Farmington Groundwater Recharge/Seasonal Habitat Study

Final Report

Prepared by:

Montgomery Watson Harza
Sacramento, CA

For:

U.S. Army Corps of Engineers
Sacramento District

August 2001

TABLE OF CONTENTS

PLATES

APPENDICES

LIST OF TABLES

Items **Page**

LIST OF FIGURES

Items **Follows Page**

LIST OF ACRONYMS AND ABBREVIATIONS

af	acre-feet
af/yr	acre-feet per year
API	aerial photography interpretation
ARWRI	American River Water Resources Investigation
ASTM	American Society for Testing Materials
bgs	below ground surface
BNSF	Burlington Northern and Sante Fe
USBR	U.S. Bureau of Reclamation
CALFED	California Federal Bay-Delta Program
CalSites	California Environmental Protection Agency Site Listings
Cal Water	California Water Service Company
CCWD	Calaveras County Water District
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
cfs	cubic-feet per second
CNPS	California Native Plant Society
Corps	U.S. Army Corps of Engineers
CSJWCD	Central San Joaquin Water Conservation District
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DBCP	dibromochloropropane
DMG	Division of Mines and Geology
DMM	Data Management Model
DPR	California Department of Pesticide Regulation
DWR	Department of Water Resources
EA/FONSI	Environmental Assessment/Finding of No Significant Impact
EBMUD	East Bay Municipal Utility District
ECC	Executive Coordinating Committee
EDB	ethylene dibromide
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
EPA	California Environmental Protection Agency
ESA	Environmental Site Assessment
ESJP	Eastern San Joaquin Parties
ESJPWA	Eastern San Joaquin Parties Water Authority
FCWCD	Flood Control and Water Conservation District
FS	Feasibility Study
FSCA	Feasibility Study Cost Sharing Agreement
ft	Feet
ft/day	feet per day
FWS	U.S. Fish and Wildlife Service
GIS	geographic information system
HCP	Habitat Conservation Plan

HTRW	Hazardous Toxic Radiologic Waste
IGSM	integrated groundwater and surface water model
IS/ND	Initial Study/Negative Declaration
LCSA	local sponsor cost sharing agreement
LER	leans, easements, and right-of-way
LUST	leaking underground storage tank
MARS	Mokelumne Aquifer Recharge and Storage
mg/l	milligrams per liter
MRA	Mokelumne River Aqueduct
M&I	Municipal and Industrial
NA	not applicable
NEPA	National Environmental Policy Act
NOI/NOP	Notice of Intent/Notice of Preparation
NRCS	National Resource Conservation Service
NSJWCD	North San Joaquin Water Conservation District
NTU	Nephelometric Turbidity Units
PED	pre-construction engineering and design
ppm	parts per million
REP	Real Estate Plan
RWQCB	California Regional Water Quality Control Board
SAR	sodium absorption ratio
SCS	Soil Conservation Service
SESA	Standard Environmental Site Assessment
SEWD	Stockton East Water District
SJAFCA	San Joaquin Area Flood Control Agency
SJCGP	San Joaquin County General Plan
SJMSCP	San Joaquin County Multi-Species Habitat Conservation and Open Space Plan
SLIC/DOD/DOE	Spills, Leaks, Investigations, and Cleanup/Department of Defense/Department of Energy
SMARA	California Surface Mining and Reclamation Act of 1975
SMT	Study Management Team
SSJID	South San Joaquin Irrigation District
TDS	total dissolved solids
TM	Technical Memorandum
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UST	underground storage tank
VAMP	Vernalis Adaptive Management Plan
VOC	volatile organic compound
WID	water irrigation district
WRDA	Water Resources Development Act
1,2-D	1,2-dichloropropane

FARMINGTON GROUNDWATER RECHARGE/ SEASONAL HABITAT STUDY

FINAL REPORT

EXECUTIVE SUMMARY

INTRODUCTION

This report presents results of planning and technical studies begun in June 1999 by the U.S. Army Corps of Engineers in partnership with Stockton East Water District and other local sponsors to determine the potential for development of integrated groundwater recharge and seasonal habitat improvements in eastern San Joaquin County, California. The studies were developed by the U.S. Army Corps of Engineers and Stockton East Water District, other local agencies, and in collaboration with concerned Federal and State agencies and stakeholders, in response to a series of Congressional authorizations. The report describes the purpose, need, and objectives for a possible base project*; existing and likely future conditions in the study area if no plan or project is implemented; supporting technical analyses; development and evaluation of alternative groundwater recharge and seasonal habitat facilities; description of a strategy for phased implementation; findings and conclusions; proposal for future design work and environmental impact assessment and compliance. The findings presented in this report were developed based on existing information that was supplemented with geologic investigations and recharge pilot tests at several locations in the study area.

STUDY BACKGROUND, PROBLEMS, AND OPPORTUNITIES

Recent studies by the U.S. Army Corps of Engineers, Stockton East Water District, and others recognize that a severe groundwater overdraft condition exists in the eastern San Joaquin County. Long-term groundwater pumping in excess of natural replenishment has lowered groundwater levels, allowing the intrusion of saline water to portions of the aquifer. If groundwater overdraft is allowed to persist, saline intrusion is expected to continue, causing an irretrievable loss of the groundwater resource and economic losses to urban and agricultural areas dependent upon the groundwater.

In 1997, under the direction of Section 411(b) of the Water Resources and Development Act of 1996 (Public Law 104-303), the U.S. Army Corps of Engineers completed the Farmington Dam and Reservoir Conjunctive Use Study (revised December 1998), which evaluated potential structural and operation changes at the U.S. Army Corps of Engineers' Farmington Dam and Reservoir to help reduce the groundwater overdraft problem. Conjunctive use is the planned use of groundwater in conjunction with surface water to optimize total water resources (Ridenbaugh Press, 2001).

---

* *The base project is a series of phased implementation actions identified by the study team to reach an eventual recharge capacity of 35,000 acre-feet per year. Those actions include demonstration projects, monitoring, conveyance improvements and up to 1,200 acres of recharge fields which would require site specific study, design, environmental compliance and project approvals.*

The Conjunctive Use Study found that long-term water storage at Farmington Reservoir does not appear to be cost effective; however, operations modifications to Farmington Dam and construction of groundwater recharge facilities appear cost effective. The Conjunctive Use Study recommended that the feasibility of groundwater recharge with integrated seasonal wetland areas in eastern San Joaquin County be evaluated.

This study was therefore initiated as a follow-up to the Conjunctive Use Study under the 1996 Water Resources and Development Act, Section 411(b) authorization to study the feasibility of a groundwater recharge program in eastern San Joaquin County. However, the purpose, scope, and intent of the study were significantly altered when Congress enacted Section 502, *Environmental Infrastructure*, of the 1999 Water Resources and Development Act (Public Law 106-53), authorizing $25 million for construction of groundwater recharge and conjunctive use projects in Stockton East Water District, California. The study team then modified the study strategy to focus more on the implementation of a groundwater recharge and conjunctive use base project than justifying a new project authorization.

Because of the large size of the study area and broad range of potential solutions, this study evaluates a range of alternative recharge techniques and identifies favorable recharge areas within the study area. The study found that soils and geologic conditions that influence groundwater recharge effectiveness vary considerably throughout the region. To maximize local benefits, a successful groundwater recharge project would need to begin with small components and add project sites through a careful implementation program of site selection, evaluation, and testing. The proposed base project therefore specifies the preferred recharge technique and general recharge area, and includes a recommendation for demonstration-scale test projects as a start to a phased implementation plan.

DEVELOPMENT AND EVALUATION OF ALTERNATIVE PLANS

The development and evaluation of alternative plans was guided by recognition that replacement water supplies are needed in the study area to reduce the groundwater overdraft and the eastward migration of salinity. The preferred approach to reducing groundwater overdraft and salinity intrusion includes recharging flood-season water supplies. In addition, the opportunity exists to restore seasonal habitat that is currently severely lacking in the study area. Study objectives include (1) decreasing salinity intrusion by reducing groundwater overdraft and (2) the development of seasonal habitat areas.

As part of this study, small-scale pilot tests of alternative groundwater recharge and habitat restoration measures were completed at several sites in the study area. Measures tested included excavated pits, shallow ponds, and flooded fields. Sites were selected with the objective that results from pilot test areas would be representative of potential recharge and seasonal habitat facility conditions within other areas of similar geologic conditions. The pilot tests were conducted over several months to evaluate comparative effectiveness, but were not intended to address long-term design and operation issues. Through this testing, it was found that flooded fields provide the most cost-effective combination of groundwater recharge performance and opportunities for seasonal habitat restoration (as indicated in Table ES-1).

TABLE ES-1

SUMMARY OF COSTS AND ENVIRONMENTAL IMPACTS OF MEASURES CONSIDERED

Measure	Costs			Potential Ecosystem Benefits
	Capital Cost ($1,000$)[3]	Annual O&M Costs ($1,000)	Annual Cost $/acre-feet	
Flooded Fields (80 acre site)	$517[1]- $531[2]	$32[1]- $40[2]	$28[2]-$50[1]	• Water depths from zero to 12 inches • Most desirable waterfowl habitat
Spreading Basins (80 acre site)	$1,966	$33	$117	• Large areas of ponded water with gradually sloped sides • Desirable habitat for waterfowl
Excavated Recharge Pits (40 acre site)	$909	$23	$413	• Smaller areas of ponded water with steeply sloped sides • Fair habitat for waterfowl
Unlined Flat Canal	$15,819	$84	$244	• Similar to excavated pits • Opportunity for continuous corridor
Dry Wells	$1,651	$220	$275	• Would not create waterfowl habitat • If combined with surcharge ponds, benefits would be similar to spreading basins
Injection Wells (4 wells)	$4,510	$646	$173	• Would not create waterfowl habitat
Enhance Recharge through Streams	$2,657	$32	$119	• Broadened floodplain areas along streams would provide additional riparian habitat
Flood Detention Basins	$500[4]	$38	$48	• Similar to flooded fields for shallow flooding • Similar to excavated pits during flood events
In-Lieu Delivery (agricultural delivery program)	$7,098 - $14,195[5]	$177	$224	• Would not create waterfowl habitat

Notes:

1. Assumes infiltration rate of 0.25 ft/day.
2. Assumes infiltration rate of 0.5 ft/day.
3. Capital costs include all first costs including land acquisition, construction, PED, contingency, etc. (Appendix E).
4. Cost does not include conveyance modifications that may be necessary to support recharge.
5. Low and high cost estimates assume a pipeline length of 5 and 10 miles, respectively.

This study was undertaken at a programmatic level to provide planning and technical guidance and direction regarding the development of groundwater recharge and seasonal habitat facilities. It compares the effectiveness of recharge at different areas of the study area toward meeting planning objectives. The study team found that recharge in the western portion of the study area (east of Stockton, and roughly between Highway 99 and Jack Tone Road, north of Manteca and south of the Mokelumne River) was most effective in reducing the eastward migration of salinity in the aquifer.

This report describes a base project that was developed on the basis of existing and potentially available water supplies that could be used for flood-season recharge. A review of available supplies revealed that the amount of water that would be available varies greatly, and exceeds 100,000 acre-feet during extremely wet years. The base project however, would require land acquisition and was therefore limited to supplies that would be available in most years. An average water supply up to 35,000 acre-feet per year was used to develop the base project as summarized in Table ES-2.

TABLE ES-2

POTENTIAL WATER SUPPLIES FOR BASE PROJECT

Water Source	Flood Season Supply for Base Project
Stanislaus River	**10,000 af/yr** CVP deliveries from New Melones that can be routed through Farmington Reservoir
Littlejohns Creek	**10,000 af/yr** Local inflow to Farmington Res. after meeting instream flows on Littlejohns Creek
Calaveras River	**5,000 af/yr** Rescheduled deliveries to Stockton East Water District from New Hogan Reservoir
Mokelumne River	**10,000 af/yr** Unused NSJWCD water right
South San Joaquin Irrigation District	None
EBMUD American River Diversion	None
Stockton Delta Diversion	None
TOTAL	**35,000 af/yr**

FINDINGS AND CONCLUSIONS

The potential base project would include the development of up to 1,200 acres of land for groundwater recharge and seasonal habitat areas, as shown in the following figure. In addition, modifications to existing and construction of new conveyance facilities included in the base project would increase flexibility in water distribution and to support deliveries of recharge water to areas that are not currently served by existing facilities. One specific site for a demonstration project is identified in the study, on a 60-acre parcel adjacent to the Stockton East Water District water treatment plant. No other specific sites for demonstration projects are identified, although a second demonstration site in the in the Stockton East Water District or Central San Joaquin Water Conservation District is a possible future action.

Estimated costs for the base project are presented as a range, in recognition that recharge rates will likely vary from site to site, as observed in the pilot testing phase of the study. The total estimated costs for the base project range from about $12.8 million to about $25.5 million, with total annualized costs ranging from approximately $1.3 million to $2.4 million, as summarized in Table ES-3. Table ES-4 shows a summary of estimated annual base project costs for the first ten years.

TABLE ES-3

SUMMARY OF ESTIMATED BASE PROJECT COSTS

Capital Costs[1] ($1,000)		Annualized Capital Costs ($1,000)		Annual O&M Costs ($1,000)[2]		Total Annual Costs ($1,000)[3]	
Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
12,793[4]	25,484[4]	979	1,951	341	479	1,268	2,359

Notes:

1. Low and high cost estimates assume infiltration rates of 0.5 and 0.25 ft/day, respectively. The components of the potential base project are itemized in Table VI-4. All costs at 2000 price levels, 6-3/8%
2. Assumes recharging 100 days/year, 65% of years; see Appendix E.
3. Includes annual revenue of $90 per acre for agricultural production on the property.
4. Total capital costs include real estate acquisition costs for flooded fields of $3,000,000 to $6,000,000 for 600 to 1,200 acres of flooded fields respectively.

TABLE ES-4

SUMMARY OF ESTIMATED ANNUAL BASE PROJECT COSTS ($1,000)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual Total[1]	9	422	1,341	2,735	2,681	4,404	4,454	518	1,021	543
Cumulative Costs[1,2,3]	9	431	1,772	4,507	7,188	11,592	16,046	16,564	17,585	18,128

Note:

1. Number of acres and timing of specific projects are subject to change. The components of the potential base project are itemized in Table VI-9. Costs at 2000 price levels, 6-3/8%
2. Capital construction costs include real estate acquisition costs of $3,900,000 for 780 acres of flooded fields.
3. Net present value of project implemented over 10 years equals $12,400,000.

The environmental impacts of the potential base project phased program have not been identified and evaluated in detail. Many of the potential issues of environmental concern are site-specific and would be addressed in future site-specific studies. Although the formal scoping process and Environmental Impact Statement/Environmental Impact Report were not part of the current study, stakeholder outreach and identification of potential environmental impacts have been an integral part of the base project to date and are summarized in this document. An assessment of the environmental impacts and associated permits for the first proposed demonstration scale project and for each future site of the program will be prepared at the appropriate time.

PLAN IMPLEMENTATION

The potential base project described in this report would support the objectives of many Federal State and local agency programs. For example, the salinity control and water supply benefits fit within the primary objectives of CALFED, State of California Proposition 13 and CVPIA implementation by the Bureau of Reclamation and U.S. Fish and Wildlife Service.

Before such a large-scale groundwater project could be successfully developed, demonstration-scale projects will be needed to address remaining questions about the best design and layout of a large-scale flooded field program and potential environmental impacts. The implementation plan in the report provides guidance for site screening, investigation, testing, development, and operation and maintenance of potential sites for long-term groundwater recharge and seasonal habitat areas.

The demonstration projects identified in the report are currently being pursued by Stockton East Water District, San Joaquin County water agencies, and the State of California. A demonstration-scale recharge and seasonal habitat facility will likely be developed in Stockton East Water District in 2002.

The Corps of Engineers participation in demonstration projects or other aspects of the base project would require Congressional direction. The 1999 Water Resources and Development Act (Public Law 106-53) authorized $25 million for the Army Corps of Engineers to assist in the construction of groundwater recharge and conjunctive use projects in Stockton East Water District, California. However, no funding has yet been appropriated under this authorization.