

## **CVP Cost Allocation Study Decision for Construction and Capital Cost Evaluation Methodology**

### **Date**

May 4, 2015

### **Purpose of Paper**

Proposed Cost Estimating Methodology for Construction and Capitalized Costs for Facilities Included in the Central Valley Project (CVP) Cost Allocation.

### **Background**

In March 2012, the Bureau of Reclamation presented two alternative cost analysis methodologies at a public meeting for use in the CVP cost allocation study: indexing and re-pricing. The selected method will be used to evaluate single and multipurpose alternative costs, as well as the multipurpose costs without a “specific” function, to determine both the separable and joint costs for the study. Regardless of the method selected, consistent with FAC 09-01 (D&S for Cost Estimating), all costs will be evaluated at an appraisal level of analysis. The technical team has continued to evaluate the strengths and weaknesses of each method and presents the following information and recommendation for the leadership team’s consideration.

### **Methods:**

Indexing escalates past construction costs over time by utilizing price relationship ratios for future or past years in order to compare all costs at a common point in time (the base year). There are two cost indices from the Engineering News Record (ENR) that Reclamation has considered, Construction Cost Index (CCI) and Building Cost Index (BCI). The CCI focuses primarily on labor costs, while the BCI focuses primarily on materials costs. Additionally, Reclamation has developed an index which captures cost based upon facility type, the Construction Cost Trends (CCT).

Indexing includes potential risks:

1. Indices may not capture all cost escalations over time, especially when construction costs occur long before the base year for the study, reducing the accuracy of the index.
2. Different cost indices are developed using slightly different constituent elements. Although costs may be comparable, the results may be significantly different.

Indexing provides several potential advantages:

1. Indexing utilizes accumulated annual costs recorded in Schedule No. 1, providing fairly quick access to accurate records.
2. Meets Reclamation's Specific, Measurable, Achievable, Repeatable, and Time Related (SMART) goals, which provide easy auditing and tracking by stakeholder groups in order to verify the study results.
3. Allows ready documentation of construction costs and accounting adjustments made over time.

Re-pricing differs from indexing in that it utilizes actual material quantities for each feature and/or facility based upon the original contract award and/or close-out documents. Base year or current unit prices are then applied to these quantities; i.e. applying 2010 prices to the original quantities.

Re-pricing includes several potential risks:

1. Re-pricing requires significant records research in order to compile original contract quantities for each contract ever awarded for a facility, follow-on contracts, and accounting adjustments. These records, in some instances, either do not exist or may only exist in one place. Finding or recreating these records can be challenging and very time consuming. Re-pricing will require roughly 2-3 times as much effort as indexing due to records search and evaluation.
2. Historically long periods sometimes have significant variations in construction means and methods as well as materials quality and technology. This can create significant departures in cost structure when, for instance, you apply a 2010 unit price to a 1937 contract quantity.
3. Requires consensus or agreement on numerous assumptions that could delay or derail the study.
4. The risk of overweighting one particular contract item based upon base year pricing is increased. This promotes the risk of over inflating major

costs drivers, which in turn could grossly inflate the facility cost in the base year.

Re-pricing provides one potential advantage:

1. No re-engineering or re-designing of facilities and/or features is involved, as the original contract quantities are multiplied by the corresponding unit prices for the base year.

## **Evaluation**

Reclamation evaluated the cost of building Shasta Dam in 2010 dollars using the CCT, BCI and CCI indices as well as re-pricing. The indices predicted 2010 costs of \$1.5 billion, \$2.5 billion and \$3.3 billion, respectively. Using the re-pricing technique, Shasta Dam's cost to build in 2010 dollars was determined to be \$5 billion. Obviously, the range of both techniques, from \$1.5 to \$5 billion, is considerable.

The Upper San Joaquin River Basin Feasibility Study affords a timely and direct comparison for the Shasta Dam example. The current cost estimate for Temperance Flat Dam is \$2.48 billion. This dam is similar enough, at an appraisal level of analysis, to allow a direct, currently priced and independent evaluation of indexing and re-pricing. When comparing the \$2.48 billion cost estimate to each of the Shasta indexed and re-priced cost estimates, the result confirms that the BCI estimate of \$2.5 billion is the most reasonable technique. Refer to Figure 1, below.

Although stakeholders initially expressed a preference for re-pricing, some have recently stated that they would prefer indexing because the costs associated with acquiring the data needed to accomplish this technique would be much higher than the cost indexing approach. The technical team estimates that the re-pricing method would require 2-3 times the labor that would be required for indexing and that the re-pricing method does not increase the accuracy of the cost estimate. In conclusion, cost indexing will be repeatable, cost effective and accurate at the appraisal level of analysis.

## **Decision**

Based on the information described in this paper, Reclamation will use the cost indexing method, specifically BCI, for the final CVP Cost Allocation Study.

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## Shasta Dam vs Temperance Flat Dam for Appraisal Level Analysis

Description/Line Items	2010 Unit		Shasta Dam		Temperance Flat Dam	
	Price	Units	Units	Price Ext.	Units	Price Ext.
<b>Major Cost Drivers</b>						
Excavation	\$14.66	CY	4,992,845	\$73,176,000	16,879,000	\$246,970,000
- Excavation for non-similar uses <sup>1,2</sup>					10,871,100	<del>-\$159,328,000</del>
<i>Subtotal</i>					6,007,900	\$87,642,000
Backfill/Compaction	\$42.18	CY	2,184,712	\$92,145,000	5,193,000	\$94,010,000
- Backfill/Compaction for non-similar uses <sup>2</sup>					603,100	<del>-\$25,437,000</del>
<i>Subtotal</i>					4,589,900	\$68,573,000
Aggregate	\$11.90	Ton	3,905	\$47,000	7,022,500	\$83,592,000
Cement	\$135.43	Ton	-	\$0	727,000	\$98,454,000
Concrete	\$55.83	CY	6,537,111	\$364,980,000	4,450,000	\$248,450,000
<b>Subtotal Major Cost Drivers</b>				<b>\$530,348,000</b>		<b>\$586,711,000</b>
Unlisted Item Estimating Percent			13.8%		20.9%	
<b>Unlisted Items</b>				<b>\$84,698,000</b>		<b>\$155,257,000</b>
<b>Total Estimated Base Year (2010) Cost to Construct</b>				<b>\$615,046,000</b>		<b>\$741,968,000</b>

**Notes:**

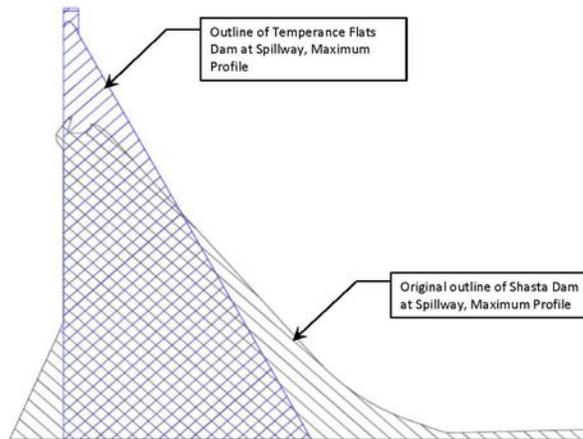
1. Excavation for Temperance Flats Dam includes Quarry and concrete batch plant with 10,268,000 CY of materials excavated, which Shasta Dam did not have.
2. Excavation and backfill/compaction for Temperance Flats Dam includes temporary cofferdams with 603,100 CY of materials.
3. Concrete values in Shasta Dam were reported as CY, where concrete values were reported as CY for small portions of conventional concrete, ton of aggregate and ton of cement for the bulk of RCC dam construction.
4. Concrete dam construction in the 1940s had a wider, more stout base and the base width for Temperance Flats Dam is at maximum 350 feet narrower than that of Shasta Dam.

PROJECT STATUS	PROJECT STAGE	LEVEL OF COST ESTIMATE PRODUCED
Planning	Planning	Preliminary
		Appraisal
		Feasibility
Construction	Design	Percent Design (Updated feasibility) Prevalidation of Funds
	Solicitation	Independent Government Cost Estimate [Award]
	Construction	Independent Government Cost Estimate for Contract Modifications
	Operation and Maintenance	Operations

**(b) Appraisal Estimate.**

- (i) Appraisal cost estimates are used in appraisal reports to determine whether more detailed investigations of a potential project are justified. These estimates may be prepared from cost graphs, simple sketches, or rough general designs which use the available site-specific design data. These estimates are intended to be used as an aid in selecting the most economical plan by comparing alternative features such as dam types, dam sites, canal or transmission line routes, and powerplant or pumping plant capacities.
- (ii) Appraisal cost estimates are not suitable for requesting project authorization or construction fund appropriations from the Congress due to the early stage of project development.

Per Reclamation Manual Directive and Standards, *FAC 09-01 Cost Estimating* dated 10/15/2007



**Figure 1 – Shasta Dam vs Temperance Flat Dam for Appraisal Level Analysis**