

**RESPONSE TO FEBRUARY 16, 2018 REQUEST FOR ADDITIONAL
INFORMATION, RESOURCE AGENCY LATE FILING, AND
OTHER RELATED INFORMATION**

ATTACHMENT N

**BASIS OF UNIT COST DEVELOPMENT FOR
USFWS AND CDFW 10(J) RECOMMENDATIONS
REGARDING FLOODPLAIN RESTORATION**

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Technical Memorandum

Date: May 02, 2018

To: Turlock and Modesto Irrigation Districts

From: Daniel March, PE and Michael Garelo, PE (HDR)

Subject: **Basis of unit cost development for USFWS and CDFW 10(j) recommendations regarding floodplain restoration**

Introduction

This Technical Memorandum (TM) summarizes the development of order of magnitude unit costs representative of the level of effort required to perform floodplain reclamation and restoration adjacent to the lower Tuolumne River. The unit cost is developed using information and knowledge obtained by the Turlock Irrigation District (TID) and HDR Engineering, Inc. (HDR) through the implementation of floodplain restoration projects in the past decade. This final range of unit costs is intended to provide a gross estimate to be scaled to develop high-level cost estimates for floodplain restoration efforts recommended by the USFWS and CDFW in their January 29, 2018 10(j) recommendations on the Don Pedro Project. Neither the agencies, nor the authors of this memo, have verified whether suitable conditions for additional restoration projects even exist in the lower Tuolumne River.

Basis of Costs

Any potential floodplain restoration efforts along the banks of the Tuolumne River would require work under challenging conditions through the gravel mining reach, through Special Run Pool reaches, or through agricultural reaches. Solutions to working with private landowners, getting access (temporary and/or permanent) through active mining operations or agricultural land, acquisition of aggregate or mineral rights, reclamation of tailings ponds, and other types of land use challenges must be identified. A previously designed project was identified and used as the basis of cost to estimate the level of effort and associated cost that would be required. The resulting cost was then divided by the modified floodplain area to generate a unit cost that can be applied on a per acre basis.

For this activity, the previous project estimate developed by TID titled “Tuolumne River Channel Restoration Project: MJ Ruddy – Warner – Deardorff Mining Reaches” located at RM 35.2 to 37.5 was used to evaluate the work tasks and costs required to accomplish the goal of floodplain restoration. Sub reaches of the project were originally designed for TID in 2002 and 2004 and all three reaches were consolidated as one project in 2010. All potential cost items and singular unit costs were escalated to reflect 2018 US dollars. Total project costs were then used to develop unit costs per acre. Base costs are developed to an order of magnitude level of accuracy and therefore the recommended cost per unit acre is provided as a potential range calculated as -20% to +40% of the base unit cost. The basis of costs include the following phases of work:

1. Project formulation, design, and development of construction drawings – Development of specific project objectives, identification of project extents, preliminary design, site surveying and characterization, final design, development of quantities, preparation of contract documents for the purpose of bidding, and coordination among stakeholders and resource agencies.
2. Project right-of-way and easement acquisition – Landowner outreach, identification of temporary and permanent right-of-way limits, development of preliminary right-of-way drawings, verification of mineral rights acquisition costs, verification of real estate value, and final easement or property acquisition.
3. Procurement of nursery stock – Procurement of native plant nursery stock one-year in advance of project construction. Costs include rearing, delivering, and installing native plant materials anticipated for the project.
4. Construction – Execution of a contractual agreement with a prime contractor to provide all labor, equipment, and materials (with the exception of native plants) and installing the project as detailed in the approved drawings and specifications.
5. Post construction monitoring and plant management (assumed to be a minimum of 5 years) – This line item includes carrying forth an agreement with the native plant nursery to actively manage native plantings and perform annual monitoring reports that are to be submitted to the resource agencies as part of the project permitting requirements. Plant management includes non-native weed eradication within the project limits, native plant replacement, and temporary irrigation systems. Monitoring includes collection of water table data, plant survival, and plant replacement activities.

The following project elements describe the example used:

- 134 total acres of floodplain reclaimed and revegetated along 2.8 miles of river;
- 1 mile of water control berm to isolate flood flows from tailings ponds, mining operations, and agricultural land uses (not in conformance with FEMA regulatory requirements);
- 16 acres of existing tailings ponds reclaimed;
- Presence of engineered log jams and other forms of engineered habitat and river training elements were not included;
- The project occurs in an active aggregate mining reach; and
- Access to both sides of the river was required in perpetuity for mining and native plant management operations (performed via railcar bridge in this case).

Estimate Approach

The revised opinion of probable project costs (OPPC) uses volumes from the MJ Ruddy – Warner – Deardorff Mining Reaches restoration project with updated unit costs to reflect assumed 2018 construction costs. A detailed breakdown of all line items is provided in Appendix 1.

1. OPPC for the 100% design of the MJ Ruddy Reach of the Tuolumne River Restoration project prepared for TID in 2002 and 2004 was used as the basis of this OPPC.
2. Unit costs were updated to reflect 2018 US dollars.

3. Gravel mineral rights acquisition costs were computed using minable gravel volumes.
4. Gold mineral rights acquisition costs were computed using minable tonnage resulting from the Mineral Report created for the MJ Ruddy Reach in 2004 (HDR, 2004), averaged site specific fine gold ounces/ton, and current (4/2018) gold prices.
5. Administrative costs are based on typical percentage of construction costs.
6. Total project cost includes administrative, construction, right-of-way, mineral rights and easements.
7. Total project costs are divided by the area of floodplain formed in the example project resulting in cost/acre that are scalable for high level cost estimates of potential projects.

Results

Detailed calculations and results are provided in Appendix 1. A summary of results is provided below. Table 1 provides a summary of costs estimated for the example project which resulted in 134 acres of floodplain restoration. Table 2 provides a range of unit costs for both construction and total project costs (including right-of-way acquisition and implementation costs). The base unit costs of \$262,000/acre and \$385,000/acre were the result of the total construction costs and total project costs divided by the total number of floodplain acres (134). These values are expressed as a range of potential costs (-20% and +40% of the base unit cost) to account for the lack of specificity associated with the 10(j) recommendations.

Table 1. Summary of example project costs.

Cost Item Description	\$US (2018)
Project formulation, design, administration, and owner construction management	\$ 13,304,940
Project right-of-way and easement acquisition	\$ 3,245,364
Procurement, installation, management, and monitoring of nursery stock	\$ 1,245,000
Construction	\$ 33,768,000
Total Example Project Costs	\$ 51,563,304

Table 2. Summary of unit costs expressed in \$US (2018) per acre of floodplain.

Unit Cost Description	LOW (-20%)	BASE	HIGH (+40%)
Unit cost of construction and revegetation	\$ 209,600	\$ 262,000	\$ 366,800
Unit cost of total project costs	\$ 308,000	\$ 385,000	\$ 539,000

References Cited

HDR. 2004. Tuolumne River Restoration Project - MJ Ruddy Reach Mineral Report. Prepared for Turlock Irrigation District, November 2004.

Appendix 1 – Cost Data and Calculations

**TURLOCK AND MODESTO IRRIGATION DISTRICTS
LA GRANGE HYDROELECTRIC PROJECT FERC NO. 14581
PRELIMINARY FLOODPLAIN GRADING - PROJECT IMPLEMENTATION AND CONSTRUCTION COSTS
SUMMARY OF TOTAL AND UNIT COSTS (\$US, 2018)**

Table 1 - Example project ROW and easement acquisition costs.

PROJECT ROW AND MINERAL RIGHTS COSTS	UNITS	UNIT COST	QUANTITY	COST
RIGHT-OF-WAY ACQUISITION, PERM	AC	\$15,000	134	\$2,008,800
RIGHT-OF-WAY ACQUISITION, TCE	AC	\$1,000	10	\$9,500
MINERAL RIGHTS ACQUISITION (GRAVEL)	AC	\$5,616	134	\$752,524
MINERAL RIGHTS ACQUISITION (GOLD)	AC	\$3,541	134	\$474,540
TOTAL PROJECT ROW AND MINERAL RIGHTS COSTS				\$3,245,364

Table 2 - Summary of example OPCC (rounded to \$1,000).

COST ITEM DESCRIPTION	BASE OPCC W/ CONT
PRIME CONSTRUCTION COSTS	\$33,768,000
NATIVE PLANT NURSERY COSTS	\$1,245,000
TOTAL CONSTRUCTION COSTS	\$35,013,000

Table 3 - Example project implementation costs shown as a percentage of the OPCC.

COST ITEM DESCRIPTION	PERCENTAGE OF OPCC
CONSTRUCTION MANAGEMENT (Owner)	8.00%
PROCUREMENT	4.00%
ENGINEERING/CONSULTING	10.00%
PERMITTING	6.00%
PROJECT ADMINISTRATION	10.00%
TOTAL PERCENTAGE OF OPCC	38.00%

Table 4 - Example project implementation and total project costs.

COST ITEM DESCRIPTION	
TOTAL PROJECT IMPLEMENTATION COSTS (from Table 3)	\$13,304,940
TOTAL CONSTRUCTION COSTS (from Table 2)	\$35,013,000
TOTAL ROW AND MINERAL RIGHTS COSTS (from Table 1)	\$3,245,364
TOTAL PROJECT COSTS	\$51,563,304
TOTAL PROJECT ACREAGE (ACRES)	134

Table 5 - Project implementation and total project costs shown as cost per acre of floodplain restored.

UNIT COST DESCRIPTION	LOW (-20%)	BASE (PER ACRE)	HIGH (+40%)
UNIT COST OF CONSTRUCTION	\$209,600	\$262,000	\$366,800
UNIT COST INCLUDING ALL PROJECT COSTS	\$308,000	\$385,000	\$539,000

**TURLOCK AND MODESTO IRRIGATION DISTRICTS
PRELIMINARY PROJECT CONSTRUCTION COSTS**

EXAMPLE WARNER-DEARDORF-MJRUDDY REACH - LOWER TUOLUMNE RIVER

PRIME CONSTRUCTION CONTRACTOR COSTS			WD-MJ Ruddy Combined Reaches		
			Area	134	acres
			Imp. Length	2.8	miles
Item	Description	Unit	Unit Price	Quantity	Item Price
1	Care of water (trenching, shoring, bypass channel)	LS	\$ 75,000	1	\$ 75,000
2	TOTAL PROJECT ROW AND MINERAL RIGHTS COSTS	ACRE	\$ 3,500	48	\$ 167,584
3	Cobble Imported Fill (based on La Grange Site)	CY	\$ 25	474,627	\$ 11,865,675
4	Imported Topsoil Fill (based on Santa Fe Agg Site)	CY	\$ 10	160,025	\$ 1,600,250
5	Dike Embankment (Imported Cobble)	CY	\$ 25	135,258	\$ 3,381,450
6	Dike Embankment (Imported Soil)	CY	\$ 10	72,129	\$ 721,290
7	Onsite Cut/Fill	CY	\$ 8	491,655	\$ 3,933,240
8	Spawning Gravel	CY	\$ 35	19,496	\$ 682,360
9	Construct Waterside Access Ramp	EA	\$ 24,000	4	\$ 96,000
10	Construct Landside Access Ramp	EA	\$ 6,000	1	\$ 6,000
11	Equalization Saddles (50-Feet)	EA	\$ 76,300	1	\$ 76,300
12	Rock Filled Flow Channel (Cobble Material)	LS	\$ 25,000	2	\$ 50,000
13	Place 1/2 Ton Rock Slope Protection	TON	\$ 60	440	\$ 26,400
14	Place 1/4 Ton Rock Slope Protection	TON	\$ 60	2,520	\$ 151,200
15	Flatcar Bridge	LS	\$ 283,500	1	\$ 283,500
16	Construct Sante Fe Agg Bridge Approach Road	CY	\$ 25	200	\$ 5,000
17	Construct Temporary Haul Road around Bridge Const.	LS	\$ 20,000	1	\$ 20,000
18	Construct Monitoring Survey Benchmarks	EA	\$ 750	16	\$ 12,000
19	Remove Miscellaneous Debris from Stream	LS	\$ 15,000	2	\$ 30,000
20	Protect Existing Trees in Place (Misc. Costs)	EA	\$ 300	27	\$ 8,100
21	Tree Removal	EA	\$ 800	39	\$ 31,200
22	Protect Existing Irrigation Piping In Place	LS	\$ 2,000	2	\$ 4,000
23	Scarify Existing Grade Terraces	ACRE	\$ 600	16	\$ 9,600
24	Slope Vegetated Rock Slope Protection	SY	\$ 80	1,889	\$ 151,120
25	Construct New Pipe Gate	EA	\$ 4,000	2	\$ 8,000
26	Remove Existing Barbed Wire Fencing	LF	\$ 5	200	\$ 1,000
27	Construct Barbed Wire Fencing	LF	\$ 12	400	\$ 4,800
Rounded Subtotal					\$ 23,401,070
General Contractor Indirect Costs					
	Mobilization	Percent	3.00%		\$ 702,032.10
	General Conditions	Percent	5.00%		\$ 1,170,053.50
	Insurance/All Risk	Percent	1.50%		\$ 351,016.05
	Bonds	Percent	1.50%		\$ 351,016.05
Rounded Subtotal					\$ 2,574,118
Total Construction Costs					\$ 25,975,188
	Contingency	Percent	30.00%		\$ 7,792,556
TOTAL PRIME CONTRACTOR CONSTRUCTION COSTS WITH CONTINGENCY					\$ 33,768,000

**TURLOCK AND MODESTO IRRIGATION DISTRICTS
PRELIMINARY PROJECT CONSTRUCTION COSTS**

EXAMPLE WARNER-DEARDORF-MJRUDDY REACH - LOWER TUOLUMNE RIVER

NATIVE PLANT NURSERY CONSTRUCTION COSTS			WD-MJ Ruddy Combined Reaches		
			Unit Price	Quantity	Item Price
Item	Description	Unit			
1	Soil Moisture Station	EA	\$ 600	9	\$ 5,400
2	Planting Module Type 1 - Rush	EA	\$ 230	90	\$ 20,700
3	Planting Module Type 2 - Sedge	EA	\$ 115	54	\$ 6,210
4	Planting Module Type 3 - Mugwort	EA	\$ 65	42	\$ 2,730
5	Planting Module Type 4 - Wild Rose	EA	\$ 156	73	\$ 11,388
6	Planting Module Type 5 - Blackberry	EA	\$ 156	41	\$ 6,396
7	Planting Module Type 7 - Elderberry	EA	\$ 138	71	\$ 9,763
8	Planting Module Type 8 - Arroyo Willow	EA	\$ 207	52	\$ 10,764
9	Planting Module Type 10 - Button Bush	EA	\$ 185	17	\$ 3,145
10	Planting Module Type 11 - Alder	EA	\$ 207	8	\$ 1,656
11	Planting Module Type 12 - Red Willow	EA	\$ 252	51	\$ 12,852
12	Planting Module Type 13 - Shining Willow	EA	\$ 271	37	\$ 10,027
13	Planting Module Type 14 - Black Willow	EA	\$ 271	78	\$ 21,138
14	Planting Module Type 15 - Mixed Willow	EA	\$ 261	58	\$ 15,138
15	Planting Module Type 16 - Cottonwood	EA	\$ 261	154	\$ 40,194
16	Planting Module Type 17 - Mixed Cottonwood	EA	\$ 261	251	\$ 65,511
17	Planting Module Type 18 - Ash	EA	\$ 280	292	\$ 81,833
18	Planting Module Type 19 - Western Sycamore	EA	\$ 261	65	\$ 16,965
19	Planting Module Type 20 - Mixed Valley Oak	EA	\$ 261	626	\$ 163,386
20	Planting - Infill Cottonwood	ACRE	\$ 690.00	1.5	\$ 1,035
21	Planting - Infill Valley Oak	ACRE	\$ 690.00	1.4	\$ 966
22	Hydroseeding (Native Grass Species)	ACRE	\$ 2,000	12.58	\$ 25,160
23	Furnish and Install Beaver Protection	EA	\$ 35	1635.48	\$ 57,242
24	Irrigation and Maintenance (2 Years Post Construction)	LS	\$ 90,000	2	\$ 180,000
25	Monitoring and reporting	EA	\$ 25,000	5	\$ 125,000
	Rounded Subtotal				\$ 895,000
General Contractor Indirect Costs					
	Mobilization	Percent	4.00%		\$ 35,800.00
	Insurance	Percent	1.50%		\$ 13,425.00
	Bonds	Percent	1.50%		\$ 13,425.00
			Rounded Subtotal		\$ 62,650
	Total Construction Costs				\$ 957,650
	Design and Construction Contingency	Percent	30.00%		\$ 287,295
TOTAL NATIVE PLANT NURSERY COSTS					\$ 1,245,000
TOTAL CONSTRUCTION AND NATIVE PLANT NURSERY COSTS					\$ 35,013,000