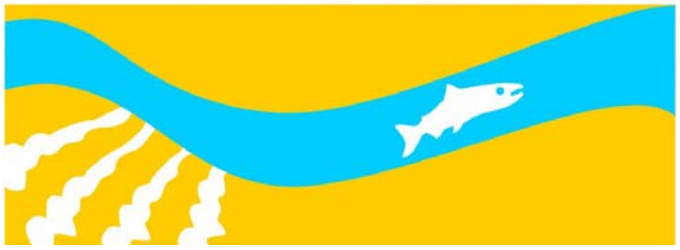
Appendix D

Sediment

Draft
Annual Technical Report

SAN JOAQUIN RIVER
RESTORATION PROGRAM



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Abbreviations and Acronyms

DWR	California Department of Water Resources
GPS	Global Positioning System
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RM	River Mile
TSC	Technical Service Center
UTM	Universal Transverse Mercator
WY	Water Year

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1.0 Monitoring Methodology

Sediment data were collected on the San Joaquin River during the week of March 2, 2009, using three methods: bulk sampling, pebble counts, and photographic documentation. Bulk sampling typically identifies (by weight) the size characterization of a sample at a specific location. Pebble counts identify (by areal frequency) the size characterization of a surface material for a larger aerial extent than with bulk samples. Photogrammetric sediment sampling offers a unique opportunity to sample a much greater number of areas at a lower cost a faster than traditional means. Hand-held Global Positioning System (GPS) coordinates were recorded at each site where sampling was performed. All data were collected and reported in Universal Transverse Mercator (UTM) Zone 11N meters.

Sediment data collection was a joint effort between the California Department of Water Resources (DWR) and U.S. Department of the Interior, Bureau of Reclamation (Reclamation), both the local field office and the Technical Service Center (TSC). Data were collected in Reach 1 of the mainstem of the San Joaquin River between Friant Dam and Gravelly Ford. Acquired sediment data will be used in the numerical modeling, gravel mobilization studies, and monitoring of bed material throughout Reach 1.

Sediment monitoring methodology used by the DWR is described in the Draft Fall 2009 Interim Flows Monitoring Data Report for the San Joaquin River Restoration Program (Appendix H). Monitoring activities conducted are summarized below.

1.1 Bulk Sampling

Bulk sampling was only performed for sediment consisting of fine gravels and sands. Different sampling techniques were applied based on whether a sample was collected under water from a boat or above water on a sand/gravel bar. For underwater samples, a hand-held rotary scoop bed material sampler was used (Figure D-1). While a sampler attempts to reduce the amount of fines lost, some silts, clays, and fine sands may be lost as the samplers are lifted through the water column. In above-water samples, a shovel was used to remove the surface layer and place the material in a bag. All samples were transported to a laboratory for grain-size analysis.

Figure D-1.
US RBMH-80 − Hand Held Rotary Scoop Bed Material Sampler

1.2 Pebble Count

Pebble counts are generally used to develop a validation data set for sieve samples, or to supplement a sieve data set with additional locations when there are budget and/or time constraints. Pebble count data characterize a larger aerial extent than a bulk sample. Pebble counts were performed both on gravel bars and within the channel. A random walk pebble count was performed, in which a field worker randomly selected a grain from the ground with an extended index finger, without looking. The first rock hit by the finger was then measured. At least 100 data points were collected for each pebble count. Once the 100 measurements were collected, the data were tabulated into bins of sediment sizes and a particle size gradation curve was computed.

1.3 Photogrammetric Sediment Sampling

As mentioned, photogrammetric sediment sampling offers a unique opportunity to sample a much greater number of areas at a lower cost and faster than traditional means. Additionally, digital image processing removes biases and errors related to human participation that can occur in traditional pebble count methods. The photograph itself is also a permanent documentation of field conditions. Photogrammetric sampling was conducted by acquiring photographs within a known picture frame size or by including scale in the photograph to mark off a rectangular grid of a sample site. This was usually accomplished by using two folding 72-inch (or 2 meter) rulers, folded in half and turned perpendicular to each other to create a 3 foot by 3 foot rectangle (Figures D-2 and D-3). Where shading was an issue, a tarp was held above the sample to reduce shadowing effects from rocks onto other rocks and from trees or the photographer onto the rocks. The camera was held as orthogonally as possible to the sample.

Image processing is currently underway using an edge detection technique through the software WipFrag (Maertz et al., 1996), and also using a pixel intensity technique (Rubin, 2004). Image-processing procedures will include corrections for radial lens distortion and for when the camera axis was not held orthogonally to the surface; identification of the grains within a selected region, calibration of the grain sizes according to the scale within the photograph; and measurement of the selected grains, resulting in a grain-size distribution and median sediment size. Attempts will be made to quantify the percentage of fines within each sample to estimate the degree of gravel embeddedness.

Figure D-2.
Rectangular Area Defined for Photogrammetric Sampling Above Water

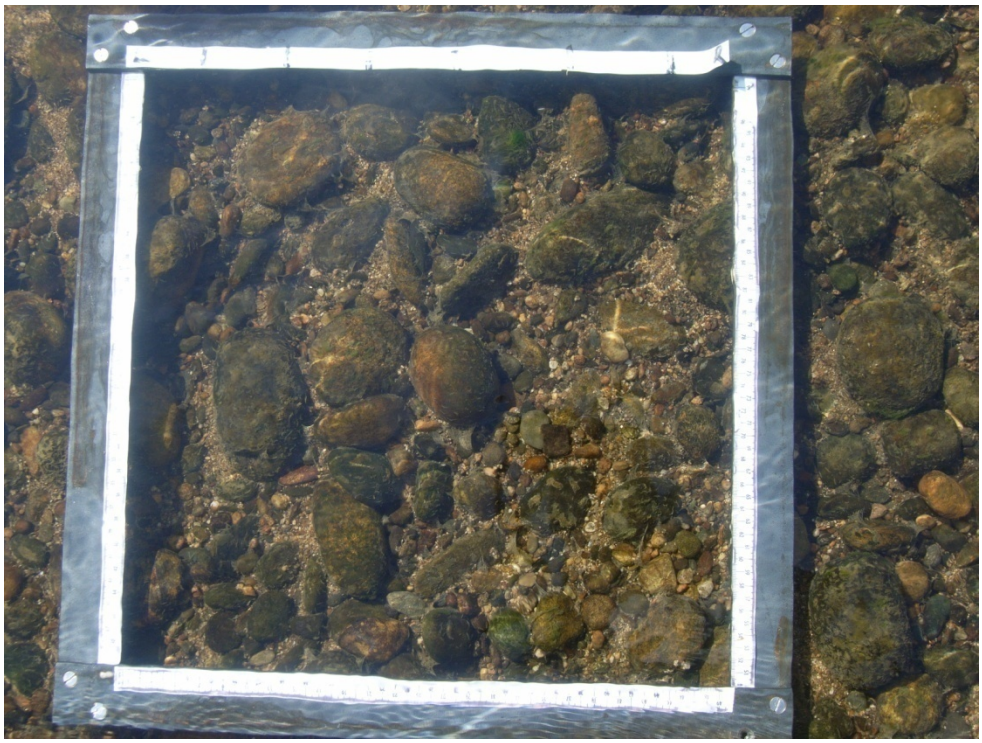

Figure D-3.
Rectangular Area Defined For Photogrammetric Sampling Under Water

1.4 Scour Chains

A total of eight scour chains were installed in Reach 2A; four chains were installed at each of two cross sections. Details regarding the installation, inspection, and environmental documentation required to install these chains is documented in Appendix H.

1.5 Monitoring Section Surveys

Monitoring section surveys were conducted by DWR to collect cross-sectional channel geometry. A total of 13 sites were surveyed during the fall Water Year (WY) 2010 Interim Flows period, one location in Reach 1A and 12 locations in Reach 2A. The location in Reach 1A coincided with other DWR studies at Riffle 38 (see Appendix H). Eleven of the twelve Reach 2A locations coincided with previously established sites in the 1999 and 2000 pilot flow studies for the San Joaquin River Riparian Habitat Restoration Program. The remaining Reach 2A site surveys were performed at a Reclamation groundwater monitoring site. Specific locations for the Reach 2A topographic swaths were further adjusted according to locations of other monitoring equipment, and needs at each site.

A complete description of the section survey monitoring methodology is provided in Appendix H.

1.6 Reach 2 Bed Sampling

Reach 2 bed sampling included collecting riverbed samples in Reach 2A to monitor changes in substrate characteristics. The riverbed samples were taken at Reach 2A from River Mile (RM) 217.5 to RM 228.2. Sections were designated M3, M4, M5, M6, M6½, M7, M8, M9, M10, M11, M12, and M13. **Error! Reference source not found.**D-4 displays the locations where each sample was taken. Samples having significant sediment size variation within one section were designated M#-# (e.g., M5-2).

Figure D-4.
Sample Locations in Reach 2A

The methodology used to collect Reach 2 bed samples is fully described in Appendix H.

1.7 Pilot Tracer Study

A pilot tracer study was completed on Riffle Cluster 38 as part of monitoring activities by DWR (see Appendix H). Riffle Cluster 38 is one of five riffles located in the upper portion of Reach 1A. The background, purpose, and monitoring methodology for the plot tracer study is fully described in Appendix H.

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2.0 Data

The results from bulk sampling, pebble counts, and photogrammetric sediment surveys are presented in this section. Appendix H reports the scour chain, monitoring section survey, Reach 2 bed sampling, and pilot tracer study data collected by DWR during the fall 2009 Interim Flows.

Table 1-2 describes landmark river mile (RM) locations that were used for consistency purposes. References to RM locations presented in this document and its appendices are offsets from the list presented in Table D-1.

Table D-1.
Features by River Mile

SJRRP Project River Mile	Type	Description	Distance
267.6	----------	Begin Reach 1 (beginning of Project Area)	0
267.6	Facility	Friant Dam (Millerton) (MIL)	0
267.4	Tributary	Cottonwood Creek Confluence	0.2
266	Gage	San Joaquin River below Friant Dam (SJF)	1.6
260.6	Tributary	Little Dry Creek Confluence	7
255.2	Crossing	California State Highway 41	12.4
255.1	Gage	San Joaquin River at Highway 41 Bridge (H41)	12.5
245.2	Crossing	Atchison Topeka Santa Fe Railroad	22.4
243.1	Crossing	California State Hwy 99	24.5
240.7	Gage	San Joaquin River at Donny Bridge (DNB)	26.9
234.2	Crossing	California State Highway 145	33.4
232.1	Gage	San Joaquin River at Skaggs Bridge (Skaggs)	35.5
229	----------	End Reach 1 – Begin Reach 2	38.6
227.6	Gage	San Joaquin River at Gravelly Ford (GRF)	40
216	Facility	Chowchilla Bypass Bifurcation Structure	51.6
216	Gage	San Joaquin River below bifurcation (SJB)	51.6
211.8	Crossing	San Mateo Road	55.8
204.6	Facility	Mendota Dam	63
204.6	----------	End Reach 2 – Begin Reach 3	63
202.1	Gage	San Joaquin River near Mendota (MEN)	65.5
195.1	Crossing	Avenue 7 1/2 Bridge	72.5
182	----------	End Reach 3 – Begin Reach 4	85.6
182	Faciltiy	Sack Dam	85.6
181.5	Gage	San Joaquin River below Sack Dam	86.1
173.9	Crossing	California State Highway 152	93.7
169	Gage	San Joaquin River at top of Reach 4B (proposed)	98.6
168.4	Facility	Reach 4B Headgates Crossing	99.2
168.2	Gage	San Joaquin River at top of Reach 4B (proposed)	99.4
168	Crossing	Indiana Avenue	99.6
157.2	Crossing	Turner Island Road Bridge	110.4
135.8	----------	End Reach 4 – Begin Reach 5	131.8
132.8	Crossing	California State Highway 165	134.8
125.1	Gage	San Joaquin at Fremont Ford Bridge (FFB)	142.5
125.1	Crossing	California State Highway 140	142.5
118.2	Facility	Temporary Fish Screen	149.4

Table D-1.
Features by River Mile

SJRRP Project River Mile	Type	Description	Distance
118.3	Gage	San Joaquin River at Hills Ferry (STC512)	149.3
118.2	Crossing	Hills Ferry Road	149.4
118.2	----------	End Reach 5 (end of Project Area)	149.4

Key:
SJRRP = San Joaquin River Restoration Program

2.1 Bulk Sampling

Table D-2 presents results from the bulk sampling that took place in March 2009.

Table D-2.
Bulk Sediment Sample Results

Site	X	Y	Nearest Mile post	D16	D35	D50	D84	D90	D95	Description
Site 1-1	255896	4093971	263.9	0.41	0.76	1.27	13.06	18.27	24.18	Sample 1-1, 1-2 in grid
Site 1-2	255896	4093971	263.9	0.50	0.87	1.44	10.66	13.82	18.93	Sample 1-1, 1-2 in grid
Site 3-1	256048	4093272	263.3	4.23	13.04	20.79	38.26	40.66	42.77	Gravel-sand riffle w/dunes bulk sample collected
Site 4-1	256379	4092240	262.4	0.82	1.39	1.97	5.79	7.56	10.76	Long stretch of sand bed before Ledger Island
Site 6-3	253393	4088769	258.8	0.40	0.68	0.94	1.92	2.50	3.29	Sand sample
Site 6-4	253392	4088766	258.8	0.62	1.62	3.30	15.03	27.86	37.23	Pea gravel
Site 6-5	253344	4088665	258.8	0.59	0.87	1.14	1.93	2.46	3.29	Sand bed channel
Site 9-1	249966	4083749	254.1	0.56	0.82	1.11	2.40	3.18	4.06	Sand sample
Site 10-1	249504	4083222	253.6	0.57	0.83	1.10	1.95	2.61	3.49	Sand bar
Site 12-1	248787	4081559	252.6	0.32	0.50	0.62	1.05	1.40	1.78	
Site 14-1	247066	4082573	251.0	0.25	0.46	0.64	1.45	1.74	2.12	Sand bed sample
Site 15-1	246187	4083173	250.0	1.28	9.78	16.91	34.49	38.11	41.41	At previous site 1-3 sand sample 15-1
Site 16-1	245848	4082394	249.4	0.45	0.60	0.70	1.07	1.39	1.73	Sand mid-channel 16-1
Site 17-1	246346	4082014	249.4	0.58	0.79	1.02	2.27	3.15	4.49	Sand bar
Site 18-1	246346	4082014	249.4	0.49	0.83	1.21	3.18	3.98	5.63	Sand mid-channel
Site 20-1	237874	4080794	242.5	0.39	0.61	0.77	1.55	1.81	2.43	Sand sample
Site 25-1	217680	4077465	227.2	3.48	10.54	16.26	27.56	30.25	34.45	
Site 25-2a	217680	4077465	227.2	0.35	0.70	1.51	19.47	23.46	27.40	
Site 25-2b	217680	4077465	227.2	0.38	0.79	1.92	18.99	23.09	27.18	
Site 26-1	217489	4077732	227.0	0.38	0.66	0.91	1.88	2.37	3.12	Photograph and sand sample

Notes:
Grain sizes are presented in millimeters.
Coordinates are in North American Datum 83, Universal Transverse Mercator Zone 11N meters.

2.2 Pebble Count

Table D-3 presents results from the pebble counts that took place in March 2009.

Table D-3.
Pebble Count Results

Site	X	Y	Nearest Mile Post	D16	D35	D50	D84	D95	Site Description
Site 5-1	255038	4091392	261.3	27.28	42.36	53.17	90.85	115.00	In-channel riffle before Rank Island
Site 5-2	254975	4090576	260.7	12.83	25.76	34.36	57.55	80.87	Channel riffle
Site 6-2	253623	4089379	259.0	15.75	36.56	50.51	90.67	119.40	In-channel
Site 7	252179	4087773	257.7	13.28	31.45	45.28	79.97	107.85	In-channel
Site 19-1	238979	4080310	242.7	< 8	15.40	23.71	41.46	55.45	In-channel riffle sample
Site 19-2	238979	4080310	242.7	10.28	23.57	29.78	41.97	52.73	In-channel riffle sample
Site 22	235683	4080631	240.8	11.66	18.60	25.22	52.54	67.65	In-channel
Site 24	218054	4077117	227.5	8.38	14.04	17.44	27.18	34.26	Gravelly Ford, small bar downstream of gage
Site 25	217680	4077465	227.2	< 8	12.99	16.48	25.71	30.85	
Site 27	227595	4079543	234.3	< 8	11.71	16.21	38.13	48.65	Upstream from Washington Bridge

Notes:
Grain sizes are presented in millimeters.
Coordinates are in North American Datum 83, Universal Transverse Mercator Zone 11N meters.

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