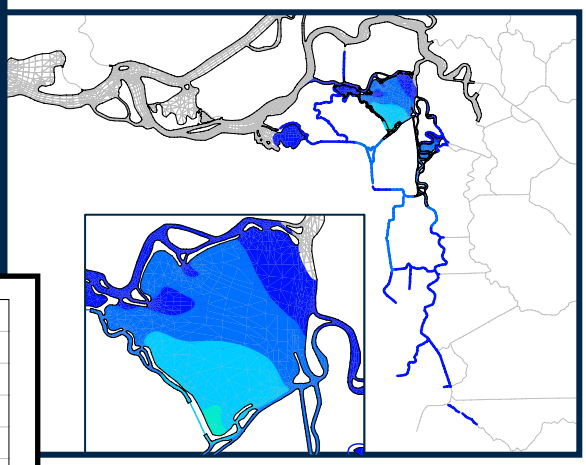
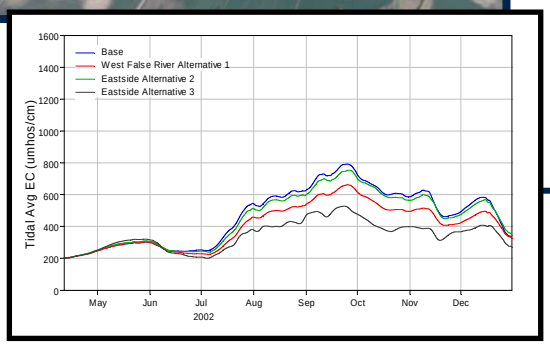
FLOODED ISLANDS

PILOT PROJECT STUDY

ALTERNATIVES MODELING REPORT





Prepared For:

California Department of Water Resources

For Submittal To:

California Bay-Delta Authority

January 31, 2006

Prepared By:

RMA Resource Management Associates

RMA

RESOURCE MANAGEMENT ASSOCIATES, INC.

FAIRFIELD, CALIFORNIA

DRAFT REPORT

FLOODED ISLANDS
Pilot Project Study

Alternatives Modeling Report

Prepared For:
California Department of Water Resources
For Submittal To:
California Bay-Delta Authority

January 2006

TABLE OF CONTENTS

1 INTRODUCTION 1-1

1.1 BACKGROUND 1-1

1.2 OBJECTIVES 1-2

2 INITIAL PILOT PROJECT ALTERNATIVE DESCRIPTIONS 2-1

2.1 BASE CASE 2-1

2.2 WEST FALSE RIVER ALTERNATIVE 1 2-1

2.3 EASTSIDE LEVEES ALTERNATIVE 2 2-1

2.4 EASTSIDE LEVEES ALTERNATIVE 3 2-2

3 INITIAL PILOT PROJECT STUDY ALTERNATIVE SIMULATIONS 3-1

4 LONG TERM SIMULATIONS 4-14

4.1 RESULTS 4-17

LIST OF FIGURES

Figure 1-1 Color contours of bathymetry (ft NGVD) in the Franks Tract vicinity. 1-4

Figure 2-1 Base case model configuration. 2-3

Figure 2-2 Grid for West False River Constriction Alternative 1. 2-4

Figure 2-3 Grid for Eastside Levees Alternative 2. 2-4

Figure 2-4 Grid for Eastside Levees Alternative 3. 2-5

Figure 3-1 EC time series locations. 3-2

Figure 3-2 Tidally averaged EC results at Jersey Point for the Base case and initial Pilot Project alternatives. 3-3

Figure 3-3 Tidally averaged EC results at the Contra Costa intake on Rock Slough for the Base case and initial Pilot Project alternatives. 3-3

Figure 3-4 Tidally averaged EC results at the Contra Costa intake on Old River for the Base case and initial Pilot Project alternatives. 3-4

Figure 3-5 Tidally averaged EC results at RMID023 for the Base case and initial Pilot Project alternatives. 3-4

Figure 3-6 Tidally averaged EC results at ROLD024 for the Base case and initial Pilot Project alternatives. 3-5

Figure 3-7 Tidally averaged EC results at the CVP intake for the Base case and initial Pilot Project alternatives. 3-5

Figure 3-8 Tidally averaged EC results at the SWP intake for the Base case and initial Pilot Project alternatives. 3-6

Figure 3-9 Tidally averaged EC contours on June 1, 2002 for the Base case and initial Pilot Project alternatives. 3-7

Figure 3-10 Tidally averaged EC contours on September 1, 2002 for the Base case and initial Pilot Project alternatives. 3-8

Figure 3-11 Tidally averaged EC contours on November 1, 2002 for the Base case and initial Pilot Project alternatives. 3-9

Figure 4-1 Monthly Net Delta Outflow for years 1991 to 2005. 4-16

Figure 4-2 Tidally averaged EC at Jersey Point for the Base case and West False River Alternative 1 simulations during 1991 - 1992. 4-19

Figure 4-3 Tidally averaged EC at Jersey Point for the Base case and West False River Alternative 1 simulations during 1995. 4-19

Figure 4-4 Tidally averaged EC at Jersey Point for the Base case and West False River Alternative 1 simulations during 2000. 4-20

Figure 4-5 Tidally averaged EC at Jersey Point for the Base case and West False River Alternative 1 simulations during 2002 - 2003. 4-20

Figure 4-6 Tidally averaged EC at the Contra Costa intake in Rock Slough for the Base case and West False River Alternative 1 simulations during 1991 - 1992. 4-21

Figure 4-7 Tidally averaged EC at the Contra Costa intake in Rock Slough for the Base case and West False River Alternative 1 simulations during 1995. 4-21

Figure 4-8 Tidally averaged EC at the Contra Costa intake in Rock Slough for the Base case and West False River Alternative 1 simulations during 2000. 4-22

Figure 4-9 Tidally averaged EC at the Contra Costa intake in Rock Slough for the Base case and West False River Alternative 1 simulations during 2002 - 2003. 4-22

Figure 4-10 Tidally averaged EC at the Contra Costa intake on Old River for the Base case and West False River Alternative 1 simulations during 1991 - 1992. 4-23

Figure 4-11 Tidally averaged EC at the Contra Costa intake on Old River for the Base case and West False River Alternative 1 simulations during 1995. 4-23

Figure 4-12 Tidally averaged EC at the Contra Costa intake on Old River for the Base case and West False River Alternative 1 simulations during 2000. 4-24

Figure 4-13 Tidally averaged EC at the Contra Costa intake on Old River for the Base case and West False River Alternative 1 simulations during 2002 - 2003. 4-24

Figure 4-14 Tidally averaged EC at RMID023 for the Base case and West False River Alternative 1 simulations during 1991 - 1992. 4-25

Figure 4-15 Tidally averaged EC at RMID023 for the Base case and West False River Alternative 1 simulations during 1995. 4-25

Figure 4-16 Tidally averaged EC at RMID023 for the Base case and West False River Alternative 1 simulations during 2000. 4-26

Figure 4-17 Tidally averaged EC at RMID023 for the Base case and West False River Alternative 1 simulations during 2002 - 2003. 4-26

Figure 4-18 Tidally averaged EC at ROLD024 for the Base case and West False River Alternative 1 simulations during 1991 - 1992. 4-27

Figure 4-19 Tidally averaged EC at ROLD024 for the Base case and West False River Alternative 1 simulations during 1995. 4-27

Figure 4-20 Tidally averaged EC at ROLD024 for the Base case and West False River Alternative 1 simulations during 2000. 4-28

Figure 4-21 Tidally averaged EC at ROLD024 for the Base case and West False River Alternative 1 simulations during 2002 - 2003. 4-28

Figure 4-22 Tidally averaged EC at the CVP intake for the Base case and West False River Alternative 1 simulations during 1991 - 1992. 4-29

Figure 4-23 Tidally averaged EC at the CVP intake for the Base case and West False River Alternative 1 simulations during 1995. 4-29

Figure 4-24 Tidally averaged EC at the CVP intake for the Base case and West False River Alternative 1 simulations during 2000. 4-30

Figure 4-25 Tidally averaged EC at the CVP intake for the Base case and West False River Alternative 1 simulations during 2002 - 2003. 4-30

Figure 4-26 Tidally averaged EC at the SWP intake for the Base case and West False River Alternative 1 simulations during 1991 - 1992. 4-31

Figure 4-27 Tidally averaged EC at the SWP intake for the Base case and West False River Alternative 1 simulations during 1995. 4-31

Figure 4-28 Tidally averaged EC at the SWP intake for the Base case and West False River Alternative 1 simulations during 2000. 4-32

Figure 4-29 Tidally averaged EC at the SWP intake for the Base case and West False River Alternative 1 simulations during 2002 - 2003. 4-32

Figure 4-30 Tidally averaged EC contours on June 1, 1991 and June 1, 1992 for the Base case and West False River Alternative 1 simulations. 4-33

Figure 4-31 Tidally averaged EC contours on June 1, 1995 and June 1, 2000 for the Base case and West False River Alternative 1 simulations. 4-34

Figure 4-32 Tidally averaged EC contours on June 1, 2002 and June 1, 2003 for the Base case and West False River Alternative 1 simulations. 4-35

Figure 4-33 Tidally averaged EC contours on September 1, 1991 and September 1, 1992 for the Base case and West False River Alternative 1 simulations. 4-36

Figure 4-34 Tidally averaged EC contours on September 1, 1995 and September 1, 2000 for the Base case and West False River Alternative 1 simulations. 4-37

Figure 4-35 Tidally averaged EC contours on September 1, 2002 and September 1, 2003 for the Base case and West False River Alternative 1 simulations. 4-38

Figure 4-36 Tidally averaged EC contours on November 1, 1991 and November 1, 1992 for the Base case and West False River Alternative 1 simulations. 4-39

Figure 4-37 Tidally averaged EC contours on November 1, 1995 and November 1, 2000 for the Base case and West False River Alternative 1 simulations. 4-40

Figure 4-38 Tidally averaged EC contours on November 1, 2002 and November 1, 2003 for the Base case and West False River Alternative 1 simulations. 4-41

Figure 4-39 Monthly Average EC at Clifton Court from DSM2 “Fingerprint” Analysis showing total EC and contribution associated with the Martinez boundary. 4-1

Figure 4-40 Percent reduction in monthly average EC at the State Water Project for Pilot Project Alternative 1 (West False River Constriction) as calculated by the RMA Delta model and estimated from the DSM2 “Fingerprint” Analysis.....4-1

LIST OF TABLES

Table 3-1 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in May 2002. 3-10

Table 3-2 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in June 2002. 3-10

Table 3-3 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in July 2002. 3-10

Table 3-4 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in August 2002. 3-10

Table 3-5 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in September 2002. 3-11

Table 3-6 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in October 2002. 3-11

Table 3-7 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in November 2002. 3-11

Table 3-8 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in December 2002. 3-11

Table 3-9 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in May 2002. 3-12

Table 3-10 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in June 2002. 3-12

Table 3-11 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in July 2002. 3-12

Table 3-12 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in August 2002. 3-12

Table 3-13 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in September 2002. 3-13

Table 3-14 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in October 2002. 3-13

Table 3-15 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in November 2002.....3-13

Table 3-16 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in December 2002. 3-13

Table 4-1 Sacramento and San Joaquin Valley Water Hydrologic Classification Indices. (DWR, http://cdec.water.ca.gov/cgi-progs/iodir/wsihist).....4-15

Table 4-2 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in May of each simulation year. 4-42

Table 4-3 Peak tidally averaged EC and % reduction from for West False River Alternative 1 at key locations in June of each simulation year.....4-42

Table 4-4 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in July of each simulation year.....4-43

Table 4-5 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in August of each simulation year.....4-43

Table 4-6 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in September of each simulation year. 4-44

Table 4-7 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in October of each simulation year. 4-44

Table 4-8 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in November of each simulation year. 4-45

Table 4-9 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in December of each simulation year. 4-45

Table 4-10 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in May of each simulation year. 4-46

Table 4-11 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in June of each simulation year.....4-46

Table 4-12 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in July of each simulation year. 4-47

Table 4-13 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in August of each simulation year. 4-47

Table 4-14 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in September of each simulation year. 4-48

Table 4-15 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in October of each simulation year.....4-48

Table 4-16 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in November of each simulation year 4-49

Table 4-17 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in December of each simulation year. 4-49

Table 4-18 Average Dry Season (July-December) Reduction in EC at State Water Project resulting from Pilot Project Alternative 1 (West False River Constriction) for 1991 through 2004.....4-50

Table 4-19 Peak Dry Season (July-December) Reduction in EC at State Water Project resulting from Pilot Project Alternative 1 (West False River Constriction) for 1991 through 2004. 4-50

1 INTRODUCTION

The calibrated RMA finite element model of Sacramento – San Joaquin Delta is used to evaluate three initial Pilot Project study alternatives for management of Franks Tract to improve water quality in the Delta. This document serves to describe the alternatives and report their impacts on EC in the Delta.

Calibration of the RMA Delta model is described in *Flooded Islands Pre-Feasibility Study, RMA Delta Model Calibration* (June 2005).

1.1 BACKGROUND

The purpose of the Flooded Islands Study is to evaluate potential to create water quality, ecosystem, recreation and other benefits at Franks Tract, Lower Sherman Lake and Big Break. Of these three study areas, the most intensively investigated has been Franks Tract because preliminary field and model data indicate that hydrodynamic conditions of the island may result in dramatic effects in overall salinity conditions in the Delta.

Franks Tract is located in the central Delta and is bound by False River and Webb Tract to the north, Old River and Mandeville Island to the east, Sand Mound Slough and Holland Tract to the southeast, and Piper Slough and Bethel Tract to the southwest. Franks Tract is approximately 3,300 ac. Little Franks Tract, a smaller submerged area of 330 ac, lies to the west and is separated from Franks Tract by levees. A color contour plot of bathymetry in the Franks Tract vicinity is shown in Figure 1-1.

Franks Tract is connected tidally to the San Joaquin River via False River. During low flow conditions, high salinity water enters Franks Tract on flood tide while fresher water flows back into False River during ebb tide. The higher salinity water mixes within Franks Tract and is

drawn into Old River through levee breaches on the east side of Franks Tract. This impacts salinity conditions in the adjacent Delta channels and the central and south Delta overall.

Previously, examination of a variety of Franks Tract management alternatives was undertaken to develop a better understanding of the complex physical phenomena involved with the salinity intrusion and mixing occurring within Franks Tract. These efforts are described in *Flooded Islands Pre-Feasibility Study, Alternatives Modeling Report* (June 2005). With this knowledge, preferred alternatives for Delta water quality improvement were selected for further analysis in the current Pilot Project study, including optimization of previously studied alternatives, and multiple-year simulations.

1.2 OBJECTIVES

The objective of this effort was to analyze potential Franks Tract management alternatives that would improve water quality in the Delta while minimizing adverse impacts such as increased residence time in Franks Tract, increased scour in sensitive locations, decreased stage in the Delta, or increased flooding risk. The following management alternatives were considered in the initial Pilot Project study.

- West False River Alternative 1;
- Eastside Levees Alternative 2; and
- Eastside Levees Alternative 3.

Each of these alternatives is described in detail in Section 2.

Measurable salinity impacts at the primary export locations and throughout the Delta result from small changes in flow and mixing processes at the tidal time scale integrated over weeks and months. Understanding and accurately representing the changes in short time scale flow and mixing processes in the model is critical to predicting the impacts of proposed alternatives. April through December 2002 was selected as the analysis period for the initial Pilot Project alternative simulations. This period corresponds with the most recent detailed calibration period for the RMA Delta Model and the extensive field monitoring program by the USGS in the Franks Tract Region, and was the period used for the Pre-Feasibility Study

simulations. The year of 2002 was considered dry, although the period encompasses a significant range of inflows, exports, and tidal conditions.

After 2002 simulations were performed for each of these alternatives, West False River Alternative 1 was chosen for further analysis. Absolute prediction of water quality impacts over a range of water year types is important in evaluating the benefits of the preferred alternative. For the West False River Alternative 1, simulations were performed for 1991-1992, 1995, 2000 and 2002-2003, representing a range of year types.

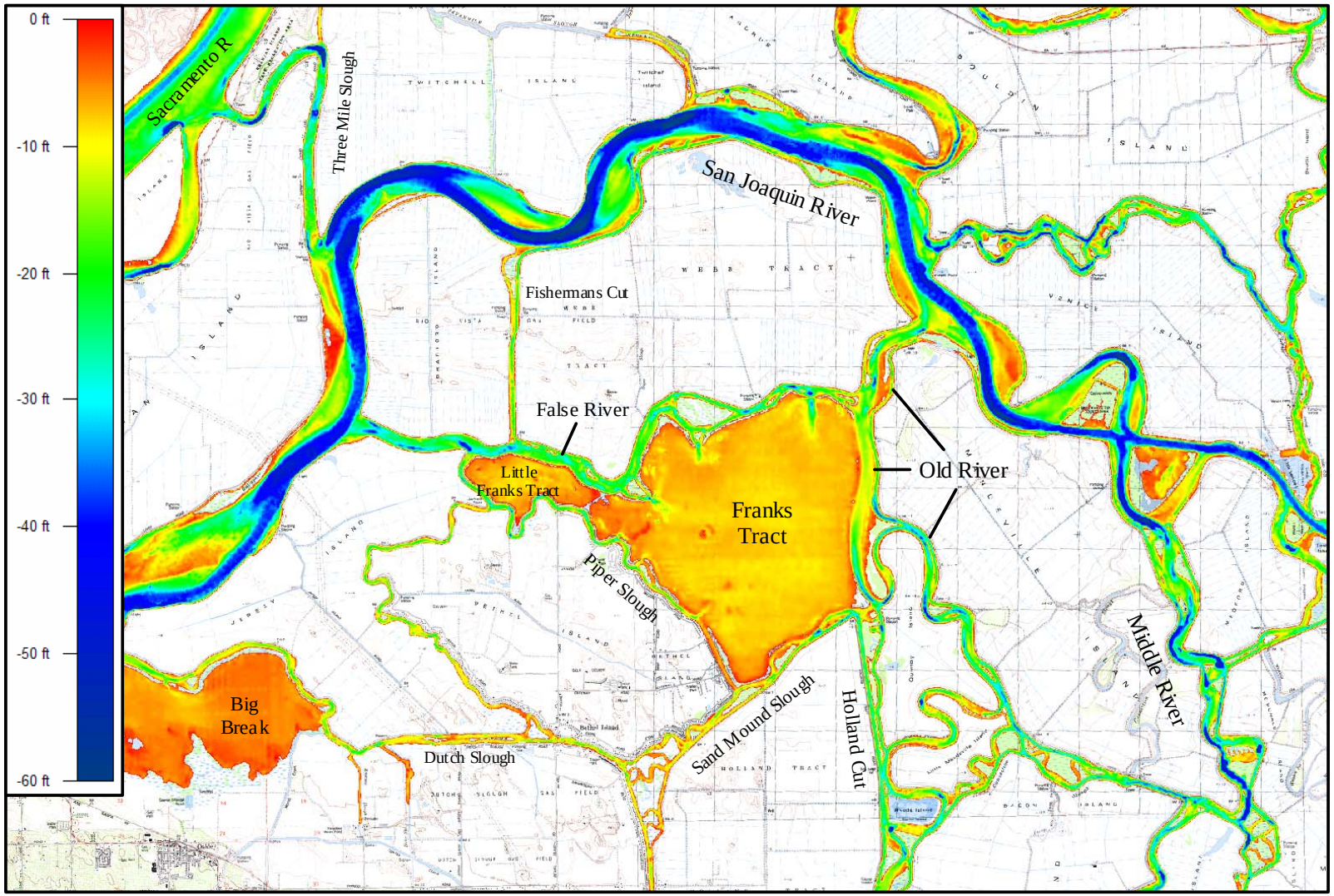


Figure 1-1 Color contours of bathymetry (ft NGVD) in the Franks Tract vicinity.

2 INITIAL PILOT PROJECT ALTERNATIVE DESCRIPTIONS

A Base case and three initial Pilot Project alternative scenarios were simulated to examine the impacts of modifications around Franks Tract on EC throughout the Delta. The alternatives include a constriction on West False River (Alternative 1), and two variations of Eastside Levees on Franks Tract (Alternatives 2 and 3). The primary objective of these alternatives is reducing salinity in the central and southern Delta.

The West False River constriction Alternative 1 aims to reduce salinity mixing in the central Delta by keeping the higher salinity water from entering Franks Tract from the west.

The Eastside Levees alternatives employ restored levees on the east side of Franks Tract. For these alternatives, salinity in Franks Tract is allowed to increase in the summer and fall, and salinity reduction in the south Delta is obtained by isolating Franks Tract from Old River.

2.1 BASE CASE

This simulation was performed using the calibrated model with currently existing conditions. The full model configuration for the Base case is shown in Figure 2-1.

2.2 WEST FALSE RIVER ALTERNATIVE 1

For the West False River alternative, a constriction is placed in False River between the San Joaquin River and Piper Slough as shown in Figure 2-2. The constriction reduces the tidal flow by about 50%.

2.3 EASTSIDE LEVEES ALTERNATIVE 2

For this alternative the east and southeast Franks Tract levees along Old River and Sand Mound Slough are all closed, as shown in Figure 2-3.

2.4 EASTSIDE LEVEES ALTERNATIVE 3

For this alternative the east Franks Tract levees along Old River are completely closed, isolating Franks Tract, False River and Sand Mound Slough from Old River, as shown in Figure 2-4.

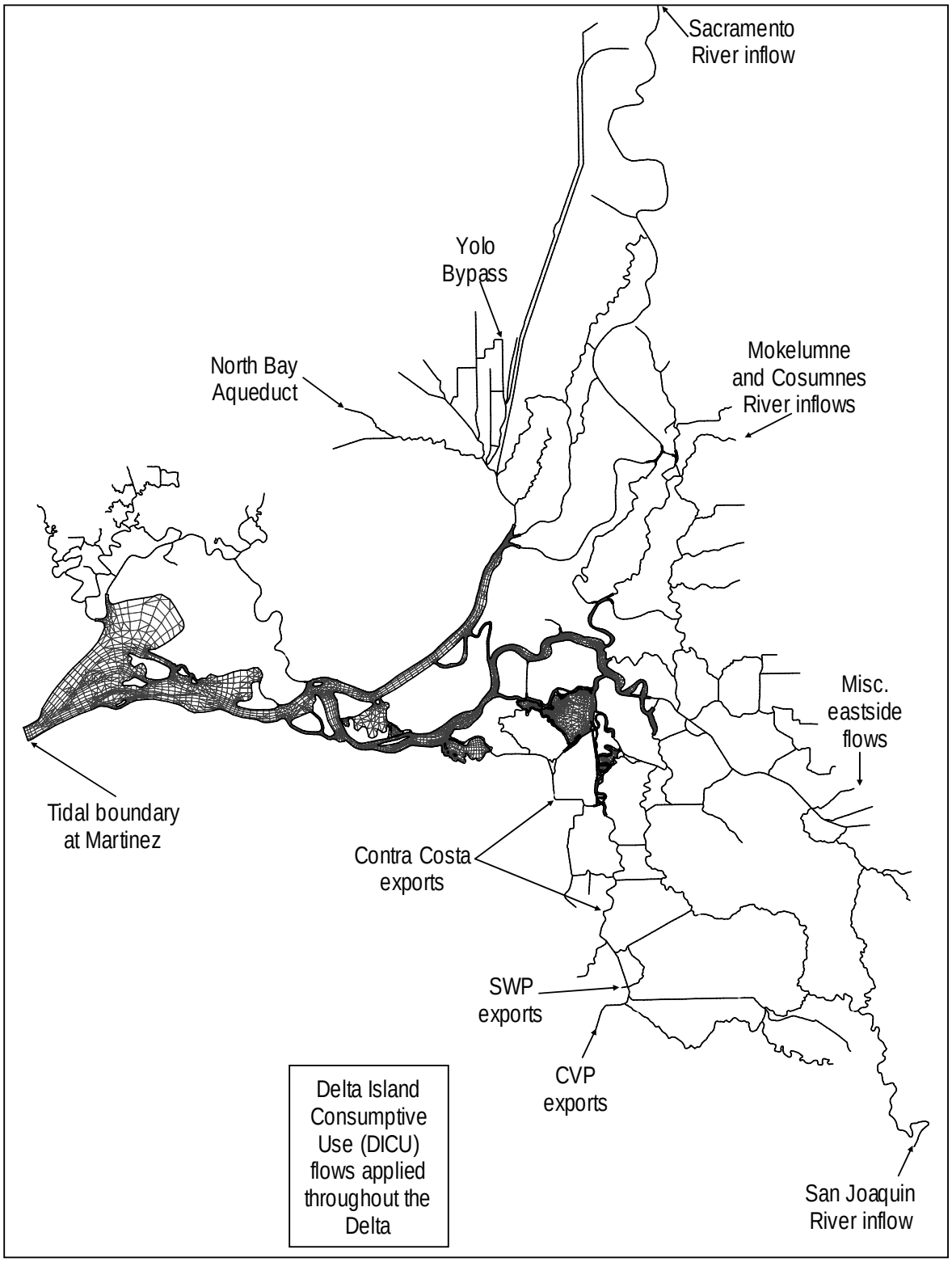


Figure 2-1 Base case model configuration.

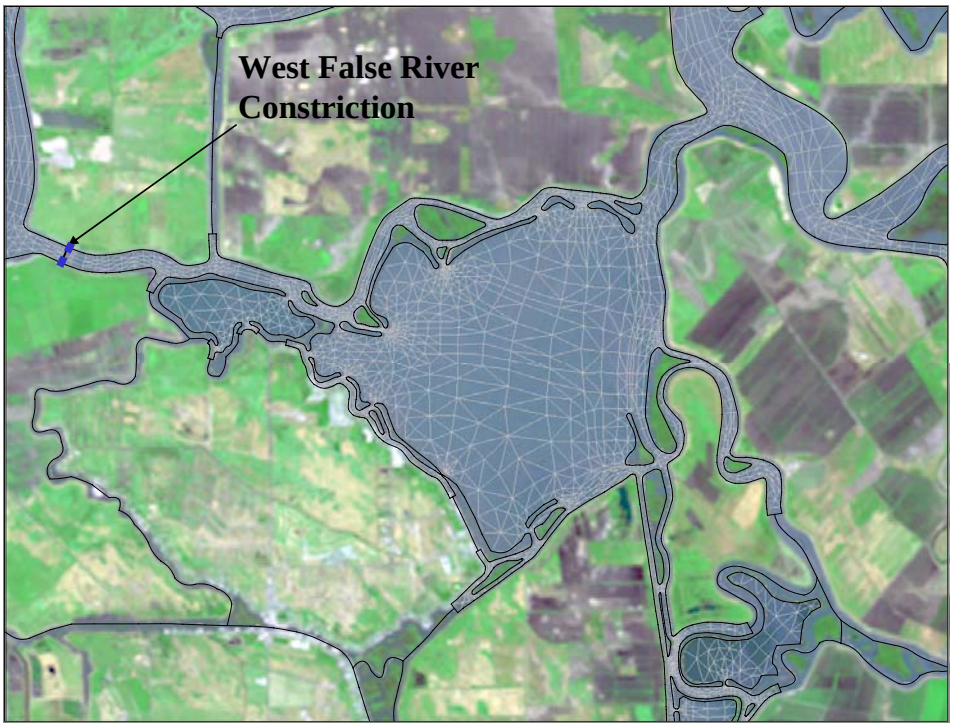


Figure 2-2 Grid for West False River Constriction Alternative 1.

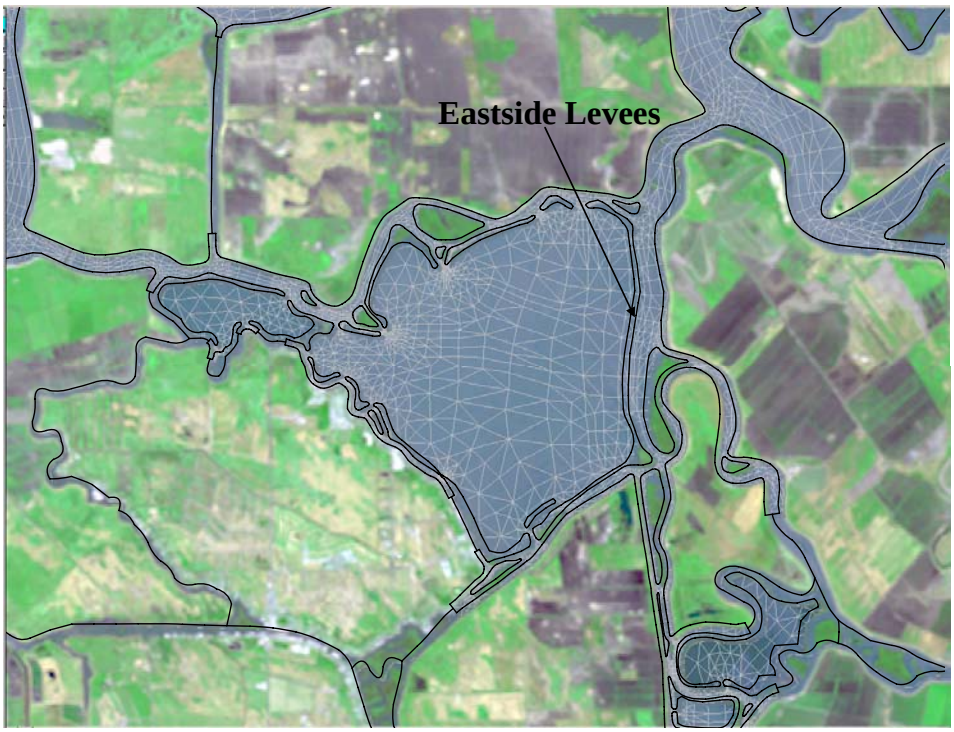


Figure 2-3 Grid for Eastside Levees Alternative 2.

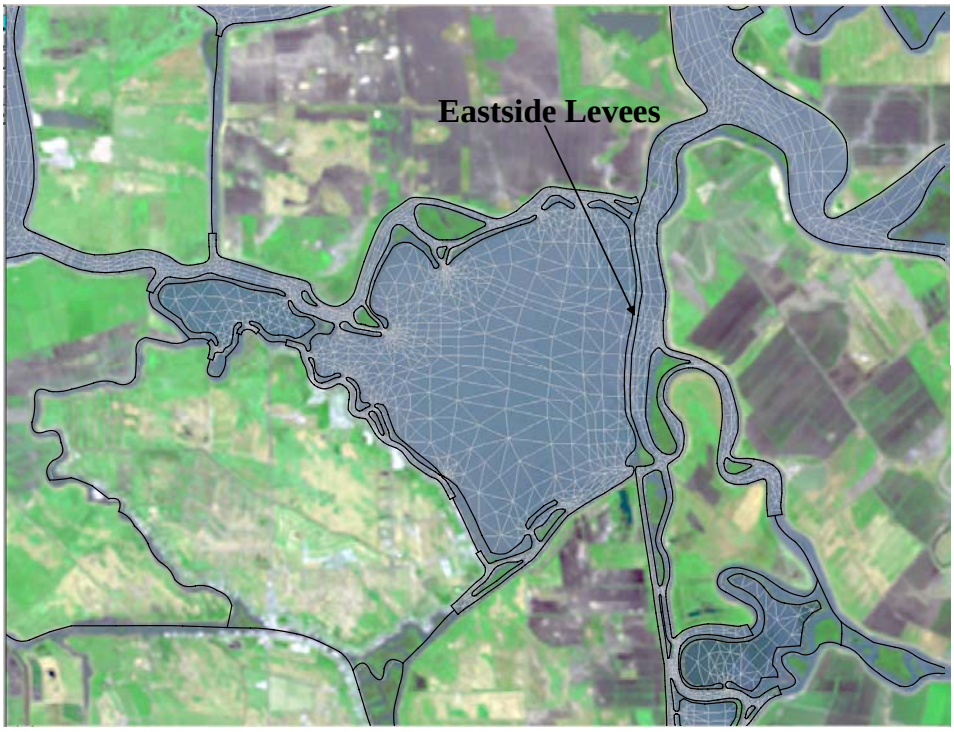


Figure 2-4 Grid for Eastside Levees Alternative 3.

3 INITIAL PILOT PROJECT STUDY ALTERNATIVE SIMULATIONS

Salinity is typically monitored using the surrogate measure of electrical conductivity (EC) measured in μmhos/cm.

Tidally averaged EC time series are provided in Figure 3-2 through Figure 3-11 at the six key locations shown in Figure 3-1: Jersey Point, the Contra Costa intake at Rock Slough, the Contra Costa intake on Old River, RMID023 (Middle River at Victoria Island), the SWP intake, and the CVP intake.

Tidally averaged EC concentration contours on June1, 2002, September 1, 2002 and November 1, 2002 are provided in Figure 3-9 through Figure 3-11 for the Base case and each of the three alternatives.

Summary tables of peak tidally averaged EC and percent decrease below Base case at key locations are provided for each month from May through December 2002 in Table 3-1 through Table 3-8. Summary tables of monthly averaged EC and percent decrease below Base case at key locations are provided for each month from May through December 2002 in Table 3-9 through Table 3-16.

The results show the Eastside Alternative 3 produces the greatest salinity reduction at the export locations, with a reduction in monthly averaged EC at the SWP intake for September 2002 of 17%, and 20% for October 2002. Alternative 1 (West False River restriction) produced monthly averaged EC reduction at the SWP intake of 9% for September 2002. Alternative 2 reduced the monthly averaged EC at the SWP intake by 3% for September 2002.

Preliminary design and cost analysis by Moffatt and Nichols indicates tidally operated gates may be feasible in a pilot project for the Alternative 1 location. With operable gates, this location may have potential for further salinity reduction for the export locations.

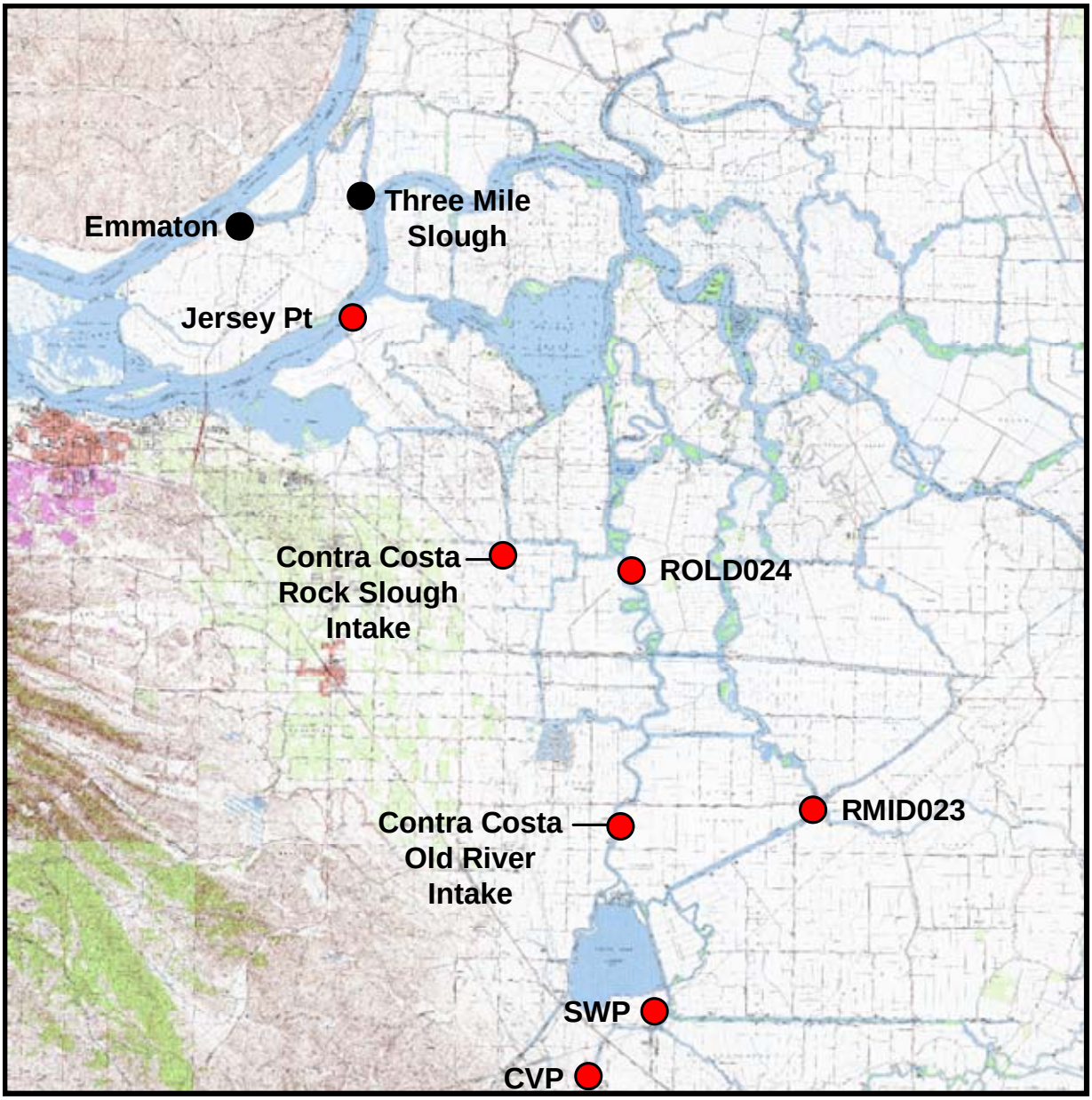


Figure 3-1 EC time series locations.

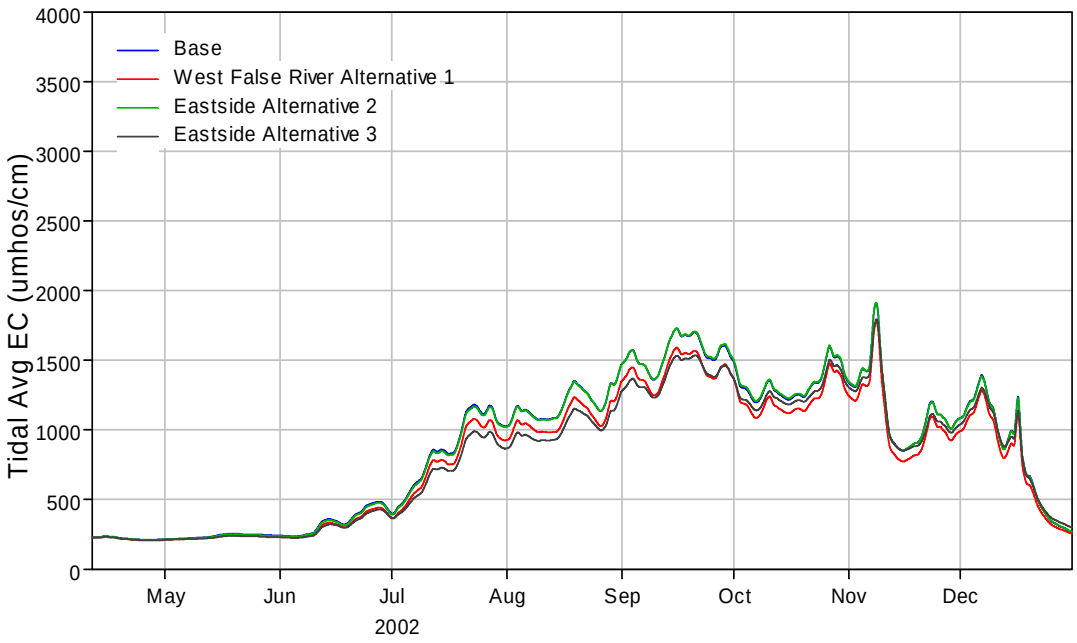


Figure 3-2 Tidally averaged EC results at Jersey Point for the Base case and initial Pilot Project alternatives.

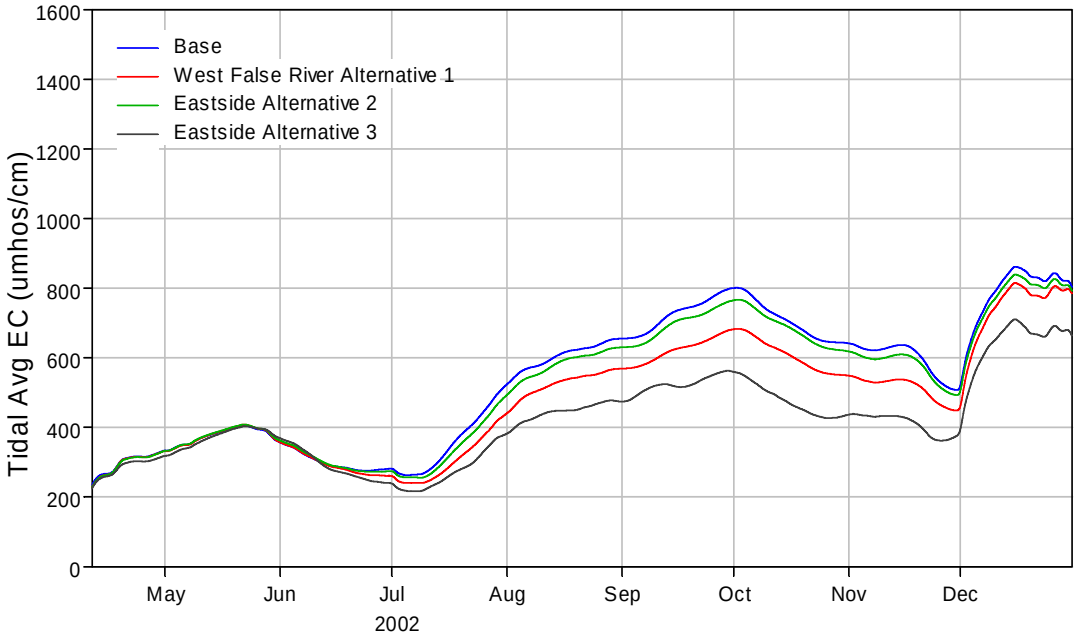


Figure 3-3 Tidally averaged EC results at the Contra Costa intake on Rock Slough for the Base case and initial Pilot Project alternatives.

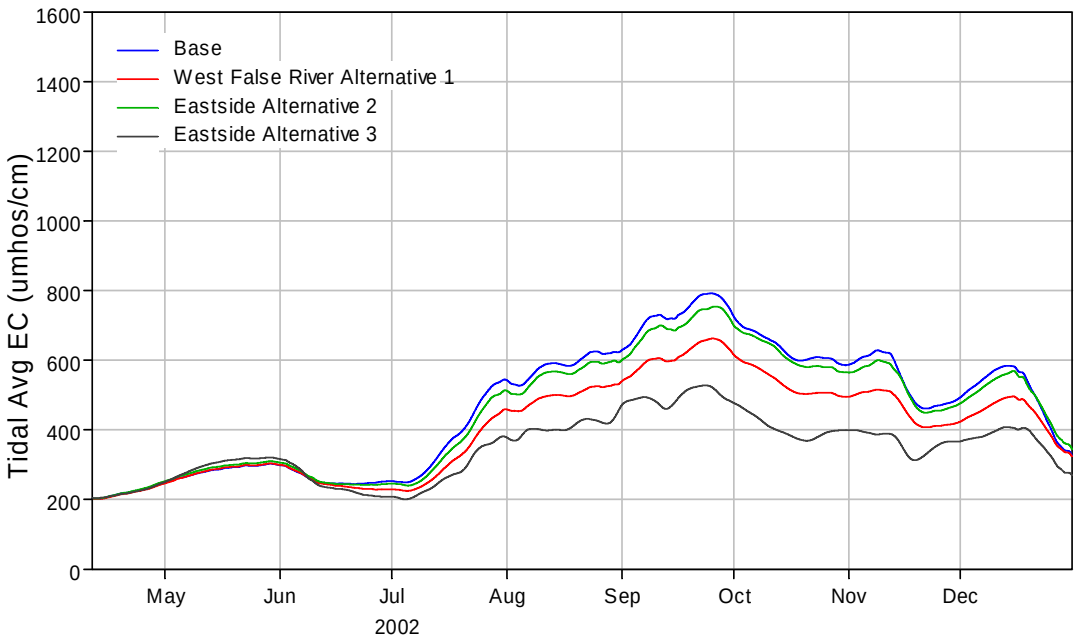


Figure 3-4 Tidally averaged EC results at the Contra Costa intake on Old River for the Base case and initial Pilot Project alternatives.

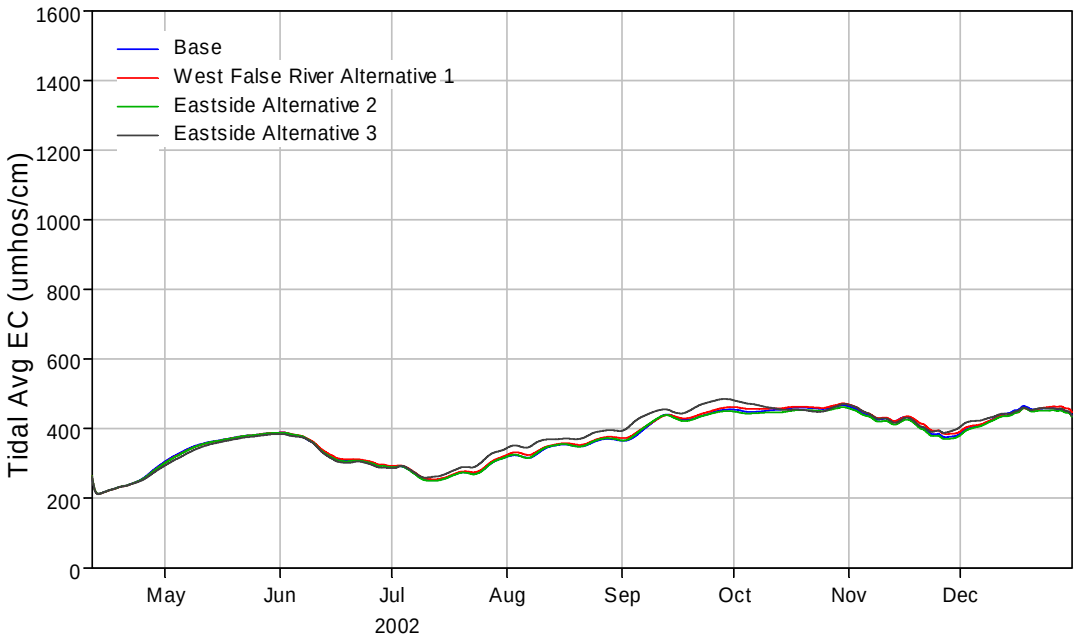


Figure 3-5 Tidally averaged EC results at RMID023 for the Base case and initial Pilot Project alternatives.

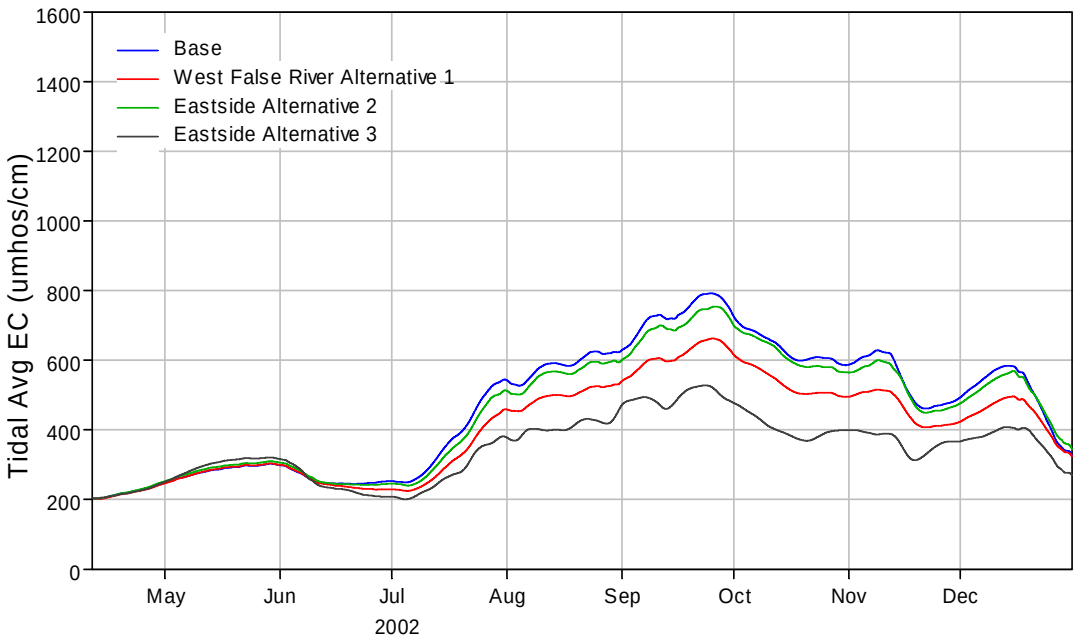


Figure 3-6 Tidally averaged EC results at ROLD024 for the Base case and initial Pilot Project alternatives.

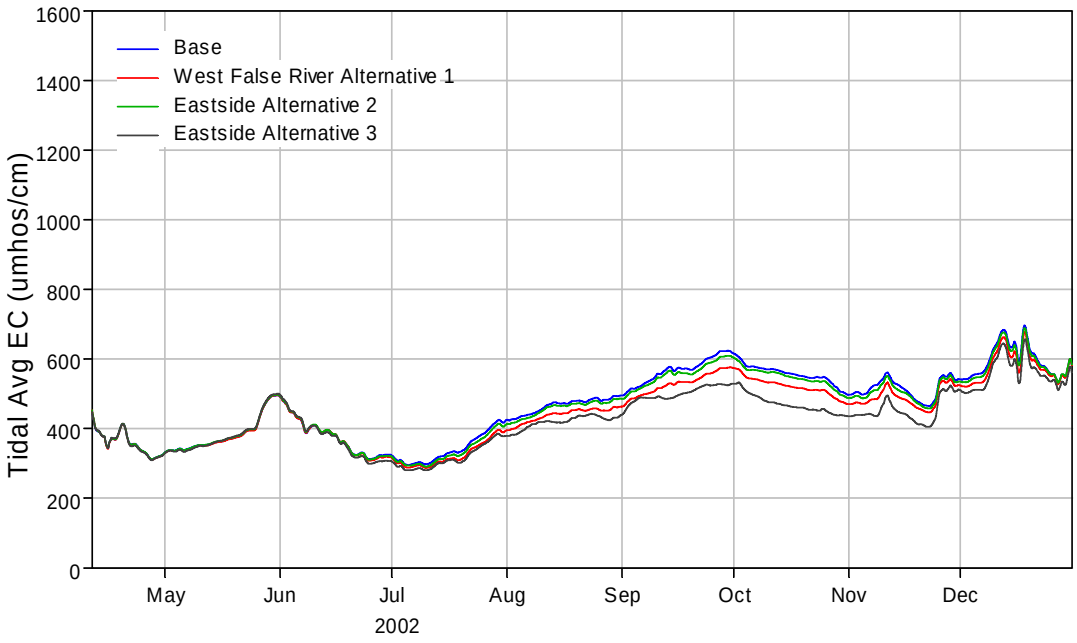


Figure 3-7 Tidally averaged EC results at the CVP intake for the Base case and initial Pilot Project alternatives.

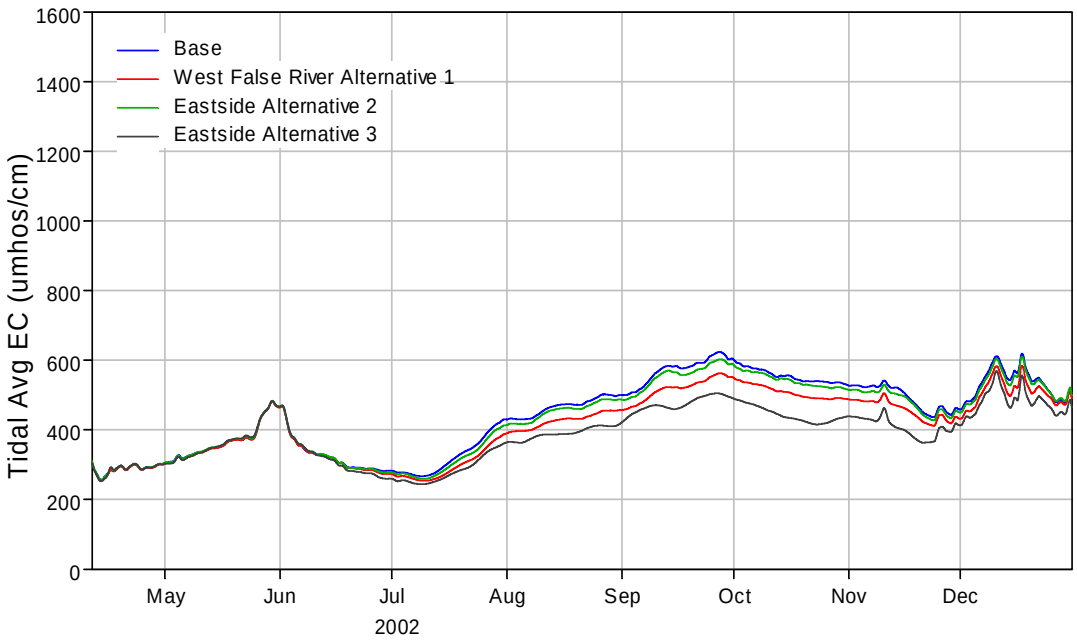


Figure 3-8 Tidally averaged EC results at the SWP intake for the Base case and initial Pilot Project alternatives.

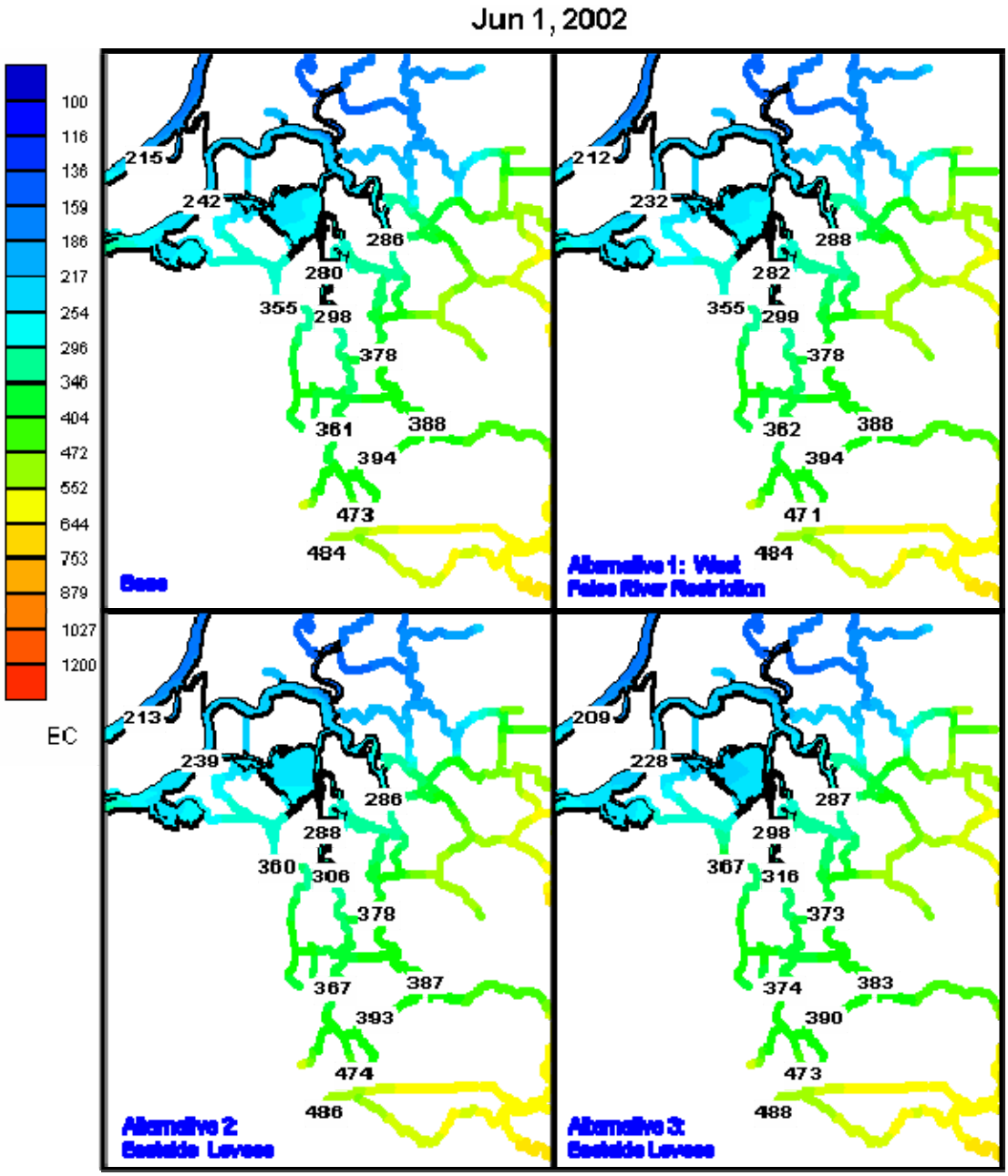


Figure 3-9 Tidally averaged EC contours on June 1, 2002 for the Base case and initial Pilot Project alternatives.

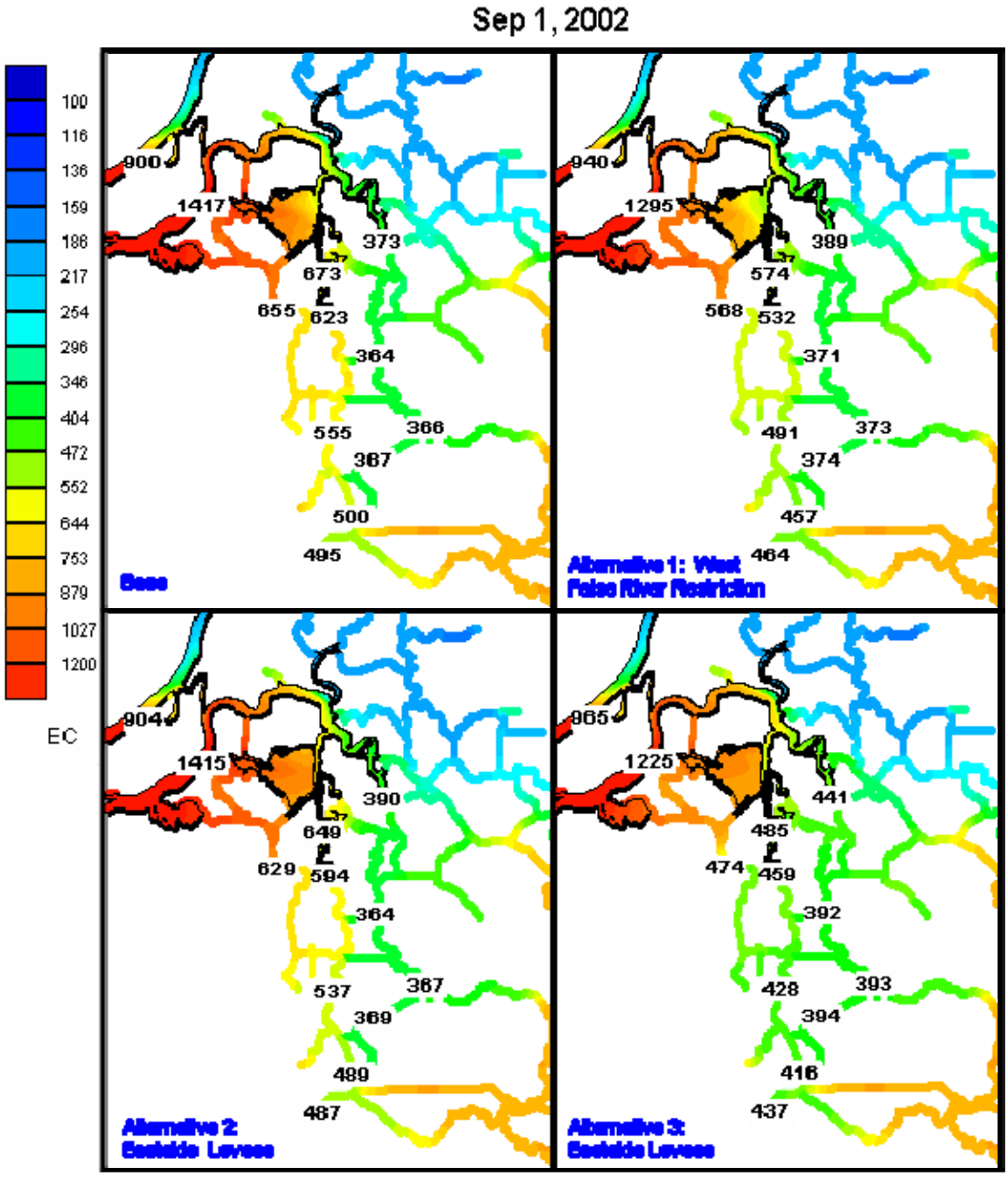


Figure 3-10 Tidally averaged EC contours on September 1, 2002 for the Base case and initial Pilot Project alternatives.

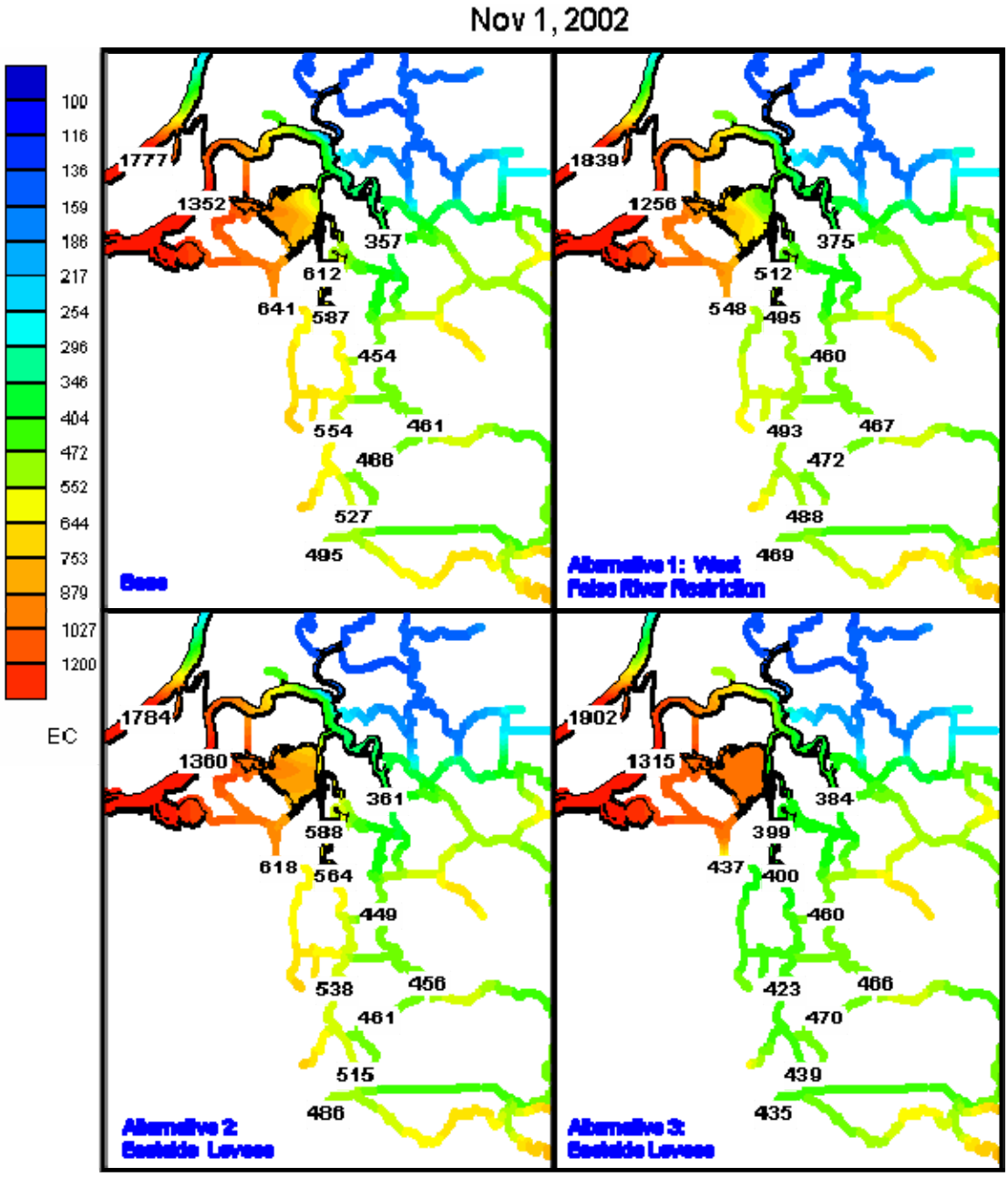


Figure 3-11 Tidally averaged EC contours on November 1, 2002 for the Base case and initial Pilot Project alternatives.

Table 3-1 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in May 2002.

May 2002	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	483		496		363		406		255		389	
West False River Alt 1	482	0.12	497	-0.08	363	-0.12	408	-0.54	244	4.31	389	0.01
Eastside Alt 2	483	-0.19	498	-0.40	369	-1.57	408	-0.60	251	1.48	388	0.15
Eastside Alt 3	483	-0.09	501	-0.94	376	-3.58	403	0.63	239	6.04	384	1.12

Table 3-2 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in June 2002.

June 2002	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	469		491		362		357		484		389	
West False River Alt 1	468	0.30	492	-0.07	363	-0.12	358	-0.23	441	8.89	389	-0.01
Eastside Alt 2	471	-0.27	493	-0.45	368	-1.57	362	-1.56	476	1.71	388	0.16
Eastside Alt 3	470	-0.11	496	-1.01	375	-3.51	369	-3.40	429	11.43	384	1.18

Table 3-3 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in July 2002.

July 2002	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	430		425		481		523		1181		319	
West False River Alt 1	390	9.37	397	6.68	422	12.29	441	15.83	1079	8.60	324	-1.68
Eastside Alt 2	414	3.83	414	2.53	459	4.67	493	5.80	1169	1.05	320	-0.23
Eastside Alt 3	364	15.41	385	9.37	374	22.22	382	27.00	990	16.18	344	-7.98

Table 3-4 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in August 2002.

August 2002	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	502		495		558		655		1,475		371	
West False River Alt 1	457	8.96	463	6.36	493	11.53	569	13.12	1,354	8.22	376	-1.45
Eastside Alt 2	488	2.75	486	1.75	537	3.68	630	3.83	1,473	0.13	372	-0.40
Eastside Alt 3	422	15.93	442	10.65	440	21.13	477	27.14	1,281	13.16	395	-6.53

Table 3-5 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in September 2002.

September 2002	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	624		623		698		800		1729		455	
West False River Alt 1	563	9.79	576	7.62	608	12.91	682	14.80	1590	8.02	462	-1.49
Eastside Alt 2	603	3.30	609	2.32	669	4.12	765	4.40	1729	-0.05	450	1.04
Eastside Alt 3	505	19.02	529	15.13	515	26.19	562	29.72	1,535	11.18	485	-6.52

Table 3-6 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in October 2002.

October 2002	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	601		616		667		801		1,599		467	
West False River Alt 1	549	8.62	574	6.79	588	11.93	683	14.75	1,478	7.56	472	-1.06
Eastside Alt 2	586	2.48	604	1.95	647	3.00	767	4.26	1,605	-0.36	462	1.24
Eastside Alt 3	490	18.56	533	13.45	489	26.79	559	30.13	1,503	5.99	481	-2.95

Table 3-7 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in November 2002.

November 2002	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	542		562		574		641		1,910		464	
West False River Alt 1	506	6.69	543	3.38	499	12.96	549	14.47	1,776	7.03	469	-1.16
Eastside Alt 2	530	2.31	553	1.50	552	3.88	618	3.63	1,913	-0.14	458	1.19
Eastside Alt 3	462	14.69	524	6.76	423	26.30	438	31.63	1,794	6.06	468	-1.00

Table 3-8 Peak tidally averaged EC and % reduction from Base for each initial Pilot Project alternative at key locations in December 2002.

December 2002	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	619		696		569		862		1394		465	
West False River Alt 1	584	5.60	678	2.68	509	10.62	815	5.40	1287	7.67	464	0.19
Eastside Alt 2	611	1.36	689	1.02	557	2.15	839	2.61	1385	0.69	459	1.18
Eastside Alt 3	569	8.11	657	5.63	448	21.26	710	17.56	1,303	6.54	461	0.83

Table 3-9 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in May 2002.

May 2002	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	368		383		332		376		237		362	
West False River Alt 1	367	0.39	382	0.26	332	0.17	377	-0.20	229	3.45	361	0.38
Eastside Alt 2	369	-0.37	384	-0.32	337	-1.26	378	-0.53	234	1.22	361	0.42
Eastside Alt 3	368	-0.09	384	-0.21	340	-2.29	372	1.18	227	4.50	355	1.95

Table 3-10 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in June 2002.

June 2002	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	325		375		295		300		345		332	
West False River Alt 1	322	0.75	374	0.36	291	1.43	294	1.82	320	7.21	334	-0.68
Eastside Alt 2	325	0.01	376	-0.06	296	-0.22	301	-0.31	339	1.65	331	0.36
Eastside Alt 3	318	2.16	370	1.33	287	2.71	289	3.57	312	9.39	327	1.35

Table 3-11 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in July 2002.

July 2002	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	323		342		345		356		862		277	
West False River Alt 1	298	7.79	324	5.09	306	11.18	307	13.78	783	9.16	280	-1.10
Eastside Alt 2	312	3.38	334	2.30	329	4.60	337	5.41	852	1.13	276	0.32
Eastside Alt 3	284	12.15	317	7.36	282	18.30	274	23.02	729	15.47	289	-4.57

Table 3-12 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in August 2002.

August 2002	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	467		466		520		605		1,189		346	
West False River Alt 1	427	8.62	439	5.85	459	11.67	526	13.13	1,083	8.93	352	-1.56
Eastside Alt 2	455	2.55	458	1.73	502	3.46	581	4.01	1,186	0.30	347	-0.33
Eastside Alt 3	391	16.33	419	10.08	399	23.23	445	26.53	1,019	14.28	371	-7.13

Table 3-13 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in September 2002.

September 2002	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	571		568		641		726		1557		424	
West False River Alt 1	518	9.32	529	6.88	561	12.57	622	14.30	1430	8.16	428	-1.01
Eastside Alt 2	555	2.80	556	2.09	618	3.71	696	4.12	1561	-0.26	423	0.14
Eastside Alt 3	474	17.03	500	11.91	485	24.42	523	27.92	1,399	10.13	452	-6.76

Table 3-14 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in October 2002.

October 2002	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	555		557		595		706		1,329		456	
West False River Alt 1	509	8.26	521	6.37	526	11.62	608	13.97	1,220	8.23	461	-1.01
Eastside Alt 2	543	2.13	547	1.77	580	2.49	685	3.04	1,338	-0.64	450	1.37
Eastside Alt 3	444	20.01	470	15.54	431	27.57	477	32.53	1,267	4.64	461	-0.94

Table 3-15 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in November 2002.

November 2002	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	492		515		512		597		1,159		416	
West False River Alt 1	457	7.24	489	4.92	457	10.83	512	14.22	1,064	8.17	421	-1.42
Eastside Alt 2	481	2.27	506	1.77	497	2.86	575	3.64	1,160	-0.04	410	1.37
Eastside Alt 3	407	17.28	453	11.95	385	24.81	409	31.37	1,121	3.26	420	-1.12

Table 3-16 Monthly average EC and % reduction from Base for each initial Pilot Project alternative at key locations in December 2002.

December 2002	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
Base	535		596		506		788		818		439	
West False River Alt 1	508	5.06	578	3.02	462	8.68	743	5.74	752	8.10	440	-0.20
Eastside Alt 2	529	1.22	590	1.03	498	1.66	769	2.40	815	0.33	434	1.09
Eastside Alt 3	481	10.09	558	6.36	414	18.24	643	18.42	800	2.21	443	-0.99

4 LONG TERM SIMULATIONS

In the previous section, the Base case and three initial Pilot Project alternatives were evaluated for the 2002 Delta hydrology. The Base and the Alternative 1 conditions were simulated for additional water years to examine the potential project benefits under a broader range of hydrologic conditions. Ideally the RMA Delta model would be run for a continuous 16 year hydrologic period. However with a multi-dimensional model, the computer run times for multiyear simulation are significant. Therefore, a subset of water years from the 1991 to 2005 period were selected for analysis. The selected simulation periods include critically dry to wet Delta hydrologic conditions. The historical conditions selected for analysis were:

- April 1, 1991 to December 31, 1992 (21 months)
- April 1, 1995 to December 31, 1995 (9 months)
- April 1, 2000 to December 31, 2000 (9 months)
- April 10, 2002 to December 31, 2003 (21 months)

The hydrologic ranking for these periods are indicated in Table 1. A plot of the monthly Net Delta Outflow (NDO) for 1991-2005 is presented in Figure 4-1.

The standard DWR water year spans from October 1 to September 30 of the following year. The April 1 start date and December 31 end date for the RMA Delta model simulations were selected to encompass the period in which the Central Delta is filled with fresh water in the spring, salinity intrudes into the Delta from the west during the summer and fall until the Delta begins to freshen again with the winter runoff. The benefits of the project are expected to result by reducing the salinity intrusion during summer and fall from high EC waters originating from Suisun Bay. For very dry winters, such as from 1991 to 1992, the Delta may not entirely flush with the winter and spring runoff. The project impacts on Delta EC for a dry winter were evaluated by performing a continuous 21 month run for 1991 and 1992.

Table 4-1 Sacramento and San Joaquin Valley Water Hydrologic Classification Indices. (DWR, http://cdec.water.ca.gov/cgi-progs/iodir/wsihist)

Sacramento Valley						San Joaquin Valley				
	Runoff (MAF)			WY Index		Runoff (MAF)			WY Index	
WY	Oct-Mar	Apr-Jul	WY sum	Index	Yr Type	Oct-Mar	Apr-Jul	WY sum	Index	Yr Type
1991	.90	4.01	8.44	4.21	C	0.56	2.57	3.20	1.96	C
1992	5.41	2.93	8.87	4.06	C	0.86	1.66	2.58	1.56	C
1993	12.44	8.98	22.21	8.54	AN	2.49	5.65	8.38	4.20	W
1994	4.55	2.73	7.81	5.02	C	0.66	1.80	2.54	2.05	C
1995	19.83	13.60	34.55	12.89	W	3.67	8.01	12.32	5.95	W
1996	13.05	8.37	22.29	10.26	W	2.57	4.51	7.22	4.12	W
1997	20.22	4.39	25.42	10.82	W	5.75	3.59	9.51	4.13	W
1998	17.65	12.54	31.40	13.31	W	2.82	7.11	10.43	5.65	W
1999	12.97	7.26	21.19	9.80	W	1.90	3.85	5.91	3.59	AN
2000	12.06	5.96	18.90	8.94	AN	1.98	3.78	5.90	3.38	AN
2001	5.64	3.46	9.81	5.76	D	0.92	2.23	3.18	2.20	D
2002	9.32	4.57	14.60	6.35	D	1.27	2.75	4.06	2.34	D
2003	10.71	7.74	19.31	8.21	AN	1.25	3.49	4.87	2.81	BN
2004	10.95	4.40	16.04	7.51	BN	1.51	2.25	3.81	2.21	D
2005	8.30	9.29	18.44	8.45	AN	2.73	6.30	9.25	4.77	W

W = Wet year type
AN = Above normal year type
BN = Below normal year type
D = Dry year type
C = Critical year type

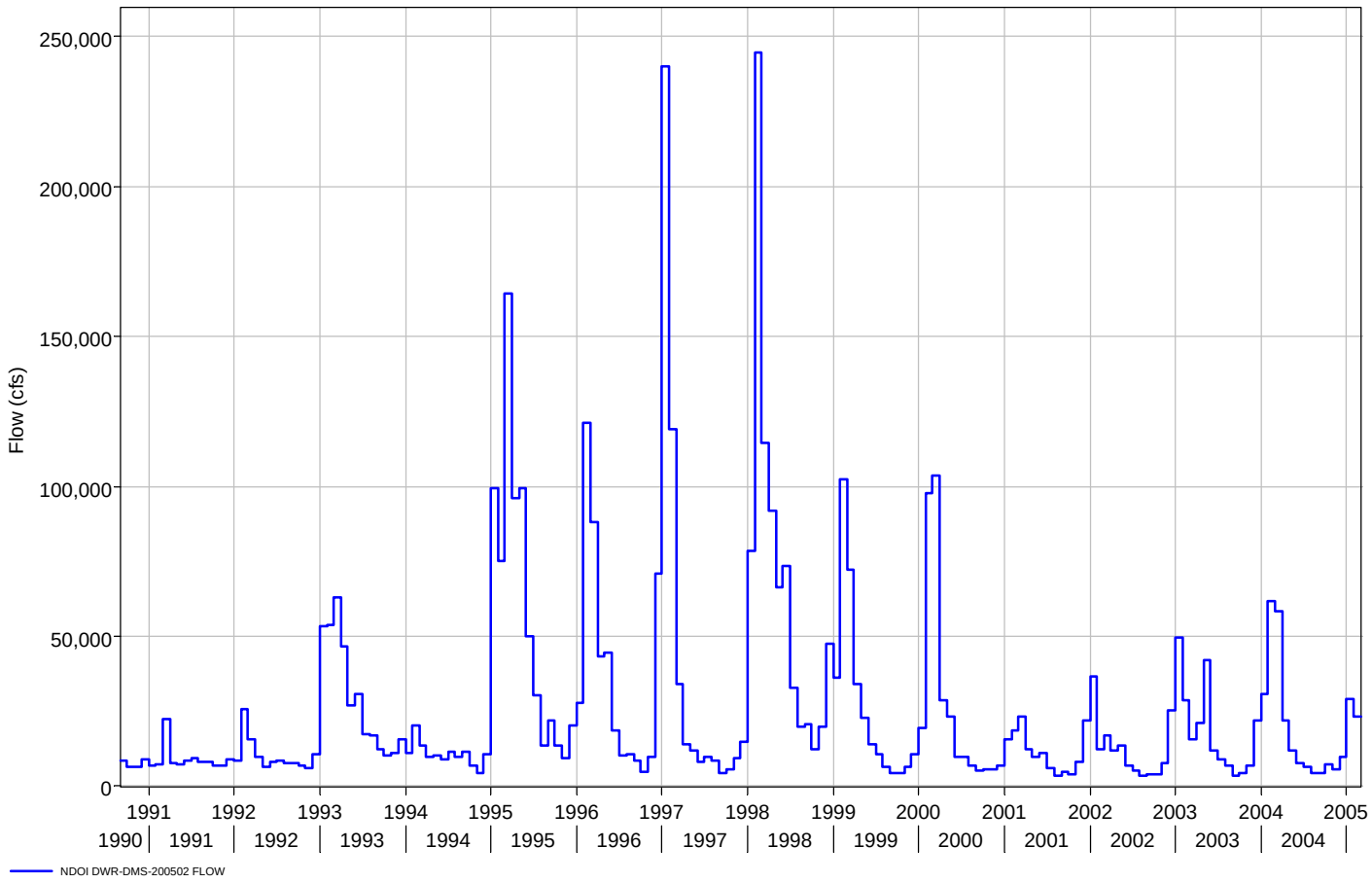


Figure 4-1 Monthly Net Delta Outflow for years 1991 to 2005.

4.1 RESULTS

Results of the multi-year simulations comparing EC for the Base and the Alternative 1 conditions are presented in Figure 4-2 to Figure 4-38, and in tables of peak tidally averaged and monthly averaged EC at the south Delta exports, Jersey Point, ROLD024 and RMID023. Figure 4-2 to Figure 4-29 show time series plots of tidally averaged EC at the export locations and other key Delta stations. Figure 4-30 to Figure 4-38 show contour plots of Delta EC for Base and Alternative 1 conditions for June 1, September 1 and November 1.

The tables and plot indicate the salinity reduction benefits of the project are greatest for dry water years and are reduced in wet years. The maximum EC reduction at the SWP intake occurs for August 1991 and July 1992, where monthly average EC are reduced by 13%. Salinity reductions at the SWP intake are minimal for the wet year 1995 (Figure 4-27). Salinity reduction at the SWP intake for above normal runoff years (2000 and 2003) occurs after September 1 (Figure 4-28 and Figure 4-29).

DSM2 “fingerprint” analysis shows the San Joaquin River and agricultural return water are the dominant EC sources at Clifton Court during wet months and wet years. In dry years the dominant source of EC at Clifton Court is Suisun Bay salinity. The difference between Base and Alternative EC for the ROLD024 station (Figure 4-18 through Figure 4-21) is a good indicator of the reduction of EC in the Central Delta due to salinity intrusion from Suisun Bay waters. When Base and Alternative EC are the same, salinity intrusion is minimal, and the primary sources of EC at the export locations are the San Joaquin River and the agricultural returns.

The beneficial EC reductions with the Alternative 1 configuration occur in dry months and dry years where salinity intrusion from Suisun Bay waters impacts the water quality at the south Delta export locations. In fact the Alternative 1 configuration, a simple restriction at the west end of False River, appears to somewhat impede the flushing of the Central Delta as river flows increase during the winter months. However, a gated structure at the False River location could potentially be operated to enhance the flushing of Franks Tract during wet season conditions and lower Central Delta EC.

The DSM2 “fingerprint” analysis provides a means of roughly estimating the effectiveness of salinity reduction over a longer period of time. The fingerprint analysis shows how much salt reaching the export locations is attributable to intrusion from the Martinez boundary. The general effect of a franks tract alternative is to reduce entrainment of salt from the Suisun Bay region into the western and central Delta. So the amount of reduction actually seen at the export location will be related to the proportion of the salinity load that is attributable to the ocean boundary. By making a simple assumption that the hydrodynamic affect of the alternative is relatively constant over time then the reduction at the export might be approximated as

*% reduction = max % reduction * (EC at export from Martinez / total EC at export),* (1)

where the max % reduction is a constant related to the effectiveness of a particular alternative in reducing mixing of Suisun Bay salt into the central Delta. This is, of course, an extreme over simplification. However it provides a surprisingly accurate means of extrapolating the RMA model results over a longer period.

Figure 4-39 shows the monthly average EC at Clifton Court and the corresponding EC contribution from the DSM2 fingerprint analysis. Figure 4-40 shows the percent reduction calculated from equation (1) taking the maximum percent reduction to be a constant equal to 17%. Also plotted are the actual percent reductions calculated by the RMA model. The value of 17% was found to provide the best fit between the fingerprint estimate and RMA model results by trial and error. While the fit is not perfect, the simple relationship does a very good job of representing the variation over different year types. From this data, Table 4-18 was developed showing the dry season % reduction (July1 through December 31) for 1991 through 2004. The overall average dry season reduction for the west false river constriction alternative is 5.5%. Table 4-19 shows the largest reduction in monthly average EC observed during July to December of each year, which over the 14 year record averages 8%.

The above relationship is for a “passive” alternative. A gated alternative operated for EC at an index location may not have such a linear relationship for %EC reduction vs. EC at export from Martinez / total EC at export.

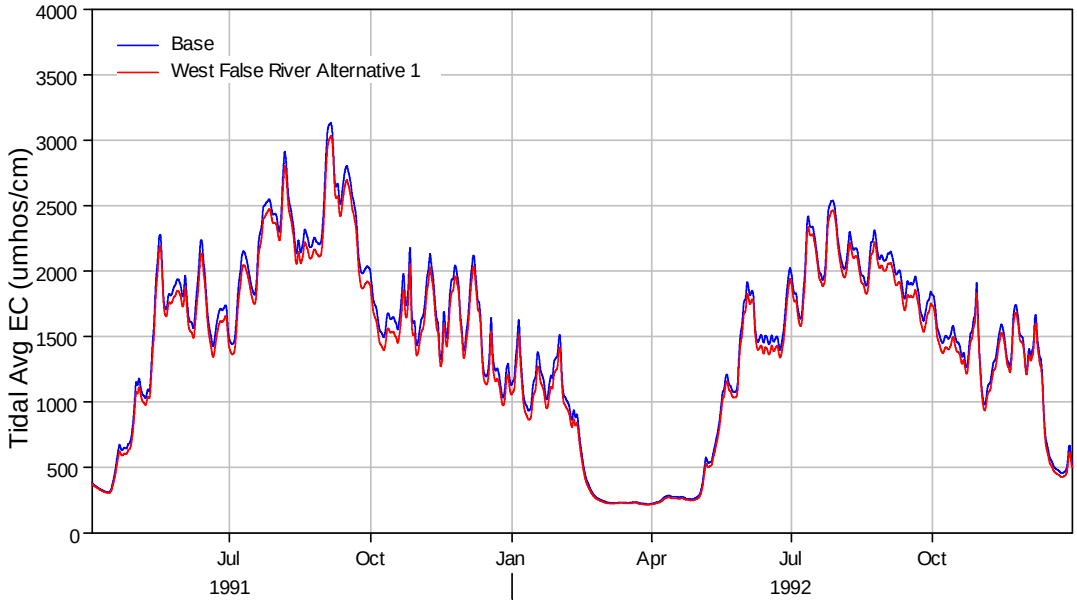


Figure 4-2 Tidally averaged EC at Jersey Point for the Base case and West False River Alternative 1 simulations during 1991 - 1992.

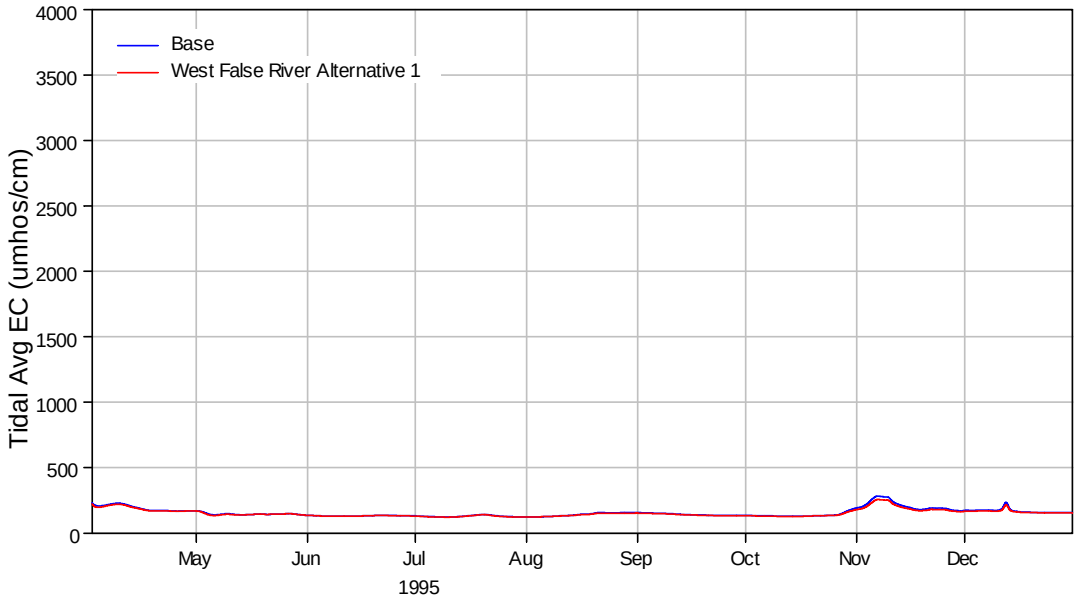


Figure 4-3 Tidally averaged EC at Jersey Point for the Base case and West False River Alternative 1 simulations during 1995.

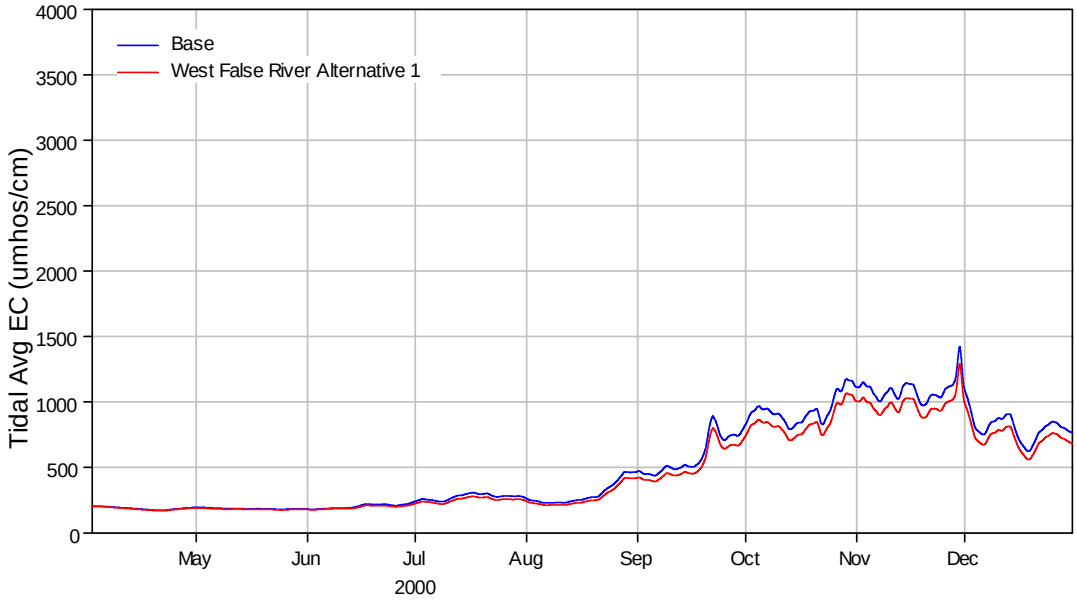


Figure 4-4 Tidally averaged EC at Jersey Point for the Base case and West False River Alternative 1 simulations during 2000.

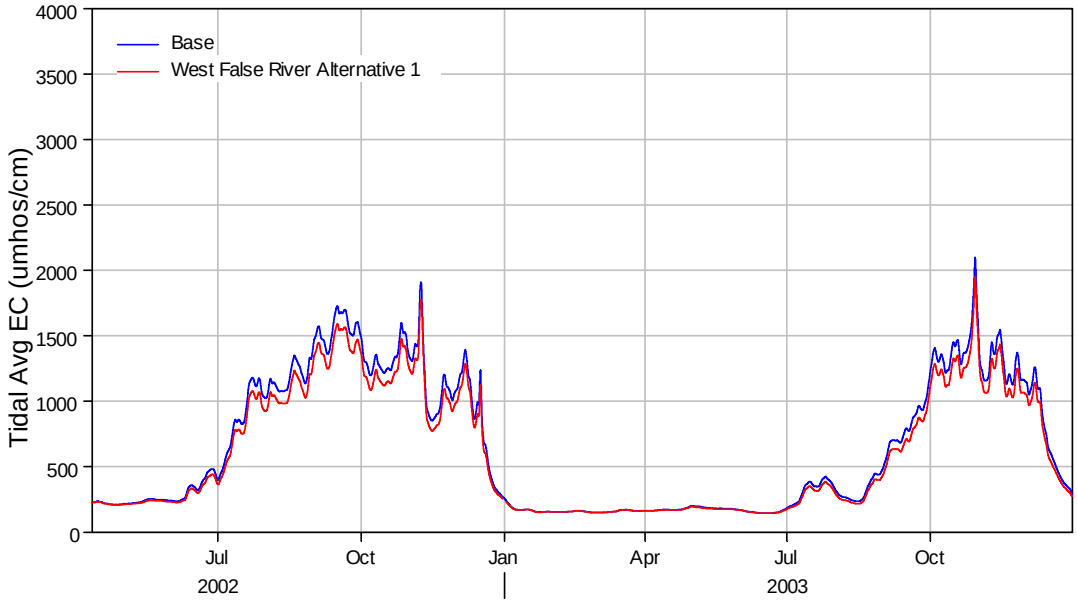


Figure 4-5 Tidally averaged EC at Jersey Point for the Base case and West False River Alternative 1 simulations during 2002 - 2003.

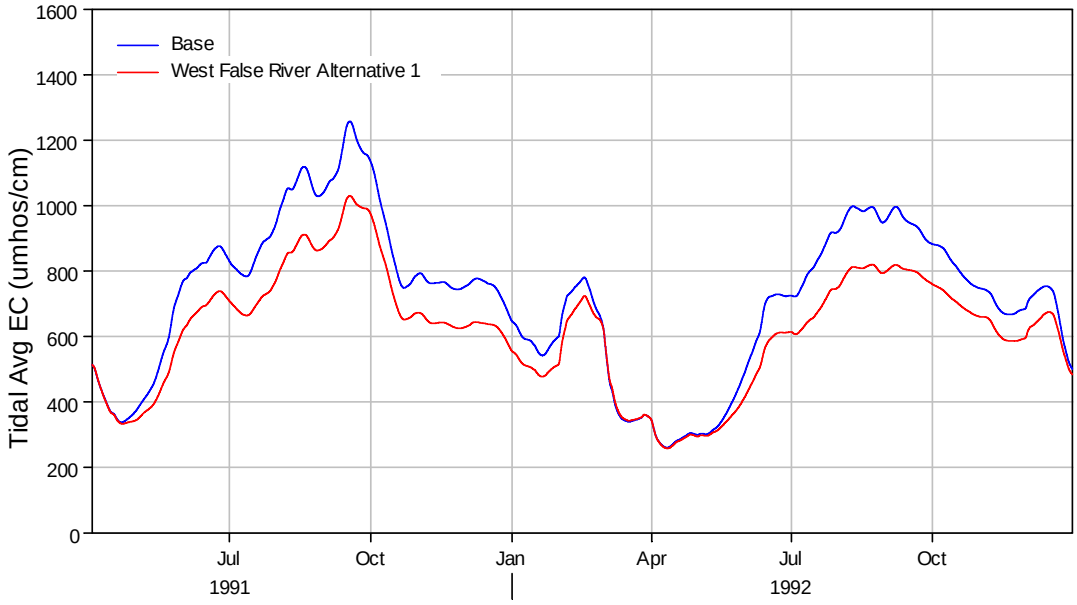


Figure 4-6 Tidally averaged EC at the Contra Costa intake in Rock Slough for the Base case and West False River Alternative 1 simulations during 1991 - 1992.

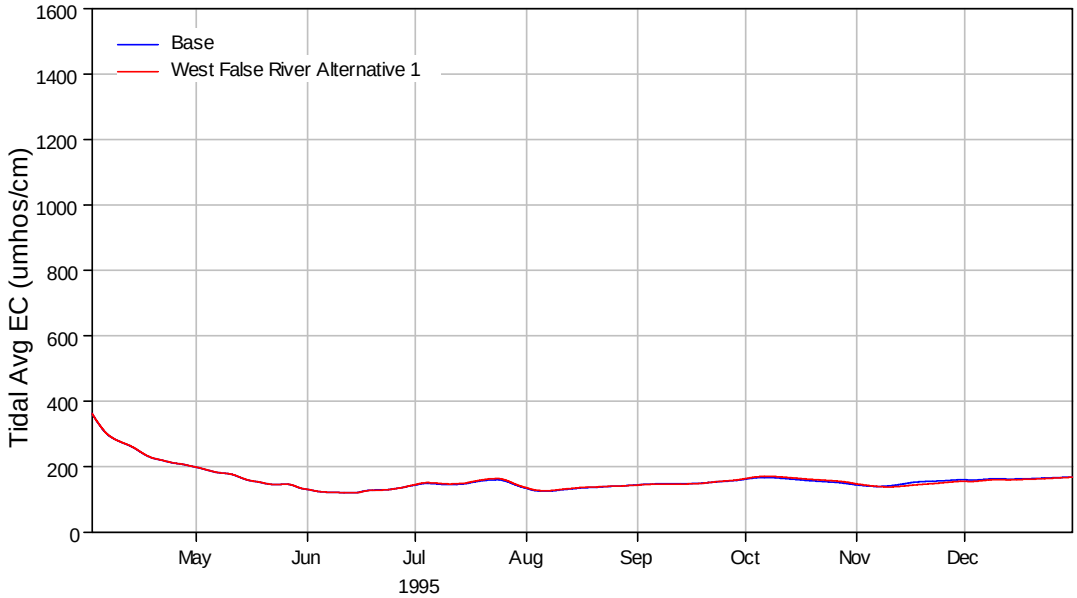


Figure 4-7 Tidally averaged EC at the Contra Costa intake in Rock Slough for the Base case and West False River Alternative 1 simulations during 1995.

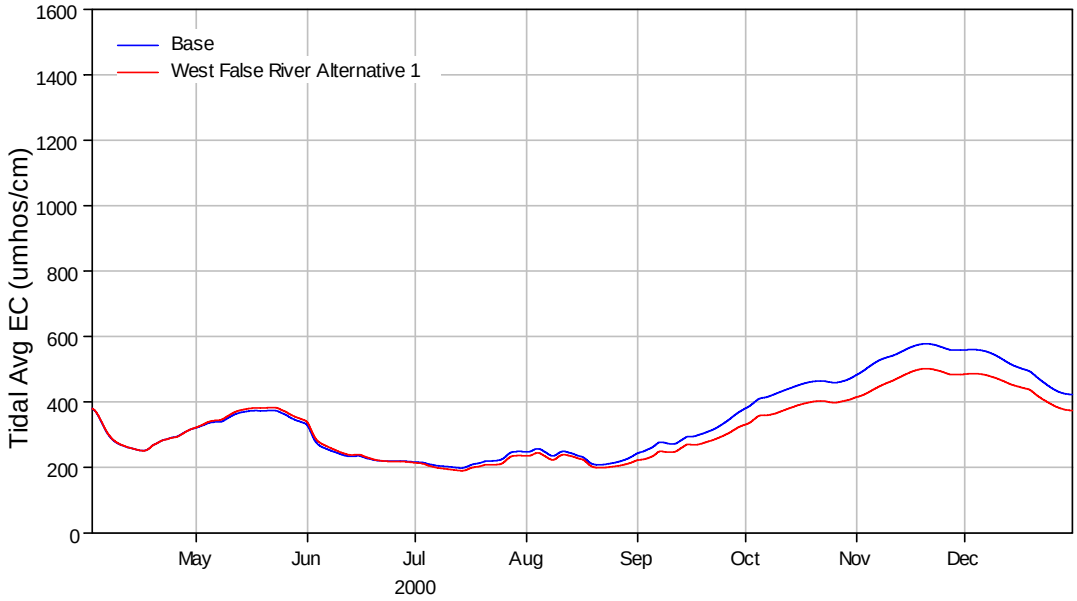


Figure 4-8 Tidally averaged EC at the Contra Costa intake in Rock Slough for the Base case and West False River Alternative 1 simulations during 2000.

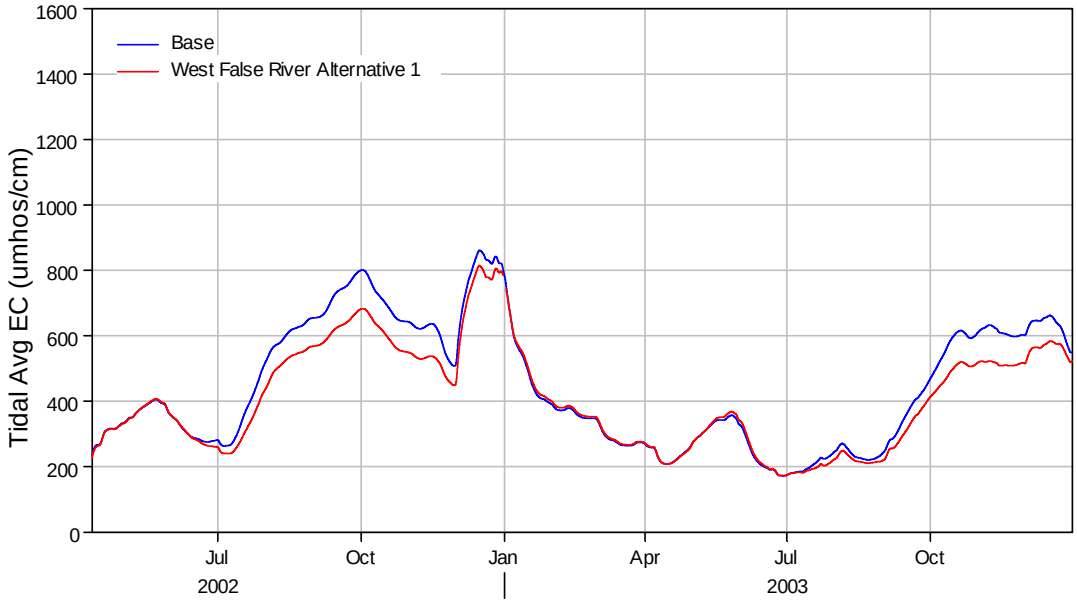


Figure 4-9 Tidally averaged EC at the Contra Costa intake in Rock Slough for the Base case and West False River Alternative 1 simulations during 2002 - 2003.

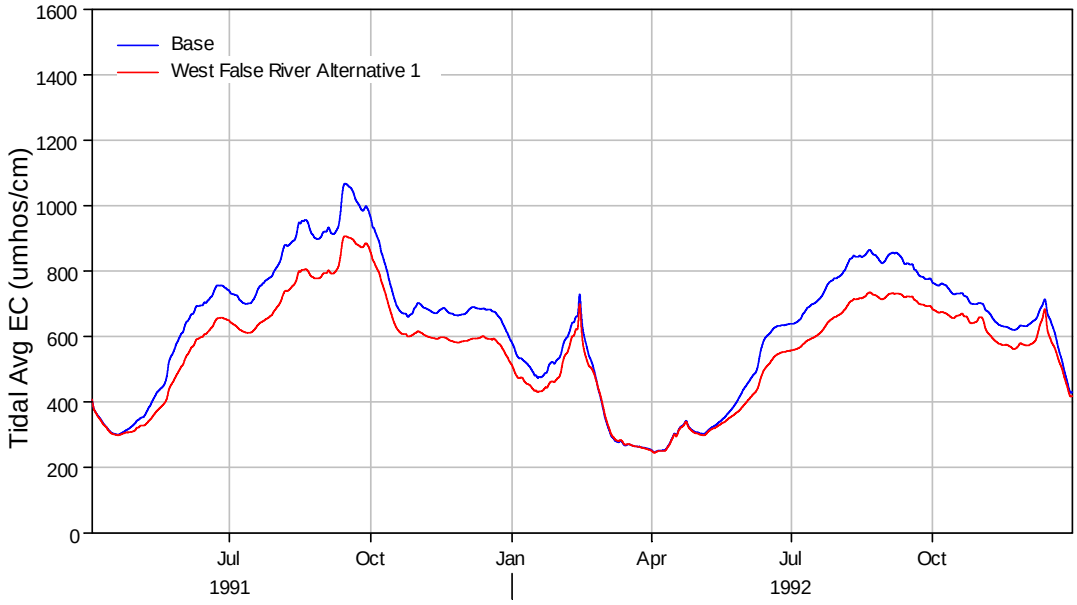


Figure 4-10 Tidally averaged EC at the Contra Costa intake on Old River for the Base case and West False River Alternative 1 simulations during 1991 - 1992.

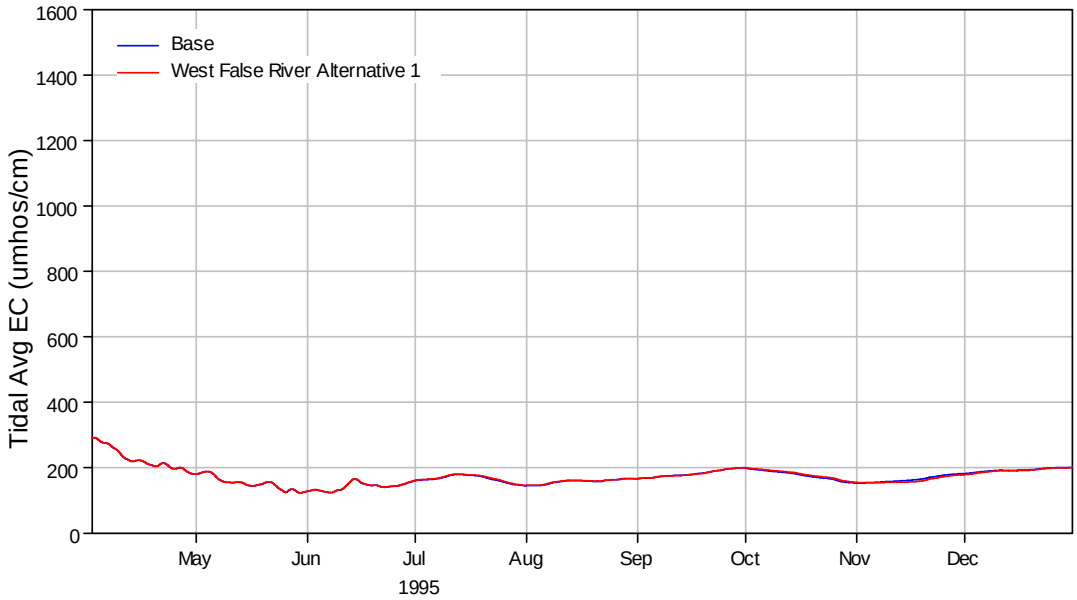


Figure 4-11 Tidally averaged EC at the Contra Costa intake on Old River for the Base case and West False River Alternative 1 simulations during 1995.

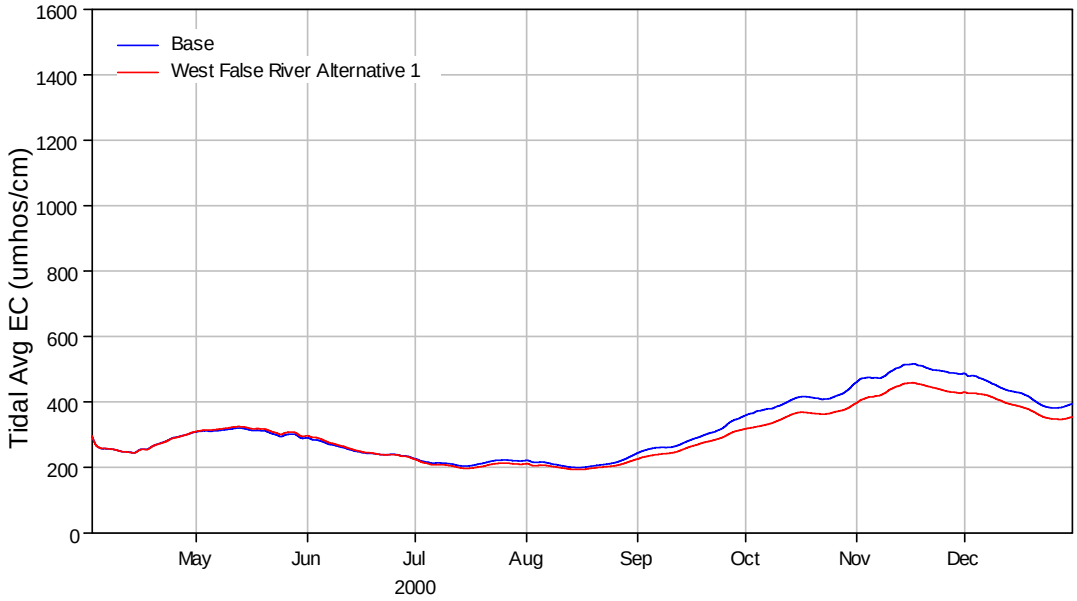


Figure 4-12 Tidally averaged EC at the Contra Costa intake on Old River for the Base case and West False River Alternative 1 simulations during 2000.

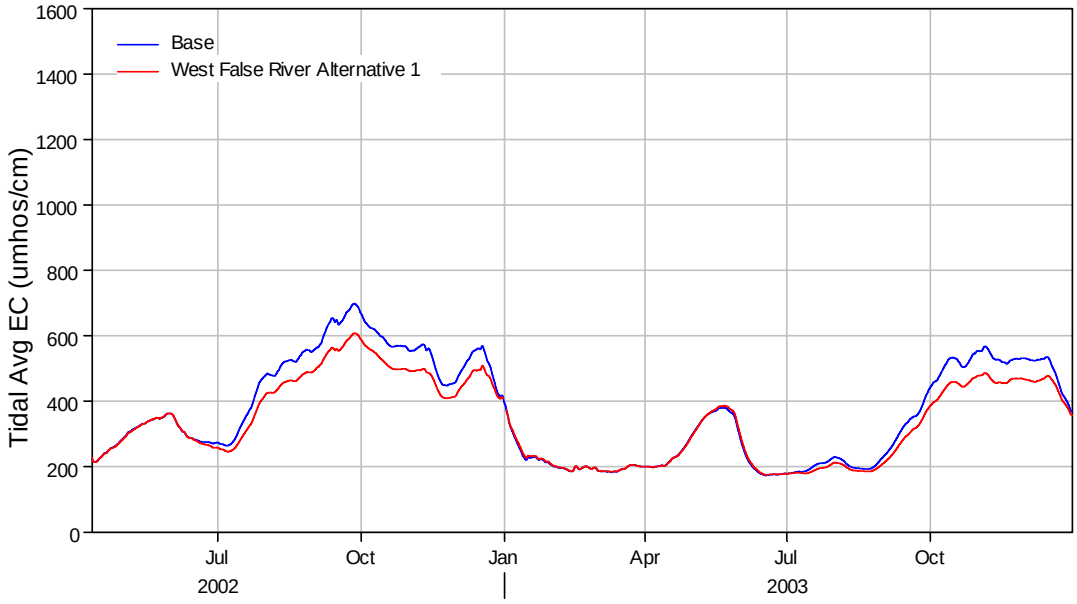


Figure 4-13 Tidally averaged EC at the Contra Costa intake on Old River for the Base case and West False River Alternative 1 simulations during 2002 - 2003.

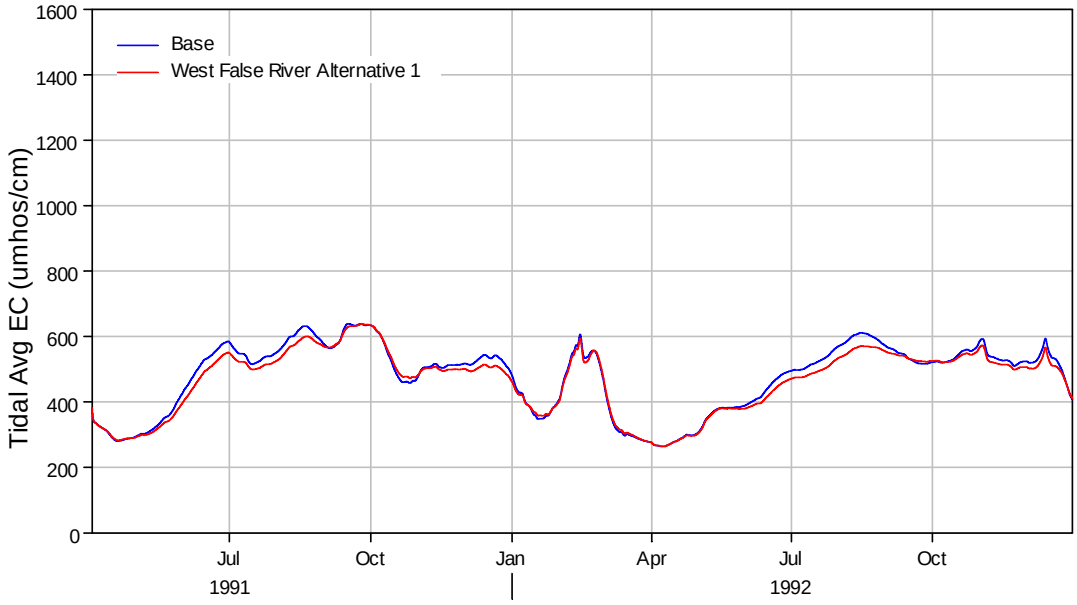


Figure 4-14 Tidally averaged EC at RMID023 for the Base case and West False River Alternative 1 simulations during 1991 - 1992.

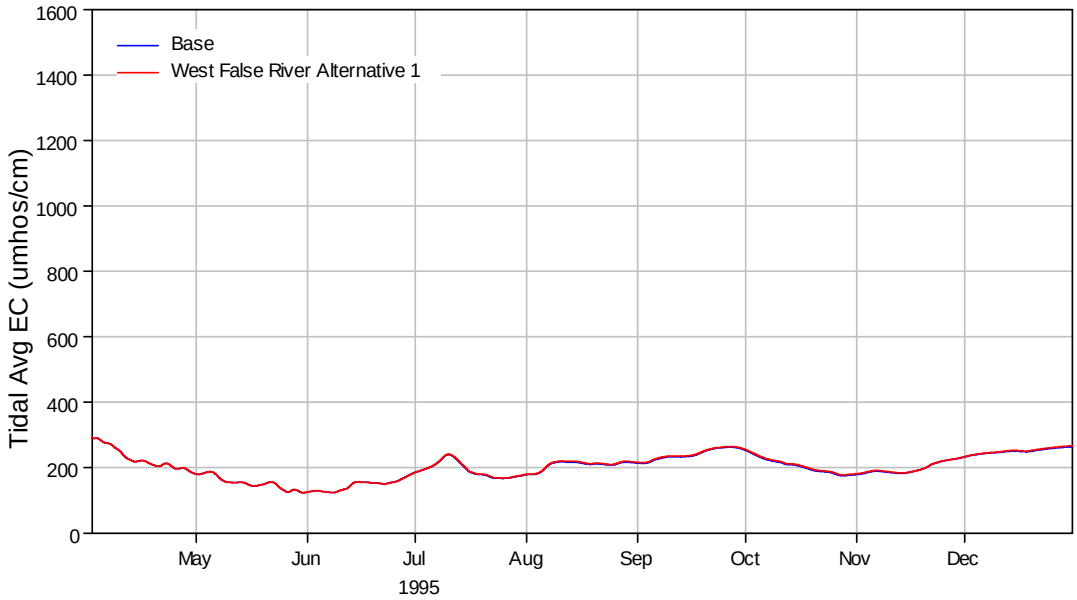


Figure 4-15 Tidally averaged EC at RMID023 for the Base case and West False River Alternative 1 simulations during 1995.

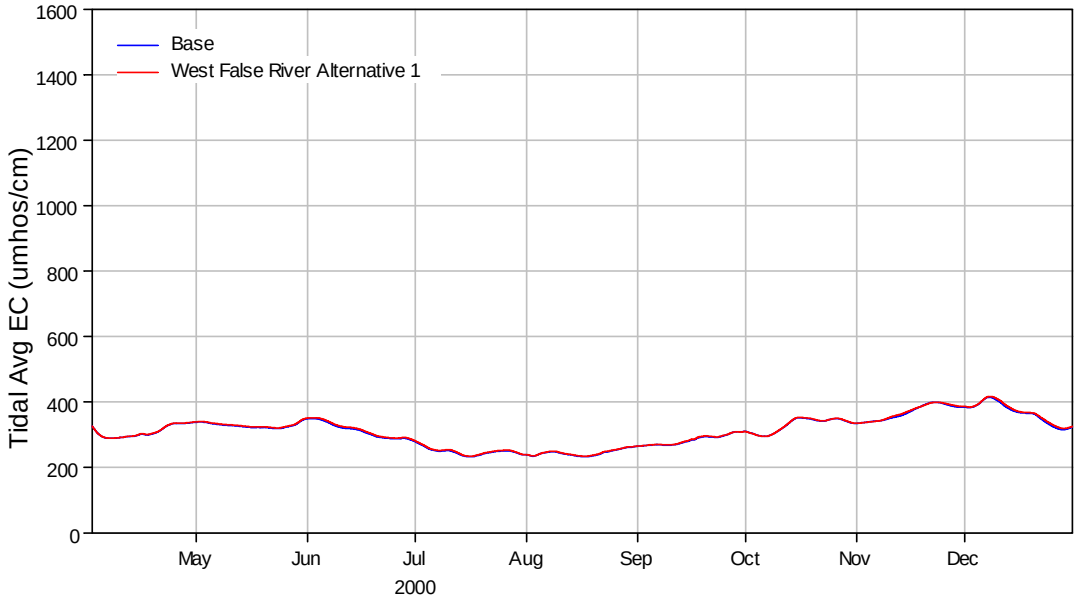


Figure 4-16 Tidally averaged EC at RMID023 for the Base case and West False River Alternative 1 simulations during 2000.

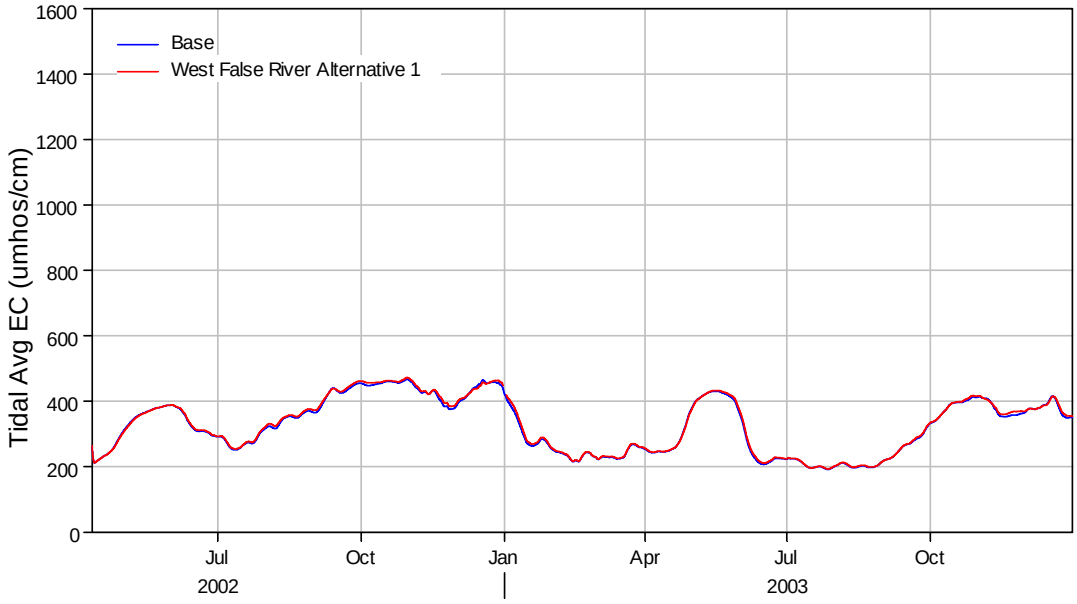


Figure 4-17 Tidally averaged EC at RMID023 for the Base case and West False River Alternative 1 simulations during 2002 - 2003.

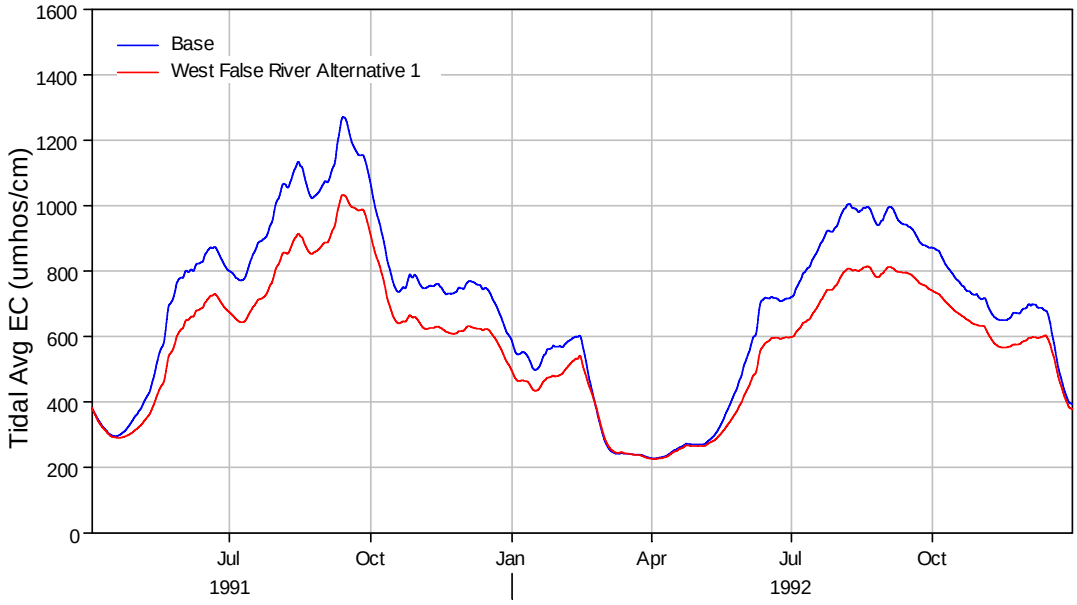


Figure 4-18 Tidally averaged EC at ROLD024 for the Base case and West False River Alternative 1 simulations during 1991 - 1992.

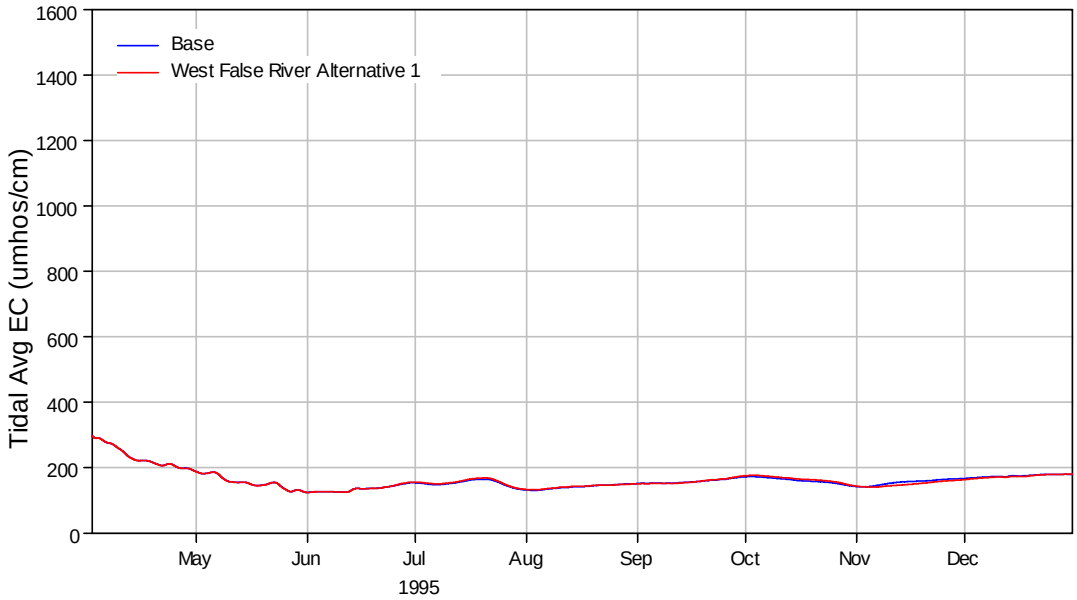


Figure 4-19 Tidally averaged EC at ROLD024 for the Base case and West False River Alternative 1 simulations during 1995.

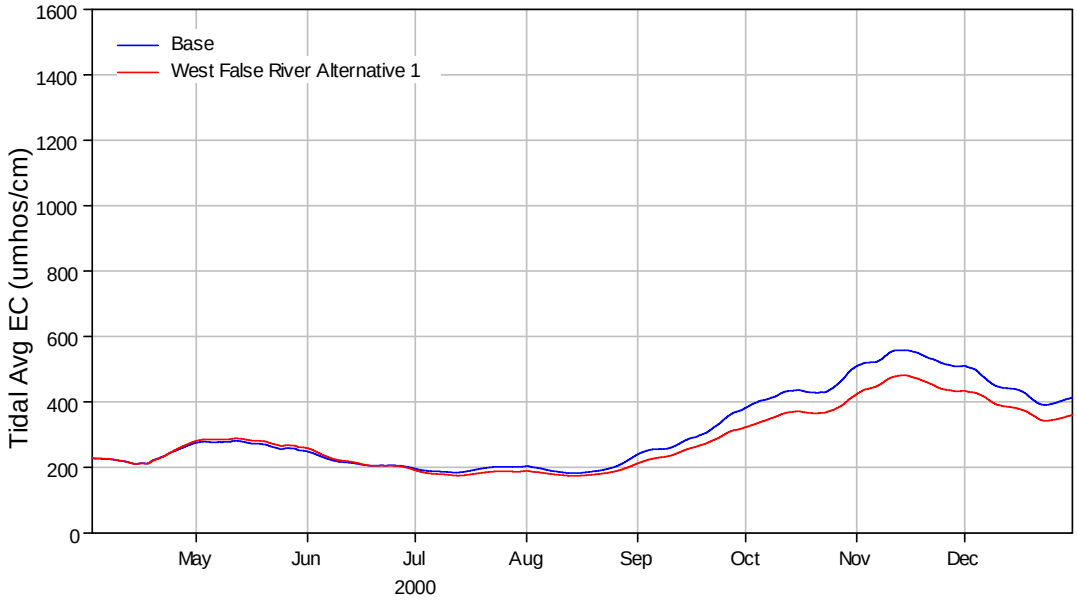


Figure 4-20 Tidally averaged EC at ROLD024 for the Base case and West False River Alternative 1 simulations during 2000.

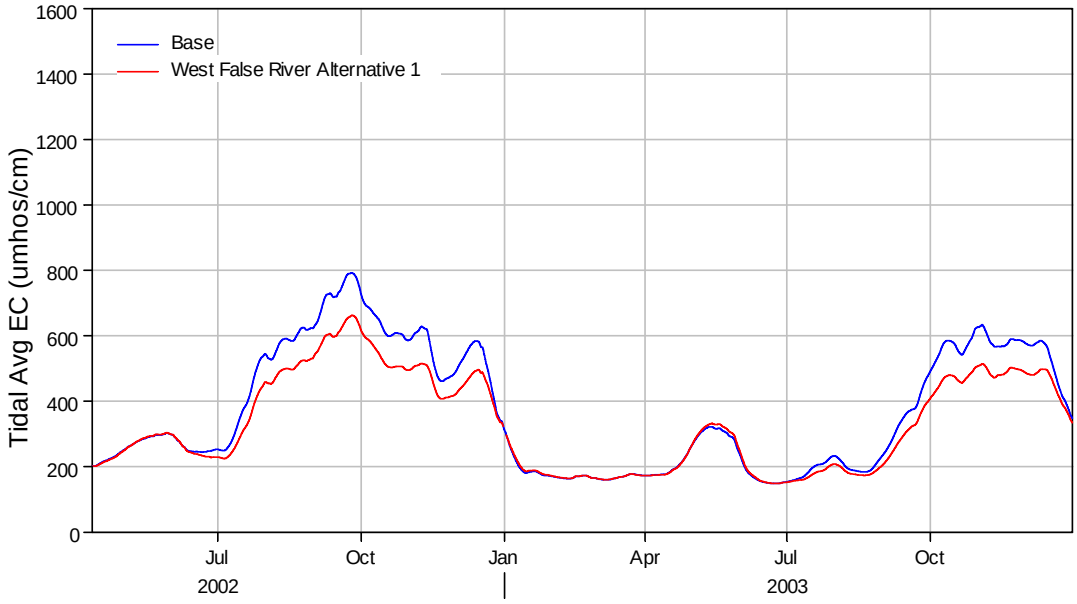


Figure 4-21 Tidally averaged EC at ROLD024 for the Base case and West False River Alternative 1 simulations during 2002 - 2003.

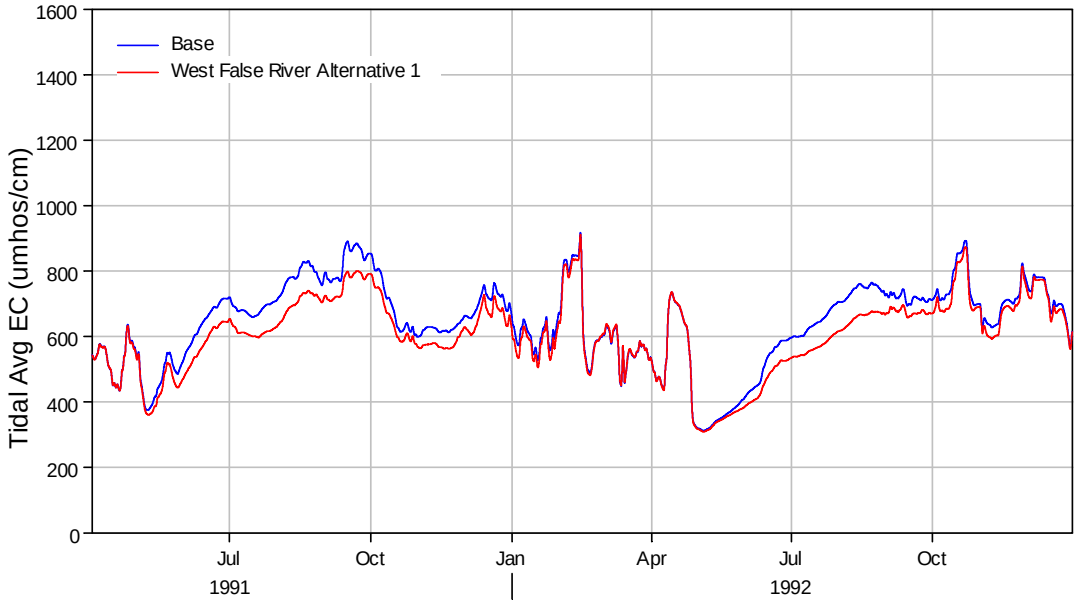


Figure 4-22 Tidally averaged EC at the CVP intake for the Base case and West False River Alternative 1 simulations during 1991 - 1992.

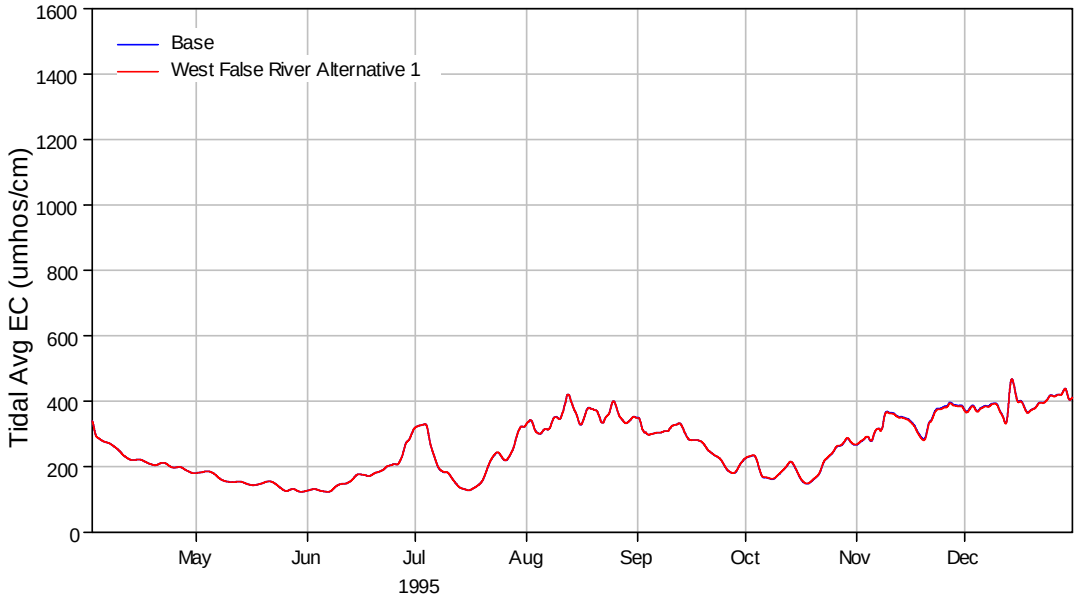


Figure 4-23 Tidally averaged EC at the CVP intake for the Base case and West False River Alternative 1 simulations during 1995.

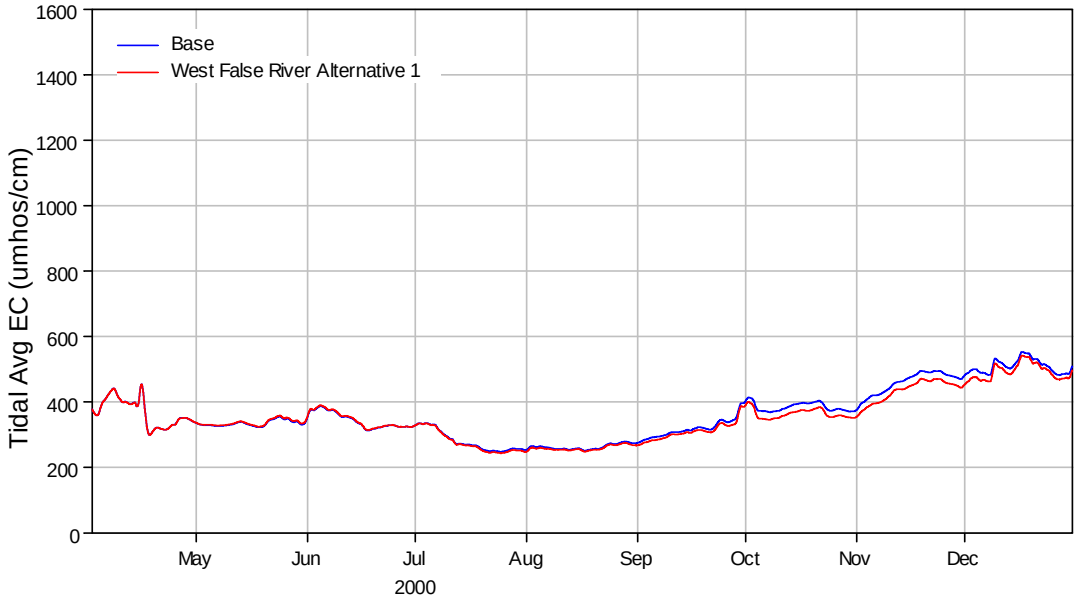


Figure 4-24 Tidally averaged EC at the CVP intake for the Base case and West False River Alternative 1 simulations during 2000.

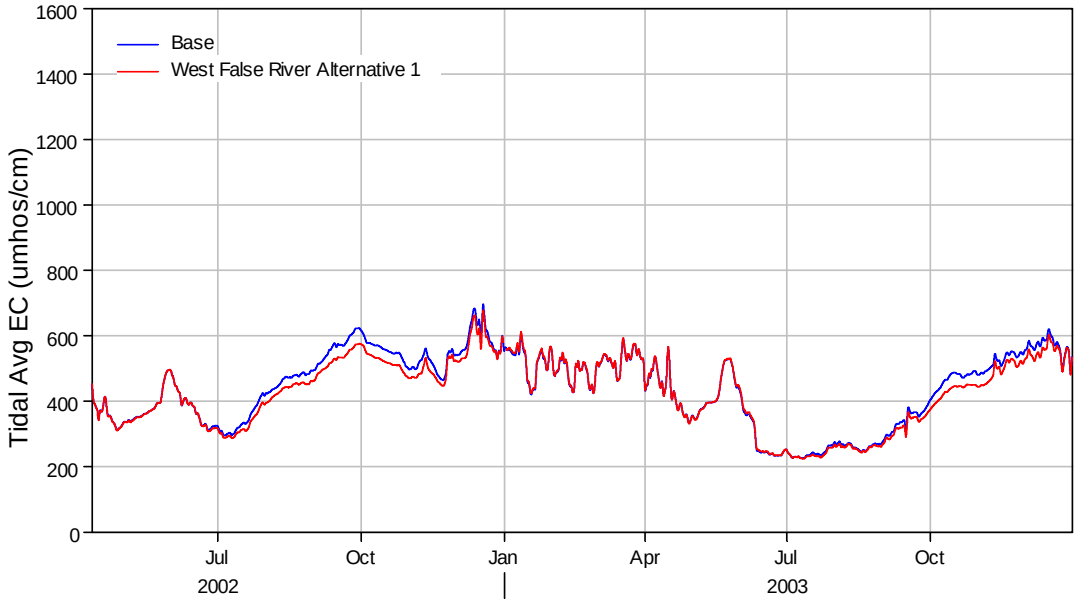


Figure 4-25 Tidally averaged EC at the CVP intake for the Base case and West False River Alternative 1 simulations during 2002 - 2003.

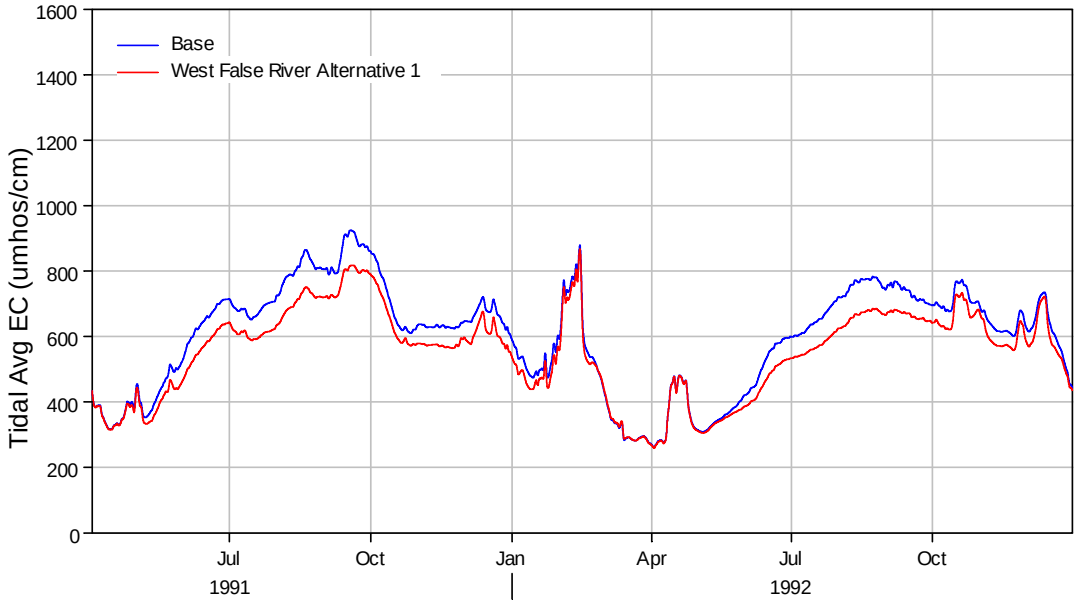


Figure 4-26 Tidally averaged EC at the SWP intake for the Base case and West False River Alternative 1 simulations during 1991 - 1992.

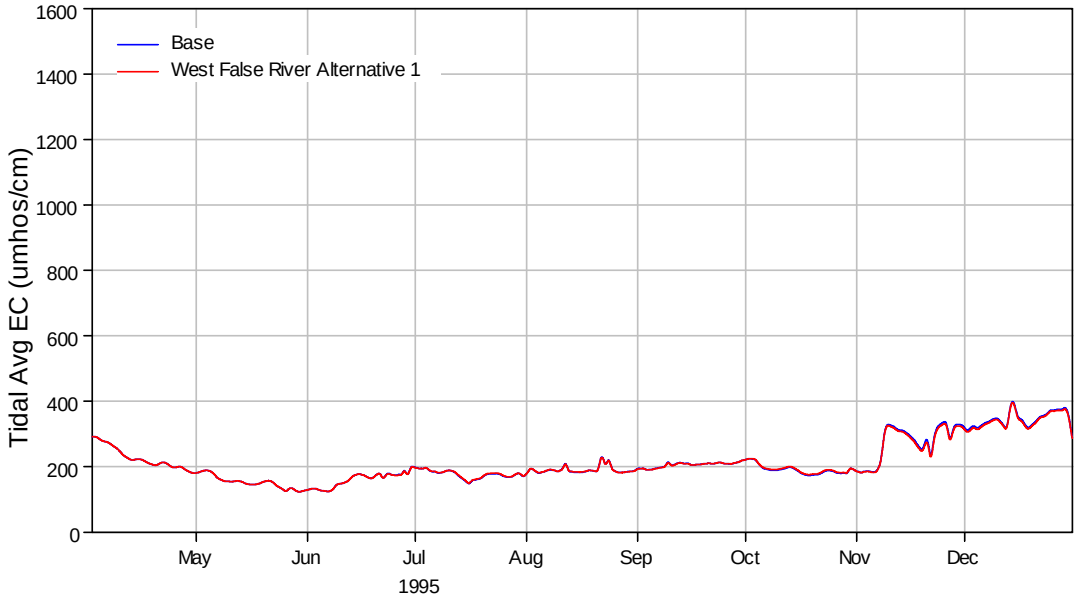


Figure 4-27 Tidally averaged EC at the SWP intake for the Base case and West False River Alternative 1 simulations during 1995.

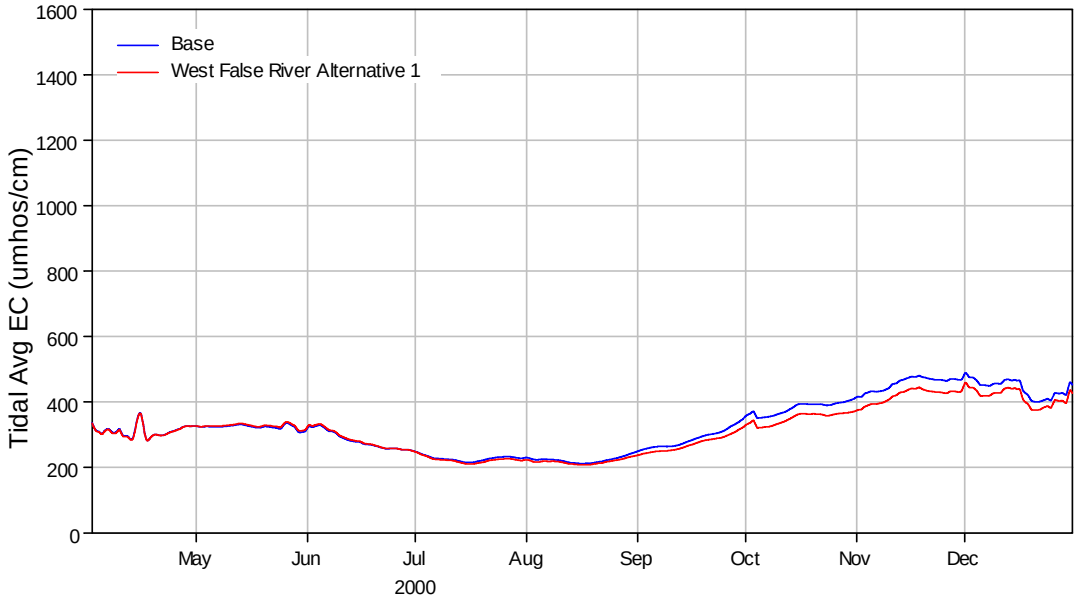


Figure 4-28 Tidally averaged EC at the SWP intake for the Base case and West False River Alternative 1 simulations during 2000.

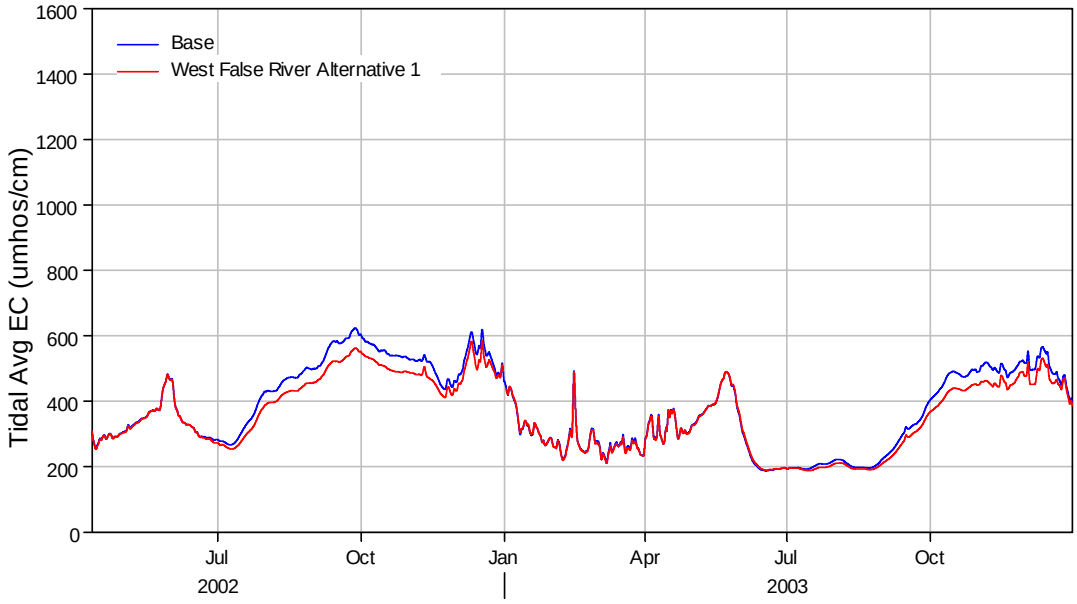


Figure 4-29 Tidally averaged EC at the SWP intake for the Base case and West False River Alternative 1 simulations during 2002 - 2003.

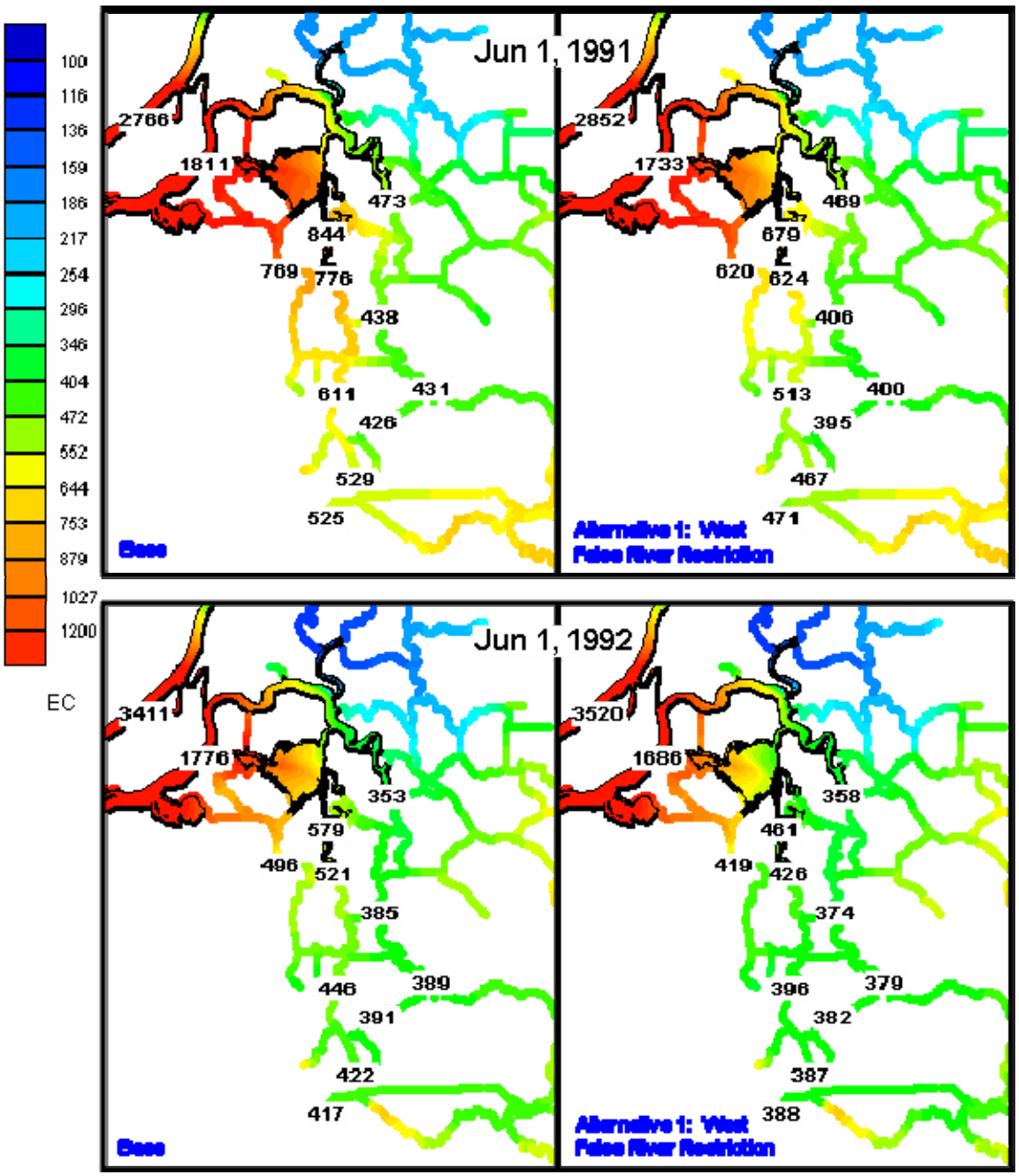


Figure 4-30 Tidally averaged EC contours on June 1, 1991 and June 1, 1992 for the Base case and West False River Alternative 1 simulations.

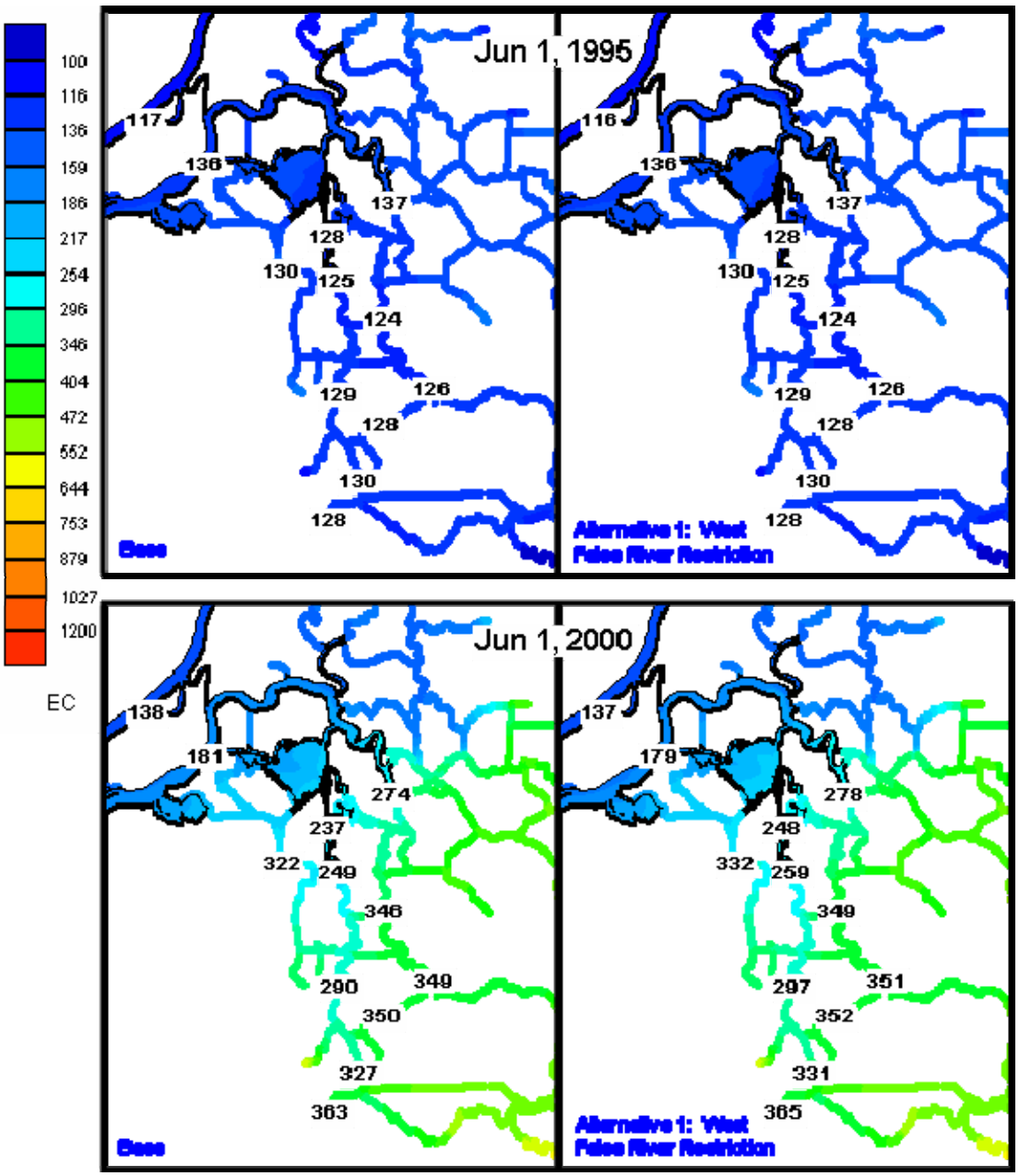


Figure 4-31 Tidally averaged EC contours on June 1, 1995 and June 1, 2000 for the Base case and West False River Alternative 1 simulations.

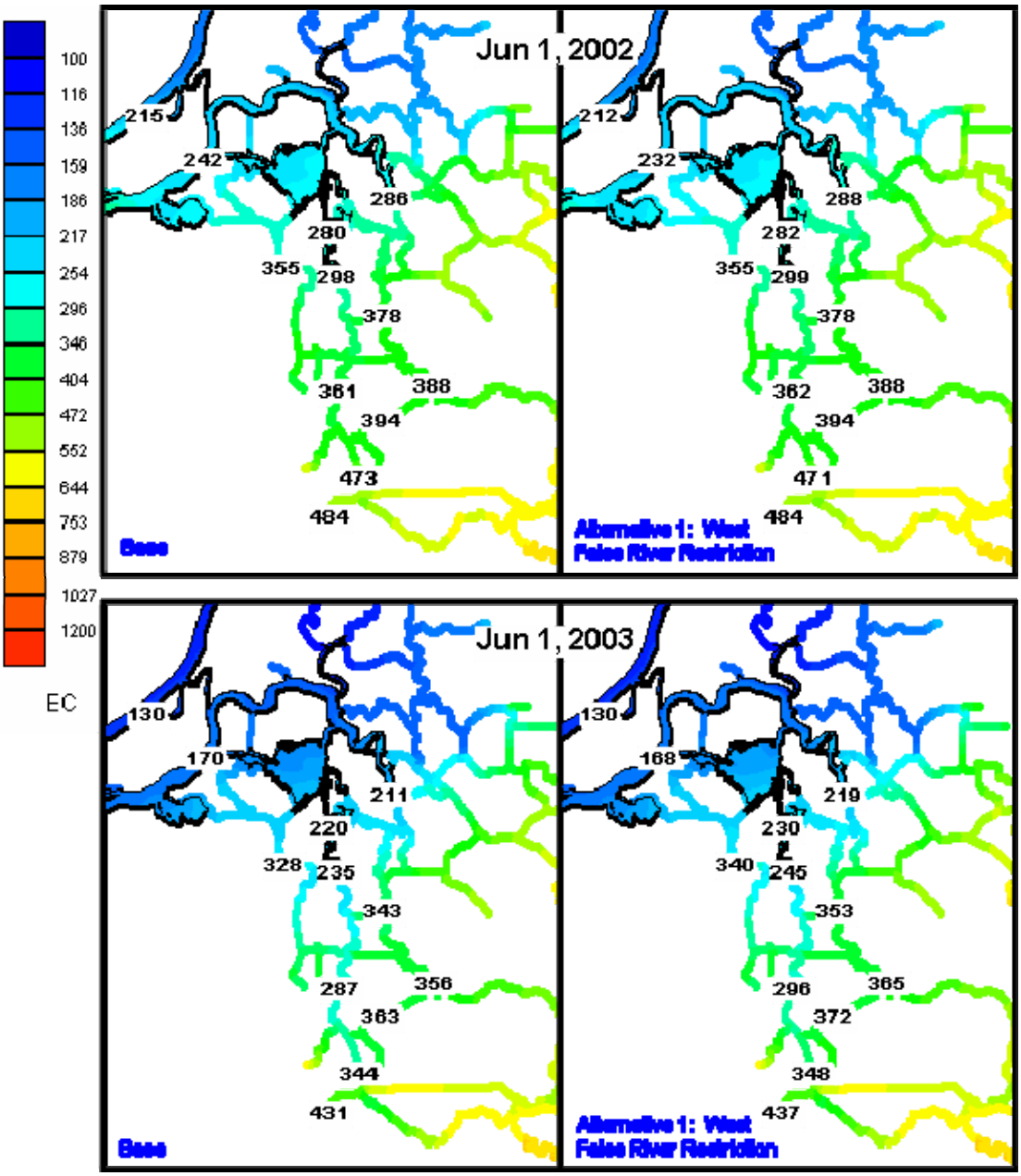


Figure 4-32 Tidally averaged EC contours on June 1, 2002 and June 1, 2003 for the Base case and West False River Alternative 1 simulations.

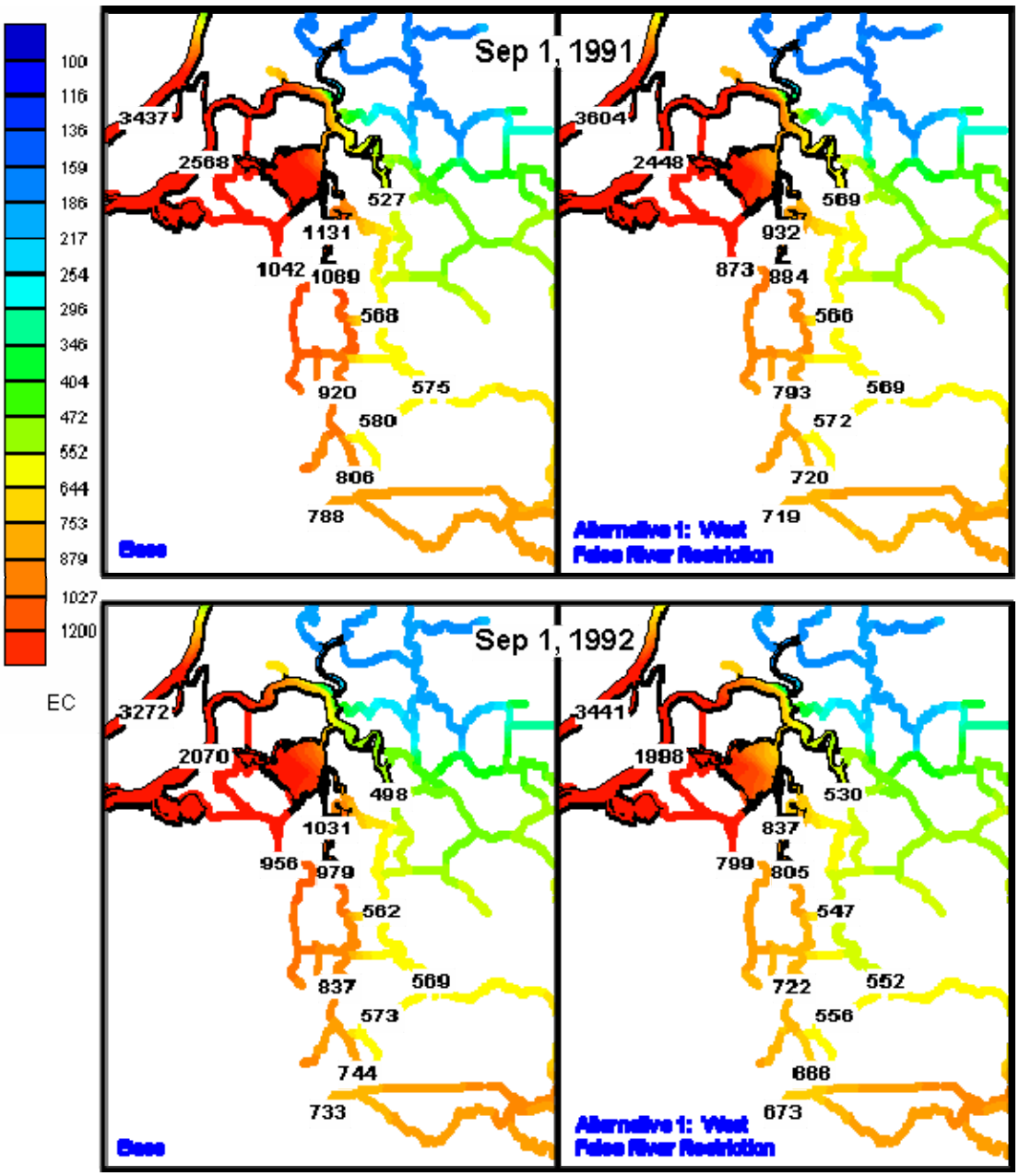


Figure 4-33 Tidally averaged EC contours on September 1, 1991 and September 1, 1992 for the Base case and West False River Alternative 1 simulations.

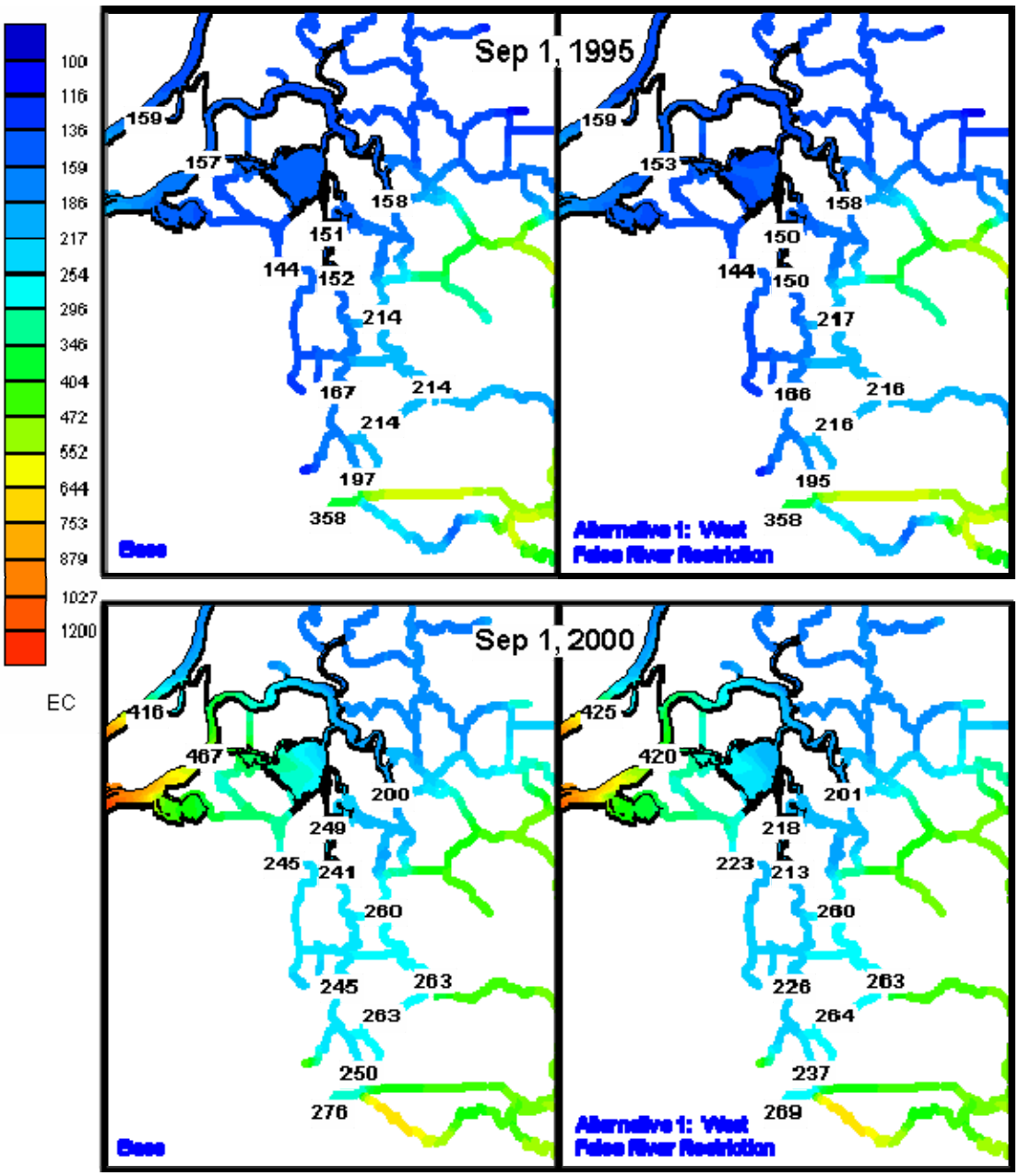


Figure 4-34 Tidally averaged EC contours on September 1, 1995 and September 1, 2000 for the Base case and West False River Alternative 1 simulations.

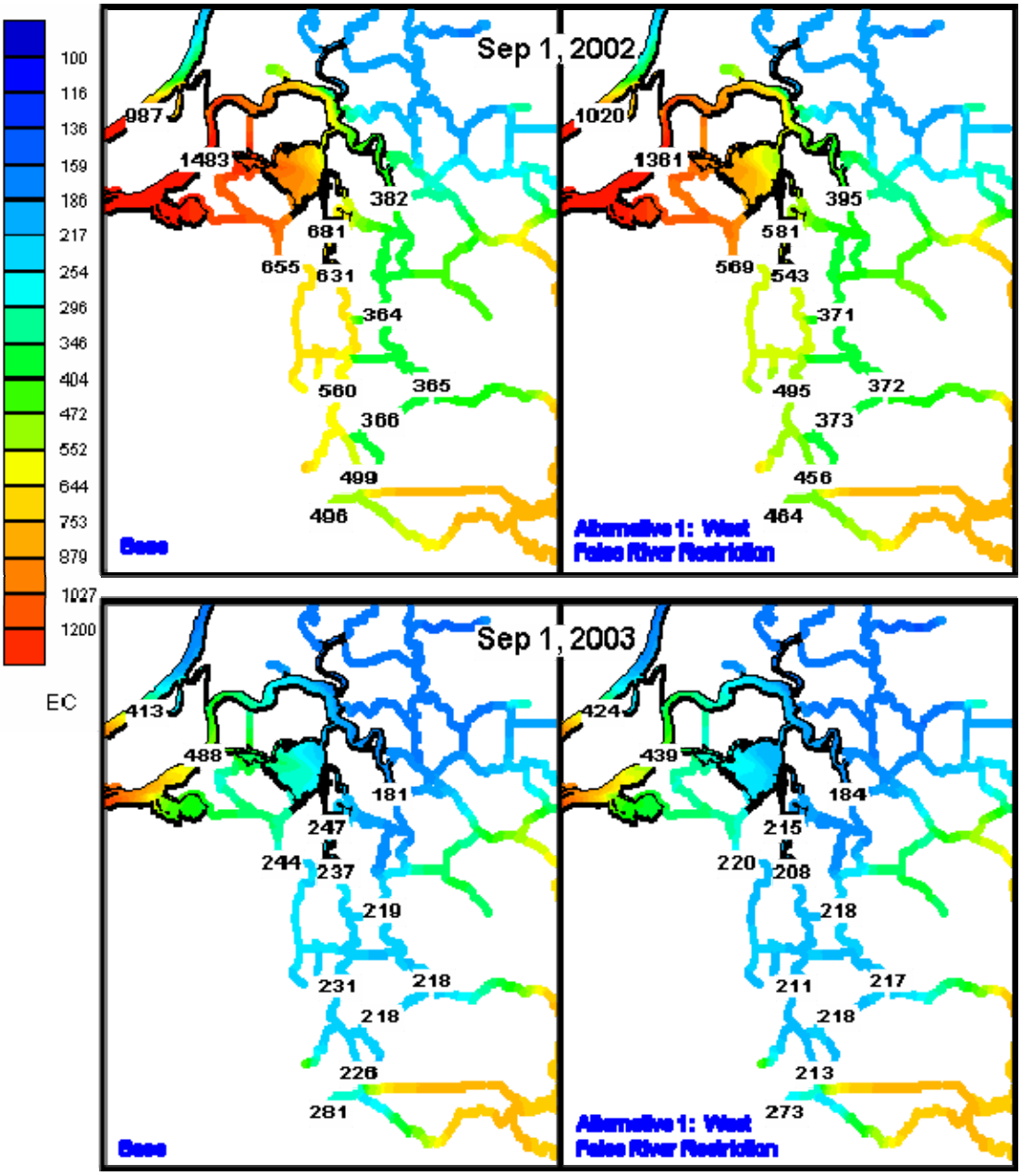


Figure 4-35 Tidally averaged EC contours on September 1, 2002 and September 1, 2003 for the Base case and West False River Alternative 1 simulations.

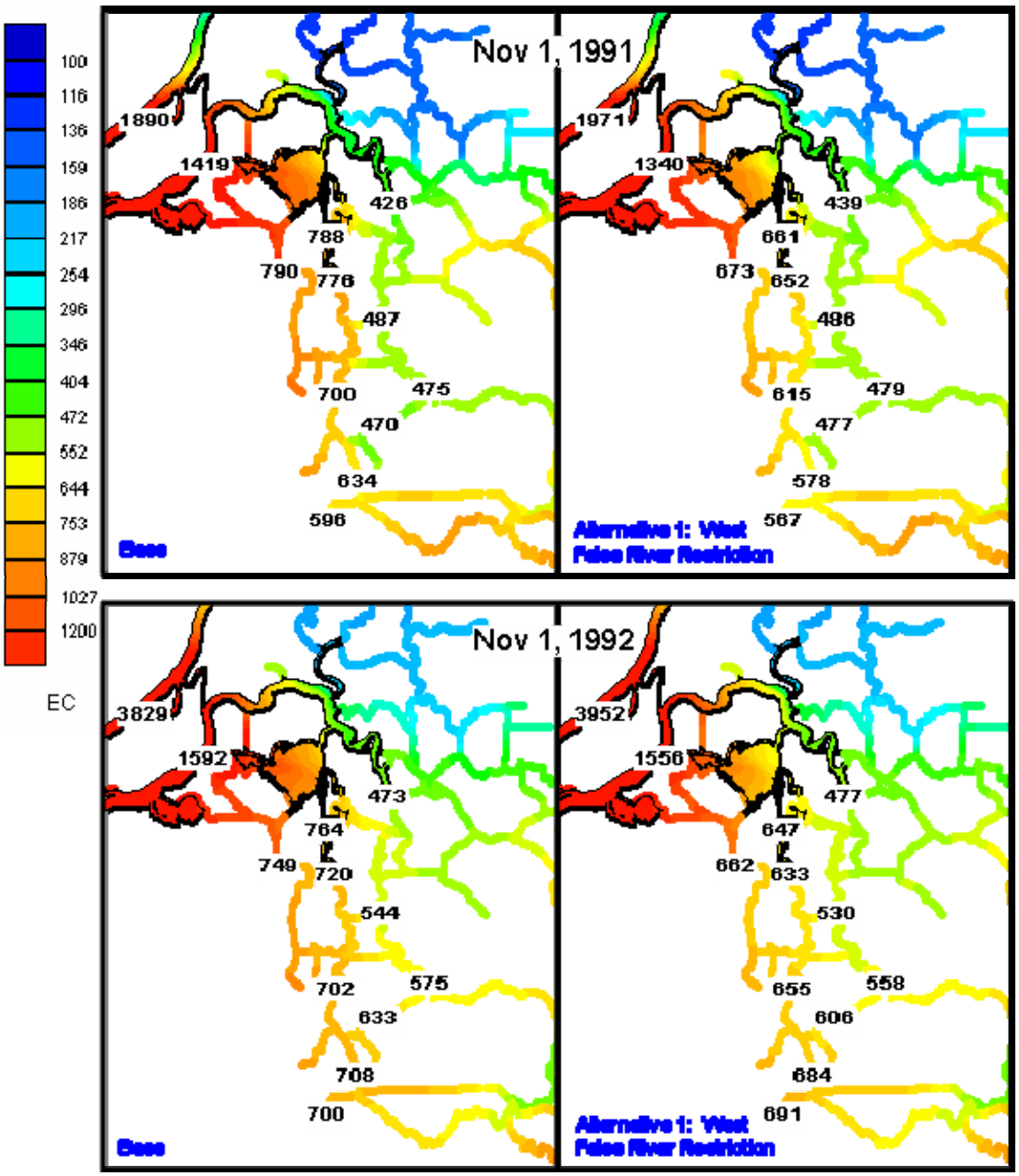


Figure 4-36 Tidally averaged EC contours on November 1, 1991 and November 1, 1992 for the Base case and West False River Alternative 1 simulations.

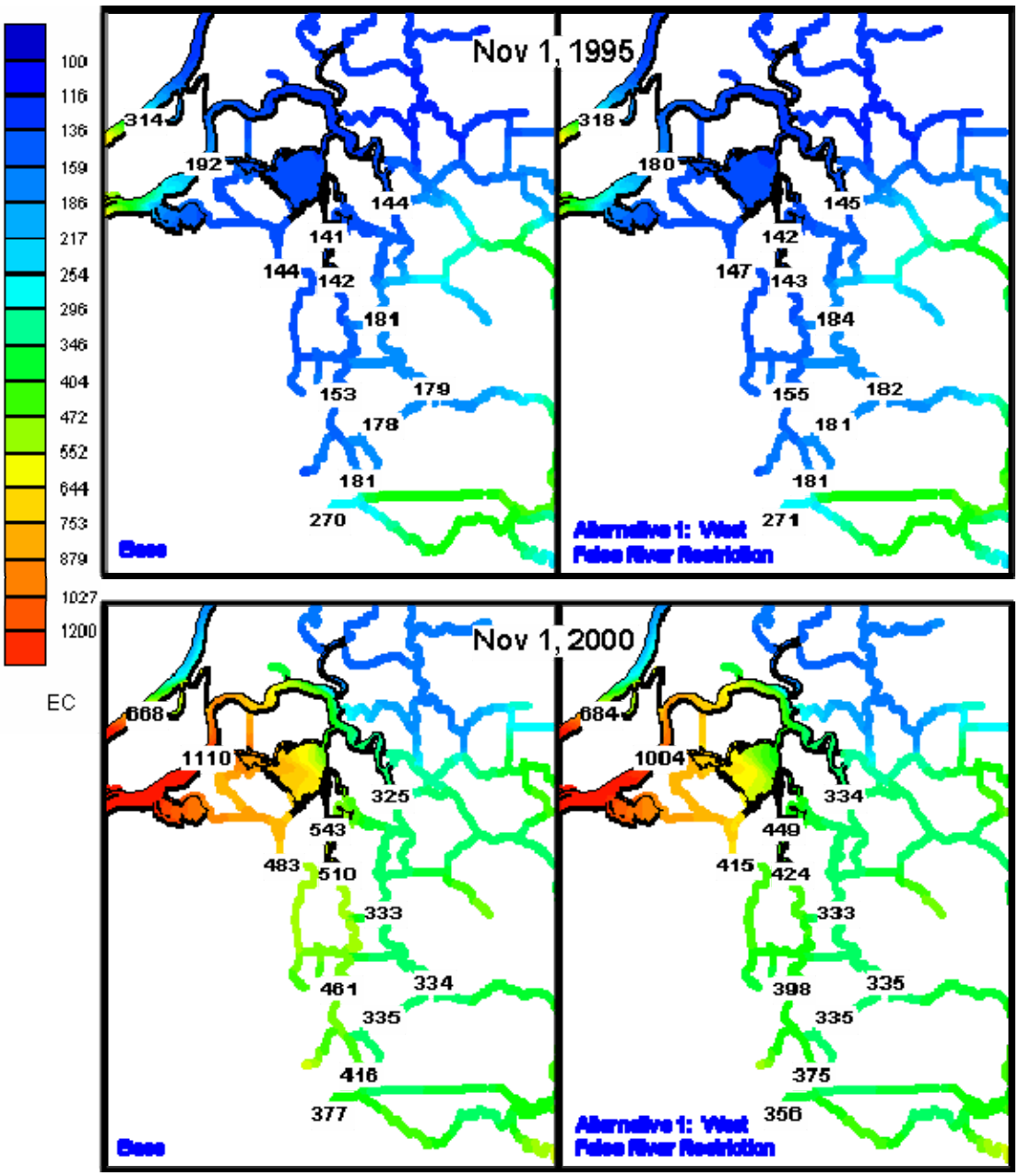


Figure 4-37 Tidally averaged EC contours on November 1, 1995 and November 1, 2000 for the Base case and West False River Alternative 1 simulations.

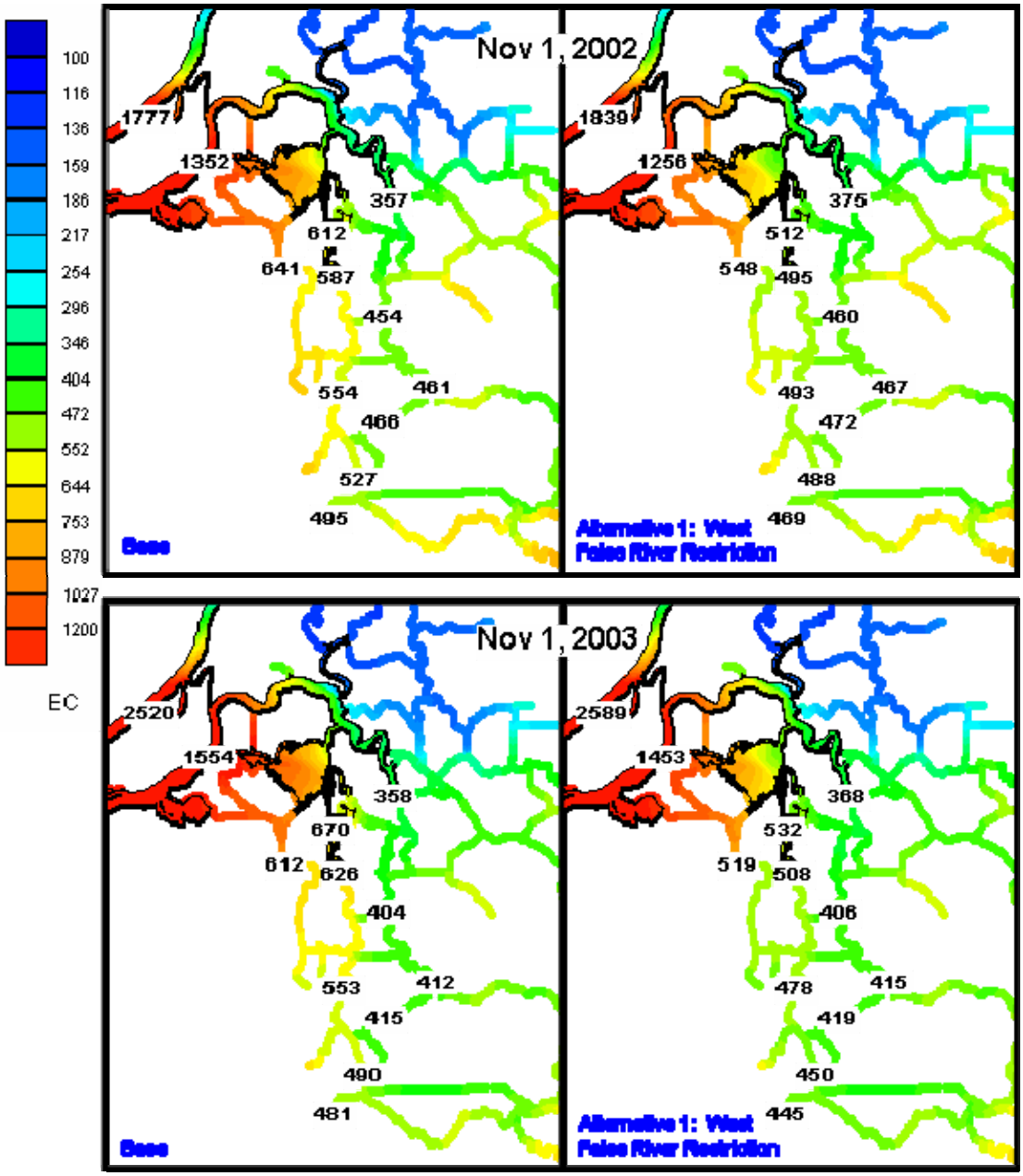


Figure 4-38 Tidally averaged EC contours on November 1, 2002 and November 1, 2003 for the Base case and West False River Alternative 1 simulations.

Table 4-2 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in May of each simulation year.

	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
May 1991												
Base	533		554		616		770		2,278		432	
West False River Alt 1	469	11.94	547	1.24	516	16.26	621	19.31	2,192	3.77	401	7.24
May 1992												
Base	422		416		446		494		1,781		389	
West False River Alt 1	387	8.28	387	6.91	395	11.41	418	15.50	1,691	5.03	381	2.24
May 1995												
Base	189		186		189		198		170		187	
West False River Alt 1	189	0.00	186	0.00	189	-0.01	199	-0.12	169	0.72	187	0.00
May 2000												
Base	336		356		320		374		194		349	
West False River Alt 1	339	-1.01	359	-0.81	325	-1.40	383	-2.39	189	2.40	351	-0.61
May 2002												
Base	483		496		363		406		255		389	
West False River Alt 1	482	0.12	497	-0.08	363	-0.12	408	-0.54	244	4.31	389	0.01
May 2003												
Base	489		529		380		357		201		431	
West False River Alt 1	490	-0.15	531	-0.44	386	-1.69	368	-3.12	196	2.65	433	-0.55

Table 4-3 Peak tidally averaged EC and % reduction from for West False River Alternative 1 at key locations in June of each simulation year.

	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
June 1991												
Base	715		721		756		876		2,239		585	
West False River Alt 1	643	10.01	653	9.38	658	13.03	739	15.68	2,134	4.67	551	5.78
June 1992												
Base	601		597		639		729		2,026		495	
West False River Alt 1	534	11.02	535	10.38	557	12.74	614	15.76	1,939	4.29	471	4.92
June 1995												
Base	201		319		165		144		136		186	
West False River Alt 1	200	0.70	320	-0.10	166	-0.12	145	-0.90	136	0.07	185	0.06
June 2000												
Base	329		388		290		328		241		349	
West False River Alt 1	333	-1.14	390	-0.57	297	-2.22	337	-2.83	224	6.81	352	-0.75
June 2002												
Base	469		491		362		357		484		389	
West False River Alt 1	468	0.30	492	-0.07	363	-0.12	358	-0.23	441	8.89	389	-0.01
June 2003												
Base	345		429		289		328		184		359	
West False River Alt 1	352	-1.95	436	-1.53	299	-3.60	340	-3.77	176	4.48	368	-2.61

Table 4-4 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in July of each simulation year.

	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
July 1991												
Base	726		721		813		956		2,551		583	
West False River Alt 1	643	11.47	654	9.28	690	15.16	780	18.41	2,475	2.95	550	5.63
July 1992												
Base	721		706		783		923		2,539		571	
West False River Alt 1	625	13.24	617	12.67	666	14.92	753	18.48	2,466	2.89	535	6.33
July 1995												
Base	198		330		179		160		143		240	
West False River Alt 1	197	0.49	331	-0.05	180	-0.65	164	-2.44	141	0.93	241	-0.50
July 2000												
Base	249		336		226		249		307		279	
West False River Alt 1	248	0.33	335	0.27	224	0.90	236	5.03	280	9.00	281	-0.90
July 2002												
Base	430		425		481		523		1,181		319	
West False River Alt 1	390	9.37	397	6.68	422	12.29	441	15.83	1,079	8.60	324	-1.68
July 2003												
Base	221		275		230		248		425		226	
West False River Alt 1	210	4.93	268	2.57	213	7.39	225	9.27	386	9.06	227	-0.60

Table 4-5 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in August of each simulation year.

	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
August 1991												
Base	865		832		957		1119		2,912		632	
West False River Alt 1	751	13.21	740	11.00	806	15.77	912	18.50	2,807	3.62	601	4.94
August 1992												
Base	783		765		865		998		2,314		611	
West False River Alt 1	685	12.59	677	11.42	735	14.99	820	17.85	2,221	4.00	571	6.59
August 1995												
Base	230		420		167		144		158		218	
West False River Alt 1	228	0.68	420	0.05	167	0.25	144	0.38	153	2.89	220	-0.89
August 2000												
Base	249		279		244		257		470		265	
West False River Alt 1	237	4.86	275	1.52	226	7.48	244	4.98	422	10.11	265	-0.16
August 2002												
Base	502		495		558		655		1,475		371	
West False River Alt 1	457	8.96	463	6.36	493	11.53	569	13.12	1,354	8.22	376	-1.45
August 2003												
Base	227		280		231		271		501		219	
West False River Alt 1	213	6.04	271	3.22	213	7.97	249	8.14	448	10.58	218	0.18

Table 4-6 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in September of each simulation year.

	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
September 1991												
Base	924		891		1067		1258		3,133		639	
West False River Alt 1	817	11.58	800	10.12	907	15.05	1,029	18.14	3,033	3.19	638	0.10
September 1992												
Base	769		745		857		997		2,149		569	
West False River Alt 1	682	11.27	696	6.59	732	14.51	819	17.83	2,064	3.96	553	2.87
September 1995												
Base	221		350		199		162		157		263	
West False River Alt 1	221	-0.06	350	0.05	200	-0.39	164	-1.17	153	2.51	264	-0.61
September 2000												
Base	356		402		359		380		890		310	
West False River Alt 1	329	7.63	390	3.02	318	11.44	331	12.99	799	10.20	310	0.19
September 2002												
Base	624		623		698		800		1,729		455	
West False River Alt 1	563	9.79	576	7.62	608	12.91	682	14.80	1,590	8.02	462	-1.49
September 2003												
Base	405		404		443		469		1,233		333	
West False River Alt 1	368	9.14	375	7.03	386	12.88	414	11.87	1,119	9.30	335	-0.56

Table 4-7 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in October of each simulation year.

	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
October 1991												
Base	859		853		964		1134		2,179		634	
West False River Alt 1	790	8.05	791	7.35	857	11.05	974	14.14	2,052	5.83	635	-0.08
October 1992												
Base	773		893		764		882		1,909		588	
West False River Alt 1	734	5.12	873	2.18	684	10.56	760	13.88	1,833	4.02	568	3.30
October 1995												
Base	224		287		199		167		193		253	
West False River Alt 1	224	-0.25	288	-0.38	200	-0.51	171	-2.18	180	6.69	255	-0.82
October 2000												
Base	415		414		461		483		1,175		352	
West False River Alt 1	374	9.85	400	3.22	398	13.79	415	14.10	1,066	9.23	353	-0.32
October 2002												
Base	601		616		667		801		1,599		467	
West False River Alt 1	549	8.62	574	6.79	588	11.93	683	14.75	1,478	7.56	472	-1.06
October 2003												
Base	498		493		554		616		2,100		414	
West False River Alt 1	453	9.05	452	8.37	478	13.63	520	15.60	1,950	7.15	417	-0.86

Table 4-8 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in November of each simulation year.

	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
November 1991												
Base	647		662		703		794		2,130		517	
West False River Alt 1	597	7.66	628	5.06	616	12.32	673	15.21	2,029	4.72	508	1.84
November 1992												
Base	689		823		702		747		1,740		593	
West False River Alt 1	668	3.01	814	1.17	659	6.13	660	11.60	1,682	3.30	573	3.41
November 1995												
Base	337		397		182		161		284		233	
West False River Alt 1	332	1.59	394	0.62	179	1.91	156	3.07	257	9.38	233	-0.24
November 2000												
Base	485		495		517		578		1,424		399	
West False River Alt 1	455	6.21	471	4.88	459	11.23	502	13.15	1,292	9.25	399	0.10
November 2002												
Base	542		562		574		641		1,910		464	
West False River Alt 1	506	6.69	543	3.38	499	12.96	549	14.47	1,776	7.03	469	-1.16
November 2003												
Base	525		557		568		633		1,548		414	
West False River Alt 1	490	6.67	530	4.83	486	14.39	523	17.34	1,434	7.36	417	-0.61

Table 4-9 Peak tidally averaged EC and % reduction from Base for West False River Alternative 1 at key locations in December of each simulation year.

	Peak Tidally Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
December 1991												
Base	721		763		691		777		2,118		545	
West False River Alt 1	676	6.15	727	4.74	601	12.96	644	17.12	2,033	4.00	515	5.50
December 1992												
Base	735		790		714		754		1,666		594	
West False River Alt 1	722	1.74	782	1.06	684	4.28	675	10.40	1,601	3.93	567	4.58
December 1995												
Base	399		468		200		168		237		264	
West False River Alt 1	396	0.80	468	0.09	200	-0.08	168	0.30	216	8.70	267	-1.17
December 2000												
Base	489		553		487		560		1,094		415	
West False River Alt 1	459	6.16	542	2.02	430	11.71	487	13.09	994	9.18	417	-0.55
December 2002												
Base	619		696		569		862		1,394		465	
West False River Alt 1	584	5.60	678	2.68	509	10.62	815	5.40	1,287	7.67	464	0.19
December 2003												
Base	567		620		536		662		1,260		416	
West False River Alt 1	532	6.15	603	2.77	478	10.83	584	11.83	1,141	9.50	415	0.11

Table 4-10 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in May of each simulation year.

	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
May 1991												
Base	440		471		455		536		1,615		343	
West False River Alt 1	403	8.37	444	5.79	396	13.13	451	15.94	1,545	4.36	330	3.81
May 1992												
Base	354		354		354		361		911		368	
West False River Alt 1	343	3.00	345	2.56	337	4.80	335	7.27	864	5.10	365	0.94
May 1995												
Base	152		151		152		162		145		153	
West False River Alt 1	152	0.00	151	0.00	152	0.00	162	-0.15	144	1.19	153	0.00
May 2000												
Base	324		335		308		355		185		328	
West False River Alt 1	327	-0.93	337	-0.61	313	-1.59	362	-2.03	181	2.23	330	-0.57
May 2002												
Base	368		383		332		376		237		362	
West False River Alt 1	367	0.39	382	0.26	332	0.17	377	-0.20	229	3.45	361	0.38
May 2003												
Base	402		428		352		326		184		414	
West False River Alt 1	403	-0.19	429	-0.17	356	-1.10	332	-1.66	180	2.56	416	-0.59

Table 4-11 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in June of each simulation year.

	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
June 1991												
Base	650		647		707		830		1,736		524	
West False River Alt 1	575	11.59	581	10.22	609	13.92	694	16.36	1,650	4.93	489	6.57
June 1992												
Base	526		519		574		663		1,613		444	
West False River Alt 1	469	10.94	468	9.77	497	13.53	551	16.88	1,537	4.69	423	4.70
June 1995												
Base	161		178		143		127		132		147	
West False River Alt 1	160	0.21	178	0.00	143	0.03	127	0.01	132	0.31	147	0.10
June 2000												
Base	282		344		253		238		203		312	
West False River Alt 1	284	-0.68	345	-0.39	255	-0.91	242	-1.50	196	3.65	315	-0.99
June 2002												
Base	325		375		295		300		345		332	
West False River Alt 1	322	0.75	374	0.36	291	1.43	294	1.82	320	7.21	334	-0.68
June 2003												
Base	215		281		194		219		155		238	
West False River Alt 1	218	-1.46	284	-1.11	197	-1.61	224	-2.30	152	1.71	244	-2.14

Table 4-12 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in July of each simulation year.

	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
July 1991												
Base	685		684		740		844		2,084		540	
West False River Alt 1	610	10.93	614	10.24	637	13.83	703	16.72	1,999	4.05	517	4.30
July 1992												
Base	647		641		708		824		2,126		523	
West False River Alt 1	569	12.03	567	11.48	606	14.43	673	18.27	2,062	3.00	494	5.54
July 1995												
Base	176		218		166		150		129		192	
West False River Alt 1	177	-0.50	218	-0.06	167	-0.93	152	-1.64	128	1.04	193	-0.50
July 2000												
Base	227		279		215		217		274		248	
West False River Alt 1	223	1.98	277	1.05	208	3.39	208	4.22	252	8.31	250	-0.80
July 2002												
Base	323		342		345		356		862		277	
West False River Alt 1	298	7.79	324	5.09	306	11.18	307	13.78	783	9.16	280	-1.10
July 2003												
Base	202		241		199		205		324		206	
West False River Alt 1	196	3.12	237	1.65	189	4.83	194	5.35	296	8.57	207	-0.40

Table 4-13 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in August of each simulation year.

	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
August 1991												
Base	804		783		903		1055		2,347		600	
West False River Alt 1	706	12.16	702	10.37	767	14.99	866	17.88	2,259	3.75	574	4.33
August 1992												
Base	759		741		835		976		2,108		594	
West False River Alt 1	664	12.52	657	11.24	711	14.79	802	17.76	2,037	3.35	560	5.70
August 1995												
Base	191		352		158		134		142		208	
West False River Alt 1	191	0.04	352	0.03	159	-0.38	135	-0.72	140	1.41	210	-0.95
August 2000												
Base	223		263		212		232		300		245	
West False River Alt 1	218	2.57	259	1.36	204	4.12	221	4.91	273	8.88	246	-0.48
August 2002												
Base	467		466		520		605		1,189		346	
West False River Alt 1	427	8.62	439	5.85	459	11.67	526	13.13	1,083	8.93	352	-1.56
August 2003												
Base	206		263		206		238		319		203	
West False River Alt 1	199	3.52	259	1.67	195	5.41	223	6.43	290	8.97	205	-0.64

Table 4-14 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in September of each simulation year.

	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
September 1991												
Base	861		830		988		1157		2,534		611	
West False River Alt 1	775	10.02	761	8.35	857	13.25	967	16.41	2,430	4.10	610	0.26
September 1992												
Base	732		717		816		945		1,894		536	
West False River Alt 1	664	9.27	675	5.89	715	12.43	797	15.67	1,805	4.72	535	0.32
September 1995												
Base	206		271		182		151		143		241	
West False River Alt 1	206	0.19	271	-0.03	182	0.26	151	0.12	140	1.68	243	-0.84
September 2000												
Base	288		319		291		301		596		284	
West False River Alt 1	273	5.48	310	2.81	267	8.25	270	10.24	535	10.25	285	-0.34
September 2002												
Base	571		568		641		726		1,557		424	
West False River Alt 1	518	9.32	529	6.88	561	12.57	622	14.30	1,430	8.16	428	-1.01
September 2003												
Base	308		343		329		358		808		267	
West False River Alt 1	284	7.69	328	4.60	293	11.00	316	11.85	728	9.86	268	-0.54

Table 4-15 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in October of each simulation year.

	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
October 1991												
Base	700		693		762		879		1,685		524	
West False River Alt 1	649	7.31	653	5.88	682	10.42	758	13.70	1,581	6.12	534	-1.76
October 1992												
Base	715		764		732		815		1,514		542	
West False River Alt 1	668	6.51	735	3.83	662	9.59	707	13.21	1,445	4.53	536	1.11
October 1995												
Base	191		207		177		159		138		204	
West False River Alt 1	192	-0.94	207	-0.40	180	-1.55	163	-2.44	135	1.97	207	-1.20
October 2000												
Base	381		385		404		443		942		330	
West False River Alt 1	351	8.10	364	5.34	356	11.78	383	13.42	845	10.33	331	-0.19
October 2002												
Base	555		557		595		706		1,329		456	
West False River Alt 1	509	8.26	521	6.37	526	11.62	608	13.97	1,220	8.23	461	-1.01
October 2003												
Base	468		467		510		571		1,424		384	
West False River Alt 1	423	9.55	431	7.61	443	13.20	485	15.08	1,307	8.22	386	-0.46

Table 4-16 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in November of each simulation year .

	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
November 1991												
Base	632		624		678		762		1,736		509	
West False River Alt 1	574	9.07	577	7.52	594	12.28	642	15.83	1,657	4.57	500	1.79
November 1992												
Base	636		691		645		696		1,371		535	
West False River Alt 1	595	6.47	667	3.42	588	8.80	612	12.04	1,320	3.73	520	2.82
November 1995												
Base	276		340		165		150		210		199	
West False River Alt 1	272	1.47	338	0.50	162	1.99	145	2.90	196	6.65	200	-0.54
November 2000												
Base	457		459		493		549		1,092		369	
West False River Alt 1	420	8.15	434	5.41	436	11.60	473	13.82	983	9.98	370	-0.41
November 2002												
Base	492		515		512		597		1,159		416	
West False River Alt 1	457	7.24	489	4.92	457	10.83	512	14.22	1,064	8.17	421	-1.42
November 2003												
Base	503		524		535		612		1,275		374	
West False River Alt 1	460	8.49	495	5.53	467	12.60	515	15.85	1,170	8.20	379	-1.36

Table 4-17 Monthly average EC and % reduction from Base for West False River Alternative 1 at key locations in December of each simulation year.

	Monthly Averaged EC (umhos/cm)											
	SWP		CVP		CCWD Old Riv		CCWD Rock S.		Jersey Pt		RMID023	
Alternative	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.	value	%reduc.
December 1991												
Base	667		705		668		747		1,452		527	
West False River Alt 1	608	8.84	662	6.20	582	12.79	627	16.04	1,380	5.00	501	4.92
December 1992												
Base	612		715		602		683		871		518	
West False River Alt 1	583	4.72	702	1.79	560	7.03	616	9.76	829	4.85	501	3.23
December 1995												
Base	345		394		193		163		169		250	
West False River Alt 1	342	1.08	393	0.34	192	0.73	161	1.36	164	2.92	252	-0.75
December 2000												
Base	442		508		427		501		806		367	
West False River Alt 1	415	6.05	492	3.17	386	9.56	440	12.12	724	10.22	370	-0.87
December 2002												
Base	535		596		506		788		818		439	
West False River Alt 1	508	5.06	578	3.02	462	8.68	743	5.74	752	8.10	440	-0.20
December 2003												
Base	496		567		486		629		731		379	
West False River Alt 1	467	5.89	548	3.36	442	9.16	561	10.84	664	9.07	381	-0.55

Table 4-18 Average Dry Season (July-December) Reduction in EC at State Water Project resulting from Pilot Project Alternative 1 (West False River Constriction) for 1991 through 2004.

	Average Dry Season (Jul-Dec) % Reduction in EC at SWP		
Year	Est. from DSM2 fingerprint analysis	RMA Model	Difference
1991	10.7	9.7	1.0
1992	8.9	8.6	0.3
1993	3.3		
1994	8.1		
1995	0.2	0.2	0.0
1996	3.2		
1997	6.4		
1998	0.0		
1999	5.3		
2000	5.0	5.4	-0.4
2001	6.6		
2002	8.1	7.7	0.4
2003	5.6	6.4	-0.8
2004	6.1		
14 yr Average	**5.5**		

Table 4-19 Peak Dry Season (July-December) Reduction in EC at State Water Project resulting from Pilot Project Alternative 1 (West False River Constriction) for 1991 through 2004.

	Peak Dry Season (Jul-Dec) % Reduction in Monthly Average EC at SWP		
Year	Est. from DSM2 fingerprint analysis	RMA Model	Difference
1991	12.8	12.2	0.6
1992	11.2	12.5	-1.3
1993	6.7		
1994	11.0		
1995	0.5	1.5	-1.0
1996	6.8		
1997	9.6		
1998	0.2		
1999	8.7		
2000	8.9	8.2	0.7
2001	8.8		
2002	11.2	9.3	1.9
2003	8.3	9.6	-1.3
2004	7.6		
14 yr Average	**8.0**		

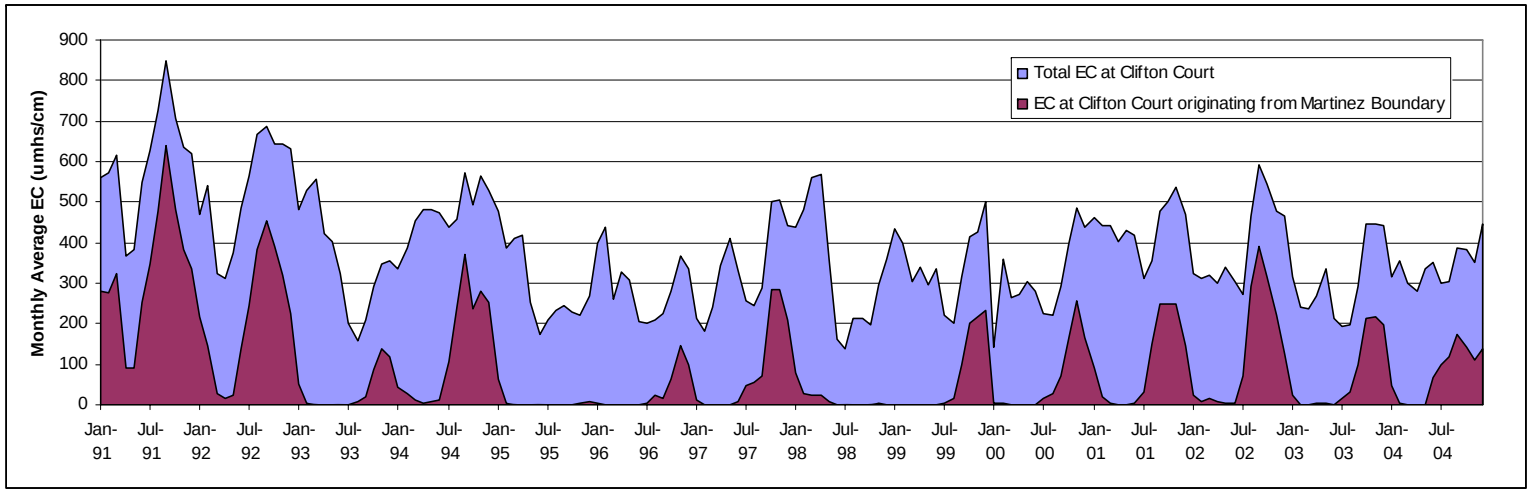


Figure 4-39 Monthly Average EC at Clifton Court from DSM2 "Fingerprint" Analysis showing total EC and contribution associated with the Martinez boundary.

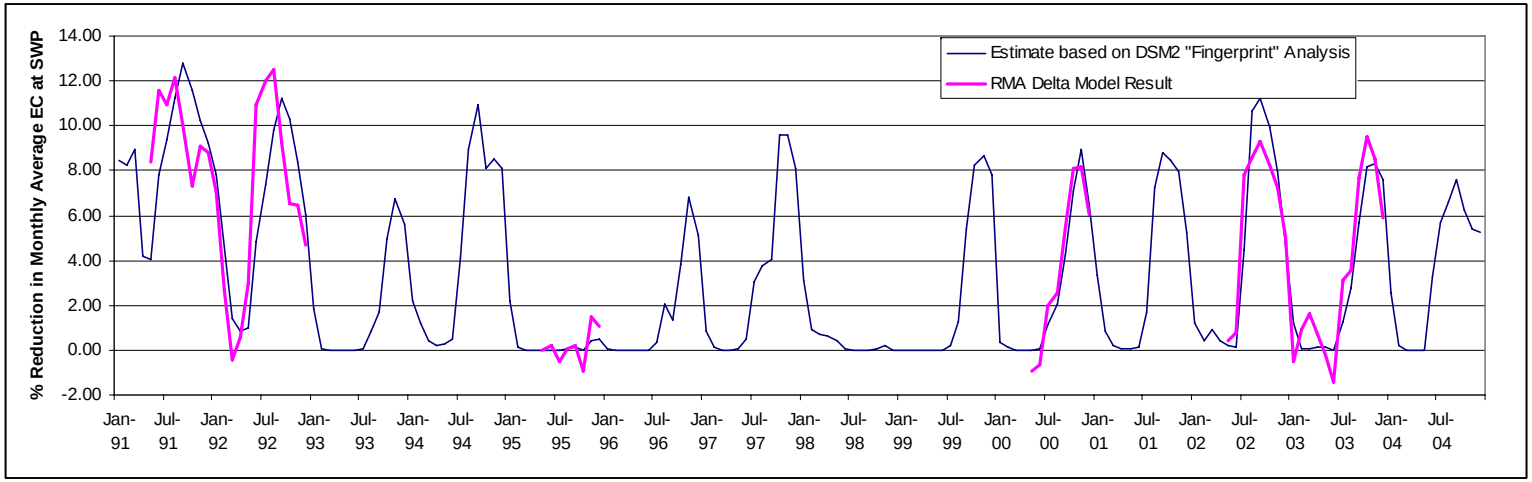


Figure 4-40 Percent reduction in monthly average EC at the State Water Project for Pilot Project Alternative 1 (West False River Constriction) as calculated by the RMA Delta model and estimated from the DSM2 "Fingerprint" Analysis.

Exhibit B

Salinity Control Gate Concept Study

Cost Analysis Results

(Click on picture to view a slide presentation)

Flooded Islands Feasibility Study
Salinity Control Gate Concept Study
Cost Analysis Results
Presented By:
Moffatt & Nichol
January 25, 2006

Exhibit C

Cost Estimate Worksheets

(Click on worksheet to view)

DIRECT COST REPORT

Activity Resource	Description	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Equip	Constr Matls	Sub-Contr	Perm Matls	Direct Total

= **100** Land Item SCHEDULE: 1 100
Description = MOB/DEMOB Unit = LS Takeoff Quan: 1.000 Engr Quan: 1.000

There are no activities in this biditem.

= **200** Land Item SCHEDULE: 1 100
Description = FABRICATE STEEL GATE STRUCTURE Unit = TONS Takeoff Quan: 137.000 Engr Quan: 137.000

40000 Furnish Steel Quan: 137.00 TON Hrs/Shift: 8.00 Cal: 40S WC: MARINE

```
Pivot Gate
Central Pile 42" x 1/2" 56 lf 12,866 lbs  1 ea  6.4 ton
Frame Pile 42" x 1/2" 56 lf 12,866 lbs 2 ea  12.9 ton
Frame  42" x 7/8" 131 lf 50,393 lbs 1 ea  25.2 ton
Reaction Pile 42" x 7/8" 53 lf 20,300 lbs 2 ea  20.4 ton
Central Sleeve 48" x 1/2" 23 lf 5,839 lbs 1 ea  2.9 ton
Pipe Frame 42" x 1/2" 23 lf 5,102 lbs 2 ea  5.1 ton
  42" x 1/2" 62 lf 13,753 lbs 2 ea  13.8 ton
Sheet Pile AZ-36  266 lf 43,767 lbs 2 ea  43.8 ton
Plate  1/2" x 36" 20 lf 1,193 lbs 4 ea  2.4 ton
Connectors
Latch Plate 1/2"x44"x30" 23 lf 4,068 lbs 2 ea  4.1 ton
Welding  511 lf
   Total weight of structure + piles  136.9
     Total weight of gate  72.0
```

Steel pipe prices based on $1800/ton and converted to a LF price; AZ-36 sheets based on a budget cost (Skyline) from previous cost estimate ($3.60/lb); Plate steel costs based on $40/cwt

2SP050	Steel Plate - @108.25	12,908.00 LB	0.400		5,589	5,589
2SP42050	Pipe Pile - 42@108.2	344.00 LF	200.000		74,476	74,476

FRANKS TRACT PILOT PROJECT
CONCEPTUAL GATE / BARRIER COSTS

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	SUBTOTAL	CONTINGENCY @ 40%	ENGINEERING / LEGAL / ADMINISTRATION @ 25%	TOTAL
WEST FALSE RIVER GATE							
Sheet Pile Wall	160	LF	$3,328	$532,480	$213,000	$186,000	$931,480
Pivot Gate Structure	1	EA	$1,986,331	$1,986,331	$795,000	$695,000	$3,476,331
Pendant Barrier Structure	26	EA	$342,686	$8,909,836	$3,564,000	$3,118,000	$15,591,836
Control Structures	1	LS	$558,002	$558,002	$223,000	$195,000	$976,002
TOTAL ALTERNATIVE COST				**$11,986,649**	**$4,795,000**	**$4,194,000**	**$20,975,649**
REAR WHEEL DRIVE							
FALSE RIVER GATE AT OLD RIVER							
Sheet Pile Wall	160	LF	$3,328	$532,480	$213,000	$186,000	$931,480
Pivot Gate Structure	1	EA	$2,017,751	$2,017,751	$807,000	$706,000	$3,530,751
Pendant Barrier Structure	11	EA	$348,456	$3,833,016	$1,533,000	$1,342,000	$6,708,016
Control Structures	1	LS	$558,002	$558,002	$223,000	$195,000	$976,002
SUBTOTAL				$6,941,249	$2,776,000	$2,429,000	$12,146,249
CLOSE EAST LEVEE ON FRANKS TRACT							
Set-Back Levee Sta. 238+00 to 268+69	2,020	LF	$1,255	$2,535,000	$1,014,000	$887,000	$4,436,000
Set-Back Levee Sta. 268+69 to 295+90	2,948	LF	$1,255	$3,700,000	$1,480,000	$1,295,000	$6,475,000
Set-Back Levee Sta. 295+90 to 325+42	2,922	LF	$1,327	$3,877,000	$1,551,000	$1,357,000	$6,785,000
Set-Back Levee Sta. 325+42 to 355+00	2,777	LF	$1,255	$3,485,000	$1,394,000	$1,220,000	$6,099,000
SUBTOTAL				$13,597,000	$5,439,000	$4,759,000	$23,795,000
SAND MOUND SLOUGH GATE AT OLD RIVER							
Sheet Pile Wall	160	LF	$3,328	$532,480	$213,000	$186,000	$931,480
Pivot Gate Structure	1	EA	$1,974,888	$1,974,888	$790,000	$691,000	$3,455,888
Pendant Barrier Structure	16	EA	$345,666	$5,530,656	$2,212,000	$1,936,000	$9,678,656
Control Structures	1	LS	$558,002	$558,002	$223,000	$195,000	$976,002
SUBTOTAL				$8,595,026	$3,438,000	$3,008,000	$15,042,026
TOTAL ALTERNATIVE COST				**$29,134,275**	**$11,653,000**	**$10,196,000**	**$50,983,275**

Exhibit D

Analysis of Long-term EC Reductions of a Franks Tract Pilot Project

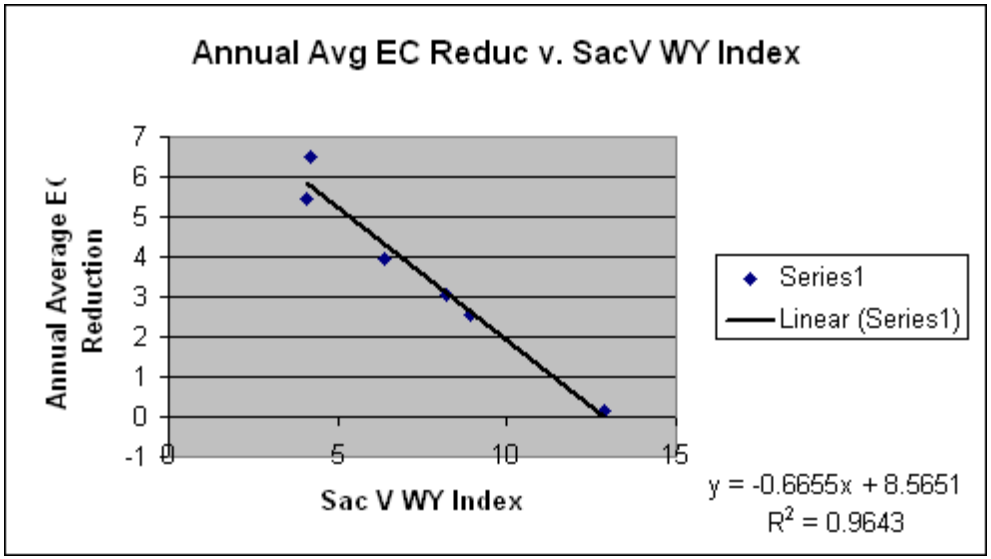
Alternative	Average Monthly Averaged EC (umhos/cm)					
	SWP %reduc.	CVP %reduc.	CCWD Old Riv %reduc.	CCWD Rock S. %reduc.	Jersey Pt %reduc.	RMID023 %reduc.
January-December 1991						
Base						
West False River Alt 1	6.52	5.38	8.72	10.74	3.07	2.02
January-December 1992						
Base						
West False River Alt 1	5.46	4.17	7.12	9.24	2.83	2.03
January--December 1995						
Base						
West False River Alt 1	0.13	0.03	0.01	-0.05	1.43	-0.39
January-'May-December 2000						
Base						
West False River Alt 1	2.56	1.51	3.85	4.60	5.32	-0.39
January-December 2002						
Base						
West False River Alt 1	3.95	2.73	5.68	6.40	5.12	-0.55
January-December 2003						
Base						
West False River Alt 1	3.05	1.93	4.46	5.12	4.76	-0.56
Six Year Average	3.61	2.62	4.97	6.01	3.76	0.36

Please Note: The above January-December averages assumed that the EC reductions for the months of January through April were zero in conjuction with the May through December values from these data tables.

Alternative	January-December Monthy Average Peak Tidally Averaged EC (umhos/cm)					
	SWP %reduc.	CVP %reduc.	CCWD Old Riv %reduc.	CCWD Rock S. %reduc.	Jersey Pt %reduc.	RMID023 %reduc.
January-December 1991						
Base						
West False River Alt 1	5.68	4.74	7.95	9.77	2.42	1.98
January-December 1992						
Base						
West False River Alt 1	4.83	3.79	6.51	8.82	2.20	2.67
January-December 1995						
Base						
West False River Alt 1	0.33	0.02	0.03	-0.25	2.60	-0.35
January-December 2000						
Base						
West False River Alt 1	2.83	1.20	4.53	5.04	5.32	-0.20
January-December 2002						
Base						
West False River Alt 1	4.11	2.79	6.01	6.51	4.67	-0.56
January-December 2003						
Base						
West False River Alt 1	3.34	2.27	5.29	5.86	4.79	-0.41
Six Year Average	3.52	2.47	5.05	5.96	3.66	0.52

Please Note: The above January-December averages assumed that the EC reductions for the months of January through April were zero in conjuction with the May through December values from these data tables.

Sac V WY Indec	EC Reduc
4.21	6.52
4.06	5.46
12.89	0.13
8.94	2.56
6.35	3.95
8.21	3.05



	[……. Sacramento Valley…….]					Estimated SWP	[……San Joaquin Valley……..]					Estimated SWP
	[….. Runoff (maf)……]			[.. WY Index…….]		EC Reduction -	[….. Runoff (maf)……..]			[..WY Index……..]		EC Reduction -
WY	Oct-Mar	Apr-Jul	WYsum	Index	Yr-type	0.6655x+8.5651'	Oct-Mar	Apr-Jul	WYsum	Index	Yr-type	1.3206x+7.5736'
----	--------	---------	-------	--------	------		----------	--------	--------	-------	---------	
1901							3.49	5.58	9.39	4.6	W	**1.5**
1902							1.12	3.81	5.08	3.41	AN	**3.1**
1903							1.45	4.13	5.71	3.45	AN	**3.0**
1904							1.96	5.37	7.64	4.31	W	**1.9**
1905							1.82	3.36	5.3	3.24	AN	**3.3**
1906	12.57	12.92	26.71	11.76	W	**0.7**	2.53	9.24	12.43	6.7	W	**-1.3**
1907	18.96	13.45	33.7	14.07	W	**-0.8**	3.67	7.61	11.82	6.2	W	**-0.6**
1908	8.29	5.6	14.77	7.73	BN	**3.4**	0.98	2.17	3.32	2.4	D	**4.4**
1909	20.61	8.98	30.68	12.1	W	**0.5**	2.85	5.91	8.97	4.59	W	**1.5**
1910	13.12	6.11	20.12	9.38	W	**2.3**	2.87	3.62	6.64	3.65	AN	**2.8**
1911	12.27	13.12	26.38	11.74	W	**0.8**	3.63	7.52	11.48	5.97	W	**-0.3**
1912	4.84	5.65	11.41	6.71	BN	**4.1**	0.54	2.57	3.21	2.55	BN	**4.2**
1913	5.72	6.29	12.85	6.24	D	**4.4**	0.44	2.34	3	2	C	**4.9**
1914	16.72	10.08	27.81	10.92	W	**1.3**	2.72	5.67	8.69	4.35	W	**1.8**
1915	11.41	11.42	23.86	10.99	W	**1.3**	1.29	4.95	6.4	4.1	W	**2.2**
1916	14.25	8.89	24.14	10.83	W	**1.4**	2.67	5.5	8.38	4.65	W	**1.4**
1917	7.25	9.14	17.26	8.83	AN	**2.7**	1.66	4.84	6.66	4.13	W	**2.1**
1918	5.27	4.89	10.99	6.19	D	**4.4**	1.07	3.4	4.59	3.08	BN	**3.5**
1919	8.12	6.77	15.66	7	BN	**3.9**	1.06	2.99	4.09	2.62	BN	**4.1**
1920	3.63	4.91	9.2	5.15	C	**5.1**	0.72	3.29	4.09	2.64	BN	**4.1**
1921	15.47	7.52	23.8	9.2	AN	**2.4**	1.97	3.84	5.9	3.23	AN	**3.3**
1922	6.63	10.57	17.98	8.97	AN	**2.6**	1.51	5.99	7.68	4.54	W	**1.6**

1923	6.21	6.27	13.21	7.06	BN	**3.9**	1.39	3.95	5.51	3.55	AN	**2.9**
1924	3.27	1.94	5.74	3.87	C	**6.0**	0.45	1.03	1.5	1.42	C	**5.7**
1925	8.76	6.51	15.99	6.39	D	**4.3**	1.45	3.93	5.51	2.93	BN	**3.7**
1926	6.37	4.79	11.76	5.75	D	**4.7**	0.89	2.56	3.49	2.3	D	**4.5**
1927	14.34	8.75	23.83	9.52	W	**2.2**	1.8	4.56	6.5	3.56	AN	**2.9**
1928	10.24	5.86	16.76	8.27	AN	**3.1**	1.69	2.64	4.37	2.63	BN	**4.1**
1929	4	3.84	8.4	5.22	C	**5.1**	0.52	2.29	2.84	2	C	**4.9**
1930	8.24	4.65	13.52	5.9	D	**4.6**	0.76	2.44	3.25	2.02	C	**4.9**
1931	3.52	2.09	6.1	3.66	C	**6.1**	0.46	1.18	1.66	1.2	C	**6.0**
1932	6.28	6.24	13.12	5.48	D	**4.9**	1.79	4.69	6.63	3.41	AN	**3.1**
1933	3.73	4.66	8.94	4.63	C	**5.5**	0.49	2.77	3.34	2.44	D	**4.4**
1934	5.68	2.45	8.63	4.07	C	**5.9**	0.98	1.26	2.28	1.44	C	**5.7**
1935	6.27	9.69	16.59	6.98	BN	**3.9**	1.26	5.03	6.41	3.56	AN	**2.9**
1936	10.32	6.41	17.35	7.75	BN	**3.4**	2	4.38	6.49	3.74	AN	**2.6**
1937	5.5	7.24	13.33	6.87	BN	**4.0**	1.78	4.66	6.53	3.9	W	**2.4**
1938	17.96	12.93	31.83	12.62	W	**0.2**	3.58	7.33	11.24	5.89	W	**-0.2**
1939	4.56	3.04	8.18	5.58	D	**4.9**	1	1.83	2.9	2.2	D	**4.7**
1940	14.78	6.93	22.43	8.88	AN	**2.7**	2.49	4.04	6.59	3.36	AN	**3.1**
1941	16.32	9.77	27.08	11.47	W	**0.9**	2.22	5.51	7.93	4.43	W	**1.7**
1942	14.33	9.93	25.24	11.27	W	**1.1**	1.93	5.28	7.38	4.44	W	**1.7**
1943	13.37	6.9	21.13	9.77	W	**2.1**	2.86	4.28	7.28	4.03	W	**2.3**
1944	4.81	4.93	10.43	6.35	D	**4.3**	0.87	2.97	3.92	2.76	BN	**3.9**
1945	8.42	5.92	15.06	6.8	BN	**4.0**	2.07	4.37	6.6	3.59	AN	**2.8**
1946	10.89	5.97	17.62	7.7	BN	**3.4**	1.99	3.65	5.73	3.3	AN	**3.2**
1947	5.9	3.83	10.39	5.61	D	**4.8**	1.26	2.12	3.42	2.18	D	**4.7**
1948	5.39	9.55	15.75	7.12	BN	**3.8**	0.56	3.58	4.21	2.7	BN	**4.0**
1949	5.73	5.59	11.97	6.09	D	**4.5**	0.62	3.12	3.79	2.53	BN	**4.2**
1950	7.01	6.72	14.44	6.62	BN	**4.2**	1.02	3.57	4.65	2.85	BN	**3.8**
1951	16.77	5.42	22.95	9.18	AN	**2.5**	4.35	2.83	7.25	3.14	AN	**3.4**
1952	13.86	13.68	28.6	12.38	W	**0.3**	2.18	6.84	9.3	5.17	W	**0.7**
1953	10.84	8.26	20.09	9.55	W	**2.2**	1.07	3.18	4.35	3.03	BN	**3.6**

1954	9.74	6.81	17.43	8.51	AN	**2.9**	1.1	3.16	4.3	2.72	BN	**4.0**
1955	5.19	5.07	10.98	6.14	D	**4.5**	0.78	2.67	3.5	2.3	D	**4.5**
1956	20.32	8.6	29.89	11.38	W	**1.0**	4.14	5.29	9.67	4.46	W	**1.7**
1957	7.72	6.29	14.89	7.83	AN	**3.4**	1.02	3.19	4.29	3.01	BN	**3.6**
1958	16.37	12.24	29.71	12.16	W	**0.5**	1.67	6.4	8.36	4.77	W	**1.3**
1959	7.4	3.84	12.05	6.75	BN	**4.1**	0.98	1.85	2.98	2.21	D	**4.7**
1960	7.72	4.65	13.06	6.2	D	**4.4**	0.85	2.07	2.96	1.85	C	**5.1**
1961	6.87	4.39	11.97	5.68	D	**4.8**	0.54	1.5	2.1	1.38	C	**5.8**
1962	8.17	6.23	15.11	6.65	BN	**4.1**	1.26	4.24	5.61	3.07	BN	**3.5**
1963	12.01	10.09	22.99	9.63	W	**2.2**	1.68	4.37	6.24	3.57	AN	**2.9**
1964	5.9	4.37	10.92	6.41	D	**4.3**	0.93	2.14	3.14	2.19	D	**4.7**
1965	16.59	8.13	25.64	10.15	W	**1.8**	3.2	4.55	8.13	3.81	W	**2.5**
1966	7.42	4.84	12.95	7.16	BN	**3.8**	1.49	2.42	3.98	2.51	BN	**4.3**
1967	12.14	11.01	24.06	10.2	W	**1.8**	2.46	7.09	9.98	5.25	W	**0.6**
1968	8.66	4.12	13.64	7.24	BN	**3.7**	1.02	1.85	2.94	2.21	D	**4.7**
1969	15.33	10.68	26.98	11.05	W	**1.2**	3.84	8.14	12.29	6.09	W	**-0.5**
1970	18.87	4.35	24.06	10.4	W	**1.6**	2.55	2.96	5.61	3.18	AN	**3.4**
1971	12.71	8.9	22.57	10.37	W	**1.7**	1.56	3.23	4.91	2.89	BN	**3.8**
1972	7.61	5.02	13.43	7.29	BN	**3.7**	1.25	2.22	3.57	2.16	D	**4.7**
1973	12.8	6.38	20.05	8.58	AN	**2.9**	1.87	4.48	6.47	3.5	AN	**3.0**
1974	21.69	9.78	32.5	12.99	W	**-0.1**	2.43	4.53	7.12	3.9	W	**2.4**
1975	9.24	8.95	19.23	9.35	W	**2.3**	1.37	4.65	6.18	3.85	W	**2.5**
1976	4.63	2.75	8.2	5.29	C	**5.0**	0.78	1.07	1.97	1.57	C	**5.5**
1977	2.49	1.93	5.12	3.11	C	**6.5**	0.22	0.8	1.05	0.84	C	**6.5**
1978	14.9	8.12	23.92	8.65	AN	**2.8**	2.57	6.5	9.65	4.58	W	**1.5**
1979	6.06	5.64	12.41	6.67	BN	**4.1**	1.87	3.99	5.98	3.67	AN	**2.7**
1980	15.49	6	22.33	9.04	AN	**2.5**	3.74	5.41	9.47	4.73	W	**1.3**
1981	6.81	3.63	11.1	6.21	D	**4.4**	0.85	2.29	3.22	2.44	D	**4.4**
1982	20.56	11.82	33.41	12.76	W	**0.1**	3.78	7	11.41	5.45	W	**0.4**
1983	22.75	13.66	37.68	15.29	W	**-1.6**	5.42	8.73	15.01	7.22	W	**-2.0**
1984	15.98	5.52	22.35	10	W	**1.9**	3.51	3.48	7.13	3.69	AN	**2.7**

1985	6.24	4	11.04	6.47	D	**4.3**	1.11	2.41	3.6	2.4	D	**4.4**
1986	19.45	5.45	25.83	9.96	W	**1.9**	4.36	4.92	9.5	4.31	W	**1.9**
1987	5.85	2.8	9.27	5.86	D	**4.7**	0.55	1.48	2.08	1.86	C	**5.1**
1988	5.78	2.9	9.23	4.65	C	**5.5**	0.86	1.55	2.48	1.48	C	**5.6**
1989	9.03	5.07	14.82	6.13	D	**4.5**	1.07	2.42	3.56	1.96	C	**5.0**
1990	4.94	3.72	9.26	4.81	C	**5.4**	0.83	1.59	2.46	1.51	C	**5.6**
1991	3.9	4.01	8.44	4.21	C	**5.8**	0.56	2.57	3.2	1.96	C	**5.0**
1992	5.41	2.93	8.87	4.06	C	**5.9**	0.86	1.66	2.58	1.56	C	**5.5**
1993	12.44	8.98	22.21	8.54	AN	**2.9**	2.49	5.65	8.38	4.2	W	**2.0**
1994	4.55	2.73	7.81	5.02	C	**5.2**	0.66	1.8	2.54	2.05	C	**4.9**
1995	19.83	13.6	34.55	12.89	W	**0.0**	3.67	8.01	12.32	5.95	W	**-0.3**
1996	13.05	8.37	22.29	10.26	W	**1.7**	2.57	4.51	7.22	4.12	W	**2.1**
1997	20.22	4.39	25.42	10.82	W	**1.4**	5.75	3.59	9.51	4.13	W	**2.1**
1998	17.65	12.54	31.4	13.31	W	**-0.3**	2.82	7.11	10.43	5.65	W	**0.1**
1999	12.97	7.26	21.19	9.8	W	**2.0**	1.9	3.85	5.91	3.59	AN	**2.8**
2000	12.06	5.96	18.9	8.94	AN	**2.6**	1.98	3.78	5.9	3.38	AN	**3.1**
2001	5.64	3.46	9.81	5.76	D	**4.7**	0.92	2.23	3.18	2.2	D	**4.7**
2002	9.32	4.57	14.6	6.35	D	**4.3**	1.27	2.75	4.06	2.34	D	**4.5**
2003	10.71	7.74	19.31	8.21	AN	**3.1**	1.25	3.49	4.87	2.81	BN	**3.9**
2004	10.95	4.4	16.04	7.51	BN	**3.6**	1.51	2.25	3.81	2.21	D	**4.7**
2005	8.3	9.29	18.44	8.45	AN	**2.9**	2.73	6.3	9.25	4.77	W	**1.3**
min	2.49	1.93	5.12	3.11		**-1.6**	1.05	0.84	1.05	0.84		**-2.0**
mean	11.5	6.72	19.06	8.52		**3.1**	2.01	3.84	6.04	3.33		**3.2**
max	22.75	13.68	37.68	15.29		**6.5**	5.75	9.24	15.01	7.22		**6.5**