

Final Project Report

San Luis and Delta Mendota Water Authority

**AGRICULTURAL DISCHARGE MANAGEMENT PROGRAM MONITORING AND
EVALUATION-WEST STANISLAUS COUNTY**

July 15, 2008

San Joaquin River

Orestimba Creek and Del Puerto Creek Sub-Watersheds

Project Type: WC § 79114

Reduce the discharge of pollutants to state waters from non-point sources

Funded by: Proposition 13 Funds

Table of Contents

II. Contract Summary

III. Table of Contents

IV. Executive Summary

V. Problem Statement & Relevant Issues

VI. Project Goals

VII. Project Description

Project Type

Project Costs – total costs; matching funds & fund sources

Existing Data

Monitoring Data

BMP Data

Project Methodology

Task 1: Quality Assurance Project Plan and Monitoring Plan

Task 2.1: Project Assessment and Evaluation Plan (PAEP)

Task 2.2: Technical Advisory Committee (TAC)

Task 2.3: Compile data from previous studies

Review of Historical Data

Analysis of diazinon and chlorpyrifos data

Trend Analysis of Flows in the San Joaquin River

Task 2.5 Monitor Regional Water Quality

Task 2.6 Analyze Flow and Water Quality

Task 2.7 Analyze Four BMPs Active within WSC

Vegetative Ditches

Retention Ponds

Constructed Wetlands

Use of Polyacrylamide (PAM)

Task 2.8 Develop Guidelines for BMP Selection

Task 2.9 Outreach and Education

Task 2.10 Draft and Final Project Reports

VIII. Public Outreach

IX. Conclusions

Project Evaluation & Effectiveness

Lessons Learned

Next Steps and Sustainability

X. Appendices

Appendix 1- List of References

Appendix 3- Project Assessment and Evaluation Plan (PAEP)

Appendix 4- Technical Advisory Committee (TAC)

Appendix 5- Historical Water Quality Data

Appendix 6- Monitoring Station Upgrades

Appendix 7 – Statistical Comparison of Flow Rates for San Joaquin Drainages and the San Joaquin Region 60-20-20 Water Supply Index for 2000-2006

Appendix 8 – Flow Summary for San Joaquin Monitoring Sites

Appendix 9 – Water Quality Measurements

Appendix 10 – Summary and Analysis of Monitoring Data

Appendix 11 – BMP Studies

Appendix 12- BMP Recommendations

Appendix 13 – Chlorpyrifos Absorption Study

Appendix 14- Bibliography of Submitted Studies

Task 2.7 Analyze Four BMPs Active within WSC

The project focused on examining and evaluating four BMPs currently being practiced within WSC--- vegetative ditches, retention ponds, wetlands and on-field practices such as the use of polyacrylamide (PAM). A map of the BMP Study sites is provided in Figure 11.

Constructed Wetlands

The wetland study site (Figure 19) is a permanent wetland originally constructed to retain irrigation drainage as part of a catfish-farming operation in the mid-1960s. This pond has a surface area of 20 acres, an approximate volume of 40 acre-feet, and receives flow from approximately 5,000 acres of farmland. Sediments are not excavated or otherwise managed in this wetland. The original inlet to the pond was at the southwest corner, but WSC drainage contains high sediment loads and this inlet is no longer open. The current inlet is approximately mid-pond on the eastside and entering drainage does not completely mix into the wetland, but has a preferential flow path along the eastside to the outlet. The wetland is a biologically active system characterized by broad swaths of native rushes, biologically active sediments, and shallow depths (approximately two feet). Documentation of field work at this site and presentation of continuous monitoring data is presented in Appendix 11.

Figure 19: Aerial view of wetland study site



Mean concentration data for seven water quality parameters (dissolved organic carbon (DOC), mineral suspended solids (MSS), ammonia nitrogen (NH_4N), nitrate and nitrite nitrogen ($\text{NO}_3\text{-N}$), soluble phosphate ($\text{PO}_4\text{-P}$), biochemical oxygen demand (BOD) and chlorophyll-a (Chl-a) as measure by phytoplankton biomass) measured at the inlet and outlet of the wetland are presented in Table 14. DOC and $\text{NH}_4\text{-N}$ concentrations were not statistically different between the inlet and outlet of the wetland (probabilities > 0.10 by both the parametric *t*-test and nonparametric Z-test) and therefore, the wetlands had very little effect on these constituents.

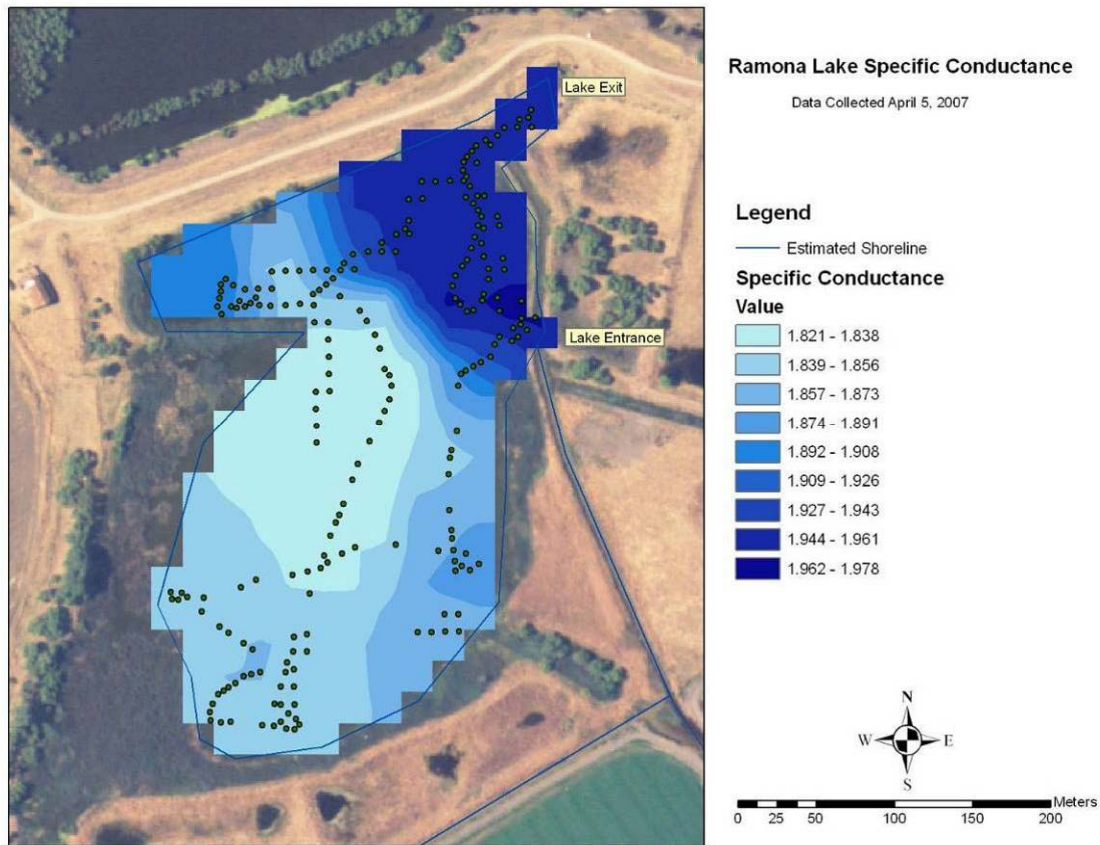
Table 14: Water quality changes occurring in wetland system.

Parameter ¹	Level	Number	Mean (mg/L)	Std Dev (mg/L)	Probability ² > t	Probability ² > Z
DOC	in	15	6.8	1.1	0.186	0.473
	out	17	7.4	1.3		
MSS	in	15	122	70	0.067	0.054
	out	17	83	39		
NH ₄ -N	in	13	0.28	0.19	0.754	0.139
	out	14	0.24	0.36		
NO ₃ -N	in	13	3.52	1.35	0.001	0.002
	out	15	1.76	1.08		
PO ₄ -P	in	13	0.24	0.15	0.011	0.006
	out	15	0.10	0.12		
BOD	in	7	10.9	2.4	0.001	0.002
	out	9	21.5	6.4		
Chl-a	in	15	0.020	0.032	0.001	0.002
	out	17	0.107	0.089		

¹DOC: dissolved organic carbon, MSS: mineral suspended solids, NH₄-N: ammonia nitrogen, NO₃-N: nitrate and nitrite nitrogen, PO₄-P: soluble reactive phosphate as P, BOD: 10 day biochemical oxygen demand, Chl-a: chlorophyll-a as a measure of phytoplankton biomass. ²Probability that inlet and outlet are different by parametric (*t*) and nonparametric (*Z*) test (see methods for explanation). For example, a probability value of 0.050 indicates the inlet and outlet have a 95% probability of being different.

As was observed with the pond study site, impounding drainage water in the wetland resulted in the removal of a significant amount of suspended sediments (MSS), but the efficiency of removal was significantly less in the wetland than the pond (31% vs. 71%). This is not surprising considering that the wetland has a load of approximately 125 farm-acres/acre-foot of wetland and the pond has a load of 96 farm-acres/acre-foot of pond. Additionally, the pond was designed specifically for sediment removal and flow in the wetland short-circuits much of the pond (see Figure 20).

Figure 20: Mapping of flow at the wetland site using conductivity measurements (note: short-circuiting of flow between inlet and outlet)



PO₄-P removal was greater at the wetland (58%) than the pond (40%). The difference in PO₄-P removal can be explained by the presence of active biological processes occurring in the wetland, including the nutrient demand by emergent vegetation and phytoplankton growth.

Significant NO₃-N removal occurred in the wetland (50%), but not at the reservoir. This difference can clearly be attributed to the increased biological activity at the wetland. NO₃-N is a nutrient for phytoplankton and emergent vegetation and a portion of the NO₃-N removal could be from nutrient demand. Another important process for NO₃-N removal is anaerobic respiration, where sediment dwelling bacteria consume nitrate while oxidizing decaying plant material (Burt and Pinay, 2005).

Disclosure: Funding for this project has been provided in full or in part through an Agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Proposition 13) and any amendments thereto. The contents of this document do not necessarily reflect the views and policies of the SWRCB. Information regarding equipment and other entities was provided solely for presenting testing materials required for the work and does not imply an endorsement of the entities or products.