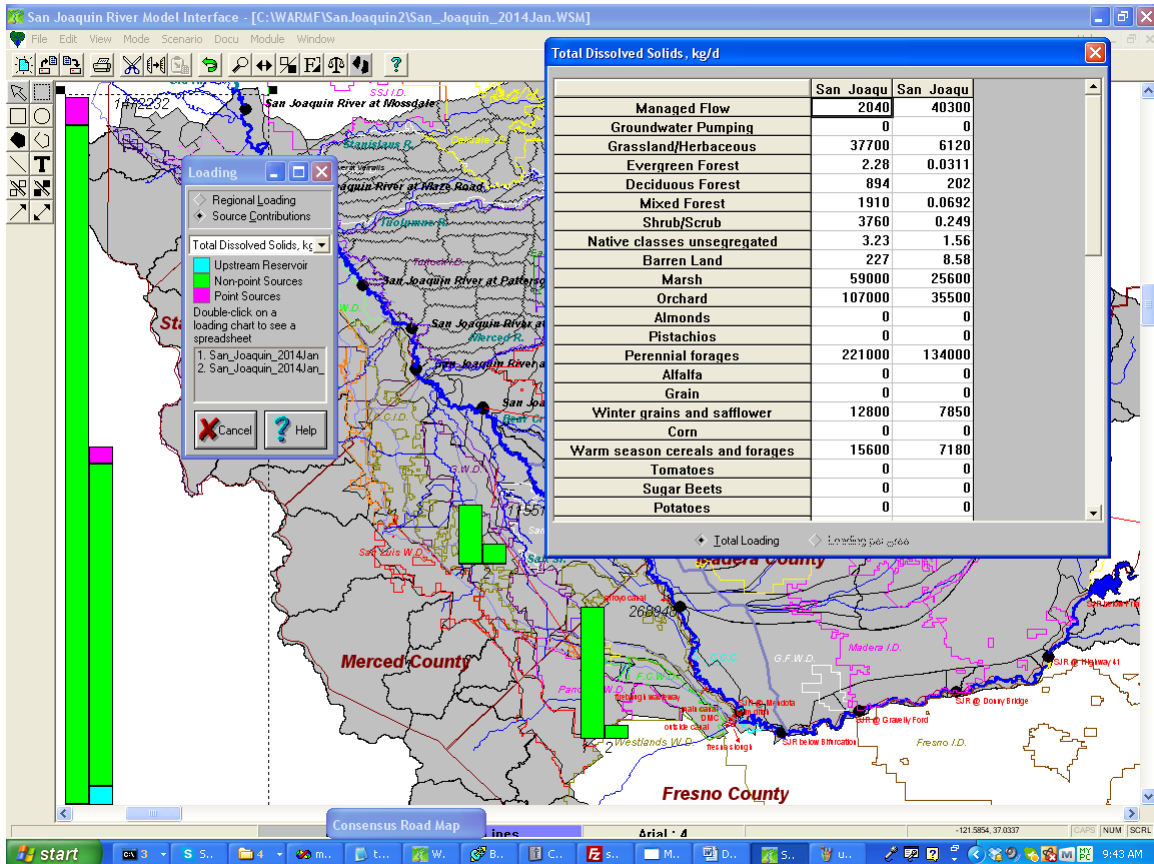**Figure 4 Direct Loading output with details for yellow region**

**Total Dissolved Solids, kg/d**

| | San Joaqu | San Joaqu |
|---|---|---|
| Managed Flow | 2040 | 40300 |
| Groundwater Pumping | 0 | 0 |
| Grassland/Herbaceous | 37700 | 6120 |
| Evergreen Forest | 2.28 | 0.0311 |
| Deciduous Forest | 894 | 202 |
| Mixed Forest | 1910 | 0.0692 |
| Shrub/Scrub | 3760 | 0.249 |
| Native classes unsegregated | 3.23 | 1.56 |
| Barren Land | 227 | 8.58 |
| Marsh | 59000 | 25600 |
| Orchard | 107000 | 35500 |
| Almonds | 0 | 0 |
| Pistachios | 0 | 0 |
| Perennial forages | 221000 | 134000 |
| Alfalfa | 0 | 0 |
| Grain | 0 | 0 |
| Winter grains and safflower | 12800 | 7850 |
| Corn | 0 | 0 |
| Warm season cereals and forages | 15600 | 7180 |
| Tomatoes | 0 | 0 |
| Sugar Beets | 0 | 0 |
| Potatoes | 0 | 0 |

**Figure 5 Source Contributions Loading with details for the San Joaquin River at Vernalis**

## *Gowdy Output*

Gowdy Output is named after Mark Gowdy of the Central Valley Regional Water Quality Control Board, who developed the output in spreadsheet form before it was incorporated into WARMF. It combines several WARMF outputs to identify the sources of flow or loading on any day of the simulation. Figure 6 shows the Gowdy Output's three components. On the upper right is a longitudinal plot showing flow or concentration along a river reach on the selected date. In the lower right is a plot showing cumulative flow or loading along the same reach of the river. The cumulative loading is separated into inputs, diversions, and net cumulative loading. The bar chart on the left shows the contributions of every loading source and diversion to the load seen at the downstream end of the selected river reach (such as at Vernalis). Green shows inflows and red shows diversions. One can view the loading in two forms: ignoring in-stream processes (comparable to direct loading above) and accounting for in-stream processes (comparable to source contributions loading above). When accounting for in-stream loading, it is possible to extract the model's calculations of the contributions from individual sources to the loading observed in any point on the river on any day of the simulation. The Gowdy Output can be exported to text files for further processing or to display the bar charts as a time series.
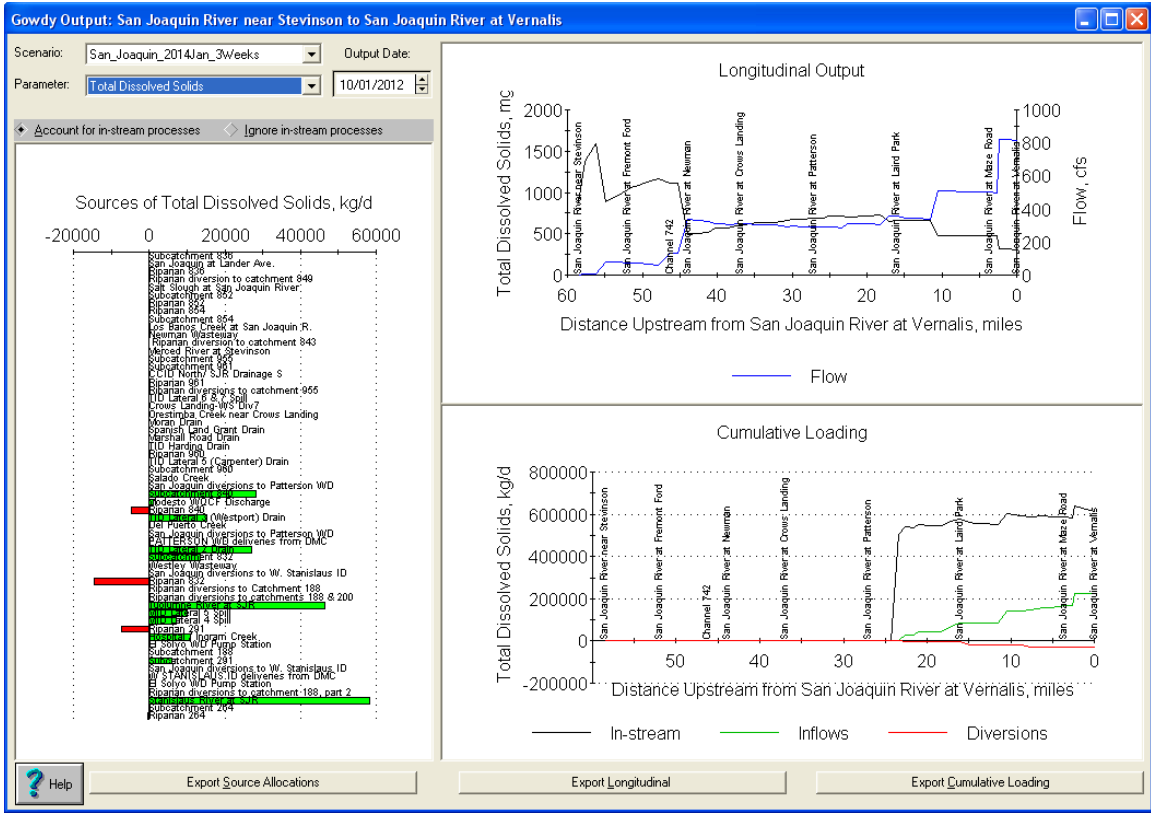
**Figure 6 Gowdy Output for San Joaquin River from Lander Avenue to Vernalis**