State of California

The Natural Resources Agency
Department of Water Resources
Division of Flood Management
Flood Project Integrity & Inspection Branch

2008
EROSION SURVEY
OF THE
SAN JOAQUIN RIVER
FLOOD CONTROL SYSTEM

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1.0 INTRODUCTION

A typical levee inspection occurs from the crown of the levee, but erosion on the slope and beyond is sometimes not visible from this vantage point. In addition, thick vegetation and wide berm can also obstruct an inspector's view of an erosion. Consequently, in April of 2006, the Flood Project Integrity and Inspection Branch (FPIIB) began developing an erosion survey program to assist in the documentation and monitoring of erosion sites.

1.1 Purpose

The primary purposes of the waterside erosion surveys of the San Joaquin River Flood Control System are to; a) monitor and document the condition of previously identified erosion sites, b) inventory any new erosion sites and c) identify erosion sites that appear to be an imminent threat to the structural integrity of the flood control system.

1.2 Scope of Work

In September 2008, FPIIB conducted its annual review and inventory of erosion sites in the San Joaquin River Flood Control System. The FPIIB scope of services included the following:

- Conduct field survey by FPIIB personnel to evaluate current condition of previously identified erosion sites;
- Inventory new erosion sites;
- Monitor repaired sites for performance evaluation;
- Prepare a GIS database for use in geo-referencing erosion sites and creating an Atlas;
- Prepare a rating table using the data obtained from the field investigation, and applying a set of modified Ayres rating criteria;
- Prepare a data sheet for each documented erosion site;
- Prepare report summarizing the results, conclusions, recommendations, and findings of our investigation.

2.0 FIELD INVESTIGATION AND PROCEDURES

Since the 2006 survey, the FPIIB has committed more resources to improve the erosion survey program. New survey equipment such as a clinometer and a more accurate GPS unit were purchased. A 23-foot jet boat was also purchased to support water-based surveys. Additional FPIIB personnel were assigned to expand the survey coverage. Much of the survey procedure and rating criteria were reviewed and improved.

2.1 Coverage Area

Figures **1, 2**, and **3** include the locations of waterways inspected during the field reconnaissance. Previously identified erosion sites were inspected, and new sites were documented and added in the inventory.

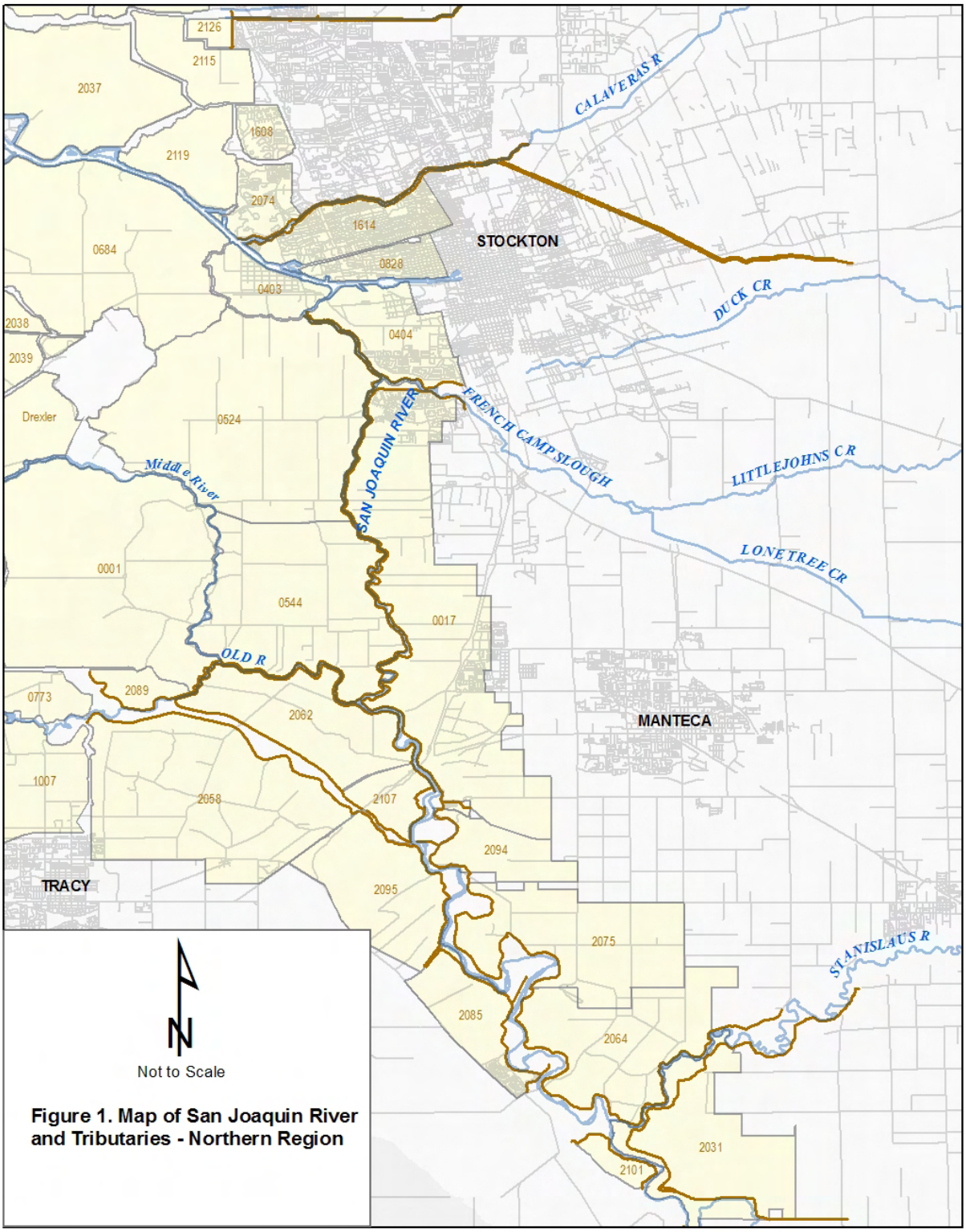


Figure 1. Map of San Joaquin River and Tributaries - Northern Region

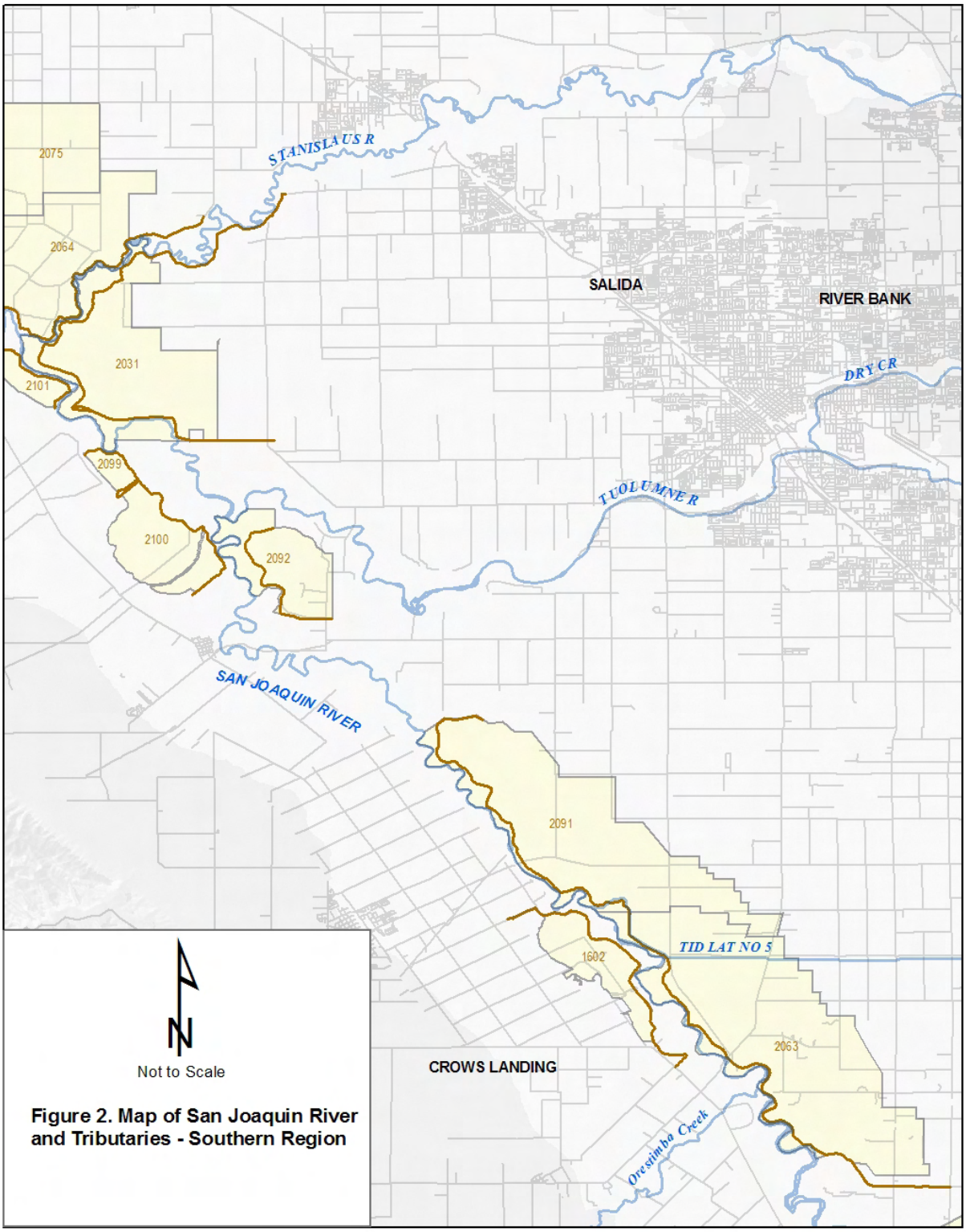


Figure 2. Map of San Joaquin River and Tributaries - Southern Region

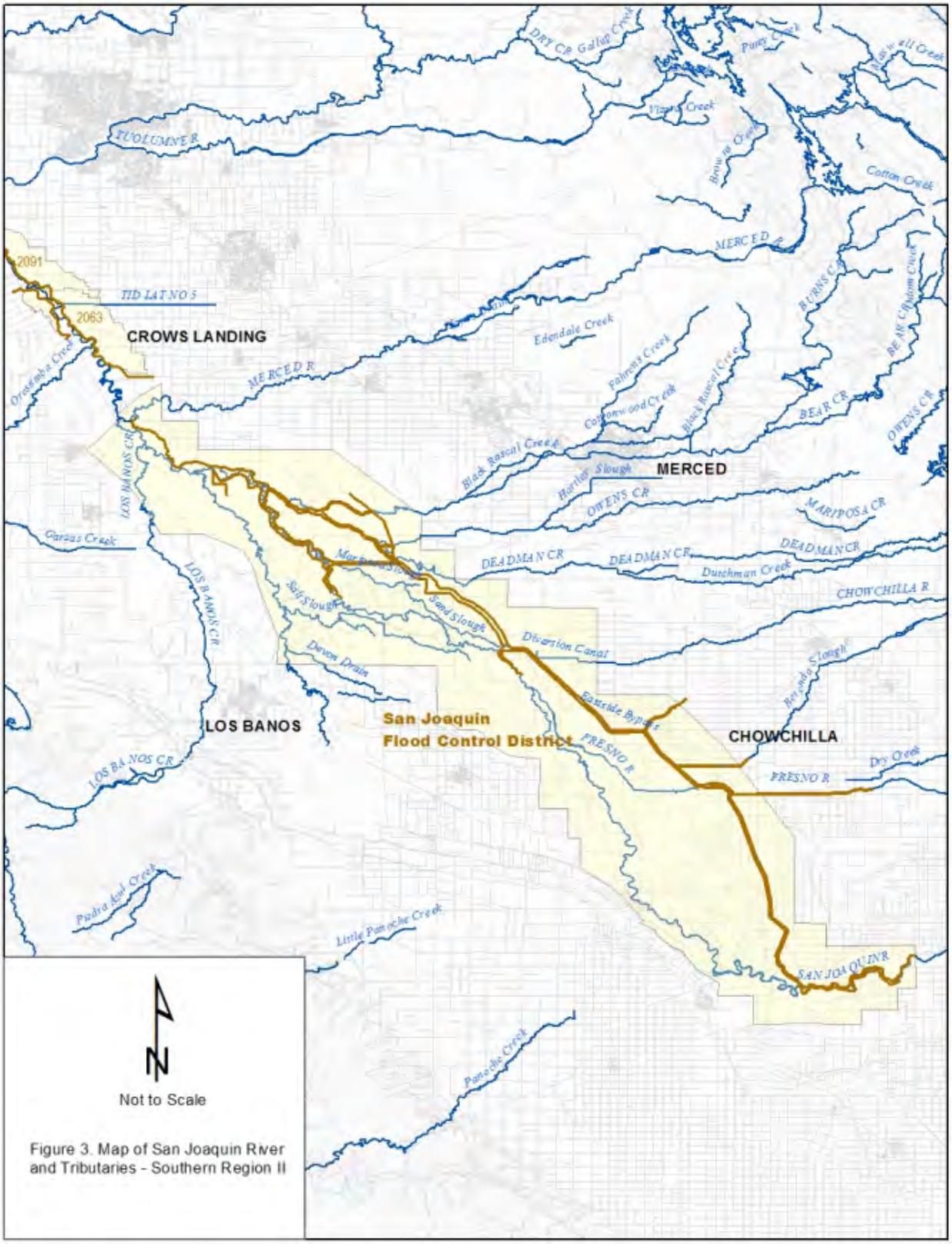


Figure 3. Map of San Joaquin River and Tributaries - Southern Region II

2.2 Procedure

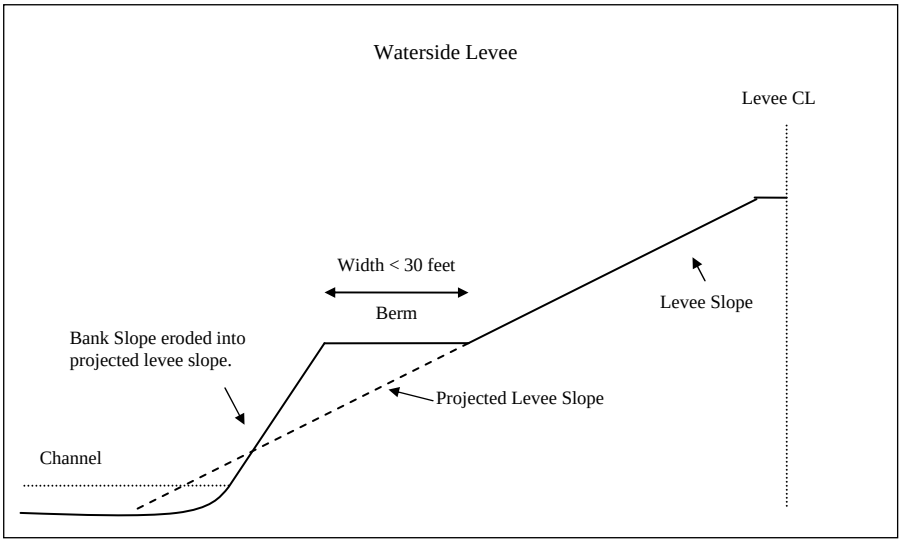
Prior to the field surveys, a master list of the most current inventory of erosion sites was reviewed. This list was used to locate previously identified erosion sites. Any new identified erosion sites were added to the inventory.
Land-based surveys were done by using a 4x4 vehicle on levee access roads. Water-based surveys were completed using a 23-foot jet-driven boat. A portable Trimble GeoXT GPS receiver was used to locate and log erosion sites. Once on site, a field survey data form, found in Appendix A of this report is used to collect specific data. It includes the following:

a.) River mile
b.) Levee mile
c.) Bank side
d.) GPS coordinates of levee crown at midpoint of the erosion site
e.) Estimated site length
f.) Location of erosion on bank (toe, lower slope, middle slope, upper slope, toe & slope)
g.) Scarp height
h.) Levee Slope
i.) Number of burrow holes on face of levee slope per 100 square feet
j.) Vegetation
k.) Upstream condition
l.) Downstream condition
m.) Comments and observation
n.) Digital photographs of the site

A site may be included in this erosion survey if it meets with one of the following criteria:

a.) Bank erosion into the projection of the levee slope.
b.) The site was submitted by the local maintaining agency for PL84-99 assistance.

Figure 3. Schematic of Waterside Levee.



Erosion sites with berm width greater than 30 feet are not rated. However, they are included in the inventory for monitoring purposes.

2.3 Site Rating Criteria

After the data was post-processed and electronically logged, the erosion sites were rated using criteria partly based upon the Ayres Associates "2007 – Field Reconnaissance Report of Bank Erosion Sites and Site Priority Ranking" dated December 18, 2007. The criteria have been partially modified to suit the type of data collected for the San Joaquin River System erosion surveys.
Following are definitions of the criteria used to rate erosion sites:

1. Berm width: The berm width is the horizontal segment of the bank that extends from the levee toe to the top of the riverbank.

2. Length of erosion: The length of erosion is the full length along the river over which the erosion occurs.

3. Location of Erosion: The location of the erosion is the position in the vertical direction where the erosion occurs along the slope of the levee. The lower on the slope, the greater the potential for failure.

4. Severity of Erosion: The severity of erosion refers to the vertical scarp height of the eroded face.

5. Burrow Holes: Burrow holes refer to the frequency of animal holes in the vertical direction of the levee slope per 100 square feet.

6. Radius of Curvature (Rc/W): The radius of the meander bend divided by the top width of the channel flowing full.

7. Site Relative to bend: The location of the erosion site relative to a meander bend.

8. Vegetation Cover: The amount of existing vegetation on the site.

9. Seepage Potential: This factor takes into account any documented history of seepage or sinkholes within 100 feet of an erosion site.

Each factor is given a point rating as defined in the San Joaquin River System Rating Guide found in Appendix B of this report. The criterion for severity of erosion is multiplied by a factor of two to account for its importance.

3.0 RESULTS

FPIIB personnel committed 11 days to complete the 2008 field survey of the San Joaquin River System. Field surveys were carried out during the following dates; July 22, August 12, August 18-20, August 25-27, September 10, October 20-22, and November 4-5, 2008. A DWR boat was used in navigable areas and where wide berms were not an issue. Otherwise, a land survey was carried out using a 4x4 off-road vehicle. Of the 57 documented sites in the 2007 Inventory, six sites were repaired, and three sites previously not rated were given a rating. Four additional sites were added to the inventory. 23 out of the 102 PL84-99 sites were reported to be repaired. A summary of the 2008 Inventory of Erosion Sites is presented in Table 1.

Table 1. Summary of Erosion Sites by Local Maintaining Agency.

Local Maintaining Agency	Miles Surveyed	2007 Erosion Sites	Repaired Sites	2008 New Sites	PL84-99 Sites†	Repaired PL84-99 Sites††
Boat Survey						
RD 1	1.15	2				
RD 17	14.37	2			11	21
RD 404	2.36	8	1	2		
RD 524	6.26	2			28	1
RD 544	10.33			1	40	1
RD 2062	8.28	9				
Land Survey						
RD 2058	6.71	3	2			
RD 2063	10.63	1				
RD 2075	7.52	4				
RD 2095	4.83	4				
RD 2089	2.9	6				
RD 2092	3.76	1				
RD 2031	13.16	2				
RD 1602	6.29	1	1			
RD 2101	3.51	1				
Lower San Joaquin Levee District	191.4	1				
San Joaquin County Flood Control District	127.99**	4	2	1		
Madera County FCWA	26.65	2				
Merced County Stream Group	6.4	4				
Total	**454.5**	**57**	**6**	**4**	**79**	**23**

** Not all mileage was covered
† Initial inventory as part of the 2007 San Joaquin Erosion Survey †† Current as of February 2009

A modified Ayres rating system, as described in Appendix B was used to rank each site. An average was found by adding the total points and dividing it by the number of sites. A rating of M, U, or Not Rated is given to each site depending on the score it receives. The average was used as a cutoff line to determine an M site from a U site. The definitions for the rating are given in the following table. Note that a rating of U does not necessarily mean that the erosion site will cause the overall system to fail.

Table 2. Definition of Ratings.

Not Rated	Minimally Acceptable	Unacceptable
A site that has a berm greater than 30 feet; or a site that does not contain enough information to be rated	A site that receives an average or less than the average is rated as M, or Minimally Acceptable.	A site that receives a score greater than the average is rated as U, or Unacceptable. This site is usually given a high repair priority over the M site, as it can be a serious deficiency that can fail during normal flow or in the next high water event.

Of the 54 erosion sites rated in the 2008 Inventory, 27 were given a rating of M, while 25 sites were given a rating of U. 13 additional sites were inventoried, but not rated. Ratings for some sites were carried over from the previous year because these sites were not visited in 2008. Ratings for the sites reported in the 2007 Inventory did not change much at all. The 2008 Rating Table is included in the Appendix.

4.0 CONCLUSIONS

Based on the findings of our field investigation, along with previous experiences and report on the San Joaquin River Flood Control System, the following is a summary of our evaluations.

1. The 2008 Inventory of Erosion Sites contains a total of 173 sites. This number includes Rated sites, Not Rated sites, Repaired sites, and PL84-99 sites.
2. 54 sites were rated using the modified Ayres rating system. 27 sites received a rating of M, and 25 received a rating of U.
3. Four new sites were added to the 2008 Inventory.
4. Six sites were observed to be repaired. These sites will be monitored for performance evaluation.
5. 102 PL84-99 erosion sites continue to be monitored. Of the 102 sites, 23 were found to be repaired by the U.S. Army Corp of Engineer (USACE).
6. In some sites that were repaired recently, signs of longitudinal failure and sloughing were noted. Cause(s) of these failures on the repaired sites are still unknown. Potential factors could include: steep slope, increased surface loading from the rip rap, and poor placement of the rip rap.

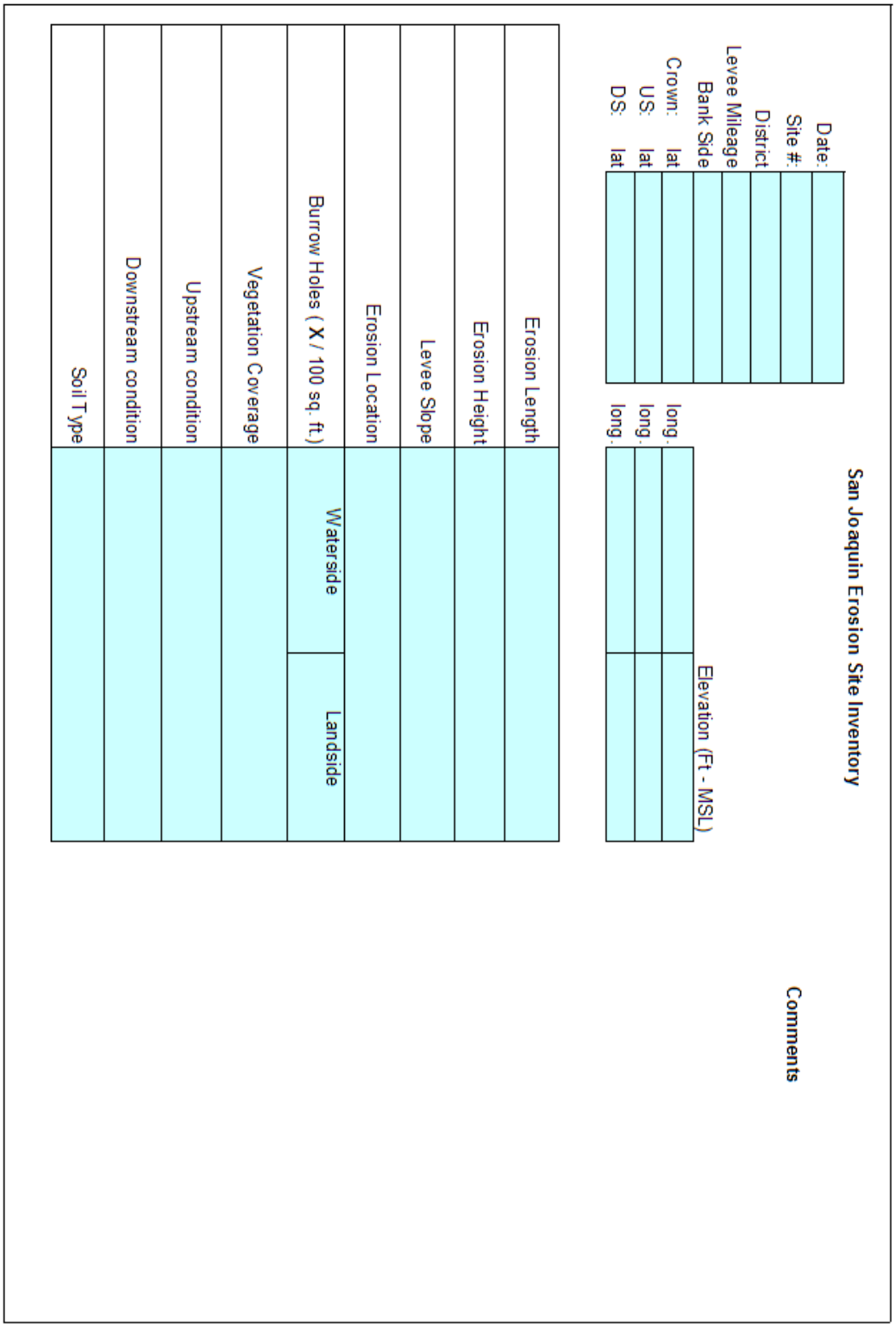
7. The 2008 Inventory of Erosion Sites does not represent all erosion sites presently active in the San Joaquin River Flood Control System. This inventory is limited to the findings from the Levee Inspection program, previous and current erosion surveys, and to what is visible above the waterline.
8. Despite the lack of significant flow events during the 2007-2008 water year, four new erosion sites were added to the Inventory. These sites could have been overlooked during the field survey from the previous year. They can also be an indication that the system continues to deteriorate even in dry season.

5.0 RECOMMENDATIONS

Based on the findings of our field investigation and conclusion, the following is a summary of recommendations.

1. Review existing bathymetry data as a tool to determine where potential erosion sites may be. The data can also provide a better understanding of some of the soil mechanisms associated with erosion otherwise invisible above water line. These mechanisms include scouring of the base, undermining and sediment transport.
2. Include slope of the levee as a criterion in the rating scheme. During the last field investigation, it was observed that the severity of an erosion site is also dependent upon the slope of the levee. A steep slope will cause the face of the levee to erode faster than one that has a gentle slope.
3. Develop a strategy to standardize the rating methodology. This will avoid objective rating and provide a more subjective and transparent structure for rating erosion sites.
4. Continue monitoring the frequency of burrow holes on the face of the waterside levee. These holes act as pores on the levee, removing levee material and allowing for the penetration of water into the levee.

APPENDIX A – FIELD SURVEY DATA FORM



San Joaquin Erosion Site Inventory

Date:	
Site #:	
District	
Levee Mileage	
Bank Side	
Crown:	lat long
US:	lat long
DS:	lat long

Erosion Length		
Erosion Height		
Levee Slope		
Erosion Location	Waterside	Landside
Burrow Holes (X / 100 sq. ft.)		
Vegetation Coverage		
Upstream condition		
Downstream condition		
Soil Type		

Elevation (Ft - MSL)

Comments

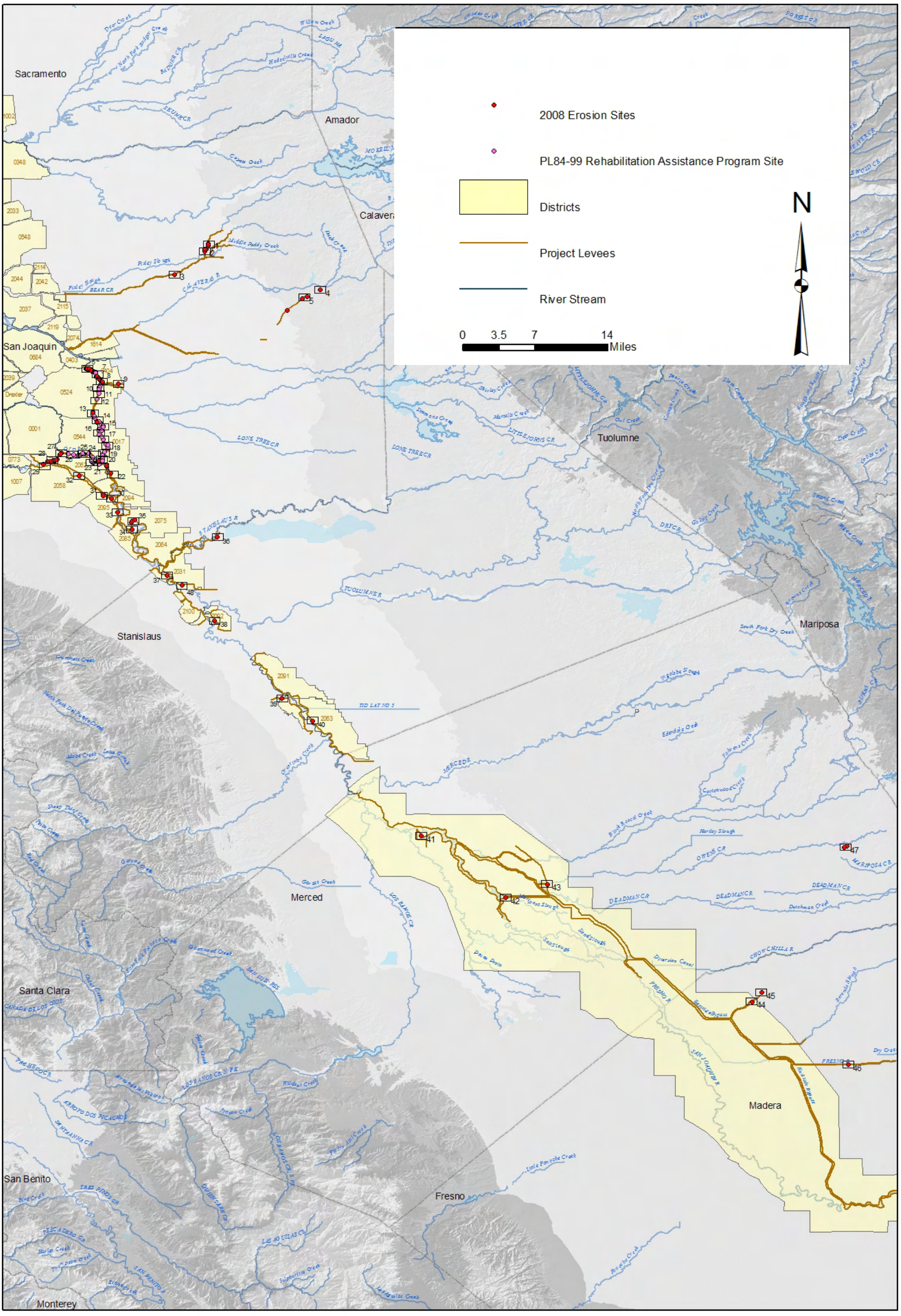
APPENDIX B – SAN JOAQUIN RIVER SYSTEM RATING GUIDE

San Joaquin River System Rating Guide	
Criteria	**Score Defintion**
Berm Width	0 - Berm width of 30 ft or greater; 1 - 20 to 29 ft of berm; 2 - 10 to 19 ft of berm; 3 - 5 to 9 ft of berm; 4 - 1 to 4 ft of berm; 5 - no berm remaining
Length of Erosion	0 - Less than 10 ft; 1 - 10 to 100 ft; 2 - 101 to 500 ft 3 - 501 to 1000 ft; 4 - 1001 to 1500 ft; 5 - Greater than 1500 ft
Location of Erosion	0 - Upper Slope; 1 - Middle Slope; 2 - Lower Slope; 3 - Toe; 4 - Toe & Slope
Severity of Erosion (*2)	0 - Scarp height less than 1 ft; 1 - Scarp height between 1 to 2 ft; 2 - 2 to 3 ft; 3 - 3 to 4 ft; 4 - 4 to 5 ft; 5 - Greater than 5 ft
Burrow Holes	0 - No holes; 1 - Holes within waterside slope; 2 - Holes at waterside toe
Rc/W (Radius of Curvature / channel width)	0 - Greater than 5 or no curve; 1 - 4 to 5 range; 2 - 3 to 4 range; 3 - 2 to 3 range; 4 - 2 to 1 range; 5 - less than 1
Site Relative to Bend	0 - Inside of Bend; 1 - Straight reach; 2 - Just downstream of a bend; 3 - Outside of bend (greater than 90 degree interior angle); 4 - Outside of bend (90 degree turn); 5 - Outside of tight bend (less than 90 degree interior angle)
Vegetation Cover	0 - Dense vegetation (80-100% coverage); 1 - Moderate vegetation (60-80%); 2 - Medium vegetation (40-60%); 3 - Mild vegetation (20-40%); 4 - Slight vegetation (up to 20%); 5 - No vegetation
Seepage Potential†	0 - No seepage history; 5 - Seepage or sink hole history

† = Any erosion site less than 100 feet from a known seepage location will be rated as 5. Boils are not considered in the analysis, even though they may be caused by seepage.

APPENDIX C – INDEX OF THE SAN JOAQUIN ATLAS

Index of San Joaquin Erosion Surveys Atlas



APPENDIX D – 2008 EROSION RATING TABLE

2008 Erosion Survey Inventory Sheet

Erosion Site Number	Latitude	Longitude	River Mile	Levee Mile Crown Point	Levee Mile Start, Mile	Levee Mile End, Mile	Estimated Site Length, ft.	Stream Name	LMA Code	LMA Name	Unit	Bank	Date Inspected	Berm Width	Erosion Length	Erosion Location	Erosion Severity	Burrow Holes	Radius of Curvature	Site Relative to Bend	Vegetation Cover	Seepage Potential	Total Points	Overall Rating	Comments
0.50	37.9394800	-121.3427300	40.86	0.230	0.227	0.233	30	San Joaquin River	RD 0404	Boggs Tract	1	R	10/21/2008	5	1	2	5	0	4	0	1		23	U	Wave wash erosion; pocket erosion; located on the inside bend
0.75	37.9394400	-121.3415700	40.93	0.300	0.291	0.309	100	San Joaquin River	RD 0404	Boggs Tract	1	R	10/21/2008	5	1	4	5	1	0	1	1		23	U	Wave wash erosion; pocket erosion on toe; located u.s. of bend; upper slope has no protection
11.00	37.9394800	-121.3407000	40.98	0.340	0.336	0.344	40	San Joaquin River	RD 0404	Boggs Tract	1	R	10/21/2008	5	1	2	3	0	0	1	4		19	M	Wave was erosion above toe rip rap
12.00	37.9396400	-121.3377400	41.14	0.510	0.506	0.514	40	San Joaquin River	RD 0404	Boggs Tract	1	R	10/21/2008	5	1	2	4	0	1	0	4		21	M	Sliding effect on lower slope just above toe rip rap
1.00	37.9287100	-121.3272200	42.17	1.570	1.569	1.571	7	San Joaquin River	RD 0404	Boggs Tract	1	R	10/21/2008	5	0	2	4	0	2	0	5		22	M	Loss of riprap below Garwood Bridge;
3.00	37.9257300	-121.3242000	42.44	1.850	1.846	1.854	40	San Joaquin River	RD 0404	Boggs Tract	1	R	10/21/2008	5	1	2	3	0	0	1	5		20	M	Several trees (12-18" DBH) with partial roots exposed
4.00	37.9239400	-121.3231700	42.57	1.980	1.974	1.986	60	San Joaquin River	RD 0404	Boggs Tract	1	R	10/21/2008	5	1	3	3	0	0	0	4		19	M	Tree (24" DBH) with partial roots exposed; undermining occurring just below the tree
5.00	37.9218900	-121.3212100	42.77	2.170	2.168	2.172	25	San Joaquin River	RD 0404	Boggs Tract	1	R	10/21/2008	5	1	2	2	0	0	1	4	5	22	M	Minor cave-in just above toe rip rap
6.00	37.9214938	-121.3205644	42.82	2.210	2.209	2.211	10	San Joaquin River	RD 0404	Boggs Tract	1	R	9/12/2006	5	1	3	2	0	0	1	4		18	M	Minor toe erosion above rip rap
7.00	37.9211463	-121.3199758	42.86	2.250	2.245	2.255	50	San Joaquin River	RD 0404	Boggs Tract	1	R	9/12/2006	5	1	3	3	1	0	2	4		22	M	Toe erosion above rip rap; squirrel holes
8.00	37.9184400	-121.2970400	1.56	1.450	1.322	1.578	1350	French Camp Slough	RD 0404	Boggs Tract	2	R	9/12/2006	5	4	4	5	0	0	3	4		30	U	Vertical rutting
2.50	37.8648200	-121.3272000	47.12	0.430	0.411	0.449	200	San Joaquin River	RD 0544	Upper Roberts Island	1	L	10/21/2008	5	2	4	4	0	3	3	3		28	U	Undermining; outside the bend; rodent holes; 3 trees (36" DBH) with roots exposed; cavein section
9.50	37.9365400	-121.3348100	41.39	0.790	0.789	0.791	15	San Joaquin River	RD 0524	Middle Roberts Island	1	L	10/18/2006	5	1	2	2	0	0	1	5		18	M	Another site near Site 9.5 about 50 ft. upstream of fence; exposed pipe
48.50	37.8778800	-121.3325500	46.12	5.650	5.647	5.653	30	San Joaquin River	RD 0524	Middle Roberts Island	1	L	11/4/2008	5	1	2	3	0	1	0	5		20	M	Old site repaired; new erosion forming, near-vertical scarp just above rip rap; u.s of Howards Road Bridge near abutment; steep slope
31.50	37.8095100	-121.3249900	53.09	10.330	10.321	10.339	100	San Joaquin River	RD 0017	Mossdale	2	R	9/12/2006											Not Rated	Sliding of revetment starting at upper slope; Inadequate photograph; Not Rated - No images currently available; UPDATE 3/10/09 - Images added; will be rated in the next cycle
1.00	37.7931200	-121.3081100	55.57	2.250	2.241	2.259	100	San Joaquin River	RD 2062	Stewart Tract	1	L	9/14/2006	5	1	2	3	0	0	1	3	5	23	U	Pocket erosion approximately 0.3-0.4 miles downstream from SPRR bridge - LM 2.3
2.00	37.8027200	-121.3137500	54.29	1.010	1.003	1.017	75	San Joaquin River	RD 2062	Stewart Tract	1	L	9/14/2006	3	1	2	4	0	0	1	1		16	M	Most likely sliding at base
3.00	37.8040800	-121.3140600	54.14	0.910	0.909	0.911	15	San Joaquin River	RD 2062	Stewart Tract	1	L	9/14/2006	5	1	2	4	0	3	0	0		19	M	Previously marked with stakes
1.00	37.8213800	-121.3769000	31.28	1.420	1.417	1.423	30	Old River	RD 2062	Stewart Tract	3	L	11/5/2008	5	1	2	2	0	3	0	1		16	M	Portion of rip rap collapsing; on the outside bend
2.00	37.8192900	-121.3788800	31.12	1.200	1.197	1.203	30	Old River	RD 2062	Stewart Tract	3	L	9/14/2006	5	1	2	2	0	4	5	3		24	U	1-2 feet into prism
3.00	37.8130700	-121.3831000	30.43	0.560	0.557	0.563	30	Old River	RD 2062	Stewart Tract	3	L	11/5/2008	5	1	2	4	1	4	0	3		24	U	Inside a bend; 5 ft. into levee prism
4.00	37.8106000	-121.3859100	30.19	0.270	0.265	0.275	50	Old River	RD 2062	Stewart Tract	3	L	11/5/2008	5	1	3	4	0	0	1	1		19	M	Top of vertical scarp is rip rap ready to collapse; minor rodent holes
5.00	37.8103300	-121.3869000	30.13	0.210	0.209	0.211	15	Old River	RD 2062	Stewart Tract	3	L	11/5/2008	5	1	3	2	0	0	1	1		15	M	3 sites, each 15' in length; small tree (12" DBH) directly above one site 2007 pictures do not match GPS and current condition
6.00	37.8097700	-121.3888800	30.02	0.090	0.052	0.128	400	Old River	RD 2062	Stewart Tract	3	L	11/5/2008	5	2	4	5	2	0	1	2		26	U	No change; combination of vertical scarp and pocket erosion on lower slope
1.00	37.8207600	-121.3783200	31.17	0.210	0.209	0.211	15	Old River	RD 0001	Union Island	1	R	11/5/2008											Not Rated	Photograph inadequate; minor rip rap slip; no change; signs of potential slipping from upper slope with longitudinal cracking; Not Rated
2.00	37.8116400	-121.3849300	30.25	1.130	1.125	1.135	50	Old River	RD 0001	Union Island	1	R	11/5/2008	5	1	2	4	0	4	2	0		22	M	No change; riprap placed during April 06 high water; toe rip rap has slipped
2.00	37.8104600	-121.3888700	30.02	0.220	0.220	0.220	5	Old River	RD 2089	Stark Tract	1	R	11/5/2008	3	0	3	3	0	0	1	3		16	M	Minor toe erosion
3.00	37.8100500	-121.3902600	29.95	0.300	0.295	0.305	50	Old River	RD 2089	Stark Tract	1	R	11/5/2008	5	1	2	5	0	0	1	2		21	M	Pocket erosion with vertical scarp; loss of rip rap; mild vegetation growth
5.00	37.8095300	-121.3921600	29.83	0.410	0.410	0.410	5	Old River	RD 2089	Stark Tract	1	R	11/5/2008	5	0	2	2	0	0	1	1		13	M	2 sites; steep upper slope; d.s. of pump
6.00	37.8097800	-121.3962300	29.61	0.660	0.658	0.662	20	Old River	RD 2089	Stark Tract	1	R	11/5/2008	5	1	2	5	2	3	3	1		27	U	No change; four rodent holes; wide levee crown
8.00	37.8055300	-121.4017000	29.11	1.180	1.179	1.181	10	Old River	RD 2089	Stark Tract	1	R	10/20/2006	4	1	3	5	0	0	0	3		21	M	Toe slough
9.00	37.8099600	-121.4132000	28.35	0.420	0.414	0.426	60	Old River	RD 2089	Stark Tract	2	R	11/5/2008	5	1	2	5	1	1	0	4		24	U	Cut into levee profile; riprap slide; rodent holes in bench; 2007 pictures do not match GPS and current condition; needs review
1.00	37.7898100	-121.3524900	3.97	4.510	4.485	4.535	260	Paradise Cut	RD 2058	Pescadero	1	L	9/10/2008	4	2	3	5	0	0	0	4		23	U	Two mature trees with 2.5' DBH; partial roots exposed
1.00	37.7636300	-121.3190000	6.74	0.730	0.725	0.735	50	Paradise Cut	RD 2095	Paradise Junction	1	L	7/22/2008	5	1	3	5	0	0	1	2		22	U	Downstream of WPRR near siphon pipe & pump; sandy levee; visited by Jeff Van Gilder and LRO in 2008 for assessment
2.00	37.7619600	-121.3181400	6.88	0.860	0.858	0.862	25	Paradise Cut	RD 2095	Paradise Junction	1	L	3/13/2007	5	1	4	5	0	0	2	2		24	U	Previous erosion site that is now partially protected with concrete rubble
3.00	37.7584700	-121.3071500	58.44	0.130	0.130	0.130	5	San Joaquin River	RD 2095	Paradise Junction	2	L	3/13/2007	5	0	0	4	0	0	0	3	5	21	M	Minor sinkhole at edge of crown road; approximately 200 ft of berm
4.00	37.7388800	-121.2982600	60.69	1.870	1.851	1.889	200	San Joaquin River	RD 2095	Paradise Junction	2	L	10/20/2006	5	2	2	5	0	0	1	3		23	U	Just upstream of where berm begins
1.00	37.7149800	-121.2785200	63.81	4.110	4.086	4.134	250	San Joaquin River	RD 2075	McMullin Ranch	1	R	8/12/2008											Not Rated	Immediately DS of old site #1;
2.00	37.7247700	-121.2790000	64.10	4.830	4.816	4.844	150	San Joaquin River	RD 2075	McMullin Ranch	1	R	8/12/2008											Not Rated	Small portion of ws levee slope covered in cobble (312 inches); tree roots partially exposed
3.00	37.7265510	-121.2783341	64.15	4.960	4.957	4.963	30	San Joaquin River	RD 2075	McMullin Ranch	1	R	8/17/2007	5	1	4	5	0	3	3	2		28	U	
4.00	37.7279327	-121.2744914	64.34	5.340	5.333	5.347	75	San Joaquin River	RD 2075	McMullin Ranch	1	R	8/17/2007	5	1	4	5	0	0	1	1		22	U	Irrigation pump inlet, 55% slope
1.00	37.6502587	-121.2289605	73.92	1.950	1.903	1.997	500	San Joaquin River	RD 2101	Blewett	1	L	8/30/2007	5	2	4	5	0	0	2	2		25	U	Recommended for short list of immediate repair sites; Silty sand levee material
1.00	37.2871040	-120.8743140	129.23	0.760	0.730	0.790	315	San Joaquin River	NA 0010	Lower San Joaquin Levee District	2a	L	8/18/2008	5	2	4	5	0	3	4	3		31	U	Scarp into levee crown; 7' remaining crown width; slight vegetation 2' tall
1.00	37.2192300	-120.6985300	0.94	0.780	0.767	0.793	140	Owens Creek	NA 0010	Lower San Joaquin Levee District	10	L	8/19/2008											Not Rated	50' ds of drop structure;
1.00	37.2009000	-120.7562300	0.79	19.290	19.270	19.310	210	Mariposa Bypass	NA 0010	Lower San Joaquin Levee District	1	R	8/19/2008											Not Rated	immediately upstream of Mariposa Bypass structure
17.00	37.2726300	-120.2803900		1.250	1.249	1.251	10	Owens Creek Diversion	NA 0013	Merced County Stream Group	3	R	8/26/2008	4	1	3	3	0	2	0	4		20	M	previously not rated; ponding occuring; 100' ds of bridge
1.00	37.0685700	-120.3986200	3.80	2.380	2.371	2.389	100	Ash Slough	NA 0011	Madera County	1	R	8/26/2008	2	1	2	5	0	0	1	0		16	M	Undulating waterside slope surface; sandy material; small area of concrete rubble found on waterside slope
2.00	37.0555958	-120.4126466	2.57	1.150	1.106	1.194	460	Ash Slough	NA 0011	Madera County	1	L	9/6/2007	5	2	3	3	0	0	2	2		20	M	
3.00	36.9681900	-120.2781100	6.06	5.370	5.367	5.373	30	Fresno River	NA 0011	Madera County	5	R	8/26/2008											Not Rated	
22.00	38.0458183	-121.0239550		0.860	0.405	1.315	4800	Mormon Slough	NA 0017M	San Joaquin FCD Mormon Slough	15a	R	2/6/2007	2	5	4	5	2	0	1	3		27	U	Lots of rodent holes; stakes are placed to track erosion; wide levee crown
23.00	38.0401700	-121.0338000		1.580	1.547	1.613	350	Mormon Slough	NA 0017M	San Joaquin FCD Mormon Slough	15a	R	2/6/2007	5	2	4	5	0	0	2	2		25	U	Near weir, no berm downstream; 10 ft wide berm upstream of site
33.00	38.1137300	-121.1720400		14.520	14.496	14.544	250	Bear Creek	NA 0017B	San Joaquin FCD Bear Creek	8	L	9/25/2008											Not Rated	Near agricultural inlet
34.00	38.0705730	-121.2189800		9.620	9.577	9.663	450	Bear Creek	NA 0017B	San Joaquin FCD Bear Creek	7	R	9/25/2008											Not Rated	Undermining of berm toe
35.00	38.1065500	-121.1745290		13.980	13.961	13.999	200	Bear Creek	NA 0017B	San Joaquin FCD Bear Creek	8	L	9/25/2008											Not Rated	Potential undermining of berm toe
36.00	38.1104080	-121.1723060		14.290	14.271	14.309	200	Bear Creek	NA 0017B	San Joaquin FCD Bear Creek	8	L	9/25/2008											Not Rated	Potential undermining of berm toe; approximately 200 ft ds of bridge
37.00	38.1129530	-121.1719850		14.470	14.469	14.471	15	Bear Creek	NA 0017B	San Joaquin FCD Bear Creek	8	L	9/25/2008											Not Rated	tailwater side of an ag. Inlet; undermining of bank and channel protection
38.00	38.1058950	-121.1764240		13.590	13.576	13.604	150	Bear Creek	NA 0017B	San Joaquin FCD Bear Creek	7	R	9/25/2008											Not Rated	Site re-visited 3/19/2009: No erosion found
1.00	37.7047400	-121.1591400		0.480	0.466	0.494	150	Stanislaus river	RD 2031	Elliot	1	L	9/6/2007	5	2	4	5	0	0	3	2		26	U	only 3' landside height differential
4.00	37.6373400	-121.2082200		2.950	2.907	2.993	450	San Joaquin River	RD 2031	Elliot	2	R	9/6/2007	5	2	4	5	0	0	1	2	5	29	U	Lots of vegetation on levee
1.00	37.5871300	-121.1628300		1.620	1.549	1.691	750	San Joaquin River	RD 2092	Dos Rios Ranch	0	R	8/9/2007	5	3	2	4	0	0	1	3		22	M	Not as serious - using lower rating
1.00	37.4474500	-121.0260900	105.50	2.720	2.719	2.721	10	San Joaquin River	RD 2063	Crows Landing	1	R	8/7/2007	5	1	1	2	0	0	2	2	5	20	M	Sinkhole; 7'x7'x2'
8.00	37.2706300	-120.2839700		0.420	0.415	0.425	50	Owens Creek Diversion	NA 0013	Merced County Stream Group	4	L	9/10/2007	5	1	1	4	0	0	1	4		20	M	GPS extended from opposite bank using Google Earth
14.00	37.2708000	-120.2841800		1.000	0.999	1.001	10	Owens Creek Diversion	NA 0013	Merced County Stream Group	3	R	9/11/2007	4	1	4	5	0	0	3	4		26	U	GPS extended from opposite bank using Google Earth
7.00	37.2722830	-120.2808690		0.210	0.144	0.276	700	Owens Creek Diversion	NA 0013	Merced County Stream Group	4	L	9/10/2007	3	3	4	4	0	3	3	3		27	U	GPS extended from opposite bank using Google Earth
32.50	37.8059823	-121.3238338	53.54	10.670	10.649	10.691	225	San Joaquin River	RD 0017	Mossdale	2	R	6/7/2007	5	2	2	5	0	3	0	3		25	U	Wave-wash damage; could be combined with Site 32? Visited site 6/7/07

Statistics:
M = 27
U = 25
Not Rated = 13
Total = 65

APPENDIX E – 2008 INVENTORY DATA SHEET INDEX

2008 Inventory Data Sheet Index

Erosion Site Number	LMA Code	Page Number
32.5	RD 0017	1
7	NA 0013	3
14	NA 0013	5
8	NA 0013	7
1	RD 2063	9
1	RD 2092	11
4	RD 2031	13
1	RD 2031	15
38	NA 0017B	17
37	NA 0017B	19
36	NA 0017B	21
35	NA 0017B	23
34	NA 0017B	25
33	NA 0017B	27
23	NA 0017M	29
22	NA 0017M	31
3	NA 0011	33
2	NA 0011	35
1	NA 0011	37
17	NA 0013	39
1	NA 0010	41
1	NA 0010	43
1	NA 0010	45
1	RD 2101	47
4	RD 2075	49
3	RD 2075	51
2	RD 2075	53
1	RD 2075	55
4	RD 2095	57
3	RD 2095	59
2	RD 2095	61
1	RD 2095	63
1	RD 2058	65
9	RD 2089	67
8	RD 2089	69
6	RD 2089	71
5	RD 2089	73
3	RD 2089	75
2	RD 2089	77
2	RD 0001	79
1	RD 0001	81
6	RD 2062	83
5	RD 2062	85
4	RD 2062	87
3	RD 2062	89
2	RD 2062	91
1	RD 2062	93
3	RD 2062	95
2	RD 2062	97
1	RD 2062	99
31.5	RD 0017	101
48.5	RD 0524	103
9.5	RD 0524	105
2.5	RD 0544	107
8	RD 0404	109
7	RD 0404	111
6	RD 0404	113
5	RD 0404	115
4	RD 0404	117
3	RD 0404	119
1	RD 0404	121
12	RD 0404	123
11	RD 0404	125
0.75	RD 0404	127
0.5	RD 0404	129

SOIL EROSION SURVEY

Erosion Site #	**32.50**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.80598	Latitude	**Erosion Height:**	7
	-121.32383	Longitude	**Erosion Length:**	225
River Mile:	53.54		**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	10.67		**Vegetation Cover:**	Mild
LMA Code:	RD 0017		**Comments:**	
Unit:	2		Wave-wash damage; could be combined with Site 32? Visited site 6/7/07	
Bank:	R			
Survey Date:	6/7/2007			

SOIL EROSION SURVEY

Erosion Site #	**7.00**		**Criteria:**	**Overall Rating:** **U**
Coordinate:	37.27228	Latitude	**Erosion Height:**	4
	-120.28087	Longitude	**Erosion Length:**	700
River Mile:			**Erosion Location:**	Toe & Slope
Stream Name:	Owens Creek Diversion		**Site and Bend:**	Outside of bend greater than 90 degree
Levee Mile:	0.21		**Vegetation Cover:**	Mild
LMA Code:	NA 0013		**Comments:**	
Unit:	4		GPS extended from opposite bank using Google Earth	
Bank:	L			
Survey Date:	9/10/2007			

SOIL EROSION SURVEY

Erosion Site #	**14.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.27080	Latitude	**Erosion Height:**	10
	-120.28418	Longitude	**Erosion Length:**	10
River Mile:			**Erosion Location:**	Toe & Slope
Stream Name:	Owens Creek Diversion		**Site and Bend:**	Outside of bend greater than 90 degree
Levee Mile:	1.00		**Vegetation Cover:**	Slight
LMA Code:	NA 0013		**Comments:**	
Unit:	3		GPS extended from opposite bank using Google Earth	
Bank:	R			
Survey Date:	9/11/2007			

SOIL EROSION SURVEY

Erosion Site #	**8.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.27063	Latitude	**Erosion Height:**	4
	-120.28397	Longitude	**Erosion Length:**	50
River Mile:			**Erosion Location:**	Middle Slope
Stream Name:	Owens Creek Diversion		**Site and Bend:**	Straight reach
Levee Mile:	0.42		**Vegetation Cover:**	Slight
LMA Code:	NA 0013		**Comments:**	
Unit:	4		GPS extended from opposite bank using Google Earth	
Bank:	L			
Survey Date:	9/10/2007			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.44745	Latitude	**Erosion Height:**	2
	-121.02609	Longitude	**Erosion Length:**	10
River Mile:	105.50		**Erosion Location:**	Middle Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Just downstream of a bend
Levee Mile:	2.72		**Vegetation Cover:**	Medium
LMA Code:	RD 2063		**Comments:**	
Unit:	1		Sinkhole; 7'x7'x2'	
Bank:	R			
Survey Date:	8/7/2007			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.58713	Latitude	**Erosion Height:**	4
	-121.16283	Longitude	**Erosion Length:**	750
River Mile:			**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	1.62		**Vegetation Cover:**	Mild
LMA Code:	RD 2092		**Comments:**	
Unit:	0		Not as serious - using lower rating	
Bank:	R			
Survey Date:	8/9/2007			

SOIL EROSION SURVEY

Erosion Site #	**4.00**		**Criteria:**	**Overall Rating:** **U**
Coordinate:	37.63734	Latitude	**Erosion Height:**	8
	-121.20822	Longitude	**Erosion Length:**	450
River Mile:			**Erosion Location:**	Toe & Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	2.95		**Vegetation Cover:**	Medium
LMA Code:	RD 2031		**Comments:**	
Unit:	2		Lots of vegetation on levee	
Bank:	R			
Survey Date:	9/6/2007			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.70474	Latitude	**Erosion Height:**	15
	-121.15914	Longitude	**Erosion Length:**	150
River Mile:			**Erosion Location:**	Toe & Slope
Stream Name:	Stanislaus river		**Site and Bend:**	Outside of bend greater than 90 degree
Levee Mile:	0.48		**Vegetation Cover:**	Medium
LMA Code:	RD 2031		**Comments:**	
Unit:	1		only 3' landside height differential	
Bank:	L			
Survey Date:	9/6/2007			

SOIL EROSION SURVEY

Erosion Site #	**38.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	38.10590	Latitude	**Erosion Height:**	5
	-121.17642	Longitude	**Erosion Length:**	150
River Mile:			**Erosion Location:**	Berm
Stream Name:	Bear Creek		**Site and Bend:**	Outside of bend greater than 90 degree
Levee Mile:	13.59		**Vegetation Cover:**	Moderate
LMA Code:	NA 0017B		**Comments:**	
Unit:	7		Site re-visited 3/19/2009 - no erosion found	
Bank:	R			
Survey Date:	9/25/2008			

SOIL EROSION SURVEY

Erosion Site #	**37.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	38.11295	Latitude	**Erosion Height:**	3
	-121.17199	Longitude	**Erosion Length:**	15
River Mile:			**Erosion Location:**	Berm
Stream Name:	Bear Creek		**Site and Bend:**	Straight reach
Levee Mile:	14.47		**Vegetation Cover:**	None
LMA Code:	NA 0017B		**Comments:**	
Unit:	8		tailwater side of an ag. Inlet; undermining of bank and channel protection	
Bank:	L			
Survey Date:	9/25/2008			

SOIL EROSION SURVEY

Erosion Site #	**36.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	38.11041	Latitude	**Erosion Height:**	6
	-121.17231	Longitude	**Erosion Length:**	200
River Mile:			**Erosion Location:**	Berm
Stream Name:	Bear Creek		**Site and Bend:**	Straight reach
Levee Mile:	14.29		**Vegetation Cover:**	Slight
LMA Code:	NA 0017B		**Comments:**	
Unit:	8		Potential undermining of berm toe; approximately 200 ft ds of bridge	
Bank:	L			
Survey Date:	9/25/2008			

SOIL EROSION SURVEY

Erosion Site #	**35.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	38.10655	Latitude	**Erosion Height:**	4
	-121.17453	Longitude	**Erosion Length:**	200
River Mile:			**Erosion Location:**	Berm
Stream Name:	Bear Creek		**Site and Bend:**	Just downstream of a bend
Levee Mile:	13.98		**Vegetation Cover:**	Slight
LMA Code:	NA 0017B		**Comments:**	
Unit:	8		Potential undermining of berm toe	
Bank:	L			
Survey Date:	9/25/2008			

SOIL EROSION SURVEY

Erosion Site #	**34.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	38.07057	Latitude	**Erosion Height:**	3
	-121.21898	Longitude	**Erosion Length:**	450
River Mile:			**Erosion Location:**	Berm
Stream Name:	Bear Creek		**Site and Bend:**	Inside of Bend
Levee Mile:	9.62		**Vegetation Cover:**	Slight
LMA Code:	NA 0017B		**Comments:**	
Unit:	7		Undermining of berm toe	
Bank:	R			
Survey Date:	9/25/2008			

SOIL EROSION SURVEY

Erosion Site #	**33.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	38.11373	Latitude	**Erosion Height:**	6
	-121.17204	Longitude	**Erosion Length:**	250
River Mile:			**Erosion Location:**	Berm
Stream Name:	Bear Creek		**Site and Bend:**	Straight reach
Levee Mile:	14.52		**Vegetation Cover:**	Slight
LMA Code:	NA 0017B		**Comments:**	
Unit:	8		Near agricultural inlet	
Bank:	L			
Survey Date:	9/25/2008			

SOIL EROSION SURVEY

Erosion Site #	**23.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	38.04017	Latitude	**Erosion Height:**	12
	-121.03380	Longitude	**Erosion Length:**	350
River Mile:			**Erosion Location:**	Toe & Slope
Stream Name:	Mormon Slough		**Site and Bend:**	Just downstream of a bend
Levee Mile:	1.58		**Vegetation Cover:**	Medium
LMA Code:	NA 0017M		**Comments:**	
Unit:	15a		Near weir, no berm downstream; 10 ft wide berm upstream of site	
Bank:	R			
Survey Date:	2/6/2007			

SOIL EROSION SURVEY

Erosion Site #	**22.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	38.04582	Latitude	**Erosion Height:**	12
	-121.02396	Longitude	**Erosion Length:**	4800
River Mile:			**Erosion Location:**	Toe & Slope
Stream Name:	Mormon Slough		**Site and Bend:**	Straight reach
Levee Mile:	0.86		**Vegetation Cover:**	Mild
LMA Code:	NA 0017M		**Comments:**	
Unit:	15a		Lots of rodent holes; stakes are placed to track erosion; wide levee crown	
Bank:	R			
Survey Date:	2/6/2007			

SOIL EROSION SURVEY

Erosion Site #	**3.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	36.96819	Latitude	**Erosion Height:**	4
	-120.27811	Longitude	**Erosion Length:**	30
River Mile:	6.06		**Erosion Location:**	Berm
Stream Name:	Fresno River		**Site and Bend:**	Straight reach
Levee Mile:	5.37		**Vegetation Cover:**	Moderate
LMA Code:	NA 0011		**Comments:**	
Unit:	5			
Bank:	R			
Survey Date:	8/26/2008			

SOIL EROSION SURVEY

Erosion Site #	**2.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.05560	Latitude	**Erosion Height:**	3
	-120.41265	Longitude	**Erosion Length:**	460
River Mile:	2.57		**Erosion Location:**	Toe
Stream Name:	Ash Slough		**Site and Bend:**	Just downstream of a bend
Levee Mile:	1.15		**Vegetation Cover:**	Medium
LMA Code:	NA 0011		**Comments:**	
Unit:	1			
Bank:	L			
Survey Date:	9/6/2007			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.06857	Latitude	**Erosion Height:**	5
	-120.39862	Longitude	**Erosion Length:**	100
River Mile:	3.80		**Erosion Location:**	Middle Slope
Stream Name:	Ash Slough		**Site and Bend:**	Straight reach
Levee Mile:	2.38		**Vegetation Cover:**	Dense
LMA Code:	NA 0011		**Comments:**	
Unit:	1		Undulating waterside slope surface; sandy material; small area of concrete rubble found on waterside slope	
Bank:	R			
Survey Date:	8/26/2008			

SOIL EROSION SURVEY

Erosion Site #	**17.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.27263	Latitude	**Erosion Height:**	3
	-120.28039	Longitude	**Erosion Length:**	10
River Mile:			**Erosion Location:**	Toe
Stream Name:	Owens Creek Diversion		**Site and Bend:**	Inside of Bend
Levee Mile:	1.25		**Vegetation Cover:**	Slight
LMA Code:	NA 0013		**Comments:**	
Unit:	3		previously not rated; ponding occuring; 100' ds of bridge	
Bank:	R			
Survey Date:	8/26/2008			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	37.20090	Latitude	**Erosion Height:**	5
	-120.75623	Longitude	**Erosion Length:**	210
River Mile:	0.79		**Erosion Location:**	Berm
Stream Name:	Mariposa Bypass		**Site and Bend:**	Straight reach
Levee Mile:	19.29		**Vegetation Cover:**	Slight
LMA Code:	NA 0010		**Comments:**	
Unit:	1		immediately upstream of Mariposa Bypass structure	
Bank:	R			
Survey Date:	8/19/2008			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	37.21923	Latitude	**Erosion Height:**	6
	-120.69853	Longitude	**Erosion Length:**	140
River Mile:	0.94		**Erosion Location:**	Berm
Stream Name:	Owens Creek		**Site and Bend:**	Straight reach
Levee Mile:	0.78		**Vegetation Cover:**	Slight
LMA Code:	NA 0010		**Comments:**	
Unit:	10		50' ds of drop structure;	
Bank:	L			
Survey Date:	8/19/2008			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.28710	Latitude	**Erosion Height:**	20
	-120.87431	Longitude	**Erosion Length:**	315
River Mile:	129.23		**Erosion Location:**	Toe & Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Outside of bend at 90 degree turn
Levee Mile:	0.76		**Vegetation Cover:**	Mild
LMA Code:	NA 0010		**Comments:**	
Unit:	2a		Scarp into levee crown; 7' remaining crown width; slight vegetation 2' tall	
Bank:	L			
Survey Date:	8/18/2008			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.65026	Latitude	**Erosion Height:**	10
	-121.22896	Longitude	**Erosion Length:**	500
River Mile:	73.92		**Erosion Location:**	Toe & Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Just downstream of a bend
Levee Mile:	1.95		**Vegetation Cover:**	Medium
LMA Code:	RD 2101		**Comments:**	
Unit:	1		Recommended for short list of immediate repair sites; Silty sand levee material	
Bank:	L			
Survey Date:	8/30/2007			

SOIL EROSION SURVEY

Erosion Site #	**4.00**		**Criteria:**	**Overall Rating:** **U**
Coordinate:	37.72793	Latitude	**Erosion Height:**	20
	-121.27449	Longitude	**Erosion Length:**	75
River Mile:	64.34		**Erosion Location:**	Toe & Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	5.34		**Vegetation Cover:**	Moderate
LMA Code:	RD 2075		**Comments:**	
Unit:	1		Irrigation pump inlet, 55% slope	
Bank:	R			
Survey Date:	8/17/2007			

SOIL EROSION SURVEY

Erosion Site #	**3.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.72655	Latitude	**Erosion Height:**	15
	-121.27833	Longitude	**Erosion Length:**	30
River Mile:	64.15		**Erosion Location:**	Toe & Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Outside of bend greater than 90 degree
Levee Mile:	4.96		**Vegetation Cover:**	Medium
LMA Code:	RD 2075		**Comments:**	
Unit:	1			
Bank:	R			
Survey Date:	8/17/2007			

SOIL EROSION SURVEY

Erosion Site #	**2.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	37.72477	Latitude	**Erosion Height:**	5
	-121.27900	Longitude	**Erosion Length:**	150
River Mile:	64.10		**Erosion Location:**	Berm
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	4.83		**Vegetation Cover:**	Slight
LMA Code:	RD 2075		**Comments:**	
Unit:	1		Small portion of ws levee slope covered in cobble (312 inches); tree roots partially exposed	
Bank:	R			
Survey Date:	8/12/2008			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	37.71498	Latitude	**Erosion Height:**	5
	-121.27852	Longitude	**Erosion Length:**	250
River Mile:	63.81		**Erosion Location:**	Berm
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	4.11		**Vegetation Cover:**	Medium
LMA Code:	RD 2075		**Comments:**	
Unit:	1		Immediately DS of old site #1;	
Bank:	R			
Survey Date:	8/12/2008			

SOIL EROSION SURVEY

Erosion Site #	**4.00**		**Criteria:**	**Overall Rating:** **U**
Coordinate:	37.73888	Latitude	**Erosion Height:**	10
	-121.29826	Longitude	**Erosion Length:**	200
River Mile:	60.69		**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	1.87		**Vegetation Cover:**	Mild
LMA Code:	RD 2095		**Comments:**	
Unit:	2		Just upstream of where berm begins	
Bank:	L			
Survey Date:	10/20/2006			

SOIL EROSION SURVEY

Erosion Site #	**3.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.75847	Latitude	**Erosion Height:**	4
	-121.30715	Longitude	**Erosion Length:**	5
River Mile:	58.44		**Erosion Location:**	Upper Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	0.13		**Vegetation Cover:**	Mild
LMA Code:	RD 2095		**Comments:**	
Unit:	2		Minor sinkhole at edge of crown road; approximately 200 ft of berm	
Bank:	L			
Survey Date:	3/13/2007			

SOIL EROSION SURVEY

Erosion Site #	**2.00**		**Criteria:**	**Overall Rating:** **U**
Coordinate:	37.76196	Latitude	**Erosion Height:**	7
	-121.31814	Longitude	**Erosion Length:**	25
River Mile:	6.88		**Erosion Location:**	Toe & Slope
Stream Name:	Paradise Cut		**Site and Bend:**	Just downstream of a bend
Levee Mile:	0.86		**Vegetation Cover:**	Medium
LMA Code:	RD 2095		**Comments:**	
Unit:	1		Previous erosion site that is now partially protected with concrete rubble	
Bank:	L			
Survey Date:	3/13/2007			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** **U**
Coordinate:	37.76363	Latitude	**Erosion Height:**	8
	-121.31900	Longitude	**Erosion Length:**	50
River Mile:	6.74		**Erosion Location:**	Toe
Stream Name:	Paradise Cut		**Site and Bend:**	Straight reach
Levee Mile:	0.73		**Vegetation Cover:**	Medium
LMA Code:	RD 2095		**Comments:**	
Unit:	1		Downstream of WPRR near siphon pipe & pump; sandy levee; visited by Jeff Van Gilder and LRO in 2008 for assessment	
Bank:	L			
Survey Date:	7/22/2008			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.78981	Latitude	**Erosion Height:**	8
	-121.35249	Longitude	**Erosion Length:**	260
River Mile:	3.97		**Erosion Location:**	Toe
Stream Name:	Paradise Cut		**Site and Bend:**	Inside of Bend
Levee Mile:	4.51		**Vegetation Cover:**	Slight
LMA Code:	RD 2058		**Comments:**	
Unit:	1		Two mature trees with 2.5' DBH; partial roots exposed	
Bank:	L			
Survey Date:	9/10/2008			

SOIL EROSION SURVEY

Erosion Site #	**9.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.80996	Latitude	**Erosion Height:**	6
	-121.41320	Longitude	**Erosion Length:**	60
River Mile:	28.35		**Erosion Location:**	Lower Slope
Stream Name:	Old River		**Site and Bend:**	Inside of Bend
Levee Mile:	0.42		**Vegetation Cover:**	Slight
LMA Code:	RD 2089		**Comments:**	
Unit:	2		Cut into levee profile; riprap slide; rodent holes in bench; 2007 pictures do not match GPS and current condition; needs review	
Bank:	R			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**8.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.80553	Latitude	**Erosion Height:**	5
	-121.40170	Longitude	**Erosion Length:**	10
River Mile:	29.11		**Erosion Location:**	Toe
Stream Name:	Old River		**Site and Bend:**	Inside of Bend
Levee Mile:	1.18		**Vegetation Cover:**	Mild
LMA Code:	RD 2089		**Comments:**	
Unit:	1		Toe slough	
Bank:	R			
Survey Date:	10/20/2006			

SOIL EROSION SURVEY

Erosion Site #	**6.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.80978	Latitude	**Erosion Height:**	5
	-121.39623	Longitude	**Erosion Length:**	20
River Mile:	29.61		**Erosion Location:**	Lower Slope
Stream Name:	Old River		**Site and Bend:**	Outside of bend greater than 90 degree
Levee Mile:	0.66		**Vegetation Cover:**	Moderate
LMA Code:	RD 2089		**Comments:**	
Unit:	1		No change; four rodent holes; wide levee crown	
Bank:	R			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**5.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.80953	Latitude	**Erosion Height:**	2
	-121.39216	Longitude	**Erosion Length:**	5
River Mile:	29.83		**Erosion Location:**	Lower Slope
Stream Name:	Old River		**Site and Bend:**	Straight reach
Levee Mile:	0.41		**Vegetation Cover:**	Moderate
LMA Code:	RD 2089		**Comments:**	
Unit:	1		2 sites; steep upper slope; d.s. of pump	
Bank:	R			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**3.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.81005	Latitude	**Erosion Height:**	7
	-121.39026	Longitude	**Erosion Length:**	50
River Mile:	29.95		**Erosion Location:**	Lower Slope
Stream Name:	Old River		**Site and Bend:**	Straight reach
Levee Mile:	0.30		**Vegetation Cover:**	Medium
LMA Code:	RD 2089		**Comments:**	
Unit:	1		Pocket erosion with vertical scarp; loss of rip rap; mild vegetation growth	
Bank:	R			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**2.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.81046	Latitude	**Erosion Height:**	3
	-121.38887	Longitude	**Erosion Length:**	5
River Mile:	30.02		**Erosion Location:**	Toe
Stream Name:	Old River		**Site and Bend:**	Straight reach
Levee Mile:	0.22		**Vegetation Cover:**	Mild
LMA Code:	RD 2089		**Comments:**	
Unit:	1		Minor toe erosion	
Bank:	R			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**2.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.81164	Latitude	**Erosion Height:**	4
	-121.38493	Longitude	**Erosion Length:**	50
River Mile:	30.25		**Erosion Location:**	Lower Slope
Stream Name:	Old River		**Site and Bend:**	Just downstream of a bend
Levee Mile:	1.13		**Vegetation Cover:**	Dense
LMA Code:	RD 0001		**Comments:**	
Unit:	1		No change; riprap placed during April 06 high water; toe rip rap has slipped	
Bank:	R			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	37.82076	Latitude	**Erosion Height:**	2
	-121.37832	Longitude	**Erosion Length:**	15
River Mile:	31.17		**Erosion Location:**	Middle Slope
Stream Name:	Old River		**Site and Bend:**	Just downstream of a bend
Levee Mile:	0.21		**Vegetation Cover:**	Moderate
LMA Code:	RD 0001		**Comments:**	
Unit:	1		Photograph inadequate; minor rip rap slip; no change; signs of potential slipping from upper slope with longitudinal cracking; Not Rated	
Bank:	R			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**6.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.80977	Latitude	**Erosion Height:**	5
	-121.38888	Longitude	**Erosion Length:**	400
River Mile:	30.02		**Erosion Location:**	Toe & Slope
Stream Name:	Old River		**Site and Bend:**	Straight reach
Levee Mile:	0.09		**Vegetation Cover:**	Medium
LMA Code:	RD 2062		**Comments:**	
Unit:	3		No change; combination of vertical scarp and pocket erosion on lower slope	
Bank:	L			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**5.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.81033	Latitude	**Erosion Height:**	2
	-121.38690	Longitude	**Erosion Length:**	15
River Mile:	30.13		**Erosion Location:**	Toe
Stream Name:	Old River		**Site and Bend:**	Straight reach
Levee Mile:	0.21		**Vegetation Cover:**	Moderate
LMA Code:	RD 2062		**Comments:**	
Unit:	3		3 sites, each 15' in length; small tree (12" DBH) directly above one site 2007 pictures do not match GPS and current condition	
Bank:	L			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**4.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.81060	Latitude	**Erosion Height:**	4
	-121.38591	Longitude	**Erosion Length:**	50
River Mile:	30.19		**Erosion Location:**	Toe
Stream Name:	Old River		**Site and Bend:**	Straight reach
Levee Mile:	0.27		**Vegetation Cover:**	Moderate
LMA Code:	RD 2062		**Comments:**	
Unit:	3		Top of vertical scarp is rip rap ready to collapse; minor rodent holes	
Bank:	L			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**3.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.81307	Latitude	**Erosion Height:**	4
	-121.38310	Longitude	**Erosion Length:**	30
River Mile:	30.43		**Erosion Location:**	Lower Slope
Stream Name:	Old River		**Site and Bend:**	Inside of Bend
Levee Mile:	0.56		**Vegetation Cover:**	Mild
LMA Code:	RD 2062		**Comments:**	
Unit:	3		Inside a bend; 5 ft. into levee prism	
Bank:	L			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**2.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.81929	Latitude	**Erosion Height:**	2
	-121.37888	Longitude	**Erosion Length:**	30
River Mile:	31.12		**Erosion Location:**	Middle Slope
Stream Name:	Old River		**Site and Bend:**	Outside of tight bend less than 90 degree
Levee Mile:	1.20		**Vegetation Cover:**	MIld
LMA Code:	RD 2062		**Comments:**	
Unit:	3		1-2 feet into prism	
Bank:	L			
Survey Date:	9/14/2006			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.82138	Latitude	**Erosion Height:**	2
	-121.37690	Longitude	**Erosion Length:**	30
River Mile:	31.28		**Erosion Location:**	Lower slope
Stream Name:	Old River		**Site and Bend:**	Inside of Bend
Levee Mile:	1.42		**Vegetation Cover:**	Moderate
LMA Code:	RD 2062		**Comments:**	
Unit:	3		Portion of rip rap collapsing; on the outside bend	
Bank:	L			
Survey Date:	11/5/2008			

SOIL EROSION SURVEY

Erosion Site #	**3.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.80408	Latitude	**Erosion Height:**	4
	-121.31406	Longitude	**Erosion Length:**	15
River Mile:	54.14		**Erosion Location:**	Middle Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	0.91		**Vegetation Cover:**	Dense
LMA Code:	RD 2062		**Comments:**	
Unit:	1		Previously marked with stakes	
Bank:	L			
Survey Date:	9/14/2006			

SOIL EROSION SURVEY

Erosion Site #	**2.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.80272	Latitude	**Erosion Height:**	4
	-121.31375	Longitude	**Erosion Length:**	75
River Mile:	54.29		**Erosion Location:**	Middle Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	1.01		**Vegetation Cover:**	Moderate
LMA Code:	RD 2062		**Comments:**	
Unit:	1		Most likely sliding at base	
Bank:	L			
Survey Date:	9/14/2006			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.79312	Latitude	**Erosion Height:**	3
	-121.30811	Longitude	**Erosion Length:**	100
River Mile:	55.57		**Erosion Location:**	Middle Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	2.25		**Vegetation Cover:**	Mild
LMA Code:	RD 2062		**Comments:**	
Unit:	1		Pocket erosion approximately 0.3-0.4 miles downstream from SPRR bridge - LM 2.3	
Bank:	L			
Survey Date:	9/14/2006			

SOIL EROSION SURVEY

Erosion Site #	**31.50**		**Criteria:**	**Overall Rating:** **Not Rated**
Coordinate:	37.80951	Latitude	**Erosion Height:**	10
	-121.32499	Longitude	**Erosion Length:**	100
River Mile:	53.09		**Erosion Location:**	Toe to Crown
Stream Name:	San Joaquin River		**Site and Bend:**	Just downstream of a bend
Levee Mile:	10.33		**Vegetation Cover:**	Slight
LMA Code:	RD 0017		**Comments:**	
Unit:	2		Sliding of revetment starting at upper slope; Inadequate photograph; Not Rated; No images available currently. UPDATE 3/10/09 - Image added; will be rated in the following cycle	
Bank:	R			
Survey Date:	9/12/2006			

SOIL EROSION SURVEY

Erosion Site #	**48.50**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.87788	Latitude	**Erosion Height:**	3
	-121.33255	Longitude	**Erosion Length:**	30
River Mile:	46.12		**Erosion Location:**	Middle Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	5.65		**Vegetation Cover:**	None
LMA Code:	RD 0524		**Comments:**	
Unit:	1		Old site repaired; new erosion forming, near-vertical scarp just above rip rap; u.s of Howards Road Bridge near abutment; steep slope	
Bank:	L			
Survey Date:	11/4/2008			

SOIL EROSION SURVEY

Erosion Site #	**9.50**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.93654	Latitude	**Erosion Height:**	2
	-121.33481	Longitude	**Erosion Length:**	15
River Mile:	41.39		**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	0.79		**Vegetation Cover:**	None
LMA Code:	RD 0524		**Comments:**	
Unit:	1		Another site near Site 9.5 about 50 ft. upstream of fence; exposed pipe	
Bank:	L			
Survey Date:	10/18/2006			

SOIL EROSION SURVEY

Erosion Site #	**2.50**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.86482	Latitude	**Erosion Height:**	4
	-121.32720	Longitude	**Erosion Length:**	200
River Mile:	47.12		**Erosion Location:**	Toe & Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Outside of bend greater than 90 degree
Levee Mile:	0.43		**Vegetation Cover:**	Mild
LMA Code:	RD 0544		**Comments:**	
Unit:	1		Undermining; outside the bend; rodent holes; 3 trees (36" DBH) with roots exposed; cavein section	
Bank:	L			
Survey Date:	10/21/2008			

SOIL EROSION SURVEY

Erosion Site #	**8.00**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.91844	Latitude	**Erosion Height:**	12
	-121.29704	Longitude	**Erosion Length:**	1350
River Mile:	1.56		**Erosion Location:**	Toe & Slope
Stream Name:	French Camp Slough		**Site and Bend:**	Outside of bend greater than 90 degree
Levee Mile:	1.45		**Vegetation Cover:**	Slight
LMA Code:	RD 0404		**Comments:**	
Unit:	2		Vertical rutting	
Bank:	R			
Survey Date:	9/12/2006			

SOIL EROSION SURVEY

Erosion Site #	**7.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.92115	Latitude	**Erosion Height:**	3
	-121.31998	Longitude	**Erosion Length:**	50
River Mile:	42.86		**Erosion Location:**	Toe
Stream Name:	San Joaquin River		**Site and Bend:**	Just downstream of a bend
Levee Mile:	2.25		**Vegetation Cover:**	Slight
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Toe erosion above rip rap; squirrel holes	
Bank:	R			
Survey Date:	9/12/2006			

SOIL EROSION SURVEY

Erosion Site #	**6.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.92149	Latitude	**Erosion Height:**	2
	-121.32056	Longitude	**Erosion Length:**	10
River Mile:	42.82		**Erosion Location:**	Toe
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	2.21		**Vegetation Cover:**	Slight
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Minor toe erosion above rip rap	
Bank:	R			
Survey Date:	9/12/2006			

SOIL EROSION SURVEY

Erosion Site #	**5.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.92189	Latitude	**Erosion Height:**	2
	-121.32121	Longitude	**Erosion Length:**	25
River Mile:	42.77		**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	2.17		**Vegetation Cover:**	Slight
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Minor cave-in just above toe rip rap	
Bank:	R			
Survey Date:	10/21/2008			

SOIL EROSION SURVEY

Erosion Site #	**4.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.92394	Latitude	**Erosion Height:**	3
	-121.32317	Longitude	**Erosion Length:**	60
River Mile:	42.57		**Erosion Location:**	Toe
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	1.98		**Vegetation Cover:**	Slight
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Tree (24" DBH) with partial roots exposed; undermining occurring just below the tree	
Bank:	R			
Survey Date:	10/21/2008			

SOIL EROSION SURVEY

Erosion Site #	**3.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.92573	Latitude	**Erosion Height:**	3
	-121.32420	Longitude	**Erosion Length:**	40
River Mile:	42.44		**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	1.85		**Vegetation Cover:**	None
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Several trees (12-18" DBH) with partial roots exposed	
Bank:	R			
Survey Date:	10/21/2008			

SOIL EROSION SURVEY

Erosion Site #	**1.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.92871	Latitude	**Erosion Height:**	4
	-121.32722	Longitude	**Erosion Length:**	7
River Mile:	42.17		**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	1.57		**Vegetation Cover:**	None
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Loss of riprap below Garwood Bridge;	
Bank:	R			
Survey Date:	10/21/2008			

SOIL EROSION SURVEY

Erosion Site #	**12.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.93964	Latitude	**Erosion Height:**	4
	-121.33774	Longitude	**Erosion Length:**	40
River Mile:	41.14		**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	0.51		**Vegetation Cover:**	Slight
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Sliding effect on lower slope just above toe rip rap	
Bank:	R			
Survey Date:	10/21/2008			

SOIL EROSION SURVEY

Erosion Site #	**11.00**		**Criteria:**	**Overall Rating:** M
Coordinate:	37.93948	Latitude	**Erosion Height:**	3
	-121.34070	Longitude	**Erosion Length:**	40
River Mile:	40.98		**Erosion Location:**	Lower Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	0.34		**Vegetation Cover:**	Slight
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Wave was erosion above toe rip rap	
Bank:	R			
Survey Date:	10/21/2008			

SOIL EROSION SURVEY

Erosion Site #	**0.75**		**Criteria:**	**Overall Rating:** U
Coordinate:	37.93944	Latitude	**Erosion Height:**	8
	-121.34157	Longitude	**Erosion Length:**	100
River Mile:	40.93		**Erosion Location:**	Toe & Slope
Stream Name:	San Joaquin River		**Site and Bend:**	Straight reach
Levee Mile:	0.30		**Vegetation Cover:**	Moderate
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Wave wash erosion; pocket erosion on toe; located u.s. of bend; upper slope has no protection	
Bank:	R			
Survey Date:	10/21/2008			

SOIL EROSION SURVEY

Erosion Site #	**0.50**		**Criteria:**	**Overall Rating:** **U**
Coordinate:	37.93948	Latitude	**Erosion Height:**	8
	-121.34273	Longitude	**Erosion Length:**	30
River Mile:	40.86		**Erosion Location:**	Lower slope
Stream Name:	San Joaquin River		**Site and Bend:**	Inside of Bend
Levee Mile:	0.23		**Vegetation Cover:**	Moderate
LMA Code:	RD 0404		**Comments:**	
Unit:	1		Wave wash erosion; pocket erosion; located on the inside bend	
Bank:	R			
Survey Date:	10/21/2008			