Appendix H
Proposed System Improvements – Backup Information for Cost Estimates

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Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR Freitas Unit - restore anabranches of Salt Slough

Estimated Material Quantity - excavated material

System Improvement - 64

A References
- F&W memo
- Review with Dennis Wollington

B Assumptions
5 side channels
30'-40' wide x 4' deep sediment
clean 150' up side channel

C Excavation Quantities
- calculate earthwork, assume uniform section throughout

width	35	ft
lower bench depth	4	ft
excavation area	140	sq ft
length	150	ft

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		140.00			
	150		140.00	21,000	778
1+50		140.00			

Total	778	cu yd
Quan.	5	
	3,889	cu yd
rounded total	**4,000**	**cu yd**

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR Freitas Unit - restore anabranches of Salt Slough

Estimate of Cost

System Improvement - 64

References / Assumptions

- F&W memo
- Review with Dennis Wollington
- 5 side channels
- 30'-40' wide x 4' deep sediment
- clean 150' up side channel
- Minimal engineering costs, say $10k
- Self mitigating, no Flood Board permit, say $10k

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Excavate sediment from Salt Slough anabranches	4,000	cubic yards	$5.00	$20,000
				Subtotal	$20,000
				50% Contingencies & Incidentals	$10,000
				Total Construction Costs	$30,000
				Environmental Compliance	$10,000
				Engineering Costs	$10,000
				Grand Total	$50,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR West Bear Creek Unit
Restore wetland slough channel connectivity with the San Joaquin River to accommodate flood flows

Estimate of Cost

System Improvement - 65

References / Assumptions

- F&W memo
- Review with Dennis Wollington
- Bid prices for typical galvanized steel gate access walkway
- Bid prices for rip rap on canal bank
- Self mitigating project, Flood Board permitting required
- Engineering - site evaluations, standard design, bidding

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Remove existing pipe & flap gate, Furnish and Install (F&I) Canal gate	4	each	$12,000	$48,000
2	F&I Metal access walkway	4	each	$12,000	$48,000
3	F&I Rip rap slope protection	4,000	square feet	$5	$20,000
4	F&I 36" RCP culverts	400	linear feet	$250	$100,000
				Subtotal	$216,000
				50% Contingencies & Incidentals	$108,000
				Total	$324,000
				Permitting	$10,000
				Engineering	$20,000
				Grand Total	$354,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Merced NWR Merced Unit

Enhance infrastructure to divert flood flows onto 1200 acres of existing wetlands and other refuge lands

Estimate of Cost

System Improvement - 66

References / Assumptions

- F&W memo
- Review with Dennis Wollington
- 2 existing pumps dewater refuge, discharge to Bypass channel
- Reconfigure with pipe & valves so pumps can be reversed to divert flood water to refuge
- Self mitigating project, Flood Board permitting required
- Engineering - site evaluations, design, bidding

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install (F&I) Steel pipe & fittings	300	linear feet	$200	$60,000
2	F&I Discharge pipe valving (for reverse flows)	8	each	$10,000	$80,000
				Subtotal	$140,000
				50% Contingencies & Incidentals	$70,000
				Total	$210,000
				Permitting	$10,000
				Engineering	$15,000
				Grand Total	$235,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Merced NWR - Modify Water Intake Structures at Selected Refuge Units

Estimate of Cost

System Improvement - 67

References / Assumptions

- F&W memo
- Approximately 15 sites per review with Dennis Wollington
- Bid prices for canal gates
- Bid prices for typical galvanized steel gate access walkway
- Bid prices for rip rap on canal bank
- Self mitigating project, Flood Board permitting required
- Engineering - site evaluations, standard design, bidding

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Remove existing flap gate, Furnish and Install (F&I) Canal gate	15	each	$7,000	$105,000
2	F&I Metal access walkway	15	each	$12,000	$180,000
3	F&I Rip rap slope protection	15,000	square feet	$5	$75,000
				Subtotal	$360,000
				50% Contingencies & Incidentals	$180,000
				Total	$540,000
				Permitting	$20,000
				Engineering	$20,000
				Grand Total	$580,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Merced NWR Sno-Bird Unit - Construct diversions off Eastside Canal

Estimate of Cost

References / Assumptions

- F&W memo
- Review with Dennis Wollington
- 3' deep sediment removal
- Existing channel to be cleaned, say 30' bottom
- Replace weir boards and make minor concrete repairs to existing weir on Eastside Canal
- 1 Existing and 1 new culvert, each with new canal gates to drain refuge ditch back to Bear Creek
- Bid prices for canal gates
- Bid prices for typical galvanized steel gate access walkway
- New channel in Bear Creek, say 5' bottom x 5' deep
- New turnout structure in Eastside Canal at northwest corner of refuge
- Bid prices for canal gates
- Self mitigating project, Flood Board and Stevinson W.D. permitting required
- Engineering - site evaluations, design, bidding

Project A

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Clean sediment up & downstream of existing weir structure	220	cubic yards	$5	$1,100
2	Replace weir boards, minor concrete repair of existing weir		lump sum		$10,000
3	Clean 1st section of existing channel downstream of weir	1,000	cubic yards	$5	$5,000
4	Furnish and Install (F&I) Canal gate on new and existing Bear Creek culvert inlets	2	each	$12,000	$24,000
5	F&I New 36" RCP culvert into Bear Creek	80	linear feet	$250	$20,000
6	F&I Metal access walkway	2	each	$12,000	$24,000
7	Excavate channel in Bear Creek from new culvert to existing pilot channel	440	cubic yards	$5	$2,200
				Subtotal	$86,300
				50% Contingencies & Incidentals	$42,700
				Total	$129,000
				Permitting	$10,000
				Engineering	$20,000
				Grand Total	$159,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Merced NWR Sno-Bird Unit - Construct diversions off Eastside Canal

Estimate of Cost

Project B

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install (F&I) Canal turnout structure	10	cubic yards	$1,500	$15,000
2	F&I 48" Canal gate	1	each	$12,000	$12,000
3	F&I 48" RGRCP culvert	50	linear feet	$350	$17,500
4	F&I Rip rap slope protection at outlet	1,000	square feet	$5	$5,000
				Subtotal	$49,500
				50% Contingencies & Incidentals	$24,500
				Total	$74,000
				Permitting	$10,000
				Engineering	$20,000
				Grand Total	$104,000

Total Cost of Projects A & B

Construction	$135,800
Contingencies & Incidentals	$67,200
Total	$203,000
Permitting	$20,000
Engineering	$40,000
Grand Total	$263,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Madera Irrigation District Water Bank Facility

System Improvement - 76

References / Assumptions

- Table 8-1 Madera County IRWMP *2005*
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html

ENR Factor for study/cost estimate - composite index	277	Jan. 2005
ENR Factor, current date - composite index	376	Jan. 2014
Inflation Ratio	**1.36**	

Description	Amount	Rounded/inflated Amount
Total project cost	$91,156,000	$124,000,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Madera Canal / Hidden Dam Pump Storage Project

System Improvement - 77

References / Assumptions

- Madera Canal/Hidden Camp Pump Storage Feasibility Stdy *Mar-03*
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html

ENR Factor for study/cost estimate - composite index	247	Apr. 2003
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**1.51**	

	Description	unit price	inflated unit price	rounded unit price
1	Pumping Facilities	$1,933,000	$2,926,891	$2,927,000
2	Pipeline	$5,115,000	$7,744,980	$7,745,000
3	Hidden Dam Outlet Modifications	$350,000	$529,960	$530,000
4	Hydroelectric Facility	$1,136,000	$1,720,097	$1,720,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Pumping Facilities		lump sum		$2,927,000
2	Pipeline		lump sum		$7,745,000
3	Hidden Dam Outlet Modifications		lump sum		$530,000
4	Hydroelectric Facility		lump sum		$1,720,000
				Subtotal	$12,922,000
				40% Contingencies & Incidentals	$5,178,000
				Total	$18,100,000
				15% Engineering Costs	$1,900,000
				15% Environmental Costs	$1,900,000
				Grand Total	**$21,900,000**

Upper San Joaquin River Regional Flood Management Plan System Improvement

Madera Lake Regulating & Recharge Project

System Improvement - 78

References / Assumptions

- Table 8-1 Madera County IRWMP *2005*
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html

ENR Factor for study/cost estimate - composite index	252	Jan. 2004
ENR Factor, current date - composite index	376	Jan. 2014
Inflation Ratio	**1.49**	

Description	Amount	Rounded/inflated Amount
Total project cost	$155,000	$231,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Siphon Extension near Chamberlain Road

Estimate of Cost

System Improvement - 79

References/Assumptions

- Review with George Park, Lone Tree Mutual Water Company
- Comparable cost estimate for Henry Miller Reclamation District project to replace existing siphon
- In channel project, 20% environmental costs
- Engineering - surveying, design, bidding

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install (F&I) 48" Rubber gasket reinforced concrete pipe	2,100	linear feet	$130	$273,000
2	F&I Inlet & outlet structures		lump sum		$50,000
3	F&I Control gates		lump sum		$20,000
4	F&I Shut off gates with vaults		lump sum		$40,000
				Subtotal	$383,000
				50% Contingencies & Incidentals	$187,000
				Total	$570,000
				20% of Subtotal for Enviornmental Permitting	$80,000
				Engineering	$50,000
				Grand Total	$700,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Bear Creek Diversion Structure

System Improvement - 1

References / Assumptions

GEI Preliminary design data *Dec-13*

ENR Factor for study/cost estimate - composite index	374	Oct. 2013
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**1.00**	

	Description	unit price	inflated unit price	rounded unit price
1	Structural Concrete	$2,000	$2,000	$2,000
2	Embankment Removal	$10	$10	$10
3	Asphalt Demo	$500	$500	$500
4	Concrete Demo	$500	$500	$500
5	Asphalt Replacement	$2,000	$2,000	$2,000
6	Rock Slope Protection	$50	$50	$50

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Structural Concrete	40	cubic yards (cy)	$2,000	$80,000
2	Embankment Removal	60	cy	$20	$1,200
3	Asphalt Demo	15	cy	$500	$7,500
4	Concrete Demo	15	cy	$500	$7,500
5	Asphalt Replacement	10	cy	$2,000	$20,000
6	Rock Slope Protection	30	cy	$50	$1,500
				Subtotal	$117,700
				40% Contingencies & Incidentals	$42,300
				Total	$160,000
				Engineering Costs	$80,000
				Environmental Costs	$20,000
				Grand Total	**$260,000**

Upper San Joaquin River Regional Flood Management Plan System Improvement

Levee Breeches LM9.90 Unit 1, LM 0.25 Unit 5

New Flash Board Flow Control Structures

System Improvement - 2

A References

- see sheet set 59-1 for applicable drawings
- see drawing no. B-2F8-1 for plan and profile sheets circa LM 9.90
- see drawing no. B-2B1-1 for levee cross section at sta 565+00 (circa LM 9.90)
- note, lack of information pertaining to levee unit 5
- assume cross-section of right bank unit 5 is similar to the right bank of levee unit 1
- see preliminary design sketch: AUTOCAD\DWGS\MISC\LowerSJLeveeDist\RFMP design sketches

B Assumptions

landside slope	2	:1
waterside slope	3	:1
crown width	12	ft
levee height	7	ft
bay width	6	ft
bay height	6	ft
wall thickness	12	inches

C Reinforced concrete quantities

Reinforced Concrete

Item	ht./wd, (ft)	thickness (ft)	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)
u/s sidewall		1.00	47.95		1.78	2	3.55
d/s sidewall		1.00	73.50		2.72	2	5.44
piers	6.00	1.00		13.67	3.04	2	6.08
deck	12.00	1.00		22.00	9.78	1	9.78
u/s floor	26.00	1.00		12.83	12.35	1	12.35
str floor	22.00	1.00		13.17	10.73	1	10.73
d/s floor	26.00	1.00		21.00	20.22	1	20.22

Total	68.16	cy
Rounded Total	**70.00**	**cy**
2 structures	**140**	**cy**

Upper San Joaquin River Regional Flood Management Plan System Improvement

Levee Breeches Unit 1, LM 9.90; Unit 5, LM 0.25

Estimate of Cost

System Improvement - 2

References/Assumptions

- Project Contract Drawings 59-1
- Dwg. Nos. B-2F8-1 & B-2B1-1
- Preliminary design sketch
- Limited work area & staging footprint, 14% environmental costs

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install (F&I) Reinforced Concrete	140	cubic yards	$1,500	$210,000
2	F&I Slope Protection	800	cubic yards	$100	$80,000
				Subtotal	$290,000
				50% Contingencies & Incidentals	$145,000
				Total	$435,000
				14% of Subtotal for Enviornmental Permitting	$40,000
				Engineering	$60,000
				Grand Total	$535,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Raise Part of Left Levee Bank - Levee Unit 6

Estimated Material Quantity - Compacted Embankment

System Improvement - 3

A References

- see sheet set 61-1: Levee and Bridge Construction
  - Left bank cross sections, see drawing no. (SDN) B-5B3-1 (sheet 8)
  - Typical levee cross sections, SDN B-0J6-1 (sheet 4)
  - ESBP Left bank Plan and Profile sheets SDN B-5F11-1 - B-5F11-7 (sheets 45-51)

B Assumptions

average levee height of 10 feet
raise levee 2 feet
per drawing no. B-0J6-1, existing maintenance strip is 10' wide
after raising levee 2', maintenance strip will be 6' wide
say edge of maintenance strip is extent of right-of-way

levee length	50,000	ft
fill area	134	sq ft

C Compacted Embankment Quantities

- calculate earthwork with average end area method, assume uniform section throughout

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		134.00			
	50,000		134.00	6,700,000	248,148
500+00		134.00			

Total	248,148	cu yd
Rounded total	**250,000**	cu yd

Upper San Joaquin River Regional Flood Management Plan System Improvement

Raise Part of Left Bank - Levee Unit 6

Estimate of Cost

System Improvement - 3

References / Assumptions

- Project Contract Drawings 61-1
- Dwg. Nos. B-5B3-1, B-0J6-1, B-5F11-1 thru B-5F11-7
- Average levee height of 10'
- Raise levee height 2'
- Engineering costs estimated at 10% of the project cost - geotechnical investigation, comp testing
- Environmental compliance estimated at 10% of project cost subtotal - 10 mile linear footprint

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install Compacted Embankment	250,000	cubic yards	$10.00	$2,500,000
				Subtotal	$2,500,000
				50% Contingencies & Incidentals	$1,250,000
				Total Construction Costs	$3,750,000
				10% of Subtotal for Environmental Compliance	$250,000
				10% of Subtotal for Engineering Costs	$250,000
				Grand Total	$4,250,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Modernize Electrical Controls, Level Sensors & SCADA for Control Structures

System Improvement - 4

References / Assumptions

- Site review / pre-design meetings for FSRP
- Fresno Valves & Castings quote
- Engineering - site surveys, design, bidding, inspection
- Environmental - Flood Board permitting required

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Remove existing gate operator motors, position sensors & brakes, Furnish and Install (F&I) new motor operators with integral position sensors, limit & torque switches, adapt to existing gear boxes	16	each	$12,000	$192,000
2	Furnish spare replacement parts for each type of existing gate operator gear box	3	each	$10,000	$30,000
3	Demo existing conduit, wire & electrical equipment		lump sum		$50,000
4	F&I New conduit, wire & electrical panels, SCADA		lump sum		$606,000
5	Remove old, F&I new 25kVA emergency generator	2	each	$25,000	$50,000
6	PG&E upgrades		lump sum		$40,000
7	F&I new gaging stations	7	each	$30,000	$210,000
				Subtotal	$1,178,000
				50% Contingencies & Incidentals	$592,000
				Total	$1,770,000
				Engineering Costs	$90,000
				Environmental Costs	$25,000
				Grand Total	**$1,885,000**

A Does the project have an existing feasibility study/cost estimate?

- If yes, proceed to step C, if no go to step B

B Preliminary design - go to applicable design spreadsheet for calculations, some rough CAD sketches may be necessary, retreive elev. data from google earth or as-built drawings

- earthwork project, see PD-1
- flow control structure modification, see PD-2
- other, develop when necessary

C.1 Compile Cost Estimate - go to applicable cost estimate spreadsheet calculations

- if existing cost estimate is used, inflate costs using Engineering News Record (ENR) Inflation Factors published by the United States Bureau of Reclamation

- existing study/cost estimate, ECE-1
- Levee cost estimate, see CE-1
- flow control structure cost estimate, see CE-2
- other, develop when necessary

C.2 Determine Environmental Complience/Permitting costs
- need a method for doing this, would it be best to assume some percentage of the entire project cost or consult an expert?

Upper San Joaquin River Regional Flood Management Plan System Improvement

System Improvement - 5: Chowchilla Bifurcation Structures, Structure Enlargement

Material Quantities

A References

- see sheet set 65-30 for applicable drawings
- see drawing no. B-0D2-1 to B-0D2-10 for structure details

B Assumptions

- wing walls and footings to be removed on each side of the structure
- add two bays (one on each side) to the structure

C Quantities

Demolition

Item	ht./wd, (ft)	thickness (ft)	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)
u/s ww fting	19.00	2.00		63.25	89.02	1	89.02
d/s ww fting	8.38	2.00		65.00	40.32	1	40.32
u/s wing wall	20.00	1.50		65.25	72.50	1	72.50
d/s wing wall	11.25	1.50		65.00	40.63	1	40.63

Total	242.47	
Rounded Total	**240.00**	**cy**
2 sides	480.00	cy

Reinforced Concrete

Item	ht./wd, (ft)	thickness (ft)	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)
road deck	16.00	2.00		22.50	26.67	1	26.67
gate deck	6.00	2.00		22.50	10.00	1	10.00
maintenance deck	10.00	2.00		22.50	16.67	1	16.67
new side walls	18.00	1.50		60.00	60.00	1	60.00
small pier	18.00	1.00		60.00	40.00	1	40.00
floor	22.50	2.00		60.00	100.00	1	100.00

Total	253	
Rounded Total	**250**	**cy**
2 each	500	cy
including wing wall replacement	980	cy

Upper San Joaquin River Regional Flood Management Plan System Improvement

System Improvement - 5: Enlarge Chowchilla Canal Bypass Control Structure

Estimate of Cost - Remove & replace wing walls and add bay with gate to each side

References / Assumptions

- Project Contract Drawings 65-30
- Dwg. Nos. B-0D2-1 thru B-0D2-10
- Fresno Valves & Castings gate/operator pricing
- Remove existing wing walls & footings on each side of struct.
- Construct new outside bays and reconstruct wing walls & footings
- Limited work area & staging footprint - 8% environmental costs
- 10% engineering costs

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Demolish existing wing walls	480	cubic yards (cy)	$200	$96,000
2	Furnish and Install (F&I) Reinforced Concrete (add bays)	980	cy	$1,500	$1,470,000
3	F&I Radial Gates	2	each	$150,000	$300,000
4	F&I Rip Rap	430	cy	$100	$43,000
5	F&I Temporary fish passage channel & rail car bridge		lump sum		$200,000
				Subtotal	$2,109,000
				50% Contingencies & Incidentals	$891,000
				Total	$3,000,000
				8% of Subtotal for Environmental Permitting	$170,000
				10% of Subtotal for Engineering	$210,000
				Grand Total	$3,380,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

System Improvement - 5A: Chowchilla Bifurcation Structures, Repair Wing Wall Settlement

Material Quantities

A References

- see sheet set 65-30 for applicable drawings
- see drawing no. B-0D2-1 to B-0D2-10 for structure details

B Assumptions

- excavate and provide wall footing extension (see sketch)

C Quantities

Wing wall footing extension

Item	ht./wd, (ft)	thickness (ft)	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)
new footing	18.50	1.00		65.00	44.54	1	44.54
short wall	4.00	1.00		65.00	9.63	1	9.63

Total	54.17	
Rounded Total	**54**	**cy**
2 each	108	cy

Upper San Joaquin River Regional Flood Management Plan System Improvement

System Improvement - 5A: Rehabilitation of San Joaquin River Control Structure

Estimate of Cost - settlement repair

References / Assumptions

- Project Contract Drawings 65-30
- Dwg. Nos. B-0D2-1 thru B-0D2-10
- Excavate outside existing wing walls and extend footings
- Limited work area & staging footprint - 10% environmental costs
- 10% engineering costs

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install (F&I) Reinforced Concrete	110	cubic yards	$1,500	$165,000
2	F&I Rip Rap	370	cubic yards	$100	$37,000
				Subtotal	$202,000
				50% Contingencies & Incidentals	$98,000
				Total	$300,000
				10% of Subtotal for Environmental Permitting	$20,000
				10% of Subtotal for Engineering	$20,000
				Grand Total	$340,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Chowchilla Bifurcation Structure Sediment Removal

Estimated Material Quantity - excavated material

System Improvement - 6

A References

- Google Earth KMZ file

..\..\..\AUTOCAD\DWGS\MISC\LowerSJLeveeDist\RFMP Map Data\Project 6 Sediment Removal Chowchilla Bifurcation.kmz

= notes from workshop

B Assumptions

sediment removal area to be 150' long x 110'+/- wide (width of river)
remove sediment to depth of 6'
dredge an additional 10' - 12' ot develop sediment trap
2:1 side slope for excavation zone due to unstable soils expected in river bed

C Compacted Embankment Quantities

- calculate earthwork, assume uniform section throughout

top width (estimated)	110	ft
side slopes	2	:1
depth	18	ft
bottom width	38	ft
excavation area	1332	sq ft
lengths	150	ft

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		1332.00			
	150		1,332.00	199,800	7,400
1+50		1,332.00			

Total	7,400	cu yd
25% bulking factor	1,850	
excavated material	9,250	cu yd
rounded total	**9,300**	**cu yd**

Upper San Joaquin River Regional Flood Management Plan System Improvement

Sediment Removal Chowchilla Canal Bypass Control Structure

Estimate of Cost

System Improvement - 6

References / Assumptions

- Google Earth KMZ file
- Review with LSJLD staff
- Sediment removal area to be 150' long x 110'+/- wide (width of river)
- Remove sediment to depth of 6'
- Excavate an additional 10' - 12' depth for sediment trap
- 2:1 excavation slopes
- In channel project, 75% environmental costs
- Engineering - grading plan, bidding

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Excavate and spread spoil adjacent to swale	9,300	cubic yards	$7.50	$69,750
				Subtotal	$69,750
				50% Contingencies & Incidentals	$35,250
				Total Construction Costs	$105,000
				Environmental Compliance	$50,000
				Engineering Costs	$20,000
				Grand Total	$175,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Sediment Removal in the Eastside Bypass

Estimated Quantity of Sediment

System Improvement - 8

A References

- Google earth sketch of pilot channel
- Arcmap for area calculation

B & C Assumptions & Calculations

pilot channel area per arcmap	3,700,000	sf
excavation depth	6	ft
excavated material ±	822,222	cy
assume 25% bulking factor	205,556	
excavated material	1,027,778	
rounded total	**1,000,000**	**cy**

work would be done by a contractor
equipment - dozers w/ operator
say that one excavator can move 2500 cy per day

num. of excavators	2	
equipment costs	$1,600	per day
operator costs	$1,600	per day
equip-days	164	days

say that hauling costs may be substantial

- use cost from GVGSP levee de-authorization

Upper San Joaquin River Regional Flood Management Plan System Improvement

Sediment Removal in the Eastside Bypass

Estimate of Cost

System Improvement - 8

References / Assumptions

- Google Earth sketch of pilot channel
- Arcmap area calculation
- Average excavation depth of 6'
- In-channel project, 20% environmental costs
- Engineering - surveying, bidding, const insp

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Remove sediment and haul to spoil area	1,000,000	cubic yards	$7.50	$7,500,000
				Subtotal	$7,500,000
				50% Contingencies & Incidentals	$3,750,000
				Total	$11,250,000
				20% Environmental Costs	$1,500,000
				Engineering Costs	$100,000
				Grand Total	$12,850,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Sand Slough Control Structure Removal

Material Quantities

System Improvement - 9

A References

- see sheet set 59-1 for applicable drawings
- see drawing no. B-5A4-1 & B-5A5-1 for structure details
- see CAD sketch "head" levee cross-sections
..\..\..\AUTOCAD\DWGS\MISC\LowerSJLeveeDist\RFMP design sketches\parshall flume levee sections.dwg
- see hand calcs for quantity backup

B Assumptions

- say the structure floor does not slope
- say head levee cross-sections are uniform throughout length
- say cobble slope protection extends the same length downstream on each side of flume
- 25% bulking factor for removed embankment, may need to haul in material for backfill
- grouted cobbles cost the same to remove as reinforced concrete
- small cost for excavated material since it can be used to fill in structure footprint and will not need to be hauled

C Material Quantities

Grouted Cobbles:		
	209	cy
	246	cy
	134	cy
	87	cy
total	676	cy
rounded total	**680**	**cy**

Excavated Material:		
	88	cy
	120	cy
total	208	cy
rounded total	**210**	**cy**

Reinforced Concrete	volume	quantity	total		
headwall	1.6	2	3		
peirs	0.6	7	4		
deck	1.7	1	2		
floor	28.7	1	29		
walls	7.4	2	15		
			53		
		say	**60**	**cy**	**- to account for no-slope assumpt.**

Demolish existing structure	740	cy
excavated material	210	cy

Upper San Joaquin River Regional Flood Management Plan System Improvement

Sand Slough Control Structure Removal

Estimate of Cost

System Improvement - 9

References / Assumptions

- Project Contract Drawings 59-1
- Dwg. Nos. B-5A4-1 & B-5A5-1
- Cobble slope protection same u/s & d/s
- Grouted cobble removal same price as reinf. conc.
- Minimal earth removal - use high unit cost
- In-channel project, 20% environmental costs
- Engineering - bidding & inspection

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Demolish existing structure	775	cubic yards	$200	$155,000
2	Remove existing embankment	210	cubic yards	$25.00	$5,250
				Subtotal	$160,250
				50% Contingencies & Incidentals	$79,750
				Total	$240,000
				20% of Subtotal for Enviornmental Permitting	$30,000
				Engineering	$20,000
				Grand Total	$290,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Great Valley Grassland State Park (GVGSP) Levee De-authorization

Excavated Material Quantity Calculation

System Improvement - 12

A References

- see DWR Drawing set 59-1
- sheet 51-52 for SJR unit 2 sta 24+19-145+50
- sheet 49-50 for Salt Slough unit 25
- sheet 8 for cross sections, use typical salt slough cross section for estimating

B Assumptions

- say levee cross section is uniform for volume calculation

C Excavation Quantities

- calculate earthwork with average end area method

levee length	25,200	ft	
crown width (cw)	12	ft	
bottom width (bw)	67	ft	
height (h)	11	ft	
cross sectional area	434.5	sq ft	A = ½ (cw+bw) x h

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		434.50			
	25,200		434.50	10,949,400	405,533
252+00		434.50			

Total	405,533	cu yd
Rounded Total	406,000	cu yd

Upper San Joaquin River Regional Flood Management Plan System Improvement

Great Valley Grassland State Park (GVGSP) Levee De-authorization

Estimate of Cost

System Improvement - 12

References / Assumptions

- Project Contract Drawings 59-1
- Sheets 8, 49-50, 51-52
- Uniform levee cross section
- Engineering, 2% - surveying
- 5 mile linear project, 10% environmental permitting

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Remove existing levee and haul excavated material to spoil area	406,000	cubic yards	$7.50	$3,045,000
				Subtotal	$3,045,000
				50% Contingencies & Incidentals	$1,525,000
				Total Construction Costs	$4,570,000
				10% of Subtotal for Environmental Permitting	$300,000
				2% of Subtotal for Engineering Costs	$60,000
				Grand Total	$4,930,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Great Valley Grassland State Park (GVGSP) Levee De-authorization

Excavated Material Unit Cost Derivation

System Improvement - 12

A Remove existing levee

say $3.00 per cy

B Hauling

*see Central Valley Concrete/Central Valley Trucking Bid Quotation

Assumptions

average truck speed	20	mph
haul distance to spoil area	5	miles
unit weight of soil	110	pcf

Calculations

haul time, from assumptions	15	min
load time*	10	min
unload time*	10	min
	35	min/load
round to nearest 10 minutes	0.67	hr per load
hourly rate for transfer truck*	$95.00	per hr
cost per load	$63.33	per load
load weight*	22.0	tons per load

- derived (2.72hr x $95/hr)/($11.75/ton) = 21.99 tons per load, say 22 tons

cost per ton	$2.88	per ton
cost per cubic yard	**$4.28**	**per cubic yard**

A + B **=** $7.30 per cy

say **$7.50** **per cy**

Upper San Joaquin River Regional Flood Management Plan System Improvement

Bridge Enlargement over Eastside Bypass at Sandy Mush Road

Material Quantities

System Improvement - 13

A References

- see DWR Drawing set 61-1
- for bent & pile cap details see drawing no (SDN) B-5E6-3
- for deck/girder details SDN B-5E6-2
- abutment details SDN B-5E6-3
- piles SDN B-0E1-2

B Assumptions

new bridge deck can be connected to existing deck
lengthen bridge 140' + 35' + 26'-3" + 3'-5" = 204.67' to the west
piles spaced at 35 feet centerline to centerline @ 45° skew
5 piles per bent (typ) and 4 piles at abutment
install 5 new interior bents w/ 25 new piles - SDN B-5E6-3, section F-F
install 1 new exterior bent w/ 5 piles - SDN B-5E6-3, section J-J
install 1 new abutment w/ 4 piles - SDN B-5E6-3, section G-G
remove abutment and exterior bent, address in cost est.

As built levee section estimated w/ dwg no. B-5E6-1
- 30' crown, 100' base and 3:1 side slopes --> levee height, say 12'

Piles are circular, diameter = 1'-4". Use FHA manual to determine cost (URL shown on page 2) chapter 5 - cost data for driven piles

C Calculations

interior bent

Item	ht./wd, (ft)	thick (ft)	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)
pile cap	2.50	2.33		42.92	9.27	1	9.3
						rounded total	9.0

Exterior bent

Item	ht./wd, (ft)	thick (ft)	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)
pile cap	5.00	2.33		42.92	18.54	1	18.5
						rounded total	19.0

Abutment

Item	ht./wd, (ft)	thick (ft)	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)
abutment	3.67	5.00		42.92	29.14	1	29.14
wing walls	4.13	1.00		12.50	1.91	2	3.82
						rounded total	33.0

C Calculations (cont'd)

Reinforced Concrete

Item	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)	
abutment[1]			33	1	33	
exterior bent[1]			19	1	19	
interior bent[1]			9	4	36	
deck extension	32.4	204.67	245	1	245	
					333	cu yd

Excavated material

length (ft)	area (sq ft)	volume (cu yd)	bulk[2] (cu yd)	total (cu yd)			
275	780.00	7,944	1,986	9,931	say	10,000	cy

- levee area taken from assumption listed on p. 1
- actual levee length to be removed is approximately 205'+20'. Add an extra 50' to facilitate construction, say 275'

Pavement

Length	width	area			
204.67	28	5730.76	say	6000	sf

Piles

	quan	unit	cost/unit	cost		
F&I pile (contractor)[3]	9.1	meters	$290	$2,700		
pile ext. above ground	0.9	cu yd	$1,500	$1,312		
geotechnical inspect.	0.25	days	$1,200	$300		
load testing	1	ea	$100	$100		
transportation[4]	1	ea	$760	$185		
				$4,597	say	$5,000

number of piles 29

1 taken from quantities calculated on page 1

2 assume 25% bulking factor

3 assume FHA type C08A1, cost = $262.48/meter (updated 4-7-2011)
http://www.fhwa.dot.gov/engineering/geotech/pubs/05159/chapter5.cfm

4 See GVGSP Levee De-commissioning for backup

System Improvement - 13

C Calculations (cont'd)

Reinforced Concrete to be removed

Item	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)	
abutment[1]			33	1	33	
exterior bent[1]			19	1	19	
deck extension	32.4	100	120	1	120	
					172	cu yd

Concrete Demolition costs

- assume it takes 1 week to demolish substructure of bridge w/ 4 excavators, two trucks, and 10 laborers

equipment costs	4	400	5	$8,000		
labor costs	10	200	5	$10,000		
hauling costs	3	95	40	$11,400		
			total costs	$29,400		
			cost per cubic yard	$171	$200	say

Upper San Joaquin River Regional Flood Management Plan System Improvement

Bridge Enlargement over Eastside Bypass at Sandy Mush Road

Estimate of Cost

System Improvement - 13

References / Assumptions

- Project Contract Drawings 61-1
- Dwg. Nos. B-0E1-2, B-5E6-1 thru B-5E6-3
- New bridge deck connected to existing deck
- Lengthen deck 205' to west
- Pile bents spaced at 35' c/c
- Potential fish passage issues, 9% environmental costs

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install (F&I) Reinforced Concrete	333	cubic yards (cy)	$1,500	$499,500
2	F&I Excavated Material	10,000	cy	$7.50	$75,000
3	F&I Driven Piles	29	each	$5,000	$145,000
4	F&I Pavement	6,000	square feet	$15	$90,000
5	Demolish Reinforced Concrete	172	cy	$200	$34,400
6	F&I Slope Protection	840	cy	$100	$84,000
				Subtotal	$927,900
				50% Contingencies & Incidentals	$462,100
				Total Construction Costs	$1,390,000
				9% of Subtotal for Environmental Permitting	$80,000
				15% of Subtotal for Engineering	$140,000
				Grand Total	$1,610,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Install New Gaging Stations

References / Assumptions

- USBR cost for gaging station near San Mateo Ave. *Oct-11*
- Use 25% contingencies since actual costs are available
- Engineering - standard design, surveying, bidding
- In-channel project, say $10k per site

ENR Factor for study/cost estimate - composite inde	360	Oct. 2011
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**1.04**	

	Description	unit price	inflated unit price	rounded unit price
1	Construct gaging station	$29,000	$30,128	$30,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Construct gaging station	6	each	$30,000	$180,000
				Subtotal	$180,000
				25% Contingencies & Incidentals	$50,000
				Total	$230,000
				Engineering Costs	$40,000
				Environmental Costs	$60,000
				Grand Total	**$330,000**

Upper San Joaquin River Regional Flood Management Plan System Improvement Sheet

Eastside Acres San Joaquin River Levee Project

Estimated Material Quantity - Compacted Embankment

System Improvement - 18

A References

- Google Earth KMZ file showing proposed levee alignment

B Assumptions

build new levee
16' wide crown and 5' height - per DWR memo
Length = 1.32 mi per DWR memo
say 3:1 waterside slopes and 2:1 landside slopes
assume 3' over excavation and recompaction for levee stability

levee length	6,970	ft
fill area	265.5	sq ft

C Compacted Embankment Quantities

- calculate earthwork with average end area method, assume uniform section throughout

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		265.50			
	6,970		265.50	1,850,429	68,534
69+70		265.50			

Total	68,534	cu yd
Rounded total	**69,000**	cu yd

Upper San Joaquin River Regional Flood Management Plan System Improvement Sheet

Eastside Acres San Joaquin River Levee Project

Estimate of Cost

System Improvement - 18

References / Assumptions

- Google Earth KMZ file showing proposed levee alignment
- No land costs - levee to be built on Eastside Acres property
- 16' wide crown and 5' height
- 3:1 waterside slopes and 2:1 landside slopes
- 3' overexcavation and recompaction for levee stability
- 1.32 mile long linear footprint next to river - 15% environmental costs
- Engineering - geotechnical, design, bidding, comp testing

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install Compacted Embankment	69,000	cubic yards	$10.00	$690,000
				Subtotal	$690,000
				50% Contingencies & Incidentals	$350,000
				Total Construction Costs	$1,040,000
				Environmental Permitting	$100,000
				10% of Subtotal for Engineering Costs	$70,000
				Grand Total	$1,210,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Fresno Slough South Levee Repair and Floodplain Enhancement Project - Levee Repair

Estimated Material Quantity - Compacted Embankment and Road Surfacing

System Improvement - 19

A References
- Steve Stadler, KRCD
- Google Earth

B Assumptions

raise levee 2 feet
existing levee is 5' high with degraded slopes
2' of overexcavation required
12' top width
resurface road
regrade landside slopes 2:1
regrade waterside slopes 3:1
interceptor drain size - say 1.5:1 side slopes, 3' depth and 15' top width

levee length	8,000	ft±	
fill area	200	sq ft	- sketch in CAD for area
road resurfacing area	96,000	sq ft	

C Compacted Embankment Quantities
- calculate earthwork with average end area method, assume uniform section throughout

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		200.00			
	8,000		200.00	1,600,000	59,259
80+00		200.00			

Total	59,259	cu yd
Rounded total	**60,000**	

Upper San Joaquin River Regional Flood Management Plan System Improvement

Fresno Slough South Levee Repair and Floodplain Enhancement Project - Levee Repair

Estimate of Cost

System Improvement - 19

References / Assumptions

- Review with Steve Stadler, KRCD
- Google Earth
- Raise levee 2 feet
- No imported fill required, existing material in channel will be used
- Existing levee is 5' high with degraded slopes
- 2' of overexcavation required
- 12' top width
- Resurface road
- Regrade landside slopes 2:1
- Regrade waterside slopes 3:1
- Environmental permitting cost per review with KRCD
- Engineering costs - geotechnical investigation, comp testing, 10% of project cost

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Compacted Embankment	60,000	cubic yards	$10.00	$600,000
2	Furnish and Install Road Surfacing	96,000	square feet	$1.00	$96,000
				Subtotal	$696,000
				50% Contingencies & Incidentals	$344,000
				Total Construction Costs	$1,040,000
				Environmental Permitting	$30,000
				10% of Subtotal for Engineering Costs	$70,000
				Grand Total	$1,140,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Fresno Slough South Levee Repair and Floodplain Enhancement Project - Floodplain Enhancement

Estimated Material Quantity - excavated material

System Improvement - 19

A References
- Steve Stadler, KRCD
- Google Earth

B Assumptions

construct swale, 100' wide 4' deep 2:1 side slopes

swale length	1000	ft
swale prism	368	sq ft

remove existing levee, (4' high, 2:1 side slopes, 12' crown)
existing levee length ±600 ft

levee length	600	ft
est. area	80	sq ft

C Excavated Material Quantities
- calculate earthwork with average end area method, assume uniform section throughout

Swale

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		368.00			
	1,000		368.00	368,000	13,630
10+00		368.00			

Total	13,630	cu yd
say	**14,000**	**cu yd**

Levee degrading

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		80.00			
	600		80.00	48,000	1,778
6+00		80.00			

Total	1,778	cu yd
say	**2,000**	**cu yd**

Upper San Joaquin River Regional Flood Management Plan System Improvement

Fresno Slough South Levee Repair and Floodplain Enhancement Project - Floodplain Enhancement

Estimate of Cost

System Improvement - 19

References / Assumptions

- Steve Stadler, KRCD
- Google Earth
- Construct swale 100' wide x 4' deep, 2:1 side slopes
- Remove existing levee, 4' high, 2:1 side slopes, 12' crown
- No hauling costs - swale and levee material can used for levee improvements
- Engineering - surveying and grading plan, 25% of project costs
- Environmental permitting - major streambed alteration

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Degrade Existing Levee	2,000	cubic yards (cy)	$5.00	$10,000
2	Excavate Swale	14,000	cy	$5.00	$70,000
				Subtotal	$80,000
				50% Contingencies & Incidentals	$40,000
				Total Construction Costs	$120,000
				Environmental Permitting	$60,000
				25% of Subtotal for Engineering Costs	$20,000
				Grand Total	$200,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Fresno Slough Sediment Removal

Estimated Quantity of Sediment

System Improvement - 20

A References
- Steve Stadler, KRCD
- Google Earth

B Assumptions

Narrow Channel Area	75,000	cy
Wide Channel Area	500,000	cy

work would be done by a contractor
equipment - dozers w/ operator
say that one excavator can move 2500 cy per day

equipment costs	$800	per day
operator costs	$800	per day
equip-days	230	days

no hauling costs, sediment will be piled against levee toe

C Estimated cost per cy

total cost for excavation	$368,000	
cost per cubic yard	$0.64	per cy
	- say $0.75	

Upper San Joaquin River Regional Flood Management Plan System Improvement

Fresno Slough Sediment Removal

Estimate of Cost

System Improvement - 20

References / Assumptions

- Steve Stadler, KRCD
- Google Earth
- No hauling costs, sediment will be piled against levee toe
- 3' average sediment depth
- Environmental permitting cost per review with KRCD
- Engineering - surveying

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Remove sediment	575,000	cubic yards	$0.75	$431,250
				Subtotal	$431,250
				50% Contingencies & Incidentals	$218,750
				Total	$650,000
				Environmental Costs	$50,000
				Engineering Costs	$20,000
				Grand Total	$720,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Le Grand Canal Flood Control Structure at Black Rascal Creek

Material Quantities

System Improvement - 24

A References

- Google Earth
- Project description from MID
- CAD sketch

..\..\..\AUTOCAD\DWGS\MISC\LowerSJLeveeDist\RFMP design sketches\la grand spill structure.dwg

B Assumptions

- say 2 bay structure in southerly bank of canal
- 8'w x 8'h bays with automated sluice gates
  - say gates are 6'x6'
- 2' x 72" diam RCP outlets to black raascal creek
- provide slope protection @ outlet and canal transition
- due to remoteness and difficult access, add 10% to rip rap cost

channel geom.

T	60	ft	(measured)
ss	1.5		(say)
depth	8	ft	
b	36	ft	
plan length	12	ft	
length over slope	14.42	ft	

C Quantities

Reinforced Concrete

Item	ht./wd, (ft)	thickness (ft)	area (sq ft)	length (ft)	Vol (cu yd)	quan.	Vol. (cu yd)
piers	8.00	1.00		4.00	1.19	3	3.56
back wall	8.00	1.00		23.00	6.81	1	6.81
footing		1.00	368.00		13.63	1	13.63
						Total	24.00
						Rounded Total	**24.00** **cy**

72" RGRCP - see CAD sketch for assumed alignment

2.00	@	100.00	**200 ft**	(see cad sketch)

slope protection

la grand canal - see sketch for assumed placement

item	area	slp factor	thickness	quan	vol (cy)
approach	203.6	1	2	1	15.1
transition	28.3	1.20	2	2	5.0
side slope	191.5	1.20	2	2	34.1
				Total	54.22
				Rounded Total	**54.00** **cy**
				say	**50.00** **cy**

pipe outlet - see sketch for assumed placement

approximate area	1600 sf	add 20% to account		
thickness	2 ft	for sloped areas	142	cy
volume	119 cy	**say**	**150**	**cy**

Upper San Joaquin River Regional Flood Management Plan System Improvement

Le Grand Canal Flood Control Structure at Black Rascal Creek

Estimate of Cost

System Improvement - 24

References / Assumptions

- Google Earth
- Project description by MID
- Prelim design sketch
- 2 bay structure in southerly bank of canal
- 8'w x 8'h bays with automated sluice gates
- 2 ea 72" dia RCP outlets to Black Rascal Creek
- Slope protection at canal and outlet
- Minor streabed alteration in creek, 15% environmental costs
- Engineering - surveying, design, bidding, inspection

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install (F&I) Reinforced Concrete	24	cubic yards	$1,500	$36,000
2	F&I Slope Protection	200	cubic yards	$110	$22,000
3	F&I 72" RGRCP	200	linear feet	$500	$100,000
4	F&I Automated Sluice Gates	2	each	$30,000	$60,000
5	F&I SCADA integration		lump sum		$40,000
				Subtotal	$258,000
				50% Contingencies & Incidentals	$132,000
				Total	$390,000
				Environmental Permitting	$40,000
				Engineering	$60,000
				Grand Total	$490,000

Upper San Joaquin Regional River Flood Management Plan System Improvement

Bear Lake Enlargement

System Improvement - 25

References / Assumptions

- USACE Design Memo - October 1979 - see page FI-102 (reference 1)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- Large impacted area - environmental costs 10% of construction

ENR Factor for study/cost estimate - composite index	121	Oct. 1979
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**3.09**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Lands and Damages	$460,000	35%	$340,741	$1,054,000
2	Reservoirs	$200,000	20%	$166,667	$516,000
3	Main Dam and Dikes	$10,740,000	20%	$8,950,000	$27,664,000
4	Spillway	$5,170,000	20%	$4,308,333	$13,317,000
5	Outlet Works	$4,170,000	20%	$3,475,000	$10,741,000
6	Roads	$310,000	20%	$258,333	$799,000
7	Permanent Operating Equipment	$100,000	20%	$83,333	$258,000
8	Engineering and Design	$2,480,000	0%	$2,480,000	$7,666,000
9	Supervision and Administration	$1,670,000	0%	$1,670,000	$5,162,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Lands and Damages		lump sum (ls)	$1,054,000	$1,054,000
2	Reservoirs		ls	$516,000	$516,000
3	Main Dam and Dikes		ls	$27,664,000	$27,664,000
4	Spillway		ls	$13,317,000	$13,317,000
5	Outlet Works		ls	$10,741,000	$10,741,000
6	Roads		ls	$799,000	$799,000
7	Permanent Operating Equipment		ls	$258,000	$258,000
8	Engineering and Design		ls	$7,666,000	$7,666,000
9	Supervision and Administration		ls	$5,162,000	$5,162,000
				Subtotal	$67,177,000
				40% Contingencies & Incidentals	$26,823,000
				Total	$94,000,000
				Environmental Permitting	$5,330,000
				Grand Total	**$99,330,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Bear Creek Channel Improvements

mprovement - 25

References / Assumptions

- USACE Design Memo October 1979 - see page FII-40 (reference 3)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- In-channel project - environmental cost 15% of construction

ENR Factor for study/cost estimate - composite index	121	Oct. 1979
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**3.09**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Channels	$50,000	20%	$41,667	$129,000
2	Levees	$4,410,000	20%	$3,675,000	$11,359,000
3	Permanent Operating Equipment	$30,000	20%	$25,000	$77,000
4	Engineering and Design	$740,000	0%	$740,000	$2,287,000
5	Supervision and Administration	$490,000	0%	$490,000	$1,515,000
6	Lands	$2,020,000	35%	$1,496,296	$4,625,000
7	Relocate Roads	$410,000	20%	$341,667	$1,056,000
8	Relocate Utilities	$1,260,000	20%	$1,050,000	$3,245,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Channels		lump sum (ls)	$129,000	$129,000
2	Levees		ls	$11,359,000	$11,359,000
3	Permanent Operating Equipment		ls	$77,000	$77,000
4	Engineering and Design		ls	$2,287,000	$2,287,000
5	Supervision and Administration		ls	$1,515,000	$1,515,000
6	Lands		ls	$4,625,000	$4,625,000
7	Relocate Roads		ls	$1,056,000	$1,056,000
8	Relocate Utilities		ls	$3,245,000	$3,245,000
				Subtotal	$24,293,000
				40% Contingencies & Incidentals	$9,707,000
				Total	$34,000,000
				Environmental Permitting	$2,380,000
				Grand Total	**$36,380,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Bear Creek Channel Improvements - Upper U/S from W. 16th Street

System Improvement - 25

References / Assumptions

- USACE Design Memo October 1979 - see page FII-46 (reference 3)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- In-channel project - environmental cost 15% of construction

ENR Factor for study/cost estimate - composite index	121	Oct. 1979
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**3.09**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Levees	$30,000	20%	$25,000	$77,000
2	Engineering and Design	$15,000	0%	$15,000	$46,000
3	Supervision and Administration	$15,000	0%	$15,000	$46,000
4	Lands	$40,000	35%	$29,630	$92,000
5	Relocate Roads	$100,000	20%	$83,333	$258,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Levees		ls	$77,000	$77,000
2	Engineering and Design		ls	$46,000	$46,000
3	Supervision and Administration		ls	$46,000	$46,000
4	Lands		ls	$92,000	$92,000
5	Relocate Roads		ls	$258,000	$258,000
				Subtotal	$519,000
				40% Contingencies & Incidentals	$211,000
				Total	$730,000
				Environmental Permitting	$50,000
				Grand Total	**$780,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Fahrens Creek Channel Improvements

System Improvement - 25

References / Assumptions

- USACE Design Memo October 1979 - see page FII-51 (reference 3)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- In-channel project - environmental cost 15% of construction

ENR Factor for study/cost estimate - composite index	121	Oct. 1979
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**3.09**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Relocate Railroad	$1,090,000	20%	$908,333	$2,808,000
2	Channels	$720,000	20%	$600,000	$1,855,000
3	Levees	$4,000,000	20%	$3,333,333	$10,303,000
4	Recreation Facilities	$240,000	20%	$200,000	$618,000
5	Engineering and Design	$1,100,000	0%	$1,100,000	$3,400,000
6	Supervision and Administration	$720,000	0%	$720,000	$2,225,000
7	Lands	$3,600,000	35%	$2,666,667	$8,242,000
8	Relocate Roads	$1,930,000	20%	$1,608,333	$4,971,000
9	Relocate Utilities	$1,120,000	20%	$933,333	$2,885,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Relocate Railroad		lump sum (ls)	$2,808,000	$2,808,000
2	Channels		ls	$1,855,000	$1,855,000
3	Levees		ls	$10,303,000	$10,303,000
4	Recreation Facilities		ls	$618,000	$618,000
5	Engineering and Design		ls	$3,400,000	$3,400,000
6	Supervision and Administration		ls	$2,225,000	$2,225,000
7	Lands		ls	$8,242,000	$8,242,000
8	Relocate Roads		ls	$4,971,000	$4,971,000
9	Relocate Utilities		ls	$2,885,000	$2,885,000
				Subtotal	$37,307,000
				40% Contingencies & Incidentals	$14,893,000
				Total	$52,200,000
				Environmental Permitting	$3,520,000
				Grand Total	**$55,720,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Lower Bear Creek Drain Channel Improvements

System Improvement - 25

References / Assumptions

- USACE Design Memo October 1979 - see page FII-59 (reference 3)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- In-channel project - environmental cost 15% of construction

ENR Factor for study/cost estimate - composite index	121	Oct. 1979
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**3.09**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Levees	$1,270,000	20%	$1,058,333	$3,271,000
2	Engineering and Design	$230,000	0%	$230,000	$711,000
3	Supervision and Administration	$160,000	0%	$160,000	$495,000
4	Lands	$470,000	35%	$348,148	$1,076,000
5	Relocate Roads	$420,000	20%	$350,000	$1,082,000
6	Relocate Utilities	$200,000	20%	$166,667	$515,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Levees		ls	$3,271,000	$3,271,000
2	Engineering and Design		ls	$711,000	$711,000
3	Supervision and Administration		ls	$495,000	$495,000
4	Lands		ls	$1,076,000	$1,076,000
5	Relocate Roads		ls	$1,082,000	$1,082,000
6	Relocate Utilities		ls	$515,000	$515,000
				Subtotal	$7,150,000
				40% Contingencies & Incidentals	$2,850,000
				Total	$10,000,000
				Environmental Permitting	$730,000
				Grand Total	**$10,730,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Cost Estimate Summary
System Improvement - 25

Improvement	Engineering & Admin	Construction	Contingencies	Property	Environmental	Improvement Total
Lake	$7,666,000	$516,000	$26,823,000	$1,054,000	$5,330,000	$99,330,000
	$5,162,000	$27,664,000				
		$13,317,000				
		$10,741,000				
		$799,000				
		$258,000				
Creek Channel I	$2,287,000	$129,000	$9,707,000	$4,625,000	$2,380,000	$36,380,000
	$1,515,000	$11,359,000				
		$77,000				
		$1,056,000				
		$3,245,000				
Creek Channel II	$46,000	$77,000	$211,000	$92,000	$50,000	$780,000
	$46,000	$258,000				
Creek Channel III	$3,400,000	$2,808,000	$14,893,000	$8,242,000	$3,520,000	$55,720,000
	$2,225,000	$1,855,000				
		$10,303,000				
		$618,000				
		$4,971,000				
		$2,885,000				
Creek Channel IV	$711,000	$3,271,000	$2,850,000	$1,076,000	$730,000	$10,730,000
	$495,000	$1,082,000				
		$515,000				
Totals	$23,553,000	$97,804,000	$54,484,000	$15,089,000	$12,010,000	$202,940,000

Upper San Joaquin Regional River Flood Management Plan System Improvement

Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements

References / Assumptions

- USACE Design Memo 1969 - see page 42 for cost table (deferred in 1979 memo) (reference 2)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- Large impacted area - environmental costs 10% of construction

ENR Factor for study/cost estimate - composite index	113	Oct. 1969
ENR Baseline adjustment factor	2.16	Oct. 1977
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**7.14**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Lands and Damages	$505,000		$505,000	$3,605,000
2	Relocations	$200,000		$200,000	$1,428,000
3	Main Dam and Dikes	$2,027,000		$2,027,000	$14,470,000
4	Spillway	$655,000	**NA**	$655,000	$4,676,000
5	Outlet Works	$1,490,000		$1,490,000	$10,637,000
6	Fish and Wildlife Facilities	$15,000		$15,000	$107,000
7	Roads	$10,000		$10,000	$71,000
8	Recreation Facilities	$455,000		$455,000	$3,248,000
9	Operation Facilities	$5,000		$5,000	$36,000
10	Engineering and Design	$695,000		$695,000	$4,961,000
11	Supervision and Administration	$450,000		$450,000	$3,212,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Lands and Damages		lump sum (ls)	$3,605,000	$3,605,000
2	Relocations		ls	$1,428,000	$1,428,000
3	Main Dam and Dikes		ls	$14,470,000	$14,470,000
4	Spillway		ls	$4,676,000	$4,676,000
5	Outlet Works		ls	$10,637,000	$10,637,000
6	Fish and Wildlife Facilities		ls	$107,000	$107,000
7	Roads		ls	$71,000	$71,000
8	Recreation Facilities		ls	$3,248,000	$3,248,000
9	Operation Facilities		ls	$36,000	$36,000
10	Engineering and Design		ls	$4,961,000	$4,961,000
11	Supervision and Administration		ls	$3,212,000	$3,212,000
				Subtotal	$46,451,000
				40% Contingencies & Incidentals	$18,549,000
				Total	$65,000,000
				Environmental Permitting	$3,500,000
				Grand Total	**$68,500,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements - Mariposa Creek Channel Improvements

System Improvement - 26

References / Assumptions

- USACE Design Memo 1969 - see page 43 (reference 2)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- In-channel project - environmental cost 15% of construction

ENR Factor for study/cost estimate - composite index	113	Oct. 1969
ENR Baseline adjustment factor	2.16	Oct. 1977
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**7.14**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Channels	$8,000		$8,000	$57,000
2	Levees	$1,580,000		$1,580,000	$11,279,000
3	Permanent Operating Equipment	$7,000	**NA**	$7,000	$50,000
4	Engineering and Design	$360,000		$360,000	$2,570,000
5	Supervision and Administration	$230,000		$230,000	$1,642,000
6	Lands	$380,000		$380,000	$2,713,000
7	Relocate Roads	$505,000		$505,000	$3,605,000
8	Relocate Utilities	$460,000		$460,000	$3,284,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Channels		lump sum (ls)	$57,000	$57,000
2	Levees		ls	$11,279,000	$11,279,000
3	Permanent Operating Equipment		ls	$50,000	$50,000
4	Engineering and Design		ls	$2,570,000	$2,570,000
5	Supervision and Administration		ls	$1,642,000	$1,642,000
6	Lands		ls	$2,713,000	$2,713,000
7	Relocate Roads		ls	$3,605,000	$3,605,000
8	Relocate Utilities		ls	$3,284,000	$3,284,000
				Subtotal	$25,200,000
				40% Contingencies & Incidentals	$10,100,000
				Total	$35,300,000
				Environmental Permitting	$2,700,000
				Grand Total	**$38,000,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements - Deadman Creek Channel Improvements

System Improvement - 26

References / Assumptions

- USACE Design Memo 1969 - see page 43 (reference 2)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- In-channel project - environmental cost 15% of construction

ENR Factor for study/cost estimate - composite index	113	Oct. 1969
ENR Baseline adjustment factor	2.16	Oct. 1977
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**7.14**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Channels	$100,000		$100,000	$714,000
2	Levees	$155,000		$155,000	$1,106,000
3	Engineering and Design	$62,000	**NA**	$62,000	$443,000
4	Supervision and Administration	$38,000		$38,000	$271,000
5	Lands and Damages	$40,000		$40,000	$286,000
6	Relocate Roads	$65,000		$65,000	$464,000
7	Relocate Utilities	$100,000		$100,000	$714,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Channels		lump sum (ls)	$714,000	$714,000
2	Levees		ls	$1,106,000	$1,106,000
3	Engineering and Design		ls	$443,000	$443,000
4	Supervision and Administration		ls	$271,000	$271,000
5	Lands and Damages		ls	$286,000	$286,000
6	Relocate Roads		ls	$464,000	$464,000
7	Relocate Utilities		ls	$714,000	$714,000
				Subtotal	$3,998,000
				40% Contingencies & Incidentals	$1,602,000
				Total	$5,600,000
				Environmental Permitting	$400,000
				Grand Total	**$6,000,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Cost Estimate Summary
System Improvement - 26

Improvement	Engineering & Admin	Construction	Contingencies	Property	Environmental		Improvement Total
Lake	$4,961,000	$1,428,000	$18,549,000	$3,605,000		$3,500,000	$68,500,000
	$3,212,000	$14,470,000					
		$4,676,000					
		$10,637,000					
		$107,000					
		$71,000					
		$3,248,000					
		$36,000					
Creek Channel I	$2,570,000	$57,000	$10,100,000	$2,713,000		$2,700,000	$38,000,000
	$1,642,000	$11,279,000					
		$50,000					
		$3,605,000					
		$3,284,000					
Creek Channel II	$443,000	$714,000	$1,602,000	$286,000		$400,000	$6,000,000
	$271,000	$1,106,000					
		$464,000					
		$714,000					
Totals	$13,099,000	$55,946,000	$30,251,000	$6,604,000		$6,600,000	$112,500,000

Upper San Joaquin Regional River Flood Management Plan System Improvement

Owens Reservoir Enlargement and Downstream Levee and Channel Improvements

System Improvement -27

References / Assumptions

- USACE Design Memo 1969 - see page 42 for cost table (deferred in 1979 memo) (reference 2)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- Large impacted area - environmental costs 10% of construction

ENR Factor for study/cost estimate - composite index	113	Oct. 1969
ENR Baseline adjustment factor	2.16	Oct. 1977
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**7.14**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Lands and Damages	$65,000		$65,000	$464,000
2	Reservoir Preparation	$3,000		$3,000	$21,000
3	Main Dam and Dikes	$90,000		$90,000	$642,000
4	Spillway	$95,000	**NA**	$95,000	$678,000
5	Outlet Works	$435,000		$435,000	$3,105,000
6	Operation Facilities	$5,000		$5,000	$36,000
7	Engineering and Design	$90,000		$90,000	$642,000
8	Supervision and Administration	$60,000		$60,000	$428,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Lands and Damages		lump sum (ls)	$464,000	$464,000
2	Reservoir Preparation		ls	$21,000	$21,000
3	Main Dam and Dikes		ls	$642,000	$642,000
4	Spillway		ls	$678,000	$678,000
5	Outlet Works		ls	$3,105,000	$3,105,000
6	Operation Facilities		ls	$36,000	$36,000
7	Engineering and Design		ls	$642,000	$642,000
8	Supervision and Administration		ls	$428,000	$428,000
				Subtotal	$6,016,000
				40% Contingencies & Incidentals	$2,384,000
				Total	$8,400,000
				Environmental Permitting	$450,000
				Grand Total	**$8,850,000**

Upper San Joaquin Regional River Flood Management Plan System Improvement

Burns Reservoir Enlargement and Downstream Levee and Channel Improvement

System Improvement - 28

References / Assumptions

- USACE Design Memo - October 1979 - see page FI-94 (reference 1)
- ENR taken from US Bureau of Reclamation - http://www.usbr.gov/pmts/estimate/cost_trend.html
- Large impacted area - environmental costs 10% of construction

ENR Factor for study/cost estimate - composite index	121	Oct. 1979
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**3.09**	

	Description	unit price	applied contingency	price w/o C&I	rounded/inflated unit price
1	Lands and Damages	$320,000	35%	$237,037	$733,000
2	Road Relocation	$140,000	20%	$116,667	$361,000
3	Utilities Relocation	$40,000	20%	$33,333	$104,000
4	Reservoirs	$380,000	20%	$316,667	$979,000
5	Main Dam and Dikes	$4,540,000	20%	$3,783,333	$11,694,000
6	Spillway	$2,140,000	20%	$1,783,333	$5,513,000
7	Outlet works	$750,000	20%	$625,000	$1,932,000
8	Roads	$40,000	20%	$33,333	$104,000
9	Equipment Acquisition	$40,000	20%	$33,333	$104,000
10	Engineering and Design	$970,000	0%	$970,000	$2,999,000
11	Supervision and Administration	$640,000	0%	$640,000	$1,979,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Lands and Damages		lump sum (ls)	$733,000	$733,000
2	Road Relocation		ls	$361,000	$361,000
3	Utilities Relocation		ls	$104,000	$104,000
4	Reservoirs		ls	$979,000	$979,000
5	Main Dam and Dikes		ls	$11,694,000	$11,694,000
6	Spillway		ls	$5,513,000	$5,513,000
7	Outlet works		ls	$1,932,000	$1,932,000
8	Roads		ls	$104,000	$104,000
9	Equipment Acquisition		ls	$104,000	$104,000
10	Engineering and Design		ls	$2,999,000	$2,999,000
11	Supervision and Administration		ls	$1,979,000	$1,979,000
				Subtotal	$26,502,000
				40% Contingencies & Incidentals	$10,598,000
				Total	$37,100,000
				Environmental Permitting	$2,080,000
				Grand Total	**$39,180,000**

Upper San Joaquin River Regional Flood Management Plan System Improvement

Black Rascal Creek Flood Control Project

System Improvement - 31

References / Assumptions

- Black Rascal Creek Flood Control Project Feasibility study *Feb-09*
- Alternative 4, single basin at site D

ENR Factor for study/cost estimate - composite index	337	Jan. 2009
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**1.11**	

	Description	unit price	inflated unit price	rounded unit price
1	Compacted Embankment	$20	$22	$22
2	Foundation	$9	$10	$10
3	Concrete	$600	$666	$670
4	Contingencies	$5,251,783	$5,828,388	$5,828,390
5	Engineering	$1,050,357	$1,165,678	$1,170,000
6	Agricultural Land	$3,250	$3,607	$3,600
7	Orchard Land	$42,000	$46,611	$46,600
8	Environmental Costs	$923,554	$1,024,953	$1,020,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Compacted Embankment	455,916	cubic yards (cy)	$22	$10,030,152
2	Foundation	136,667	cy	$10	$1,366,670
3	Concrete	259	cy	$670	$173,530
4	Agricultural Land	70	acres	$3,600	$252,000
5	Orchard Land	282	acres	$46,600	$13,141,200
				Subtotal	$24,963,552
				Contingencies & Incidentals	$5,828,390
				Total	$30,790,000
				Engineering Costs	$1,170,000
				Environmental Costs	$1,020,000
				Grand Total	**$32,980,000**

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Joaquin River Levee at Firebaugh Waste Water Treatment Plant

Estimated Material Quantity - Compacted Embankment

System Improvement - 44

A References

- Google Earth KMZ file showing proposed levee alignment

B Assumptions

16' wide crown and 8' height - (assume flood flow @ 5' above levee toe w/ 3' Fb)
say 3:1 waterside slopes and 2:1 landside slopes
assume 3' overexcavation and recompaction for levee stability

levee length	4,344	ft
fill area	456	sq ft

C Compacted Embankment Quantities

- calculate earthwork with average end area method, assume uniform section throughout

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		456.00			
	4,344		456.00	1,980,864	73,365
43+44		456.00			

Total	73,365	cu yd
Rounded total	**73,000**	cu yd

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Joaquin River Levee at Firebaugh Waste Water Treatment Plant

Estimate of Cost

System Improvement - 44

References / Assumptions

- Engineering - geotechnical investigation, design, bidding, comp testing
- Google Earth KMZ file showing proposed levee alignment
- No land costs - levee to be built on City property
- 16' wide crown and 8' height
- 3:1 waterside slopes and 2:1 landside slopes
- 3' overexcavation and recompaction for levee stability
- 1 mile long linear footprint next to river - 15% environmental costs
- Engineering - geotechnical, design, bidding, comp testing

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install Compacted Embankment	73,000	cubic yards	$10.00	$730,000
				Subtotal	$730,000
				50% Contingencies & Incidentals	$370,000
				Total Construction Costs	$1,100,000
				Environmental Permitting	$110,000
				10% of Subtotal for Engineering Costs	$70,000
				Grand Total	$1,280,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Joaquin River Bank Stabilization at Firebaugh

System Improvement - 45

References / Assumptions

- San Joaquin River Bank Restoration Project Article		*Clark Bros.*	*Fall 2009*
- http://www.clarkbrosinc.com/documents/Firebaugh_San_Joaquin.pdf			
- Phone Conversation with City of Firebaugh Engineer		*total project costs:*	$1,200,000
- Article referenced above states construction costs were $960,000			
- Previous construction length, approximately	350 ft		
- Proposed construction zone, approximately	275 ft		
- Project length is comparable to the previous project.			
- Stream bed alteration - 20% environmental costs			
- Engineering - geotechnical, design, bidding			

ENR Factor for study/cost estimate - composite index	329	Oct. 2009
ENR Factor, current date - composite index	374	Oct. 2013
Inflation Ratio	**1.14**	

	Description	unit price	inflated unit price	rounded unit price
1	Construction Costs	$960,000	$1,091,307	$1,090,000

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Construction Costs		Lump sum	$1,090,000	$1,090,000
				Subtotal	$1,090,000
				40% Contingencies & Incidentals	$410,000
				Total Construction Costs	$1,500,000
				Environmental Permitting	$220,000
				Engineering	$80,000
				Grand Total	**$1,800,000**

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Joaquin River Levee at Firebaugh Rodeo Grounds

Estimated Material Quantity - Compacted Embankment

System Improvement - 46

A References

- Google Earth KMZ file showing proposed levee alignment

B Assumptions

build new levee
16' wide crown and 8' height - (assume flood flow @ 5' above levee toe w/ 3' Fb)
say 3:1 waterside slopes and 2:1 landside slopes
assume 3' over excavation and recompaction for levee stability

levee length	4,927	ft
fill area	456	sq ft

C Compacted Embankment Quantities

- calculate earthwork with average end area method, assume uniform section throughout

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		456.00			
	4,927		456.00	2,246,712	83,212
49+27		456.00			

Total	83,212	cu yd
Rounded total	**83,000**	cu yd

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Joaquin River Levee at Firebaugh Rodeo Grounds

Estimate of Cost

System Improvement - 46

References / Assumptions

- Google Earth KMZ file showing proposed levee alignment
- No land costs - levee to be built on City property
- 16' wide crown and 8' height
- 3:1 waterside slopes and 2:1 landside slopes
- 3' overexcavation and recompaction for levee stability
- 1 mile long linear footprint next to river - 15% environmental costs
- Engineering - geotechnical, design, bidding, comp testing

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install Compacted Embankment	83,000	cubic yards	$10.00	$830,000
				Subtotal	$830,000
				50% Contingencies & Incidentals	$420,000
				Total Construction Costs	$1,250,000
				Environmental Permitting	$120,000
				10% of Subtotal for Engineering Costs	$80,000
				Grand Total	$1,450,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

Modify Water Intake Structures at Selected Refuge Units

Estimate of Cost

System Improvement - 60

References / Assumptions

- F&W memo
- Listing of culvert sizes in Project O&M manual shows mostly 24", some 30", 36" & 48" culverts
- Bid prices for 24" canal gates
- Bid prices for typical galvanized steel gate access walkway
- Bid prices for rip rap on canal bank
- Self mitigating project, Flood Board permitting required
- Engineering - site evaluations, standard design, bidding

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Remove existing flap gate, Furnish and Install (F&I) Canal gate	40	each	$7,000	$280,000
2	F&I Metal access walkway	40	each	$12,000	$480,000
3	F&I Rip rap slope protection	40,000	square feet	$5	$200,000
				Subtotal	$960,000
				50% Contingencies & Incidentals	$480,000
				Total	$1,440,000
				Permitting	$50,000
				Engineering	$50,000
				Grand Total	$1,540,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR East Bear Creek Unit

Install lift pumps to divert water onto 1000 acres of wetland basins during flood flows

Estimate of Cost

System Improvement - 61

References / Assumptions

- F&W memo
- Inlet channel, say 10' bottom, 6' deep
- Self mitigating project, Flood Board permitting required
- Engineering - surveying, design, bidding

Project A

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Excavate pump inlet channel	400	linear feet	$35	$14,000
2	Furnish and Install (F&I) Pump sump structure		lump sum		$85,000
3	F&I 125 HP pump unit	1	each	$50,000	$50,000
4	F&I Electrical work		lump sum		$105,000
5	F&I 30" Steel discharge pipe	150	linear feet	$200	$30,000
6	F&I Miscellaneous site work		lump sum		$30,000
				Subtotal	$314,000
				50% Contingencies & Incidentals	$156,000
				Total	$470,000
				Permitting	$50,000
				Engineering	$50,000
				Grand Total	$570,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR East Bear Creek Unit

Install lift pumps to divert water onto 1000 acres of wetland basins during flood flows

Estimate of Cost

Project B

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Furnish and Install (F&I) 48" Inlet pipe	150	linear feet	$300	$45,000
2	F&I Pump sump structure		lump sum		$85,000
3	F&I 125 HP pump unit	1	each	$50,000	$50,000
4	F&I Electrical work		lump sum		$105,000
5	F&I 30" Steel discharge pipe	200	linear feet	$200	$40,000
6	F&I Discharge valves		lump sum		$40,000
7	F&I Miscellaneous site work		lump sum		$30,000
				Subtotal	$395,000
				50% Contingencies & Incidentals	$195,000
				Total	$590,000
				Permitting	$50,000
				Engineering	$50,000
				Grand Total	$690,000

Total Cost of Projects A & B

Construction	$709,000
Contingencies & Incidentals	$351,000
Total	$1,060,000
Permitting	$100,000
Engineering	$100,000
Grand Total	$1,260,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR East Bear Creek Unit
Restore a wetland swale to divert floodwaters onto 1000 acres of wetland basins during flood flows

Estimated Material Quantity - excavated material

System Improvement - 62

A References

- Google Earth KMZ file

..\..\..\AUTOCAD\DWGS\MISC\LowerSJLeveeDist\RFMP Map Data\Project 62 San Luis NWR Restore Wetland Swale

- F&W memo

B Assumptions

swale to be 150' avg width at top
excavate 5' deep with 8:1 side slopes
spread spoil adjacent to swale

C Excavation Quantities

- calculate earthwork, assume uniform section throughout

top width (estimated)	150	ft
side slopes	8	:1
depth	1.5	ft
bottom width	126	ft
excavation area	207	sq ft
lengths	3600	ft
	1400	
	1500	
	800	
	1000	
total	8300	

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		207.00			
	8,300		207.00	1,718,100	63,633
83+00		207.00			

Total	63,633	cu yd
rounded total	**64,000**	**cu yd**

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR East Bear Creek Unit

Restore a wetland swale to divert floodwaters onto 1000 acres of wetland basins during flood flows

Estimate of Cost

System Improvement - 62

References / Assumptions

- Google Earth KMZ file
- F&W memo
- Swale to be 150' avg width at top
- Excavate 5' deep with 8:1 side slopes
- Engineering costs, topo survey, grading plan, say $40k
- Self mitigating, no Flood Board permit, say $10k

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Excavate and spread spoil adjacent to swale	64,000	cubic yards	$3.00	$192,000
				Subtotal	$192,000
				50% Contingencies & Incidentals	$98,000
				Total Construction Costs	$290,000
				Environmental Compliance	$10,000
				Engineering Costs	$40,000
				Grand Total	$340,000

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR East Bear Creek Unit
Enhance existing wetland depth and configuration to provide additional habitat and flood water storage on approximately 500 acres of wetland basins

Estimated Material Quantity - excavated material

System Improvement - 63

A References
- Google Earth KMZ file

..\..\..\AUTOCAD\DWGS\MISC\LowerSJLeveeDist\RFMP Map Data\Project 64 San Luis NWR Enhance Wetland Depth

- F&W memo

B Assumptions
basin to be 1000' avg width at top
excavate benches on each side of existing channel
lower benchs: ex 2'x175', upper benches: ex 1'x250'
spread spoil adjacent to swale

C Excavation Quantities
- calculate earthwork, assume uniform section throughout

lower bench width	175	ft
lower bench depth	2	ft
upper bench width	250	ft
upper bench depth	1	ft
excavation area	1200	sq ft
lengths	3000	ft
	2500	ft
total	5500	ft

Station	length (ft)	area (sq ft)	avg. area (sq ft)	volume (cu ft)	volume (cu yd)
0+00		1200.00			
	5,500		1,200.00	6,600,000	244,444
55+00		1,200.00			

Total	244,444	cu yd
rounded total	**244,000**	**cu yd**

Upper San Joaquin River Regional Flood Management Plan System Improvement

San Luis NWR East Bear Creek Unit

Enhance existing wetland depth and configuration to provide additional habitat and flood water storage on approximately 500 acres of wetland basins

Estimate of Cost

System Improvement - 63

References / Assumptions

- Google Earth KMZ file
- F&W memo
- Basin to be 1000' avg width at top
- Excavate benches on each side of existing channel
- Lower benchs: ex 2'x175', upper benches: ex 1'x250'
- Spread spoil adjacent to swale
- Engineering costs, topo survey, grading plan, say $40k
- Self mitigating, no Flood Board permit, say $10k

Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Excavate and spread spoil adjacent to basin area	244,000	cubic yards	$3.00	$732,000
				Subtotal	$732,000
				50% Contingencies & Incidentals	$368,000
				Total Construction Costs	$1,100,000
				Environmental Compliance	$10,000
				Engineering Costs	$40,000
				Grand Total	$1,150,000