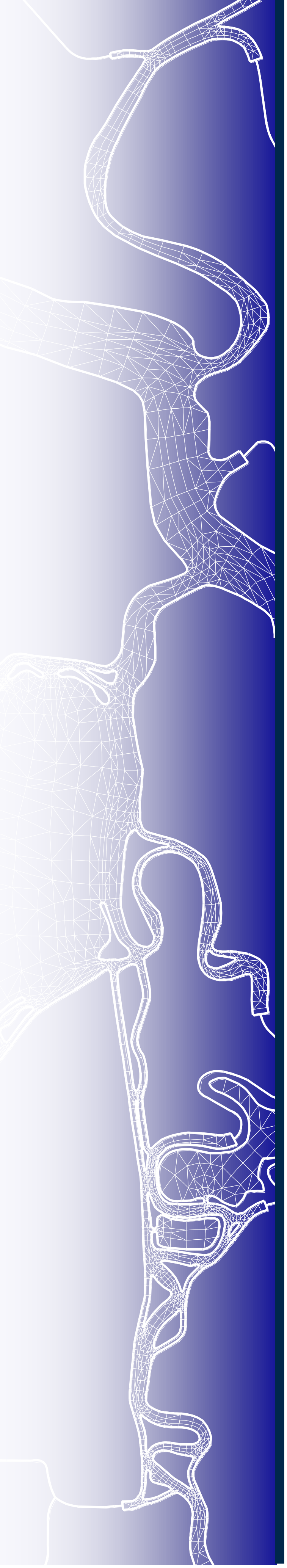
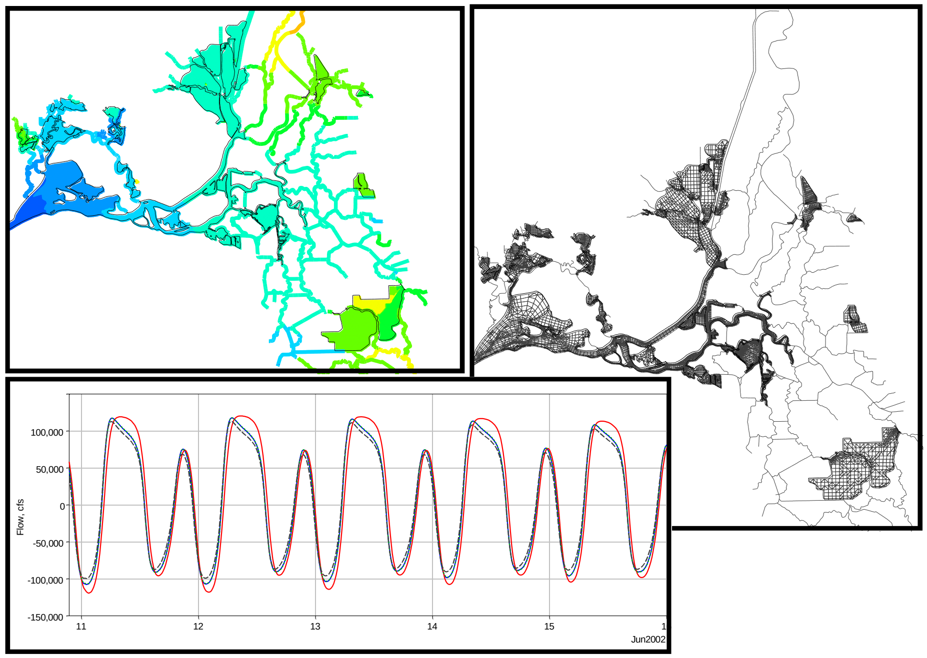


NUMERICAL MODELING IN SUPPORT OF BAY DELTA CONSERVATION PLAN TIDAL MARSH ASSUMPTIONS SENSITIVITY ANALYSIS

JULY 2012



Prepared For:
ICF International
630 K Street, Suite 400
Sacramento, CA 94952
Contact:
Jennifer Pierre
Project Manager, Effects Analysis
707-280-9673

Prepared By:
Resource Management Associates
4171 Suisun Valley Road, Suite J
Fairfield, CA 94534
Contact:
John DeGeorge
707-864-2950

RMA RESOURCE MANAGEMENT ASSOCIATES

Executive Summary

Restoration of tidal marsh has been proposed for various regions of the Delta to improve habitat diversity and food availability for covered species. Assessments of tidal marsh effects on flows, stage, velocity and EC were performed for areas throughout the Delta. Early Long-term (ELT) and Late Long-term (LLT) BDCP restoration cases were simulated to represent two points in time with two different total areas of restoration. Restoration Opportunity Areas (ROAs) include Suisun Marsh, Cache Slough, West Delta, Mokelumne-Cosumnes, East Delta and South Delta.

Under the current phase of the project, analyses were conducted to assess the sensitivity of physical parameters to tidal marsh habitat restoration hypothetical assumptions used in the initial effects analysis.

With the ELT and LLT simulations as base cases, three types of sensitivity analyses were conducted: sensitivity to tidal marsh area, to conveyance and to breach location. Two to three individual analyses are performed for each. The set of sensitivity simulations is as follows:

- *Tidal marsh area*
    - *ELT – Maximize Suisun ROA (shift restoration acreage from Cache to Suisun ROA)*
    - *LLT – No South Delta ROA (remove South Delta ROA)*
- *Conveyance*
    - *LLT – Middle River Conveyance (increase conveyance capacity in Middle River)*
    - *LLT – Suisun Scour (scour in main channels, incised channels in ROAs)*
- *Breach location*
    - *ELT – Prospect Island Breach (remove one of two Prospect Island breaches)*
    - *LLT – Little Egbert Breach (remove one of two Little Egbert Tract breaches)*
    - *LLT – Sherman Breach (move Sherman breach from Threemile Slough to San Joaquin River)*

Among the most important hydrodynamic impacts was the transfer of net flow between the Sacramento River and the Delta Cross Channel / Georgiana Slough. Breach removal in the LLT – Little Egbert Breach case had the greatest impact on Georgiana Slough flows, while breach removal in the ELT – Prospect Breach case had the greatest impact on DCC flows. In each case, the combined DCC plus Georgiana Slough flows are increased by 2% above their respective base restoration case due to breach removal.

All sensitivity scenarios with changes in Suisun marsh or the south Delta had a 5% or greater impact on average flows at both ends of Montezuma Slough, relative to the base restoration cases. Montezuma Slough flows are sensitive to conditions within Suisun Marsh, and to a lesser degree to conditions in the south Delta.

Restoration diminishes tidal range throughout the system. Sensitivity analyses show that increases in channel conveyance, certain changes to breach configurations and moving or removing certain restoration areas can all impact tidal range. Geometry modifications in Suisun primarily impact Suisun Marsh and south Delta tidal range. Geometry changes in the south Delta have localized tidal range impacts. Breach removal in the ELT – Prospect Breach case only affected tidal range in the north Delta, while the impacts of LLT – Little Egbert Breach removal were more far reaching.

The distribution of salinity in the Delta is a function of the overall flow balance, net flow distribution, and dispersive mixing associated with tidal flows.

None of the scenarios has large EC impacts north of Rio Vista. LLT – Suisun Scour and ELT – Max Suisun result in the largest EC increases overall, while LLT – Little Egbert results in the largest decreases overall.

Changes in freshwater coming down Georgiana Slough and Mokelumne River impact EC in the San Joaquin River around San Andreas Landing and on down into the South Delta. The LLT – Little Egbert case increases Georgiana Slough and Mokelumne River flows above LLT, resulting in EC decreases of up to 7% below LLT in the south Delta.

Suisun Marsh restoration has the greatest impact on EC in the central and south Delta. Shifting restoration area from Cache Slough to Suisun Marsh increased EC in these areas and increased X2. Increasing conveyance in Suisun Marsh amplified the impact of Suisun Marsh restoration on central and south Delta EC and resulted in the highest X2 and highest EC at the exports of any scenario.

Most of the sensitivity cases impact July 2002 X2 by 0.3 km or less, relative to the base restoration cases. The LLT – Suisun Scour case increases X2 by 0.7 km relative to LLT and the ELT – Max Suisun case increases it by a full kilometer, bringing it closer to LLT X2.

BDCP –Tidal Marsh Assumptions Sensitivity Analysis

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1 Introduction

1.1 Background

Restoration of tidal marsh has been proposed for various regions of the Delta, denoted Restoration Opportunity Areas (ROAs), to improve habitat diversity and food availability for covered species. Assessments of tidal marsh effects on flows, stage, velocity and EC were performed for areas throughout the Delta under three time step scenarios in the tidal marsh restoration process: Near-term (NT) with 14,000 acres of restoration; Early Long-term (ELT) with 25,000 acres of restoration and Late Long-term (LLT) with 65,000 acres of restoration. Under the current phase of the project, sensitivity analyses were subsequently conducted to determine the sensitivity of tidal marsh habitat restoration hypothetical assumptions used in the effects analysis on physical parameters. Analyses were based on ELT and LLT scenarios. This progress report illustrates the RMA model sensitivity analysis for tidal marsh assumptions.

1.2 RMA Bay-Delta Model

RMA has developed and refined a numerical model of the San Francisco Bay and Sacramento-San Joaquin Delta system (Bay-Delta model) utilizing the RMA finite element models for surface waters. RMA2 (King, 1990) is a generalized free surface hydrodynamic model that is used to compute two-dimensional depth-averaged velocity and water surface elevation. RMA11 (King, 1998) is a generalized two-dimensional depth-averaged water quality model that computes a temporal and spatial description of conservative and non-conservative water quality parameters. RMA11 uses the results from RMA2 for its description of the flow field. As shown in Figure 2-1, the full model extends from the Golden Gate to the confluence of the American and Sacramento Rivers and to Vernalis on the San Joaquin River.

The current version of RMA's Bay-Delta model has been developed and continually refined during numerous studies over the past 14 years. One of the most important additions has been the capability to accurately represent wetting and drying in shallow estuaries. The most comprehensive calibration efforts in recent years were performed during studies for the City of Novato (RMA, 1997), the City of Palo Alto Regional Water Quality Control Plant (RMA, 1998), Central Contra Costa Sanitary District (RMA, 2000a), CALFED (RMA, 2000b), Flooded Islands Feasibility Study (RMA, 2005) and Numerical Modeling in Support of Suisun Marsh PEIR/EIS (RMA, 2008).

1.3 Objectives

The objective of this effort is to assess sensitivity of physical parameters to tidal marsh habitat restoration assumptions.

2 Model Configuration

The RMA Bay-Delta model can be used with the tidal boundary condition applied at the Golden Gate (full Bay-Delta network) or with the tidal boundary condition applied at Martinez (Delta-only network). The Delta-only network is used when the physical or operational alternatives under consideration do not impact the flow or water quality at Martinez. Because the large-scale tidal marsh restoration configuration considered for the BDCP can impact conditions at Martinez, the RMA full-Bay-Delta network is used.

2.1 Base Model

Figure 2-1 shows the entire network of the Bay-Delta model used for the Base case hydrodynamic and EC simulations in this study.

The model was developed from GIS data, USGS shapefiles and digital orthoquad (DOQ) images. Bottom elevations and the extent of mudflats were based on bathymetry data collected by NOAA, DWR, USACE and USGS. These data sets have been compiled by DWR and can be downloaded from DWR's Cross Section Development Program (CSDP) website at http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/models/csdp/csdp.cfm.

Additional data were collected around Franks Tract by DWR and the USGS in 2004. USGS 10 m resolution Delta Bathymetry grids were obtained from the Access USGS website at http://sfbay.wr.usgs.gov/sediment/sfbay/downloads.html.

During a previous study (RMA, 2008) the finite element mesh was refined in the Suisun Marsh area. The length of the 1-D elements was reduced and additional channels were added. Overbank/fringe marsh was added as off-channel storage based on observed flow data (DWR, Suisun Marsh Branch, 2004), LIDAR elevation data and aerial photos.

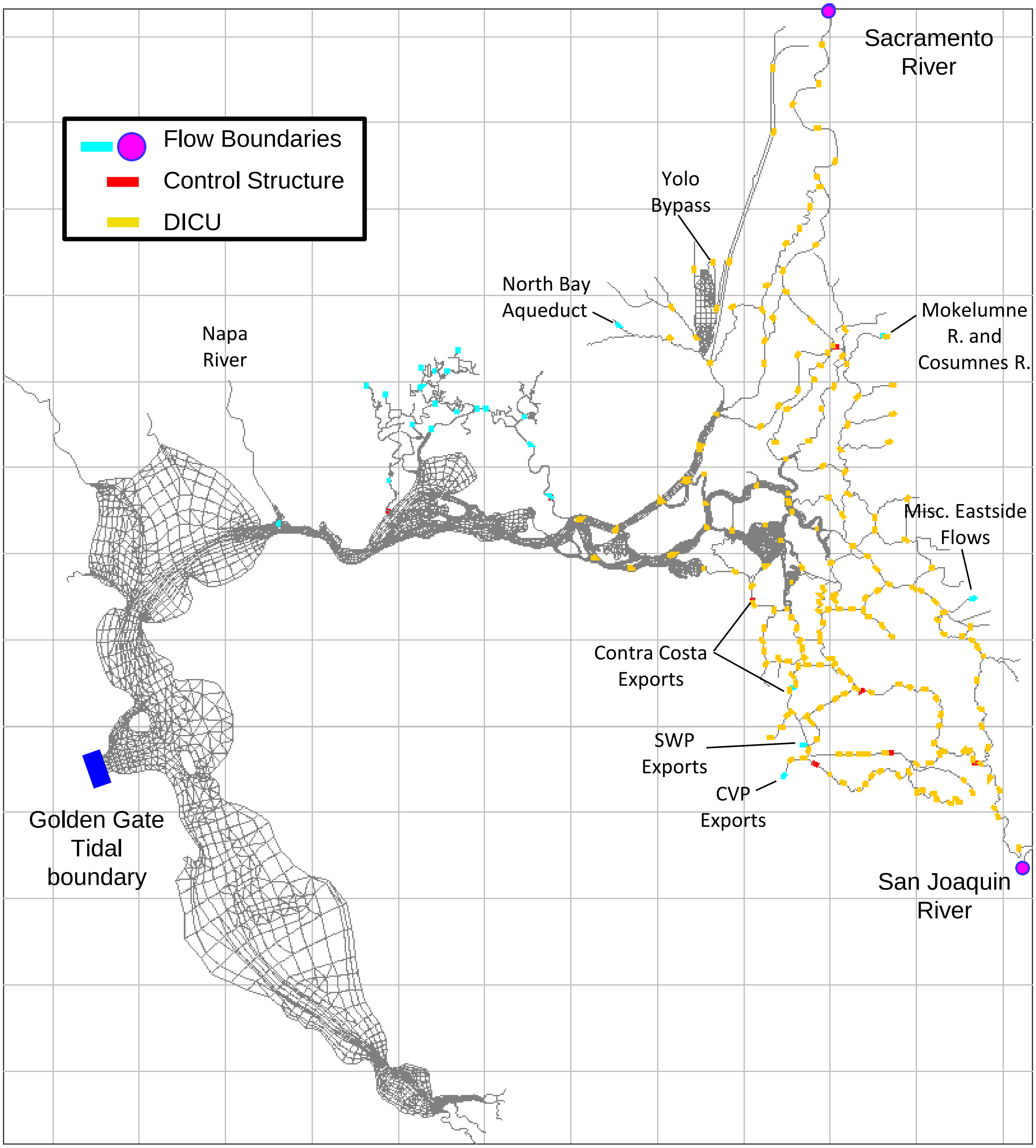


Figure 2-1 Model grid showing inflow and export locations, DICU and flow control structures.

2.2 ELT and LLT

During a previous phase of work, Early Long-term (ELT) and Late Long-term (LLT) BDCP restoration cases were simulated to represent two points in time with two different total areas of restoration. Areas of restoration include Suisun Marsh, Cache Slough, West Delta, Mokelumne-Cosumnes, East Delta and South Delta.

The restoration acreage goal for the Early Long-term (ELT) restorations scenario is 25,000 acres. The modeled ELT restoration scenario consists of 12,900 acres in the Cache Slough ROA, 8,130 acres in Suisun Marsh, 3,990 acres in the West Delta ROA, and 2,900 acres in the Mokelumne-Cosumnes ROA. A summary of the acreages, including areas at tidal datums, is provided in Table 2-1. A detail view of the ELT grid is shown in Figure 2-2. There is no restoration in the East Delta ROA or South Delta ROA for the ELT case.

The restoration acreage goal for the Late Long-term (LLT) restorations scenario is 65,000 acres. The modeled LLT restoration scenario consists of 20,330 acres in the Cache Slough ROA, 14,390 acres in Suisun Marsh, 4,240 acres in the West Delta ROA, 3,290 acres in the Mokelumne-Cosumnes ROA, 2,160 acres in the East Delta ROA and 22,480 acres in the South Delta ROA. A summary of the acreages, including areas at tidal datums, is provided in Table 2-2. A detail view of the LLT grid is shown in Figure 2-3.
Note that there are approximately 2,000 acres of existing tidal marsh included in the Suisun Marsh ROA acreages, therefore the overall total acreage exceeds the goal for both cases.

Further details on the ELT and LLT simulations are provided in the RMA report *Numerical Modeling in Support of Bay Delta Conservation Plan, Technical Study #4 – Evaluation of Tidal Marsh Restoration Effects, Preliminary Results* (RMA, 2010).

Table 2-1 Summary of Early Long-Term ROA acreages.

ROA	Area Above EHW (Ac)	Area MHHW to EHW (Ac)	Area MLLW to MHHW (Ac)	Area Below MLLW (Ac)	Total Area (Ac)	% Tidal Marsh (between MLLW and MHHW)
Suisun Marsh	159	289	3,495	4,190	8,133	43%
Cache Slough	2,944	1,669	5,946	2,338	12,897	46%
West Delta	284	38	2,743	927	3,992	69%
Mokelumne-Cosumnes	3	83	846	1,972	2,904	29%
East Delta	-	-	-	-	-	-
South Delta	-	-	-	-	-	-
Total	3,390	2,079	13,030	9,427	27,926	43%

Table 2-2 Summary of Late Long-Term ROA acreages.

ROA	Area Above EHW (Ac)	Area MHHW to EHW (Ac)	Area MLLW to MHHW (Ac)	Area Below MLLW (Ac)	Total Area (Ac)	% Tidal Marsh (between MLLW and MHHW)
Suisun Marsh	205	435	3,676	10,073	14,389	26%
Cache Slough	4,080	1,955	6,878	7,421	20,334	34%
West Delta	287	39	2,954	956	4,236	70%
Mokelumne-Cosumnes	344	109	822	2,018	3,293	25%
East Delta	792	221	240	910	2,163	70%
South Delta	8,292	1,395	1,848	10,948	22,483	8%
Total	14,000	4,154	16,418	32,326	66,898	25%

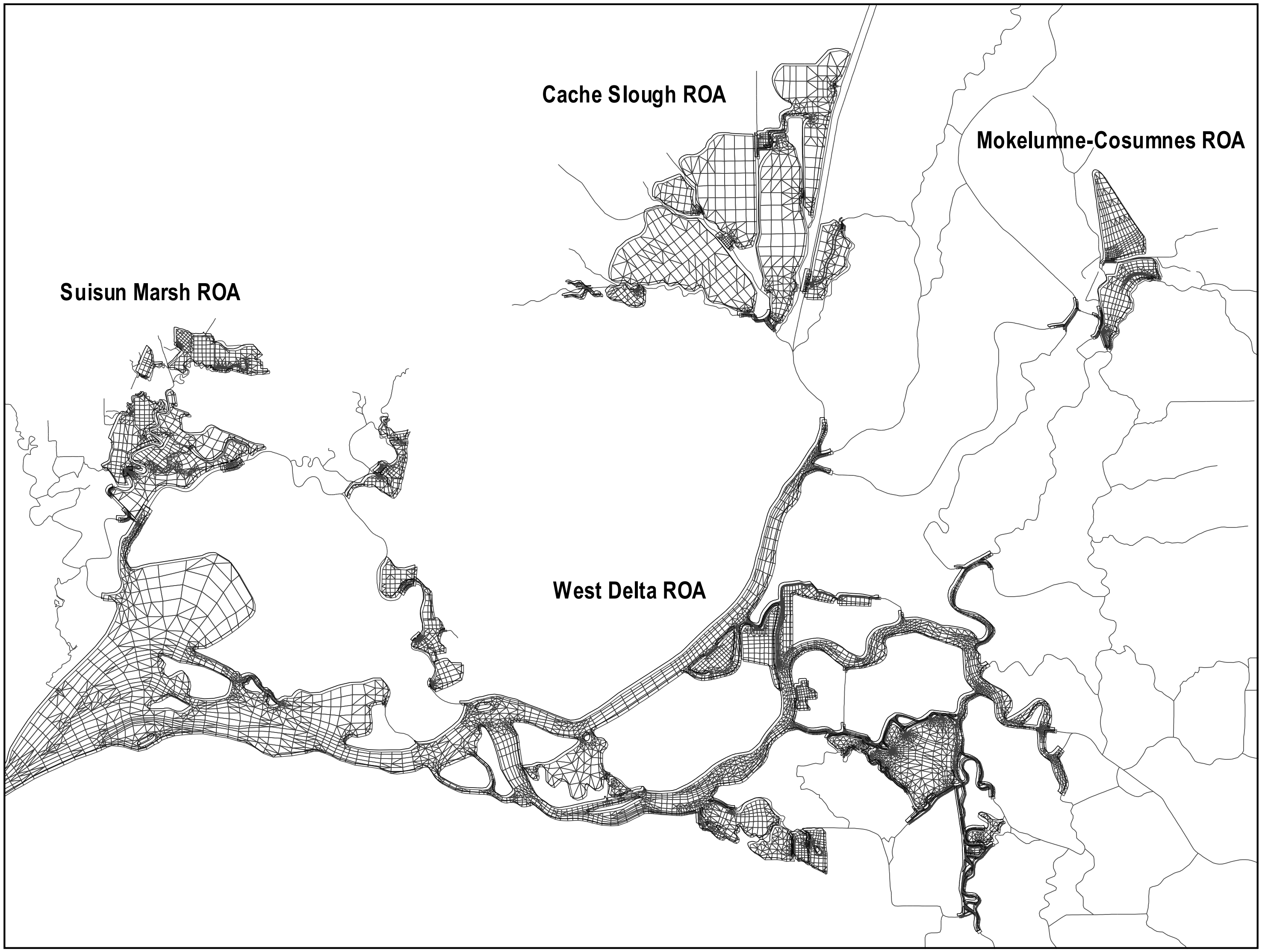


Figure 2-2 RMA Early Long-Term model finite element mesh.

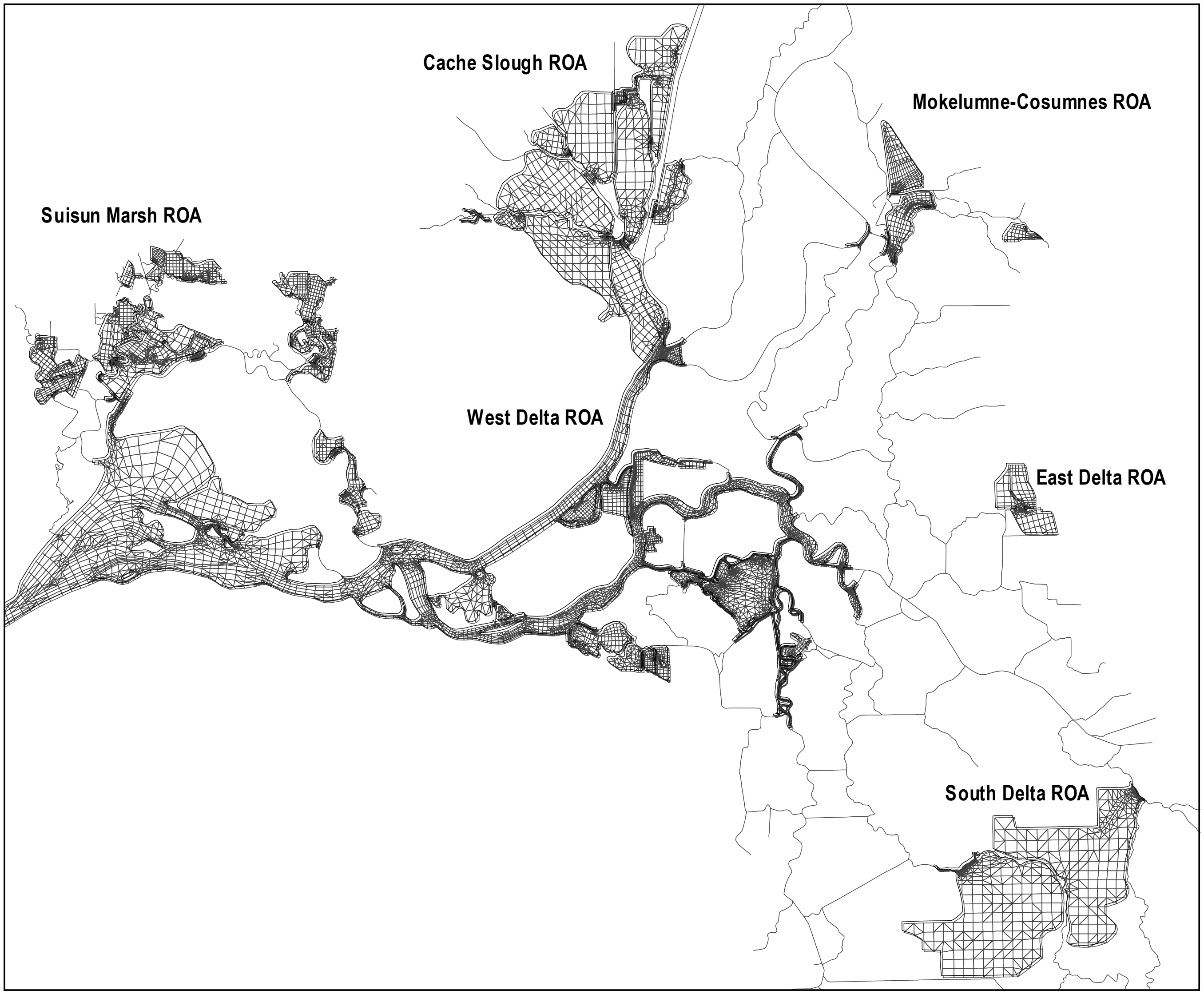


Figure 2-3 RMA Late Long-Term ROA model finite element mesh.

2.3 Sensitivity Cases

Three types of sensitivity analyses are addressed in this report: tidal marsh area, conveyance and breach location. Two to three individual analyses are performed for each. The set of sensitivity simulations is as follows:

- Tidal marsh area
    - ELT – Maximize Suisun ROA
    - LLT – No South Delta ROA
- Conveyance
    - LLT – Middle River Conveyance
    - LLT – Suisun Scour
- Breach location
    - ELT – Prospect Island Breach
    - LLT – Little Egbert Breach
    - LLT – Sherman Breach

Full descriptions of each simulation are provided below.

2.3.1 ELT – Maximize Suisun ROA

The total restored acreage for the ELT-Max Suisun sensitivity case is the same as that for the ELT case, approximately 25,000 ac, however the restoration within the Suisun Marsh ROA is the same as that for the LLT case, approximately 14,000 ac. To maintain the ELT acreage total, the Cache Slough ROA area is reduced. All other ROAs are the same as for the ELT case. Figure 2-4 and Figure 2-5 show comparisons of the Suisun Marsh and Cache ROA model grids for the ELT and ELT – Max Suisun scenarios.

The simulation uses ELT boundary conditions. The sensitivity analysis for the ELT – Max Suisun case relies on comparisons with the Base – No SMSCG and ELT simulations. The Base – No SMSCG simulation is a new base case that was run for the purpose of more meaningful comparisons in Montezuma Slough. The Suisun Marsh Salinity Control Gate (SMSCG) remains out for the entire simulation period, just as it does in the ELT case and all ELT based sensitivity simulations. This allows for analysis of the restoration and sensitivity impacts, without the bias of the differing gate operations. The Middle River barrier uses historic operations, as with the ELT case.

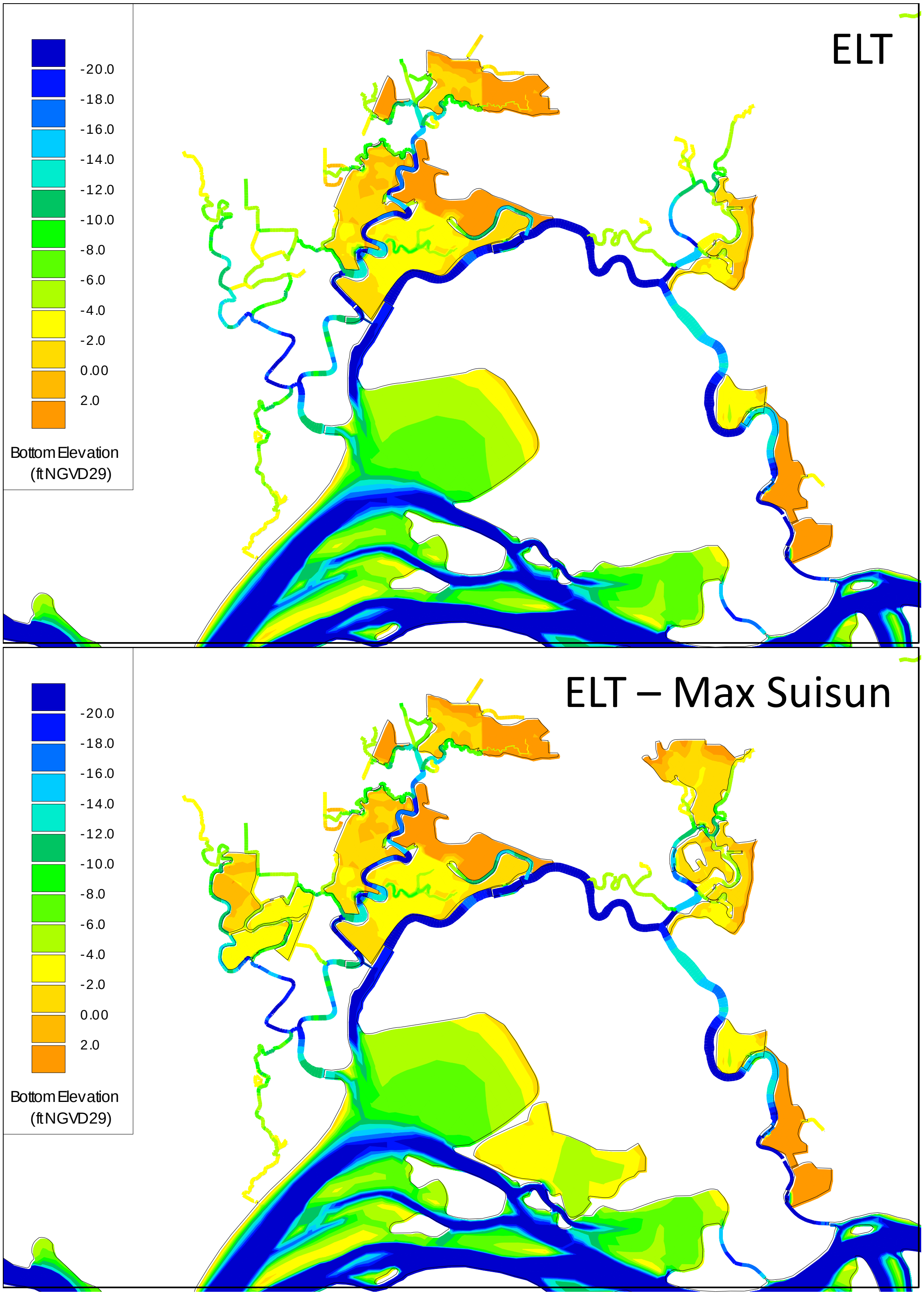


Figure 2-4 Comparison of Suisun Marsh ROA geometry for the ELT and ELT – Max Suisun scenarios.

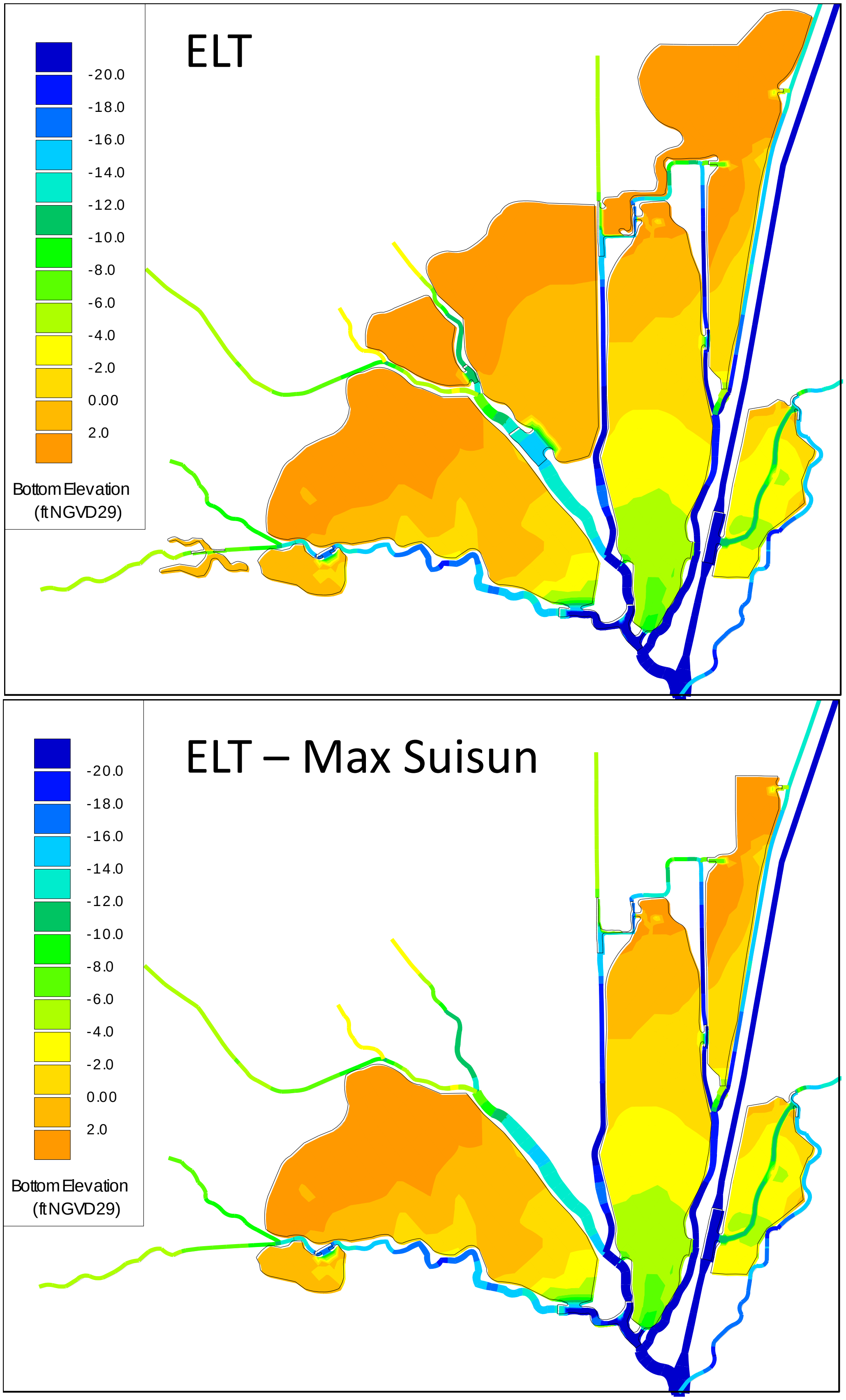


Figure 2-5 Comparison of Cache ROA geometry for the ELT and ELT – Max Suisun scenarios.

2.3.2 LLT – No South Delta ROA

The LLT – No South sensitivity case uses the LLT grid without the South Delta ROA. All other ROAs and the boundary conditions are the same as for the LLT case. A comparison of the LLT and LLT – No South model grids is shown in Figure 2-6.

The sensitivity analysis for the LLT – No South case relies on comparisons with the Base – No MRB and LLT simulations. The Base – No MRB simulation is a new base case that was run for the purpose of more meaningful comparisons in the south Delta. The Middle River Barrier (MRB) remains out for the entire simulation period, just as it does in the LLT case and all LLT based sensitivity simulations. This allows for analysis of the restoration and sensitivity impacts, without the bias of the differing gate operations. The Montezuma Slough salinity control gates are also open for the entire period, as with the LLT case.

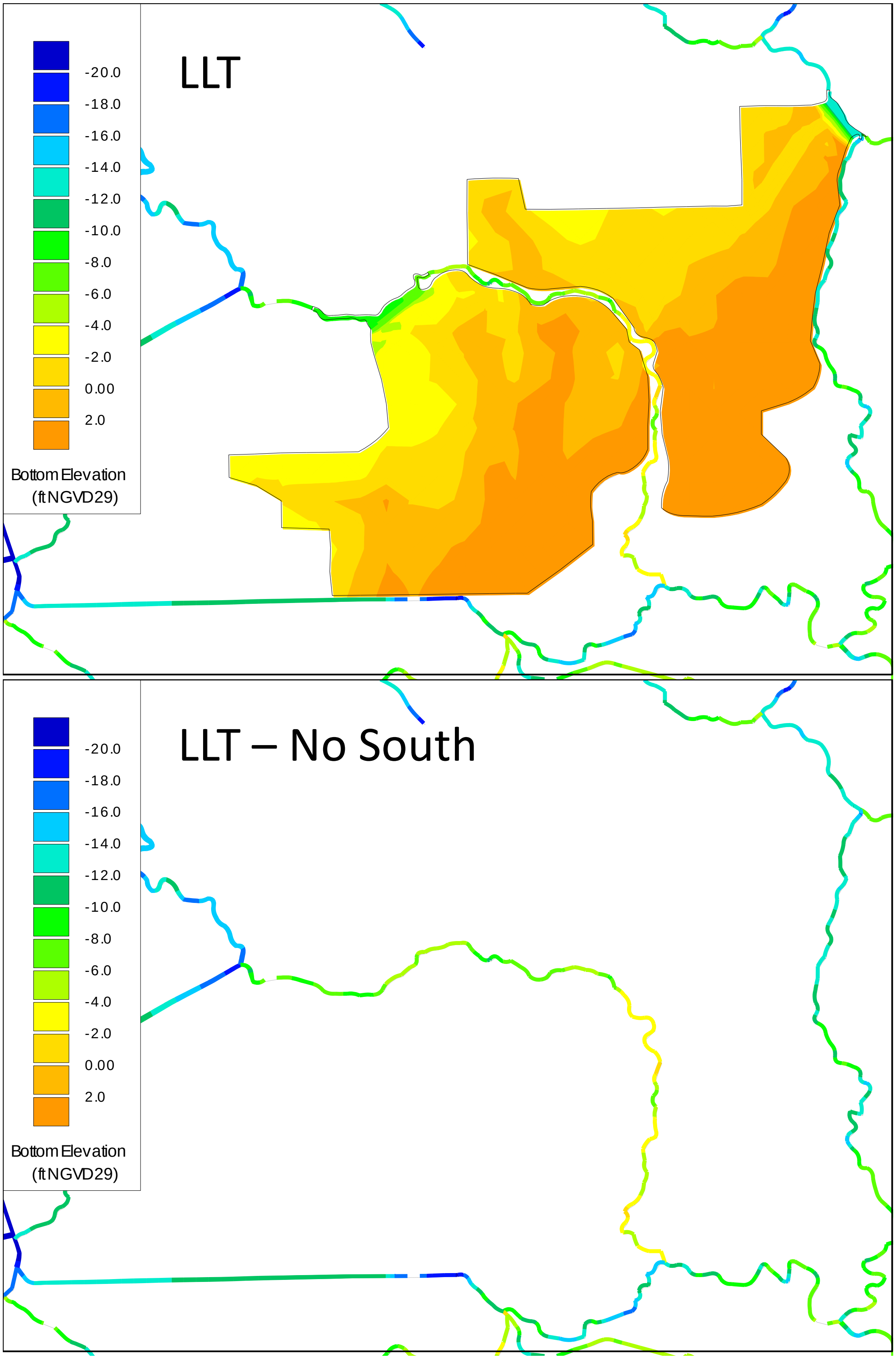


Figure 2-6 Comparison of South Delta ROA geometry for the LLT and LLT – No South scenarios.

2.3.3 LLT – Middle River Conveyance

The Middle River conveyance sensitivity run (LLT – Middle River) is the same as the LLT simulation with widened and deepened Middle River from Railroad Cut to the Union Island breach. The channel was widened based on an empirical hydraulic geometry relationship developed for San Francisco Bay (Williams et al., 2002). This relationship relates area at a cross-section to tidal prism at the cross-section. The sediment in the south Delta is likely to be mostly non-cohesive while San Francisco Bay sediment at the sites for which Williams et al. (2002) developed the empirical hydraulic relationship is mostly cohesive. Furthermore, due to management actions in the south Delta including the use of temporary barriers, it is not clear that an equilibrium geometry is present in Middle River near the restoration site. For this reason the Williams et al. (2002) relationship might not be accurate for the south Delta. However, the predicted equilibrium cross-sectional area at RMID027 was similar to the existing area, providing some evidence of the validity of the William et al. (2002) approach for the south Delta. The area for the LLT-Middle River conveyance sensitivity run was determined based on the predicted tidal prism at RMID023 and RMID027 for LLT. This is likely an underestimate of equilibrium cross-sectional area that would result from the south Delta ROAs because the increased cross-sectional area will lead to increased prism in suggesting that an iterative approach would be required to achieve a cross-sectional area that is consistent with the predicted tidal prism.

The final geometry changes for the LLT - Middle River scenario included widening and deepening the Middle River channel from Victoria Canal to the Union Island breach to achieve a 4X increase from base case cross-sectional area, and from Victoria Canal to Woodward Canal to achieve a 1.3X increase from base case area. The Middle River barrier is present but open in the LLT case, but removed completely for the LLT – Middle River case. A comparison of LLT and LLT – Middle River channel geometry is provided in Figure 2-7.

All ROAs and the boundary conditions are the same as for the LLT case.

The sensitivity analysis for the LLT – Middle River case relies on comparisons with the Base – No MRB and LLT simulations.

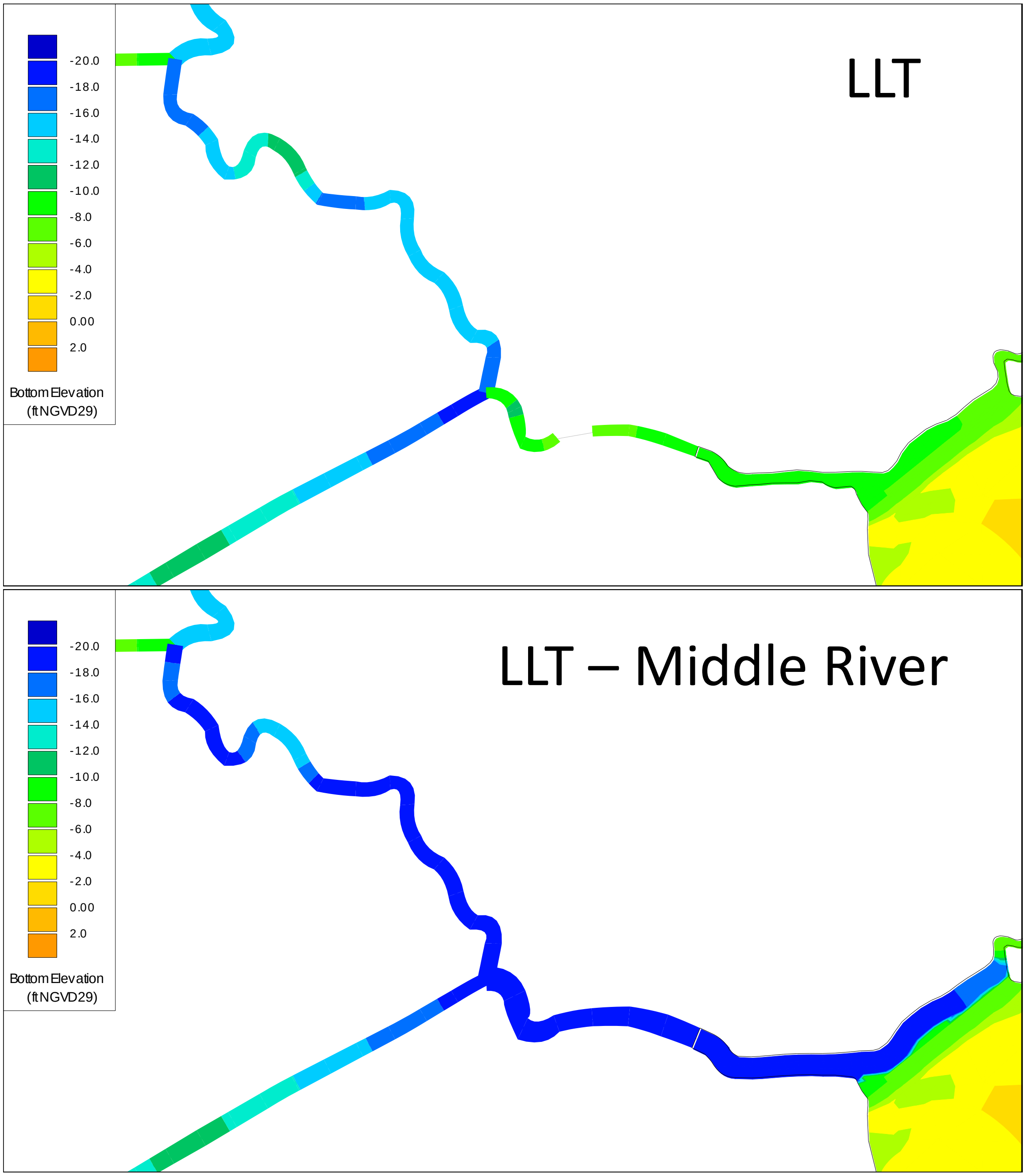


Figure 2-7 Comparison of Middle River channel geometry for the LLT and LLT - Middle River scenarios.

2.3.4 LLT - Suisun Scour

RMA collaborated with ESA PWA to conduct an analysis of channel scour and tidal marsh evolution in Suisun Marsh under the LLT conditions (ESA PWA, 2011). The simulations performed for that study are further analyzed here as a sensitivity case. The LLT grid was modified to reflect evolved tidal marsh and scoured channels as predicted by ESA PWA. This included deepening and widening most channels in the marsh, incised channels in the ROAs, and additional breaches in the ROAs for improved circulation. A comparison of the LLT and LLT – Suisun Scour model geometries is provided in Figure 2-8.

All other ROAs and all boundary conditions are the same as for the LLT case.

The sensitivity analysis for the LLT – Suisun Scour case relies on comparisons with the Base – No MRB and LLT simulations.

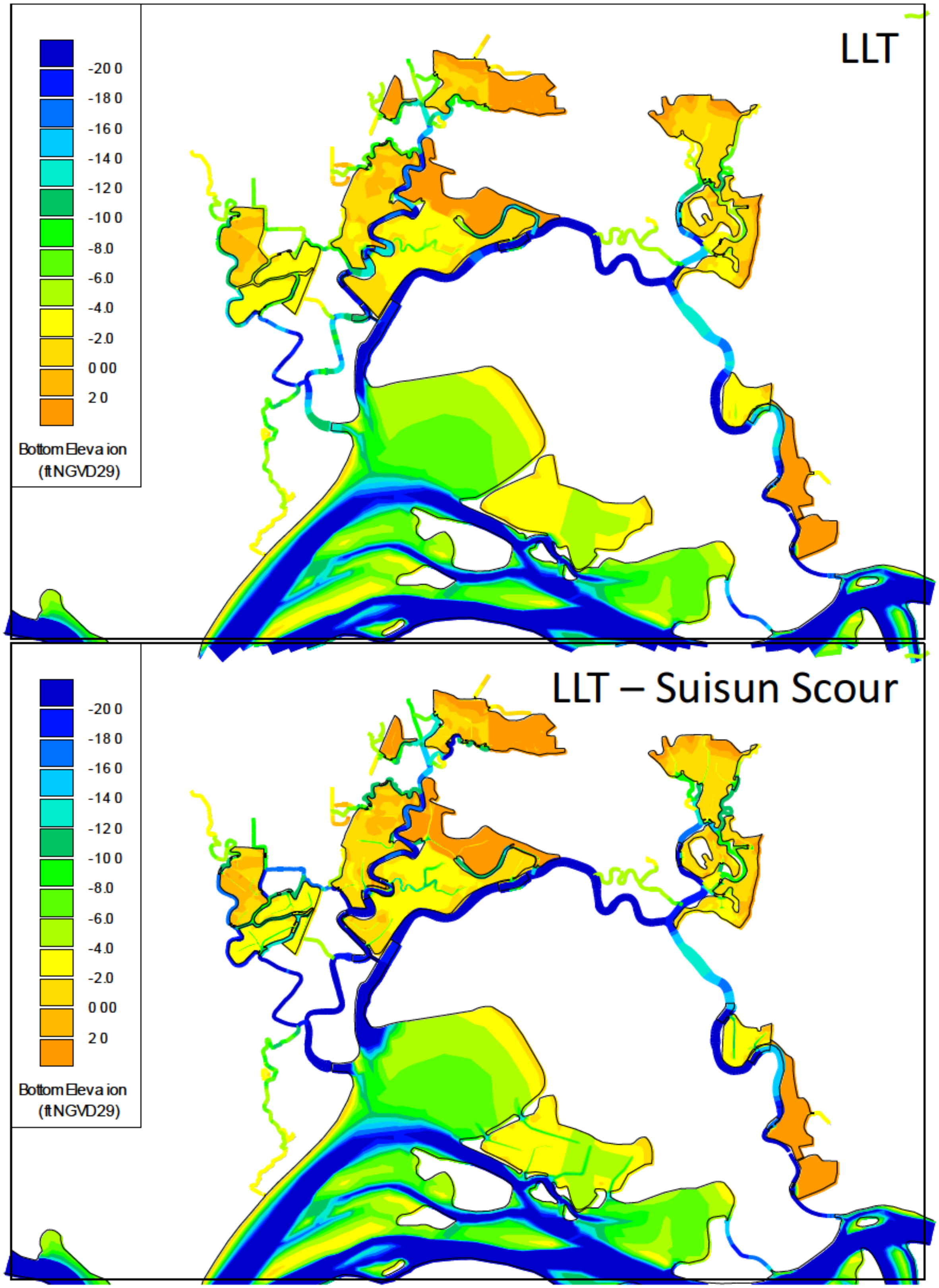


Figure 2-8 Comparison of Suisun Marsh ROA geometry for the LLT and LLT – Suisun Scour scenarios.

2.3.5 ELT – Prospect Breach

In both the ELT and LLT cases, restoration in the Cache Slough ROA includes Prospect Island with breaches on both Miner Slough and the Ship Channel. The flow through effect resulting from this configuration was thought to be impacting flows throughout the north Delta including Delta Cross Channel and Georgiana Slough flows. To discern the exact impact of the flow through Prospect Island, a sensitivity analysis was performed using the ELT configuration but with the Prospect Island breach on Miner Slough removed. The ELT and ELT – Prospect Breach model grids of Prospect Island are shown in Figure 2-9. All ROAs and boundary conditions are otherwise the same as for the ELT case.

The sensitivity analysis for the ELT – Prospect Island case relies on comparisons with the Base – No SMSCG and ELT simulations.

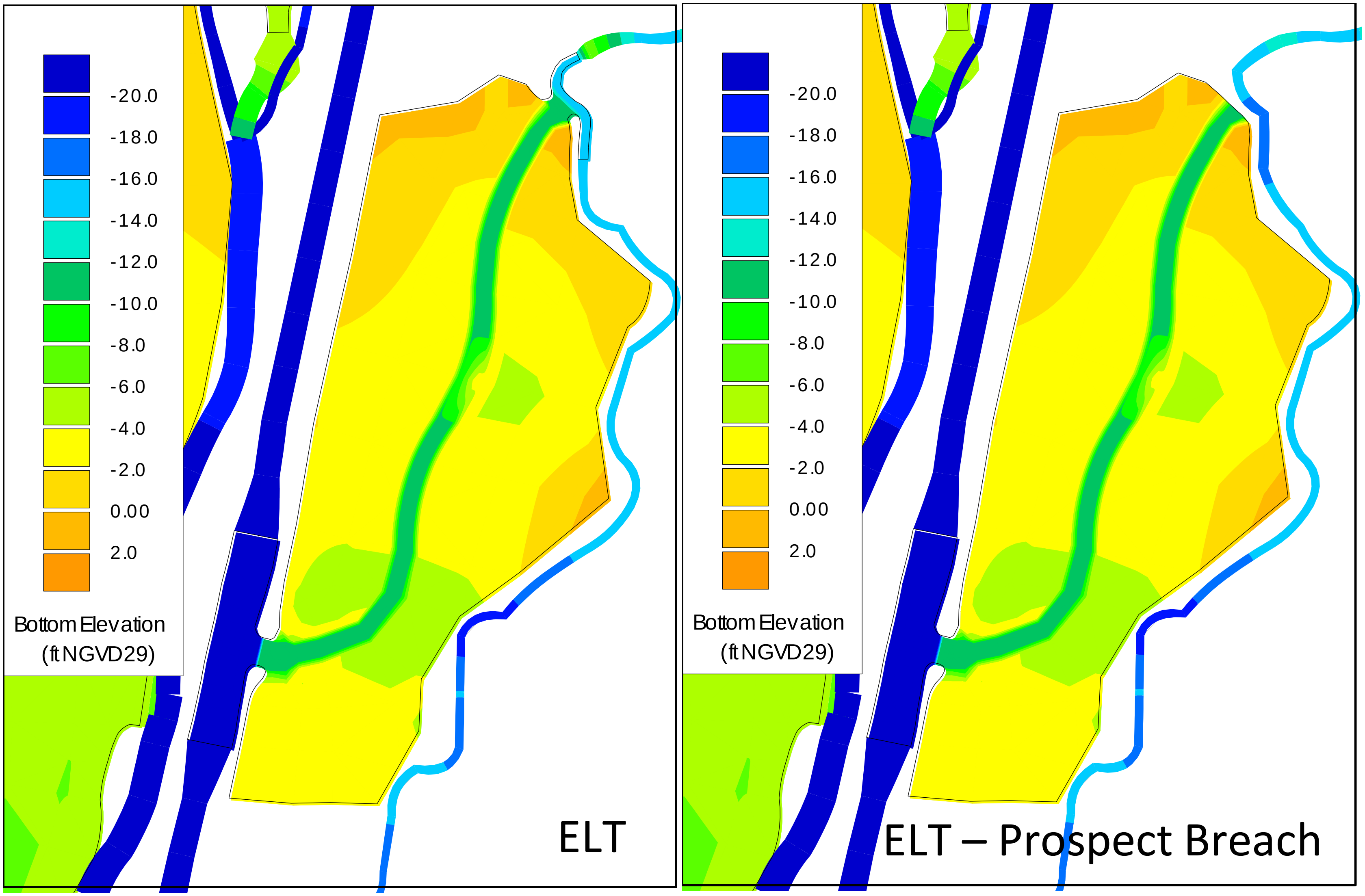


Figure 2-9 Comparison of Prospect Island geometry for the ELT and ELT – Prospect Breach scenarios.

2.3.6 LLT – Little Egbert Breach

For the LLT case, Little Egbert Island was breached on Cache Slough just upstream of Steamboat Slough, and on Lindsey Slough just above Cache Slough. This configuration was chosen to provide additional conveyance. For the LLT – Little Egbert Breach sensitivity case, the Cache Slough breach was removed, eliminating this potential conveyance. The LLT and LLT – Little Egbert Breach model grids of Little Egbert Island are shown in Figure 2-10. All ROAs and boundary conditions are otherwise the same as for the LLT case.

The sensitivity analysis for the LLT – Little Egbert Breach case relies on comparisons with the Base – No MRB and LLT simulations.

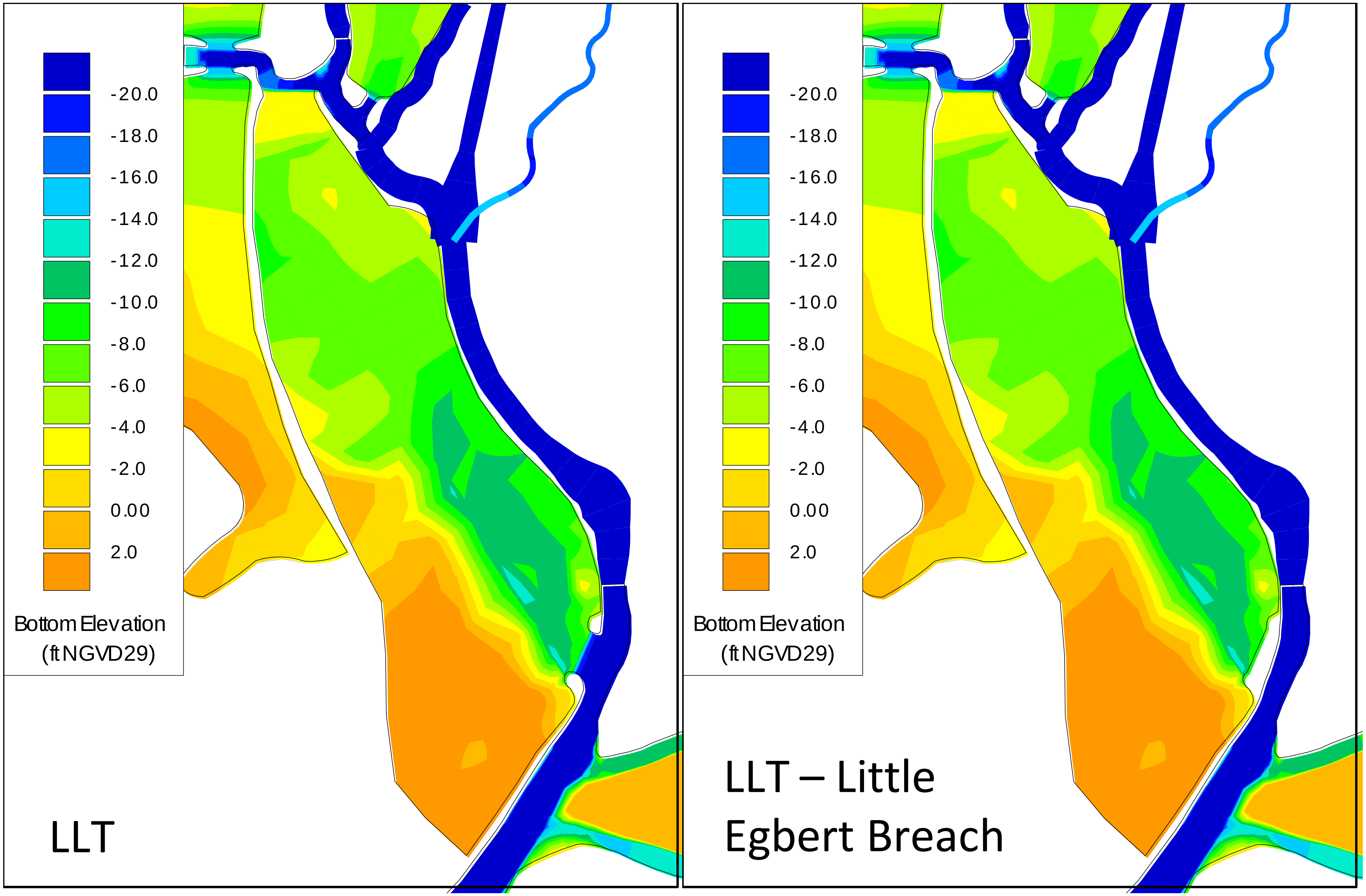


Figure 2-10 Comparison of Little Egbert Tract geometry for the LLT and LLT – Little Egbert Breach scenarios.

2.3.7 LLT – Sherman Breach

For a final breach location sensitivity case, the Sherman Island breach on Threemile Slough in the LLT case was moved to the San Joaquin River. The LLT and LLT – Sherman Breach model grids of Sherman Island are shown in Figure 2-11. All ROAs and boundary conditions are otherwise the same as for the LLT case.

The sensitivity analysis for the LLT – Sherman Breach case relies on comparisons with the Base – No MRB and LLT simulations.

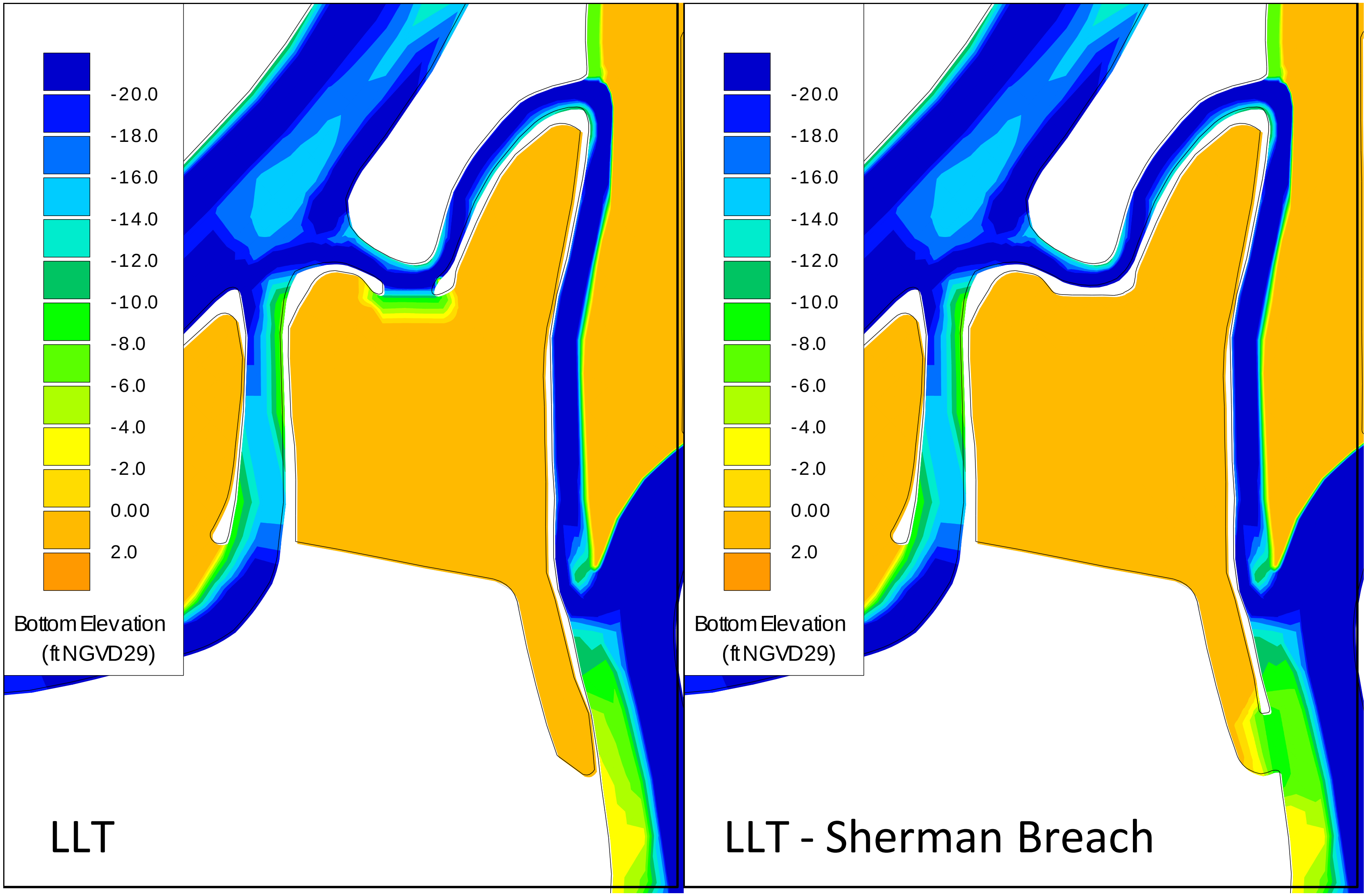


Figure 2-11 Comparison of Sherman Island geometry for the LLT and LLT – Sherman Breach scenarios.

3 Boundary Conditions

The simulation period for the Base Case and the restoration scenarios was from April 2002 through December 2002, a dry period in both the Sacramento and San Joaquin watersheds.
Boundary conditions are specified for all inflow and outflow locations and for flow control structures. The locations of the model boundaries are shown in Figure 2-1.

3.1.1 Tidal boundary

The tidal boundary is set at the Golden Gate, the western boundary of the model, using observed data for the NOAA station at San Francisco. These data were smoothed using a 5 point moving average of the 6-minutes data, and shifted to NGVD + 0.1 m. The 0.1 m shift accounts for density effects between the tidal boundary and Suisun Marsh. The result at Martinez varies with Delta outflow, tidal and atmospheric conditions.

3.1.2 Flows, exports, precipitation, evaporation, DICU

Inflow locations in the model are shown in Figure 2-1. Suisun Marsh inflow locations are shown in Figure 3-1.

Time series of daily average inflow boundary conditions are plotted in Figure 3-2 to Figure 3-5 for the 2002-2003 simulation period (the longer period was used for the previous BDCP simulations). These flows are applied for the Sacramento River, Yolo Bypass, Napa River, San Joaquin River, Cosumnes River, Mokelumne River, and miscellaneous eastside flows which include Calaveras River and other minor flows. The model interpolates between the daily average flows at noon each day. Data from Dayflow (http://www.iep.ca.gov/dayflow/index.html) and the IEP database (http://iep.water.ca.gov/dss/) are used to set these boundary conditions.

Estimated Fairfield Wastewater Treatment Plant (WWTP) flows are plotted in
Figure 3-3 (lower) for the 2002-2003 period. The reported average dry weather flow (ADWF) for the Fairfield WWTP is 13.2 – 14.8 mgd, with a peak wet weather capacity of 34.8 mgd. During dry periods, the WWTP flow in the model was set to 14 mgd. Daily precipitation data from the CIMIS station at Suisun Valley were used to estimate wet weather flows. Total wet weather flows were 14 mgd plus an additional flow of 3.8 mgd for each inch of the previous day's precipitation.

Flow data for Suisun Creek at Putah South Canal and Green Valley Creek at Green Valley Country Club are plotted in Figure 3-4 for the 2002-2003 period. Data were provided by Solano County Water Agency. Gaps in the Suisun Creek data were filled using flows estimated from Napa River flows scaled based on drainage area. This Suisun Creek data set was in turn scaled by drainage area for application to Ledgewood and Laurel Creeks.

Delta exports applied in the model include SWP, CVP, Contra Costa exports at Rock Slough and Old River intakes, and North Bay Aqueduct intake at Barker Slough. Exports are plotted for the 2002-2003 period in Figure 3-5. Dayflow and IEP database data are used to set daily average export flows for the CVP, North Bay Aqueduct and Contra Costa's exports.
Hourly SWP export flows for 2003 are computed using the Clifton Court gate ratings and inside and outside water levels. The flows are adjusted on a monthly basis so the total computed flow

matches the monthly SWP export. For 2002, when water levels inside and outside the gates were not available, SWP exports were defined using DSM2 node 72 flow, modified to remove erroneously large flows. Further details on Clifton Court Forebay gate operations can be found in (RMA, 2000), RMA's Flooded Islands Feasibility Study (RMA, 2005), and in (DWR, 2004a).

DICU flows incorporate channel depletions, infiltration, evaporation, and precipitation, as well as Delta island agricultural use (DWR, 1995). DICU values are applied on a monthly average basis and were derived from monthly DSM2 input values (DWR, 1995). Table 3-1 summarizes the total monthly diversions (incorporates agricultural use, evaporation and precipitation), drains (agricultural returns), seeps (channel depletions) and total flows used for DICU flows. Negative flows indicate net withdrawal from the system. These flows are distributed to multiple elements throughout the Delta using an in-house utility program. For the restoration cases, flooding new regions in the Delta may, in reality, change the net Delta consumptive use, possibly affecting net Delta outflow. However, for the sake of modeling DICU was applied the same for the Base and restoration simulations.

Duck club ponds are filled and drained seasonally to provide appropriate habitat and opportunity to attract migrating ducks. Flows had to be estimated to approximate diversion (filling) and return (draining) flows in the vicinity of the marsh. For modeling purposes, it was assumed that they filled at a constant rate (no tidal variation) from a depth of -1.0 ft to +1.0 ft over a 14 day period beginning October 1. The ponds were subsequently drained at a constant rate between March 1 and June 1. Flow rates were computed as the area to be filled multiplied by the depth of water (2.0 ft) divided by the time to fill or drain. No exchange between the modeled marsh flows and the duck club ponds occurred during the summer, from June 1 through October 1.

Evaporation and precipitation data were used to compute flows required to maintain ponds at a constant level from October 15 (following filling) through February. Flow volumes were based on areas for the following locations: Montezuma Slough (East, Middle and West), Suisun Slough, Nurse Slough, Morrow Island (fill only) and Roaring River. Locations of inflow/withdrawal in the Marsh are shown for the Base case mesh in Figure 3-1 – these locations are the same for the four scenarios, as applicable. For the restoration cases, some of the duck club ponds are restored and thus the duck club exchange flows are removed from the model. Those removed for each case are indicated in Figure 3-1.

Daily Suisun Valley CIMIS station precipitation data was used to compute additional inflows from tidal marsh areas during rainfall events. Areas of tidal marsh were estimated and multiplied by the daily precipitation data. Inflows from tidal marsh were input at Beldon's Landing, Boynton Slough, Cutoff Slough, First Mallard Slough, Hill Slough and Peytonia Slough. Locations are shown in Figure 3-1. As some of these areas were added into the grids for the restoration cases, they become subject to the precipitation and evaporation by element type (see Section 3.1.5) and so the inflows are removed from the model. Those removed for each case are indicated in Figure 3-1.

3.1.3 Electrical Conductivity (EC)

The western EC boundary condition at the Golden Gate is set at 50,000 µmhos cm^{-1}, the EC of seawater.

EC boundary conditions are set at all inflow boundaries. Table 3-2 gives the source of the EC boundary conditions. Figure 3-6 shows the EC time series boundary conditions at the major boundaries.

3.1.4 Gate and barrier operations

Historical Delta Cross Channel and south Delta barrier operations were included in the model for all cases with the exception of the Middle River barrier, which was kept open for the LLT simulation, associated sensitivity analysis simulations and Base – No MRB simulation.

Suisun Marsh salinity control gates (SMSCG) were kept open for all simulations analyzed in this report.

3.1.5 Precipitation and evaporation by element type

The ability to apply daily time series of precipitation and evaporation was added to the model for the Suisun Marsh simulations. In previous versions of the model, the monthly DICU inflows/outflows were the only evaporation and precipitation inputs, and these were applied to individual model elements only in the Delta. In Suisun Marsh, the impacts of evaporation and short time scale variations in precipitation were incorporated in selected areas of the grid by element type ID, and applied on a per-unit-area basis using daily time series of precipitation and evaporation data from the Suisun Valley CIMIS Station.

1	Green Valley Creek
2	Suisun Creek
3	Suisun Sl. duck clubs
4	Morrow Is. duck clubs
5	Montezuma Sl. duck clubs
6	Boynton Sl. tidal marsh
7	Fairfield WWTP
8	Ledgewood Creek
9	Peytonia Sl. tidal marsh**
10	Hill Sl. tidal marsh*
11	Laurel Creek
12	First Mallard Sl. tidal marsh
13	Cutoff Sl. tidal marsh*
14	Beldon's Landing tidal marsh*
15	Montezuma Sl. duck clubs
16	Nurse Sl. duck clubs
17	Montezuma Sl. duck clubs
18	Roaring River duck clubs

*not included in NT, ELT or LLT simulations
** not included in ELT or LLT simulations

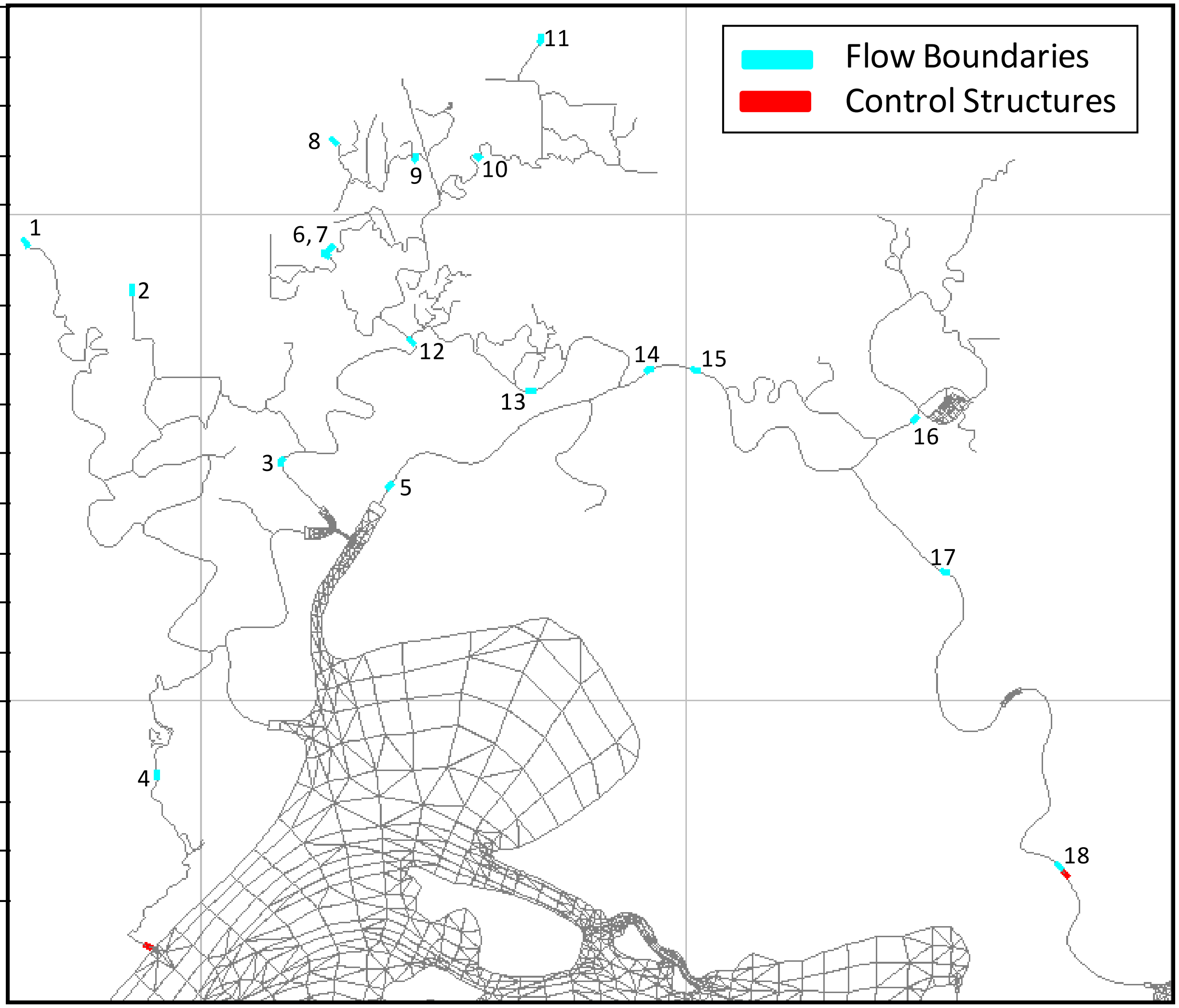


Figure 3-1 Inflow/export locations in Suisun Marsh.

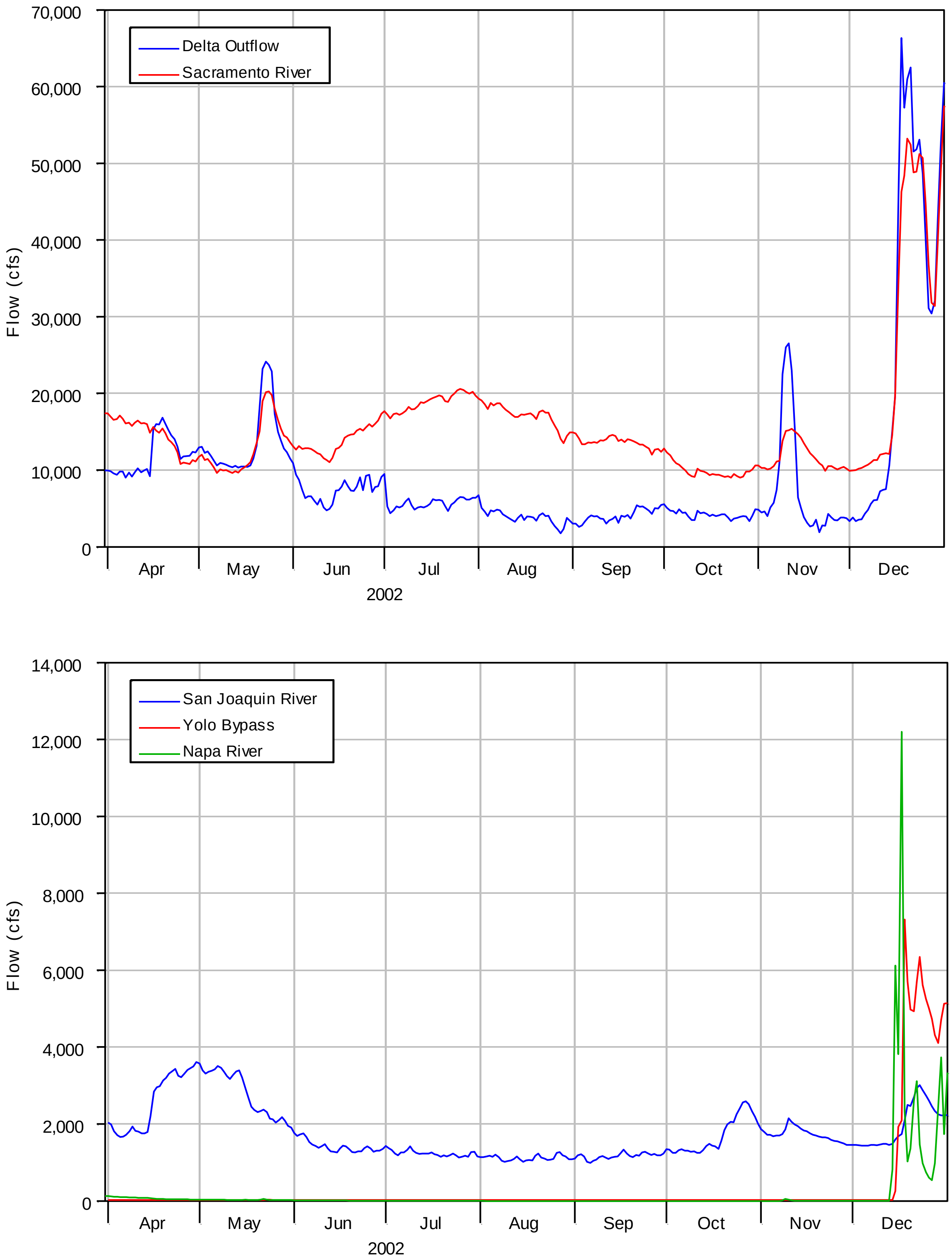


Figure 3-2 Net Delta outflow and major boundary flows for the April – December 2002simulation period.

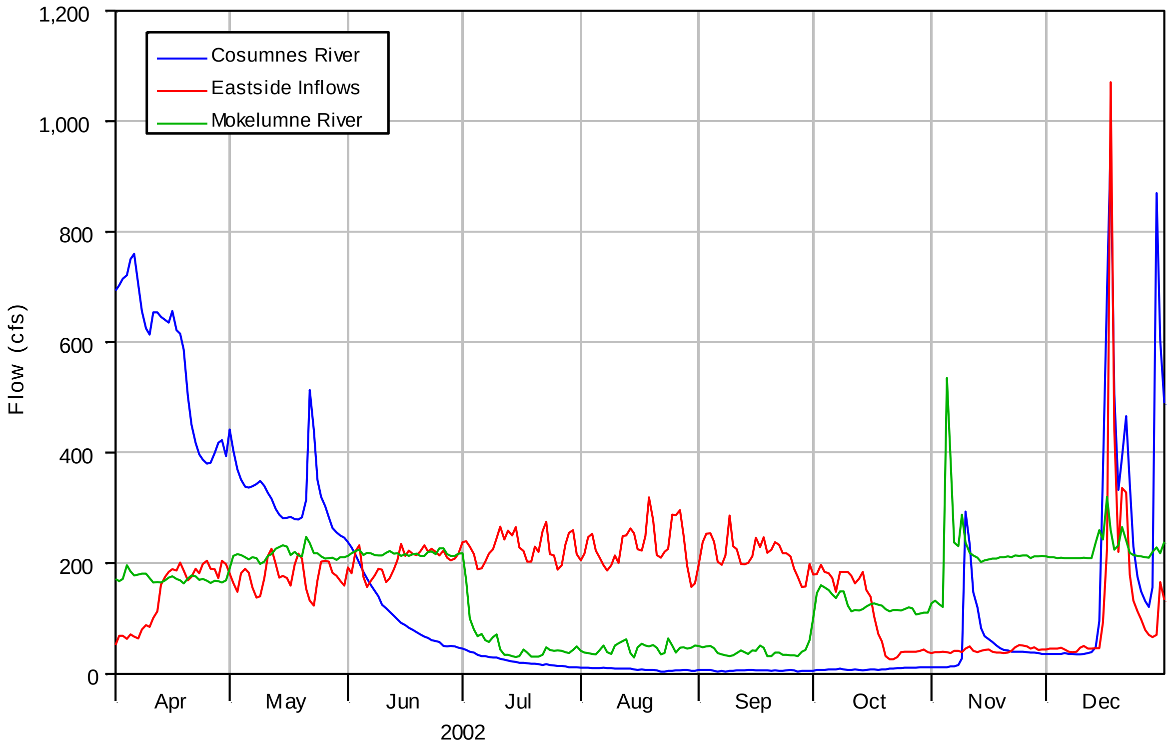


Figure 3-3 Minor boundary flows for the April - December 2002 simulation period.

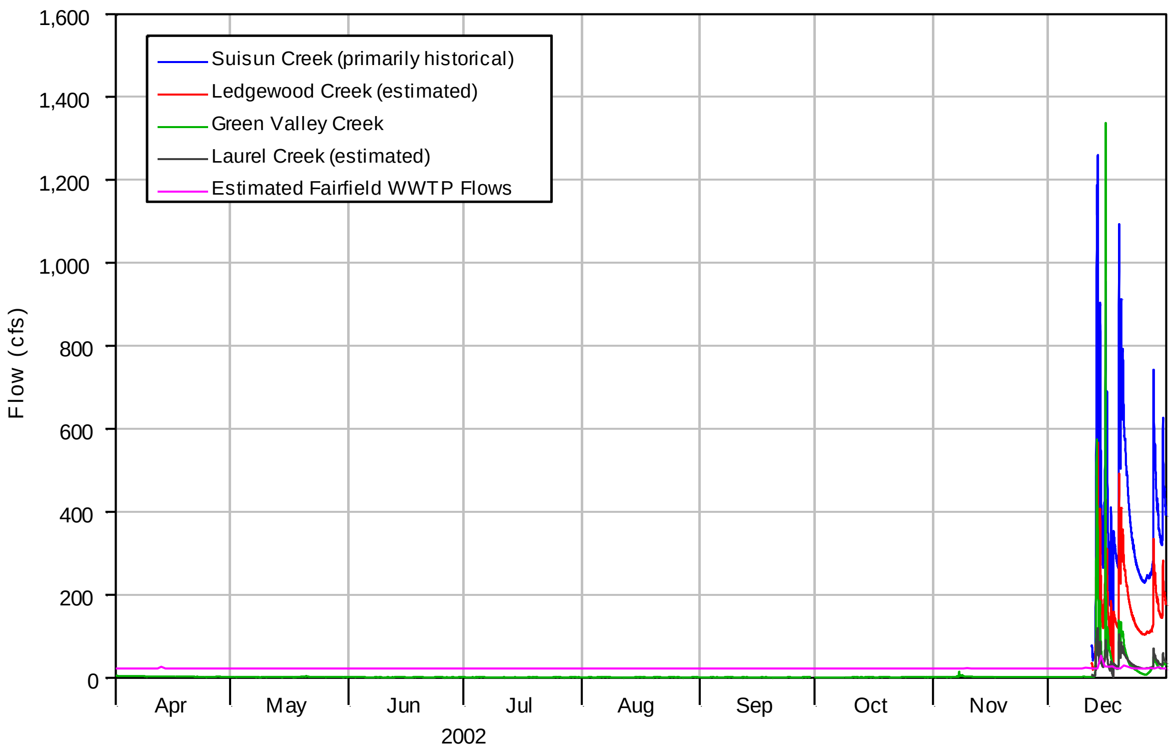
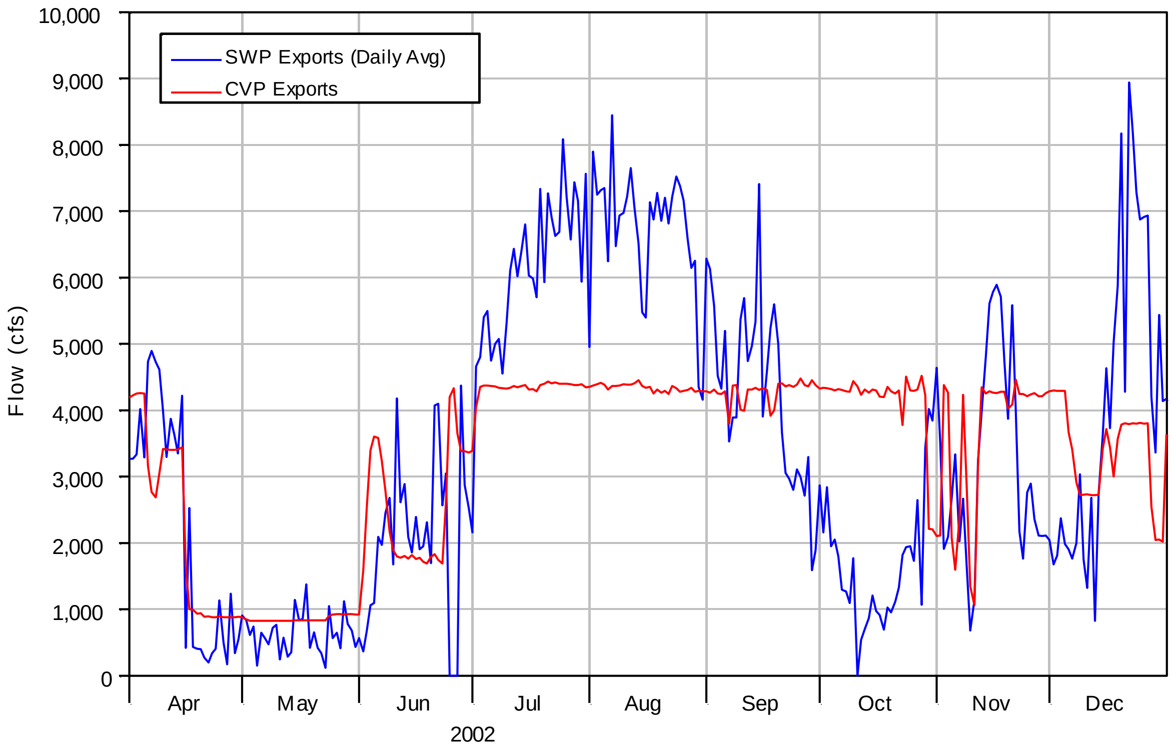


Figure 3-4 Suisun Marsh local creek and WWTP flows for the 2002-2003 simulation period.



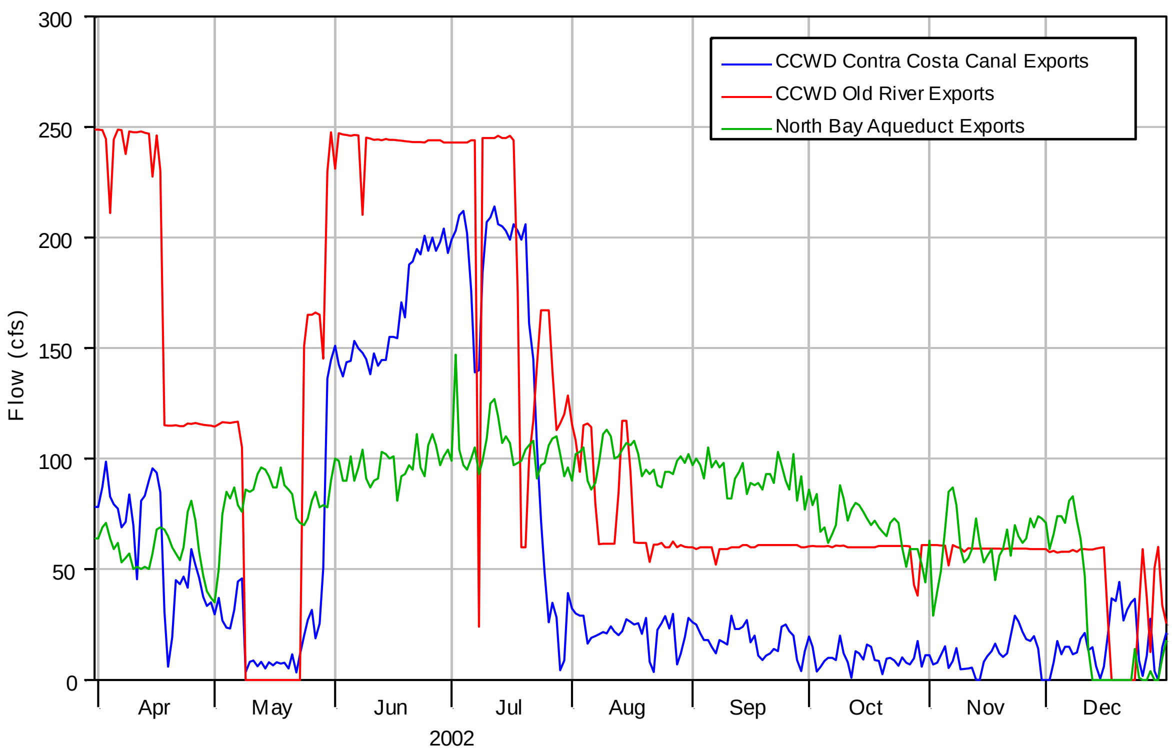


Figure 3-5 Historical exports used in the model for the April – December 2002 simulation period. Note that daily averaged SWP exports are plotted, however the model uses 15-minute inputs.

Table 3-1 Summary of monthly DICU flows ($ft^3 sec^{-1}$) for the simulation period. Negative values indicate Delta withdrawal.

Month	Diversions	Drains	Seeps	Total
April 2002	-2109.9	1121.8	-1006.4	-1994.5
May 2002	-3978.0	1710.4	-973.4	-3241.0
June 2002	-4850.2	1995.6	-1006.4	-3860.9
July 2002	-4943.0	2011.0	-973.4	-3905.4
August 2002	-2659.8	1265.9	-973.4	-2367.3
September 2002	-1231.2	848.4	-1006.2	-1389.1
October 2002	-875.2	681.1	-973.2	-1167.4
November 2002	-268.9	576.2	-1018.0	-710.8
December 2002	-429.2	2318.5	-633.9	1255.4

Table 3-2 EC boundary conditions.

Boundary Location	Value (μmhos cm^{-1})	Data Source
Golden Gate	50,000	Seawater EC
Sacramento River	Time Series	DWR DSM2
Yolo Bypass	Sac. River Time Series	DWR DSM2
San Joaquin River	Time Series	DWR DSM2
DICU	Monthly Time Series	DWR's DICU model
Cosumnes River	150	Estimated
Mokelumne River	150	Estimated
Misc. Eastside Rivers	750	Estimated
Fairfield WWTP	120	Estimated
Napa River, Green Valley Creek, Suisun Creek, Ledgewood Creek, Laurel Creek	120	Estimated; Napa R. based on measured data
Duck Club Drains: Nurse Slough drain Suisun Slough drain Roaring River drain Montezuma Slough West Montezuma Slough Middle Montezuma Slough East	Estimated Using Source Time Series Data:	 Beldon's Landing Observed EC Boynton Sl. Observed EC, shifted in time Roaring River Observed EC Hunter Cut Observed EC Beldon's Landing Observed EC National Steel Observed EC
Tidal Marsh – Boynton Slough Peytonia Slough Hill Slough First Mallard Slough Cutoff Slough Beldon's Landing	Estimated Using Source Time Series Data:	 Boynton Sl. Observed EC, shifted in time Hill Slough Observed EC Hill Slough Observed EC Beldon's Landing Observed EC Beldon's Landing Observed EC Beldon's Landing Observed EC

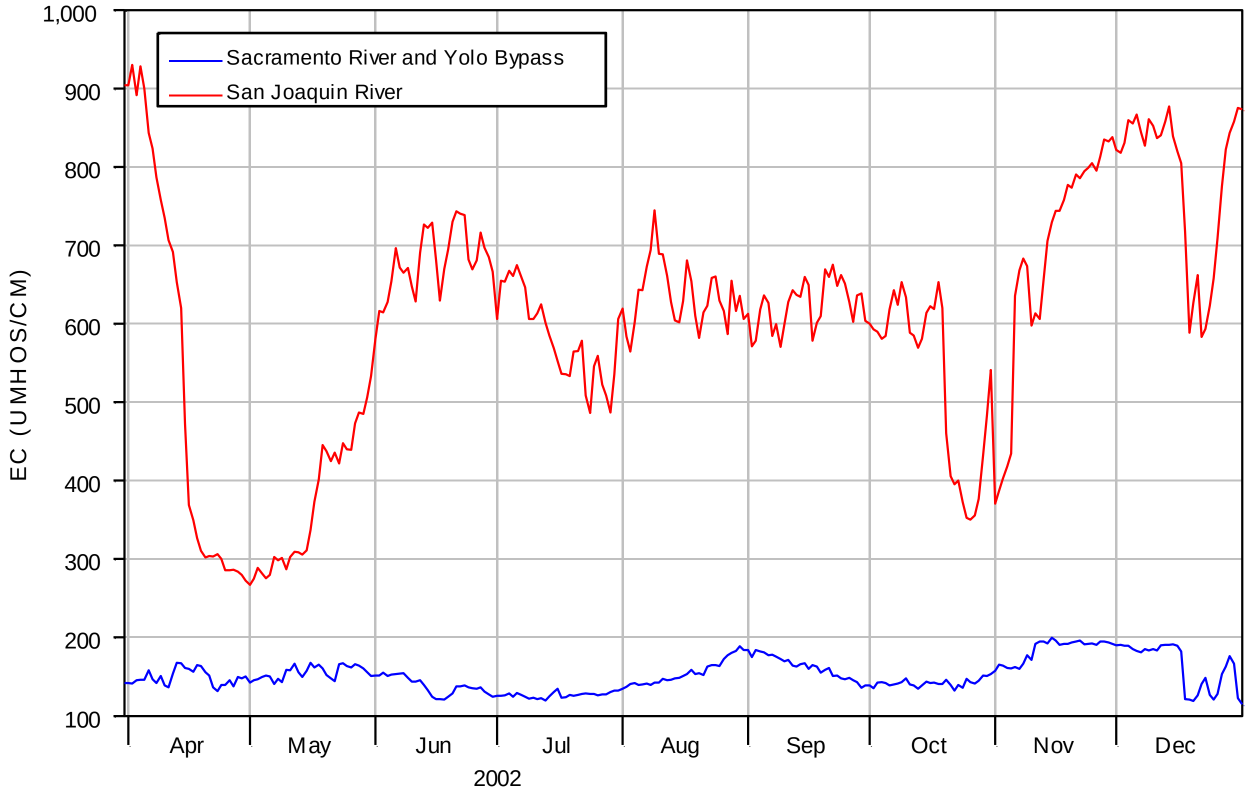


Figure 3-6 Daily EC time series used as boundary conditions for the Sacramento River and Yolo Bypass and for the San Joaquin River for the April – December 2002 simulation period.

4 Hydrodynamic Impacts

4.1 Description of Analysis Types

4.1.1 Net Flows

Net flows have been computed at several locations for each of the scenarios. Net flows were computed as the overall average of flows for the 3-month period of July 1 through September 20, 2002. Values are presented as bar charts plotted spatially. These plots illustrate how the flow distribution changes with the sensitivity scenarios.

The difference in average Delta water surface elevation between the beginning and end of the 3-month average period can slightly affect the net flow computation.

A map of flow locations is shown in Figure 4-1. Directions of ebb (positive) flow for each location are listed in Table 4-1.

Table 4-1 Direction of ebb (positive) flow for analysis locations.

Location	Ebb (Positive) Direction
Cache Sl at Ryer	southeast
DCC	east
False River	west
Martinez	west
Miner Slough	west
Mokelumne nr SJR	southeast
Montezuma Sl at Head	west
Montezuma Sl at Mouth	south
RMID015	north
RMID027	west
ROLD024	north
ROLD034	north
RSAC075 Chipps Island	west
RSAC092 Emmaton	southwest
RSAC101 Rio Vista	southwest
RSAC123	west
RSAC128	southeast
RSAN018 Jersey Pt	southwest
RSAN032 San Andreas	west
RSAN058	northwest
SLDUT007	west
SLGEO019 Georgiana Sl	southwest
SLTRM004 Threemile Sl	north
Steamboat Sl	south
Sutter Slough	south
Victoria Canal	northeast

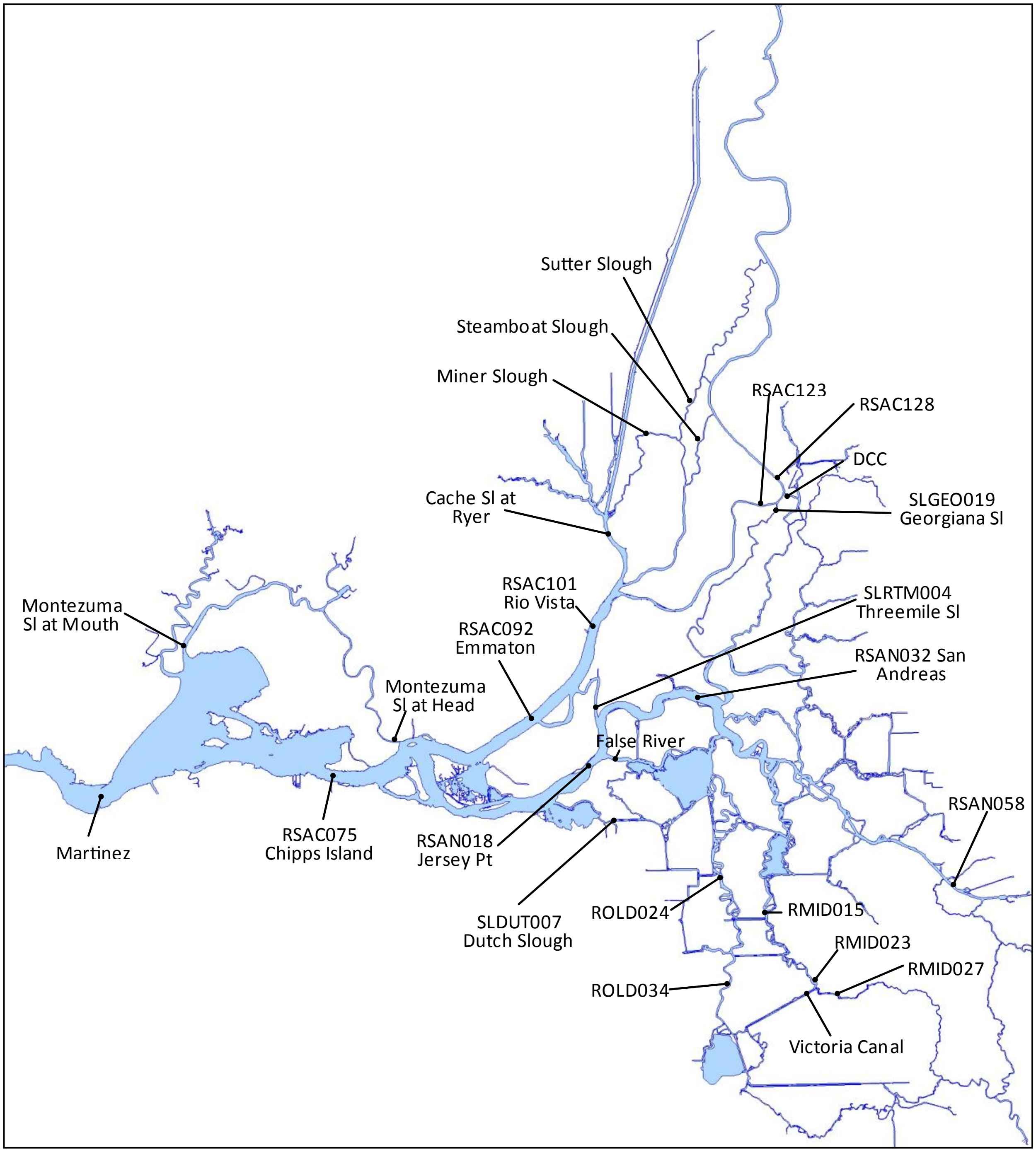


Figure 4-1 Flow, tidal prism and tidal range analysis locations.

4.1.2 Tidal Prism

Tidal prism has been computed at several locations for each of the sensitivity scenarios for the entire April – December 2002 simulation period, and compared with base case and ELT/LLT results. Percent change from base case tidal prism was also calculated. All values are presented as bar charts plotted spatially. These plots illustrate how the tidal flow distribution changes with the sensitivity scenarios. Values are also tabulated with additional locations included.

Tidal flow is computed by subtracting the mean flow <Q> from the instantaneous flow Q, giving Q′

$$Q' = Q - \langle Q \rangle$$

The tidal prism is then computed as the volume of tidal flow that passes a cross-section on a flood tide and the individual tidal prism values are averaged to calculate the average predicted tidal prism during the simulation period.

4.1.3 Stage and Tidal Range

"Tidal range" analysis in this report addresses, more specifically, mean diurnal tidal range, or the difference between average MHHW and MLLW. For simplicity, the term "tidal range" is used. Spatially referenced bar charts of tidal range are provided for comparison of relative changes between the base and sensitivity cases. These values are also tabulated, along with additional locations.

Profiles of July 2002 tidal datums (MHHW, MSL and MLLW) comparing the base and sensitivity scenarios are provided for the following.

- Martinez to the upstream Sacramento River boundary.
- Martinez to the upstream San Joaquin River boundary.
- Martinez to the upstream San Joaquin River boundary via Middle River.
- Montezuma Slough from mouth to head.

Inset maps for each plot show the profile locations.

RMA model tidal datum results shown in the profile plots were processed with the "RMA Tools" tidal analysis module developed by DWR (2004b). Mean Lower Low Water (MLLW), Mean Sea Level (MSL), Mean Higher High Water (MHHW) were computed for July 2002. The MLLW analysis provides a measure of changes in the Lower Low minimums averaged over the month. The MHHW analysis quantifies the changes in peak Higher High stage, averaged for the month.

Time series of 15-minute stage results are plotted at various locations for a three-day period in July 2002. A location map is provided in Figure 4-2. Each plot compares a sensitivity case with a base result and the relevant ELT or LLT result.

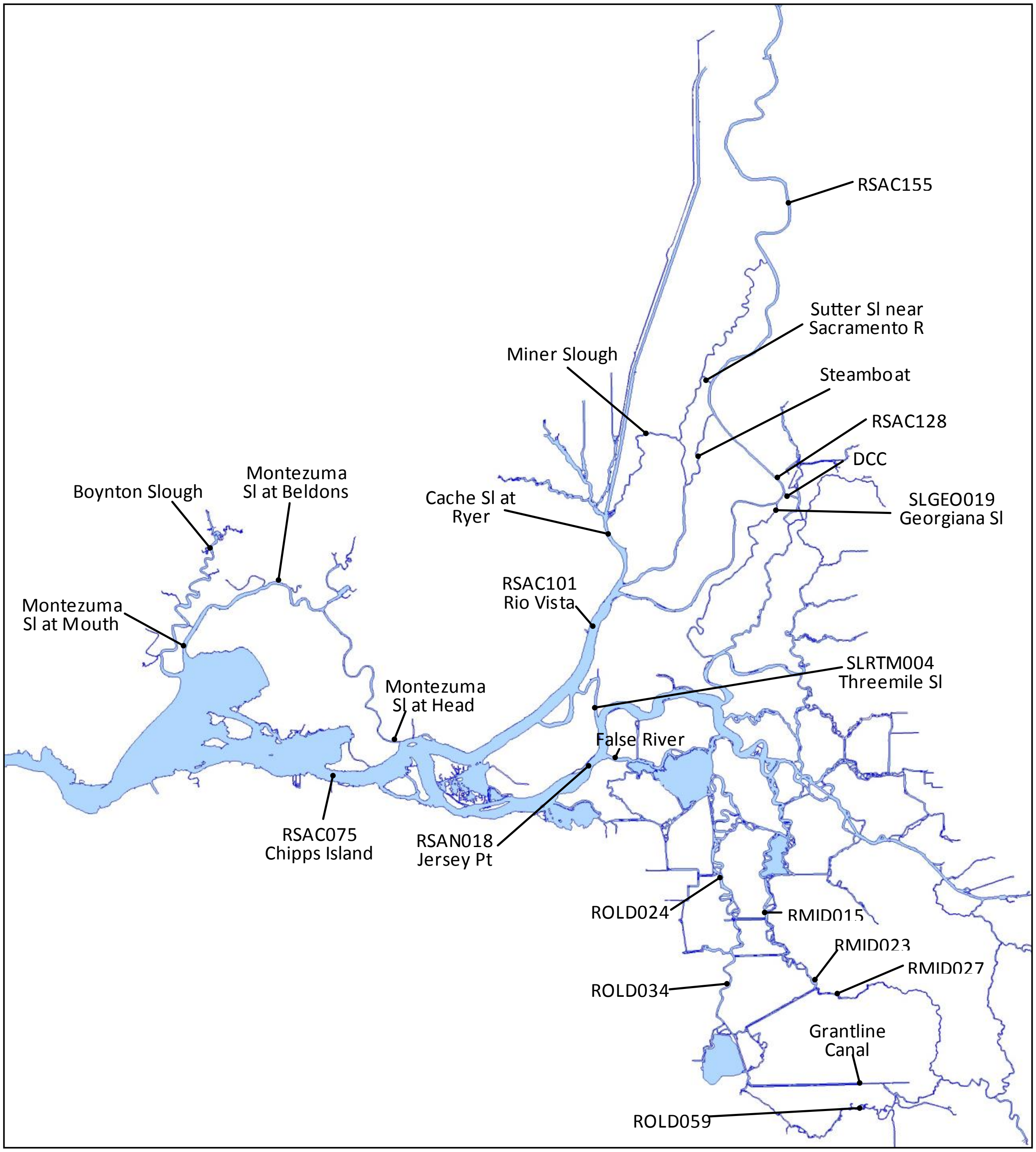


Figure 4-2 Stage time series plot locations.

4.1.4 Bed Shear

For each scenario, bed shear was calculated for the low flow month of July 2002 to help identify areas of scour potential. Spatial contour plots of bed shear for July 2002 are provided at times of peak bed shear for scenarios and locations where bed shear is high and/or it has changed significantly as a result of grid modifications for the sensitivity analyses.

Bed shear is computed using fluid shear velocity for a smooth bed.

4.2 Sensitivity Cases

4.2.1 ELT - Maximize Suisun ROA

The ELT – Max Suisun case is compared with both the ELT and LLT scenarios. The overall restoration acreage is the same as the ELT acreage, however the Suisun Marsh ROA acreage is the same as the LLT acreage.

Three-month average flows for the ELT-Max Suisun simulation are compared with base case, ELT and LLT flows in Table 4-2 and Figure 4-3. Shifting restoration area from the Cache Slough ROA to the Suisun Marsh ROA strongly affects 3-month average flows in Montezuma Slough. At Montezuma Slough at Mouth the flow changes from outflow (towards Suisun Bay) for ELT to inflow (into Montezuma Slough) for ELT – Max Suisun. This is partly caused by additional evaporation in the increased area of ROAs and by differences in spring-neap filling and draining between the scenarios. The 3-month average flow at this location is similar to the LLT, in which restoration acreage in the Suisun ROA is the same.

Flows elsewhere in the Bay-Delta generally change by 2% or less relative to ELT. ELT – Max Suisun outflow at Martinez falls between the ELT and LLT results. Evaporation in Suisun Marsh and spring-neap filling and draining throughout the Delta are, again, likely impacting the results. The overall evaporation is increased because evaporation terms were included in Suisun Marsh ROAs but not Cache Slough ROAs in the RMA Bay Delta model simulations. Additional changes relative to ELT included decreased flow through Miner and Sutter Sloughs, decreased flows in Cache Slough at Ryer, and decreased outflow from the Sacramento River at Emmaton. These changes are all 2% or less, and are reporting with the previous finding that averaged flows in the Sacramento River at Emmaton and Rio Vista increase with increased restoration area. These decreased outflows in the north Delta are roughly balanced by increased flow at RSAC128 and through the Delta Cross Channel. ELT – Max Suisun also has decreased inflow to the San Joaquin River at Jersey Point and decreased inflow to False River. The changes to flows in the south Delta and east Delta were typically small.

Tidal prism results are provided in Table 4-3, Figure 4-4 and Figure 4-5 as volume and percent change from the base case. Shifting restoration area from the Cache Slough ROA to the Suisun Marsh ROA increases tidal prism at Montezuma Slough at Mouth by 5%, relative to ELT. Relative to the LLT case, ELT – Max Suisun tidal prism in Montezuma Slough at mouth is only 1% lower. At the head of Montezuma Slough, ELT – Max Suisun tidal prism is reduced by 2% relative to ELT and by 4% relative to LLT. Thus tidal prism at the mouth seems more impacted by restoration area within Suisun Marsh, whereas tidal prism at the head of the slough is more impacted by upstream restoration area. Tidal prism at Martinez increased by 2%, relative to ELT. Tidal prism changes in the south Delta and east Delta were small. Tidal prism decreased in most of the Delta in ELT – Max Suisun relative to ELT. This was expected due to the increase in tidal prism and energy dissipation in Suisun Marsh. Tidal prism decreased by 3% in Cache Slough at Ryer, partially due to the decreased acreage of ROAs in the Cache Slough Complex for the ELT – Max Suisun case. Tidal prism increased in Miner Slough by 6% and in Sutter slough by 3%. Particularly significant tidal prism changes in Georgiana Slough were caused by changes in tidal phase for the ELT – Max Suisun case. Tidal prism decreased by 8% in

Georgiana Slough but decreased only 1% in the Delta Cross Channel and 2% at RSAC128. Tidal prism changes in the south Delta and east Delta were typically small.

Tidal range results are provided in Table 4-7 and Figure 4-6. Tidal range decreased by 4% at Montezuma Slough at Head and by 6% at Montezuma Slough at Mouth for ELT – Max Suisun relative to ELT. Tidal range increased by 0.5-1% at Cache Slough at Ryer and in Miner and Sutter Sloughs due to the reduced ROA acreage in the Cache Slough ROA. Throughout Suisun Bay and the west Delta, tidal range decreased by 2% to 4% for ELT – Max Suisun relative to ELT. In the south Delta and east Delta smaller decreases in tidal range were predicted to result from shifting restoration area from the Cache Slough ROA to the Suisun Marsh ROA. These results indicate, as noted in previous BDCP work, that increased restoration leads to decreased tidal range both locally and landward of the ROAs.

Profile plots of July 2002 MHHW, MSL and MLLW, in Figure 4-7 through Figure 4-10, show that the ELT – Max Suisun tidal range is similar to the LLT tidal range downstream of Chipps Island and in Montezuma Slough. The Suisun Marsh ROA acreage has the most important impact in this area. In the Sacramento River upstream of Rio Vista and in the upstream portion of San Joaquin River, the ELT – Max Suisun tidal range is similar to the ELT case. The overall restoration acreage has the most important impact in these areas.

For reference, time series plots of stage are provided for various locations in Figure 4-11 through Figure 4-25. A map of locations plotted is shown in Figure 4-2.

There are no new or resolved bed shear issues for this sensitivity case.

4.2.1.1 Net Flows

Table 4-2 Summary of 3-month Average flow (Jul – Sep 2002) for Base – No SMSCG, ELT, ELT - Max Suisun and LLT simulations.

Location	3-month Average Flow, Jul – Sep 2002 (cfs)			
	Base – No SMSCG	ELT	ELT – Max Suisun	LLT
Cache Sl at Ryer	1535	2167	2132	2565
DCC	4609	3661	3686	3449
False River	-1696	-1837	-1797	-1806
Martinez	4423	4241	4148	4080
Miner Slough	2018	2681	2637	2667
Mokelumne nr SJR	4721	4157	4175	3781
Montezuma Sl at Head	12	-10	38	13
Montezuma Sl at Mouth	-71	85	-172	-191
RMID015	-5406	-5384	-5380	-5265
RMID027	-58	-58	-59	-45
ROLD024	-4402	-4421	-4430	-4541
ROLD034	-6452	-6443	-6445	-6603
RSAC075 Chipps Island	4504	4474	4422	4395
RSAC092 Emmaton	5873	6321	6296	6484
RSAC101 Rio Vista	8255	9273	9255	9712
RSAC123	3607	3991	3992	4258
RSAC128	10999	10338	10365	10137
RSAN018 Jersey Pt	-1002	-1695	-1668	-1914
RSAN032 San Andreas	-1720	-2750	-2755	-3216
RSAN058	389	383	388	391
SLDUT007	-112	84	87	68
SLGEO019 Georgiana Sl	2762	2665	2666	2408
SLTRM004 Threemile Sl	-2310	-2732	-2741	-3012
Steamboat Sl	2280	2471	2471	2629
Sutter Sl	2965	3436	3408	3480

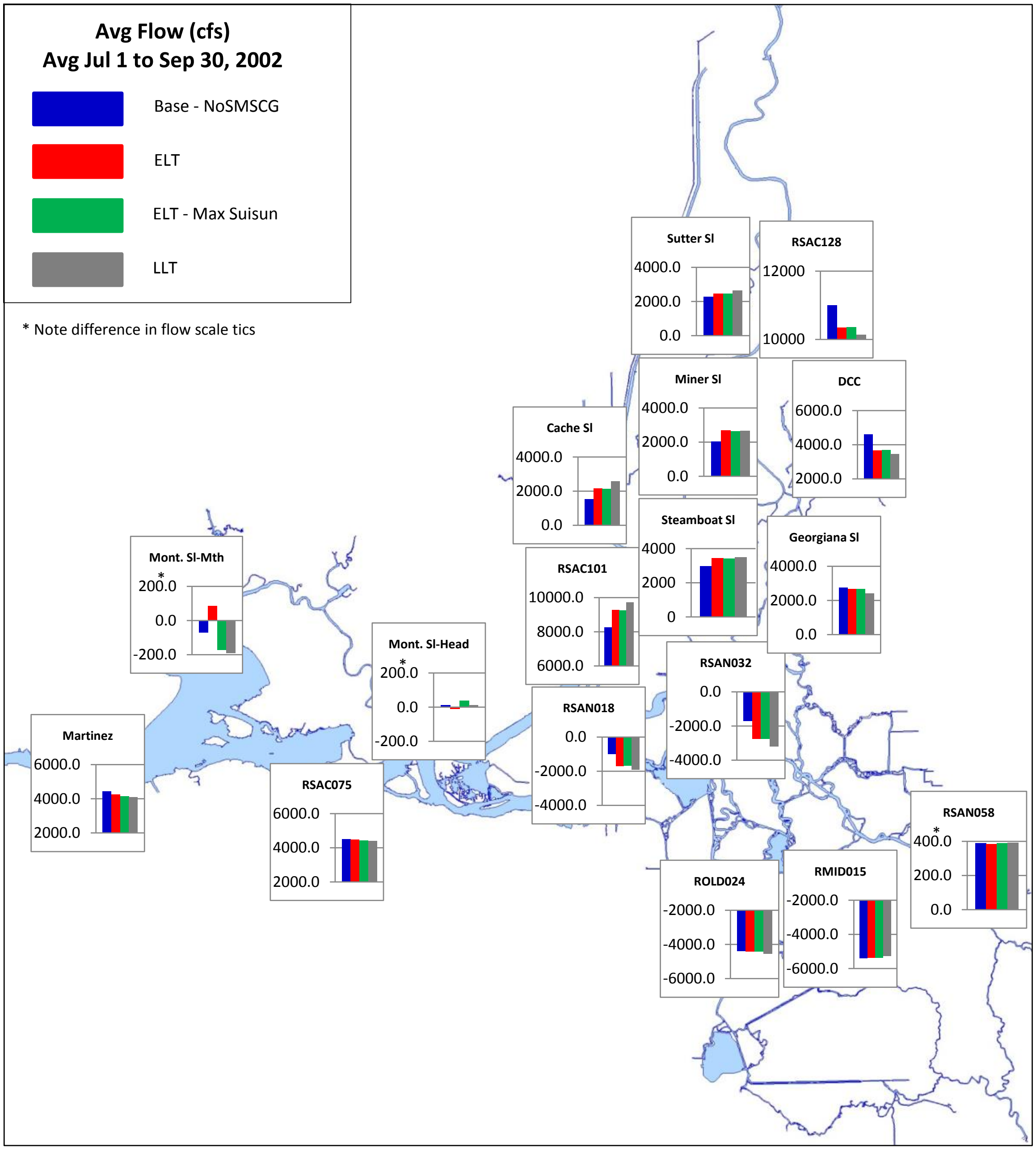


Figure 4-3 Average flows (Jul - Sep 2002) for Base – No SMSCG, ELT, ELT - Max Suisun and LLT simulations.

4.2.1.2 Tidal Prism

Table 4-3 Summary of Apr – Dec 2002 Average Tidal Prism for Base – No SMSCG, ELT, ELT - Max Suisun and LLT simulations, and percent change from Base – No SMSCG.

Location	Base – No SMSCG	ELT		ELT – Max Suisun		LLT	
	Tidal Prism (ac-ft)	Tidal Prism (ac-ft)	% Change from Base	Tidal Prism (ac-ft)	% Change from Base	Tidal Prism (ac-ft)	% Change from Base
Cache Sl at Ryer	28,681	30,744	7%	29,685	4%	26,884	-6%
DCC	783	1,225	57%	1,210	55%	949	21%
False River	18,890	17,565	-7%	17,137	-9%	16,508	-13%
Martinez	167,685	169,171	1%	173,144	3%	170,966	2%
Miner Slough	618	578	-6%	611	-1%	455	-26%
Mokelumne nr SJR	4,613	4,509	-2%	4,410	-4%	4,490	-3%
Montezuma Sl at Head	2,054	3,221	87%	3,148	82%	3,283	90%
Montezuma Sl at Mouth	10,987	21,983	95%	22,981	104%	23,108	105%
RMID015	4,021	3,704	-8%	3,623	-10%	3,333	-17%
RMID027	243	231	-5%	228	-6%	1,784	634%
ROLD024	4,412	4,090	-7%	3,993	-9%	3,655	-17%
ROLD034	2,289	2,107	-8%	2,074	-9%	1,960	-14%
RSAC075 Chipps Island	115,295	110,508	-4%	109,192	-5%	108,506	-6%
RSAC092 Emmaton	49,254	49,180	0%	48,011	-2%	50,591	3%
RSAC101 Rio Vista	36,156	36,783	2%	35,715	-1%	40,582	12%
RSAC123	2,501	2,252	-10%	2,220	-11%	1,811	-28%
RSAC128	1,605	1,130	-30%	1,103	-31%	1,175	-27%
RSAN018 Jersey Pt	50,165	46,935	-6%	45,670	-9%	44,549	-11%
RSAN032 San Andreas	37,894	35,019	-7%	34,045	-10%	32,450	-14%
RSAN058	2,386	2,173	-9%	2,121	-11%	2,603	9%
SLDUT007	3,076	2,368	-23%	2,319	-25%	2,226	-28%
SLGEO019 Georgiana Sl	224	301	35%	278	24%	415	86%
SLTRM004 Threemile Sl	9,431	7,921	-16%	7,714	-18%	6,526	-31%
Steamboat Sl	914	784	-14%	777	-15%	598	-35%
Sutter Sl	823	726	-12%	744	-10%	574	-30%

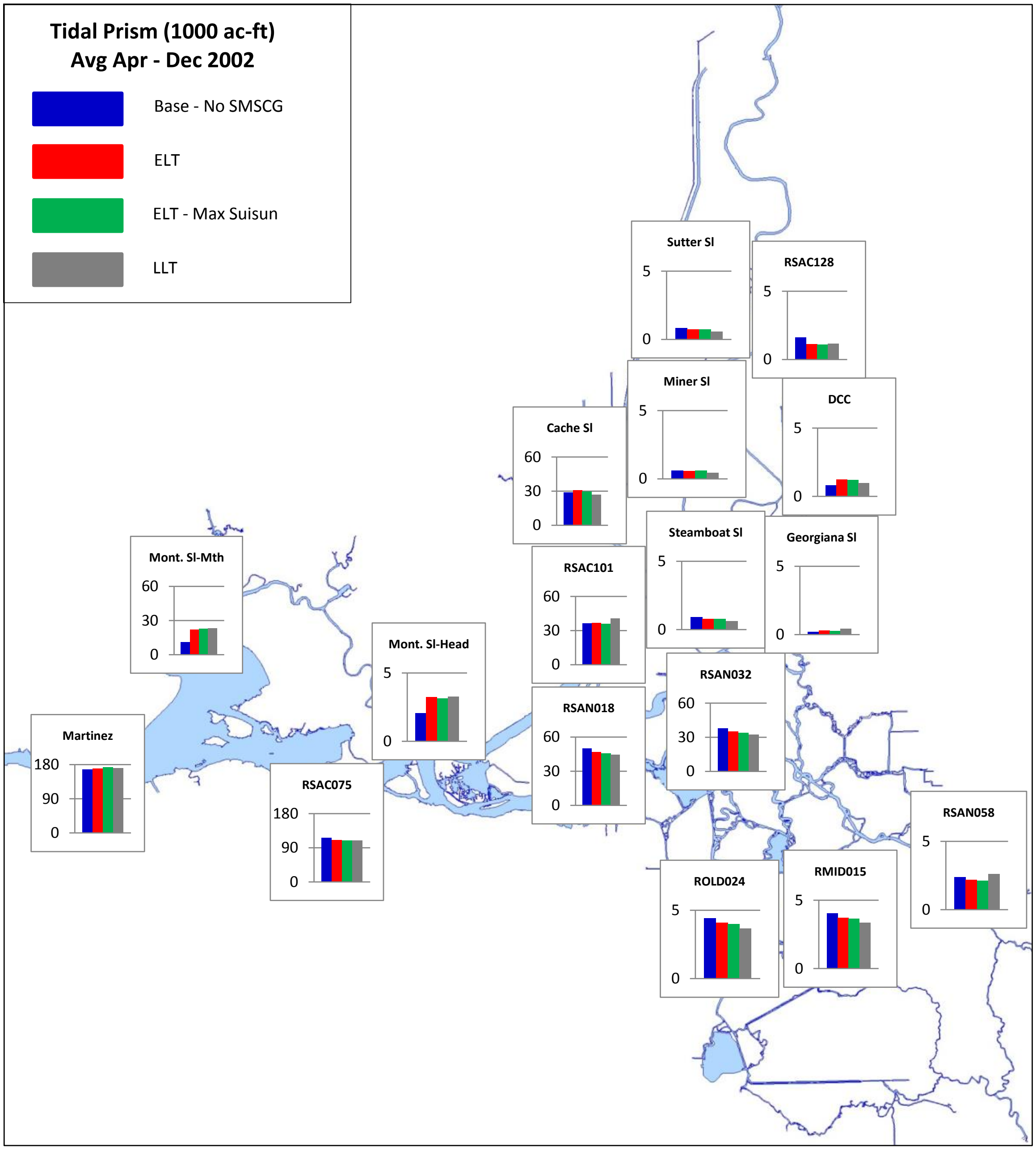


Figure 4-4 Average tidal prism (Apr - Dec 2002) for Base – No SMSCG, ELT, ELT - Max Suisun and LLT simulations.

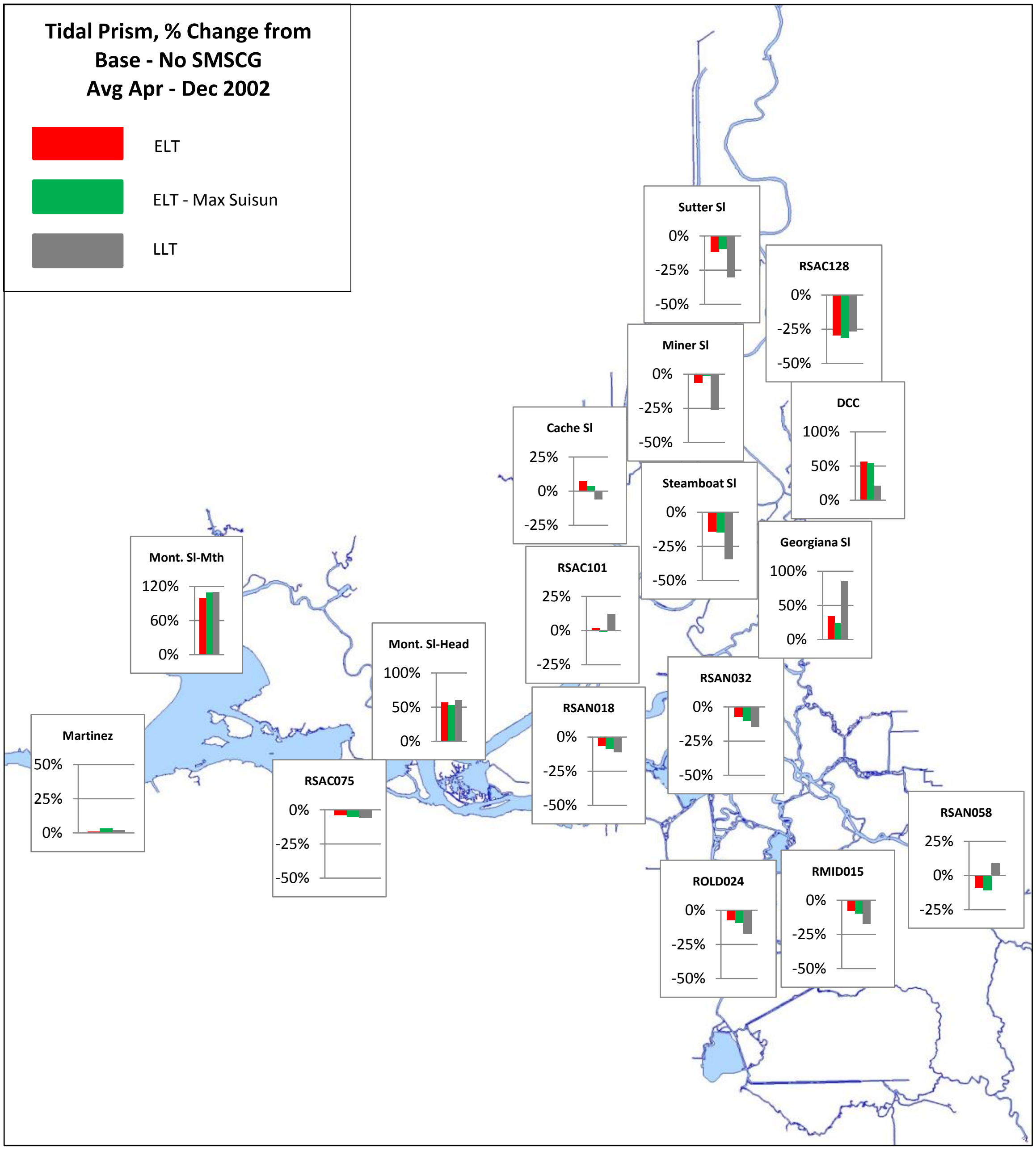


Figure 4-5 Average percent change from Base – No SMSCG tidal prism (Apr - Dec 2002) for ELT, ELT - Max Suisun and LLT simulations.

4.2.1.3 Tidal Range

Table 4-4 Summary of Apr – Dec 2002 Average Tidal Range for Base – No SMSCG, ELT, ELT - Max Suisun and LLT simulations.

	Apr – Dec 2002 Average Tidal Range (ft)			
Location	Base – No SMSCG	ELT	ELT – Max Suisun	LLT
Cache Sl at Ryer	3.95	3.21	3.24	2.75
DCC	2.92	2.31	2.3	2.11
False River	3.4	3.08	3.0	2.93
Martinez	5.47	5.24	5.1	5.14
Miner Slough	3.11	3.01	3.04	2.62
Montezuma Sl at Head	4.25	3.85	3.69	3.64
Montezuma Sl at Mouth	5.0	4.32	4.04	4.05
RMID015	3.77	3.45	3.38	3.14
RMID023	3.54	3.27	3.2	2.48
ROLD024	3.56	3.27	3.2	3.02
ROLD034	3.41	3.15	3.09	2.73
RSAC075 Chipps Island	4.42	4.04	3.87	3.85
RSAC092 Emmaton	3.93	3.52	3.42	3.23
RSAC101 Rio Vista	3.87	3.23	3.2	2.79
RSAC123	2.95	2.34	2.33	2.14
RSAC128	2.91	2.33	2.32	2.12
RSAN018 Jersey Pt	3.47	3.13	3.05	2.98
RSAN032 San Andreas	3.37	3.07	3.00	2.89
RSAN058	4.06	3.69	3.61	3.25
SLDUT007 Dutch Slough	3.59	3.19	3.1	3.04
SLGEO019 Georgiana Sl	2.95	2.36	2.35	2.16
SLTRM004 Threemile Sl	3.45	3.09	3.02	2.9
Steamboat Sl	2.69	2.22	2.22	1.99
Sutter Sl	2.57	2.17	2.18	1.94
Victoria Canal	3.54	3.28	3.21	2.48

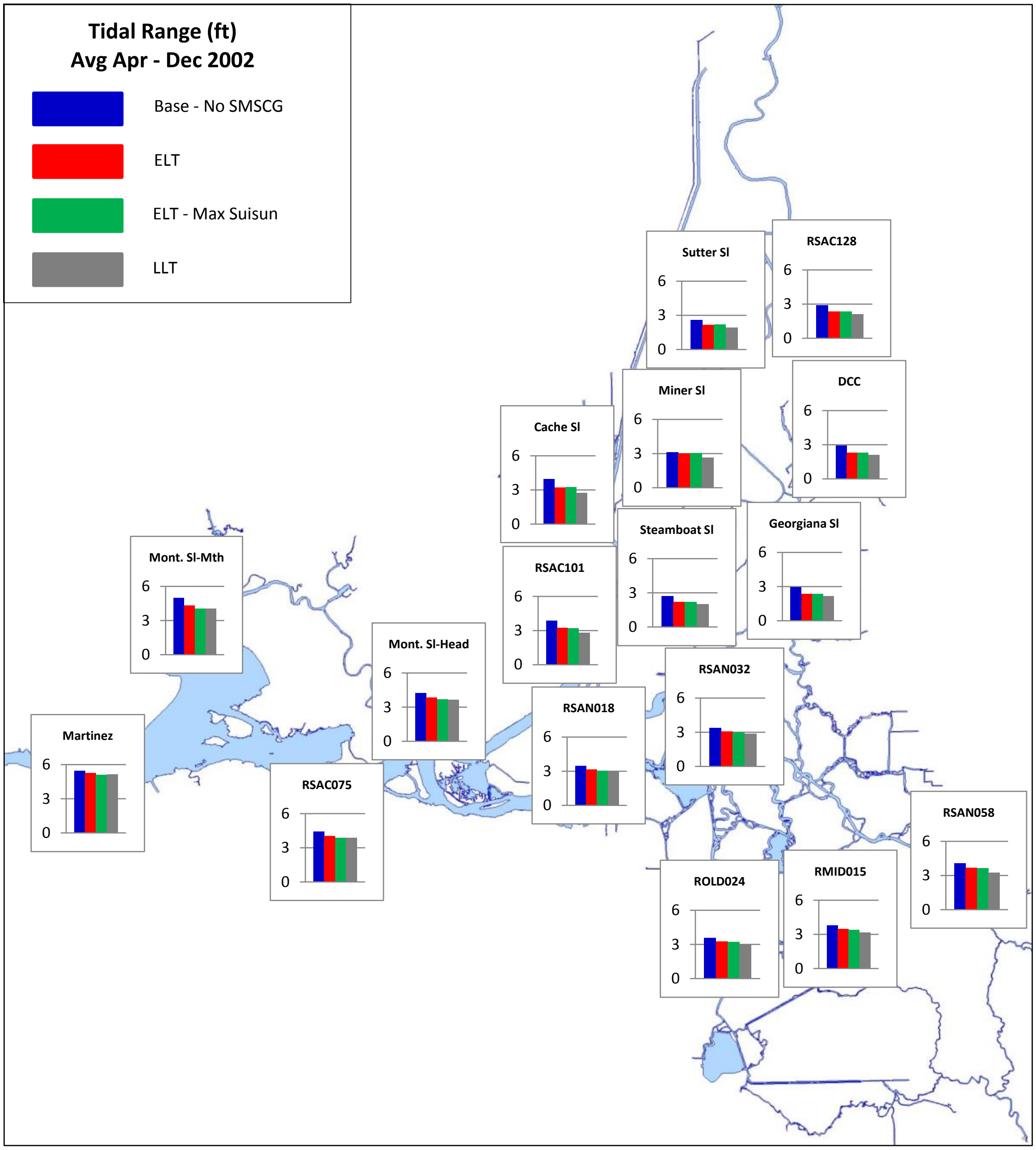


Figure 4-6 Average tidal range (Apr - Dec 2002) for Base – No SMSCG, ELT, ELT - Max Suisun and LLT simulations.

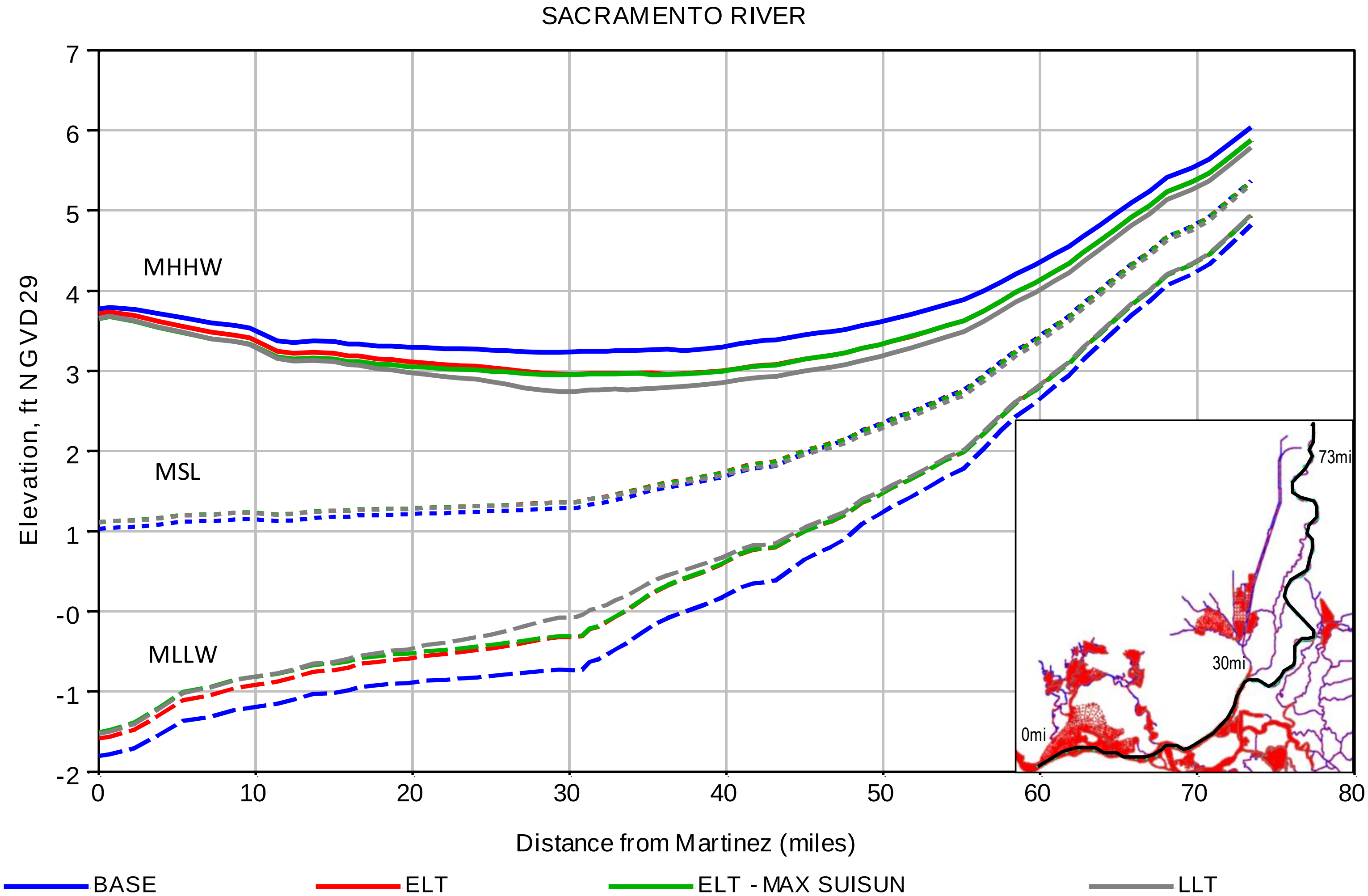


Figure 4-7 Profiles of July 2002 MHHW, MSL and MLLW along the Sacramento River for the Base – No SMSCG (Base), ELT and ELT - Max Suisun simulations.

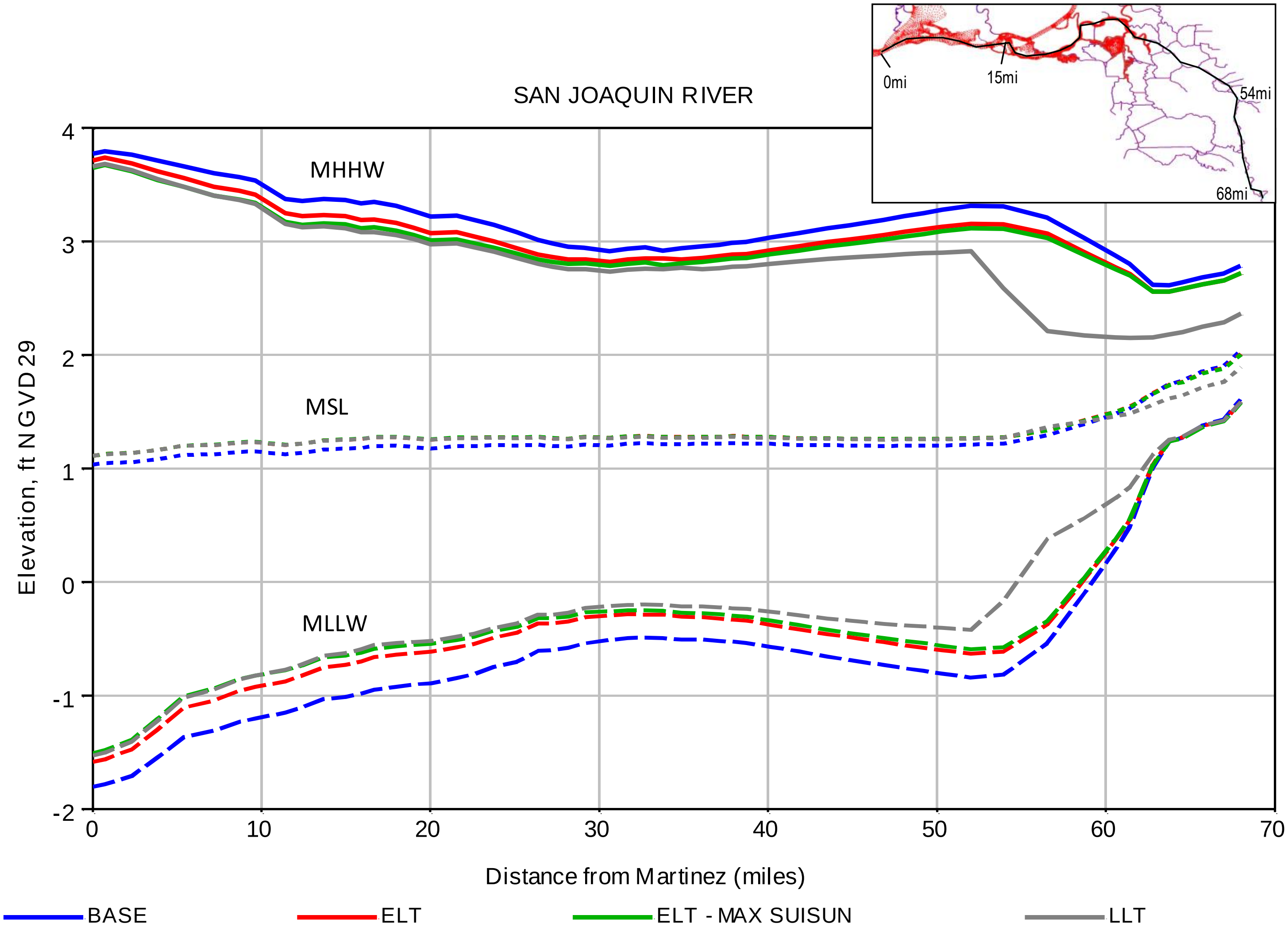


Figure 4-8 Profiles of July 2002 MHHW, MSL and MLLW along the San Joaquin River for the Base – No SMSCG (Base), ELT and ELT - Max Suisun simulations.

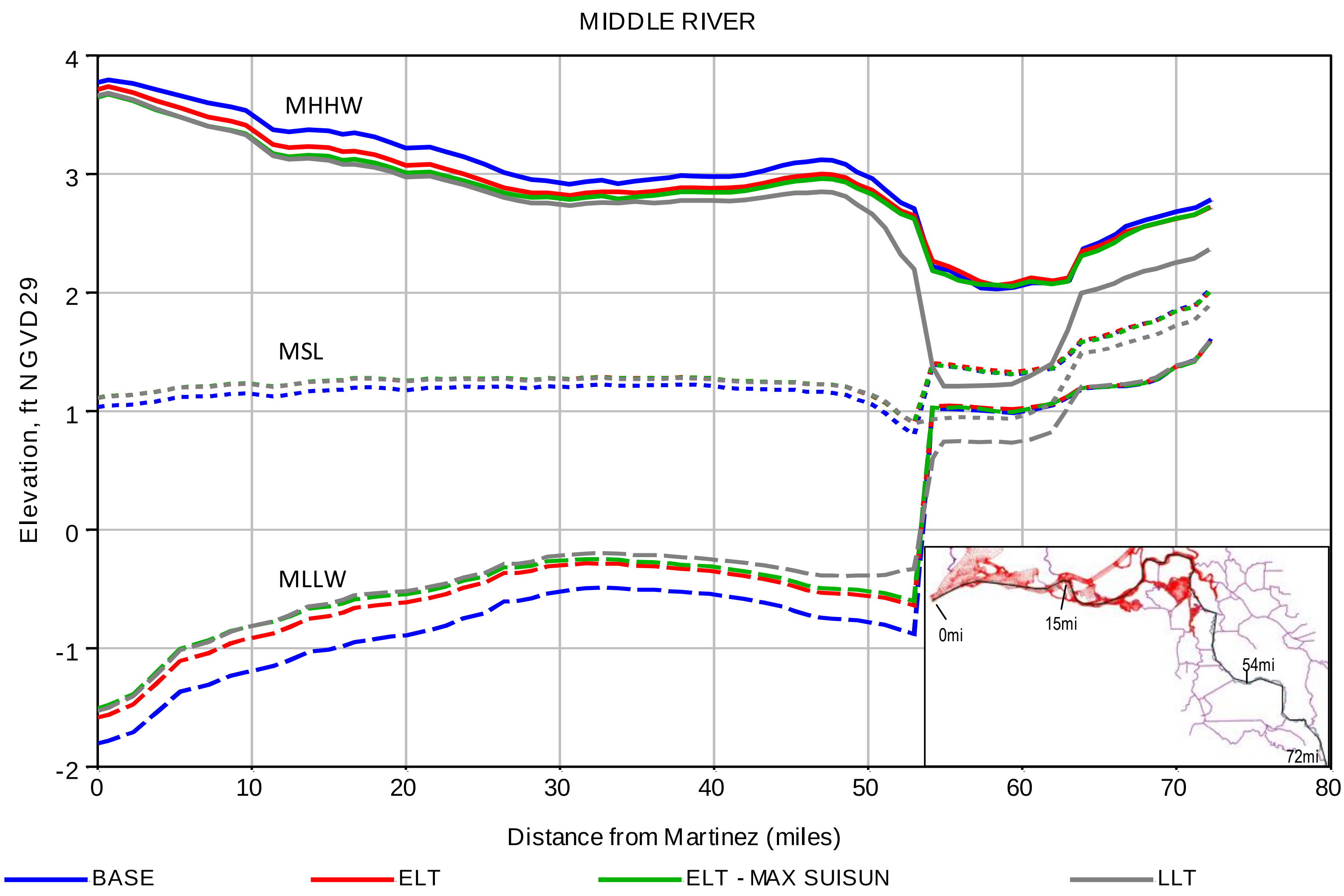


Figure 4-9 Profiles of July 2002 MHHW, MSL and MLLW along the Middle River for the Base – No SMSCG (Base), ELT and ELT - Max Suisun simulations.

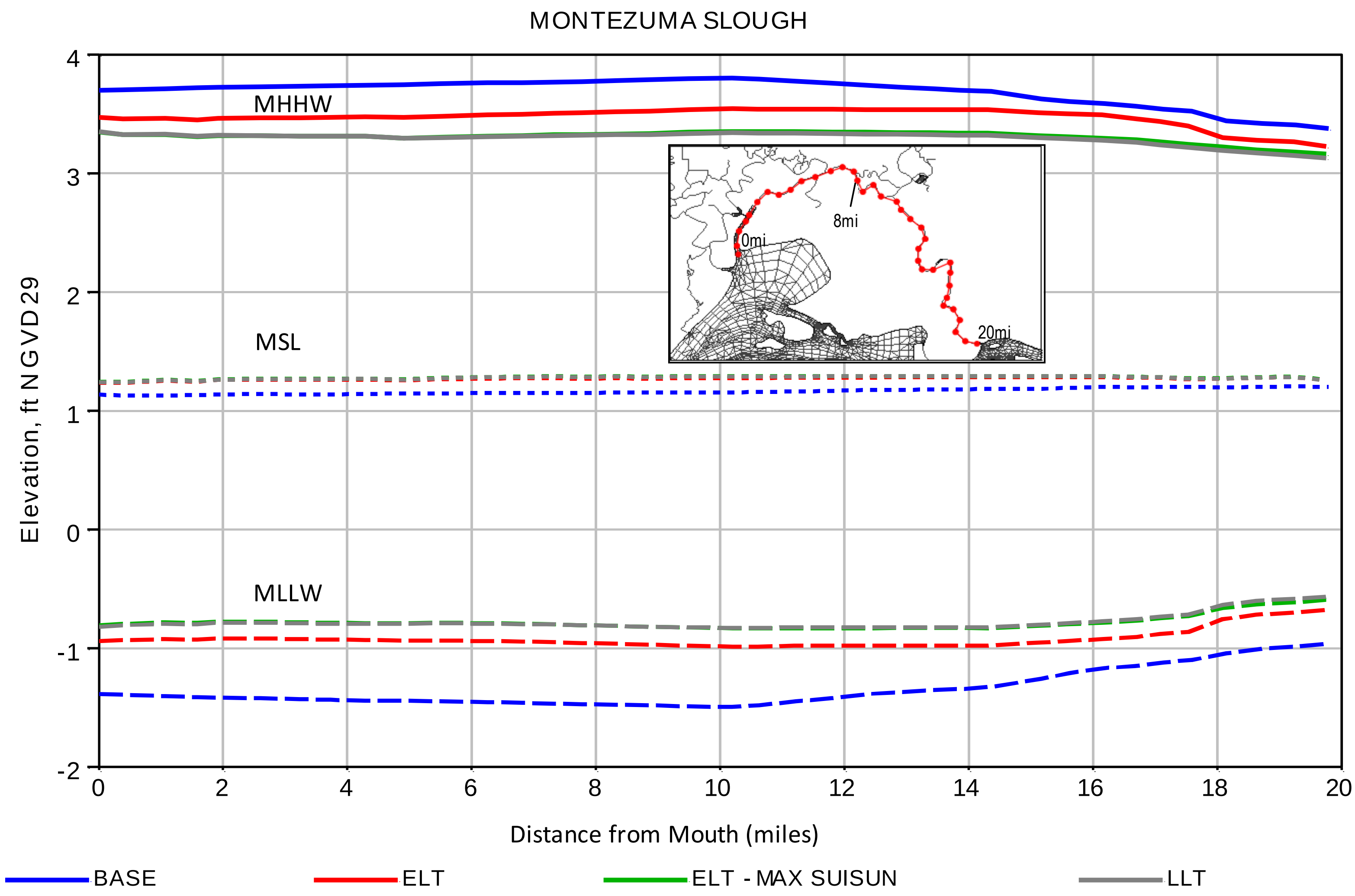


Figure 4-10 Profiles of July 2002 MHHW, MSL and MLLW along Montezuma Slough for the Base – No SMSCG (Base), ELT and ELT - Max Suisun simulations.

4.2.1.4 Stage Time Series Plots

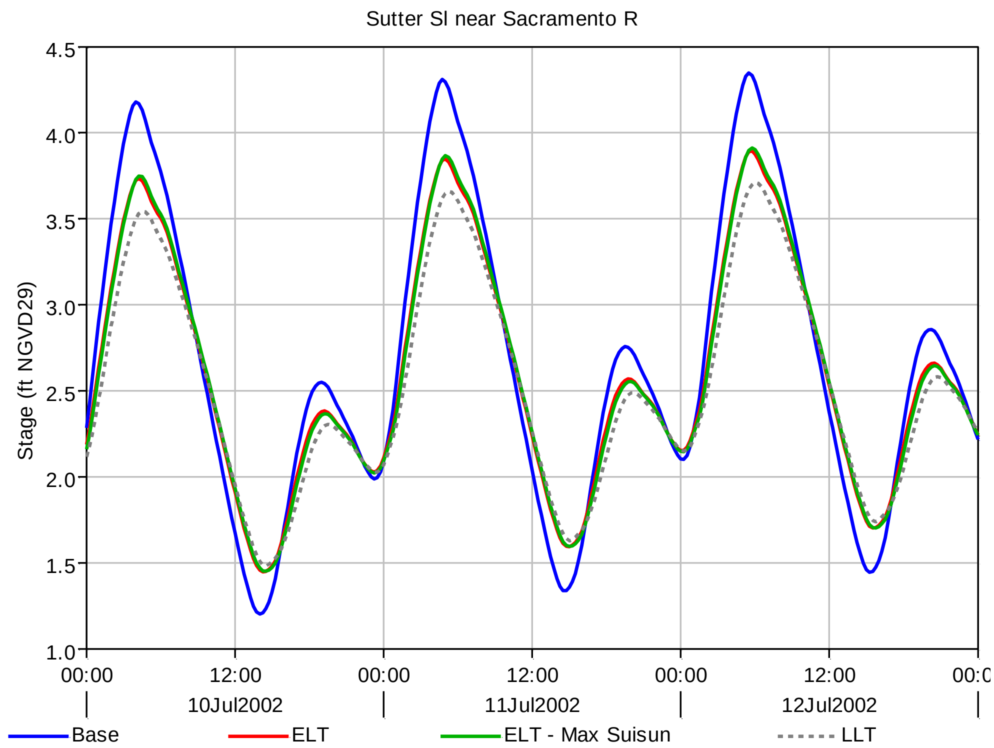


Figure 4-11 Stage in Sutter Slough near Sacramento R. for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

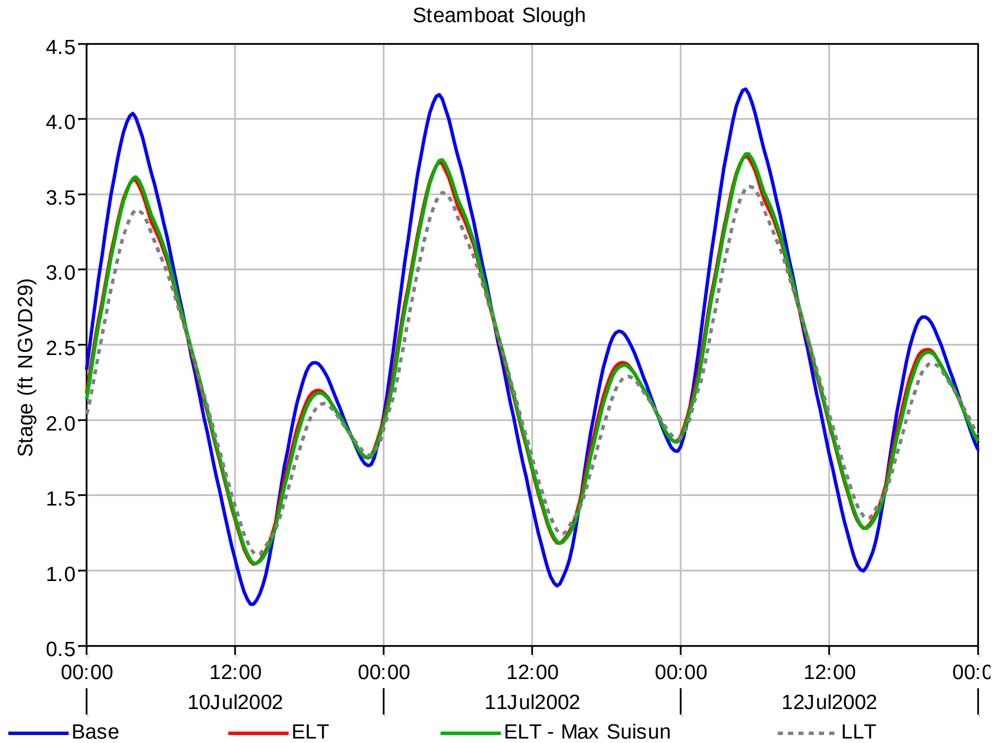


Figure 4-12 Stage in Steamboat Slough for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

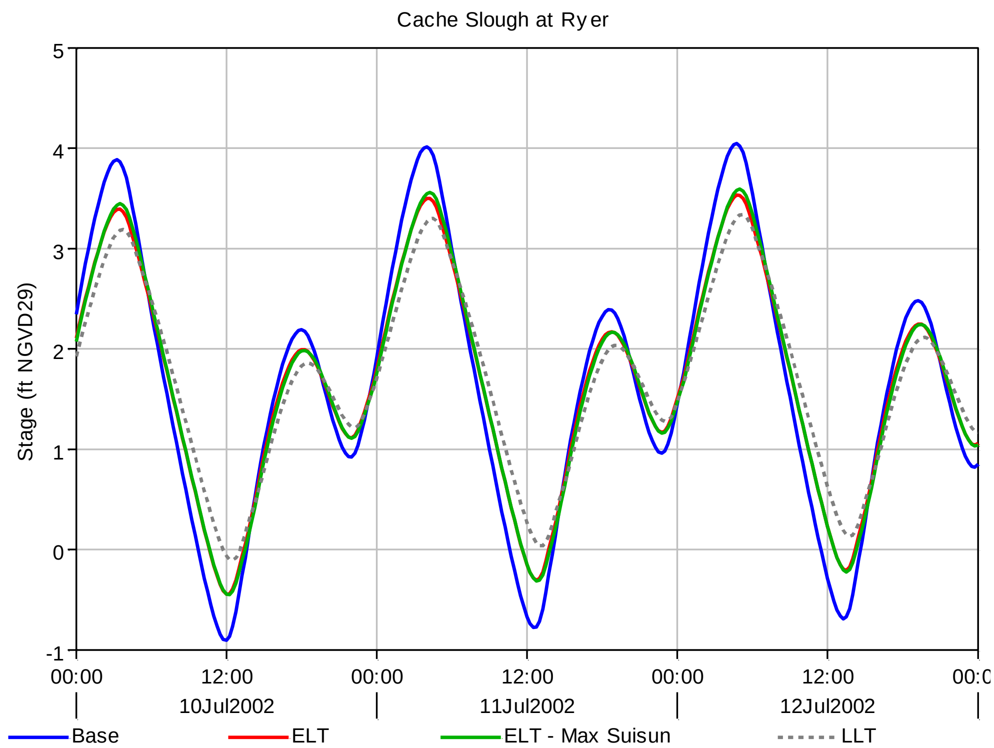


Figure 4-13 Stage in Cache Slough at Ryer Island for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

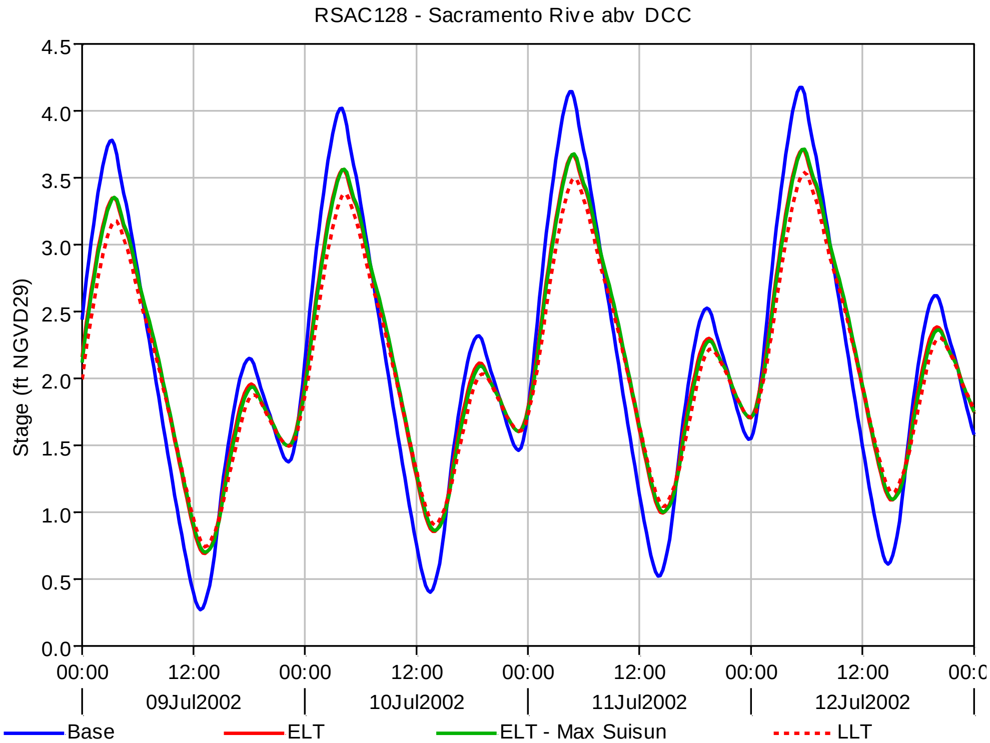


Figure 4-14 Stage at RSAC128 for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

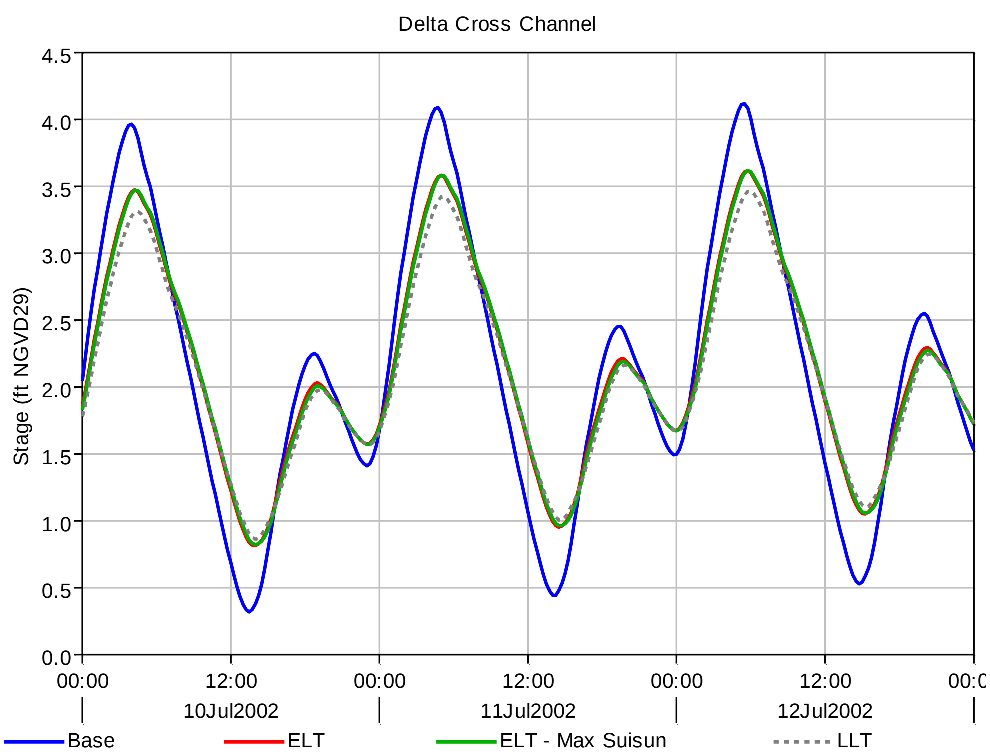


Figure 4-15 Stage in Delta Cross Channel for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

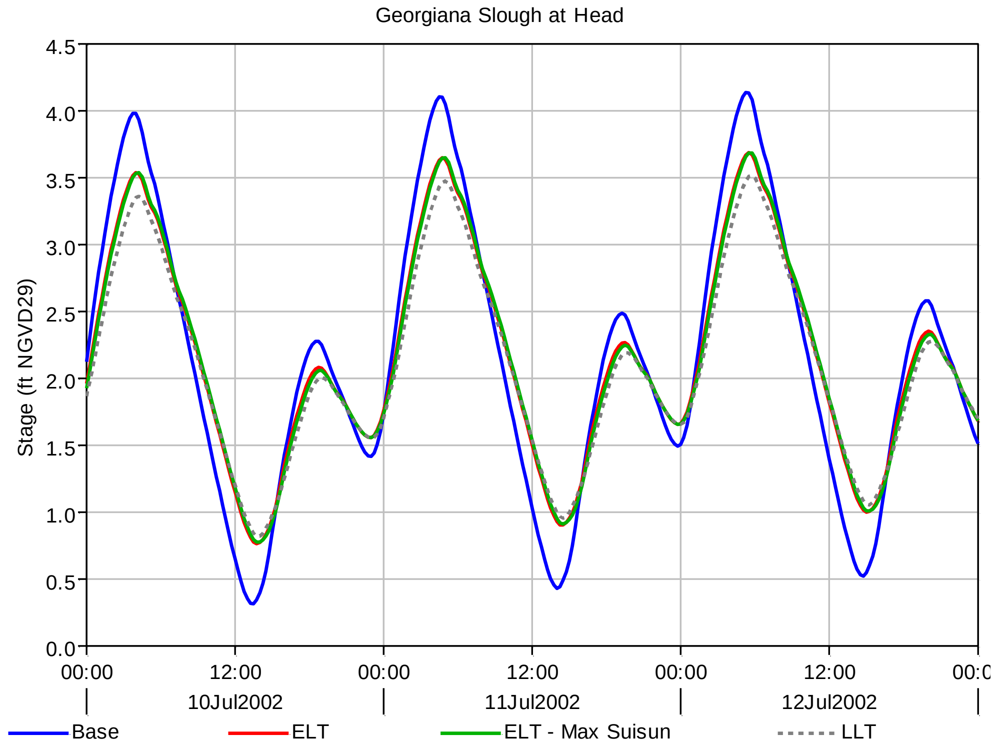


Figure 4-16 Stage in Georgiana Slough at head for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

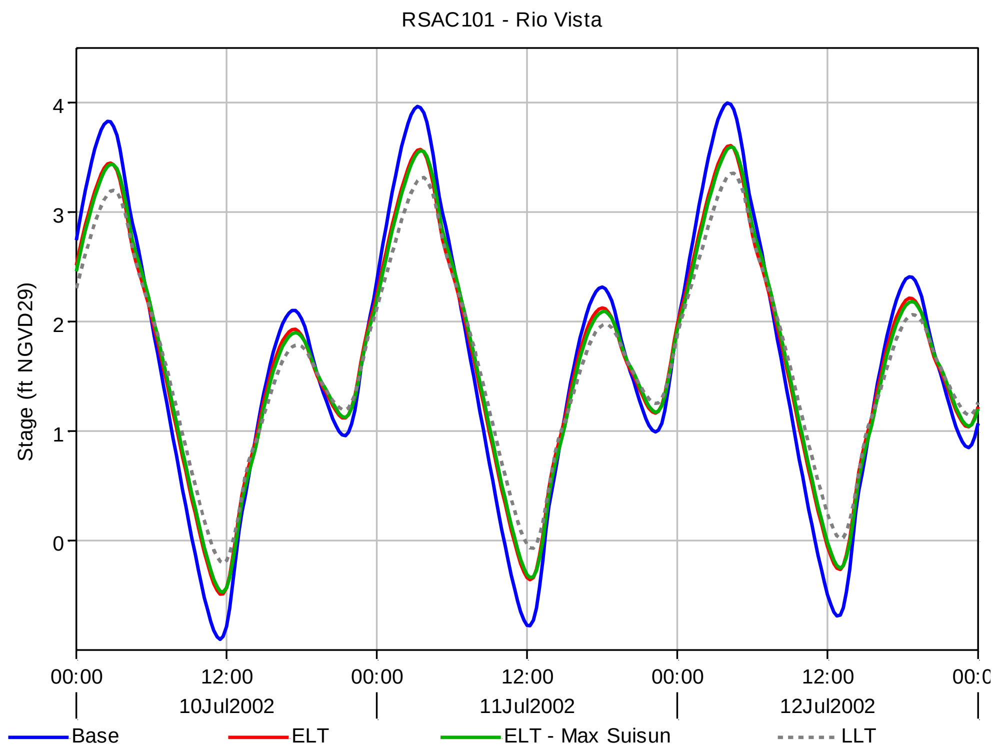


Figure 4-17 Stage at Rio Vista for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

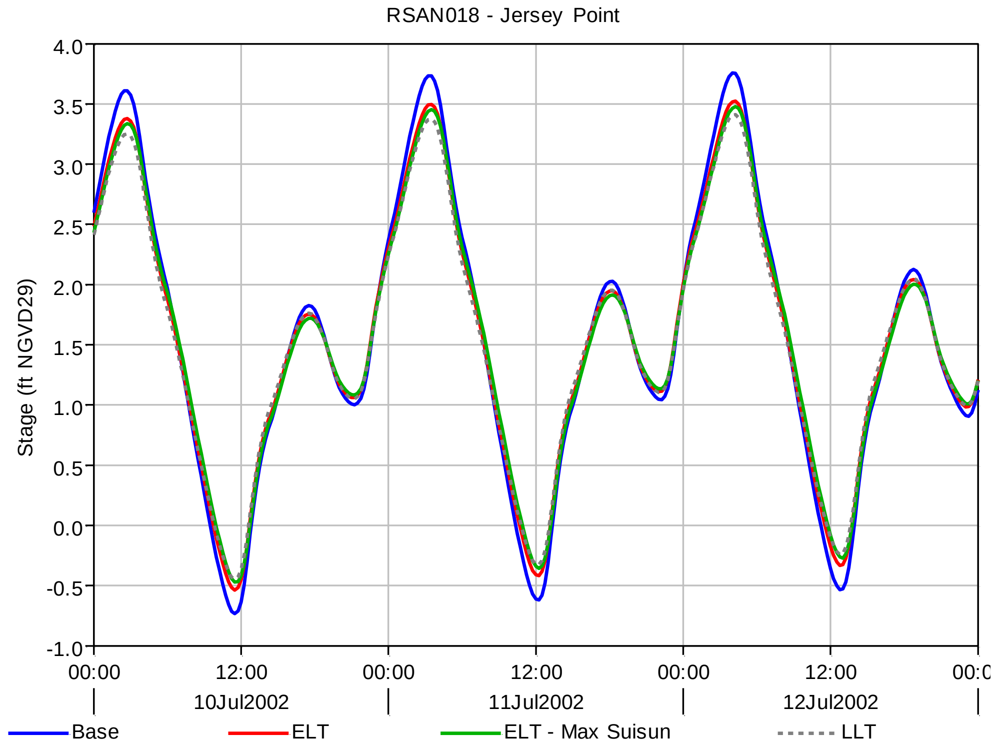


Figure 4-18 Stage at Jersey Point for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

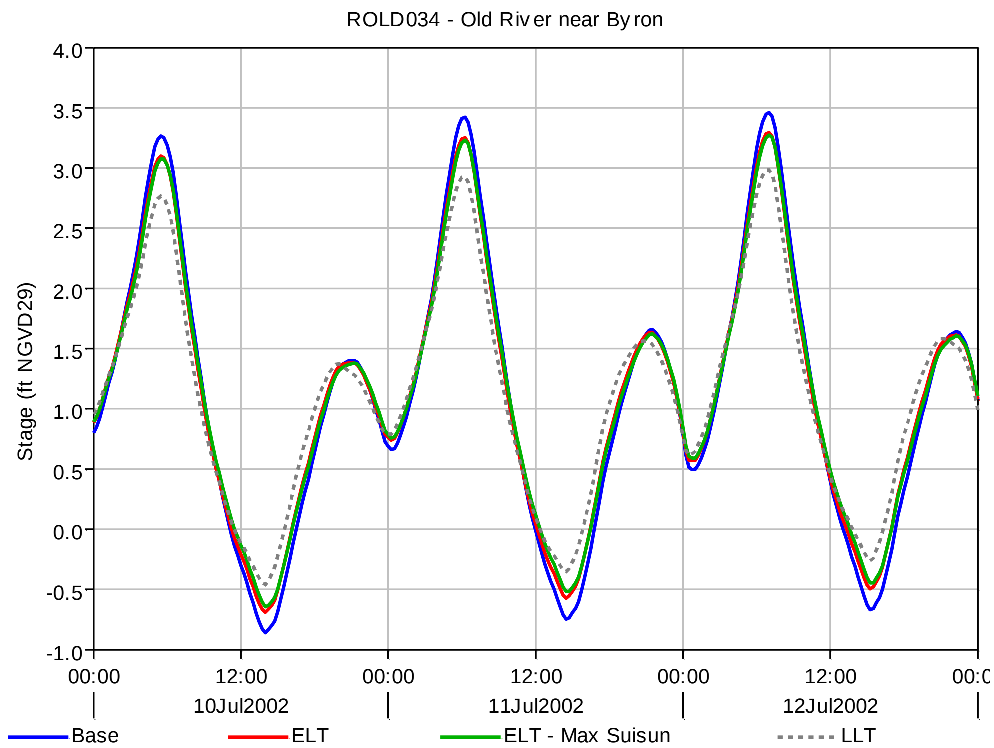


Figure 4-19 Stage at ROLD034 for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

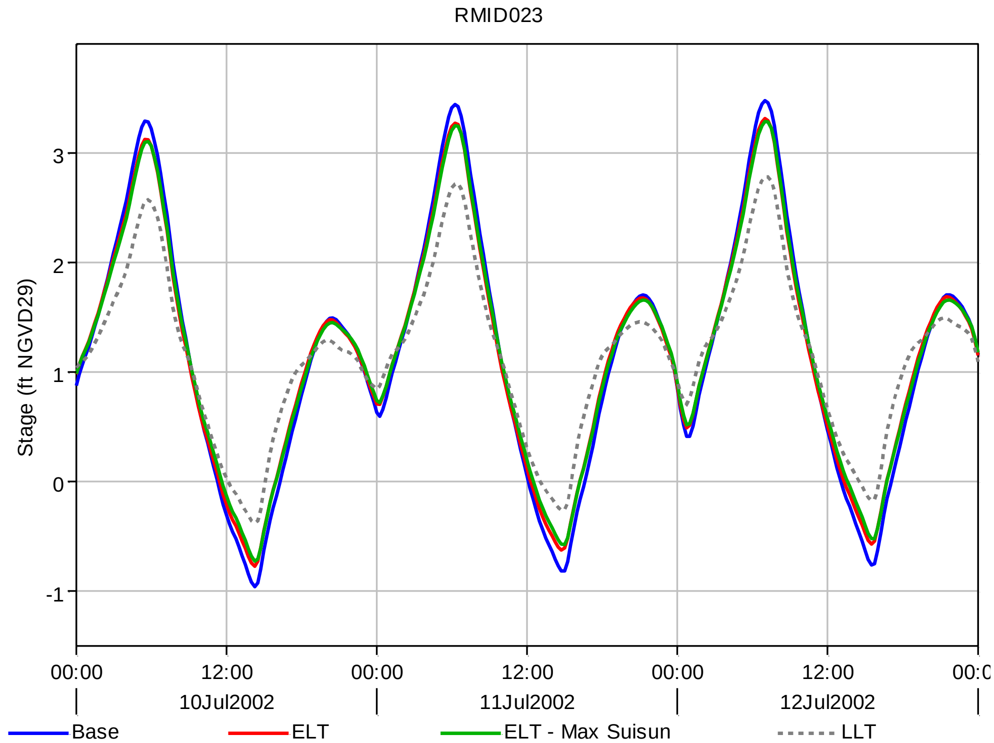


Figure 4-20 Stage at RMID023 for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

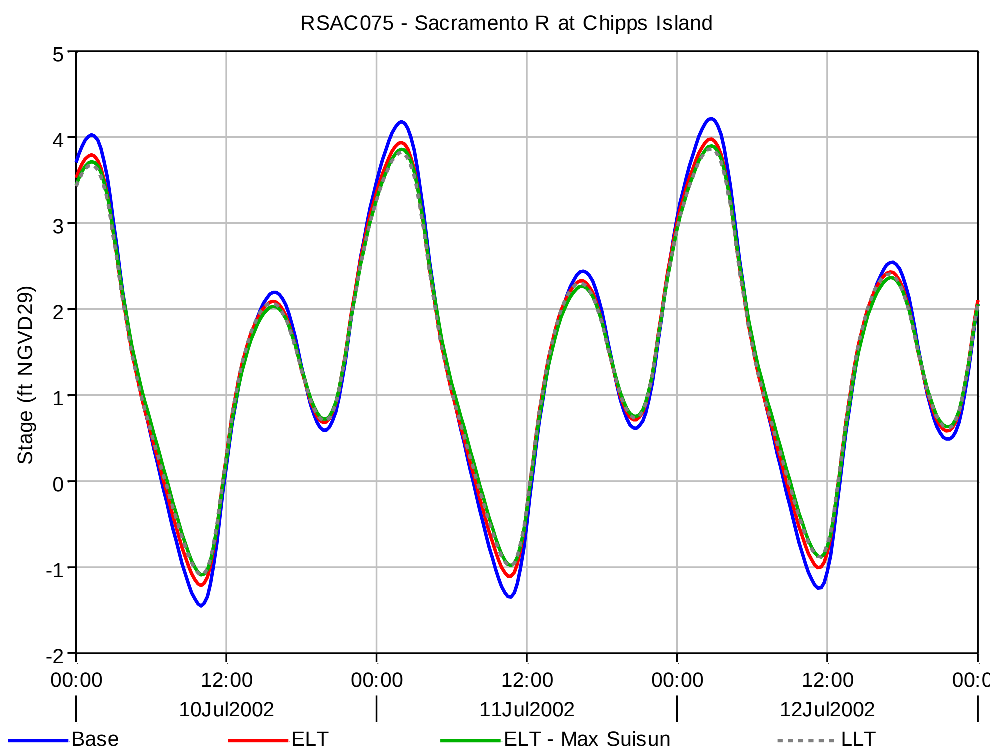


Figure 4-21 Stage at Chipps Island for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

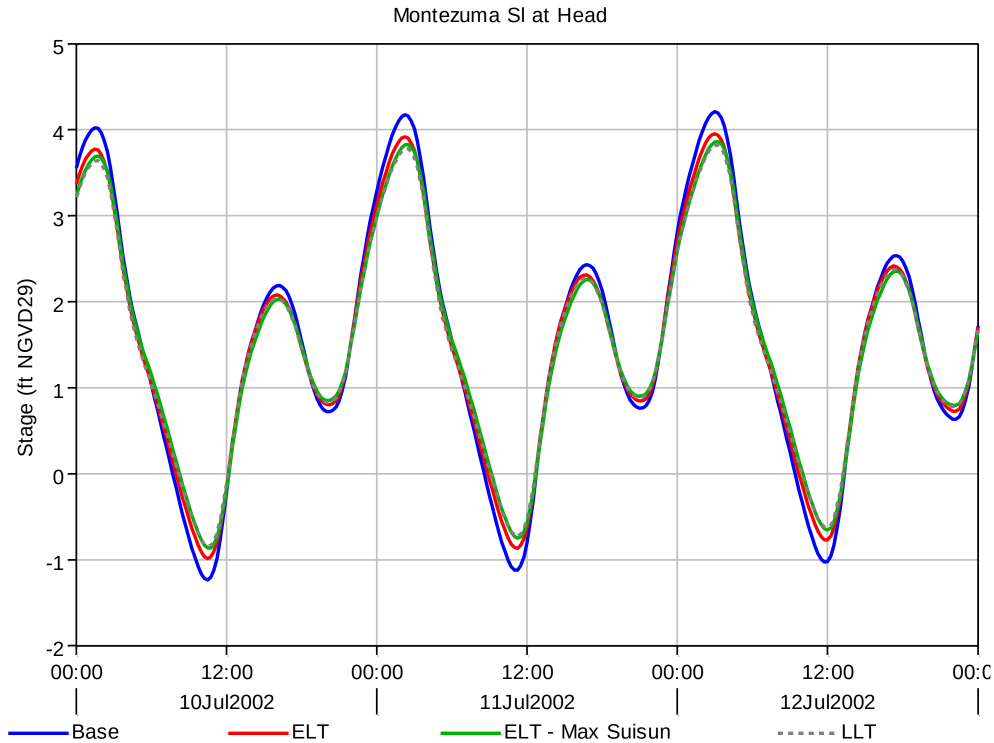


Figure 4-22 Stage in Montezuma Slough at Head for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

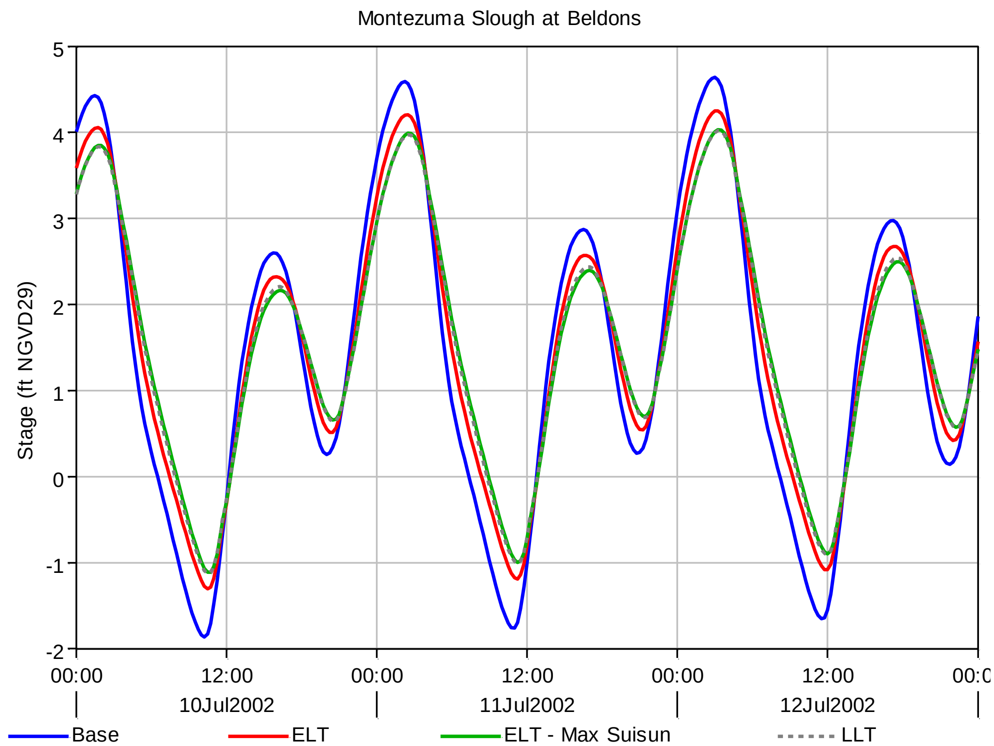


Figure 4-23 Stage in Montezuma Slough at Beldon's Landing (S-49) for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

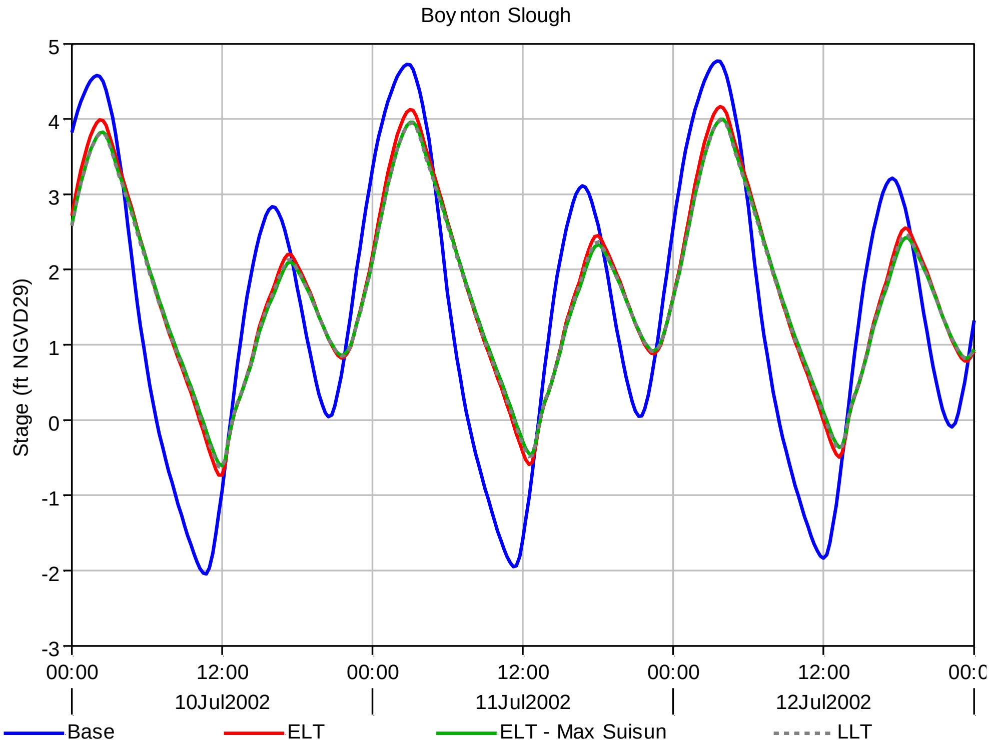


Figure 4-24 Stage in Boynton Slough at S-40 for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

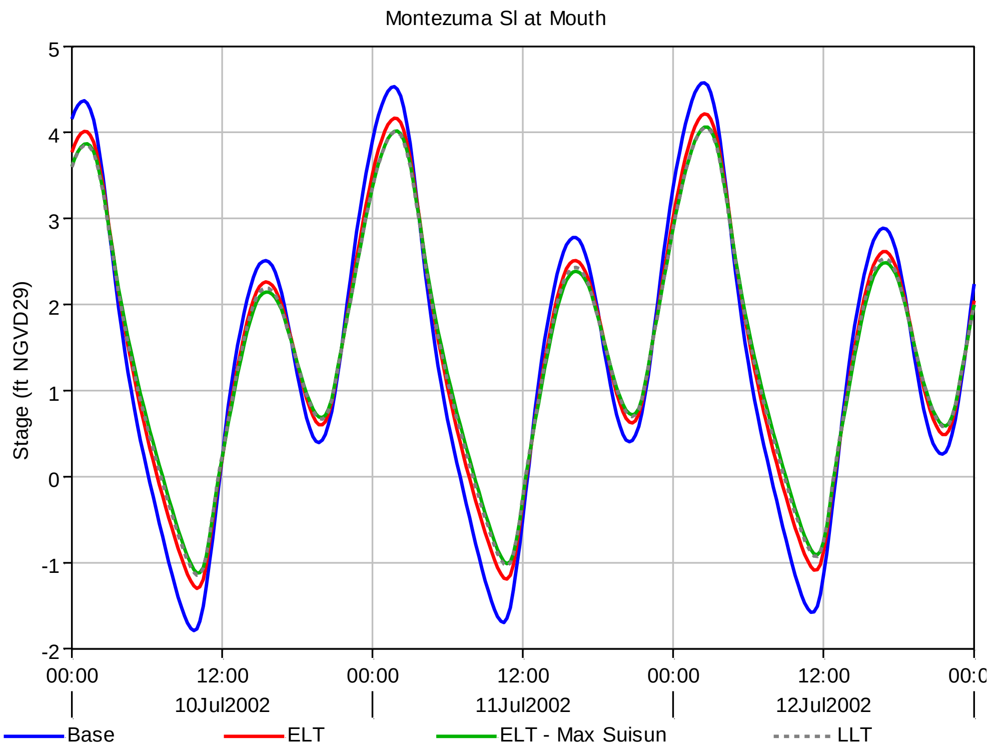


Figure 4-25 Stage in Montezuma Slough at mouth for Base - No SMSCG (Base), ELT, LLT and LLT - Max Suisun scenarios.

4.2.2 LLT - No South Delta ROA

Elimination of the South Delta ROA from the LLT case has varied impacts on net flows, as seen in Table 4-5 and Figure 4-26. Relative to LLT, reverse flows in Middle River are slightly increased at RMID015 and decreased at RMID027, with the balance of flow through Victoria Canal. Old River reverse flows are slightly decreased. Impacts on San Joaquin River flows are small at Jersey Point and San Andreas. Further upstream at RSAN058, the average flows are decreased by 23 cfs, or about 6%. In the north Delta, flow impacts are small. Flow through the DCC and Georgiana Slough is increased by less than 1%. In Montezuma Slough, there is a small increase in flow into the marsh from both the head and mouth of the slough. The increase at Montezuma Slough at Head is 92%, however the average flow is small and the increase is only 12 cfs. Small stage differences are responsible for these flow changes.

Tidal prism and percent change from base tidal prism is tabulated in Table 4-6 and plotted in Figure 4-27 and Figure 4-28. LLT - No South increases tidal prism in Old River and at RMID015 by 5-10% relative to LLT, bringing them closer to Base – No MRB. Victoria Canal tidal prism increases by 47% relative to LLT. At RMID027, there is very little tidal flow in the base case, but LLT restoration increases it by 277%. Without the South Delta ROA, tidal prism returns to near base condition. In the San Joaquin River, tidal prism increases by about 2% (about 700 ac-ft) relative to LLT at Jersey Point and San Andreas, and decreases by 21% (about 600 ac-ft) at RSAN058. Tidal prism changes at all locations in the Sacramento River, in Cache Slough, Montezuma Slough, and at Martinez are 1% or less, relative to LLT. Tidal prism in DCC increases by 3% relative to LLT, and decreases by 6% in Georgiana Slough.

As shown in Table 4-7 and Figure 4-29, without the South Delta LLT, tidal range is increased in Old and Middle River (particularly at RMID027 with an increase of 2.4 ft or 434% over LLT), Victoria Canal (0.6 ft or 23% increase over LLT), and in San Joaquin River at RSAN058 (0.2 ft or 6% increase over LLT). Most other locations show a 1% or smaller decrease in tidal range (0.04 ft or less) relative to LLT.

Profile plots of MHHW, MSL and MLLW, in Figure 4-30 through Figure 4-33, show that relative to LLT, the LLT – No South MHHW is higher and MLLW is lower in the south Delta in Middle River and San Joaquin River. Relative to LLT, MSL is slightly lower in Middle River upstream of Victoria Canal and slightly higher in the uppermost portion of San Joaquin River – in both cases returning closer to the base case MSL. Sacramento River and Montezuma Slough profiles show minimal difference between LLT and LLT – No South MHHW and MLLW, and virtually no change in MSL.

For reference, time series plots of stage are provided for various locations in Figure 4-37 through Figure 4-46. A map of locations plotted is shown in Figure 4-2.

Color contour plots of peak bed shear in Middle River during July 2002 are shown for LLT – No South in comparison with LLT in Figure 4-47. Without the south Delta ROA, the peak Middle River bed shear is reduced from about 1.3 N/m^2 to below 0.5 N/m^2. Bed shear in the reach between Railroad Cut and Victoria Canal is increased relative to LLT, while the highest bed shear upstream of Victoria Canal is decreased.

4.2.2.1 Net Flows

Table 4-5 Summary of 3-month Average flow (Jul – Sep 2002) for Base - No MRB, LLT, LLT – No South simulations.

Location	3-month Average Flow, Jul – Sep 2002 (cfs)		
	Base – No MRB	**LLT**	**LLT – No South**
Cache Sl at Ryer	1535	2565	2549
DCC	4609	3449	3467
False River	-1696	-1806	-1808
Martinez	4422	4080	4104
Miner Slough	2018	2667	2664
Mokelumne nr SJR	4719	3781	3831
Montezuma Sl at Head	12	13	25
Montezuma Sl at Mouth	-71	-191	-180
RMID015	-5351	-5265	-5319
RMID027	-25	-45	-29
ROLD024	-4425	-4541	-4465
ROLD034	-6493	-6603	-6489
RSAC075 Chipps Island	4503	4395	4411
RSAC092 Emmaton	5870	6484	6489
RSAC101 Rio Vista	8256	9712	9672
RSAC123	3607	4258	4229
RSAC128	10999	10137	10143
RSAN018 Jersey Pt	-999	-1914	-1890
RSAN032 San Andreas	-1716	-3216	-3160
RSAN058	366	391	368
SLDUT007	-113	68	70
SLGEO019 Georgiana Sl	2762	2408	2426
SLTRM004 Threemile Sl	-2313	-3012	-2974
Steamboat Sl	2280	2629	2625
Sutter Sl	2965	3480	3477
Victoria Canal	-3580	-3486	-3584

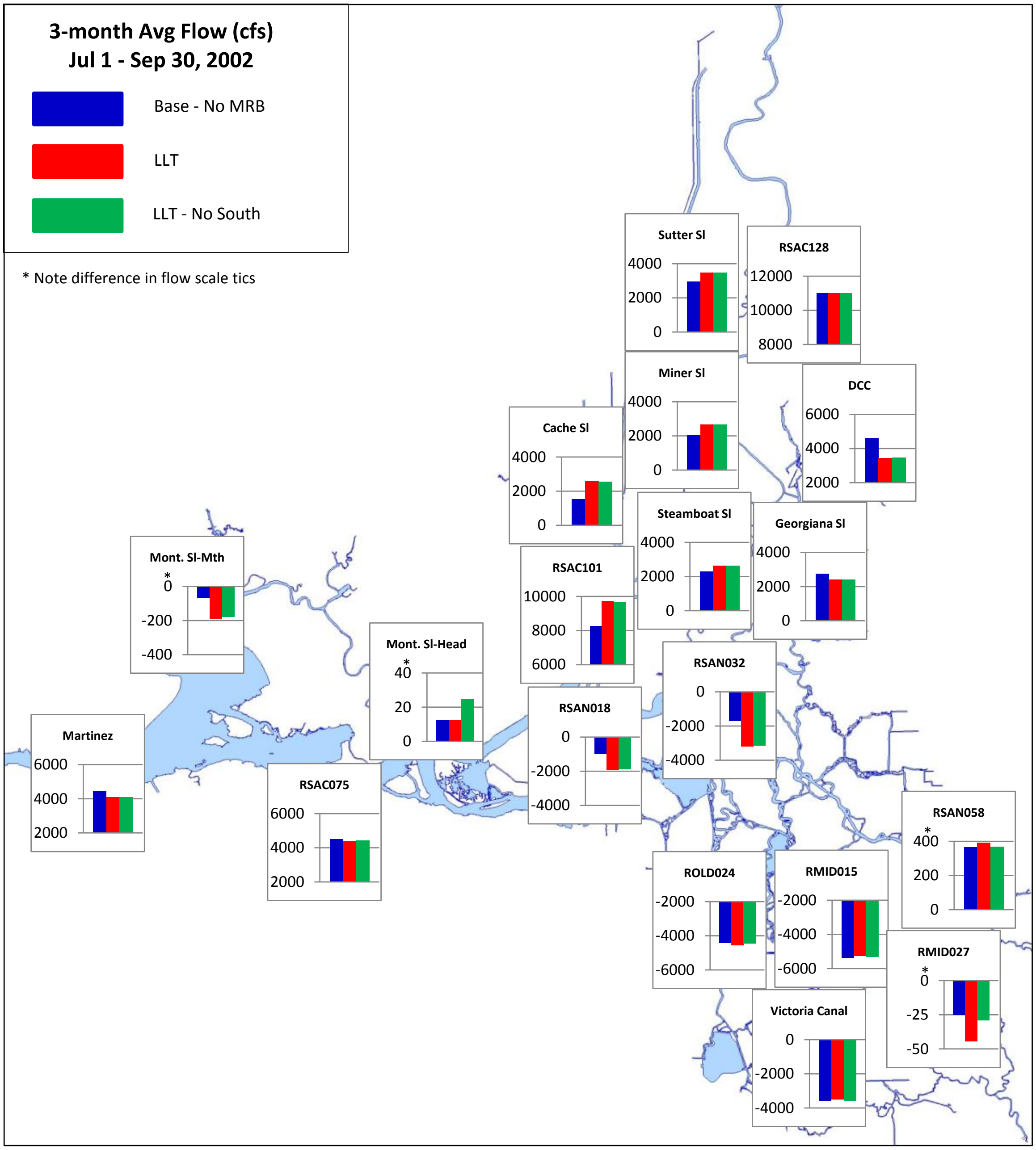


Figure 4-26 Average flows (Jul - Sep 2002) for Base - No MRB, LLT and LLT – No South simulations.

4.2.2.2 Tidal Prism

Table 4-6 Summary of Apr – Dec 2002 Average Tidal Prism for Base - No MRB, LLT and LLT – No South simulations, and percent change from Base-No MRB.

Location	Base – No MRB	LLT		LLT – No South	
	Tidal Prism (ac-ft)	Tidal Prism (ac-ft)	% Change from Base	Tidal Prism (ac-ft)	% Change from Base
Cache Sl at Ryer	28,697	26,884	-6%	26,717	-7%
DCC	782	949	21%	977	25%
False River	18,870	16,508	-13%	16,763	-11%
Martinez	167,717	170,966	2%	170,658	2%
Miner Slough	618	455	-26%	462	-25%
Mokelumne nr SJR	4,615	4,490	-3%	4,433	-4%
Montezuma Sl at Head	2,053	3,283	60%	3,295	60%
Montezuma Sl at Mouth	10,988	23,108	110%	23,114	110%
RMID015	4,119	3,333	-19%	3,603	-13%
RMID027	474	1,784	277%	450	-5%
ROLD024	4,427	3,655	-17%	3,923	-11%
ROLD034	2,352	1,960	-17%	2,061	-12%
RSAC075 Chipps Island	115,263	108,506	-6%	108,789	-6%
RSAC092 Emmaton	49,256	50,591	3%	50,612	3%
RSAC101 Rio Vista	36,171	40,582	12%	40,365	12%
RSAC123	2,499	1,811	-28%	1,834	-27%
RSAC128	1,608	1,175	-27%	1,140	-29%
RSAN018 Jersey Pt	50,110	44,549	-11%	45,228	-10%
RSAN032 San Andreas	37,847	32,450	-14%	33,145	-12%
RSAN058	2,385	2,603	9%	2,044	-14%
SLDUT007	3,073	2,226	-28%	2,283	-26%
SLGEO019 Georgiana Sl	222	415	87%	389	75%
SLTRM004 Threemile Sl	9,413	6,526	-31%	6,770	-28%
Steamboat Sl	913	598	-35%	603	-34%
Sutter Sl	823	574	-30%	580	-30%
Victoria Canal	1,337	786	-41%	1,152	-14%

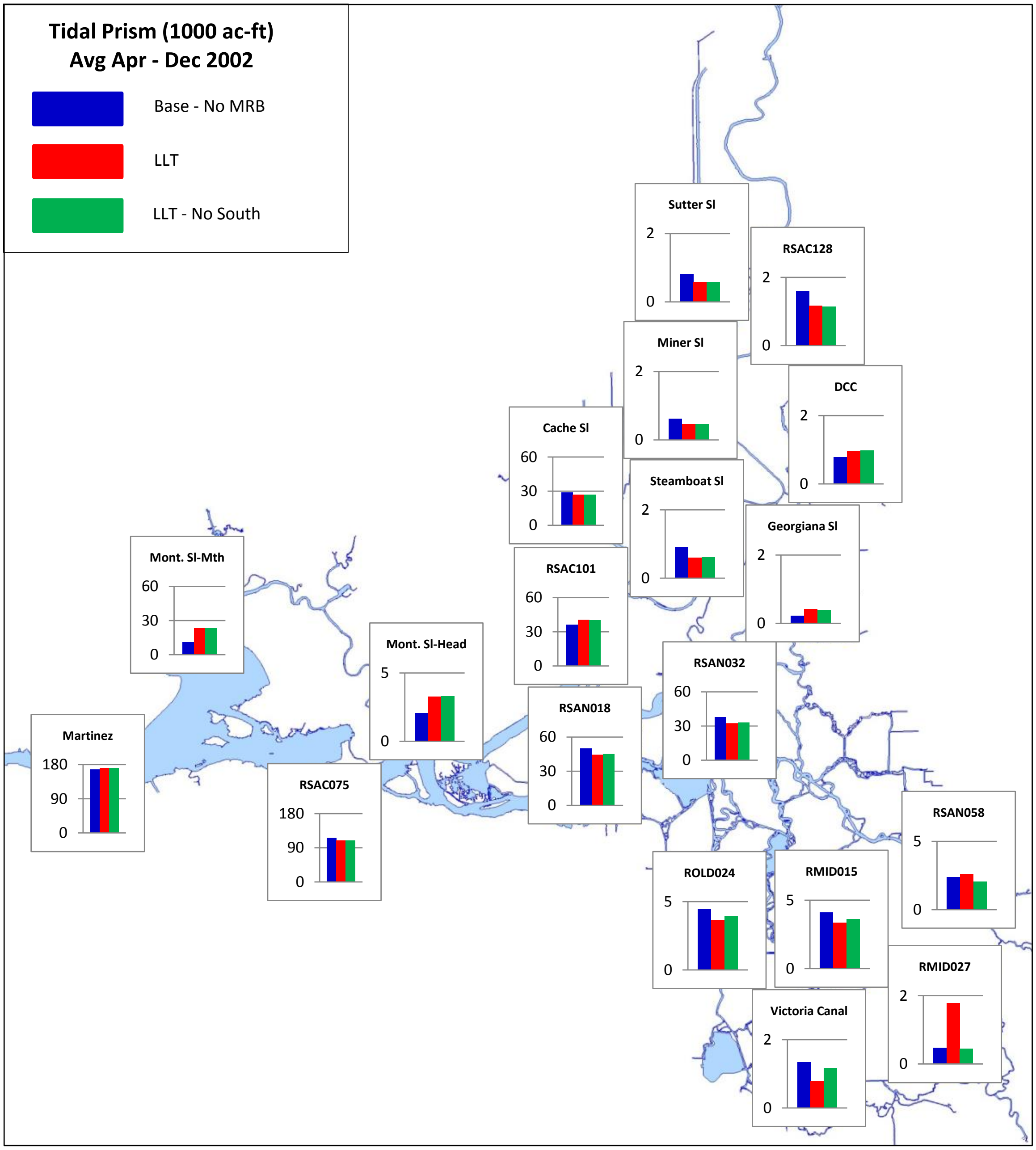


Figure 4-27 Average tidal prism (Apr - Dec 2002) for Base - No MRB, LLT and LLT – No South simulations.

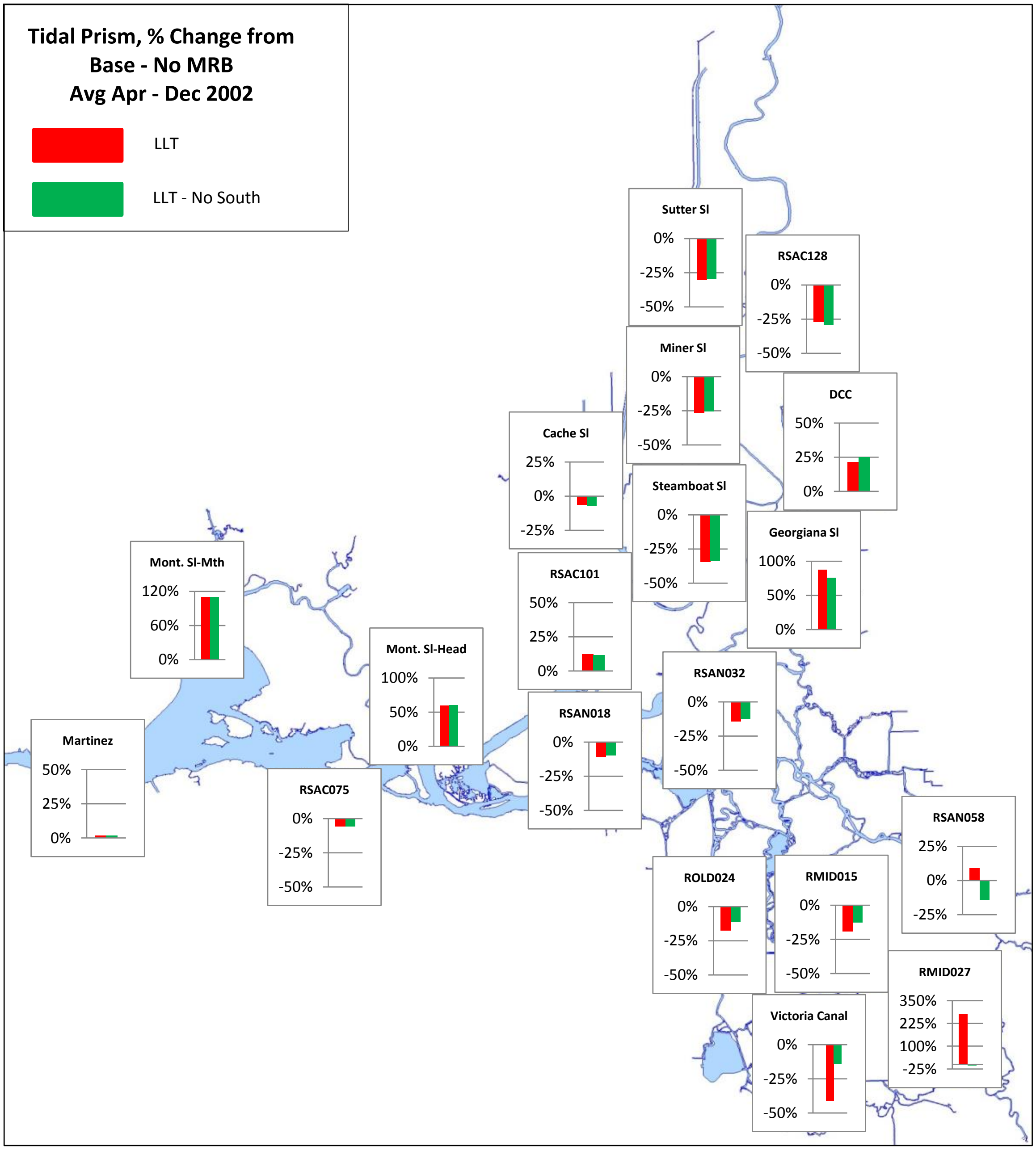


Figure 4-28 Average percent change from Base - No MRB tidal prism (Apr - Dec 2002) for LLT and LLT – No South simulations.

4.2.2.3 Tidal Range

Table 4-7 Summary of Apr – Dec 2002 Average Tidal Range for Base - No MRB, LLT and LLT – No South simulations.

Location	Apr – Dec 2002 Average Tidal Range (ft)		
	Base – No MRB	LLT	LLT – No South
Cache Sl at Ryer	3.95	2.75	2.74
DCC	2.92	2.11	2.09
False River	3.4	2.93	2.9
Martinez	5.47	5.14	5.13
Miner Slough	3.12	2.62	2.6
Montezuma Sl at Head	4.25	3.64	3.6
Montezuma Sl at Mouth	5	4.05	4.05
RMID015	3.76	3.14	3.23
RMID023	3.49	2.48	3.04
RMID027	3.33	0.56	2.99
ROLD024	3.55	3.02	3.06
ROLD034	3.36	2.73	2.96
RSAC075 Chipps Island	4.42	3.85	3.84
RSAC092 Emmaton	3.93	3.23	3.19
RSAC101 Rio Vista	3.86	2.79	2.76
RSAC123	2.95	2.14	2.13
RSAC128	2.91	2.12	2.11
RSAN018 Jersey Pt	3.47	2.98	2.95
RSAN032 San Andreas	3.37	2.89	2.88
RSAN058	4.05	3.25	3.45
SLDUT007 Dutch Slough	3.59	3.04	3.01
SLGEO019 Georgiana Sl	2.95	2.16	2.16
SLTRM004 Threemile Sl	3.45	2.9	3
Steamboat Slough	2.69	1.99	1.98
Sutter Slough	2.57	1.94	1.91
Victoria Canal	3.48	2.48	3.05

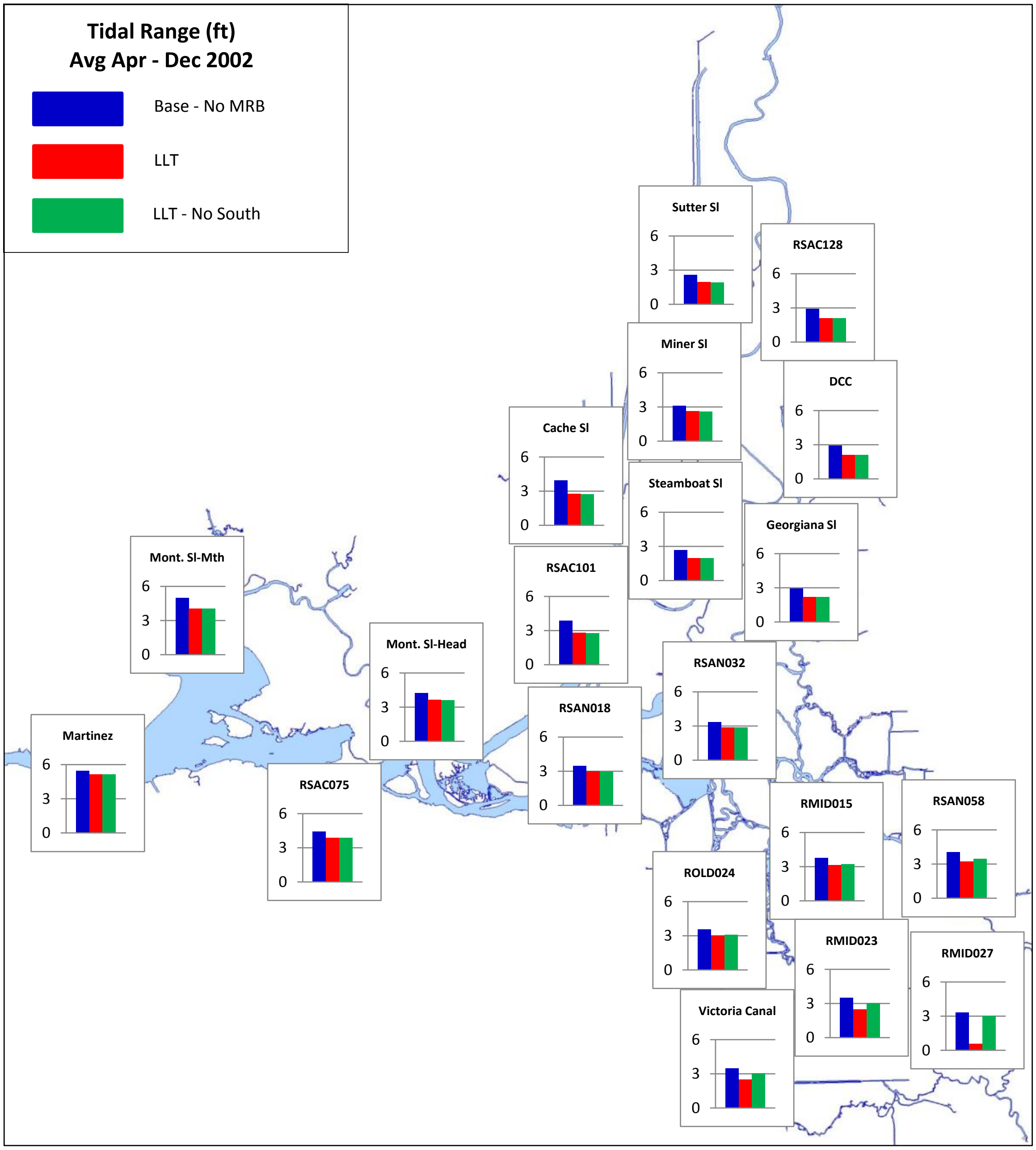


Figure 4-29 Average tidal range (Apr - Dec 2002) for Base - No MRB, LLT and LLT – No South simulations.

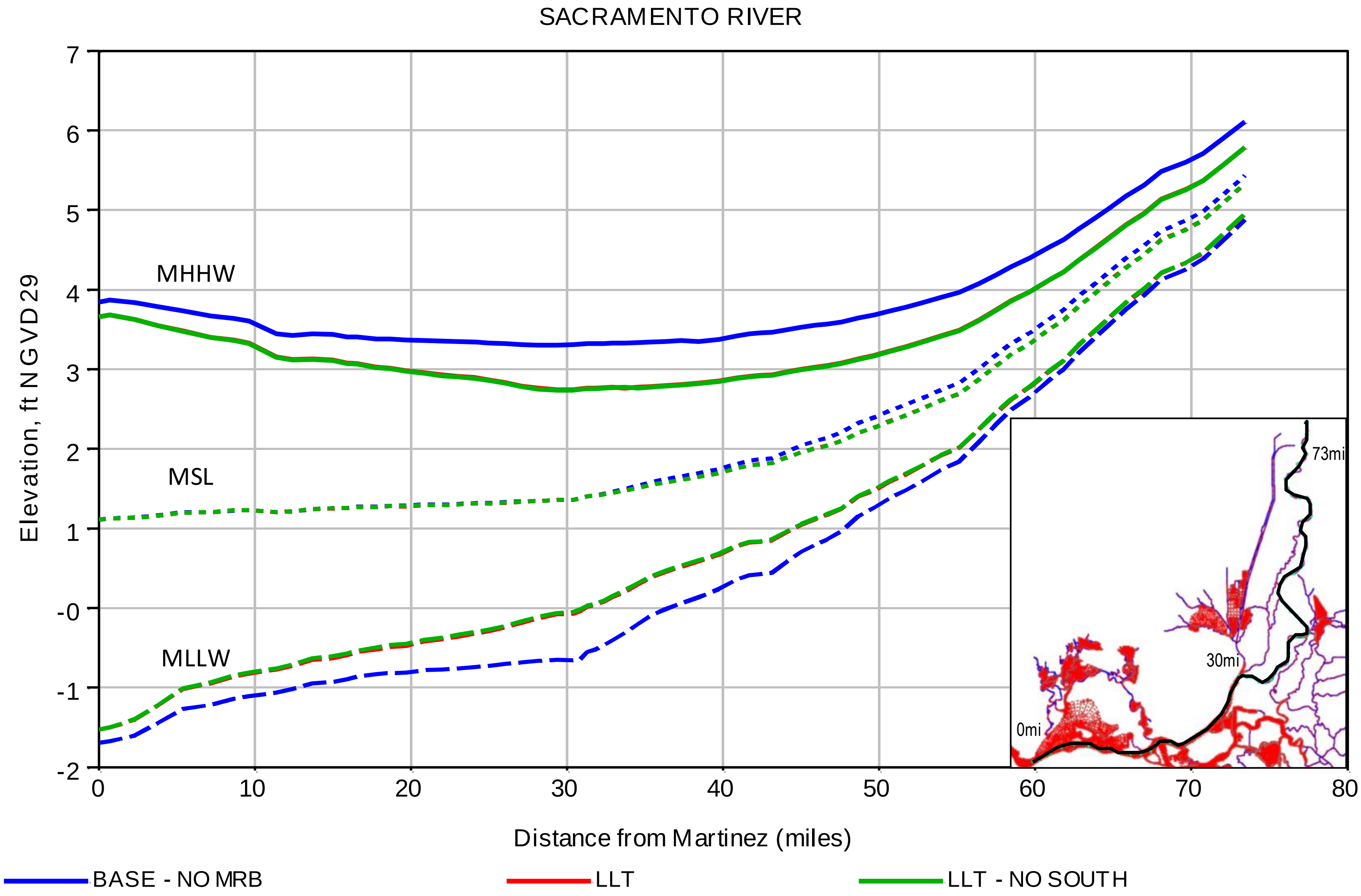


Figure 4-30 Profiles of July 2002 MHHW, MSL and MLLW along the Sacramento River for the Base - No MRB, LLT and LLT - No South simulations.

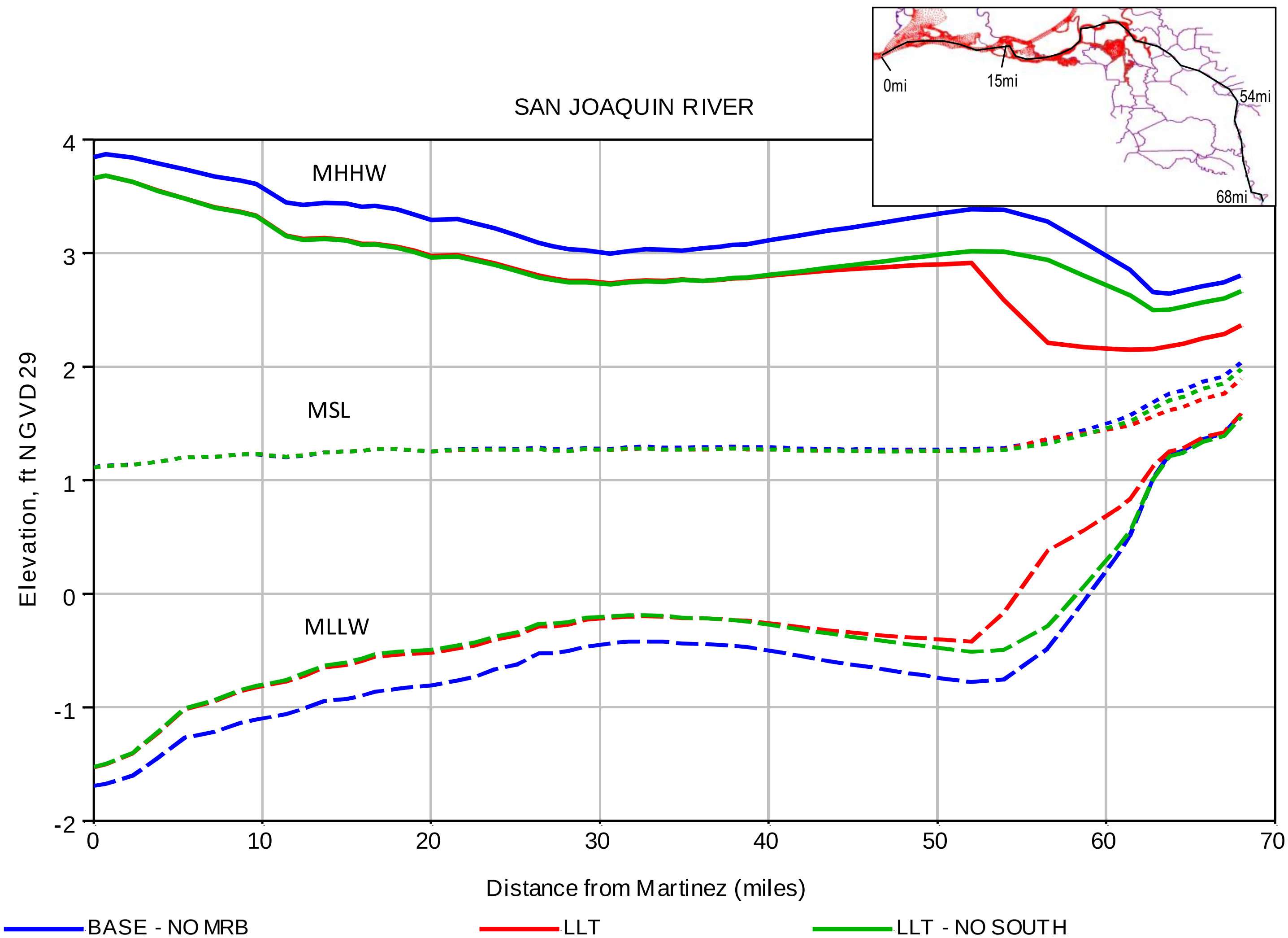


Figure 4-31 Profiles of July 2002 MHHW, MSL and MLLW along the San Joaquin River for the Base - No MRB, LLT and LLT - No South simulations.

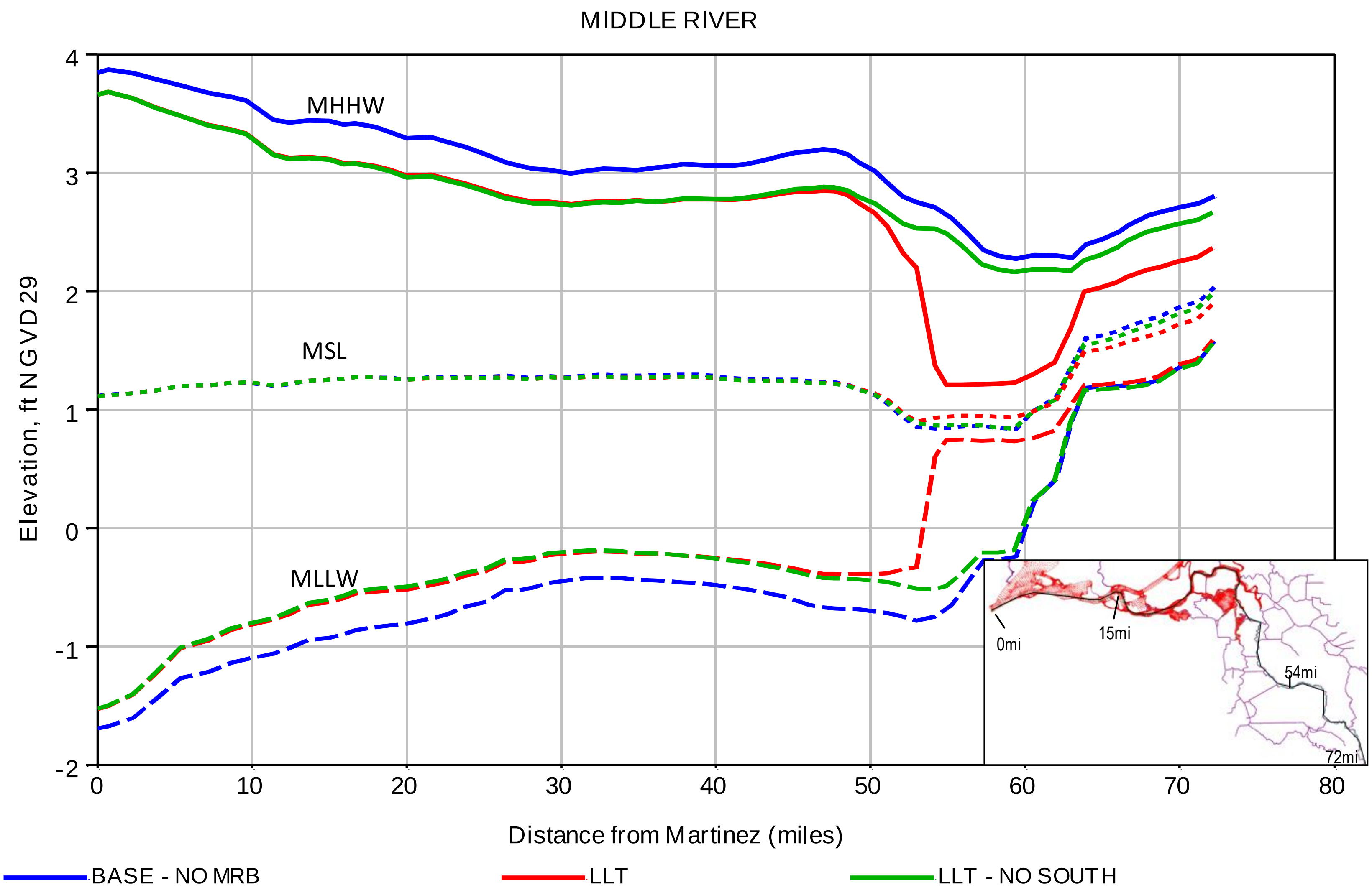


Figure 4-32 Profiles of July 2002 MHHW, MSL and MLLW along the Middle River for the Base - No MRB, LLT and LLT - No South simulations.

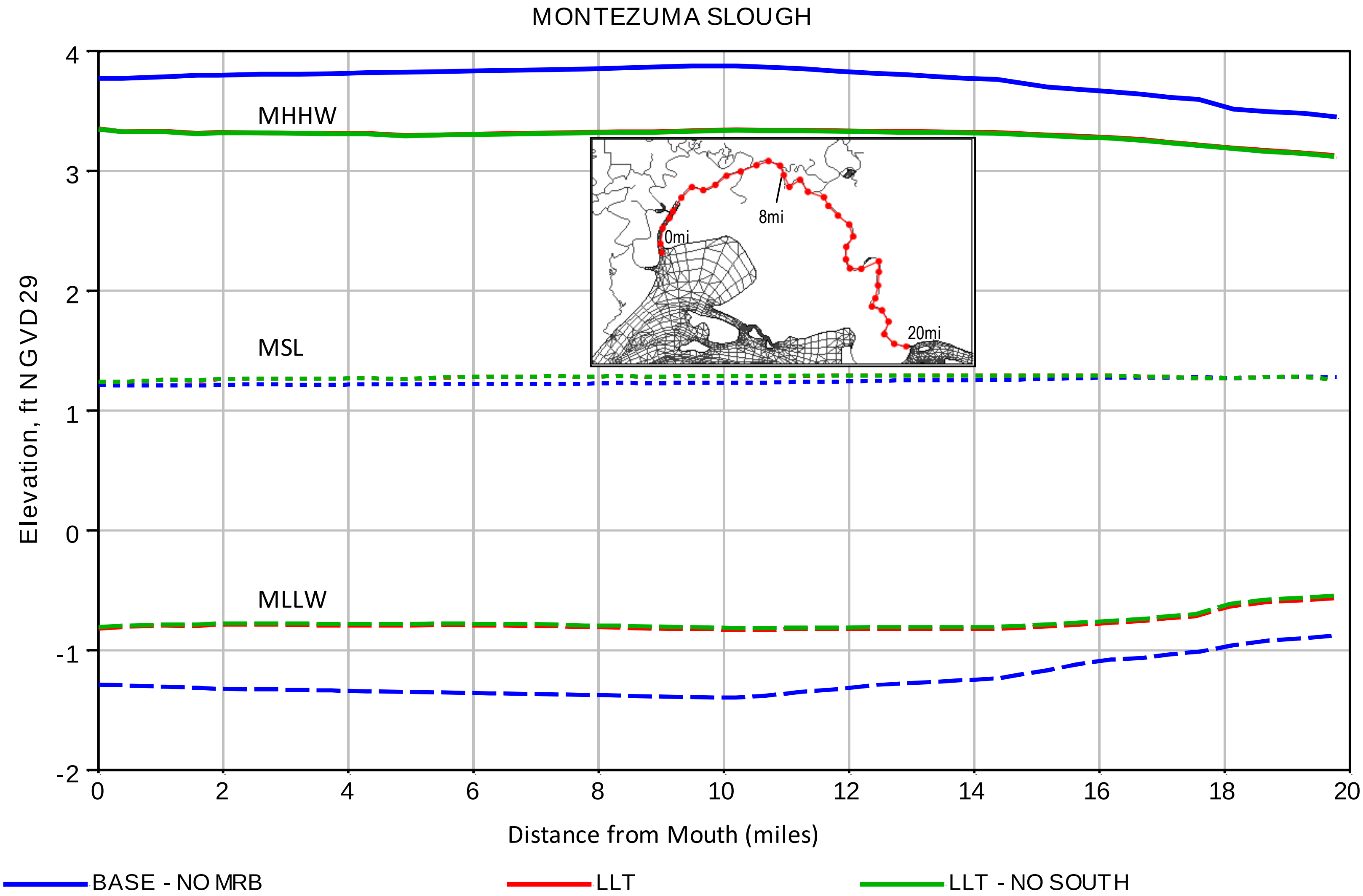


Figure 4-33 Profiles of July 2002 MHHW, MSL and MLLW along Montezuma Slough for the Base - No MRB, LLT and LLT - No South simulations.

4.2.2.4 Stage Time Series Plots

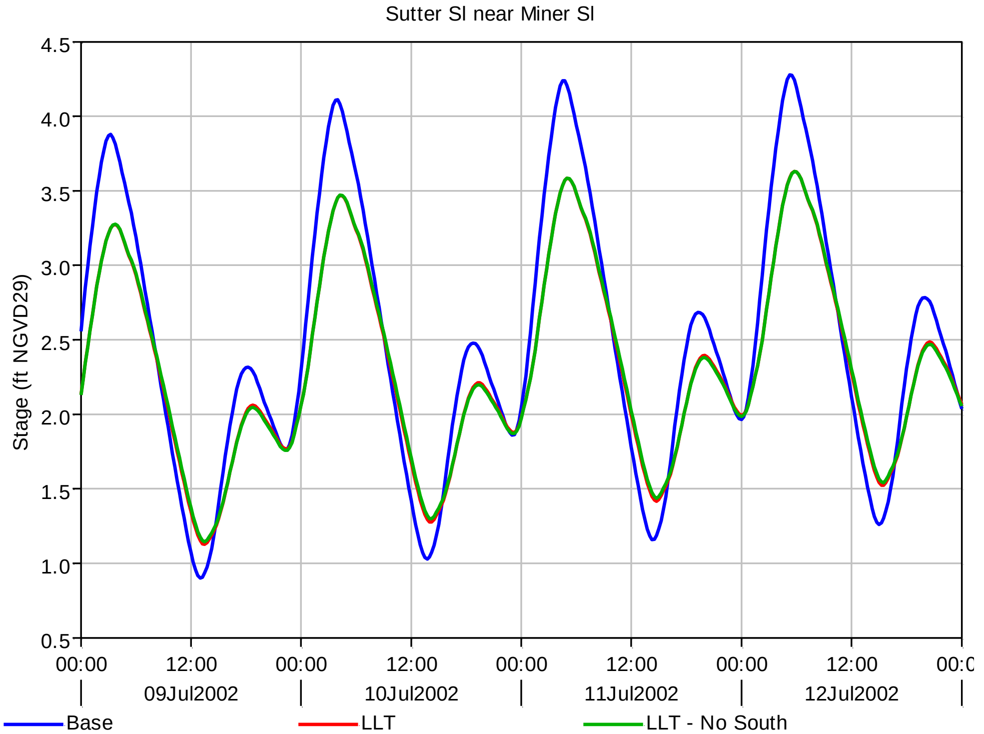


Figure 4-34 Stage in Sutter Slough for Base - No MRB, LLT and LLT - No South scenarios.

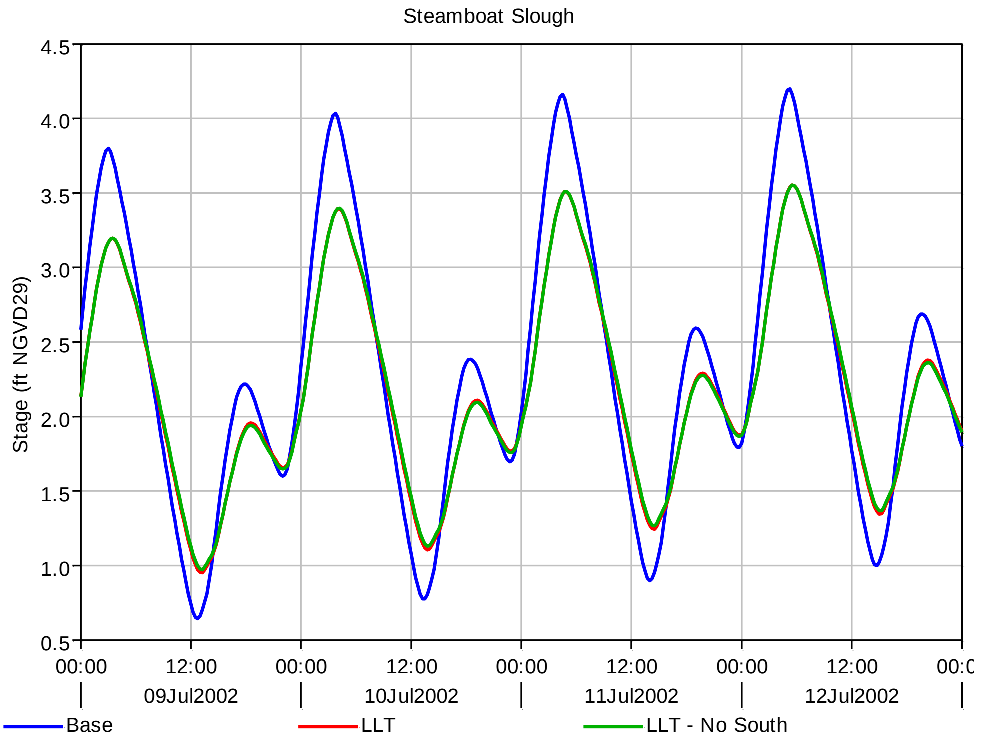


Figure 4-35 Stage in Steamboat Slough for Base - No MRB, LLT and LLT - No South scenarios.

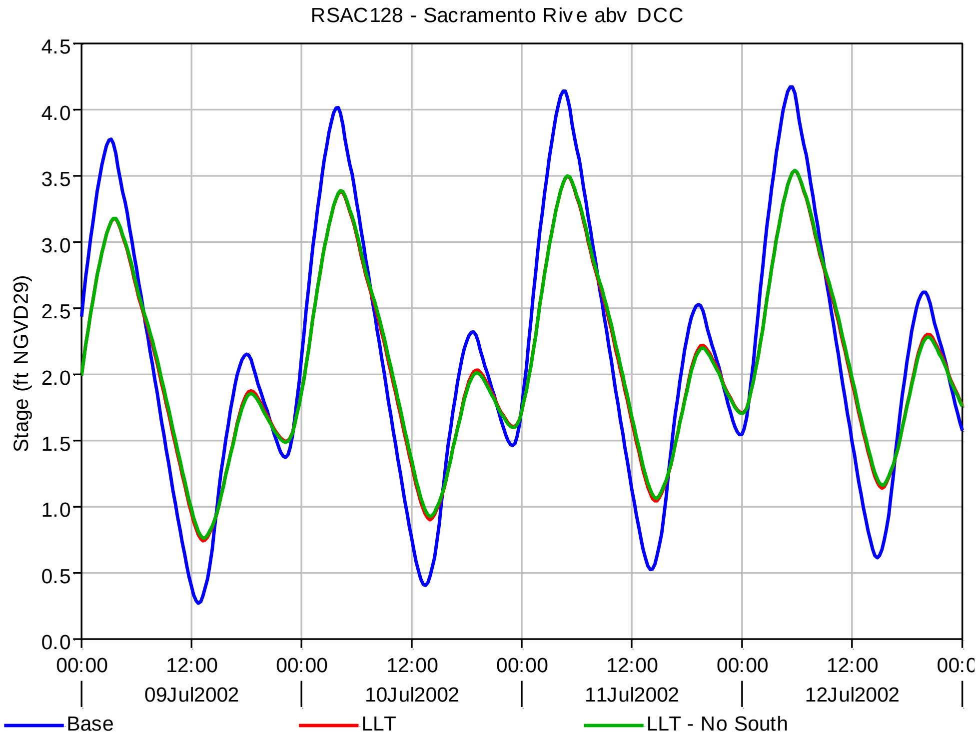


Figure 4-36 Stage at RSAC128 for Base - No MRB, LLT and LLT - No South scenarios.

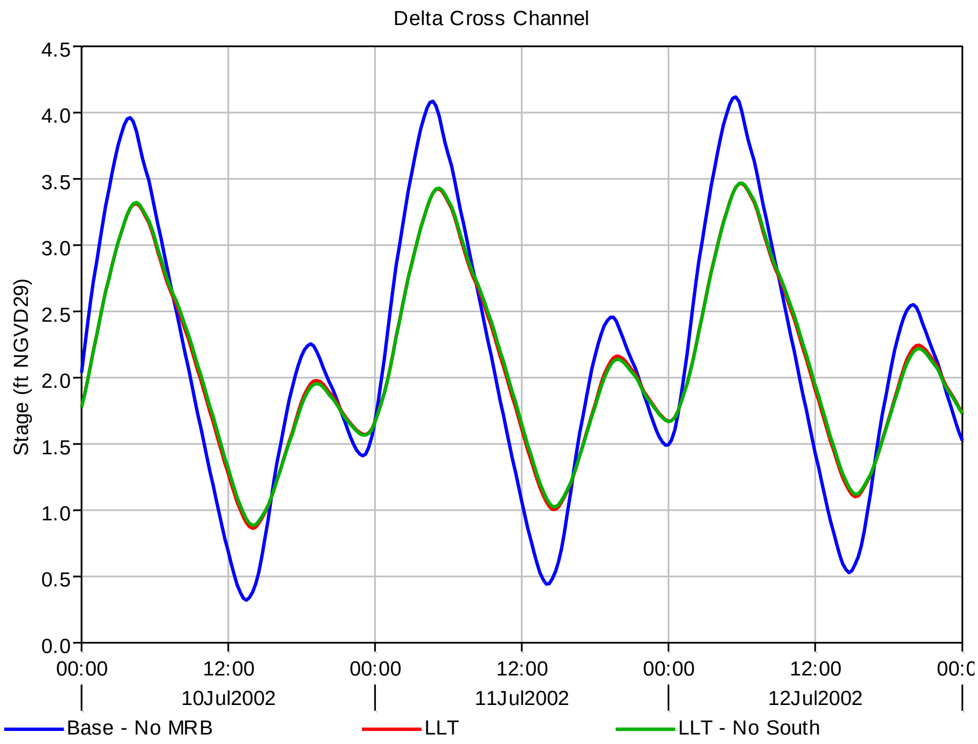


Figure 4-37 Stage in Delta Cross Channel for Base - No MRB, LLT and LLT - No South scenarios.

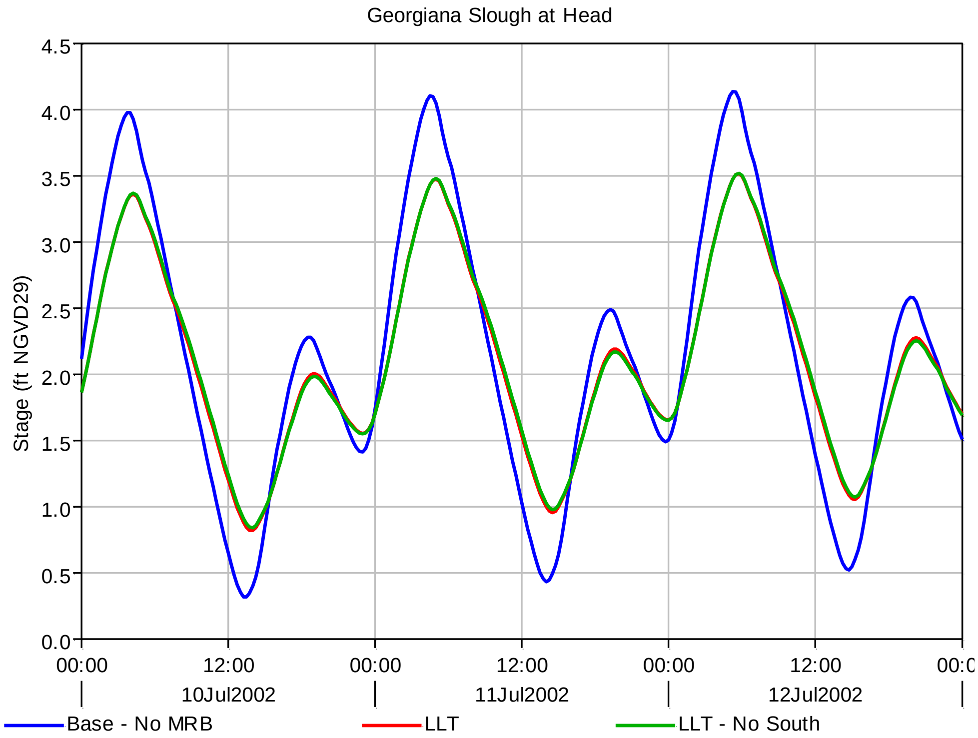


Figure 4-38 Stage in Georgiana Slough at head for Base - No MRB, LLT and LLT - No South scenarios.

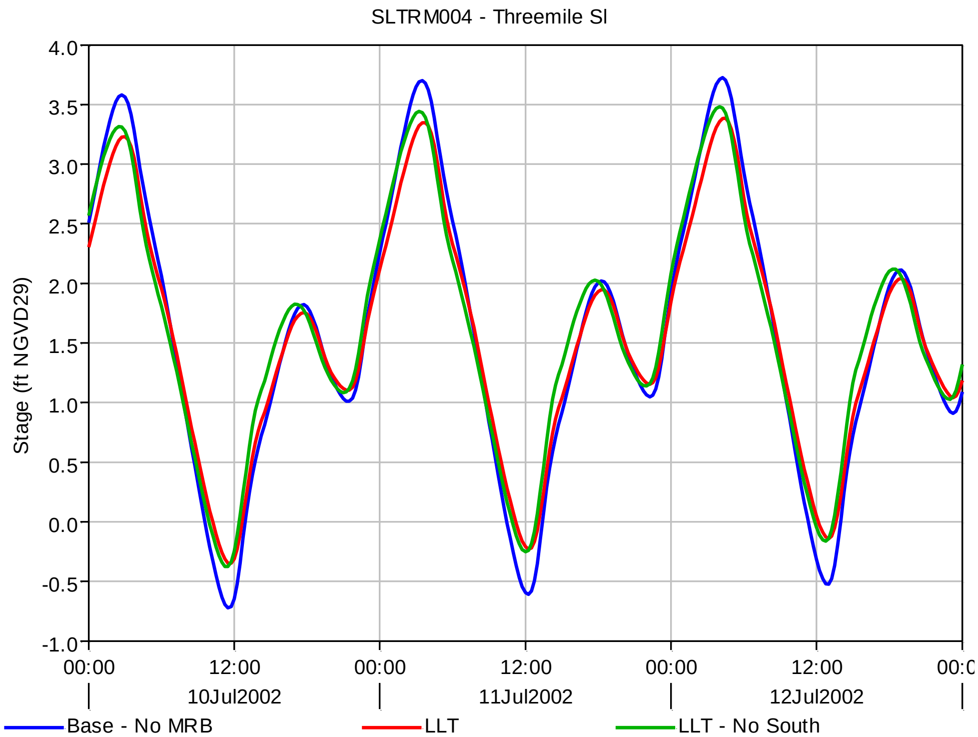


Figure 4-39 Stage in Threemile Slough for Base - No MRB, LLT and LLT - No South scenarios.

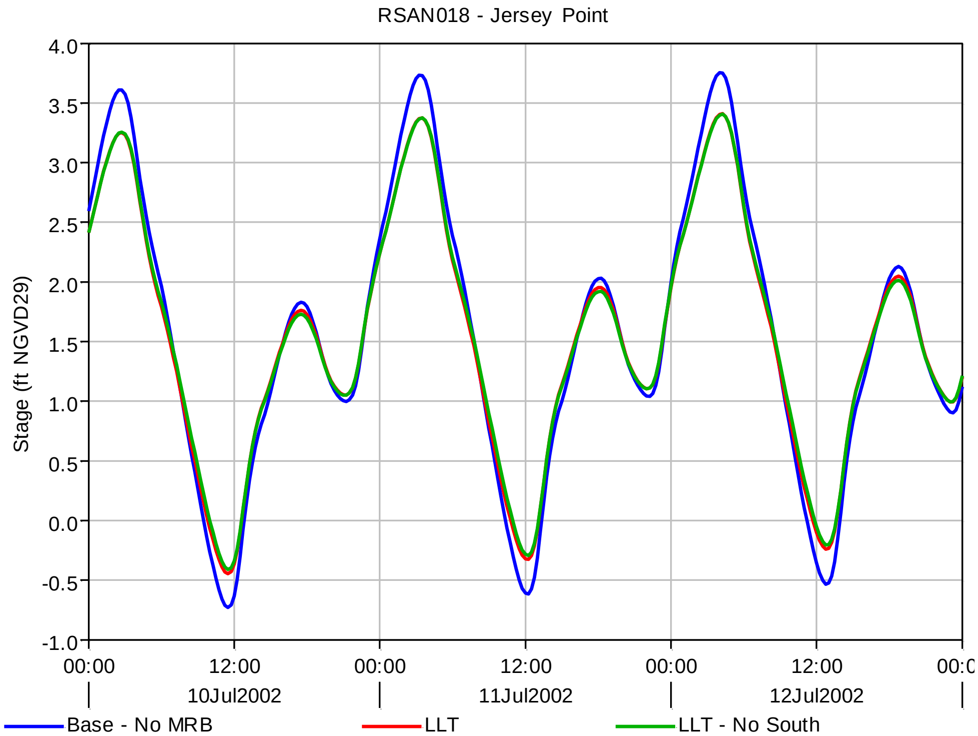


Figure 4-40 Stage at Jersey Point for Base - No MRB, LLT and LLT - No South scenarios.

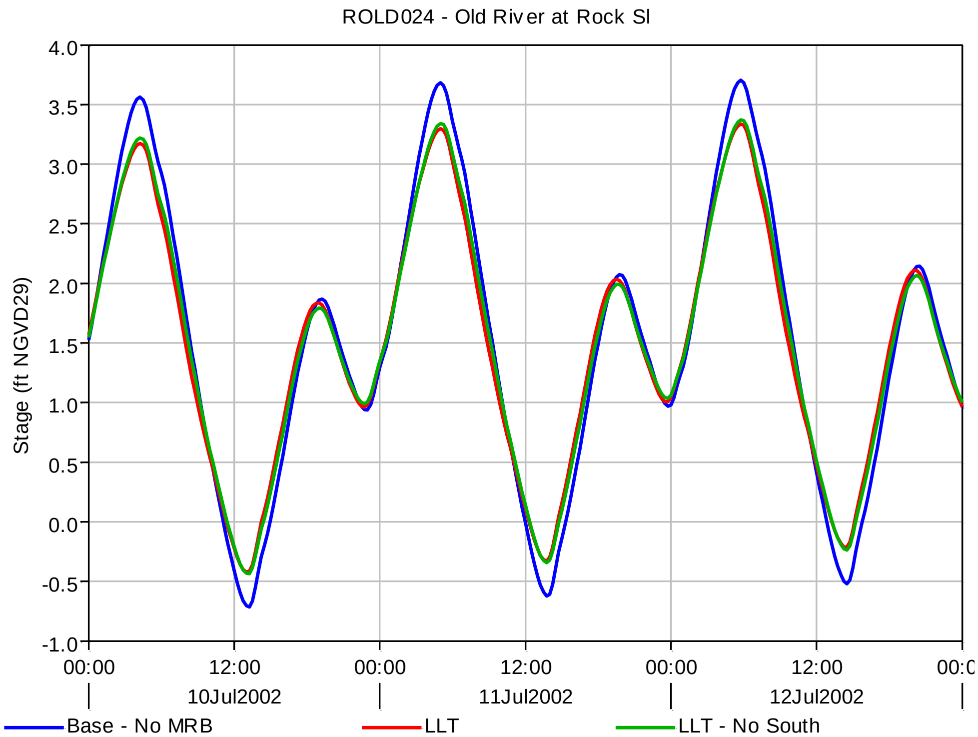


Figure 4-41 Stage at ROLD024 for Base - No MRB, LLT and LLT - No South scenarios.

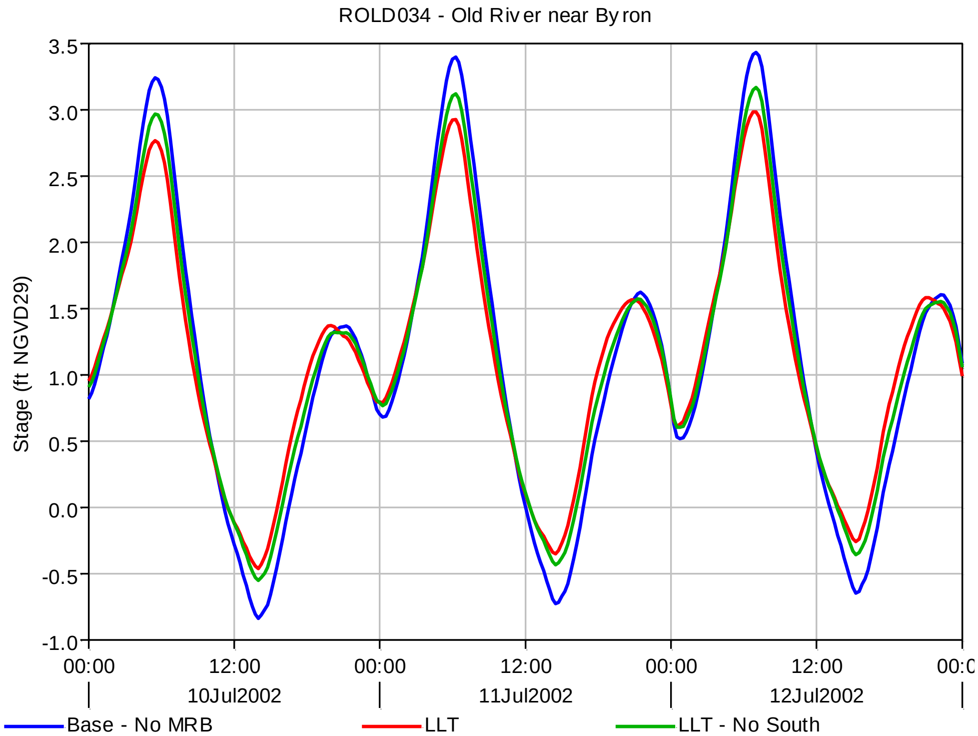


Figure 4-42 Stage at ROLD034 Base – No MRB, LLT and LLT - No South scenarios.

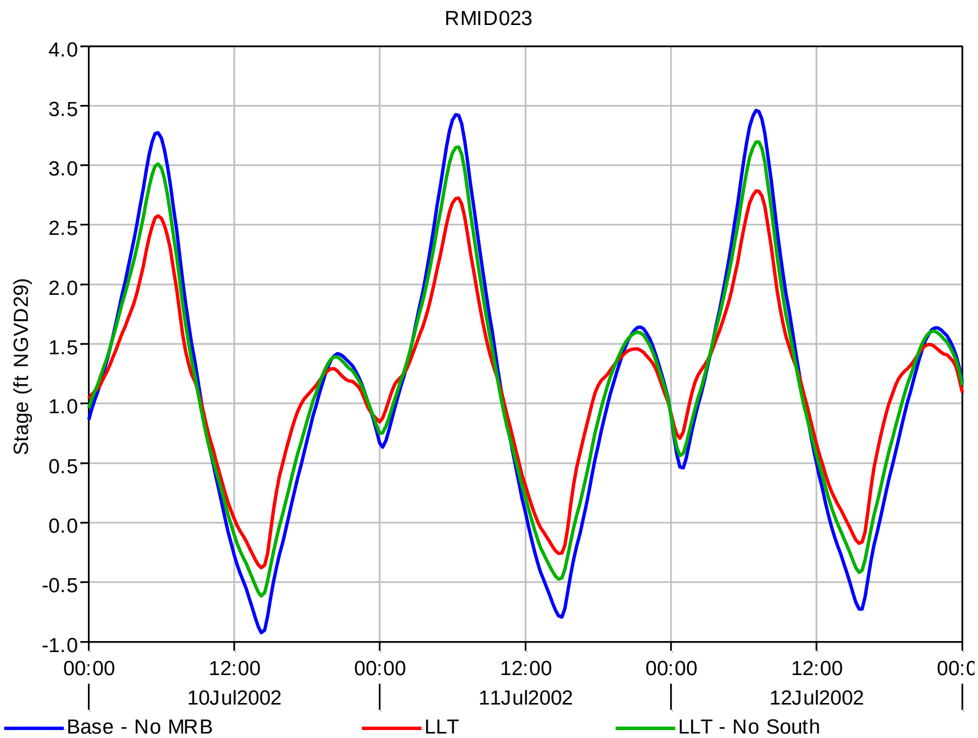


Figure 4-43 Stage RMID023 for Base - No MRB, LLT and LLT - No South scenarios.

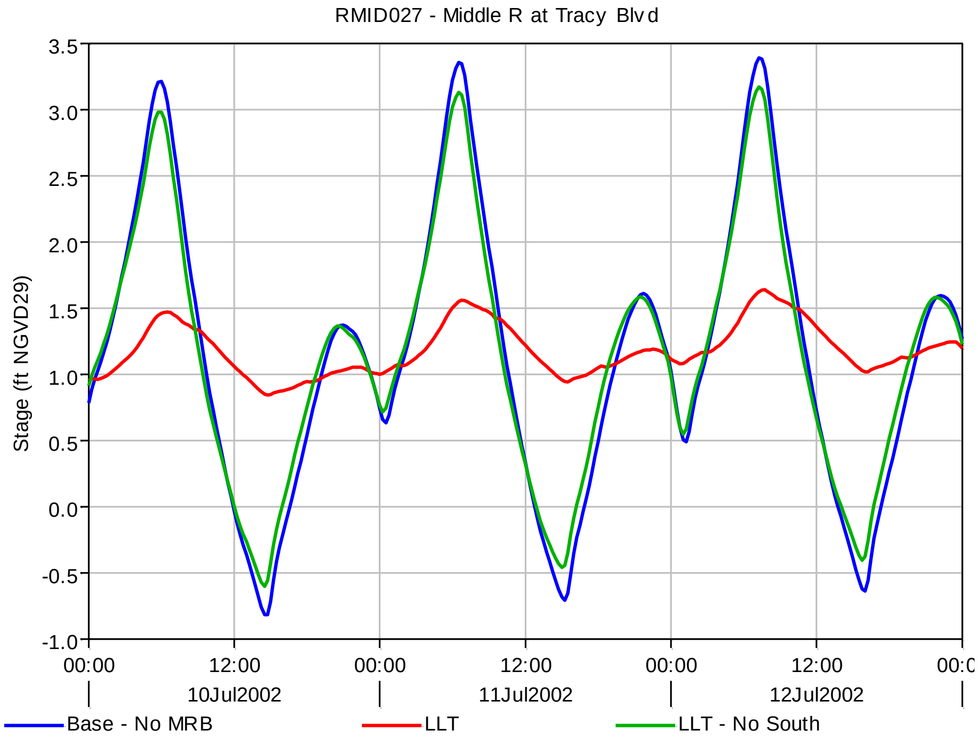


Figure 4-44 Stage at RMID027 for Base - No MRB, LLT and LLT - No South scenarios.

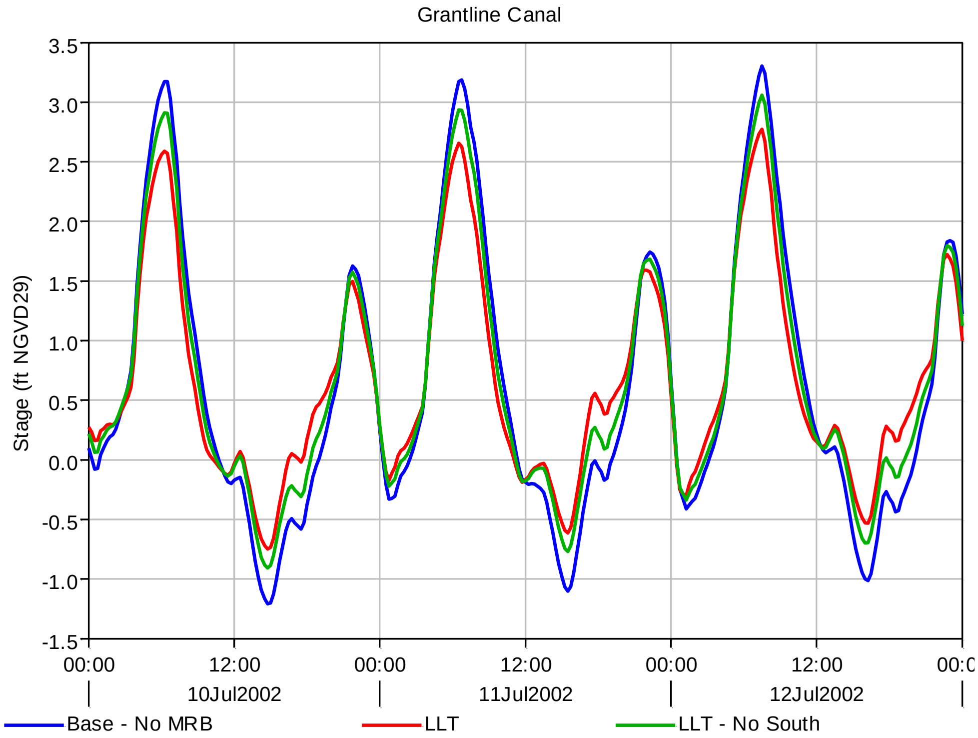


Figure 4-45 Stage in Grantline Canal for Base - No MRB, LLT and LLT - No South scenarios.

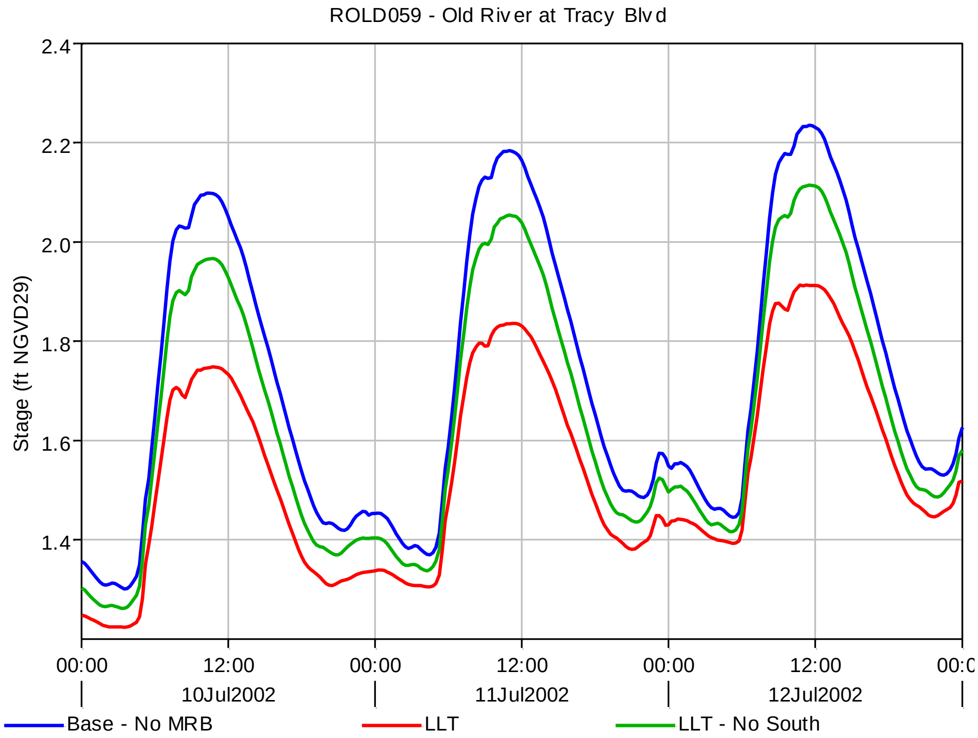


Figure 4-46 Stage at ROLD059 for Base - No MRB, LLT and LLT - No South scenarios.

4.2.2.5 Bed Shear

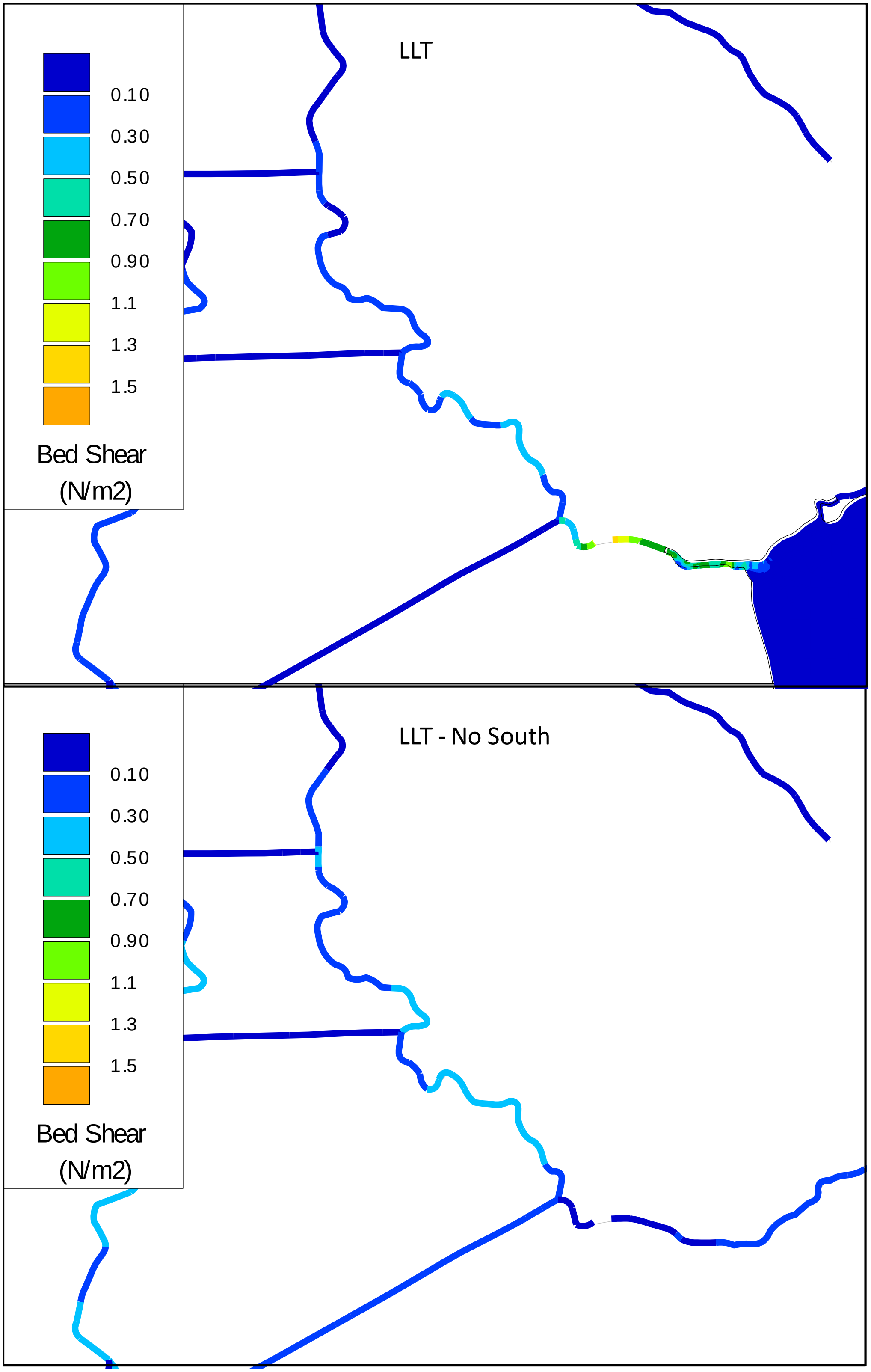


Figure 4-47 Comparison of Middle River bed shear for the LLT and LLT- No South simulations at times of peak bed shear during July 2002.

4.2.3 LLT – Middle River Conveyance

Three-month average flows for LLT-Middle River are compared with base case and LLT flows in Table 4-8 and Figure 4-50. The increased conveyance in Middle River shifts reverse flows from Middle River (456 cfs, or 9% decrease in reverse flows at RMID015) to Old River (339 cfs or 8% increase in reverse flows at ROLD024) in the reaches downstream of Victoria Canal. RMID027 reverse flows increase by 26 cfs (58%) relative to LLT, while Victoria Canal reverse flows decrease by 45 cfs (1%).

Plots of flows in Middle River at RMID015 and through the Union Island breach shown in Figure 4-48 illustrate that with the increased conveyance in Middle River, breach flows are more in phase with Middle River flows, resulting in the increased tidal flows in Middle River. With the increased tidal flow in Middle River, net flows shift to Old River for the LLT – Middle River case.

The increased tidal prism for the LLT - Middle River case means that the South Delta ROA contains more water volume at high water relative to the LLT case. Figure 4-49 shows the stage time series for RMID023 (Middle River at Victoria Canal) and RMID015. RMID023 is located just downstream of Victoria Canal. Upstream of the junction with Victoria Canal, the channel area decreases sharply in the LLT case, while the channel area remains larger for the LLT - Middle River case. The LLT - Middle River case (red line) suggests that low water is delayed at RMID023 because a larger volume is draining from the south Delta ROAs due to the increased tidal prism for the LLT - Middle River case relative to the LLT case.

At RSAN058, LLT – Middle River reduces average flow by 54 cfs (14%) relative to LLT. In the San Joaquin River at San Andreas and below, in the north Delta, along the Sacramento River and at Martinez, average flows change by 1% or less. Average flow in Montezuma Slough at head decreases from 13 cfs flowing into the marsh for LLT to 0 for LLT-Middle River (100% decrease). At the mouth of the slough, flow into the marsh increases by 10 cfs (5%).

Tidal prism and percent change from base tidal prism is tabulated in Table 4-9 and plotted in Figure 4-51 and Figure 4-52. LLT – Middle River increases tidal prism in Middle River at RMID015 by 30% and at RMID027 by 173% relative to LLT. In Old River, there is no change in tidal prism at ROLD024, but a 19% increase at ROLD034. Tidal prism in Victoria Canal increases by 17% relative to LLT. Tidal prism in San Joaquin River changes by 2% or less relative to LLT. In the Sacramento River, Cache Slough, Montezuma Slough and Martinez, tidal prism changes by 0 to 1%. Tidal Prism decreases by 2% in DCC and Miner Slough, and increases by 7% in Georgiana Slough.

Profile plots of July 2002 MHHW, MSL and MLLW, in Figure 4-54 through Figure 4-57, show that relative to LLT, the LLT – Middle River MHHW is lower in the San Joaquin River from about San Andreas to the upstream boundary. MLLW is higher from San Andreas to just upstream of Rough and Ready Island. In Middle River, LLT – Middle River MHHW is lower and MLLW is higher from San Joaquin River to just upstream of Victoria Canal. Above this point, the MHHW is higher and the MLLW is lower. This could indicate that the "bottleneck" to filling and draining as moved from above Victoria Canal to below Victoria Canal. Relative to LLT, MSL is slightly lower in Middle River upstream of Victoria Canal and in the uppermost portion of San Joaquin River. Sacramento River and Montezuma Slough profiles show minimal difference between LLT and LLT – Middle River MLLW, and virtually no change in MHHW or MSL.

For reference, time series plots of stage are provided for various locations in Figure 4-61 through Figure 4-69. A map of locations plotted is shown in Figure 4-2.

Color contour plots of peak bed shear in Middle River during July 2002 are shown for LLT – Middle River in comparison with LLT. With increased conveyance capacity in Middle River, the peak overall Middle River bed shear is reduced from about 1.3 N/m^2 to below 0.7 N/m^2. Bed shear in the reach between Railroad Cut and Victoria Canal is increased relative to LLT, while the highest bed shear upstream of Victoria Canal is decreased.

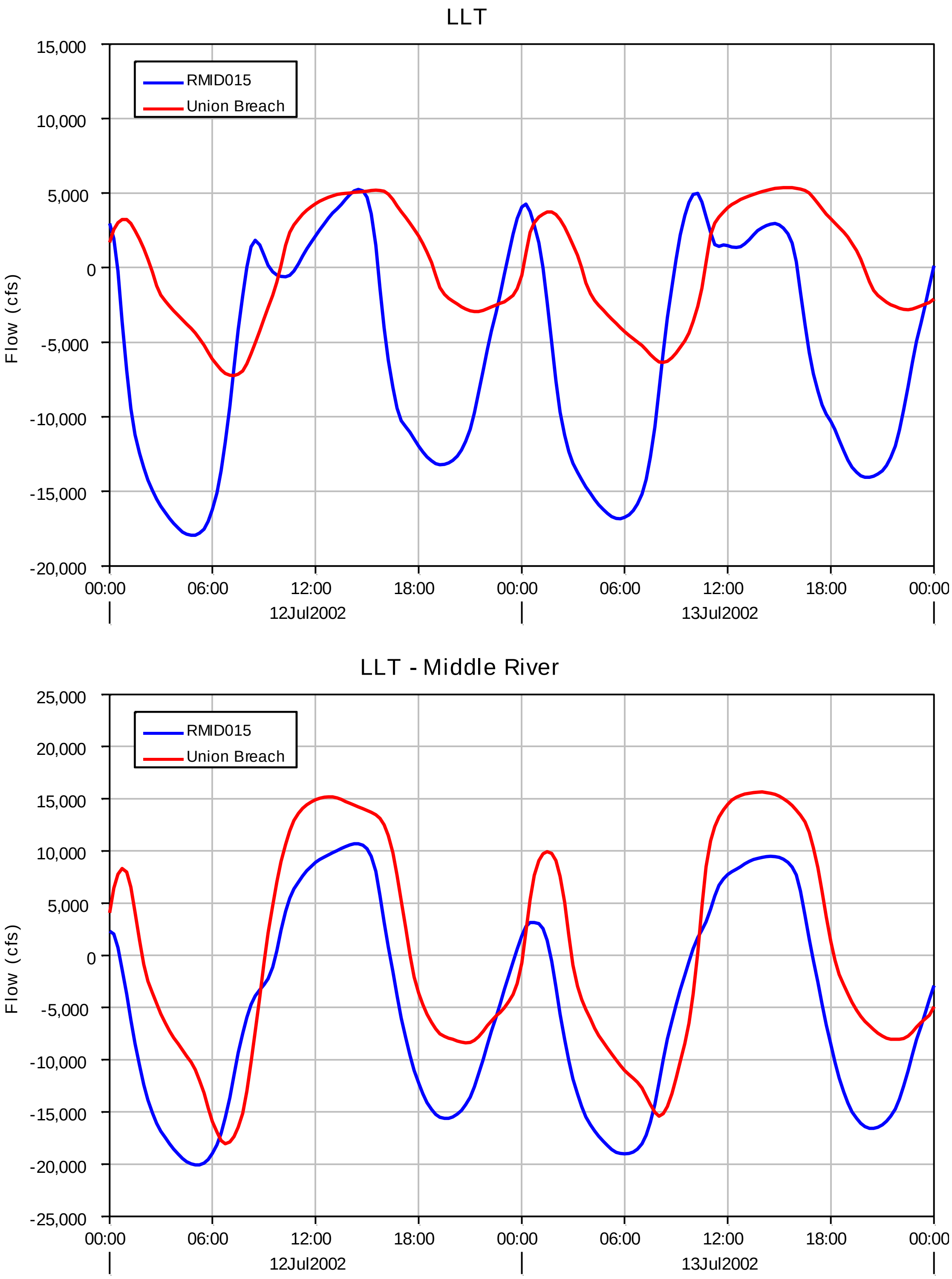


Figure 4-48 Flows in Middle River at RMID015 and through the Union Island breach for the LLT and LLT - Middle River cases.

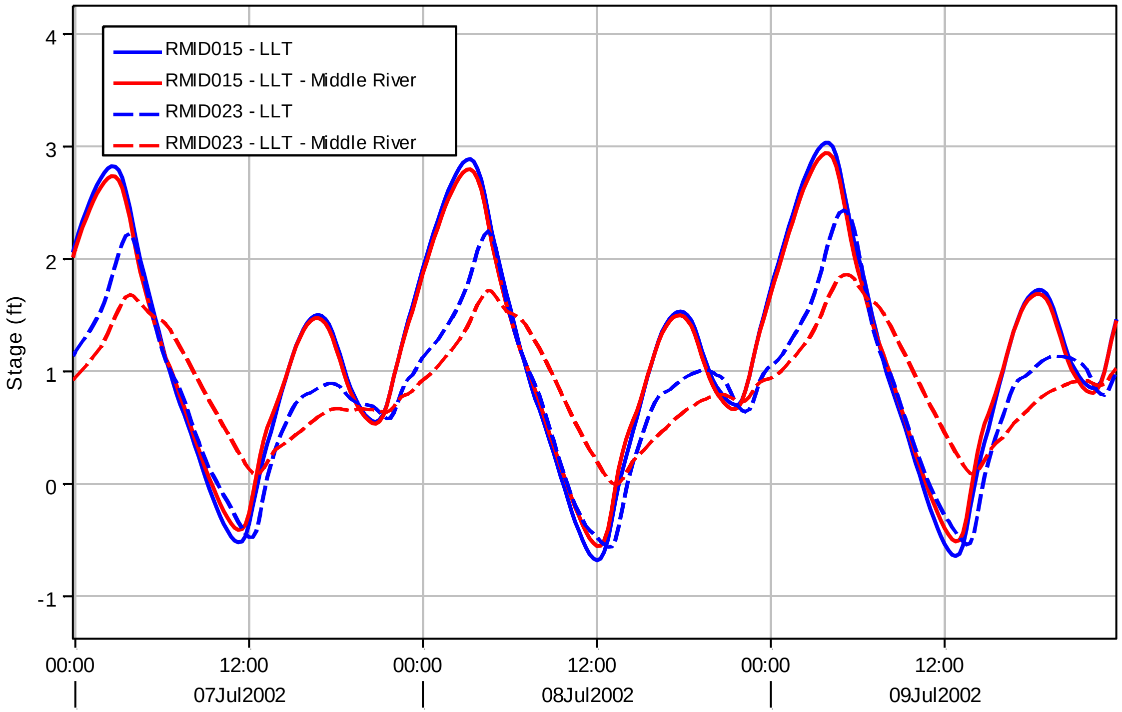


Figure 4-49 Comparison of stage at RMID015 and RMID023 for LLT and LLT - Middle River.

4.2.3.1 Net Flows

Table 4-8 Summary of 3-month Average flow (Jul – Sep 2002) for Base - No MRB, LLT, LLT – Middle River simulations.

Location	3-month Average Flow, Jul – Sep 2002 (cfs)		
	Base – No MRB	LLT	LLT – Middle River
Cache Sl at Ryer	1535	2565	2584
DCC	4609	3449	3435
False River	-1696	-1806	-1821
Martinez	4422	4080	4080
Miner Slough	2018	2667	2671
Mokelumne nr SJR	4719	3781	3745
Montezuma Sl at Head	12	13	0
Montezuma Sl at Mouth	-71	-191	-201
RMID015	-5351	-5265	-4809
RMID027	-25	-45	-71
ROLD024	-4425	-4541	-4880
ROLD034	-6493	-6603	-6579
RSAC075 Chipps Island	4503	4395	4403
RSAC092 Emmaton	5870	6484	6471
RSAC101 Rio Vista	8256	9712	9750
RSAC123	3607	4258	4286
RSAC128	10999	10137	10130
RSAN018 Jersey Pt	-999	-1914	-1901
RSAN032 San Andreas	-1716	-3216	-3204
RSAN058	366	391	337
SLDUT007	-113	68	62
SLGEO019 Georgiana Sl	2762	2408	2388
SLTRM004 Threemile Sl	-2313	-3012	-3058
Steamboat Sl	2280	2629	2634
Sutter Sl	2965	3480	3482
Victoria Canal	-3580	-3486	-3441

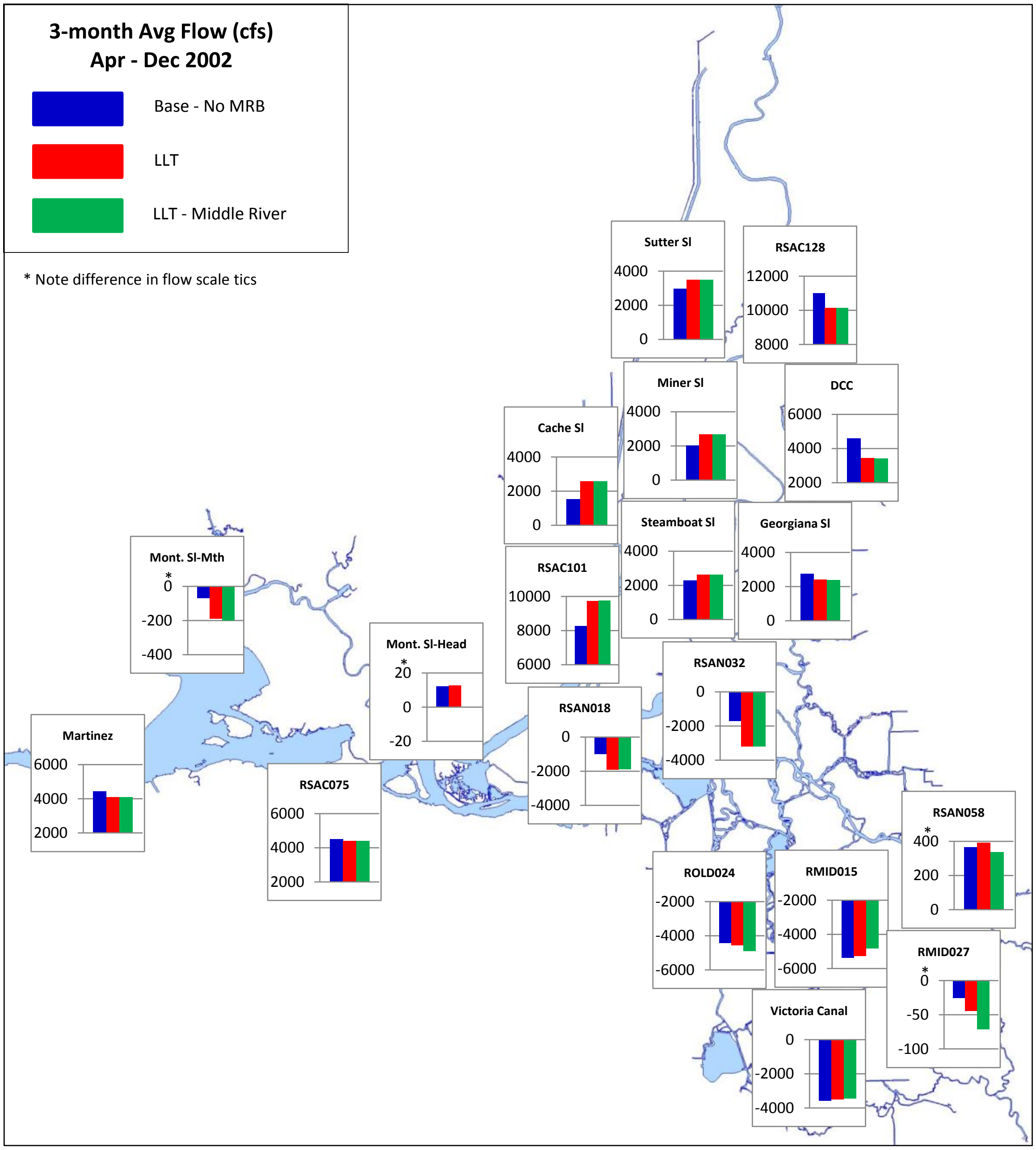


Figure 4-50 Average flows (Jul - Sep 2002) for Base - No MRB, LLT and LLT – Middle River simulations.

4.2.3.2 Tidal Prism

Table 4-9 Summary of Apr – Dec 2002 Average Tidal Prism for Base - No MRB, LLT and LLT – Middle River simulations, and percent change from Base - No MRB.

Location	Base – No MRB	LLT		LLT – Middle River	
	Tidal Prism (ac-ft)	Tidal Prism (ac-ft)	% Change from Base	Tidal Prism (ac-ft)	% Change from Base
Cache Sl at Ryer	28,697	26,884	-6%	27,080	-6%
DCC	782	949	21%	928	19%
False River	18,870	16,508	-13%	16,239	-14%
Martinez	167,717	170,966	2%	171,263	2%
Miner Slough	618	455	-26%	447	-28%
Mokelumne nr SJR	4,615	4,490	-3%	4,542	-2%
Montezuma Sl at Head	2,053	3,283	60%	3,275	60%
Montezuma Sl at Mouth	10,988	23,108	110%	23,110	110%
RMID015	4,119	3,333	-19%	4,326	5%
RMID027	474	1,784	277%	4,879	930%
ROLD024	4,427	3,655	-17%	3,660	-17%
ROLD034	2,352	1,960	-17%	2,334	-1%
RSAC075 Chipps Island	115,263	108,506	-6%	108,113	-6%
RSAC092 Emmaton	49,256	50,591	3%	50,578	3%
RSAC101 Rio Vista	36,171	40,582	12%	40,844	13%
RSAC123	2,499	1,811	-28%	1,787	-29%
RSAN018 Jersey Pt	50,110	44,549	-11%	43,854	-12%
RSAN032 San Andreas	37,847	32,450	-14%	31,763	-16%
RSAN058	2,385	2,603	9%	2,619	10%
SLDUT007	3,073	2,226	-28%	2,170	-29%
SLGEO019 Georgiana Sl	222	415	87%	443	100%
SLTRM004 Threemile Sl	9,413	6,526	-31%	6,266	-33%
Victoria Canal	1,337	786	-41%	920	-31%

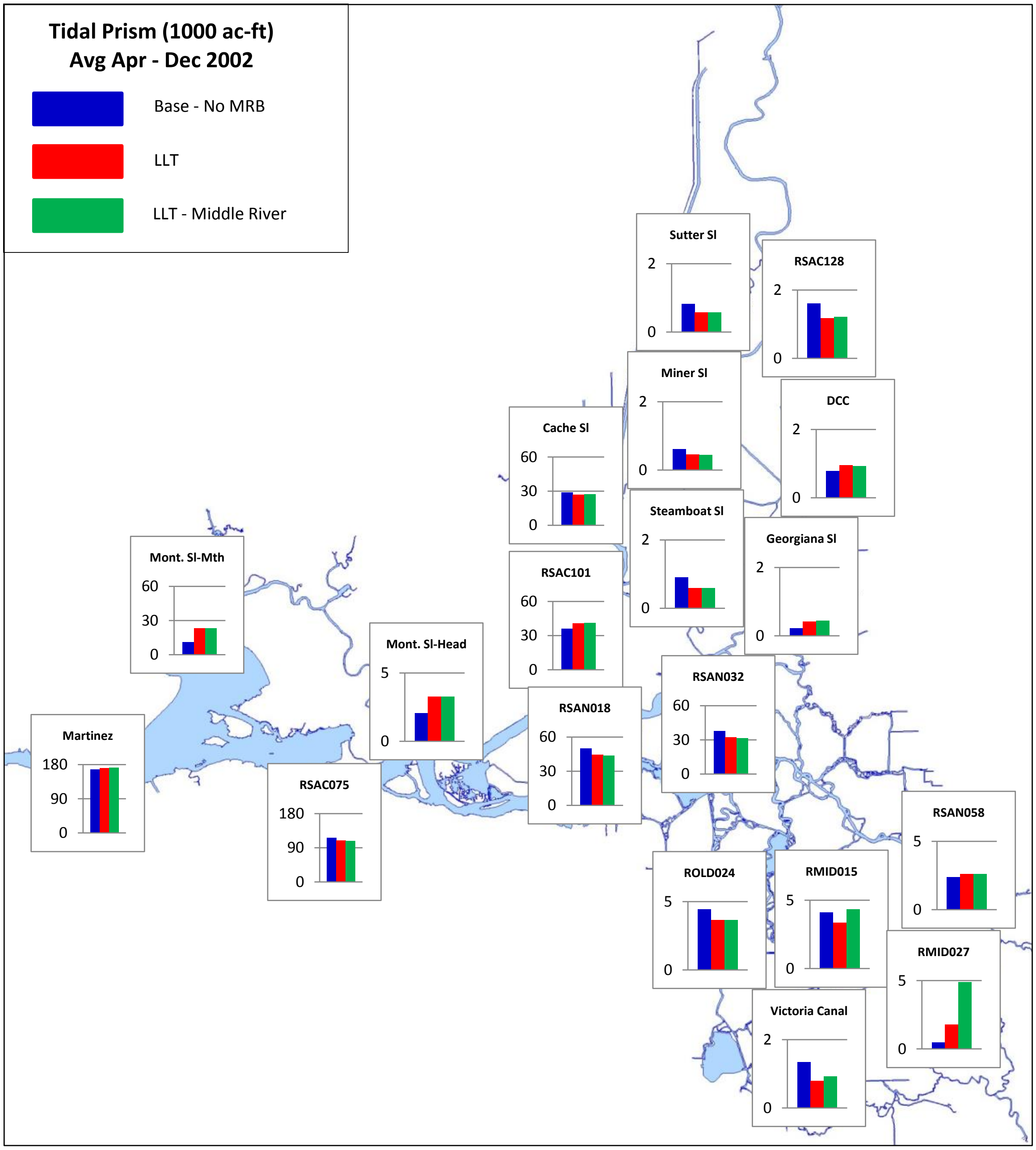


Figure 4-51 Average tidal prism (Apr - Dec 2002) for Base - No MRB, LLT and LLT – Middle River simulations.

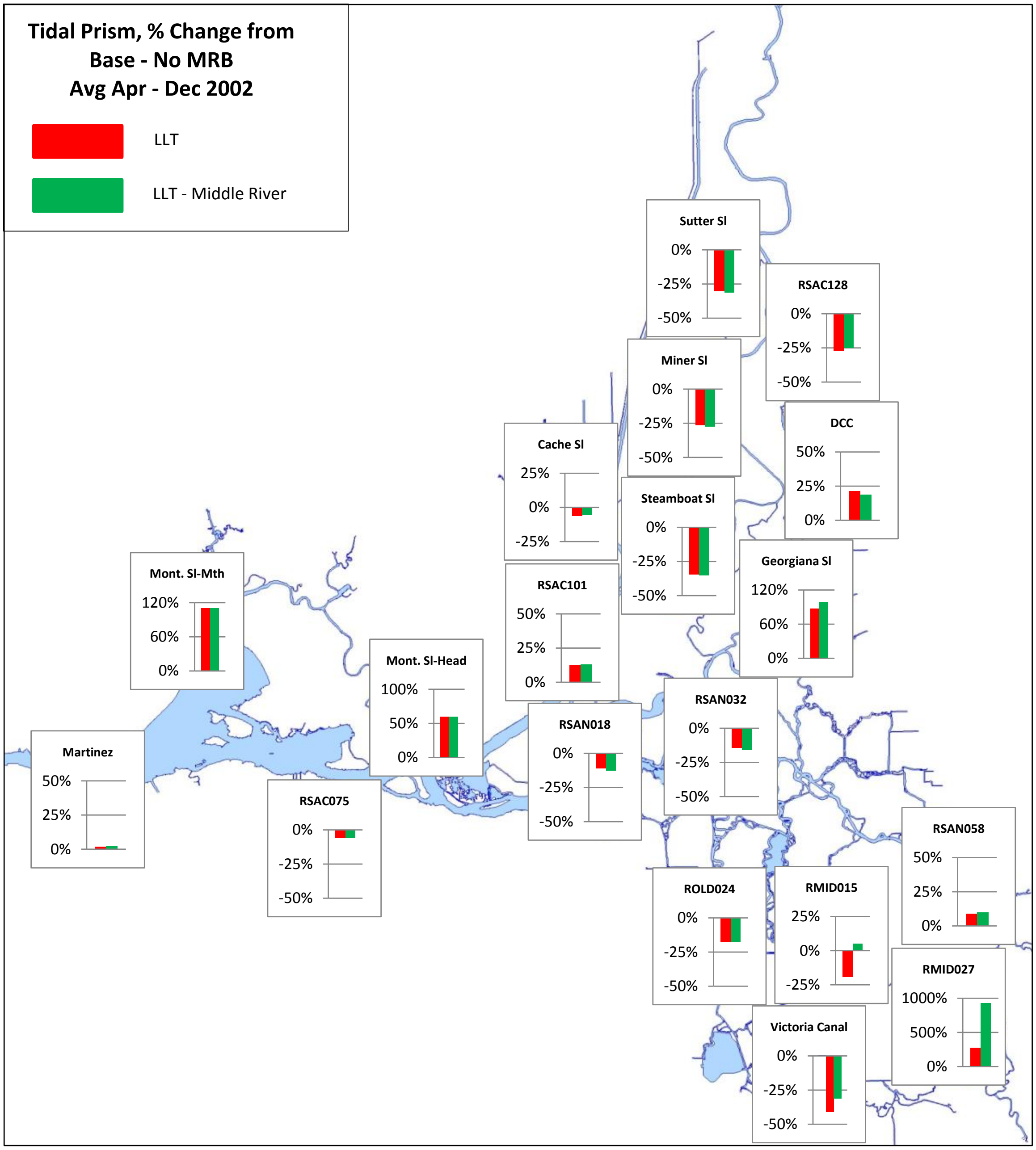


Figure 4-52 Average percent change from Base - No MRB tidal prism (Apr - Dec 2002) for LLT and LLT – Middle River simulations.

4.2.3.3 Tidal Range

Table 4-10 Summary of Apr – Dec 2002 Average Tidal Range for Base - No MRB, LLT and LLT – Middle River simulations.

	Apr – Dec 2002 Average Tidal Range (ft)		
Location	**Base – No MRB**	**LLT**	**LLT – Middle River**
Cache Sl at Ryer	3.95	2.75	2.76
DCC	2.92	2.11	2.11
False River	3.4	2.93	2.94
Martinez	5.47	5.14	5.14
Miner Slough	3.12	2.62	2.64
Montezuma Sl at Head	4.25	3.64	3.66
Montezuma Sl at Mouth	5.0	4.05	4.07
RMID015	3.76	3.14	2.94
RMID023	3.49	2.48	1.41
RMID027	3.33	0.56	1.29
ROLD024	3.55	3.02	2.86
ROLD034	3.36	2.73	2.14
RSAC075 Chipps Island	4.42	3.85	3.87
RSAC092 Emmaton	3.93	3.23	3.25
RSAC101 Rio Vista	3.86	2.79	2.8
RSAC123	2.95	2.14	2.14
RSAC128	2.91	2.12	2.12
RSAN018 Jersey Pt	3.47	2.98	3.01
RSAN032 San Andreas	3.37	2.89	2.87
RSAN058	4.05	3.25	3.18
SLDUT007 Dutch Slough	3.59	3.04	3.07
SLGEO019 Georgiana Sl	2.95	2.16	2.16
SLTRM004 Threemile Sl	3.45	2.9	2.9
Steamboat Sl	2.69	1.99	2.0
Sutter Sl	2.57	1.94	1.93
Victoria Canal	3.48	2.48	1.38

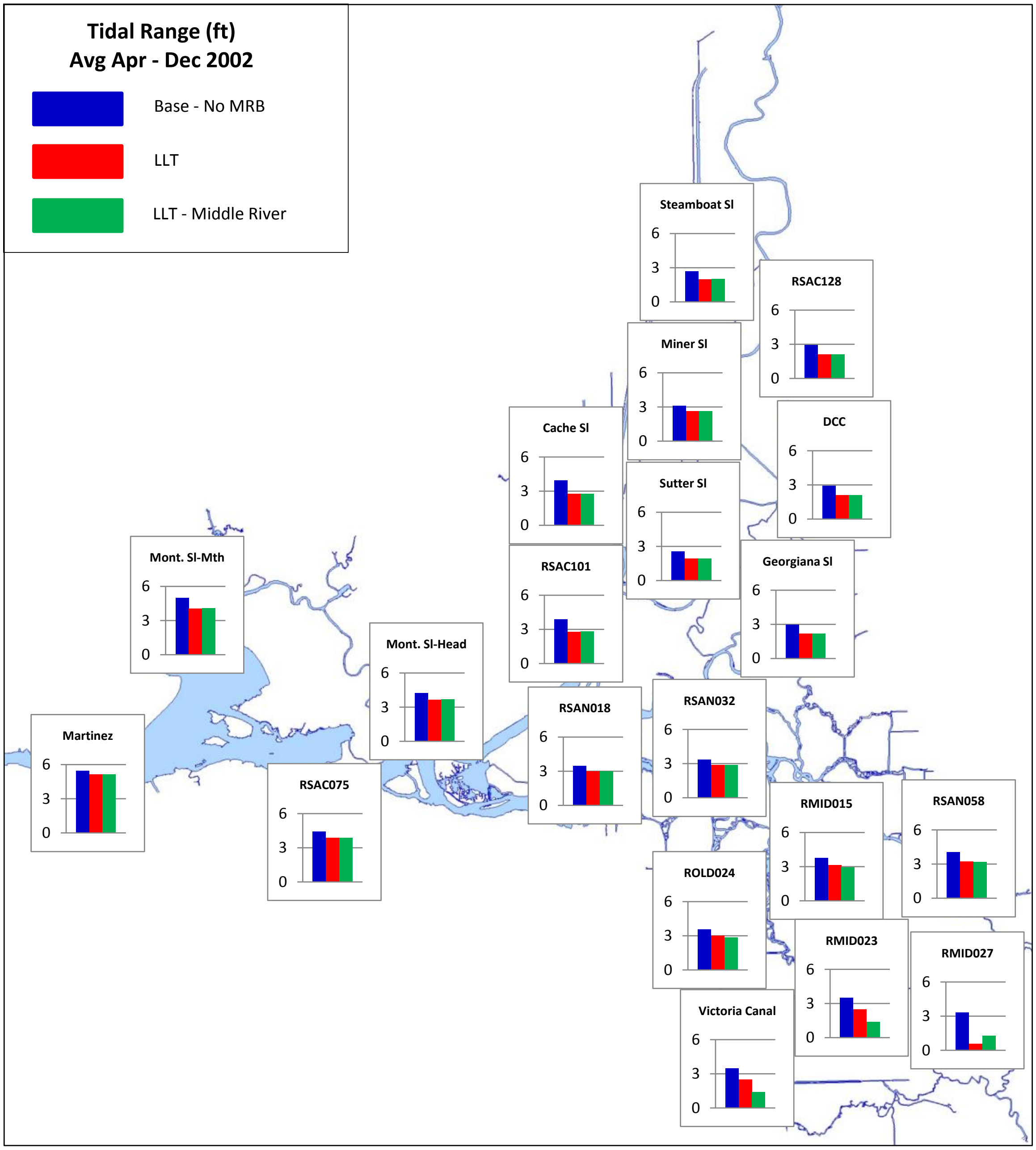


Figure 4-53 Average tidal range (Apr - Dec 2002) for Base - No MRB, LLT and LLT – Middle River simulations.

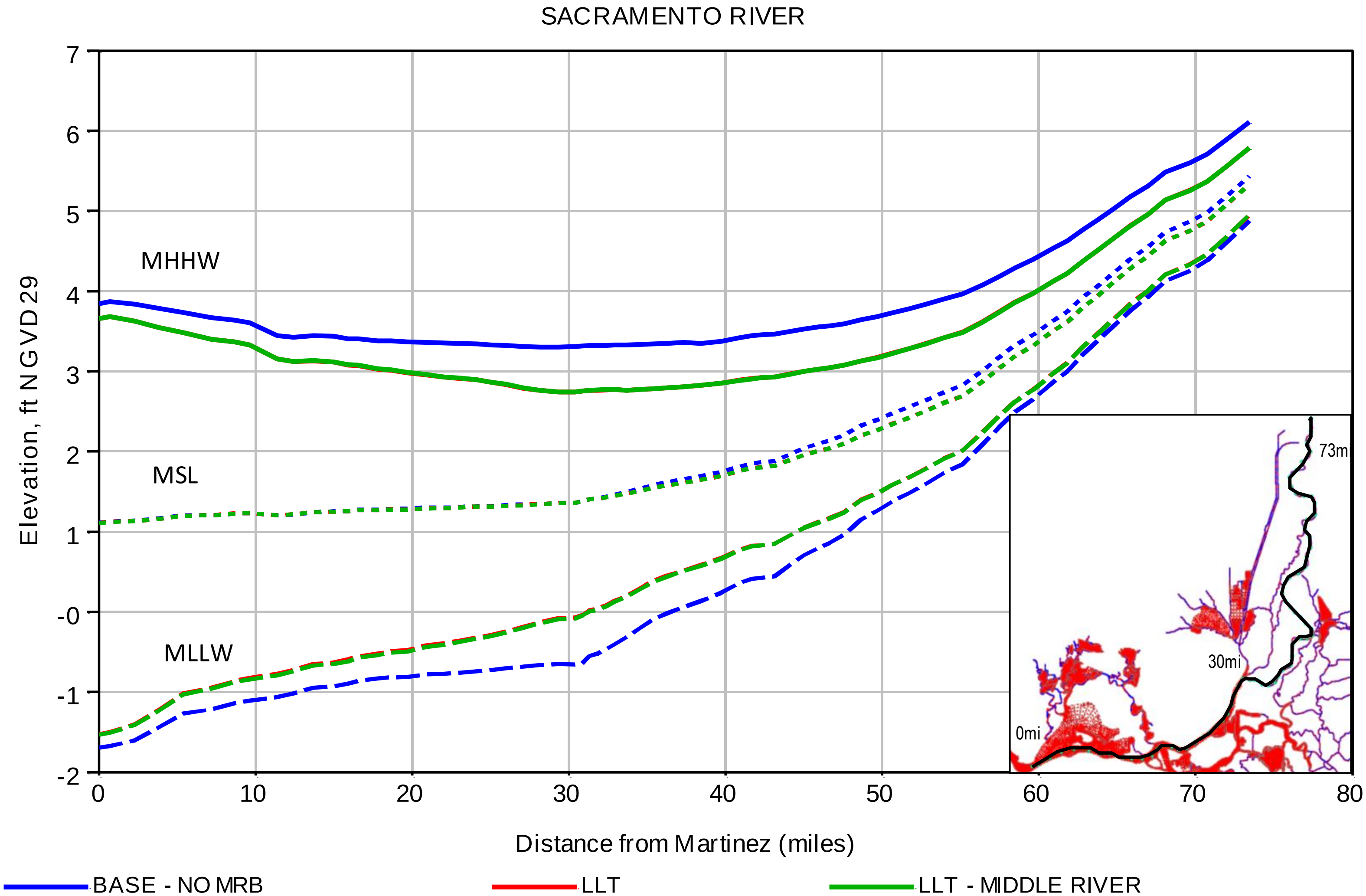


Figure 4-54 Profiles of July 2002 MHHW, MSL and MLLW along the Sacramento River for the Base - No MRB, LLT and LLT - Middle River simulations.

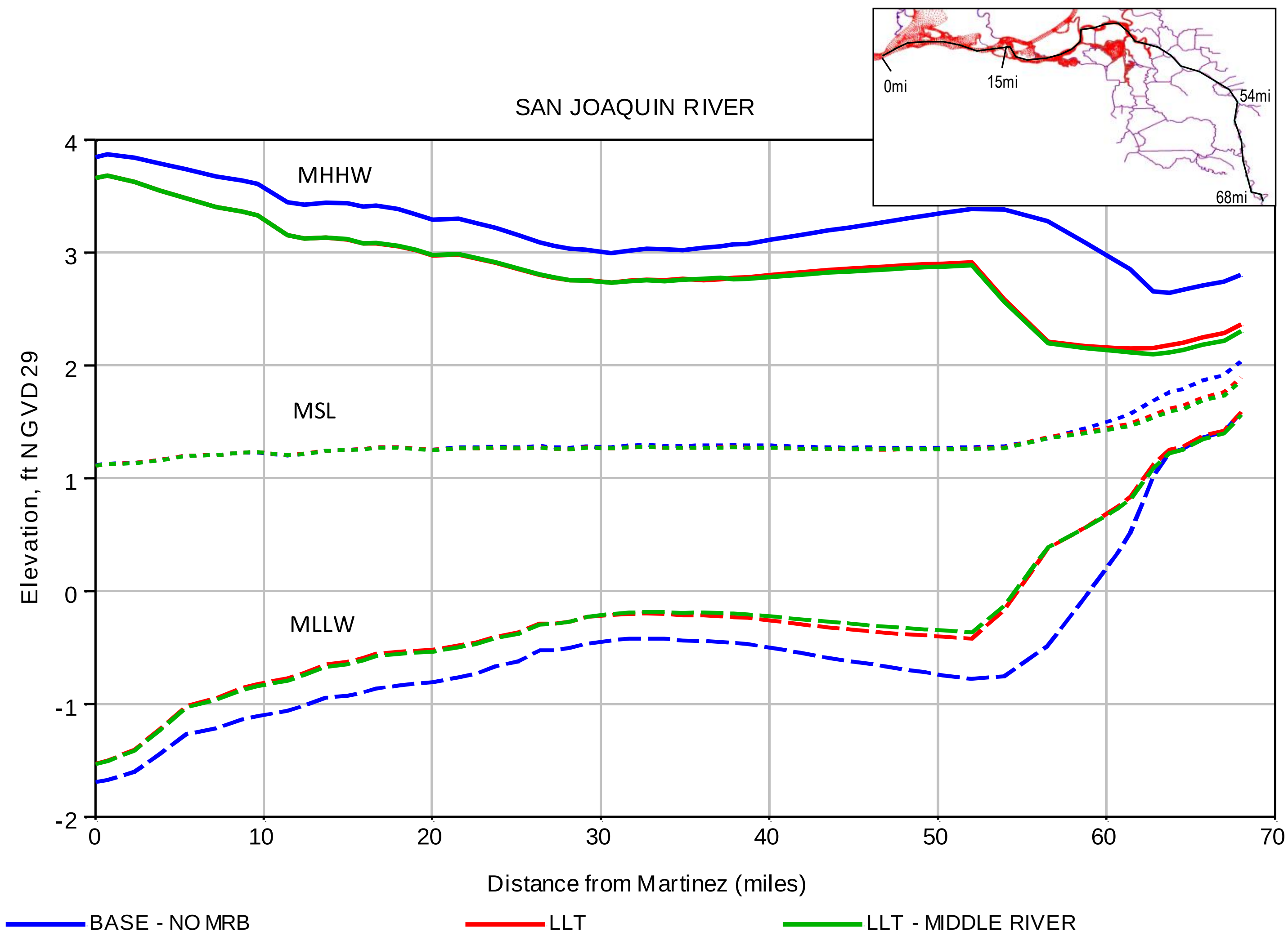


Figure 4-55 Profiles of July 2002 MHHW, MSL and MLLW along the San Joaquin River for the Base - No MRB, LLT and LLT - Middle River simulations.

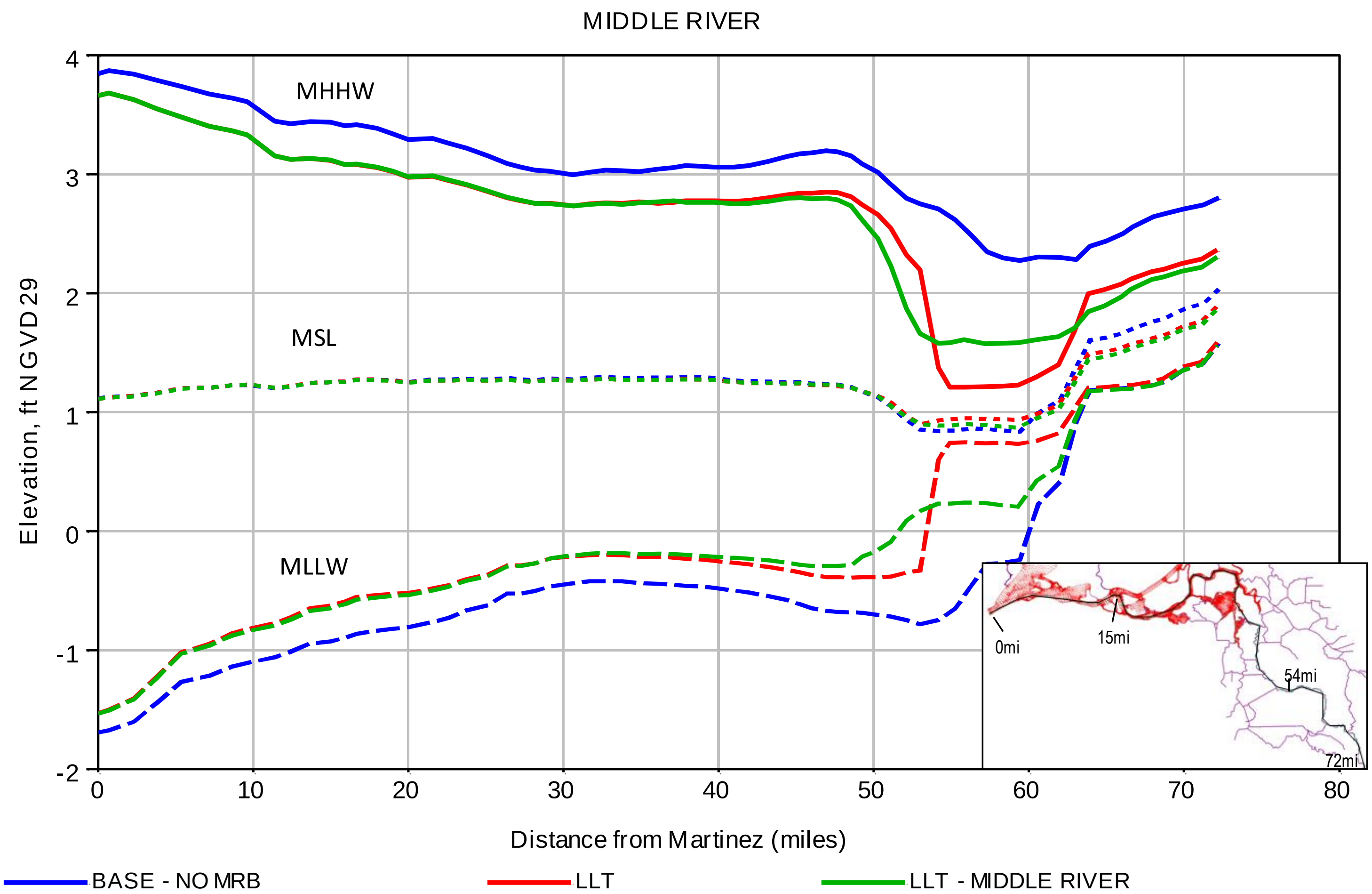


Figure 4-56 Profiles of July 2002 MHHW, MSL and MLLW along the Middle River for the Base - No MRB, LLT and LLT - Middle River simulations.

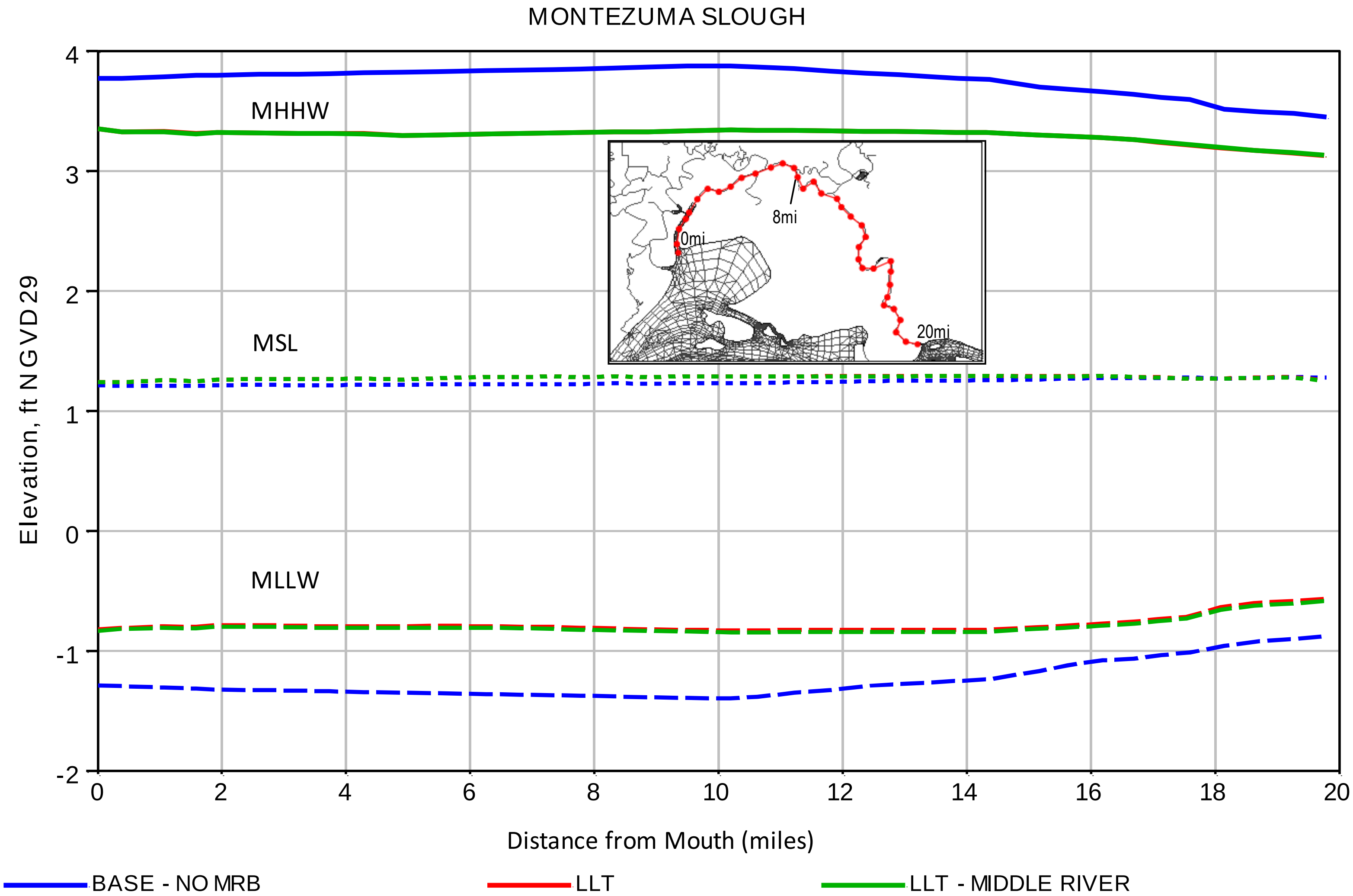


Figure 4-57 Profiles of July 2002 MHHW, MSL and MLLW along Montezuma Slough for the Base - No MRB, LLT and LLT - Middle River simulations.

4.2.3.4 Stage Time Series Plots

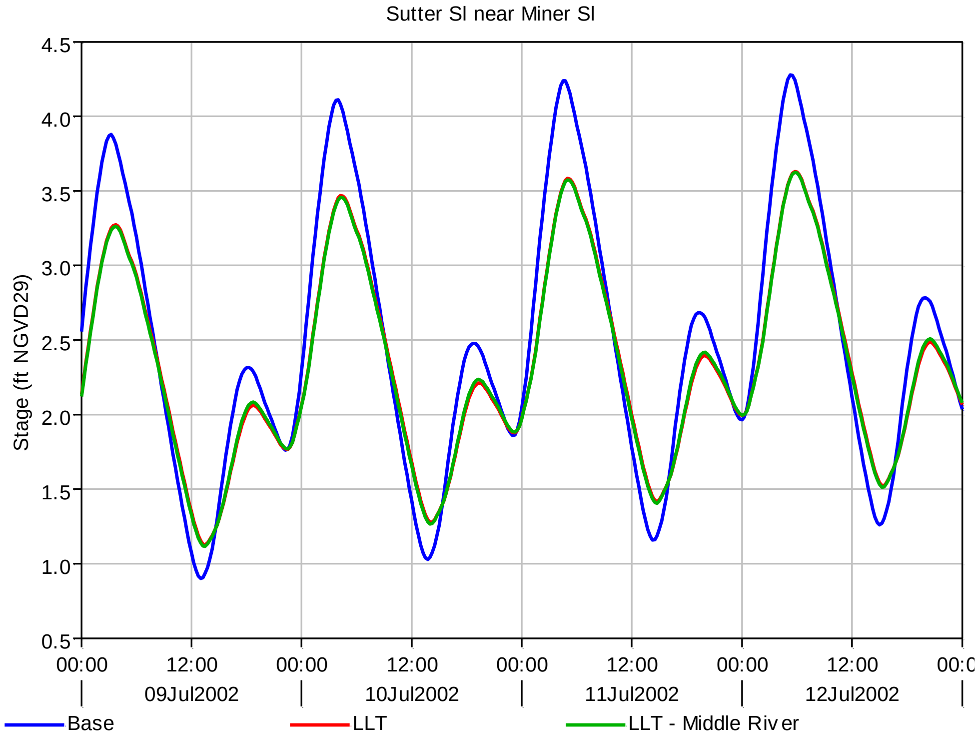


Figure 4-58 Stage in Sutter Slough for Base - No MRB, LLT and LLT - Middle River scenarios.

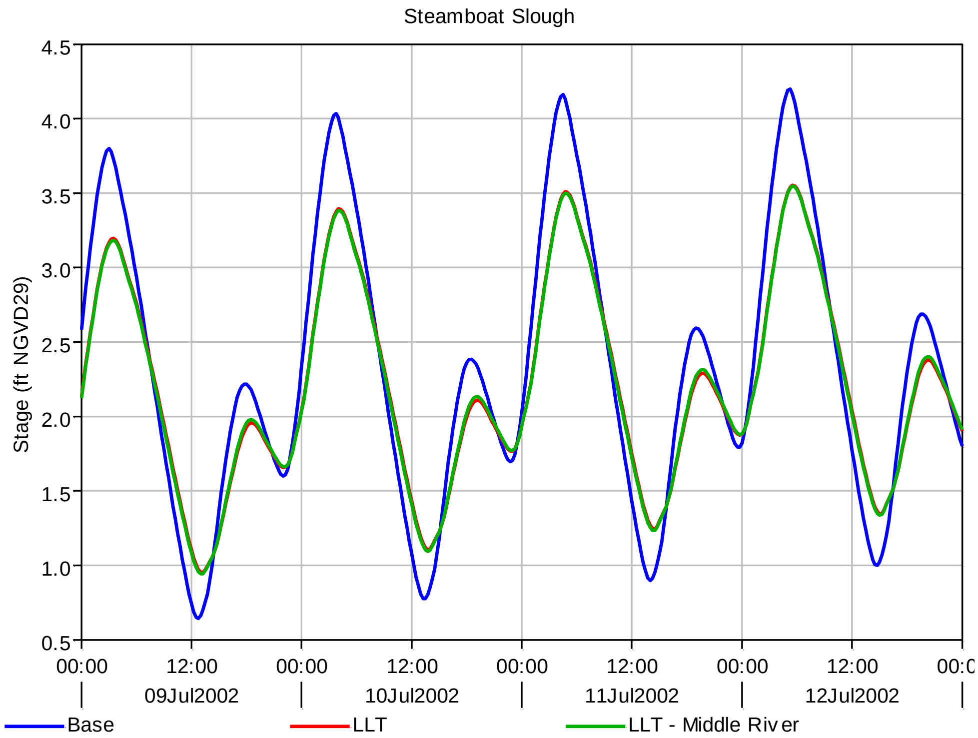


Figure 4-59 Stage in Steamboat Slough for Base - No MRB, LLT and LLT - Middle River scenarios.

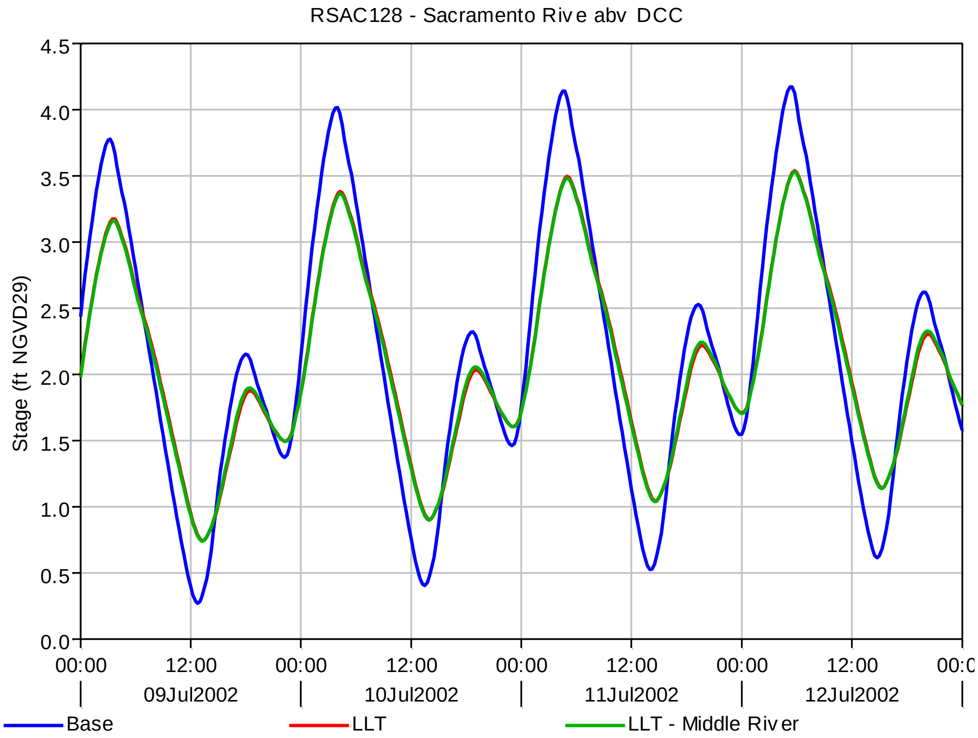


Figure 4-60 Stage at RSAC128 for Base - No MRB, LLT and LLT - Middle River scenarios.

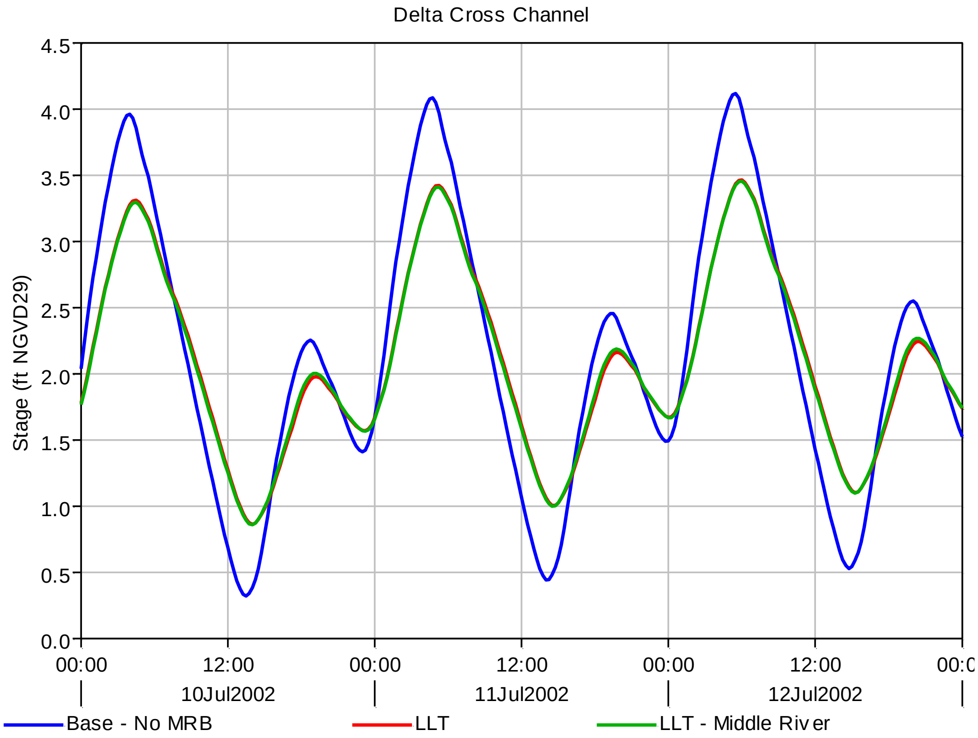


Figure 4-61 Stage at Delta Cross Channel for Base - No MRB, LLT and LLT - Middle River scenarios.

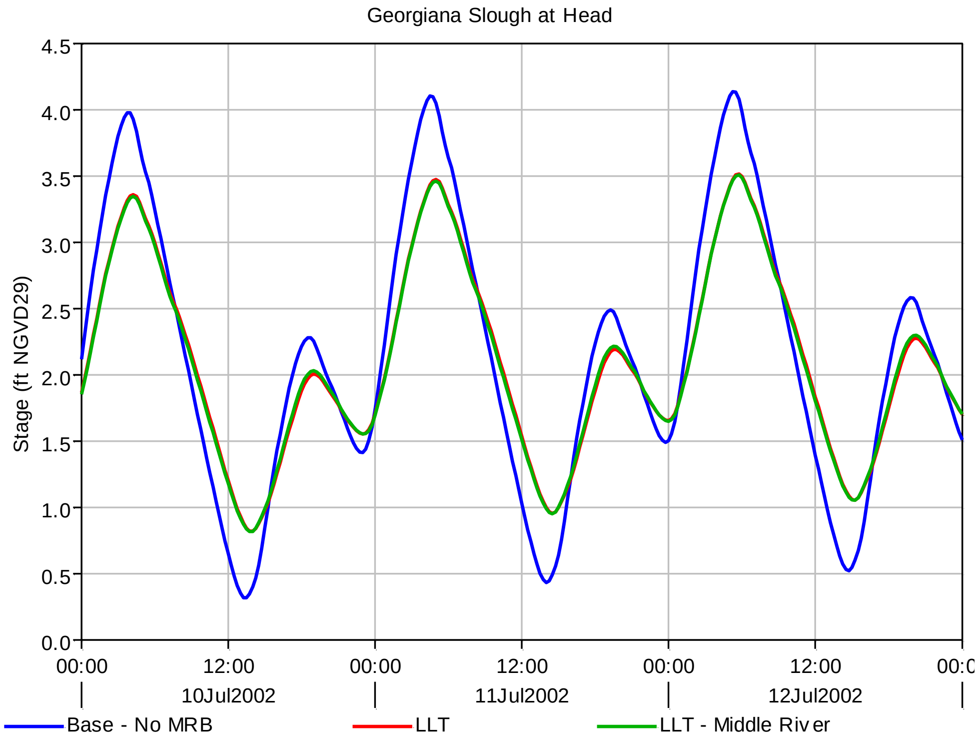


Figure 4-62 Stage at Georgiana Slough for Base - No MRB, LLT and LLT - Middle River scenarios.

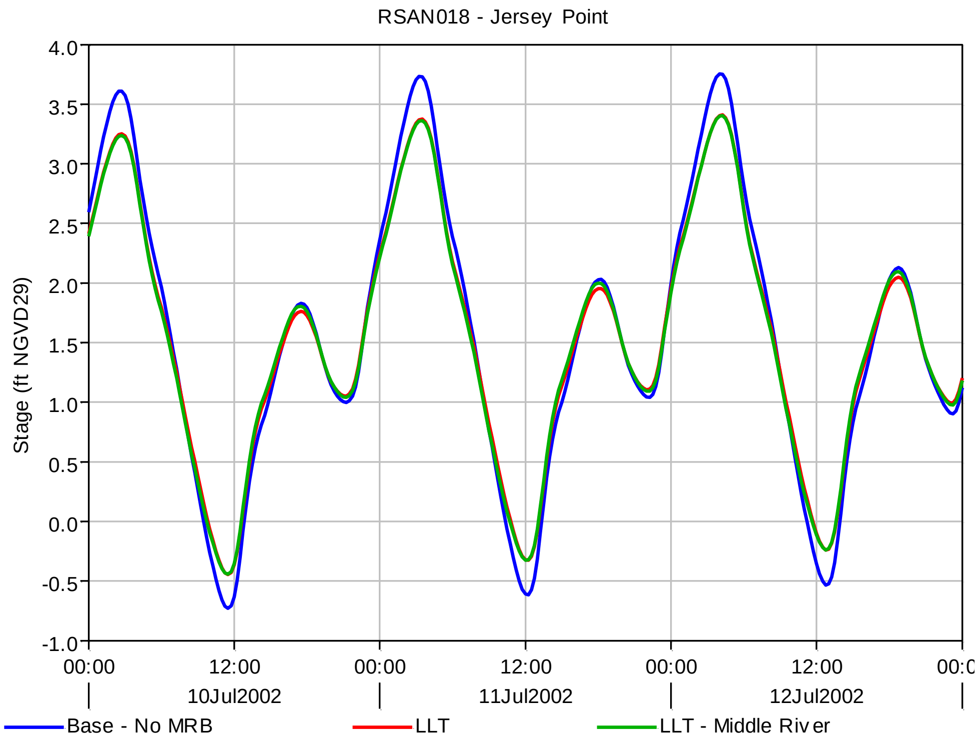


Figure 4-63 Stage at Jersey Point for Base - No MRB, LLT and LLT - Middle River scenarios.

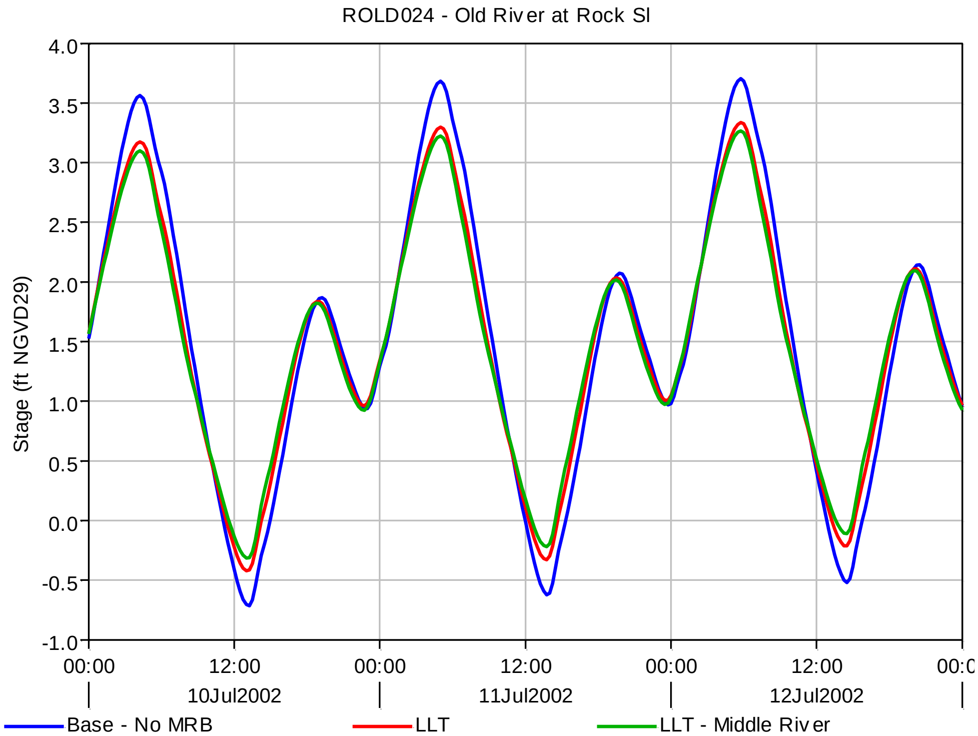


Figure 4-64 Stage at ROLD024 for Base - No MRB, LLT and LLT - Middle River scenarios.

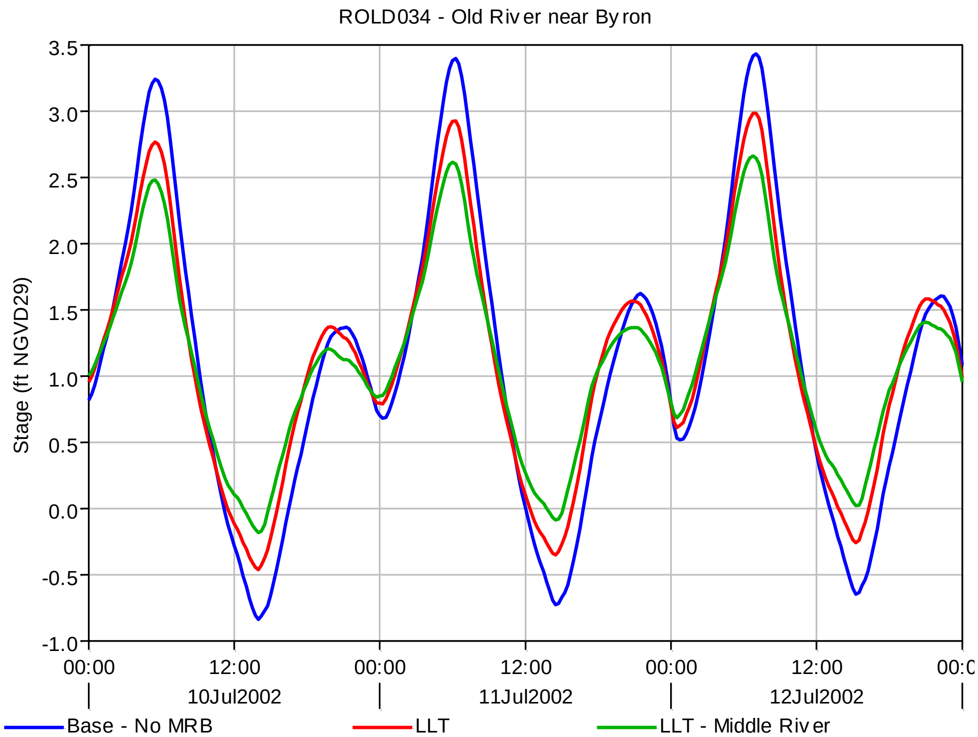


Figure 4-65 Stage at ROLD034 Base, LLT and LLT - Middle River scenarios.

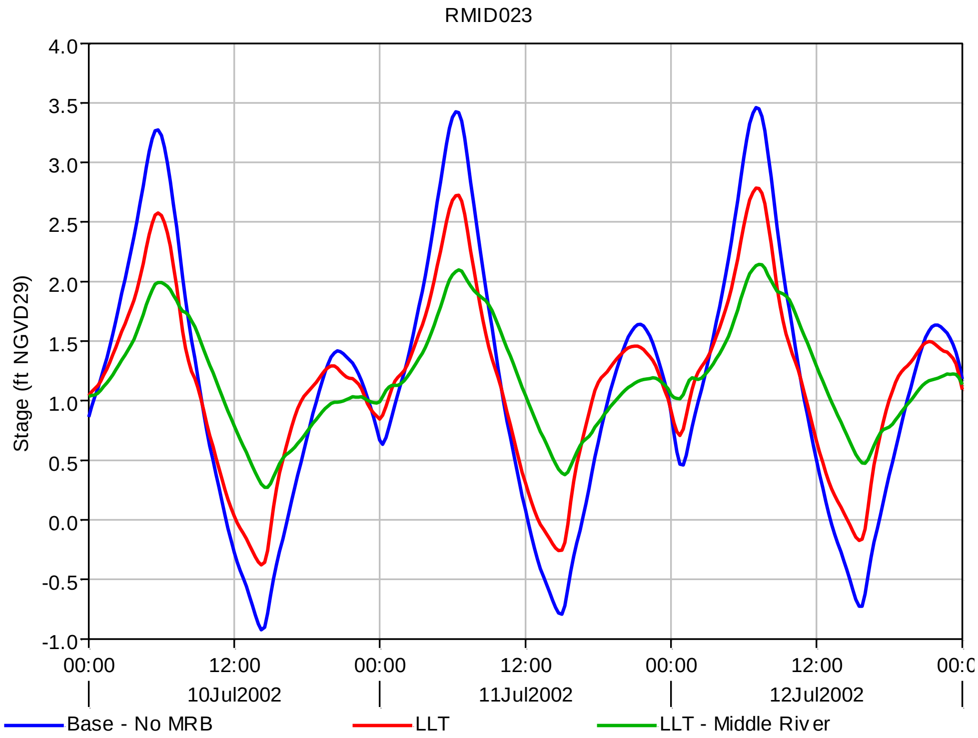


Figure 4-66 Stage RMID023 for Base - No MRB, LLT and LLT - Middle River scenarios.

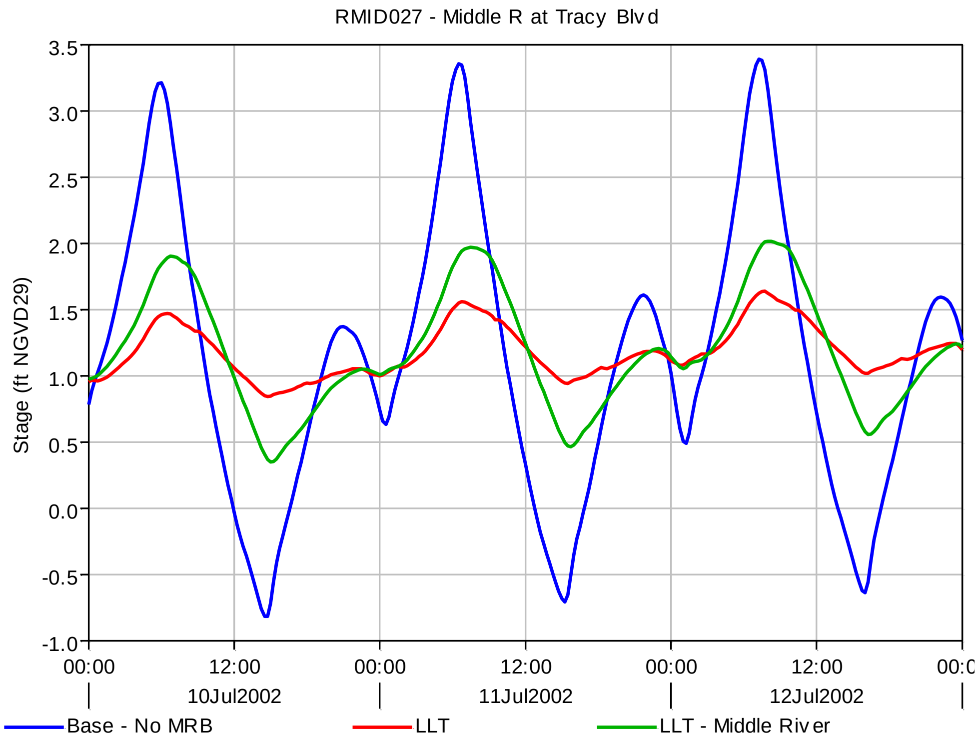


Figure 4-67 Stage at RMID027 for Base - No MRB, LLT and LLT - Middle River scenarios.

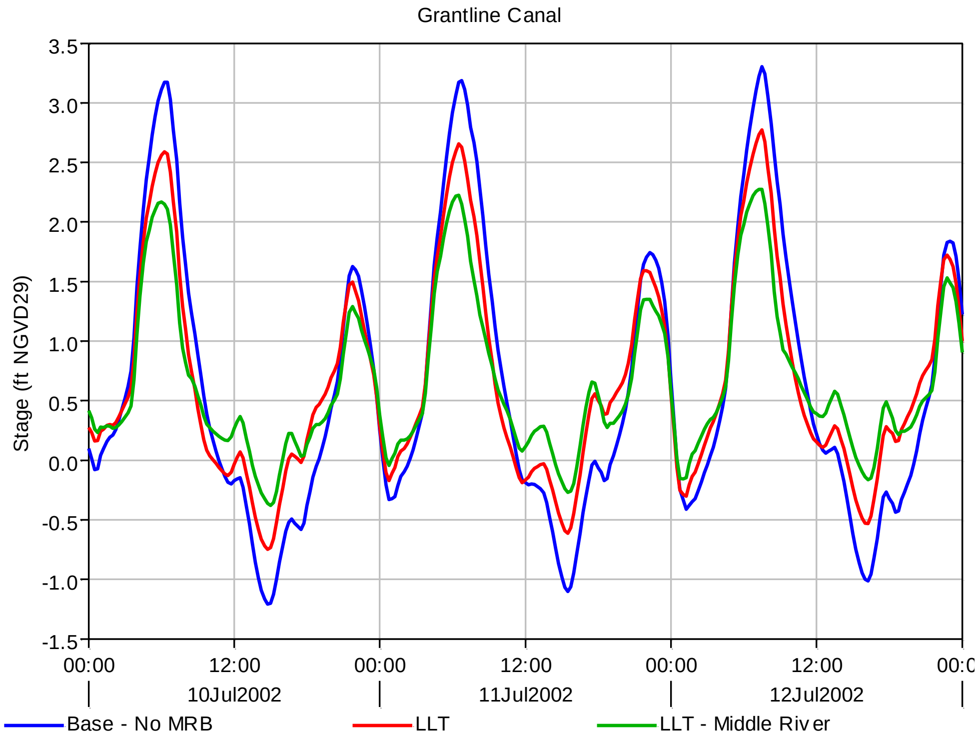


Figure 4-68 Stage in Grantline Canal for Base - No MRB, LLT and LLT - Middle River scenarios.

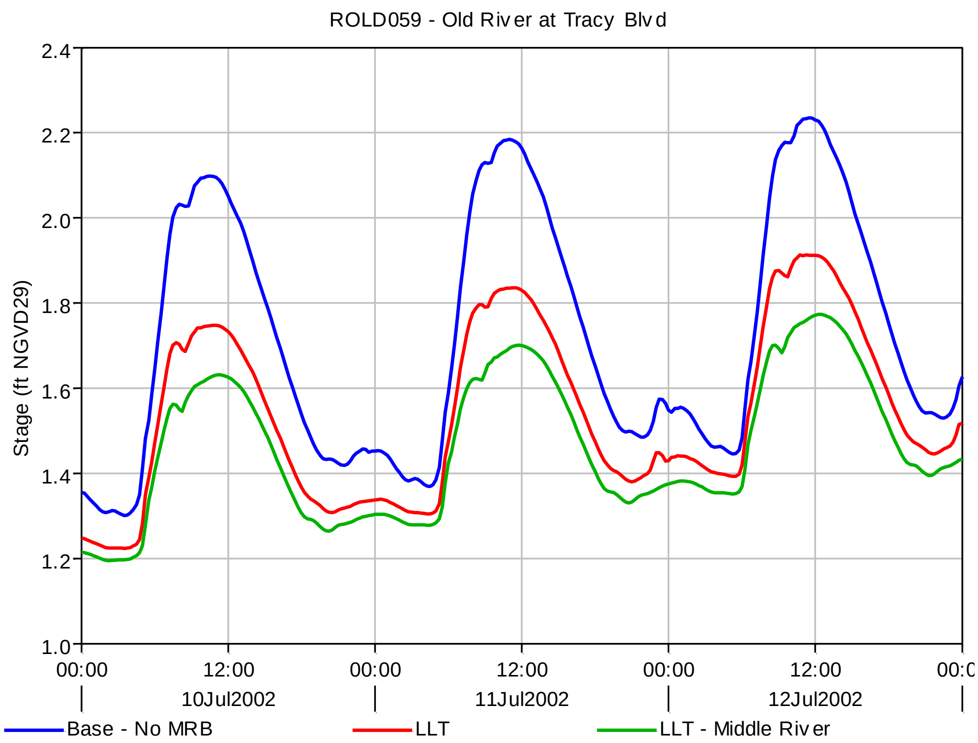


Figure 4-69 Stage at ROLD059 for Base - No MRB, LLT and LLT - Middle River scenarios.

4.2.3.5 Bed Shear

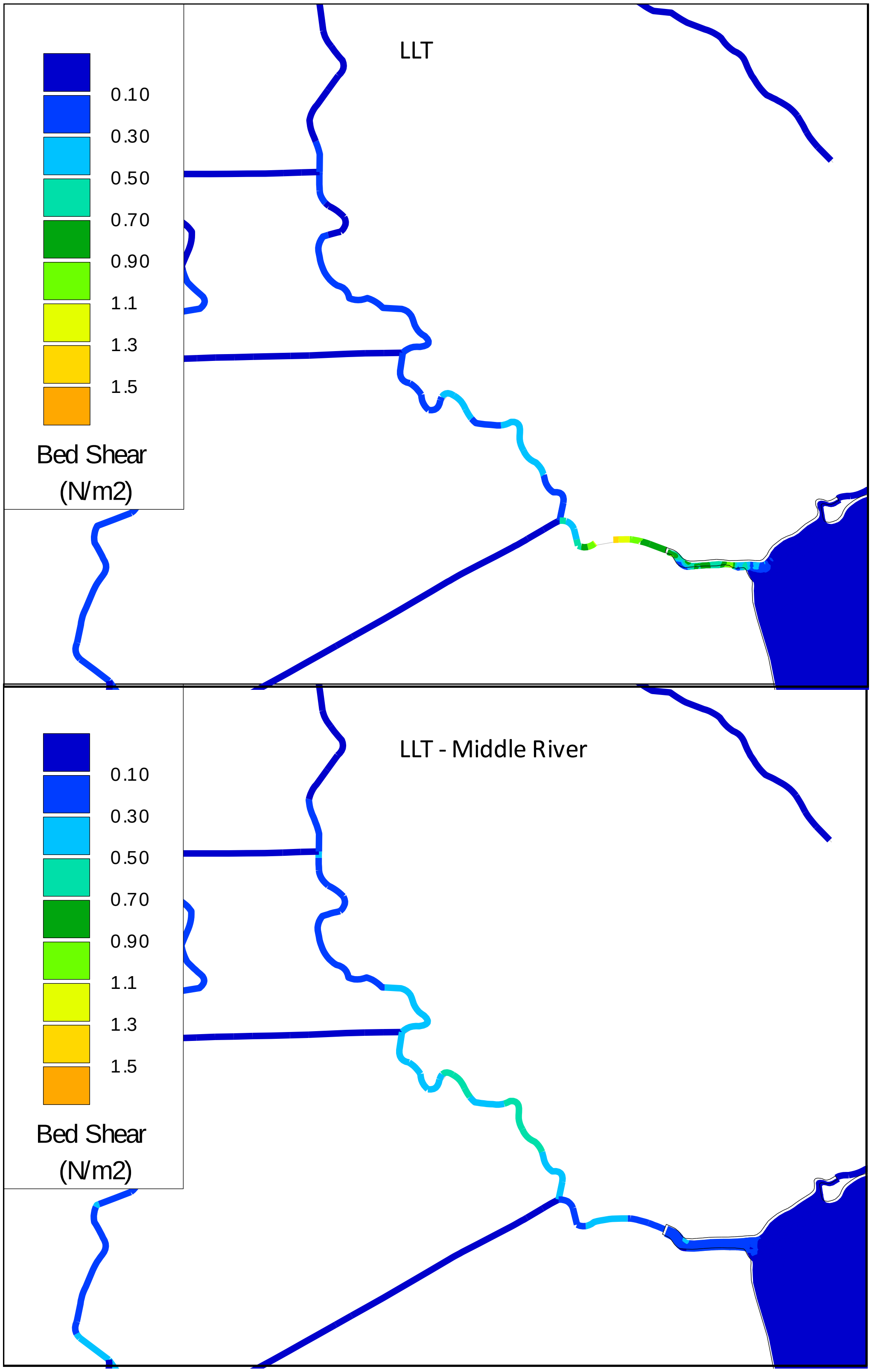


Figure 4-70 Comparison of Middle River bed shear for the LLT and LLT- Middle River simulations at times of peak bed shear during July 2002.

4.2.4 LLT – Suisun Scour

Three-day average flows for LLT – Suisun Scour are compared with base case and LLT flows in Table 4-11 and Figure 4-71. The grid modifications in LLT – Suisun Scour strongly impact flows in Montezuma Slough, resulting in a net east to west flow. Average flows at the head of the slough change from 13 cfs for LLT to 454 cfs (a 3400% increase). Average flows at the mouth of the slough reverse direction from 191 cfs into the marsh for LLT to 81 cfs out of the marsh, a 142% change. As a result, average flow at Chipps Island (RSAC075) decreases by 10% (455 cfs). Average flows elsewhere on the Sacramento River, in the north and south Delta and San Joaquin River change by 1% or less (generally less than 30 cfs) for LLT – Suisun Scour.

Tidal prism and percent change from base tidal prism is tabulated in Table 4-12 and plotted in Figure 4-72 and Figure 4-73. LLT – Suisun Scour increases tidal prism in Montezuma Slough by 37% at head and 26% at mouth, relative to LLT. At Martinez, tidal prism is increased by 4%. Decreases of 3% or less occur at most other locations.

RSAC128. Tidal prism changes in the south Delta and east Delta were typically small.

Tidal range results are provided in Table 4-13 and Figure 4-74. Tidal range decreased by 2% at Montezuma Slough at Head and increased by 1% at Montezuma Slough at Mouth for LLT – Suisun Scour relative to LLT. The increased conveyance within Suisun Marsh decreases tidal range throughout the Delta, with decreases of about 2% for LLT – Suisun Scour relative to LLT. The decrease was slightly smaller, about 1%, at DCC and Georgiana Slough, and slightly larger, about 3%, at Chipps Island and Martinez.

Profile plots of July 2002 MHHW, MSL and MLLW, in Figure 4-75 through Figure 4-78, show that the LLT – Suisun Scour tidal has larger impacts on MHHW and MLLW downstream in the Suisun Bay area and minimal impacts in the upstream ends of the Sacramento and San Joaquin Rivers. MSL is minimally impacted in Sacramento, San Joaquin and Middle Rivers. The largest tidal range impacts are seen in Suisun Marsh in the middle of Montezuma Slough.

For reference, time series plots of stage are provided for various locations in Figure 4-79 through Figure 4-93. A map of locations plotted is shown in Figure 4-2.

There are no new or resolved bed shear issues for this sensitivity case.

4.2.4.1 Net Flows

Table 4-11 Summary of 3-month Average flow (Jul – Sep 2002) for Base - No MRB, LLT, LLT – Suisun Scour simulations.

Location	3-month Average Flow, Jul – Sep 2002 (cfs)		
	Base – No MRB	LLT	LLT – Suisun Scour
Cache Sl at Ryer	1535	2565	2538
DCC	4609	3449	3438
False River	-1696	-1806	-1797
Martinez	4422	4080	4067
Miner Slough	2018	2667	2659
Mokelumne nr SJR	4719	3781	3762
Montezuma Sl at Head	12	13	454
Montezuma Sl at Mouth	-71	-191	81
RMID015	-5351	-5265	-5260
RMID027	-25	-45	-45
ROLD024	-4425	-4541	-4541
ROLD034	-6493	-6603	-6595
RSAC075 Chipps Island	4503	4395	3940
RSAC092 Emmaton	5870	6484	6518
RSAC101 Rio Vista	8256	9712	9739
RSAC123	3607	4258	4276
RSAC128	10999	10137	10127
RSAN018 Jersey Pt	-999	-1914	-1941
RSAN032 San Andreas	-1716	-3216	-3237
RSAN058	366	391	388
SLDUT007	-113	68	61
SLGEO019 Georgiana Sl	2762	2408	2392
SLTRM004 Threemile Sl	-2313	-3012	-3008
Steamboat Sl	2280	2629	2639
Sutter Sl	2965	3480	3480

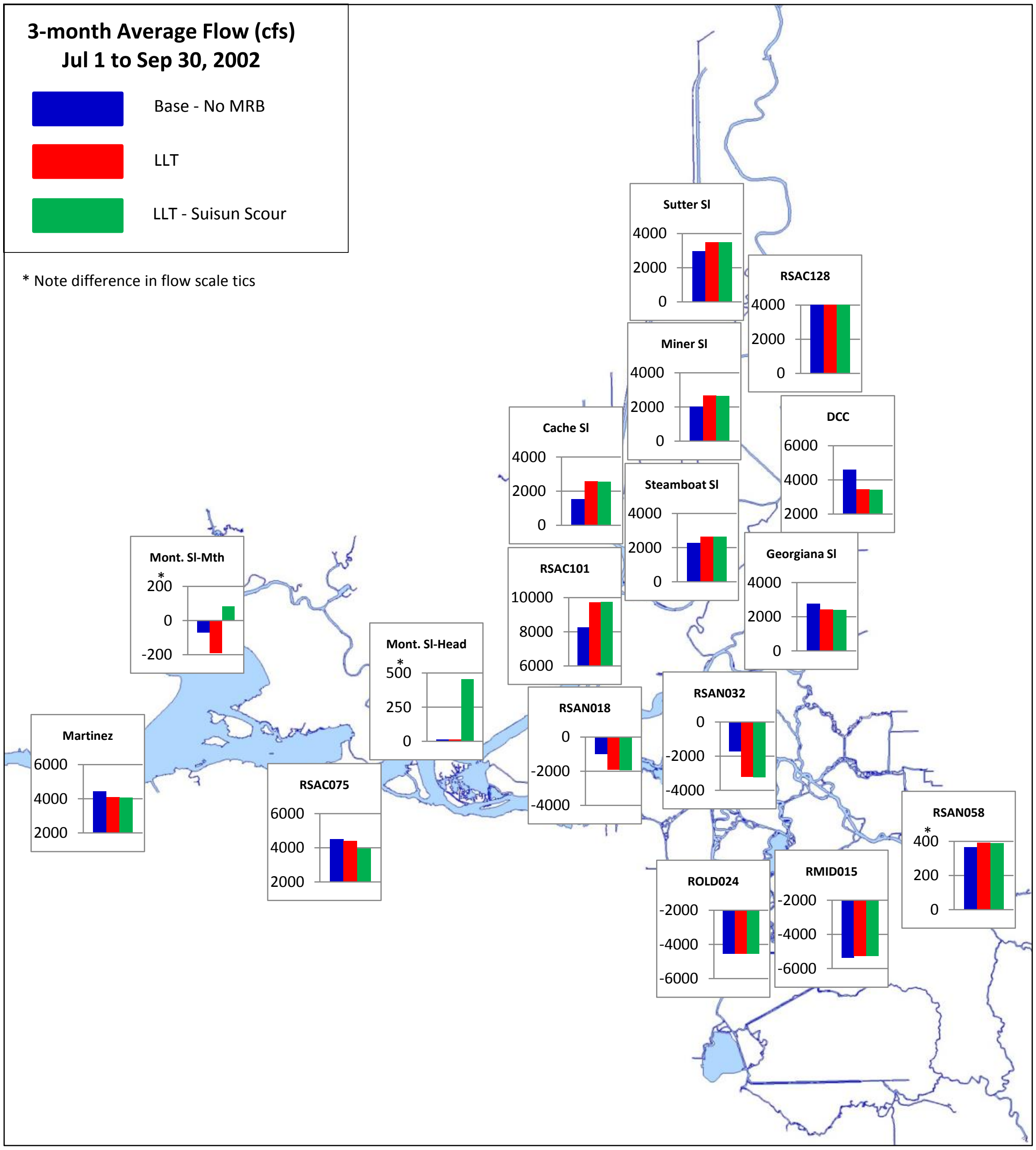


Figure 4-71 Average flows (Jul - Sep 2002) for Base - No MRB, LLT and LLT – Suisun Scour simulations.

4.2.4.2 Tidal Prism

Table 4-12 Summary of Apr – Dec 2002 Average Tidal Prism for Base - No MRB, LLT and LLT – Suisun Scour simulations, and percent change from Base - No MRB.

Location	Base – No MRB	LLT		LLT – Suisun Scour	
	Tidal Prism (ac-ft)	Tidal Prism (ac-ft)	% Change from Base	Tidal Prism (ac-ft)	% Change from Base
Cache Sl at Ryer	28,697	26,884	-6%	26,264	-8%
DCC	782	949	21%	926	18%
False River	18,870	16,508	-13%	16,122	-15%
Martinez	167,717	170,966	2%	177,711	6%
Miner Slough	618	455	-26%	450	-27%
Mokelumne nr SJR	4,615	4,490	-3%	4,401	-5%
Montezuma Sl at Head	2,053	3,283	60%	4,502	119%
Montezuma Sl at Mouth	10,988	23,108	110%	29,077	165%
RMID015	4,119	3,333	-19%	3,272	-21%
RMID027	474	1,784	277%	1,769	273%
ROLD024	4,427	3,655	-17%	3,579	-19%
ROLD034	2,352	1,960	-17%	1,947	-17%
RSAC075 Chipps Island	115,263	108,506	-6%	106,021	-8%
RSAC092 Emmaton	49,256	50,591	3%	49,416	0%
RSAC101 Rio Vista	36,171	40,582	12%	39,693	10%
RSAC123	2,499	1,811	-28%	1,762	-29%
RSAC128	1,608	1,175	-27%	1,154	-28%
RSAN018 Jersey Pt	50,110	44,549	-11%	43,472	-13%
RSAN032 San Andreas	37,847	32,450	-14%	31,620	-16%
RSAN058	2,385	2,603	9%	2,550	7%
SLDUT007	3,073	2,226	-28%	2,184	-29%
SLGEO019 Georgiana Sl	222	415	87%	411	85%
SLTRM004 Threemile Sl	9,413	6,526	-31%	6,345	-33%
Steamboat Sl	913	598	-35%	580	-36%
Sutter Sl	823	574	-30%	561	-32%

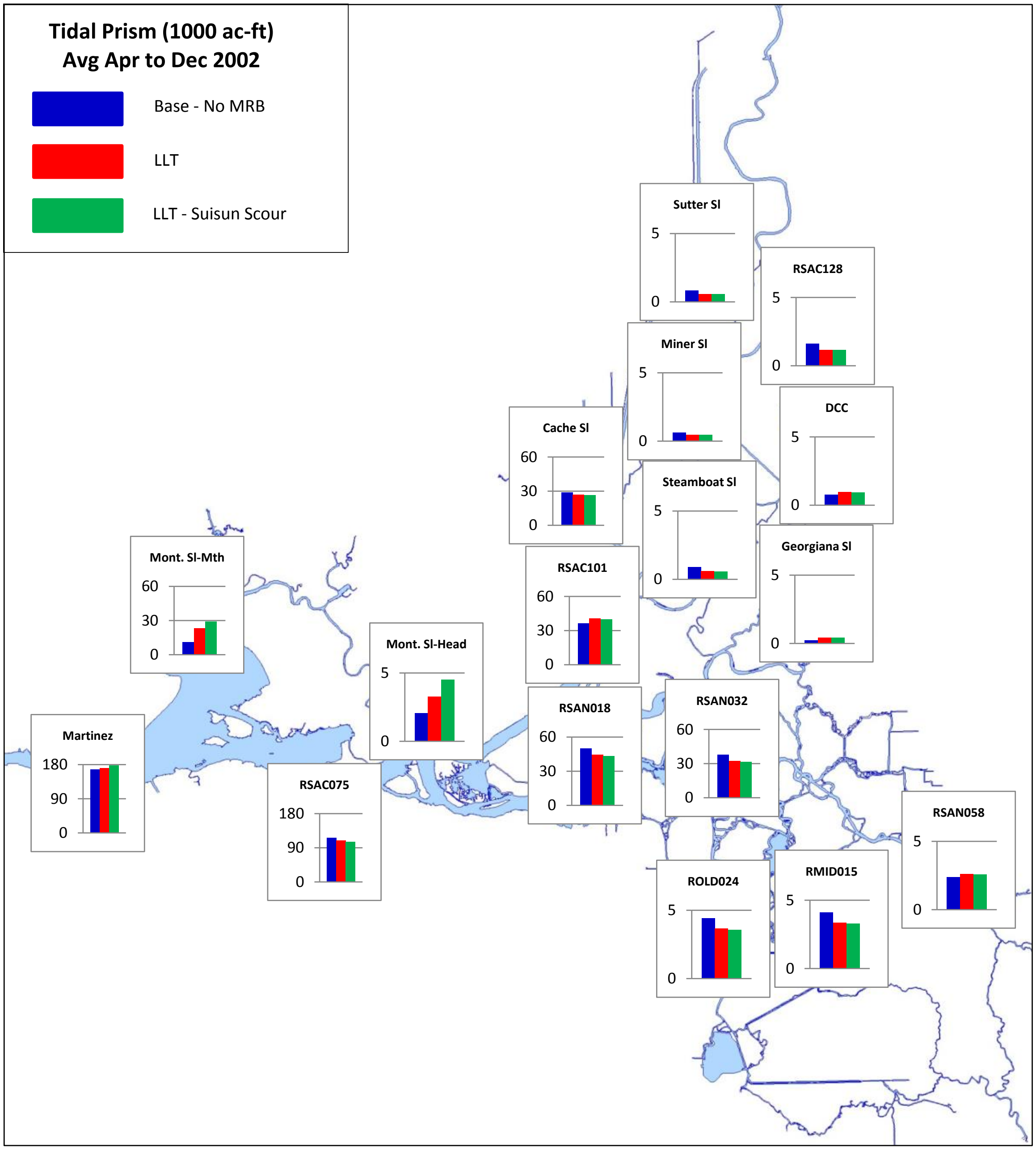


Figure 4-72 Average tidal prism (Apr - Dec 2002) for Base - No MRB, LLT and LLT –Suisun Scour simulations.

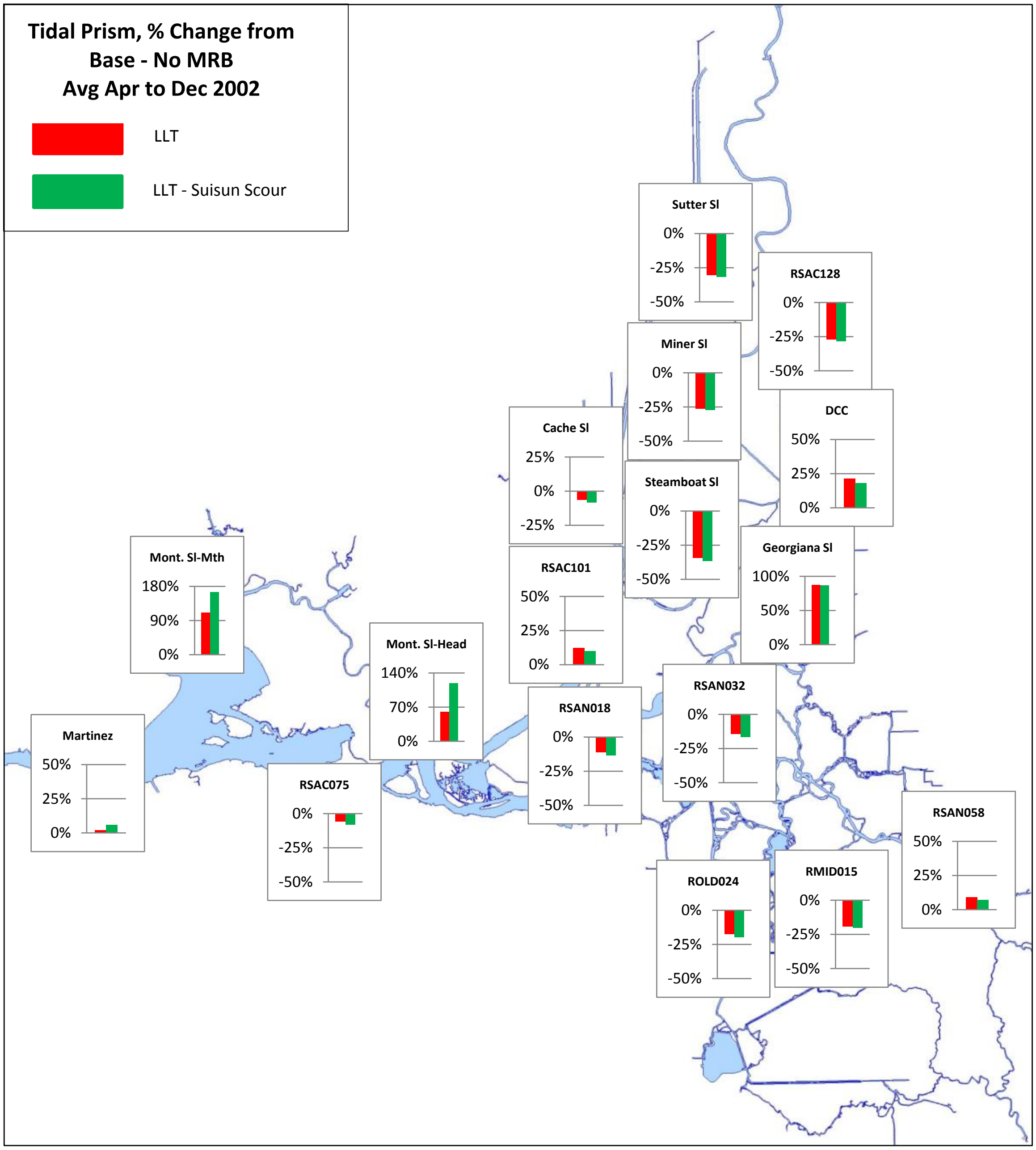


Figure 4-73 Average percent change from Base - No MRB tidal prism (Apr - Dec 2002) for LLT and LLT – Suisun Scour simulations.

4.2.4.3 Tidal Range

Table 4-13 Summary of Apr – Dec 2002 Average Tidal Range for Base - No MRB, LLT and LLT – Suisun Scour simulations.

Location	Apr – Dec 2002 Average Tidal Range (ft)		
	Base – No MRB	LLT	LLT – Suisun Scour
Cache Sl at Ryer	3.95	2.75	2.7
DCC	2.92	2.11	2.08
False River	3.4	2.93	2.87
Martinez	5.47	5.14	4.99
Miner Slough	3.12	2.62	2.58
Montezuma Sl at Head	4.25	3.64	3.58
Montezuma Sl at Mouth	5	4.05	4.09
RMID015	3.76	3.14	3.08
RMID023	3.49	2.48	2.45
RMID027	3.33	0.56	0.48
ROLD024	3.55	3.02	2.96
ROLD034	3.36	2.73	2.68
RSAC075 Chipps Island	4.42	3.85	3.75
RSAC092 Emmaton	3.93	3.23	3.15
RSAC101 Rio Vista	3.86	2.79	2.73
RSAC123	2.95	2.14	2.1
RSAC128	2.91	2.12	2.08
RSAN018 Jersey Pt	3.47	2.98	2.91
RSAN032 San Andreas	3.37	2.89	2.83
RSAN058	4.05	3.25	3.2
SLDUT007 Dutch Slough	3.59	3.04	2.98
SLGEO019 Georgiana Sl	2.95	2.16	2.13
SLTRM004 Threemile Sl	3.45	2.9	2.83
Steamboat Sl	2.69	1.99	1.96
Sutter Sl	2.57	1.94	1.9
Victoria Canal	3.48	2.48	2.43

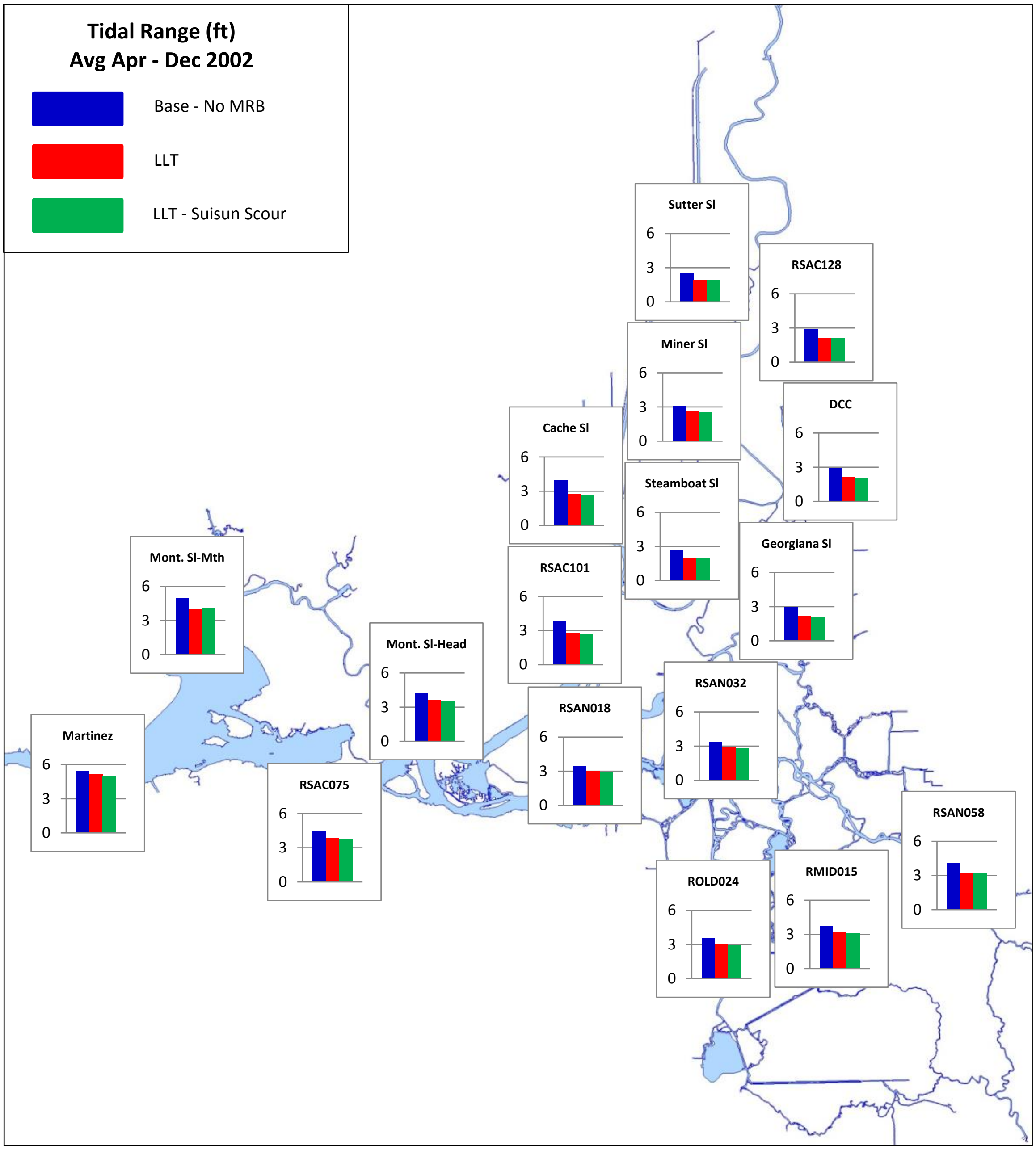


Figure 4-74 Average tidal range (Apr - Dec 2002) for Base - No MRB, LLT and LLT –Suisun Scour simulations.

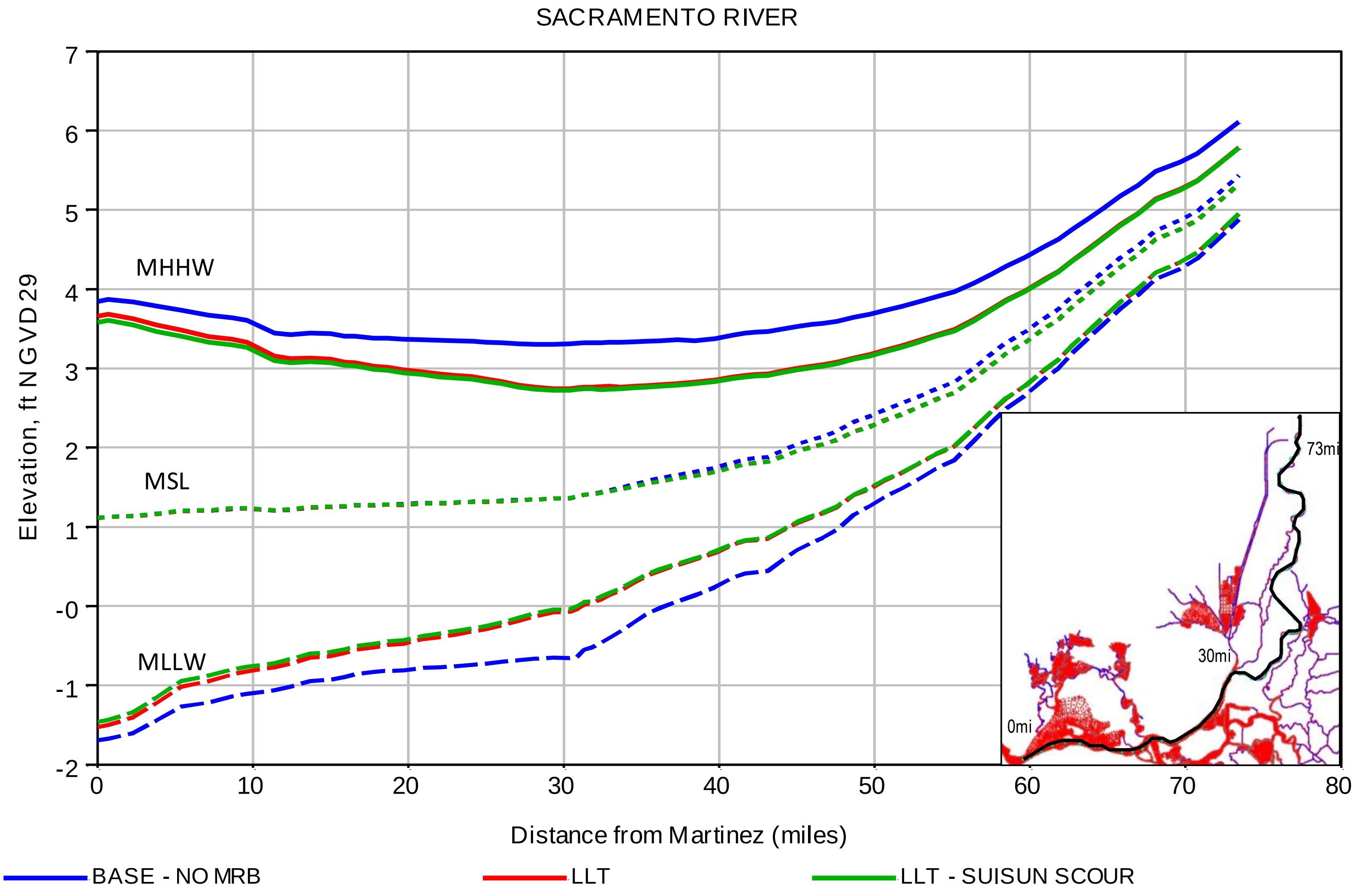


Figure 4-75 Profiles of July 2002 MHHW, MSL and MLLW along the Sacramento River for the Base - No MRB, LLT and LLT - Suisun Scour simulations.

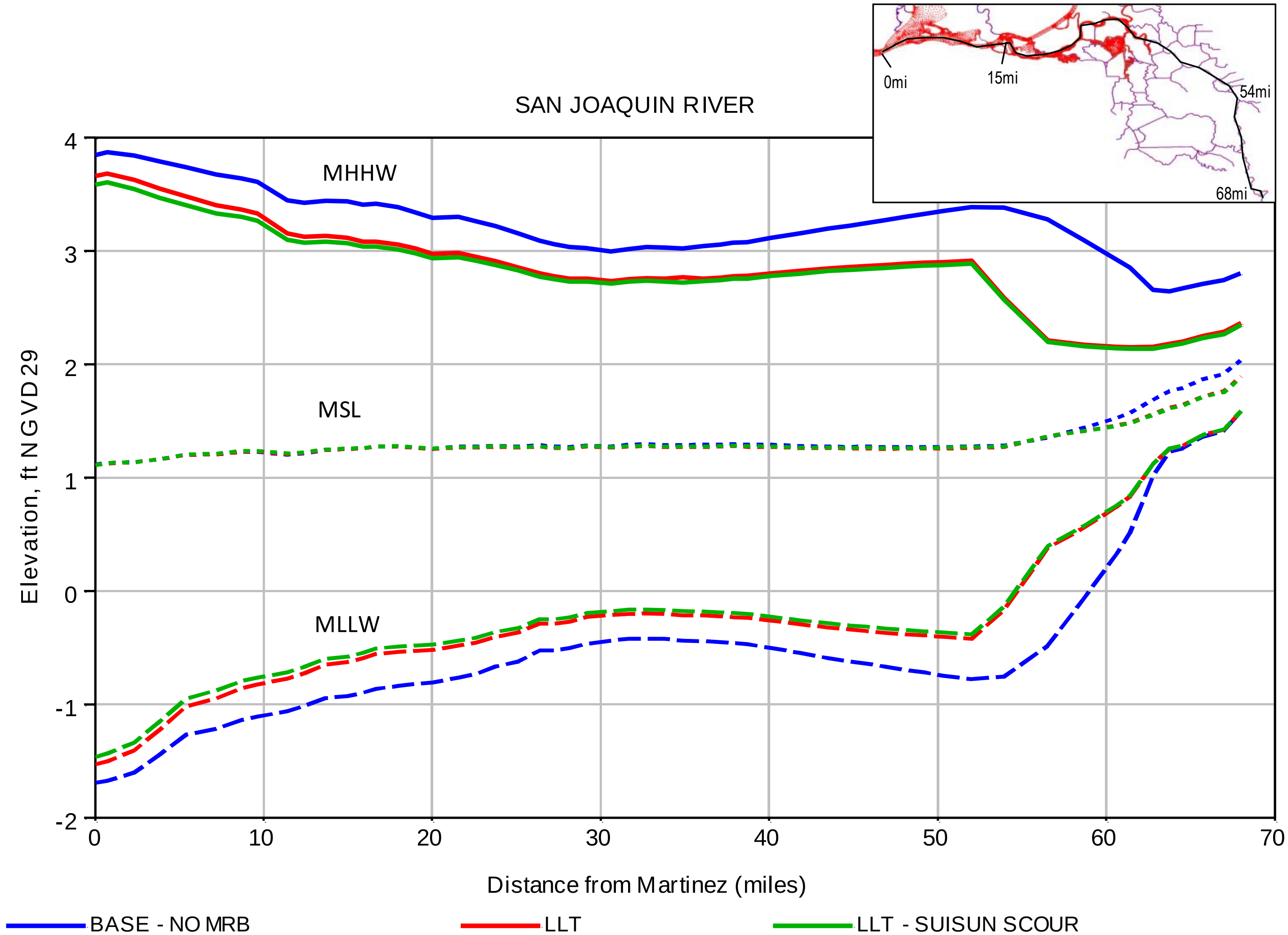


Figure 4-76 Profiles of July 2002 MHHW, MSL and MLLW along the San Joaquin River for the Base - No MRB, LLT and LLT - Suisun Scour simulations.

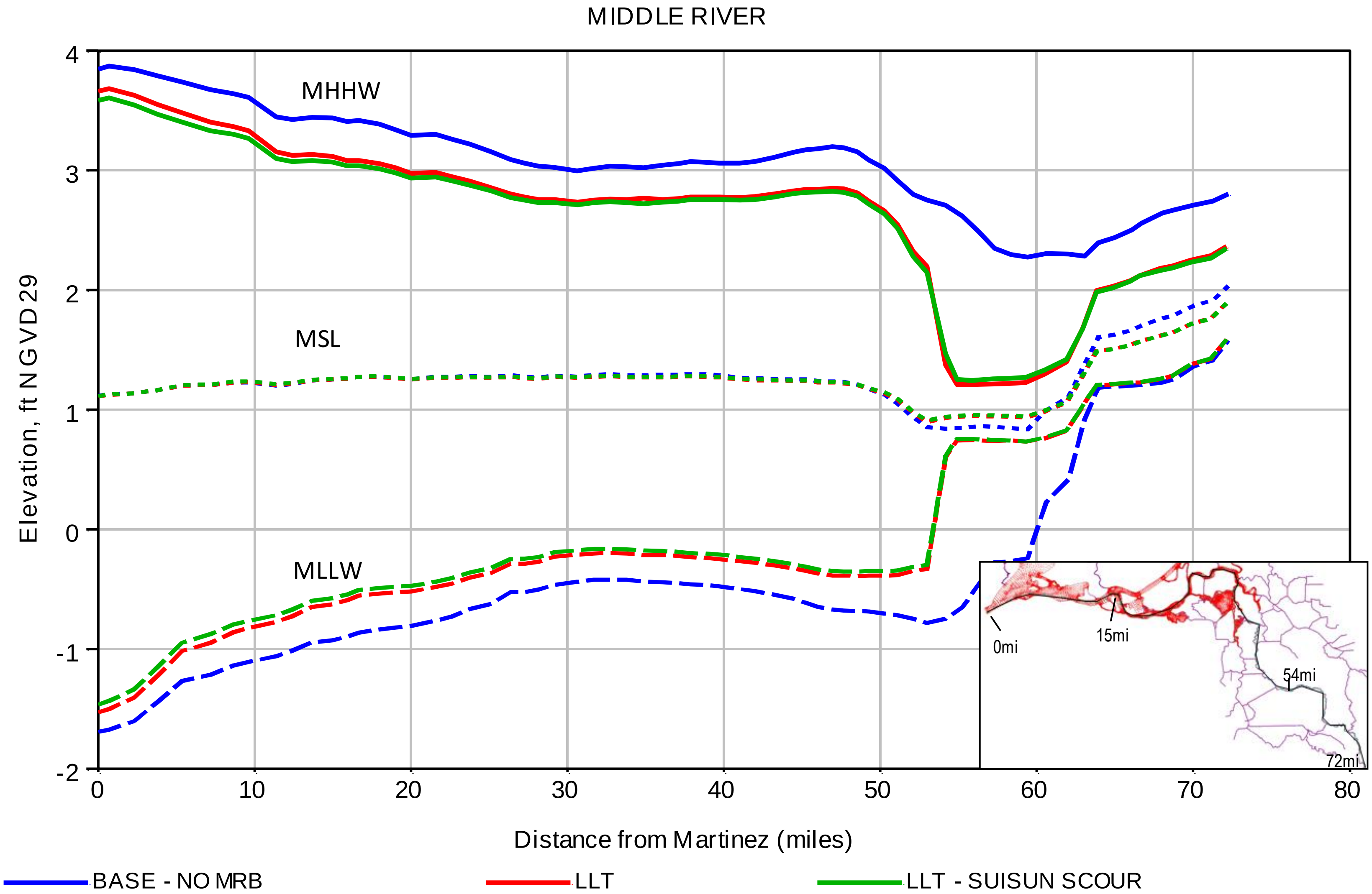


Figure 4-77 Profiles of July 2002 MHHW, MSL and MLLW along the Middle River for the Base - No MRB, LLT and LLT - Suisun Scour simulations.

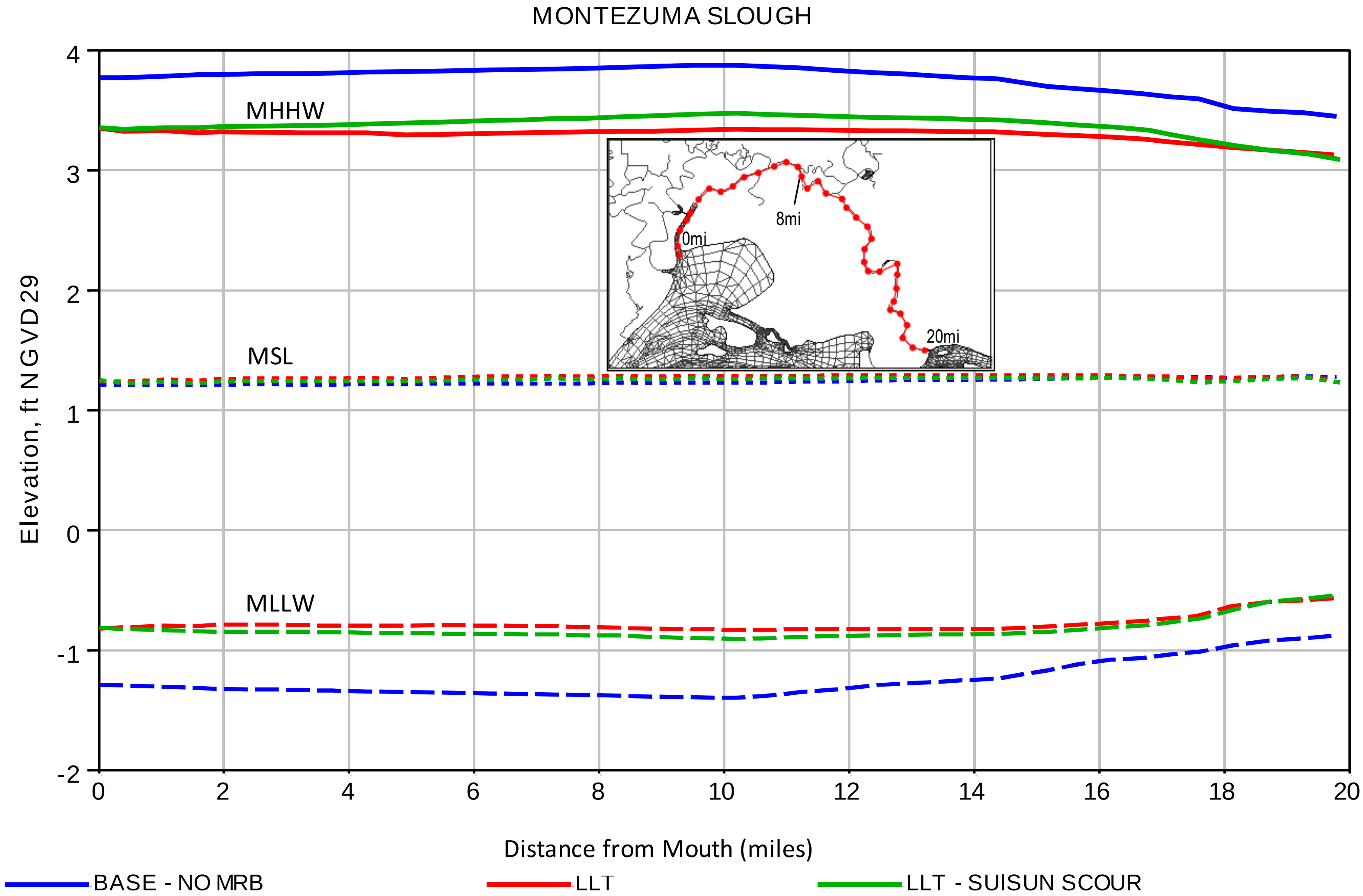


Figure 4-78 Profiles of July 2002 MHHW, MSL and MLLW along Montezuma Slough for the Base - No MRB, LLT and LLT - Suisun Scour simulations.

4.2.4.4 Stage Time Series Plots

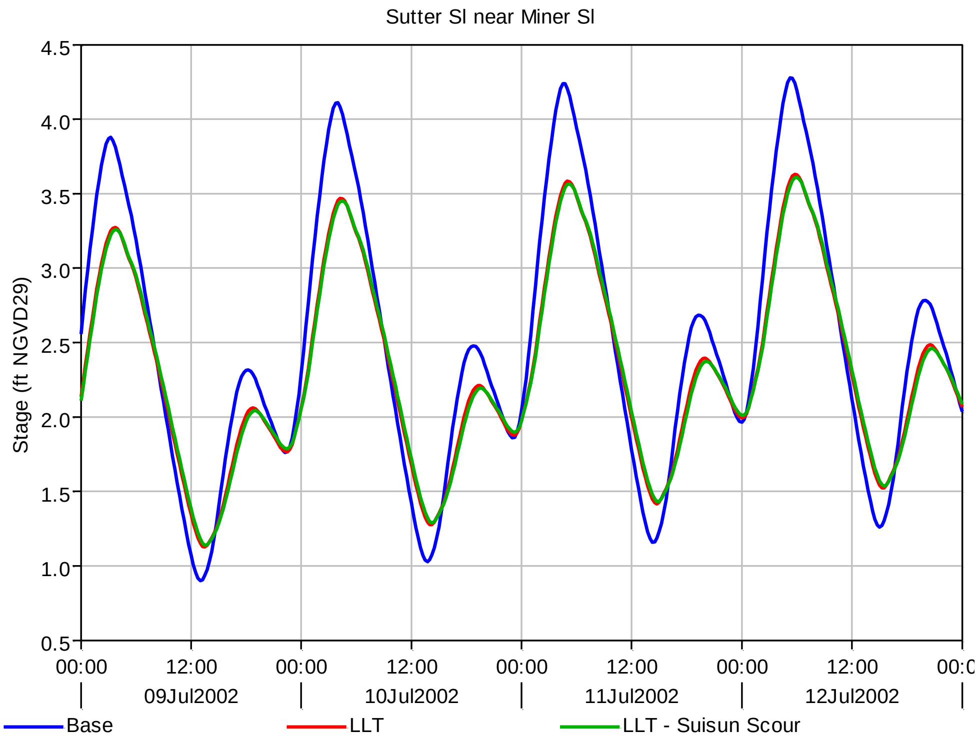


Figure 4-79 Stage in Sutter Slough for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

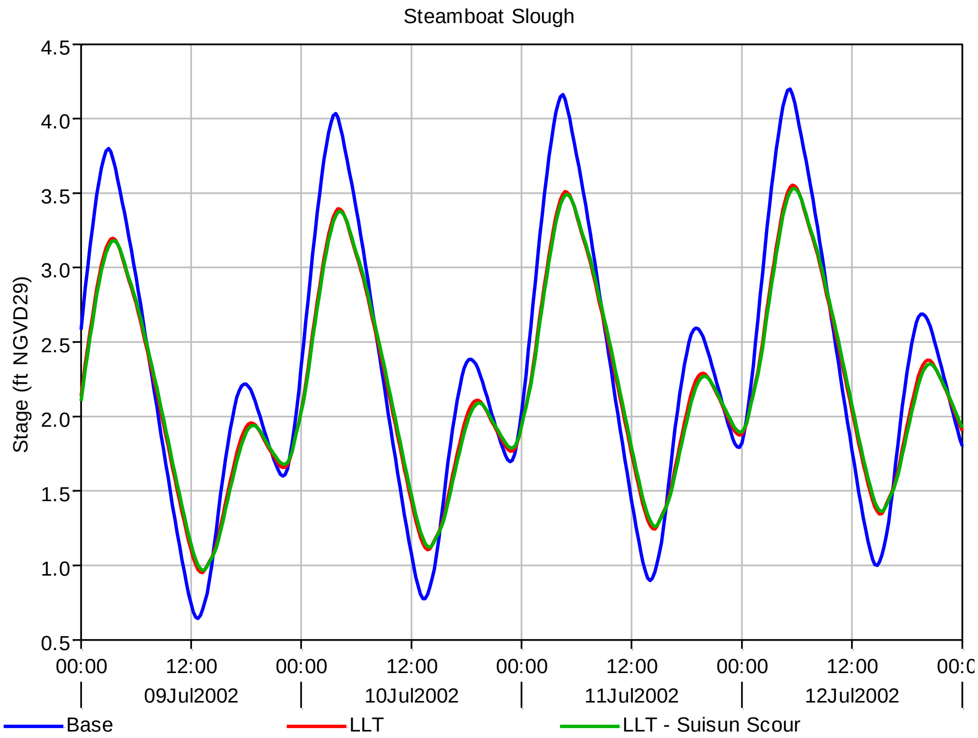


Figure 4-80 Stage in Steamboat Slough for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

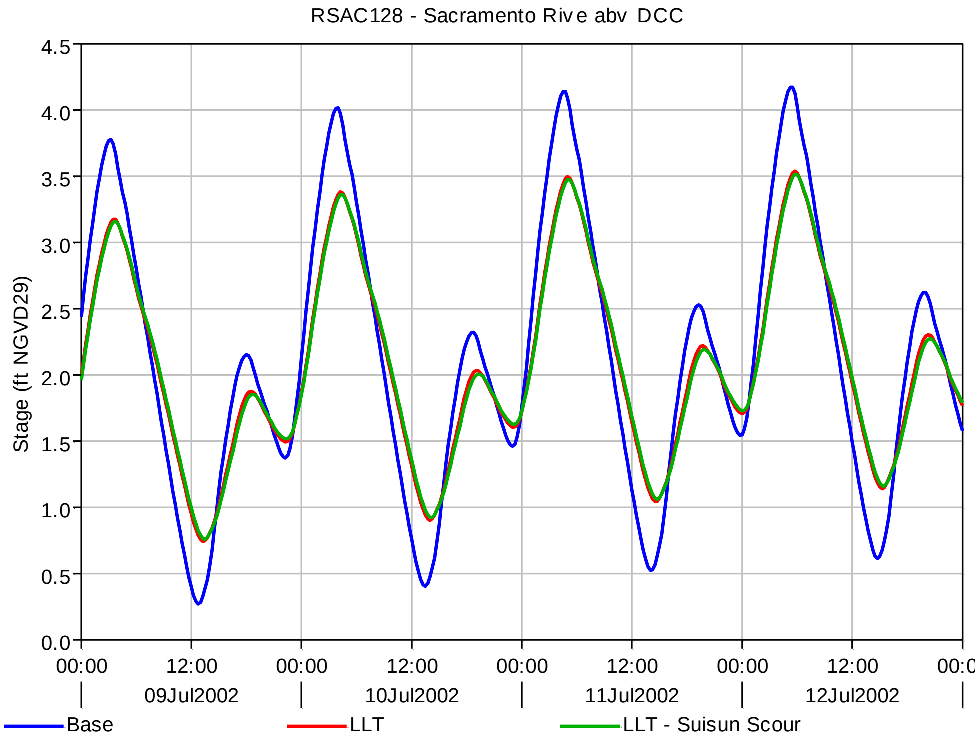


Figure 4-81 Stage at RSAC128 for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

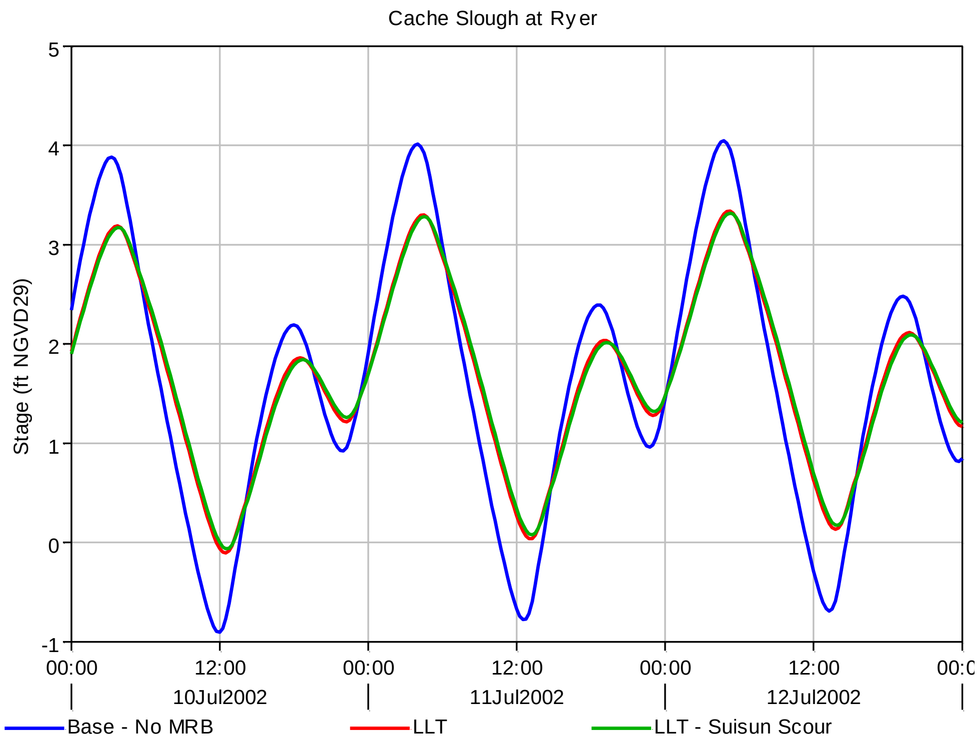


Figure 4-82 Stage in Cache Slough at Ryer Island for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

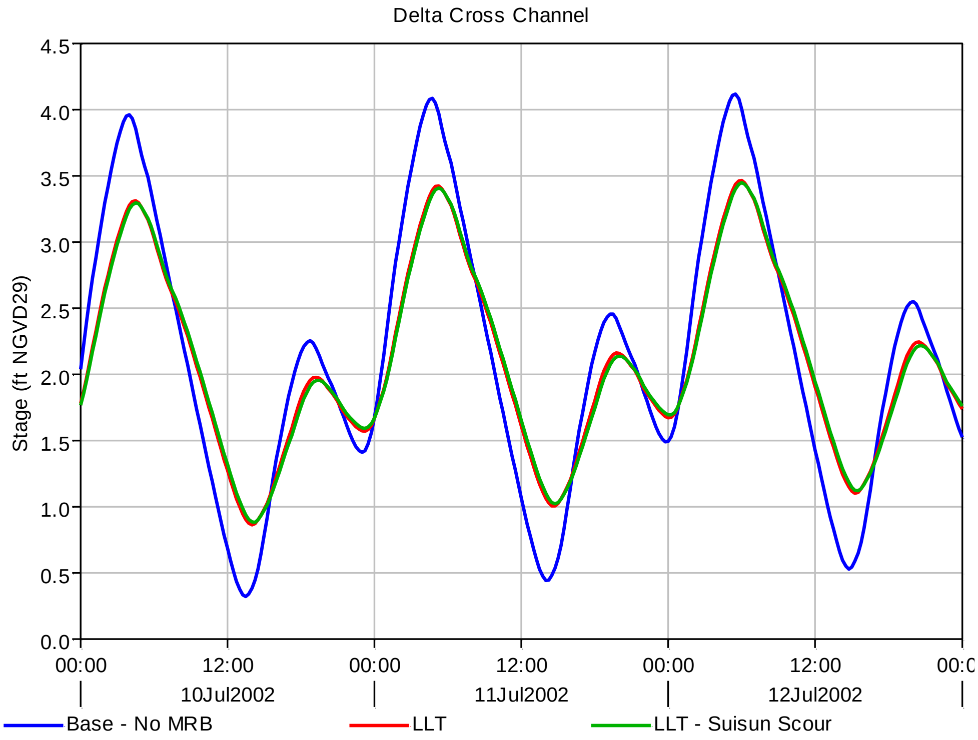


Figure 4-83 Stage in Delta Cross Channel for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

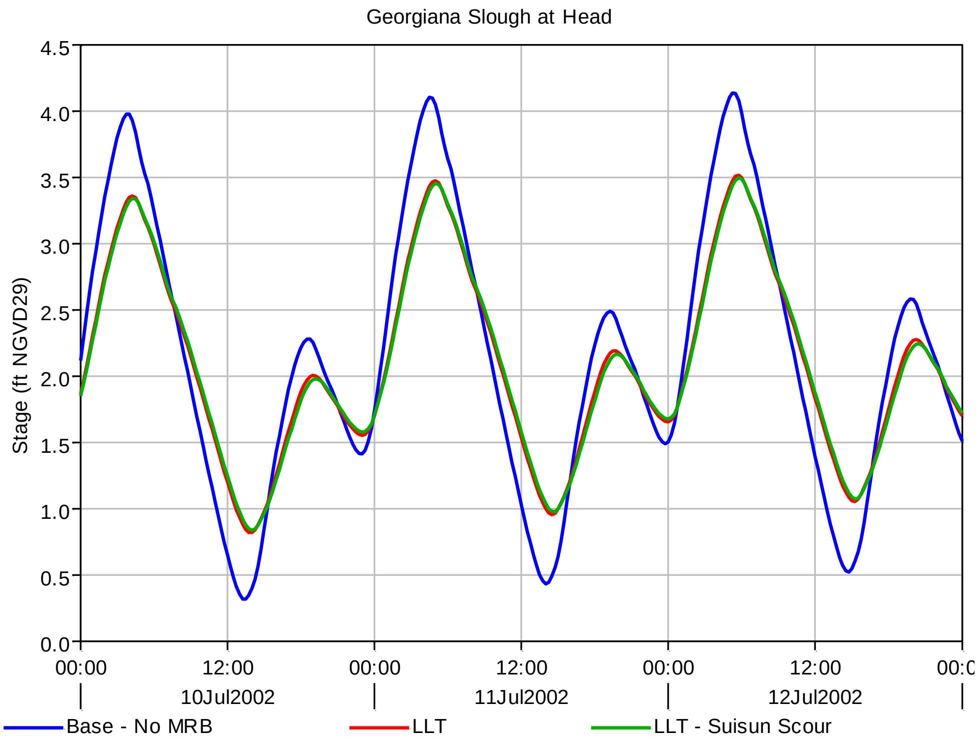


Figure 4-84 Stage in Georgiana Slough at head for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

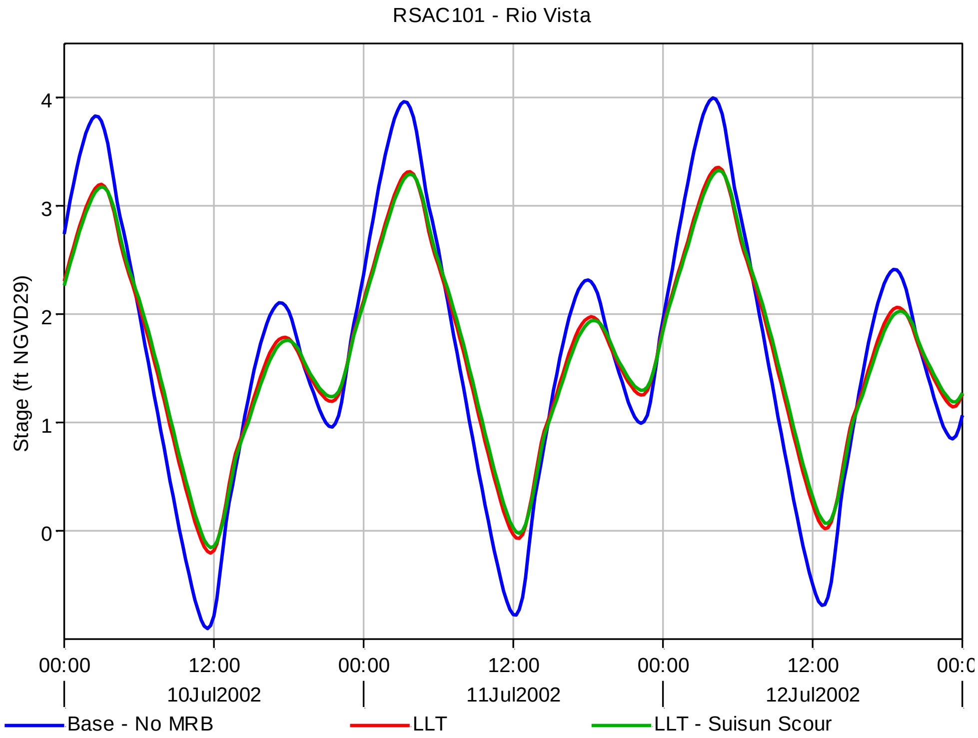


Figure 4-85 Stage at Rio Vista for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

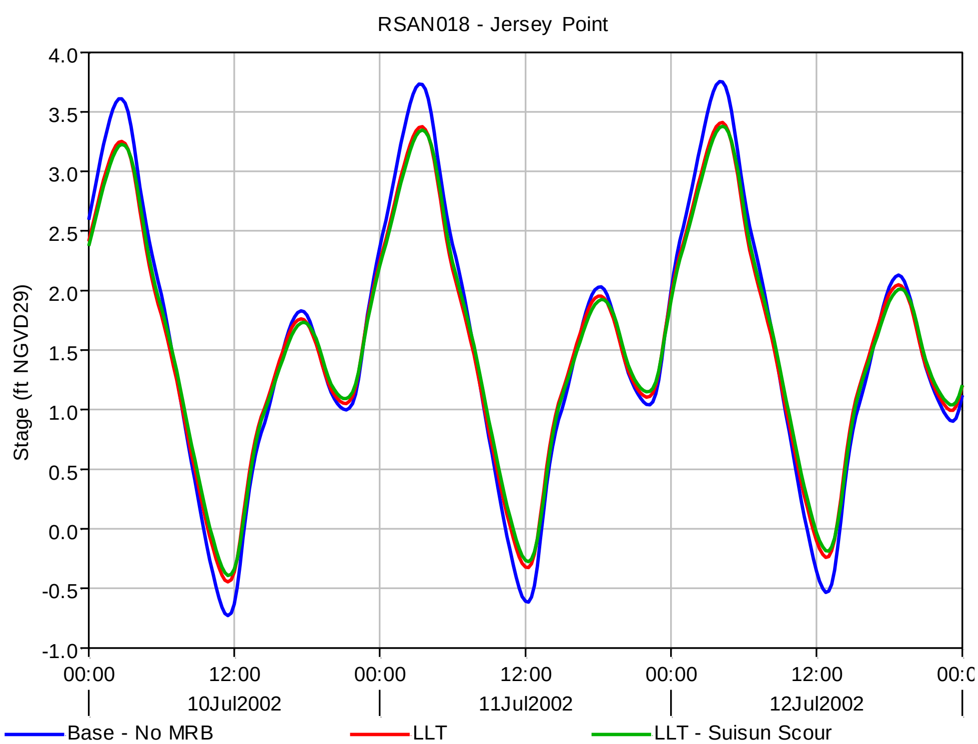


Figure 4-86 Stage at Jersey Point for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

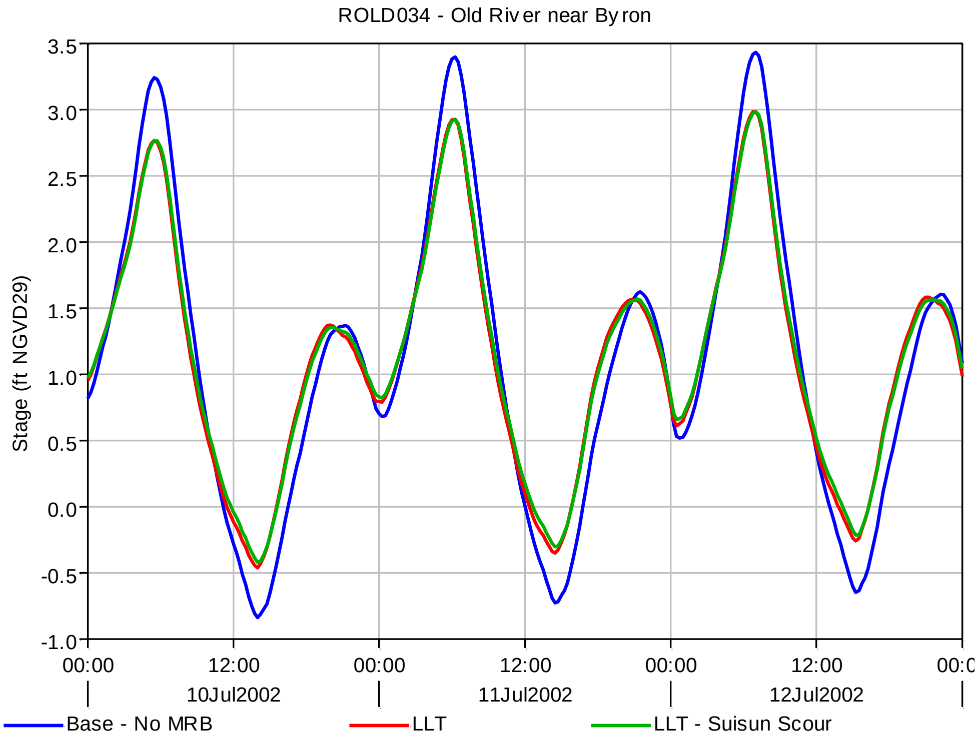


Figure 4-87 Stage at ROLD034 for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

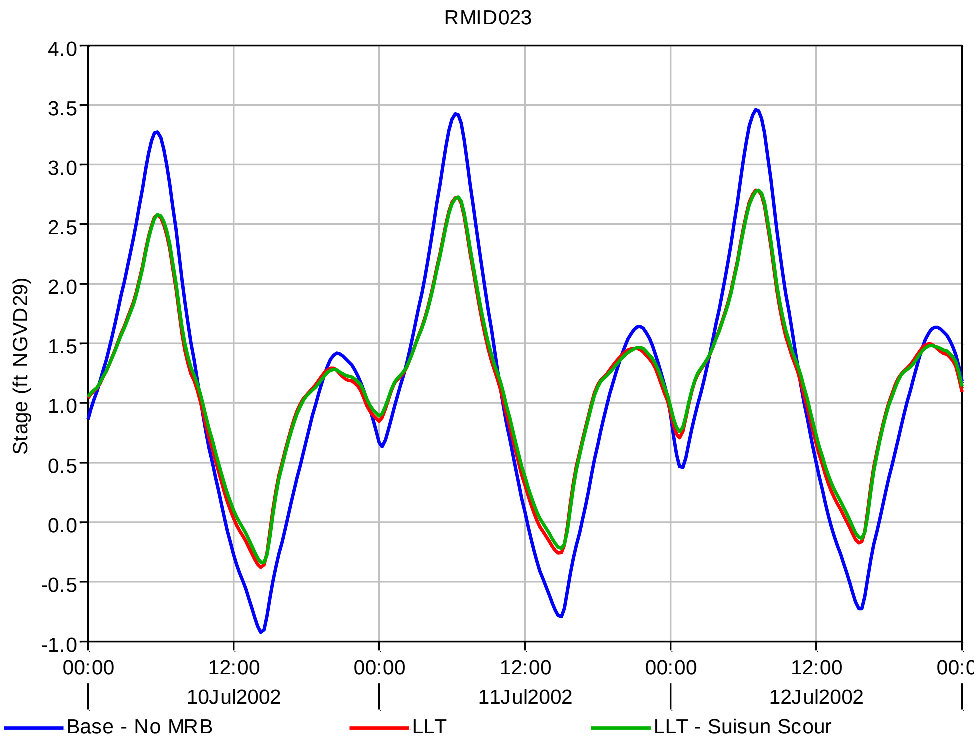


Figure 4-88 Stage at RMID023 for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

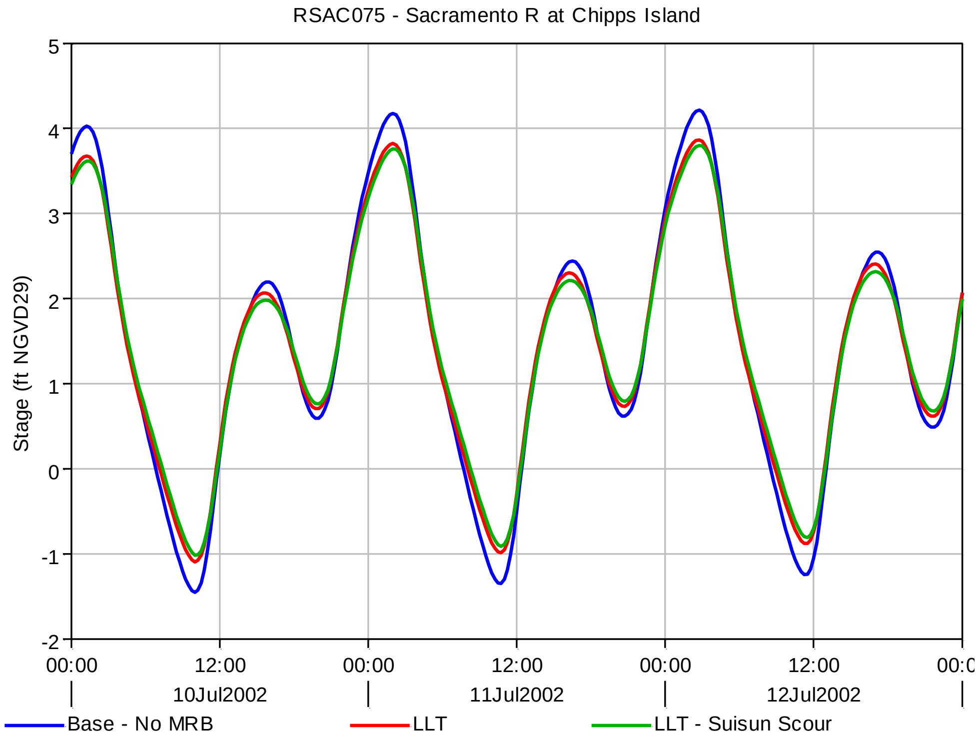


Figure 4-89 Stage at Chipps Island for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

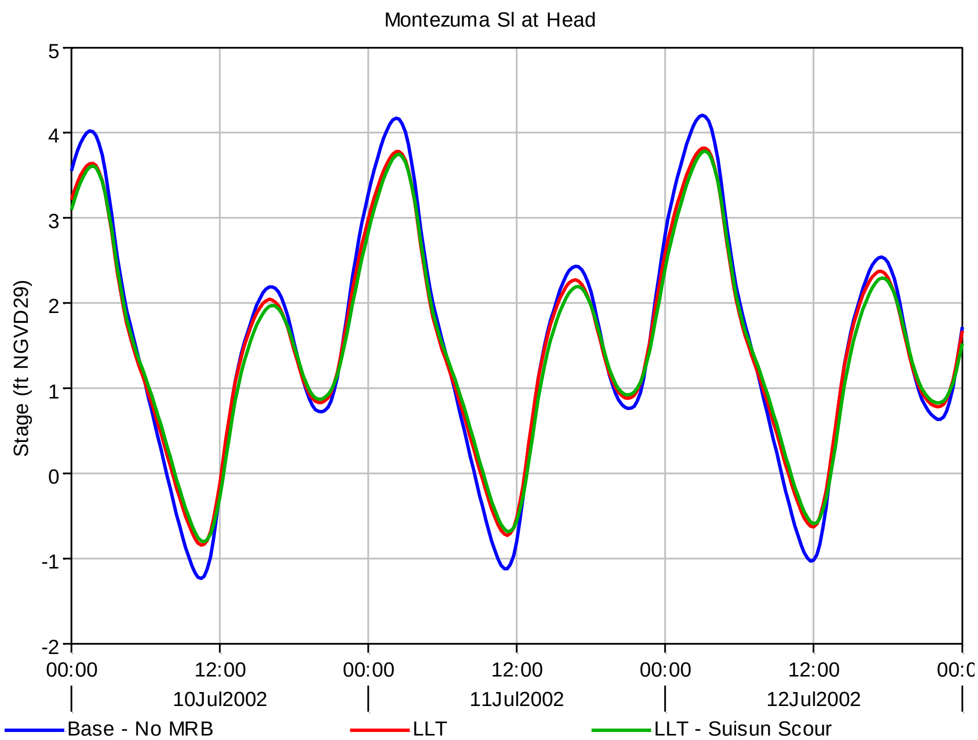


Figure 4-90 Stage in Montezuma Slough at Head for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

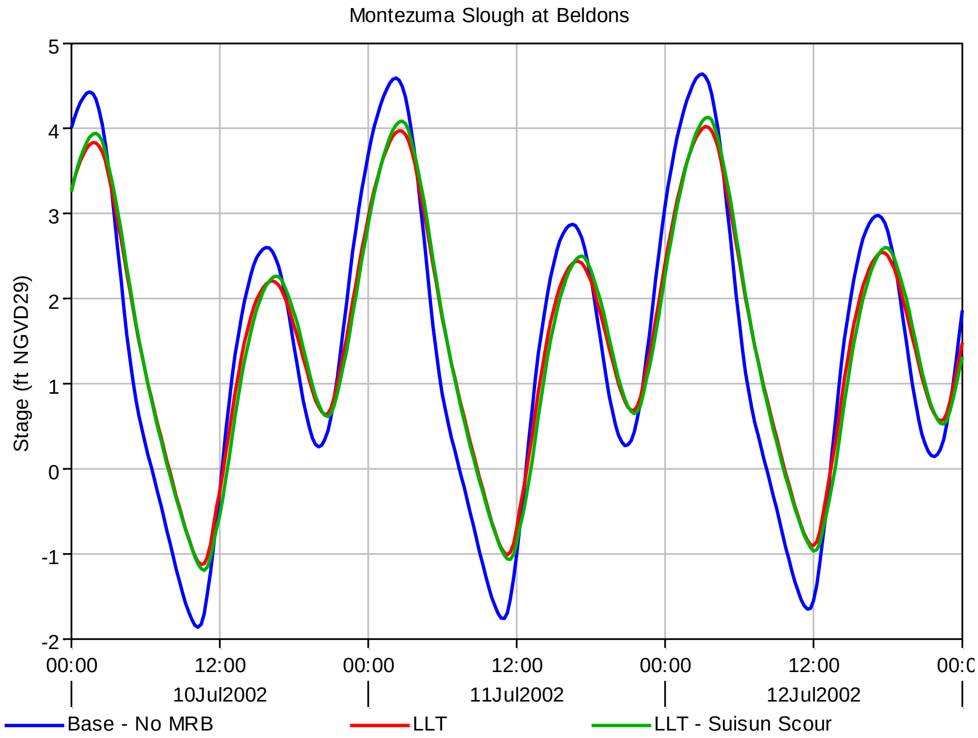


Figure 4-91 Stage in Montezuma Slough at Beldon's Landing (S-49) for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

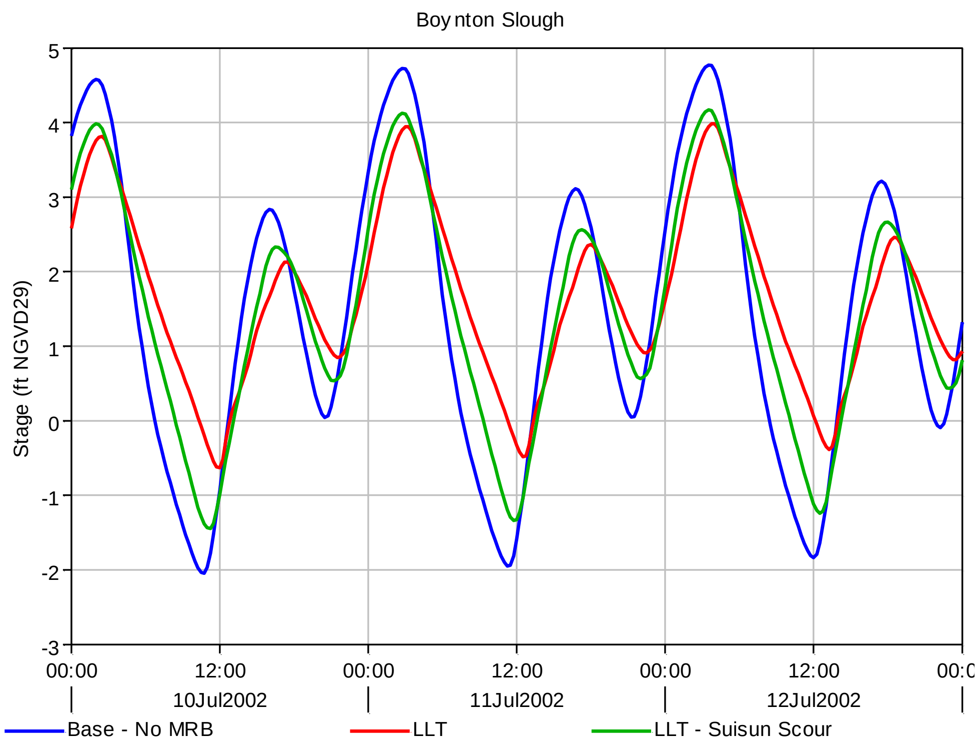


Figure 4-92 Stage in Boynton Slough at S-40 for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

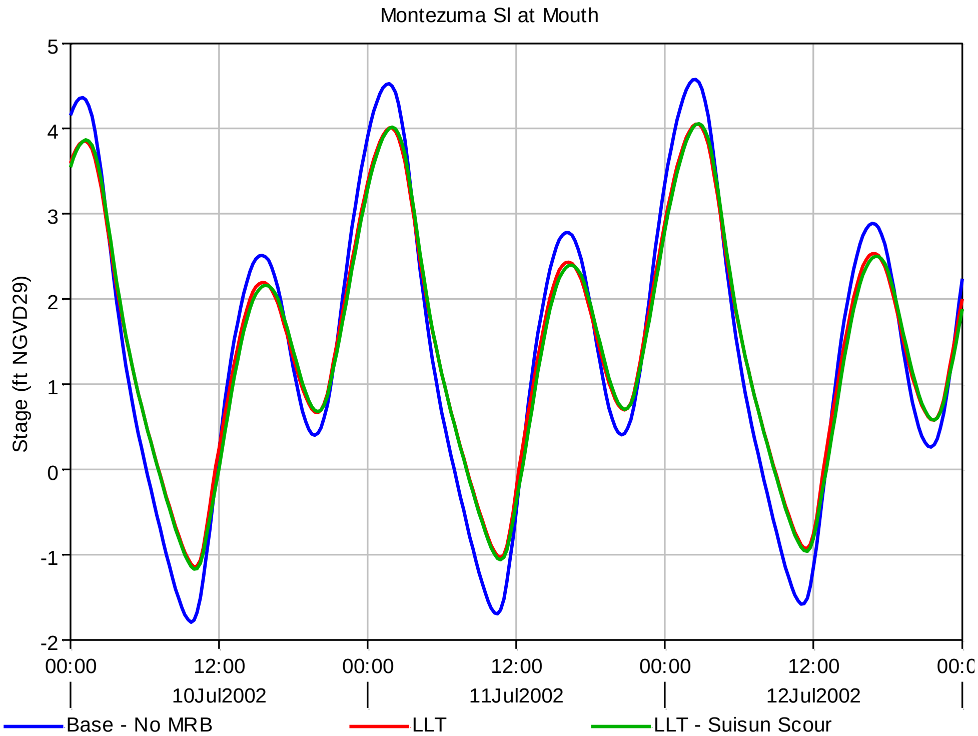


Figure 4-93 Stage in Montezuma Slough at mouth for Base - No MRB, LLT and LLT - Suisun Scour scenarios.

4.2.5 ELT – Prospect Breach

Three-month average flows for the ELT – Prospect Breach simulation are tabulated in Table 4-14 and plotted in Figure 4-94. Elimination of the Prospect Island breach on Miner Slough for the ELT – Prospect Breach case impacts flows in the north and central Delta. For the ELT case, the two breaches on Prospect Island provide additional conveyance through the island, increasing the net flow in Miner Slough. This results in decreased flows through the DCC and Georgiana Slough. By eliminating the breach on Miner Slough, the flow balance returns closer to the base case. Of all sensitivity cases, ELT – Prospect Breach has the greatest impact on DCC flows, increasing the three-month average flows by 87 cfs relative to ELT. In the Sacramento River above DCC (at RSAC128) flows are increased by 269 cfs and in Georgiana Slough, there is a 38 cfs increase. There are corresponding reductions in three-month average flows in Sutter Slough (-279 cfs), Miner Slough (-524 cfs) and lower Steamboat Slough (-257 cfs) and a small increase in upper Steamboat Slough above Miner Slough (12 cfs).

Relative to the base case, three-month average flows in Miner Slough are 33% greater for ELT, but only 7% greater than Base – No SMSCG for ELT – Prospect Breach. The DCC average flows are 21% below Base – No SMSCG for ELT and 19% lower for ELT – Prospect Breach and the Georgiana Slough flows change from 4% below Base – No SMSCG to 2% below Base – No SMSCG for ELT – Prospect Breach. Flows in the Sacramento River below Georgiana, at RSAC123 increase by 4% for the ELT – Prospect case relative to ELT. Flows in Cache Slough at Ryer are 41% greater than Base – No SMSCG for ELT and only 7% greater for ELT – Prospect Breach. Sacramento River flows at RSAC101 and below show a 1% reduction or less between ELT and ELT – Prospect Breach. On the San Joaquin River, San Andreas flows decline by 5% and Jersey Point flows decline by 4% with the eliminated breach. There is essentially no impact in Old and Middle River. ELT – Prospect Breach average flows out of Suisun Marsh in Montezuma Slough at head are increased by 10% relative to ELT and in Montezuma Slough at mouth flows are reduced by 2% relative to ELT.

ELT – Prospect Breach tidal prism results are shown in Table 4-15, Figure 4-95 and Figure 4-96. Tidal prism is impacted only in the north Delta. Elimination of the Miner Slough breach reduces tidal prism in Miner Slough by 22%, in Steamboat Slough by 3% and Sutter Slough by 12% relative to ELT. Tidal prism is reduced by 2% in DCC and increased by 3% at RSAC128 and Georgiana Slough, relative to ELT. Tidal prism changes due to the breach elimination are 0.1% or less throughout the rest of the system.

As shown in Table 4-16 and Figure 4-97, elimination of the Prospect Island breach on Miner Slough decreases tidal range in Miner Slough by 0.51 ft (17%) below ELT. Relative to ELT there is a 3% reduction in tidal range in Steamboat Slough, a 7% reduction in Sutter Slough, 2% reduction at RSAC128 and DCC and 1% reduction at Georgiana Slough and RSAC123. There is no change elsewhere in the system.

Profile plots of July 2002 MHHW, MSL and MLLW, in Figure 4-98 through Figure 4-101, show that relative to ELT, the ELT – Prospect Breach MLLW and MSL slightly higher in the upper Sacramento River. There are no significant differences between ELT and ELT – Prospect Breach in the other profiles.

For reference, time series plots of stage are provided for various locations in Figure 4-102 through Figure 4-112. A map of locations plotted is shown in Figure 4-2.

Color contour plots of peak bed shear in in the Prospect Island vicinity during July 2002 are shown for ELT – Prospect Breach in comparison with ELT. For ELT – Prospect, there is a slight increase in bed shear in the Ship Channel and at the remaining Prospect Island breach to the Ship Channel, although bed shear remains relatively low.

4.2.5.1 Net Flows

Table 4-14 Summary of 3-month Average flow (Jul – Sep 2002) for Base - No SMSCG, ELT, ELT – Prospect Breach simulations.

	3-month Average Flow, Jul – Sep 2002 (cfs)		
Location	**Base – No SMSCG**	**ELT**	**ELT – Prospect Breach**
Cache Sl at Ryer	1535	2167	1644
DCC	4609	3661	3748
False River	-1696	-1837	-1810
Martinez	4423	4241	4241
Miner Slough	2018	2681	2157
Mokelumne nr SJR	4721	4157	4245
Montezuma Sl at Head	12	-10	-11
Montezuma Sl at Mouth	-71	85	83
RMID015	-5406	-5384	-5389
RMID027	-58	-58	-58
ROLD024	-4402	-4421	-4423
ROLD034	-6452	-6443	-6446
RSAC075 Chipps Island	4504	4474	4476
RSAC092 Emmaton	5873	6321	6240
RSAC101 Rio Vista	8255	9273	9149
RSAC123	3607	3991	4134
RSAC128	10999	10338	10606
RSAN018 Jersey Pt	-1002	-1695	-1618
RSAN032 San Andreas	-1720	-2750	-2650
RSAN058	389	383	389
SLDUT007	-112	84	88
SLGEO019 Georgiana Sl	2762	2665	2703
SLTRM004 Threemile Sl	-2310	-2732	-2690
Steamboat Sl	2280	2471	2483
Sutter Sl	2965	3436	3157

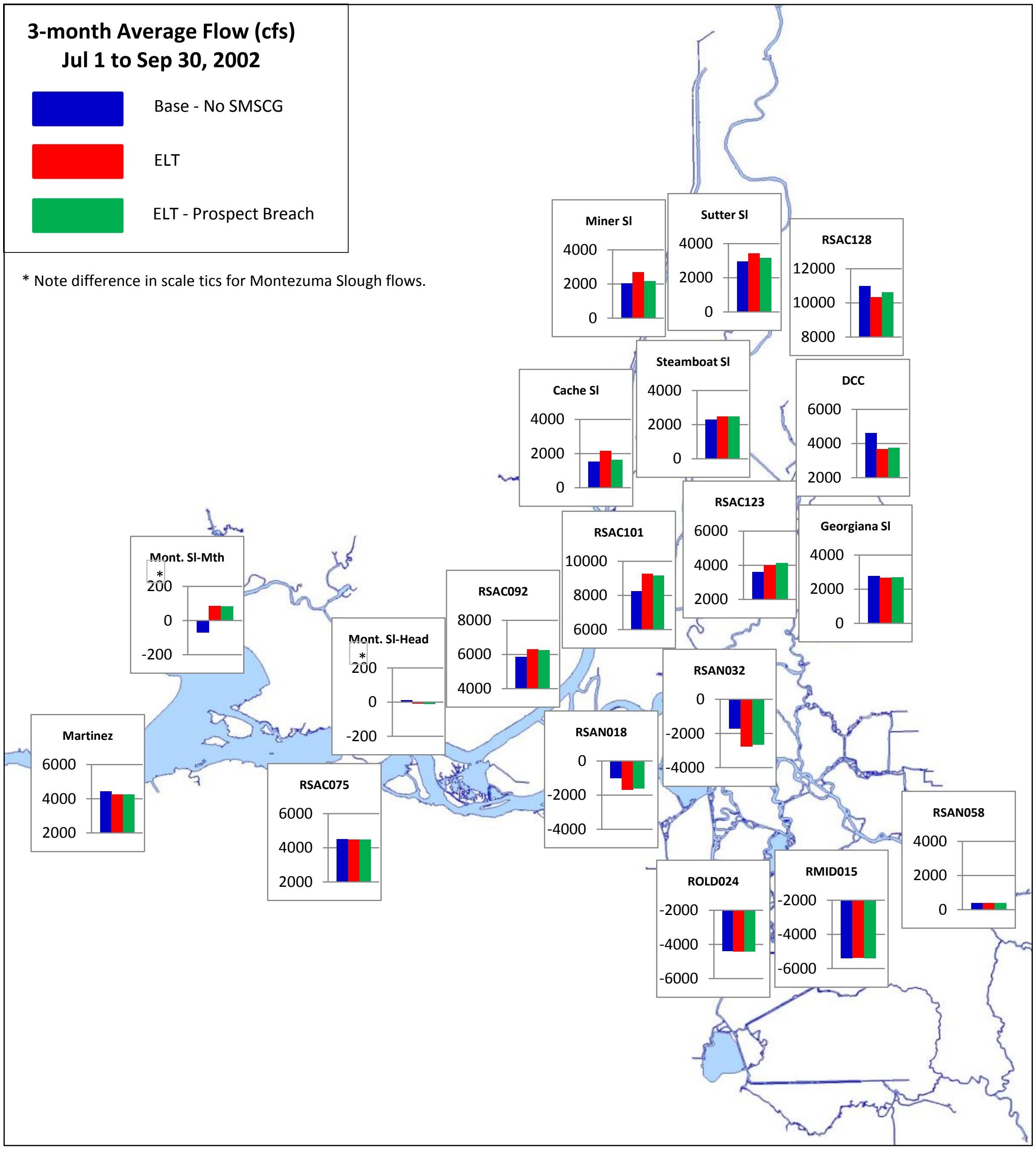


Figure 4-94 Average flows (Jul - Sep 2002) for Base - No SMSCG, ELT and ELT – Prospect Breach simulations.

4.2.5.2 Tidal Prism

Table 4-15 Summary of Apr – Dec 2002 Average Tidal Prism for Base - No SMSCG, ELT and ELT – Prospect Breach simulations, and percent change from Base - SMSCG.

Location	Base – No SMSCG	ELT		ELT – Prospect Breach	
	Tidal Prism (ac-ft)	Tidal Prism (ac-ft)	% Change from Base	Tidal Prism (ac-ft)	% Change from Base
Cache Sl at Ryer	28,681	30,744	7%	30,794	7%
DCC	783	1,225	57%	1,205	54%
False River	18,890	17,565	-7%	17,565	-7%
Martinez	167,685	169,171	1%	169,194	1%
Miner Slough	618	578	-6%	450	-27%
Mokelumne nr SJR	4,613	4,509	-2%	4,496	-2%
Montezuma Sl at Head	2,054	3,221	87%	3,219	87%
Montezuma Sl at Mouth	10,987	21,983	95%	21,983	95%
RMID015	4,021	3,704	-8%	3,704	-8%
RMID027	243	231	-5%	231	-5%
ROLD024	4,412	4,090	-7%	4,090	-7%
ROLD034	2,289	2,107	-8%	2,105	-8%
RSAC075 Chipps Island	115,295	110,508	-4%	110,505	-4%
RSAC092 Emmaton	49,254	49,180	0%	49,167	0%
RSAC101 Rio Vista	36,156	36,783	2%	36,765	2%
RSAC123	2,501	2,252	-10%	2,236	-11%
RSAC128	1,605	1,130	-30%	1,159	-28%
RSAN018 Jersey Pt	50,165	46,935	-6%	46,929	-6%
RSAN032 San Andreas	37,894	35,019	-7%	35,015	-8%
RSAN058	2,386	2,173	-9%	2,174	-9%
SLDUT007	3,076	2,368	-23%	2,368	-23%
SLGEO019 Georgiana Sl	224	301	35%	309	38%
SLTRM004 Threemile Sl	9,431	7,921	-16%	7,924	-16%
Steamboat Sl	914	784	-14%	761	-17%
Sutter Sl	823	726	-12%	641	-22%

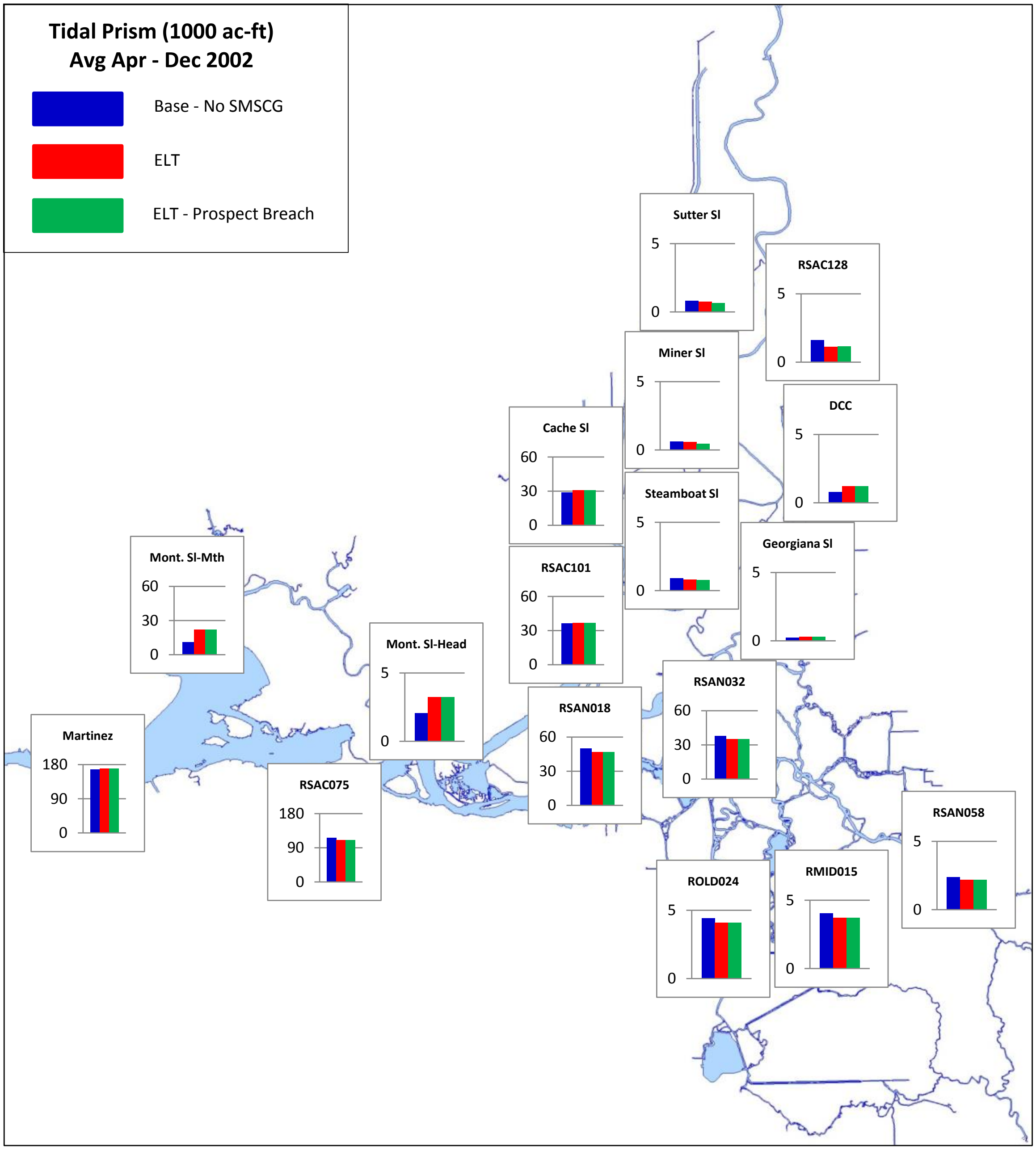


Figure 4-95 Average tidal prism (Apr - Dec 2002) for Base – No SMSCG, ELT and ELT – Prospect Breach simulations.

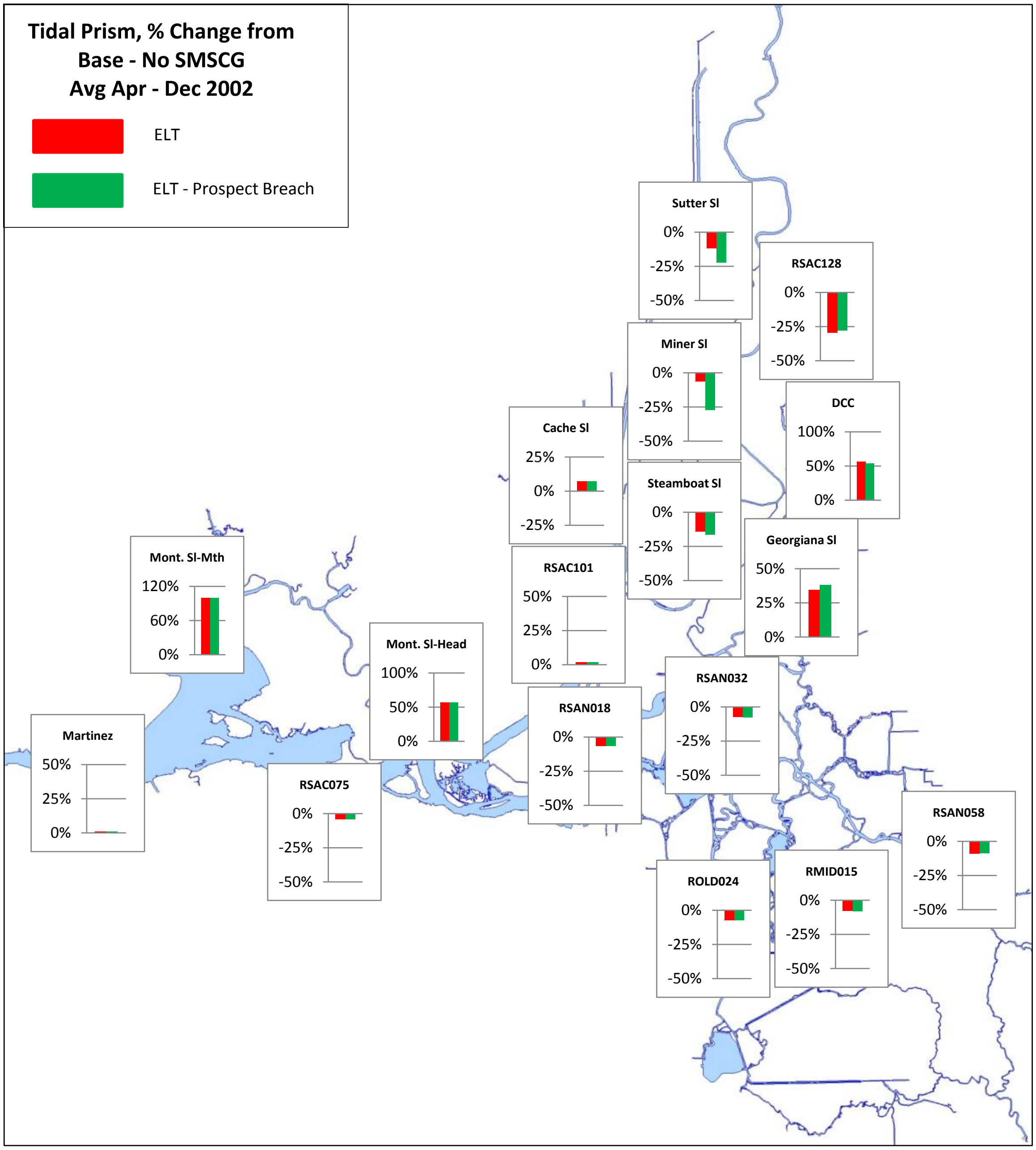


Figure 4-96 Average percent change from Base – No SMSCG tidal prism (Apr - Dec 2002) for ELT and ELT – Prospect Breach simulations.

4.2.5.3 Tidal Range

Table 4-16 Summary of Apr – Dec 2002 Average Tidal Range for Base – No SMSCG, ELT and ELT – Prospect Breach simulations.

Location	Apr – Dec 2002 Average Tidal Range (ft)		
	Base – No SMSCG	ELT	ELT – Prospect Breach
Cache Sl at Ryer	3.95	3.21	3.21
DCC	2.92	2.31	2.27
False River	3.4	3.08	3.08
Martinez	5.47	5.24	5.24
Miner Slough	3.11	3.01	2.5
Montezuma Sl at Head	4.25	3.85	3.85
Montezuma Sl at Mouth	5	4.32	4.32
RMID015	3.77	3.45	3.45
RMID023	3.54	3.27	3.27
ROLD024	3.56	3.27	3.27
ROLD034	3.41	3.15	3.15
RSAC075 Chipps Island	4.42	4.04	4.04
RSAC092 Emmaton	3.93	3.52	3.53
RSAC101 Rio Vista	3.87	3.23	3.23
RSAC123	2.95	2.34	2.32
RSAC128	2.91	2.33	2.29
RSAN018 Jersey Pt	3.47	3.13	3.13
RSAN032 San Andreas	3.37	3.07	3.07
RSAN058	4.06	3.69	3.69
SLDUT007 Dutch Slough	3.59	3.19	3.19
SLGEO019 Georgiana Sl	2.95	2.36	2.33
SLTRM004 Threemile Sl	3.45	3.09	3.09
Steamboat Sl	2.69	2.22	2.15
Sutter Sl	2.57	2.17	2.02
Victoria Canal	3.54	3.28	3.28

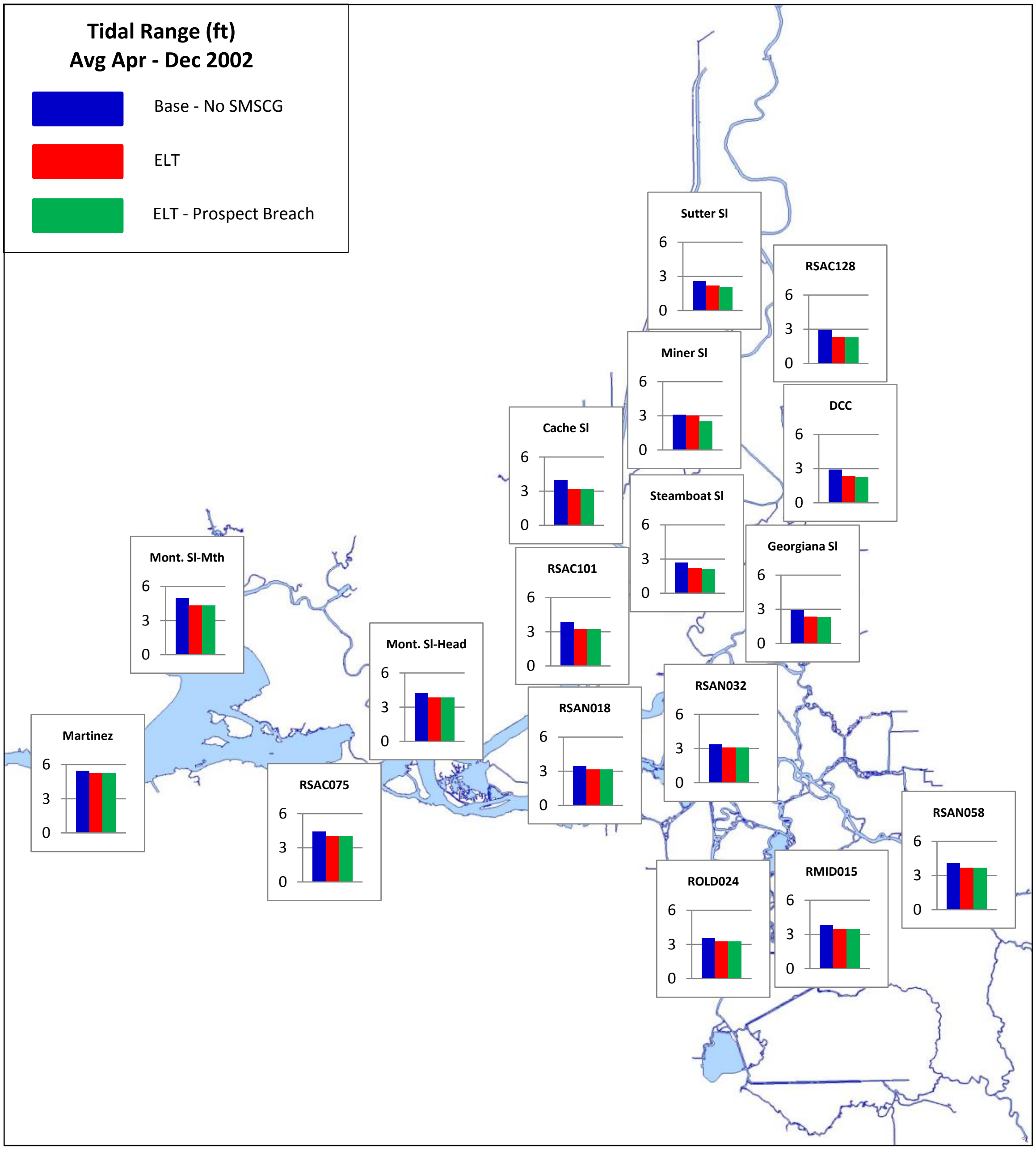


Figure 4-97 Average tidal range (Apr - Dec 2002) for Base – No SMSCG, ELT and ELT – Prospect Breach simulations.

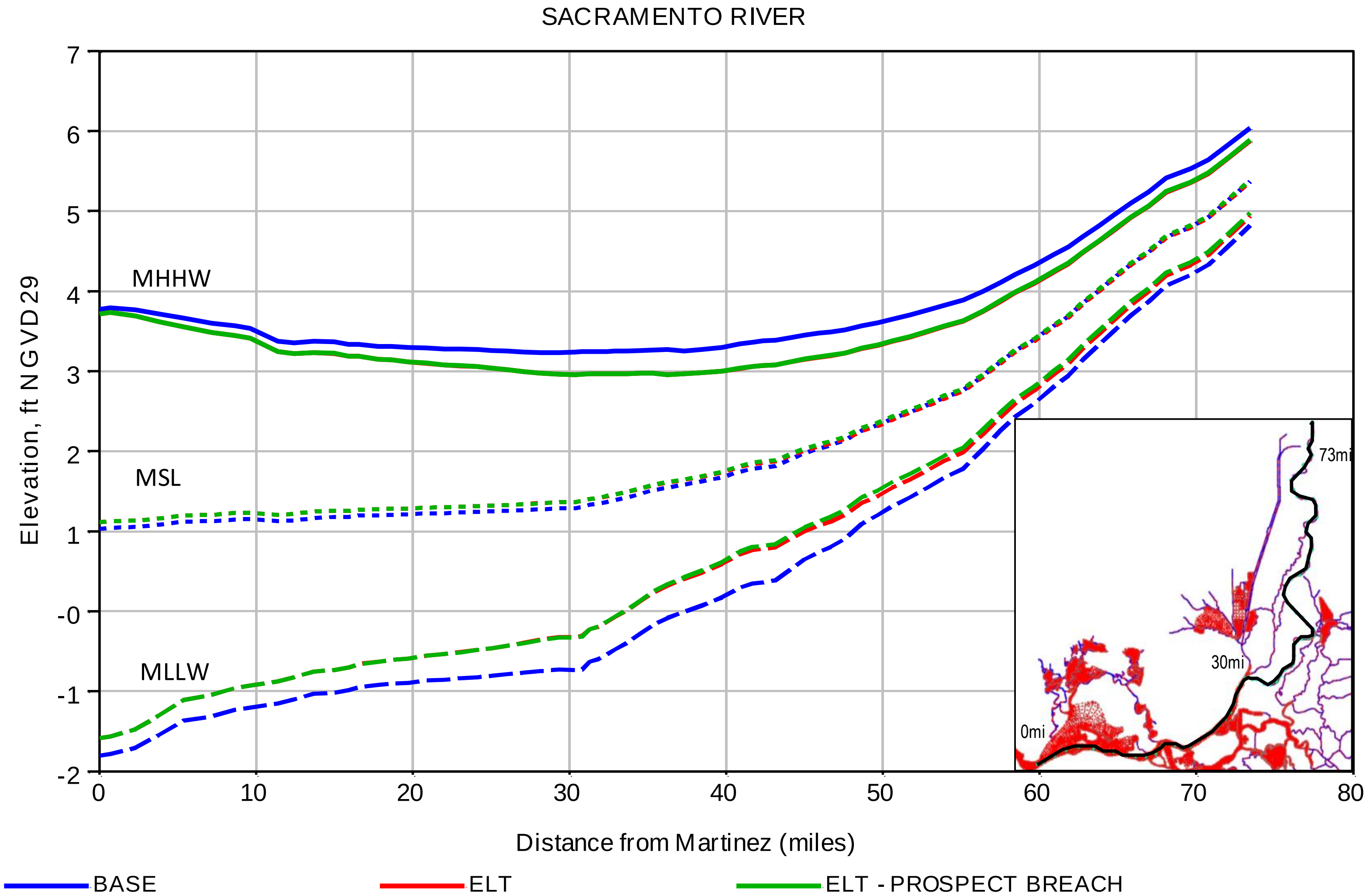


Figure 4-98 Profiles of July 2002 MHHW, MSL and MLLW along the Sacramento River for the Base - No SMSCG (Base), ELT and ELT - Prospect Breach simulations.

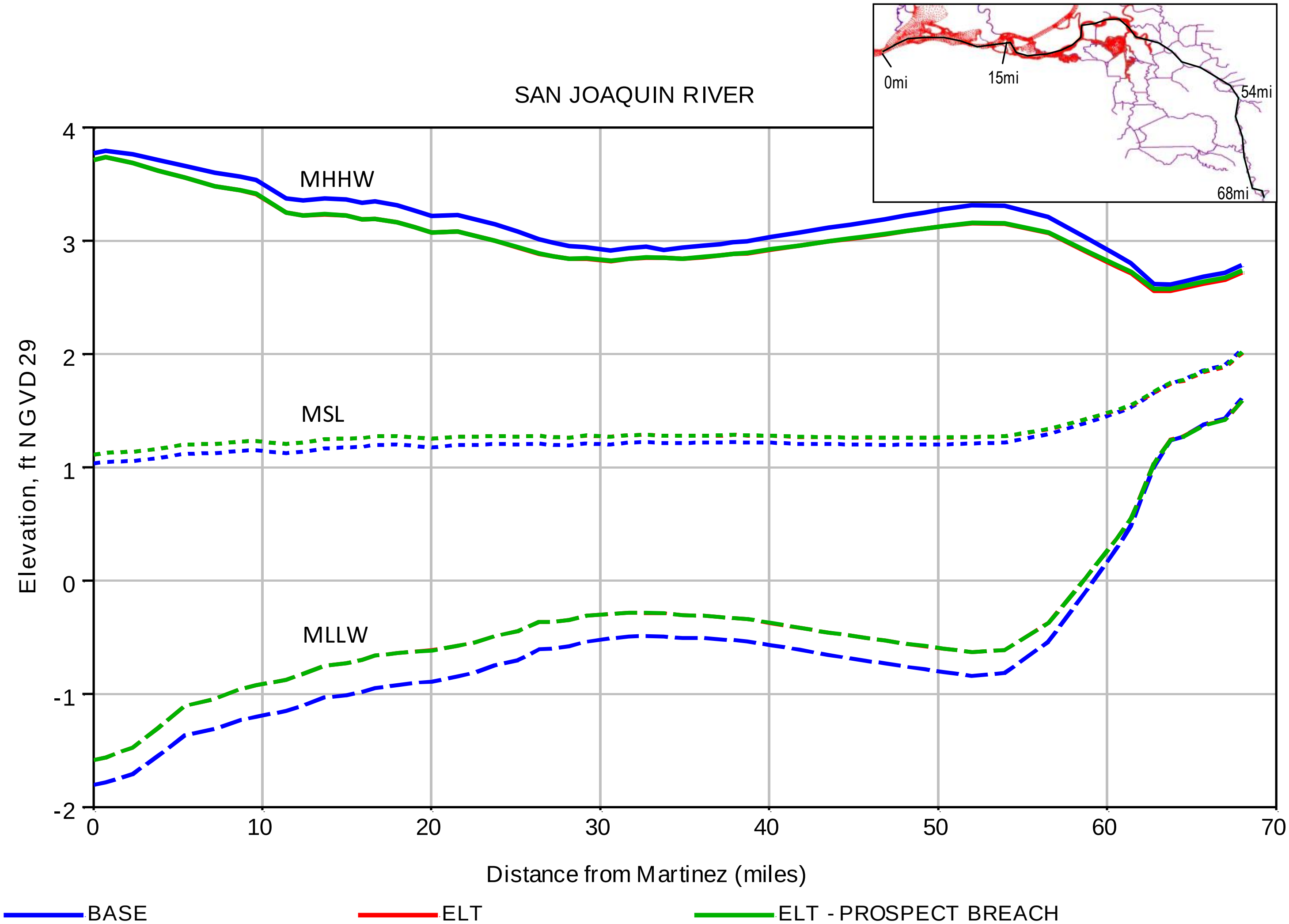


Figure 4-99 Profiles of July 2002 MHHW, MSL and MLLW along the San Joaquin River for the Base - No SMSCG (Base), ELT and ELT - Prospect Breach simulations.

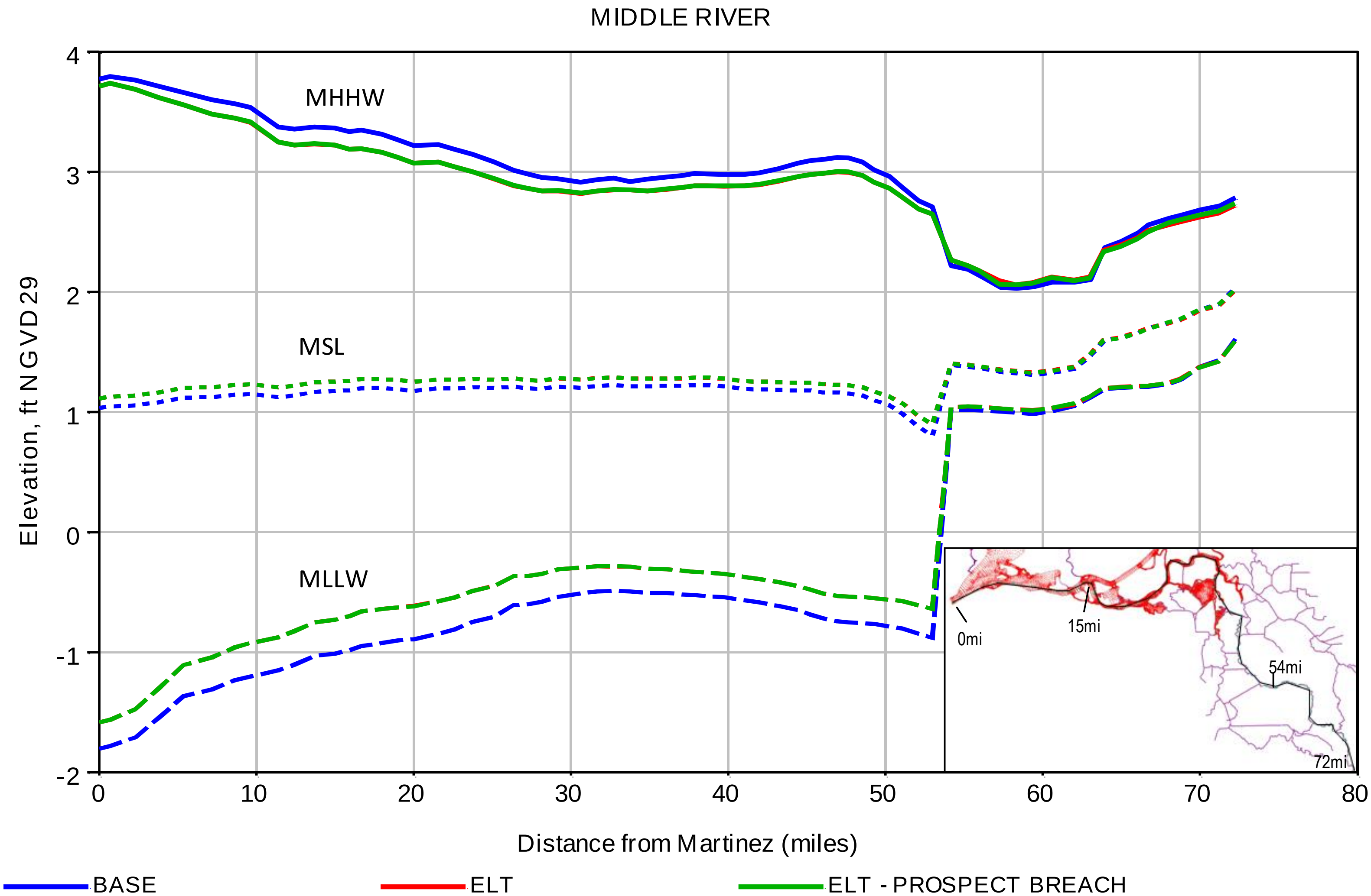


Figure 4-100 Profiles of July 2002 MHHW, MSL and MLLW along the Middle River for the Base - No SMSCG (Base), ELT and ELT - Prospect Breach simulations.

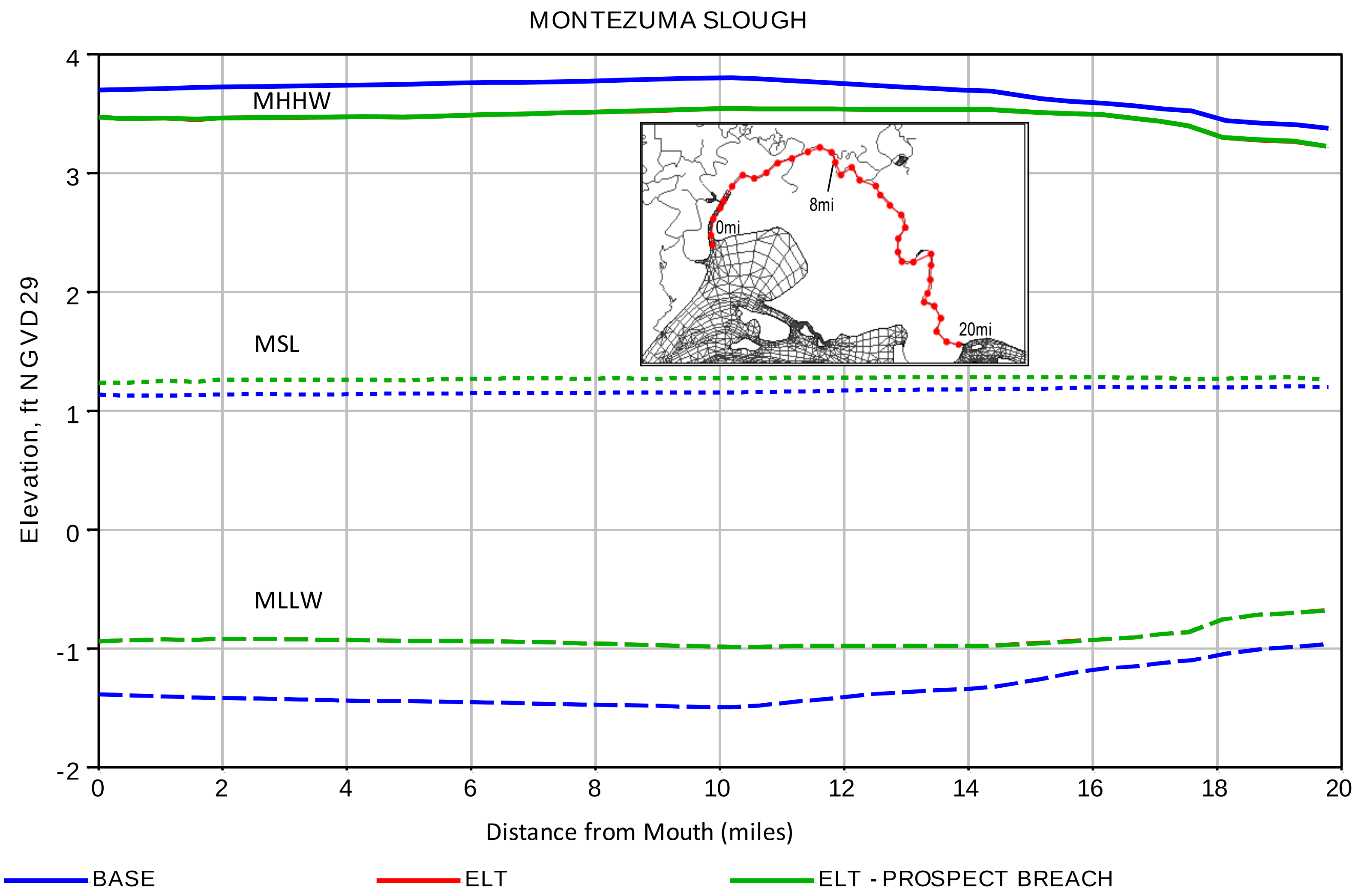


Figure 4-101 Profiles of July 2002 MHHW, MSL and MLLW along Montezuma Slough for the Base - No SMSCG (Base), ELT and ELT - Prospect Breach simulations.

4.2.5.4 Stage Time Series

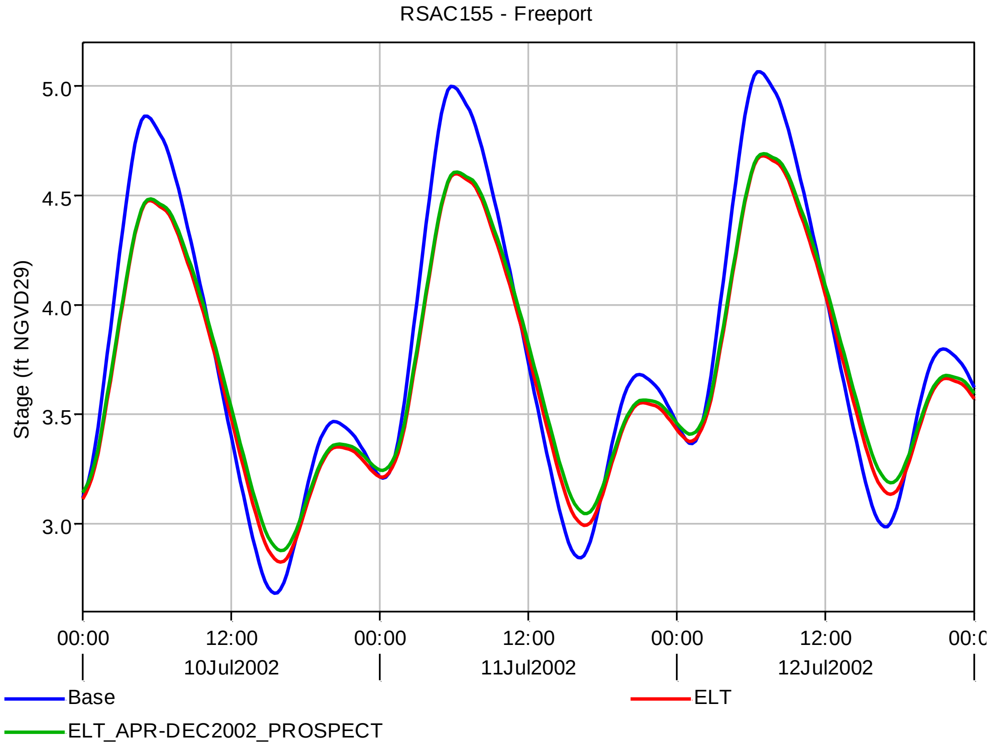


Figure 4-102 Stage at RSAC155 for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

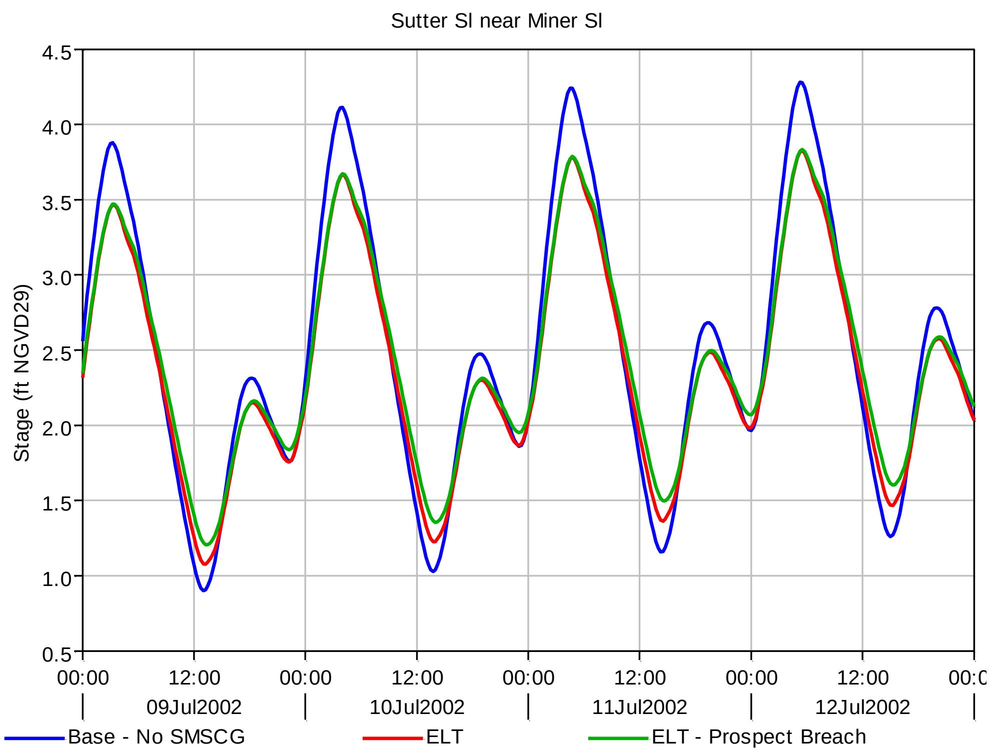


Figure 4-103 Stage in Sutter Slough for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

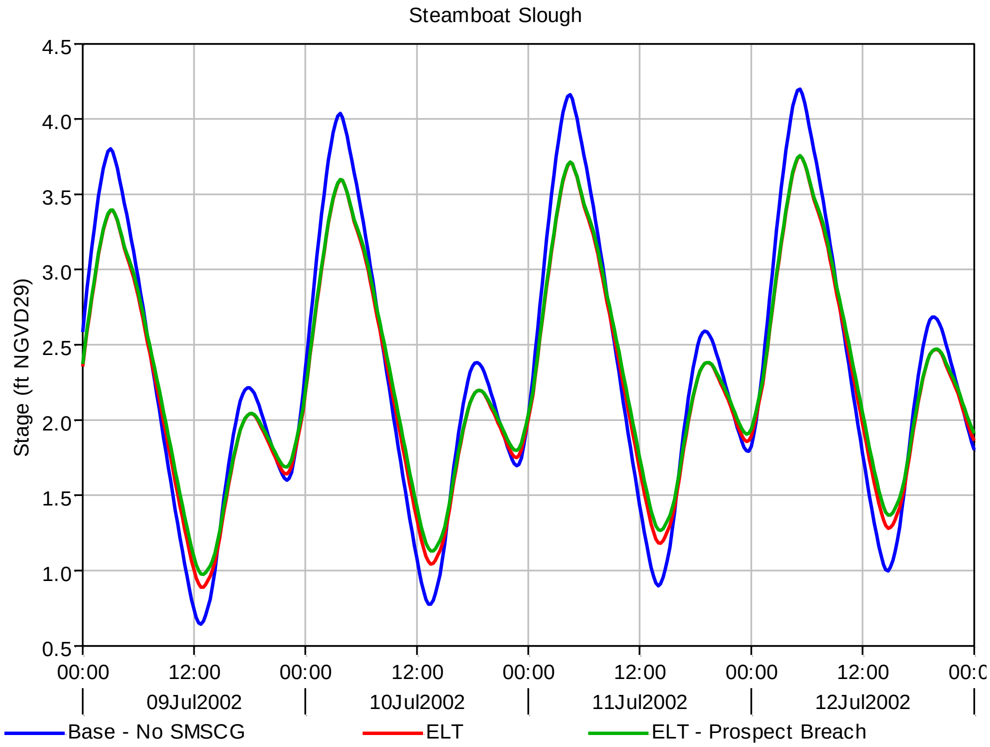


Figure 4-104 Stage in Steamboat Slough for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

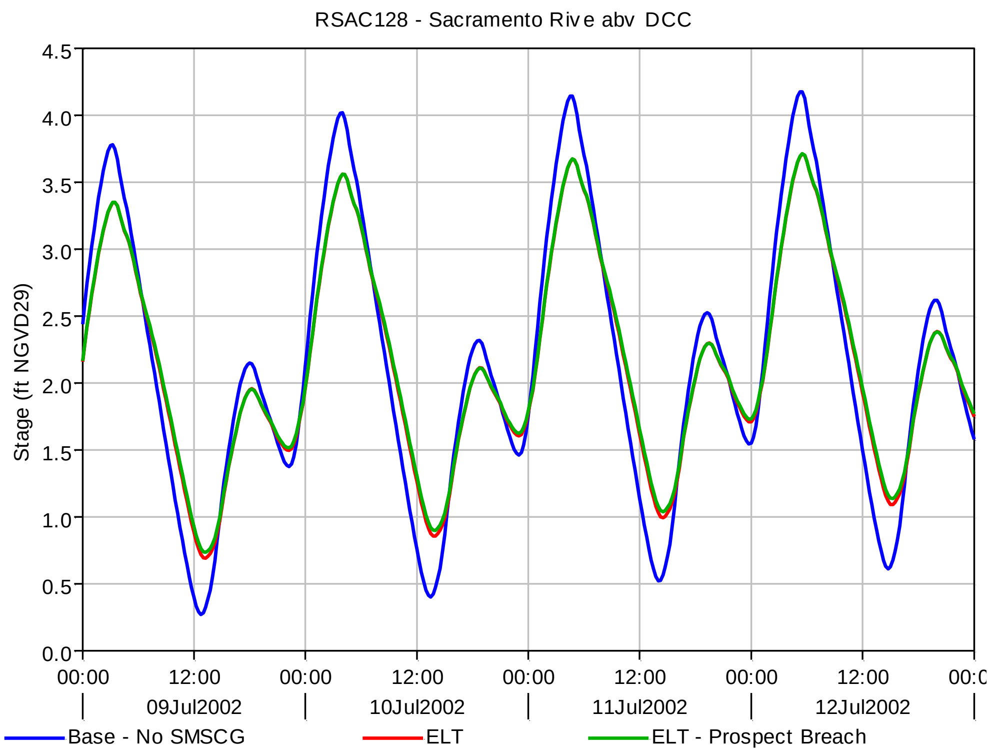


Figure 4-105 Stage at RSAC128 for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

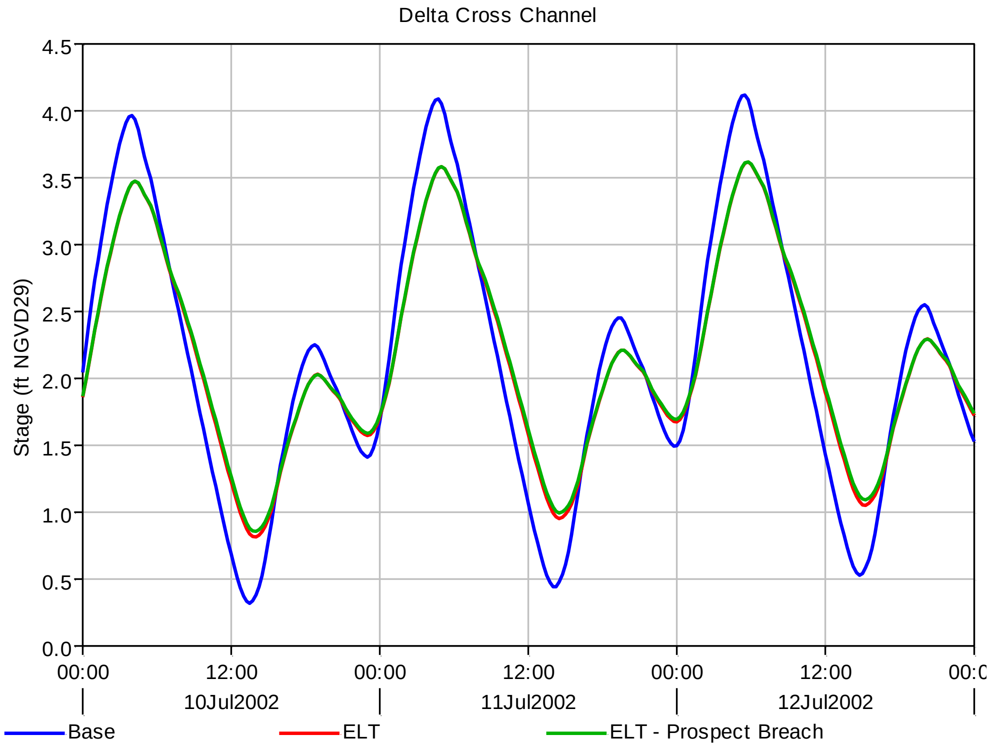


Figure 4-106 Stage in Delta Cross Channel for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

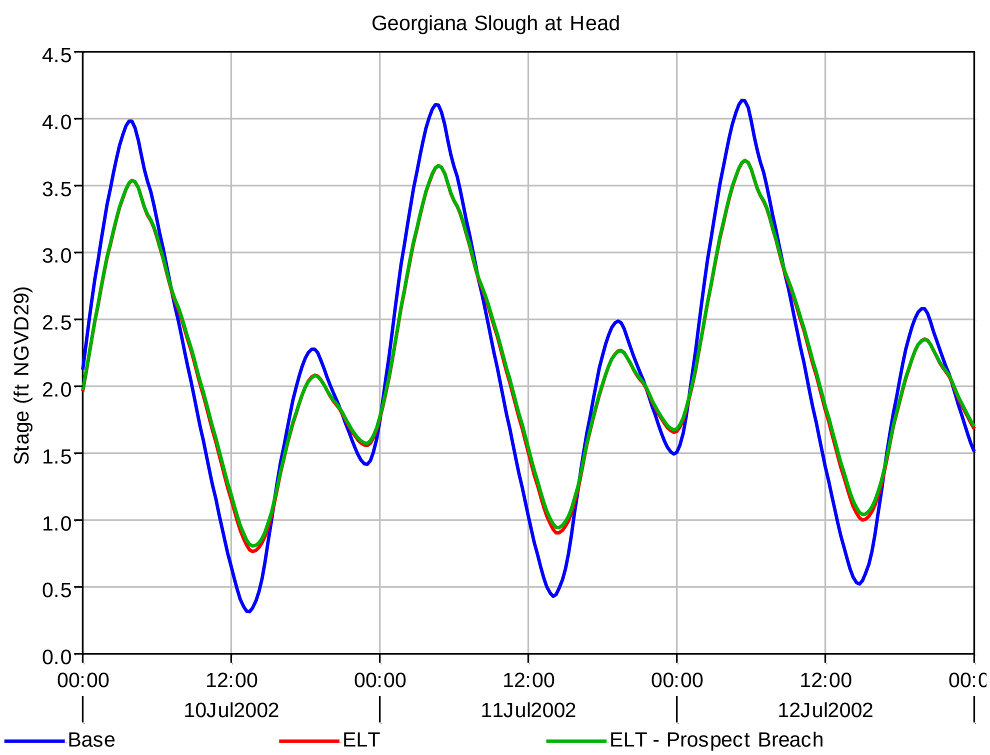


Figure 4-107 Stage in Georgiana Slough at head for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

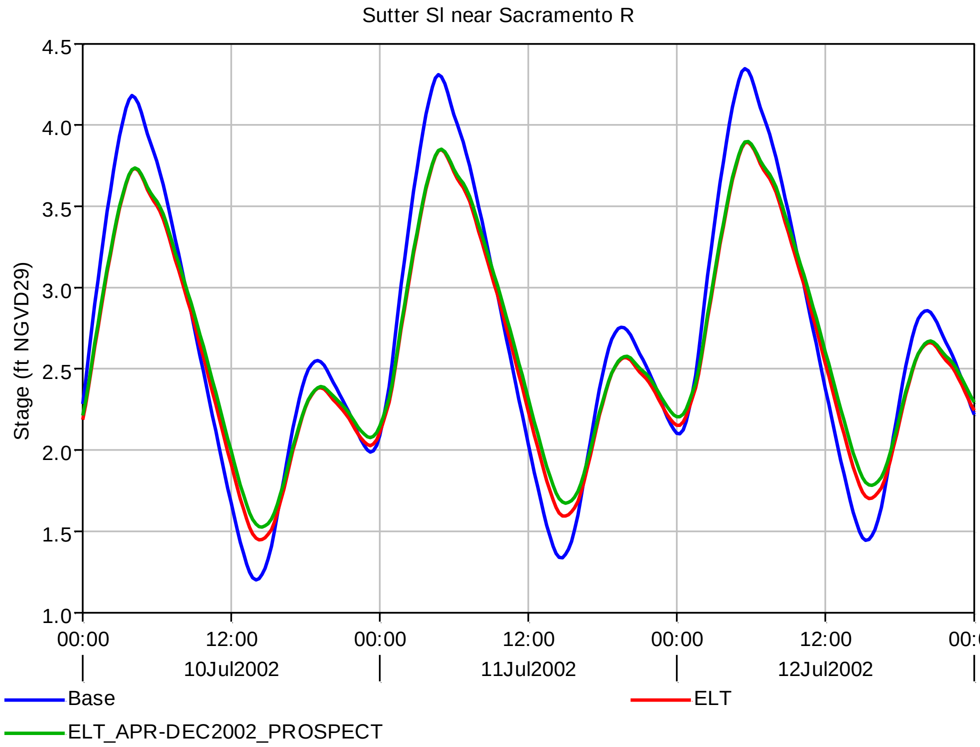


Figure 4-108 Stage in Sutter Slough near Sacramento R. for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

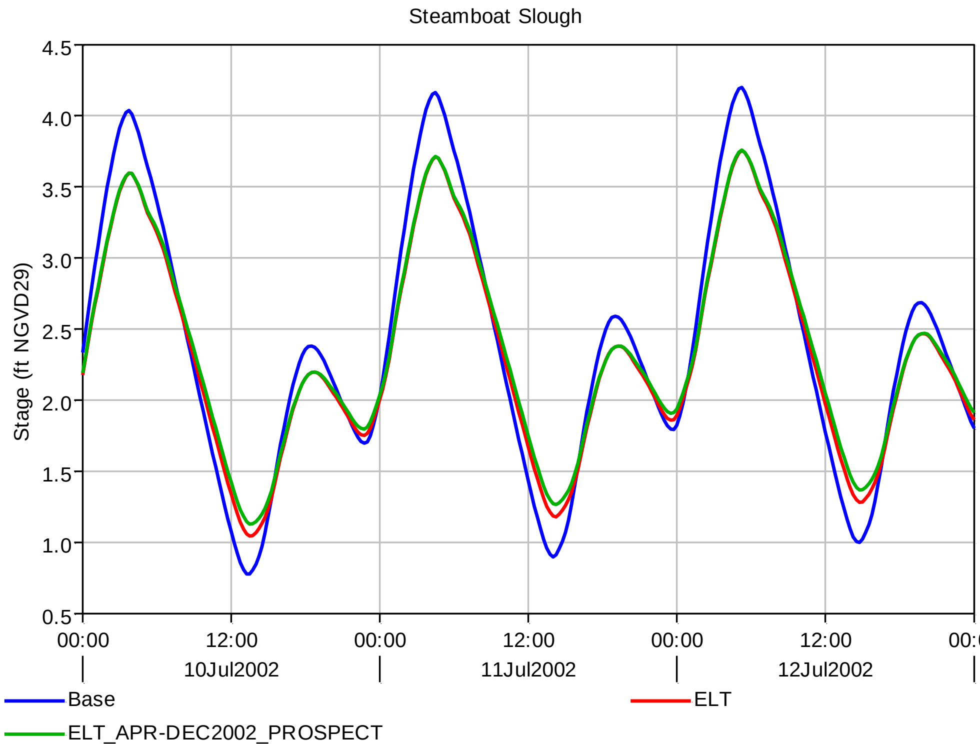


Figure 4-109 Stage in Steamboat Slough for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

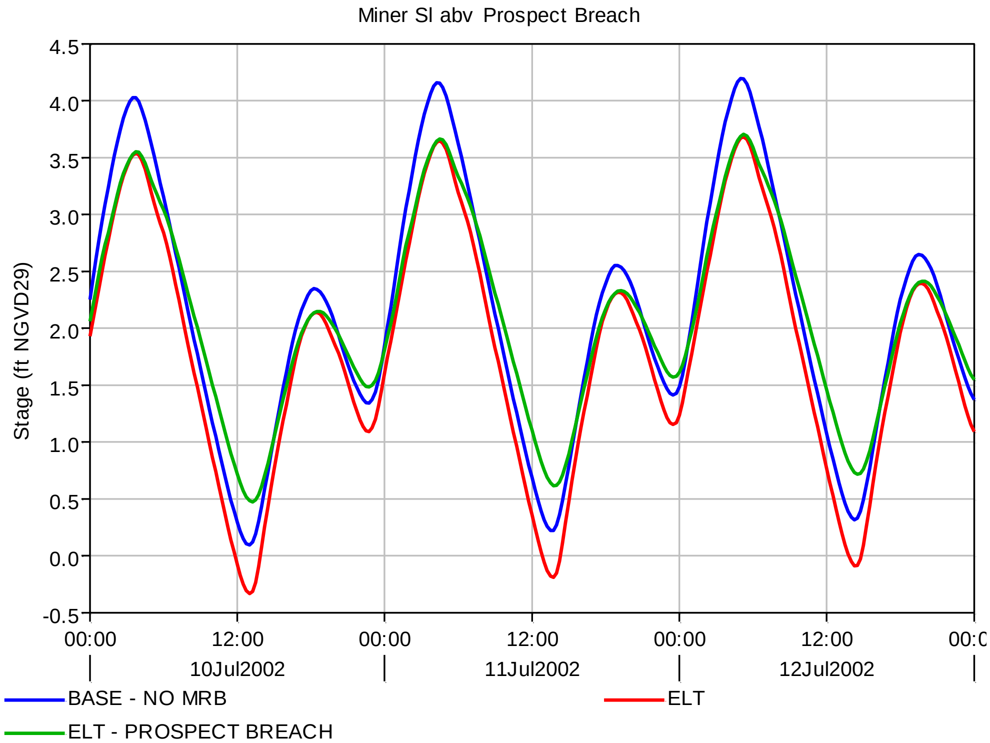


Figure 4-110 Stage in Miner Slough for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

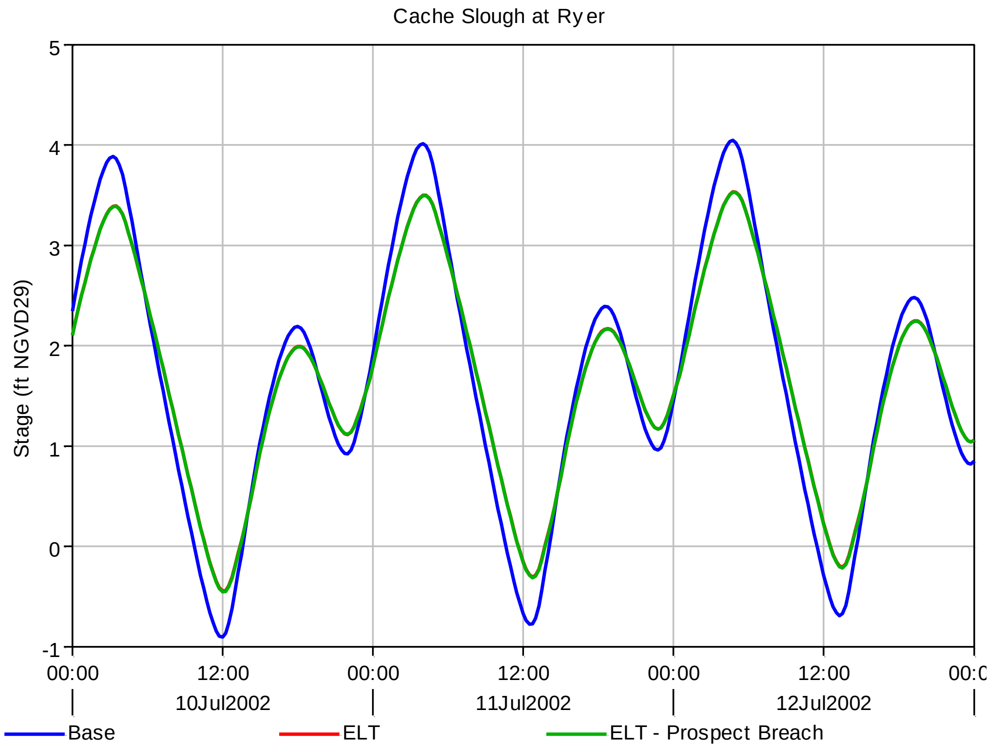


Figure 4-111 Stage in Cache Slough at Ryer Island for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

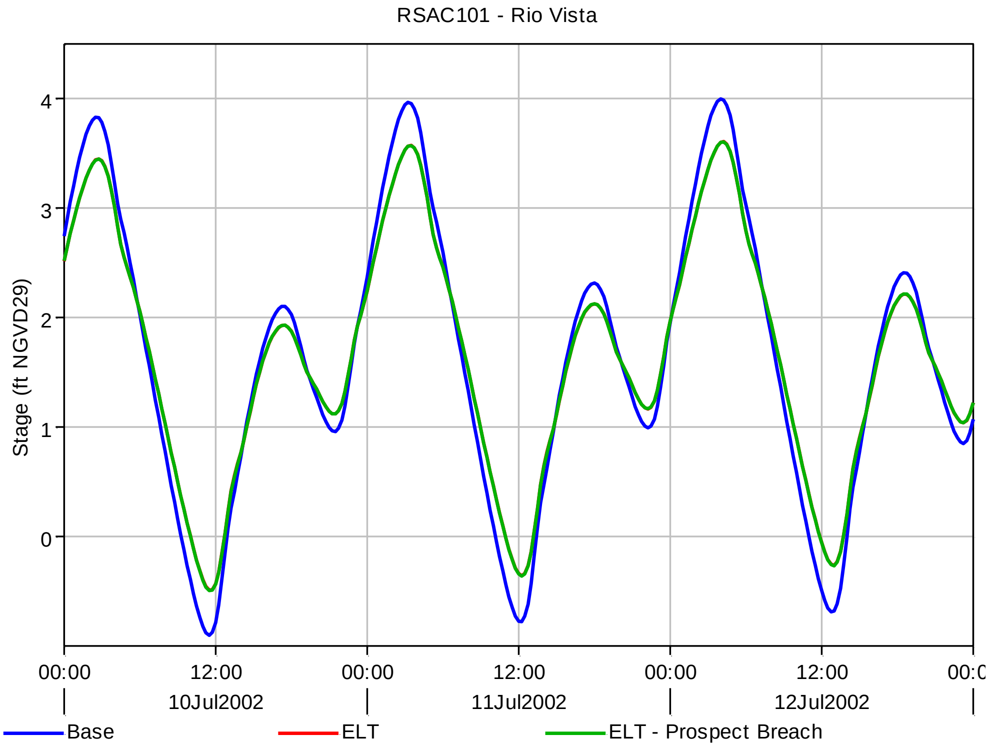


Figure 4-112 Stage in Sacramento River at RSAC101 for Base - No SMSCG (Base), ELT and ELT - Prospect Breach scenarios.

4.2.5.5 Bed Shear

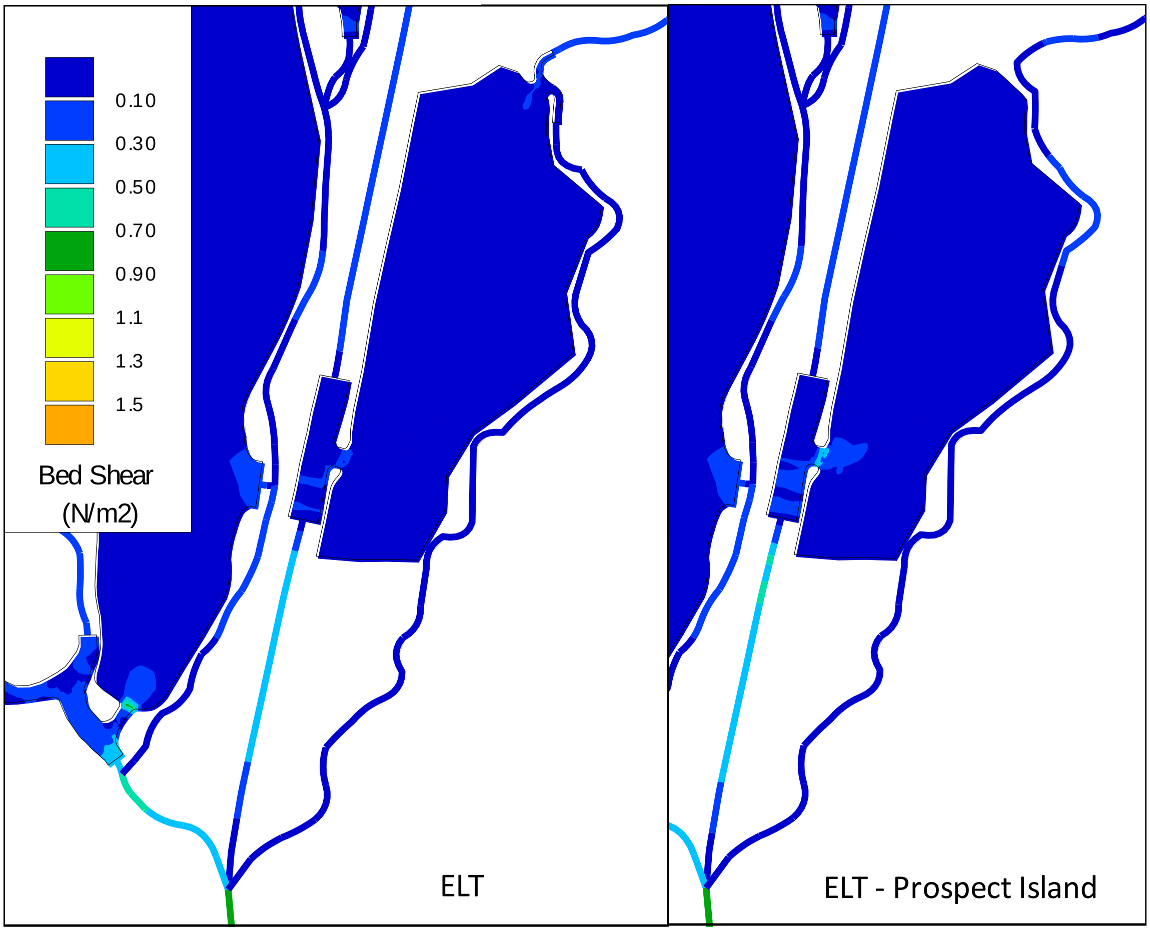


Figure 4-113 Comparison of bed shear in the Prospect Island vicinity for the ELT and ELT-Prospect Island simulations at times of peak bed shear during July 2002.

4.2.6 LLT – Little Egbert Breach

Three-month average flows for the LLT – Little Egbert Breach simulation are tabulated in Table 4-17 and plotted in Figure 4-114. Elimination of the Little Egbert breach on Cache Slough for the LLT – Little Egbert Breach case impacts flows in the north and central Delta. For the LLT case, the two breaches on Little Egbert provide additional conveyance through the island. For the LLT case, net flow direction through Little Egbert is in the upstream direction, resulting in increased net flow in the downstream direction in Cache Slough. Thus when one of the breaches is removed, as in the LLT – Little Egbert Case, the three-month average flow in Cache is decreased by 12% relative to LLT. Average flows in Miner Slough are increased by 5% relative to LLT. Impacts at RSAC128 and DCC are very small, but Georgiana Slough flows are increased by 3% relative to LLT. Other notable impacts include decreased average flows in Threemile Slough (-7%) San Andreas Landing (-4%) and Dutch Slough (-10%), and increased average flows at Jersey Point (6%), False River (4%) and Emmaton (2%).

LLT – Little Egbert Breach tidal prism results are shown in Table 4-18, Figure 4-115 and Figure 4-116. Tidal prism is strongly impacted in the north Delta. Elimination of the Little Egbert breach increases tidal prism relative to LLT by 20% in Cache Slough, by 8% in Steamboat Slough, by 13% in DCC and by 9% at RSAC123. Tidal prism is reduced relative to LLT by 24% in Miner Slough, by 10% in Sutter Slough and by 2% in Georgiana Slough. Tidal prism is reduced by 8% relative to LLT at Rio Vista, by 7% at Emmaton and by 2% at Chipps Island. Tidal prism in Threemile Slough increases by 13%. Changes in the San Joaquin River and south Delta are generally 3% or less, relative to LLT.

As shown in Table 4-19 and Figure 4-117, elimination of the Little Egbert breach on Cache Slough decreases tidal range relative to LLT by 4% in Cache Slough, by 6% in Miner Slough, by 3% in Sutter Slough and by 2% in Steamboat Slough. At most other locations throughout the Delta and Suisun Bay, tidal range is increased by 0 to 3% relative to LLT.

Profile plots of July 2002 MHHW, MSL and MLLW, in Figure 4-118 through Figure 4-121, show the small increases in tidal range in the Sacramento River below Cache Slough, in the San Joaquin River below Stockton, in Middle River below Victoria Canal and in Montezuma Slough.

For reference, time series plots of stage are provided for various locations in Figure 4-122 through Figure 4-137. A map of locations plotted is shown in Figure 4-2.

There are no new or resolved bed shear issues for this sensitivity case.

4.2.6.1 Net Flows

Table 4-17 Summary of 3-month Average flow (Jul – Sep 2002) for Base - No MRB, LLT, LLT – Little Egbert Breach simulations.

	3-month Average Flow, Jul – Sep 2002 (cfs)		
Location	**Base – No MRB**	**LLT**	**LLT – Little Egbert Breach**
Cache Sl at Ryer	1535	2565	2254
DCC	4609	3449	3455
False River	-1696	-1806	-1874
Martinez	4422	4080	4082
Miner Slough	2018	2667	2795
Mokelumne nr SJR	4719	3781	3849
Montezuma Sl at Head	12	13	13
Montezuma Sl at Mouth	-71	-191	-190
RMID015	-5351	-5265	-5271
RMID027	-25	-45	-43
ROLD024	-4425	-4541	-4533
ROLD034	-6493	-6603	-6604
RSAC075 Chipps Island	4503	4395	4396
RSAC092 Emmaton	5870	6484	6605
RSAC101 Rio Vista	8256	9712	9628
RSAC123	3607	4258	4139
RSAC128	10999	10137	10104
RSAN018 Jersey Pt	-999	-1914	-2023
RSAN032 San Andreas	-1716	-3216	-3087
RSAN058	366	391	393
SLDUT007	-113	68	61
SLGEO019 Georgiana Sl	2762	2408	2490
SLTRM004 Threemile Sl	-2313	-3012	-2805
Steamboat Sl	2280	2629	2601
Sutter Sl	2965	3480	3540

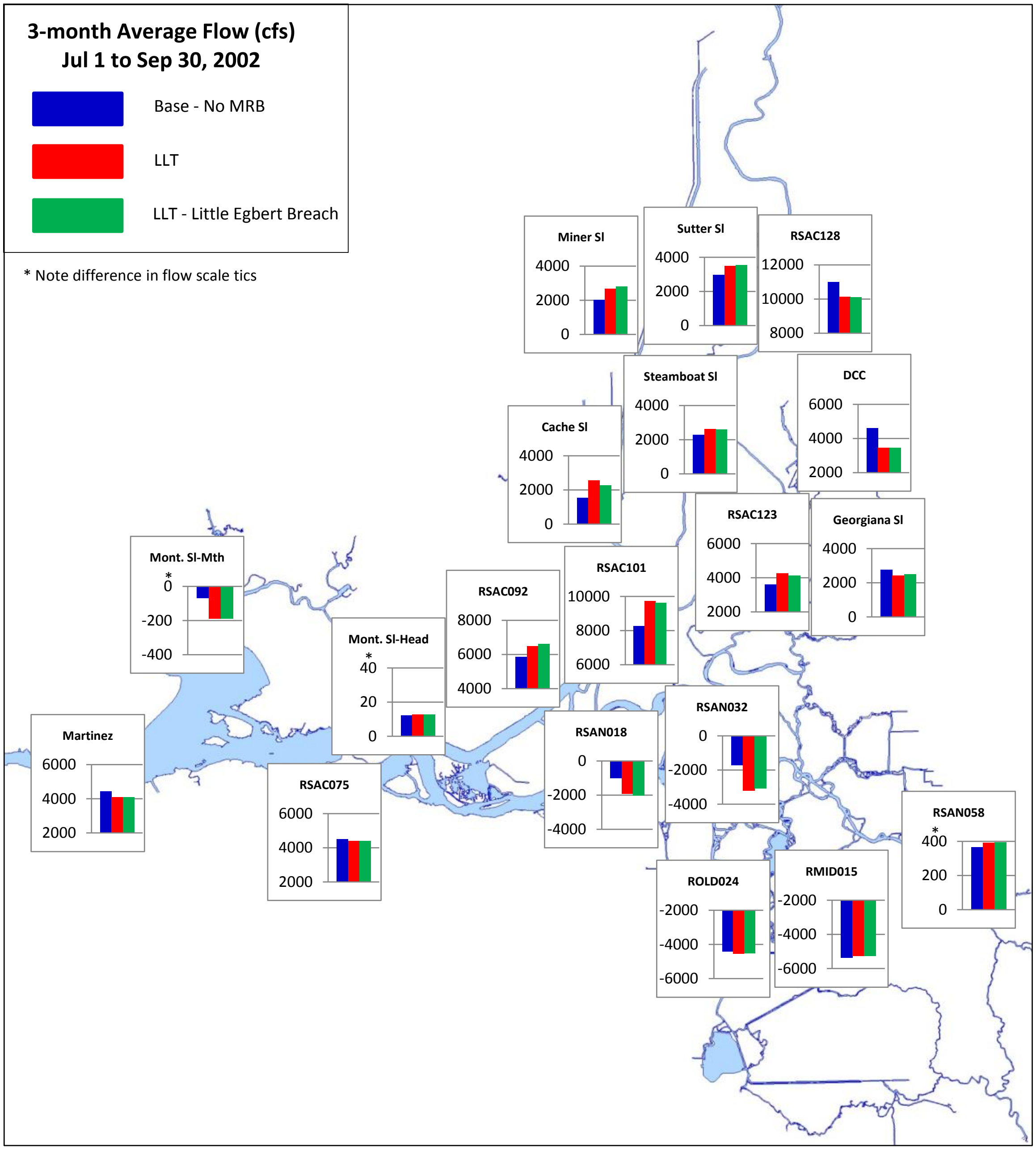


Figure 4-114 Average flows (Jul - Sep 2002) for Base - No MRB, LLT and LLT – Little Egbert Breach simulations.

4.2.6.2 Tidal Prism

Table 4-18 Summary of Apr – Dec 2002 Average Tidal Prism for Base - No MRB, LLT and LLT – Little Egbert Breach simulations, and percent change from Base- No MRB.

Location	Base – No MRB	LLT		LLT – Little Egbert Breach	
	Tidal Prism (ac-ft)	Tidal Prism (ac-ft)	% Change from Base	Tidal Prism (ac-ft)	% Change from Base
Cache Sl at Ryer	28,697	26,884	-6%	32,242	12%
DCC	782	949	21%	1,073	37%
False River	18,870	16,508	-13%	16,845	-11%
Martinez	167,717	170,966	2%	171,420	2%
Miner Slough	618	455	-26%	345	-44%
Mokelumne nr SJR	4,615	4,490	-3%	4,470	-3%
Montezuma Sl at Head	2,053	3,283	60%	3,356	63%
Montezuma Sl at Mouth	10,988	23,108	110%	23,258	112%
RMID015	4,119	3,333	-19%	3,418	-17%
RMID027	474	1,784	277%	1,802	281%
ROLD024	4,427	3,655	-17%	3,750	-15%
ROLD034	2,352	1,960	-17%	2,005	-15%
RSAC075 Chipps Island	115,263	108,506	-6%	106,519	-8%
RSAC092 Emmaton	49,256	50,591	3%	47,273	-4%
RSAC101 Rio Vista	36,171	40,582	12%	37,224	3%
RSAC123	2,499	1,811	-28%	1,983	-21%
RSAN018 Jersey Pt	50,110	44,549	-11%	45,046	-10%
RSAC128	1,608	1,175	-27%	1,164	-28%
RSAN032 San Andreas	37,847	32,450	-14%	33,291	-12%
RSAN058	2,385	2,603	9%	2,663	12%
SLDUT007	3,073	2,226	-28%	2,249	-27%
SLGEO019 Georgiana Sl	222	415	87%	406	83%
SLTRM004 Threemile Sl	9,413	6,526	-31%	7,359	-22%
Steamboat Sl	913	598	-35%	643	-30%
Sutter Sl	823	574	-30%	518	-37%

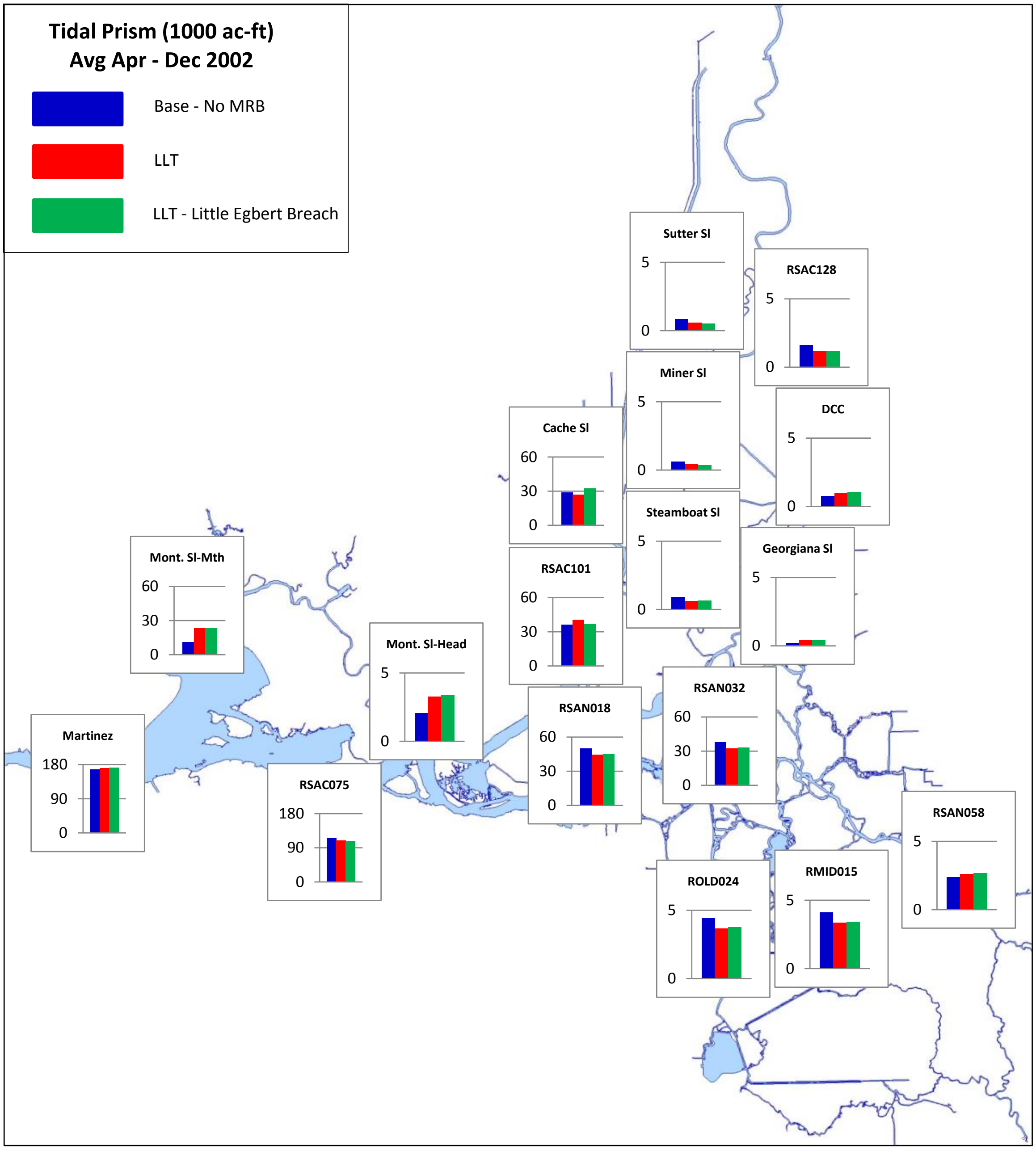


Figure 4-115 Average tidal prism (Apr - Dec 2002) for Base - No MRB, LLT and LLT – Little Egbert Breach simulations.

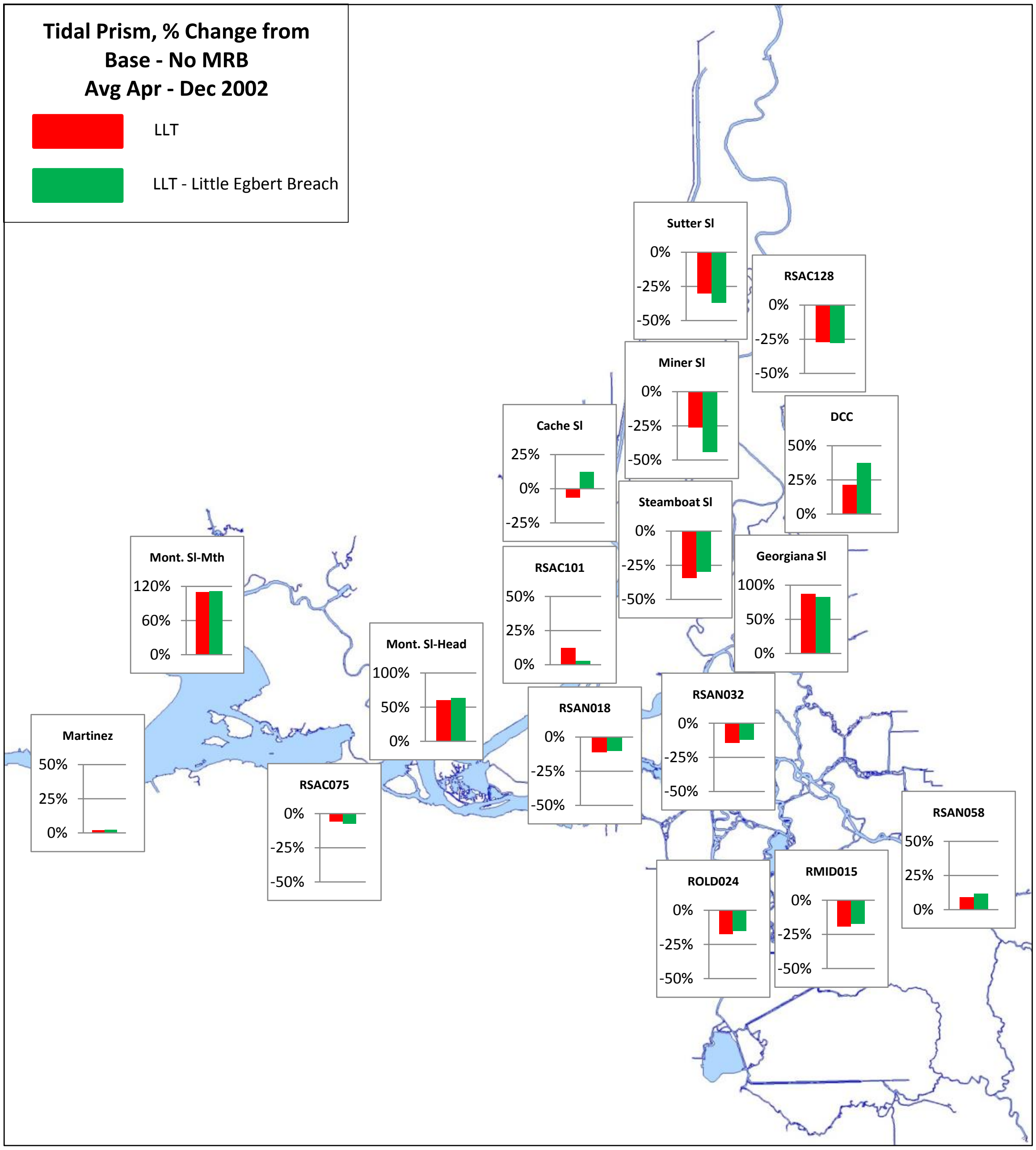


Figure 4-116 Average percent change from Base - No MRB tidal prism (Apr - Dec 2002) for LLT and LLT – Little Egbert Breach simulations.

4.2.6.3 Tidal Range

Table 4-19 Summary of Apr – Dec 2002 Average Tidal Range for Base - No MRB, LLT and LLT – Little Egbert Breach simulations.

Location	Apr – Dec 2002 Average Tidal Range (ft)		
	Base – No MRB	LLT	LLT – Little Egbert Breach
Cache Sl at Ryer	3.95	2.75	2.63
DCC	2.92	2.11	2.1
False River	3.4	2.93	3.0
Martinez	5.47	5.14	5.17
Miner Slough	3.12	2.62	2.47
Montezuma Sl at Head	4.25	3.64	3.72
Montezuma Sl at Mouth	5.0	4.05	4.11
RMID015	3.76	3.14	3.21
RMID023	3.49	2.48	2.54
RMID027	3.33	0.56	0.49
ROLD024	3.55	3.02	3.08
ROLD034	3.36	2.73	2.78
RSAC075 Chipps Island	4.42	3.85	3.93
RSAC092 Emmaton	3.93	3.23	3.32
RSAC101 Rio Vista	3.86	2.79	2.87
RSAC123	2.95	2.14	2.14
RSAC128	2.91	2.12	2.11
RSAN018 Jersey Pt	3.47	2.98	3.06
RSAN032 San Andreas	3.37	2.89	2.95
RSAN058	4.05	3.25	3.32
SLDUT007 Dutch Slough	3.59	3.04	3.12
SLGEO019 Georgiana Sl	2.95	2.16	2.16
SLTRM004 Threemile Sl	3.45	2.9	2.96
Steamboat Sl	2.69	1.99	1.96
Sutter Sl	2.57	1.94	1.88
Victoria Canal	3.48	2.48	2.53

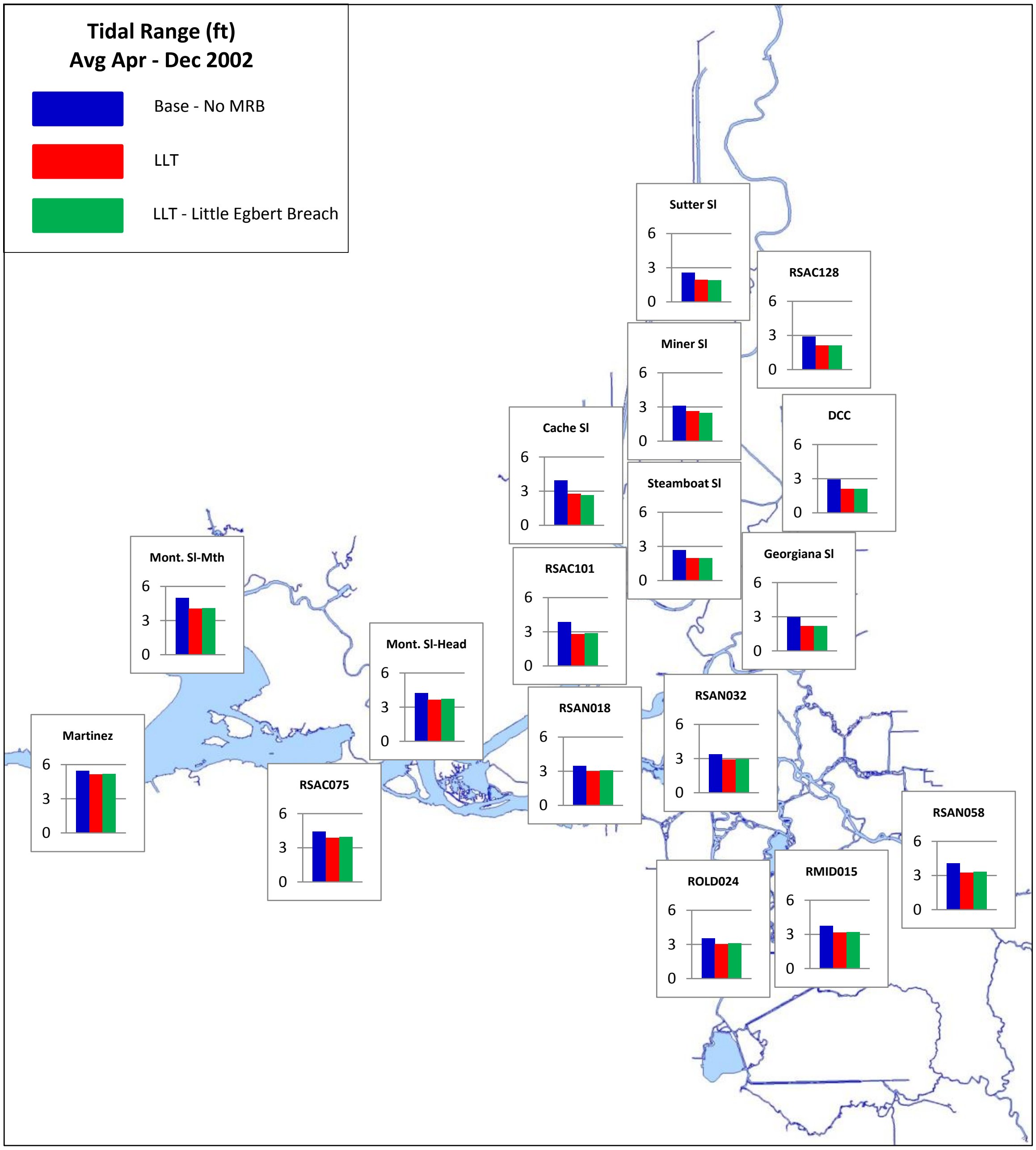


Figure 4-117 Average tidal range (Apr - Dec 2002) for Base - No MRB, LLT and LLT – Little Egbert Breach simulations.

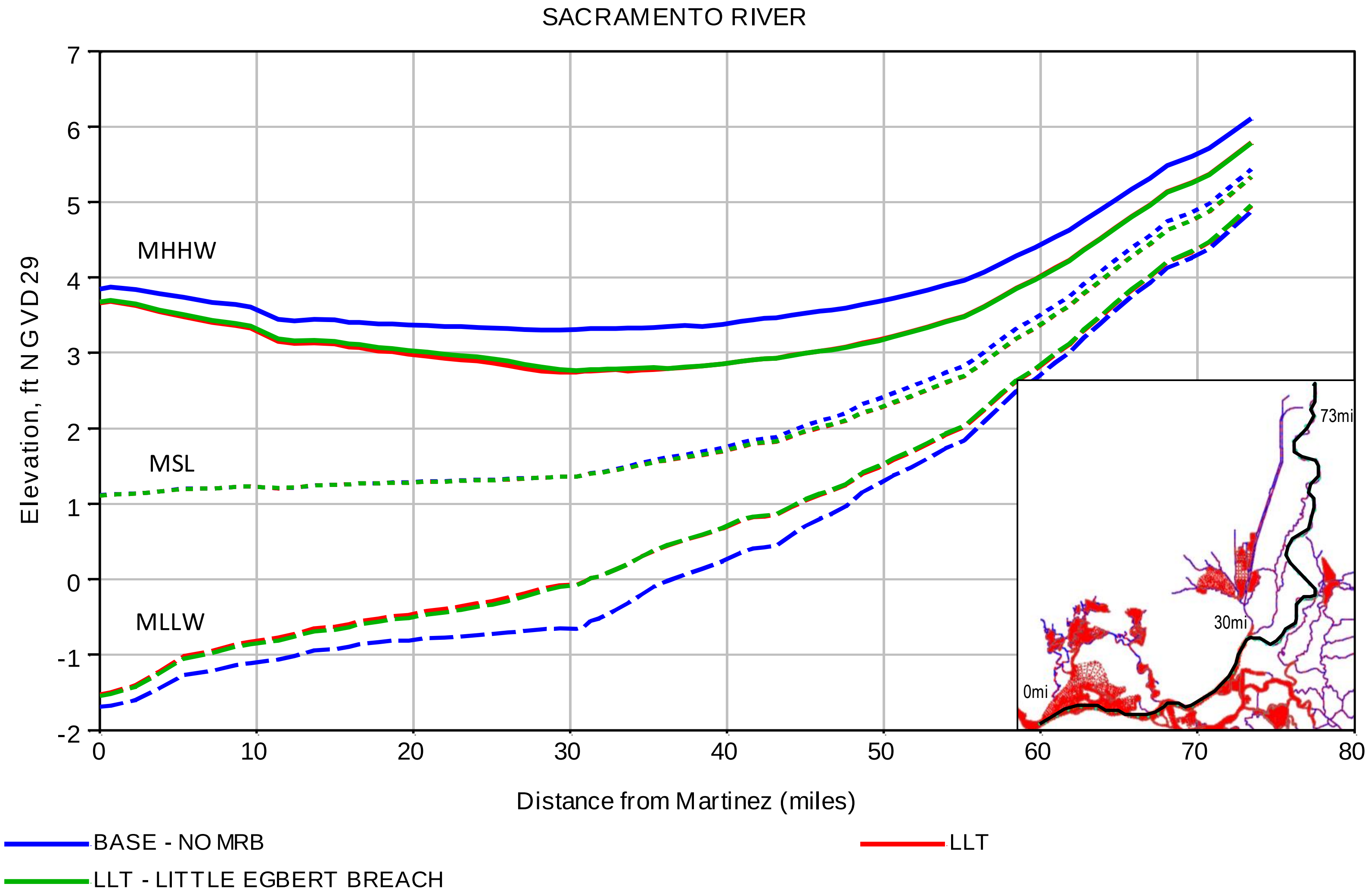


Figure 4-118 Profiles of July 2002 MHHW, MSL and MLLW along the Sacramento River for the Base - No MRB, LLT and LLT - Little Egbert Breach simulations.

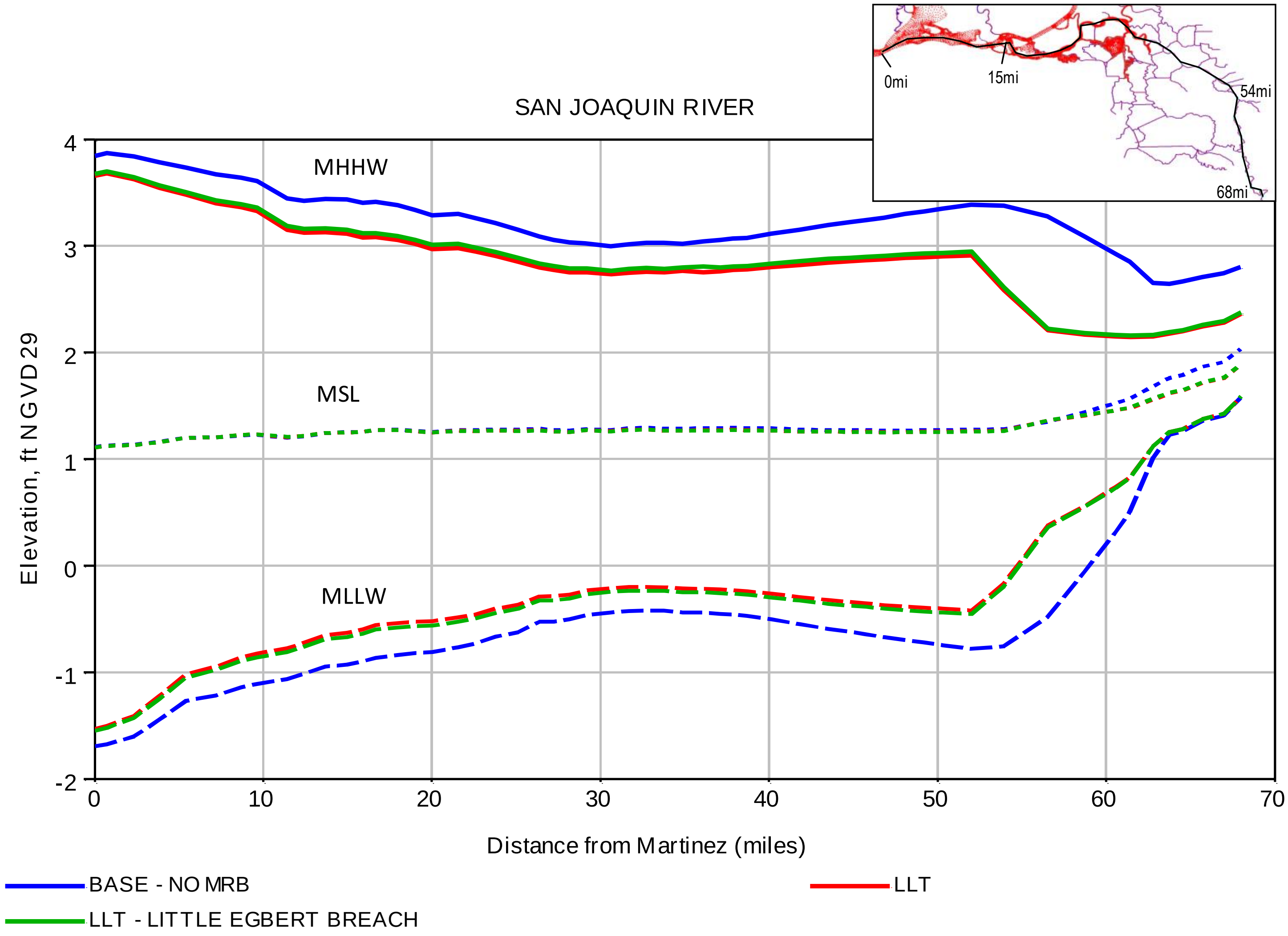


Figure 4-119 Profiles of July 2002 MHHW, MSL and MLLW along the San Joaquin River for the Base - No MRB, LLT and LLT - Little Egbert Breach simulations.

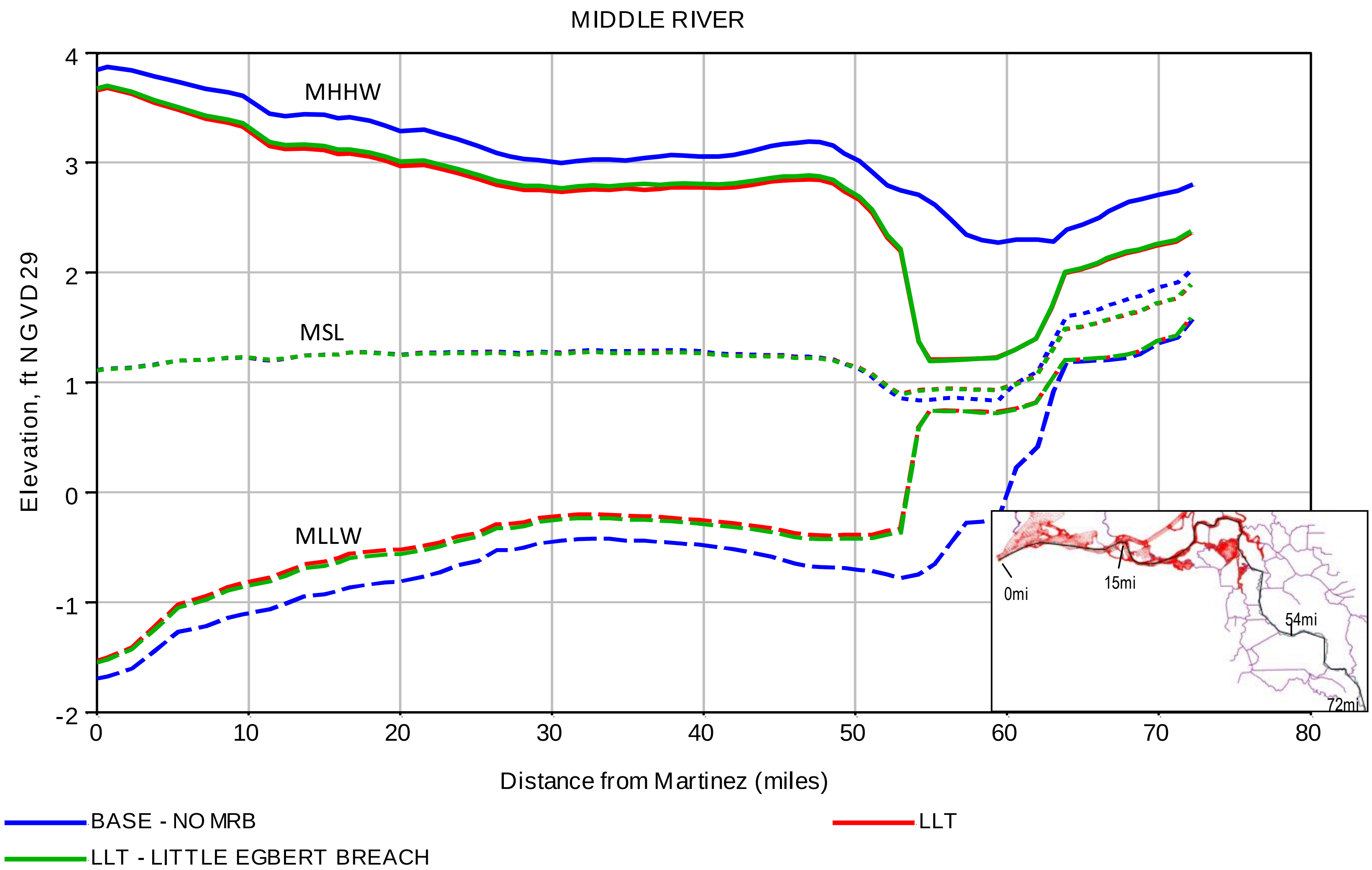


Figure 4-120 Profiles of July 2002 MHHW, MSL and MLLW along the Middle River for the Base - No MRB, LLT and LLT - Little Egbert Breach simulations.

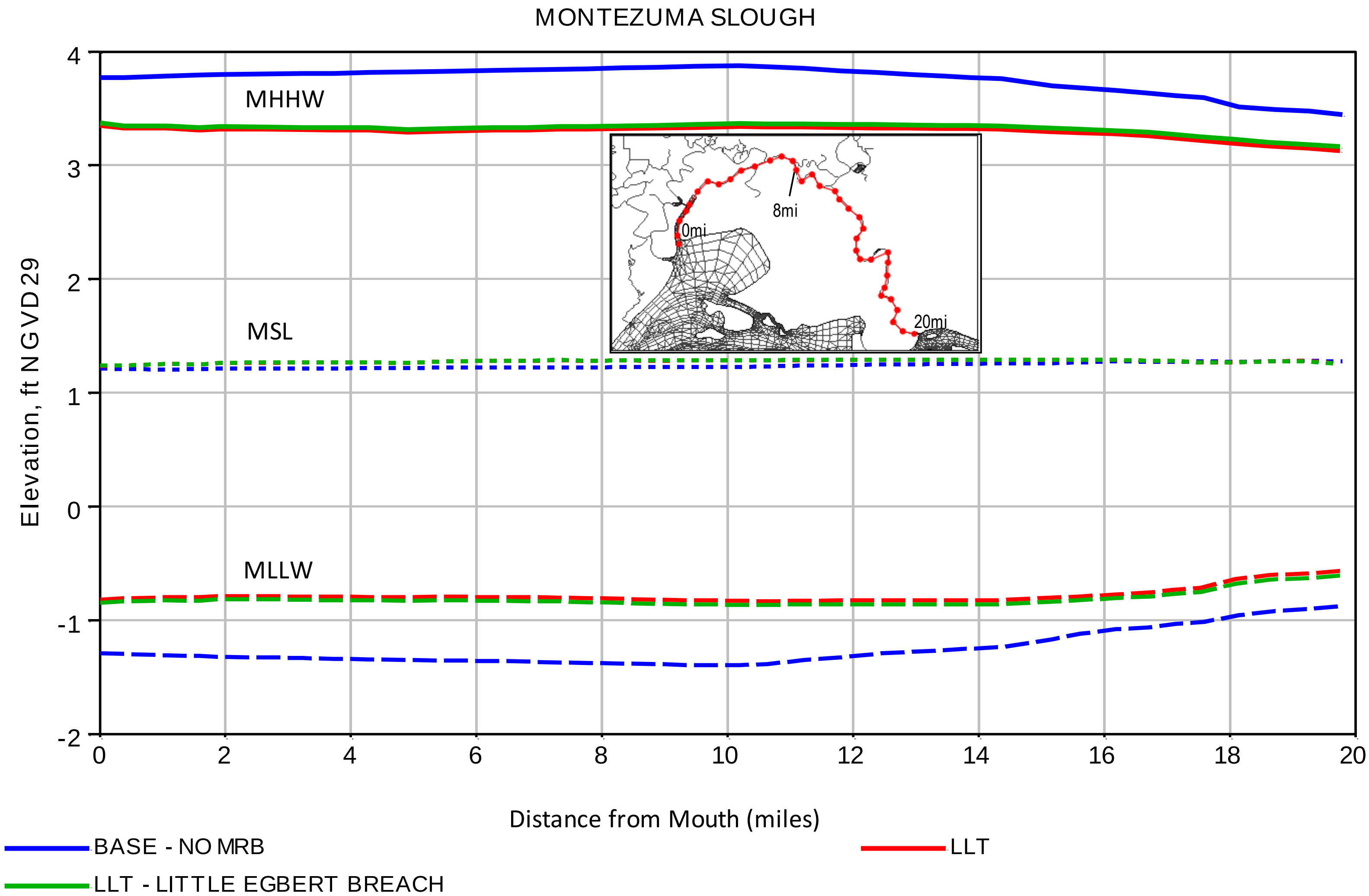


Figure 4-121 Profiles of July 2002 MHHW, MSL and MLLW along Montezuma Slough for the Base - No MRB, LLT and LLT - Little Egbert Breach simulations.

4.2.6.4 Stage Time Series

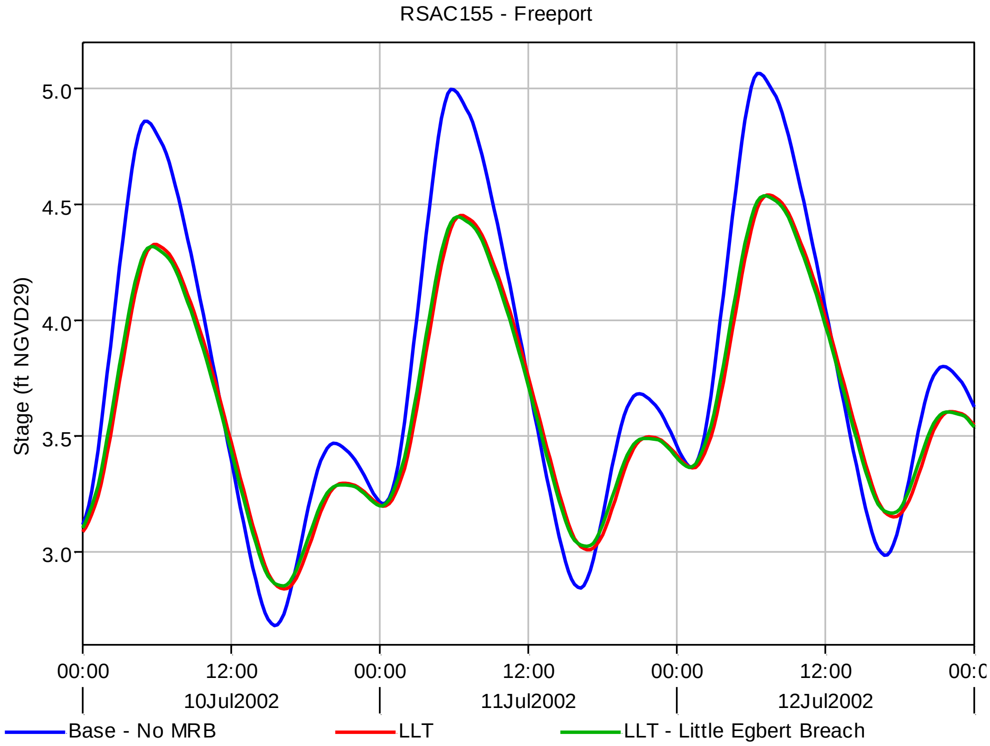


Figure 4-122 Stage at Freeport for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

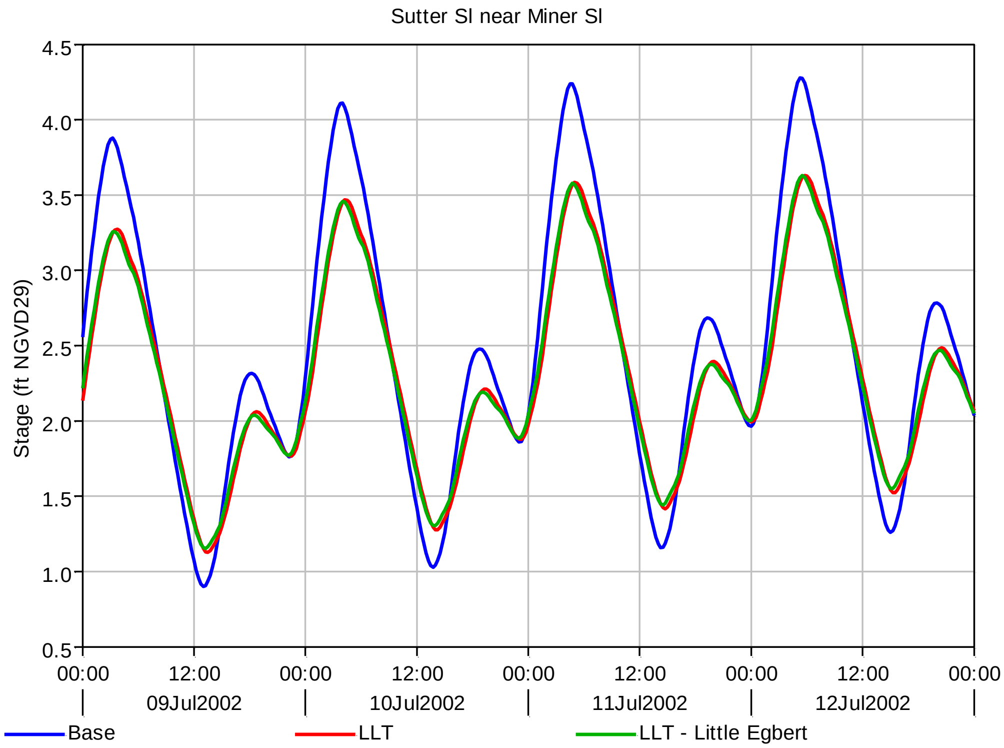


Figure 4-123 Stage in Sutter Slough for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

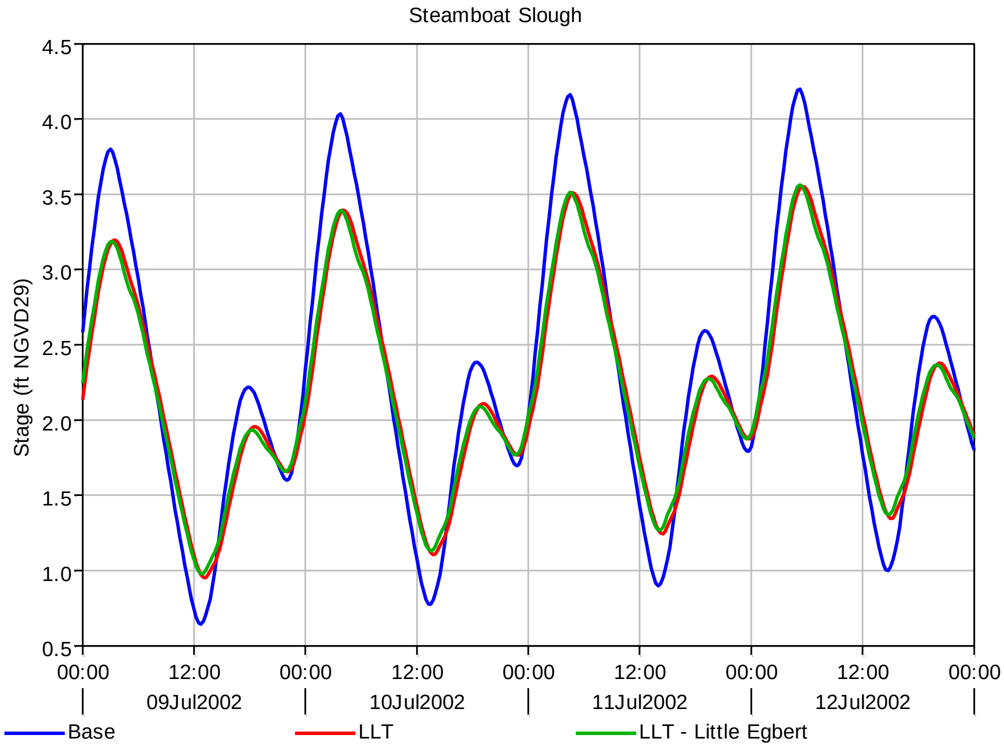


Figure 4-124 Stage in Steamboat Slough for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

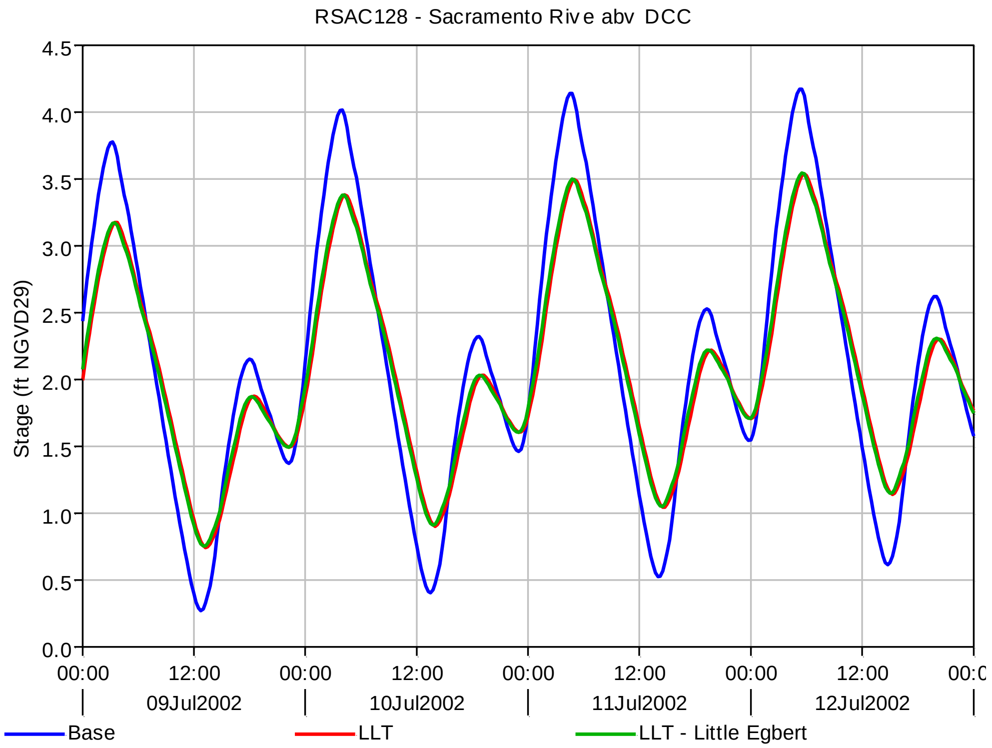


Figure 4-125 Stage at RSAC128 for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

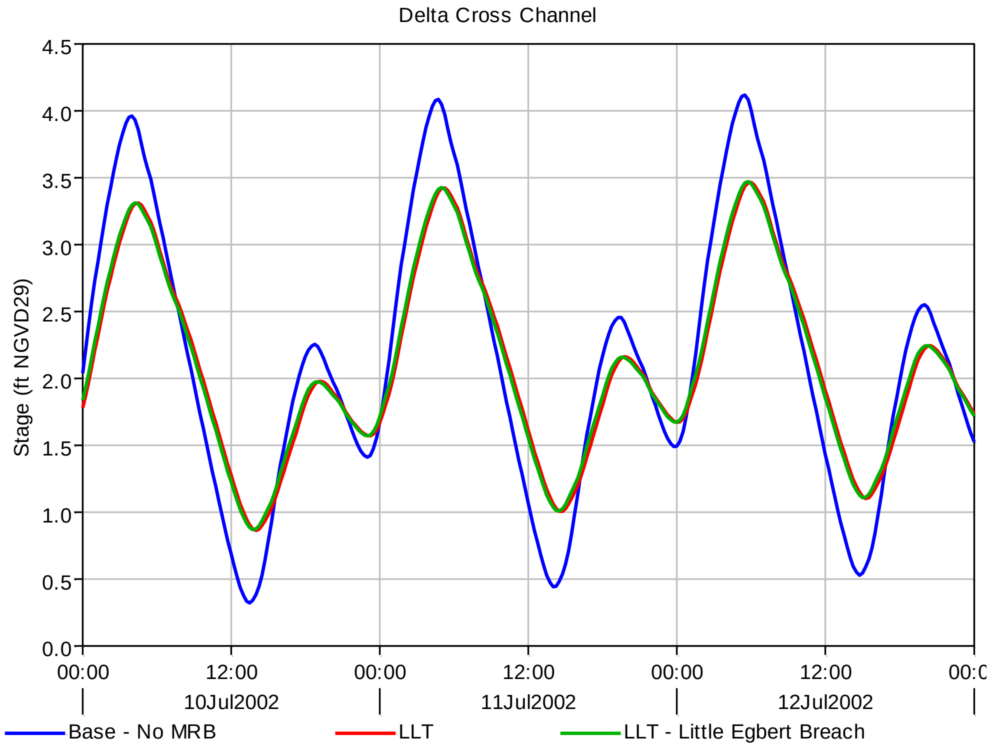


Figure 4-126 Stage at Delta Cross Channel for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

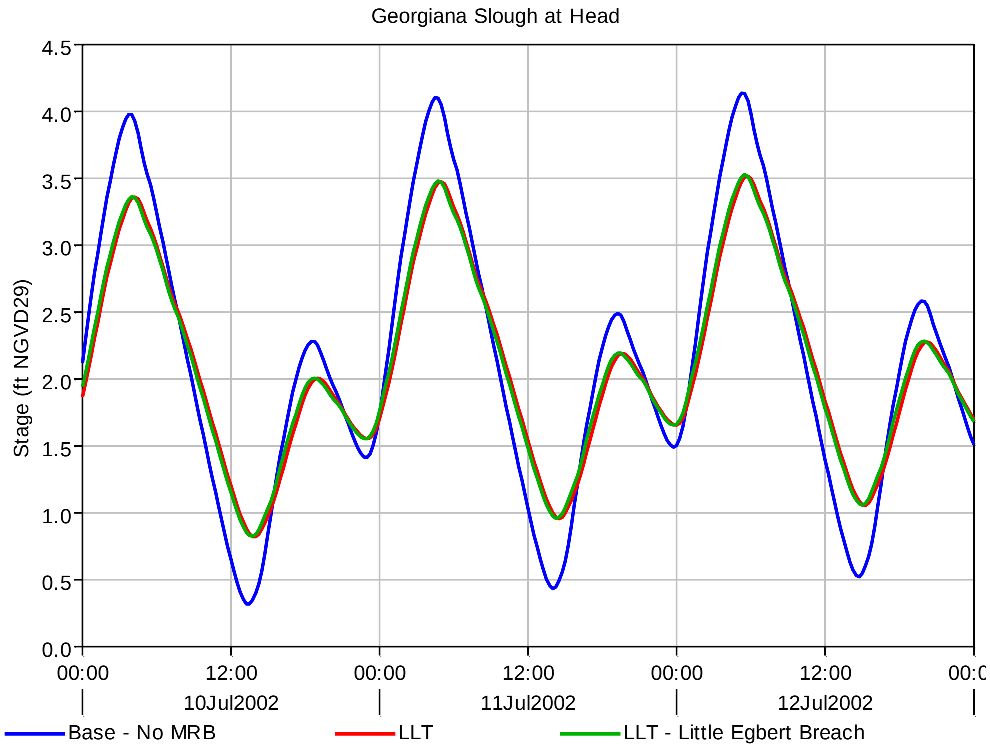


Figure 4-127 Stage in Georgiana Slough at head for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

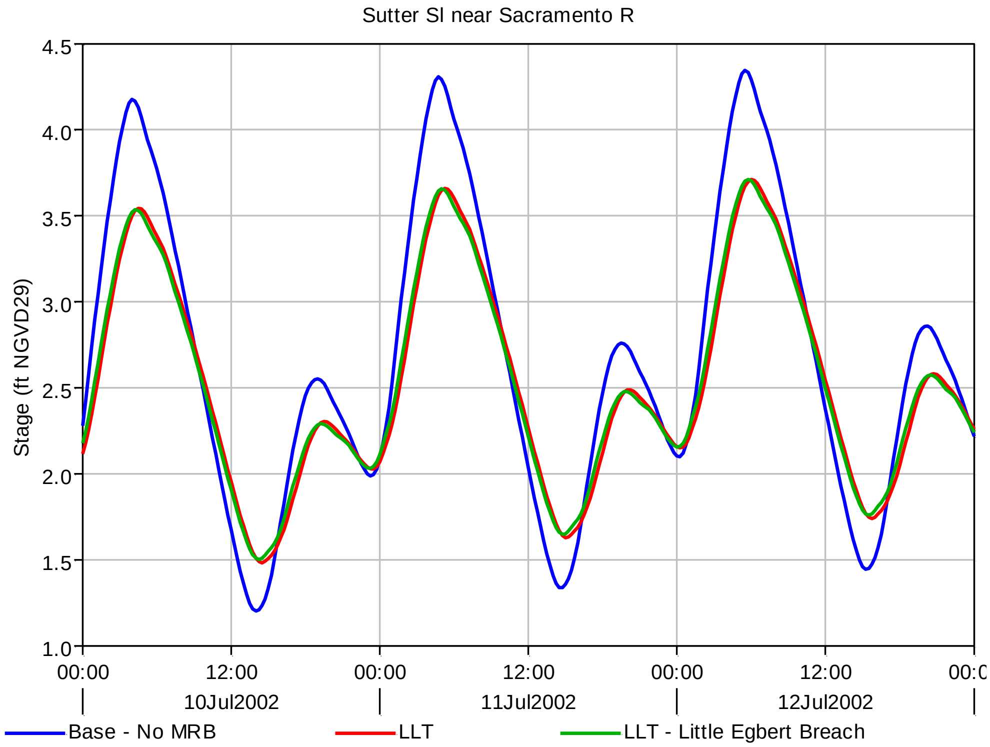


Figure 4-128 Stage in Sutter Slough near Sacramento R. for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

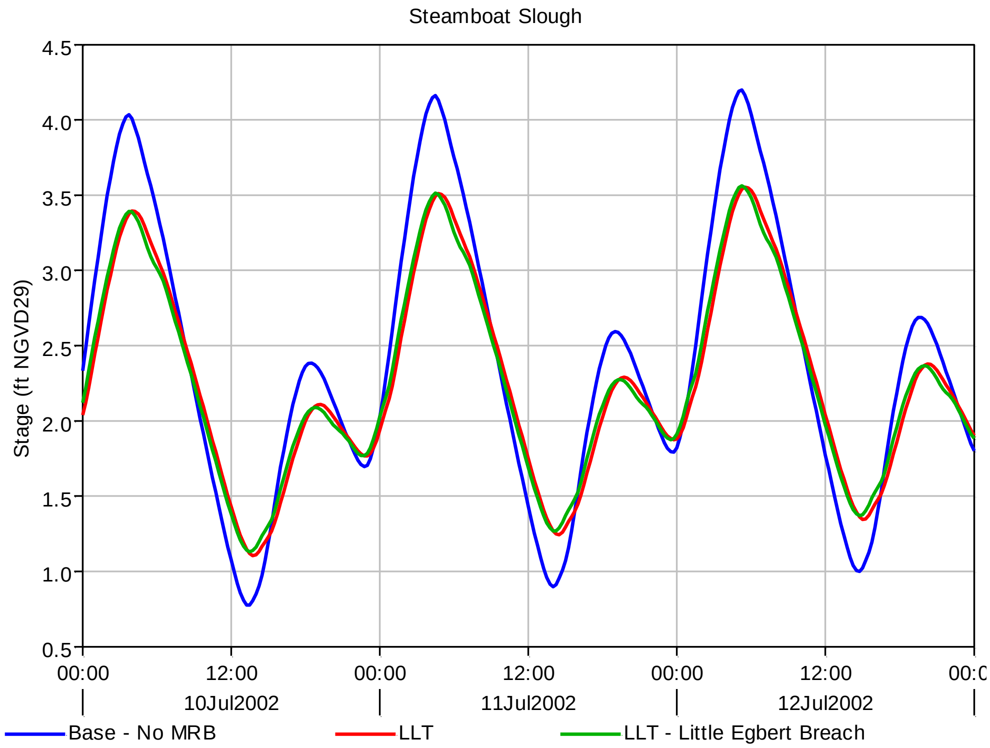


Figure 4-129 Stage in Steamboat Slough for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

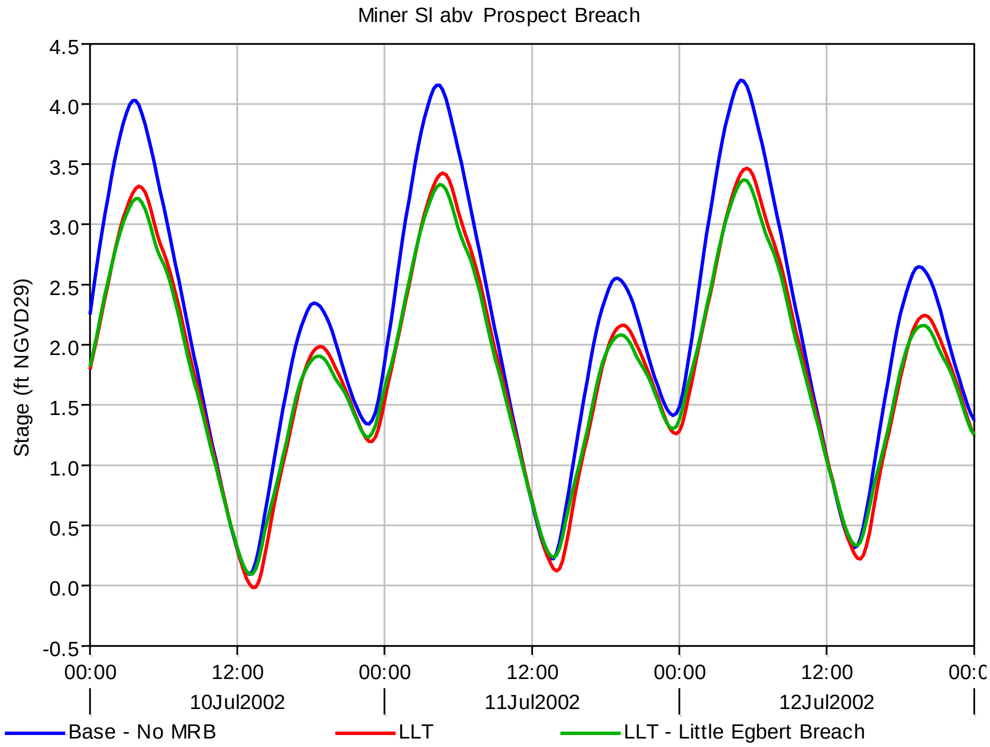


Figure 4-130 Stage in Miner Slough for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

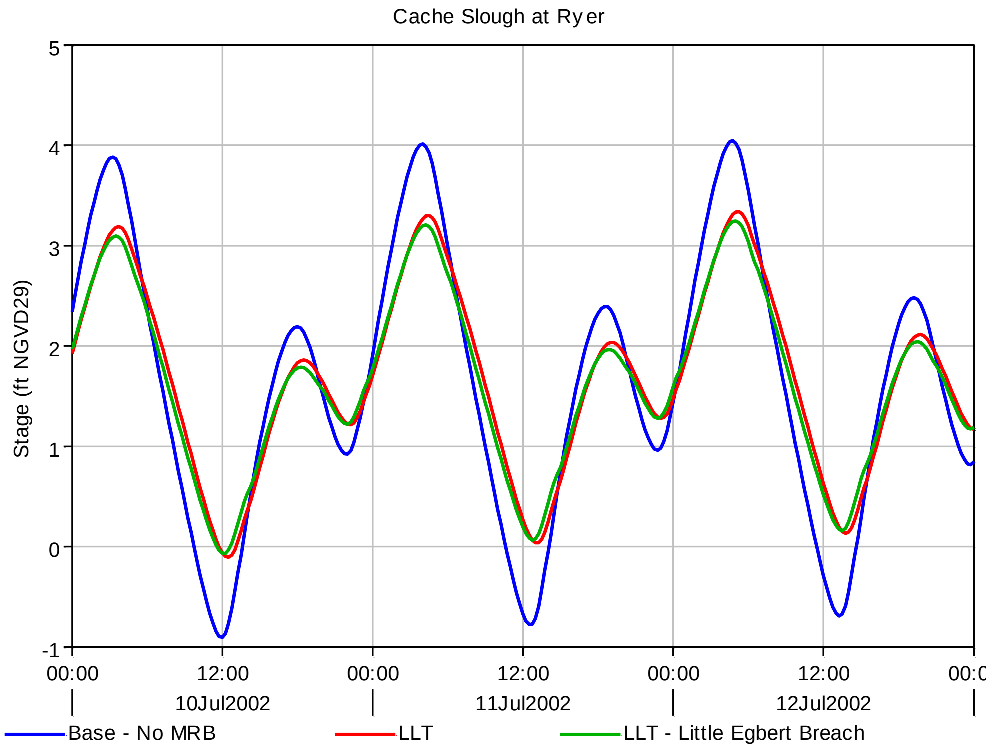


Figure 4-131 Stage in Cache Slough at Ryer Island for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

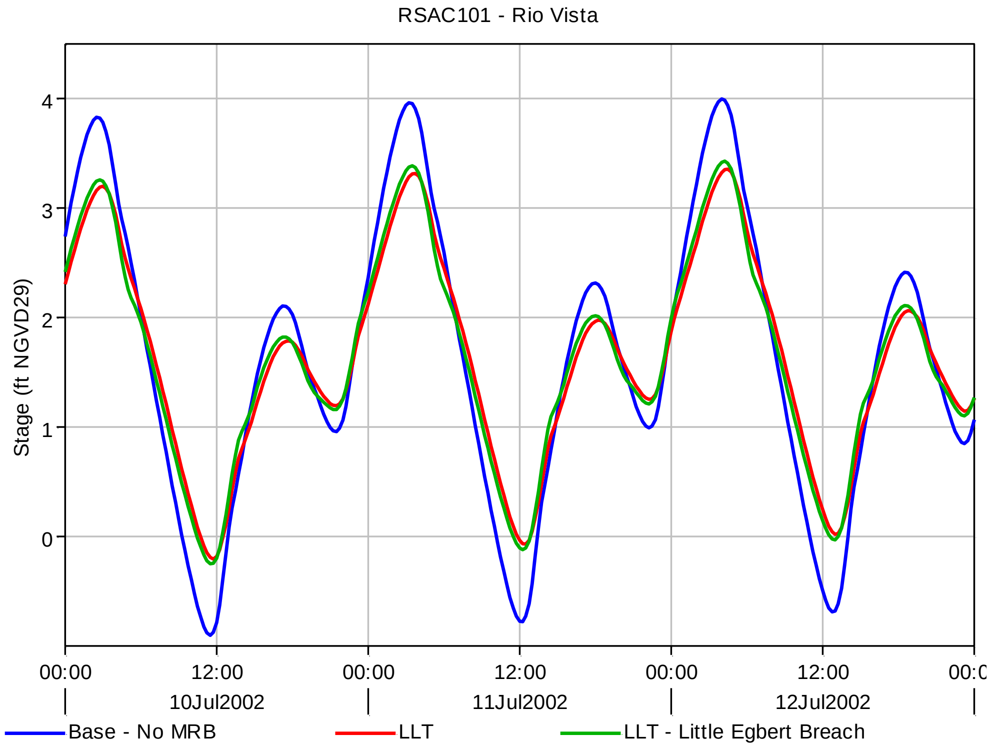


Figure 4-132 Stage at Rio Vista for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

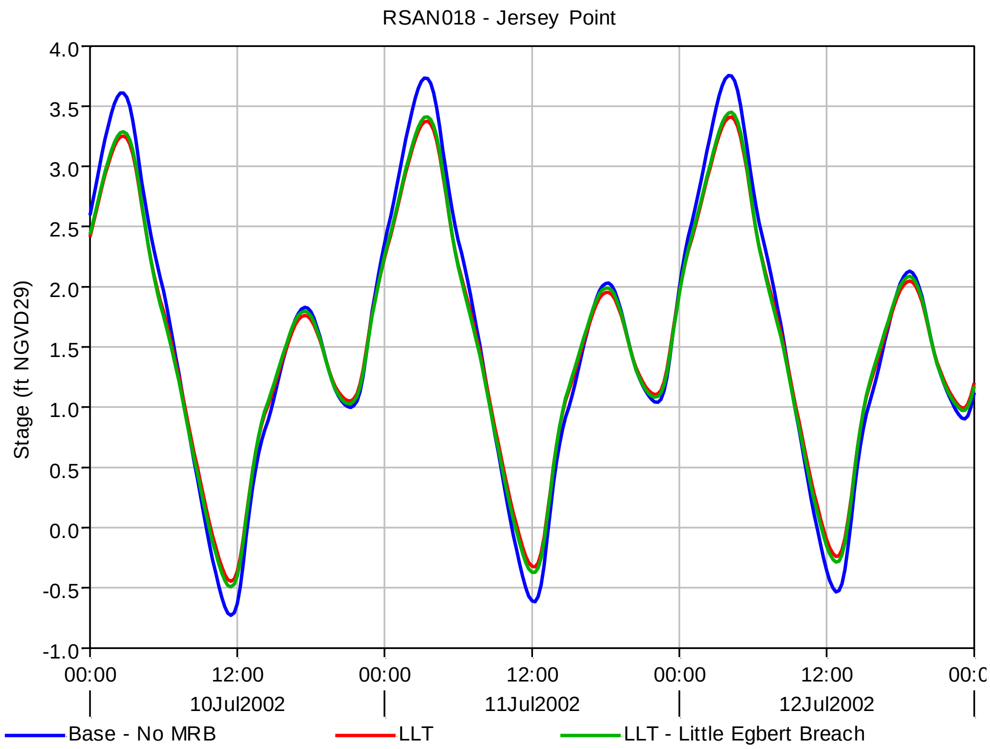


Figure 4-133 Stage at Jersey Point for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

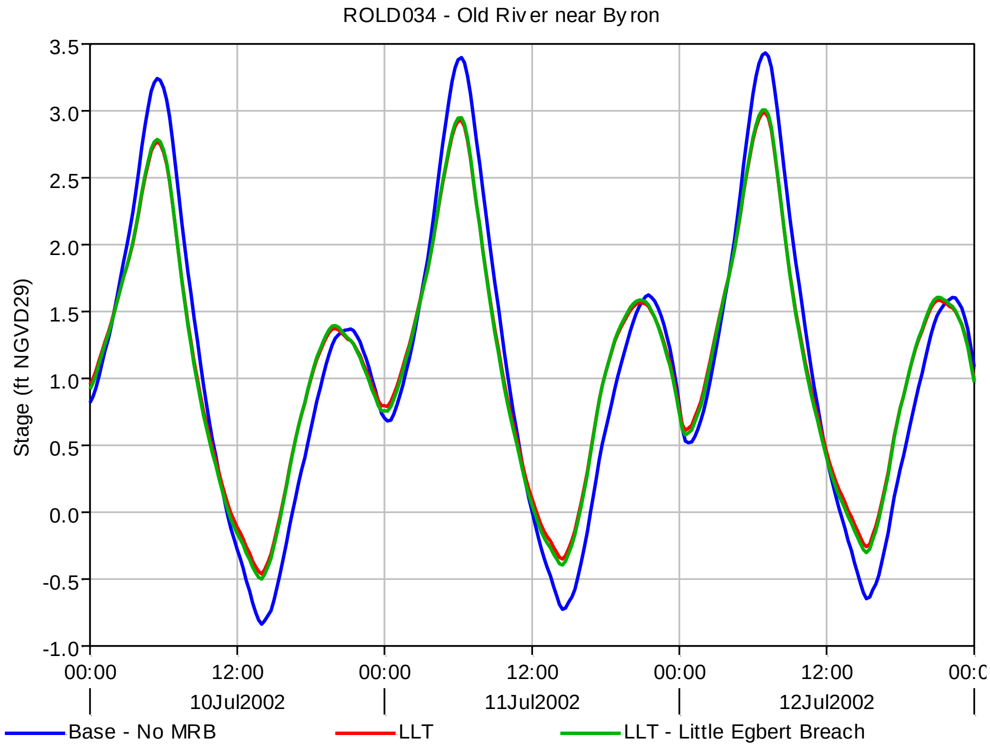


Figure 4-134 Stage in Old River at ROLD034 for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

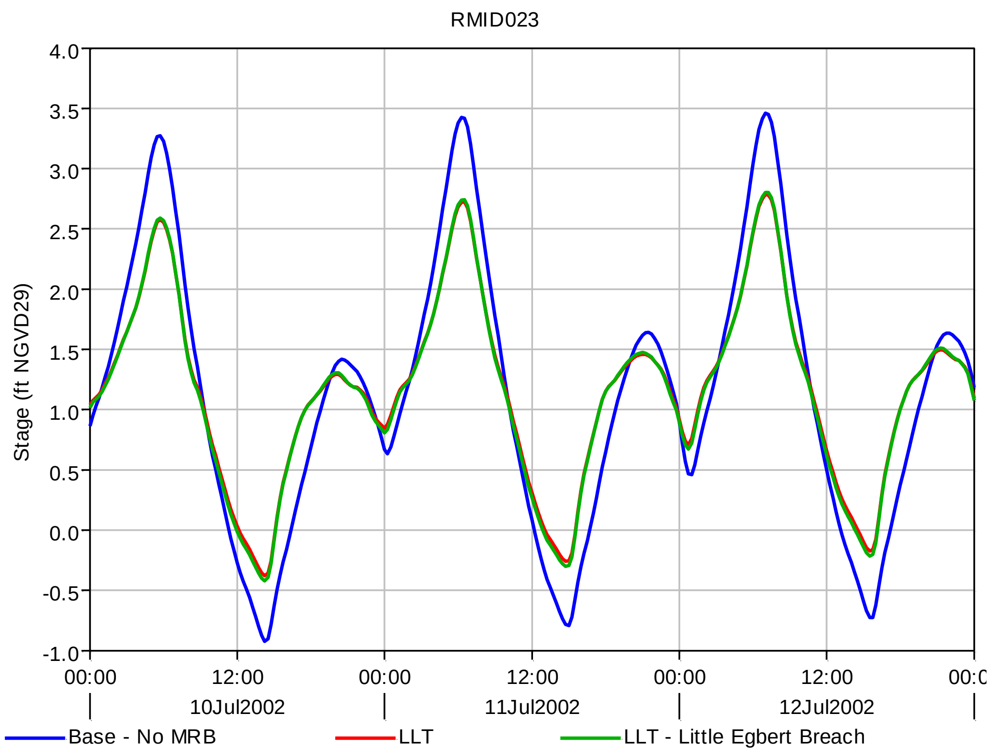


Figure 4-135 Stage in Middle River at RMID023 for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

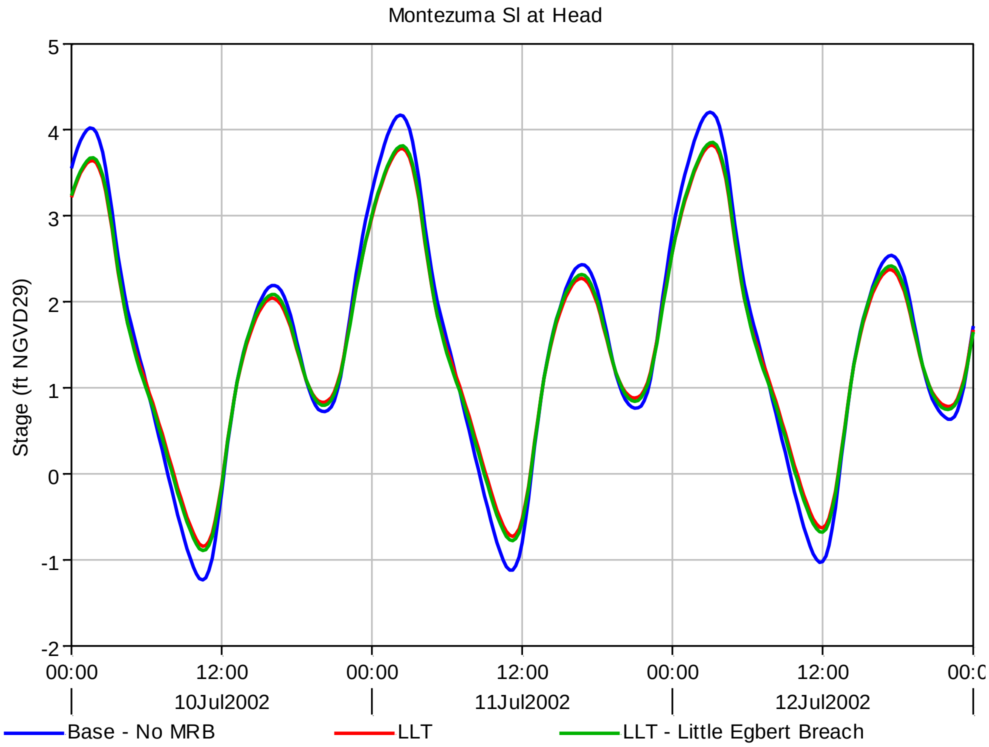


Figure 4-136 Stage in Montezuma Slough at head for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

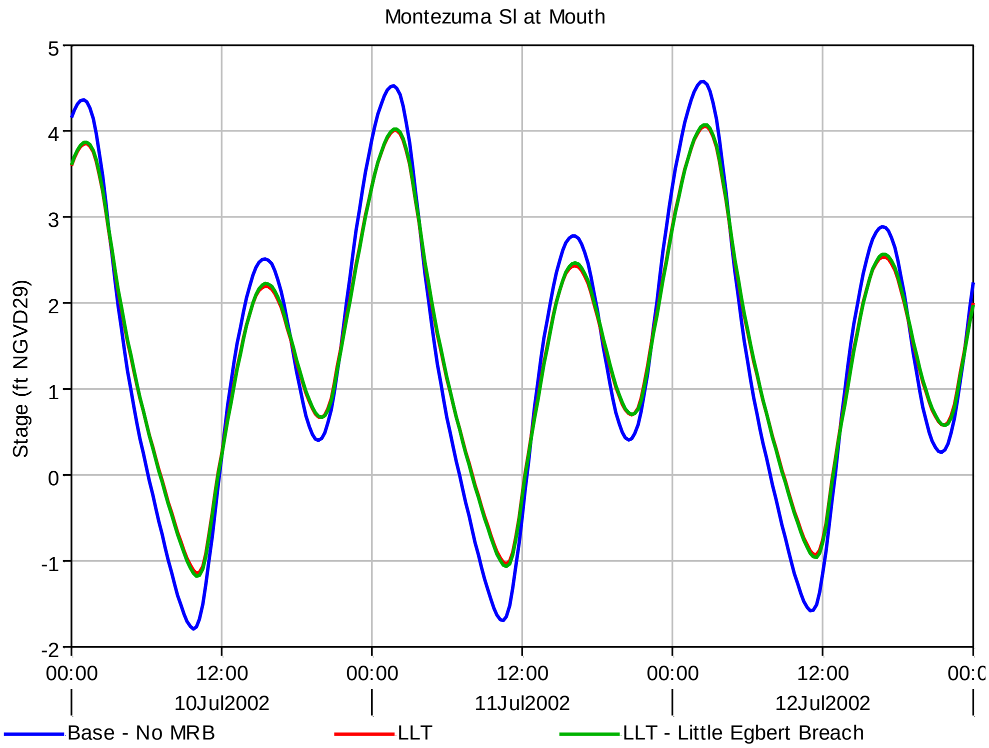


Figure 4-137 Stage in Montezuma Slough at mouth for Base - No MRB, LLT and LLT - Little Egbert Breach scenarios.

4.2.7 LLT – Sherman Breach

Three-month average flows for the LLT – Sherman Breach simulation are tabulated in Table 4-20 and plotted in Figure 4-138. Relocation of the Sherman Island breach from Threemile Slough to the San Joaquin River has minimal impact on average flows throughout the system. The largest change is in Threemile Slough itself, where average flows are decreased by 1% relative to LLT.

LLT – Sherman Breach tidal prism results are shown in Table 4-21, Figure 4-139 and Figure 4-140. Tidal prism changes are less than 1% throughout the system. The largest changes include and increase, relative to LLT, of 0.7% in Threemile Slough and a decrease of 0.7% in Georgiana Slough.

As shown in Table 4-22 and Figure 4-141, the change in the Sherman Island breach location has minimal impact on tidal range, with less than 1% change relative to LLT throughout the system.

Profile plots of July 2002 MHHW, MSL and MLLW, in Figure 4-142 through Figure 4-144, show barely discernible differences between LLT and LLT – Sherman Breach MHHW in the Sacramento and San Joaquin River near Sherman island, and no changes elsewhere.

For reference, time series plots of stage are provided for various locations in Figure 4-145 through Figure 4-153. A map of locations plotted is shown in Figure 4-2.

There are no new or resolved bed shear issues for this sensitivity case.

4.2.7.1 Net Flows

Table 4-20 Summary of 3-month Average flow (Jul – Sep 2002) for Base - No MRB, LLT, LLT – Sherman Breach simulations.

Location	3-month Average Flow, Jul – Sep 2002 (cfs)		
	Base – No MRB	LLT	LLT – Sherman Breach
Cache Sl at Ryer	1535	2565	2564
DCC	4609	3449	3451
False River	-1696	-1806	-1798
Martinez	4422	4080	4081
Miner Slough	2018	2667	2668
Mokelumne nr SJR	4719	3781	3787
Montezuma Sl at Head	12	13	13
Montezuma Sl at Mouth	-71	-191	-191
RMID015	-5351	-5265	-5265
RMID027	-25	-45	-44
ROLD024	-4425	-4541	-4541
ROLD034	-6493	-6603	-6604
RSAC075 Chipps Island	4503	4395	4395
RSAC092 Emmaton	5870	6484	6508
RSAC101 Rio Vista	8256	9712	9702
RSAC123	3607	4258	4254
RSAC128	10999	10137	10142
RSAN018 Jersey Pt	-999	-1914	-1937
RSAN032 San Andreas	-1716	-3216	-3209
RSAN058	366	391	392
SLDUT007	-113	68	68
SLGEO019 Georgiana Sl	2762	2408	2415
SLTRM004 Threemile Sl	-2313	-3012	-2982
Steamboat Sl	2280	2629	2625
Sutter Sl	2965	3480	3479

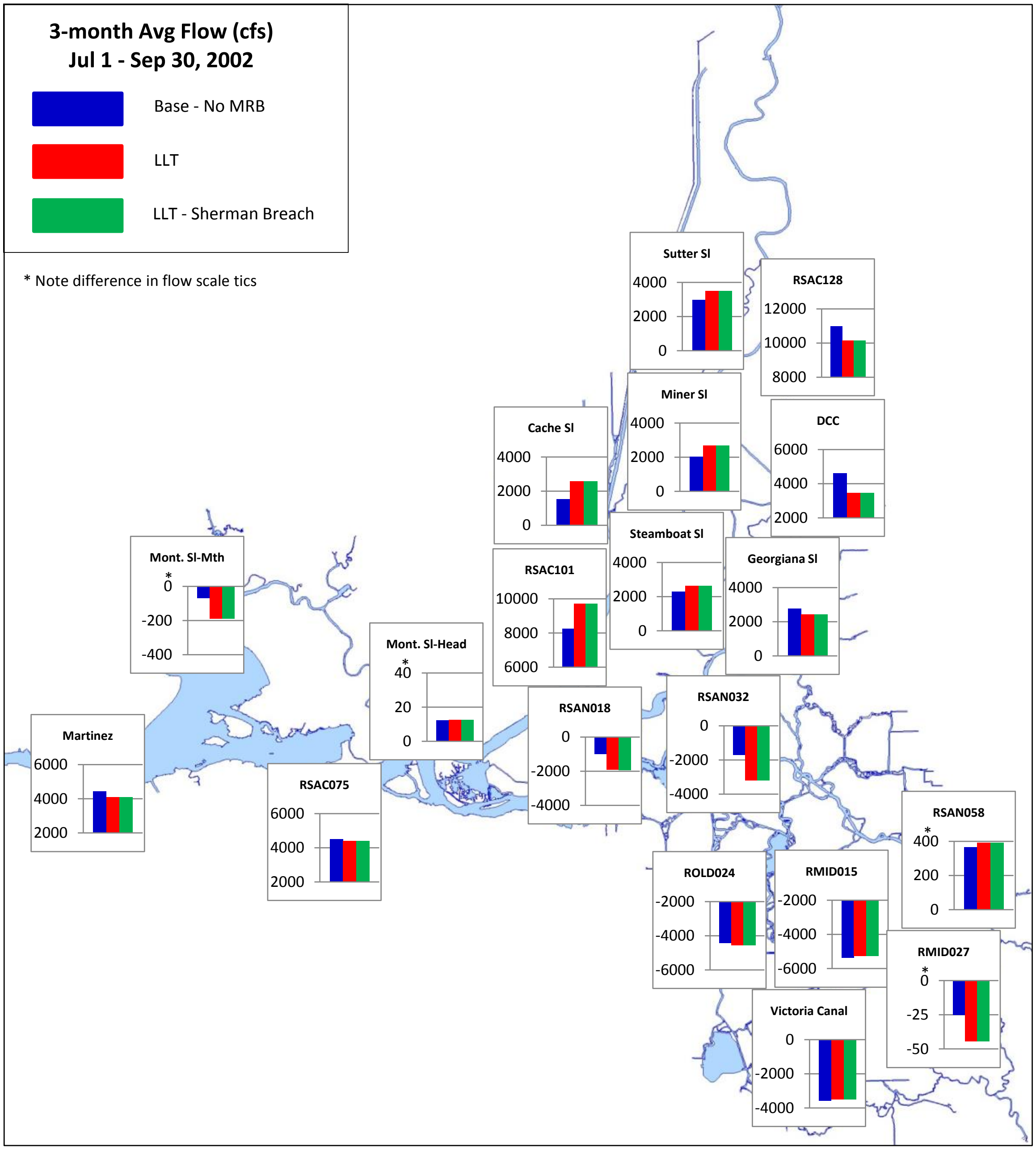


Figure 4-138 Average flows (Jul - Sep 2002) for Base - No MRB, LLT and LLT – Sherman Breach simulations.

4.2.7.2 Tidal Prism

Table 4-21 Summary of Apr – Dec 2002 Average Tidal Prism for Base - No MRB, LLT and LLT – Sherman Breach simulations, and percent change from Base- No MRB.

Location	Base – No MRB	LLT		LLT – Sherman Breach	
	Tidal Prism (ac-ft)	Tidal Prism (ac-ft)	% Change from Base	Tidal Prism (ac-ft)	% Change from Base
Cache Sl at Ryer	28,697	26,884	-6%	26,943	-6%
DCC	782	949	21%	953	22%
False River	18,870	16,508	-13%	16,514	-12%
Martinez	167,717	170,966	2%	171,015	2%
Miner Slough	618	455	-26%	457	-26%
Mokelumne nr SJR	4,615	4,490	-3%	4,491	-3%
Montezuma Sl at Head	2,053	3,283	60%	3,285	60%
Montezuma Sl at Mouth	10,988	23,108	110%	23,114	110%
RMID015	4,119	3,333	-19%	3,335	-19%
RMID027	474	1,784	277%	1,785	277%
ROLD024	4,427	3,655	-17%	3,659	-17%
ROLD034	2,352	1,960	-17%	1,961	-17%
RSAC075 Chipps Island	115,263	108,506	-6%	108,362	-6%
RSAC092 Emmaton	49,256	50,591	3%	50,344	2%
RSAC101 Rio Vista	36,171	40,582	12%	40,688	12%
RSAC123	2,499	1,811	-28%	1,819	-27%
RSAC128	1,608	1,175	-27%	1,174	-27%
RSAN018 Jersey Pt	50,110	44,549	-11%	44,643	-11%
RSAN032 San Andreas	37,847	32,450	-14%	32,484	-14%
RSAN058	2,385	2,603	9%	2,605	9%
SLDUT007	3,073	2,226	-28%	2,228	-27%
SLGEO019 Georgiana Sl	222	415	87%	412	86%
SLTRM004 Threemile Sl	9,413	6,526	-31%	6,574	-30%
Steamboat Sl	913	598	-35%	602	-34%
Sutter Sl	823	574	-30%	576	-30%

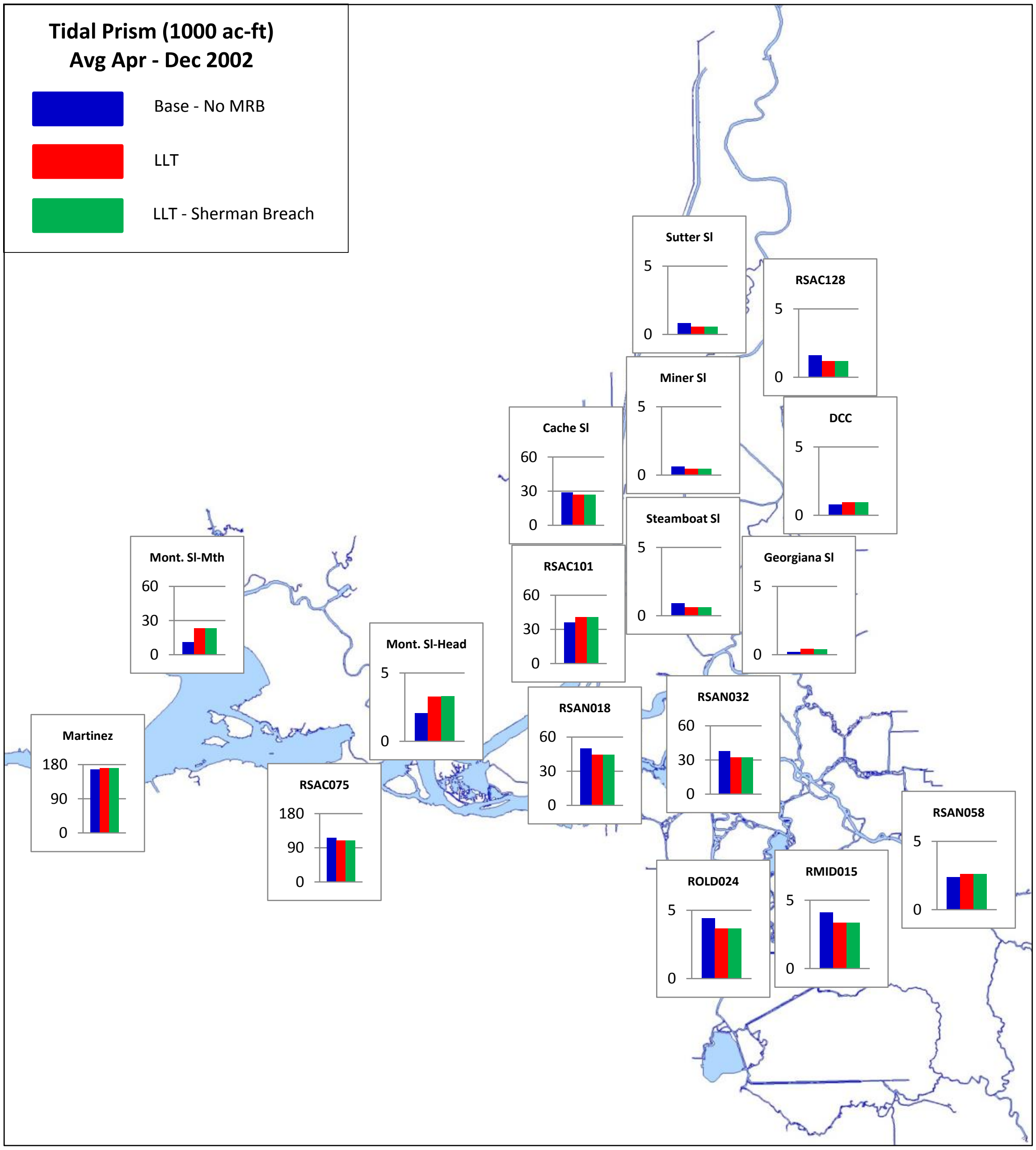


Figure 4-139 Average tidal prism (Apr - Dec 2002) for Base - No MRB, LLT and LLT – Sherman Breach simulations.

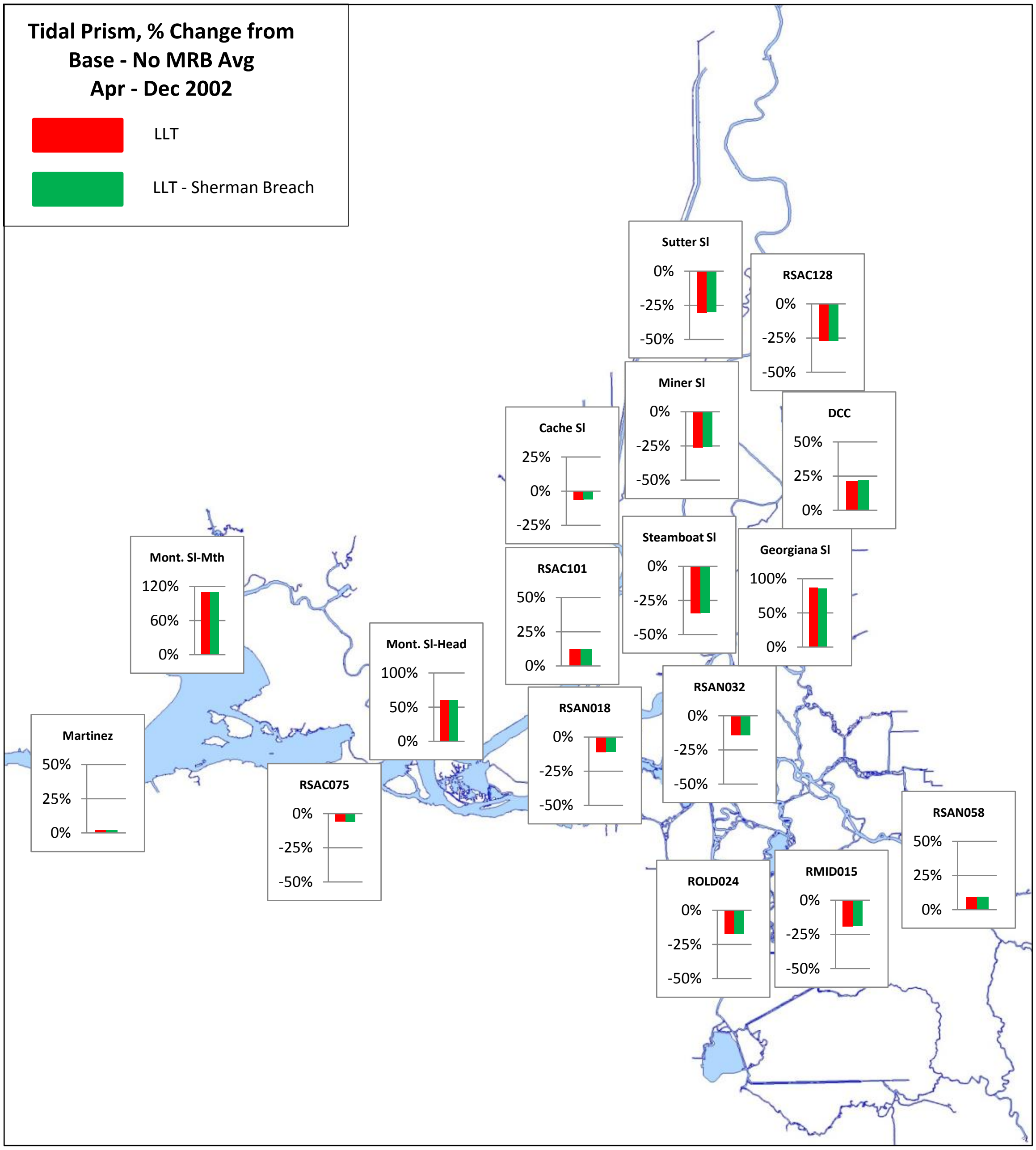


Figure 4-140 Average percent change from Base - No MRB tidal prism (Apr - Dec 2002) for LLT and LLT – Sherman Breach simulations.

4.2.7.3 Tidal Range

Table 4-22 Summary of Apr – Dec 2002 Average Tidal Range for Base - No MRB, LLT and LLT – Sherman Breach simulations.

	Apr – Dec 2002 Average Tidal Range (ft)		
Location	**Base – No MRB**	**LLT**	**LLT – Sherman Breach**
Cache Sl at Ryer	3.95	2.75	2.76
DCC	2.92	2.11	2.12
False River	3.4	2.93	2.94
Martinez	5.47	5.14	5.14
Miner Slough	3.12	2.62	2.63
Montezuma Sl at Head	4.25	3.64	3.65
Montezuma Sl at Mouth	5.0	4.05	4.06
RMID015	3.76	3.14	3.15
RMID023	3.49	2.48	2.49
RMID027	3.33	0.56	0.56
ROLD024	3.55	3.02	3.02
ROLD034	3.36	2.73	2.73
RSAC075 Chipps Island	4.42	3.85	3.86
RSAC092 Emmaton	3.93	3.23	3.25
RSAC101 Rio Vista	3.86	2.79	2.8
RSAC123	2.95	2.14	2.15
RSAC128	2.91	2.12	2.13
RSAN018 Jersey Pt	3.47	2.98	2.99
RSAN032 San Andreas	3.37	2.89	2.9
RSAN058	4.05	3.25	3.26
SLDUT007 Dutch Slough	3.59	3.04	3.05
SLGEO019 Georgiana Sl	2.95	2.16	2.17
SLTRM004 Threemile Sl	3.45	2.9	2.9
Steamboat Sl	2.69	1.99	2.0
Sutter Sl	2.57	1.94	1.92
Victoria Canal	3.48	2.48	2.48

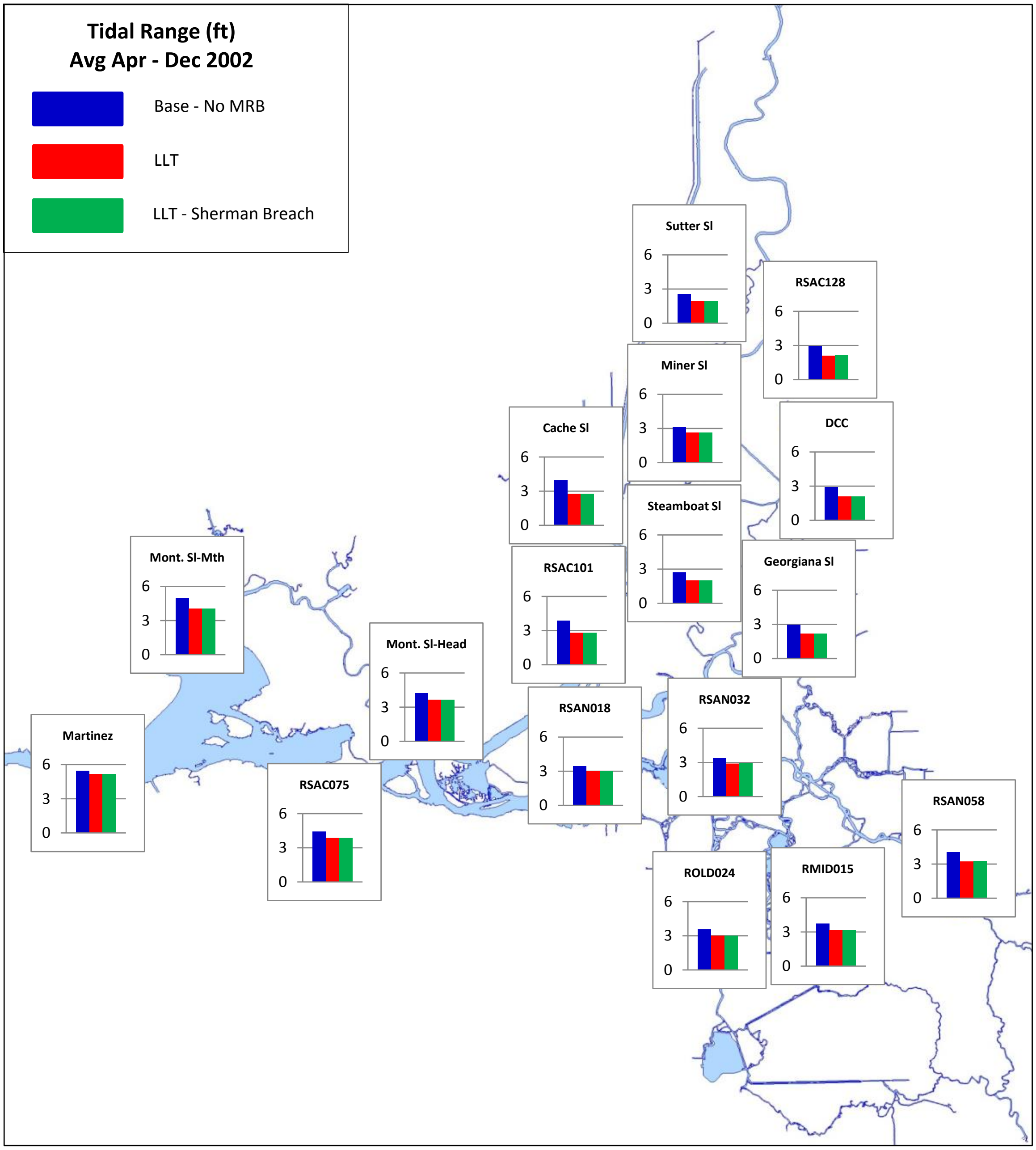


Figure 4-141 Average tidal range (Apr - Dec 2002) for Base - No MRB, LLT and LLT – Sherman Breach simulations.

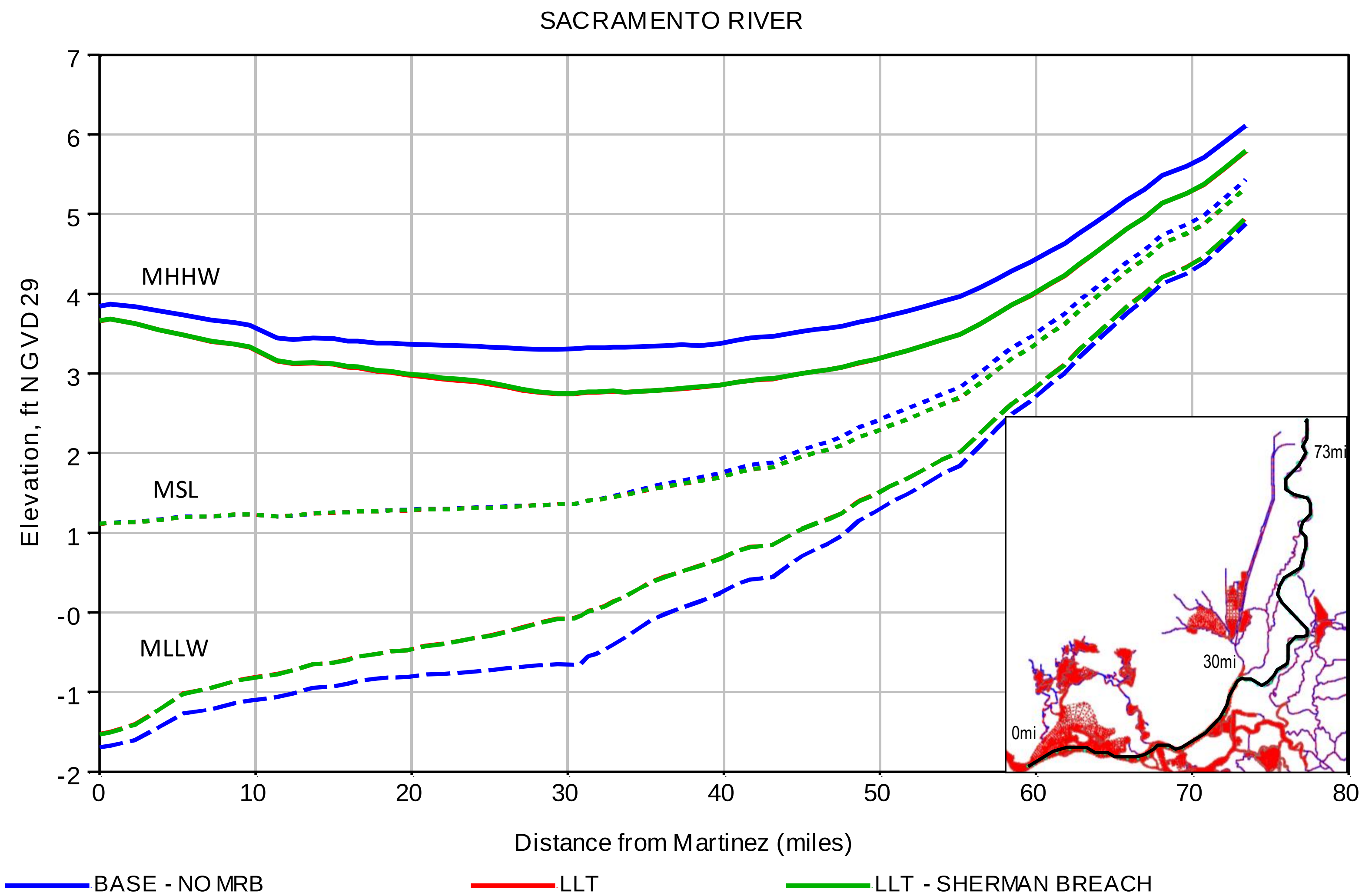


Figure 4-142 Profiles of July 2002 MHHW, MSL and MLLW along the Sacramento River for the Base - No MRB, LLT and LLT - Sherman Breach simulations.

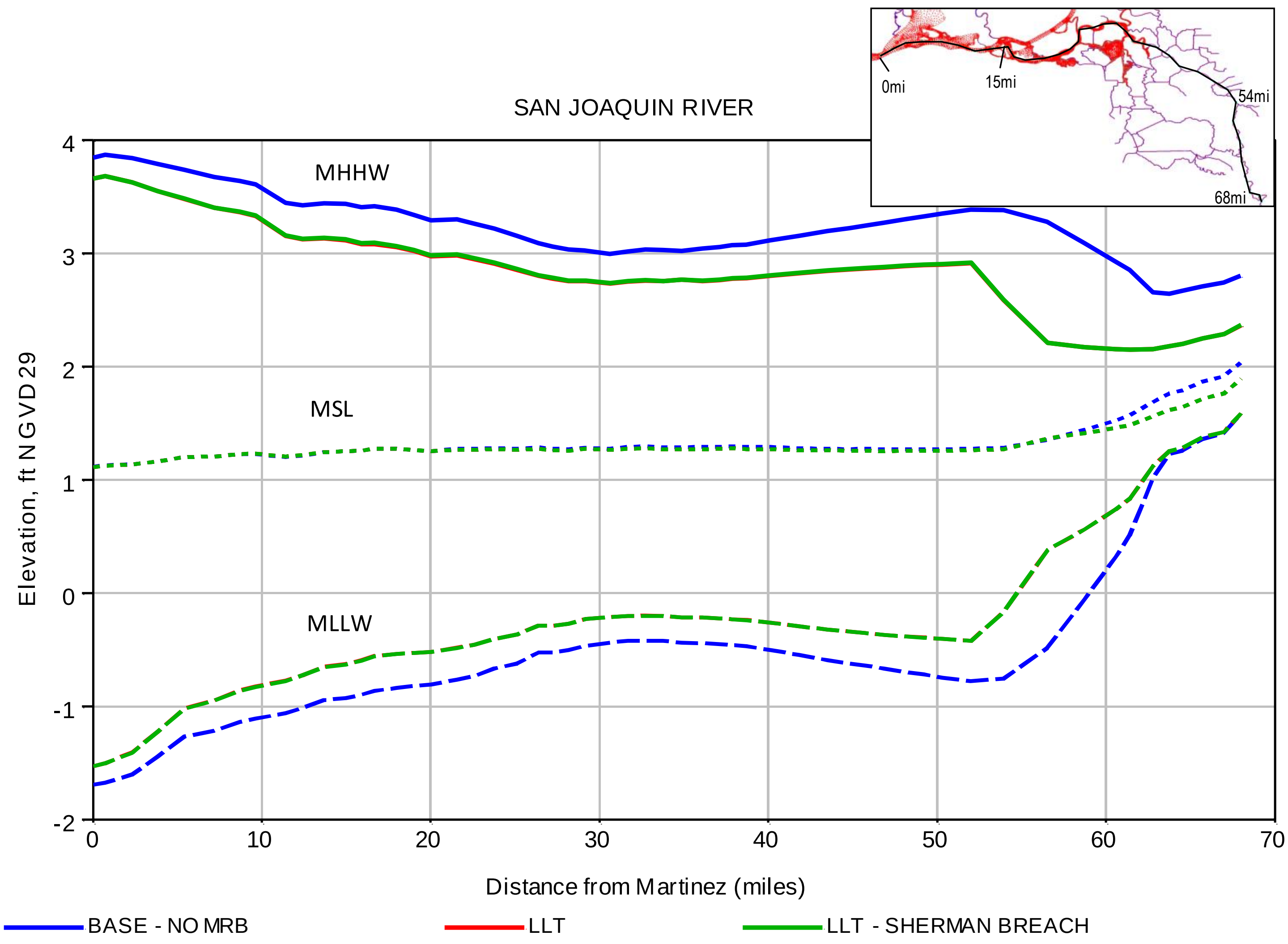


Figure 4-143 Profiles of July 2002 MHHW, MSL and MLLW along the San Joaquin River for the Base - No MRB, LLT and LLT - Sherman Breach simulations.

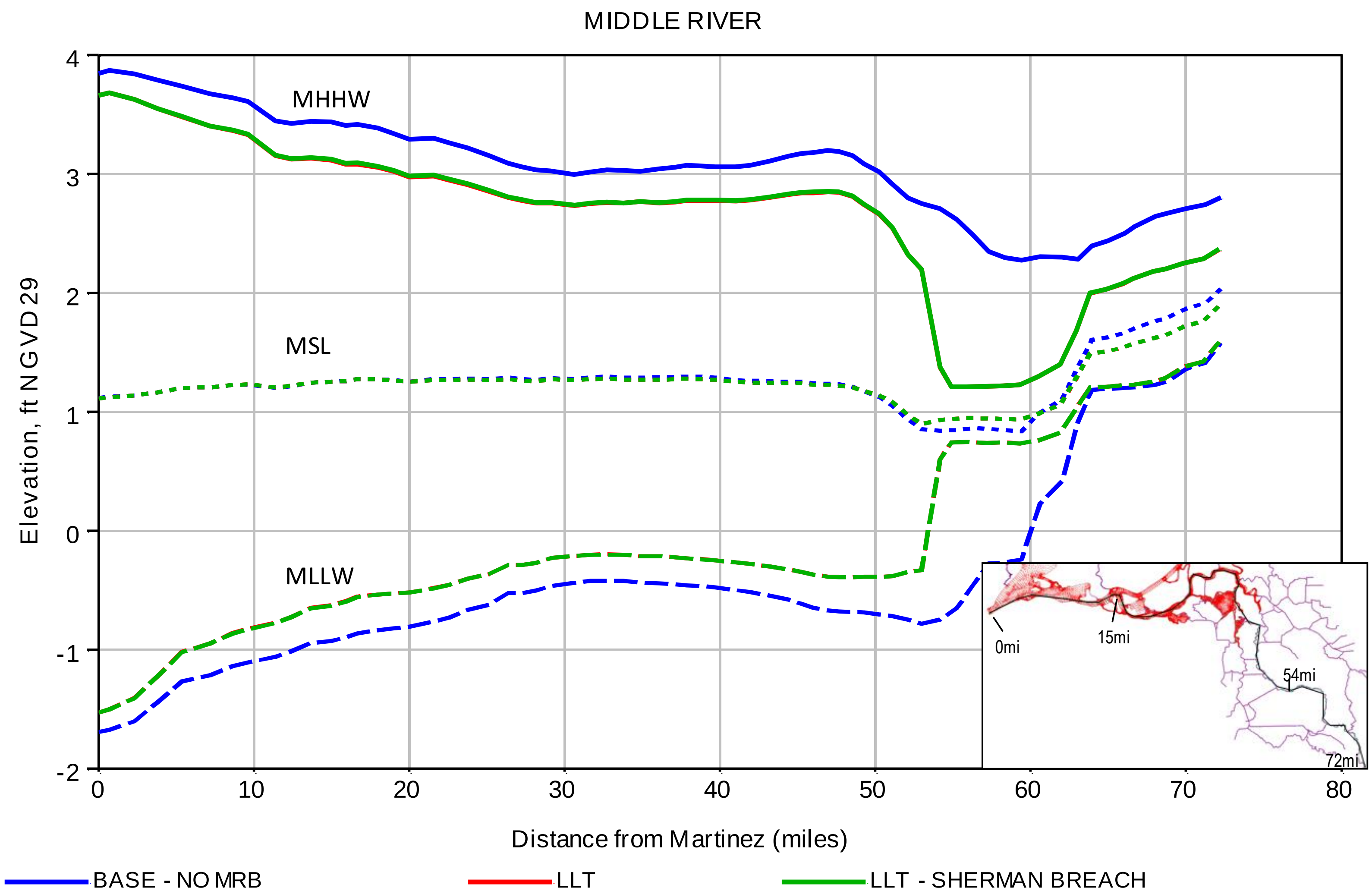


Figure 4-144 Profiles of July 2002 MHHW, MSL and MLLW along the Middle River for the Base - No MRB, LLT and LLT - Sherman Breach simulations.

4.2.7.4 Stage Time Series Plots

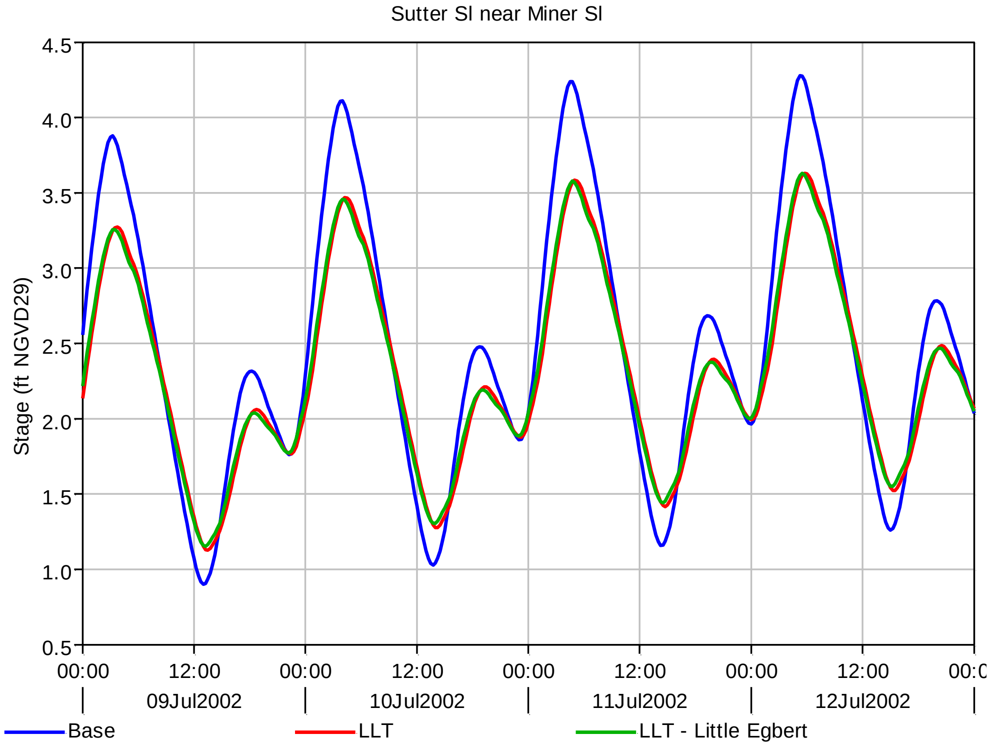


Figure 4-145 Stage in Sutter Slough for Base - No MRB, LLT and LLT - No South scenarios.

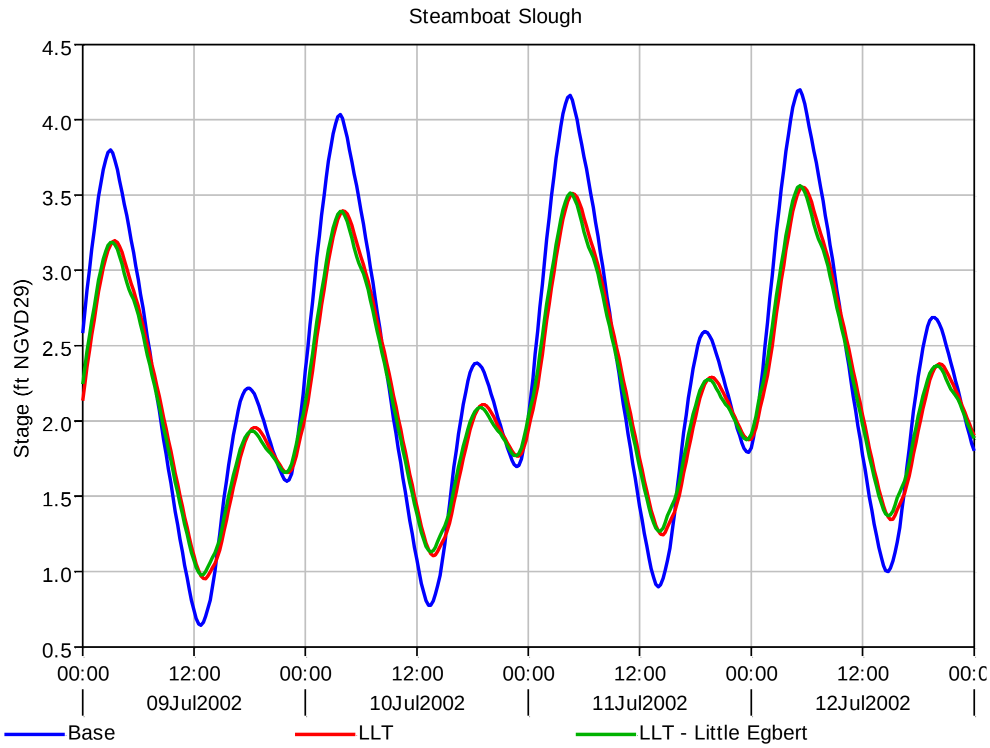


Figure 4-146 Stage in Steamboat Slough for Base - No MRB, LLT and LLT - No South scenarios.

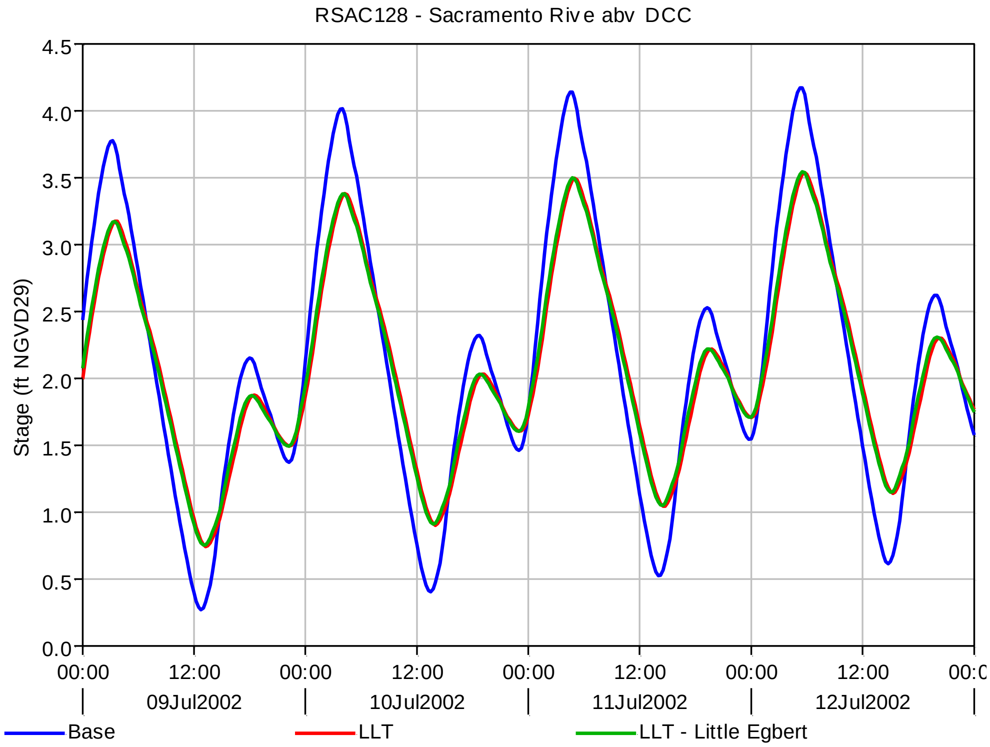


Figure 4-147 Stage at RSAC128 for Base - No MRB, LLT and LLT - No South scenarios.

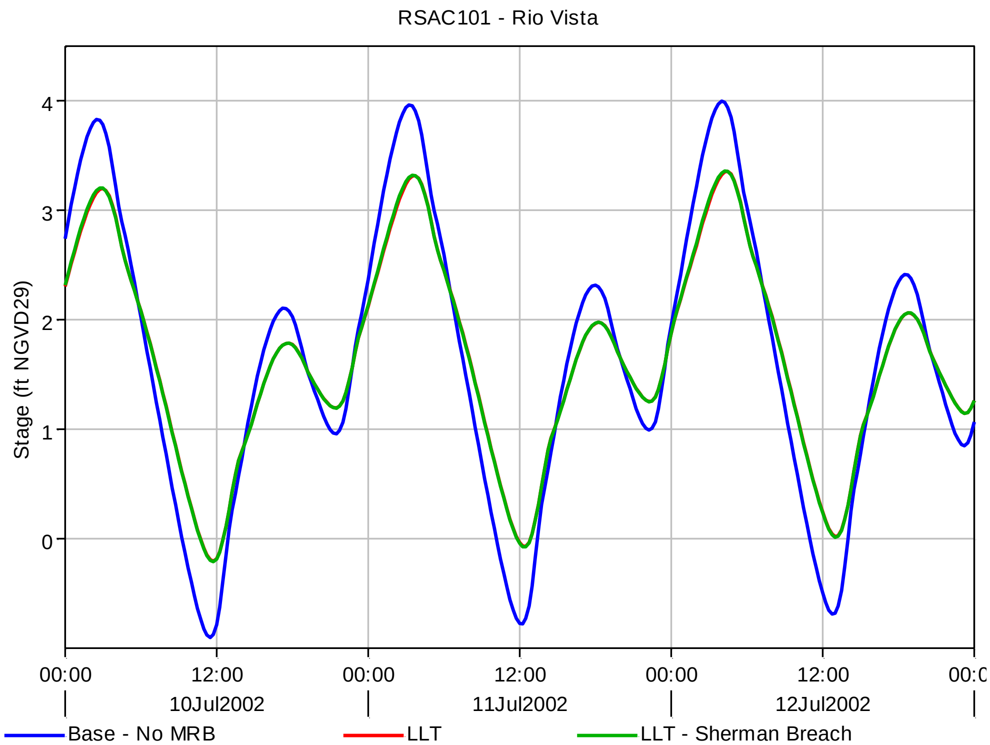


Figure 4-148 Stage at Rio Vista for Base - No MRB, LLT and LLT - No South scenarios.

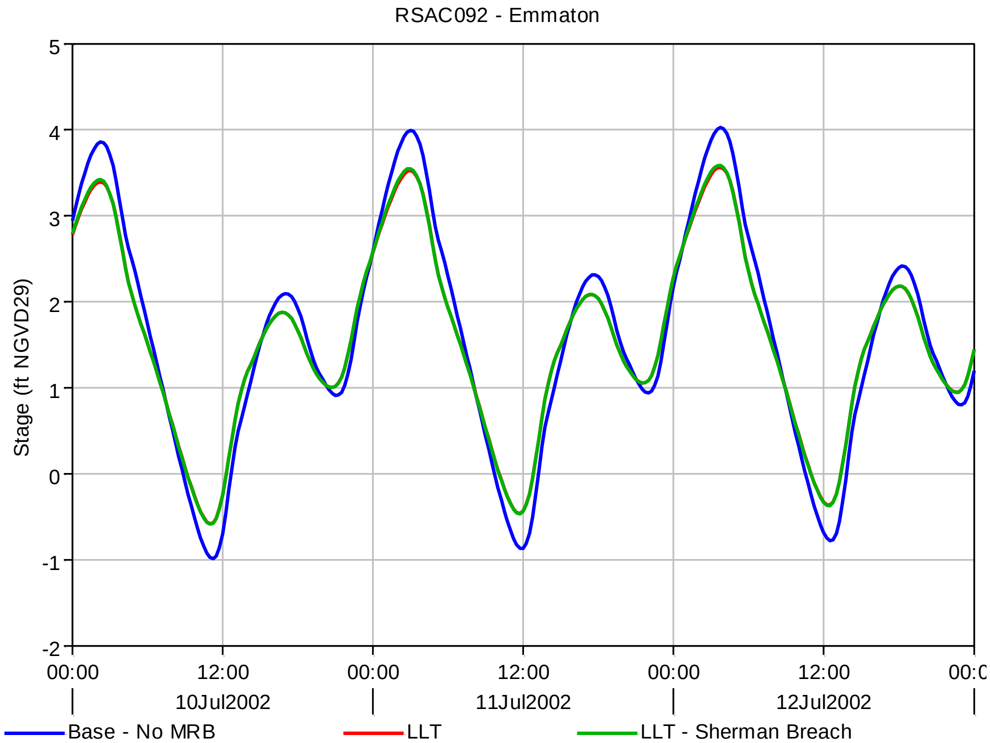


Figure 4-149 Stage at Emmaton for Base - No MRB, LLT and LLT - No South scenarios.

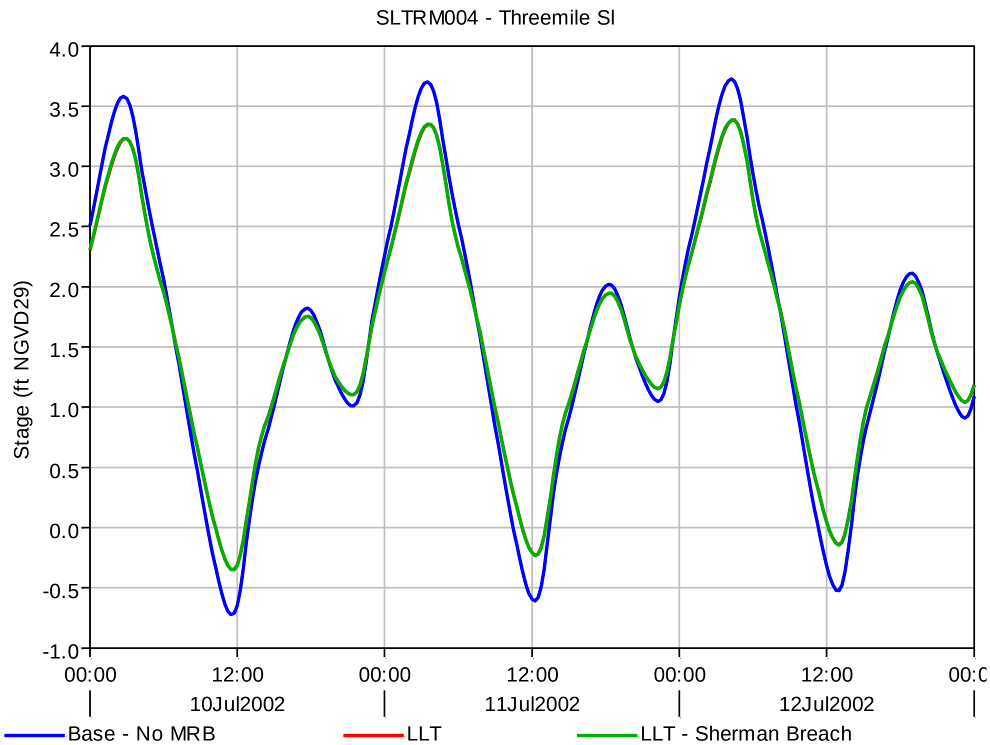


Figure 4-150 Stage in Threemile Slough for Base - No MRB, LLT and LLT - No South scenarios.

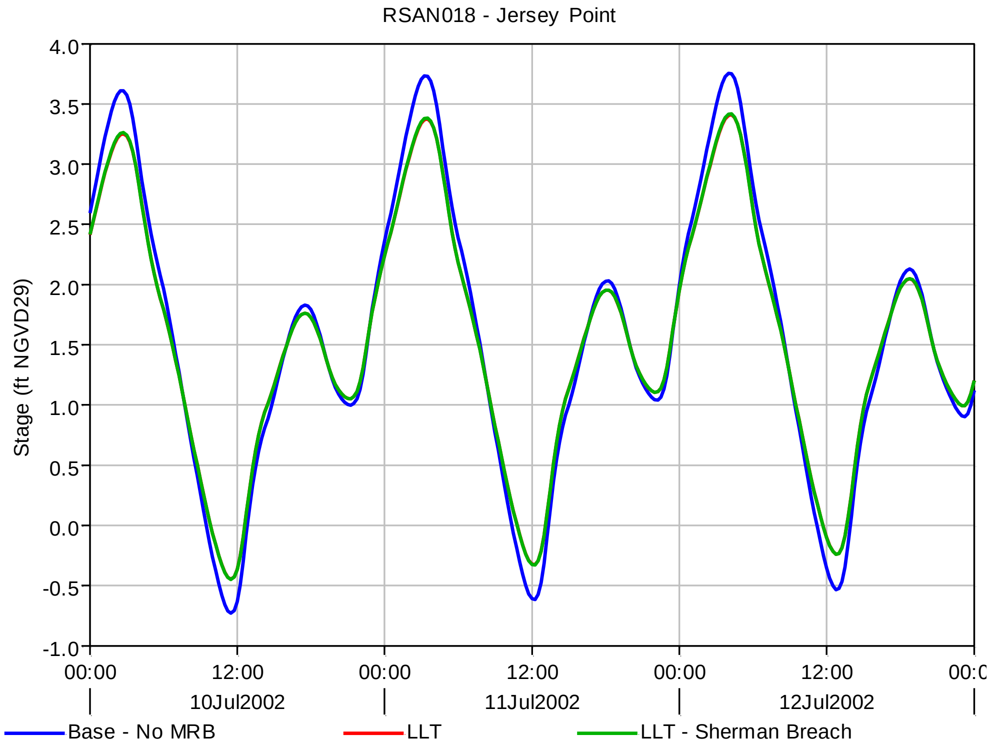


Figure 4-151 Stage at Jersey Point for Base - No MRB, LLT and LLT - No South scenarios.

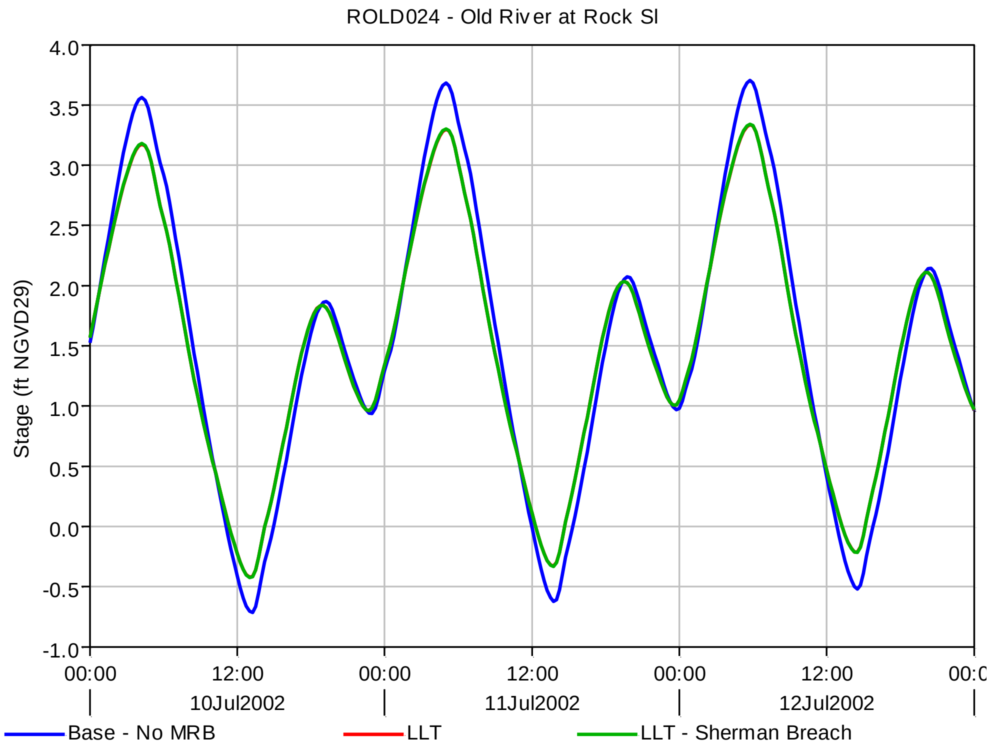


Figure 4-152 Stage at ROLD024 for Base - No MRB, LLT and LLT - No South scenarios.

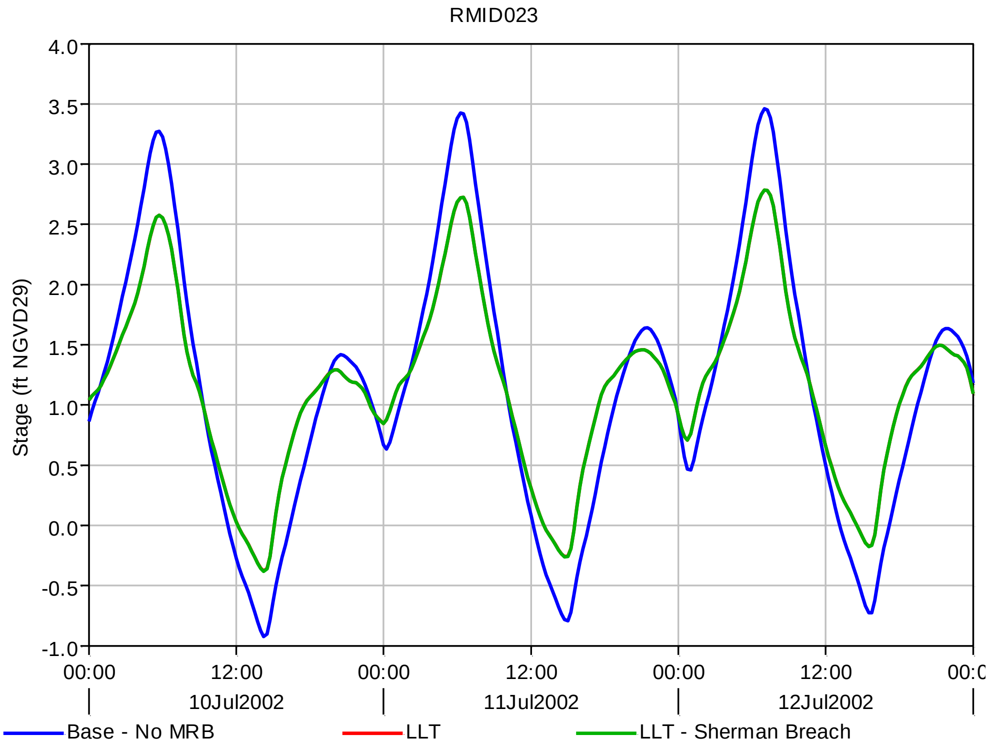


Figure 4-153 Stage RMID023 for Base - No MRB, LLT and LLT - No South scenarios.

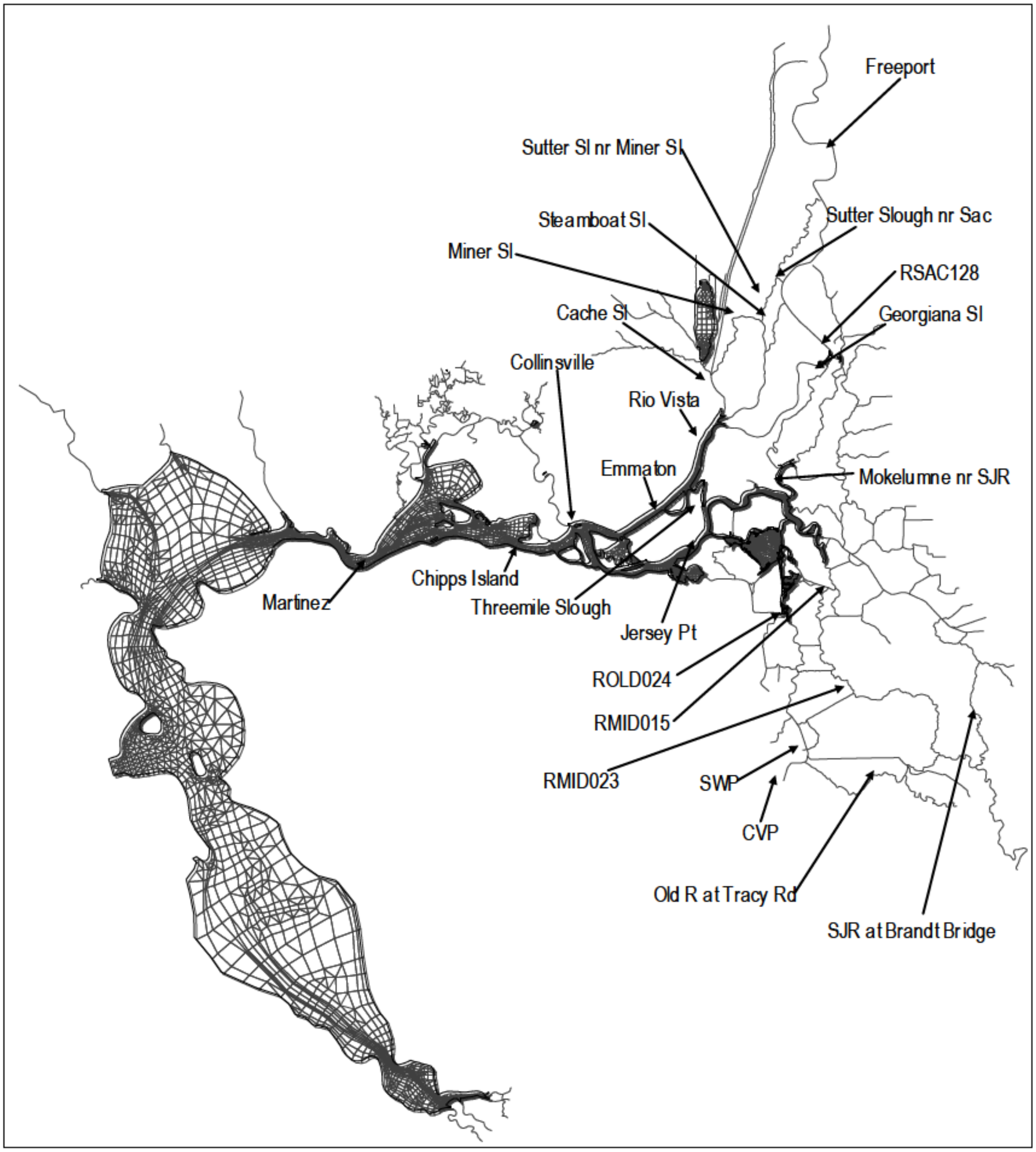


Figure 4-154 Time series plot locations in the Delta.

4.3 Hydrodynamics Summary

The hydrodynamic impacts examined in the sensitivity analysis include

- Transfer of net flows within the Delta
- Changes in Montezuma Slough flows
- Changes in the volume filling and draining during a spring-neap cycle
- Change in tidal prism at specific channel locations
- Changes in stage range

The hydrodynamic analysis metrics for the restoration cases are summarized in Table 4-23 as percent change from base restoration cases.

Transfer of Net Flow from Georgiana Slough and the Delta Cross Channel toward the Sacramento River

Of all the sensitivity cases, LLT – Little Egbert breach had the greatest impact on Georgiana Slough flows, while ELT – Prospect Breach had the greatest impact on DCC flows. In each case, the combined DCC plus Georgiana Slough flows are increased by 2% (around 100 cfs) above their respective base restoration case (LLT and ELT). Averaged flows at RSAC128, through the Delta Cross Channel and through Georgiana Slough decrease with added restoration area, however the breach configurations play an important role as well. Little Egbert and Prospect Island were breached at either end for the base restoration cases, providing conveyance through the islands. The sensitivity analyses confirm that this added conveyance results in reduced flows through Georgiana Slough and DCC, but each for different reasons.

For ELT relative to the base case, there is about a 660 cfs increase in average flow for Miner Slough upstream of the Prospect Island breach opening. By eliminating the breach, increase over the base case is reduced to 140 cfs. This shows that the connection between Miner Slough and the Ship Channel through Prospect Island increases the overall conveyance capacity between the Sacramento River above the DCC through Sutter and Steamboat Sloughs to the lower Sacramento River system, and decreases DCC flows and Sacramento River flows between Steamboat and Cache sloughs.

While elimination of the Prospect Island breach decreases Miner Slough flows, elimination of the Little Egbert breach increases flows in Miner Slough. Despite this difference, both cases result in increased DCC + Georgiana Slough flows. Thus it appears that for the LLT – Little Egbert case, the slight shift in tidal phase seen in Figure 4-127, as well as an increased tidal amplitude difference between RSAC123 and RSAN032 (see Table 4-19) cause the increased Georgiana Slough flow despite the increases in Miner Slough flows.

Montezuma Slough Flows

All sensitivity scenarios with changes in Suisun marsh or the south Delta have a 5% or greater impact on average flows at both ends of Montezuma Slough, relative to the base restoration cases. Montezuma Slough flows are obviously sensitive to conditions within Suisun Marsh, and to a lesser degree are sensitive to conditions in the south Delta. Note that average flows in Montezuma Slough at head are 12 – 13 cfs for the base and base restoration cases, so a change of 13 cfs equates to a 100% change. At the mouth of the slough, a 5% change can be 10 cfs.

Increase in Volume filling and draining the Delta between Spring and Neap Tide Cycle

In general, restoration results in overall increases in the fluctuations in tidally averaged flow over the neap-spring tide cycle downstream of the restoration areas. A comparison of Middle River tidally averaged flows for LLT and LLT – No South (Figure 4-155) illustrate this. With the South Delta ROA removed, the fluctuations in tidally averaged flows are dampened. Average water surface elevation increases in the restoration areas during the spring tide period and decreases during the neap tide period. An example of this action is shown in Figure 4-156, a plot of stage and tidally averaged stage in Middle River for the LLT – No South case. With this increasing and decreasing average water surface elevation, the restoration areas are "filling" up to the peak of the spring tide and "draining" afterwards. Any of the modifications in the sensitivity analysis can change the nature of this filling and draining action and affect the calculated 3-month average flows. The LLT – No South case shows 3-month average flows at Martinez are increased by 24 cfs relative to LLT. This is likely the result of the 3-month averaging period capturing the decreased filling and draining in the south Delta due to elimination of the south Delta ROA. The average flows are affected by the chosen averaging period. For example if the period starts when the water surface is at MSL at the midpoint of filling and draining and ends at the end of a draining cycle, there will be more outflow in LLT than in LLT – South because there is more filling and draining in LLT than LLT – No South. However, if the averaging period happens to end at the end of a filling cycle, there will be less outflow for LLT relative to LLT – No South.

Change in Tidal Prism

Of all the sensitivity cases, only the LLT – Suisun Scour case has a significant impact on tidal prism at Martinez. At this location, change from Base – No MRB tidal prism was 2% for LLT and 6% for LLT – Suisun Scour. This scenario also changes tidal prism in Montezuma Slough as expected. LLT – Suisun Scour increased tidal prism by 37% over LLT at the head of the slough and increased tidal prism 26% at the mouth of the slough.

Tidal prism changes in Montezuma Slough were smaller for the ELT – Max Suisun case. At the head of the slough, ELT – Max Suisun decreased tidal prism by 2% relative to ELT and by 4% relative to LLT. At the mouth of the slough ELT – Max Suisun increased tidal prism by 5% over ELT and decreased it by 1% below LLT. Thus a large increase in ROA area in Suisun does not increase tidal prism very much because tidal prism is limited by channel conveyance.

LLT – No South and LLT – Middle River have the largest impact on south Delta tidal prism, with changes varying between the two scenarios and by location. Aside from south Delta locations, the two scenarios have consistently the opposite effect on tidal prism relative to LLT. If one decreases the other increases. At any location where there are no impacts on tidal prism, the same is true for both scenarios. These results indicate that the LLT – Middle River case magnifies any tidal prism impacts of the south Delta ROA in the LLT case.

Tidal prism in Middle River is reduced by the South Delta restoration in the LLT scenario because flow out of the Union Island breach is out of phase with flow in the Middle River channel. This large, shallow restoration area fills and drains very slowly, so that when Middle River flows begin ebbing, Union Island is still filling. With increased Middle River conveyance capacity in LLT – Middle River, Union Island breach flows are more in phase with Middle River flows, increasing tidal prism in Middle River.

In Cache Slough at Ryer, while tidal prism is increased by 7% over the base case for the ELT restoration cases, it is decreased by 6% for the LLT case. This is because of the restoration of Little Egbert Tract, which is breached downstream of Cache Slough at Ryer and provides flow-through conveyance with a second breach at the upstream end. Eliminating the downstream breach on Little Egbert in the LLT – Little Egbert simulation results in a 12% increase in tidal prism over the base case.

Reduction of Stage Range

Restoration diminishes tidal range throughout the system. Sensitivity analyses show that increases in channel conveyance, certain changes to breach configurations and moving or removing certain restoration areas can all impact tidal range. Geometry modifications in Suisun primarily impact Suisun Marsh and south Delta tidal range.

Geometry changes in the south Delta have localized tidal range impacts. LLT – No South increased tidal range relative to LLT in upper Middle River and Victoria Canal. LLT – Middle River reduced tidal range at RMID023 and Victoria Canal, but increased tidal range at RMID027.

ELT – Prospect Breach only affected tidal range in the north Delta, reducing it in Miner, Sutter and Steamboat Sloughs, relative to ELT. The impacts of LLT – Little Egbert were more far reaching, with increases at Rio Vista and Jersey Point, relative to LLT, and decreases in Cache, Miner, Sutter and Steamboat Sloughs.

Table 4-23 Summary of percent change from base restoration case for average flow, average tidal prism and average tidal range.

	% Change from Base Restoration Case (ELT or LLT)																				
	3-month average flow (cfs)							Apr - Dec 2002 Average Tidal Prism (ac-ft)							Apr - Dec 2002 Average Tidal Range (ft)						
Location	ELT – Max Suisun	LLT – No South	LLT – Middle River	LLT – Suisun Scour	ELT – Prospect Breach	LLT – Little Egbert Breach	LLT – Sherman Breach	ELT – Max Suisun	LLT – No South	LLT – Middle River	LLT – Suisun Scour	ELT – Prospect Breach	LLT – Little Egbert Breach	LLT – Sherman Breach	ELT – Max Suisun	LLT – No South	LLT – Middle River	LLT – Suisun Scour	ELT – Prospect Breach	LLT – Little Egbert Breach	LLT – Sherman Breach
Cache Sl at Ryer	-1.6%	-0.6%	0.7%	-1.1%	-24.1%	-12.1%	0.0%	-3.4%	-0.6%	0.7%	-2.3%	0.2%	19.9%	0.2%	0.9%	-0.4%	0.4%	-1.8%	0.0%	-4.4%	0.4%
DCC	0.7%	0.5%	-0.4%	-0.3%	2.4%	0.2%	0.1%	-1.2%	3.0%	-2.2%	-2.4%	-1.6%	13.1%	0.4%	-0.4%	-0.9%	0.0%	-1.4%	-1.7%	-0.5%	0.5%
False River	-2.2%	0.1%	0.8%	-0.5%	-1.5%	3.8%	-0.4%	-2.4%	1.5%	-1.6%	-2.3%	0.0%	2.0%	0.0%	-2.6%	-1.0%	0.3%	-2.0%	0.0%	2.4%	0.3%
Martinez	-2.2%	0.6%	0.0%	-0.3%	0.0%	0.0%	0.0%	2.3%	-0.2%	0.2%	3.9%	0.0%	0.3%	0.0%	-2.7%	-0.2%	0.0%	-2.9%	0.0%	0.6%	0.0%
Miner Slough	-1.6%	-0.1%	0.1%	-0.3%	-19.5%	4.8%	0.0%	5.7%	1.5%	-1.8%	-1.1%	-22.1%	-24.2%	0.4%	1.0%	-0.8%	0.8%	-1.5%	-16.9%	-5.7%	0.4%
Montezuma Sl at Head	-480.0%	92.3%	-100.0%	3392.3%	10.0%	0.0%	0.0%	-2.3%	0.4%	-0.2%	37.1%	-0.1%	2.2%	0.1%	-4.2%	-1.1%	0.5%	-1.6%	0.0%	2.2%	0.3%
Montezuma Sl at Mouth	-302.4%	-5.8%	5.2%	-142.4%	-2.4%	-0.5%	0.0%	4.5%	0.0%	0.0%	25.8%	0.0%	0.6%	0.0%	-6.5%	0.0%	0.5%	1.0%	0.0%	1.5%	0.2%
RMID015	-0.1%	1.0%	-8.7%	-0.1%	0.1%	0.1%	0.0%	-2.2%	8.1%	29.8%	-1.8%	0.0%	2.6%	0.1%	-2.0%	2.9%	-6.4%	-1.9%	0.0%	2.2%	0.3%
RMID027	1.7%	-35.6%	57.8%	0.0%	0.0%	-4.4%	-2.2%	-1.3%	-74.8%	173.5%	-0.8%	0.0%	1.0%	0.1%	--	433.9%	130.4%	-14.3%	--	-12.5%	0.0%
ROLD024	0.2%	-1.7%	7.5%	0.0%	0.0%	-0.2%	0.0%	-2.4%	7.3%	0.1%	-2.1%	0.0%	2.6%	0.1%	-2.1%	1.3%	-5.3%	-2.0%	0.0%	2.0%	0.0%
ROLD034	0.0%	-1.7%	-0.4%	-0.1%	0.0%	0.0%	0.0%	-1.6%	5.2%	19.1%	-0.7%	-0.1%	2.3%	0.1%	-1.9%	8.4%	-21.6%	-1.8%	0.0%	1.8%	0.0%
RSAC075 Chipps Island	-1.2%	0.4%	0.2%	-10.4%	0.0%	0.0%	0.0%	-1.2%	0.3%	-0.4%	-2.3%	0.0%	-1.8%	-0.1%	-4.2%	-0.3%	0.5%	-2.6%	0.0%	2.1%	0.3%
RSAC092 Emmaton	-0.4%	0.1%	-0.2%	0.5%	-1.3%	1.9%	0.4%	-2.4%	0.0%	0.0%	-2.3%	0.0%	-6.6%	-0.5%	-2.8%	-1.2%	0.6%	-2.5%	0.3%	2.8%	0.6%
RSAC101 Rio Vista	-0.2%	-0.4%	0.4%	0.3%	-1.3%	-0.9%	-0.1%	-2.9%	-0.5%	0.6%	-2.2%	0.0%	-8.3%	0.3%	-0.9%	-1.1%	0.4%	-2.2%	0.0%	2.9%	0.4%
RSAC123	0.0%	-0.7%	0.7%	0.4%	3.6%	-2.8%	-0.1%	-1.4%	1.3%	-1.3%	-2.7%	-0.7%	9.5%	0.4%	-0.4%	-0.5%	0.0%	-1.9%	-0.9%	0.0%	0.5%
RSAC128	0.3%	0.1%	-0.1%	-0.1%	2.6%	-0.3%	0.1%	-2.4%	-3.0%	2.9%	-1.8%	2.6%	-1.0%	0.0%	-0.4%	-0.5%	0.0%	-1.9%	-1.7%	-0.5%	0.5%
RSAN018 Jersey Pt	-1.6%	-1.3%	-0.7%	1.4%	-4.5%	5.7%	1.2%	-2.7%	1.5%	-1.6%	-2.4%	0.0%	1.1%	0.2%	-2.6%	-1.0%	1.0%	-2.3%	0.0%	2.7%	0.3%
RSAN032 San Andreas	0.2%	-1.7%	-0.4%	0.7%	-3.6%	-4.0%	-0.2%	-2.8%	2.1%	-2.1%	-2.6%	0.0%	2.6%	0.1%	-2.3%	-0.3%	-0.7%	-2.1%	0.0%	2.1%	0.3%
RSAN058	1.3%	-5.9%	-13.8%	-0.8%	1.6%	0.5%	0.3%	-2.4%	-21.5%	0.6%	-2.0%	0.0%	2.3%	0.1%	-2.2%	6.2%	-2.2%	-1.5%	0.0%	2.2%	0.3%
SLDUT007	3.6%	2.9%	-8.8%	-10.3%	4.8%	-10.3%	0.0%	-2.1%	2.6%	-2.5%	-1.9%	0.0%	1.0%	0.1%	-2.8%	-1.0%	1.0%	-2.0%	0.0%	2.6%	0.3%
SLGEO019 Georgiana Sl	0.0%	0.7%	-0.8%	-0.7%	1.4%	3.4%	0.3%	-7.6%	-6.3%	6.7%	-1.0%	2.7%	-2.2%	-0.7%	-0.4%	0.0%	0.0%	-1.4%	-1.3%	0.0%	0.5%
SLTRM004 Threemile Sl	0.3%	-1.3%	1.5%	-0.1%	-1.5%	-6.9%	-1.0%	-2.6%	3.7%	-4.0%	-2.8%	0.0%	12.8%	0.7%	-2.3%	3.4%	0.0%	-2.4%	0.0%	2.1%	0.0%
Steamboat Sl	0.0%	-0.2%	0.2%	0.4%	0.5%	-1.1%	-0.2%	-0.8%	0.9%	-0.9%	-3.0%	-2.9%	7.6%	0.6%	0.0%	-0.5%	0.5%	-1.5%	-3.2%	-1.5%	0.5%
Sutter Sl	-0.8%	-0.1%	0.1%	0.0%	-8.1%	1.7%	0.0%	2.5%	1.1%	-1.2%	-2.1%	-11.7%	-9.7%	0.5%	0.5%	-1.5%	-0.5%	-2.1%	-6.9%	-3.1%	-1.0%

--Tidal range was not computed at RMID027 for all simulations.

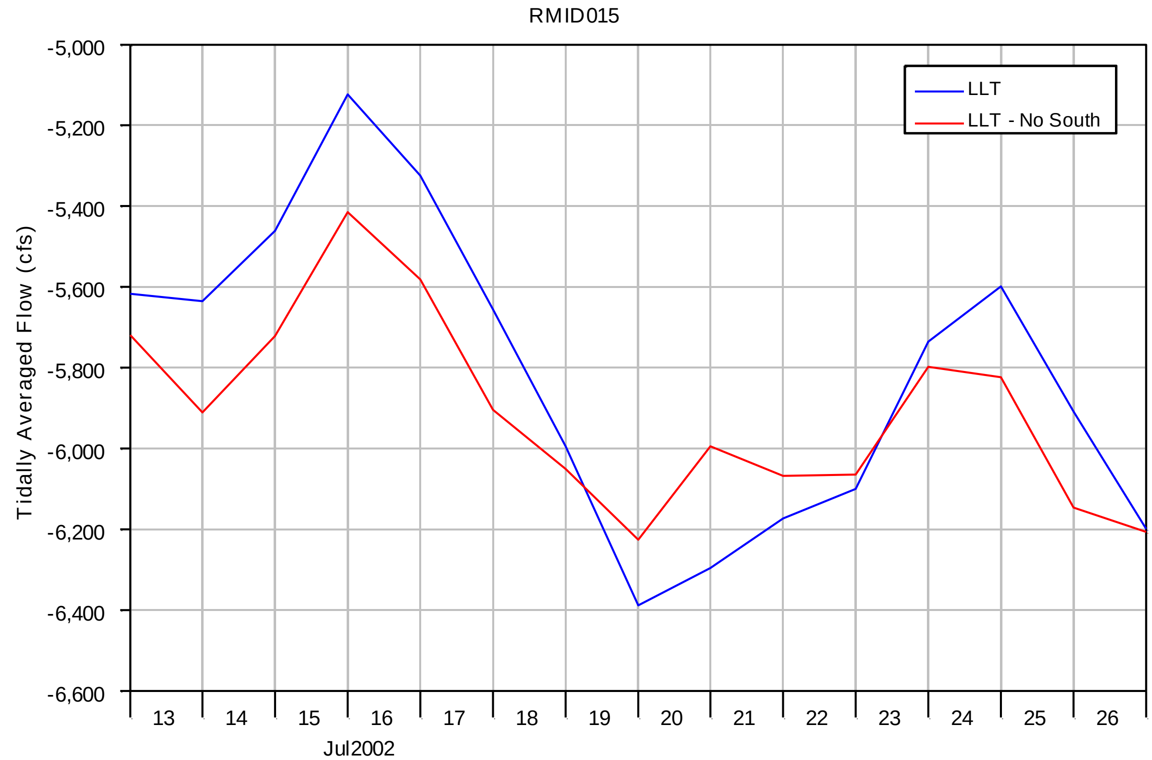


Figure 4-155 Tidally averaged flow in Middle River at RMID015 for LLT and LLT - No South.

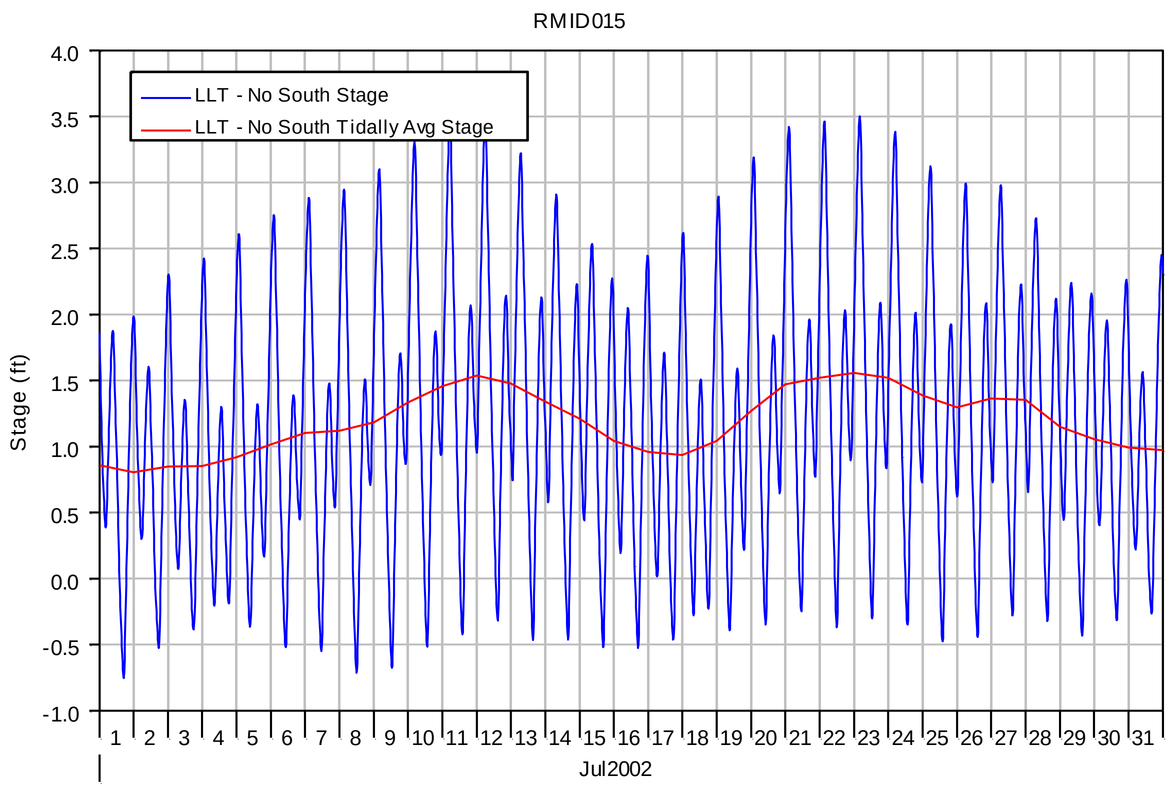


Figure 4-156 Stage and tidally averaged stage in Middle River at RMID015 for LLT - No South.

5 Electrical Conductivity (EC)

Electrical conductivity (µmhos cm^{-1}), or EC, was modeled as a surrogate for salinity. Although the RMA11 formulation assumes transport of a conservative constituent, EC is used as a practical surrogate for modeled salinity in the Bay-Delta model for several reasons, despite concerns about its non-conservative behavior. The number and reliability of measurement locations in the Bay-Delta region is much greater for EC than for other measures of salinity. In addition, transformation relationships between EC and constituents generally considered conservative, such as chloride and Total Dissolved Solids (TDS), can introduce additional error. EC underestimates true salinity at high concentrations (DWR, 2002).

To assess EC results, time series plots of tidally averaged EC and spatial plots of change from base restoration case (ELT or LLT) tidally averaged EC are provided. Locations for EC time series are shown in Figure 5-1.

For each sensitivity scenario, spatial plots are provided showing percent change from base restoration case (ELT or LLT) EC (computed using tidally averaged results). Plots of change from base case tidally averaged EC for the sensitivity cases compared with the base restoration cases are provided in the appendix. All spatial plots show results from 24 September 2002, around a time when restoration alternatives result in the greatest change from the base case. Several different views are used to emphasize different areas.

Time series of X2 are plotted for the April through December 2002 simulation period comparing the sensitivity cases with the relevant base and base restoration cases.

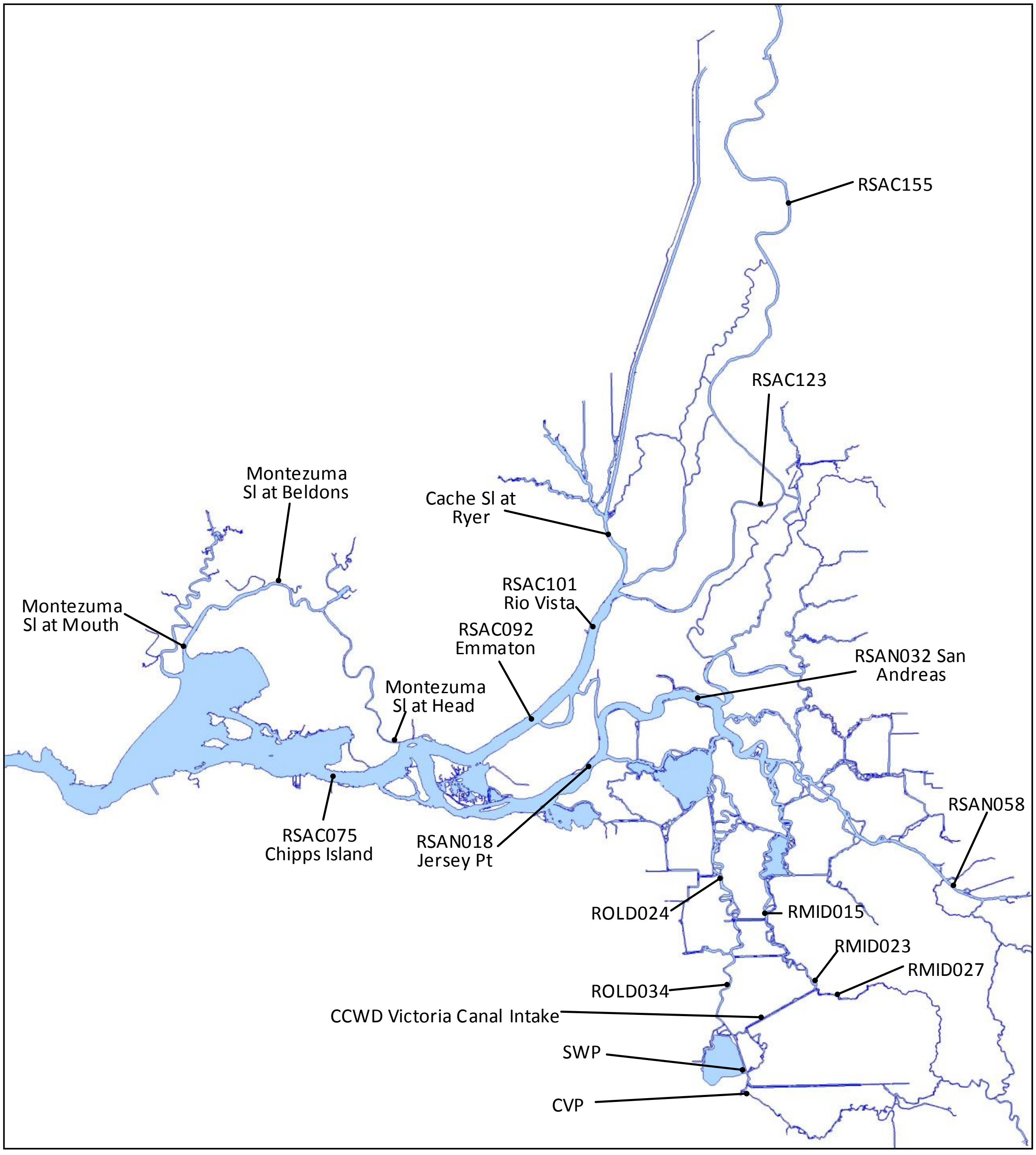


Figure 5-1 EC time series plot locations.

5.1 ELT – Maximize Suisun

EC results for the ELT – Max Suisun case are shown as time series plots of tidally averaged values in Figure 5-2 through Figure 5-20. ELT – Max Suisun EC results are very similar to ELT in the North Delta. In the central and south Delta, EC falls somewhere between ELT and LLT, tending closer to ELT at Emmaton and Rio Vista, and closer to LLT at Jersey Point. Shifting restoration area from Cache to Suisun increases EC at the exports. In Suisun Marsh and Sacramento River at Chipps Island, the ELT – Max Suisun EC is similar to LLT. None of the scenarios impact EC at Freeport.

Contour plots of tidally averaged EC percent change from ELT on September 24, 2002 are shown in Figure 5-21 through Figure 5-23 for the Delta, the south and central Delta and for Suisun Marsh. These plots show very small changes in the north Delta. There are significant EC increases around Chipps Island and up the San Joaquin to Turner Cut and into the southwest Delta in Dutch Slough, Franks Tract and Old and Middle Rivers. EC is decreased throughout most of Suisun Marsh, with the exception of Nurse Slough and in Montezuma Slough down to Beldon's Landing.

A summary of July – December 2002 monthly average EC at key locations throughout the Delta is provided in Table 5-1 for Base – No SMSCG, ELT and ELT – Max Suisun. Percent change in monthly average EC relative to the base case are provided in Table 5-2 for ELT and ELT – Max Suisun. Shifting restoration acreage from Cache to Suisun tends to have the greatest EC impacts during July and August. At Chipps Island, ELT – Max Suisun EC is about 10% greater than ELT. In the south Delta, ELT – Max Suisun EC is 2 – 8% greater than ELT. At Emmaton and above, differences are generally +/-2% or less. In Montezuma Slough at Head, EC increases by 3 – 5%. EC generally increases by about 1% at Beldon's Landing, and at Montezuma Slough at head, changes are generally +/-1% or less.

ELT – Max Suisun X2, shown in Figure 5-24, is increased by about 1 km relative to ELT during the spring and earlier summer, falling closer to LLT X2. During the remainder of the year, X2 changes are generally less than 0.5 km.

Table 5-1 Summary of July - December 2002 monthly average EC for Base - No SMSCG, ELT and ELT - Max Suisun.

Location	Monthly Average EC (umhos/cm)																	
	July 2002			August 2002			September 2002			October 2002			November 2002			December 2002		
	Base - No SMSCG	ELT	ELT - Max Suisun	Base - No SMSCG	ELT	ELT - Max Suisun	Base - No SMSCG	ELT	ELT - Max Suisun	Base - No SMSCG	ELT	ELT - Max Suisun	Base - No SMSCG	ELT	ELT - Max Suisun	Base - No SMSCG	ELT	ELT - Max Suisun
Cache Sl at Ryer	136	134	134	153	151	151	176	174	173	164	157	156	189	184	182	196	192	192
CCWD Victoria Canal	265	274	280	369	400	421	468	513	538	509	561	576	452	484	489	483	513	520
CVP	334	341	352	517	540	573	665	698	737	658	713	740	587	627	640	631	661	668
Montezuma Sl at Head	3539	3254	3427	4653	4294	4417	6856	6412	6618	7404	7064	7410	6557	6322	6545	3148	3132	3262
Montezuma Sl at Mouth	13705	14342	14244	15976	16618	16571	18956	19533	19456	20763	21199	21184	19462	20292	20456	12058	13439	13943
RMID015	262	272	278	369	401	423	471	517	542	504	556	570	441	475	480	464	494	501
RMID023	263	273	278	369	400	422	469	514	539	507	559	574	447	480	485	477	507	514
ROLD024	402	409	432	709	725	785	937	967	1036	828	901	947	713	782	808	607	652	673
ROLD034	361	368	386	617	638	688	805	838	895	755	822	861	651	710	732	601	646	663
RSAC075 Chipps Island	8211	7983	8869	9743	9397	10349	12563	12203	13236	13607	13119	14278	11989	11729	12815	6033	6014	6602
RSAC092 Emmaton	624	563	570	809	696	698	1499	1288	1290	2015	1791	1830	1749	1612	1642	821	789	797
RSAC101 Rio Vista	148	142	141	176	162	161	240	207	204	284	239	232	290	269	258	222	216	212
RSAC123	127	127	127	154	154	154	165	165	165	142	142	142	184	184	184	169	169	169
RSAC155 Freeport	126	126	126	156	156	156	162	162	162	142	142	142	184	184	184	164	164	164
RSAN018 Jersey Pt	955	943	1033	1462	1422	1565	1977	1956	2115	1730	1750	1864	1504	1572	1661	945	980	1033
RSAN032 San Andreas	285	341	360	460	573	618	557	741	787	449	632	656	404	549	561	333	411	421
RSAN058	650	658	663	673	684	689	716	724	727	674	674	674	637	640	641	763	771	775
S-49 Beldon's Landing	10401	11241	11335	13265	14198	14348	15825	16810	17030	18853	19376	19485	18356	19374	19754	12763	14636	15254
SWP	330	338	352	541	565	607	698	736	783	681	744	776	593	643	659	594	630	641

Table 5-2 Summary of July - December 2002 percent change in monthly average EC for ELT and ELT – Max Suisun relative to Base - No SMSCG.

Location	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Case											
	July 2002		August 2002		September 2002		October 2002		November 2002		December 2002	
	ELT	ELT - Max Suisun	ELT	ELT - Max Suisun	ELT	ELT - Max Suisun	ELT	ELT - Max Suisun	ELT	ELT - Max Suisun	ELT	ELT - Max Suisun
Cache Sl at Ryer	-1%	-1%	-1%	-1%	-1%	-1%	-4%	-5%	-3%	-4%	-2%	-2%
CCWD Victoria Canal	3%	6%	8%	14%	9%	15%	10%	13%	7%	8%	6%	8%
CVP	2%	5%	4%	11%	5%	11%	8%	13%	7%	9%	5%	6%
Montezuma Sl at Head	-8%	-3%	-8%	-5%	-6%	-3%	-5%	0%	-4%	0%	-1%	4%
Montezuma Sl at Mouth	5%	4%	4%	4%	3%	3%	2%	2%	4%	5%	11%	16%
RMID015	4%	6%	9%	14%	10%	15%	10%	13%	8%	9%	6%	8%
RMID023	4%	6%	8%	14%	10%	15%	10%	13%	7%	8%	6%	8%
ROLD024	2%	8%	2%	11%	3%	11%	9%	14%	10%	13%	7%	11%
ROLD034	2%	7%	3%	11%	4%	11%	9%	14%	9%	12%	7%	10%
RSAC075 Chipps Island	-3%	8%	-4%	6%	-3%	5%	-4%	5%	-2%	7%	0%	9%
RSAC092 Emmaton	-10%	-9%	-14%	-14%	-14%	-14%	-11%	-9%	-8%	-6%	-4%	-3%
RSAC101 Rio Vista	-4%	-5%	-8%	-8%	-14%	-15%	-16%	-18%	-7%	-11%	-2%	-4%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	-1%	8%	-3%	7%	-1%	7%	1%	8%	4%	10%	4%	9%
RSAN032 San Andreas	20%	26%	24%	34%	33%	41%	41%	46%	36%	39%	23%	26%
RSAN058	1%	2%	2%	2%	1%	2%	0%	0%	1%	1%	1%	2%
S-49 Beldon's Landing	8%	9%	7%	8%	6%	8%	3%	3%	6%	8%	15%	20%
SWP	2%	7%	4%	12%	5%	12%	9%	14%	8%	11%	6%	8%

5.1.1 Tidally averaged EC time series

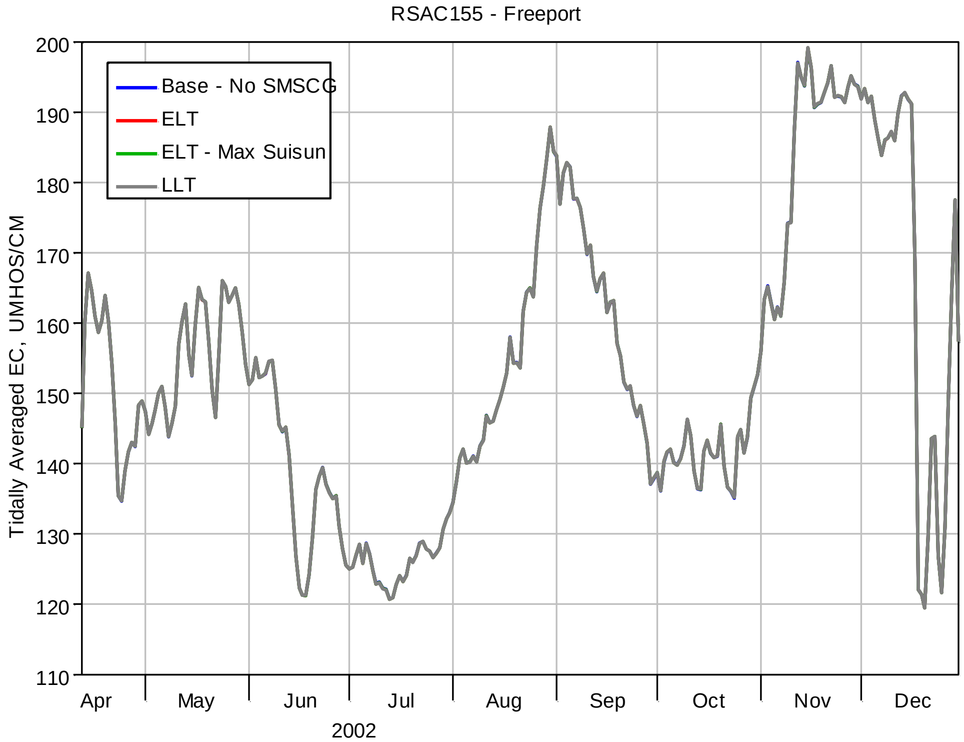


Figure 5-2 Tidally averaged EC at RSAC155 for Base – No SMSCG, ELT and ELT – Max Suisun.

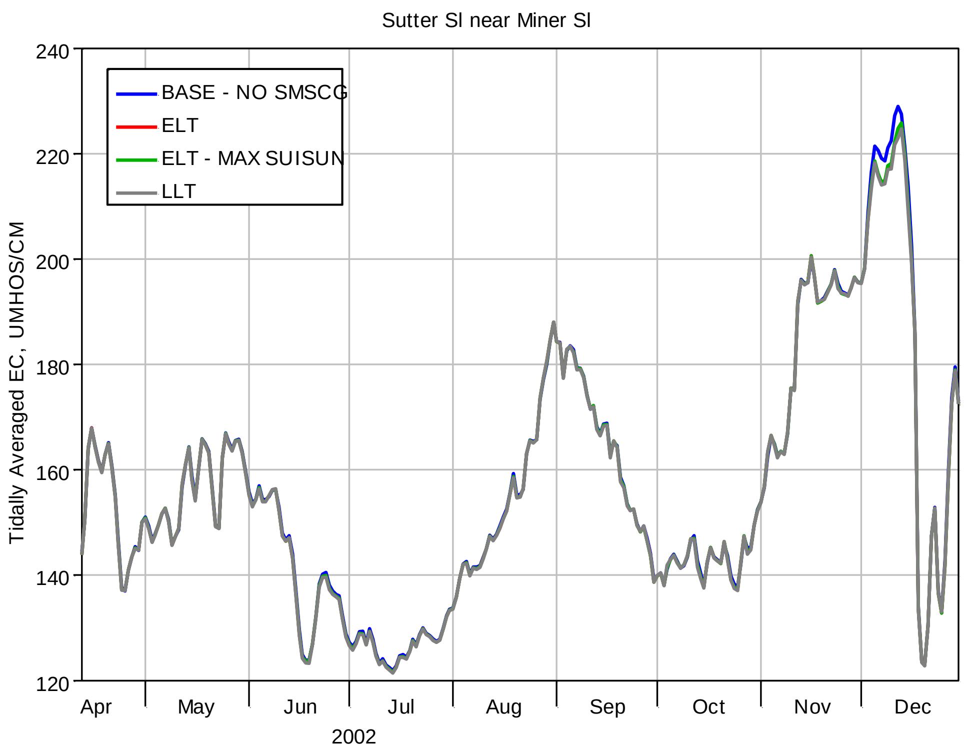


Figure 5-3 Tidally averaged EC in Sutter Slough for Base – No SMSCG, ELT and ELT – Max Suisun.

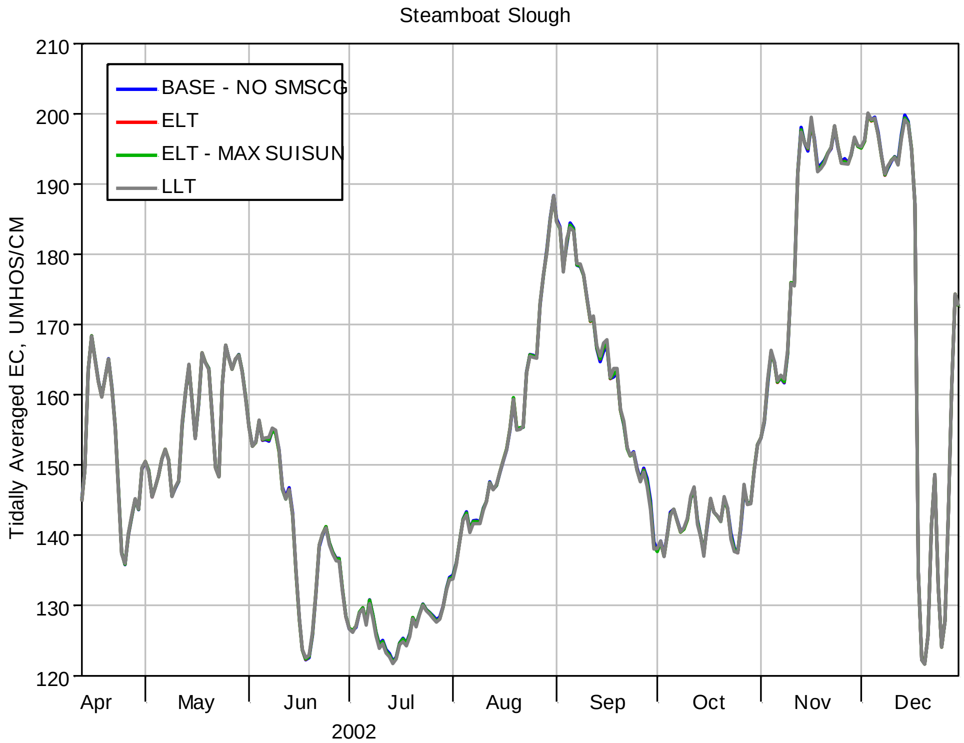


Figure 5-4 Tidally averaged EC in Steamboat Slough for Base – No SMSCG, ELT and ELT – Max Suisun.

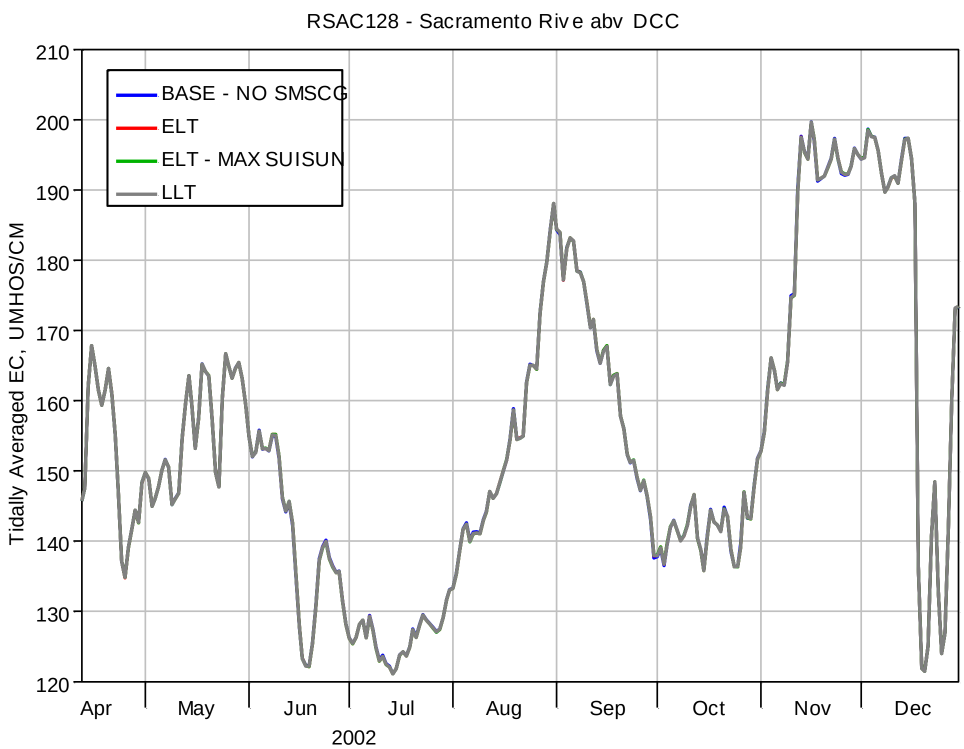


Figure 5-5 Tidally averaged EC at RSAC128 for Base – No SMSCG, ELT and ELT – Max Suisun.

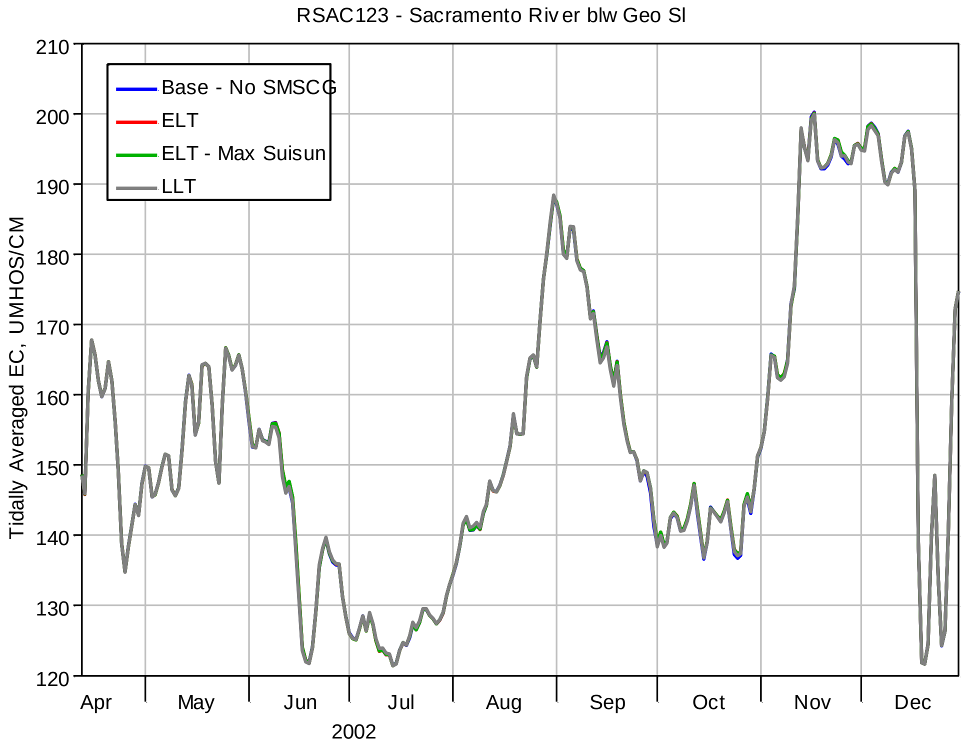


Figure 5-6 Tidally averaged EC at RSAC123 for Base – No SMSCG, ELT and ELT – Max Suisun.

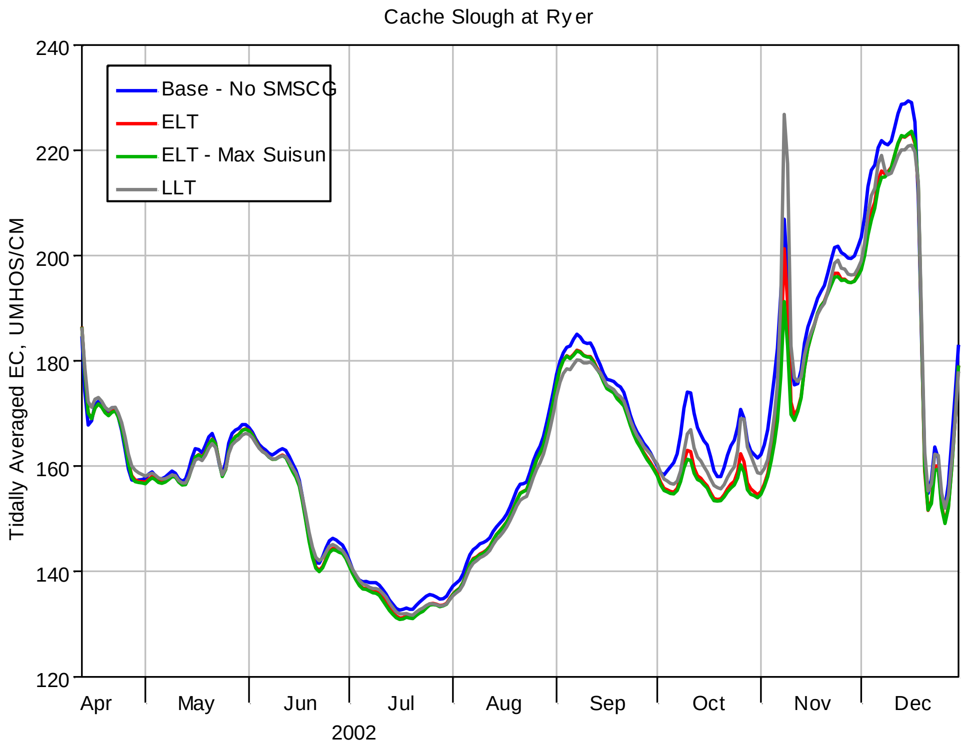


Figure 5-7 Tidally averaged EC in Cache Slough at Ryer for Base – No SMSCG, ELT and ELT – Max Suisun.

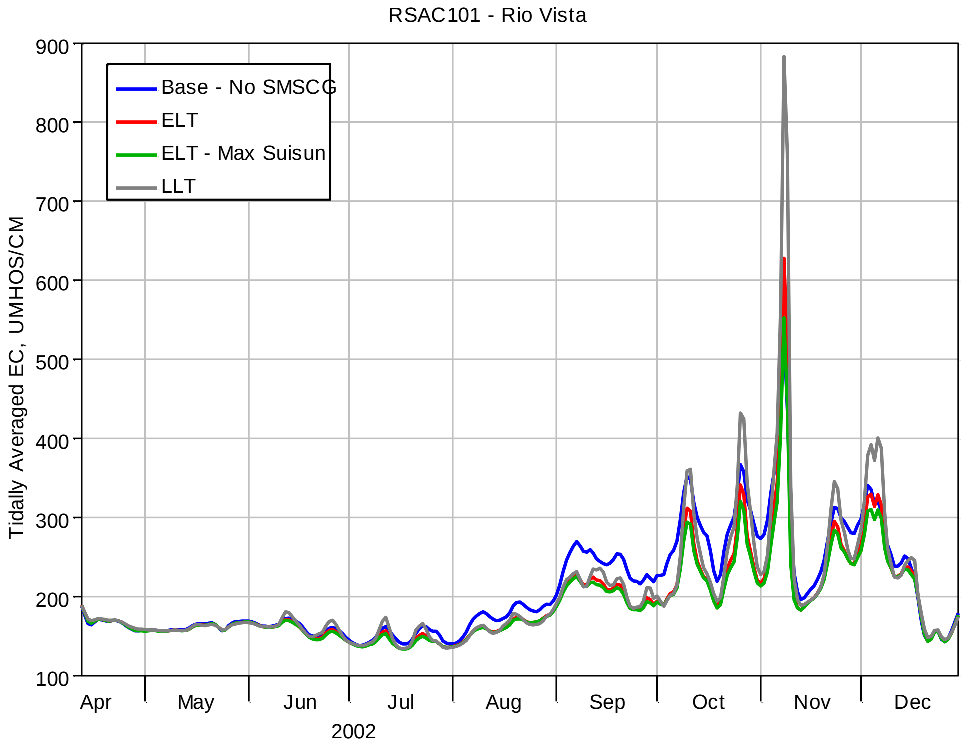


Figure 5-8 Tidally averaged EC at RSAC101 for Base – No SMSCG, ELT and ELT – Max Suisun.

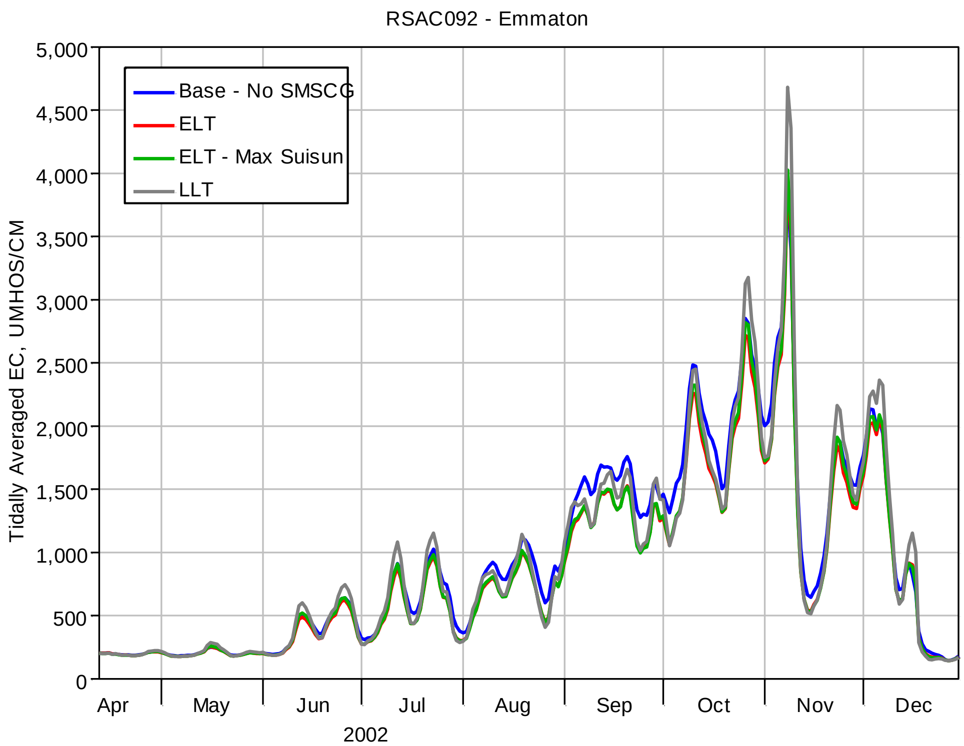


Figure 5-9 Tidally averaged EC at RSAC092 for Base – No SMSCG, ELT and ELT – Max Suisun.

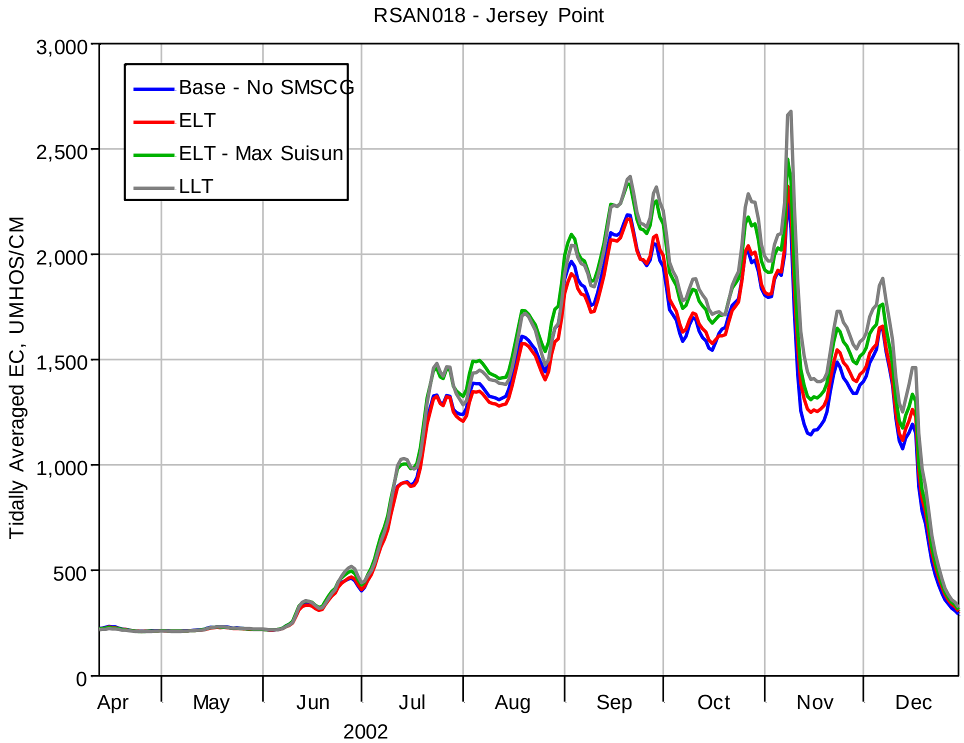


Figure 5-10 Tidally averaged EC at RSAC018 for Base – No SMSCG, ELT and ELT – Max Suisun.

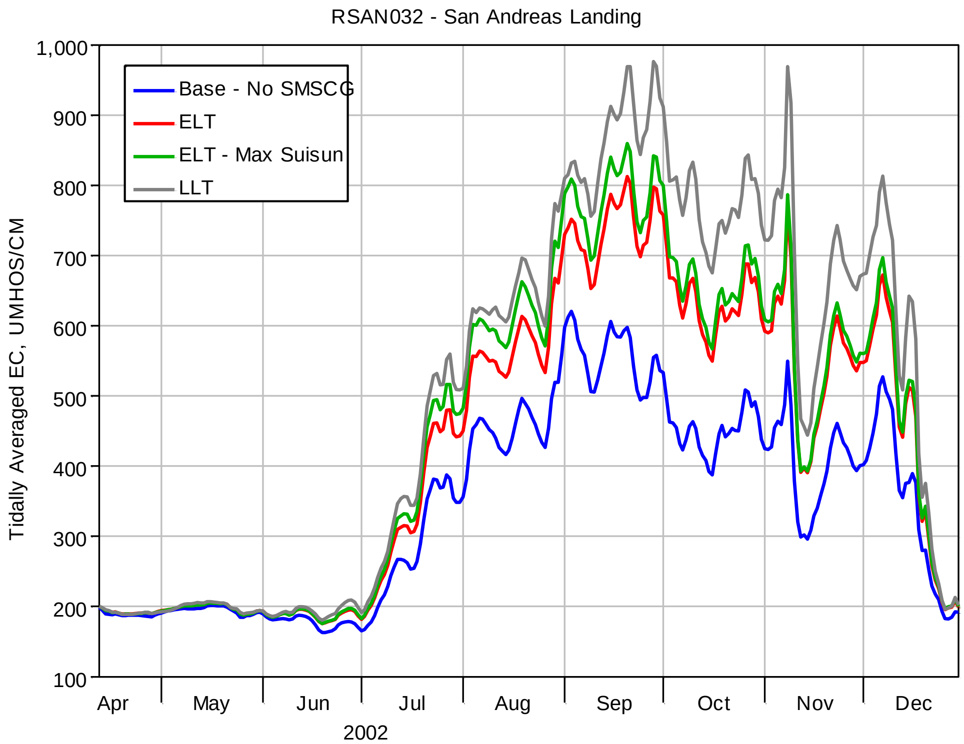


Figure 5-11 Tidally averaged EC at RSAC032 for Base – No SMSCG, ELT and ELT – Max Suisun.

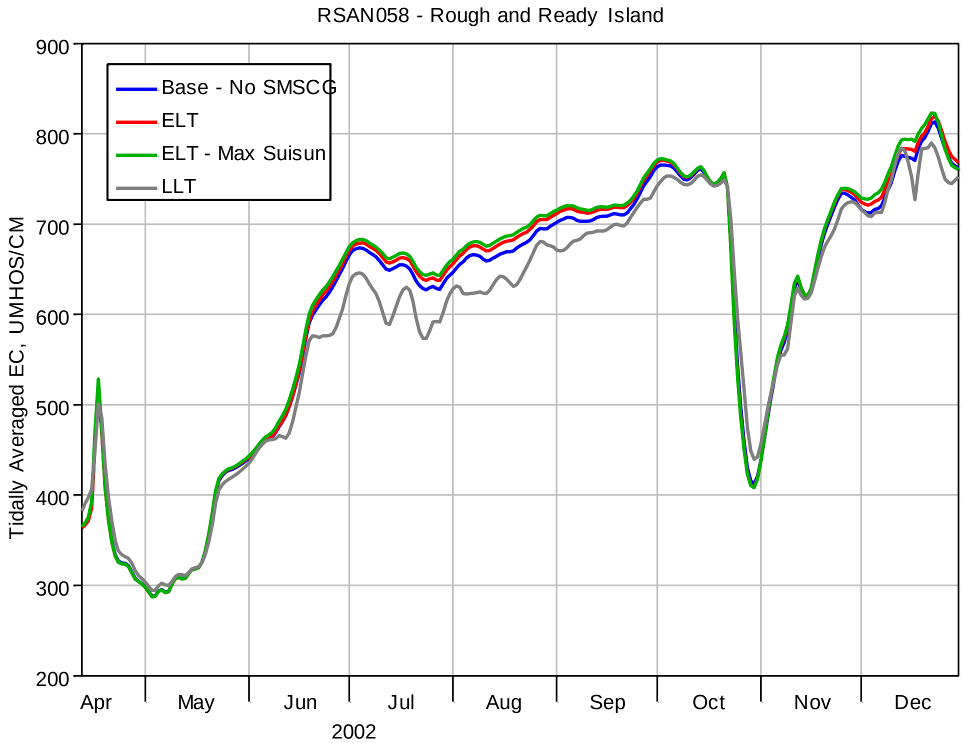


Figure 5-12 Tidally averaged EC at RSAN058 for Base – No SMSCG, ELT and ELT – Max Suisun.

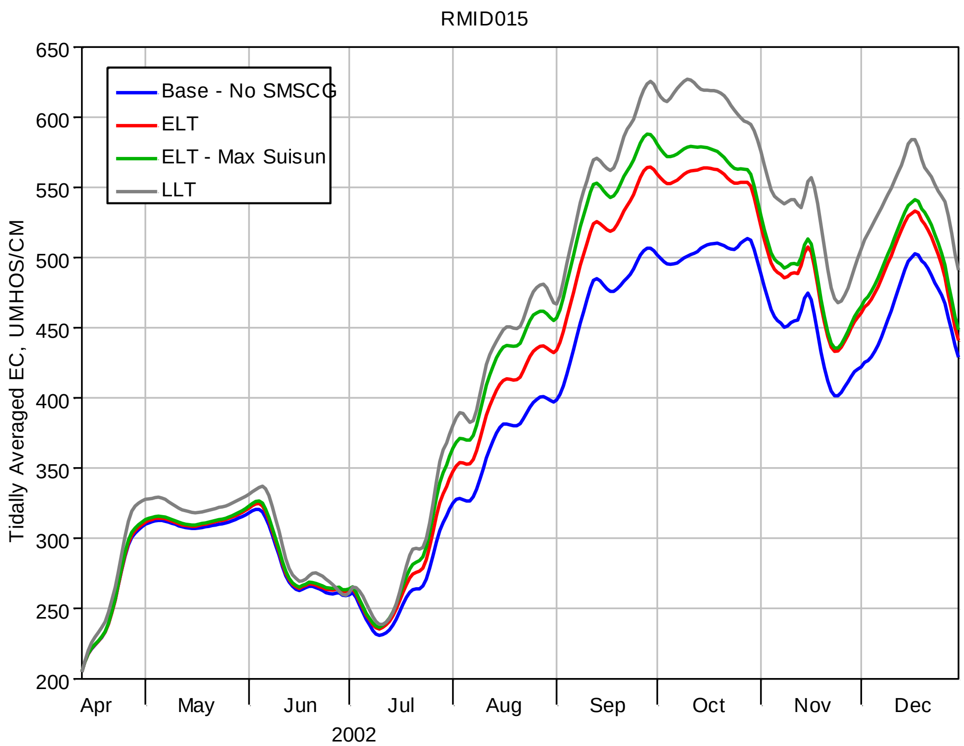


Figure 5-13 Tidally averaged EC at RMID015 for Base – No SMSCG, ELT and ELT – Max Suisun.

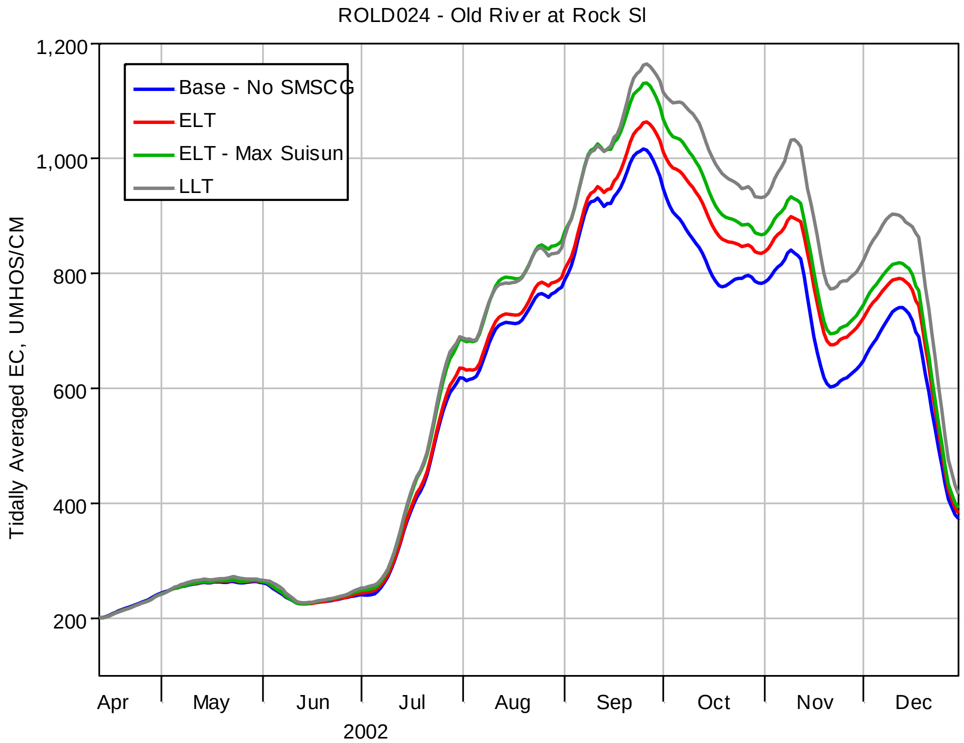


Figure 5-14 Tidally averaged EC at ROLD024 for Base – No SMSCG, ELT and ELT – Max Suisun.

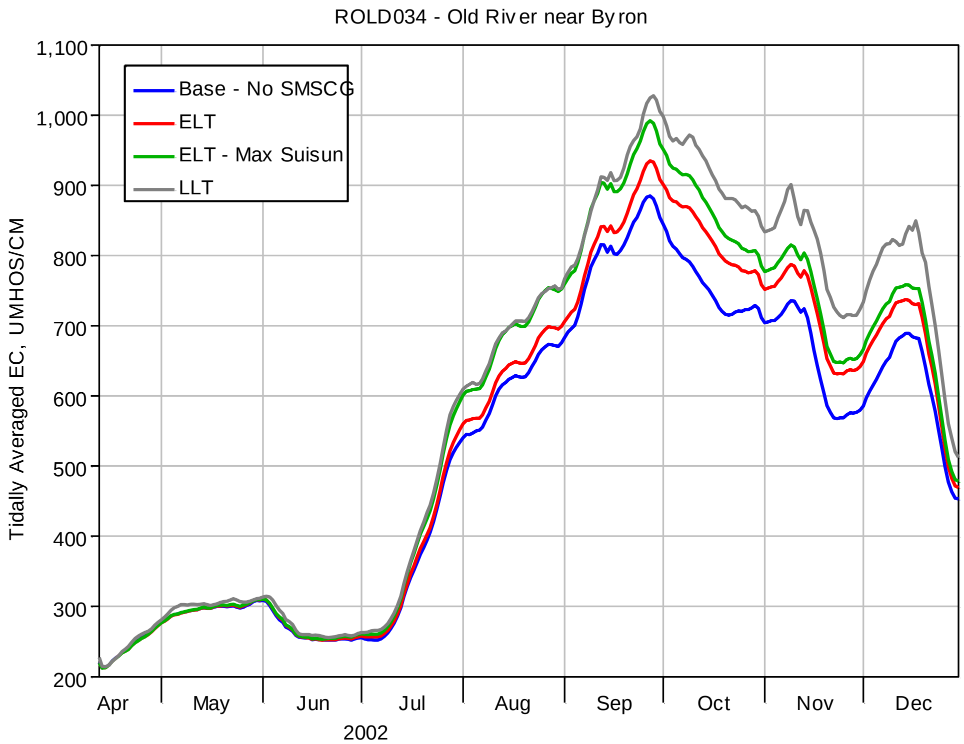


Figure 5-15 Tidally averaged EC at SWP for Base – No SMSCG, ELT and ELT – Max Suisun.

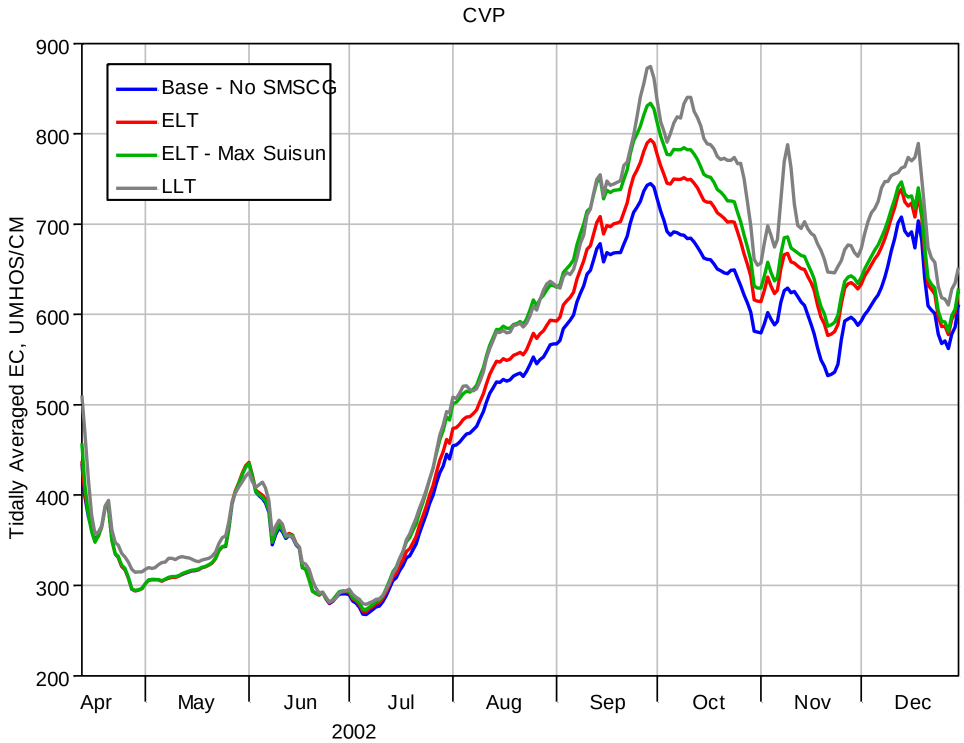


Figure 5-16 Tidally averaged EC at CVP for Base – No SMSCG, ELT and ELT – Max Suisun.

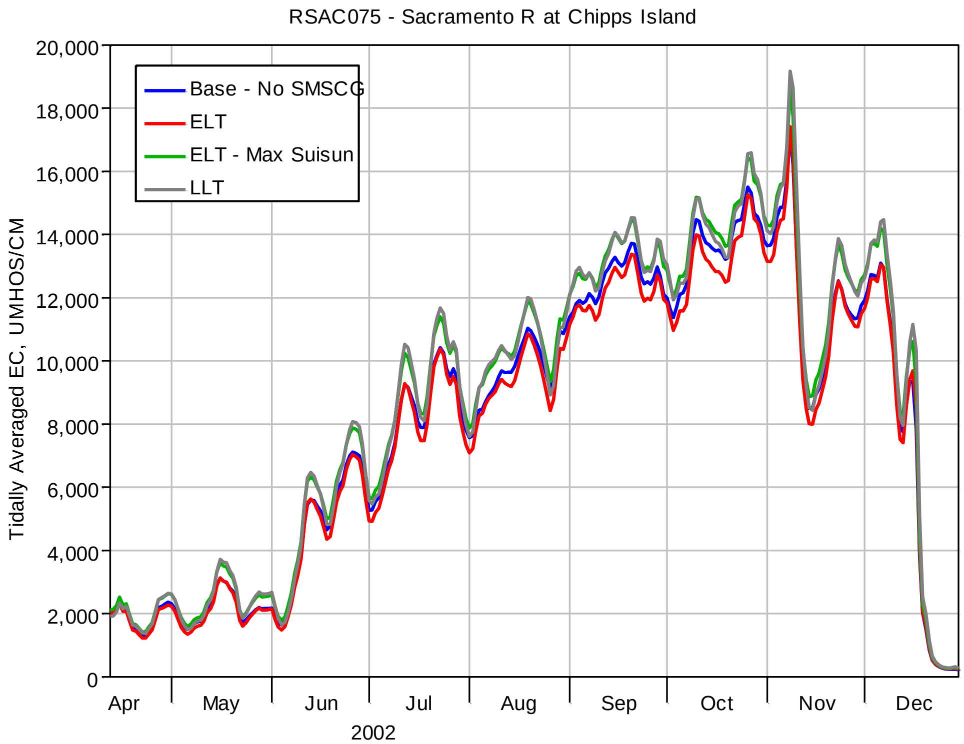


Figure 5-17 Tidally averaged EC at RSAC075 for Base – No SMSCG, ELT and ELT – Max Suisun.

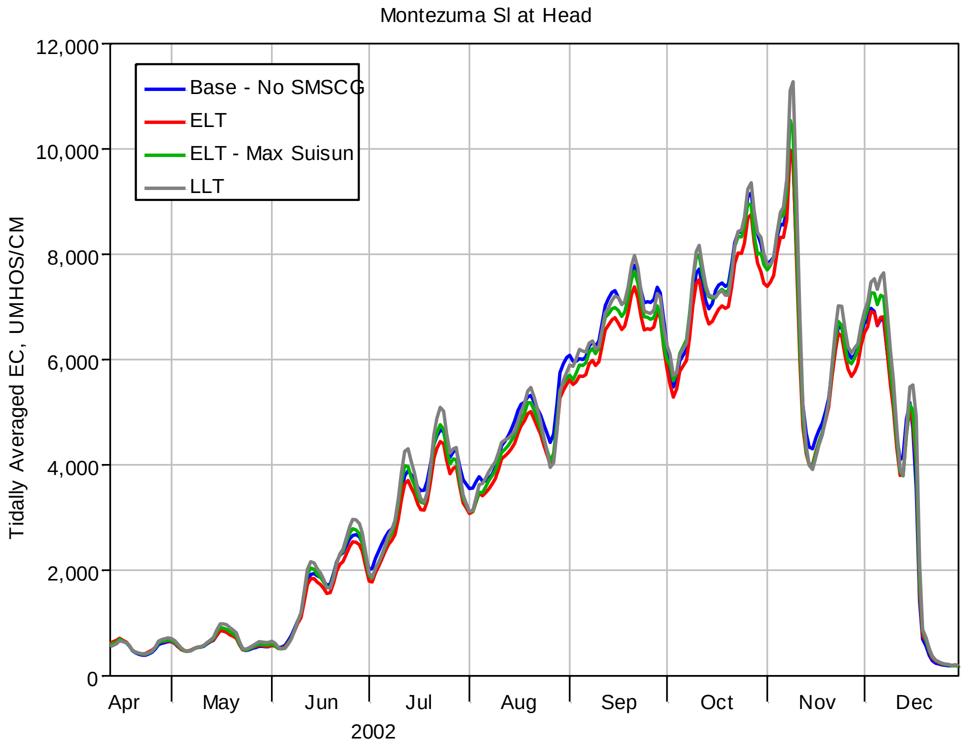


Figure 5-18 Tidally averaged EC at Montezuma SL at Head for Base – No SMSCG, ELT and ELT – Max Suisun.

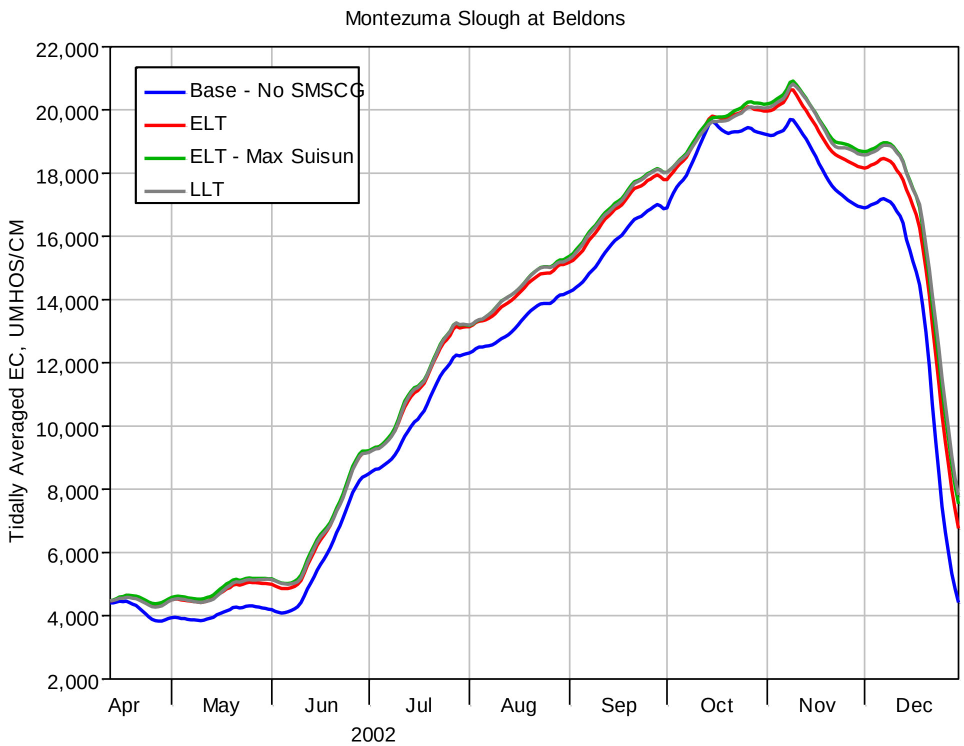


Figure 5-19 Tidally averaged EC at Montezuma Slough at Beldon's for Base – No SMSCG, ELT and ELT – Max Suisun.

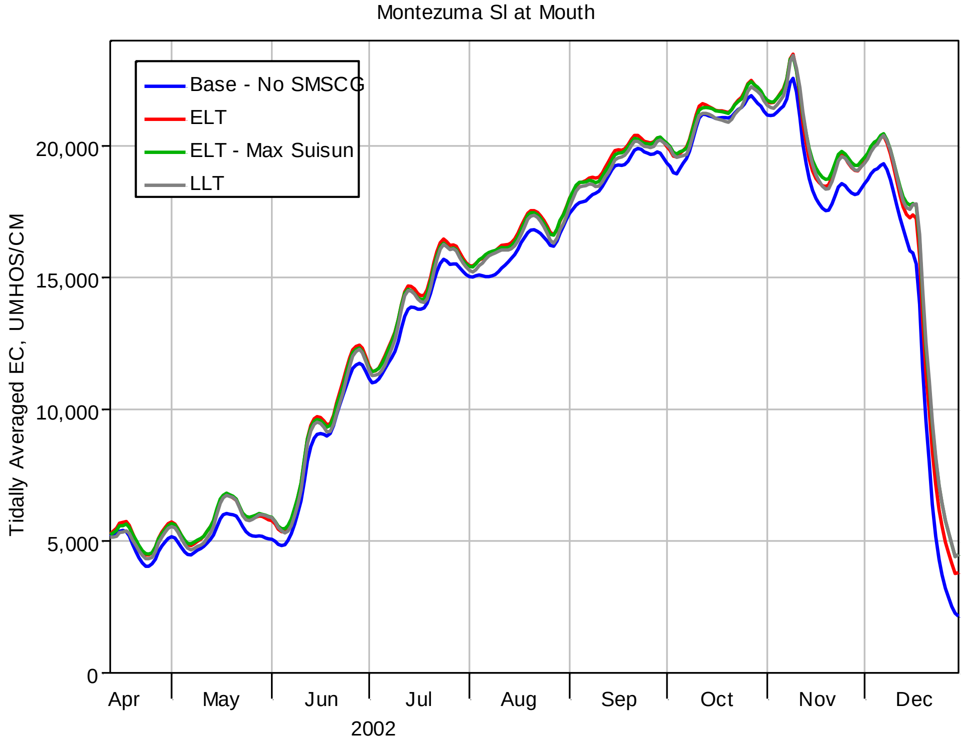


Figure 5-20 Tidally averaged EC at Montezuma SL at Mouth for Base – No SMSCG, ELT and ELT – Max Suisun.

5.1.2 Spatial Plots of EC Change

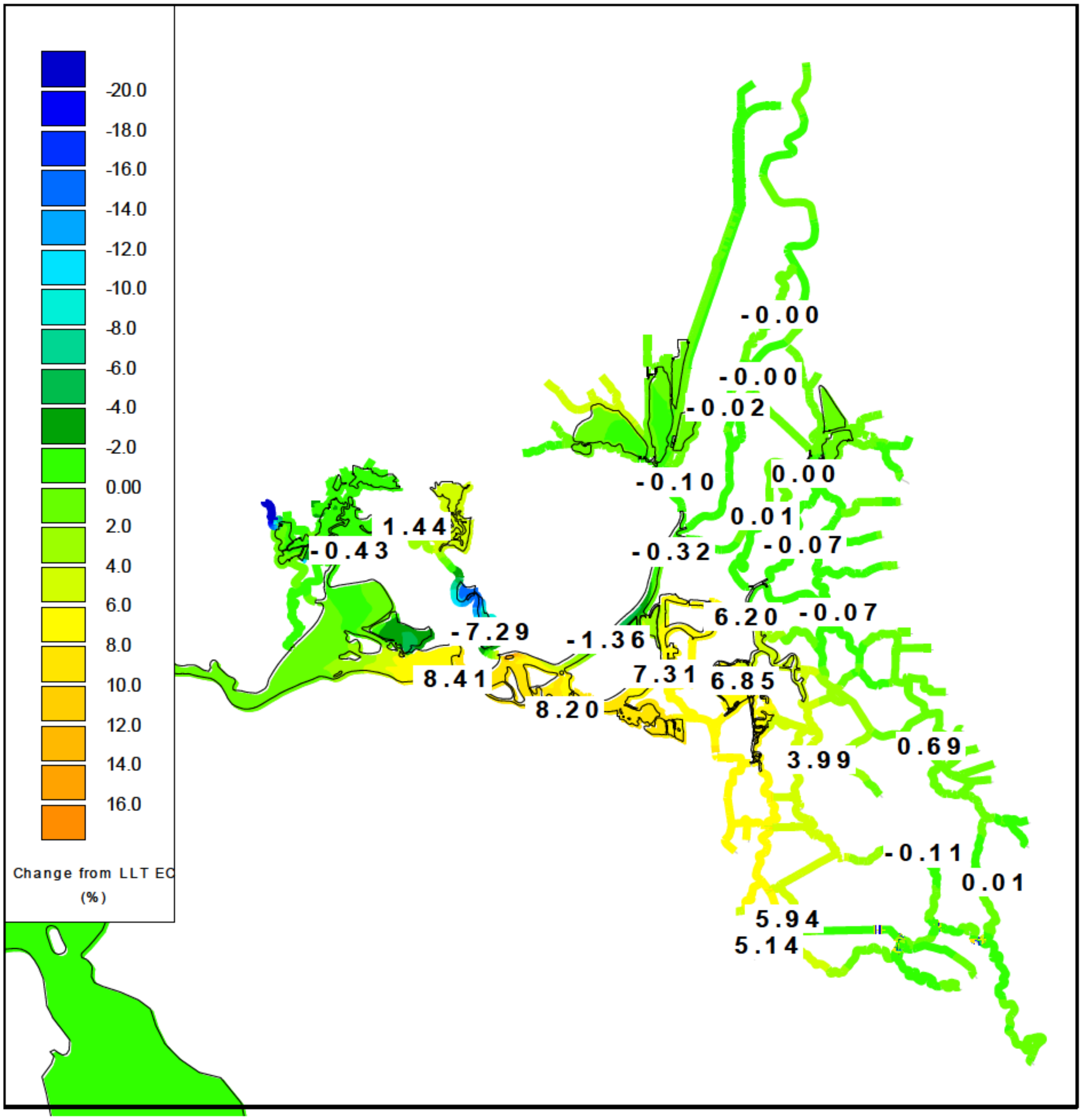


Figure 5-21 Contour plots of ELT – Max Suisun change from ELT tidally averaged EC on September 24, 2002.

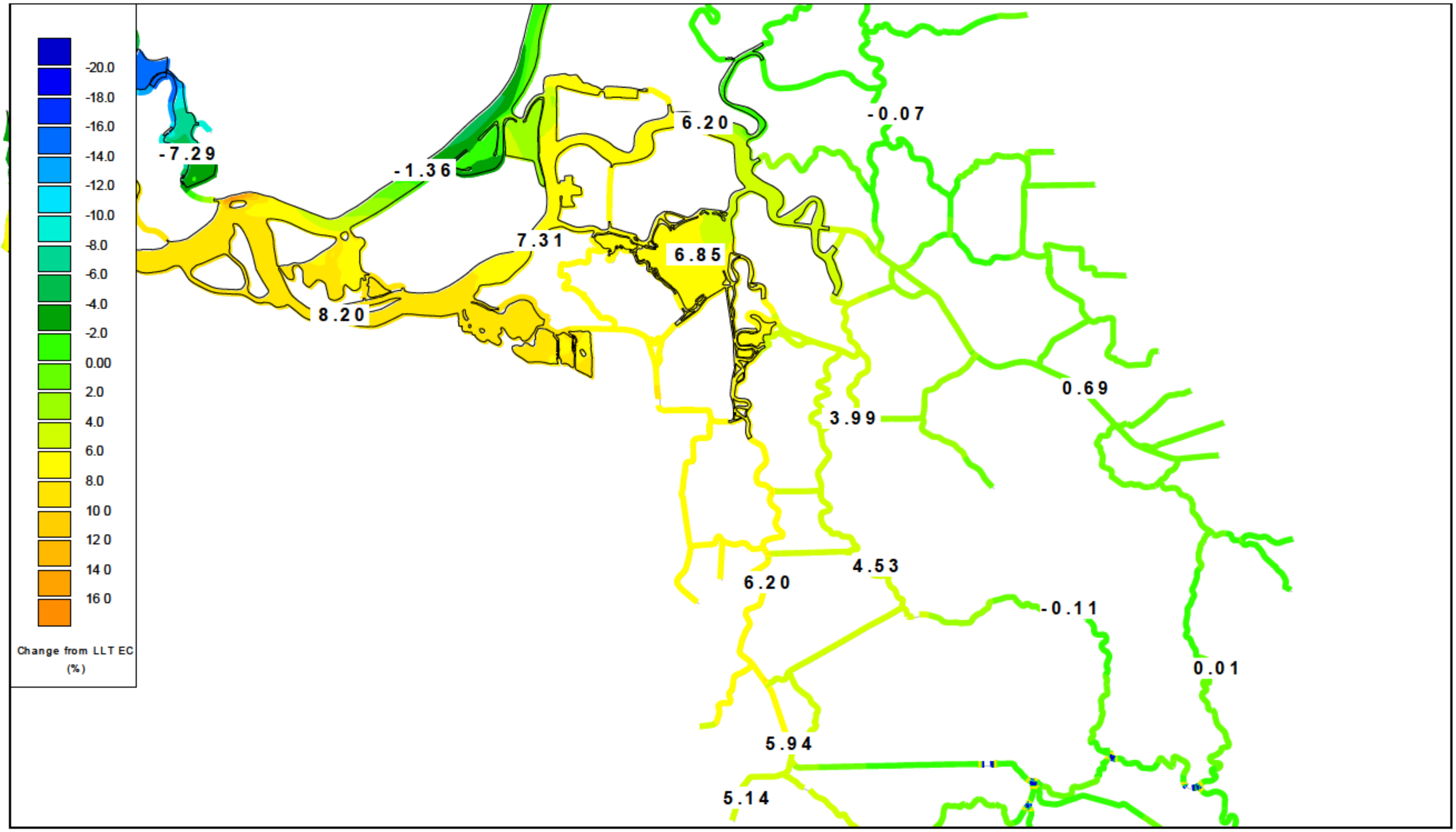


Figure 5-22 Contour plots of ELT – Max Suisun change from ELT tidally averaged EC in south Delta on September 24, 2002.

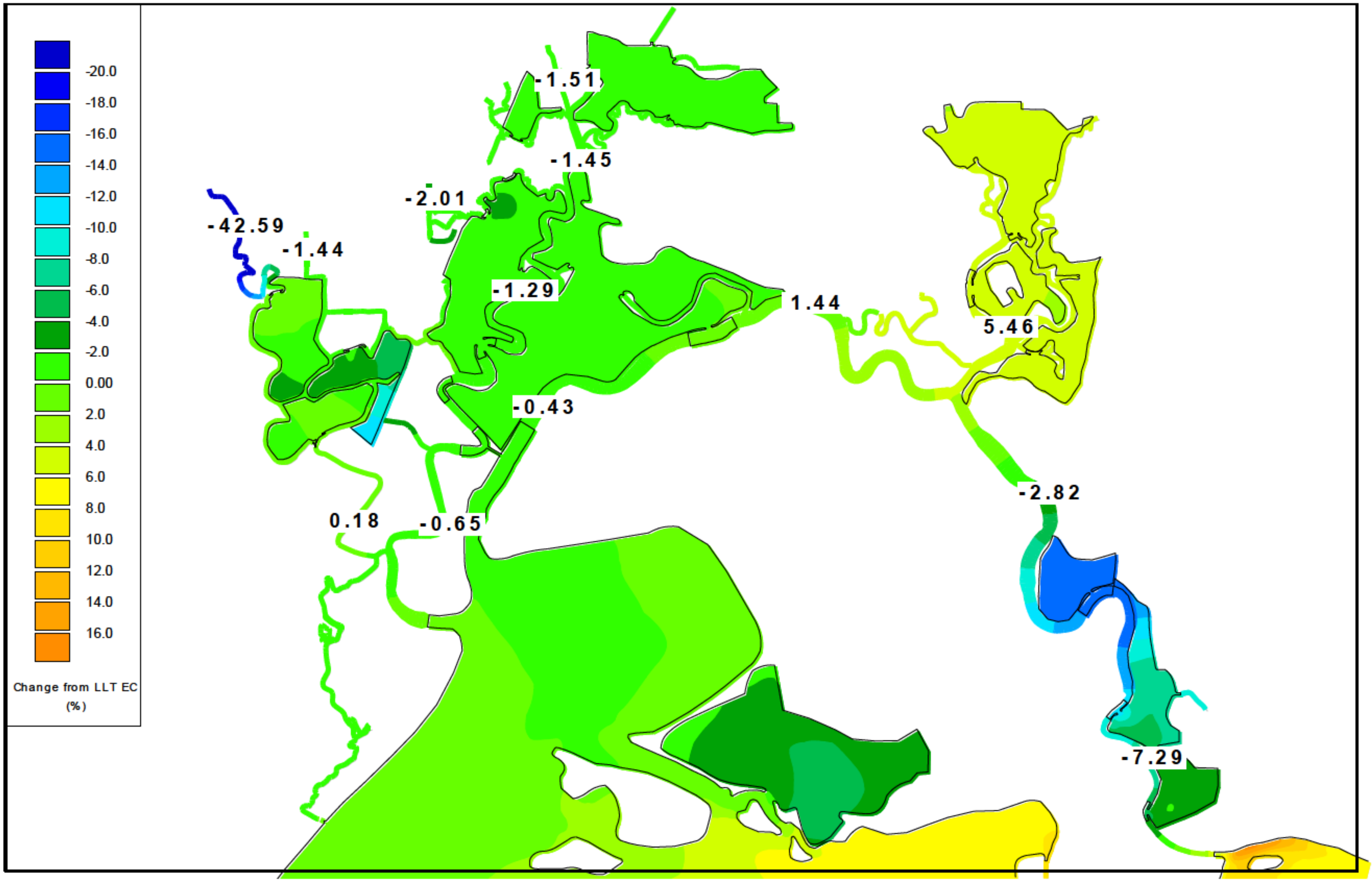


Figure 5-23 Contour plots of ELT – Max Suisun change from ELT tidally averaged EC in Suisun Marsh on September 24, 2002.

5.1.3 X2 Time Series

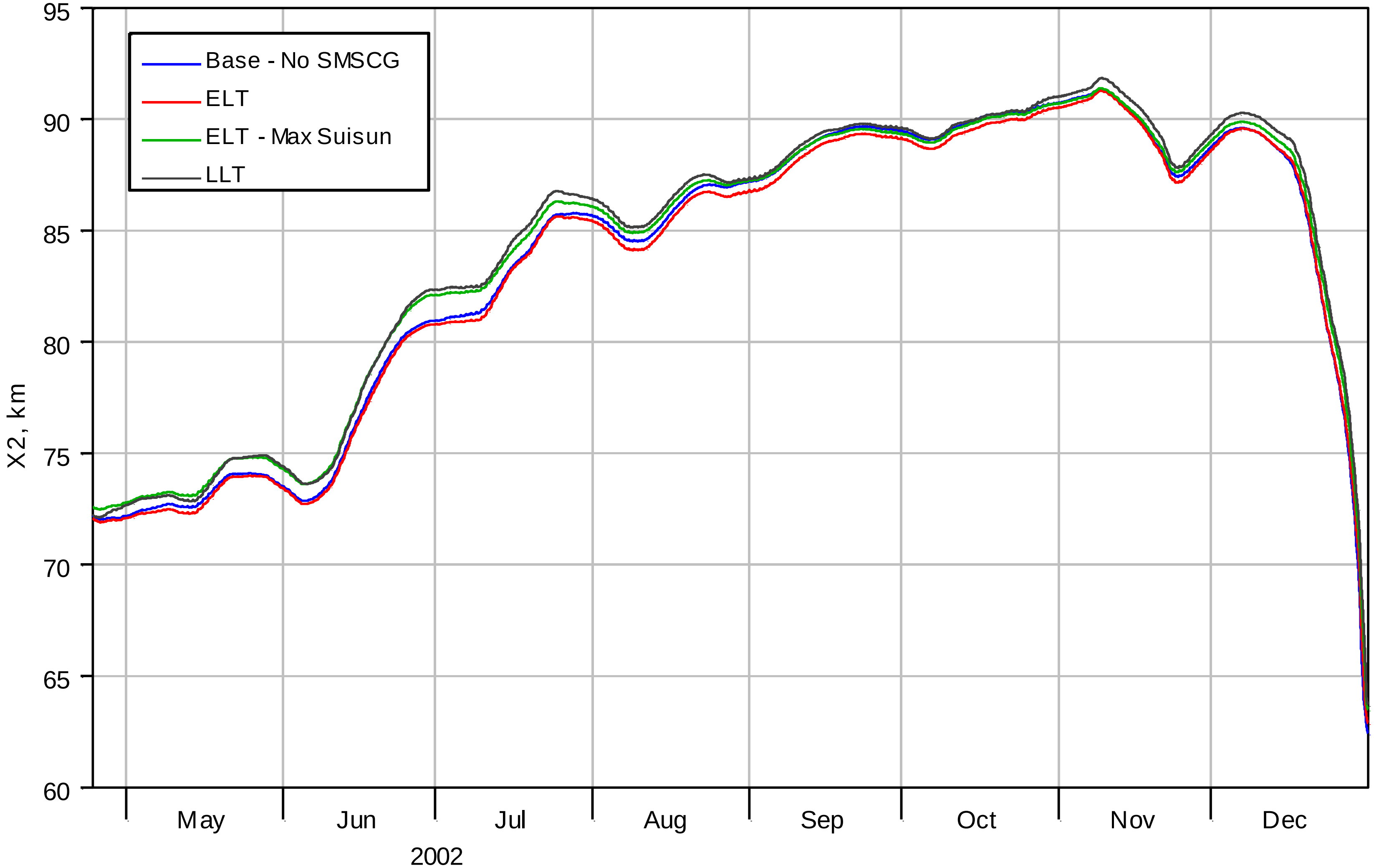


Figure 5-24 Time series of X2 for Base - No SMSCG, ELT, ELT - Max Suisun and LLT.

5.2 LLT – No South Delta ROA

EC results for the LLT – No South case are shown as time series plots of tidally averaged values in Figure 5-25 through Figure 5-46. LLT – No South EC results are very similar to LLT in the North Delta. Relative to LLT, LLT – No South decreased EC in the San Joaquin River at Jersey Point and San Andreas and increases it at Rough and Ready Island. In the south Delta, EC generally tends to decrease relative to LLT during the spring, fall and winter, when exports are lower, and increase very slightly during the summer when exports are high. Changes in Montezuma Slough are small. None of the scenarios impact EC at Freeport.

Contour plots of tidally averaged EC percent change from LLT on September 24, 2002 are shown in Figure 5-47 through Figure 5-49 for the Delta, the south and central Delta and for Suisun Marsh. Throughout most of the model domain, the LLT – No South case results in small EC changes (within +/-2%) relative to LLT. There are isolated areas with larger changes, including the channels where the South Delta ROA breaches were located in the LLT case, Sherman Island in the West Delta ROA and in Threemile Slough and the Sacramento River adjacent to the breach. There is a steep EC gradient between the Sacramento River and Threemile Slough at this time, so the small increase in Threemile Slough tidal prism (see Table 4-6) impacts salinity at this location.

A summary of July – December 2002 monthly average EC at key locations throughout the Delta is provided in Table 5-3 for Base – No MRB, LLT and LLT – No South. Percent change in monthly average EC relative to the base case are provided in Table 5-4 for LLT and LLT – No South. LLT – No South changes from base are generally within 2% of LLT changes from base.

Removal of the south Delta ROA has minimal impact on X2, as shown in Figure 5-50. Differences between LLT and LLT – No South are generally less than 0.1 km.

Table 5-3 Summary of July - December 2002 monthly average EC for Base - No MRB, LLT and LLT – No South.

	Monthly Average EC (umhos/cm)																	
	July 2002			August 2002			September 2002			October 2002			November 2002			December 2002		
Location	Base - No MRB	LLT	LLT - No South	Base - No MRB	LLT	LLT - No South	Base - No MRB	LLT	LLT - No South	Base - No MRB	LLT	LLT - No South	Base - No MRB	LLT	LLT - No South	Base - No MRB	LLT	LLT - No South
Cache Sl at Ryer	136	135	135	153	150	150	176	173	173	164	160	161	189	188	188	196	193	193
CCWD Victoria Canal	264	288	286	367	432	436	469	553	563	511	615	614	453	543	522	482	561	553
CVP	333	354	358	515	572	583	664	745	756	658	780	781	587	688	679	631	704	697
Montezuma Sl at Head	3536	3567	3567	4650	4521	4550	6853	6816	6785	7400	7510	7511	6555	6739	6713	3149	3440	3393
Montezuma Sl at Mouth	13705	14112	14063	15976	16392	16351	18958	19301	19219	20766	20950	20878	19465	20279	20190	12062	13926	13798
RMID015	261	285	285	367	437	437	469	565	567	503	612	607	442	522	513	463	542	534
RMID023	262	285	285	367	436	436	468	560	564	507	614	611	448	527	518	477	552	547
ROLD024	401	438	440	707	781	787	934	1049	1052	826	1014	1003	712	891	874	607	744	725
ROLD034	360	392	393	615	692	693	804	912	913	755	915	912	651	801	789	601	732	711
RSAC075 Chipps Island	8209	8880	8884	9741	10267	10303	12563	13253	13195	13606	14160	14153	11990	12802	12790	6035	6735	6671
RSAC092 Emmaton	623	629	636	808	742	761	1498	1384	1400	2012	1919	1946	1748	1782	1790	821	874	878
RSAC101 Rio Vista	148	146	146	176	162	163	241	213	215	285	264	268	290	308	310	222	232	232
RSAC123	127	127	127	154	155	155	165	165	165	142	142	142	184	184	184	169	168	168
RSAC155 Freeport	126	126	126	156	156	156	162	162	162	142	142	142	184	184	184	164	164	164
RSAN018 Jersey Pt	954	1028	1029	1461	1519	1530	1975	2116	2103	1728	1913	1895	1503	1766	1730	945	1108	1078
RSAN032 San Andreas	284	383	385	459	649	656	555	871	868	448	773	763	403	668	658	333	480	471
RSAN058	643	612	660	664	644	686	711	698	726	674	682	674	636	629	642	763	751	778
S-49 Beldon's Landing	10402	11292	11226	13266	14335	14233	15826	16973	16861	18856	19371	19254	18357	19659	19517	12766	15349	15164
SWP	329	360	359	540	615	616	698	807	804	682	835	823	593	725	708	594	691	679

Table 5-4 Summary of July - December 2002 percent change in monthly average EC for LLT and LLT – No South relative to Base - No MRB.

	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Case											
	July 2002		August 2002		September 2002		October 2002		November 2002		December 2002	
Location	LLT	LLT - No South	LLT	LLT - No South	LLT	LLT - No South	LLT	LLT - No South	LLT	LLT - No South	LLT	LLT - No South
Cache Sl at Ryer	-1%	-1%	-2%	-2%	-1%	-1%	-2%	-2%	-1%	-1%	-2%	-2%
CCWD Victoria Canal	9%	9%	18%	19%	18%	20%	20%	20%	20%	15%	16%	15%
CVP	7%	8%	11%	13%	12%	14%	19%	19%	17%	16%	12%	11%
Montezuma Sl at Head	1%	1%	-3%	-2%	-1%	-1%	1%	1%	3%	2%	9%	8%
Montezuma Sl at Mouth	3%	3%	3%	2%	2%	1%	1%	1%	4%	4%	15%	14%
RMID015	9%	9%	19%	19%	20%	21%	22%	21%	18%	16%	17%	15%
RMID023	9%	9%	19%	19%	20%	21%	21%	21%	18%	16%	16%	15%
ROLD024	9%	10%	10%	11%	12%	13%	23%	21%	25%	23%	23%	19%
ROLD034	9%	9%	13%	13%	13%	14%	21%	21%	23%	21%	22%	18%
RSAC075 Chipps Island	8%	8%	5%	6%	5%	5%	4%	4%	7%	7%	12%	11%
RSAC092 Emmaton	1%	2%	-8%	-6%	-8%	-6%	-5%	-3%	2%	2%	6%	7%
RSAC101 Rio Vista	-2%	-1%	-8%	-7%	-12%	-10%	-7%	-6%	6%	7%	5%	5%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	8%	8%	4%	5%	7%	6%	11%	10%	18%	15%	17%	14%
RSAN032 San Andreas	35%	36%	42%	43%	57%	56%	73%	71%	66%	63%	44%	41%
RSAN058	-5%	3%	-3%	3%	-2%	2%	1%	0%	-1%	1%	-2%	2%
S-49 Beldon's Landing	9%	8%	8%	7%	7%	7%	3%	2%	7%	6%	20%	19%
SWP	9%	9%	14%	14%	16%	15%	23%	21%	22%	19%	16%	14%

5.2.1 Tidally averaged EC time series

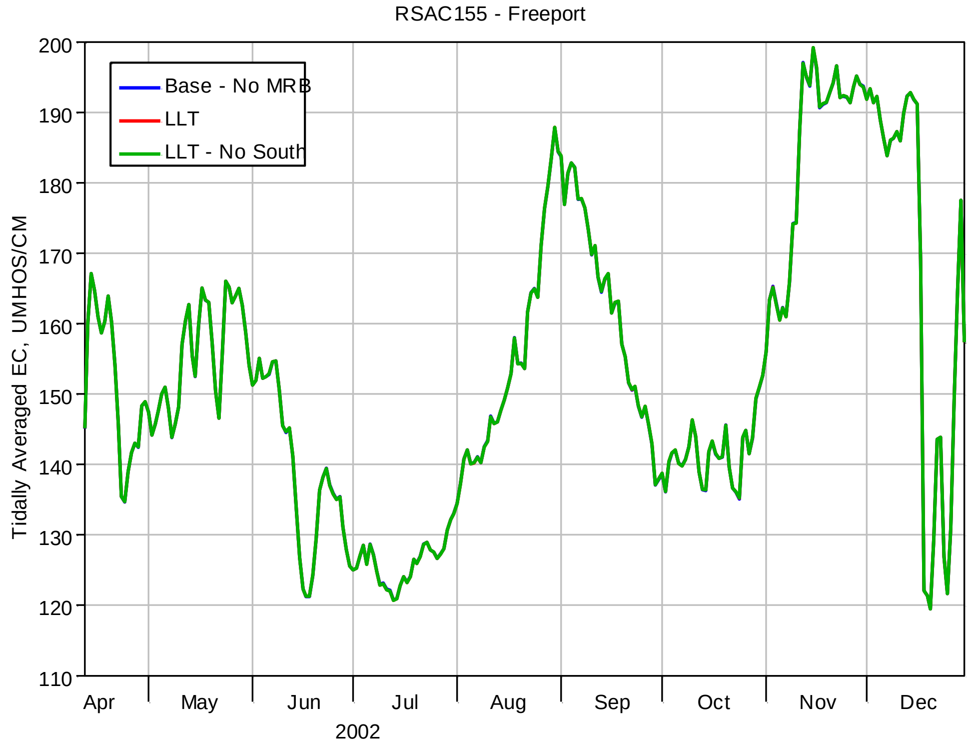


Figure 5-25 Tidally averaged EC at RSAC155 for Base – No MRB, LLT and LLT – No South.

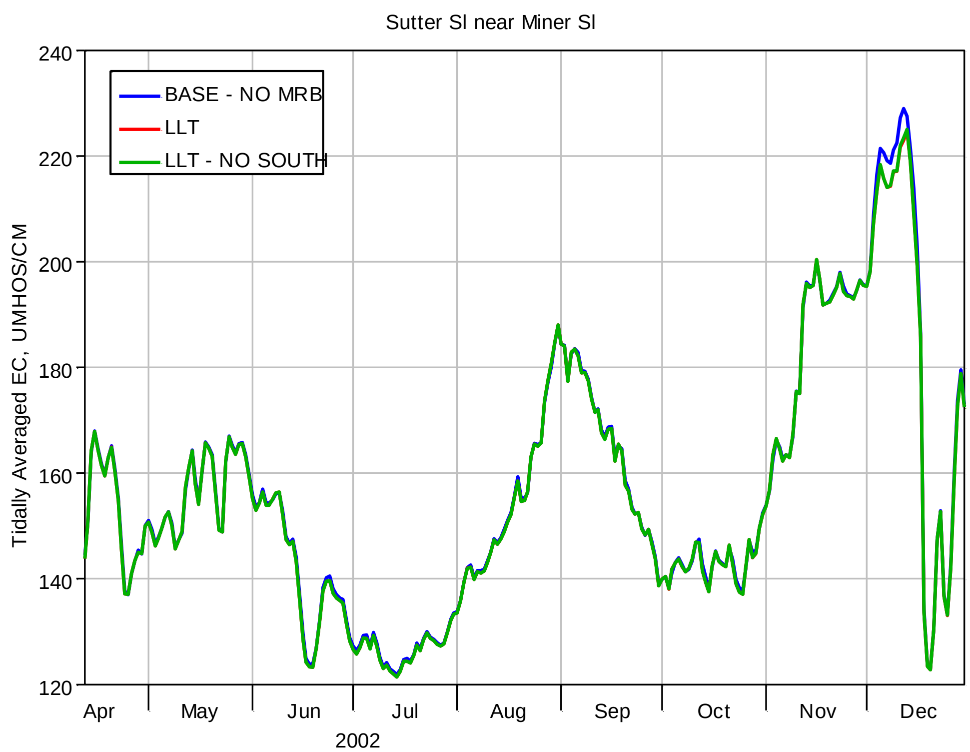


Figure 5-26 Tidally averaged EC in Sutter Slough for Base – No MRB, LLT and LLT – No South.

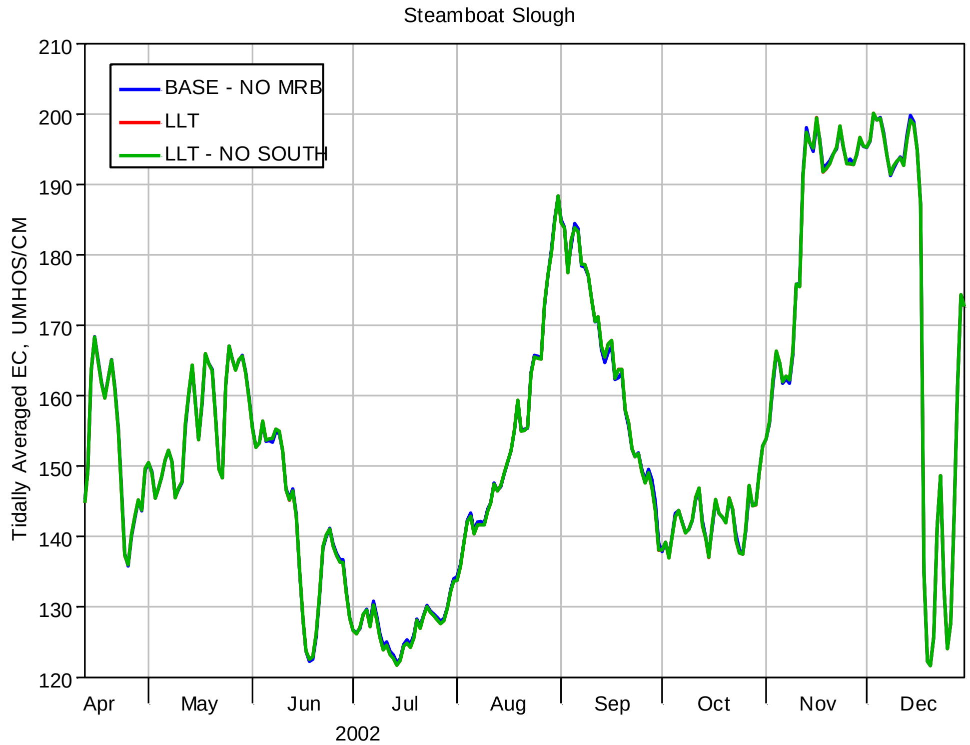


Figure 5-27 Tidally averaged EC in Steamboat Slough for Base – No MRB, LLT and LLT – No South.

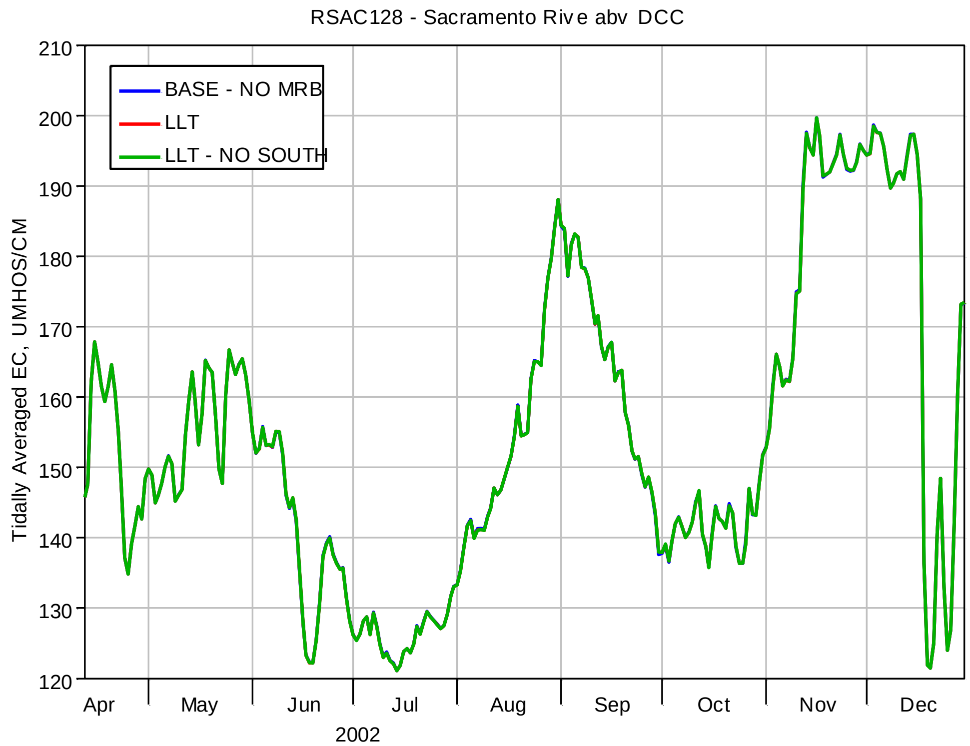


Figure 5-28 Tidally averaged EC at RSAC128 for Base – No MRB, LLT and LLT – No South.

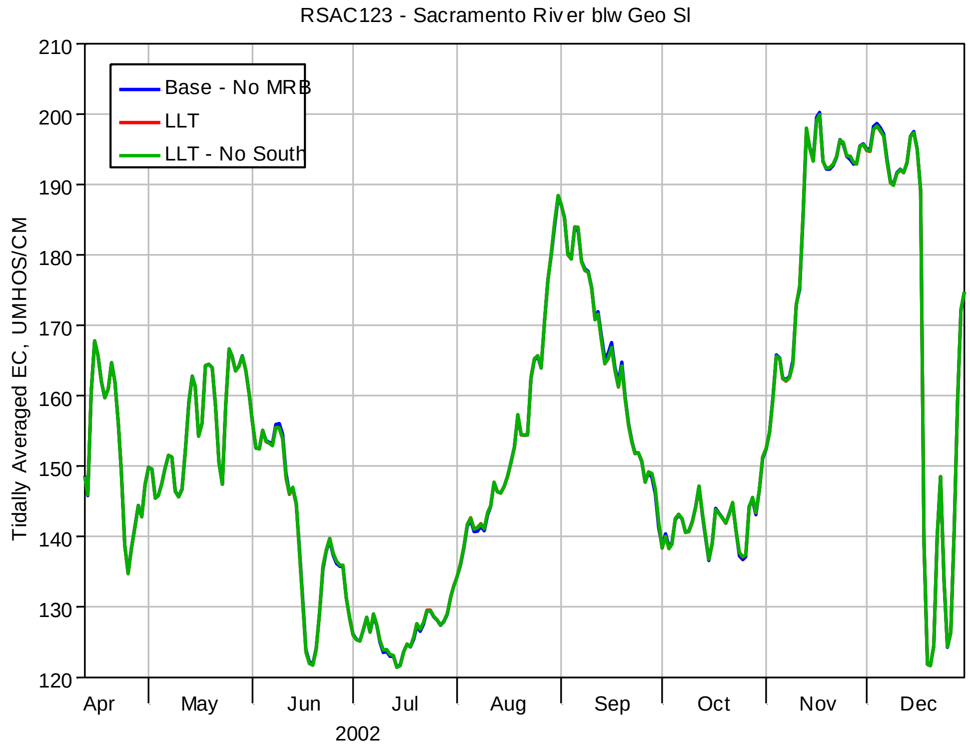


Figure 5-29 Tidally averaged EC at RSAC123 for Base – No MRB, LLT and LLT – No South.

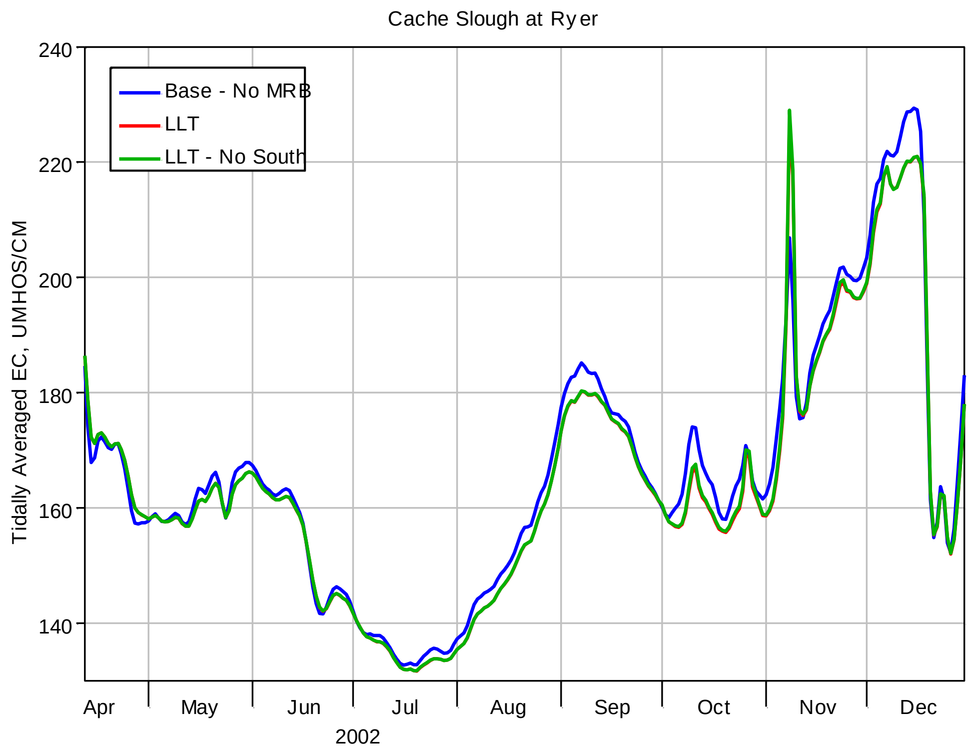


Figure 5-30 Tidally averaged EC in Cache Slough at Ryer for Base – No MRB, LLT and LLT – No South.

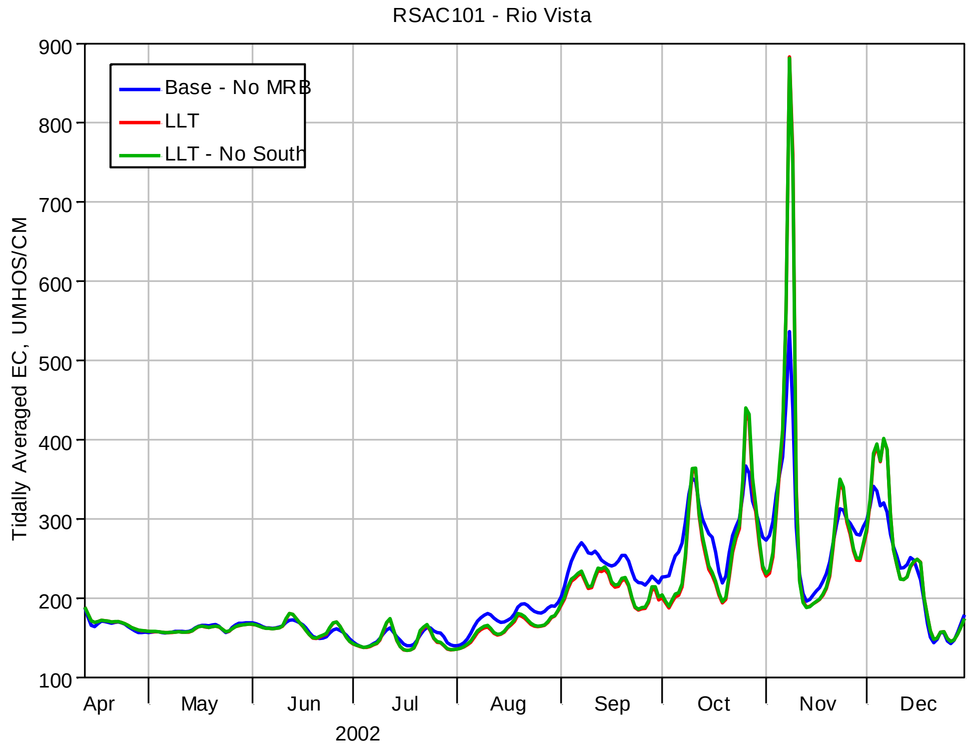


Figure 5-31 Tidally averaged EC at RSAC101 for Base – No MRB, LLT and LLT – No South.

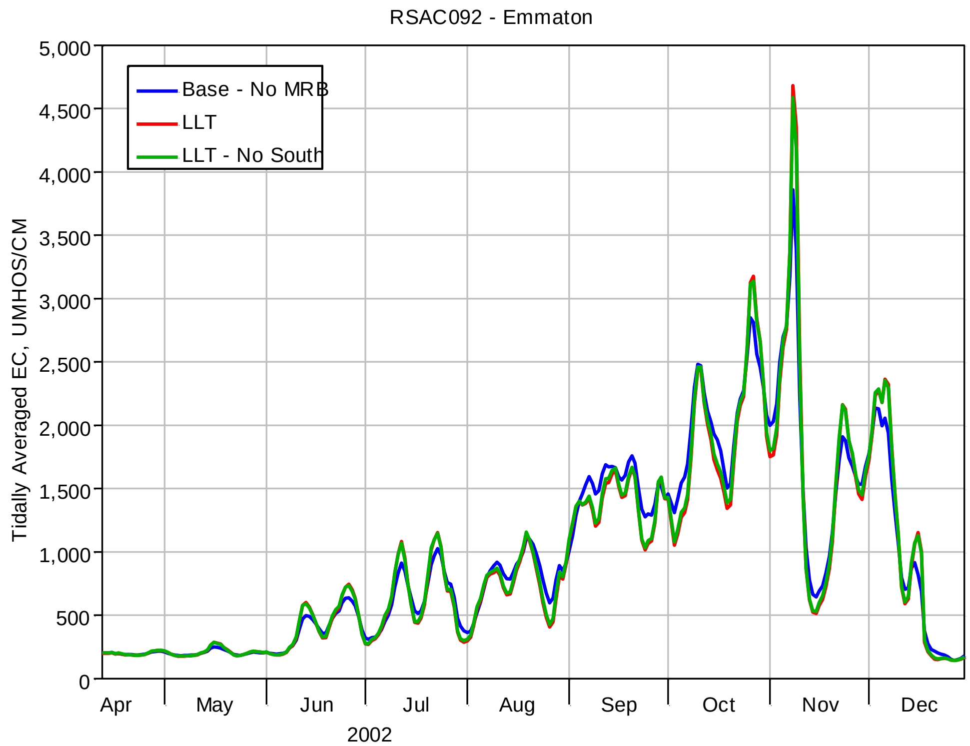


Figure 5-32 Tidally averaged EC at RSAC092 for Base – No MRB, LLT and LLT – No South.

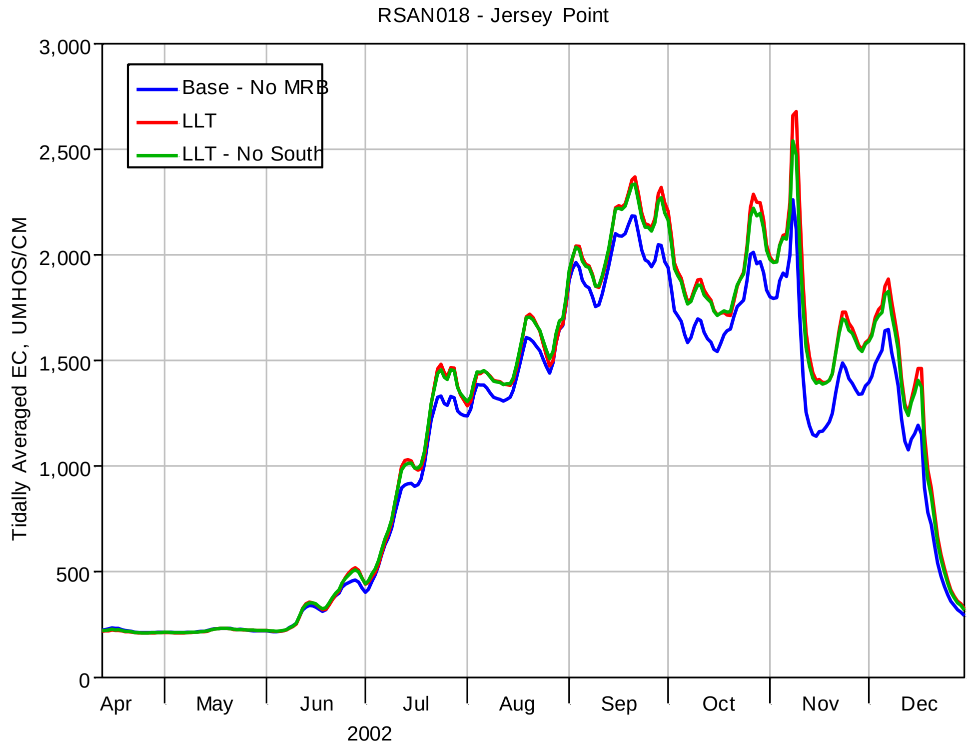


Figure 5-33 Tidally averaged EC at RSAN018 for Base – No MRB, LLT and LLT – No South.

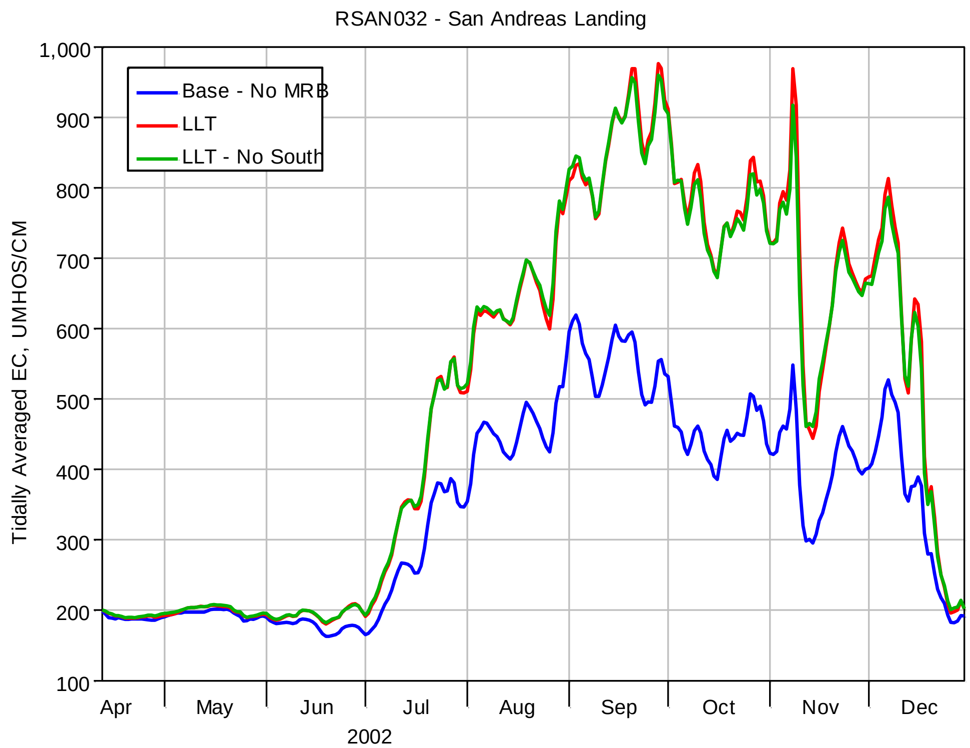


Figure 5-34 Tidally averaged EC at RSAN032 for Base – No MRB, LLT and LLT – No South.

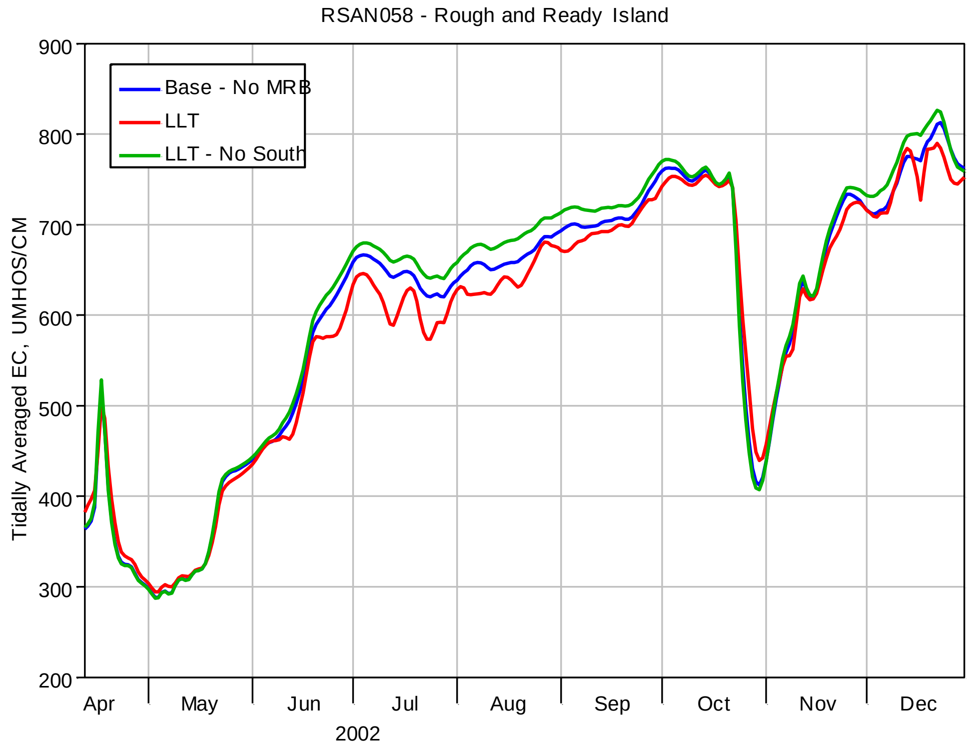


Figure 5-35 Tidally averaged EC at RSAN058 for Base – No MRB, LLT and LLT – No South.

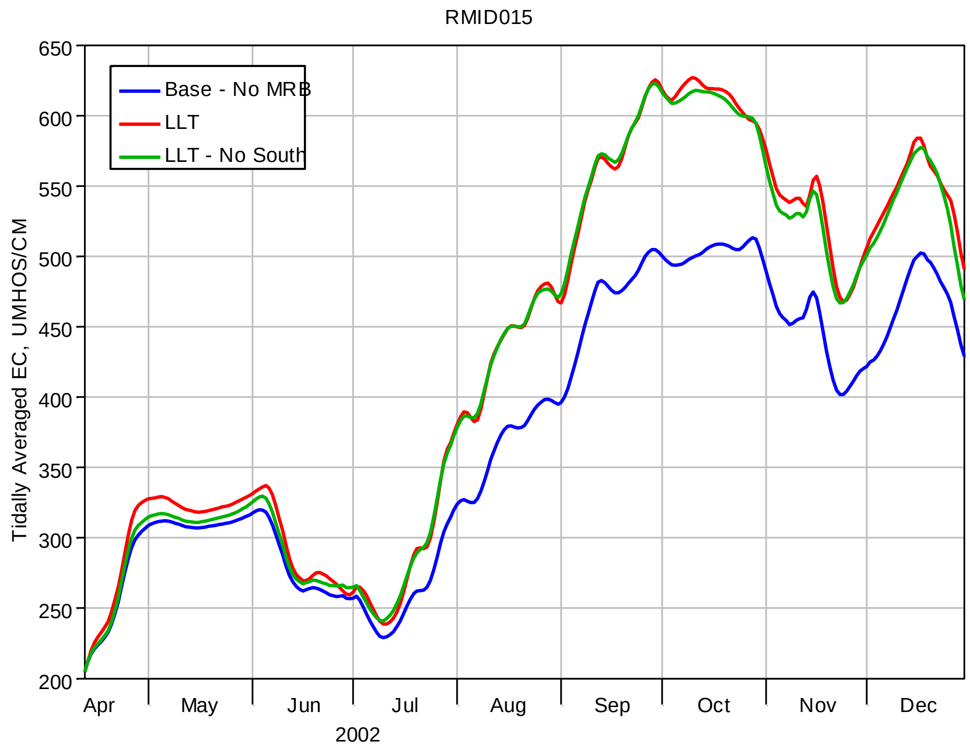


Figure 5-36 Tidally averaged EC at RMID015 for Base – No MRB, LLT and LLT – No South.

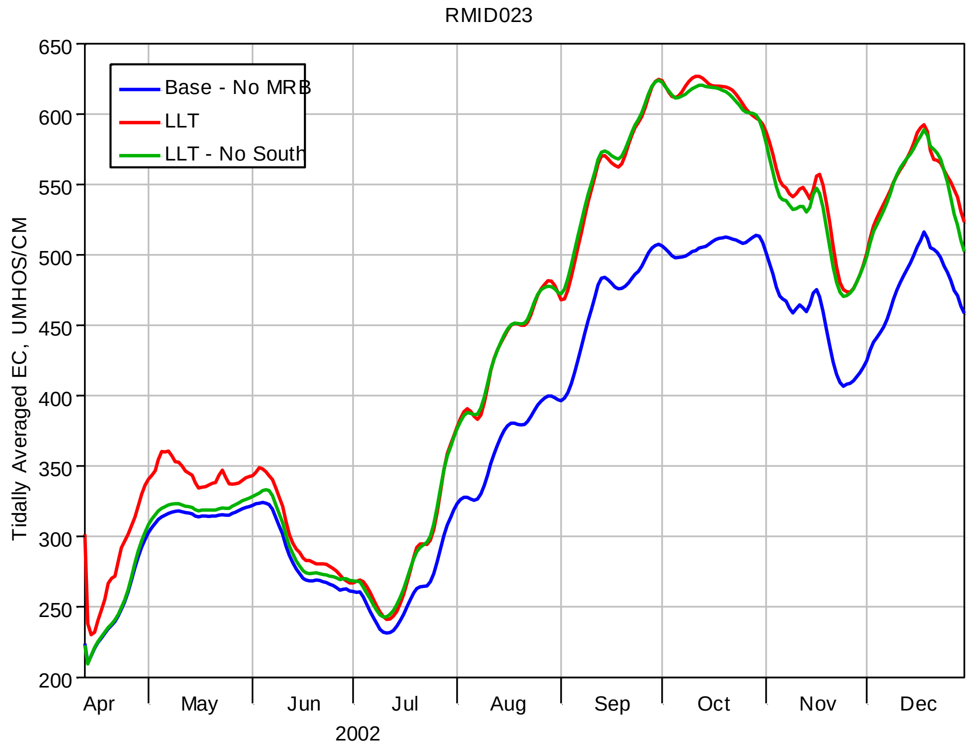


Figure 5-37 Tidally averaged EC at RMID023 for Base – No MRB, LLT and LLT – No South.

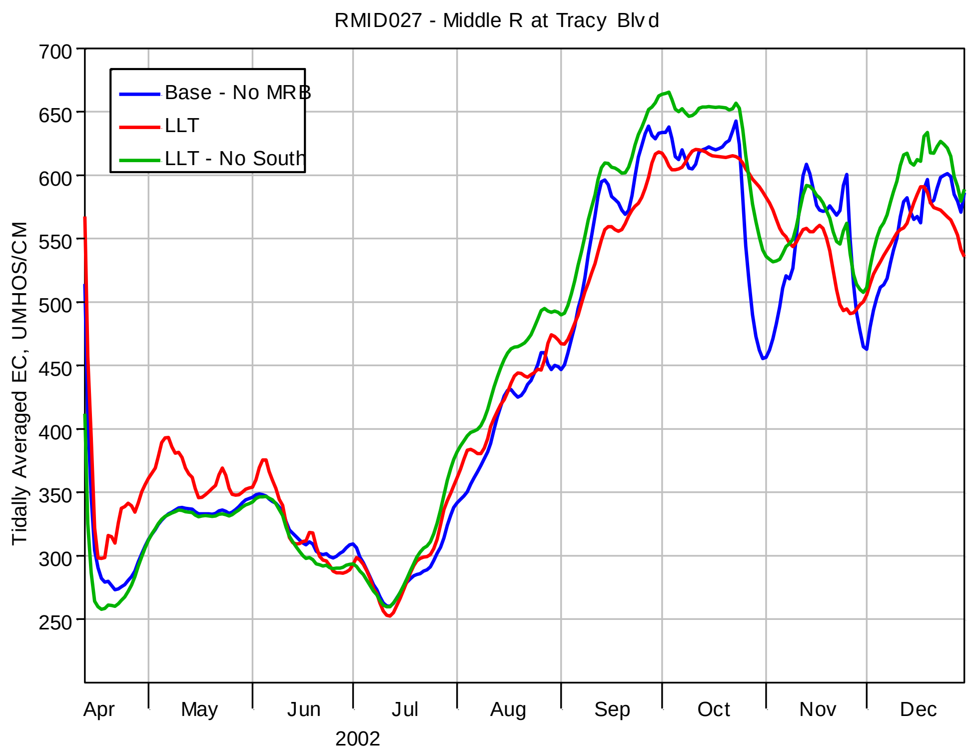


Figure 5-38 Tidally averaged EC at RMID027 for Base – No MRB, LLT and LLT – No South.

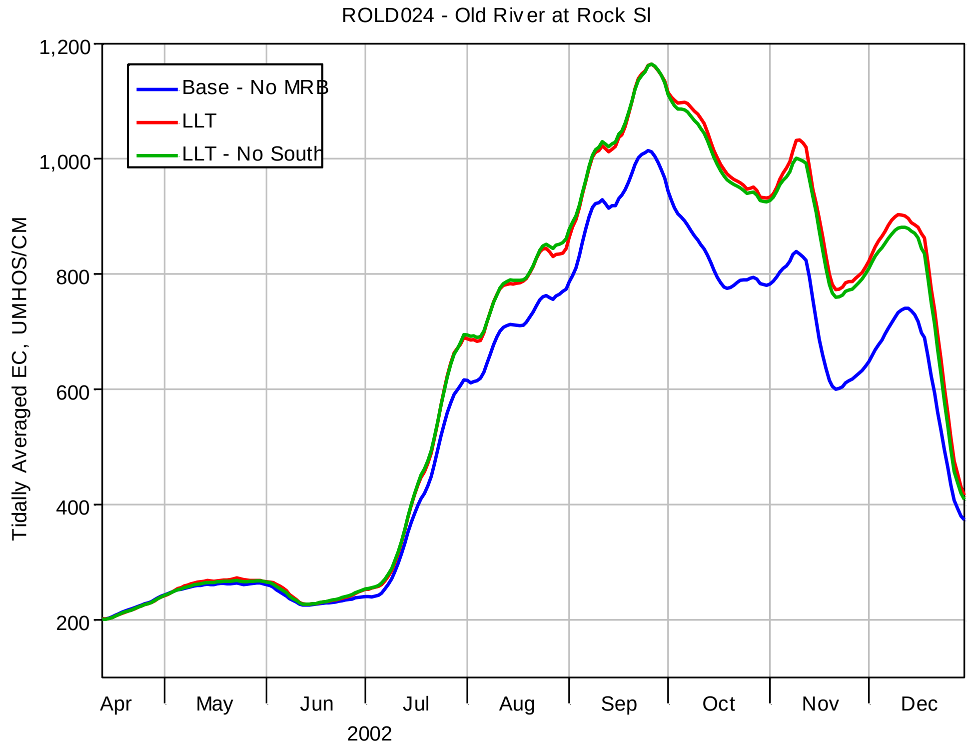


Figure 5-39 Tidally averaged EC at ROLD024 for Base – No MRB, LLT and LLT – No South.

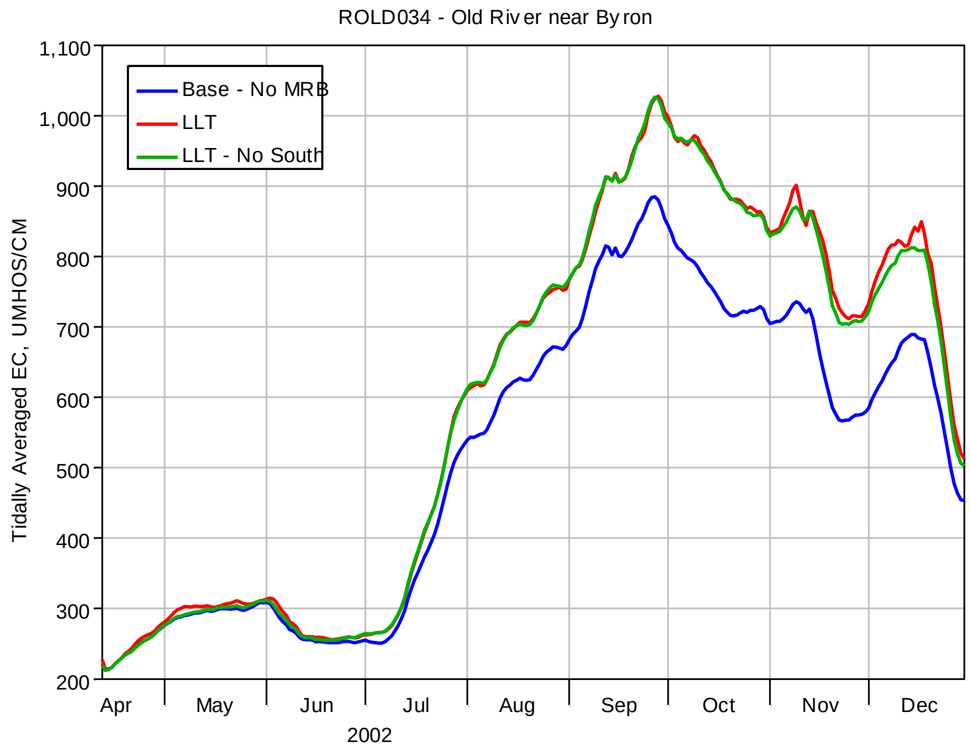


Figure 5-40 Tidally averaged EC at ROLD034 for Base – No MRB, LLT and LLT – No South.

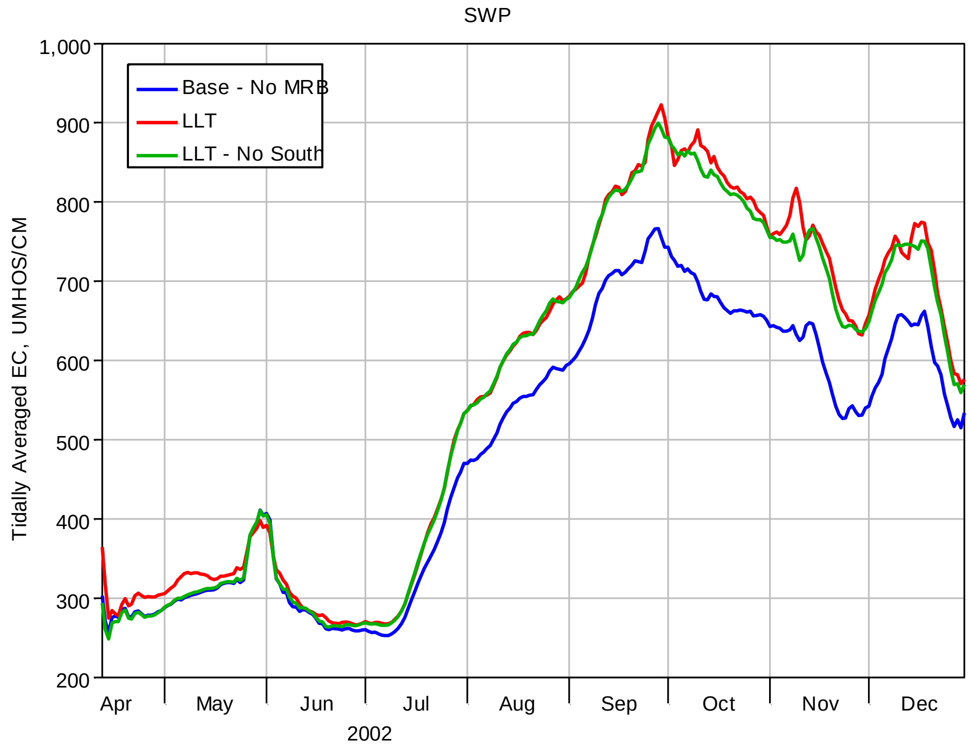


Figure 5-41 Tidally averaged EC at SWP for Base – No MRB, LLT and LLT – No South.

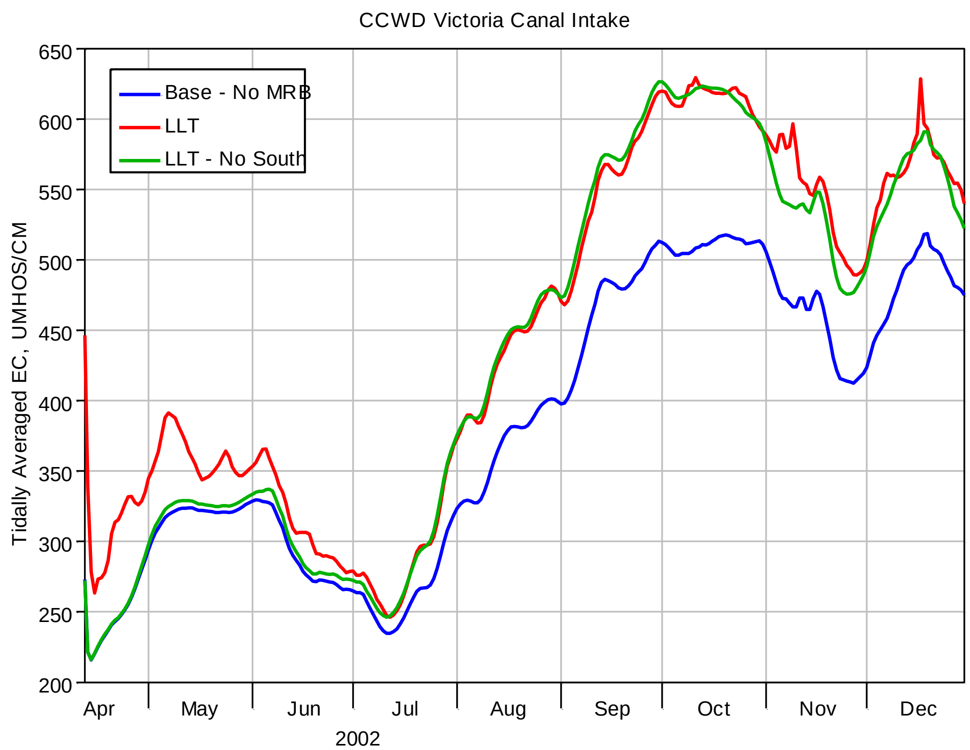


Figure 5-42 Tidally averaged EC at CCWD for Base – No MRB, LLT and LLT – No South.

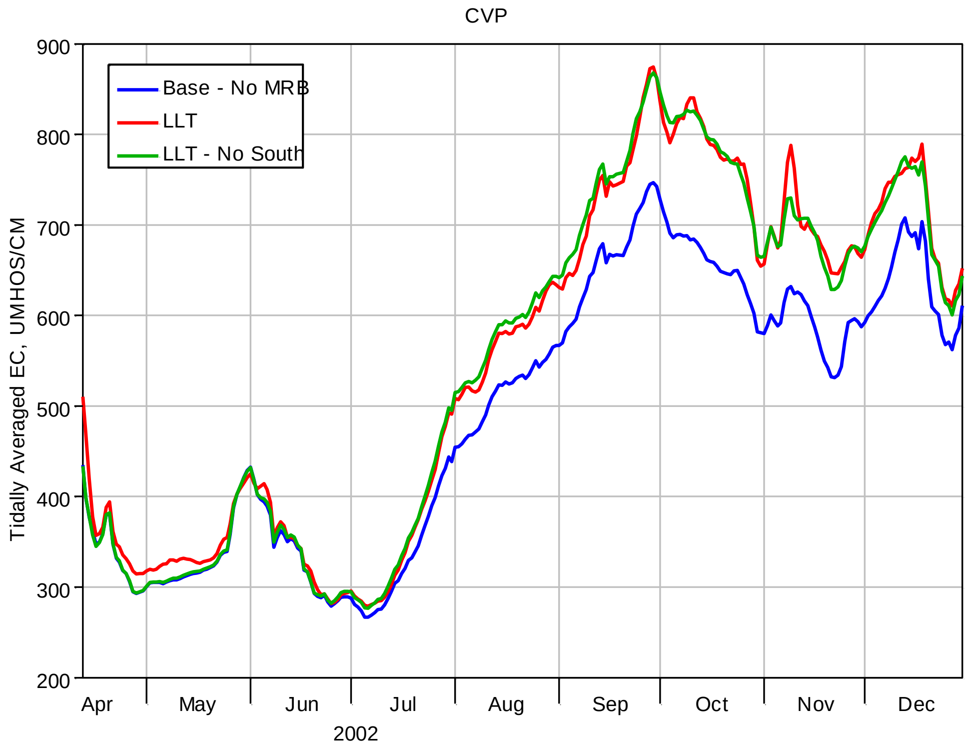


Figure 5-43 Tidally averaged EC at CVP for Base – No MRB, LLT and LLT – No South.

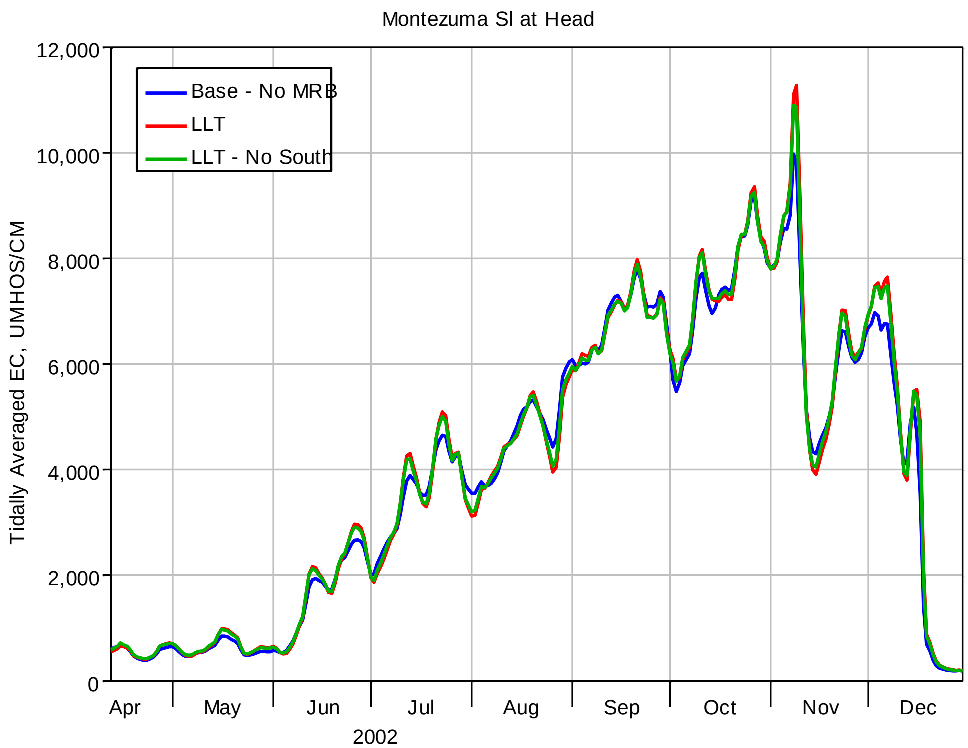


Figure 5-44 Tidally averaged EC at Montezuma Sl at Head for Base – No MRB, LLT and LLT – No South.

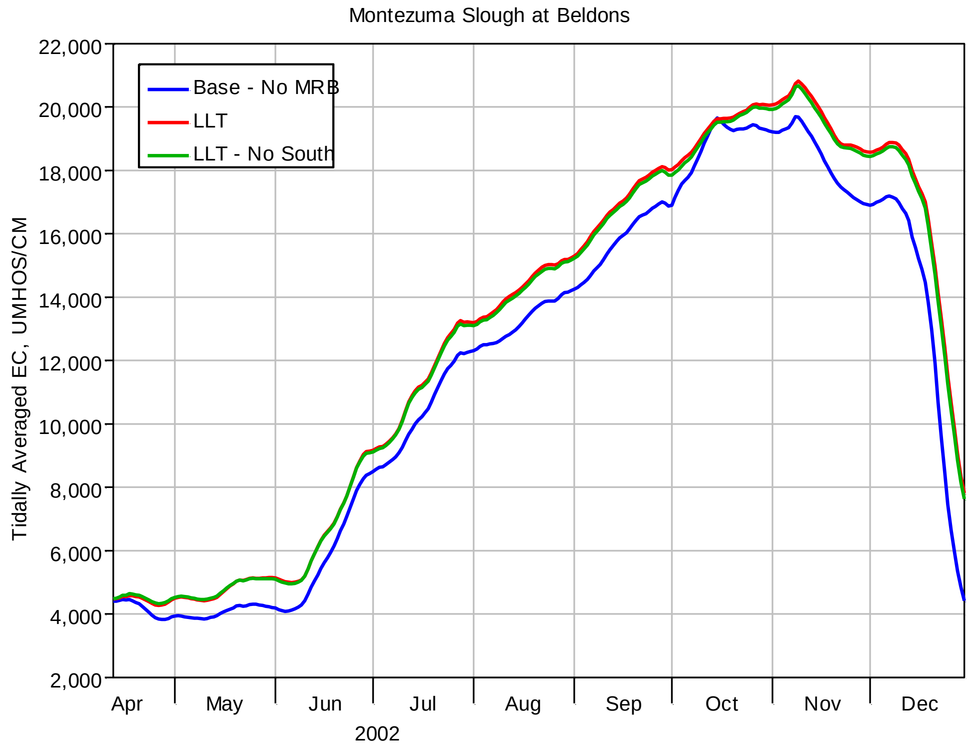


Figure 5-45 Tidally averaged EC at Montezuma Slough at Beldon's for Base – No MRB, LLT and LLT – No South.

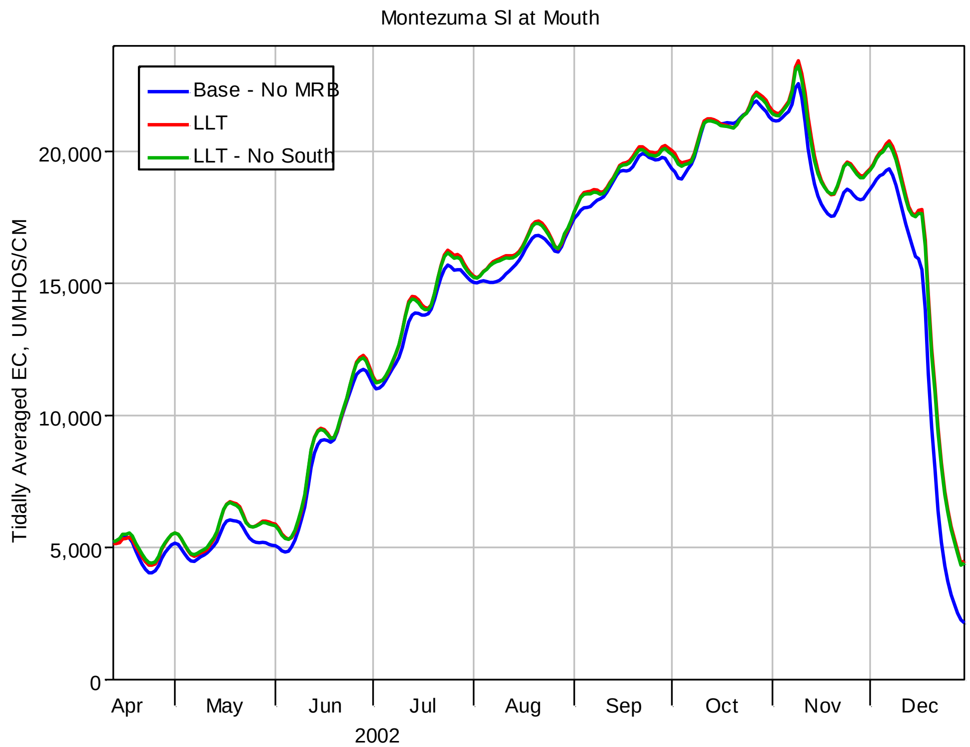


Figure 5-46 Tidally averaged EC at Montezuma Sl at Mouth for Base – No MRB, LLT and LLT – No South.

5.2.2 Spatial Plots of EC Change

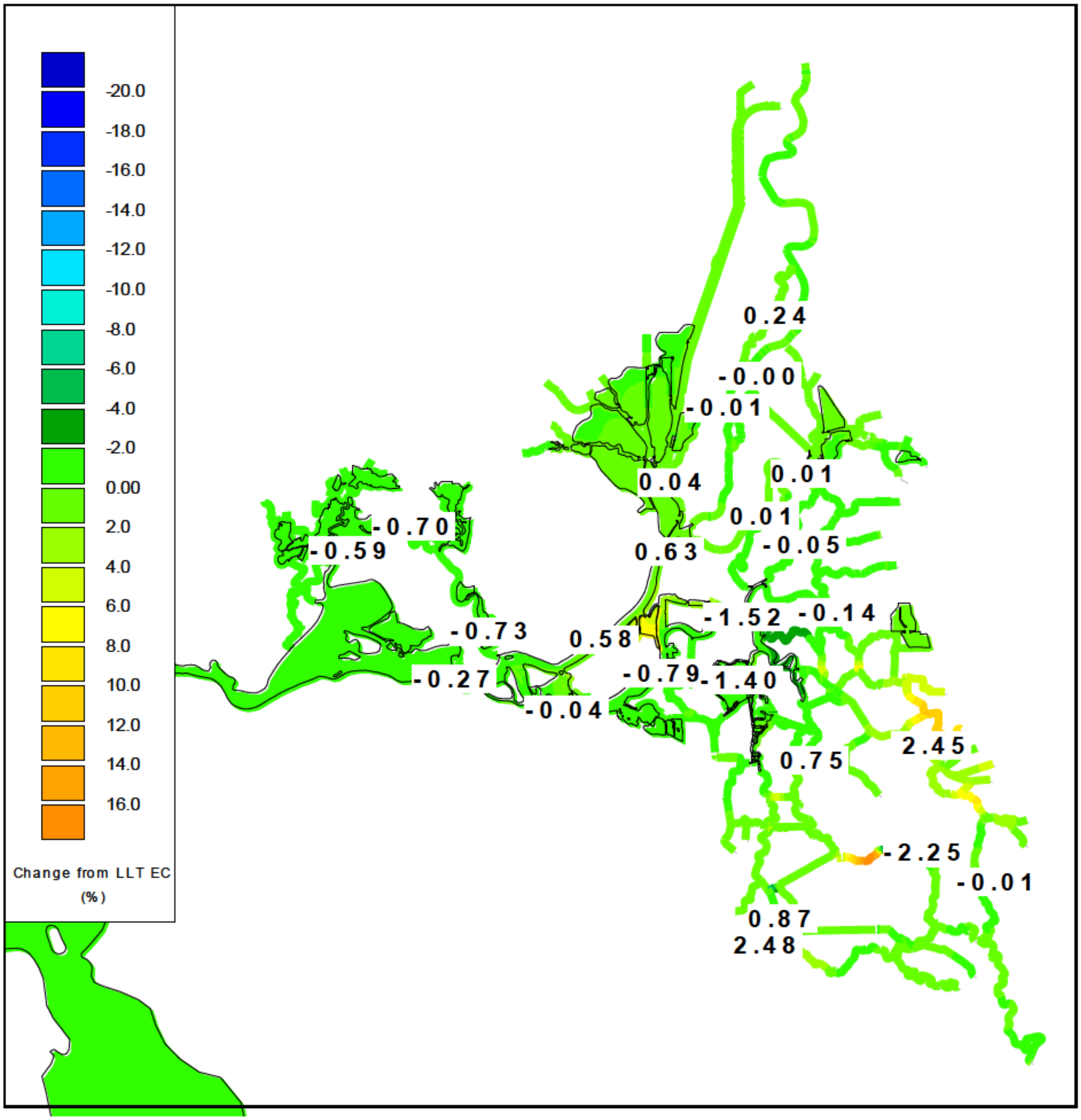


Figure 5-47 Contour plots of LLT – No South change from LLT tidally averaged EC on September 24, 2002.

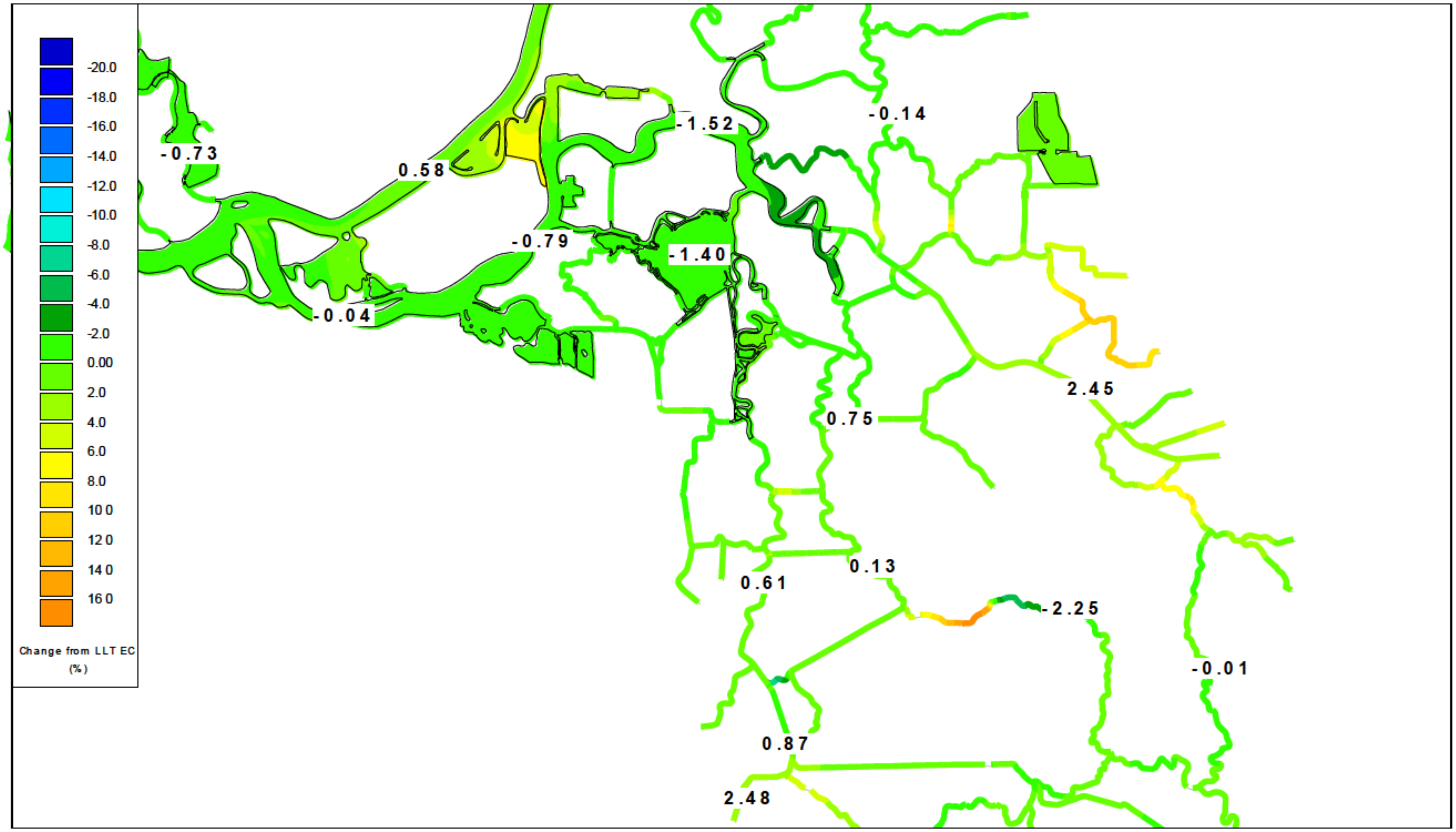


Figure 5-48 Contour plots of LLT – No South change from LLT tidally averaged EC in south Delta on September 24, 2002.

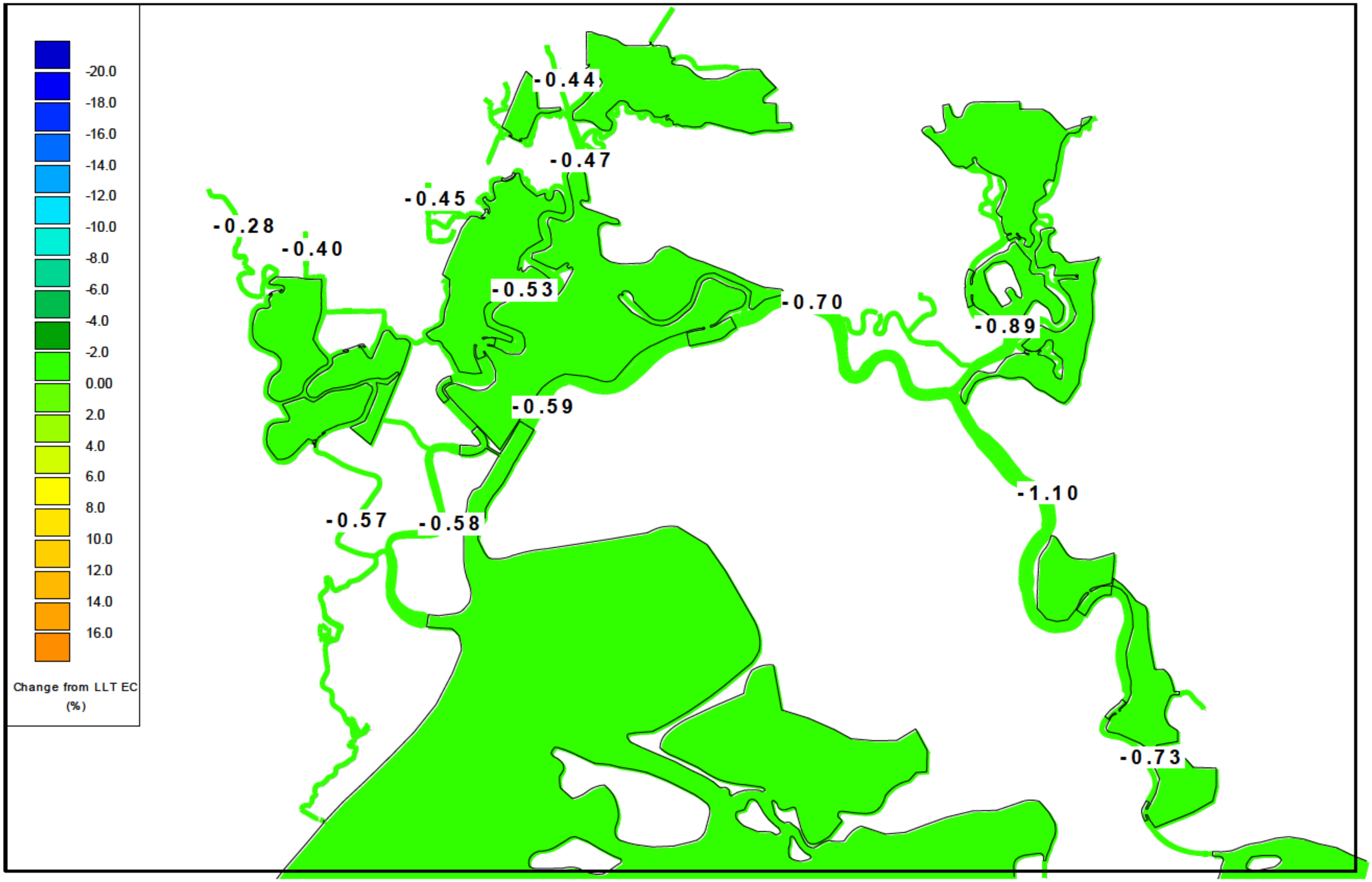


Figure 5-49 Contour plots of LLT – No South change from LLT tidally averaged EC in Suisun Marsh on September 24, 2002.

5.2.3 X2 Time Series

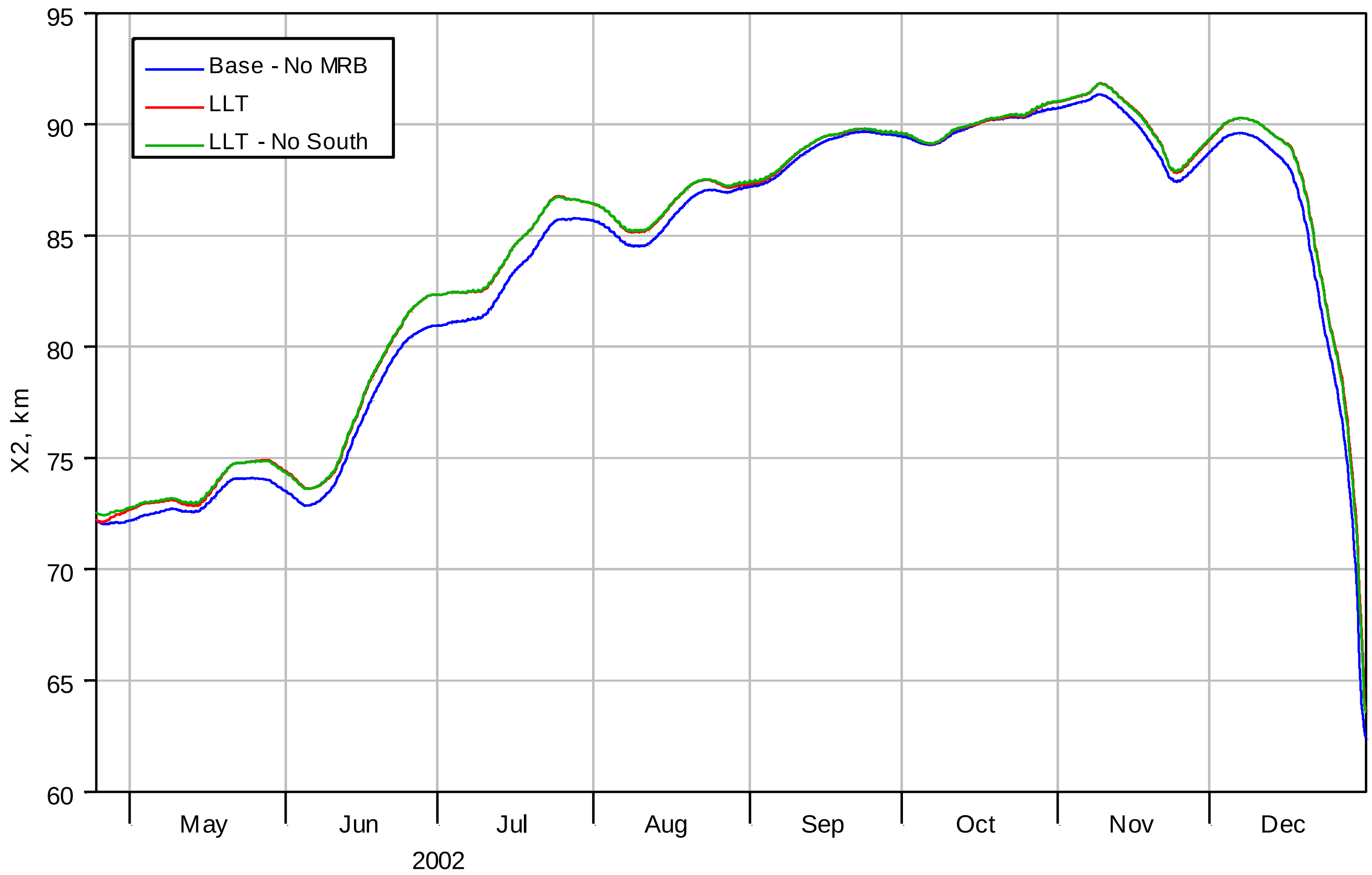


Figure 5-50 Time series of X2 for Base - No MRB, LLT and LLT - No south.

5.3 LLT – Middle River Conveyance

LLT – Middle River tidally averaged EC results are plotted as time series in Figure 5-51 through Figure 5-73. With the increased conveyance in Middle River, EC in Middle River is slower to respond to seasonal changes in flow, and peaks are lower. With increased conveyance, Union Island in the South Delta ROA is better connected to Middle River, resulting in increased mixing between the river and the restoration area. The slow mixing of Union Island water with Middle River water lags and dampens the Middle River EC response to flow changes.

At ROLD024 EC is decreased relative to LLT, while EC is increased at ROLD034. Small and varied changes occur at the exports. In Victoria Canal, the fall peak is higher for LLT – Middle River relative to LLT due to increased tidal flow and the associated influence of higher EC from Old River. In the San Joaquin River at San Andreas and RSAN058, EC is reduced relative to LLT, while changes at Jersey Point are minimal. Small decreases occur, particularly in peaks, in the Sacramento River at Emmaton and Rio Vista and in Cache Slough. Upstream and downstream on the Sacramento River, and in Suisun Marsh, EC changes are minimal. None of the scenarios impact EC at Freeport.

Contour plots of tidally averaged EC percent change from LLT on September 24, 2002 are shown in Figure 5-74 through Figure 5-76 for the Delta, the south and central Delta and for Suisun Marsh. Throughout most of the model domain, the LLT – Middle River case results in small EC changes (within +/-2%) relative to LLT. There are isolated areas with larger changes, including Union Island in the South Delta ROA. Union Island is impacted by changes in Middle River EC that vary with time. Therefore, EC increases are seen deeper in the island due to earlier increases in Middle River EC, while EC decreases occur near the breach due to decreases in Middle River EC at the time of the plot. EC is reduced in Sherman Island in the West Delta ROA and in Threemile Slough and the Sacramento River adjacent to the breach. There is a steep EC gradient between the Sacramento River and Threemile Slough at this time, so the small reduction in Threemile Slough tidal prism (see Table 4-9) impacts salinity at this location. Old River EC is higher than Middle River EC, thus flow changes in the channels joining the two rivers result in larger local EC changes at the channel junctions.

A summary of July – December 2002 monthly average EC at key locations throughout the Delta is provided in Table 5-5 for Base – No MRB, LLT and LLT – Middle River. Percent change from base EC is tabulated in Table 5-6. Percent change from base for the LLT – Middle River sensitivity case is generally within 0 – 3% of the percent change from base for LLT. The exception is San Andreas Landing, where LLT changes from base range from 30 – 70% and LLT – Middle River changes are 3 – 4% less than that.

Increased conveyance in Middle River has minimal impact on X2, as shown in Figure 5-77. Differences between LLT and LLT – Middle River are generally less than 0.1 km.

Table 5-5 Summary of July - December 2002 monthly average EC for Base - No MRB, LLT and LLT – Middle River.

Location	Monthly Average EC (umhos/cm)																	
	July 2002			August 2002			September 2002			October 2002			November 2002			December 2002		
	Base - No MRB	LLT	LLT - Middle River	Base - No MRB	LLT	LLT - Middle River	Base - No MRB	LLT	LLT - Middle River	Base - No MRB	LLT	LLT - Middle River	Base - No MRB	LLT	LLT - Middle River	Base - No MRB	LLT	LLT - Middle River
Cache Sl at Ryer	136	135	135	153	150	150	176	173	173	164	160	160	189	188	187	196	193	193
CCWD Victoria Canal	264	288	284	367	432	421	469	553	557	511	615	636	453	543	578	482	561	576
CVP	333	354	355	515	572	562	664	745	739	658	780	783	587	688	698	631	704	716
Montezuma Sl at Head	3536	3567	3544	4650	4521	4496	6853	6816	6782	7400	7510	7456	6555	6739	6693	3149	3440	3428
Montezuma Sl at Mouth	13705	14112	14130	15976	16392	16410	18958	19301	19327	20766	20950	20971	19465	20279	20295	12062	13926	13949
RMID015	261	285	281	367	437	426	469	565	552	503	612	610	442	522	529	463	542	546
RMID023	262	285	281	367	436	422	468	560	541	507	614	609	448	527	539	477	552	555
ROLD024	401	438	431	707	781	761	934	1049	1024	826	1014	987	712	891	873	607	744	730
ROLD034	360	392	398	615	692	699	804	912	932	755	915	933	651	801	823	601	732	740
RSAC075 Chipps Island	8209	8880	8857	9741	10267	10238	12563	13253	13225	13606	14160	14121	11990	12802	12756	6035	6735	6716
RSAC092 Emmaton	623	629	616	808	742	725	1498	1384	1352	2012	1919	1870	1748	1782	1740	821	874	856
RSAC101 Rio Vista	148	146	145	176	162	161	241	213	210	285	264	257	290	308	302	222	232	230
RSAC123	127	127	127	154	155	155	165	165	165	142	142	142	184	184	184	169	168	168
RSAC155 Freeport	126	126	126	156	156	156	162	162	162	142	142	142	184	184	184	164	164	164
RSAN018 Jersey Pt	954	1028	1017	1461	1519	1502	1975	2116	2099	1728	1913	1896	1503	1766	1755	945	1108	1096
RSAN032 San Andreas	284	383	371	459	649	623	555	871	839	448	773	742	403	668	645	333	480	464
RSAN058	643	612	593	664	644	625	711	698	685	674	682	679	636	629	626	763	751	746
S-49 Beldon's Landing	10402	11292	11351	13266	14335	14411	15826	16973	17052	18856	19371	19434	18357	19659	19732	12766	15349	15446
SWP	329	360	361	540	615	612	698	807	807	682	835	843	593	725	736	594	691	690

Table 5-6 Summary of July - December 2002 percent change in monthly average EC for LLT and LLT – Middle River relative to Base - No MRB.

	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Case											
	July 2002		August 2002		September 2002		October 2002		November 2002		December 2002	
Location	LLT	LLT - Middle River	LLT	LLT - Middle River	LLT	LLT - Middle River	LLT	LLT - Middle River	LLT	LLT - Middle River	LLT	LLT - Middle River
Cache Sl at Ryer	-1%	-1%	-2%	-2%	-1%	-1%	-2%	-3%	-1%	-1%	-2%	-2%
CCWD Victoria Canal	9%	8%	18%	15%	18%	19%	20%	25%	20%	27%	16%	19%
CVP	7%	7%	11%	9%	12%	11%	19%	19%	17%	19%	12%	14%
Montezuma Sl at Head	1%	0%	-3%	-3%	-1%	-1%	1%	1%	3%	2%	9%	9%
Montezuma Sl at Mouth	3%	3%	3%	3%	2%	2%	1%	1%	4%	4%	15%	16%
RMID015	9%	8%	19%	16%	20%	18%	22%	21%	18%	20%	17%	18%
RMID023	9%	7%	19%	15%	20%	16%	21%	20%	18%	20%	16%	16%
ROLD024	9%	7%	10%	8%	12%	10%	23%	20%	25%	23%	23%	20%
ROLD034	9%	10%	13%	14%	13%	16%	21%	24%	23%	26%	22%	23%
RSAC075 Chipps Island	8%	8%	5%	5%	5%	5%	4%	4%	7%	6%	12%	11%
RSAC092 Emmaton	1%	-1%	-8%	-10%	-8%	-10%	-5%	-7%	2%	0%	6%	4%
RSAC101 Rio Vista	-2%	-2%	-8%	-9%	-12%	-13%	-7%	-10%	6%	4%	5%	4%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	8%	7%	4%	3%	7%	6%	11%	10%	18%	17%	17%	16%
RSAN032 San Andreas	35%	31%	42%	36%	57%	51%	73%	66%	66%	60%	44%	39%
RSAN058	-5%	-8%	-3%	-6%	-2%	-4%	1%	1%	-1%	-2%	-2%	-2%
S-49 Beldon's Landing	9%	9%	8%	9%	7%	8%	3%	3%	7%	7%	20%	21%
SWP	9%	10%	14%	13%	16%	16%	23%	24%	22%	24%	16%	16%

5.3.1 Tidally averaged EC time series

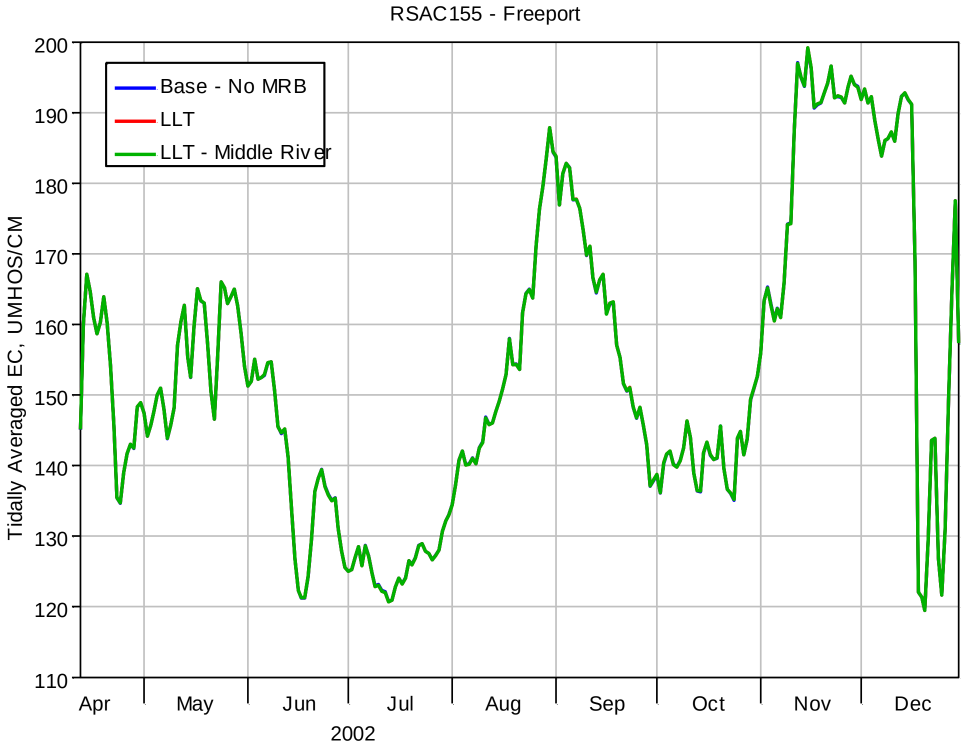


Figure 5-51 Tidally averaged EC at RSAC155 for Base-No MRB, LLT and LLT-Middle River.

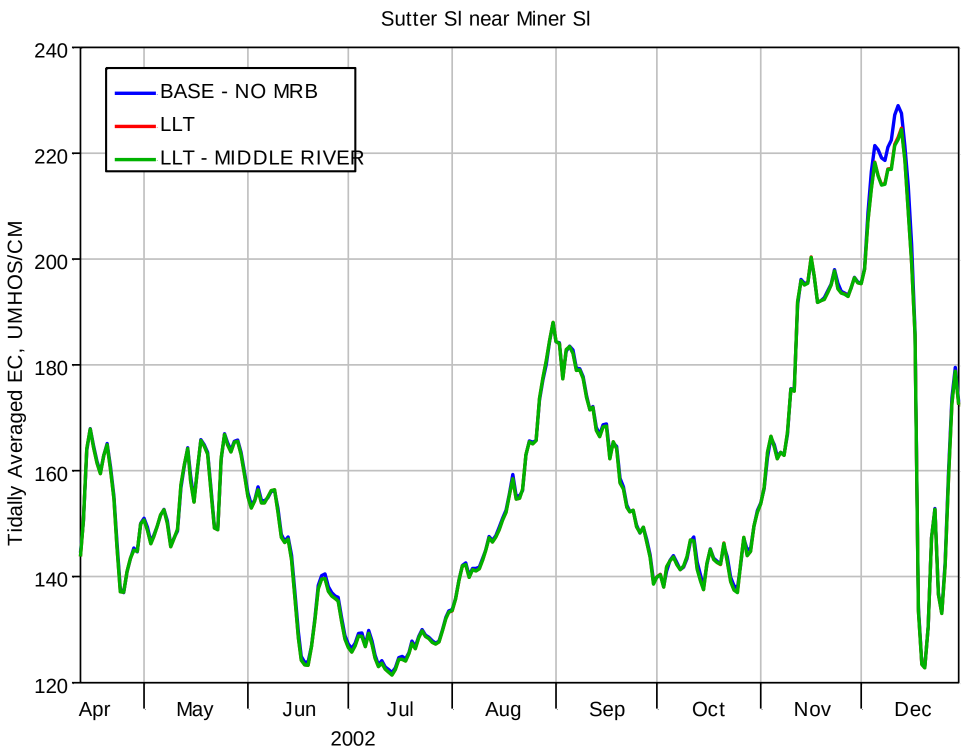


Figure 5-52 Tidally averaged EC in Sutter Slough for Base-No MRB, LLT and LLT-Middle River.

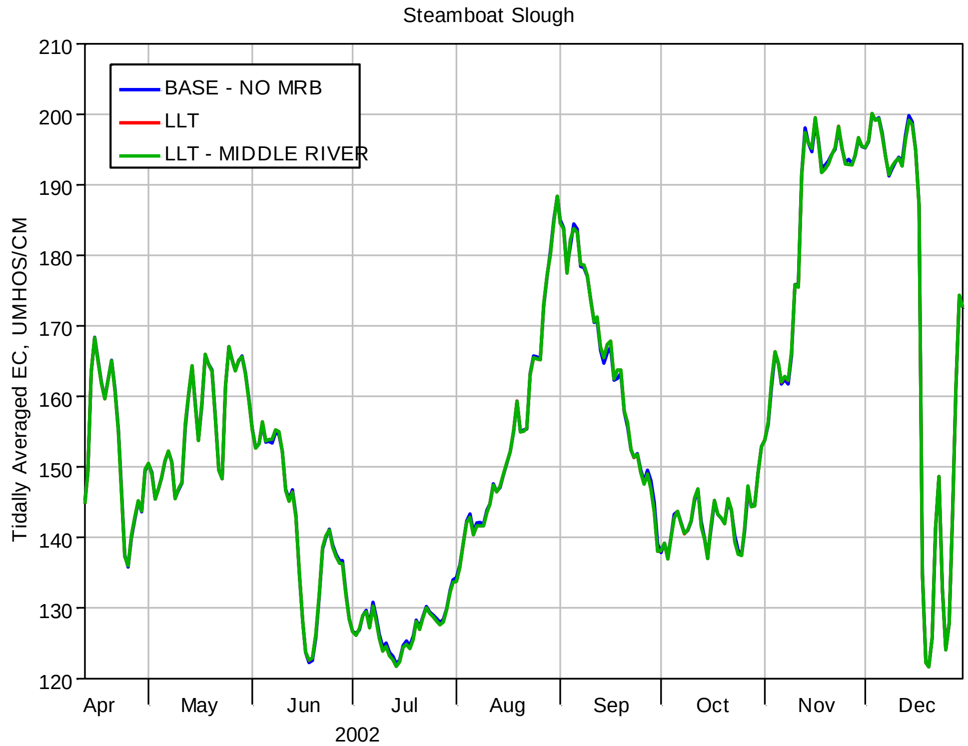


Figure 5-53 Tidally averaged EC in Steamboat Slough for Base-No MRB, LLT and LLT-Middle River.

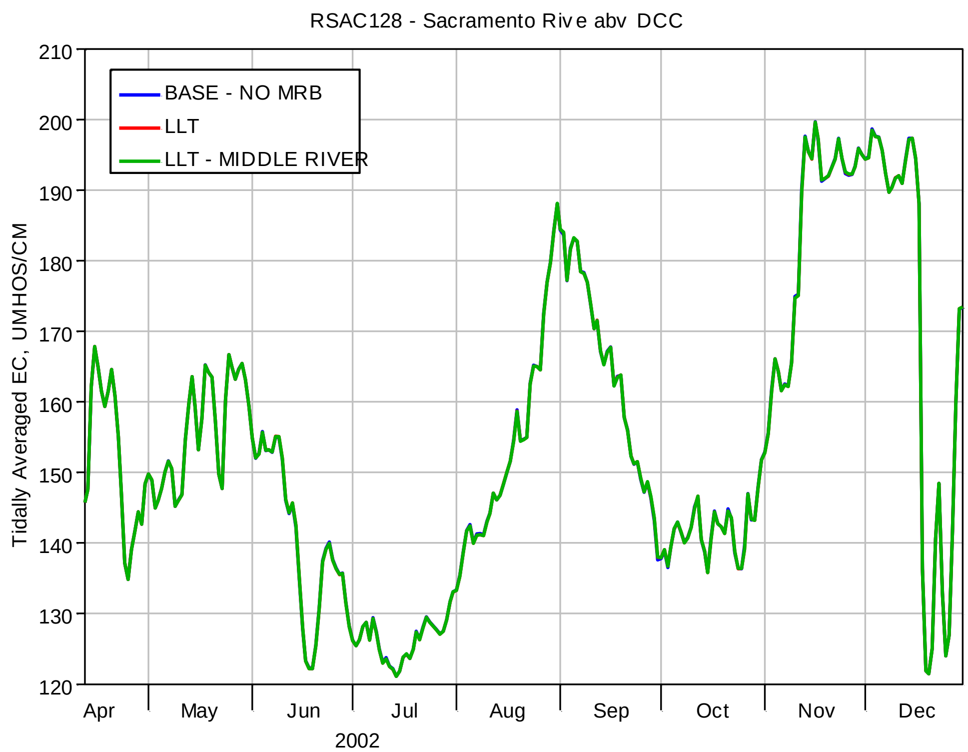


Figure 5-54 Tidally averaged EC at RSAC128 for Base-No MRB, LLT and LLT-Middle River.

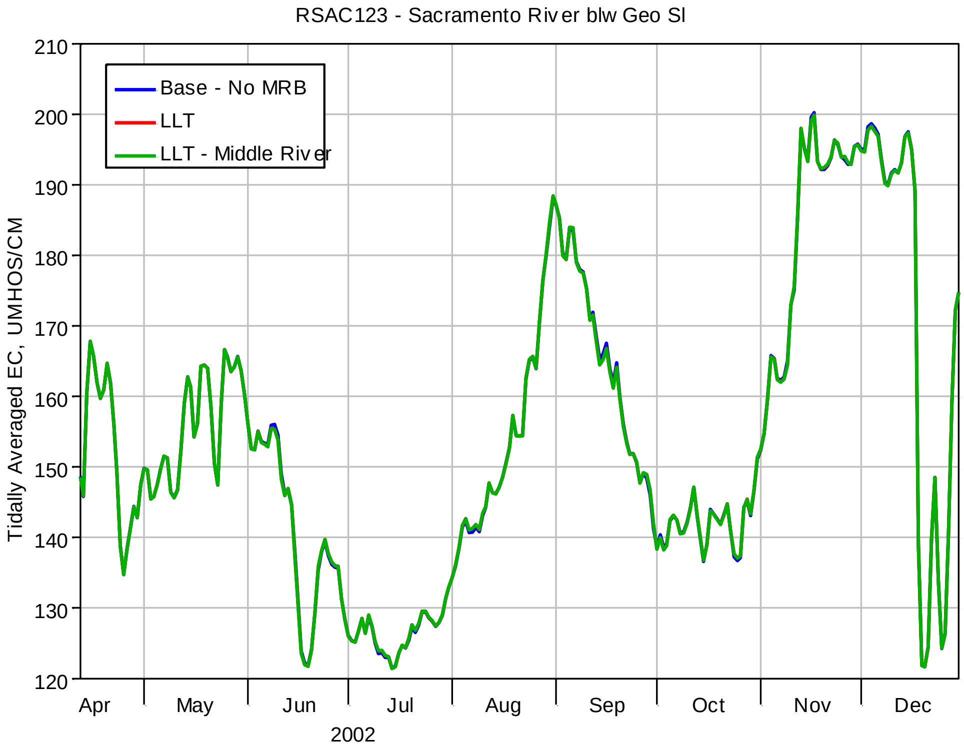


Figure 5-55 Tidally averaged EC at RSAC123 for Base-No MRB, LLT and LLT-Middle River.

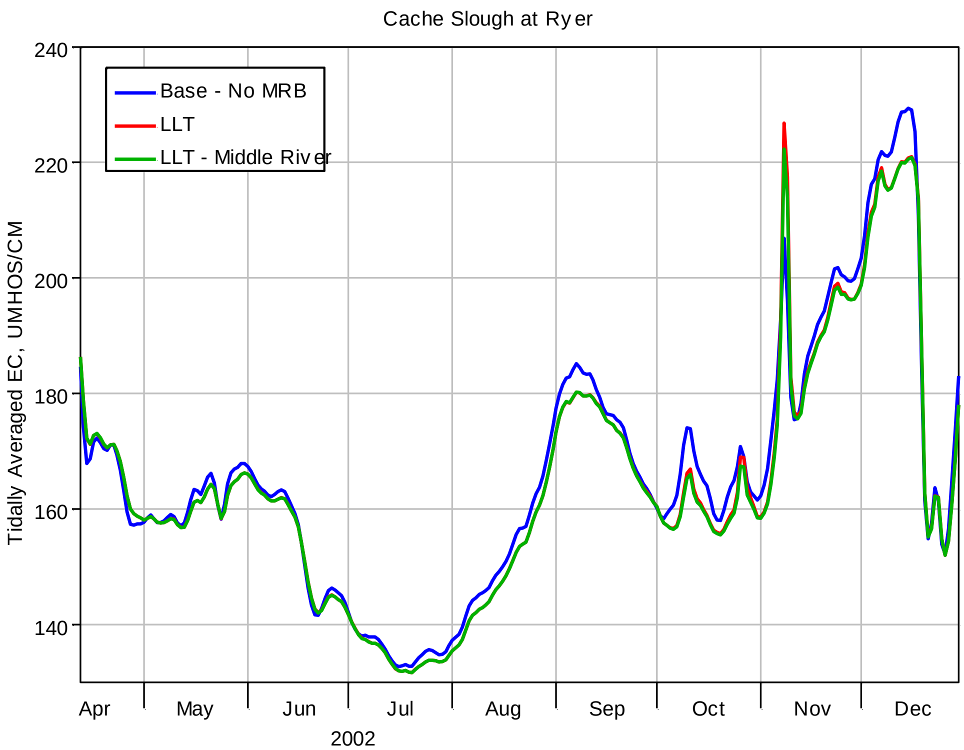


Figure 5-56 Tidally averaged EC at Cache Slough at Ryer for Base-No MRB, LLT and LLT-Middle River.

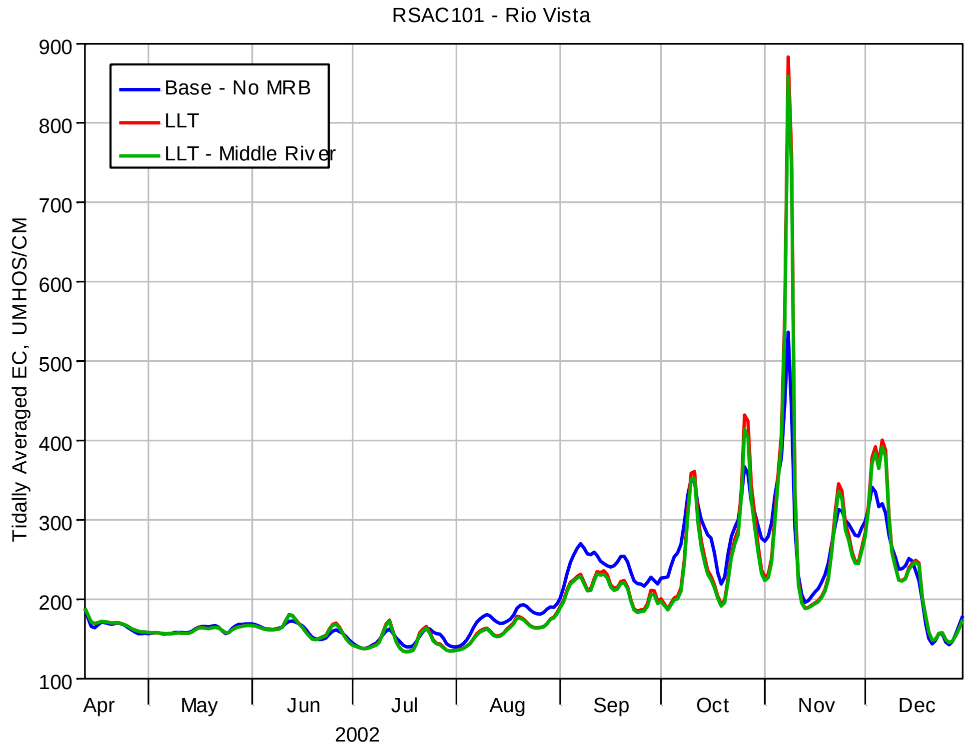


Figure 5-57 Tidally averaged EC at RSAC101 for Base-No MRB, LLT and LLT-Middle River.

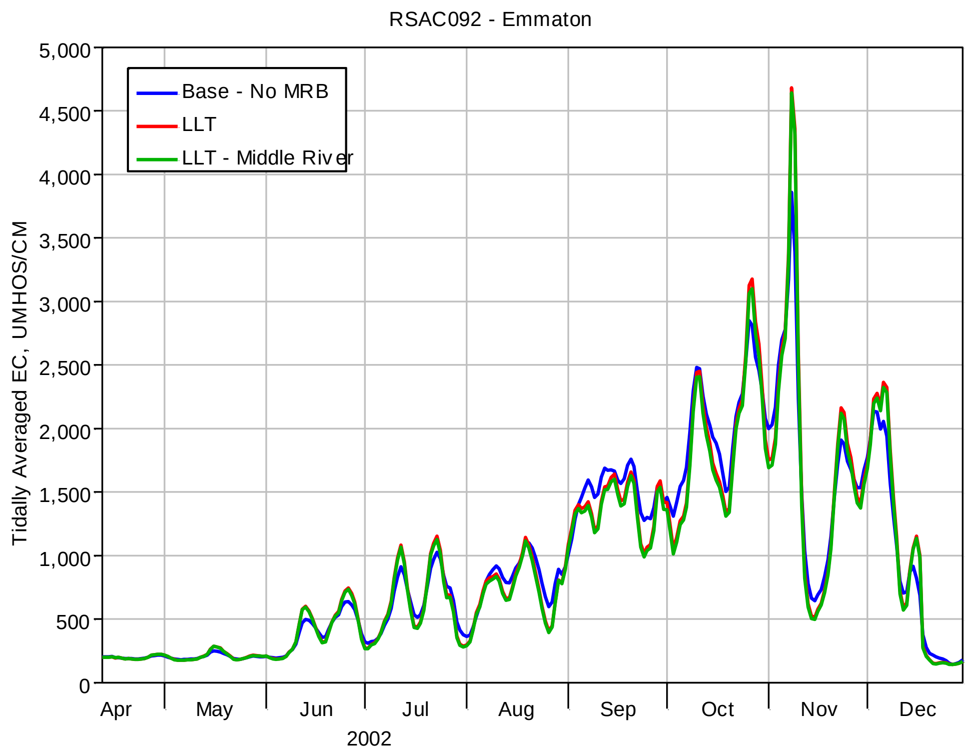


Figure 5-58 Tidally averaged EC at RSAC092 for Base-No MRB, LLT and LLT-Middle River.

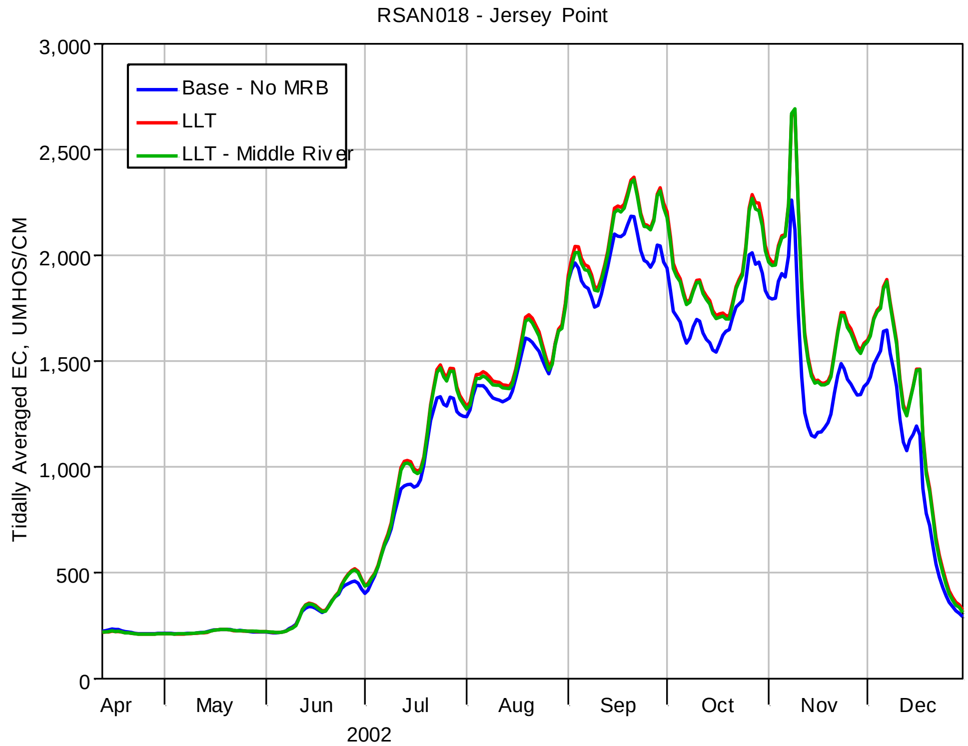


Figure 5-59 Tidally averaged EC at RSAN018 for Base-No MRB, LLT and LLT-Middle River.

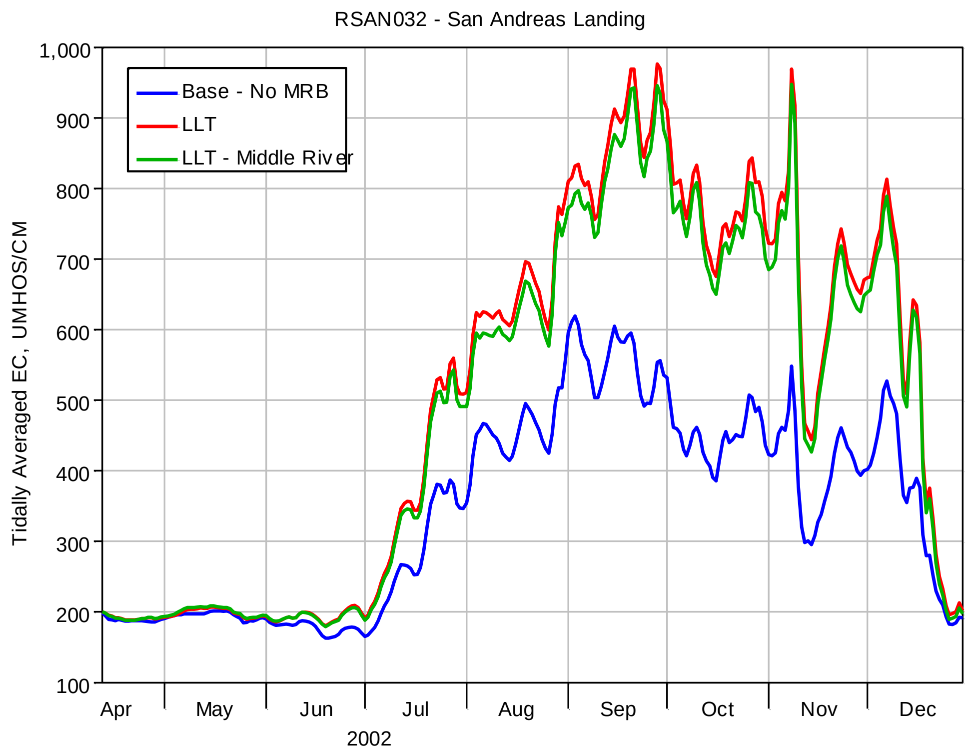


Figure 5-60 Tidally averaged EC at RSAN032 for Base-No MRB, LLT and LLT-Middle River.

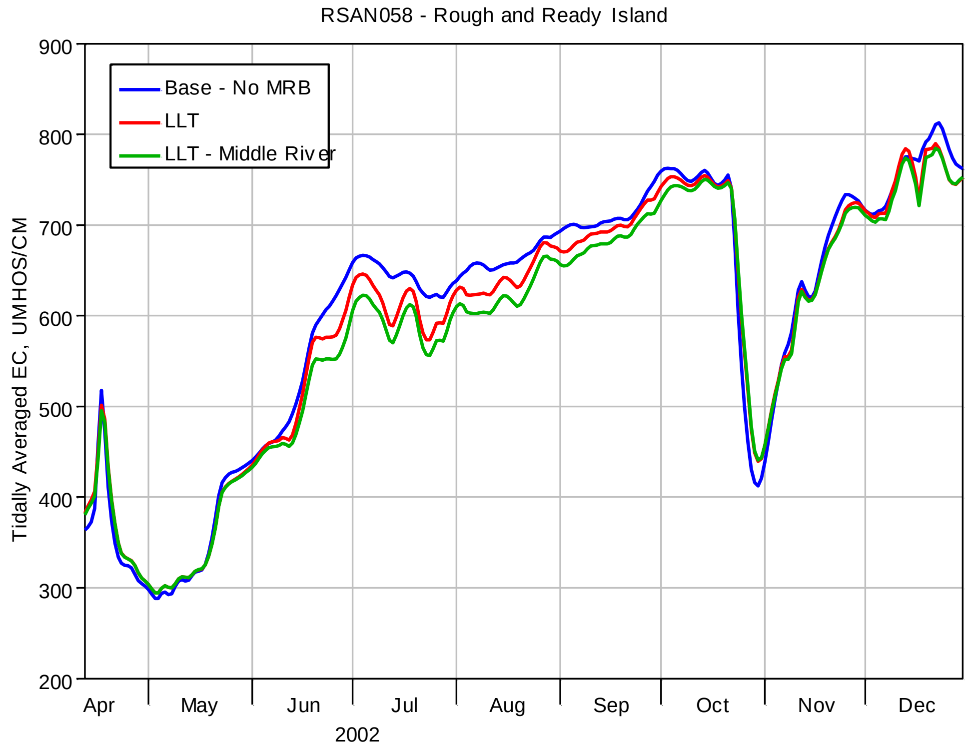


Figure 5-61 Tidally averaged EC at RSAN058 for Base-No MRB, LLT and LLT-Middle River.

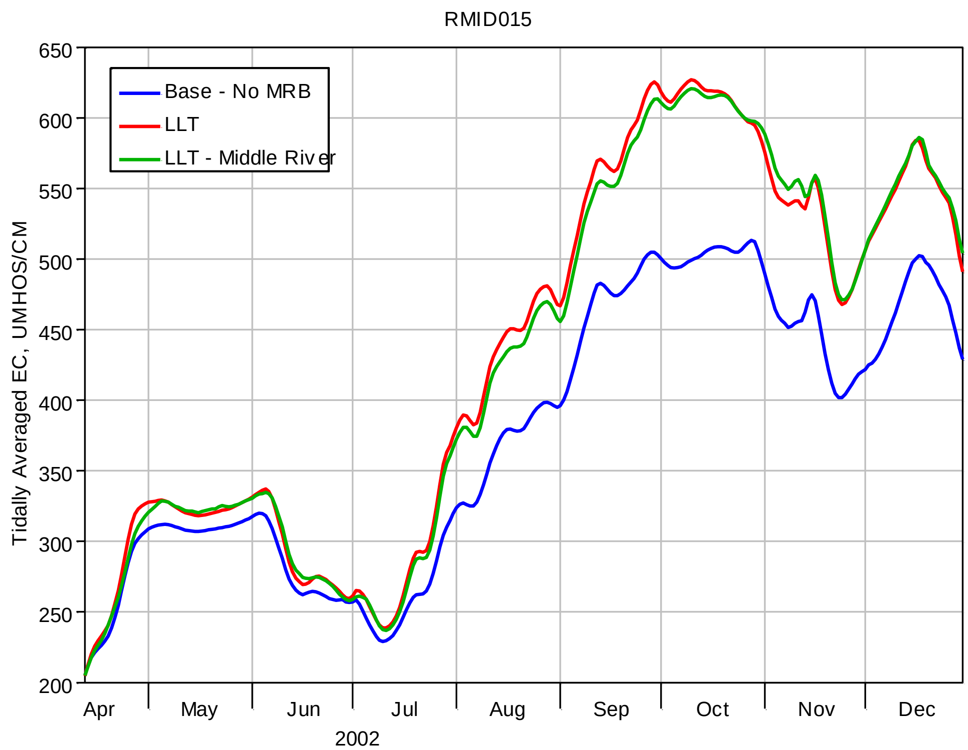


Figure 5-62 Tidally averaged EC at RMID015 for Base-No MRB, LLT and LLT-Middle River.

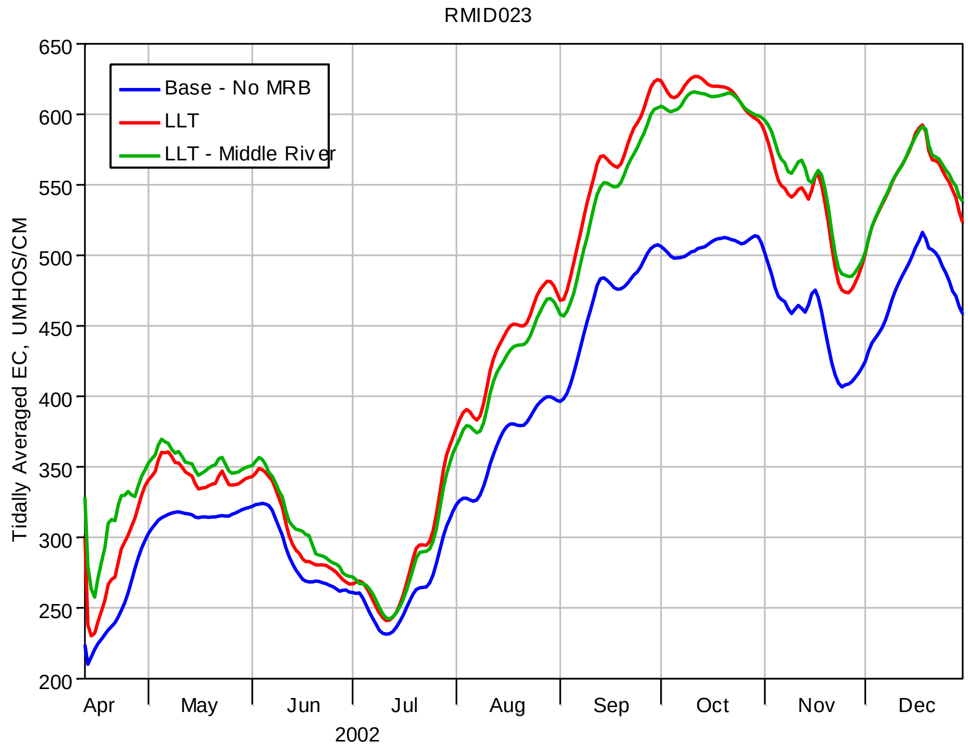


Figure 5-63 Tidally averaged EC at RMID023 for Base-No MRB, LLT and LLT-Middle River.

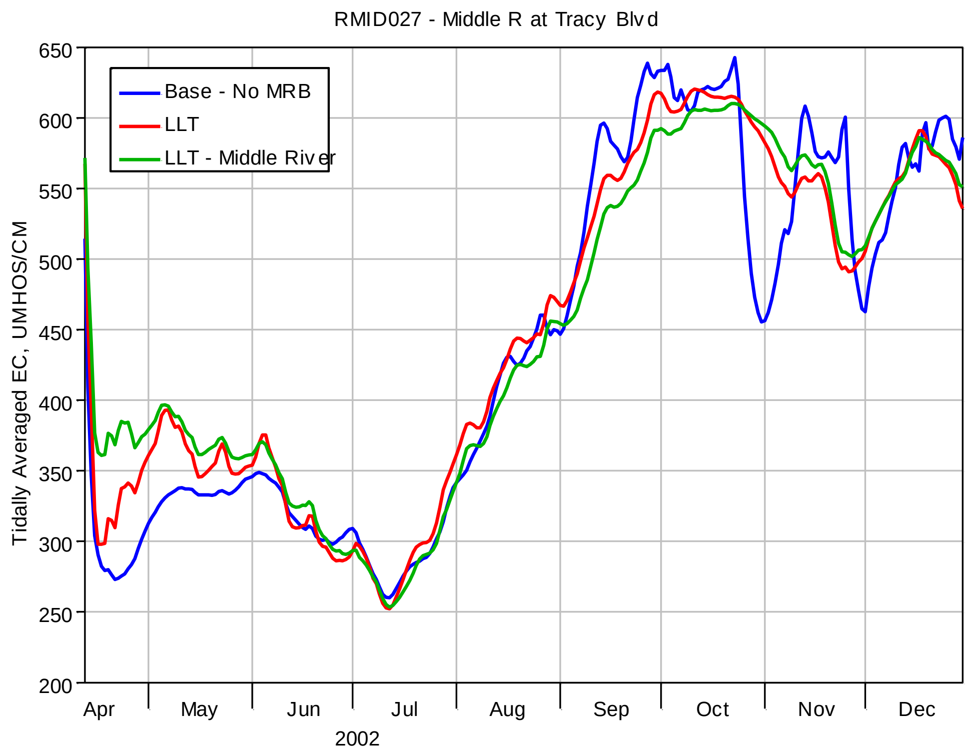


Figure 5-64 Tidally averaged EC at RMID027 for Base-No MRB, LLT and LLT-Middle River.

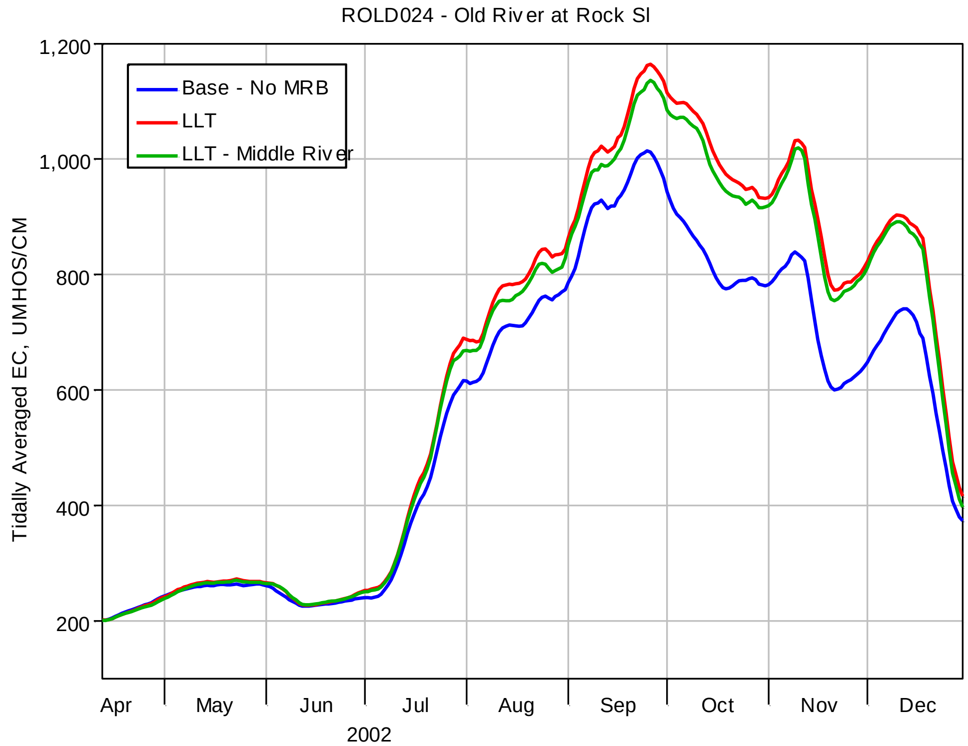


Figure 5-65 Tidally averaged EC at ROLD024 for Base-No MRB, LLT and LLT-Middle River.

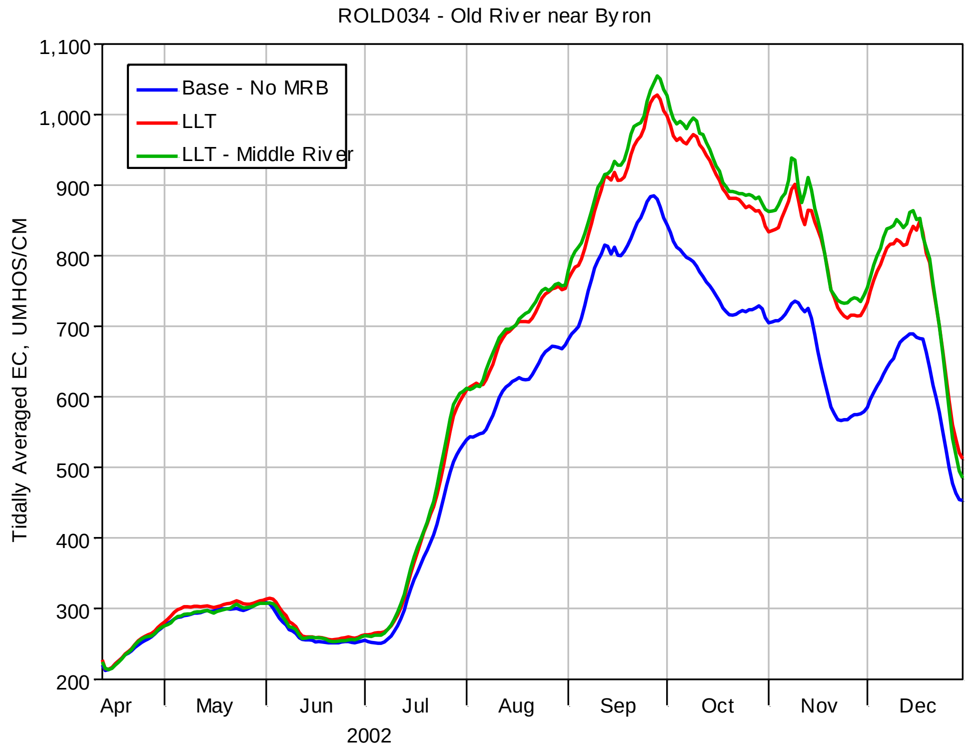


Figure 5-66 Tidally averaged EC at ROLD034 for Base-No MRB, LLT and LLT-Middle River.

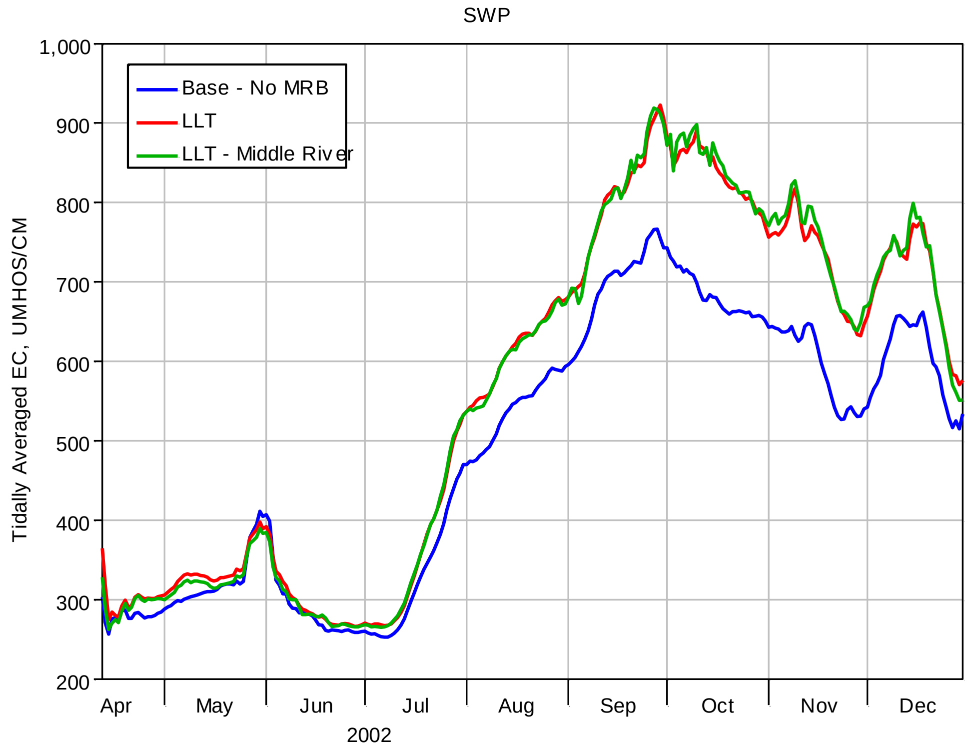


Figure 5-67 Tidally averaged EC at SWP for Base-No MRB, LLT and LLT-Middle River.

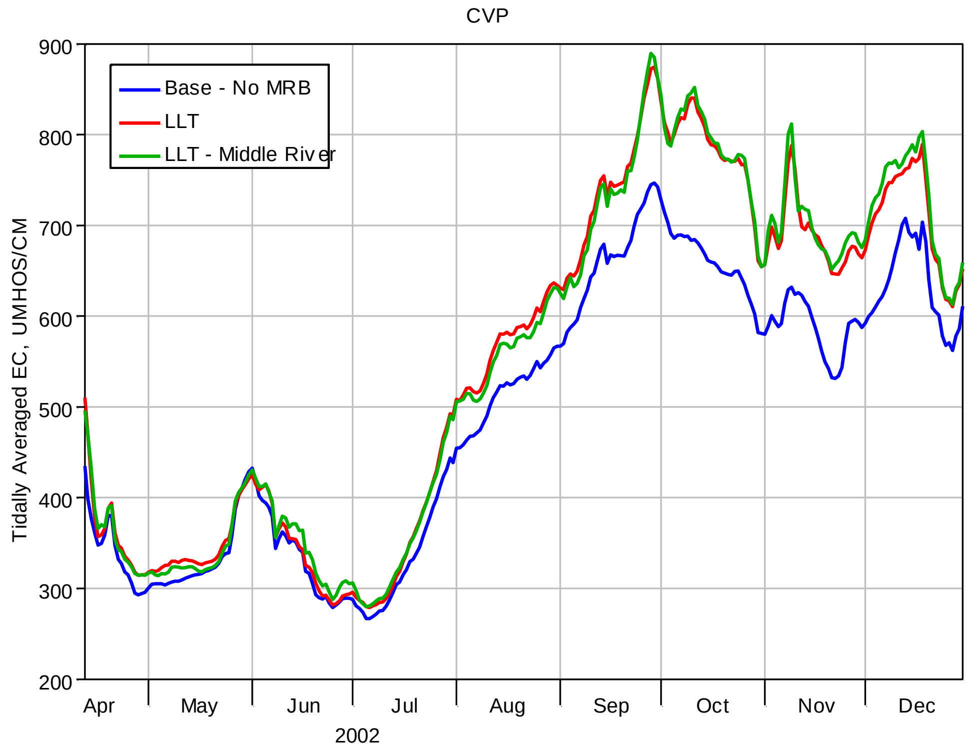


Figure 5-68 Tidally averaged EC at CVP for Base-No MRB, LLT and LLT-Middle River.

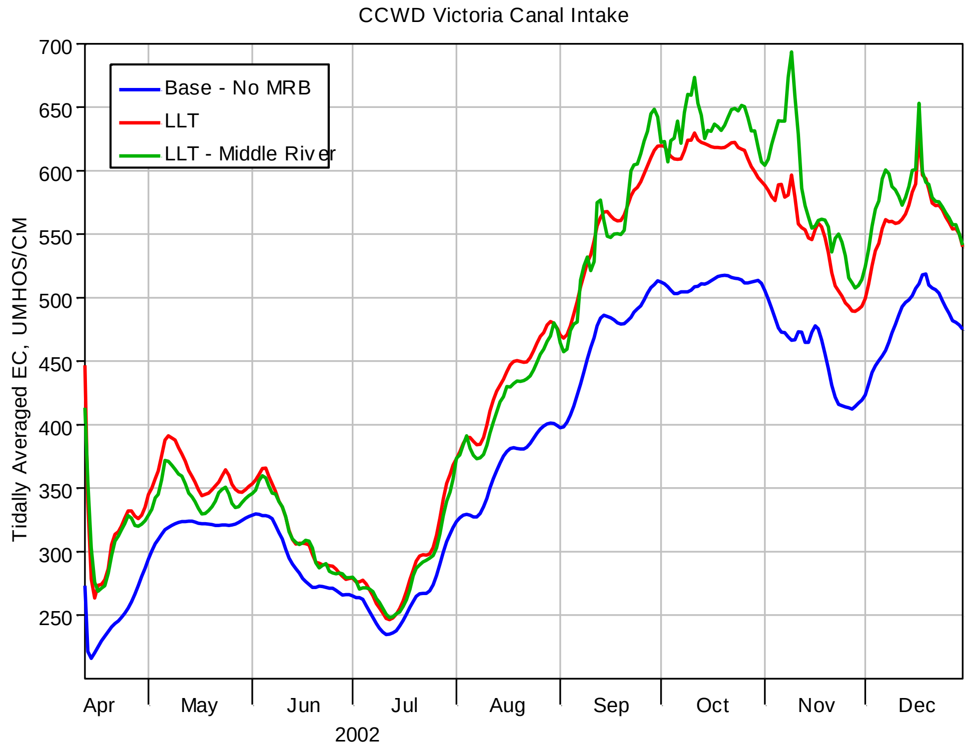


Figure 5-69 Tidally averaged EC at CCWD for Base-No MRB, LLT and LLT-Middle River.

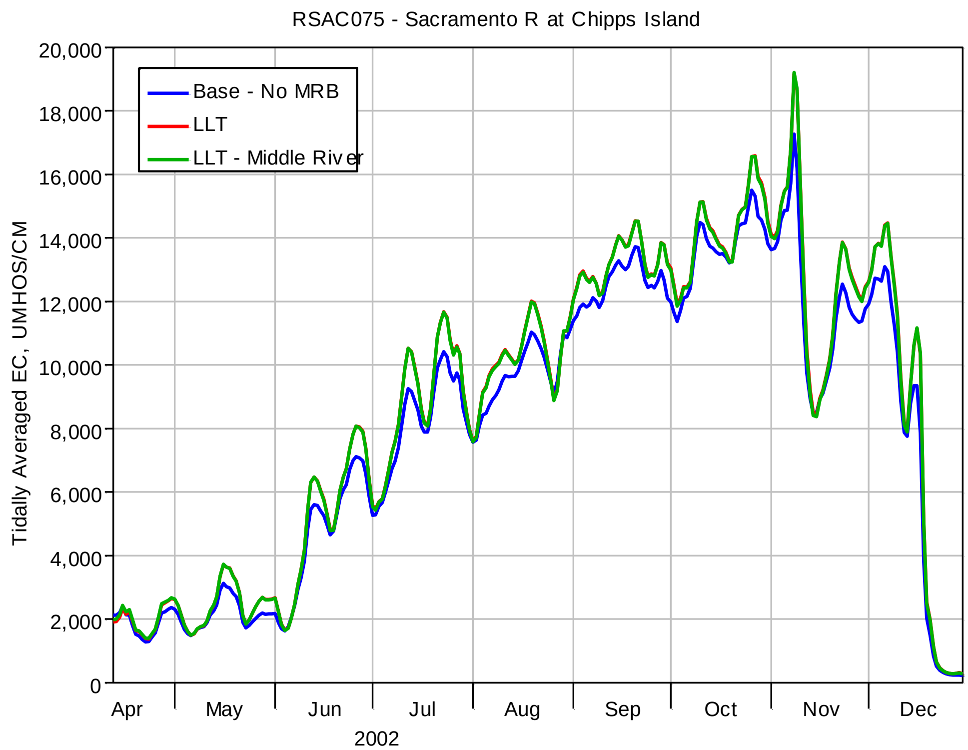


Figure 5-70 Tidally averaged EC at RSAC075 for Base-No MRB, LLT and LLT-Middle River.

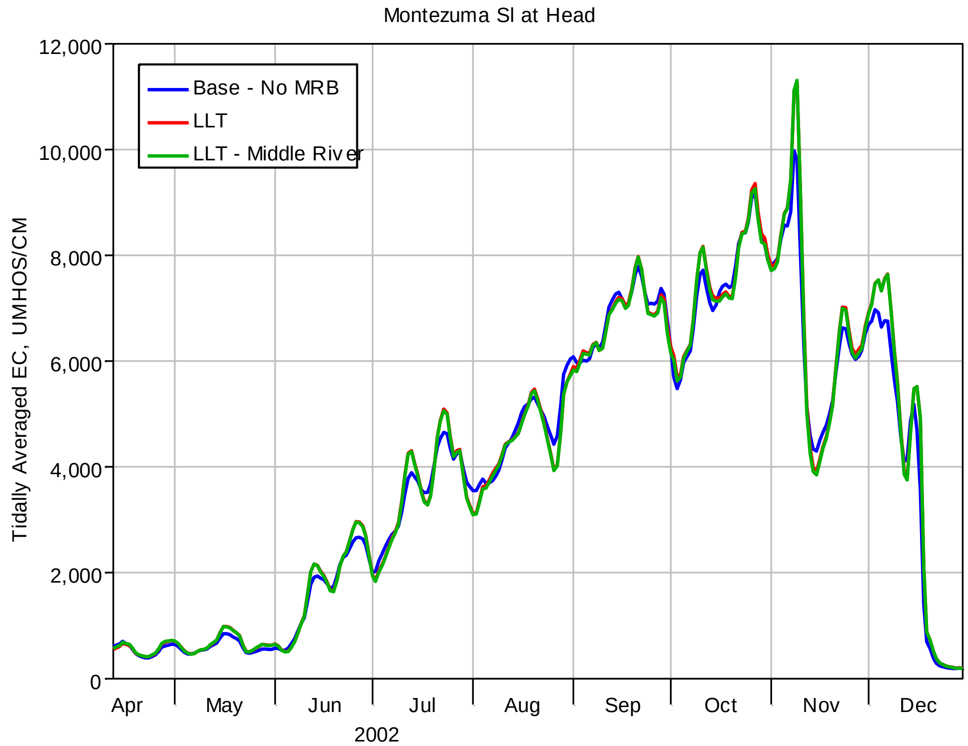


Figure 5-71 Tidally averaged EC at Montezuma Sl at Head for Base-No MRB, LLT and LLT-Middle River.

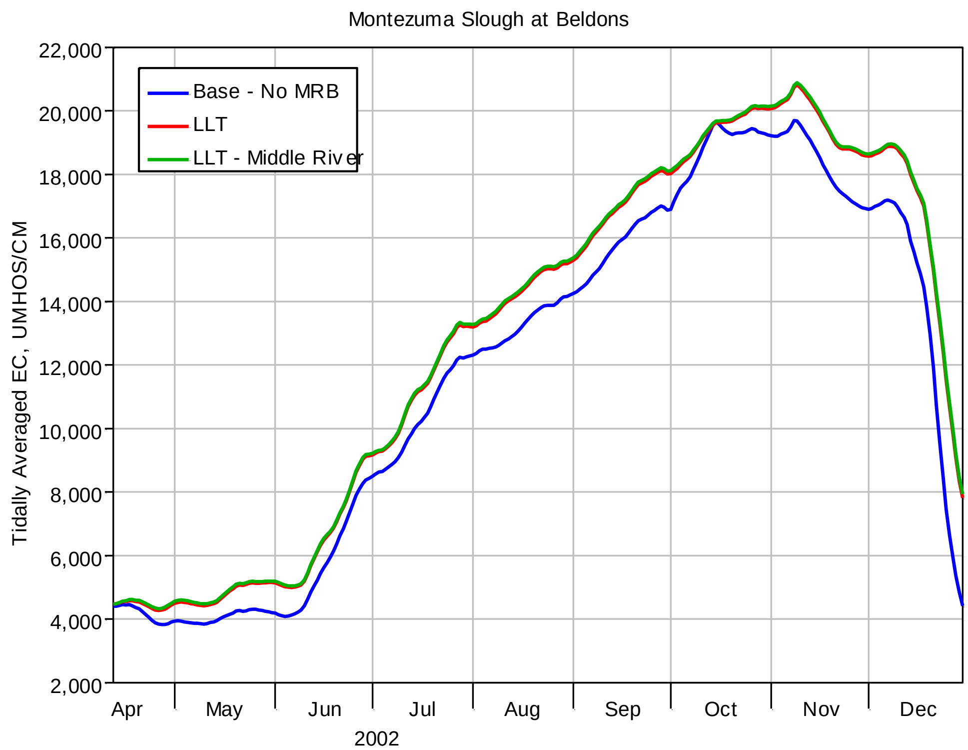


Figure 5-72 Tidally averaged EC at Montezuma Slough at Beldon's for Base-No MRB, LLT and LLT-Middle River.

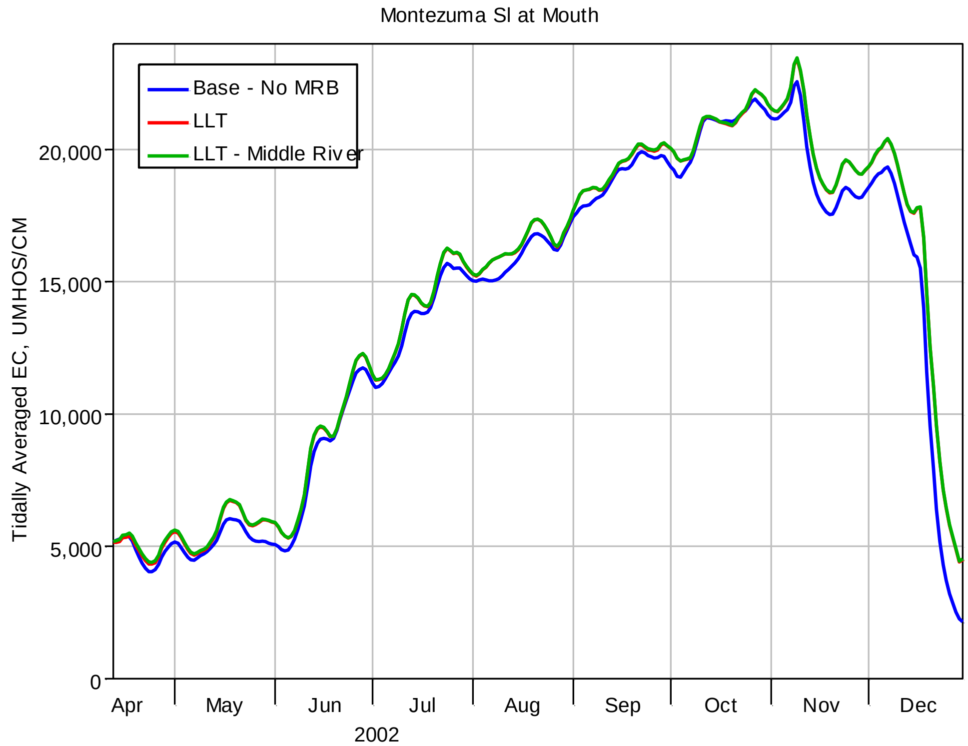


Figure 5-73 Tidally averaged EC at Montezuma Sl at Mouth for Base-No MRB, LLT and LLT-Middle River.

5.3.2 Spatial Plots of EC Change

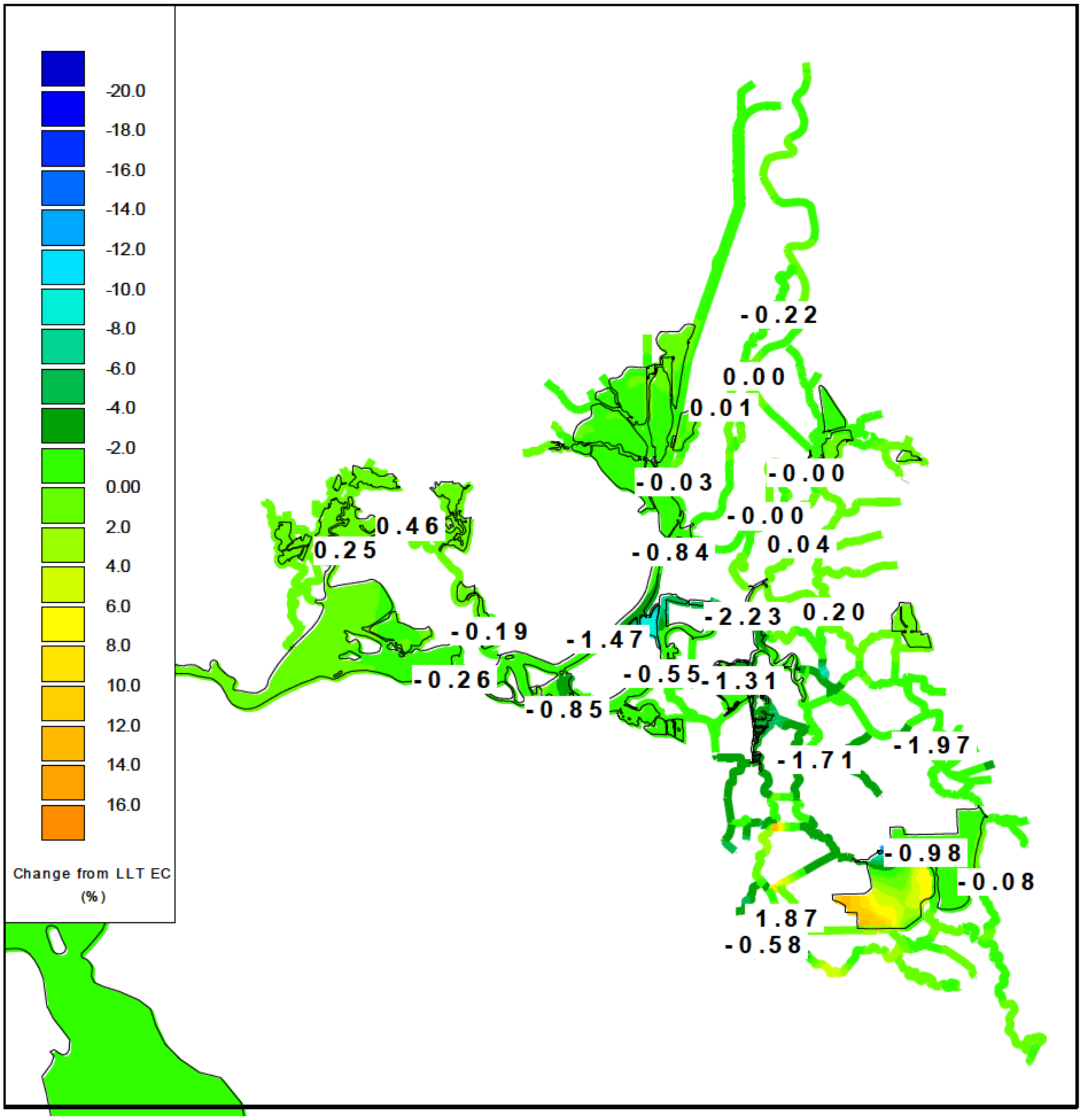


Figure 5-74 Contour plots of LLT – Middle River change from LLT tidally averaged EC on September 24, 2002.

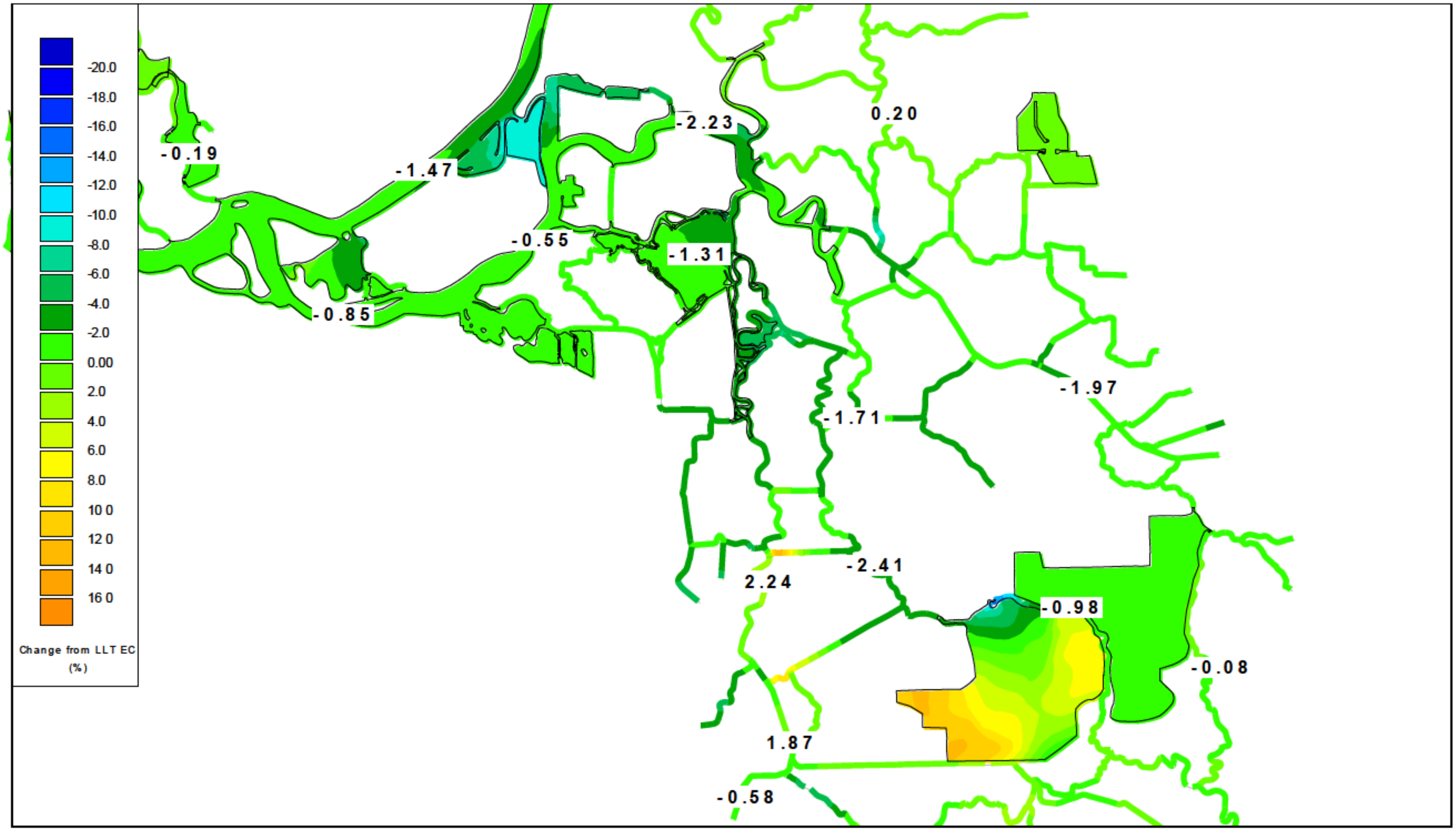


Figure 5-75 Contour plots of LLT – Middle River change from LLT tidally averaged EC in south Delta on September 24, 2002.

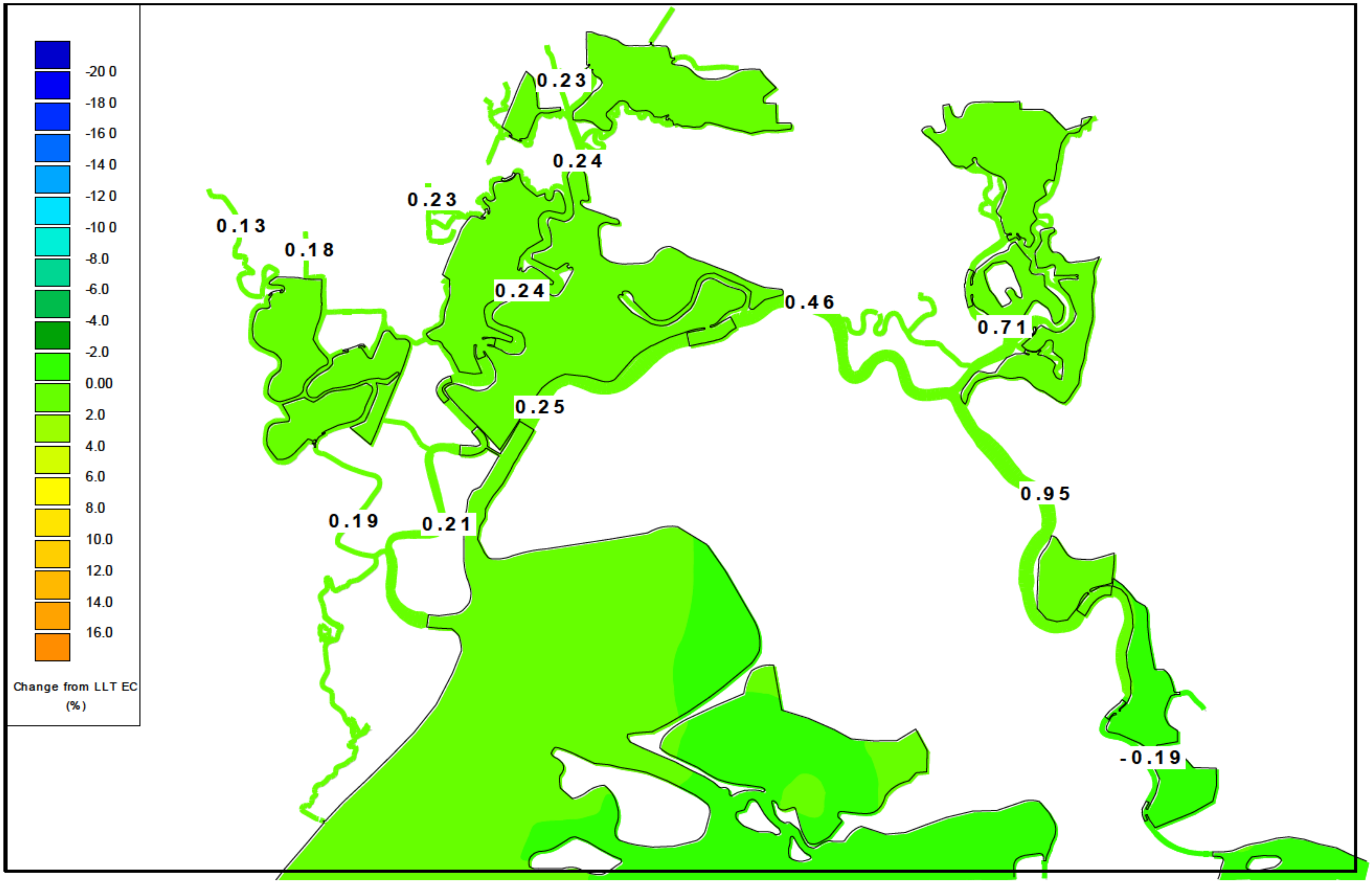


Figure 5-76 Contour plots of LLT – Middle River change from LLT tidally averaged EC in Suisun Marsh on September 24, 2002.

5.3.3 X2 Time Series

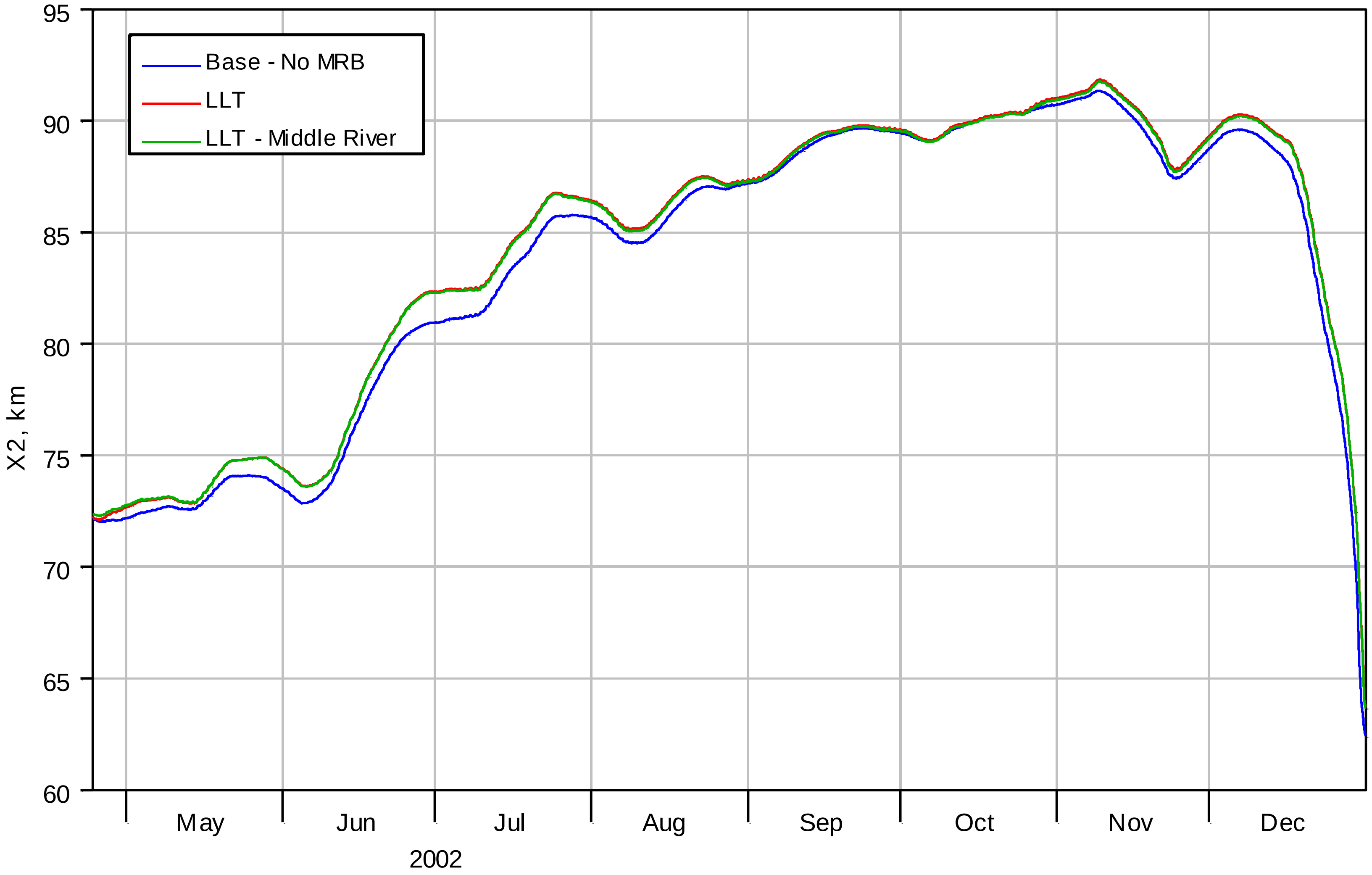


Figure 5-77 Time series of X2 for Base - No MRB, LLT and LLT – Middle River.

5.4 LLT – Suisun Scour

EC results for the LLT – Suisun Scour case are shown as time series plots of tidally averaged values in Figure 5-78 through Figure 5-97. LLT – Suisun Scour EC results are very similar to LLT in the North Delta. In the central and south Delta (including the export locations), at Chipps Island and the head and mouth of Montezuma Slough, EC is substantially increased. Time series in Montezuma Slough at Beldon's Landing (Figure 5-96) show that LLT – Suisun Scour reduces EC below LLT throughout the simulation period. None of the scenarios impact EC at Freeport.

Contour plots of tidally averaged EC percent change from LLT on September 24, 2002 are shown in Figure 5-98 through Figure 5-100 for the Delta, the south and central Delta and for Suisun Marsh. These plots show very small changes in the north Delta. There are significant EC increases from Suisun Bay up the San Joaquin to Turner Cut and into the southwest Delta in Dutch Slough, Franks Tract and Old and Middle Rivers, including Union Island in the South Delta ROA. EC is decreased throughout most of Suisun Marsh, with the largest reductions occurring in the eastern portion of the Marsh, in Nurse Slough and in Montezuma Slough just upstream of Nurse Slough.

A summary of July – December 2002 monthly average EC at key locations throughout the Delta is provided in Table 5-7 for Base – No MRB, LLT and LLT – Suisun Scour Suisun. Percent change in monthly average EC relative to the base case are provided in Table 5-8 for LLT and LLT – Suisun Scour. LLT impacts to EC in the south Delta are on the order of 10 – 20% increase. The LLT – Suisun Scour case increases these already sizeable impacts by as much as 8 – 11% on average during July and August.

LLT – Suisun Scour X2, shown in Figure 5-101, is increased by about 1 km relative to LLT during the spring and earlier summer. During the remainder of the year, X2 changes are generally less than 0.5 km.

Table 5-7 Summary of July - December 2002 monthly average EC for Base - No MRB, LLT and LLT – Suisun Scour.

	Monthly Average EC (umhos/cm)																	
	July 2002			August 2002			September 2002			October 2002			November 2002			December 2002		
Location	Base - No MRB	LLT	LLT - Suisun Scour	Base - No MRB	LLT	LLT - Suisun Scour	Base - No MRB	LLT	LLT - Suisun Scour	Base - No MRB	LLT	LLT - Suisun Scour	Base - No MRB	LLT	LLT - Suisun Scour	Base - No MRB	LLT	LLT - Suisun Scour
Cache Sl at Ryer	136	135	135	153	150	150	176	173	173	164	160	159	189	188	186	196	193	192
CCWD Victoria Canal	264	288	296	367	432	462	469	553	589	511	615	642	453	543	558	482	561	576
CVP	333	354	371	515	572	617	664	745	799	658	780	824	587	688	715	631	704	721
Montezuma Sl at Head	3536	3567	3898	4650	4521	4829	6853	6816	7214	7400	7510	7928	6555	6739	6979	3149	3440	3538
Montezuma Sl at Mouth	13705	14112	14581	15976	16392	16915	18958	19301	19760	20766	20950	21585	19465	20279	20901	12062	13926	14140
RMID015	261	285	294	367	437	468	469	565	602	503	612	638	442	522	536	463	542	557
RMID023	262	285	293	367	436	466	468	560	596	507	614	641	448	527	541	477	552	566
ROLD024	401	438	473	707	781	860	934	1049	1144	826	1014	1088	712	891	941	607	744	785
ROLD034	360	392	419	615	692	759	804	912	991	755	915	978	651	801	843	601	732	767
RSAC075 Chipps Island	8209	8880	9602	9741	10267	11046	12563	13253	14101	13606	14160	15066	11990	12802	13679	6035	6735	7238
RSAC092 Emmaton	623	629	659	808	742	766	1498	1384	1412	2012	1919	1976	1748	1782	1847	821	874	906
RSAC101 Rio Vista	148	146	145	176	162	161	241	213	209	285	264	258	290	308	303	222	232	229
RSAC123	127	127	127	154	155	155	165	165	165	142	142	142	184	184	184	169	168	168
RSAC155 Freeport	126	126	126	156	156	156	162	162	162	142	142	142	184	184	184	164	164	164
RSAN018 Jersey Pt	954	1028	1147	1461	1519	1692	1975	2116	2317	1728	1913	2063	1503	1766	1893	945	1108	1188
RSAN032 San Andreas	284	383	414	459	649	713	555	871	944	448	773	824	403	668	703	333	480	503
RSAN058	643	612	614	664	644	646	711	698	701	674	682	682	636	629	629	763	751	753
S-49 Beldon's Landing	10402	11292	10644	13266	14335	13307	15826	16973	15785	18856	19371	18463	18357	19659	18273	12766	15349	13414
SWP	329	360	380	540	615	671	698	807	874	682	835	889	593	725	759	594	691	716

Table 5-8 Summary of July - December 2002 percent change in monthly average EC for LLT and LLT – Suisun Scour relative to Base - No MRB.

Location	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Case											
	July 2002		August 2002		September 2002		October 2002		November 2002		December 2002	
	LLT	LLT - Suisun Scour	LLT	LLT - Suisun Scour	LLT	LLT - Suisun Scour	LLT	LLT - Suisun Scour	LLT	LLT - Suisun Scour	LLT	LLT - Suisun Scour
Cache Sl at Ryer	-1%	-1%	-2%	-2%	-1%	-1%	-2%	-3%	-1%	-2%	-2%	-2%
CCWD Victoria Canal	9%	12%	18%	26%	18%	26%	20%	26%	20%	23%	16%	19%
CVP	7%	11%	11%	20%	12%	20%	19%	25%	17%	22%	12%	14%
Montezuma Sl at Head	1%	10%	-3%	4%	-1%	5%	1%	7%	3%	6%	9%	12%
Montezuma Sl at Mouth	3%	6%	3%	6%	2%	4%	1%	4%	4%	7%	15%	17%
RMID015	9%	13%	19%	27%	20%	28%	22%	27%	18%	21%	17%	20%
RMID023	9%	12%	19%	27%	20%	27%	21%	27%	18%	21%	16%	19%
ROLD024	9%	18%	10%	22%	12%	22%	23%	32%	25%	32%	23%	29%
ROLD034	9%	16%	13%	23%	13%	23%	21%	30%	23%	30%	22%	28%
RSAC075 Chipps Island	8%	17%	5%	13%	5%	12%	4%	11%	7%	14%	12%	20%
RSAC092 Emmaton	1%	6%	-8%	-5%	-8%	-6%	-5%	-2%	2%	6%	6%	10%
RSAC101 Rio Vista	-2%	-2%	-8%	-9%	-12%	-13%	-7%	-9%	6%	4%	5%	4%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	8%	20%	4%	16%	7%	17%	11%	19%	18%	26%	17%	26%
RSAN032 San Andreas	35%	46%	42%	55%	57%	70%	73%	84%	66%	74%	44%	51%
RSAN058	-5%	-4%	-3%	-3%	-2%	-1%	1%	1%	-1%	-1%	-2%	-1%
S-49 Beldon's Landing	9%	2%	8%	0%	7%	0%	3%	-2%	7%	0%	20%	5%
SWP	9%	15%	14%	24%	16%	25%	23%	30%	22%	28%	16%	21%

5.4.1 Tidally averaged EC time series

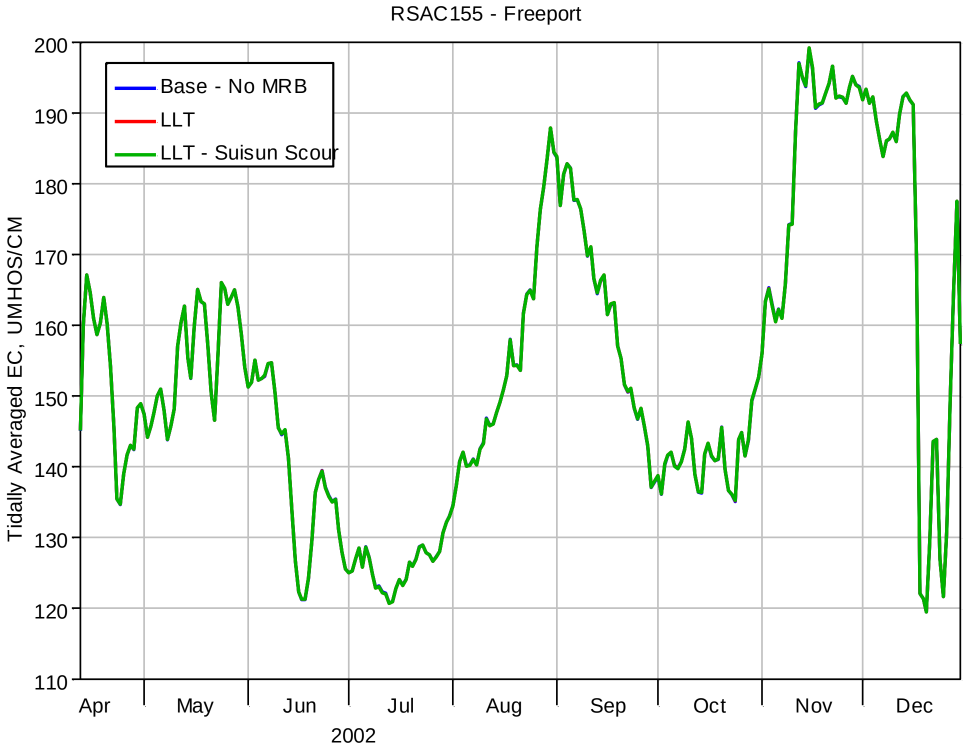


Figure 5-78 Tidally averaged EC at RSAC155 for Base-No MRB, LLT and LLT-Suisun Scour.

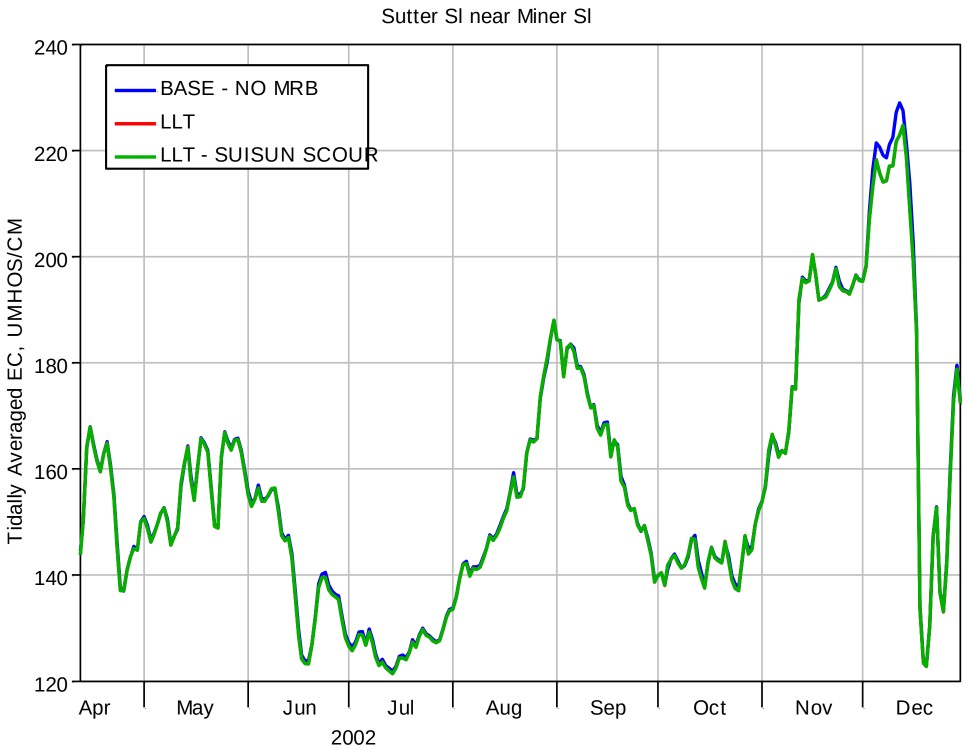


Figure 5-79 Tidally averaged EC in Sutter Slough for Base-No MRB, LLT and LLT-Suisun Scour.

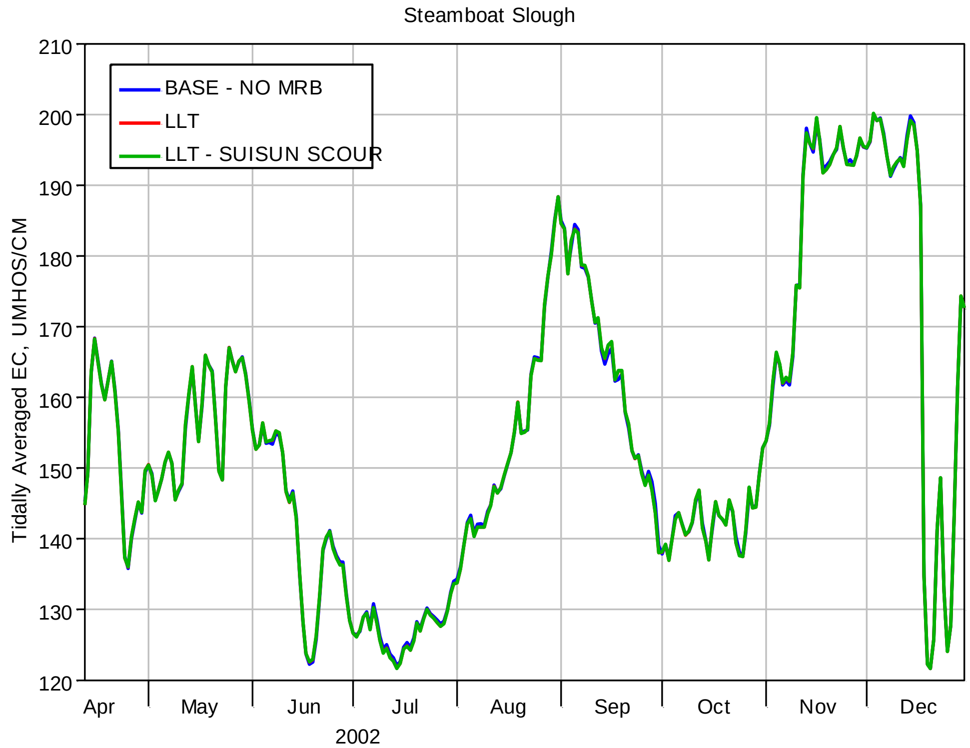


Figure 5-80 Tidally averaged EC in Steamboat Slough for Base-No MRB, LLT and LLT-Suisun Scour.

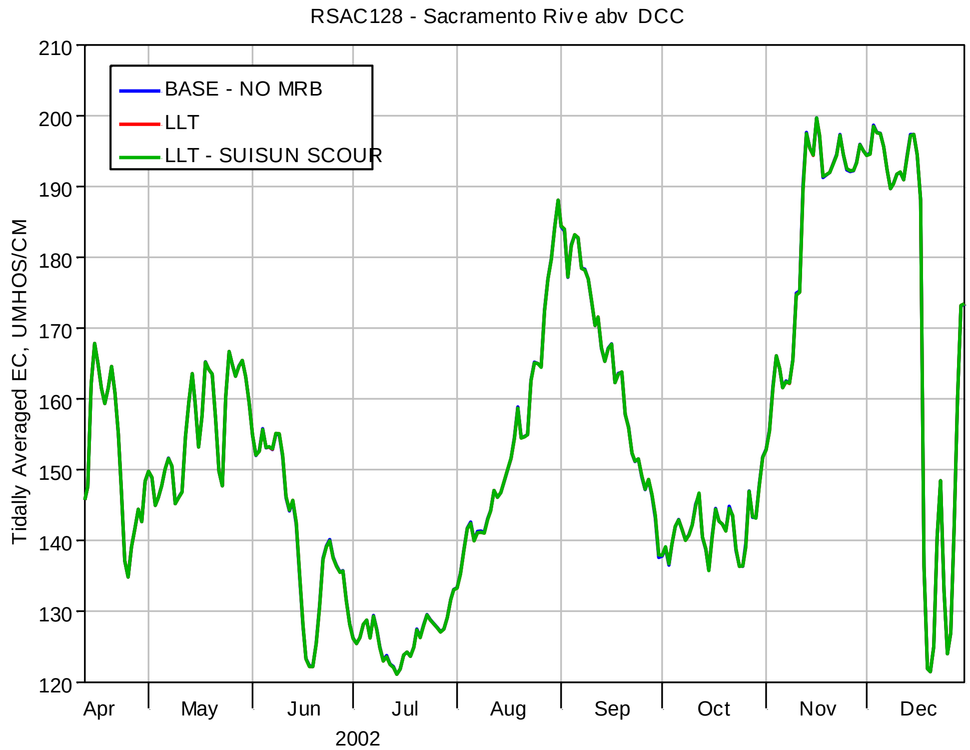


Figure 5-81 Tidally averaged EC at RSAC128 for Base-No MRB, LLT and LLT-Suisun Scour.

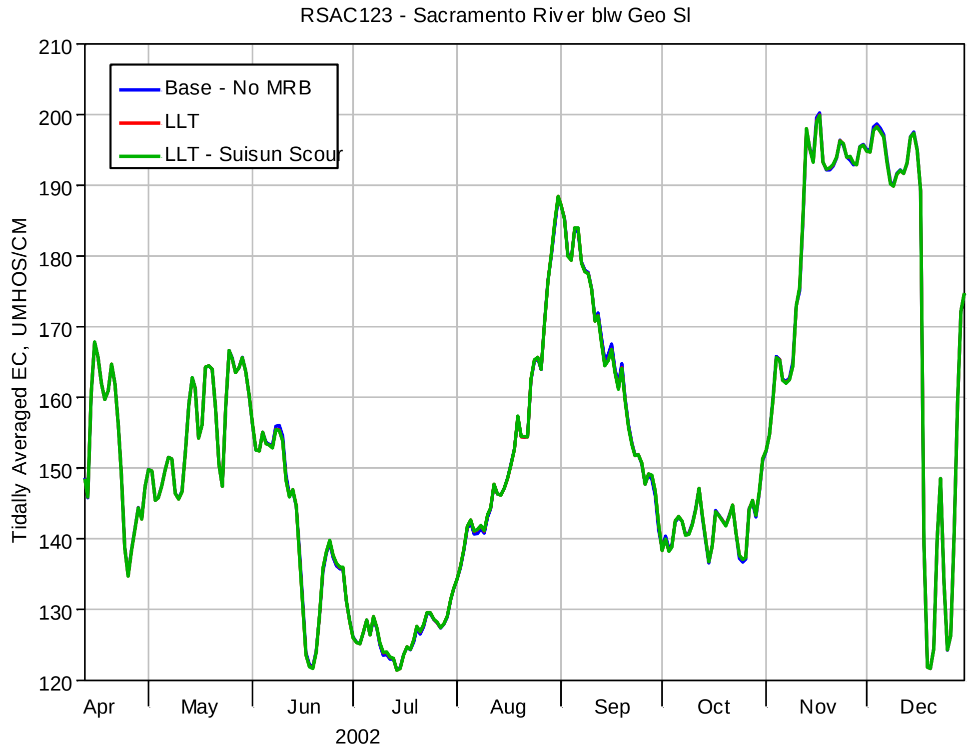


Figure 5-82 Tidally averaged EC at RSAC123 for Base-No MRB, LLT and LLT-Suisun Scour.

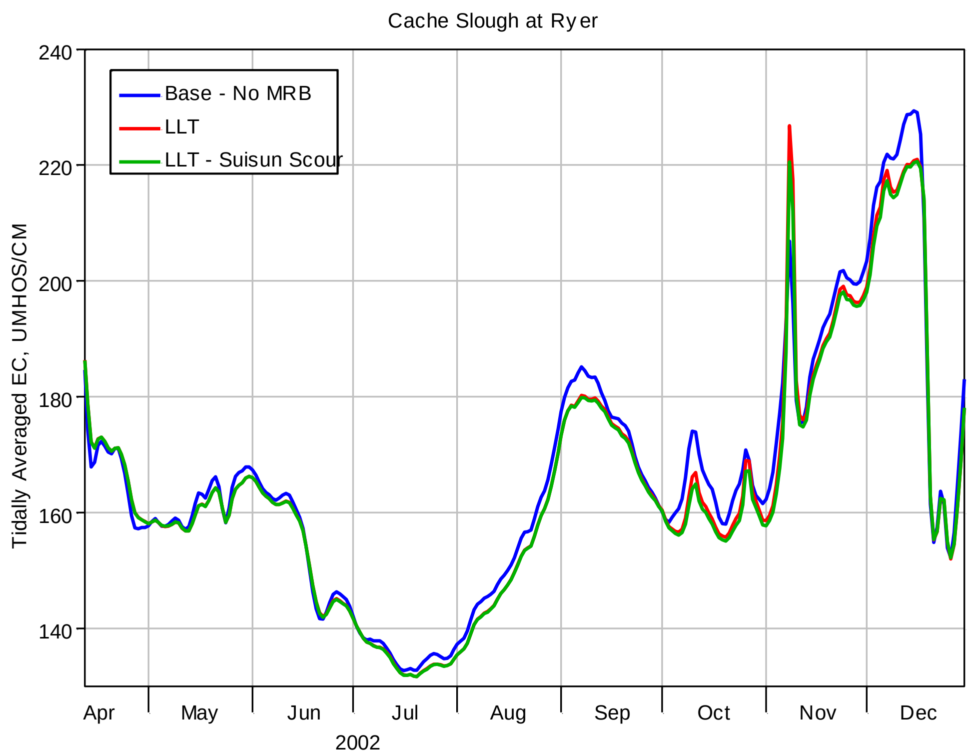


Figure 5-83 Tidally averaged EC at Cache Slough at Ryer for Base-No MRB, LLT and LLT-Suisun Scour.

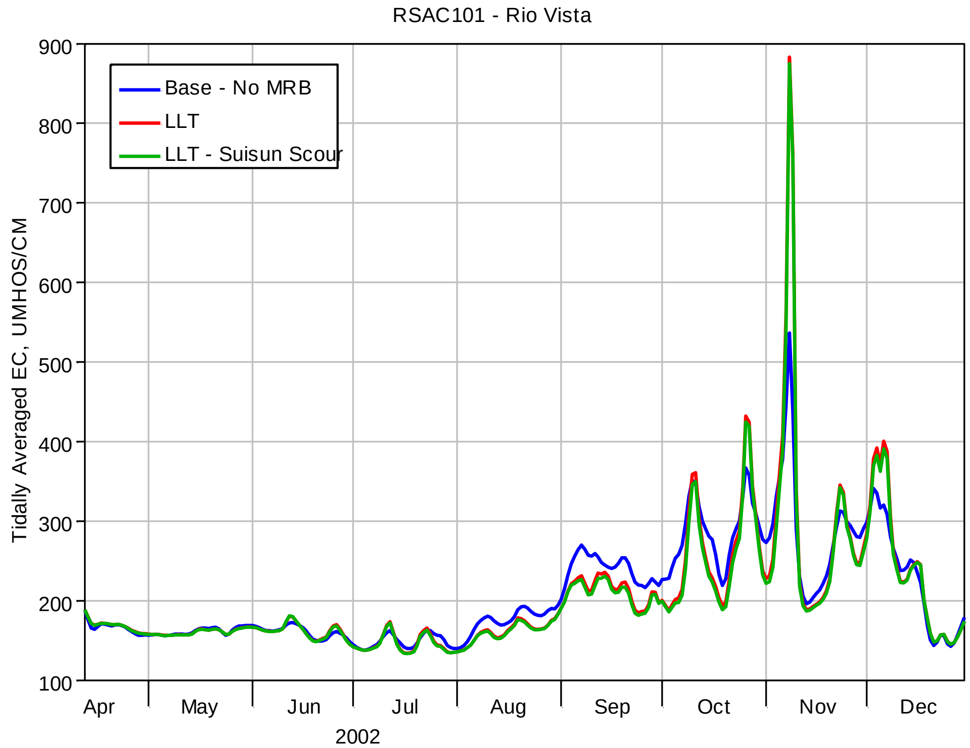


Figure 5-84 Tidally averaged EC at RSAC101 for Base-No MRB, LLT and LLT-Suisun Scour.

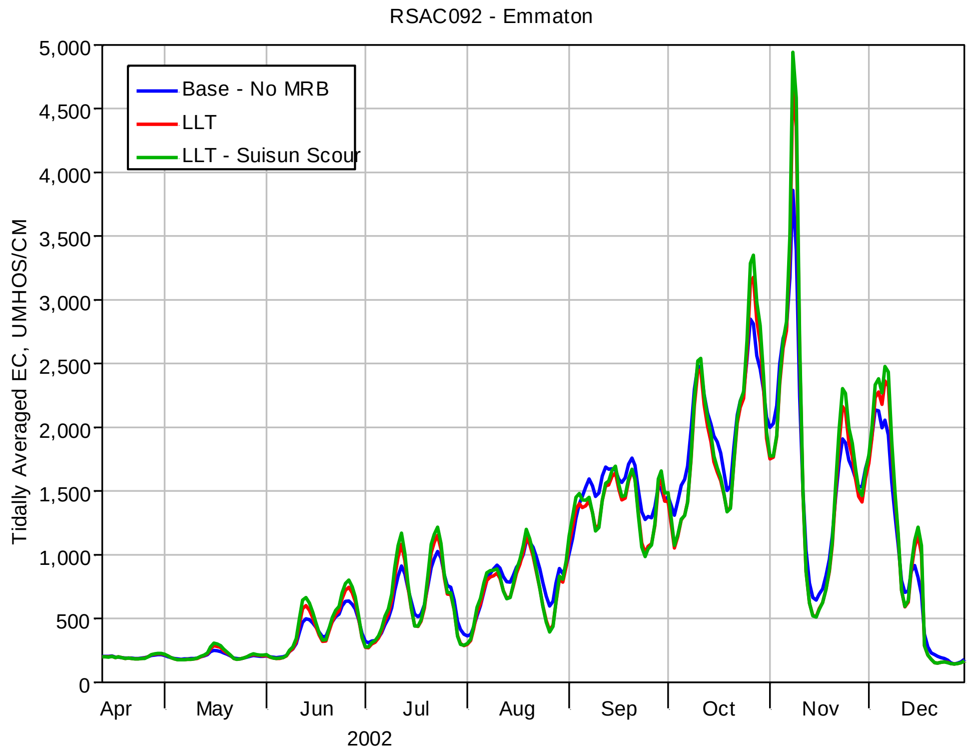


Figure 5-85 Tidally averaged EC at RSAC092 for Base-No MRB, LLT and LLT-Suisun Scour.

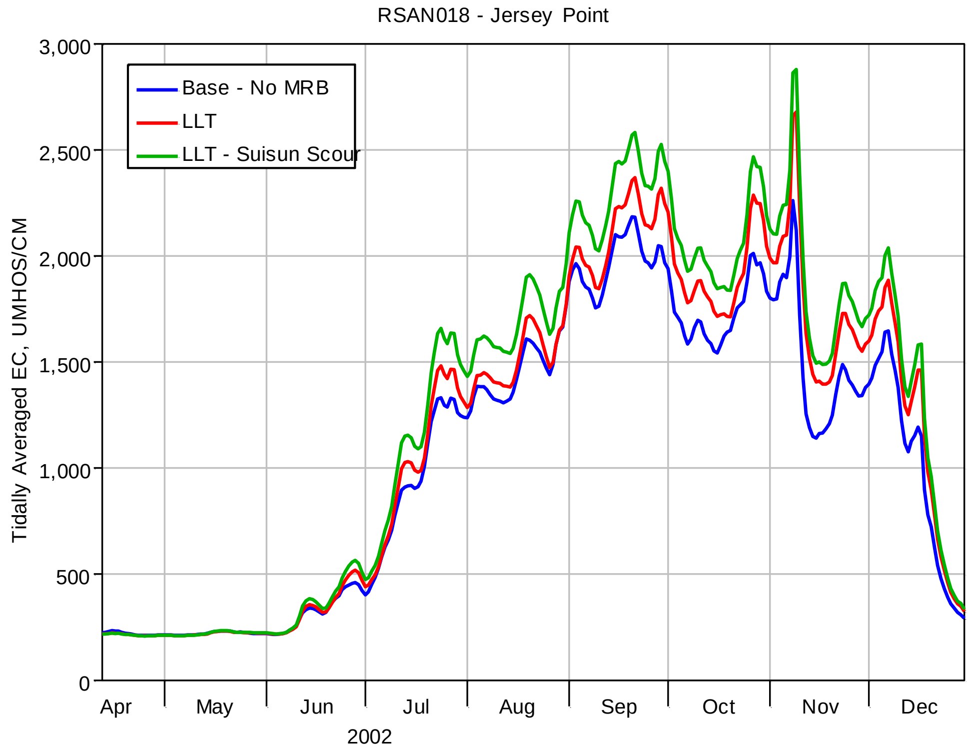


Figure 5-86 Tidally averaged EC at RSAN018 for Base-No MRB, LLT and LLT-Suisun Scour.

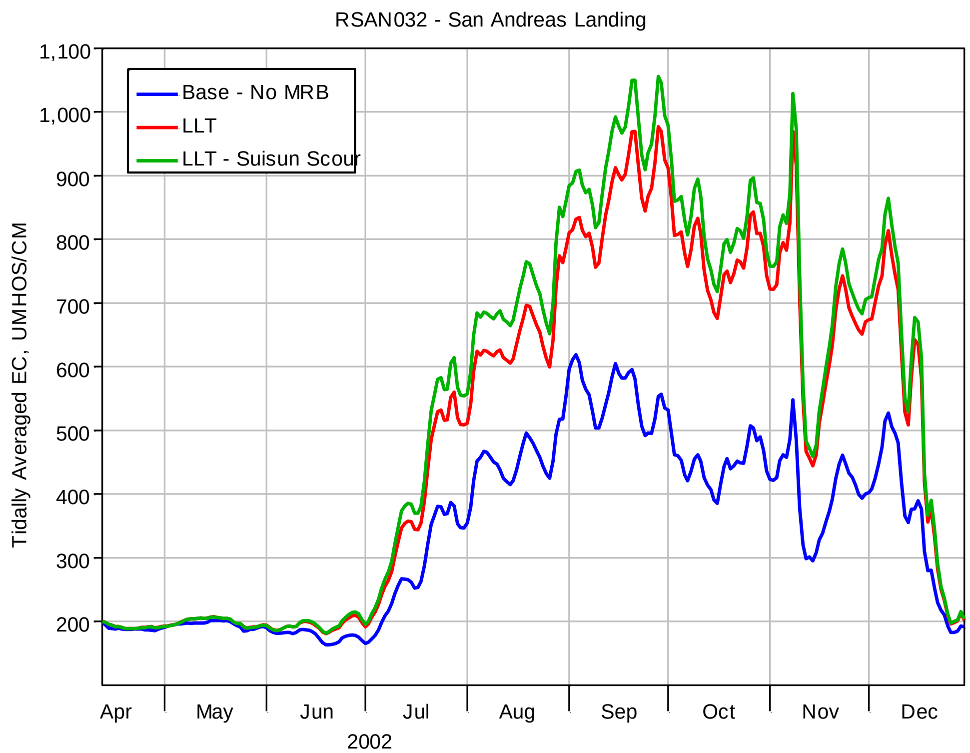


Figure 5-87 Tidally averaged EC at RSAN032 for Base-No MRB, LLT and LLT-Suisun Scour.

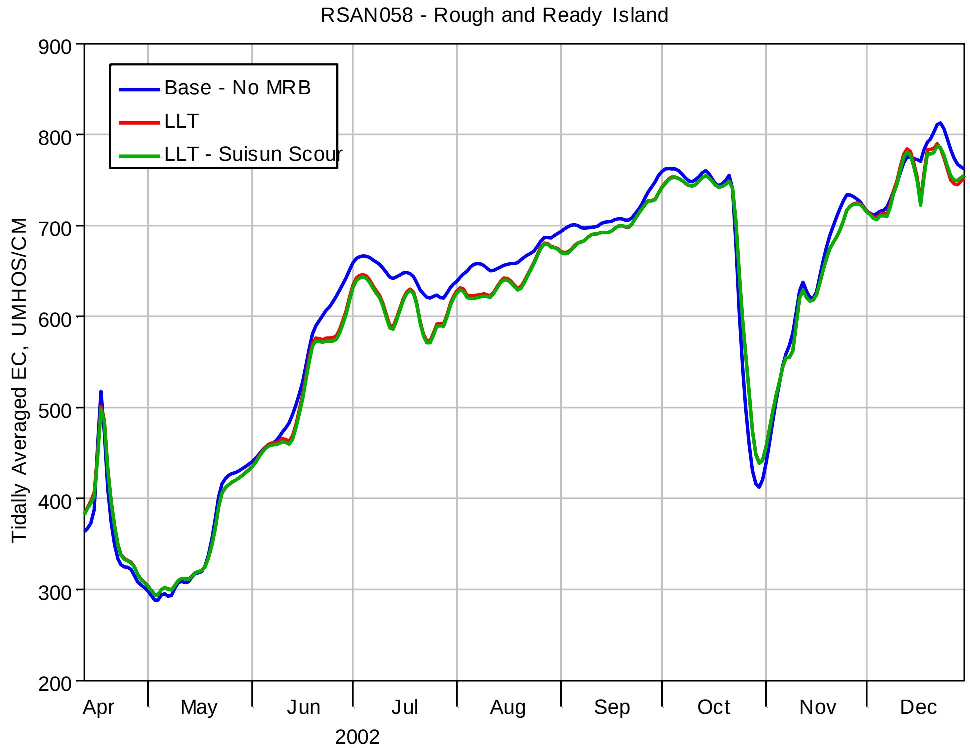


Figure 5-88 Tidally averaged EC at RSAN058 for Base-No MRB, LLT and LLT-Suisun Scour.

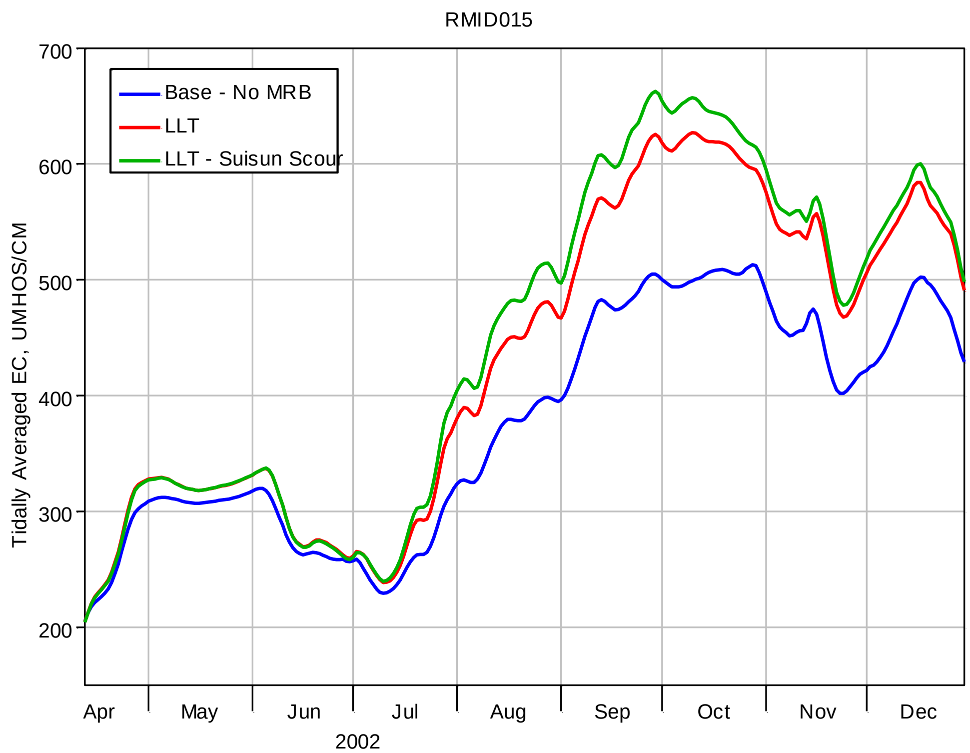


Figure 5-89 Tidally averaged EC at RMID015 for Base-No MRB, LLT and LLT-Suisun Scour.

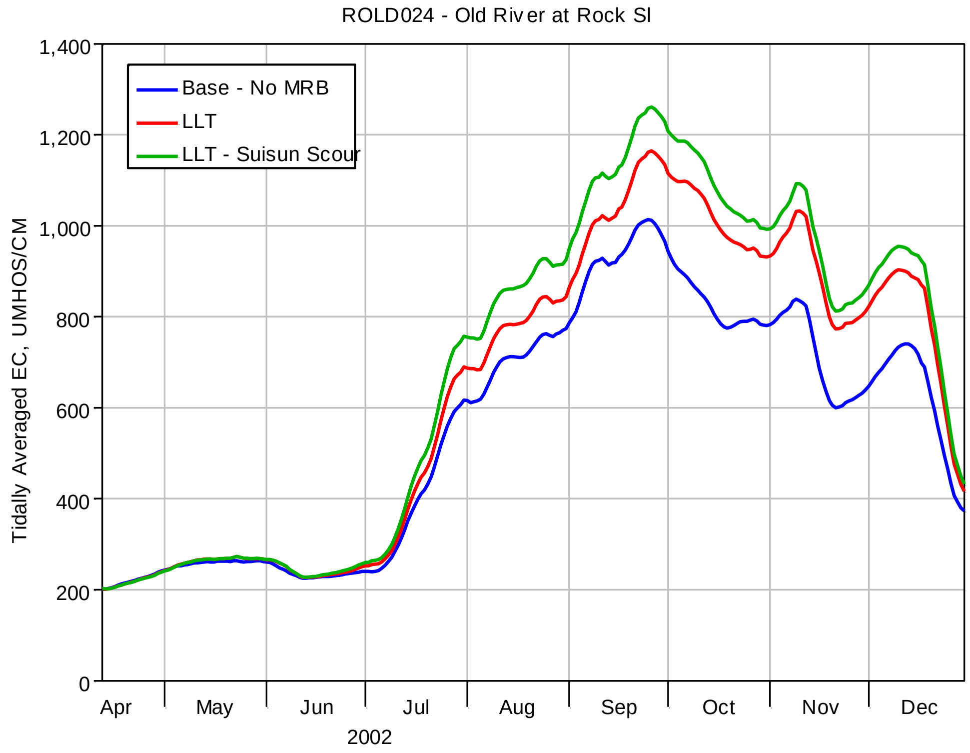


Figure 5-90 Tidally averaged EC at ROLD024 for Base-No MRB, LLT and LLT-Suisun Scour.

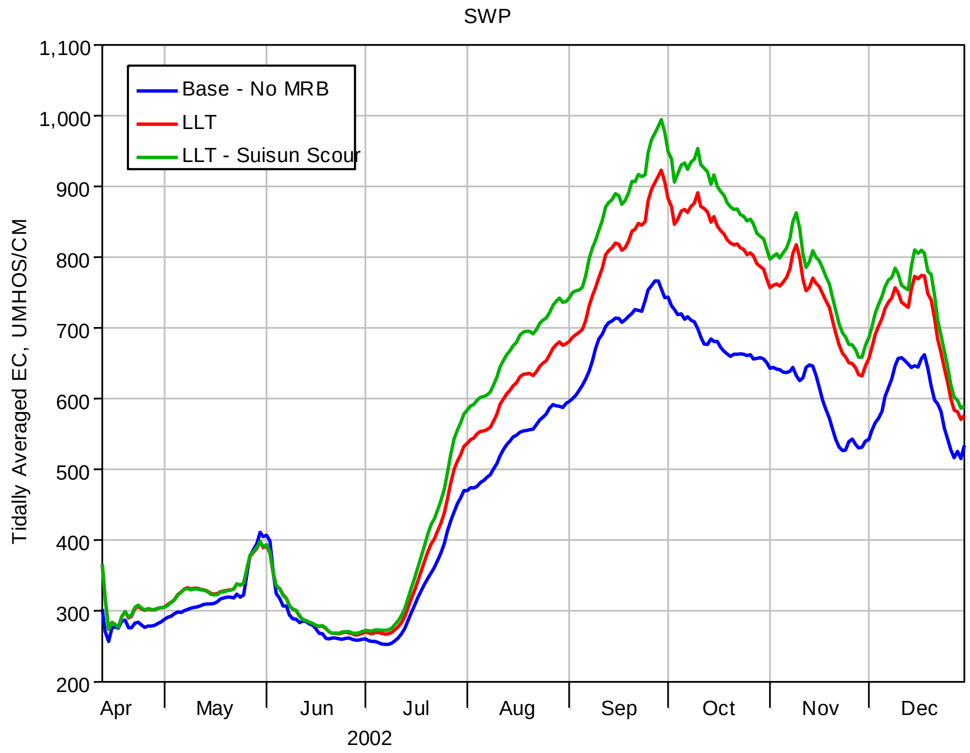


Figure 5-91 Tidally averaged EC at SWP for Base-No MRB, LLT and LLT-Suisun Scour.

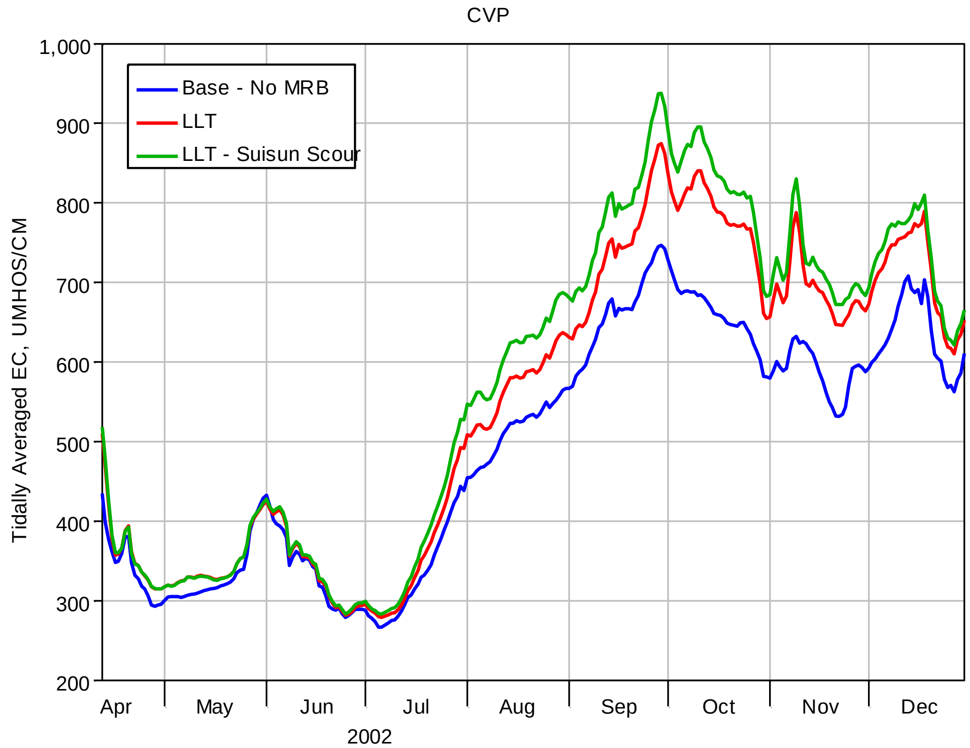


Figure 5-92 Tidally averaged EC at CVP for Base-No MRB, LLT and LLT-Suisun Scour.

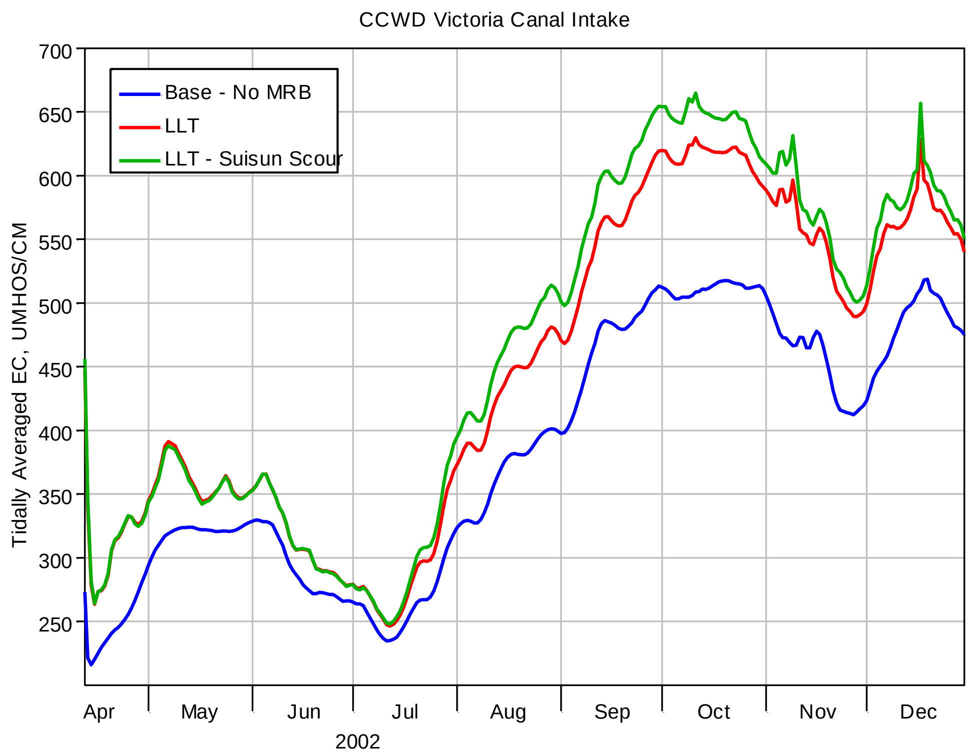


Figure 5-93 Tidally averaged EC at CCWD for Base-No MRB, LLT and LLT-Suisun Scour.

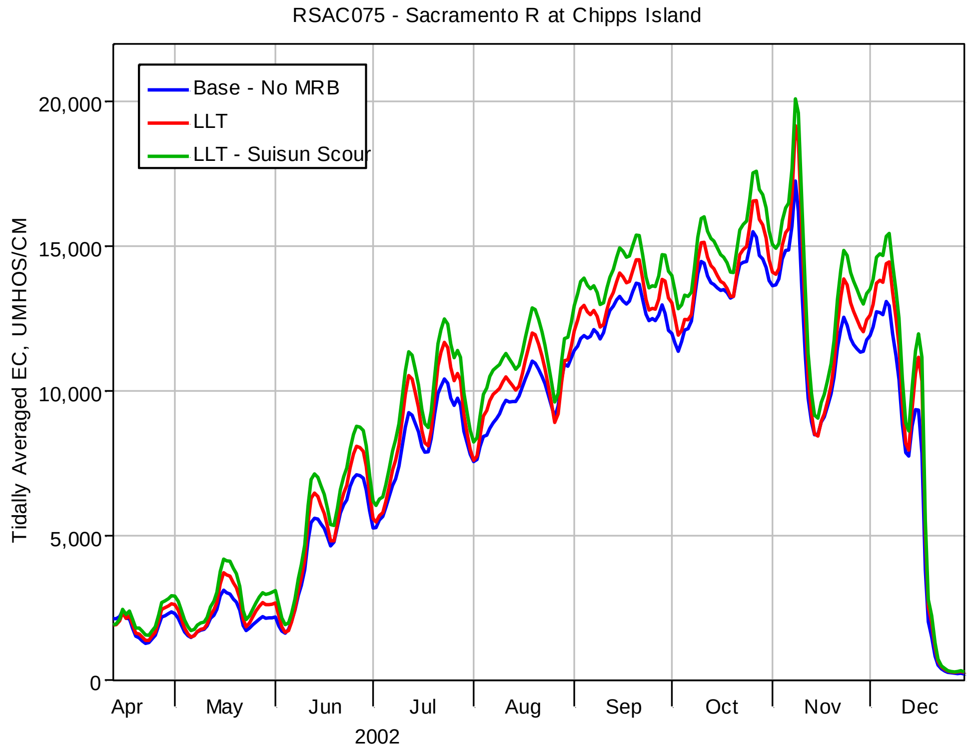


Figure 5-94 Tidally averaged EC at RSAC075 for Base-No MRB, LLT and LLT-Suisun Scour.

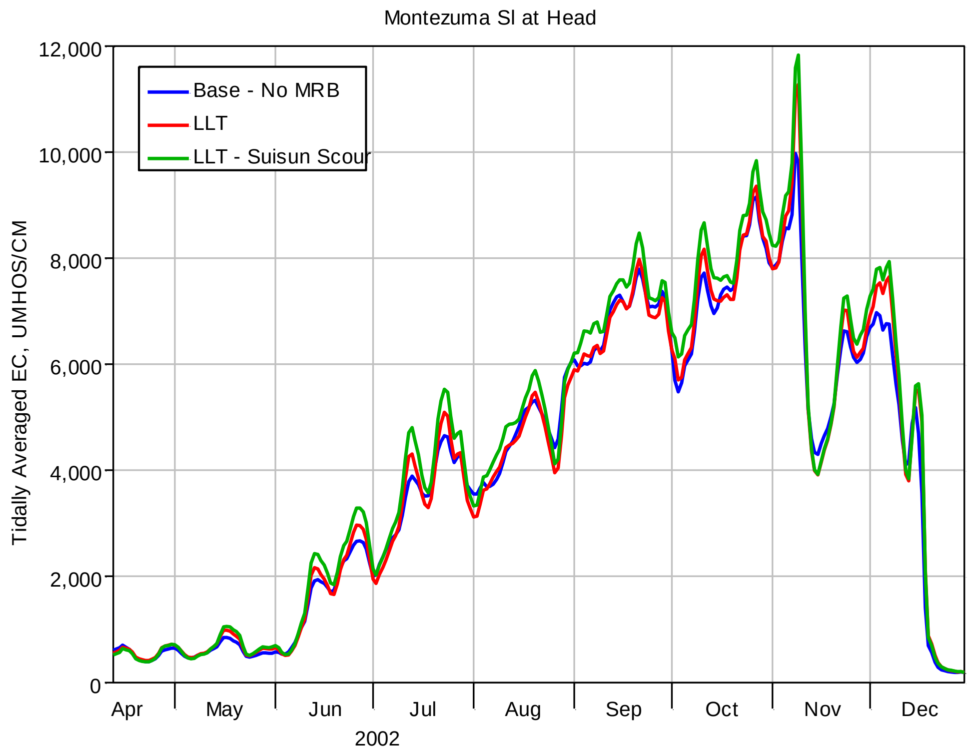


Figure 5-95 Tidally averaged EC at Montezuma Sl at Head for Base-No MRB, LLT and LLT-Suisun Scour.

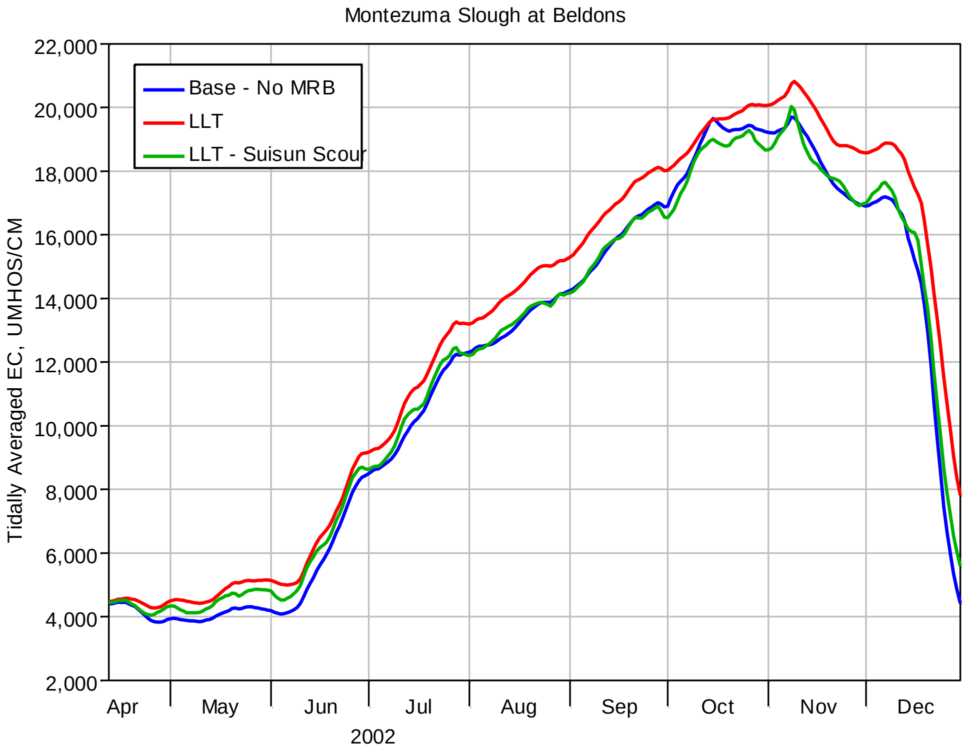


Figure 5-96 Tidally averaged EC at Montezuma Slough at Beldon's for Base-No MRB, LLT and LLT-Suisun Scour.

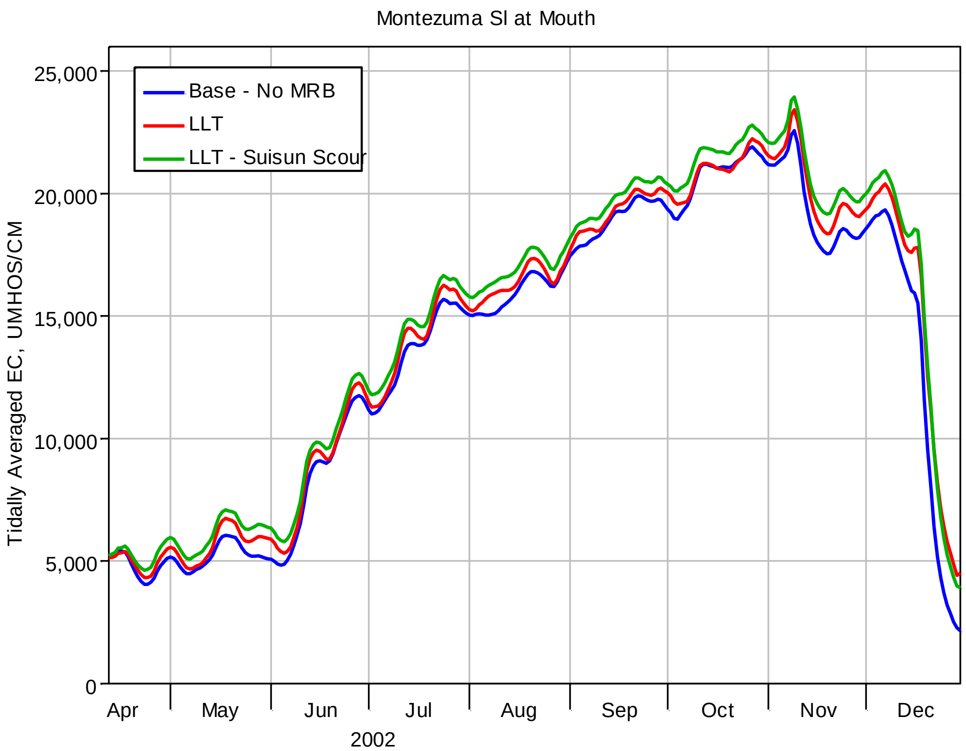


Figure 5-97 Tidally averaged EC at Montezuma Sl at Mouth for Base-No MRB, LLT and LLT-Suisun Scour.

5.4.2 Spatial Plots of EC Change

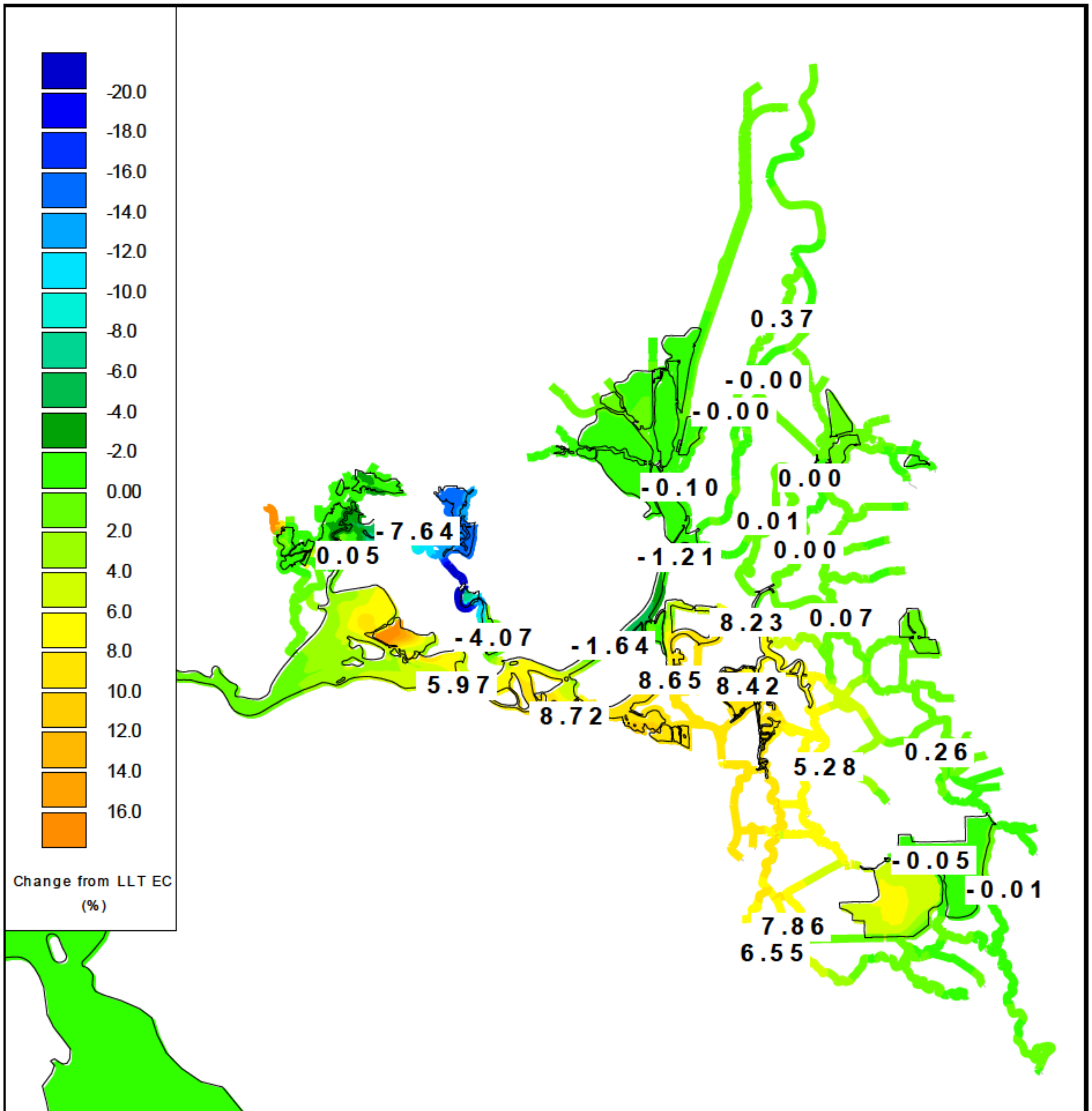


Figure 5-98 Contour plots of LLT – Suisun Scour change from LLT tidally averaged EC on September 24, 2002.

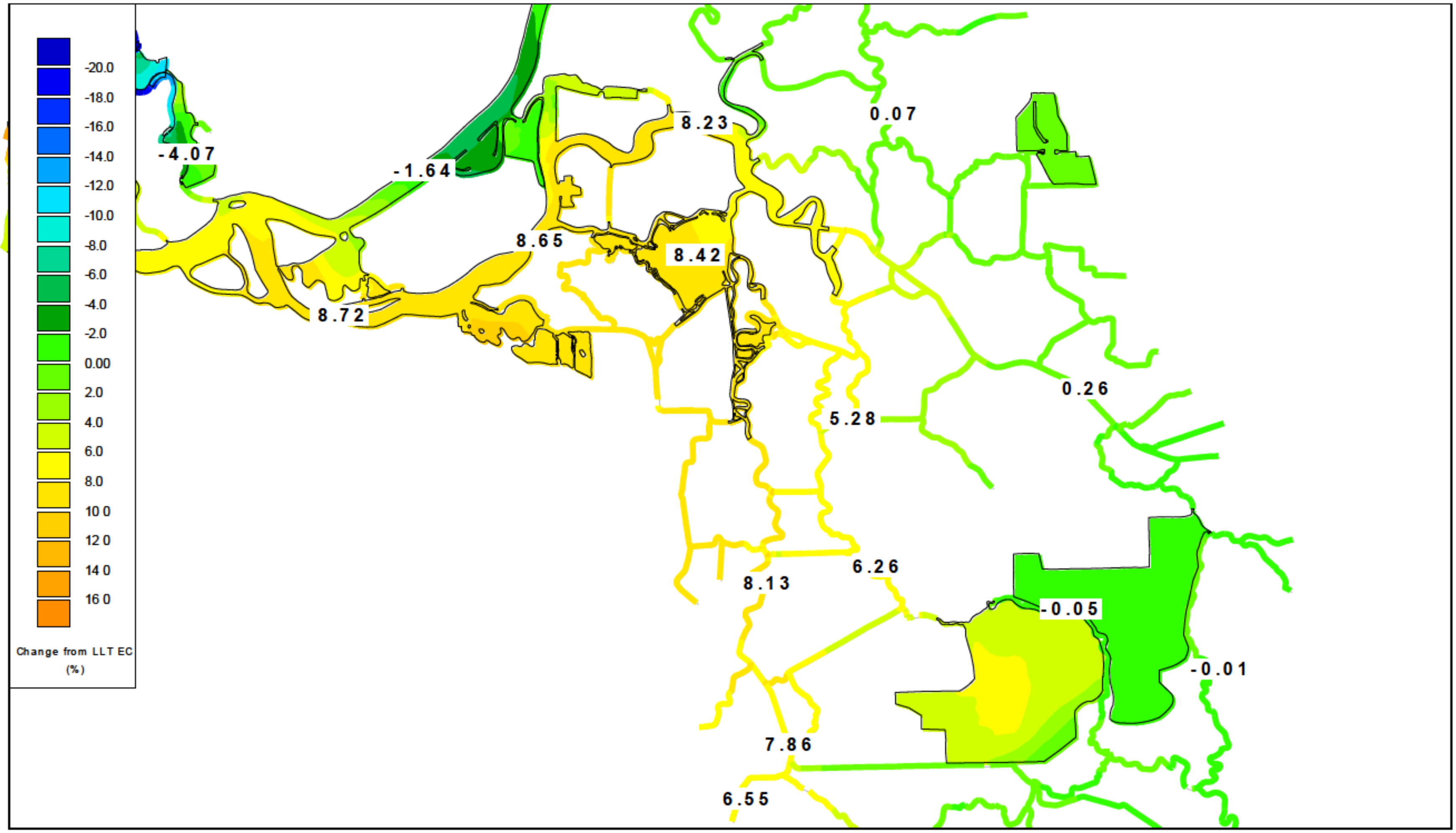


Figure 5-99 Contour plots of LLT – Suisun Scour change from LLT tidally averaged EC in south Delta on September 24, 2002.

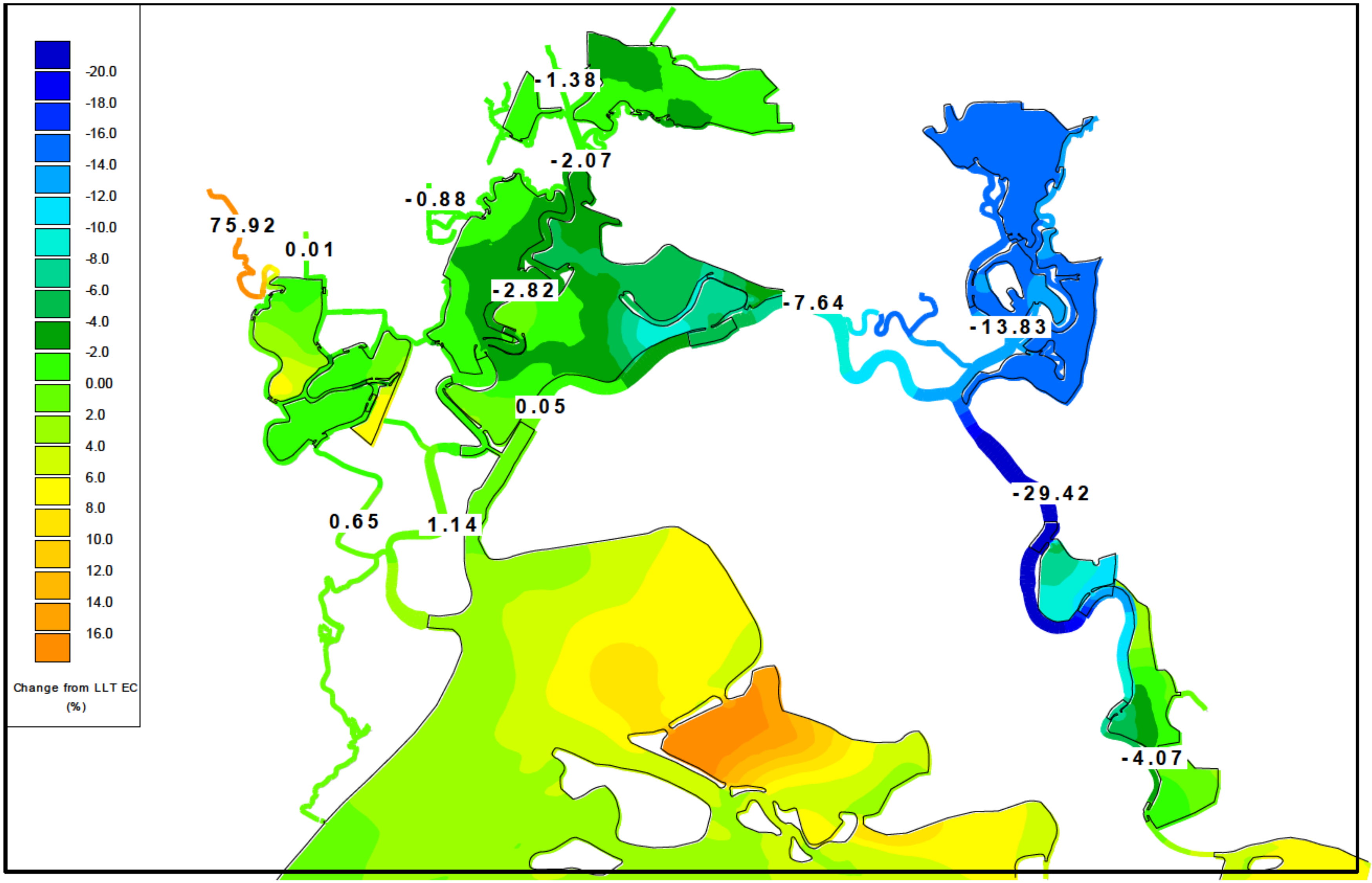


Figure 5-100 Contour plots of LLT – Suisun Scour change from LLT tidally averaged EC in Suisun Marsh on September 24, 2002.

5.4.3 X2 Time Series

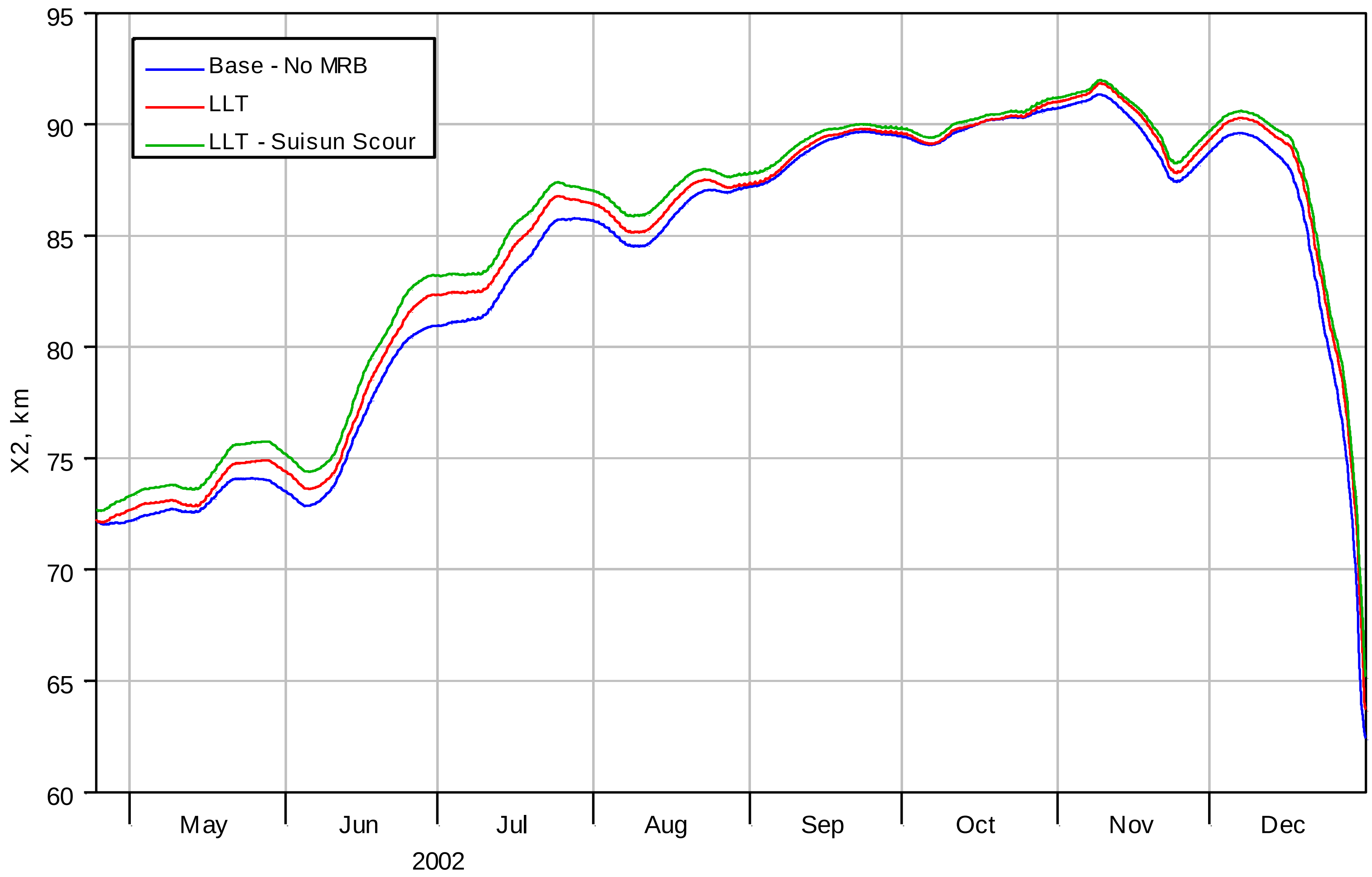


Figure 5-101 Time series of X2 for Base - No MRB, LLT and LLT – Suisun Scour.

5.5 ELT – Prospect Breach

Time series plots of tidally averaged EC for the ELT – Prospect Breach case, compared with Base and ELT results are provided in Figure 5-102 through Figure 5-121. EC in the north Delta is low overall and thus changes are small in magnitude. The difference between the ELT and ELT – Prospect Breach EC in Cache Slough at Ryer is generally less than +/-2 umhos/cm. Aside from localized impacts near Prospect Island, the largest EC impacts from the ELT – Prospect Breach case are due to the increased flow in DCC and Georgiana Slough, which causes EC in San Joaquin River at San Andreas, and in Old and Middle River to decline by about 2 – 3% relative to ELT. EC impacts along the Sacramento River and in Suisun Marsh are minimal. None of the scenarios impact EC at Freeport.

Contour plots of tidally averaged EC percent change from ELT on September 24, 2002 are shown in Figure 5-123 through Figure 5-125 for the Delta, the south and central Delta, for Suisun Marsh and for the Cache Slough ROA. These plots show that at this time, throughout most of the model domain, the LLT – No South case results in small EC changes (within +/-2% or less) relative to ELT. There are localized increases in the Cache Slough ROA in the Sacramento Deepwater Ship Channel and in Prospect Island due to removal of the Prospect Island breach and the subsequent elimination of flow conveyance from Miner Slough through Prospect Island to the Ship Channel. Changes in Suisun Marsh are minimal – less than 0.5%.

A summary of July – December 2002 monthly average EC at key locations throughout the Delta is provided in Table 5-9 for Base – No SMSCG, ELT and ELT – Prospect Breach. Percent change in monthly average EC relative to the base case are provided in Table 5-10 for ELT and ELT – Prospect Breach.

Removal of the Prospect Breach has minimal impact on X2, as shown in Figure 5-126. Differences between ELT and ELT – Prospect Breach are less than 0.1 km.

Table 5-9 Summary of July - December 2002 monthly average EC for Base - No SMSCG, ELT and ELT – Prospect Breach.

	Monthly Average EC (umhos/cm)																	
	July 2002			August 2002			September 2002			October 2002			November 2002			December 2002		
Location	Base - No SMSCG	ELT	ELT - Prospect Breach	Base - No SMSCG	ELT	ELT - Prospect Breach	Base - No SMSCG	ELT	ELT - Prospect Breach	Base - No SMSCG	ELT	ELT - Prospect Breach	Base - No SMSCG	ELT	ELT - Prospect Breach	Base - No SMSCG	ELT	ELT - Prospect Breach
Cache Sl at Ryer	136	134	135	153	151	152	176	174	173	164	157	158	189	184	185	196	192	193
CCWD Victoria Canal	265	274	271	369	400	390	468	513	502	509	561	550	452	484	475	483	513	506
CVP	334	341	337	517	540	529	665	698	687	658	713	700	587	627	616	631	661	653
Montezuma Sl at Head	3539	3254	3268	4653	4294	4316	6856	6412	6442	7404	7064	7086	6557	6322	6343	3148	3132	3141
Montezuma Sl at Mouth	13705	14342	14348	15976	16618	16631	18956	19533	19549	20763	21199	21215	19462	20292	20306	12058	13439	13450
RMID015	262	272	269	369	401	391	471	517	506	504	556	545	441	475	466	464	494	487
RMID023	263	273	270	369	400	391	469	514	503	507	559	548	447	480	471	477	507	500
ROLD024	402	409	401	709	725	712	937	967	951	828	901	883	713	782	765	607	652	638
ROLD034	361	368	362	617	638	626	805	838	824	755	822	806	651	710	695	601	646	634
RSAC075 Chipps Island	8211	7983	7990	9743	9397	9411	12563	12203	12221	13607	13119	13135	11989	11729	11742	6033	6014	6020
RSAC092 Emmaton	624	563	568	809	696	705	1499	1288	1308	2015	1791	1814	1749	1612	1631	821	789	795
RSAC101 Rio Vista	148	142	142	176	162	163	240	207	208	284	239	242	290	269	273	222	216	217
RSAC123	127	127	127	154	154	154	165	165	165	142	142	142	184	184	184	169	169	169
RSAC155 Freeport	126	126	126	156	156	156	162	162	162	142	142	142	184	184	184	164	164	164
RSAN018 Jersey Pt	955	943	934	1462	1422	1413	1977	1956	1943	1730	1750	1734	1504	1572	1554	945	980	968
RSAN032 San Andreas	285	341	333	460	573	561	557	741	725	449	632	614	404	549	533	333	411	400
RSAN058	650	658	660	673	684	685	716	724	725	674	674	674	637	640	641	763	771	773
S-49 Beldon's Landing	10401	11241	11251	13265	14198	14218	15825	16810	16833	18853	19376	19395	18356	19374	19391	12763	14636	14659
SWP	330	338	333	541	565	554	698	736	722	681	744	730	593	643	630	594	630	619

Table 5-10 Summary of July - December 2002 percent change in monthly average EC for ELT and ELT – Prospect Breach relative to Base - No SMSCG.

	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Case											
	July 2002		August 2002		September 2002		October 2002		November 2002		December 2002	
Location	ELT	ELT - Prospect Breach	ELT	ELT - Prospect Breach	ELT	ELT - Prospect Breach	ELT	ELT - Prospect Breach	ELT	ELT - Prospect Breach	ELT	ELT - Prospect Breach
Cache Sl at Ryer	-1%	0%	-1%	-1%	-1%	-1%	-4%	-4%	-3%	-2%	-2%	-2%
CCWD Victoria Canal	3%	2%	8%	6%	9%	7%	10%	8%	7%	5%	6%	5%
CVP	2%	1%	4%	2%	5%	3%	8%	6%	7%	5%	5%	3%
Montezuma Sl at Head	-8%	-8%	-8%	-7%	-6%	-6%	-5%	-4%	-4%	-3%	-1%	0%
Montezuma Sl at Mouth	5%	5%	4%	4%	3%	3%	2%	2%	4%	4%	11%	12%
RMID015	4%	3%	9%	6%	10%	7%	10%	8%	8%	6%	6%	5%
RMID023	4%	2%	8%	6%	10%	7%	10%	8%	7%	5%	6%	5%
ROLD024	2%	0%	2%	0%	3%	2%	9%	7%	10%	7%	7%	5%
ROLD034	2%	0%	3%	1%	4%	2%	9%	7%	9%	7%	7%	5%
RSAC075 Chipps Island	-3%	-3%	-4%	-3%	-3%	-3%	-4%	-3%	-2%	-2%	0%	0%
RSAC092 Emmaton	-10%	-9%	-14%	-13%	-14%	-13%	-11%	-10%	-8%	-7%	-4%	-3%
RSAC101 Rio Vista	-4%	-4%	-8%	-7%	-14%	-14%	-16%	-15%	-7%	-6%	-2%	-2%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	-1%	-2%	-3%	-3%	-1%	-2%	1%	0%	4%	3%	4%	2%
RSAN032 San Andreas	20%	17%	24%	22%	33%	30%	41%	37%	36%	32%	23%	20%
RSAN058	1%	2%	2%	2%	1%	1%	0%	0%	1%	1%	1%	1%
S-49 Beldon's Landing	8%	8%	7%	7%	6%	6%	3%	3%	6%	6%	15%	15%
SWP	2%	1%	4%	2%	5%	3%	9%	7%	8%	6%	6%	4%

5.5.1 Tidally averaged EC time series

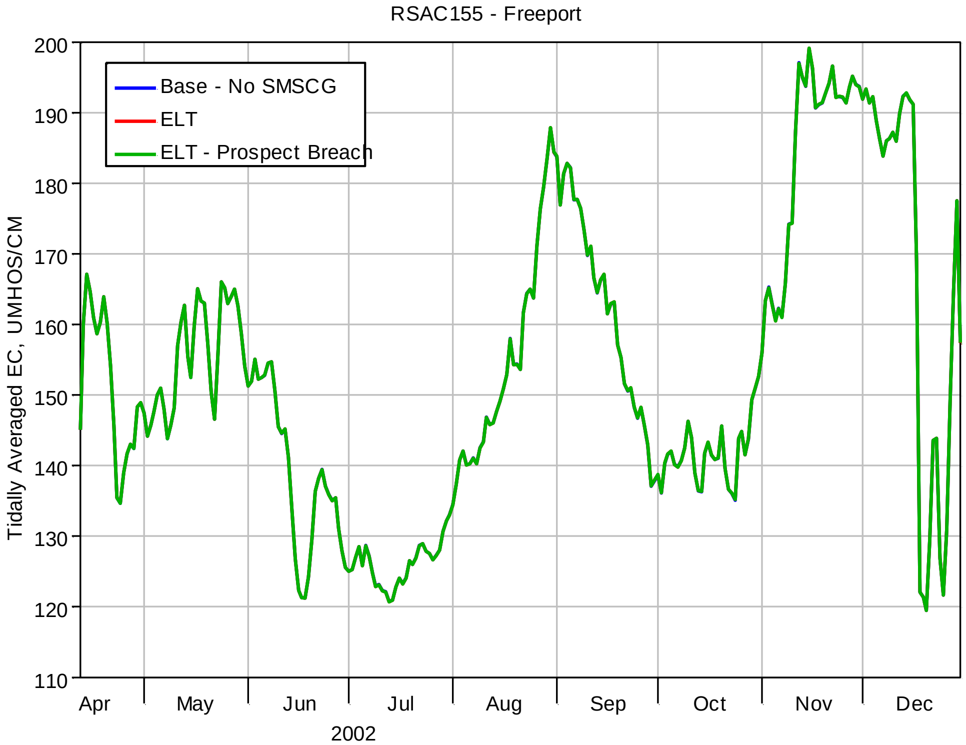


Figure 5-102 Tidally averaged EC at RSAC155 for Base-No SMSCG, ELT and ELT-Prospect Breach.

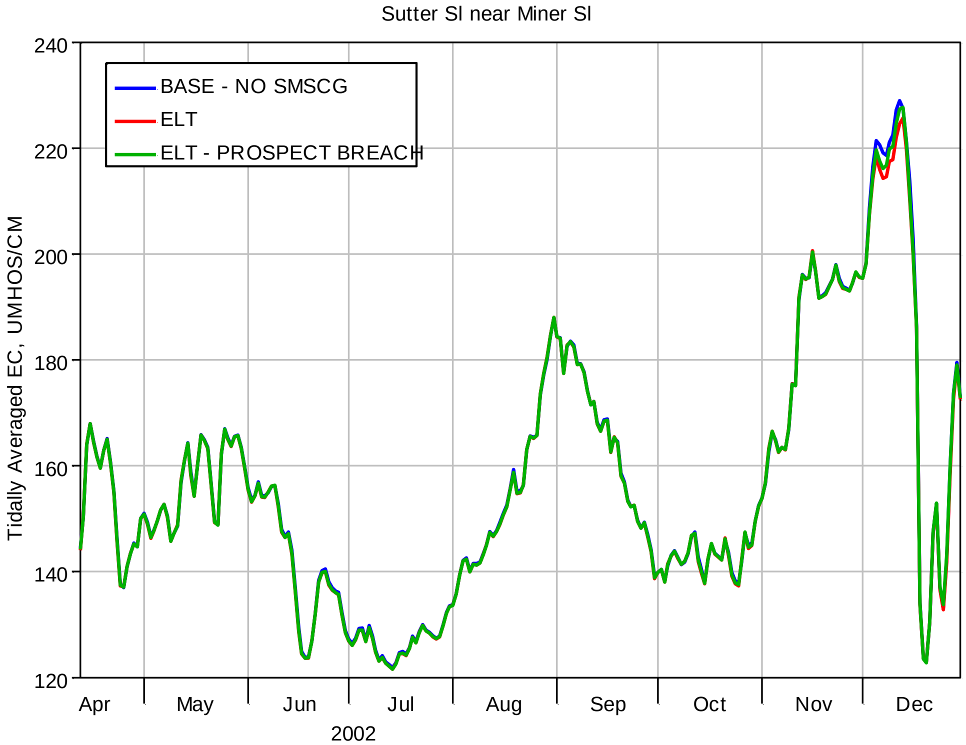


Figure 5-103 Tidally averaged EC in Sutter Slough for Base-No SMSCG, ELT and ELT-Prospect Breach.

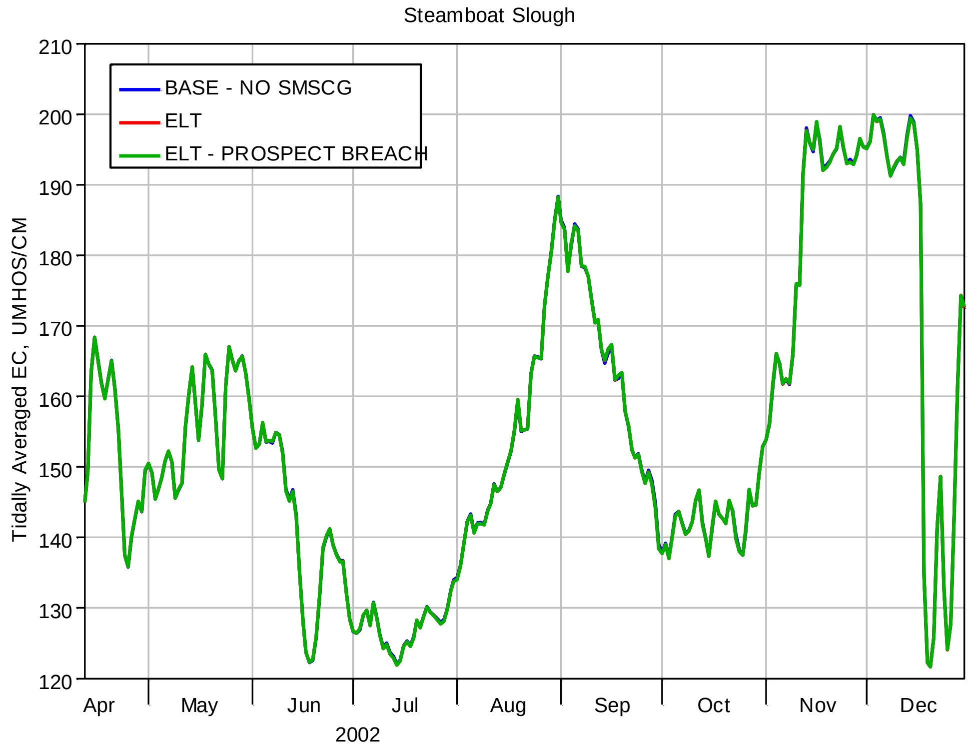


Figure 5-104 Tidally averaged EC in Steamboat Slough for Base-No SMSCG, ELT and ELT-Prospect Breach.

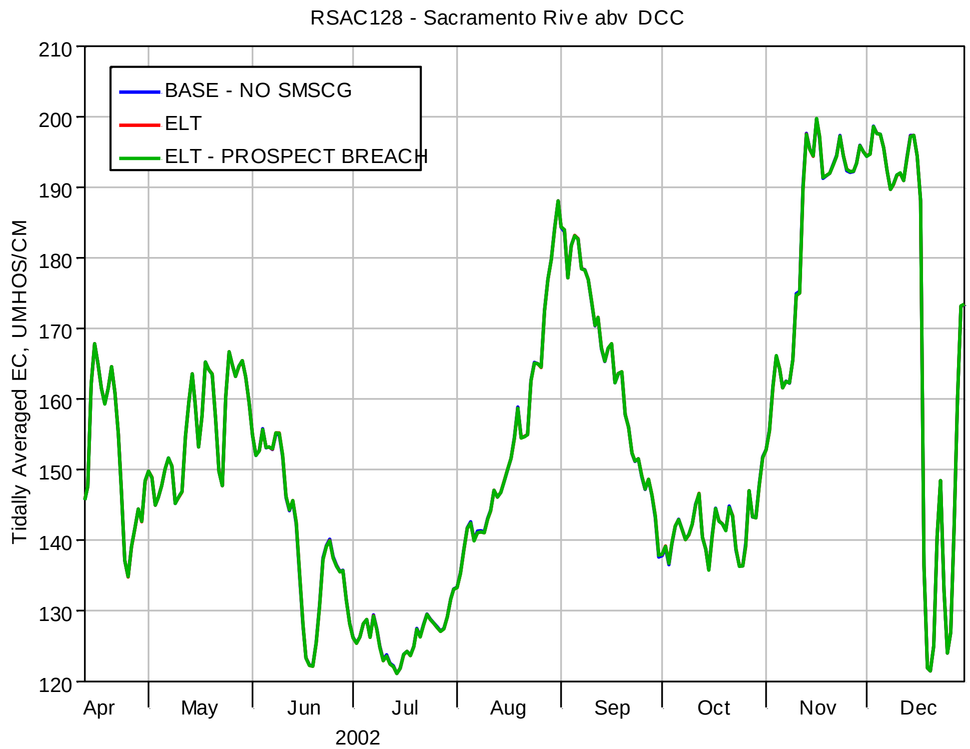


Figure 5-105 Tidally averaged EC at RSAC128 for Base-No SMSCG, ELT and ELT-Prospect Breach.

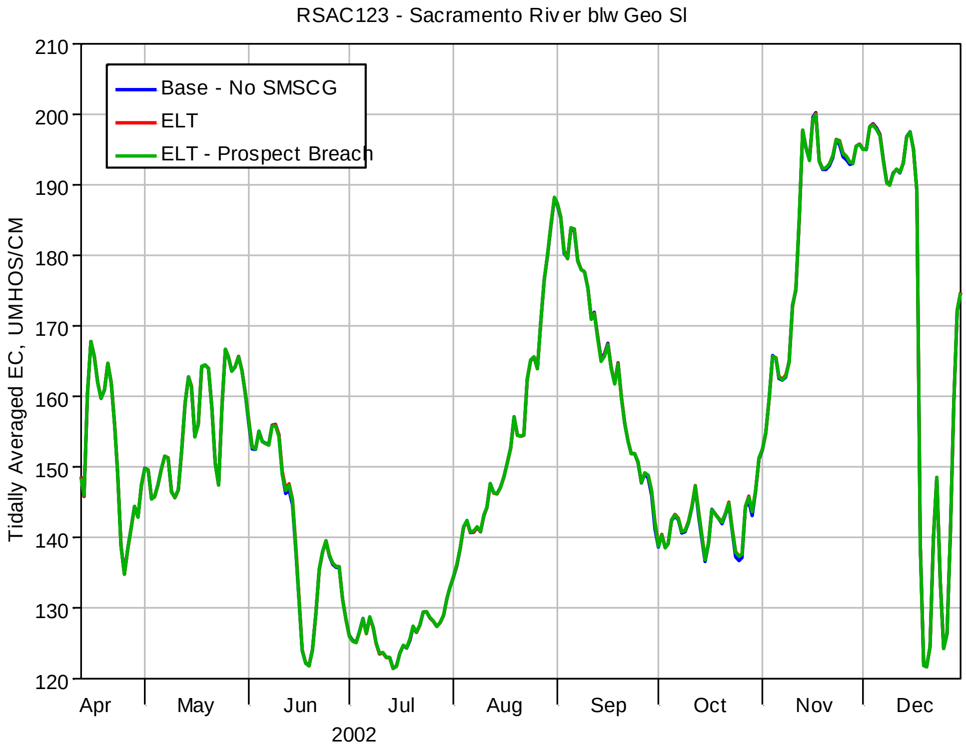


Figure 5-106 Tidally averaged EC at RSAC123 for Base-No SMSCG, ELT and ELT-Prospect Breach.

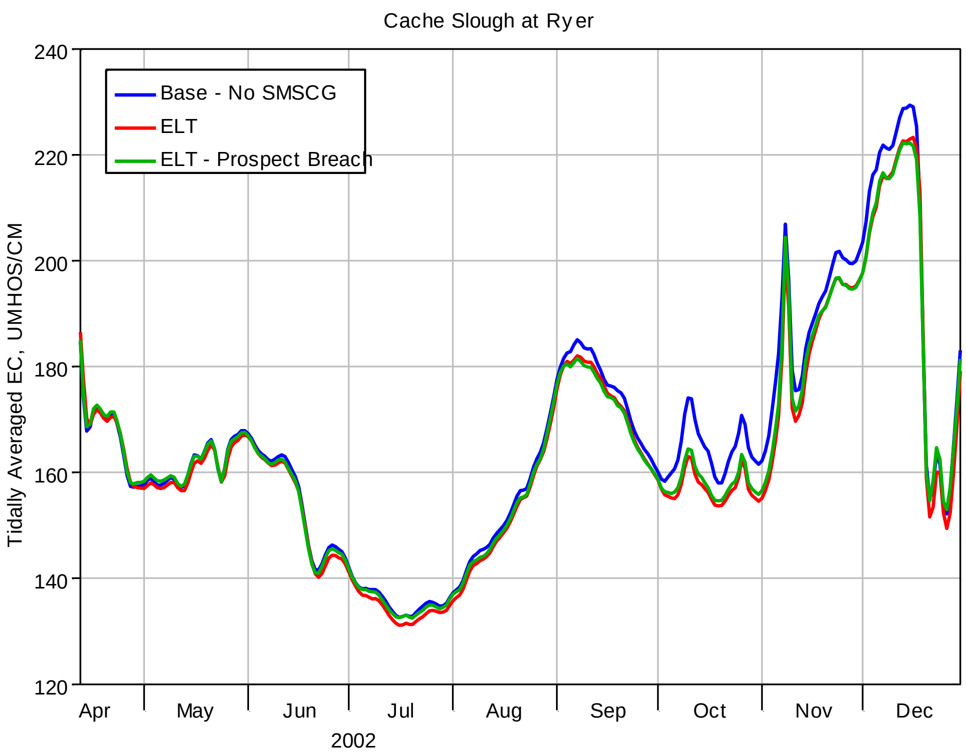


Figure 5-107 Tidally averaged EC at Cache Slough at Ryer for Base-No SMSCG, ELT and ELT-Prospect Breach.

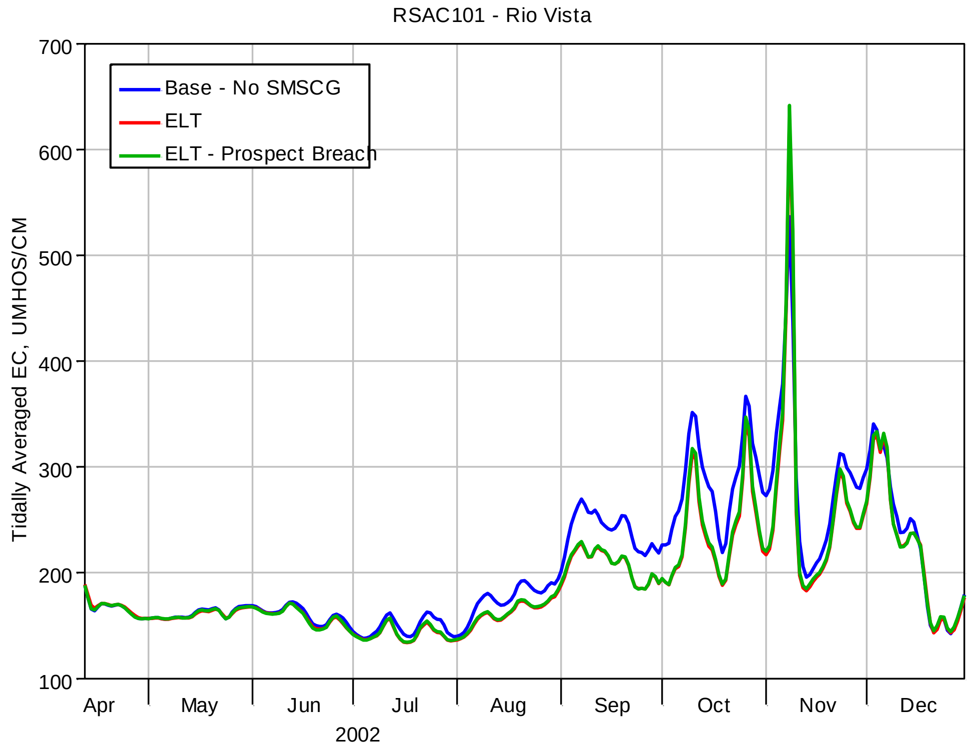


Figure 5-108 Tidally averaged EC at RSAC101 for Base-No SMSCG, ELT and ELT-Prospect Breach.

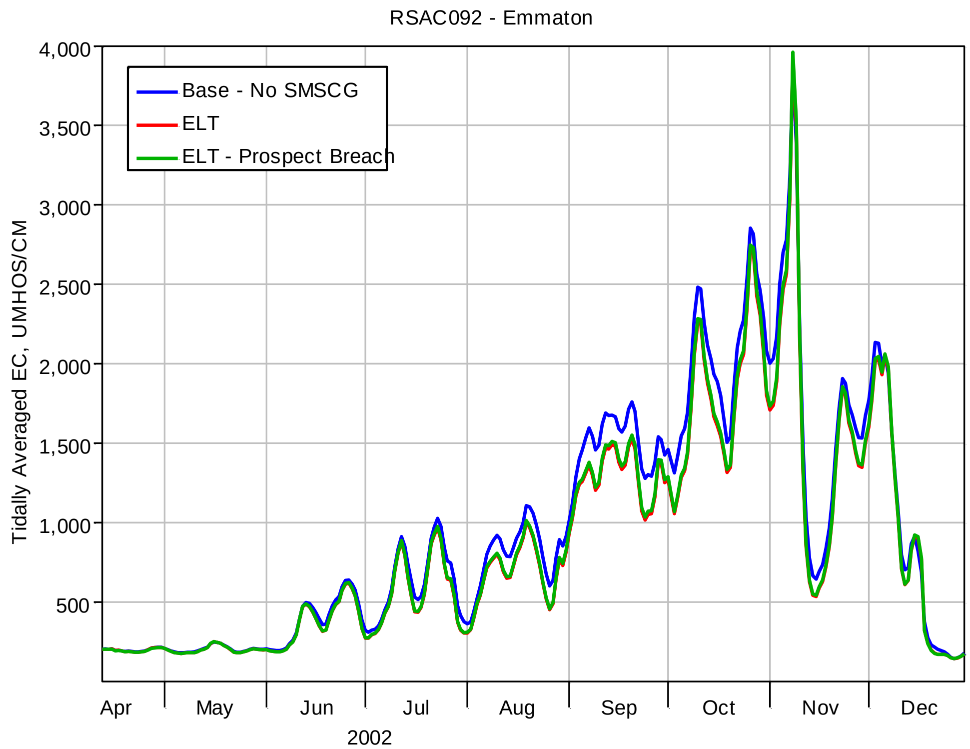


Figure 5-109 Tidally averaged EC at RSAC092 for Base-No SMSCG, ELT and ELT-Prospect Breach.

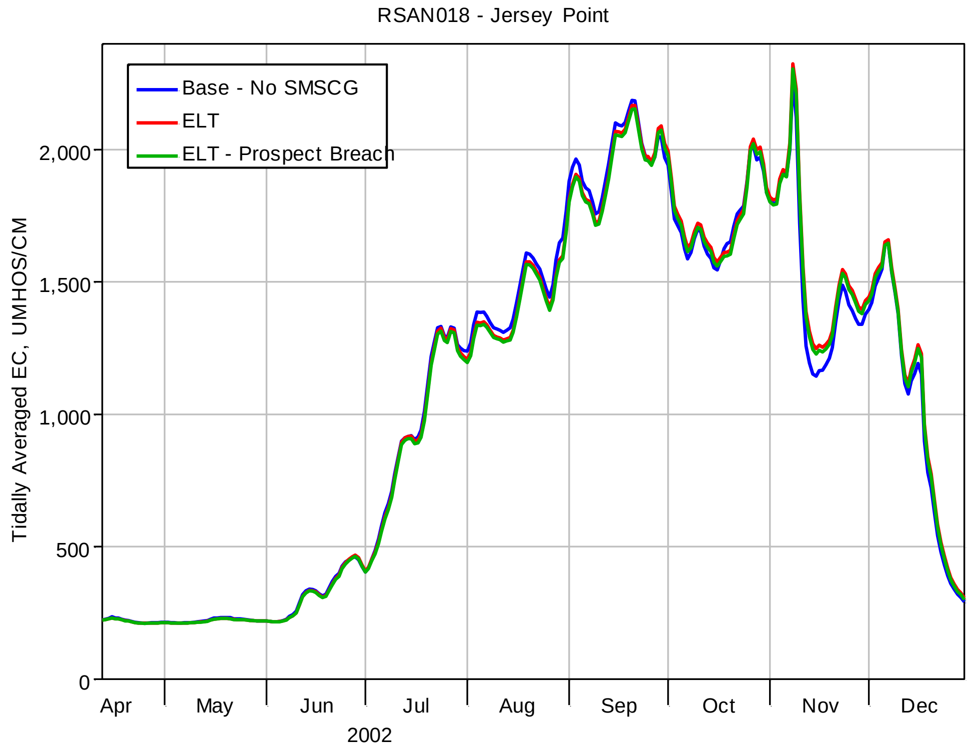


Figure 5-110 Tidally averaged EC at RSAN018 for Base-No SMSCG, ELT and ELT-Prospect Breach.

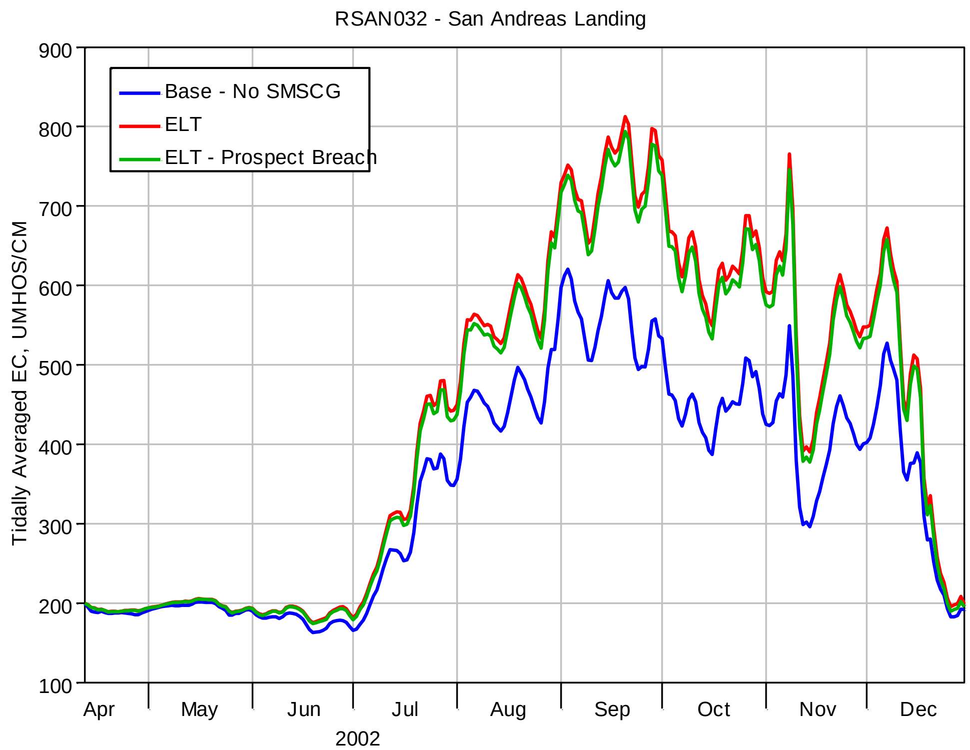


Figure 5-111 Tidally averaged EC at RSAN032 for Base-No SMSCG, ELT and ELT-Prospect Breach.

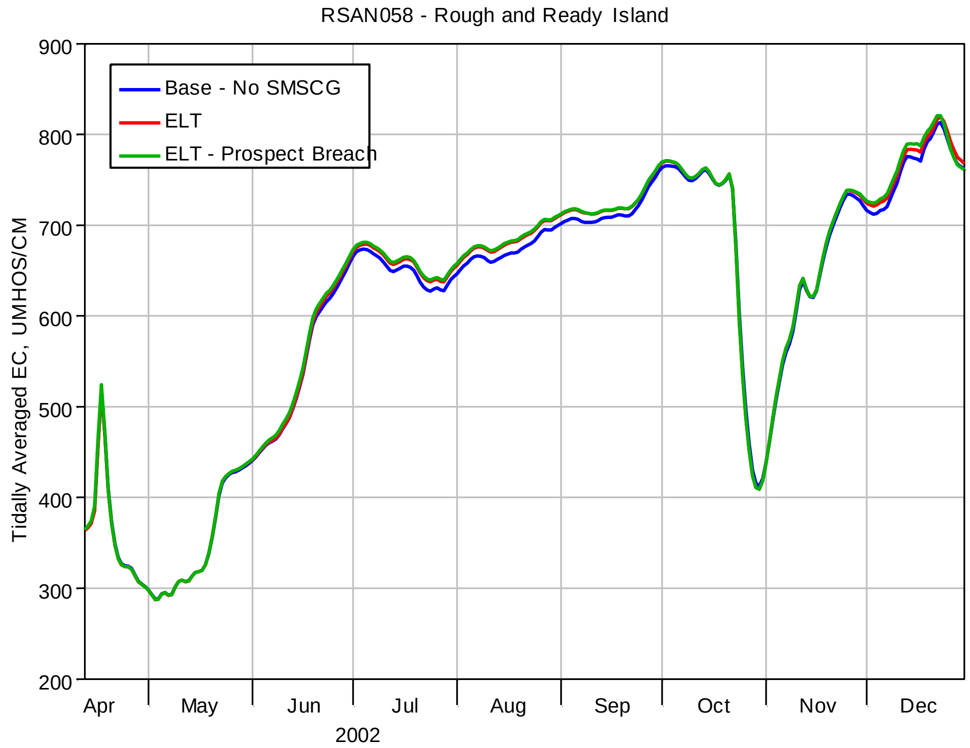


Figure 5-112 Tidally averaged EC at RSAN058 for Base-No SMSCG, ELT and ELT-Prospect Breach.

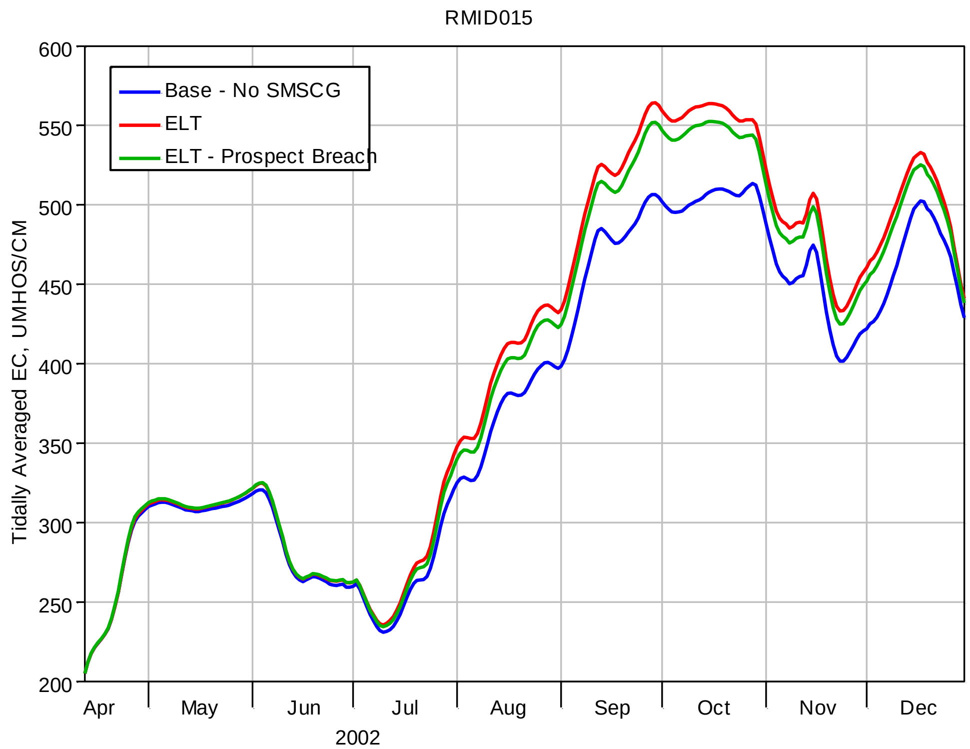


Figure 5-113 Tidally averaged EC at RMID015 for Base-No SMSCG, ELT and ELT-Prospect Breach.

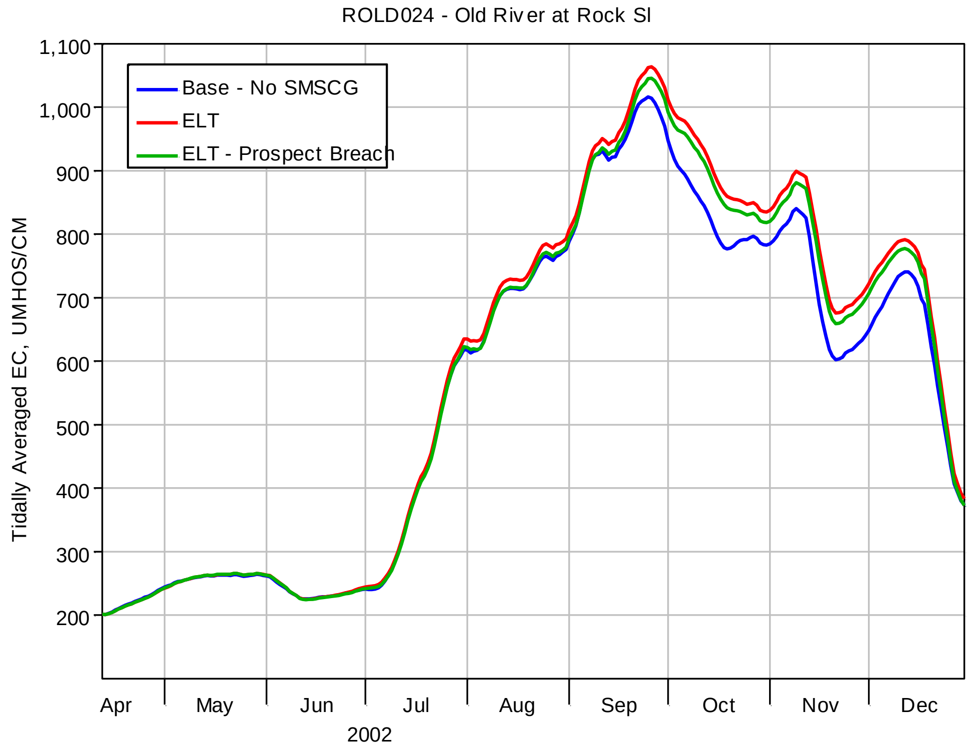


Figure 5-114 Tidally averaged EC at ROLD024 for Base-No SMSCG, ELT and ELT-Prospect Breach.

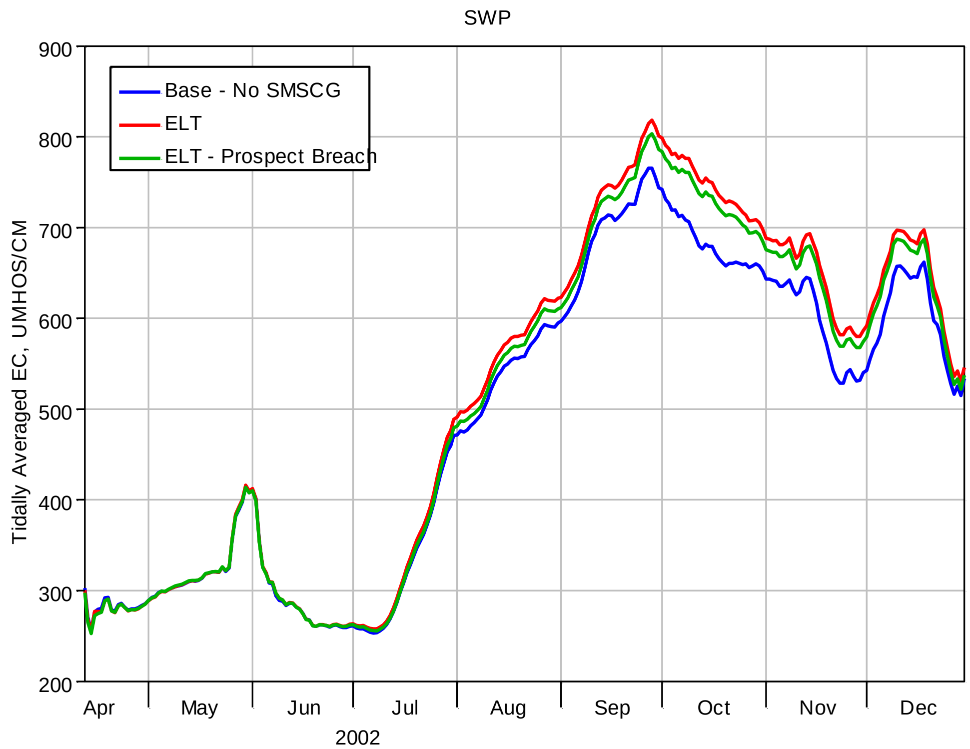


Figure 5-115 Tidally averaged EC at SWP for Base-No SMSCG, ELT and ELT-Prospect Breach.

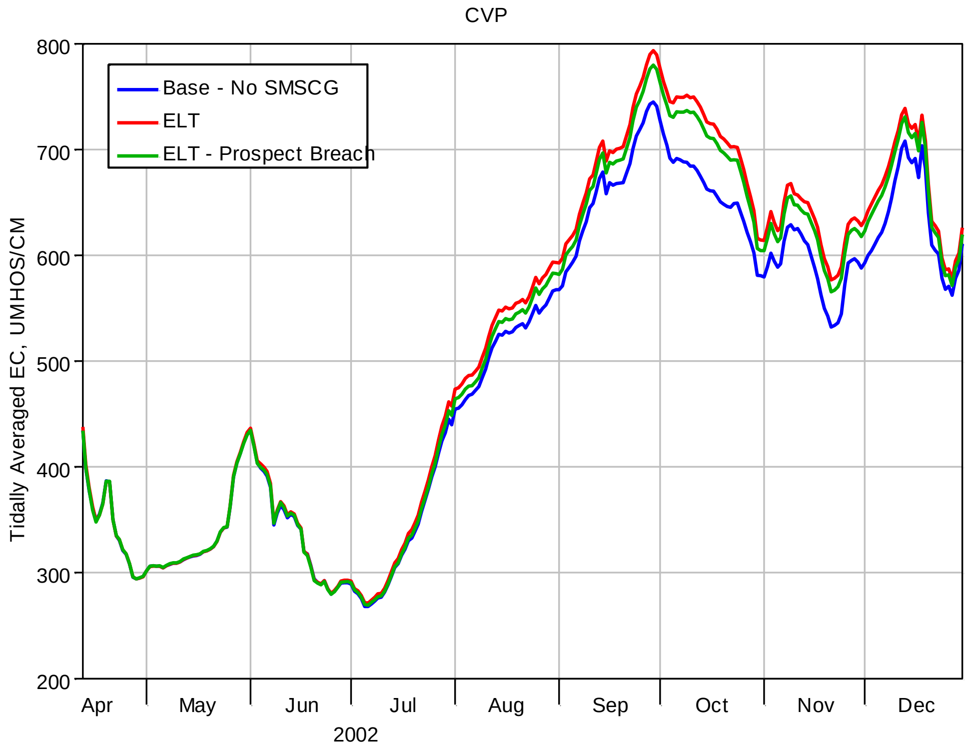


Figure 5-116 Tidally averaged EC at CVP for Base-No SMSCG, ELT and ELT-Prospect Breach.

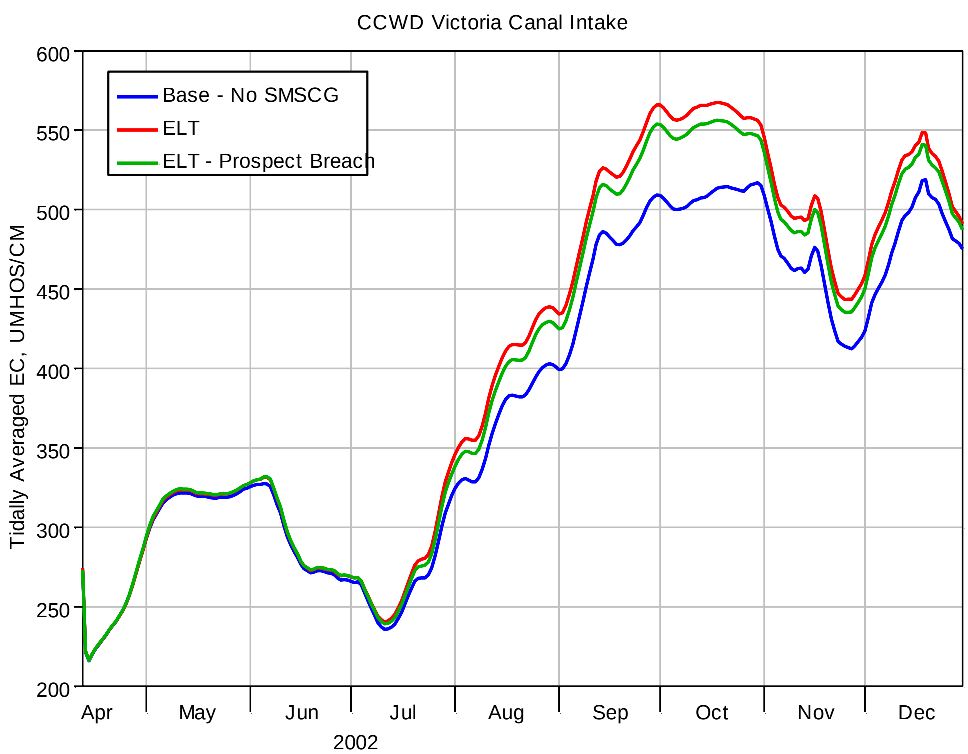


Figure 5-117 Tidally averaged EC at CCWD for Base-No SMSCG, ELT and ELT-Prospect Breach.

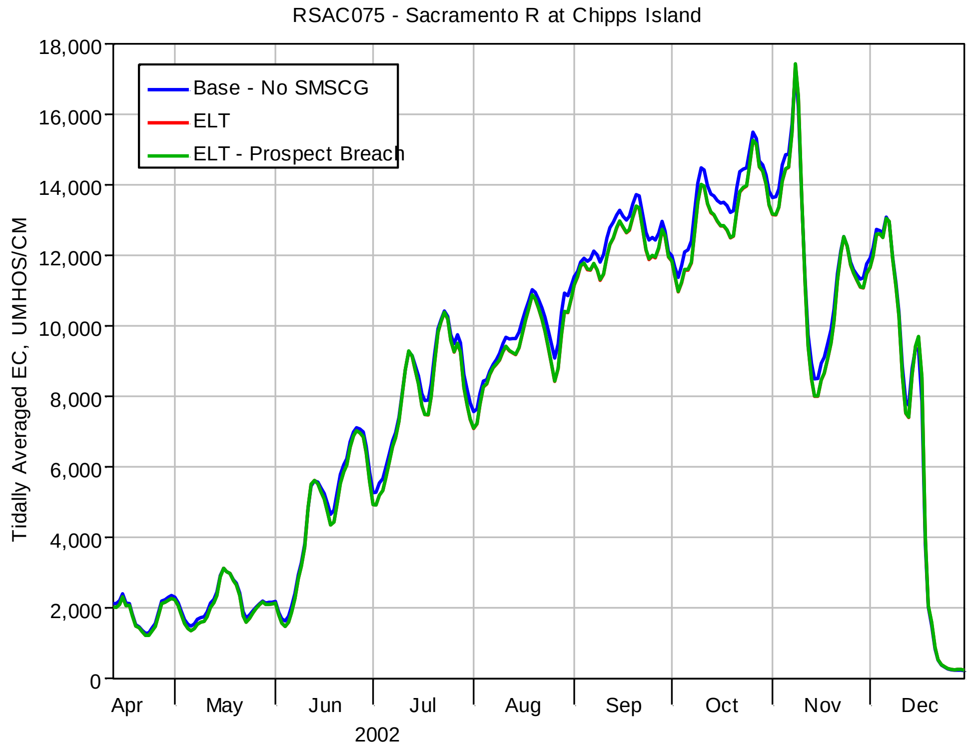


Figure 5-118 Tidally averaged EC at RSAC075 for Base-No SMSCG, ELT and ELT-Prospect Breach.

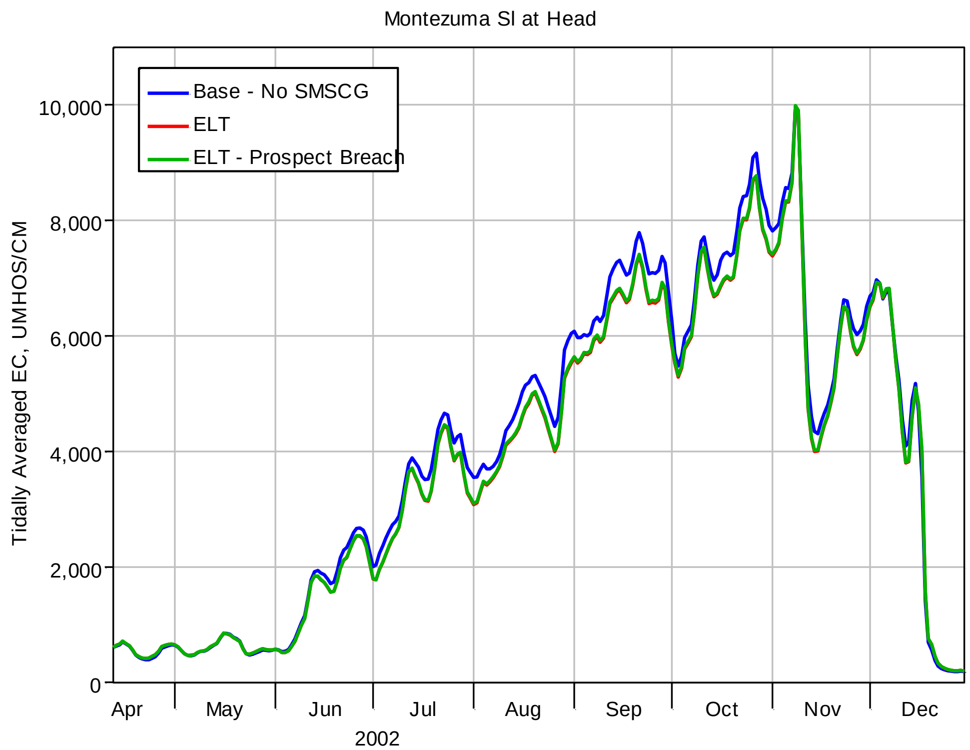


Figure 5-119 Tidally averaged EC at Montezuma Sl at Head for Base-No SMSCG, ELT and ELT-Prospect Breach.

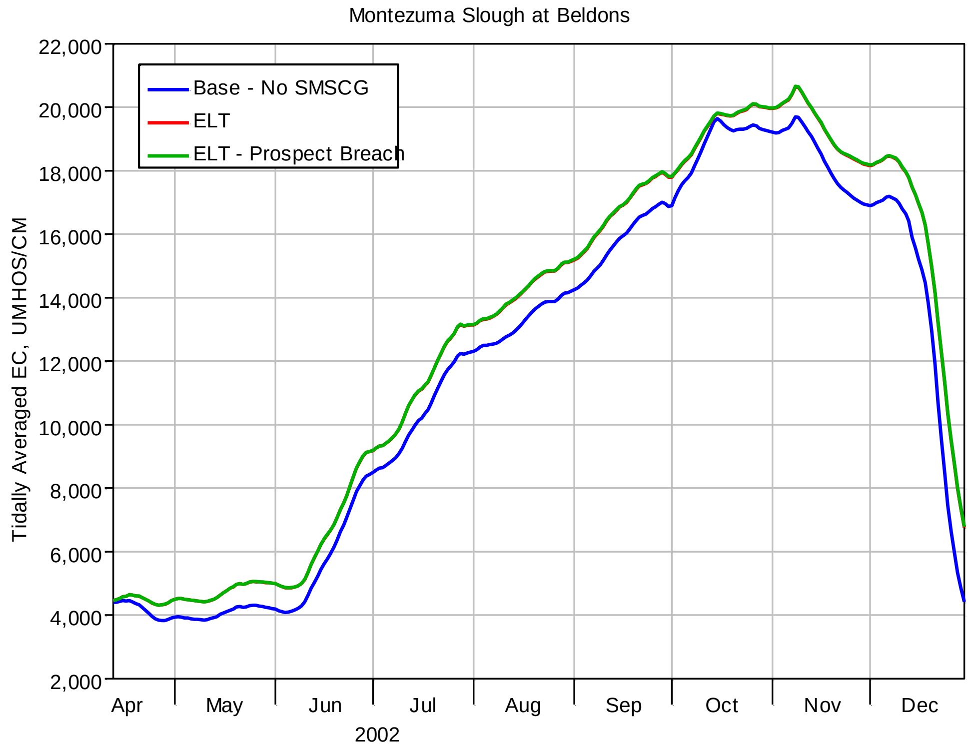


Figure 5-120 Tidally averaged EC at Montezuma Slough at Beldon's for Base-No SMSCG, ELT and ELT-Prospect Breach.

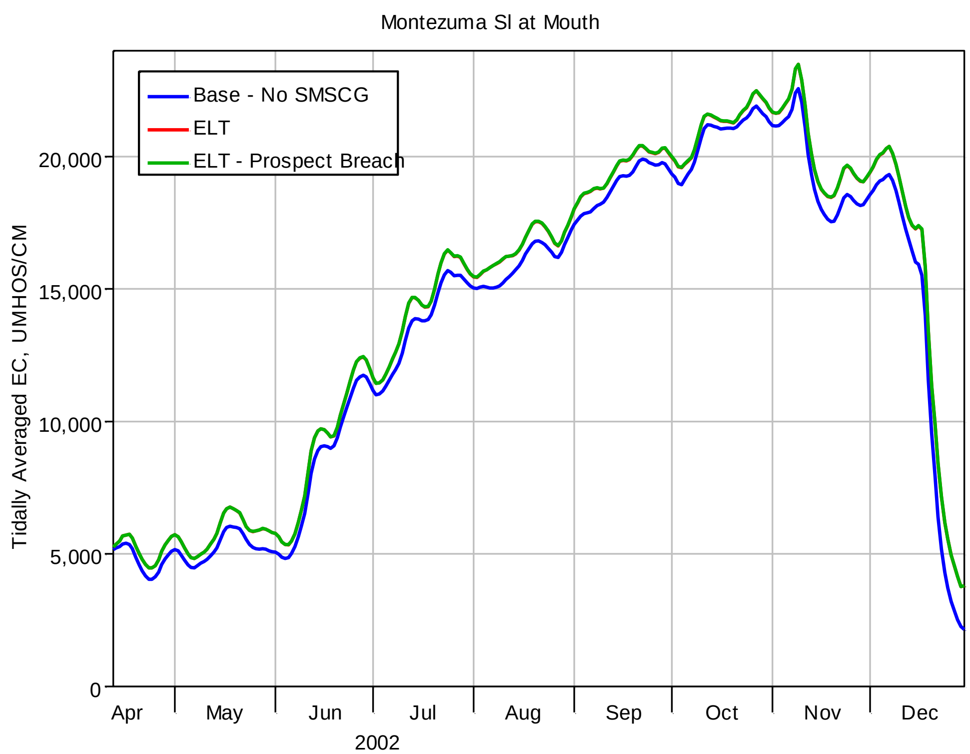


Figure 5-121 Tidally averaged EC at Montezuma Sl at Mouth for Base-No SMSCG, ELT and ELT-Prospect Breach.

5.5.2 Spatial Plots of EC Change

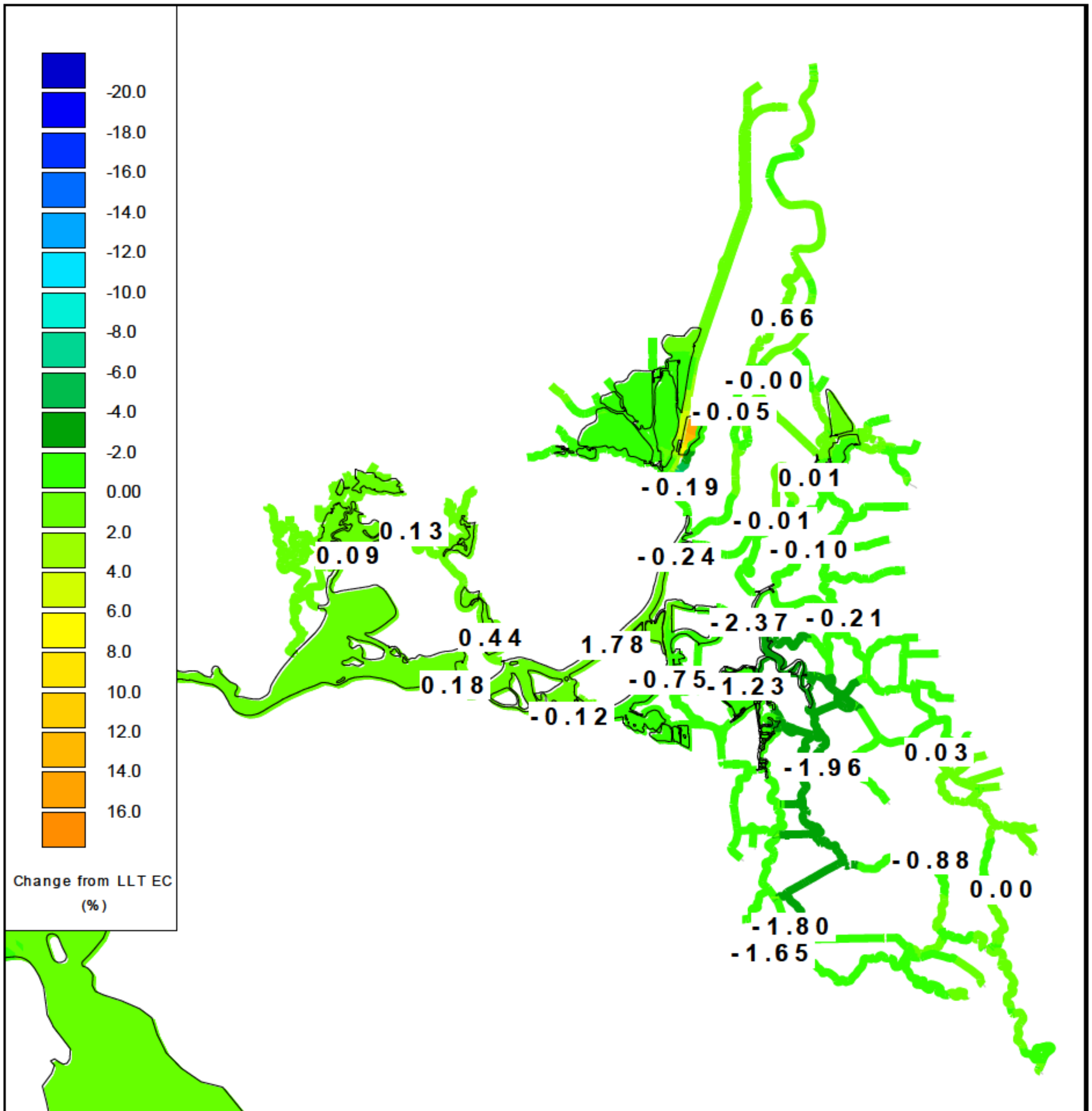


Figure 5-122 Contour plots of ELT – Prospect Breach change from ELT tidally averaged EC on September 24, 2002.

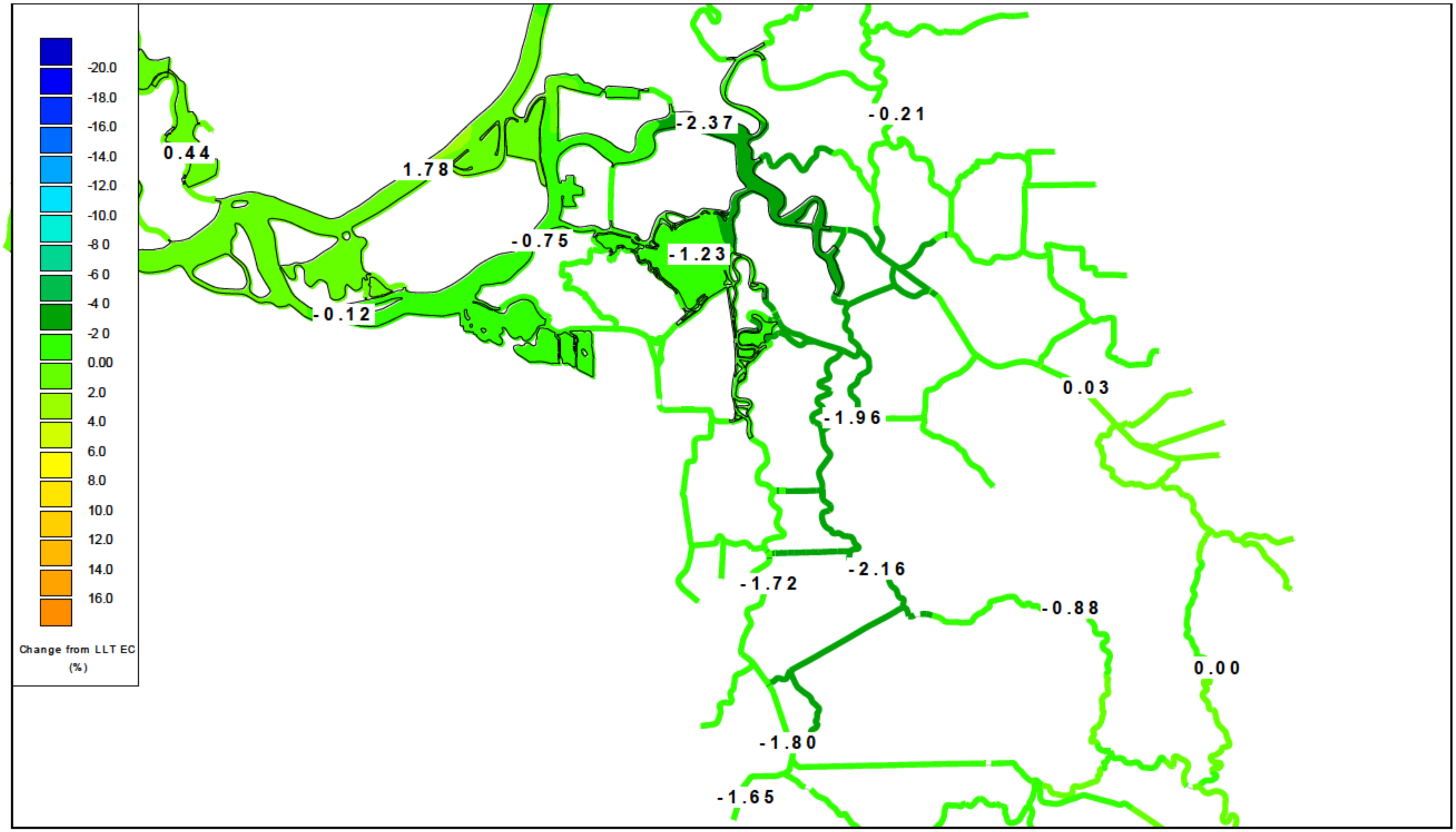


Figure 5-123 Contour plots of ELT – Prospect Breach change from ELT tidally averaged EC in south Delta on September 24, 2002.

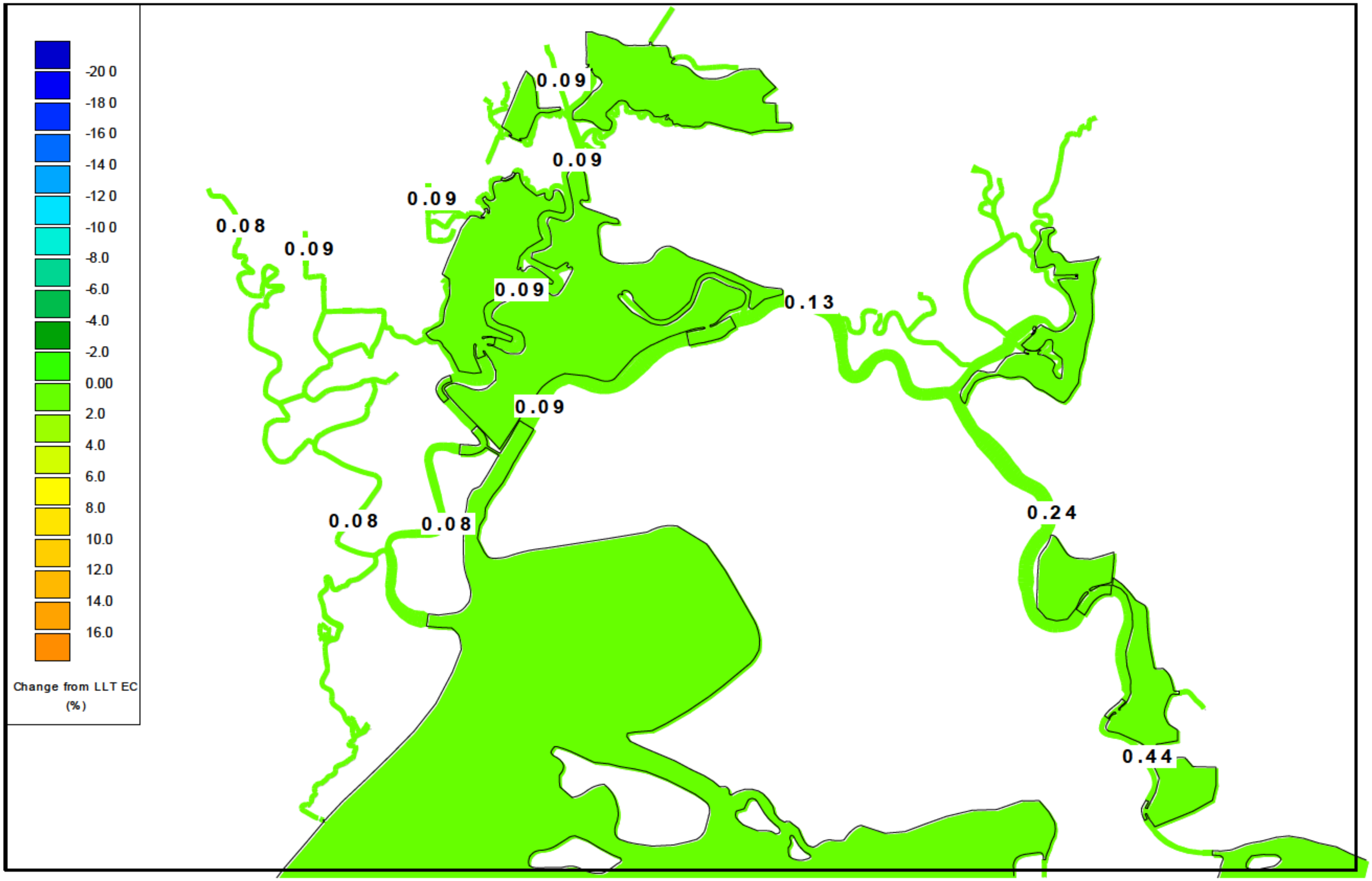


Figure 5-124 Contour plots of ELT – Prospect Breach change from ELT tidally averaged EC in Suisun Marsh on September 24, 2002.

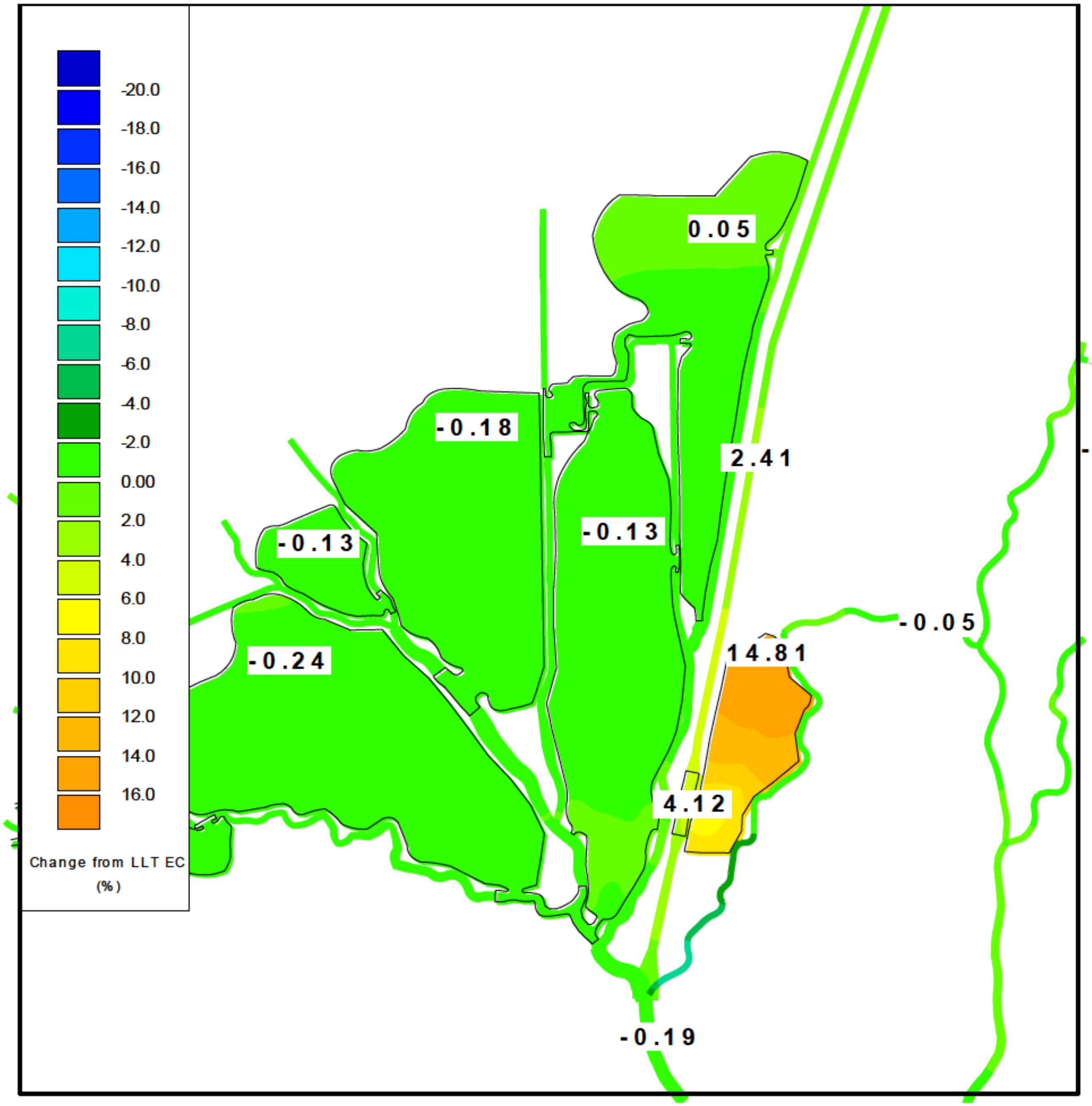


Figure 5-125 Contour plots of ELT – Prospect Breach change from ELT tidally averaged EC in the Cache Slough ROA on September 24, 2002.

5.5.3 X2 Time Series

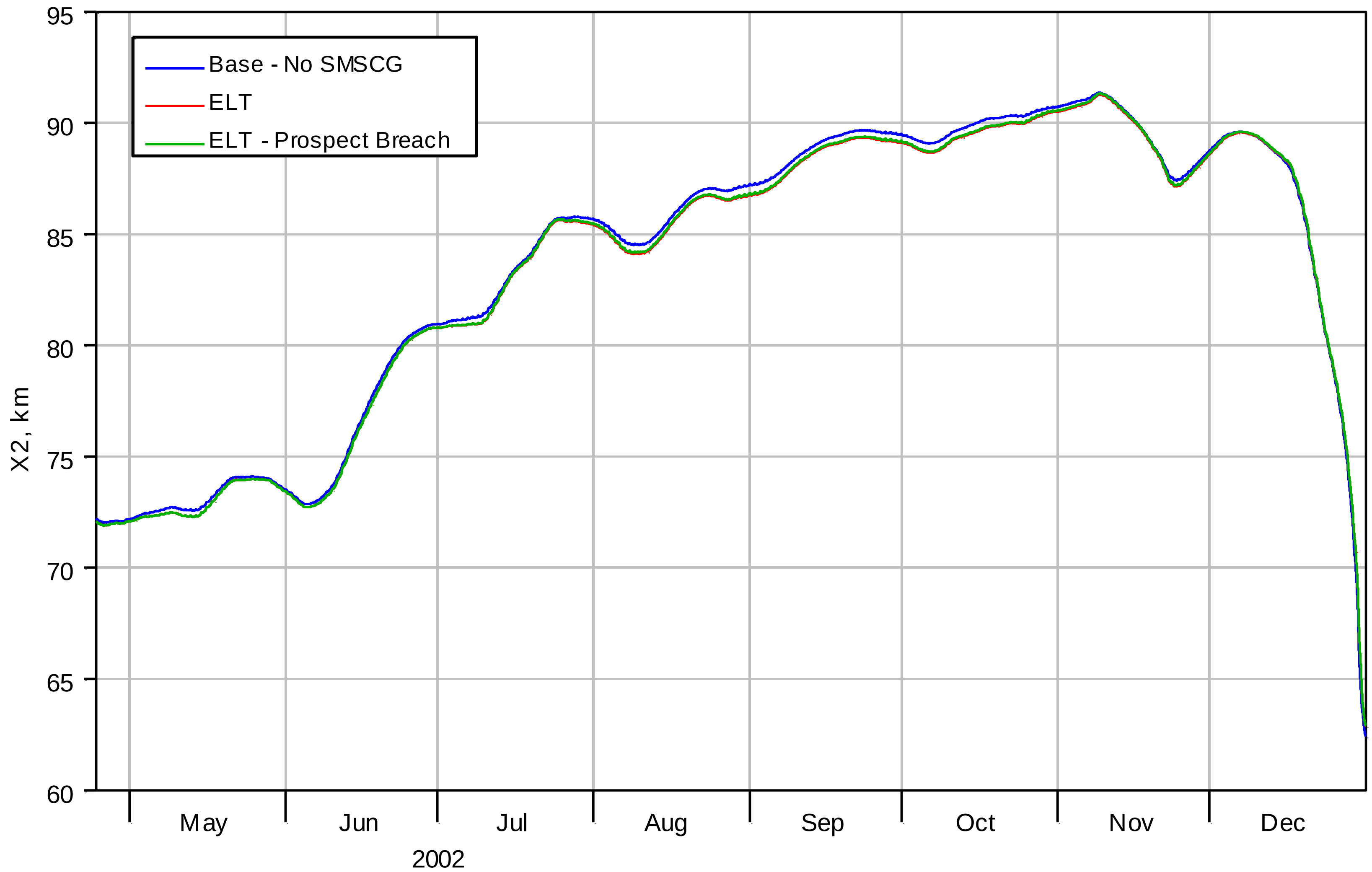


Figure 5-126 Time series of X2 for Base - No SMSCG, ELT and ELT - Prospect Breach.

5.6 LLT – Little Egbert Breach

EC results for the LLT – Little Egbert Breach case are shown as time series plots of tidally averaged values in Figure 5-127 through Figure 5-145. With the southern breach on Little Egbert Tract removed, EC is reduced in the south and central Delta, relative to the LLT case. EC is also decreased in the Sacramento River at Rio Vista and downstream to Chipps Island, and in the eastern part of Suisun Marsh. In Cache Slough at Ryer during the fall, EC is slightly reduced below LLT. There are no EC impacts at Freeport.

Contour plots of tidally averaged EC percent change from LLT on September 24, 2002 are shown in Figure 5-146 through Figure 5-149 for the Delta, the south and central Delta, for Suisun Marsh and for the Cache Slough area. These plots show small reductions (less than 1%) throughout most of the Cache Slough ROA. In the southern end of Little Egbert Tract there are larger reductions where the breach was eliminated. Changes are small throughout the remainder of the north Delta. In Suisun Marsh, EC is generally increased by 1% or less, with the exception of some areas of up to 2% decrease in Montezuma Slough upstream of Meins Landing. EC is decreased by 7% in the San Joaquin River around San Andreas Landing and decreased by 4-5% in the south Delta due to increased net flows in Georgiana Slough and Mokelumne River (see Table 4-17). Increased net flows in the Sacramento River at Emmaton (see Table 4-17) also reduce EC by 6-7% there. EC is increased by up to 15% in the West Delta ROA in Sherman Island, Decker Island and adjacent channels. This is in part due to a shift in net flows, with less flow from the Sacramento River toward the San Joaquin River (see Table 4-17).

A summary of July – December 2002 monthly average EC at key locations throughout the Delta is provided in Table 5-11 for Base – No MRB, LLT and LLT – Little Egbert Breach. Percent change in monthly average EC relative to the base case are provided in Table 5-12 for LLT and LLT – Little Egbert Breach. Monthly average EC reductions throughout south Delta, relative to LLT, are as high as 4 – 9%. There are larger reductions in the San Joaquin River at Jersey Point (3 – 7%) and San Andreas (7 – 15%), and in the Sacramento River at Emmaton (6 – 10%).

LLT – Little Egbert Breach X2, shown in Figure 5-150, is decreased by less than 0.5 km relative to LLT throughout the simulation period.

Table 5-11 Summary of July - December 2002 monthly average EC for Base - No MRB, LLT and LLT – Little Egbert Breach.

	Monthly Average EC (umhos/cm)																	
	July 2002			August 2002			September 2002			October 2002			November 2002			December 2002		
Location	Base - No MRB	LLT	LLT - Little Egbert	Base - No MRB	LLT	LLT - Little Egbert	Base - No MRB	LLT	LLT - Little Egbert	Base - No MRB	LLT	LLT - Little Egbert	Base - No MRB	LLT	LLT - Little Egbert	Base - No MRB	LLT	LLT - Little Egbert
Cache Sl at Ryer	136	135	135	153	150	150	176	173	172	164	160	158	189	188	187	196	193	192
CCWD Victoria Canal	264	288	282	367	432	416	469	553	531	511	615	590	453	543	522	482	561	537
CVP	333	354	346	515	572	553	664	745	716	658	780	744	587	688	656	631	704	680
Montezuma Sl at Head	3536	3567	3527	4650	4521	4461	6853	6816	6772	7400	7510	7469	6555	6739	6693	3149	3440	3412
Montezuma Sl at Mouth	13705	14112	14167	15976	16392	16476	18958	19301	19410	20766	20950	21061	19465	20279	20376	12062	13926	13992
RMID015	261	285	278	367	437	420	469	565	541	503	612	586	442	522	500	463	542	518
RMID023	262	285	278	367	436	419	468	560	536	507	614	588	448	527	506	477	552	528
ROLD024	401	438	423	707	781	753	934	1049	1006	826	1014	954	712	891	830	607	744	695
ROLD034	360	392	380	615	692	667	804	912	874	755	915	866	651	801	751	601	732	688
RSAC075 Chipps Island	8209	8880	8831	9741	10267	10217	12563	13253	13224	13606	14160	14127	11990	12802	12745	6035	6735	6676
RSAC092 Emmaton	623	629	568	808	742	676	1498	1384	1275	2012	1919	1788	1748	1782	1665	821	874	821
RSAC101 Rio Vista	148	146	144	176	162	162	241	213	209	285	264	253	290	308	295	222	232	225
RSAC123	127	127	127	154	155	154	165	165	165	142	142	142	184	184	184	169	168	169
RSAC155 Freeport	126	126	126	156	156	156	162	162	162	142	142	142	184	184	184	164	164	164
RSAN018 Jersey Pt	954	1028	998	1461	1519	1479	1975	2116	2051	1728	1913	1821	1503	1766	1661	945	1108	1047
RSAN032 San Andreas	284	383	362	459	649	613	555	871	812	448	773	709	403	668	609	333	480	444
RSAN058	643	612	609	664	644	640	711	698	695	674	682	681	636	629	628	763	751	748
S-49 Beldon's Landing	10402	11292	11373	13266	14335	14453	15826	16973	17119	18856	19371	19531	18357	19659	19820	12766	15349	15502
SWP	329	360	350	540	615	592	698	807	773	682	835	793	593	725	685	594	691	656

Table 5-12 Summary of July - December 2002 percent change in monthly average EC for LLT and LLT – Little Egbert relative to Base - No MRB.

	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Case											
	July 2002		August 2002		September 2002		October 2002		November 2002		December 2002	
Location	LLT	LLT - Little Egbert	LLT	LLT - Little Egbert	LLT	LLT - Little Egbert	LLT	LLT - Little Egbert	LLT	LLT - Little Egbert	LLT	LLT - Little Egbert
Cache Sl at Ryer	-1%	-1%	-2%	-2%	-1%	-2%	-2%	-3%	-1%	-1%	-2%	-2%
CCWD Victoria Canal	9%	7%	18%	13%	18%	13%	20%	15%	20%	15%	16%	11%
CVP	7%	4%	11%	7%	12%	8%	19%	13%	17%	12%	12%	8%
Montezuma Sl at Head	1%	0%	-3%	-4%	-1%	-1%	1%	1%	3%	2%	9%	8%
Montezuma Sl at Mouth	3%	3%	3%	3%	2%	2%	1%	1%	4%	5%	15%	16%
RMID015	9%	7%	19%	14%	20%	15%	22%	17%	18%	13%	17%	12%
RMID023	9%	6%	19%	14%	20%	15%	21%	16%	18%	13%	16%	11%
ROLD024	9%	5%	10%	7%	12%	8%	23%	16%	25%	17%	23%	14%
ROLD034	9%	6%	13%	8%	13%	9%	21%	15%	23%	15%	22%	14%
RSAC075 Chipps Island	8%	8%	5%	5%	5%	5%	4%	4%	7%	6%	12%	11%
RSAC092 Emmaton	1%	-9%	-8%	-16%	-8%	-15%	-5%	-11%	2%	-5%	6%	0%
RSAC101 Rio Vista	-2%	-3%	-8%	-8%	-12%	-13%	-7%	-11%	6%	2%	5%	1%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	8%	5%	4%	1%	7%	4%	11%	5%	18%	11%	17%	11%
RSAN032 San Andreas	35%	28%	42%	34%	57%	46%	73%	58%	66%	51%	44%	33%
RSAN058	-5%	-5%	-3%	-4%	-2%	-2%	1%	1%	-1%	-1%	-2%	-2%
S-49 Beldon's Landing	9%	9%	8%	9%	7%	8%	3%	4%	7%	8%	20%	21%
SWP	9%	6%	14%	10%	16%	11%	23%	16%	22%	15%	16%	10%

5.6.1 Tidally averaged EC time series

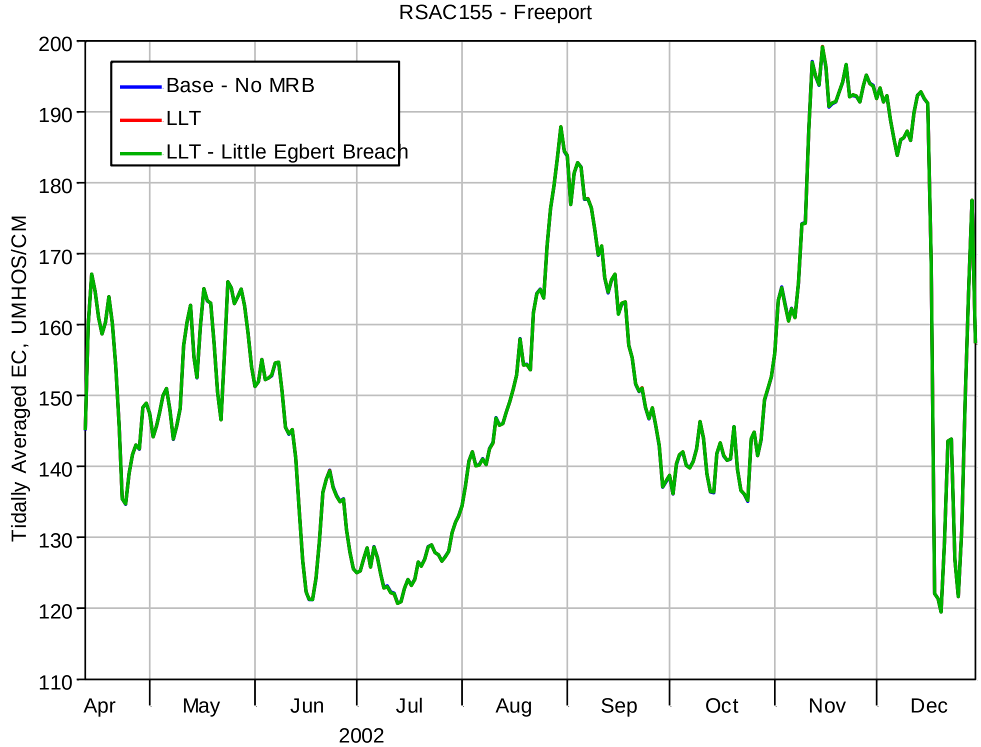


Figure 5-127 Tidally averaged EC at RSAC155 for Base-No MRB, LLT and LLT-Little Egbert Breach.

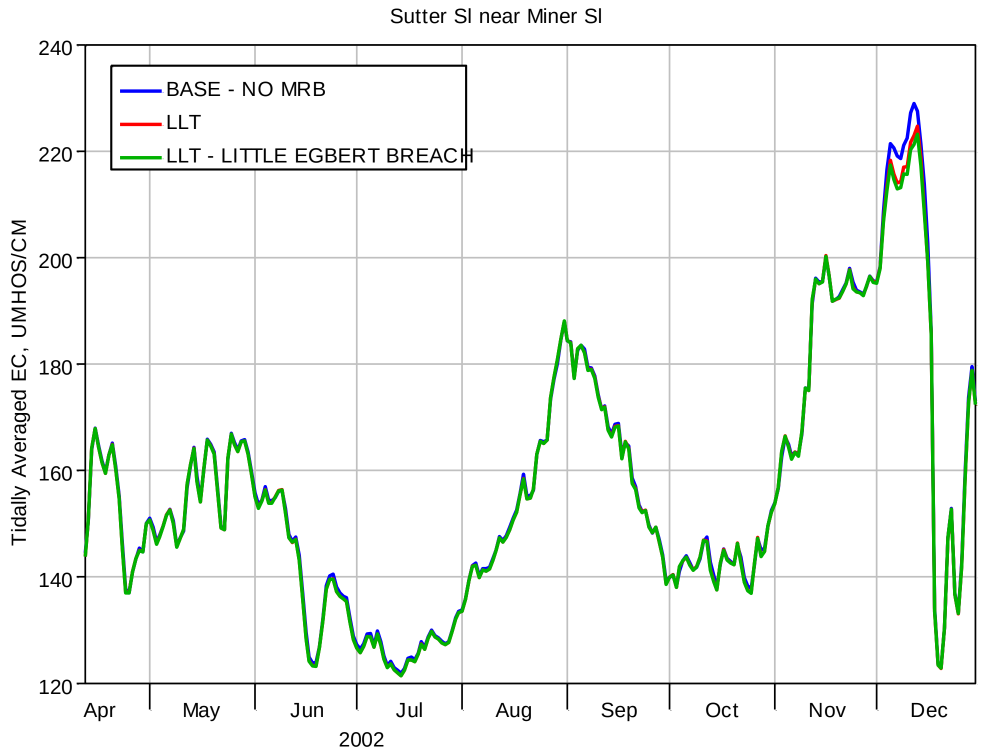


Figure 5-128 Tidally averaged EC in Sutter Slough for Base-No MRB, LLT and LLT-Little Egbert Breach.

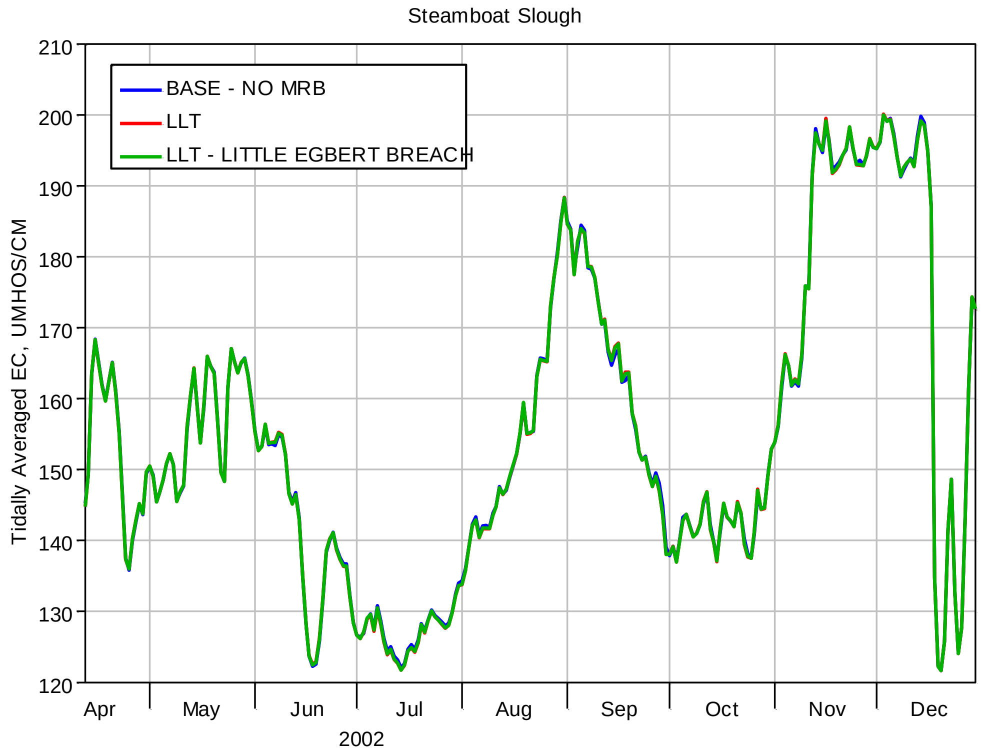


Figure 5-129 Tidally averaged EC in Steamboat Slough for Base-No MRB, LLT and LLT-Little Egbert Breach.

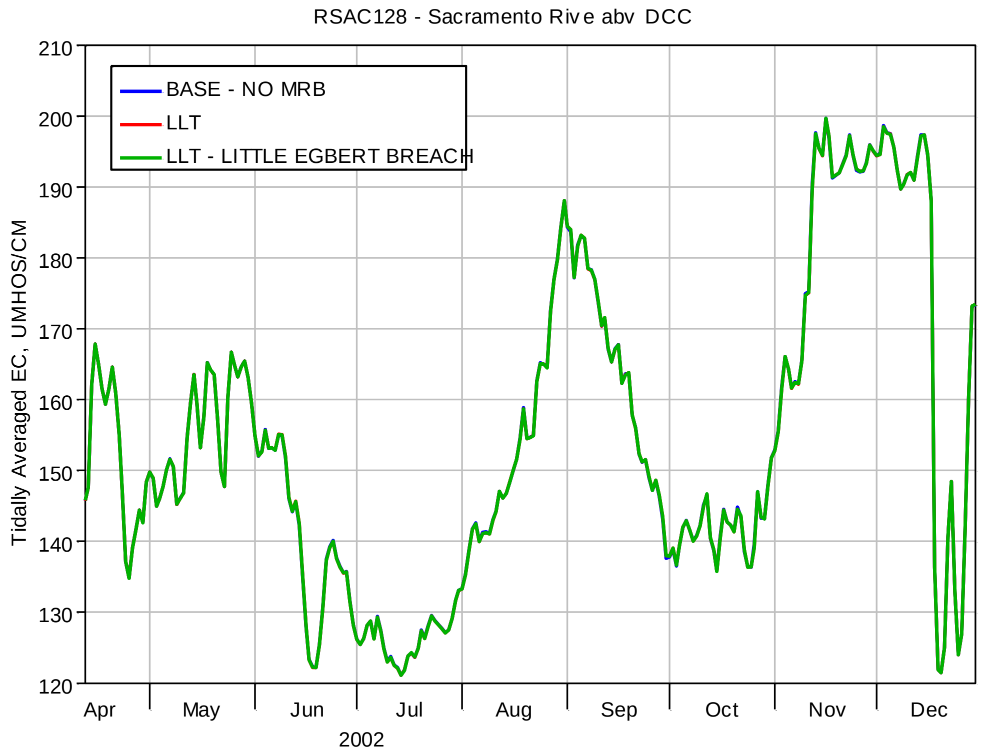


Figure 5-130 Tidally averaged EC at RSAC128 for Base-No MRB, LLT and LLT-Little Egbert Breach.

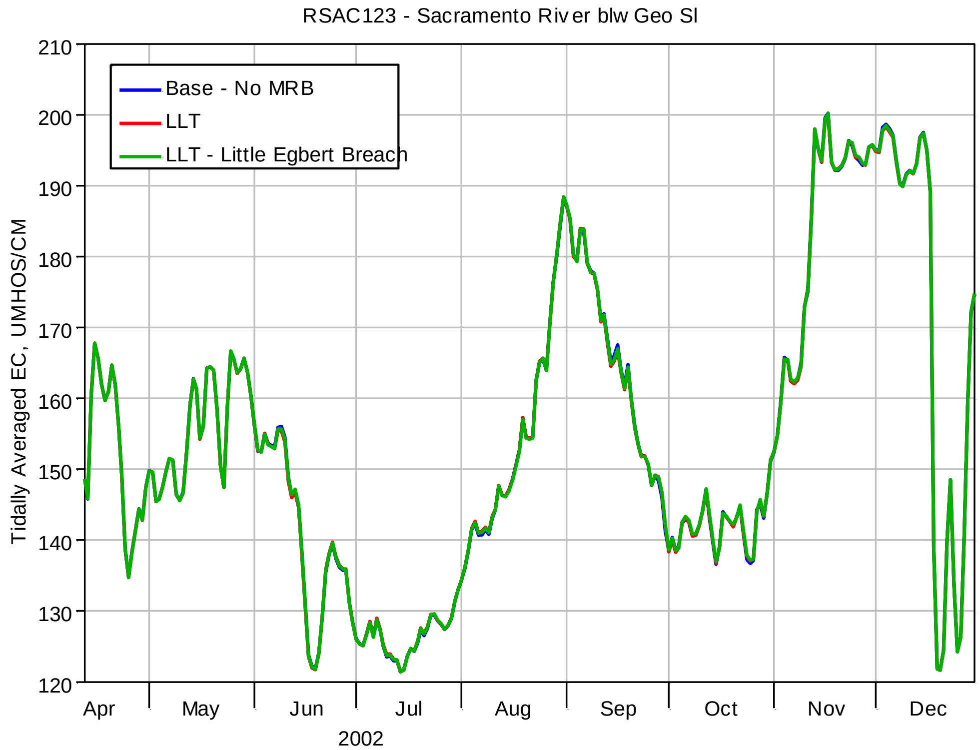


Figure 5-131 Tidally averaged EC at RSAC123 for Base-No MRB, LLT and LLT-Little Egbert Breach.

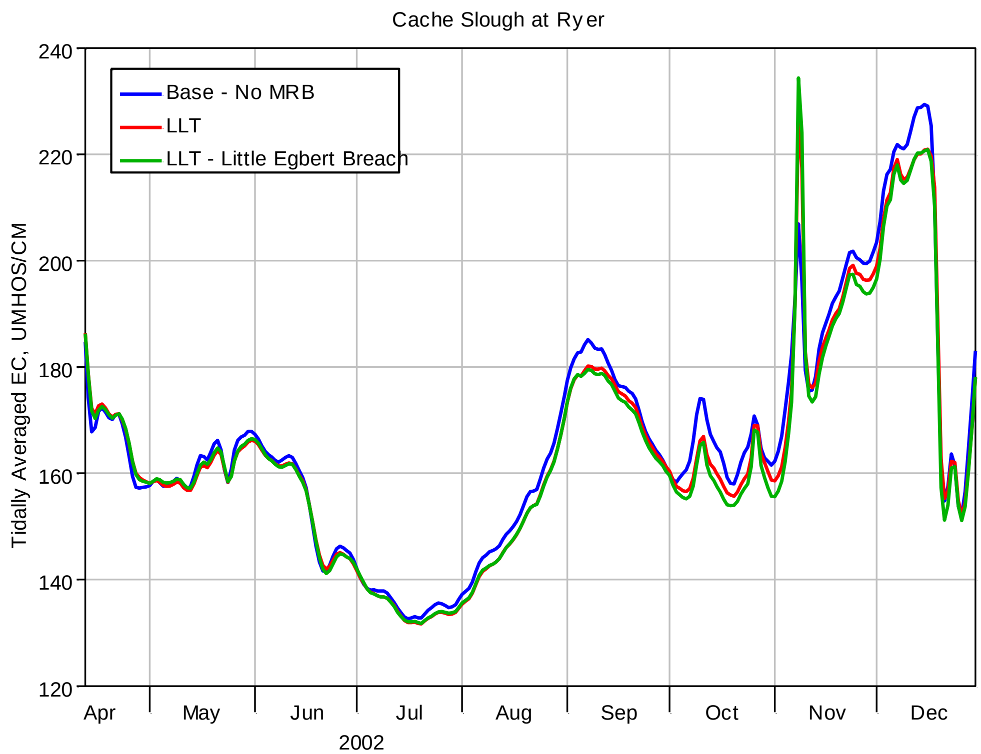


Figure 5-132 Tidally averaged EC at Cache Slough at Ryer for Base-No MRB, LLT and LLT-Little Egbert Breach.

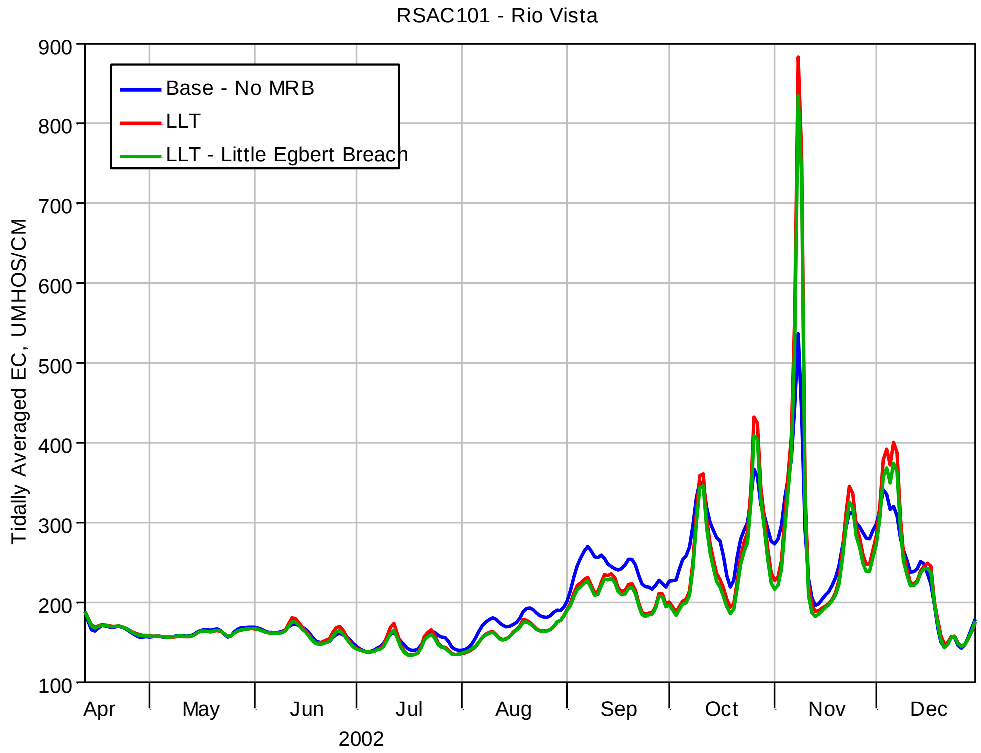


Figure 5-133 Tidally averaged EC at RSAC101 for Base-No MRB, LLT and LLT-Little Egbert Breach.

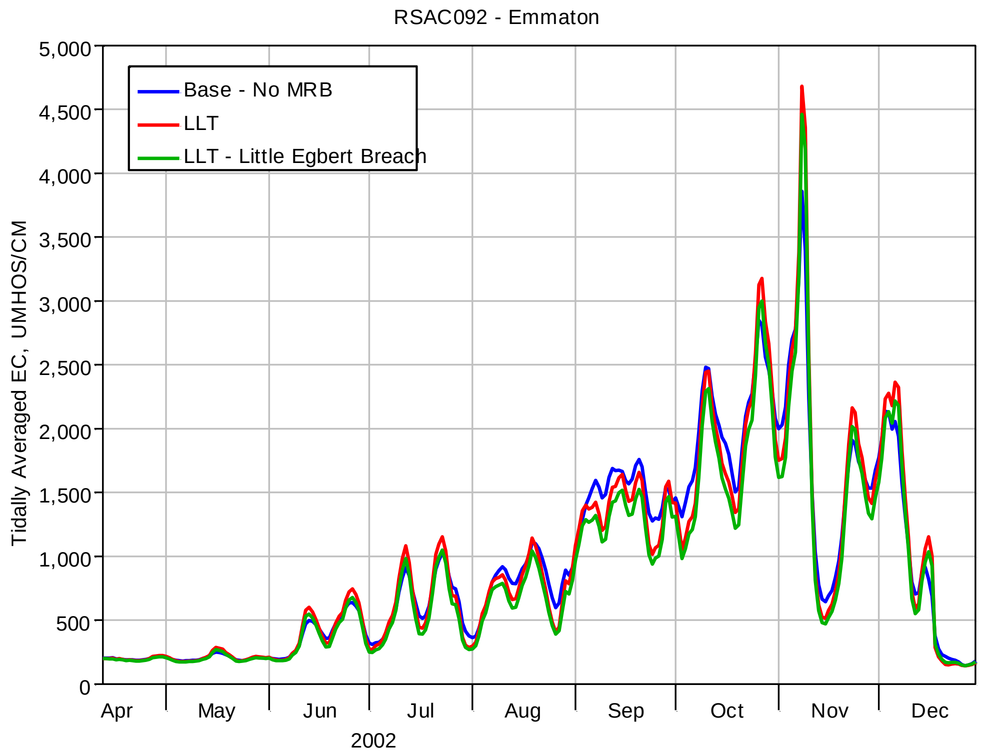


Figure 5-134 Tidally averaged EC at RSAC092 for Base-No MRB, LLT and LLT-Little Egbert Breach.

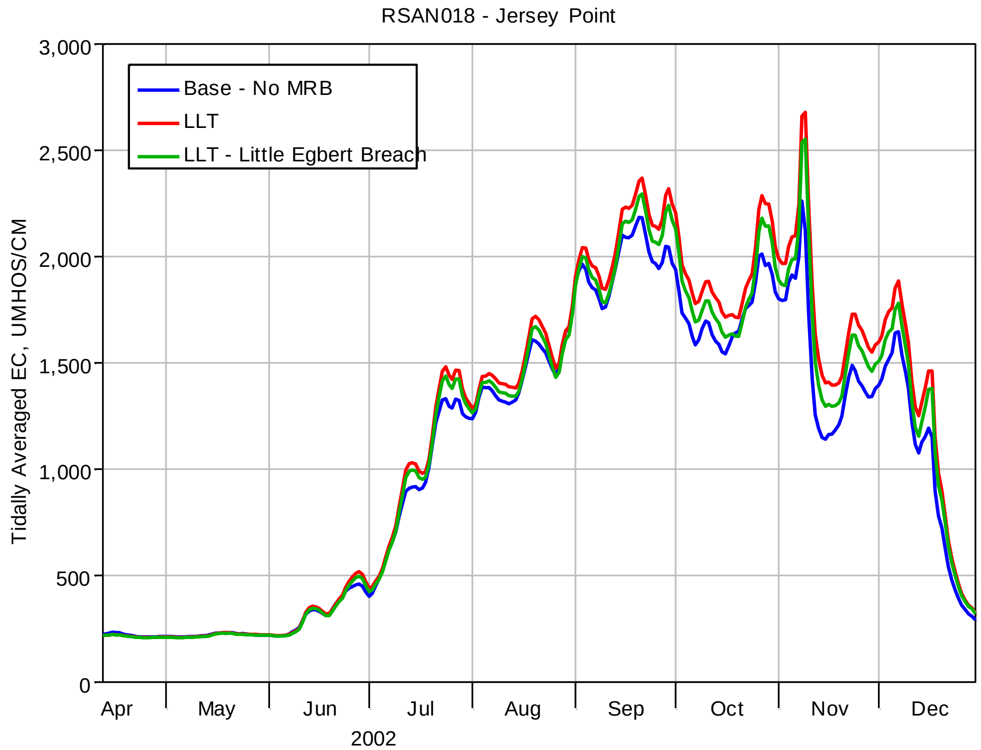


Figure 5-135 Tidally averaged EC at RSAN018 for Base-No MRB, LLT and LLT-Little Egbert Breach.

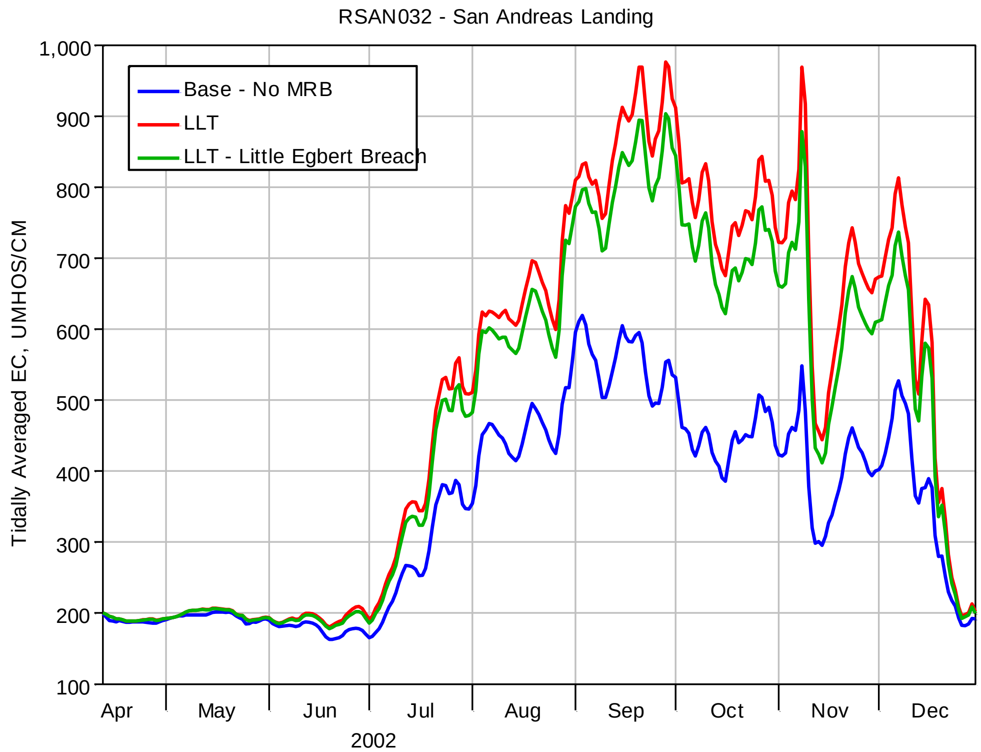


Figure 5-136 Tidally averaged EC at RSAN032 for Base-No MRB, LLT and LLT-Little Egbert Breach.

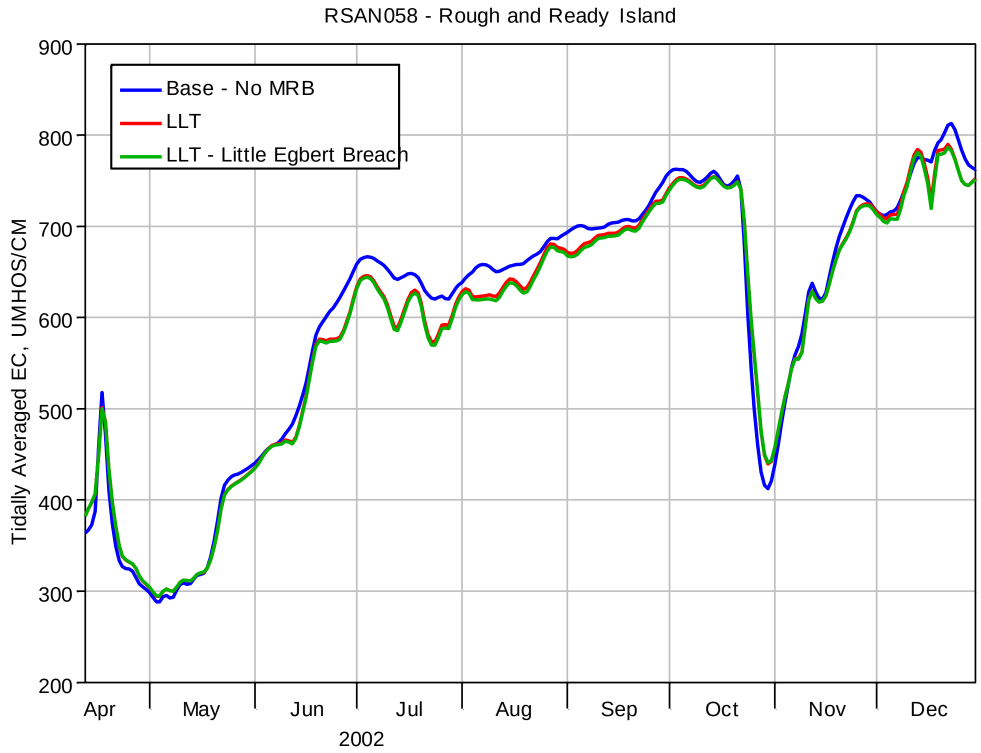


Figure 5-137 Tidally averaged EC at RSAN058 for Base-No MRB, LLT and LLT-Little Egbert Breach.

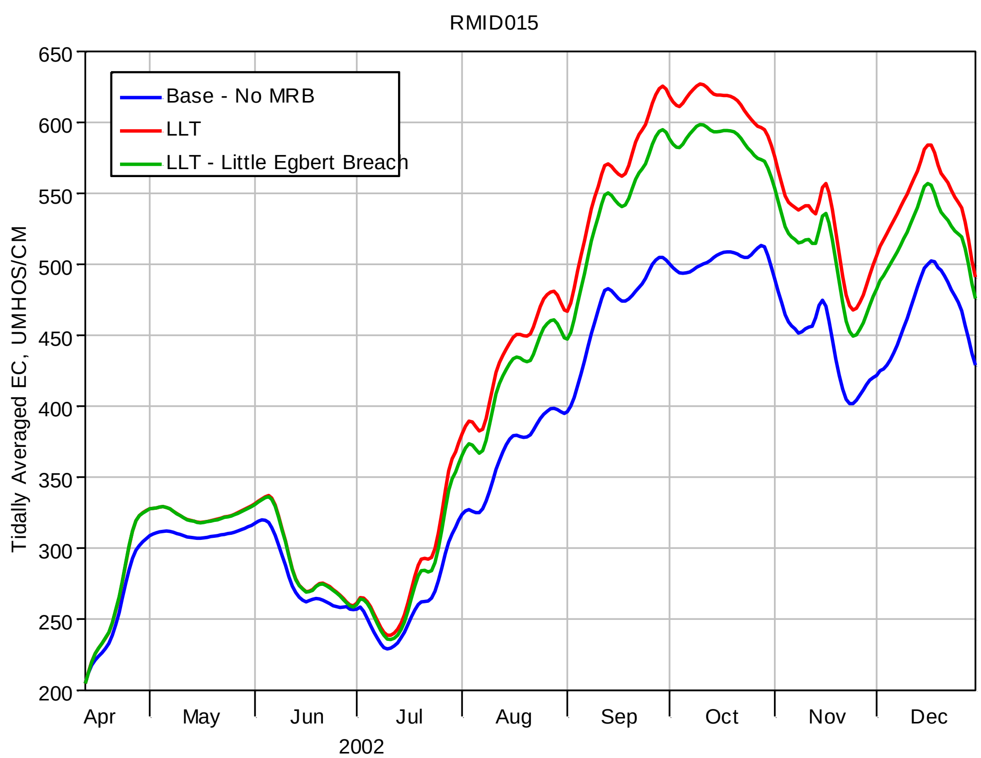


Figure 5-138 Tidally averaged EC at RMID015 for Base-No MRB, LLT and LLT-Little Egbert Breach.

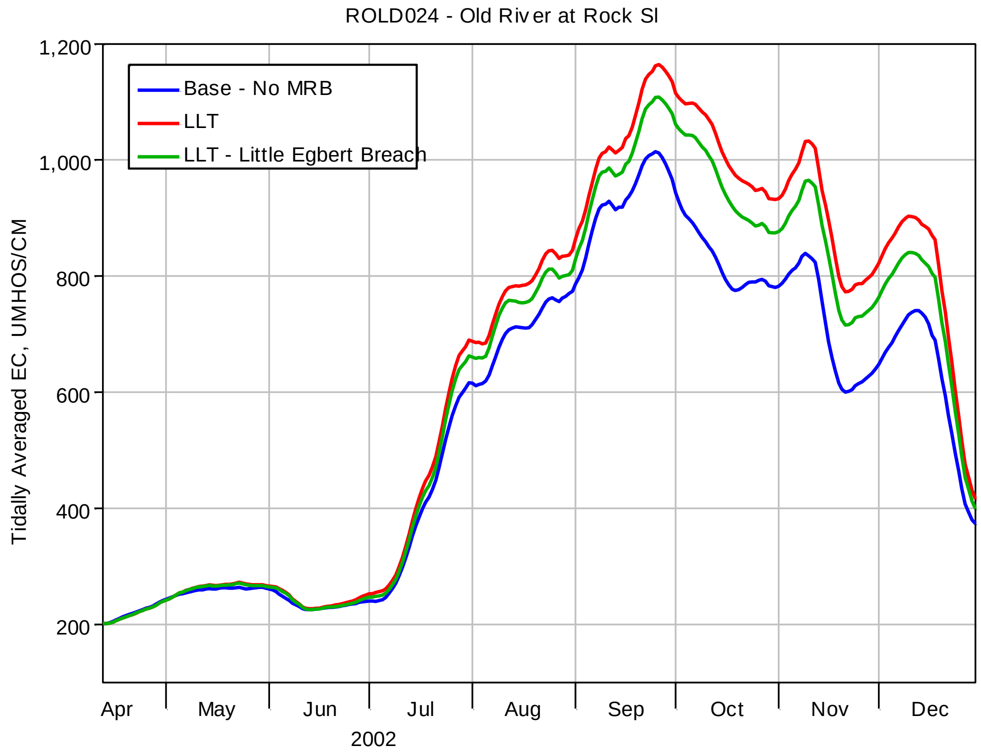


Figure 5-139 Tidally averaged EC at ROLD024 for Base-No MRB, LLT and LLT-Little Egbert Breach.

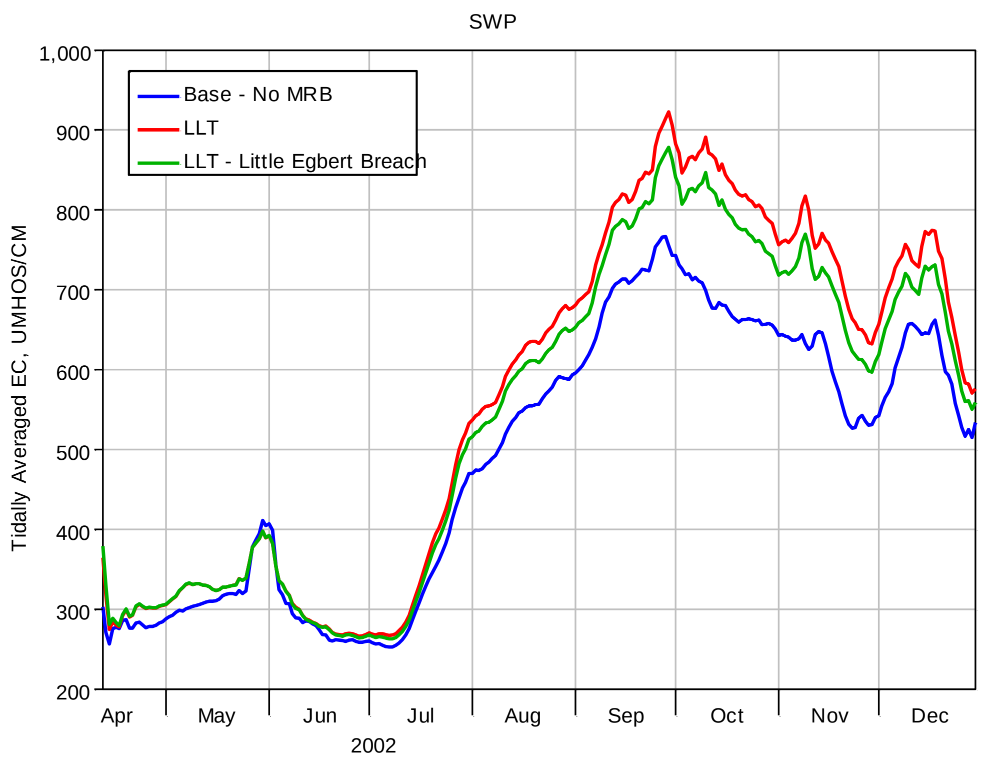


Figure 5-140 Tidally averaged EC at SWP for Base-No MRB, LLT and LLT-Little Egbert Breach.

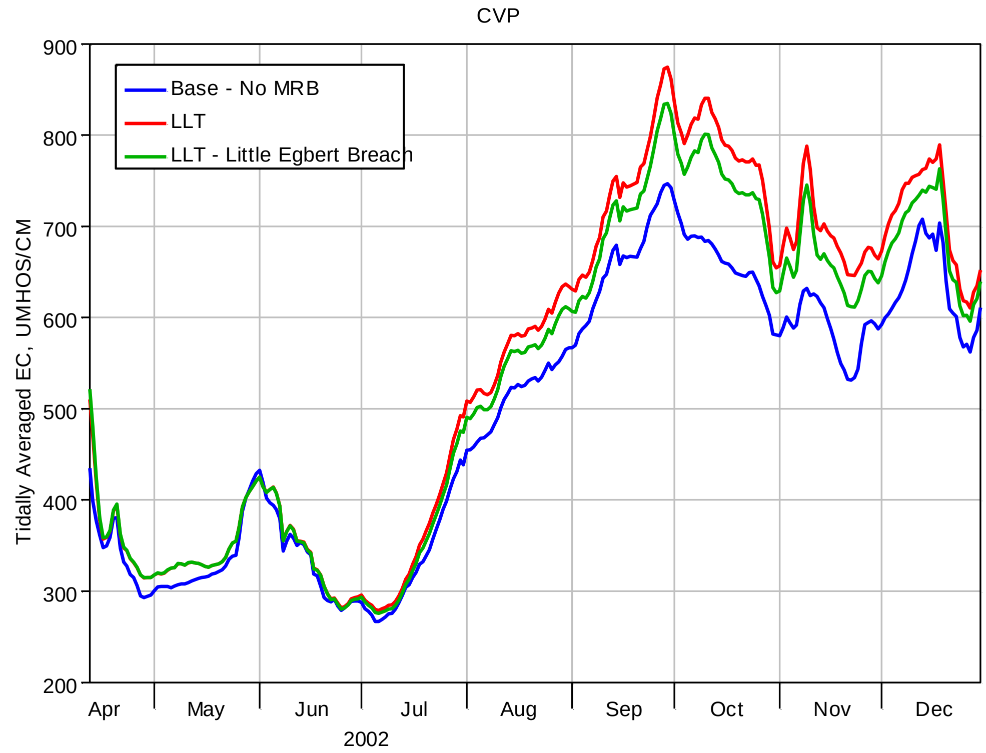


Figure 5-141 Tidally averaged EC at CVP for Base-No MRB, LLT and LLT-Little Egbert Breach.

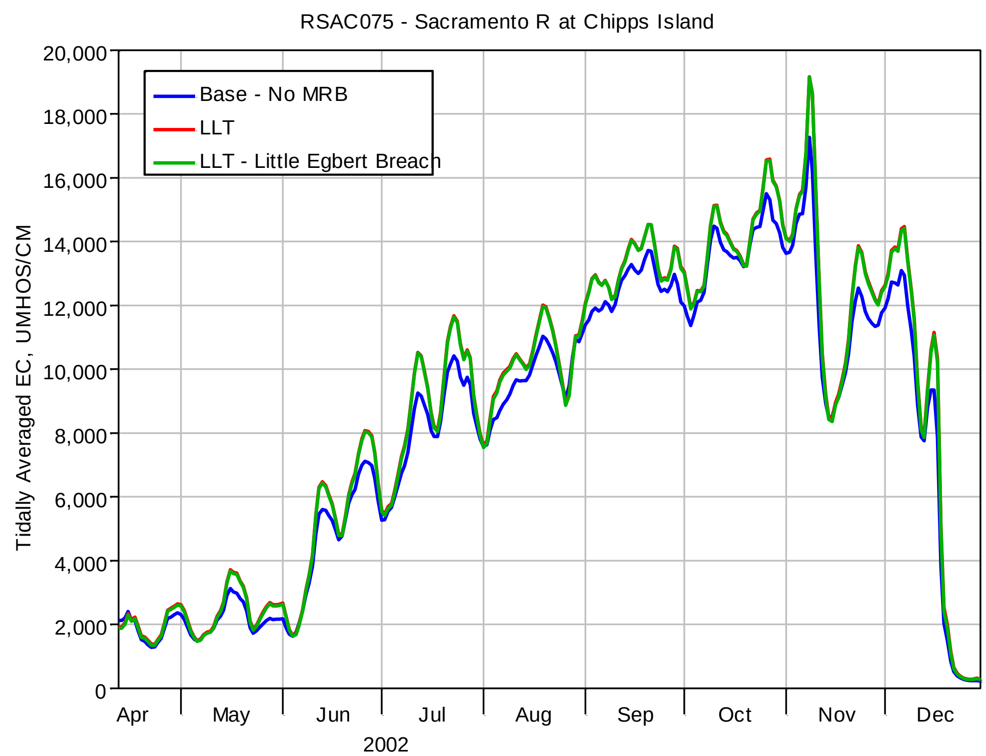


Figure 5-142 Tidally averaged EC at RSAC075 for Base-No MRB, LLT and LLT-Little Egbert Breach.

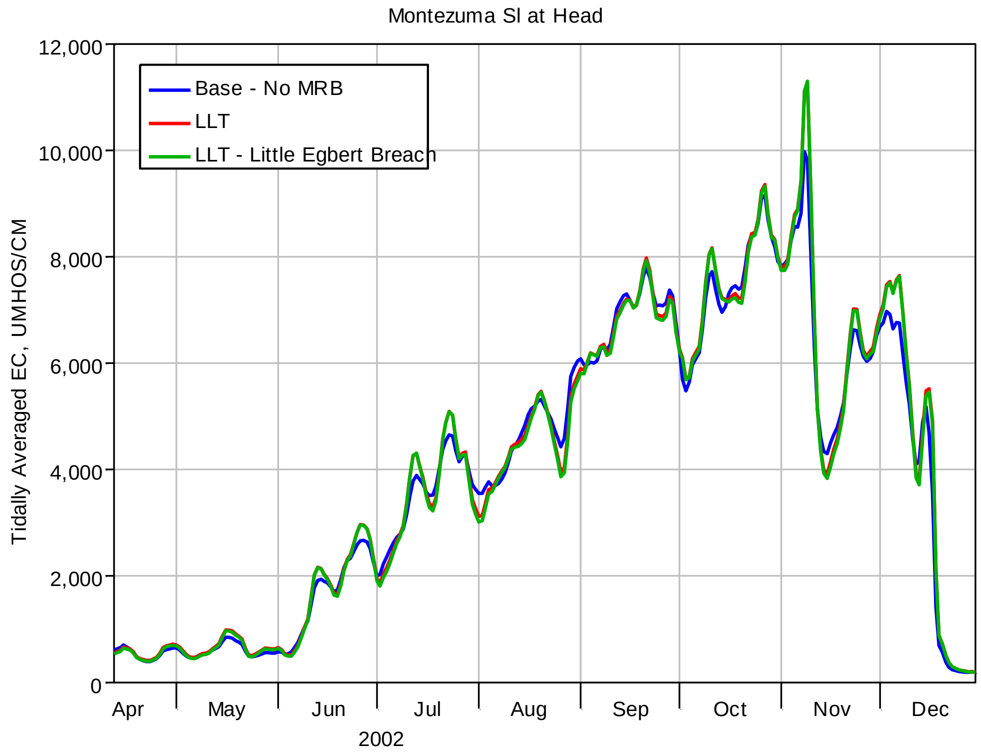


Figure 5-143 Tidally averaged EC at Montezuma Sl at Head for Base-No MRB, LLT and LLT-Little Egbert Breach.

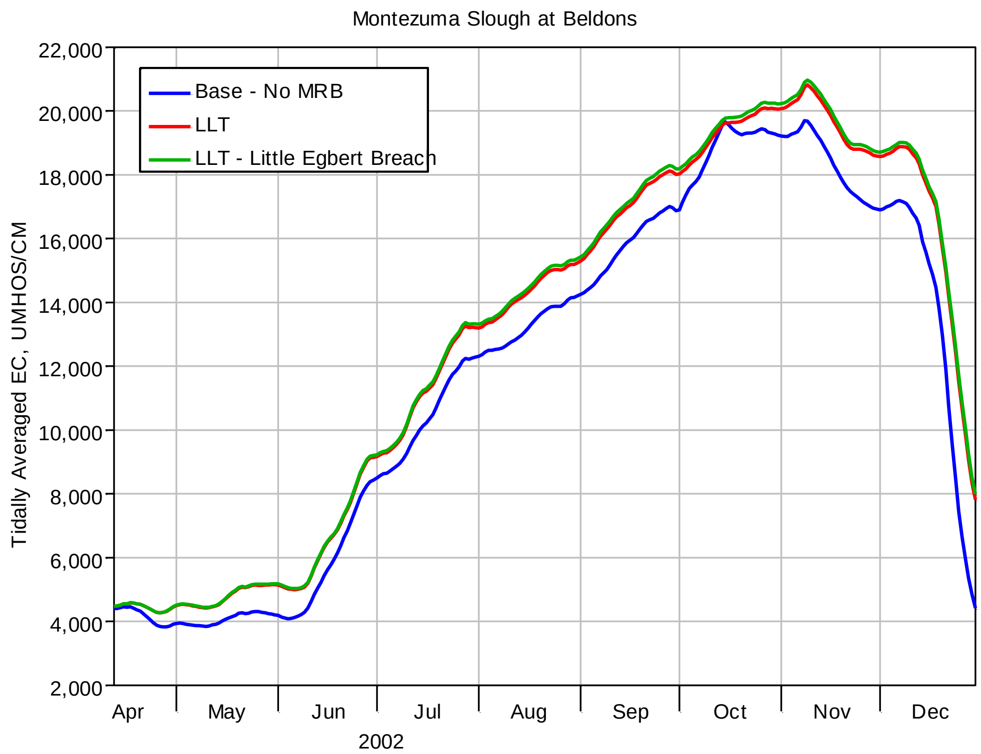


Figure 5-144 Tidally averaged EC at Montezuma Slough at Beldon's for Base-No MRB, LLT and LLT-Little Egbert Breach.

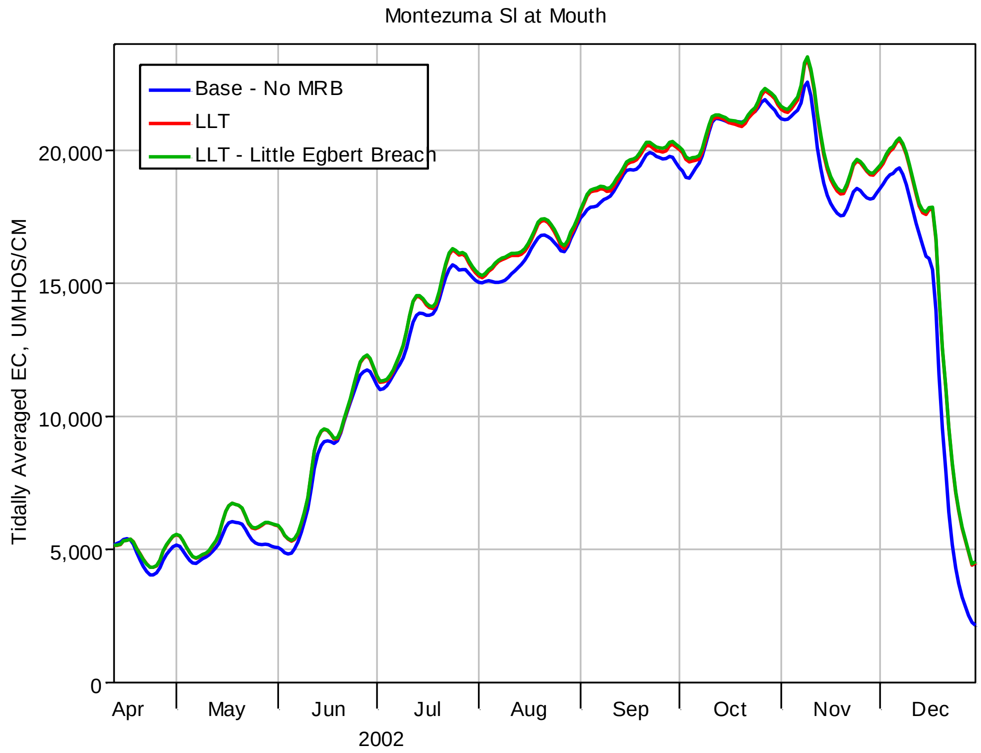


Figure 5-145 Tidally averaged EC at Montezuma Sl at Mouth for Base-No MRB, LLT and LLT-Little Egbert Breach.

5.6.2 Spatial Plots of EC Change

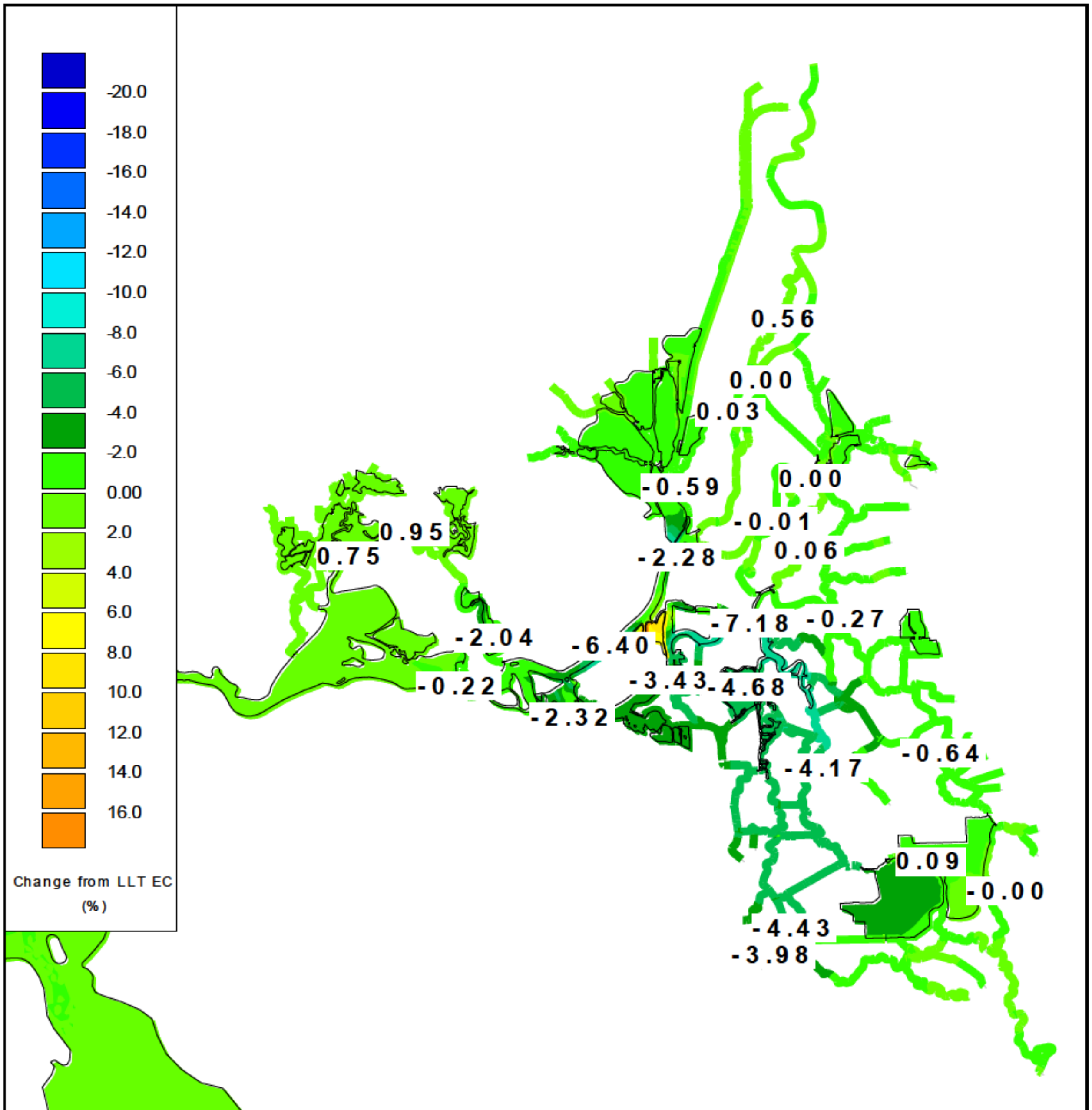


Figure 5-146 Contour plots of LLT – Little Egbert change from LLT tidally averaged EC on September 24, 2002.

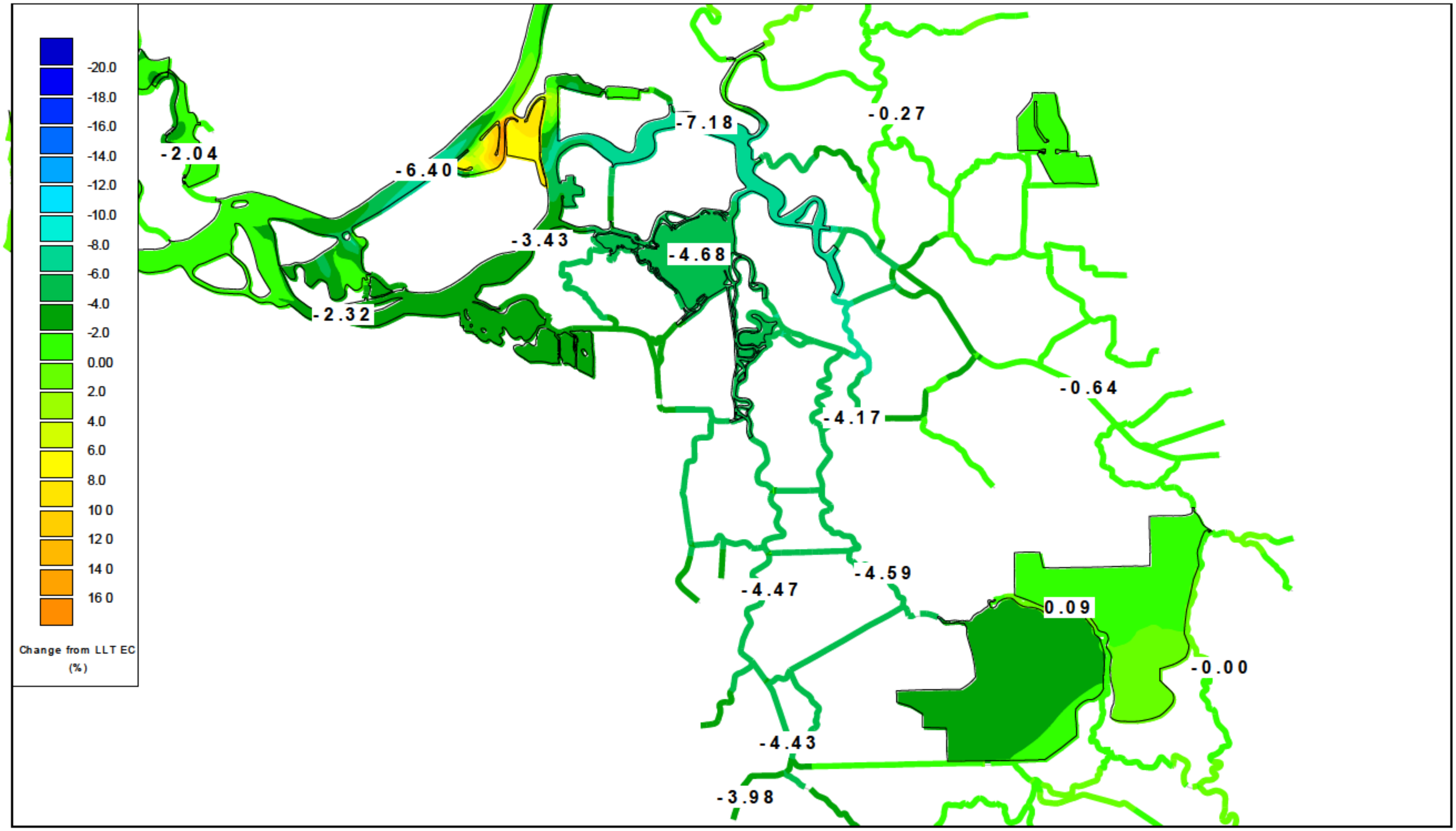


Figure 5-147 Contour plots of LLT – Little Egbert change from LLT tidally averaged EC in south Delta on September 24, 2002.

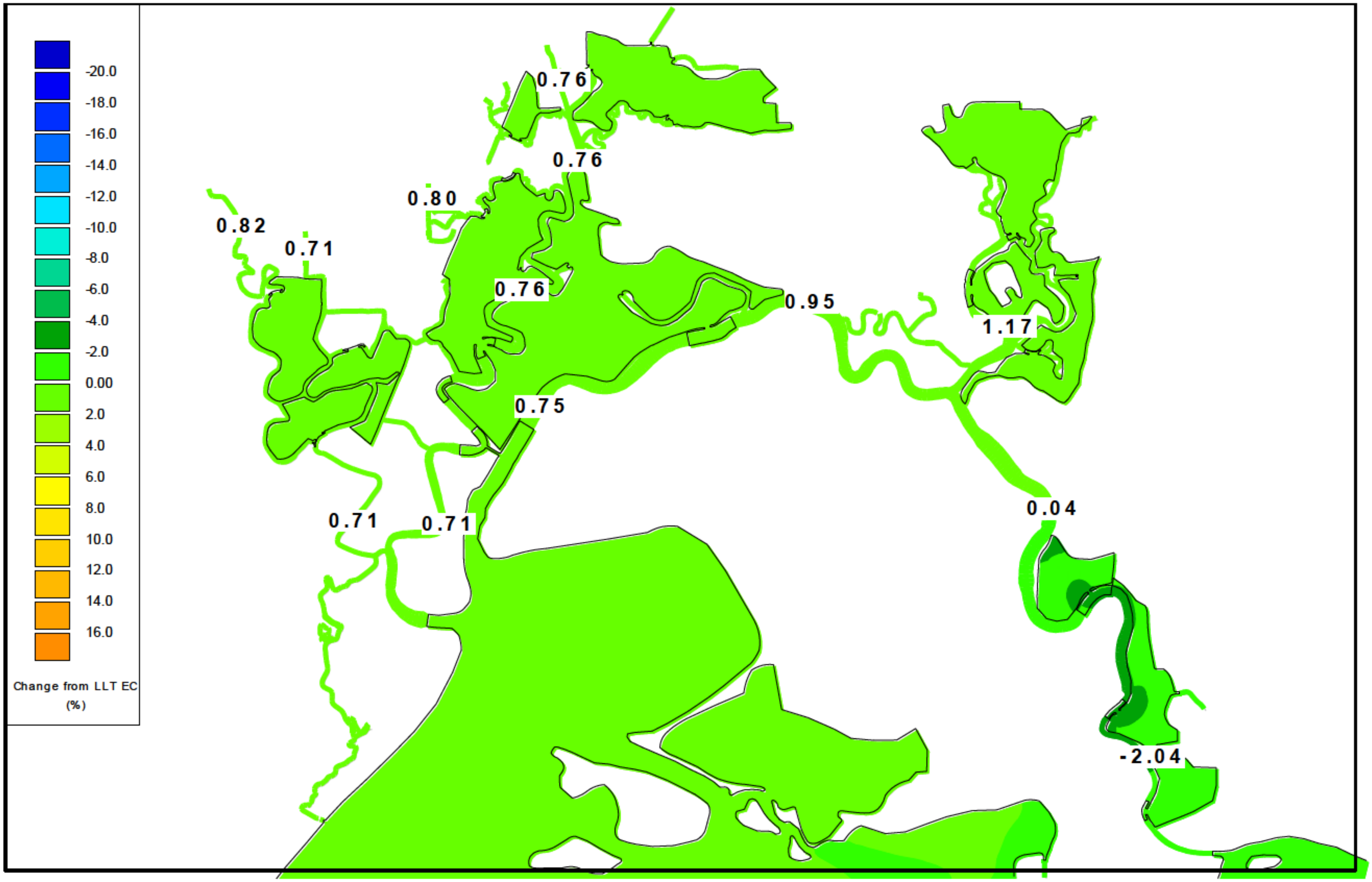


Figure 5-148 Contour plots of LLT – Little Egbert change from LLT tidally averaged EC in Suisun Marsh on September 24, 2002.

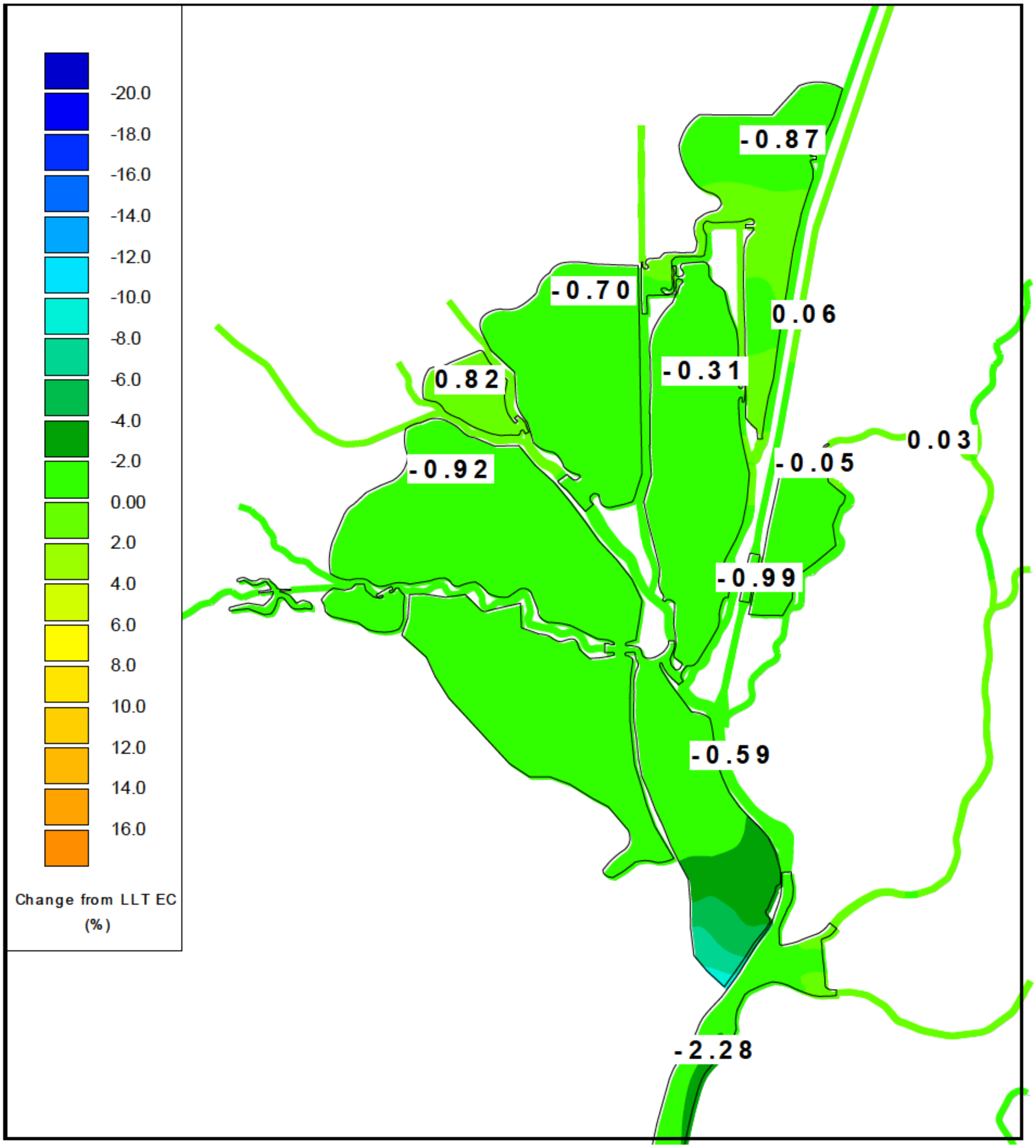


Figure 5-149 Contour plots of LLT – Little Egbert change from LLT tidally averaged EC in the Cache Slough ROA on September 24, 2002.

5.6.3 X2 Time Series

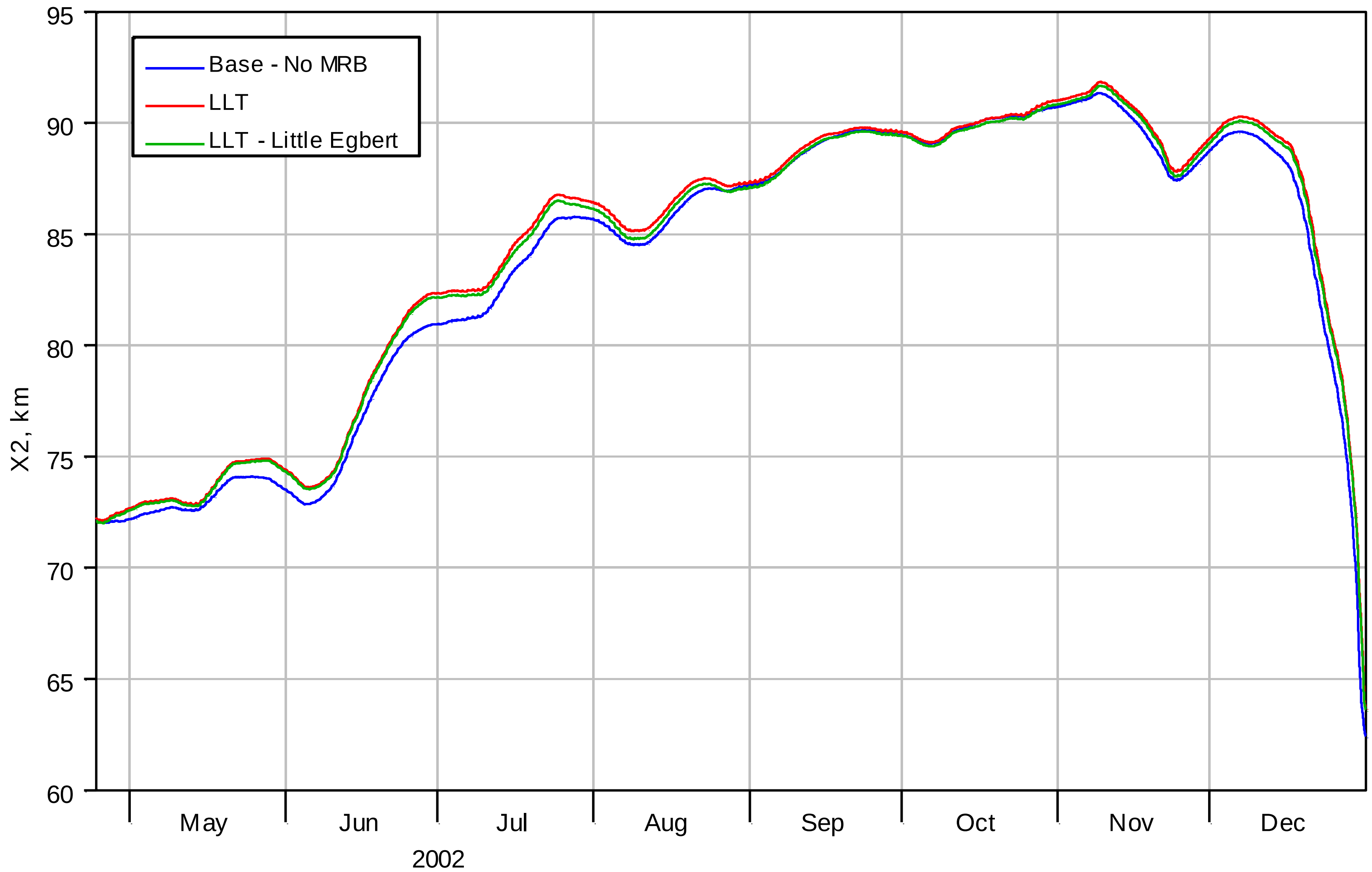


Figure 5-150 Time series of X2 for Base - No MRB, LLT and LLT – Little Egbert Breach.

5.7 LLT – Sherman Breach

EC results for the LLT – Sherman Breach case are shown as time series plots of tidally averaged values in Figure 5-151 through Figure 5-166. The EC impact of moving the Sherman Island breach from Threemile Slough to the San Joaquin River is minimal. EC peaks on the Sacramento River at Rio Vista and Emmaton are slightly reduced compared with LLT (the greatest tidally averaged EC reductions of about 40 umhos/cm occur in November). Outside that reach of the Sacramento River, and on the San Joaquin River, in the south Delta and Suisun Marsh, changes are negligible. There are no EC impacts at Freeport.

Contour plots of tidally averaged EC percent change from LLT on September 24, 2002 are shown in Figure 5-167 through Figure 5-169 for the Delta, the south and central Delta and for Suisun Marsh. These plots show a localized EC increase relative to LLT in the Sherman Island restoration area. In the LLT – Sherman Breach case, this restoration area fills with higher EC San Joaquin River water, rather than Threemile Slough water as in the LLT case.

A summary of July – December 2002 monthly average EC at key locations throughout the Delta is provided in Table 5-13 for Base – No MRB, LLT and LLT – Sherman Breach. Percent change in monthly average EC relative to the base case are provided in Table 5-14 for LLT and LLT – Sherman. These tables show reductions in monthly average EC relative to LLT up to 2% at Emmaton and Rio Vista. There are no significant changes elsewhere.

LLT – Sherman Breach X2, shown in Figure 5-170, is decreased by less than 0.1 km relative to LLT throughout the simulation period.

Table 5-13 Summary of July - December 2002 monthly average EC for Base - No MRB, LLT and LLT – Sherman Breach.

	Monthly Average EC (umhos/cm)																	
	July 2002			August 2002			September 2002			October 2002			November 2002			December 2002		
Location	Base - No MRB	LLT	LLT - Sherman Breach	Base - No MRB	LLT	LLT - Sherman Breach	Base - No MRB	LLT	LLT - Sherman Breach	Base - No MRB	LLT	LLT - Sherman Breach	Base - No MRB	LLT	LLT - Sherman Breach	Base - No MRB	LLT	LLT - Sherman Breach
Cache Sl at Ryer	136	135	135	153	150	150	176	173	173	164	160	160	189	188	188	196	193	193
CCWD Victoria Canal	264	288	288	367	432	433	469	553	554	511	615	615	453	543	543	482	561	560
CVP	333	354	355	515	572	573	664	745	746	658	780	780	587	688	688	631	704	703
Montezuma Sl at Head	3536	3567	3556	4650	4521	4502	6853	6816	6794	7400	7510	7496	6555	6739	6726	3149	3440	3430
Montezuma Sl at Mouth	13705	14112	14115	15976	16392	16395	18958	19301	19303	20766	20950	20954	19465	20279	20285	12062	13926	13929
RMID015	261	285	285	367	437	438	469	565	566	503	612	612	442	522	521	463	542	541
RMID023	262	285	285	367	436	436	468	560	561	507	614	614	448	527	527	477	552	551
ROLD024	401	438	439	707	781	784	934	1049	1053	826	1014	1015	712	891	890	607	744	742
ROLD034	360	392	393	615	692	695	804	912	914	755	915	916	651	801	800	601	732	730
RSAC075 Chipps Island	8209	8880	8873	9741	10267	10256	12563	13253	13243	13606	14160	14155	11990	12802	12795	6035	6735	6727
RSAC092 Emmaton	623	629	618	808	742	729	1498	1384	1361	2012	1919	1897	1748	1782	1757	821	874	860
RSAC101 Rio Vista	148	146	145	176	162	162	241	213	212	285	264	262	290	308	303	222	232	229
RSAC123	127	127	127	154	155	155	165	165	165	142	142	142	184	184	184	169	168	168
RSAC155 Freeport	126	126	126	156	156	156	162	162	162	142	142	142	184	184	184	164	164	164
RSAN018 Jersey Pt	954	1028	1032	1461	1519	1525	1975	2116	2124	1728	1913	1917	1503	1766	1766	945	1108	1109
RSAN032 San Andreas	284	383	383	459	649	651	555	871	871	448	773	772	403	668	666	333	480	478
RSAN058	643	612	612	664	644	644	711	698	698	674	682	682	636	629	629	763	751	751
S-49 Beldon's Landing	10402	11292	11295	13266	14335	14339	15826	16973	16978	18856	19371	19378	18357	19659	19668	12766	15349	15354
SWP	329	360	360	540	615	617	698	807	809	682	835	836	593	725	725	594	691	689

Table 5-14 Summary of July - December 2002 percent change in monthly average EC for LLT and LLT – Sherman Breach relative to Base - No MRB.

Location	July 2002 LLT	July 2002 LLT - Sherman Breach	August 2002 LLT	August 2002 LLT - Sherman Breach	September 2002 LLT	September 2002 LLT - Sherman Breach	October 2002 LLT	October 2002 LLT - Sherman Breach	November 2002 LLT	November 2002 LLT - Sherman Breach	December 2002 LLT	December 2002 LLT - Sherman Breach
	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Case											
Cache Sl at Ryer	-1%	-1%	-2%	-2%	-1%	-1%	-2%	-2%	-1%	-1%	-2%	-2%
CCWD Victoria Canal	9%	9%	18%	18%	18%	18%	20%	20%	20%	20%	16%	16%
CVP	7%	7%	11%	11%	12%	12%	19%	19%	17%	17%	12%	11%
Montezuma Sl at Head	1%	1%	-3%	-3%	-1%	-1%	1%	1%	3%	3%	9%	9%
Montezuma Sl at Mouth	3%	3%	3%	3%	2%	2%	1%	1%	4%	4%	15%	15%
RMID015	9%	9%	19%	19%	20%	21%	22%	22%	18%	18%	17%	17%
RMID023	9%	9%	19%	19%	20%	20%	21%	21%	18%	18%	16%	16%
ROLD024	9%	9%	10%	11%	12%	13%	23%	23%	25%	25%	23%	22%
ROLD034	9%	9%	13%	13%	13%	14%	21%	21%	23%	23%	22%	22%
RSAC075 Chipps Island	8%	8%	5%	5%	5%	5%	4%	4%	7%	7%	12%	11%
RSAC092 Emmaton	1%	-1%	-8%	-10%	-8%	-9%	-5%	-6%	2%	0%	6%	5%
RSAC101 Rio Vista	-2%	-2%	-8%	-8%	-12%	-12%	-7%	-8%	6%	4%	5%	3%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	8%	8%	4%	4%	7%	8%	11%	11%	18%	18%	17%	17%
RSAN032 San Andreas	35%	35%	42%	42%	57%	57%	73%	72%	66%	65%	44%	44%
RSAN058	-5%	-5%	-3%	-3%	-2%	-2%	1%	1%	-1%	-1%	-2%	-2%
S-49 Beldon's Landing	9%	9%	8%	8%	7%	7%	3%	3%	7%	7%	20%	20%
SWP	9%	9%	14%	14%	16%	16%	23%	23%	22%	22%	16%	16%

5.7.1 Tidally averaged EC time series

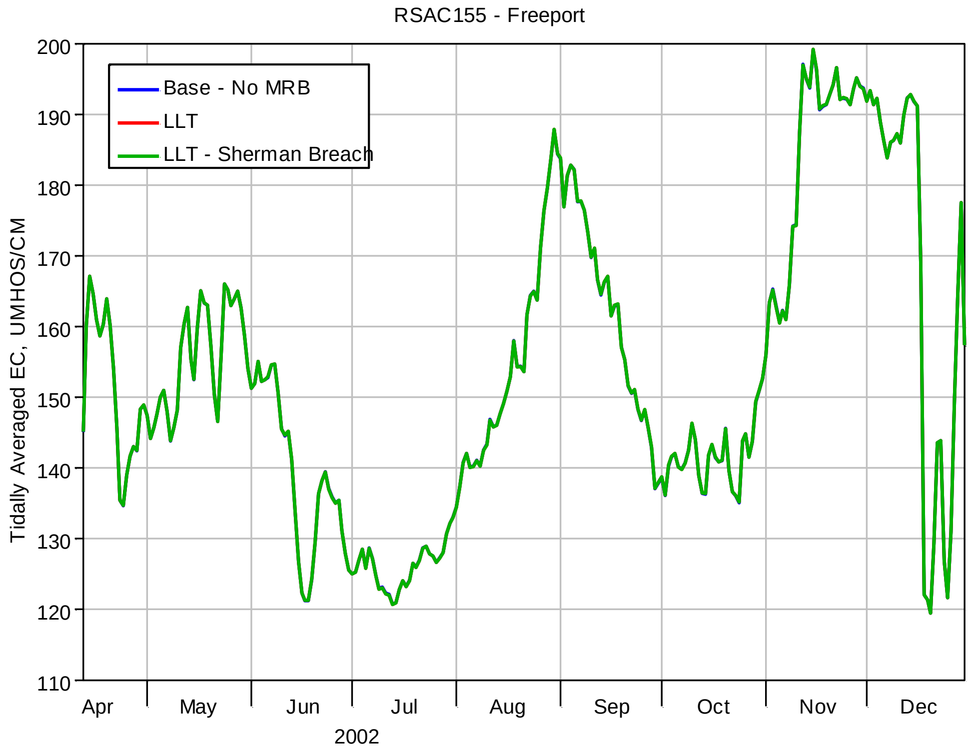


Figure 5-151 Tidally averaged EC at RSAC155 for Base-No MRB, LLT and LLT-Sherman Breach.

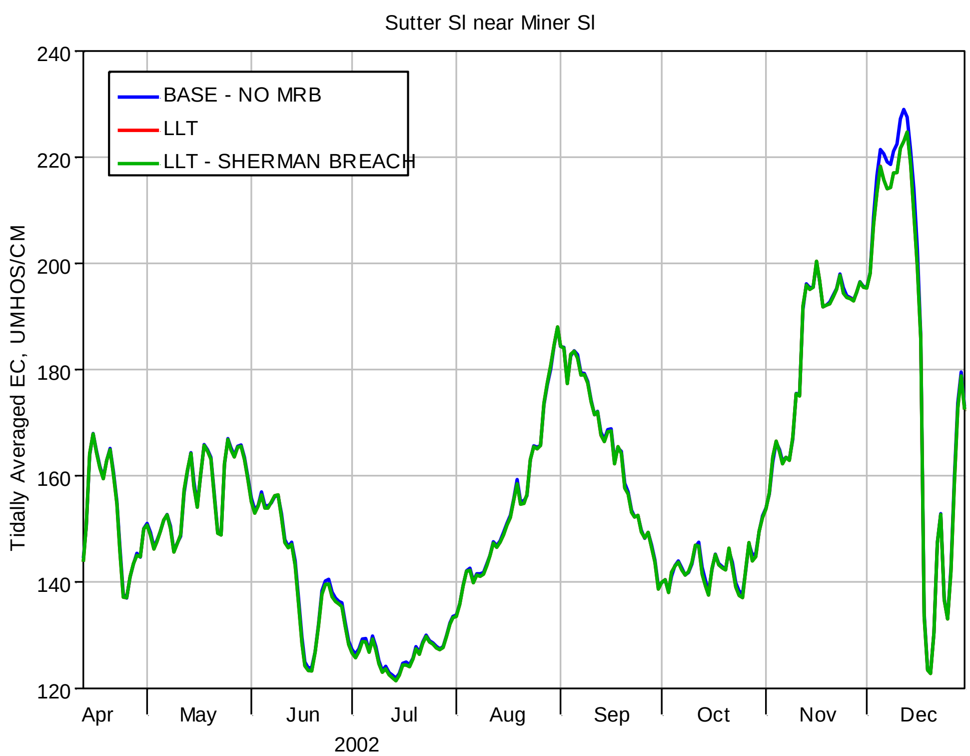


Figure 5-152 Tidally averaged EC in Sutter Slough for Base-No MRB, LLT and LLT-Sherman Breach.

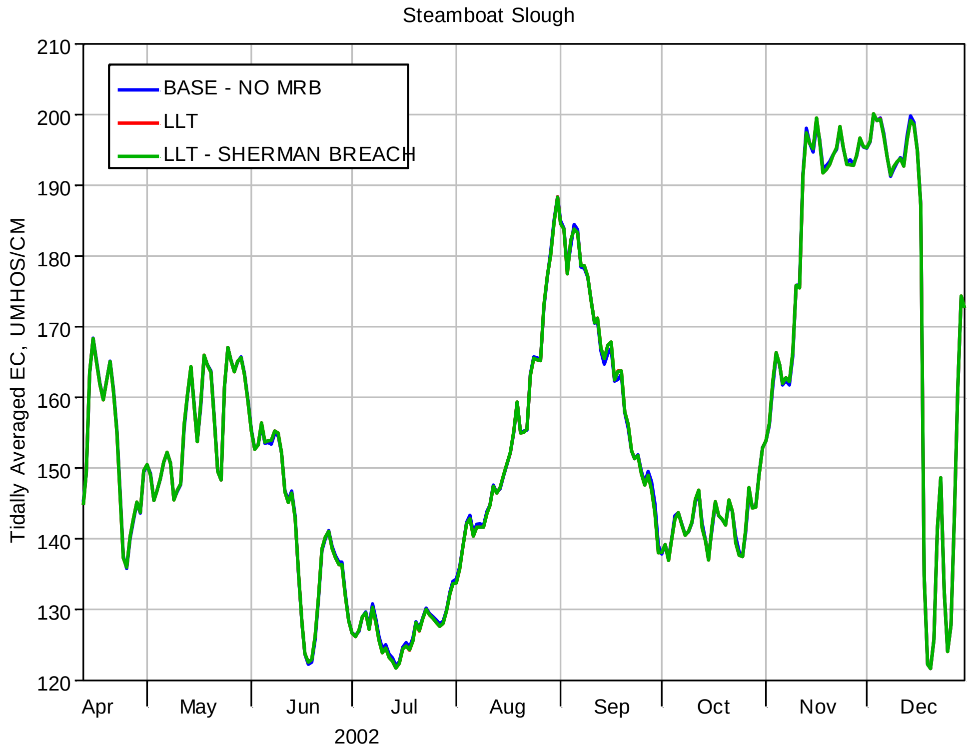


Figure 5-153 Tidally averaged EC in Steamboat Slough for Base-No MRB, LLT and LLT-Sherman Breach.

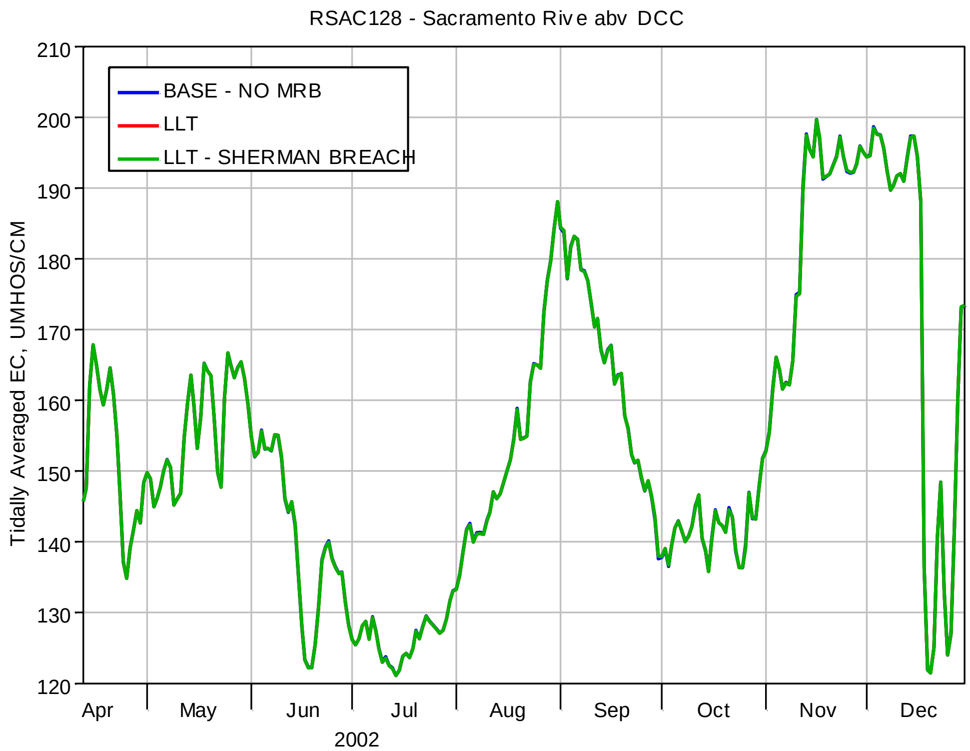


Figure 5-154 Tidally averaged EC at RSAC128 for Base-No MRB, LLT and LLT-Sherman Breach.

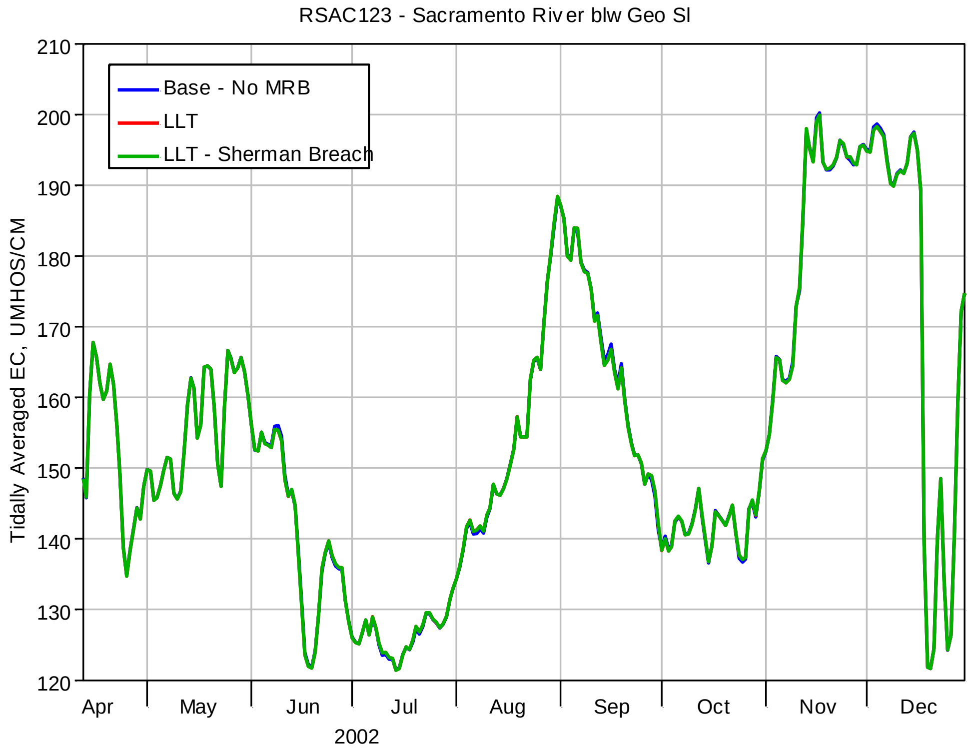


Figure 5-155 Tidally averaged EC at RSAC123 for Base-No MRB, LLT and LLT-Sherman Breach.

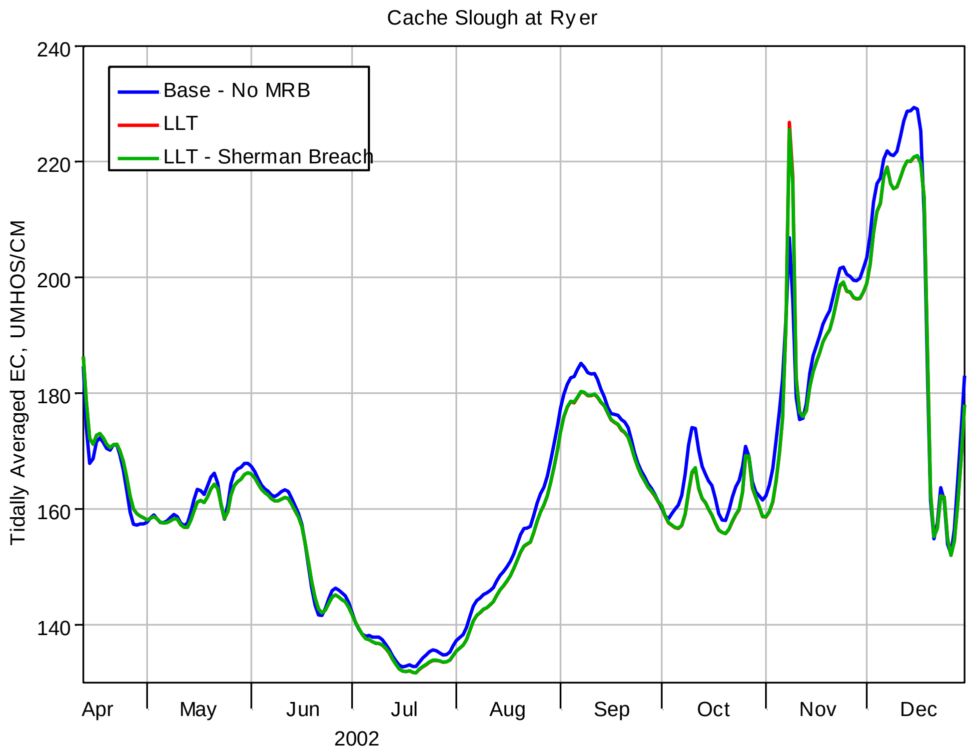


Figure 5-156 Tidally averaged EC at Cache Slough at Ryer for Base-No MRB, LLT and LLT-Sherman Breach.

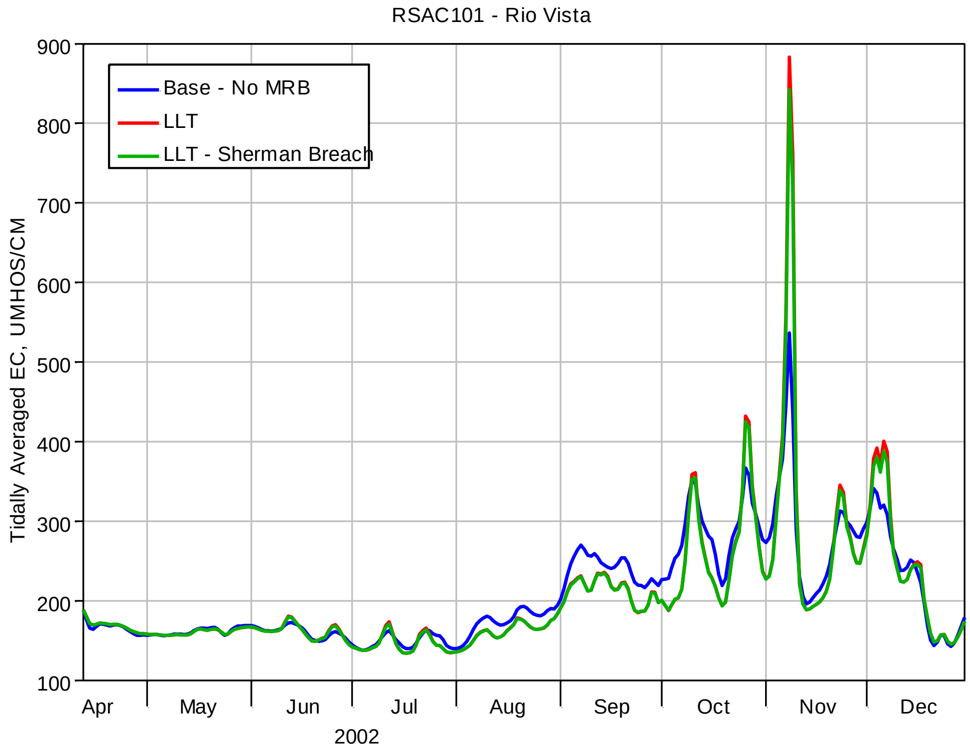


Figure 5-157 Tidally averaged EC at RSAC101 for Base-No MRB, LLT and LLT-Sherman Breach.

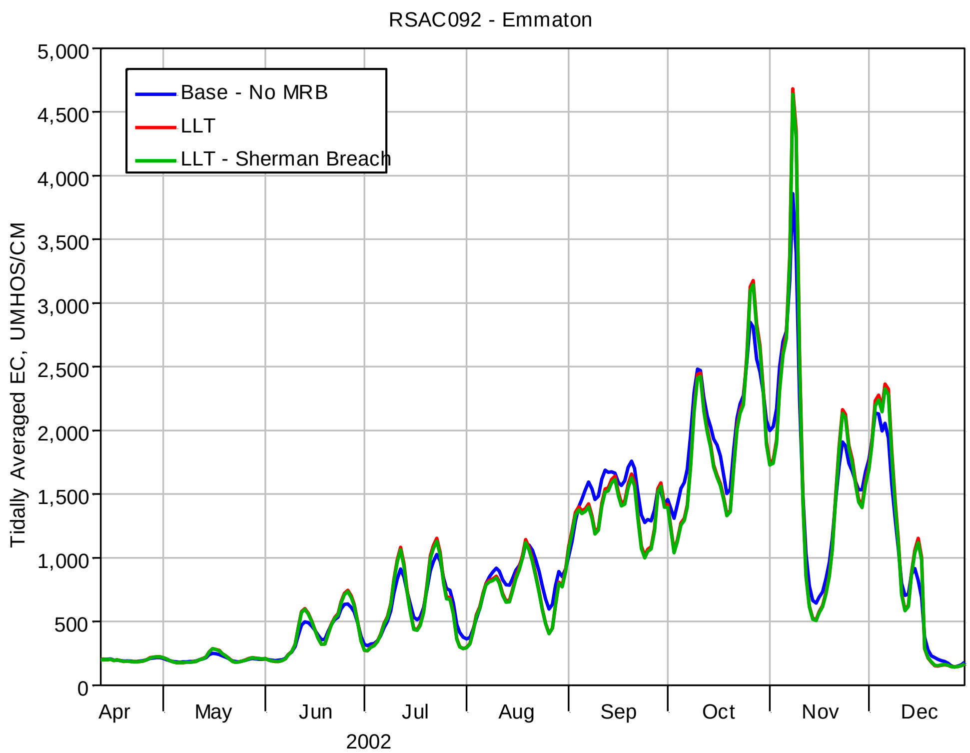


Figure 5-158 Tidally averaged EC at RSAC092 for Base-No MRB, LLT and LLT-Sherman Breach.

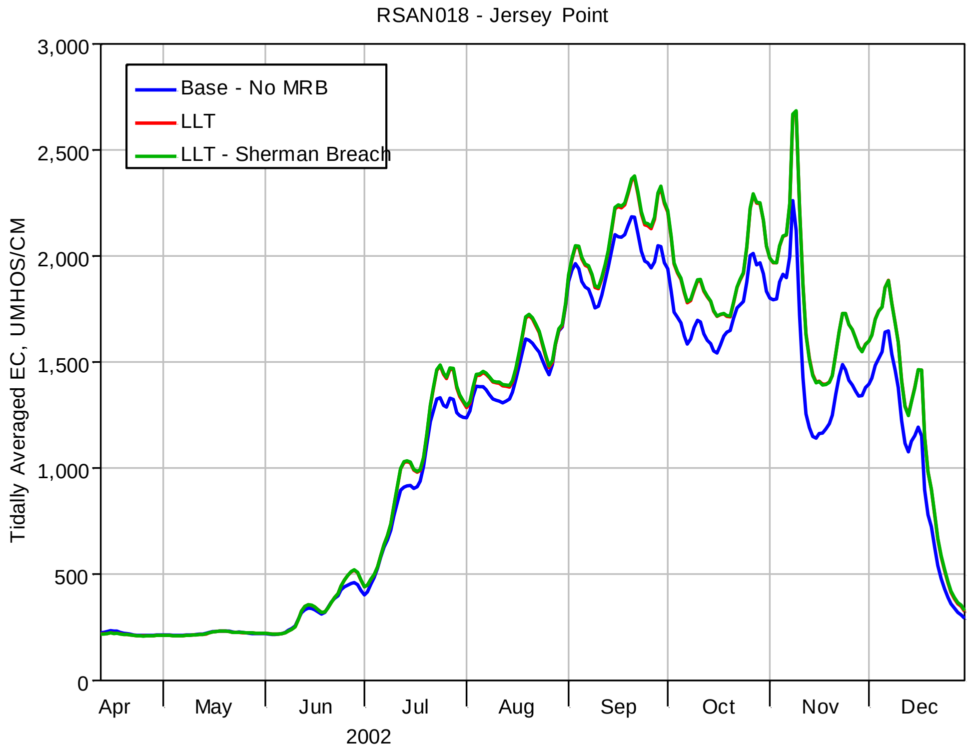


Figure 5-159 Tidally averaged EC at RSAN018 for Base-No MRB, LLT and LLT-Sherman Breach.

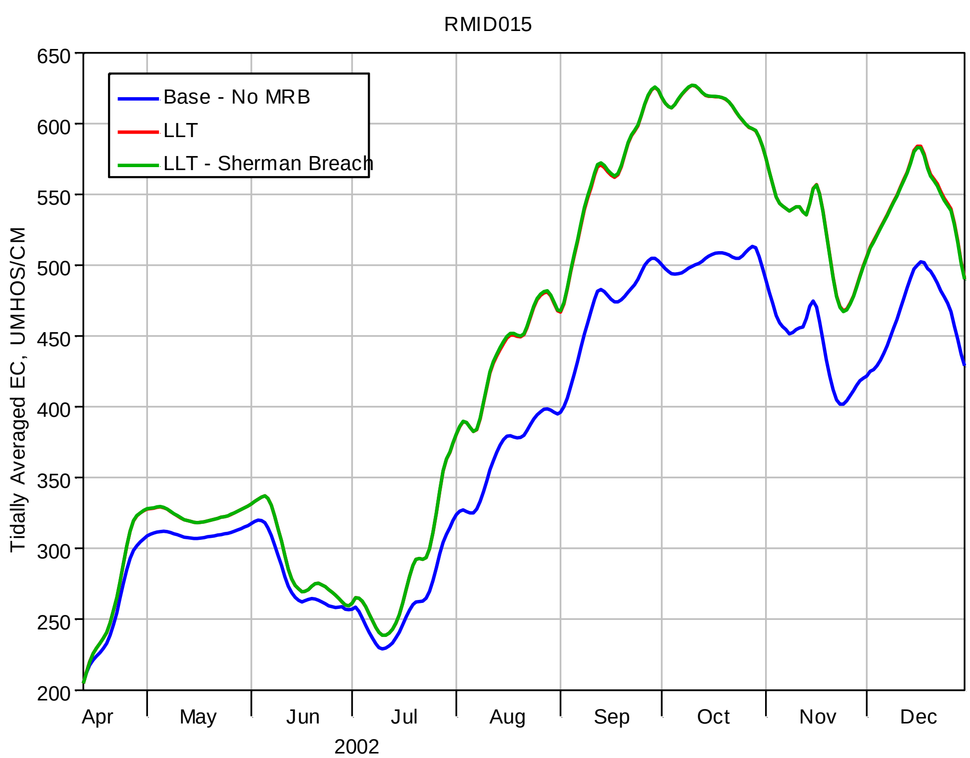


Figure 5-160 Tidally averaged EC at RMID015 for Base-No MRB, LLT and LLT-Sherman Breach.

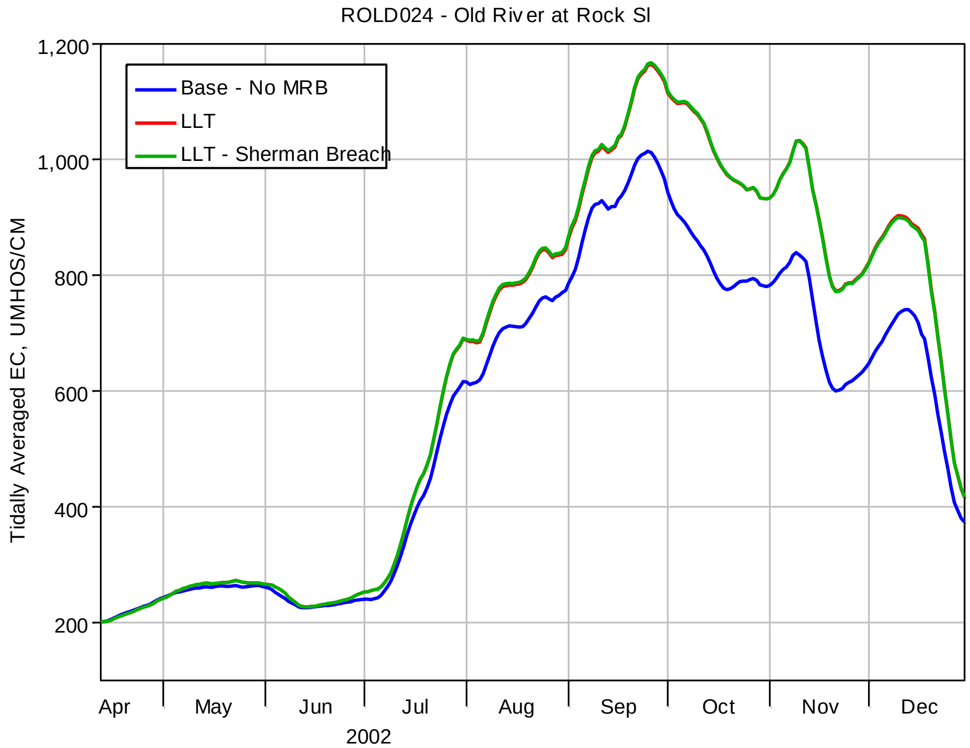


Figure 5-161 Tidally averaged EC at ROLD024 for Base-No MRB, LLT and LLT-Sherman Breach.

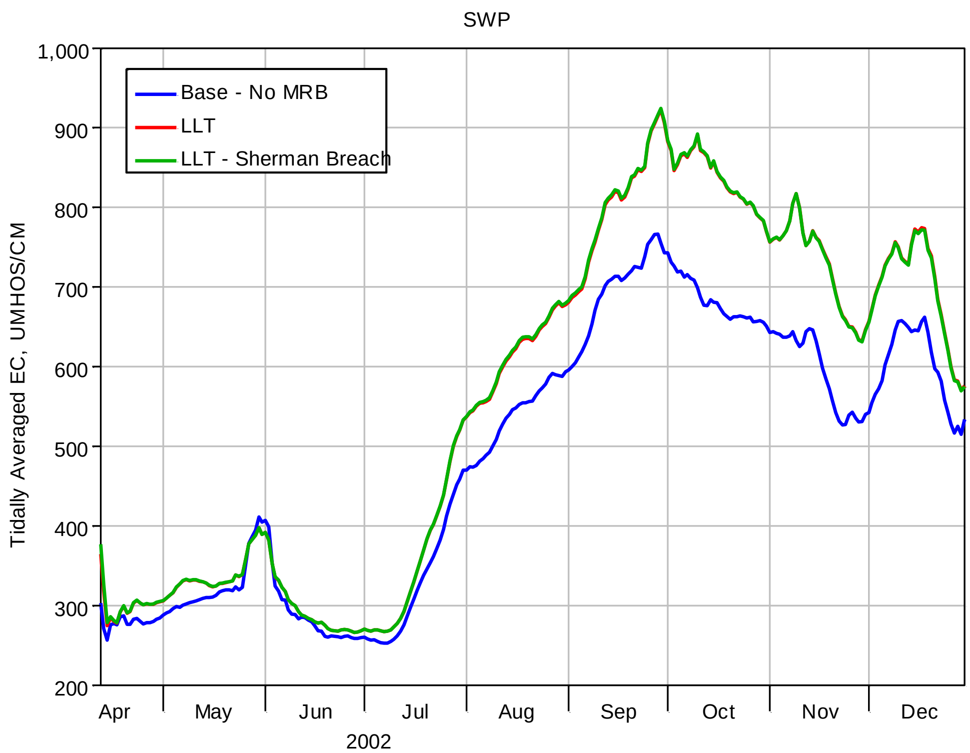


Figure 5-162 Tidally averaged EC at SWP for Base-No MRB, LLT and LLT-Sherman Breach.

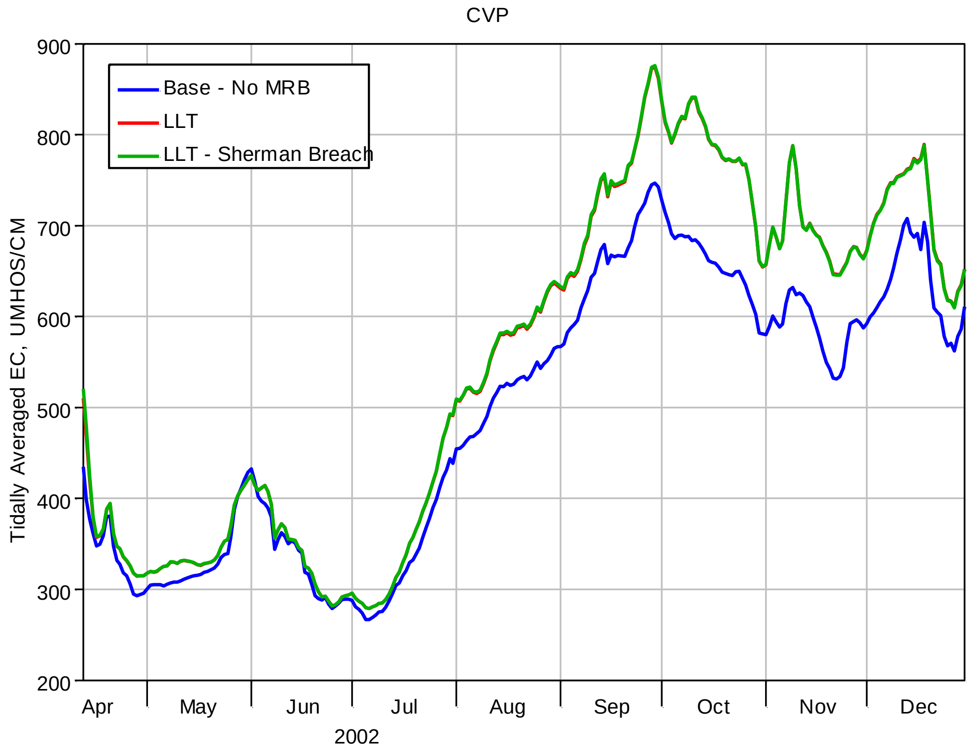


Figure 5-163 Tidally averaged EC at CVP for Base-No MRB, LLT and LLT-Sherman Breach.

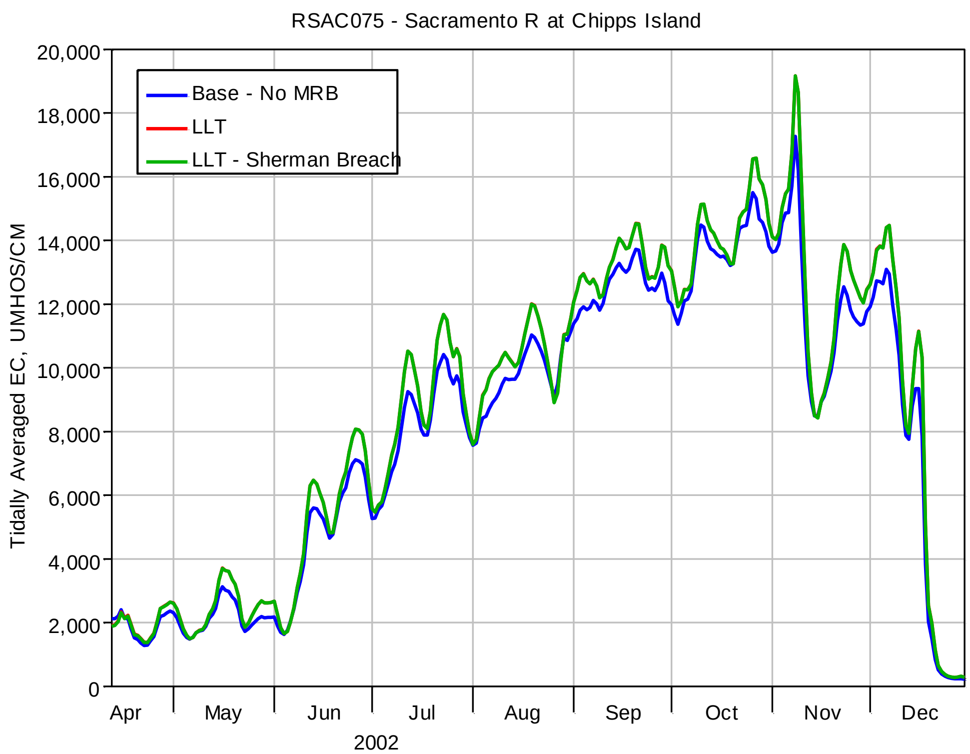


Figure 5-164 Tidally averaged EC at RSAC075 for Base-No MRB, LLT and LLT-Sherman Breach.

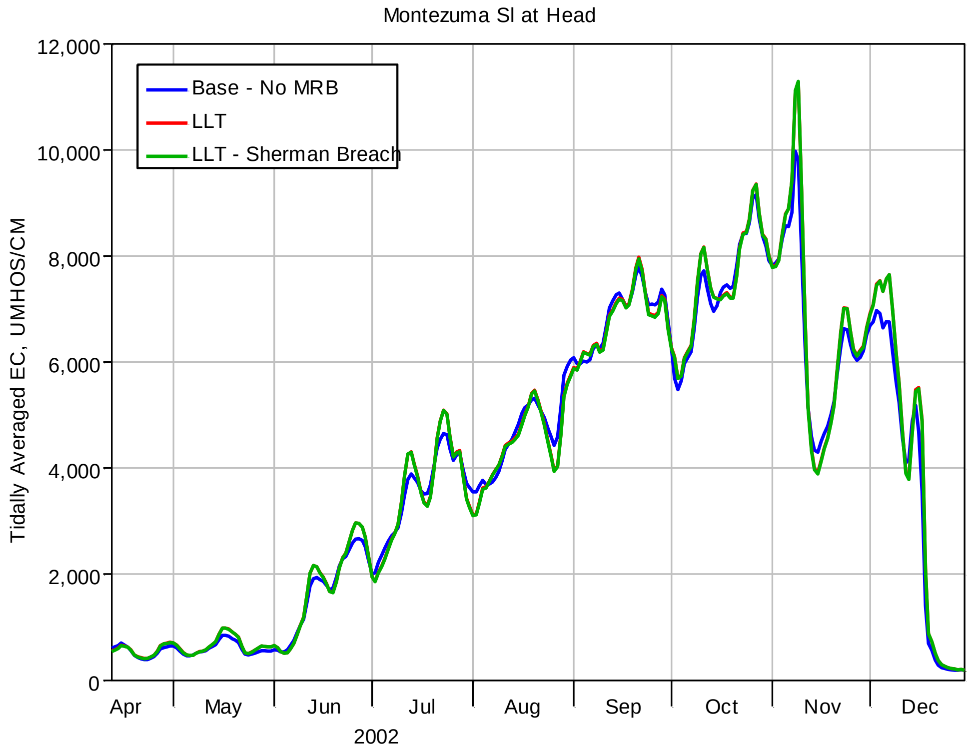


Figure 5-165 Tidally averaged EC at Montezuma Sl at Head for Base-No MRB, LLT and LLT-Sherman Breach.

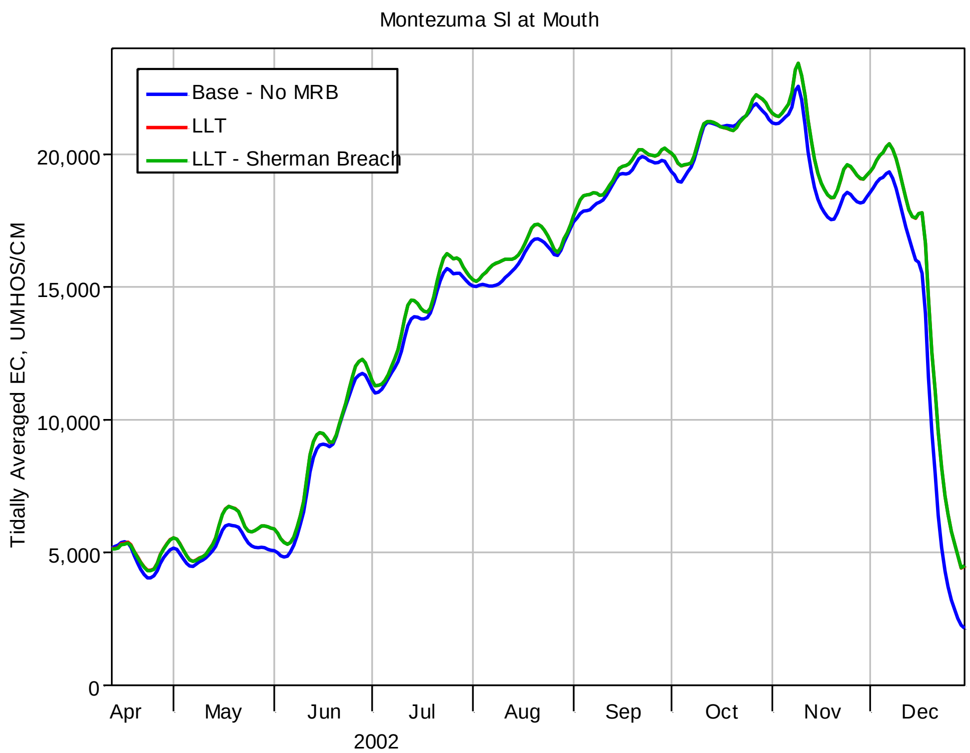


Figure 5-166 Tidally averaged EC at Montezuma Sl at Mouth for Base-No MRB, LLT and LLT-Sherman Breach.

5.7.2 Spatial Plots of EC Change

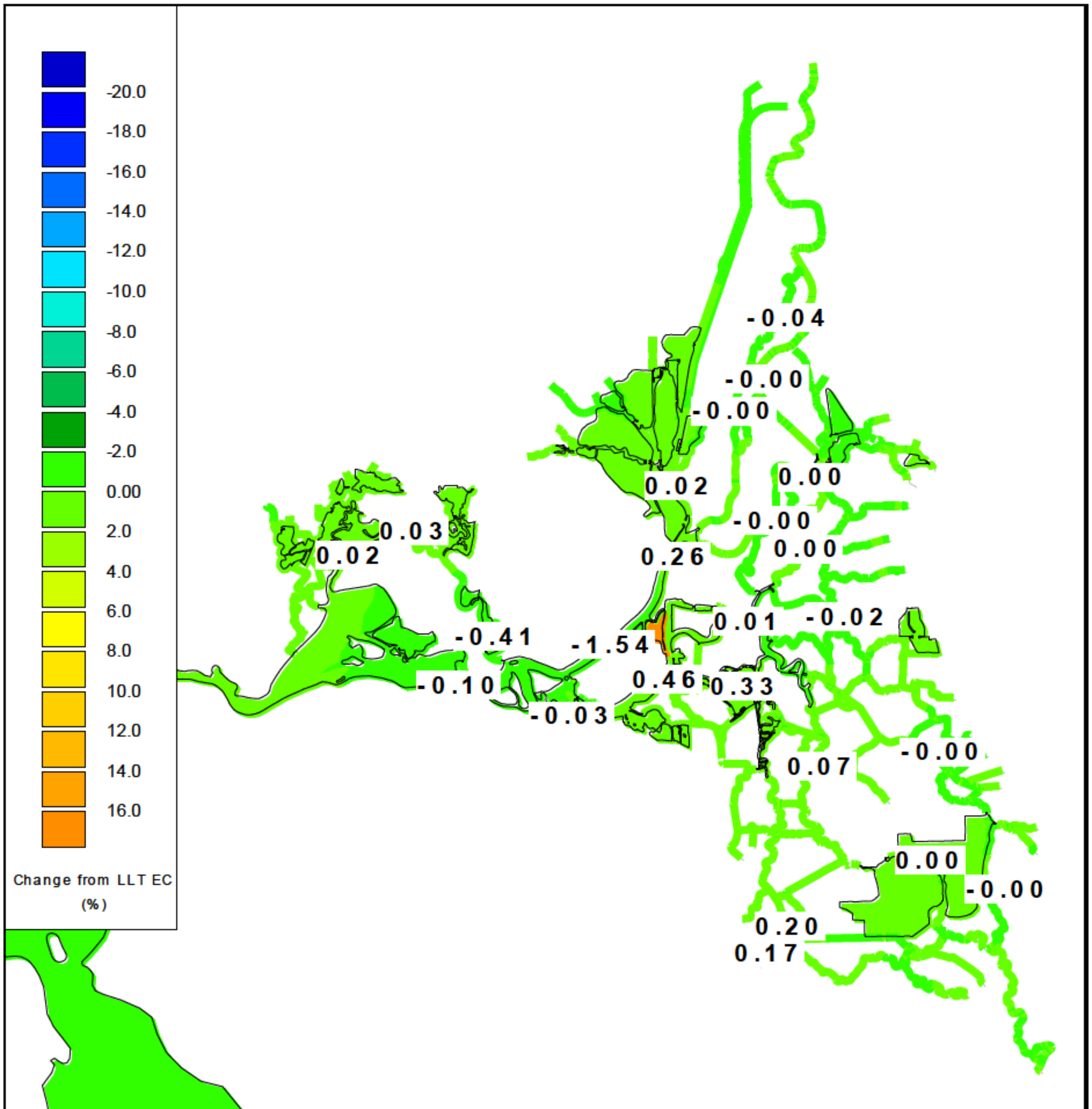


Figure 5-167 Contour plots of LLT – Sherman Breach change from LLT tidally averaged EC on September 24, 2002.

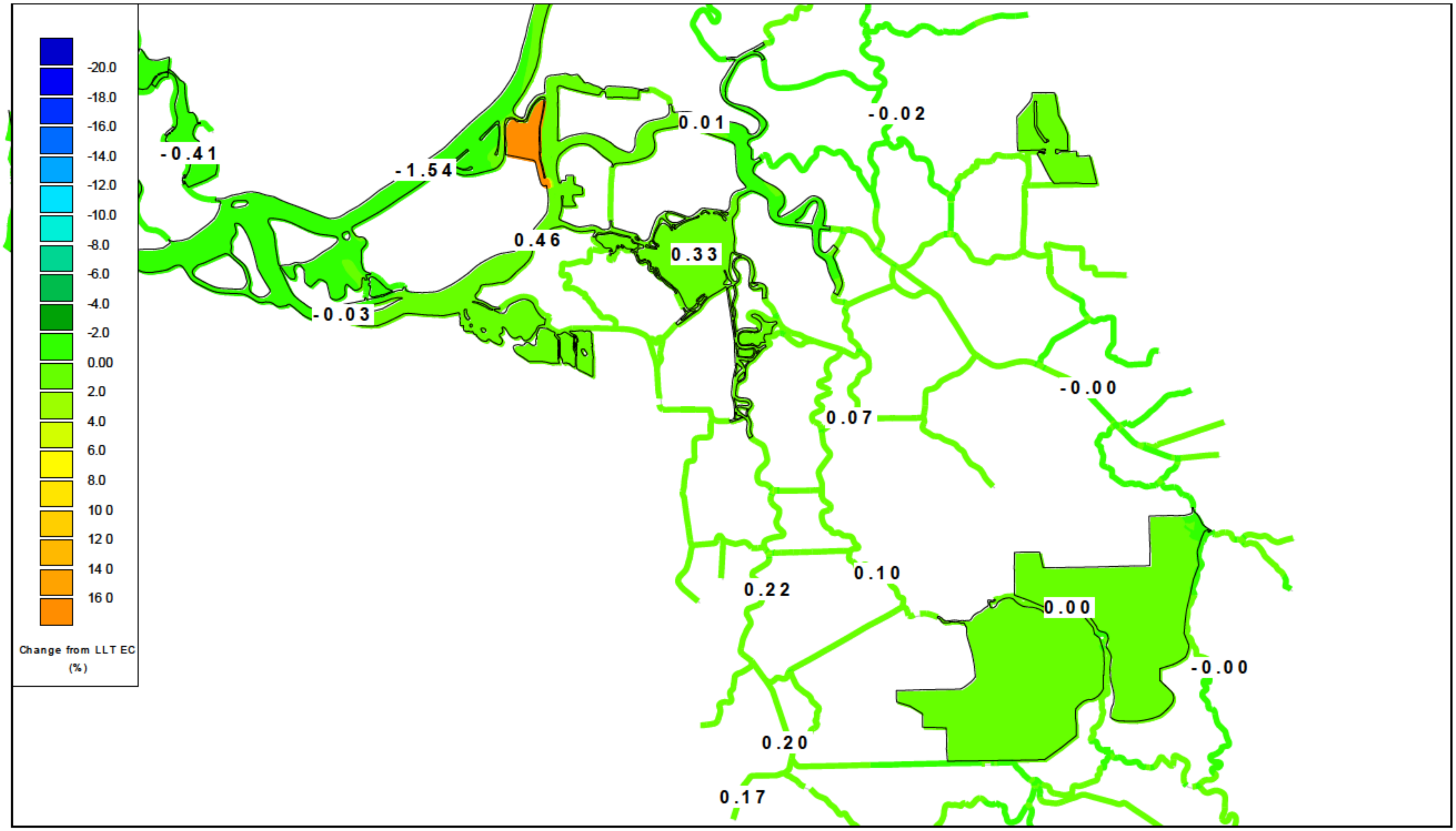


Figure 5-168 Contour plots of LLT – Sherman Breach change from LLT tidally averaged EC in south Delta on September 24, 2002.

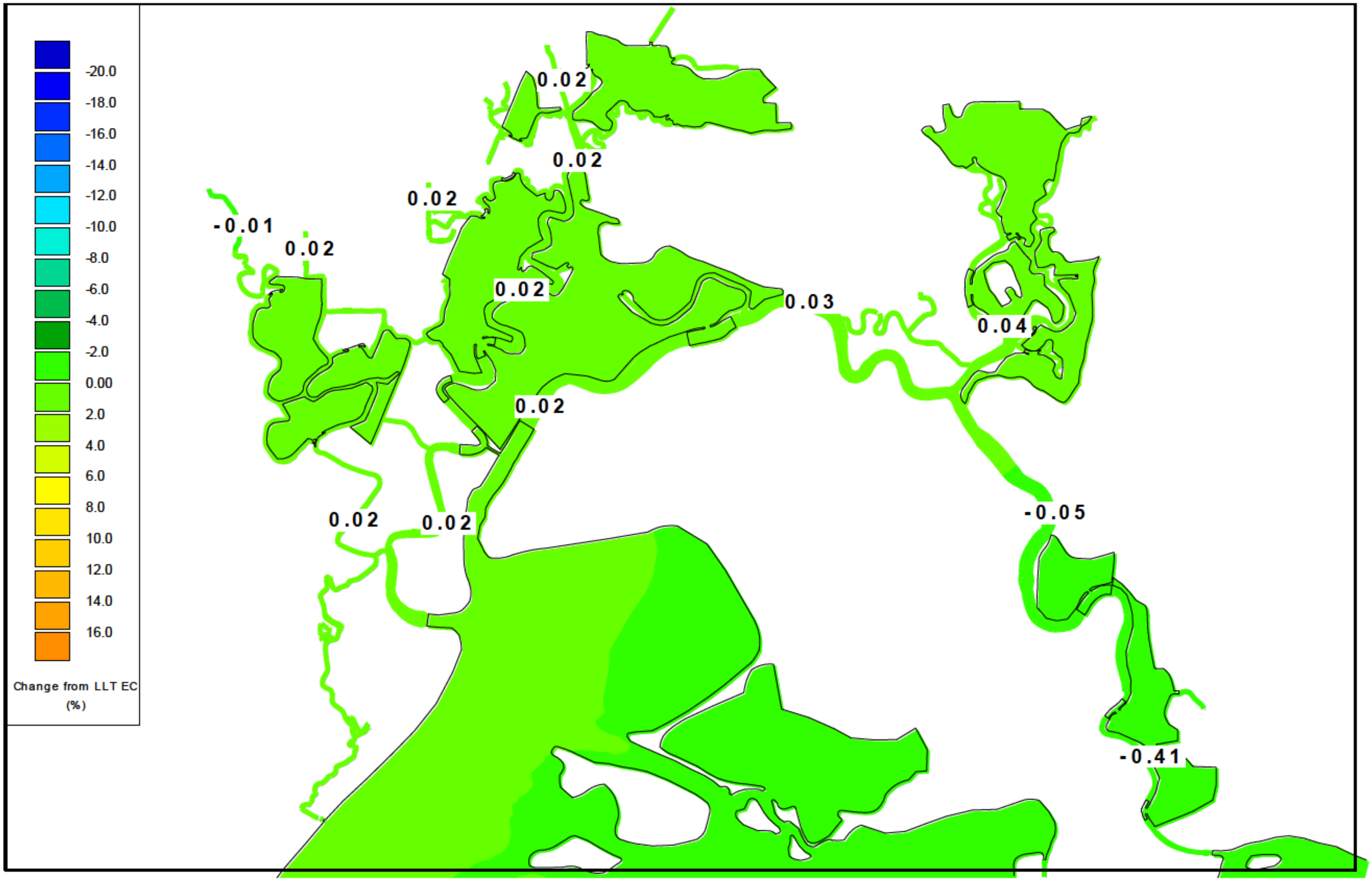


Figure 5-169 Contour plots of LLT – Sherman Breach change from LLT tidally averaged EC in Suisun Marsh on September 24, 2002.

5.7.3 X2 Time Series

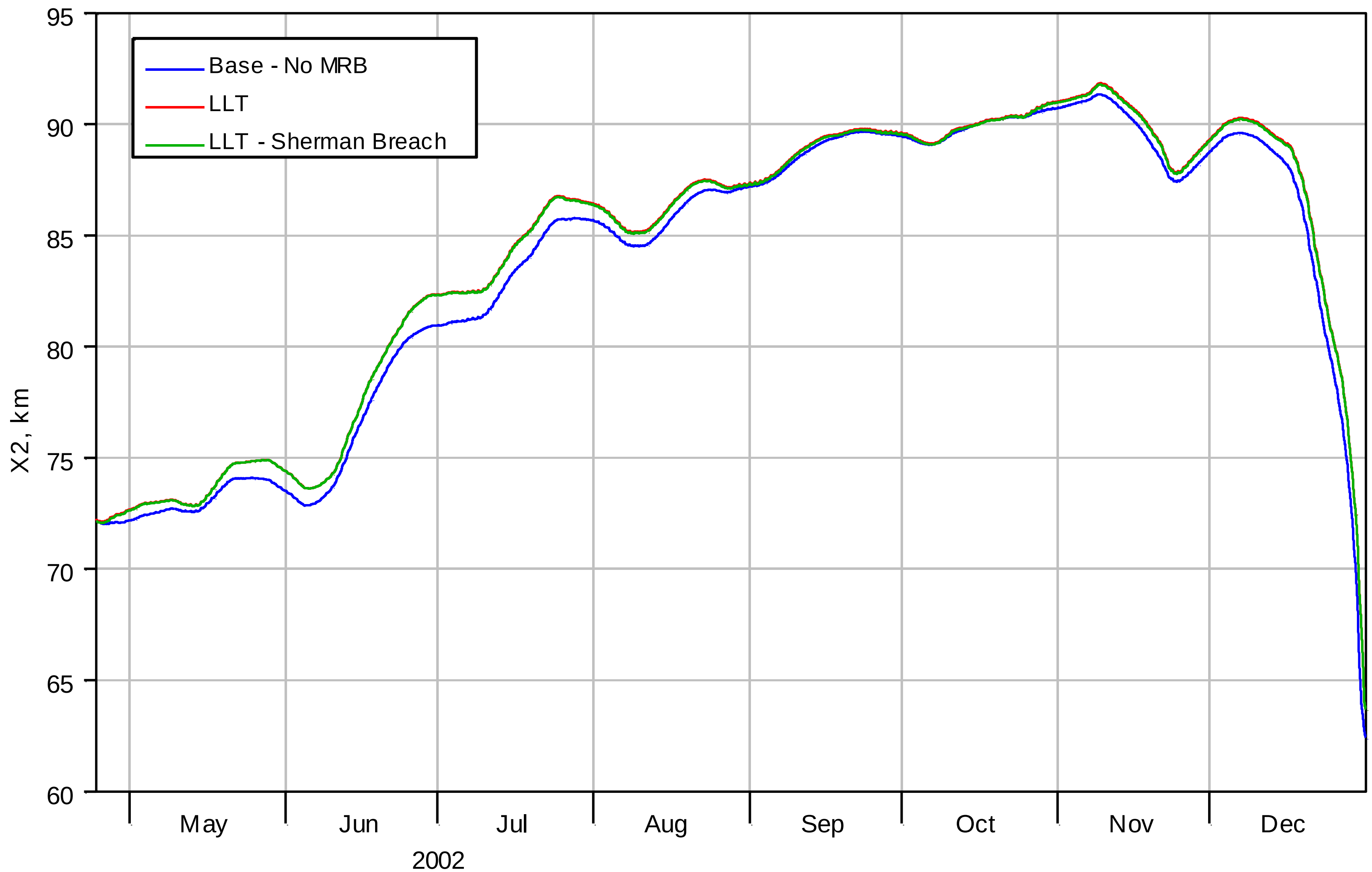


Figure 5-170 Time series of X2 for Base - No MRB, LLT and LLT – Sherman Breach.

5.8 EC Summary

The distribution of salinity in the Delta is a function of the overall flow balance, net flow distribution, and dispersive mixing associated with tidal flows.

The tidal and net (or averaged) flow changes discussed in the "Hydrodynamic Impacts" section act to change the salinity distribution in the Delta, Suisun Bay and Suisun Marsh.

A summary of July and August 2002 changes in monthly average EC relative to base restoration case (ELT or LLT) for each of the sensitivity cases is provided in Table 5-15 (Tables for September – December 2002 are provided in the Appendix). Coloration of the table cells indicates largest increases (red) and decreases (blue). None of the scenarios has large EC impacts north of Rio Vista. LLT – Suisun Scour and ELT – Max Suisun result in the largest EC increases overall, while LLT – Little Egbert results in the largest decreases overall.

Average X2 values for July 2002 are summarized in Table 5-16. The LLT restoration increases July 2002 X2 by 1.1 km. Most of the LLT sensitivity cases impact this value by a tenth of a kilometer or less. The LLT – Little Egbert case reduces July X2 by 0.3 km relative to LLT and the LLT – Suisun Scour case increase X2 by 0.7 km relative to LLT.

The ELT restoration decreases July X2 by 0.2 km relative to Base. ELT – Prospect Island does not impact July X2, however the ELT – Max Suisun case increases it by a full kilometer, bringing it closer to LLT X2.

Suisun Marsh Restoration Impacts

Acre for acre, Suisun Marsh restoration has the greatest impact on EC in the central and south Delta. Shifting restoration area from Cache Slough to Suisun Marsh increased EC in these areas and increased X2. Increasing conveyance in Suisun Marsh amplified the impact of Suisun Marsh restoration on central and south Delta EC and resulted in the highest X2 and highest EC at the exports of any scenario.

Delta Cross Channel and Georgiana Slough Flow Impacts

Changes in freshwater coming through DCC and down Georgiana Slough impact EC in the San Joaquin River around San Andreas Landing and on down into the South Delta. The LLT – Little Egbert case increases Georgiana Slough and DCC flows by 88 cfs above LLT, resulting in EC decreases of up to 7% below LLT in the south Delta.

Middle River Conveyance Impacts

With the increased conveyance in Middle River, EC in Middle River is slower to respond to changes in flow and peaks are lower. This is because the Union Island in the South Delta ROA is better connected to Middle River resulting in more mixing between Middle River and the restoration area.

Table 5-15 Summary of July and August 2002 change in monthly average EC relative to base restoration case for ELT - Max Suisun, ELT - Prospect Breach and LLT - Middle River (values for September through December are tabulated in the Appendix). Darker red indicates largest increases and darkest blue indicates largest decreases.

	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Restoration Case (ELT or LLT)													
	July 2002							August 2002						
Location	ELT - Max Suisun	LLT - No South	LLT - Middle River	LLT - Suisun Scour	ELT - Prospect Breach	LLT - Little Egbert Breach	LLT - Sherman Breach	ELT - Max Suisun	LLT - No South	LLT - Middle River	LLT - Suisun Scour	ELT - Prospect Breach	LLT - Little Egbert Breach	LLT - Sherman Breach
Cache Sl at Ryer	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CCWD Victoria Canal	2%	0%	-1%	3%	-1%	-2%	0%	5%	1%	-3%	7%	-2%	-4%	0%
CVP	3%	1%	0%	5%	-1%	-2%	0%	6%	2%	-2%	8%	-2%	-3%	0%
Montezuma Sl at Head	5%	0%	-1%	9%	0%	-1%	0%	3%	1%	-1%	7%	1%	-1%	0%
Montezuma Sl at Mouth	-1%	0%	0%	3%	0%	0%	0%	0%	0%	0%	3%	0%	1%	0%
RMID015	2%	0%	-1%	3%	-1%	-2%	0%	5%	0%	-3%	7%	-2%	-4%	0%
RMID023	2%	0%	-1%	3%	-1%	-2%	0%	5%	0%	-3%	7%	-2%	-4%	0%
ROLD024	6%	0%	-2%	8%	-2%	-3%	0%	8%	1%	-2%	10%	-2%	-4%	0%
ROLD034	5%	0%	1%	7%	-2%	-3%	0%	8%	0%	1%	10%	-2%	-4%	0%
RSAC075 Chipps Island	11%	0%	0%	8%	0%	-1%	0%	10%	0%	0%	8%	0%	0%	0%
RSAC092 Emmaton	1%	1%	-2%	5%	1%	-10%	-2%	0%	3%	-2%	3%	1%	-9%	-2%
RSAC101 Rio Vista	-1%	0%	-1%	-1%	0%	-1%	0%	-1%	1%	-1%	-1%	1%	0%	0%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	9%	0%	-1%	12%	-1%	-3%	0%	10%	1%	-1%	11%	-1%	-3%	0%
RSAN032 San Andreas	6%	1%	-3%	8%	-2%	-6%	0%	8%	1%	-4%	10%	-2%	-6%	0%
RSAN058	1%	8%	-3%	0%	0%	0%	0%	1%	7%	-3%	0%	0%	-1%	0%
S-49 Beldon's Landing	1%	-1%	1%	-6%	0%	1%	0%	1%	-1%	1%	-7%	0%	1%	0%
SWP	4%	0%	0%	6%	-1%	-3%	0%	7%	0%	-1%	9%	-2%	-4%	0%

Table 5-16 Average X2 values for July.

Simulation	Average X2 July 2002
Base	83.4
ELT	83.2
LLT	84.5
ELT – Max Suisun	84.2
LLT – No South	84.5
LLT – Middle River	84.4
LLT – Suisun Scour	85.2
ELT – Prospect Breach	83.2
LLT – Little Egbert	84.2
LLT – Sherman Breach	84.4

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7 Appendix

7.1 Spatial Plots of EC Change from base

7.1.1 ELT – Maximize Suisun ROA

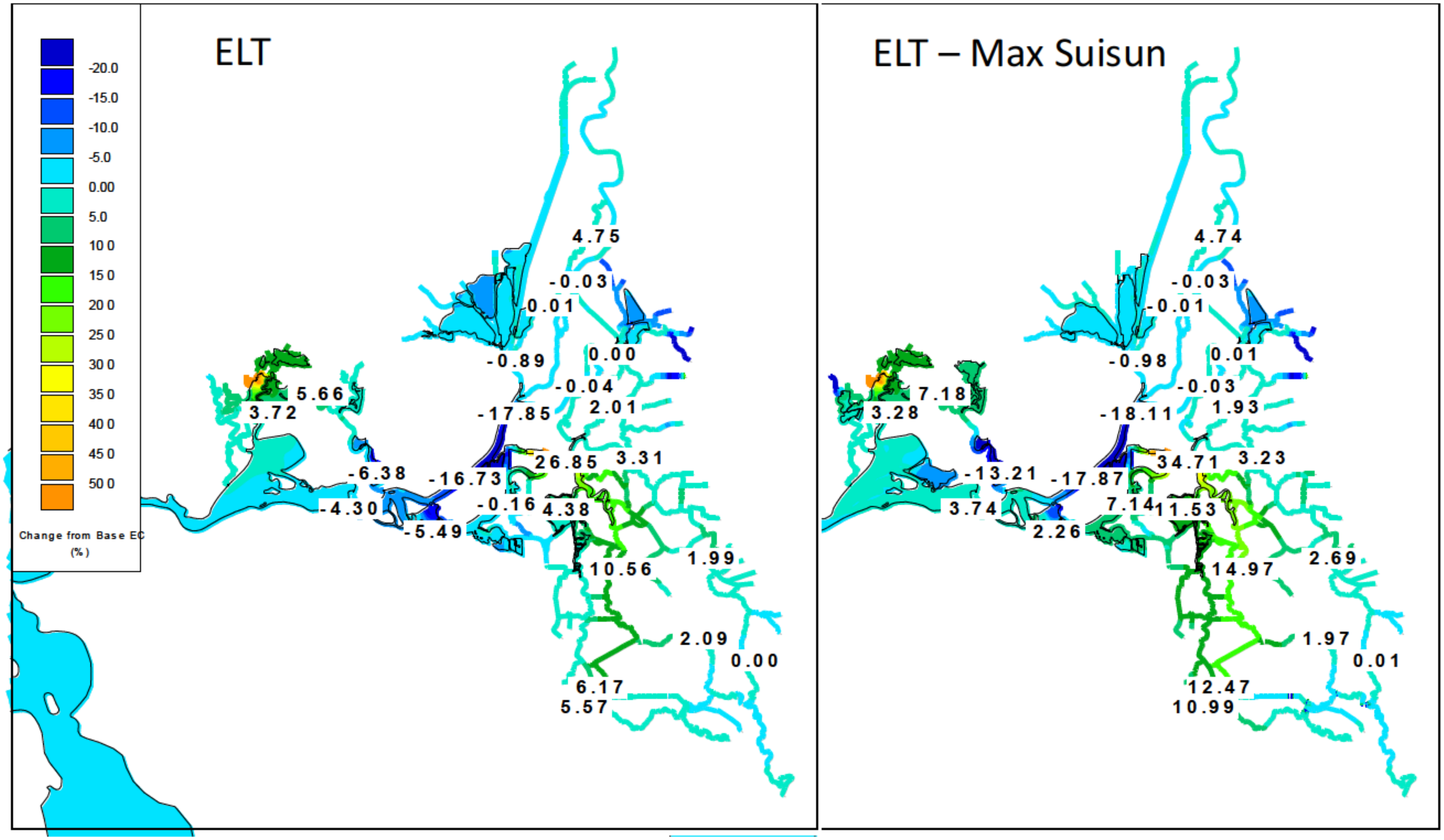


Figure 7-1 Contour plots of EC change from Base - No SMSCG on September 24, 2002, for the ELT and ELT – Max Suisun simulations.

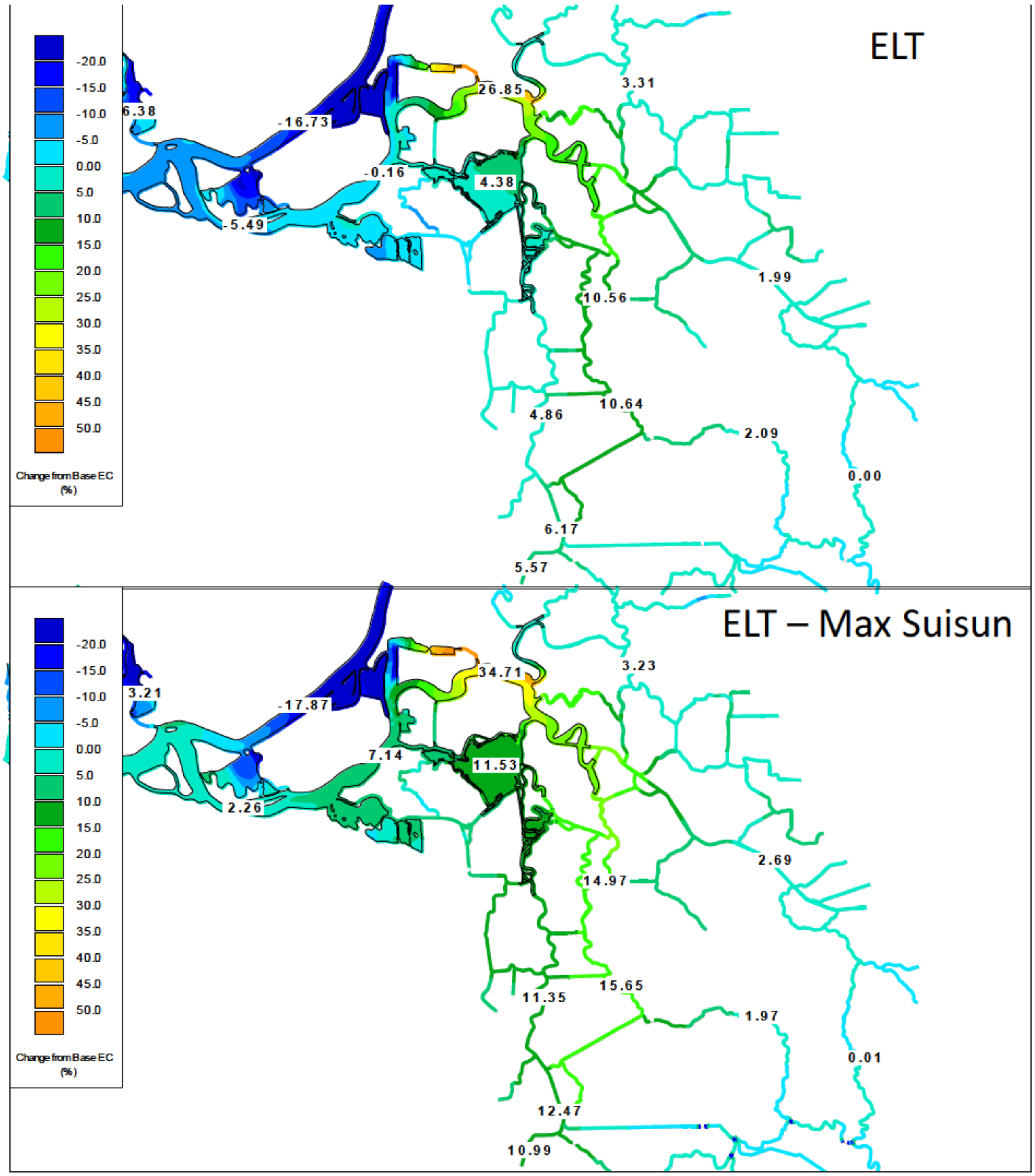
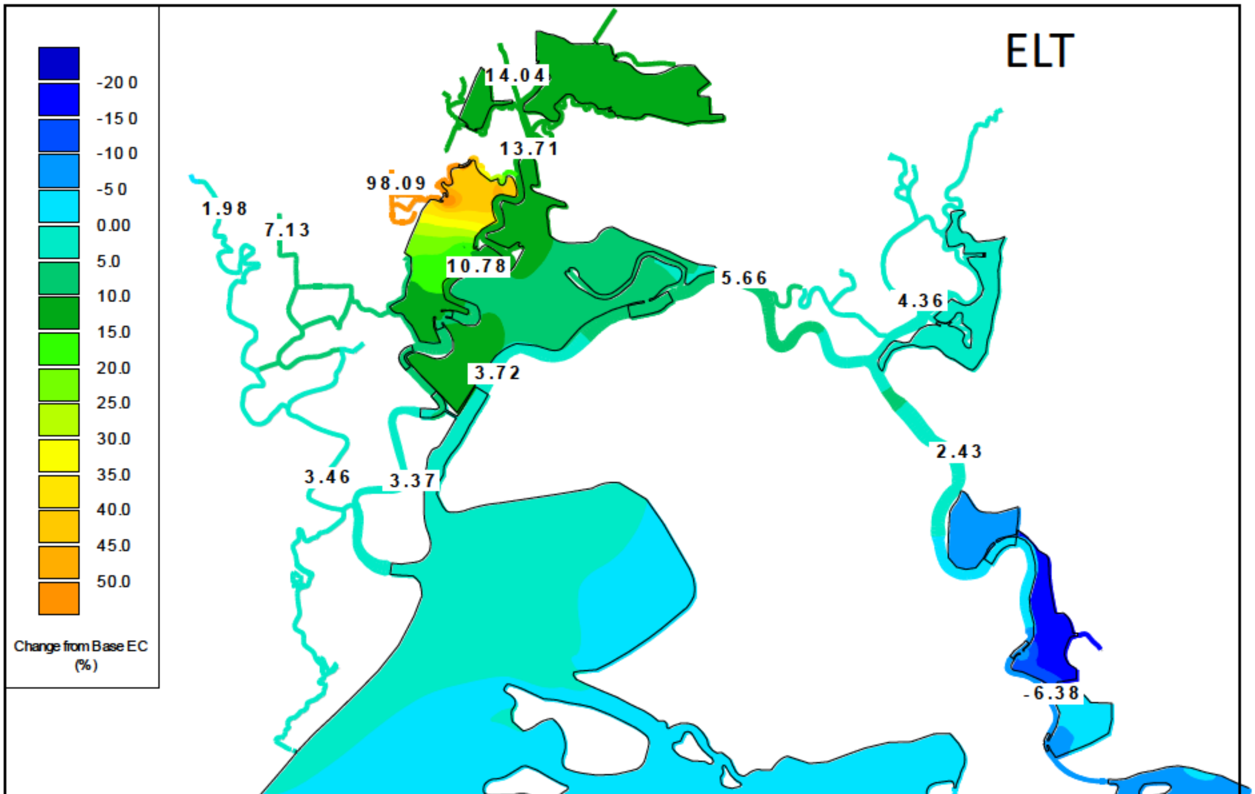


Figure 7-2 Contour plots of tidally averaged EC change from Base - No SMSCG in the south Delta on September 24, 2002, for the ELT and ELT – Max Suisun simulations.



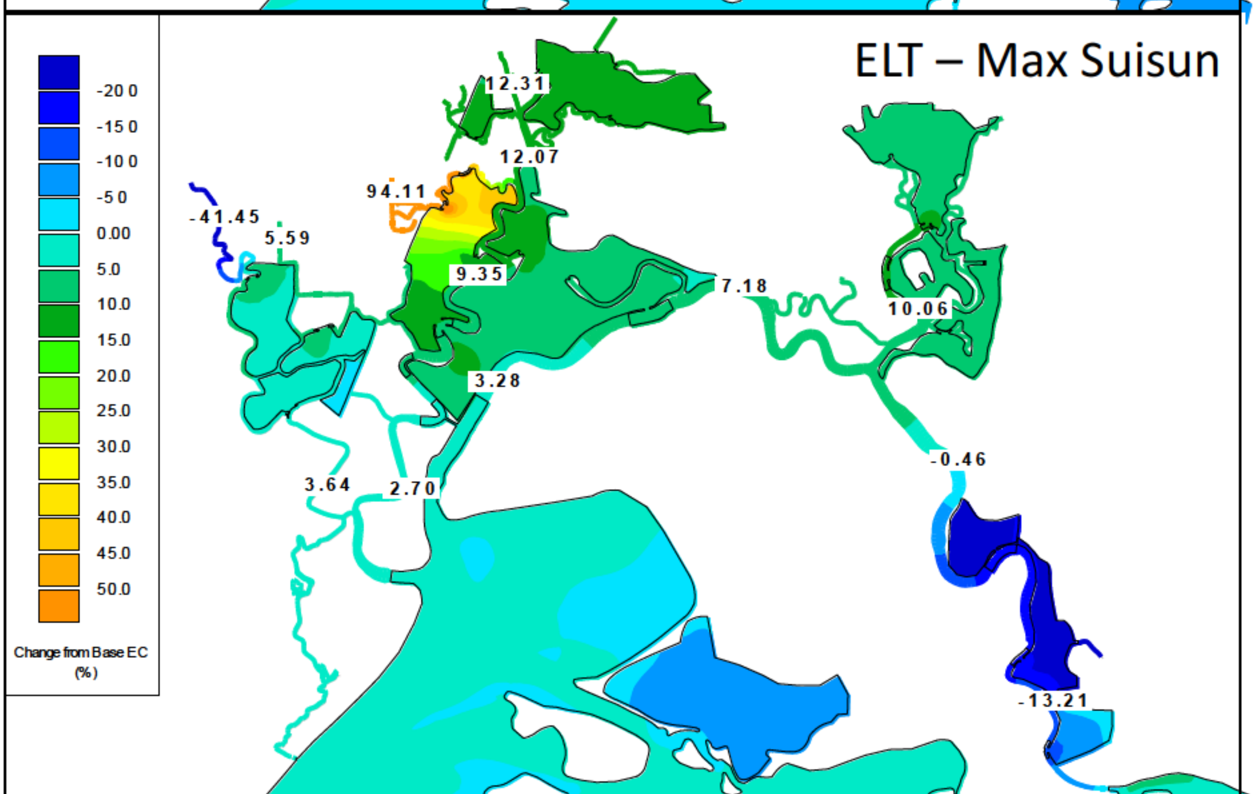


Figure 7-3 Contour plots of EC change from Base - No SMSCG in Suisun Marsh on September 24, 2002, for the ELT and ELT – Max Suisun simulations.

7.1.2 LLT – No South Delta ROA

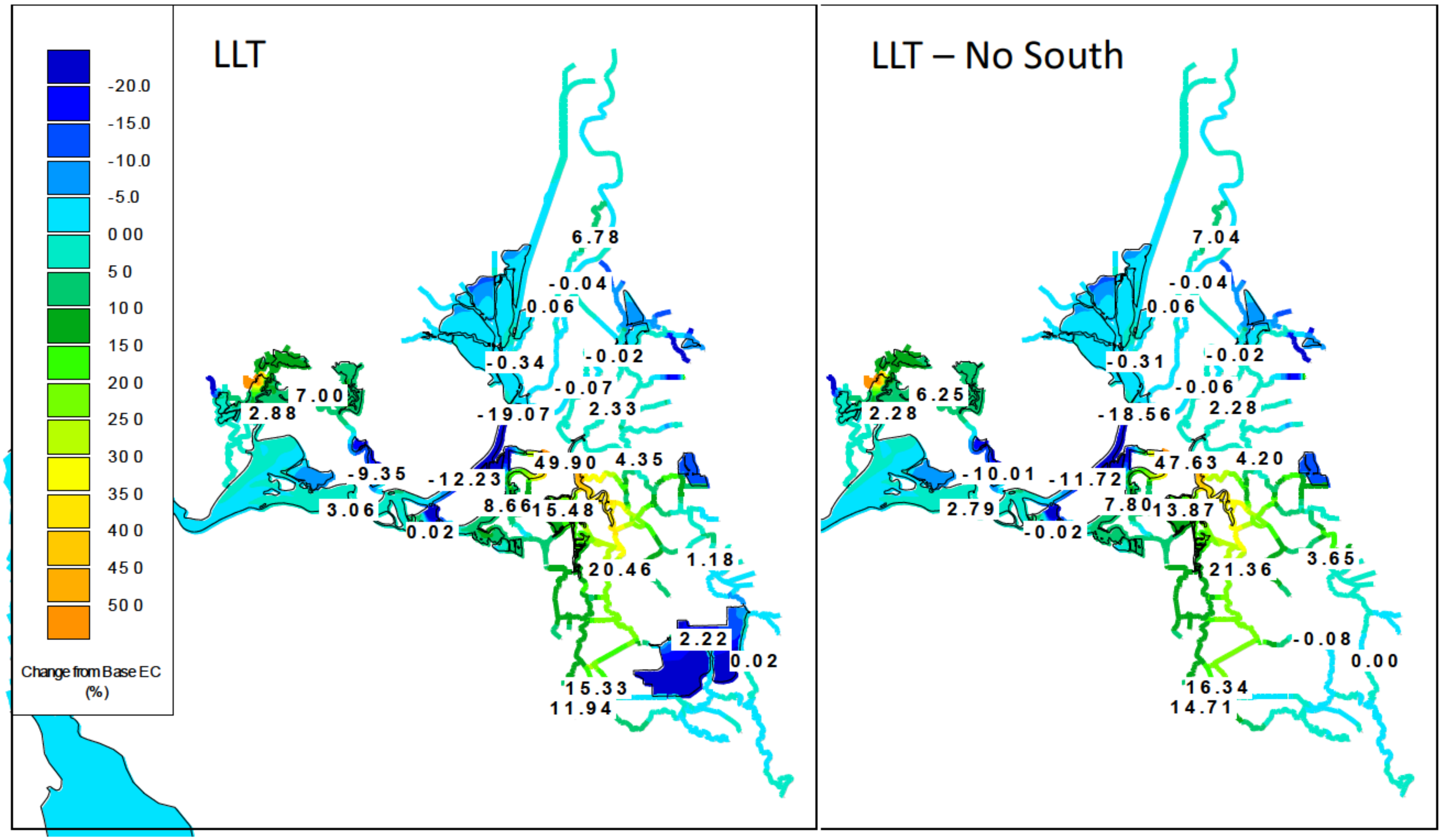


Figure 7-4 Contour plots of EC change from Base - No MRB on September 24, 2002, for the LLT and LLT - No South simulations.

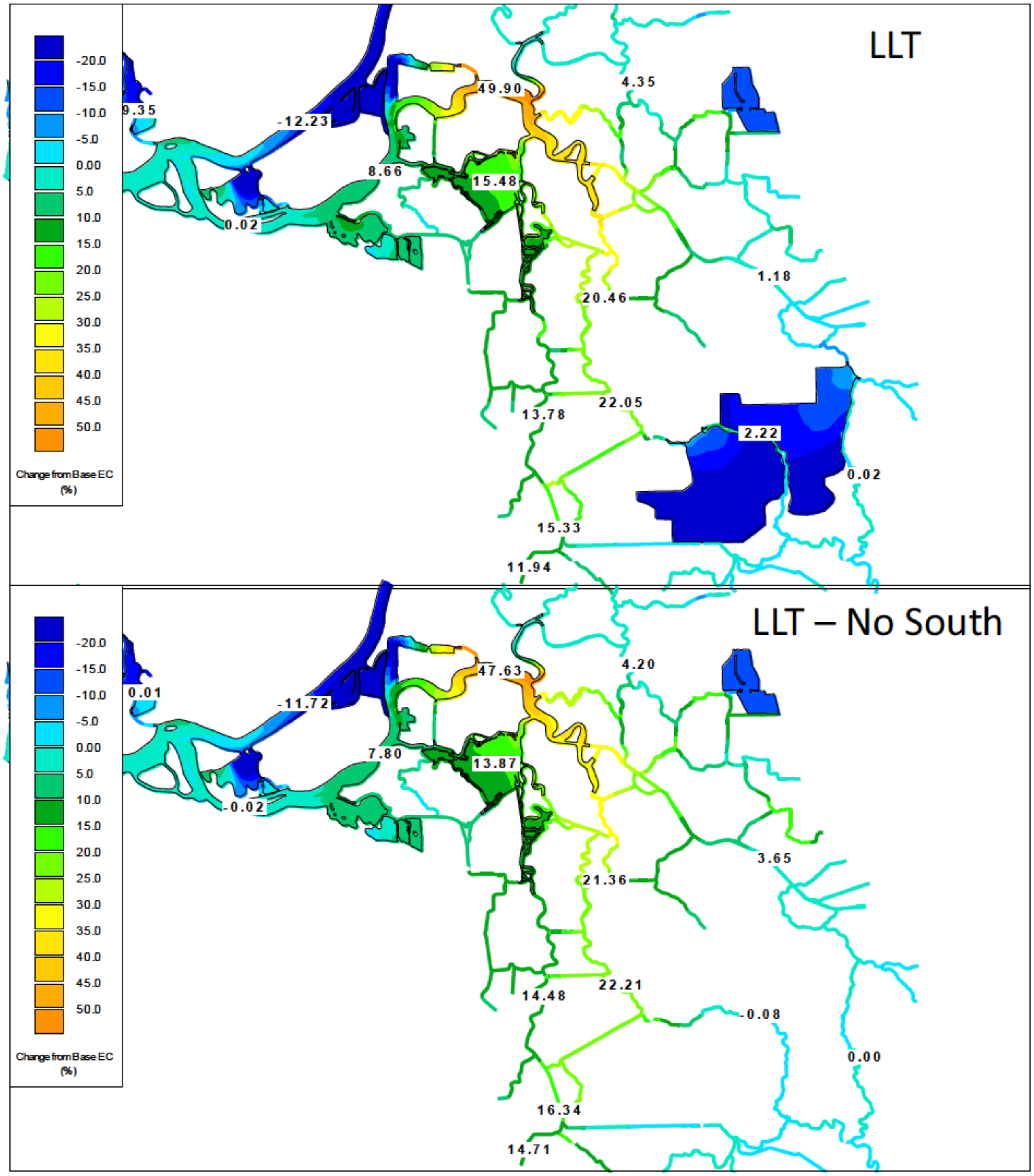


Figure 7-5 Contour plots of EC change from Base - No MRB in the south Delta on September 24, 2002, for the LLT and LLT - No South simulations.

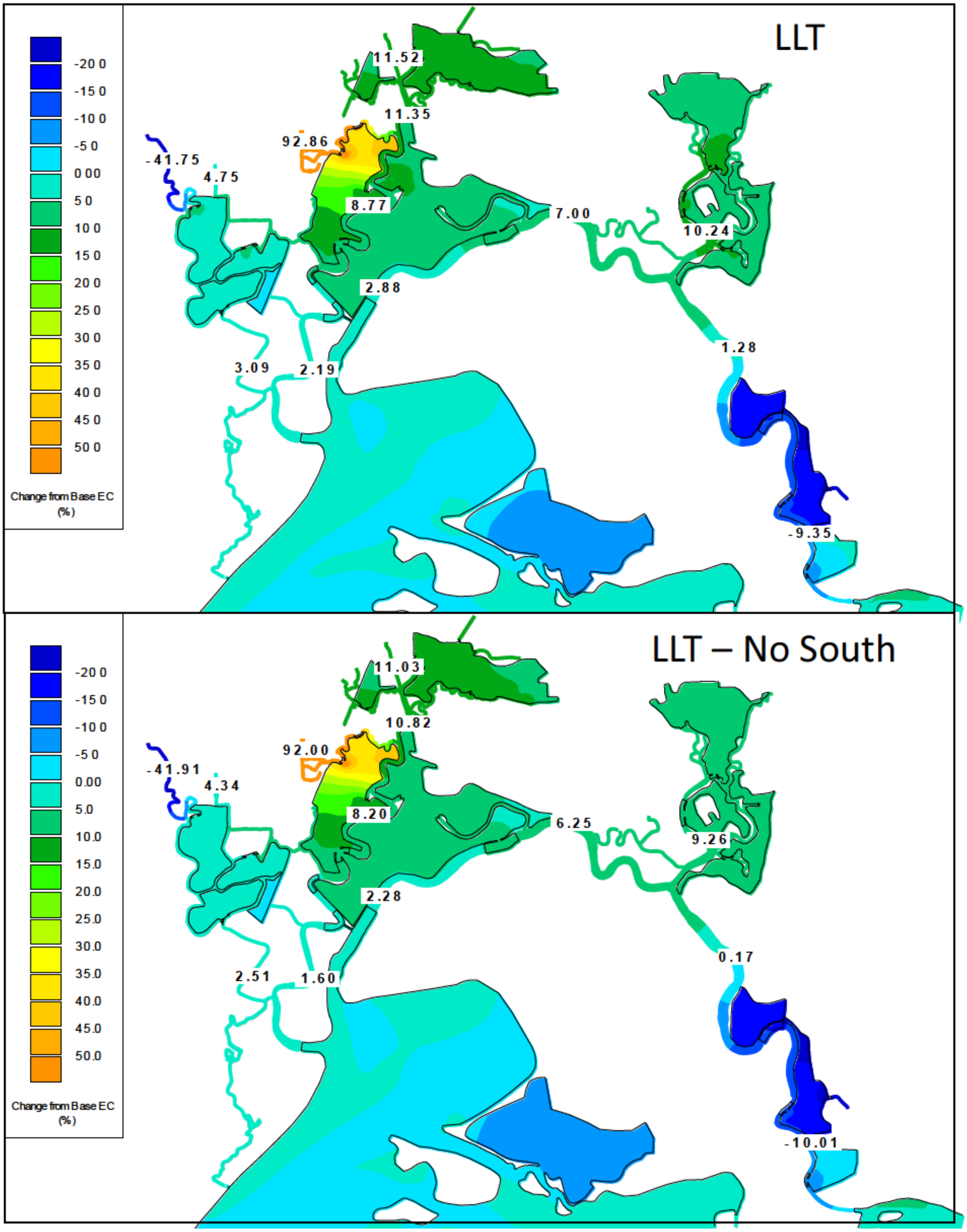


Figure 7-6 Contour plots of EC change from Base - No MRB in Suisun Marsh on September 24, 2002, for the LLT and LLT - No South simulations.

7.1.3 LLT – Middle River Conveyance

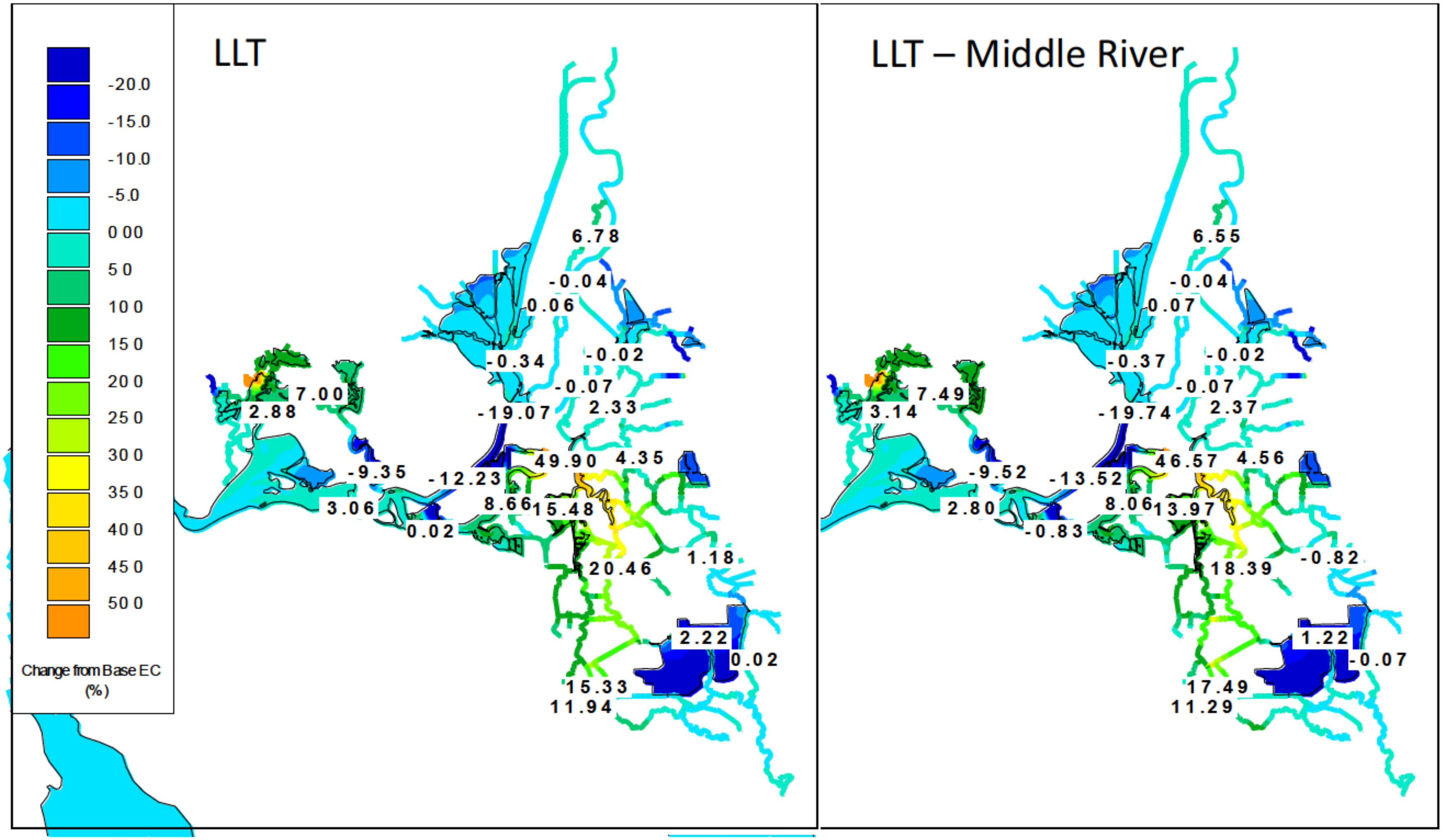


Figure 7-7 Contour plots of EC change from Base - No MRB on September 24, 2002, for the LLT and LLT – Middle River simulations.

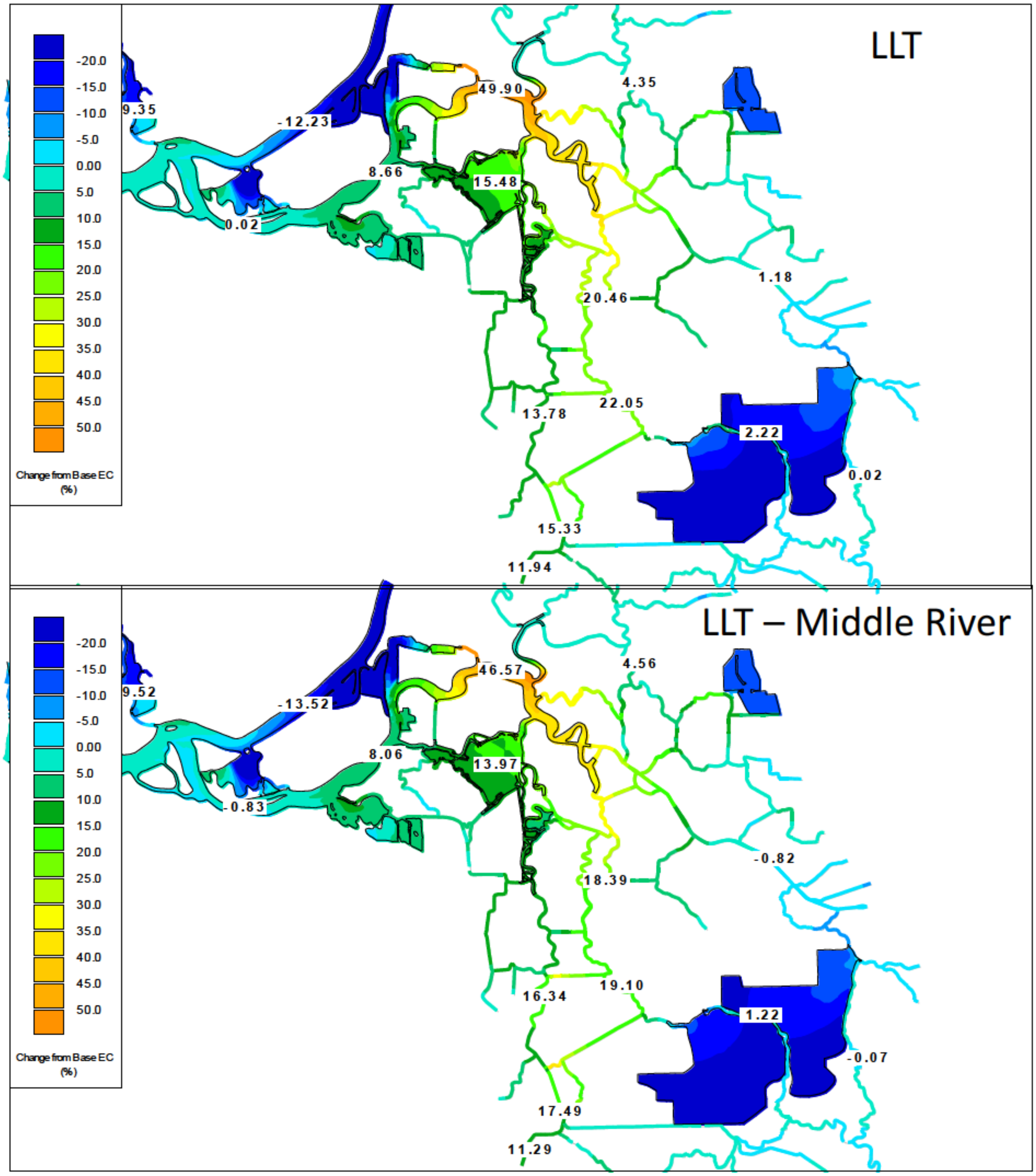


Figure 7-8 Contour plots of EC change from Base - No MRB in south Delta on September 24, 2002, for the LLT and LLT - Middle River simulations.

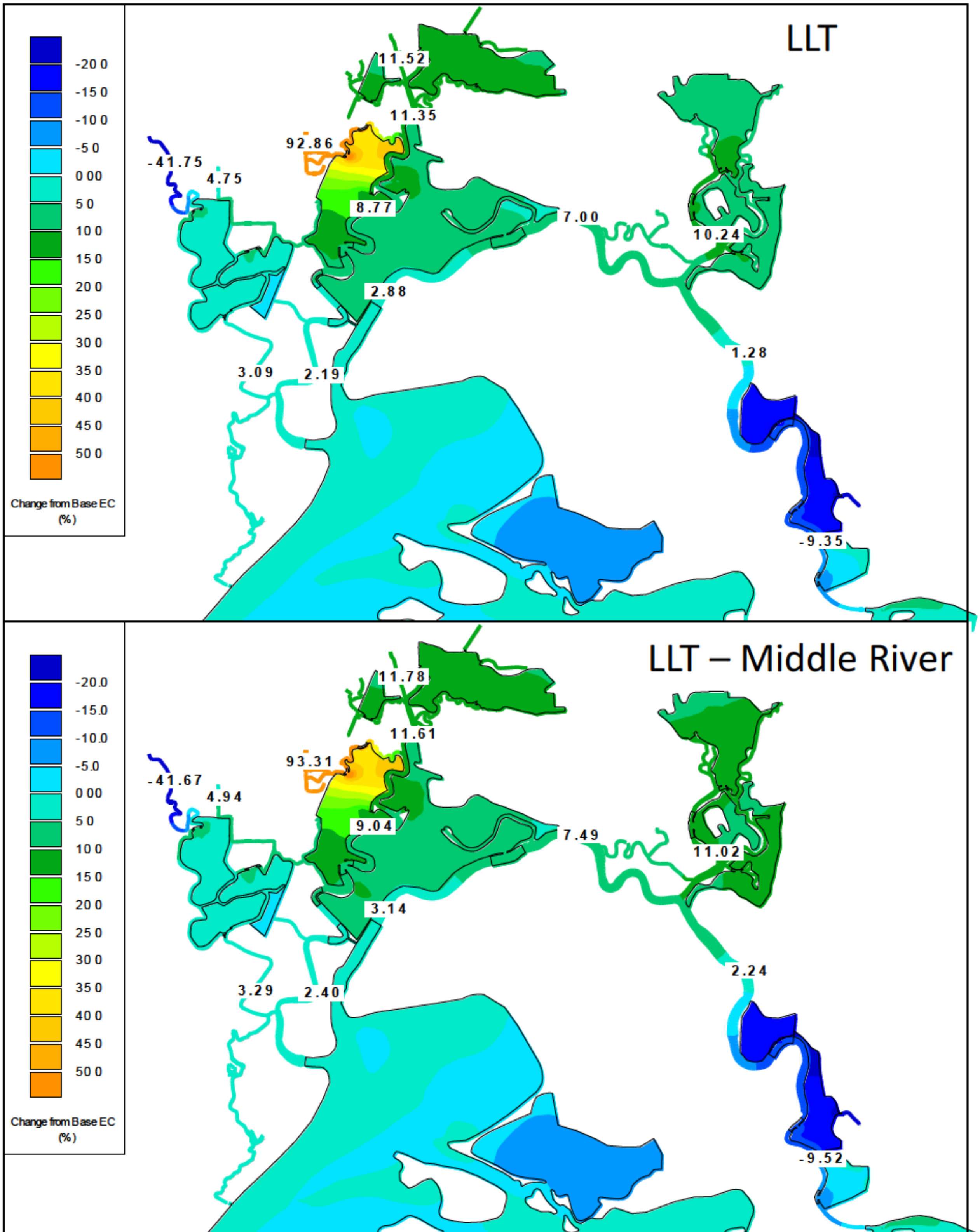


Figure 7-9 Contour plots of EC change from Base - No MRB in Suisun Marsh on September 24, 2002, for the LLT and LLT - Middle River simulations.

7.1.4 LLT – Suisun Scour

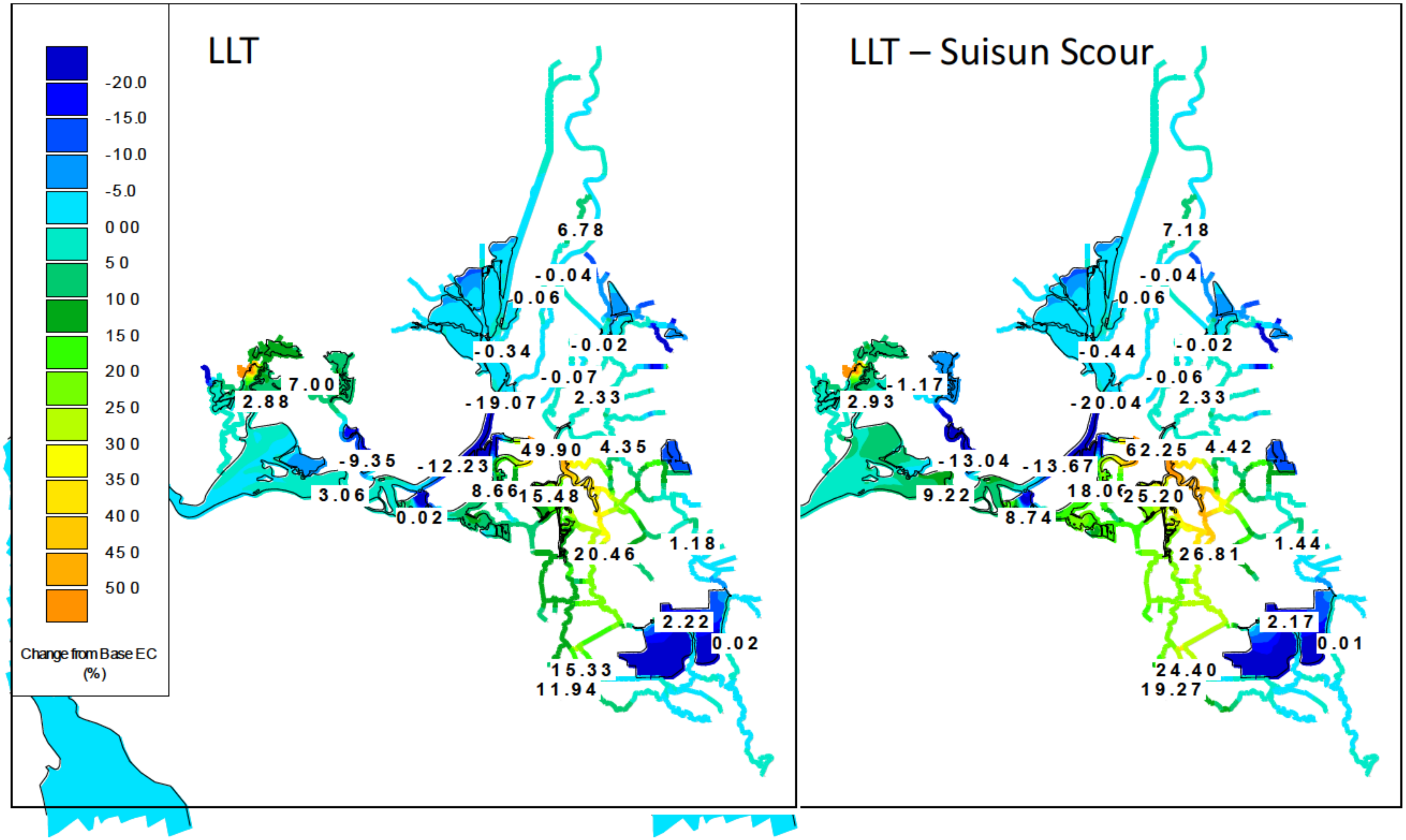


Figure 7-10 Contour plots of tidally averaged EC change from Base - No MRB on September 24, 2002, for the LLT and LLT – Suisun Scour simulations.

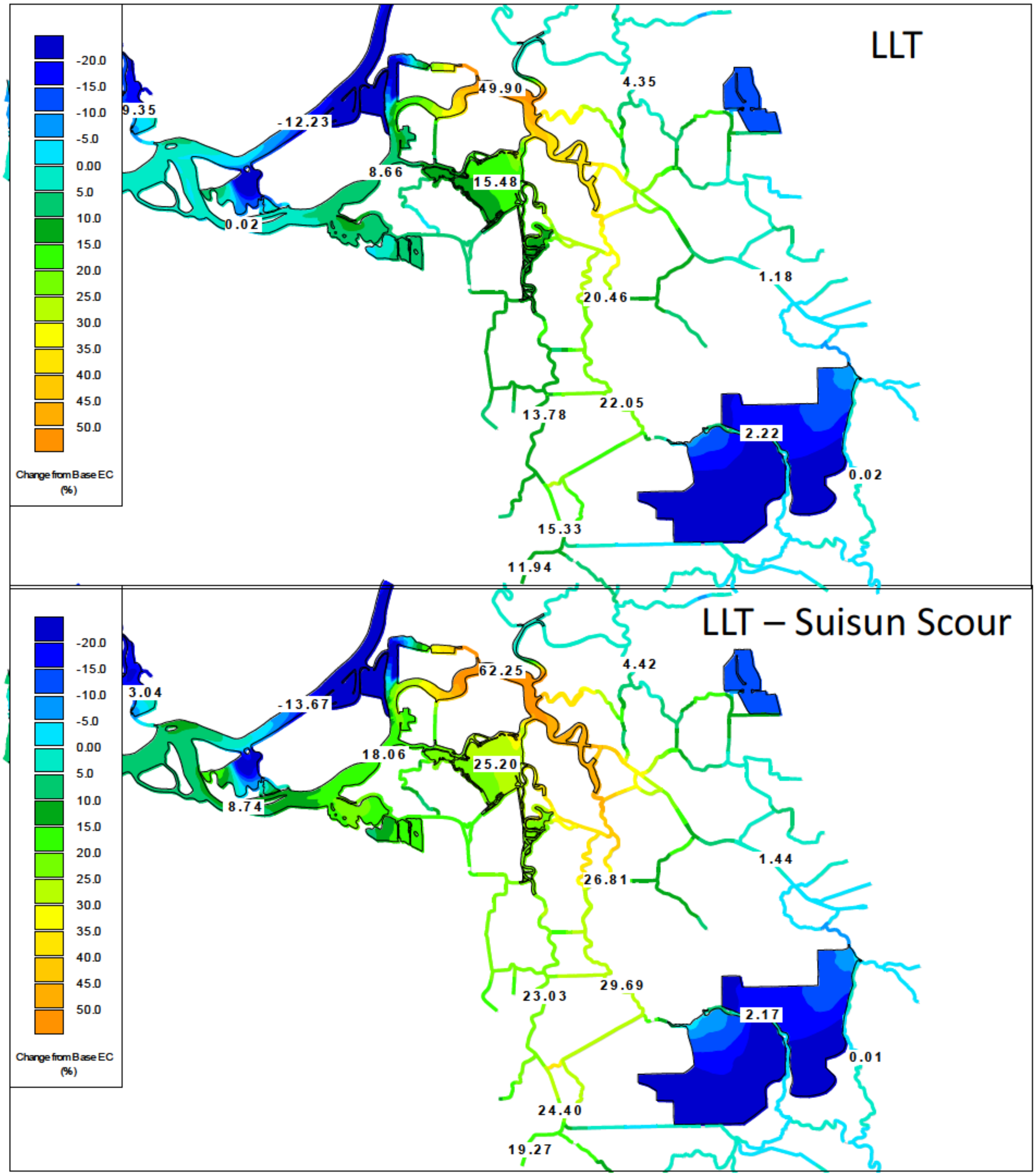


Figure 7-11 Contour plots of tidally averaged EC change from Base - No MRB in south Delta on September 24, 2002, for the LLT and LLT - Suisun Scour simulations.

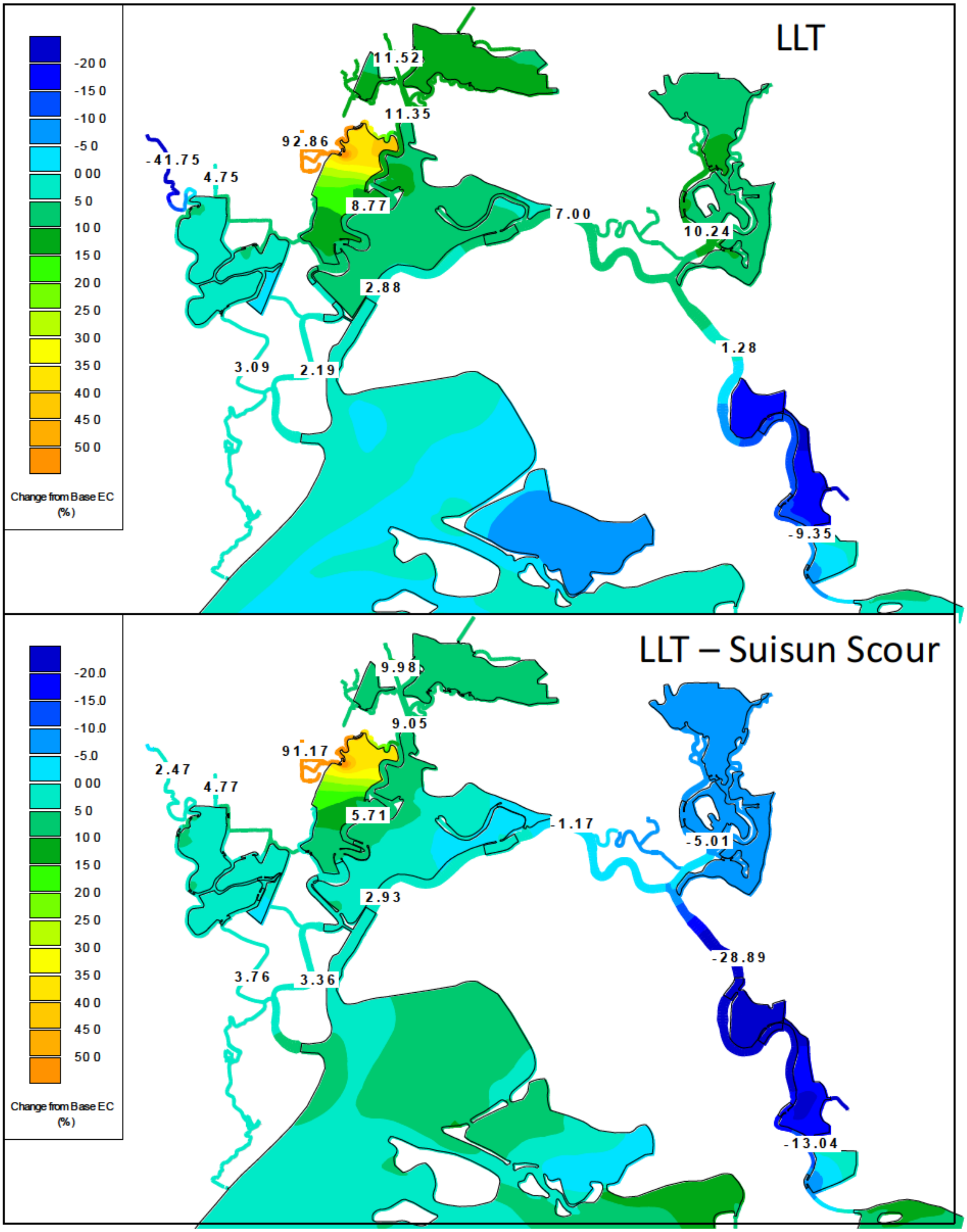


Figure 7-12 Contour plots of tidally averaged EC change from Base - No MRB in Suisun Marsh on September 24, 2002, for the LLT and LLT - Suisun Scour simulations.

7.1.5 ELT – Prospect Breach

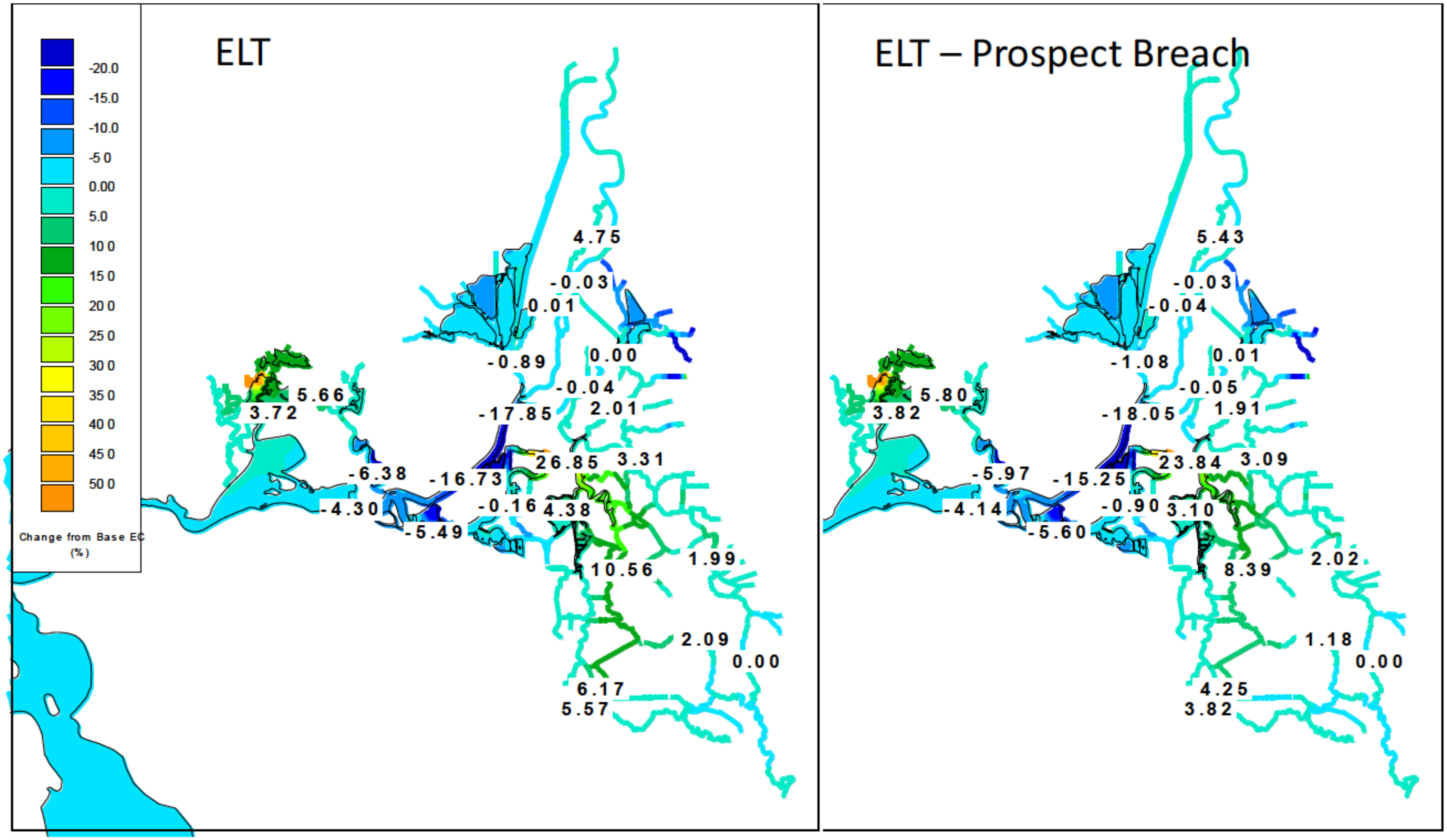


Figure 7-13 Contour plots of EC change from Base – No SMSCG on September 24, 2002, for the ELT and ELT – Prospect Breach simulations.

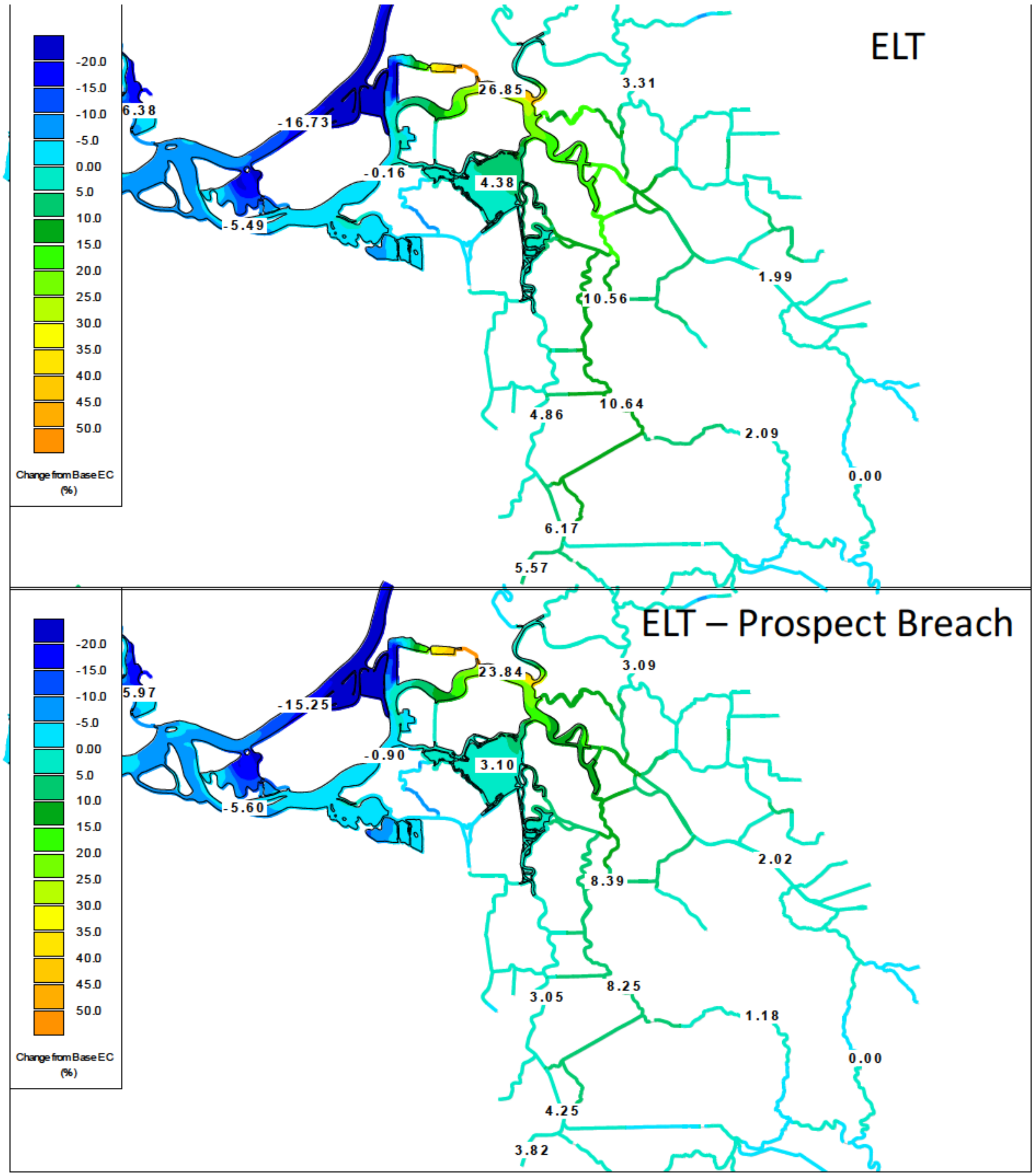


Figure 7-14 Contour plots of EC change from Base - No SMSCG in central and south Delta on September 24, 2002, for the ELT and ELT – Prospect Breach simulations.

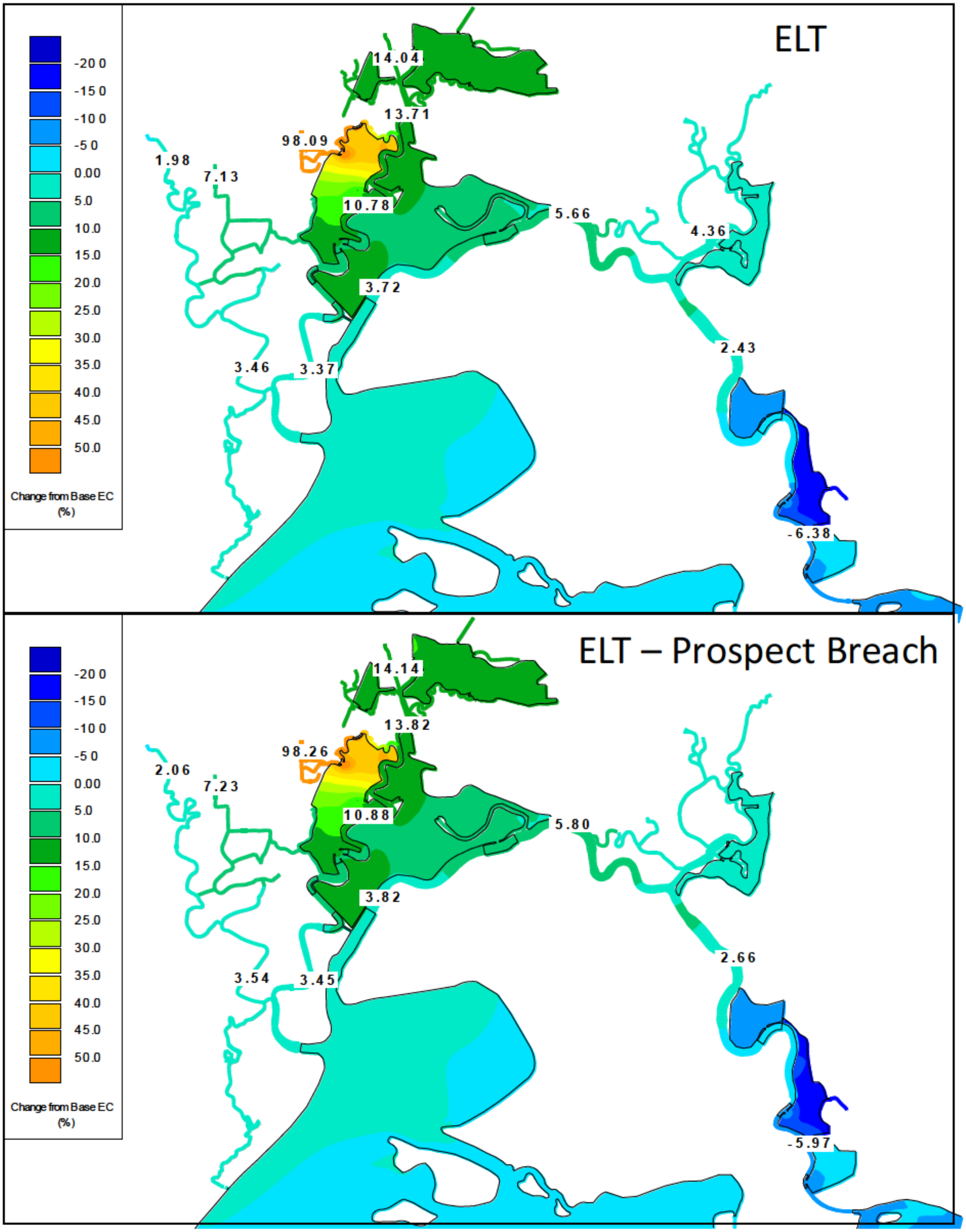


Figure 7-15 Contour plots of EC change from Base - No SMSCG in Suisun Marsh on September 24, 2002, for the ELT and ELT – Prospect Breach simulations.

7.1.6 LLT – Little Egbert Breach

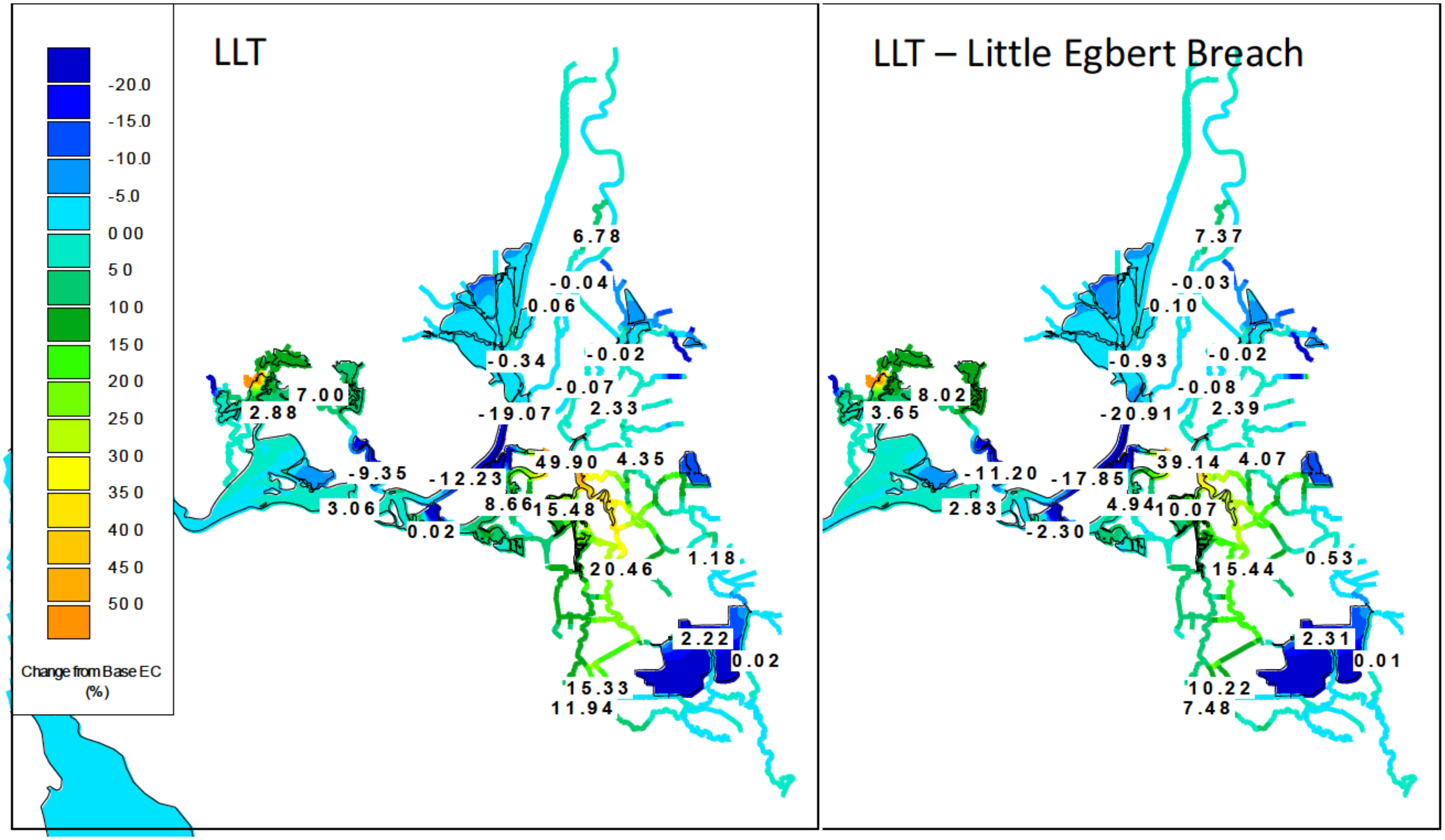


Figure 7-16 Contour plots of EC change from Base - No MRB on September 24, 2002, for the LLT and LLT – Little Egbert Breach simulations.

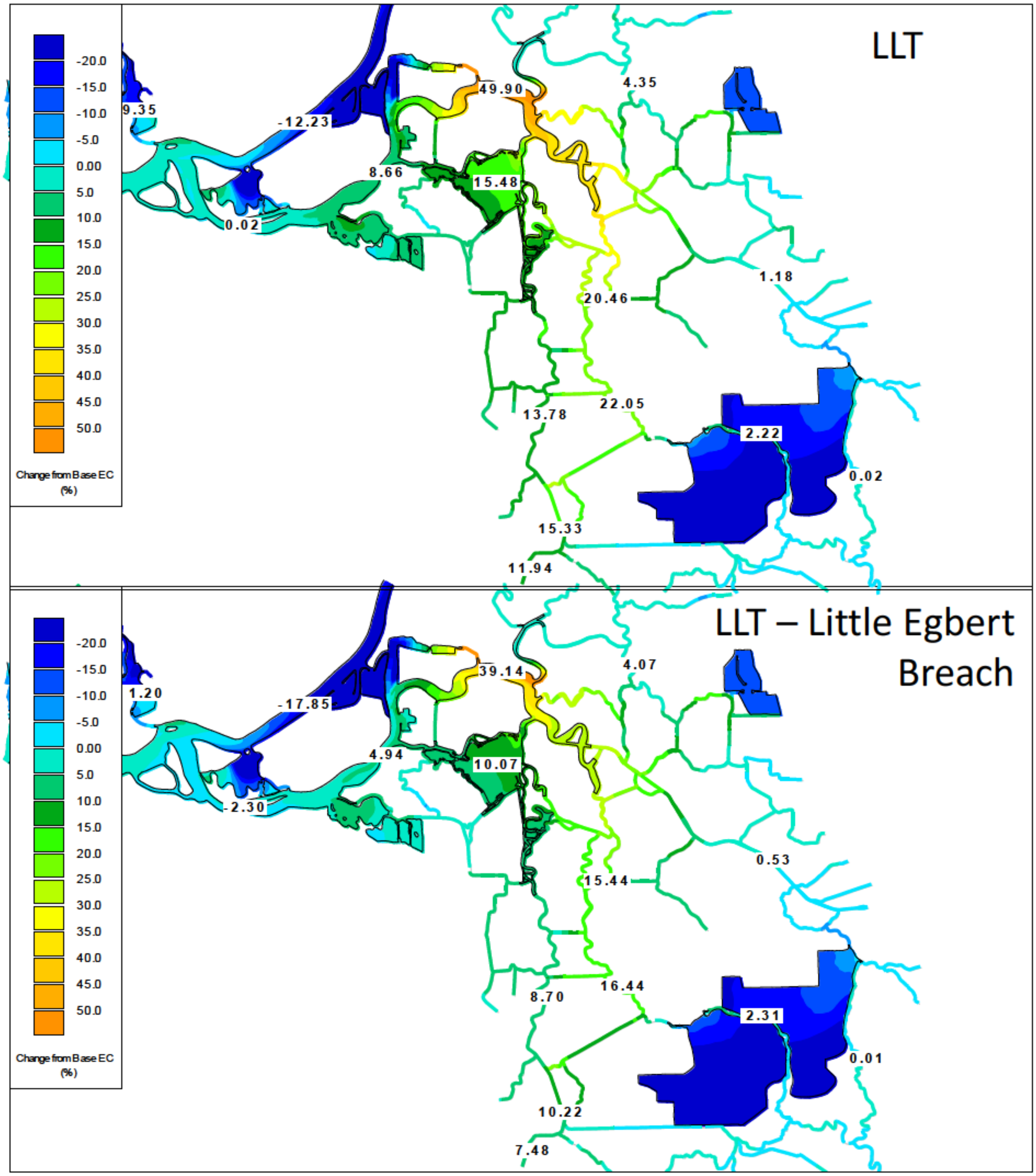


Figure 7-17 Contour plots of EC change from Base - No MRB in south Delta on September 24, 2002, for the LLT and LLT - Little Egbert Breach simulations.

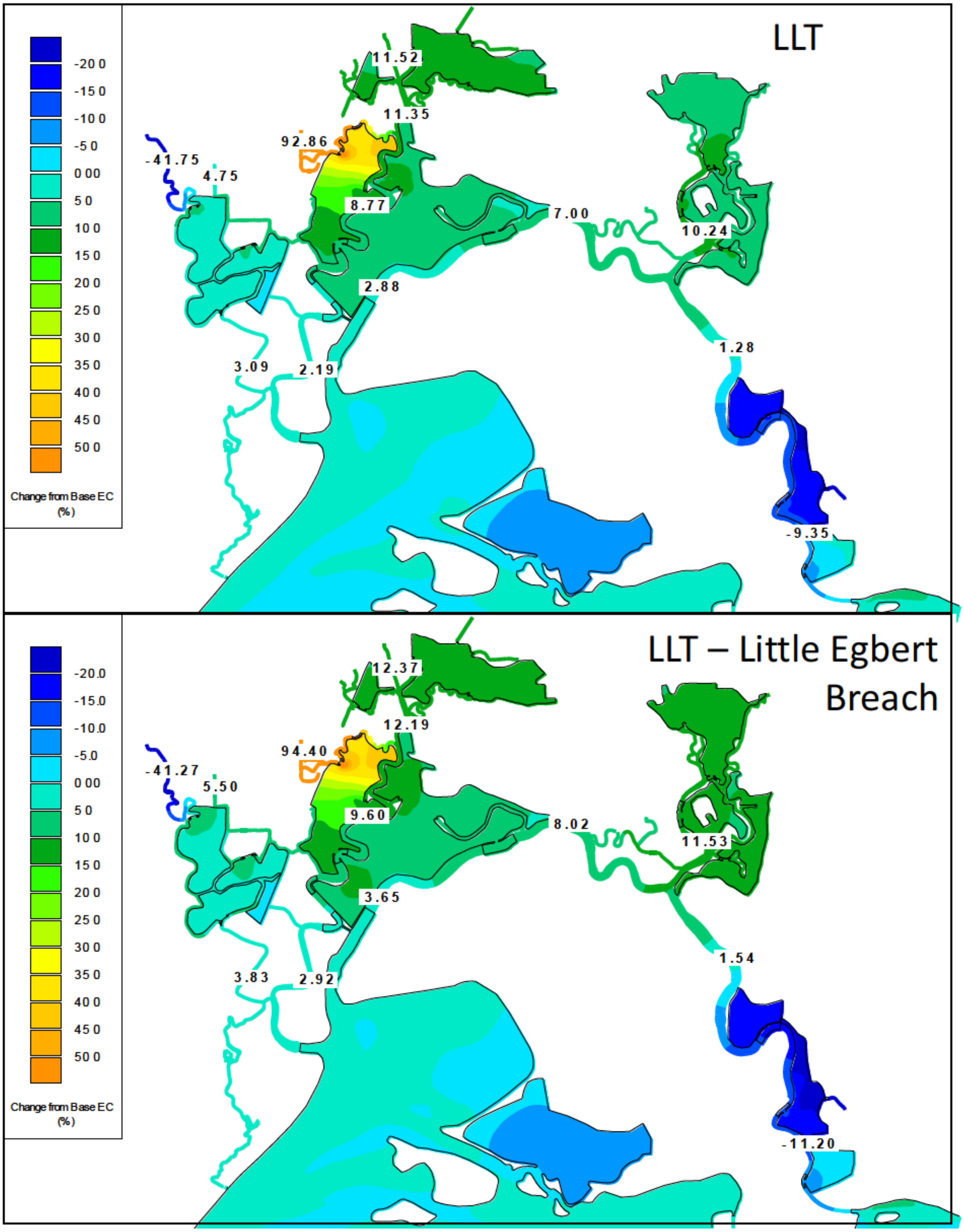


Figure 7-18 Contour plots of EC change from Base - No MRB in Suisun Marsh on September 24, 2002, for the LLT and LLT - Little Egbert Breach simulations.

7.1.7 LLT – Sherman Breach

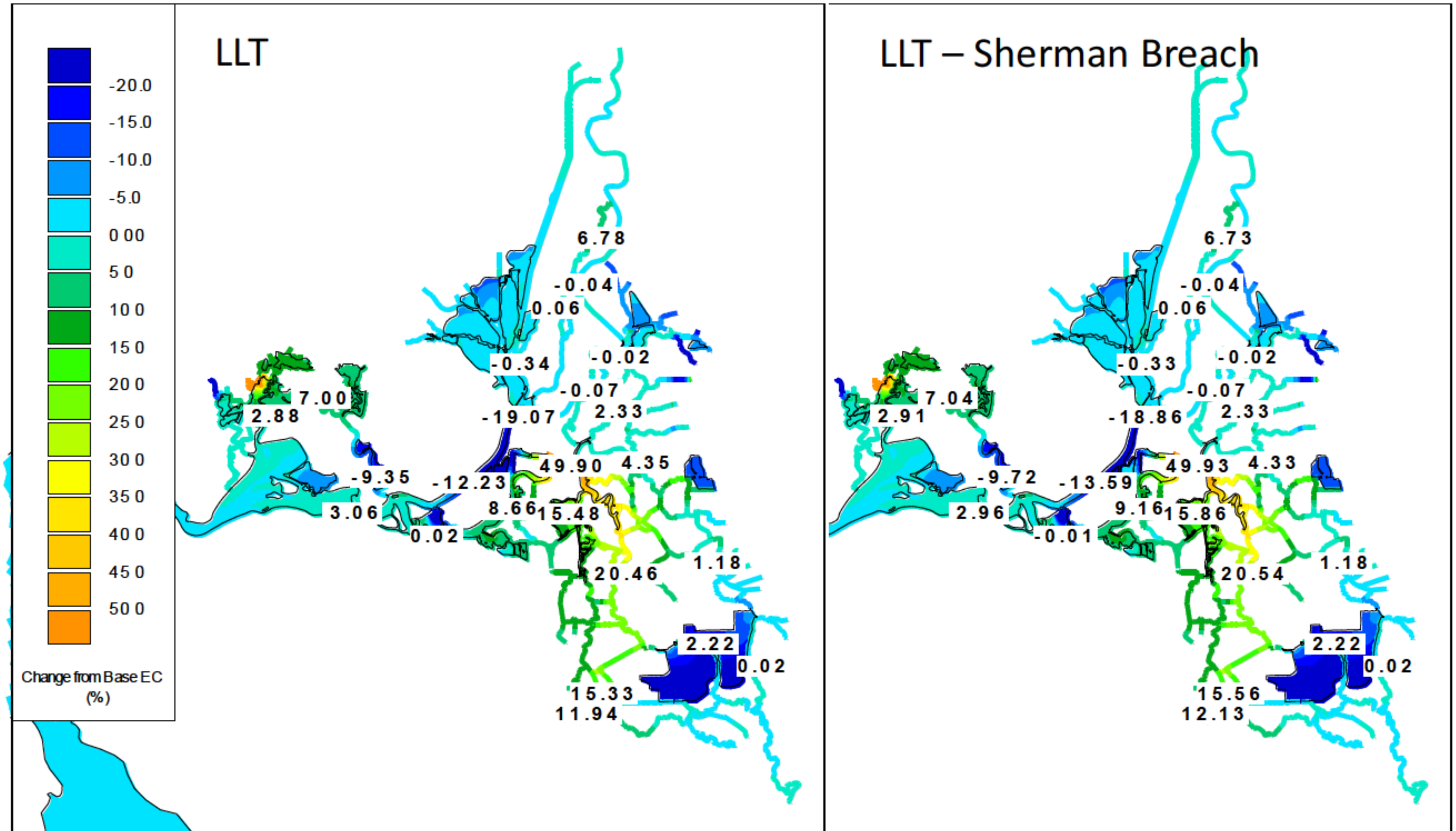


Figure 7-19 Contour plots of EC change from Base - No MRB on September 24, 2002, for the LLT and LLT – Sherman Breach simulations.

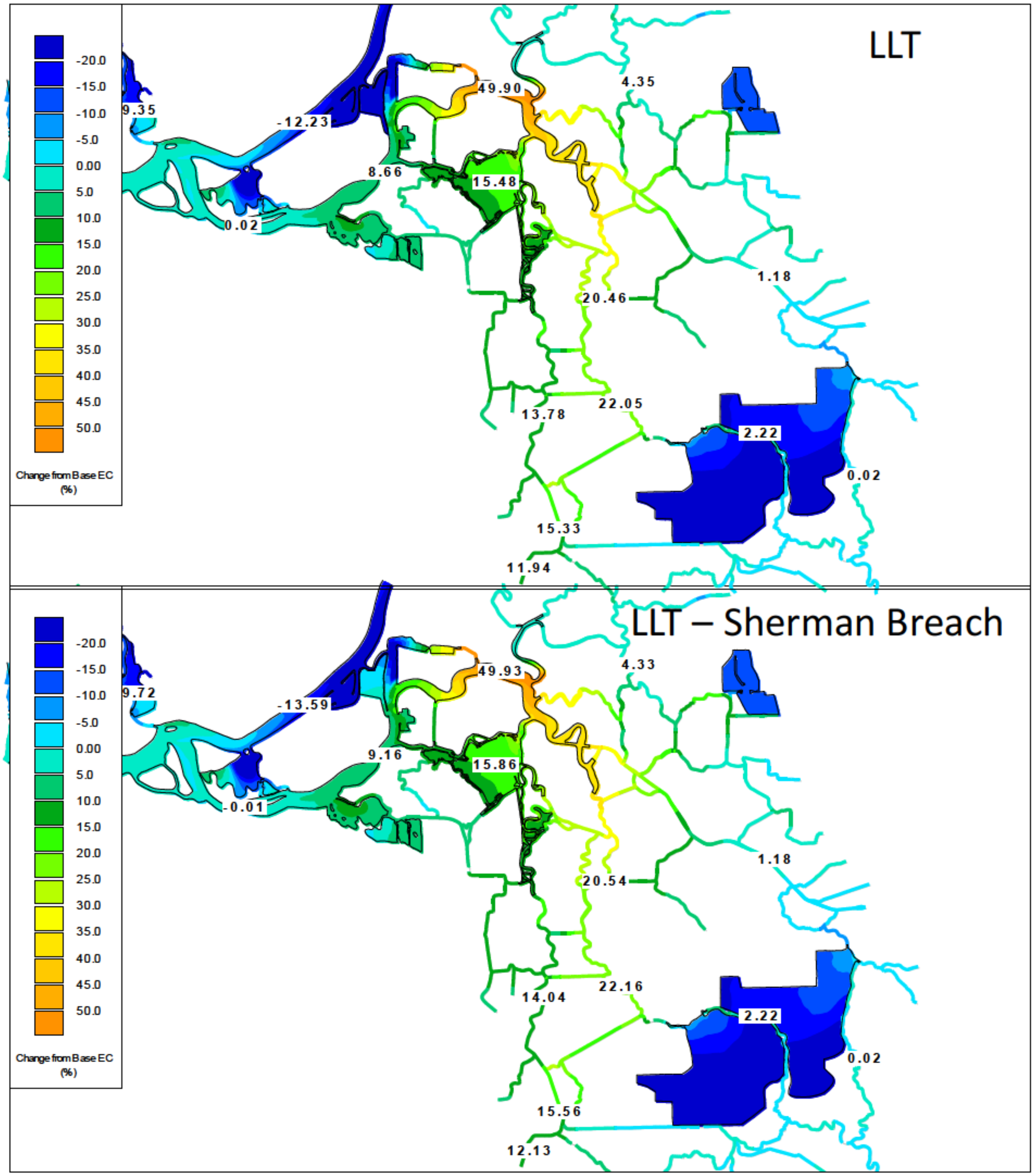


Figure 7-20 Contour plots of EC change from Base - No MRB in south Delta on September 24, 2002, for the LLT and LLT - Sherman Breach simulations.

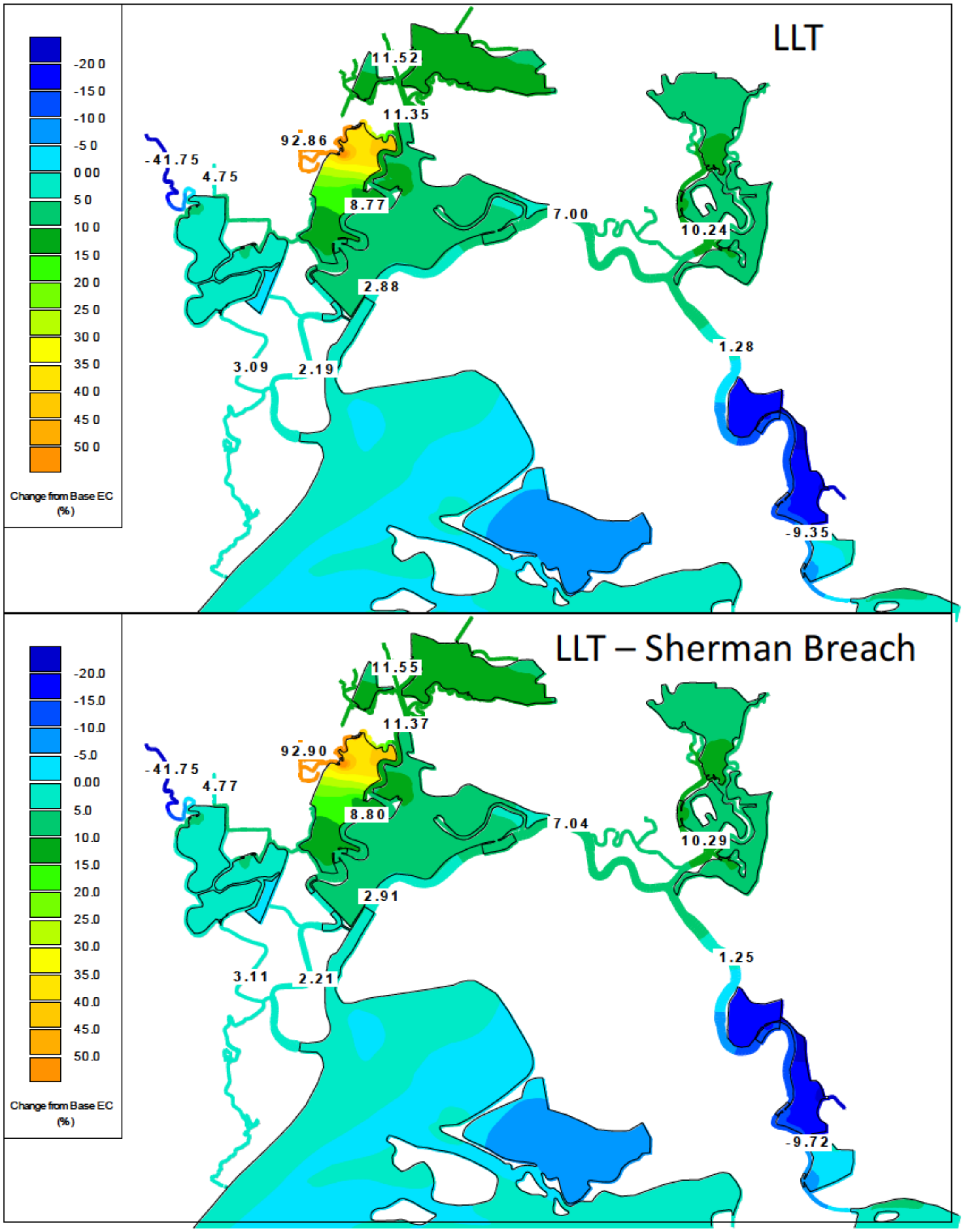


Figure 7-21 Contour plots of EC change from Base - No MRB in Suisun Marsh on September 24, 2002, for the LLT and LLT - Sherman Breach simulations.

7.2 Summary tables of change in monthly average EC

Table 7-1 Summary of September and October 2002 change in monthly average EC relative to base restoration case for ELT - Max Suisun, ELT - Prospect Breach and LLT - Middle River. Darker red indicates largest increases and darkest blue indicates largest decreases.

Location	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Restoration Case (ELT or LLT)													
	September 2002							October 2002						
	ELT - Max Suisun	LLT - No South	LLT - Middle River	LLT - Suisun Scour	ELT - Prospect Breach	LLT - Little Egbert Breach	LLT - Sherman Breach	ELT - Max Suisun	LLT - No South	LLT - Middle River	LLT - Suisun Scour	ELT - Prospect Breach	LLT - Little Egbert Breach	LLT - Sherman Breach
Cache Sl at Ryer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	1%	-1%	0%
CCWD Victoria Canal	5%	2%	1%	6%	-2%	-4%	0%	3%	0%	4%	4%	-2%	-4%	0%
CVP	6%	2%	-1%	7%	-2%	-4%	0%	4%	0%	0%	6%	-2%	-5%	0%
Montezuma Sl at Head	3%	0%	0%	6%	0%	-1%	0%	5%	0%	-1%	6%	0%	-1%	0%
Montezuma Sl at Mouth	0%	0%	0%	2%	0%	1%	0%	0%	0%	0%	3%	0%	1%	0%
RMID015	5%	0%	-2%	7%	-2%	-4%	0%	3%	-1%	0%	4%	-2%	-4%	0%
RMID023	5%	1%	-3%	7%	-2%	-4%	0%	3%	0%	-1%	4%	-2%	-4%	0%
ROLD024	7%	0%	-2%	9%	-2%	-4%	0%	5%	-1%	-3%	7%	-2%	-6%	0%
ROLD034	7%	0%	2%	9%	-2%	-4%	0%	5%	0%	2%	7%	-2%	-5%	0%
RSAC075 Chipps Island	8%	0%	0%	6%	0%	0%	0%	9%	0%	0%	6%	0%	0%	0%
RSAC092 Emmaton	0%	1%	-2%	2%	2%	-8%	-2%	2%	1%	-3%	3%	1%	-7%	-1%
RSAC101 Rio Vista	-2%	1%	-1%	-2%	0%	-2%	0%	-3%	2%	-3%	-2%	1%	-4%	-1%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	8%	-1%	-1%	9%	-1%	-3%	0%	7%	-1%	-1%	8%	-1%	-5%	0%
RSAN032 San Andreas	6%	0%	-4%	8%	-2%	-7%	0%	4%	-1%	-4%	7%	-3%	-8%	0%
RSAN058	0%	4%	-2%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%
S-49 Beldon's Landing	1%	-1%	0%	-7%	0%	1%	0%	1%	-1%	0%	-5%	0%	1%	0%
SWP	7%	0%	0%	8%	-2%	-4%	0%	4%	-1%	1%	6%	-2%	-5%	0%

Table 7-2 Summary of November and December 2002 change in monthly average EC relative to base restoration case for ELT - Max Suisun, ELT - Prospect Breach and LLT - Middle River. Darker red indicates largest increases and darkest blue indicates largest decrease

Location	Percent Change in Monthly Average EC (umhos/cm) Relative to Base Restoration Case (ELT or LLT)													
	November 2002							December 2002						
	ELT - Max Suisun	LLT - No South	LLT - Middle River	LLT - Suisun Scour	ELT - Prospect Breach	LLT - Little Egbert Breach	LLT - Sherman Breach	ELT - Max Suisun	LLT - No South	LLT - Middle River	LLT - Suisun Scour	ELT - Prospect Breach	LLT - Little Egbert Breach	LLT - Sherman Breach
Cache Sl at Ryer	-1%	0%	0%	-1%	1%	-1%	0%	0%	0%	0%	0%	0%	-1%	0%
CCWD Victoria Canal	1%	-4%	6%	3%	-2%	-4%	0%	1%	-1%	3%	3%	-1%	-4%	0%
CVP	2%	-1%	2%	4%	-2%	-5%	0%	1%	-1%	2%	2%	-1%	-3%	0%
Montezuma Sl at Head	4%	0%	-1%	4%	0%	-1%	0%	4%	-1%	0%	3%	0%	-1%	0%
Montezuma Sl at Mouth	1%	0%	0%	3%	0%	0%	0%	4%	-1%	0%	2%	0%	0%	0%
RMID015	1%	-2%	1%	3%	-2%	-4%	0%	1%	-1%	1%	3%	-1%	-4%	0%
RMID023	1%	-2%	2%	3%	-2%	-4%	0%	1%	-1%	1%	3%	-1%	-4%	0%
ROLD024	3%	-2%	-2%	6%	-2%	-7%	0%	3%	-3%	-2%	5%	-2%	-7%	0%
ROLD034	3%	-2%	3%	5%	-2%	-6%	0%	3%	-3%	1%	5%	-2%	-6%	0%
RSAC075 Chipps Island	9%	0%	0%	7%	0%	0%	0%	10%	-1%	0%	7%	0%	-1%	0%
RSAC092 Emmaton	2%	0%	-2%	4%	1%	-7%	-1%	1%	0%	-2%	4%	1%	-6%	-2%
RSAC101 Rio Vista	-4%	1%	-2%	-2%	1%	-4%	-2%	-2%	0%	-1%	-1%	0%	-3%	-1%
RSAC123	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAC155 Freeport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RSAN018 Jersey Pt	6%	-2%	-1%	7%	-1%	-6%	0%	5%	-3%	-1%	7%	-1%	-6%	0%
RSAN032 San Andreas	2%	-2%	-4%	5%	-3%	-9%	0%	2%	-2%	-3%	5%	-3%	-8%	0%
RSAN058	0%	2%	0%	0%	0%	0%	0%	1%	4%	-1%	0%	0%	0%	0%
S-49 Beldon's Landing	2%	-1%	0%	-7%	0%	1%	0%	4%	-1%	1%	-13%	0%	1%	0%
SWP	3%	-2%	1%	5%	-2%	-6%	0%	2%	-2%	0%	4%	-2%	-5%	0%