

An aerial photograph of the San Joaquin River, showing its winding path through a valley. The river is dark and contrasts with the lighter, textured landscape of the valley floor and surrounding hills. The river flows from the top left towards the bottom right of the frame.

SAN JOAQUIN RIVER RESTORATION STUDY BACKGROUND REPORT

DECEMBER 2002

PREPARED FOR:

Friant Water Users Authority
854 North Harvard Avenue
Lindsay, CA 93247
and
Natural Resources Defense Council
71 Stevenson Street, Suite 1825
San Francisco, CA 94105

EDITED BY:

McBain & Trush, Inc.
PO Box 663
Arcata, CA 95518

CONTRIBUTING AUTHORS:

HDR, Inc.
Jones & Stokes Associates, Inc.
Kamman Hydrology and Engineering, Inc.
McBain & Trush, Inc.
Musseter Engineering, Inc.
Science Applications International Corporation
Stillwater Sciences
Trinity Associates

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71 Stevenson Street, Suite 1825
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Overseen by:

San Joaquin River Restoration Oversight Team (ROST)

Edited by:

McBain & Trush, Inc.

Contributing Authors:

HDR, Inc.
271 Turnpike Drive
Folsom, CA 95630

Jones & Stokes Associates, Inc.
2600 V Street
Sacramento, CA 95818

Kamman Hydrology and Engineering, Inc.
706 Del Ganado Road
San Rafael, CA 94903

McBain & Trush, Inc.
P.O. Box 663
Arcata, CA 95518

Mussetter Engineering, Inc.
173 South College Avenue, Suite 100
Fort Collins, CO 80527

Science Applications International Corporation
525 Anacapa Street
Santa Barbara, CA 93101

Stillwater Sciences, Inc.
2532 Durant Avenue, Suite 201
Berkeley, CA 94704

Trinity Associates
814 13th Street
Arcata, CA 95521

DECEMBER 2002

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PREFACE

The transformation of the San Joaquin River ecosystem from the mid 1800's to present is perhaps the most dramatic alteration of all the large Central Valley Rivers. This transformation imposes daunting challenges to rehabilitation and restoration. However severe these challenges, restoration opportunities that improve the health of the river, restore the fishery, and increase riparian habitat are great, and beginning this ambitious effort now will benefit future generations for years to come.

This report provides historical and contemporary background information, and builds a foundation for developing a scientifically sound restoration plan. The transformation of the San Joaquin River to the present-day condition was virtually complete several generations ago, such that the present generation does not have the institutional memory of what the San Joaquin River used to be. The same can be said from a scientific standpoint. Building a strong restoration plan requires a strong underpinning of historical facts and understanding; hence, the river's background information is important. This historical information is not an indictment of basin development, nor will historical conditions be set as absolute goals for the restoration program. Rather, the historical story of the San Joaquin River is meant to provide an understanding of how the river ecosystem functioned historically, and how human-induced changes impacted the physical and biological components of the ecosystem. With this understanding, we can better prioritize restoration actions that achieve restoration objectives.

ACKNOWLEDGEMENTS

Much of this report's material was compiled by Jones & Stokes Associates and Mussetter Engineering, and we acknowledge their important contribution to this effort. They provided draft text for all chapters of this Background Report. Subsequently, HDR, Kamman Hydrology and Engineering, McBain & Trush, Science Applications International Corporation (SAIC), Stillwater Sciences, and Trinity Associates collected and synthesized additional information on behalf of the Restoration Oversight Team (ROST) to complete this Background Report. The collective authors of this report would also like to acknowledge the important assistance from Marcia Wolfe and Associates, Monty Schmitt of NRDC, Valerie Curley and Siran Eryasian of the Bureau of Reclamation, Amanda Kochanek of GreenInfo, Chris White of CCID, and others who have contributed data and ideas for this report.

Revisions to all chapters were overseen by McBain & Trush, with specific revisions assigned to assisting consultants. The technical leads and contributors for each chapter revision are listed below:

<u>Chapter</u>	<u>Topic</u>	<u>Technical Leads</u>
1	Introduction	McBain & Trush
2	Surface Water Hydrology	McBain & Trush
3	Fluvial Processes and Channel Form	McBain & Trush, Stillwater Sciences
4	Shallow Groundwater Hydrology	Kamman Hydrology, McBain & Trush
5	Water Related Infrastructure and Human Channel Modification	HDR, McBain & Trush
6	Water Quality	Stillwater Sciences, SAIC, McBain & Trush
7	Fish Resources	Stillwater Sciences, McBain & Trush
8	Vegetation	SAIC, McBain & Trush, Stillwater Sciences
9	Special Status Plants and Wildlife	Stillwater Sciences
10	Land Use and Ownership	Trinity Associates, SAIC
11	Social and Cultural Factors	Trinity Associates
12	Other Programs, Downstream Opportunities and Constraints	McBain & Trush, HDR

<u>Appendix</u>	<u>Topic</u>	<u>Technical Leads</u>
A	Annual Hydrographs	McBain & Trush
B	Fish Life History Summary	Stillwater Sciences
C	Chinook Salmon Distribution	Yoshiyama et al. (1996)
D	Fish Life History Timing Tables	Stillwater Sciences

ACRONYMS USED IN THE BACKGROUND REPORT

<u>ACRONYM</u>	<u>DEFINITION</u>
ac-ft	acre-feet
ACOE	[U.S.] Army Corps of Engineers
AEAM	Adaptive Environmental Assessment and Management
AFRP	Anadromous Fish Restoration Project
BLM	[U.S.] Bureau of Land Management
CalEPA	California Environmental Protection Agency
CALFED	CALFED Bay-Delta Program
Caltrans	California Department of Transportation
CCR	California Code Regulations
CDEC	California Data Exchange Center
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cfs	cubic feet per second
Chl-a	Chlorophyll-a
CIMIS	California Irrigation Meteorologic Information System
CNPS	California Native Plant Society
CRWQCB	California Regional Water Quality Control Board
CSSC	California Species of Special Concern
CSU	California State University
CVHJV	Central Valley Habitat Joint Venture
CVP	Central Valley Project
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
Delta	Saramento-San Joaquin River Delta
DMC	Delta-Mendota Canal
DO	dissolved oxygen
DOI	[U.S.] Department of the Interior
DPR	[California] Department of Pesticide Regulation
DWR	[California] Department of Water Resources
EC	Electrical Conductivity
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	[U.S.] Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
ET	Evapotranspiration
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
GIS	geographic information System
HEC	Hydraulic Engineering Center model (U.S. Army Corps of Engineers)
IEP	Interagency Ecological Program
IFIM	Instream Flow Incremental Methodology
JSA	Jones and Stokes and Associates

LWD	Large Woody Debris
MCL	maximum contaminant level
mg/l	milligrams per liter
MOU	memorandum of understanding
mS/cm	milisiemens per centimeter
msl	mean sea level
NAWQA	[USGS] National Water Quality Assessment Program
NDDDB	Natural Diversity Database
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDWR	National Primary Drinking Water Regulations
NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
NTU	nephelometric turbidity units
NWR	National Wildlife Refuge
NWS	National Weather Service
OCAP	Operating Criteria and Procedures
°F	degrees Fahrenheit
PCBs	polychlorinated biphenyls
PEIS	Programmatic Environmental Impact Statement
PFMC	Pacific Fishery Management Council
PHABSIM	Physical Habitat Simulation
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion; parts per thousand
PRBO	Point Reyes Bird Observatory
PROSIM	Project Simulation Model
psi	pounds per square inch
RM	River Mile
ROD	Record of Decision
SJRRP	San Joaquin River Restoration Plan
SR	State Road
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TNC	The Nature Conservancy
TSS	total suspended solids
USBR	[U.S. Bureau of] Reclamation
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
μS/cm	microsiemens per centimeter
VAMP	Vernalis Adaptive Management Plan
VELB	valley elderberry longhorn beetle
WQO	water quality objective
WUA	weighted usable area
WY	water year

CONVERSION FACTORS

While the authors prefer to use Metric units, most historical and contemporary information is available only in English units. Therefore, this report uses English in most cases rather than Metric units of measure. The table below is provided to enable English to Metric conversion of most measures used in this report.

Quantity	English Unit	Metric Unit	To Convert English Unit Metric Unit Unit Multiply English Unit by	To Convert Metric Unit English Unit Unit Multiply Metric Unit by
Length	inches (in)	millimeters (mm)	25.4	0.03937
	Inches (cm)	centimeters (cm)	2.54	0.3937
	feet (ft)	meters (m)	0.3048	3.2808
	yards (yd)	meters (m)	0.9144	1.094
	miles (mi)	kilometers (km)	1.6093	0.62139
Area	square feet (ft ²)	square meters (m ²)	0.092903	10.764
	square miles (mi ²)	square kilometers (km ²)	2.59	0.3861
Volume	cubic feet (ft ³)	cubic meters (m ³)	0.028317	35.315
	cubic yards (yd ³)	cubic meters (m ³)	0.76455	1.308
	acre-feet (ac-ft)	cubic decameters (dam ³)	1.2335	0.8107
Flow	cubic feet per second (cfs)	cubic meters per second (cms)	0.028317	35.315
Velocity	feet per second (ft/s)	meters per second (m/s)	0.3048	3.2808
Temperature	degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F-32)/1.8	(1.8x°C)+32

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