



**US Army Corps
of Engineers®**

**Sacramento District
Engineering Division**

**Lower San Joaquin River Feasibility Report -
Environmental Impact Report /
Environmental Impacts Statement**

San Joaquin County, California

COST ENGINEERING ADDENDUM

December 2017

COST ENGINEERING ADDENDUM

H.1 General

This document provides Cost Engineering data for the recommended plan (TRP) and provides a history of Cost Engineering data determined for the final array of alternatives leading to the TSP (Alternative 7A of the Final Array of Alternatives) that has become the recommended plan. The project area is near and around the city of Stockton, CA.

The final array of alternatives was based on the ‘focused’ array of alternatives developed during the planning process. There were six alternatives in the final array, as listed below. For descriptions of the alternatives, see Chapter 4 of the Draft Integrated Feasibility Report and Section 2.4.4 of Appendix B - Engineering Summary.

Final Array of Alternatives

Alternative 1: No Action

Alternative 7a: North and Central Stockton, Delta Front, Lower Calaveras River, and San Joaquin River Levee Improvements excluding RD 17

Alternative 7b: North and Central Stockton, Delta Front, Lower Calaveras River, and San Joaquin River Levee Improvements including RD 17

Alternative 8a: North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River, and Stockton Diverting Canal Levee Improvements excluding RD 17

Alternative 8b: North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River, and Stockton Diverting Canal Levee Improvements including RD 17

Alternative 9a: North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass excluding RD 17

Alternative 9b: North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass including RD 17

H.2 Cost Engineering Data for the Final Array of Alternatives Leading to the TSP

H.2.1 Quantity Takeoffs

Quantities for most project items relative to levee construction/modifications were developed by Civil Design Section using a spreadsheet called PCET (Parametric Cost Estimating Tool). This spreadsheet utilizes generic cross sections with predetermined cost elements (typical levee work such as clearing and grubbing, earth fill, aggregate base, etc.). The PCET provides quantities for those elements based on input of design levee parameters as determined by the Geotechnical Section.

H.2.2 General Methodology in Cost Estimate Preparation

During the period of alternatives study leading to the TSP, ER 1110-2-1302 requires Class 4 Cost Estimates as a minimum. Class 4 estimates are primarily stochastic in nature with an expected accuracy range index of 3 to 12 where the value of ‘3’ represents +30/-15 percent and a

value of 12 represents a +120/-60 percent range. In developing the class 4 cost estimates for the alternatives, the Cost Engineering team (Cost Engineers and Civil Design Engineers) utilized a number of different methods to determine project costs.

1) PCET and Levee Improvement Cost Summary - Each of the cost elements in the PCET has a unit cost (Contractor Cost) associated with it. These unit costs are input by the user. Generic/parametric/characteristic unit construction costs for many typical levee improvement elements were developed using estimating software MII (MCACES, 2nd Generation). For example, a typical element such as a slurry wall or borrow material (acquisition and placement), a unit cost was established based on a 'typical' crew, production rate, material cost, assumed/typical haul distance, etc. Davis Bacon labor rates (2014), MII Equipment rates (2011 Equipment Book), current fuel prices (2014) and generic/typical Contractor markups were utilized to establish unit costs. For any particular levee improvement (such as to fix-in-place the levee by degrading, placing a slurry wall/seepage barrier and restoring the levee), the PCET sums the quantities times the unit costs, adds a percentage for such items as mobilization and demobilization, and indicates a total cost per linear foot of levee improvement.

2) Historical Cost Data – Historical unit costs for some items have been utilized based on cost estimates for past projects in the vicinity of Sacramento. For example, pump station costs were based on costs for similar pump stations developed for the Natomas PACR.

3) Cost Data supplied by other Disciplines, specifically Real Estate and Environmental (Mitigation)

4) Cost Engineering Experience – Cost Engineering judgment and experience was used to base some costs on a percentage of construction costs (e.g. Preconstruction Engineering and Design / PED cost, Construction Management cost). The percentages are based on historical data and typical rates used by SPK Cost Engineers in the past.

Each alternative consists of several separable areas divided into reaches/sub-alternatives of various lengths and each reach has an associated type of levee improvement. The sum of all applicable costs for each reach is entered into a spreadsheet that is a compilation of total project costs. The total project cost summaries (first cost) follow the Civil Works Work Breakdown Structure (CWWBS) code of accounts. Feature Codes typically involved in this estimate are 01-Lands and Damages (Real Estate), 02-Relocations, 06-Fish and Wildlife Facilities, 11-Levees and Floodwalls, 15-Floodway Control & Diversion Structure, 18-Cultural Resource Preservation, 30-Preconstruction Engineering and Design, and 31-Construction Management. The 30 and 31 accounts involve any costs associated with USACE staffing on the project for the federal share and anticipated costs associated with local sponsor costs for the non-federal share. The cost estimate for each Alternative is the summation of the costs from the major cost categories. The costs do not account for life cycle costs.

H.2.3 OMRR&R Costs

A brief investigation of additional OMRR&R costs required due to new physical features constructed by this project was done by the Civil Design Engineer. This was done by first gathering info from various Levee Districts and State Maintenance Agencies within the Stockton

area in order to establish the current OMRR&R costs/budgets for the existing levees and associated roads and utilities. Data was acquired from the 2012 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Protection System. Data was in the form of annual costs which were pro-rated by length of levee maintained. The following shows the OMRR&R Costs for each alternative in the final array:

OMRR&R COSTS		
Alternative	OMRR&R Annual Cost	OMRR&R Lifespan Cost (50 yr)
7a	\$ 274,800	\$ 13,740,000
7b	\$ 386,700	\$ 19,335,000
8a	\$ 296,600	\$ 14,830,000
8b	\$ 408,500	\$ 20,425,000
9a	\$ 344,800	\$ 17,240,000
9b	\$ 456,700	\$ 22,835,000

H.2.4 Total Project Schedule (including Construction)

No formal construction schedule has been developed at this stage, but the assumption has been made that the yearly federal monetary allotment for the project will be approximately \$100M. The initial PED portion of the project is assumed to take about 2 years, with approximate total duration until construction completion for each alternative in the final array as indicated in the following table:

APPROXIMATE DURATION	
Alternative	Yrs
7a	12
7b	15
8a	12
8b	15
9a	12
9b	15

H.2.5 Cost Uncertainties & Risk Analysis

There are inherent uncertainties in the costs at this level of design (alternatives analysis) since there is no detailed design, plans or specs. There are also inherent uncertainties as the construction contractor(s) are responsible for obtaining the construction materials, accomplishing the work in a timely manner as per the project due date, using overtime and/or multiple crews to accomplish the same, etc. Funding appropriations are uncertain. The Central Valley of California is home to many threatened/endangered species that require much of the work to be done within certain construction windows, typically May-October.

For this project, more than 50% of the costs for this project are directly related to levee improvements. A large percentage of this is obtaining and hauling materials for placement of levee fill or impervious fill material (clay cap). For the purposes of the cost estimate, the assumption has been made that stone material will be placed from the landside (trucked). Stone materials are expected to come from either the Bay Area or the Sierra Nevada mountains. In either case, haul distance is approximately 75-100 miles (one-way). Much of the existing levee material can be re-used but still must be hauled to/from stockpiles. Impervious fill is assumed to come from within 25 miles (one-way haul). The potential contractors are free to obtain borrow from wherever they see fit, as long as it meets specs. Haul costs in general have some uncertainty as material supply locations are up to the contractor, as well as whether the contractor uses their own trucks or utilizes independent truckers for hauling. Another work feature of high risk/costs is the cutoff walls, particularly those using the deep soil mixing (DSM) method, which requires significant placement time.

An Abbreviated Cost Risk Analysis (ACRA) using the Cost MCX Abbreviated Risk Analysis Template (spreadsheet) was performed for each of the final array of alternatives. The alternative was divided into its main component areas (e.g. North Stockton, Central Stockton, and RD17) and risks were assessed relative to each area.

The ACRA meeting was held 4 NOV 2013 with the project manager and most PDT members. The meeting focused primarily on risk identification using the CRA template and brainstorming techniques. The risk analysis process involved dividing project costs into typical risk elements and placing them into a Risk Register, then identifying the risks/concerns relative to those risk elements, and then justifying the likelihood of the risk occurring and the impact if the risk occurs. A Risk Matrix utilizing weighted likelihood/impacts is used to establish the cost contingency to use for each risk element (work feature) for use in alternatives comparisons. Project risks were identified and the risk register developed within the spreadsheet for the component areas of each alternative. The likelihood of, and impact on, each risk element was assessed by the PDT. The draft risk register and results were then forwarded to the PDT for review.

Risk elements were identified for each alternative based on the Civil Works Work Breakdowns Structure (CWWBS) and work feature. Prime construction work features identified were Earthwork, Cutoff Walls, DSM walls (Seismic), and Slope/Erosion Protection, These items typically accounted for 80 percent or more of the costs, except for the Central Stockton area,

where there are several diversion structures and bridges that are, with remaining construction features such as mob/demob, relocations, and hydroseeding, lumped together in a category for 'Remaining Construction Items.' The risk register thus serves the purpose of historical documenting as well as to support follow-on risk studies as the project and its accompanying risks evolve. The results of the ACRA therefore reflect the risk register parameters and are considered adequate for establishing contingencies for alternatives comparison. See also, Attachment A.

To fully recognize its benefits, risk analysis must be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, budgeting and scheduling.

H.2.6 Review/DQC

The screening level cost engineering data has been reviewed by estimators at the Sacramento District.

H.2.7 Screening Level Costs

For draft Project First cost for each alternative (including the contingencies), see Attachment B. All costs are considered preliminary and are only to be used to compare the relative cost between the Alternatives. Focus on the Cost Engineering data has been on the alternatives. Once the PDT has selected the TSP and any locally preferred plan (if different from the TSP), Feasibility Level design details and quantities (by Civil Design) and Cost Engineering data must be developed. This includes creation of feasibility level plans and associated quantities, development of a detailed MII estimate, a Total Project Schedule (including Construction), PDT estimates for Planning, Engineering and Design, an updated Cost and Schedule Risk Analysis and a Total Project Cost Summary (TPCS) extending costs out through the life of the Project. The MII estimate must be detailed indicating labor, equipment and materials with accompanying production rates.

H.2.8 Key Assumptions

H.2.8.1 Quantities and Parametric Cost Estimates

- Cross Sections for the various levee improvements or new levees are representative of the levee reach. Where design is insufficient to produce detailed quantities for each reach, the use of these typical cross-sections represents quantities adequate to screen alternatives to the point of determining a tentatively selected plan.

- Unit Costs utilized are reasonable.

H.2.8.2 Haul Distances

- Levee Fill Borrow will come from within 25 miles (one-way haul).

H.2.8.3 Project Schedule

– For each area of construction, PED and Real Estate acquisition will occur over 1 to 2 years prior to commencement of construction. For construction, the duration developed is based on the assumption that the yearly federal monetary allotment for the project will be approximately \$100M.

H.2.8.4 Real Estate

- Real Estate Costs are reasonable.

H.2.8.5 Environmental Mitigation

- Costs provided by the Environmental Specialists in Planning are reasonable.

H.2.8.6 PED Costs

– 15% of Federal Share Construction Costs & 15% of Non-Federal Construction Costs are consistent with those used in recent years for feasibility studies performed by the Sacramento District.

H.2.8.7 Construction Management

Costs – 10% of Federal Share Construction Costs & 10% of Non-Federal Construction Costs are consistent with those used in recent years for feasibility studies performed by the Sacramento District.

H.3 COST ENGINEERING DATA FOR THE RECOMMENDED PLAN

H.3.1 BASIS OF ESTIMATE

This estimate is based on the Final Feasibility Report:
San Joaquin River Basin
Lower San Joaquin River, CA
Final Integrated Interim Feasibility Report
September 2017

Cost Engineering Data for the recommended plan has been developed.

For Feasibility Level cost of the recommended plan, ER 1110-2-1302 requires Class 3 Cost Estimates as a minimum. Class 3 estimates are primarily stochastic in nature. In general, the unit costs for the construction features are computed by estimating the equipment, labor, material, required and the production rates suitable for the project features. The baseline feasibility cost estimate was developed from quantity take-off calculations provided by the Sacramento District's Civil Design Section. Levee alignments were provided to Cost Engineering as Google Earth files. No detailed plans/drawings were developed. Supplementary drawings of certain items such as floodwalls were developed to provide some clarity for cost estimating and review.

Due to the large scope, the project is broken into construction contracts by reach. Each reach is assumed to be a separate contract. The type of solicitation is expected to be unrestricted IFB.

H.3.2 PROJECT SCOPE/DESCRIPTION

The project provides for flood risk reduction near and around the city of Stockton, CA and consists primarily of the construction of in-place levee improvement measures to address erosion protection and slope stability, seepage, and overtopping (height) concerns. Flood risk management will also be aided by constructing and operating closure structures on Fourteenmile Slough and Smith Canal. Below is a brief description of the design remediation methods. Further detail can be found in Appendix B - Engineering Summary.

Erosion protection and slope stability are improved by placing rock revetment on the waterside of the levee. The rivers, creeks and sloughs are too shallow for barges and placement will be from the land side.

The levee remediation to address seepage is provided through cutoff walls, by degrading the levee and then constructing a cutoff wall utilizing soil-bentonite slurry walls. Cutoff walls are typically through the centerline of the levee. In one reach, a new levee will be constructed, offset from the existing levee. Part of this new levee will utilize deep-soil-mixing (DSM). A grid pattern of DSM walls will provide seismic stability for the levee that overtops it. At one of the crossings of Interstate 5, relief wells are used where the top of levee is below the I-5 bridge deck.

Height improvements to address overtopping concerns include levee raising and new floodwalls or height improvements to existing floodwalls.

Along the levees, there are utilities that need to be relocated or removed. Active utilities such as pressure pipes, irrigation pipes, drainage pipes, electrical, sewer, gas, cable and water lines are to be removed and replaced in order to construct the cutoff walls. Temporary utilities service is to be provided during the service outages. Roads or bike paths on the levee crowns that must be removed in order to demolish or relocate utilities will be replaced. In a few locations, the utilities are of such a size or depth that it is considered to be impractical to provide temporary utility services and at these locations jet grouting is assumed in lieu of cutoff walls.

H.3.3 ENVIRONMENTAL AND CULTURAL RESOURCES (UPDATE FROM STUDY OF ALTERNATIVES FOR SELECTION OF TSP)

Mitigation costs were estimated based on acreages of habitat types impacted per the requirements of the Biological Opinions. Each habitat type's costs were assessed considering onsite mitigation and offsite mitigation. For habitat mitigation, a habitat evaluation was performed to assess the quality of the existing habitat compared to an estimate of the future with project condition. The results of the habitat evaluation was applied to a cost effectiveness/incremental cost analysis to determine the most cost effective mitigation alternatives for the Government. Mitigation is proposed in quantities ranging from in-kind, to a

2 to 1 ratio or 3 to 1 ratio. Larger quantities of mitigation are only proposed when required by the terms and conditions of the Biological Opinions.

On-site mitigation is preferred because it provides higher habitat compensation values than off-site mitigation because the restoration activities occur on the same area as the area of the impact, and was used to the extent practicable. On-site mitigation costs were coordinated with the Corps' landscape architecture department and were based on past experience for implementation of these types of sites in the area. Additional consideration went into the feasibility of whether or not on-site mitigation was practicable for the impacted habitat type. The cost for offsite mitigation is based on the acreage required multiplied by a standard rate for buying credits from a local mitigation bank.

The Cultural Resources Mitigation cost estimate is performed by SPK Cultural Resources and provided to Cost Engineering. Since this is a construction cost, the effective contingency is derived from the Cost and Schedule Risk Analysis. Mitigation costs were initially set at 1% of the project cost; this has since been revised during the comment period. Revised mitigation costs were estimated based on the size of the proposed project, the number of known cultural resources sites within a portion of the project area, the diversity of site types, and costs for mitigation on other SPK Civil Works Projects of similar scales. Importantly, mitigation costs are a component of the broader compliance process undertaken by SPK, and should not be seen as the total cost of compliance activities.

H.3.4 OMRR&R UPDATE

The Table below provides the annual cost of OMRR&R for the recommended alternative based on a 50 year design life. This also accounts for subsidence of the non-federal levees with the assumption of a 2 FT high floodwall constructed at the end of 25 years (over 46,800 LF of levee).

	OMRR&R Annual Cost	OMRR&R Lifespan Cost (50 yr)
recommended plan	\$ 274,800	\$ 13,740,000
Subsidence (assumes floodwall constructed after 25 YR)	\$ 595,000	\$ 29,750,000

H.3.5 MII COST ESTIMATE - NOTES & ASSUMPTIONS

The MII (MCACES, 2nd generation) Cost Estimate is divided into reaches, with each reach assumed to be a separate construction contract. Separate MII files were developed for two control structures (considered two additional construction contracts). See Attachment C for summary costs from the MII estimates.

PROJECT SCOPE/DESCRIPTION

The recommended plan has been divided into five levee reaches (typically 4-6 MI long) and two control structures (one at Fourteenmile Slough and one at the Smith Canal). The description of each reach, and typical work involved for each, is as follows:

North Stockton Area

North Stockton: Mosher Slough (LB), Stuart Tract (RB), Fivemile Slough (RB) – Begins along Fivemile Slough running east along the slough, turning north along Stuart Tract, then east along Mosher Slough, terminating at Thornton Rd. - Work consists of Levee Improvements, Relocations and Bank Stabilization. The reach consists of five levee segments. Levee Heights vary from 5 FT (Mosher Slough) to 15-20 FT (Stuart Tract and Fivemile Slough). Levee Crest Widths vary from 15-20 FT. Cutoff Walls are assumed to be SB, Cutoff Wall Depths are typically 50 FT.

Delta Front & Fourteenmile Slough Control Structure: Fourteenmile Slough (LB), Tenmile Slough (LB), San Joaquin River (RB) – Begins at the confluence of the San Joaquin and Calaveras Rivers, runs downstream on the San Joaquin to the marina at Buckley Cove Way, then turns North and follows along Tenmile Slough, then Fourteen Mile Slough until a short way past its juncture with Fivemile Slough. This will be the location of the new Fourteenmile Slough Control Structure. - Work consists of Levee Improvements, new levee offset from the existing, Relocations, Bank Stabilization, and seismic stability to the new levee through a grid pattern of DSM walls. The reach consists of six levee segments. Levee Heights vary from 10-20 FT. Levee Crest Widths are typically 20 FT. Four of the six segments has a Cutoff Wall, assumed to be SB, Cutoff Wall Depths are typically 50 FT. The other two segments have the DSM grid, 20-40 FT deep.

Calaveras River (RB) - Begins at the confluence of the San Joaquin and Calaveras Rivers, runs upstream on the Calaveras River right bank to North El Dorado Street. - Work consists of Levee Improvements and Relocations. The reach consists of eight levee segments. Levee Heights vary from 10-15 FT. Levee Crest Widths vary from 15-20 FT. Cutoff Walls are assumed to be SB, Cutoff Wall Depths vary from 20-50 FT.

Central Stockton Area

Calaveras River (LB) and San Joaquin River (RB, North Port) – There is relatively short levee segment along the San Joaquin River (RB) at the Golf Course. Work on the Calaveras River begins at the confluence of the San Joaquin and Calaveras Rivers, runs upstream on the Calaveras River left bank to North El Dorado Street. - Work consists of Levee Improvements and Relocations. The reach consists of eight levee segments. Levee Heights vary from 10-20 FT. Levee Crest Widths vary from 15-20 FT. Cutoff Walls are assumed to be SB, Cutoff Wall Depths vary from 20-50 FT.

Smith Canal Control Structure - Note that the Smith Canal Closure Structure will be constructed adjacent to the segment along the San Joaquin River, with some Levee Improvements at Dad's Point.

RD 404 and Duck Creek: San Joaquin River (RB), French Camp Slough (RB), Duck Creek (RB) – Begins at a railroad bridge over the San Joaquin River at the port of Stockton, continues upstream to the confluence of French Camp Slough and the San Joaquin River. This reach then continues upstream along French Camp Slough to Duck Creek, then upstream along Duck Creek, ending at El Dorado Street. - Work consists of Levee Improvements and Relocations. The reach consists of nine levee segments. Levee Heights vary from 10-15 FT. Levee Crest Widths vary from 15-20 FT. Cutoff Walls are assumed to be SB, Cutoff Wall depths vary from 20-70 FT.

ACQUISITION PLAN

The type of solicitation is expected to be unrestricted IFB. All the reaches are fairly long with most having several road/highway/interstate crossings and many utility relocations, several for large pipes. The work for any individual reach can probably be performed in one or two construction seasons (see TOTAL PROJECT SCHEDULE below), except for the Delta Front. For this reason, large business is assumed throughout.

CONTRACTING PLAN

For each reach, the prime contractor expected to be an earthwork contractor responsible for the general site work, borrow site excavation, levee degrading and rebuilding to the restored or new levee height, and bank stabilization.

Miscellaneous/General Subcontractors are expected to be utilized for cutoff walls, jet grouting, hydroseeding, and vibration monitoring.

CONSTRUCTION WINDOWS

The total project schedule for this estimate breaks construction for large reaches into seasons based on construction work windows. The construction work window for major Levee Improvement and Relocations construction activities is typically May-Oct, April and November are available for mobilization and demobilization of equipment and non-flood protection items such as hydroseeding that do not change the effectiveness of flood control and drainage system.

OVERTIME and PRODUCTIVITY

Overtime is included in this estimate. Assumption is 10 hr days, 6 days/week.

Normal Productivity/Task Durations are based on production for 50 minutes/hr to allow for meetings/breaks, accessing the working area/office trailer to get supplies, etc.

TOTAL PROJECT SCHEDULE (including Construction)

The Total Project Schedule including design, pre-construction and construction was developed using MS Project with construction durations based on those developed in MII. These are used to insure the project reaches could, in general, be completed within the construction windows and with the anticipated crews.

PROJECT CONSTRUCTION

The project has been divided into 7 reaches where construction will occur, with multiple utility relocations for penetrations through the levees, including several pumping stations or plants for

interior drainage or irrigation as well as several very large sewer force mains. There are multiple road crossings and four crossings of Interstate 5.

SITE ACCESS

The project sites are accessible by paved local roads to levee access points and then along the levee. In some areas, the haul route is required to be through residential or highly developed areas.

Traffic control will be required at levee access points. Traffic control costs are based on 5% of Extended Direct Cost of construction for most reaches, except the Delta Front, where much of the work is concentrated on the grid of DSM walls. In this case, 3% of the Extended Direct Cost of construction is used. Work at some of the I-5 crossings will likely be at night and costs for traffic control in these cases are determined separately.

It is assumed that placement will in general be about 12 loads per hour. Some of the local roads will receive many passes of heavy trucks and this may require resurfacing the roads following construction.

Locating Contractor Storage areas is problematical. The assumption on haul distances is dependent on the location, but it may be as long as 10 miles round trip in some areas.

BORROW \ DISPOSAL AREAS

The local sponsors have identified three potential Soil Borrow areas, and the furthest is assumed as the general location for borrow. In general, it is about 10-20 MI (one way) to the various reaches. It is uncertain whether all borrow can be obtained from these sites at the time of construction, so some borrow may need to be obtained from local suppliers or by development of new borrow sites by the Contractor. This was considered during the Cost and Schedule Risk Analysis (see below) and considered low risk. The Sponsor has confirmed that suitable borrow material is available within 25 miles.

The assumed landfill is the North County Landfill (San Joaquin County). The haul distance is 15-25 MI (one way), dependent on the reach segment location.

Certain companies in the Stockton area receive such items as green waste, broken concrete, and excavation that may not be satisfactory for reuse in levees, etc. The typical haul distance to these areas is about 10-20 MI (one way).

CONSTRUCTION METHODOLOGY

The construction methodologies are considered standard for most construction work. One exception to standard construction is jet grouting around deep utilities.

UNUSUAL CONDITIONS

Construction of the Control Structures such as those proposed for the project has not been done in the area for many years. Construction may be tidally influenced.

Night work is anticipated at the I-5 road crossings.

UNIQUE TECHNIQUES OF CONSTRUCTION

Deep Soil Mixing and Jet Grouting are considered unique in that relatively few contractors perform this work.

EQUIPMENT AND LABOR AVAILABILITY & DISTANCE TRAVELED

In an urban area such as Stockton and Sacramento (less than 50 MI away), equipment and labor is readily available. Deep Soil Mixing and Jet Grouting rigs are available, but in limited number, and there is a great deal of levee improvement work anticipated in the California Central Valley for the next 10 years or more. For this reason, it is assumed that no more than three DSM rigs are used within any construction reach.

ENVIRONMENTAL CONCERNS

Environment protection requires consideration of air, water, and land, and involves noise, solid-waste management and management of other pollutants. In order to prevent or provide for abatement and control of any environmental pollution arising from the work activities, the Contractor and his subcontractors in the performance of this contract, shall comply with all applicable Federal, State, and local laws, and regulations concerning environmental pollution control and abatement. The Contractor shall use best management practices at all times to minimize the potential for environmental impacts. The TOTAL PROJECT SCHEDULE reflects this.

LABOR RATES, EQUIPMENT RATES, MATERIAL & FUEL COSTS & SALES TAX

This estimate meets Davis Bacon wage rates for Davis Bacon wage determinations for the state of California as of September 2017.

Equipment unit costs were obtained from historical Quotes or verbal/telephone conversations with Contractors performing like or similar work and the MII/MCACES Equipment Library 2016, Region VII.

DIRECT COST SUBBID ITEMS

Subbid items are those expected to be either performed by a subcontractor or as a cost not directly for labor, materials or equipment (e.g. accessory items such as soil tests and Lab). Some of these items within the MII estimate have not been specifically designed for this feasibility study. Many of these items are based on quotes or historical data from previous projects. Assumptions for Crew Output or crew duration have been made, and in some cases, an allowance for cost made based on engineering judgment. Among the major cost items are the following:

DSM Placement

- DSM Placement – an Assembly (consisting of multiple construction items, laborers, and equipment) was developed for placement based on historic contact with a Contractor for DSM type work
- Lab Technician and Testing– for DSM placement, it is assumed a lab tech will be onsite and performing testing 100% of the time – Testing types are uncertain but have been assumed to include permeability testing and unconfined compressive tests. Cost per hour is per a Construction Tests Lab
- Trench Plates – for cutoff wall placement by DSM methods, contractors have utilized trench plates to support the heavy equipment as work progresses along the levee. These costs have been developed using rental rates. The number of plates assumed is based on historic DSM work.
- Survey Crew - This work involves a grid pattern of DSM panels. A survey crew is assumed to be onsite 25% of the time. Costs are per a contractor hourly quote.

Select Fill

- Lab Technician and Testing–it is assumed a lab tech will be onsite and performing testing 25% of the time. Cost per hour is per a Construction Tests Lab. Soils Tests are assumed to be typical tests for soils such as Atterberg Limits and Proctor Tests and testing costs are typically per the MII Cost Book.
-

Pumps (typically, these are replacement pumps for interior drainage pumping stations)

- Misc. Electrical Equipment – Pump Sizes have not been designed but are based on the pipe discharge sizes from similar pumping stations done for other projects in the Central Valley. Electrical Equipment required is uncertain and so an allowance has been made of 1/3 of the costs for pumps and motors. This is believed to be conservative. Pump Costs are per quotes.

Vibration Monitoring

- Vibration Monitoring is a typical requirement for levee improvement work. Costs are based on a historic project where the service was \$2400/MO for a 4000 LF stretch of levee. Costs presented in the MI estimate are extrapolated based on levee reach length and duration of work.

Hydroseeding

- Hydroseeding costs used in the estimate are per a contractor quote.

These items equate to more than 80% of the direct cost subbid items. Allowances for other minor items also are included in the MII estimate based on the MII Cost Book or cost engineering judgment. These include water for construction, dump fees, pavement marking for pavement crossings, tremies (hopper and pipe through which SB or SCB mix is placed in slurry filled trench below the bentonite-water slurry surface), pipe gates, and internal cleaning of pipes for utility relocations.

DIRECT COST USER ITEMS

In the MII estimate, the costs for several items are designated as USER and have been based on a percentage of direct costs of construction, rather than detailed out by crew output and labor, material and equipment costs. This has been done for multiple feasibility studies in the past and similar percentages are used here. Most of the costs are included in the following items Mob/Demob, Traffic Control, and SWPP. For Mob/Demob of Levee Improvements, 5% of construction is typically assumed. These costs are most relative to the beginning and end of construction, as equipment is mobilized and demobilized to the site. Mob/Demob for cutoff walls and jet grouting is presented in a separate cost item. Mob/Demob of 5% is also assumed for Traffic Control. The levee improvements span between many major arterial roads and there will be several crossings of a major interstate (I-5). Trucks will continually be hauling to/from the levees on public roads that will require extensive signage, some k-rail, temporary fencing/gates, and flaggers. One exception to this is the Delta Front Area, where the construction costs are high because of the great amount of DSM being performed yet access points where traffic control would be required are few in number. Here, only 3% of construction is assumed for traffic control. SWPP costs are assumed as 3% of construction. Extensive use of silt fence, straw waddles, and other methods of controlling runoff into the streams are utilized, require periodic maintenance and monitoring. SWPP costs for the Delta Front area are assumed at only 2% of construction, again because of the high construction costs due to DSM grid.

These items constitute more than 99% of the costs of User items in the MII estimate

Note: Fuel prices updated October 2017 using 5 year average of fuel costs for CA from <http://www.eia.gov/petroleum/gasdiesel/>. Off-road diesel costs are not subject to state and federal excise taxes, so those taxes are removed from off-road diesel prices.

Material prices were obtained from Quotes, supply catalogs, previous similar estimates, and the MII/MCACES Cost Book.

Sales tax is applied at 9%.

H.3.6 TOTAL PROJECT SCHEDULE, INCLUDING CONSTRUCTION (SEE ATTACHMENT D)

The Total Project Schedule including design, pre-construction, and construction was developed using MS Project with construction durations based on those developed in MII. This was used to insure the project reaches could be completed within the construction windows and with the anticipated crews.

H.3.7 COST AND SCHEDULE RISK ANALYSIS (SEE ATTACHMENT E)

The scope of the risk analysis was to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes, as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The study does not include consideration for operation and maintenance or life cycle costs.

H.3.8 TOTAL PROJECT COST SUMMARY (SEE ATTACHMENT F)

First Costs are based on 1 Oct 2017 price levels. Fully funded costs are first costs escalated to the midpoint of design or construction (as per the anticipated construction schedule).

REAL ESTATE (01 Account)

The Real Estate cost estimate (01 Account Lands & Damages and Administrative costs) is performed by the SPK Real Estate Division and provided to the Cost Engineering section. The 01 Account Lands and Damages, Relocation Assistance Payment, and New Utility Easements cost estimates were appraised (please refer to the Real Estate Plan for more detail). These technical Real Estate increments estimated by the appraiser are independent of the contingency derived through the Cost and Schedule Risk Analysis (CSRA). The contingencies were provided by the Real Estate Division.

RELOCATIONS (02 Account)

Construction costs for relocation of utilities and roads were developed primarily through the use of MII and the local 'database' of construction methods (labor, equipment, and materials cost data, construction crews and anticipated production rate, anticipated borrow and disposal sites, etc.). These are relatively up-to-date (2017 Davis-Bacon rates, 2016 MII equipment rates, and recent quotes for bulk materials and high cost items, such as pumps for interior drainage). Contingency applied to this account is the effective contingency derived from the Cost and Schedule Risk Analysis.

FISH & WILDLIFE FACILITIES - ENVIRONMENTAL MITIGATION (06 Account)

The Environmental Mitigation cost estimate was performed by SPK Environmental Planning and provided to Cost Engineering. Since this is a construction cost the contingency applied to this account is the effective contingency derived from the Cost and Schedule Risk Analysis.

LEVEES AND FLOODWALLS (including erosion protection) (11 Account)

Construction costs for these accounts were developed using MII. Contingency applied is the effective contingency derived from the Cost and Schedule Risk Analysis.

FLOODWAY CONTROL AND DIVERSION STRUCTURES (15 Account)

Construction costs for these accounts were developed using MII. Contingency applied is the effective contingency derived from the Cost and Schedule Risk Analysis.

PLANNING, ENGINEERING AND DESIGN (30 Account)

The cost for Planning, Engineering and Design (PED) is assumed as 17.6% of the Construction Estimate Total, based on historical estimates done by SPK. Contingency applied is the effective contingency derived from the Cost and Schedule Risk Analysis.

For this project, the assumed percentages are as follows:

Project Management	1.60%
Planning & Environmental Compliance	2.18%
Engineering and Design	8.20%
Review, ATRs, IEPRs, VE	0.30%
Life Cycle Cost Updates (costs, schedule, risks)	0.70%
Contracting & Reprographics	1.00%
Engineering During Construction	2.00%
Planning During Construction	0.30%
Project Operations	1.30%

CONSTRUCTION MANAGEMENT (31 Account)

The cost for Construction Management (CM) is assumed as 10% of the Construction Estimate Total, based on historical estimates done by SPK. Contingency applied is the effective contingency derived from the Cost and Schedule Risk Analysis.

For this project, the assumed percentages are as follows:

Construction Management	7.00%
Project Operations	1.30%
Project Management	1.70%

ATTACHMENT A – ACRA RESULTS & SUPPORTING RISK REGISTERS

FOUO

Abbreviated Risk Analysis

Project (less than \$40M): **Lower San Joaquin River Feasibility Study, Alt 7a, N Stockton, Fix B**
 Project Development Stage: **Feasibility (Alternatives)**
 Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = \$ **325,811,013**

<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
--------------	------------------------	----------------------	----------------------	-----------------------	--------------

	01 LANDS AND DAMAGES	Real Estate	\$ 79,569,213	28.72%	\$ 22,851,571	\$ 102,420,783.86
1	06 FISH AND WILDLIFE FACILITIES	Fish & Wildlife Facilities	\$ 33,941,435	33.04%	\$ 11,213,304	\$ 45,154,738.58
2	11 01 LEVEES	Earthwork	\$ 93,674,505	44.69%	\$ 41,865,576	\$ 135,540,081.56
3	11 01 LEVEES	Cutoff Walls	\$ 26,171,400	38.21%	\$ 10,000,933	\$ 36,172,332.55
4	11 01 LEVEES	DSM (Seismic)	\$ 130,949,900	47.10%	\$ 61,673,179	\$ 192,623,078.98
5	11 01 LEVEES	Slope/Erosion Protection	\$ 8,213,271	49.44%	\$ 4,060,381	\$ 12,273,652.40
6	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Control Structure	\$ 15,598,000	50.70%	\$ 7,907,948	\$ 23,505,948.47
12		Remaining Construction Items	\$ 17,262,502	5.3%	\$ 5,675,328	\$ 22,937,829.90
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 48,871,652	63.33%	\$ 30,948,166	\$ 79,819,817.87
14	31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 32,581,101	43.71%	\$ 14,239,665	\$ 46,820,766.24 *

Totals						
	Real Estate	\$ 79,569,213	28.72%	\$ 22,851,571	\$ 102,420,783.86	
	Total Construction Estimate	\$ 325,811,013	43.71%	\$ 142,396,649	\$ 468,207,662	
	Total Planning, Engineering & Design	\$ 48,871,652	63.33%	\$ 30,948,166	\$ 79,819,818	
	Total Construction Management	\$ 32,581,101	43.71%	\$ 14,239,665	\$ 46,820,766	
	Total	\$ 486,832,979	46.06%	\$ 210,436,051	\$ 697,269,030	

Lower San Joaquin River Feasibility Study, Alt 7a, N Stockton, Fix B

Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 4-Nov-13

Risk Level

Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Significant	Critical	Crisis

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth						
					Max Potential Cost Growth	75%
PS-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Construction QA/QC concerns Water side work concerns Implementing SWPPP Jeporady opinion Enough Mitigation? 	<ul style="list-style-type: none"> Potential modifications to closure structures for fish and wildlife. Additional mitigation features at offsite areas would increase scope and subsequent costs FWS may require additional features to mitigate onsite which may be unaccounted for if they are significant features like gartner snake canals. 	Possible	Significant	2
PS-2	Earthwork	<ul style="list-style-type: none"> Soil testing at borrow sites, endangered species, cultural Have conservative estimates been provided Is there plenty of land for borrow material Is there enough borrow material within 25miles or less? availability of temporary storage areas will influence efficiency of levee construction. material reuse % can significantly swing costs 	<ul style="list-style-type: none"> Scope will likely change in PED for amount of earthwork, reusable material would hopefully increase lowering total amounts Borrow sites are plenty as areas are building subdivisions and need to create water recharge areas. 	Likely	Significant	3
PS-3	Cutoff Walls	<ul style="list-style-type: none"> Investigations sufficient to support design assumptions? type of cutoff wall, SCB, SB, locations Areas w/no geotech data, adjacent fixes assumed 	<ul style="list-style-type: none"> Cutoff wall depth may change with increased PED, however the overall scope or method of wall isn't significant. Quantities are where this risk may be evaluated. 	Likely	Marginal	2
PS-4	DSM (Seismic)	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Sciesmic design criteria is not strictly defined by USACE 	<ul style="list-style-type: none"> Fixes will not be fully continuous, PED will define areas more specifically. Design features could change depending on the seismic design event 	Likely	Significant	3
PS-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Will need to add landside erosion protection to address levee superiority design criteria Larger or smaller Rock revetment may be necessary for erosion projection along delta from levees. 	<ul style="list-style-type: none"> This is not a risk, small feature in project cost and occurs in dry land levee areas. Levee superiority is a design requirement. However, we have not designed that feature yet. Rock size and extent was based on initial assessment. Larger rock size would increase cost due to increased thickness 	Very LIKELY	Significant	4
PS-6	Control Structure	<ul style="list-style-type: none"> Gate mechanism and control structure may change depending on function and projected OMR&R costs Temporary construction and bypass facilities not fully realized 	<ul style="list-style-type: none"> Obeymeyer gate design is not standard. May not perform well from daily operations, opening and closing with the tide. If different gate mechanism chosen (sluice gates), may require more robust structure 	Possible	Critical	3
PS-12	Remaining Construction Items	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> Permitting, air quality, minor construction items all have minimal sway. SWPPP and restoration of borrow sites may be of concern, however these borrow areas are intended to be water recharge areas and shouldn't need much. Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010) 	Possible	Marginal	1
PS-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 15% may be too much for certain areas but may not be enough for complicated areas like siesmic delta front 	<ul style="list-style-type: none"> Portion of study area has already been evaluated by ULE study and other efforts with subsurface borings. These in-kind materials would significantly lower additional PED efforts and lead to construction sooner. 	Possible	Significant	2
PS-14	Construction Management	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> In order to construct such a large project, with many concurrent construction features, the effort may be higher than normal. 	Likely	Significant	3

Acquisition Strategy

					Max Potential Cost Growth	30%
AS-1	Fish & Wildlife Facilities	1. Mitigation lands cannot be acquired by Eminent Domain	- Based on the preliminary information available the real estate acquisition activities may require 2-6 years to complete. - (HCP) Habitat Conservation Plan exists	Possible	Marginal	1
AS-2	Earthwork	N/A	N/A	Unlikely	Negligible	0
AS-3	Cutoff Walls	Contracting Plan has not been firmly established Bid competition is limited	- There will likely be multiple contracts spread out over multiple construction seasons. This work may be performed by a subcontractor. - Prime contractor for the seperable elements will likely have most experience in traditional cutoff walls, sub out DSM work.	Likely	Marginal	2
AS-4	DSM (Seismic)	Contracting Plan has not been firmly established Work is likely to be performed by a subcontractor and competition is very limited for DSM work	- There will likely be multiple contracts spread out over multiple construction seasons. This work typically procceds slowly and the number of contractors capable of doing the work is very limited. - DSM work is the largest most expensive feature in NS. If contracts are broken out by area (NS, CS, RD17) then prime contractor for NS should be DSM Contractor. This would reduce costs overall instead of having prime add additional OH and profit onto the Sub's cost.	Likely	Marginal	2
AS-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
AS-6	Control Structure	- Control structure will likely to be sub-contractor that specializes in type of work.	- Higher overheads may result	Possible	Significant	2
AS-12	Remaining Construction Items	N/A	N/A	Unlikely	Negligible	0
AS-13	Planning, Engineering, & Design	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there will likely be increased time and costs for project development.	Very LIKELY	Significant	4
AS-14	Construction Management	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there may be more personnel required to provide quality assurance/control than on a more typical project.	Likely	Significant	3

Construction Elements						
					Max Potential Cost Growth	25%
CE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> - future changes to requirements - additional requirements to meet models, SRA habitat quotas, and planting densities * Work windows (TT) 	- future changes to requirements possible	Likely	Marginal	2
CE-2	Earthwork	<ul style="list-style-type: none"> QC at the borrow sites • Potential for construction modification and claims? • Discovery of buried Cultural Resources (TT) 	- Borrow sites are to facilitate ground water recharge and may benefit local interests in development as well. Quantities are large, but PED should refine how much is needed and what borrow sites are appropriate.	Likely	Significant	3
CE-3	Cutoff Walls	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	<ul style="list-style-type: none"> - staging areas and available real estate may affect progress. - SF quantities are large and fixes assumed continuous cutoff wall for all reaches. Depths may be deeper or more shallow, or no wall needed. Unlikely that cutoff wall quantities are going to exceed 15% over. 	Possible	Significant	2
CE-4	DSM (Seismic)	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-5	Slope/Erosion Protection	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-6	Control Structure	<ul style="list-style-type: none"> - Accelerated schedule - Water quality control plan, SWPPP, BMPs - Temporary bypass facilities 	<ul style="list-style-type: none"> - Limited window of working in wet and on levees per CCR title 23. Special agreements are likely necessary to complete construction. - Environmental impacts and water quality procedures may be more restrictive. - Water bypass may need to be more robust to account for tides and storms 	Likely	Marginal	2
CE-12	Remaining Construction Items	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- all the above may lead to possible minor impacts to PED	Possible	Marginal	1
CE-14	Construction Management	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- added years could have marginal effects on CM	Possible	Marginal	1

Quantities for Current Scope

				Max Potential Cost Growth	20%	
Q-1	Fish & Wildlife Facilities	• Confidence level in our generated quantities for current scope?	- Costs were generated as % of construction cost, most areas ranging from 5-15%. Until we have official opinion for mitigation requirements we do not have a good idea of if we're high or low.	Very LIKELY	Marginal	3
Q-2	Earthwork	• Confidence level in our generated quantities for current scope?	- Typical Section used in analysis. Existing geometries would round up to next size so quantities of earthwork should be relatively conservative. Past improvements from RD 404 and RD 17 have also been neglected which would significantly reduce earthwork quantities.	Possible	Significant	2
Q-3	Cutoff Walls	• Confidence level in our generated quantities for current scope?	- Quantities will change in PED but should not exceed total amount. Use of 3x3x3 evaluation and applying fix adjacencies come with risk and the design of walls address that risk to a certain degree.	Very LIKELY	Marginal	3
Q-4	DSM (Seismic)	• Confidence level in our generated quantities for current scope?	- Fix applied throughout reach length, which may be conservative when evaluated in PED. Depth and grid spacing are appropriate for design level at this time.	Possible	Marginal	1
Q-5	Slope/Erosion Protection	• Confidence level in our generated quantities for current scope?	- Based on typical section methodology and blanket thickness, quantity exceedance is not expected.	Unlikely	Significant	1
Q-6	Control Structure	- Quantities were pro-rated from sponsor developed design'	- Estimates for original structure were prepared at a higher level of confidence (30%) and should be good. Pro-rate has limitations and may not account for all site specifics which contribute cost.	Likely	Significant	3
Q-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 25% of the Remaining Constr items)	- permitting, and swppp items not quantified for features or at borrow site. These items are likely covered in cost through the unallocated items in PCET - Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010)	Likely	Marginal	2
Q-13	Planning, Engineering, & Design	Design elements have been shifted to PED	- Refinements are being kicked down road to PED. However, portion of study area already has PED development design and can be used in-kind. Big policy issues like veg etl or real estate requirements, if held for this period, could kill progress.	Likely	Significant	3
Q-14	Construction Management	N/A	- based on historical values, not likely to change significantly.	Unlikely	Significant	1

Specialty Fabrication or Equipment

					Max Potential Cost Growth	75%
FE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> • Construction QA/QC concerns • Water side work concerns • Implementing SWPPP 	- Potential modifications to closure structures for fish and wildlife.	Possible	Marginal	1
FE-2	Earthwork	Gate structure is not a common design	- Features necessary for project to perform may be missing from design.	Likely	Marginal	2
FE-3	Cutoff Walls	<ul style="list-style-type: none"> • uncertainty of cutoff wall methods, different equipment for different methods • availability of special equipment 	- Traditional walls are not a new thing for area and equipment should be readily available to construct. Project quantities do not demand a large fleet or amount of crews to build within 15 year period. Project competition should not be issue.	Likely	Marginal	2
FE-4	DSM (Seismic)	<ul style="list-style-type: none"> • availability of special equipment 	- PED will drive how extensive the seismic fix will need to be. Multiple DSM rigs should be available, however, competition between other Corps and Sponsor projects may drive costs.	Likely	Marginal	2
FE-5	Slope/Erosion Protection	• N/A	N/A	Unlikely	Negligible	0
FE-6	Control Structure	<ul style="list-style-type: none"> • Obermeyer gates and system as proposed are not as common - Reduced amount of contractors that have experience with system - Manufacturer availability 	<ul style="list-style-type: none"> - Manufacturer may be farther distance away, custom gates - Testing and inspection may be more extensive - Training for locals on how to operate may pose issues 	Likely	Marginal	2
FE-12	Remaining Construction Items	• N/A	N/A	Unlikely	Negligible	0
FE-13	Planning, Engineering, & Design	• N/A	N/A	Unlikely	Negligible	0
FE-14	Construction Management	• N/A	N/A	Unlikely	Negligible	0

Cost Estimate Assumptions

				Max Potential Cost Growth		35%
CT-1	Fish & Wildlife Facilities	Underestimate of mitigation requirements.	- Coordination with Resource Agencies may require additional mitigation.	Possible	Marginal	1
CT-2	Earthwork	<ul style="list-style-type: none"> Reliability and number of key quotes? Site accessibility, transport delays, congestion? Assumptions regarding crew, productivity, overtime? 	- Site access may be limited, construction along major highways has been ongoing for some years	Possible	Significant	2
CT-3	Cutoff Walls	<ul style="list-style-type: none"> Assumptions related to prime and subcontractor markups/assignments? Assumptions regarding crew, productivity, overtime? 	- Estimate assumes the prime will construct the cutoff walls. Cutoff wall placement rate considered relatively conservative.	Possible	Marginal	1
CT-4	DSM (Seismic)	- Type of fix/methodology is not common for district. Design unknowns or construction sequencing may affect rates and subsequently cost.	- Costs were gut checked with DSM values from Marysville. Materials or construction may not change, but seismic grid methodology may be different that what DSM contractors are used to.	Possible	Significant	2
CT-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
CT-6	Control Structure	<ul style="list-style-type: none"> Work crews and production may be affected by tides No delays regarding the closing of channel to complete structure Sound emission/environmental impact may restrict impact hammer for sheet piling and cast in steel shell piles 	<ul style="list-style-type: none"> May require additional efforts in PED phase to identify constructability issues phasing may be required instead which will take longer 	Possible	Marginal	1
CT-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 25% of the Remaining Constr items)	- Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010)	Likely	Marginal	2
CT-13	Planning, Engineering, & Design	Coordination with railroads may increase costs (AK)	<ul style="list-style-type: none"> Historical cost percentages are appropriate at this cost level estimate. Will be determined through negotiation with railroads. Estimate assumes that railroad alignments won't change but service could be disrupted for cutoff wall construction. Unknown how cooperative railroad will be 	Possible	Critical	3
CT-14	Construction Management	• N/A	- Historical cost percentages are appropriate at this cost level estimate.	Unlikely	Negligible	0

External Project Risks

				Max Potential Cost Growth	40%	
EX-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Potential for severe adverse weather? *Endangered Species Work Windows (TT) 	- Yes, this is a concern. More SWPP monitoring is required.	Possible	Significant	2
EX-2	Earthwork	<ul style="list-style-type: none"> Potential for severe adverse weather? Unanticipated inflations in fuel, key materials? hazardous excavation materials, expensive removal 	<ul style="list-style-type: none"> Estimates were built on excavators used only. For some areas this is not practical and scrapers will be used which are much more efficient at moving earth. HTRW sites should be defined by EA, chance of coming across an unknown large site is not as likely 	Possible	Significant	2
EX-3	Cutoff Walls	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? material availability (bentonite) 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? Can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. 	Possible	Significant	2
EX-4	DSM (Seismic)	<ul style="list-style-type: none"> DSM rig availability, competition construction issues - blow outs, fractures 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. DSM rig availability, competition – Limited availability, frequent breakdown Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. Competition from other projects may drive up bids. 	Possible	Significant	2
EX-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Availability of rocks and quarries available to manufacture it Water traffic 	- Quarry availability should not be a problem. Size of rock will not be for velocity but rather for wave impact. Quantity is not significant for general area.	Possible	Marginal	1
EX-6	Control Structure	<ul style="list-style-type: none"> Recreational boaters and accessibility issues Yacht club may want just compensation 	- Boat owners and businesses in the slough will be affected by construction	Likely	Significant	3
EX-12	Remaining Construction Items	<ul style="list-style-type: none"> Political influences, lack of support, obstacles? Unanticipated inflations in fuel, key materials? possible environmental BO, difficult to proceed Potential for market volatility impacting competition, pricing? input from cultural agencies, tribes 	<ul style="list-style-type: none"> Unanticipated inflations in costs of fuel & key materials can occur SPK Planning has identified several areas where Cultural Resources (remains) are very likely 	Very LIKELY	Marginal	3
EX-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Possibility of land prices going up Cultural resources, remains Late construction season, delays 	<ul style="list-style-type: none"> land prices could increase or there may be unwilling sellers several areas have been identified where cultural remains appear likely to be found 	Likely	Critical	4
EX-14	Construction Management	N/A	N/A	Unlikely	Negligible	0

Abbreviated Risk Analysis

**Lower San Joaquin River Feasibility Study, Alt 7a, C Stockton, Fixes B & C
plus Duck Cr**

Project (less than \$40M):

Project Development Stage: **Feasibility (Alternatives)**

Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = \$ **108,302,310**

CWWBS Feature of Work Contract Cost % Contingency \$ Contingency Total

	01 LANDS AND DAMAGES	Real Estate	\$ 22,577,987	26.45%	\$ 5,972,949	\$ 28,550,936.14
1	06 FISH AND WILDLIFE FACILITIES	Fish & Wildlife Facilities	\$ 6,104,019	33.04%	\$ 2,016,598	\$ 8,120,616.58
2	11 01 LEVEES	Earthwork	\$ 54,350,396	40.55%	\$ 22,037,251	\$ 76,387,646.46
3	11 01 LEVEES	Cutoff Walls	\$ 22,525,000	38.21%	\$ 8,607,526	\$ 31,132,525.99
4	11 01 LEVEES	DSM (Seismic)	\$ -	0.00%	\$ -	\$ -
5	11 01 LEVEES	Slope/Erosion Protection	\$ 13,400	40.45%	\$ 5,420	\$ 18,819.89
6	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Control Structure	\$ 14,187,000	50.70%	\$ 7,192,593	\$ 21,379,592.95
12		Remaining Construction Items	\$ 11,122,495	10.3% 32.88%	\$ 3,656,701	\$ 14,779,195.87
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 16,245,346	63.33%	\$ 10,287,430	\$ 26,532,776.00
14	31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 10,830,231	40.18%	\$ 4,351,609	\$ 15,181,839.77 *

Totals						
		Real Estate	\$ 22,577,987	26.45%	\$ 5,972,949	\$ 28,550,936.14
		Total Construction Estimate	\$ 108,302,310	40.18%	\$ 43,516,088	\$ 151,818,398
		Total Planning, Engineering & Design	\$ 16,245,346	63.33%	\$ 10,287,430	\$ 26,532,776
		Total Construction Management	\$ 10,830,231	40.18%	\$ 4,351,609	\$ 15,181,840
		Total	\$ 157,955,874	42.96%	\$ 64,128,076	\$ 222,083,950

Lower San Joaquin River Feasibility Study, Alt 7a, C Stockton, Fixes B & C plus Duck Cr

Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 4-Nov-13

Risk Level

Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Significant	Critical	Crisis

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth						
					Max Potential Cost Growth	75%
PS-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Construction QA/QC concerns Water side work concerns Implementing SWPPP Enough Mitigation? 	<ul style="list-style-type: none"> Additional mitigation features at offsite areas would increase scope and subsequent costs FWS may require additional features to mitigate onsite which may be unaccounted for if they are significant features like gartner snake canals. 	Possible	Significant	2
PS-2	Earthwork	<ul style="list-style-type: none"> Soil testing at borrow sites, endangered species, cultural Have conservative estimates been provided Is there plenty of land for borrow material Is there enough borrow material within 25miles or less? material reuse % can significantly swing costs 	<ul style="list-style-type: none"> Scope will likely change in PED for amount of earthwork, reusable material would hopefully increase lowering total amounts Borrow sites are plenty as areas are building subdivisions and need to create water recharge areas. 	Likely	Significant	3
PS-3	Cutoff Walls	<ul style="list-style-type: none"> Investigations sufficient to support design assumptions? type of cutoff wall, SCB, SB, locations Areas w/no geotech data, adjacent fixes assumed 	<ul style="list-style-type: none"> Cutoff wall depth may change with increased PED, however the overall scope or method of wall isn't significant. Quantities are where this risk may be evaluated. 	Likely	Marginal	2
PS-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
PS-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Larger or smaller Rock revetment may be necessary for erosion projection along delta from levees. 	<ul style="list-style-type: none"> This is not a risk, small feature in project cost and occurs in dry land levee areas. Rock size and extent was based on initial assessment. Larger rock size would increase cost due to increased thickness 	Very LIKELY	Significant	4
PS-6	Control Structure	<ul style="list-style-type: none"> Gate mechanism and control structure may change depending on function and projected OMR&R costs Temporary construction and bypass facilities not fully realized 	<ul style="list-style-type: none"> Obemeyer gate design is not standard. May not perform well from daily operations, opening and closing with the tide. If different gate mechanism chosen (sluice gates), may require more robust structure 	Possible	Critical	3
PS-12	Remaining Construction Items	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> Permitting, air quality, minor construction items all have minimal sway. SWPPP and restoration of borrow sites may be of concern, however these borrow areas are intended to be water recharge areas and shouldn't need much. Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010). 	Possible	Marginal	1
PS-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 15% may be too much for certain areas but may not be enough for complicated areas like seismic delta front 	<ul style="list-style-type: none"> Portion of study area has already been evaluated by ULE study and other efforts with subsurface borings. These in-kind materials would significantly lower additional PED efforts and lead to construction sooner. 	Possible	Significant	2
PS-14	Construction Management	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> In order to construct such a large project, with many concurrent construction features, the effort may be higher than normal. 	Likely	Significant	3

Acquisition Strategy

					Max Potential Cost Growth	30%
AS-1	Fish & Wildlife Facilities	1. Potential to delay award of construction contracts when non-federal partners cannot certify real estate rights. 2. Mitigation lands cannot be acquired by Eminent Domain	- Based on the preliminary information available the real estate acquisition activities may require 2-6 years to complete.	Possible	Marginal	1
AS-2	Earthwork	N/A	N/A	Unlikely	Negligible	0
AS-3	Cutoff Walls	Contracting Plan has not been firmly established Bid competition is limited	- There will likely be multiple contracts spread out over multiple construction seasons. This work may be performed by a subcontractor. - Prime contractor for the seperable elements will likely have most experience in traditional cutoff walls, sub out DSM work.	Likely	Marginal	2
AS-4	DSM (Seismic)	N/A	N/A	Unlikely	Marginal	0
AS-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
AS-6	Control Structure	- Control structure will likely to be sub-contractor that specializes in type of work.	- Higher overheads may result	Possible	Significant	2
AS-12	Remaining Construction Items	N/A	N/A	Unlikely	Negligible	0
AS-13	Planning, Engineering, & Design	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there will likely be increased time and costs for project development.	Very LIKELY	Significant	4
AS-14	Construction Management	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there may be more personnel required to provide quality assurance/control than on a more typical project.	Likely	Significant	3

Construction Elements						
					Max Potential Cost Growth	25%
CE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> - future changes to requirements - additional requirements to meet models, SRA habitat quotas, and planting densities * Work windows (TT) 	- future changes to requirements possible	Likely	Marginal	2
CE-2	Earthwork	<ul style="list-style-type: none"> QC at the borrow sites • Potential for construction modification and claims? • Discovery of buried Cultural Resources (TT) 	- Borrow sites are to facilitate ground water recharge and may benefit local interests in development as well. Quantities are large, but PED should refine how much is needed and what borrow sites are appropriate.	Likely	Significant	3
CE-3	Cutoff Walls	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	<ul style="list-style-type: none"> - staging areas and available real estate may affect progress. - SF quantities are large and fixes assumed continuous cutoff wall for all reaches. Depths may be deeper or more shallow, or no wall needed. Unlikely that cutoff wall quantities are going to exceed 15% over. 	Possible	Significant	2
CE-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
CE-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
CE-6	Control Structure	<ul style="list-style-type: none"> - Accelerated schedule - Water quality control plan, SWPPP, BMPs - Temporary bypass facilities 	<ul style="list-style-type: none"> - Limited window of working in wet and on levees per CCR title 23. Special agreements are likely necessary to complete construction. - Environmental impacts and water quality procedures may be more restrictive. - Water bypass may need to be more robust to account for tides and storms 	Likely	Marginal	2
CE-12	Remaining Construction Items	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- all the above may lead to possible minor impacts to PED	Possible	Marginal	1
CE-14	Construction Management	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- added years could have marginal effects on CM	Possible	Marginal	1

Quantities for Current Scope

				Max Potential Cost Growth	20%	
Q-1	Fish & Wildlife Facilities	• Confidence level in our generated quantities for current scope?	- Costs were generated as % of construction cost, most areas ranging from 5-15%. Until we have official opinion for mitigation requirements we do not have a good idea of if we're high or low.	Very LIKELY	Marginal	3
Q-2	Earthwork	• Confidence level in our generated quantities for current scope?	- Typical Section used in analysis. Existing geometries would round up to next size so quantities of earthwork should be relatively conservative. Past improvements from RD 404 and RD 17 have also been neglected which would significantly reduce earthwork quantities.	Possible	Significant	2
Q-3	Cutoff Walls	• Confidence level in our generated quantities for current scope?	- Quantities will change in PED but should not exceed total amount. Use of 3x3x3 evaluation and applying fix adjacencies come with risk and the design of walls address that risk to a certain degree.	Very LIKELY	Marginal	3
Q-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
Q-5	Slope/Erosion Protection	• Confidence level in our generated quantities for current scope?	- Quantities from AE 30% design, no drawing supplied, but this is a very small feature	Unlikely	Significant	1
Q-6	Control Structure	- Quantities were taken from sponsor provided design	- Estimates for original structure were prepared at a higher level of confidence (30% draft) and should be good at this time. Locals are pursuing this design further and more detail and cost confidence will be forthcoming.	Likely	Significant	3
Q-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 55% of the Remaining Constr items)	- permitting, and swppp items not quantified for features or at borrow site. These items are likely covered in cost through the unallocated item in PCET - Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010).	Likely	Marginal	2
Q-13	Planning, Engineering, & Design	Design elements have been shifted to PED	- Refinements are being kicked down road to PED. However, portion of study area already has PED development design and can be used in-kind. Big policy issues like veg etl or real estate requirements, if held for this period, could kill progress.	Likely	Significant	3
Q-14	Construction Management	N/A	- based on historical values, not likely to change significantly.	Unlikely	Negligible	0

Specialty Fabrication or Equipment

					Max Potential Cost Growth	75%
FE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> • Construction QA/QC concerns • Water side work concerns • Implementing SWPPP 	- Potential modifications to closure structures for fish and wildlife.	Possible	Marginal	1
FE-2	Earthwork	Gate structure is not a common design	- Features necessary for project to perform may be missing from design.	Likely	Marginal	2
FE-3	Cutoff Walls	<ul style="list-style-type: none"> • uncertainty of cutoff wall methods, different equipment for different methods • availability of special equipment 	- Traditional walls are not a new thing for area and equipment should be readily available to construct. Project quantities do not demand a large fleet or amount of crews to build within 15 year period. Project competition should not be issue.	Likely	Marginal	2
FE-4	DSM (Seismic)	• N/A	N/A	Unlikely	Negligible	0
FE-5	Slope/Erosion Protection	• N/A	N/A	Unlikely	Negligible	0
FE-6	Control Structure	<ul style="list-style-type: none"> • Obermeyer gates and system as proposed are not as common - Reduced amount of contractors that have experience with system - Manufacturer availability 	<ul style="list-style-type: none"> - Manufacturer may be farther distance away, custom gates - Testing and inspection may be more extensive - Training and O&M for locals may pose issues 	Likely	Marginal	2
FE-12	Remaining Construction Items	• N/A	N/A	Unlikely	Negligible	0
FE-13	Planning, Engineering, & Design	• N/A	N/A	Unlikely	Negligible	0
FE-14	Construction Management	• N/A	N/A	Unlikely	Negligible	0

Cost Estimate Assumptions

					Max Potential Cost Growth	35%
CT-1	Fish & Wildlife Facilities	Underestimate of mitigation requirements.	- Coordination with Resource Agencies may require additional mitigation.	Possible	Marginal	1
CT-2	Earthwork	N/A	N/A	Unlikely	Negligible	0
CT-3	Cutoff Walls	<ul style="list-style-type: none"> Assumptions related to prime and subcontractor markups/assignments? Assumptions regarding crew, productivity, overtime? 	- Estimate assumes the prime will construct the cutoff walls. Cutoff wall placement rate considered relatively conservative.	Possible	Marginal	1
CT-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
CT-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
CT-6	Control Structure	<ul style="list-style-type: none"> Work crews and production may be affected by tides No delays regarding the closing of channel to complete structure Sound emission may restrict impact hammer for sheet piling and cast in steel shell piles 	<ul style="list-style-type: none"> May require additional efforts in PED phase to identify constructability issues Phasing may be required instead which will take longer 	Possible	Marginal	1
CT-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 55% of the Remaining Constr items)	- Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010).	Likely	Marginal	2
CT-13	Planning, Engineering, & Design	Coordination with railroads may increase costs (AK)	<ul style="list-style-type: none"> Historical cost percentages are appropriate at this cost level estimate. Will be determined through negotiation with railroads. Estimate assumes that railroad alignments won't change but service could be disrupted for cutoff wall construction. Unknown how cooperative railroad will be 	Possible	Critical	3
CT-14	Construction Management	• N/A	- Historical cost percentages are appropriate at this cost level estimate.	Likely	Marginal	2

External Project Risks						
					Max Potential Cost Growth	40%
EX-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Potential for severe adverse weather? *Endangered Species Work Windows (TT) 	- Yes, this is a concern. More SWPP monitoring is required.	Possible	Significant	2
EX-2	Earthwork	<ul style="list-style-type: none"> Potential for severe adverse weather? Unanticipated inflations in fuel, key materials? hazardous excavation materials, expensive removal 	<ul style="list-style-type: none"> Estimates were built on excavators used only. For some areas this is not practical and scrapers will be used which are much more efficient at moving earth. HTRW sites should be defined by EA, chance of coming across an unknown large site is not as likely 	Possible	Significant	2
EX-3	Cutoff Walls	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? material availability (bentonite) 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? Can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. 	Possible	Significant	2
EX-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
EX-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
EX-6	Control Structure	- Recreational boaters and accessibility issues	- Boat owners and businesses in the slough will be affected by construction	Likely	Significant	3
EX-12	Remaining Construction Items	<ul style="list-style-type: none"> Political influences, lack of support, obstacles? Unanticipated inflations in fuel, key materials? possible environmental BO, difficult to proceed Potential for market volatility impacting competition, pricing? input from cultural agencies, tribes 	<ul style="list-style-type: none"> Unanticipated inflations in costs of fuel & key materials can occur SPK Planning has identified several areas where Cultural Resources (remains) are very likely 	Very LIKELY	Marginal	3
EX-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Possibility of land prices going up Cultural resources, remains Late construction season, delays 	<ul style="list-style-type: none"> land prices could increase or there may be unwilling sellers several areas have been identified where cultural remains appear likely to be found 	Likely	Critical	4
EX-14	Construction Management	N/A	N/A	Unlikely	Negligible	0

Abbreviated Risk Analysis

Project (less than \$40M): **Lower San Joaquin River Feasibility Study, Alt 8a, C Stockton, Fix D + Duck Cr**
 Project Development Stage: **Feasibility (Alternatives)**
 Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = \$ **158,945,400**

	<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
	01 LANDS AND DAMAGES	Real Estate	\$ 27,465,085	25.59%	\$ 7,027,527	\$ 34,492,611.99
1	06 FISH AND WILDLIFE FACILITIES	Fish & Wildlife Facilities	\$ 8,381,698	33.04%	\$ 2,769,079	\$ 11,150,776.99
2	11 01 LEVEES	Earthwork	\$ 87,977,323	44.69%	\$ 39,319,357	\$ 127,296,679.57
3	11 01 LEVEES	Cutoff Walls	\$ 32,383,000	38.21%	\$ 12,374,584	\$ 44,757,584.42
4	11 01 LEVEES	DSM (Seismic)	\$ -	0.00%	\$ -	\$ -
5	11 01 LEVEES	Slope/Erosion Protection	\$ 13,400	41.94%	\$ 5,620	\$ 19,020.07
6	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Control Structure	\$ 14,187,000	50.70%	\$ 7,192,593	\$ 21,379,592.95
12		Remaining Construction Items	\$ 16,002,980	10.1% 32.88%	\$ 5,261,240	\$ 21,264,219.58
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 23,841,810	63.33%	\$ 15,097,920	\$ 38,939,730.11
14	31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 15,894,540	42.10%	\$ 6,692,247	\$ 22,586,787.36 *

Totals						
	Real Estate	\$	27,465,085	25.59%	\$ 7,027,527	\$ 34,492,611.99
	Total Construction Estimate	\$	158,945,400	42.10%	\$ 66,922,473	\$ 225,867,874
	Total Planning, Engineering & Design	\$	23,841,810	63.33%	\$ 15,097,920	\$ 38,939,730
	Total Construction Management	\$	15,894,540	42.10%	\$ 6,692,247	\$ 22,586,787
	Total	\$	226,146,836	44.65%	\$ 95,740,167	\$ 321,887,003

Lower San Joaquin River Feasibility Study, Alt 8a, C Stockton, Fix D + Duck Cr

Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 4-Nov-13

Risk Level

Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Significant	Critical	Crisis

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth						
					Max Potential Cost Growth	75%
PS-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Construction QA/QC concerns Water side work concerns Implementing SWPPP Enough Mitigation? 	<ul style="list-style-type: none"> Additional mitigation features at offsite areas would increase scope and subsequent costs FWS may require additional features to mitigate onsite which may be unaccounted for if they are significant features like gartner snake canals. 	Possible	Significant	2
PS-2	Earthwork	<ul style="list-style-type: none"> Soil testing at borrow sites, endangered species, cultural Have conservative estimates been provided Is there plenty of land for borrow material Is there enough borrow material within 25miles or less? material reuse % can significantly swing costs 	<ul style="list-style-type: none"> Scope will likely change in PED for amount of earthwork, reusable material would hopefully increase lowering total amounts Borrow sites are plenty as areas are building subdivisions and need to create water recharge areas. 	Likely	Significant	3
PS-3	Cutoff Walls	<ul style="list-style-type: none"> Investigations sufficient to support design assumptions? type of cutoff wall, SCB, SB, locations Areas w/no geotech data, adjacent fixes assumed 	<ul style="list-style-type: none"> Cutoff wall depth may change with increased PED, however the overall scope or method of wall isn't significant. Quantities are where this risk may be evaluated. 	Likely	Marginal	2
PS-4	DSM (Seismic)	• N/A	N/A	Unlikely	Negligible	0
PS-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Larger or smaller Rock revetment may be necessary for erosion projection along delta from levees. 	<ul style="list-style-type: none"> This is not a risk, small feature in project cost and occurs in dry land levee areas. Rock size and extent was based on initial assessment. Larger rock size would increase cost due to increased thickness 	Very LIKELY	Significant	4
PS-6	Control Structure	<ul style="list-style-type: none"> Gate mechanism and control structure may change depending on function and projected OMR&R costs Temporary construction and bypass facilities not fully realized 	<ul style="list-style-type: none"> Obemeyer gate design is not standard. May not perform well from daily operations, opening and closing with the tide. If different gate mechanism chosen (sluice gates), may require more robust structure 	Possible	Critical	3
PS-12	Remaining Construction Items	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> Permitting, air quality, minor construction items all have minimal sway. SWPPP and restoration of borrow sites may be of concern, however these borrow areas are intended to be water recharge areas and shouldn't need much. Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010) 	Possible	Marginal	1
PS-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 15% may be too much for certain areas but may not be enough for complicated areas like seismic delta front 	<ul style="list-style-type: none"> Portion of study area has already been evaluated by ULE study and other efforts with subsurface borings. These in-kind materials would significantly lower additional PED efforts and lead to construction sooner. 	Possible	Significant	2
PS-14	Construction Management	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> In order to construct such a large project, with many concurrent construction features, the effort may be higher than normal. 	Likely	Significant	3

Acquisition Strategy

					Max Potential Cost Growth	30%
AS-1	Fish & Wildlife Facilities	1. Potential to delay award of construction contracts when non-federal partners cannot certify real estate rights. 2. Mitigation lands cannot be acquired by Eminent Domain	- Based on the preliminary information available the real estate acquisition activities may require 2-6 years to complete.	Possible	Marginal	1
AS-2	Earthwork	N/A	N/A	Unlikely	Negligible	0
AS-3	Cutoff Walls	Contracting Plan has not been firmly established Bid competition is limited	- There will likely be multiple contracts spread out over multiple construction seasons. This work may be performed by a subcontractor. - Prime contractor for the seperable elements will likely have most experience in traditional cutoff walls, sub out DSM work.	Likely	Marginal	2
AS-4	DSM (Seismic)	N/A	N/A	Unlikely	Marginal	0
AS-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
AS-6	Control Structure	- Control structure will likely to be sub-contractor that specializes in type of work.	- Higher overheads may result	Possible	Significant	2
AS-12	Remaining Construction Items	N/A	N/A	Unlikely	Negligible	0
AS-13	Planning, Engineering, & Design	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there will likely be increased time and costs for project development.	Very LIKELY	Significant	4
AS-14	Construction Management	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there may be more personnel required to provide quality assurance/control than on a more typical project.	Likely	Significant	3

Construction Elements					Max Potential Cost Growth	25%
CE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> - future changes to requirements - additional requirements to meet models, SRA habitat quotas, and planting densities * Work windows (TT) 	- future changes to requirements possible	Likely	Marginal	2
CE-2	Earthwork	<ul style="list-style-type: none"> QC at the borrow sites • Potential for construction modification and claims? * Discovery of buried Cultural Resources (TT) 	- Borrow sites are to facilitate ground water recharge and may benefit local interests in development as well. Quantities are large, but PED should refine how much is needed and what borrow sites are appropriate.	Likely	Significant	3
CE-3	Cutoff Walls	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	<ul style="list-style-type: none"> - staging areas and available real estate may affect progress. - SF quantities are large and fixes assumed continuous cutoff wall for all reaches. Depths may be deeper or more shallow, or no wall needed. Unlikely that cutoff wall quantities are going to exceed 15% over. 	Possible	Significant	2
CE-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
CE-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
CE-6	Control Structure	<ul style="list-style-type: none"> - Accelerated schedule - Water quality control plan, SWPPP, BMPs - Temporary bypass facilities' 	<ul style="list-style-type: none"> - Limited window of working in wet and on levees per CCR title 23. Special agreements are likely necessary to complete construction. - Environmental impacts and water quality procedures may be more restrictive. - Water bypass may need to be more robust to account for tides and storms 	Likely	Marginal	2
CE-12	Remaining Construction Items	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- all the above may lead to possible minor impacts to PED	Possible	Marginal	1
CE-14	Construction Management	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- added years could have marginal effects on CM	Possible	Marginal	1

Quantities for Current Scope

				Max Potential Cost Growth	20%	
Q-1	Fish & Wildlife Facilities	• Confidence level in our generated quantities for current scope?	- Costs were generated as % of construction cost, most areas ranging from 5-15%. Until we have official opinion for mitigation requirements we do not have a good idea of if we're high or low.	Very LIKELY	Marginal	3
Q-2	Earthwork	• Confidence level in our generated quantities for current scope?	- Typical Section used in analysis. Existing geometries would round up to next size so quantities of earthwork should be relatively conservative. Past improvements from RD 404 and RD 17 have also been neglected which would significantly reduce earthwork quantities.	Possible	Significant	2
Q-3	Cutoff Walls	• Confidence level in our generated quantities for current scope?	- Quantities will change in PED but should not exceed total amount. Use of 3x3x3 evaluation and applying fix adjacencies come with risk and the design of walls address that risk to a certain degree.	Very LIKELY	Marginal	3
Q-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
Q-5	Slope/Erosion Protection	• Confidence level in our generated quantities for current scope?	- Quantities from AE 30% design, no drawing supplied, but this is a very	Likely	Marginal	2
Q-6	Control Structure	- Quantities were taken from sponsor provided design	- Estimates for original structure were prepared at a higher level of confidence (30% draft) and should be good at this time. Locals are pursuing this design further and more detail and cost confidence will be forthcoming.	Likely	Significant	3
Q-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 55% of the Remaining Constr items)	- permitting, and swppp items not quantified for features or at borrow site. These items are likely covered in cost through the unallocated item in PCET - Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010)	Likely	Marginal	2
Q-13	Planning, Engineering, & Design	Design elements have been shifted to PED	- Refinements are being kicked down road to PED. However, portion of study area already has PED development design and can be used in-kind. Big policy issues like veg etl or real estate requirements, if held for this period, could kill progress.	Likely	Significant	3
Q-14	Construction Management	N/A	- based on historical values, not likely to change significantly.	Possible	Significant	2

Specialty Fabrication or Equipment

					Max Potential Cost Growth	75%
FE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> • Construction QA/QC concerns • Water side work concerns • Implementing SWPPP 	- Potential modifications to closure structures for fish and wildlife.	Possible	Marginal	1
FE-2	Earthwork	Gate structure is not a common design	- Features necessary for project to perform may be missing from design.	Likely	Marginal	2
FE-3	Cutoff Walls	<ul style="list-style-type: none"> • uncertainty of cutoff wall methods, different equipment for different methods • availability of special equipment 	- Traditional walls are not a new thing for area and equipment should be readily available to construct. Project quantities do not demand a large fleet or amount of crews to build within 15 year period. Project competition should not be issue.	Likely	Marginal	2
FE-4	DSM (Seismic)	• N/A	N/A	Unlikely	Negligible	0
FE-5	Slope/Erosion Protection	• N/A	N/A	Unlikely	Negligible	0
FE-6	Control Structure	<ul style="list-style-type: none"> • Obermeyer gates and system as proposed are not as common - Reduced amount of contractors that have experience with system - Manufacturer availability 	<ul style="list-style-type: none"> - Manufacturer may be farther distance away, custom gates - Testing and inspection may be more extensive - Training and O&M for locals may pose issues 	Likely	Marginal	2
FE-12	Remaining Construction Items	• N/A	N/A	Unlikely	Negligible	0
FE-13	Planning, Engineering, & Design	• N/A	N/A	Unlikely	Negligible	0
FE-14	Construction Management	• N/A	N/A	Unlikely	Negligible	0

Cost Estimate Assumptions						
					Max Potential Cost Growth	35%
CT-1	Fish & Wildlife Facilities	Underestimate of mitigation requirements.	- Coordination with Resource Agencies may require additional mitigation.	Possible	Marginal	1
CT-2	Earthwork	• Site accessibility, transport delays, congestion?	- Site access may be limited, construction along major highways has been ongoing for some years	Possible	Significant	2
CT-3	Cutoff Walls	• Assumptions related to prime and subcontractor markups/assignments? • Assumptions regarding crew, productivity, overtime?	- Estimate assumes the prime will construct the cutoff walls. Cutoff wall placement rate considered relatively conservative.	Possible	Marginal	1
CT-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
CT-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
CT-6	Control Structure	- Work crews and production may be affected by tides - No delays regarding the closing of channel to complete structure - Sound emission may restrict impact hammer for sheet piling and cast in steel shell piles	- May require additional efforts in PED phase to identify constructability issues - Phasing may be required instead which will take longer	Possible	Marginal	1
CT-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 55% of the Remaining Constr items)	- Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010)	Likely	Marginal	2
CT-13	Planning, Engineering, & Design	Coordination with railroads may increase costs (AK)	- Historical cost percentages are appropriate at this cost level estimate. - Will be determined through negotiation with railroads. Estimate assumes that railroad alignments won't change but service could be disrupted for cutoff wall construction. Unknown how cooperative railroad will be	Possible	Critical	3
CT-14	Construction Management	• N/A	- Historical cost percentages are appropriate at this cost level estimate.	Likely	Significant	3

External Project Risks						
					Max Potential Cost Growth	40%
EX-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Potential for severe adverse weather? *Endangered Species Work Windows (TT) 	- Yes, this is a concern. More SWPP monitoring is required.	Possible	Significant	2
EX-2	Earthwork	<ul style="list-style-type: none"> Potential for severe adverse weather? Unanticipated inflations in fuel, key materials? hazardous excavation materials, expensive removal 	<ul style="list-style-type: none"> Estimates were built on excavators used only. For some areas this is not practical and scrapers will be used which are much more efficient at moving earth. HTRW sites should be defined by EA, chance of coming across an unknown large site is not as likely 	Possible	Significant	2
EX-3	Cutoff Walls	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? material availability (bentonite) 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? Can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. 	Possible	Significant	2
EX-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
EX-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
EX-6	Control Structure	- Recreational boaters and accessibility issues	- Boat owners and businesses in the slough will be affected by construction	Likely	Significant	3
EX-12	Remaining Construction Items	<ul style="list-style-type: none"> Political influences, lack of support, obstacles? Unanticipated inflations in fuel, key materials? possible environmental BO, difficult to proceed Potential for market volatility impacting competition, pricing? input from cultural agencies, tribes 	<ul style="list-style-type: none"> Unanticipated inflations in costs of fuel & key materials can occur SPK Planning has identified several areas where Cultural Resources (remains) are very likely 	Very LIKELY	Marginal	3
EX-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Possibility of land prices going up Cultural resources, remains Late construction season, delays 	<ul style="list-style-type: none"> land prices could increase or there may be unwilling sellers several areas have been identified where cultural remains appear likely to be found 	Likely	Critical	4
EX-14	Construction Management	N/A	N/A	Unlikely	Negligible	0

Abbreviated Risk Analysis

Project (less than \$40M): **Lower San Joaquin River Feasibility Study, Alt 8a, N Stockton, Fix F**
 Project Development Stage: **Feasibility (Alternatives)**
 Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = \$ **350,564,416**

	<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
	01 LANDS AND DAMAGES	Real Estate	\$ 88,700,915	28.08%	\$ 24,905,073	\$ 113,605,988.01
1	06 FISH AND WILDLIFE FACILITIES	Fish & Wildlife Facilities	\$ 36,818,361	33.04%	\$ 12,163,760	\$ 48,982,121.03
2	11 01 LEVEES	Earthwork	\$ 107,269,842	44.69%	\$ 47,941,686	\$ 155,211,528.47
3	11 01 LEVEES	Cutoff Walls	\$ 30,178,200	38.21%	\$ 11,532,060	\$ 41,710,259.52
4	11 01 LEVEES	DSM (Seismic)	\$ 130,949,900	47.10%	\$ 61,673,179	\$ 192,623,078.98
5	11 01 LEVEES	Slope/Erosion Protection	\$ 8,213,271	49.44%	\$ 4,060,381	\$ 12,273,652.40
6	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Control Structure	\$ 15,598,000	50.70%	\$ 7,907,948	\$ 23,505,948.47
12		Remaining Construction Items	\$ 21,536,842	6.1% 37.17%	\$ 8,005,795	\$ 29,542,636.67
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 52,584,662	63.33%	\$ 33,299,444	\$ 85,884,106.80
14	31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 35,056,442	43.73%	\$ 15,328,481	\$ 50,384,922.55 *

Totals						
	Real Estate	\$	88,700,915	28.08%	\$ 24,905,073	\$ 113,605,988.01
	Total Construction Estimate	\$	350,564,416	43.73%	\$ 153,284,809	\$ 503,849,226
	Total Planning, Engineering & Design	\$	52,584,662	63.33%	\$ 33,299,444	\$ 85,884,107
	Total Construction Management	\$	35,056,442	43.73%	\$ 15,328,481	\$ 50,384,923
	Total	\$	526,906,435	46.08%	\$ 226,817,808	\$ 753,724,243

Lower San Joaquin River Feasibility Study, Alt 8a, N Stockton, Fix F

Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 4-Nov-13

Risk Level

Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Significant	Critical	Crisis

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth						75%
PS-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Construction QA/QC concerns Water side work concerns Implementing SWPPP Jeporady opinion Enough Mitigation? 	<ul style="list-style-type: none"> Potential modifications to closure structures for fish and wildlife. Additional mitigation features at offsite areas would increase scope and subsequent costs FWS may require additional features to mitigate onsite which may be unaccounted for if they are significant features like gartner snake canals. 	Possible	Significant	2
PS-2	Earthwork	<ul style="list-style-type: none"> Soil testing at borrow sites, endangered species, cultural Have conservative estimates been provided Is there plenty of land for borrow material Is there enough borrow material within 25miles or less? availability of temporary storage areas will influence efficiency of levee construction. material reuse % can significantly swing costs 	<ul style="list-style-type: none"> Scope will likely change in PED for amount of earthwork, reusable material would hopefully increase lowering total amounts Borrow sites are plenty as areas are building subdivisions and need to create water recharge areas. 	Likely	Significant	3
PS-3	Cutoff Walls	<ul style="list-style-type: none"> Investigations sufficient to support design assumptions? type of cutoff wall, SCB, SB, locations Areas w/no geotech data, adjacent fixes assumed 	<ul style="list-style-type: none"> Cutoff wall depth may change with increased PED, however the overall scope or method of wall isn't significant. Quantities are where this risk may be evaluated. 	Likely	Marginal	2
PS-4	DSM (Seismic)	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Sciesmic design criteria is not strictly defined by USACE 	<ul style="list-style-type: none"> Fixes will not be fully continuous, PED will define areas more specifically. Design features could change depending on the seismic design event 	Likely	Significant	3
PS-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Will need to add landside erosion protection to address levee superiority design criteria Larger or smaller Rock revetment may be necessary for erosion projection along delta from levees. 	<ul style="list-style-type: none"> This is not a risk, small feature in project cost and occurs in dry land levee areas. Levee superiority is a design requirement. However, we have not designed that feature yet. Rock size and extent was based on initial assessment. Larger rock size would increase cost due to increased thickness 	Very LIKELY	Significant	4
PS-6	Control Structure	<ul style="list-style-type: none"> Gate mechanism and control structure may change depending on function and projected OMRR&R costs Temporary construction and bypass facilities not fully realized 	<ul style="list-style-type: none"> Obeymeyer gate design is not standard. May not perform well from daily operations, opening and closing with the tide. If different gate mechanism chosen (sluice gates), may require more robust structure 	Possible	Critical	3
PS-12	Remaining Construction Items	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> Permitting, air quality, minor construction items all have minimal sway. SWPPP and restoration of borrow sites may be of concern, however these borrow areas are intended to be water recharge areas and shouldn't need much. Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010) 	Possible	Marginal	1
PS-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 15% may be too much for certain areas but may not be enough for complicated areas like siesmic delta front 	<ul style="list-style-type: none"> Portion of study area has already been evaluated by ULE study and other efforts with subsurface borings. These in-kind materials would significantly lower additional PED efforts and lead to construction sooner. 	Possible	Significant	2
PS-14	Construction Management	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> In order to construct such a large project, with many concurrent construction features, the effort may be higher than normal. 	Likely	Significant	3

Acquisition Strategy

					Max Potential Cost Growth	30%
AS-1	Fish & Wildlife Facilities	1. Mitigation lands cannot be acquired by Eminent Domain	- Based on the preliminary information available the real estate acquisition activities may require 2-6 years to complete. - (HCP) Habitat Conservation Plan exists	Possible	Marginal	1
AS-2	Earthwork	N/A	N/A	Unlikely	Negligible	0
AS-3	Cutoff Walls	Contracting Plan has not been firmly established Bid competition is limited	- There will likely be multiple contracts spread out over multiple construction seasons. This work may be performed by a subcontractor. - Prime contractor for the seperable elements will likely have most experience in traditional cutoff walls, sub out DSM work.	Likely	Marginal	2
AS-4	DSM (Seismic)	Contracting Plan has not been firmly established Work is likely to be performed by a subcontractor and competition is very limited for DSM work	- There will likely be multiple contracts spread out over multiple construction seasons. This work typically procceds slowly and the number of contractors capable of doing the work is very limited. - DSM work is the largest most expensive feature in NS. If contracts are broken out by area (NS, CS, RD17) then prime contractor for NS should be DSM Contractor. This would reduce costs overall instead of having prime add additional OH and profit onto the Sub's cost.	Likely	Marginal	2
AS-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
AS-6	Control Structure	- Control structure will likely to be sub-contractor that specializes in type of work.	- Higher overheads may result	Possible	Significant	2
AS-12	Remaining Construction Items	N/A	N/A	Unlikely	Negligible	0
AS-13	Planning, Engineering, & Design	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there will likely be increased time and costs for project development.	Very LIKELY	Significant	4
AS-14	Construction Management	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there may be more personnel required to provide quality assurance/control than on a more typical project.	Likely	Significant	3

Construction Elements						
					Max Potential Cost Growth	25%
CE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> - future changes to requirements - additional requirements to meet models, SRA habitat quotas, and planting densities * Work windows (TT) 	- future changes to requirements possible	Likely	Marginal	2
CE-2	Earthwork	<ul style="list-style-type: none"> QC at the borrow sites • Potential for construction modification and claims? • Discovery of buried Cultural Resources (TT) 	- Borrow sites are to facilitate ground water recharge and may benefit local interests in development as well. Quantities are large, but PED should refine how much is needed and what borrow sites are appropriate.	Likely	Significant	3
CE-3	Cutoff Walls	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	<ul style="list-style-type: none"> - staging areas and available real estate may affect progress. - SF quantities are large and fixes assumed continuous cutoff wall for all reaches. Depths may be deeper or more shallow, or no wall needed. Unlikely that cutoff wall quantities are going to exceed 15% over. 	Possible	Significant	2
CE-4	DSM (Seismic)	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-5	Slope/Erosion Protection	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-6	Control Structure	<ul style="list-style-type: none"> - Accelerated schedule - Water quality control plan, SWPPP, BMPs - Temporary bypass facilities 	<ul style="list-style-type: none"> - Limited window of working in wet and on levees per CCR title 23. Special agreements are likely necessary to complete construction. - Environmental impacts and water quality procedures may be more restrictive. - Water bypass may need to be more robust to account for tides and storms 	Likely	Marginal	2
CE-12	Remaining Construction Items	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- all the above may lead to possible minor impacts to PED	Possible	Marginal	1
CE-14	Construction Management	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- added years could have marginal effects on CM	Possible	Marginal	1

Quantities for Current Scope

				Max Potential Cost Growth	20%	
Q-1	Fish & Wildlife Facilities	• Confidence level in our generated quantities for current scope?	- Costs were generated as % of construction cost, most areas ranging from 5-15%. Until we have official opinion for mitigation requirements we do not have a good idea of if we're high or low.	Very LIKELY	Marginal	3
Q-2	Earthwork	• Confidence level in our generated quantities for current scope?	- Typical Section used in analysis. Existing geometries would round up to next size so quantities of earthwork should be relatively conservative. Past improvements from RD 404 and RD 17 have also been neglected which would significantly reduce earthwork quantities.	Possible	Significant	2
Q-3	Cutoff Walls	• Confidence level in our generated quantities for current scope?	- Quantities will change in PED but should not exceed total amount. Use of 3x3x3 evaluation and applying fix adjacencies come with risk and the design of walls address that risk to a certain degree.	Very LIKELY	Marginal	3
Q-4	DSM (Seismic)	• Confidence level in our generated quantities for current scope?	- Fix applied throughout reach length, which may be conservative when evaluated in PED. Depth and grid spacing are appropriate for design level at this time.	Possible	Marginal	1
Q-5	Slope/Erosion Protection	• Confidence level in our generated quantities for current scope?	- Based on typical section methodology and blanket thickness, quantity exceedance is not expected.	Unlikely	Significant	1
Q-6	Control Structure	- Quantities were pro-rated from sponsor developed design	- Estimates for original structure were prepared at a higher level of confidence (30%) and should be good. Pro-rate has limitations and may not account for all site specifics which contribute cost.	Likely	Significant	3
Q-12	Remaining Construction Items	No Design has been done on the Diversion Structure (structure is roughly 25% of the Remaining Constr items)	- permitting, and swpp items not quantified for features or at borrow site. These items are likely covered in cost through the unallocated item in PCET - Diversion structure costs are ro-rated based on costs from the Natomas PACR (2010)	Likely	Marginal	2
Q-13	Planning, Engineering, & Design	Design elements have been shifted to PED	- Refinements are being kicked down road to PED. However, portion of study area already has PED development design and can be used in-kind. Big policy issues like veg etl or real estate requirements, if held for this period, could kill progress.	Likely	Significant	3
Q-14	Construction Management	N/A	- based on historical values, not likely to change significantly.	Unlikely	Negligible	0

Specialty Fabrication or Equipment

					Max Potential Cost Growth	75%
FE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> • Construction QA/QC concerns • Water side work concerns • Implementing SWPPP 	- Potential modifications to closure structures for fish and wildlife.	Possible	Marginal	1
FE-2	Earthwork	Gate structure is not a common design	- Features necessary for project to perform may be missing from design.	Likely	Marginal	2
FE-3	Cutoff Walls	<ul style="list-style-type: none"> • uncertainty of cutoff wall methods, different equipment for different methods • availability of special equipment 	- Traditional walls are not a new thing for area and equipment should be readily available to construct. Project quantities do not demand a large fleet or amount of crews to build within 15 year period. Project competition should not be issue.	Likely	Marginal	2
FE-4	DSM (Seismic)	<ul style="list-style-type: none"> • availability of special equipment 	- PED will drive how extensive the seismic fix will need to be. Multiple DSM rigs should be available, however, competition between other Corps and Sponsor projects may drive costs.	Likely	Marginal	2
FE-5	Slope/Erosion Protection	• N/A	N/A	Unlikely	Negligible	0
FE-6	Control Structure	<ul style="list-style-type: none"> • Obermeyer gates and system as proposed are not as common - Reduced amount of contractors that have experience with system - Manufacturer availability 	<ul style="list-style-type: none"> - Manufacturer may be farther distance away, custom gates - Testing and inspection may be more extensive - Training for locals on how to operate may pose issues 	Likely	Marginal	2
FE-12	Remaining Construction Items	• N/A	N/A	Unlikely	Negligible	0
FE-13	Planning, Engineering, & Design	• N/A	N/A	Unlikely	Negligible	0
FE-14	Construction Management	• N/A	N/A	Unlikely	Negligible	0

Cost Estimate Assumptions

				Max Potential Cost Growth		35%
CT-1	Fish & Wildlife Facilities	Underestimate of mitigation requirements.	- Coordination with Resource Agencies may require additional mitigation.	Possible	Marginal	1
CT-2	Earthwork	<ul style="list-style-type: none"> Reliability and number of key quotes? Site accessibility, transport delays, congestion? Assumptions regarding crew, productivity, overtime? 	- Site access may be limited, construction along major highways has been ongoing for some years	Possible	Significant	2
CT-3	Cutoff Walls	<ul style="list-style-type: none"> Assumptions related to prime and subcontractor markups/assignments? Assumptions regarding crew, productivity, overtime? 	- Estimate assumes the prime will construct the cutoff walls. Cutoff wall placement rate considered relatively conservative.	Possible	Marginal	1
CT-4	DSM (Seismic)	- Type of fix/methodology is not common for district. Design unknowns or construction sequencing may affect rates and subsequently cost.	- Costs were gut checked with DSM values from Marysville. Materials or construction may not change, but seismic grid methodology may be different that what DSM contractors are used to.	Possible	Significant	2
CT-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
CT-6	Control Structure	<ul style="list-style-type: none"> Work crews and production may be affected by tides No delays regarding the closing of channel to complete structure Sound emission/environmental impact may restrict impact hammer for sheet piling and cast in steel shell piles 	<ul style="list-style-type: none"> May require additional efforts in PED phase to identify constructability issues phasing may be required instead which will take longer 	Possible	Marginal	1
CT-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 25% of the Remaining Constr items)	- Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010)	Likely	Significant	3
CT-13	Planning, Engineering, & Design	Coordination with railroads may increase costs (AK)	<ul style="list-style-type: none"> Historical cost percentages are appropriate at this cost level estimate. Will be determined through negotiation with railroads. Estimate assumes that railroad alignments won't change but service could be disrupted for cutoff wall construction. Unknown how cooperative railroad will be 	Possible	Critical	3
CT-14	Construction Management	• N/A	- Historical cost percentages are appropriate at this cost level estimate.	Likely	Significant	3

External Project Risks						
					Max Potential Cost Growth	40%
EX-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Potential for severe adverse weather? *Endangered Species Work Windows (TT) 	- Yes, this is a concern. More SWPP monitoring is required.	Possible	Significant	2
EX-2	Earthwork	<ul style="list-style-type: none"> Potential for severe adverse weather? Unanticipated inflations in fuel, key materials? hazardous excavation materials, expensive removal 	<ul style="list-style-type: none"> Estimates were built on excavators used only. For some areas this is not practical and scrapers will be used which are much more efficient at moving earth. HTRW sites should be defined by EA, chance of coming across an unknown large site is not as likely 	Possible	Significant	2
EX-3	Cutoff Walls	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? material availability (bentonite) 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? Can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. 	Possible	Significant	2
EX-4	DSM (Seismic)	<ul style="list-style-type: none"> DSM rig availability, competition construction issues - blow outs, fractures 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. DSM rig availability, competition – Limited availability, frequent breakdown Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. Competition from other projects may drive up bids. 	Possible	Significant	2
EX-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Availability of rocks and quarries available to manufacture it Water traffic 	- Quarry availability should not be a problem. Size of rock will not be for velocity but rather for wave impact. Quantity is not significant for general area.	Possible	Marginal	1
EX-6	Control Structure	<ul style="list-style-type: none"> Recreational boaters and accessibility issues Yacht club may want just compensation 	- Boat owners and businesses in the slough will be affected by construction	Likely	Significant	3
EX-12	Remaining Construction Items	<ul style="list-style-type: none"> Political influences, lack of support, obstacles? Unanticipated inflations in fuel, key materials? possible environmental BO, difficult to proceed Potential for market volatility impacting competition, pricing? input from cultural agencies, tribes 	<ul style="list-style-type: none"> Unanticipated inflations in costs of fuel & key materials can occur SPK Planning has identified several areas where Cultural Resources (remains) are very likely 	Very LIKELY	Marginal	3
EX-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Possibility of land prices going up Cultural resources, remains Late construction season, delays 	<ul style="list-style-type: none"> land prices could increase or there may be unwilling sellers several areas have been identified where cultural remains appear likely to be found 	Likely	Critical	4
EX-14	Construction Management	N/A	N/A	Unlikely	Negligible	0

Abbreviated Risk Analysis

**Lower San Joaquin River Feasibility Study, Alt 9a, C Stockton, Fixes B & C
plus Duck Creek & Mormon Channel**

Project (less than \$40M):

Project Development Stage: **Feasibility (Alternatives)**

Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = \$ **124,760,655**

	<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
	01 LANDS AND DAMAGES	Real Estate	\$ 25,485,082	25.14%	\$ 6,407,596	\$ 31,892,677.56
1	06 FISH AND WILDLIFE FACILITIES	Fish & Wildlife Facilities	\$ 7,028,675	33.04%	\$ 2,322,078	\$ 9,350,753.58
2	11 01 LEVEES	Earthwork	\$ 58,962,574	44.69%	\$ 26,351,910	\$ 85,314,484.53
3	11 01 LEVEES	Cutoff Walls	\$ 22,525,000	38.21%	\$ 8,607,526	\$ 31,132,525.99
4	11 01 LEVEES	DSM (Seismic)	\$ -	0.00%	\$ -	\$ -
5	11 01 LEVEES	Slope/Erosion Protection	\$ 13,400	44.66%	\$ 5,985	\$ 19,384.51
6	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Control Structures	\$ 24,370,000	52.81%	\$ 12,869,380	\$ 37,239,380.10
12		Remaining Construction Items	\$ 11,861,005	9.5%	\$ 3,899,498	\$ 15,760,503.03
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 18,714,098	63.33%	\$ 11,850,776	\$ 30,564,874.51
14	31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 12,476,065	43.33%	\$ 5,405,638	\$ 17,881,703.17 *

Totals						
		Real Estate	\$ 25,485,082	25.14%	\$ 6,407,596	\$ 31,892,677.56
		Total Construction Estimate	\$ 124,760,655	43.33%	\$ 54,056,377	\$ 178,817,032
		Total Planning, Engineering & Design	\$ 18,714,098	63.33%	\$ 11,850,776	\$ 30,564,875
		Total Construction Management	\$ 12,476,065	43.33%	\$ 5,405,638	\$ 17,881,703
		Total	\$ 181,435,900	45.73%	\$ 77,720,387	\$ 259,156,287

Lower San Joaquin River Feasibility Study, Alt 9a, C Stockton, Fixes B & C plus Duck Creek & Mormon Channel

Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 4-Nov-13

Risk Level

Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Significant	Critical	Crisis

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth						
					Max Potential Cost Growth	75%
PS-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Construction QA/QC concerns Water side work concerns Implementing SWPPP Enough Mitigation? 	<ul style="list-style-type: none"> Additional mitigation features at offsite areas would increase scope and subsequent costs FWS may require additional features to mitigate onsite which may be unaccounted for if they are significant features like gartner snake canals. 	Possible	Significant	2
PS-2	Earthwork	<ul style="list-style-type: none"> Soil testing at borrow sites, endangered species, cultural Have conservative estimates been provided Is there plenty of land for borrow material Is there enough borrow material within 25miles or less? material reuse % can significantly swing costs 	<ul style="list-style-type: none"> Scope will likely change in PED for amount of earthwork, reusable material would hopefully increase lowering total amounts Borrow sites are plenty as areas are building subdivisions and need to create water recharge areas. 	Likely	Significant	3
PS-3	Cutoff Walls	<ul style="list-style-type: none"> Investigations sufficient to support design assumptions? type of cutoff wall, SCB, SB, locations Areas w/no geotech data, adjacent fixes assumed 	<ul style="list-style-type: none"> Cutoff wall depth may change with increased PED, however the overall scope or method of wall isn't significant. Quantities are where this risk may be evaluated. 	Likely	Marginal	2
PS-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
PS-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Larger or smaller Rock revetment may be necessary for erosion projection along delta from levees. 	<ul style="list-style-type: none"> This is not a risk, small feature in project cost and occurs in dry land levee areas. Rock size and extent was based on initial assessment. Larger rock size would increase cost due to increased thickness 	Very LIKELY	Significant	4
PS-6	Control Structures	<ul style="list-style-type: none"> Gate mechanism and control structure may change depending on function and projected OMRR&R costs Temporary construction and bypass facilities not fully realized (MC) Temporary traffic control for bridges and road relocations (MC) UPR RR embankment improvements 	<ul style="list-style-type: none"> Obeymeyer gate design is not standard. May not perform well from daily operations, opening and closing with the tide. If different gate mechanism chosen (sluice gates), may require more robust structure (MC) estimates did not fully realize these efforts and instead relied on pro-rates. (MC) UPR may not accept microtunneling for increased conveyance. If RR bridge is required, there will be a lot more effort developing a temporary relocation of RR with shoefly and building bridge across channel. 	Possible	Critical	3
PS-12	Remaining Construction Items	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> Permitting, air quality, minor construction items all have minimal sway. SWPPP and restoration of borrow sites may be of concern, however these borrow areas are intended to be water recharge areas and shouldn't need much. Diversion structre costs are pro-rated based on csts from the Natomas PACR (2010). Bridge costs are based on typical costs per CALTRANS. 	Possible	Marginal	1
PS-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 15% may be too much for certain areas but may not be enough for complicated areas like siesmic delta front 	<ul style="list-style-type: none"> Portion of study area has already been evaluated by ULE study and other efforts with subsurface borings. These in-kind materials would significantly lower additional PED efforts and lead to construction sooner. 	Possible	Significant	2
PS-14	Construction Management	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> In order to construct such a large project, with many concurrent construction features, the effort may be higher than normal. 	Likely	Significant	3

Acquisition Strategy					Max Potential Cost Growth	30%
AS-1	Fish & Wildlife Facilities	1. Potential to delay award of construction contracts when non-federal partners cannot certify real estate rights. 2. Mitigation lands cannot be acquired by Eminent Domain	- Based on the preliminary information available the real estate acquisition activities may require 2-6 years to complete.	Possible	Marginal	1
AS-2	Earthwork	N/A	N/A	Unlikely	Negligible	0
AS-3	Cutoff Walls	Contracting Plan has not been firmly established Bid competition is limited	- There will likely be multiple contracts spread out over multiple construction seasons. This work may be performed by a subcontractor. - Prime contractor for the seperable elements will likely have most experience in traditional cutoff walls, sub out DSM work.	Likely	Marginal	2
AS-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
AS-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
AS-6	Control Structures	- Control structure will likely to be sub-contractor that specializes in type of work.	- Higher overheads may result	Possible	Significant	2
AS-12	Remaining Construction Items	N/A	N/A	Unlikely	Negligible	0
AS-13	Planning, Engineering, & Design	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there will likely be increased time and costs for project development.	Very LIKELY	Significant	4
AS-14	Construction Management	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there may be more personnel required to provide quality assurance/control than on a more typical project.	Likely	Significant	3

Construction Elements					Max Potential Cost Growth	25%
CE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> - future changes to requirements - additional requirements to meet models, SRA habitat quotas, and planting densities * Work windows (TT) 	- future changes to requirements possible	Likely	Marginal	2
CE-2	Earthwork	<ul style="list-style-type: none"> QC at the borrow sites • Potential for construction modification and claims? * Discovery of buried Cultural Resources (TT) 	- Borrow sites are to facilitate ground water recharge and may benefit local interests in development as well. Quantities are large, but PED should refine how much is needed and what borrow sites are appropriate.	Likely	Significant	3
CE-3	Cutoff Walls	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	<ul style="list-style-type: none"> - staging areas and available real estate may affect progress. - SF quantities are large and fixes assumed continuous cutoff wall for all reaches. Depths may be deeper or more shallow, or no wall needed. Unlikely that cutoff wall quantities are going to exceed 15% over. 	Possible	Significant	2
CE-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
CE-5	Slope/Erosion Protection	N/A	N/	Unlikely	Negligible	0
CE-6	Control Structures	<ul style="list-style-type: none"> - Accelerated schedule - Water quality control plan, SWPPP, BMPs - Temporary bypass facilities - (MC) Foundation design for diversion structure not evaluated. - (MC) Microtunneling assumed under UPR RR embankment 	<ul style="list-style-type: none"> - Limited window of working in wet and on levees per CCR title 23. Special agreements are likely necessary to complete construction. - Environmental impacts and water quality procedures may be more restrictive. - Water bypass may need to be more robust to account for tides and storms - (MC) foundation type can have a big impact on cost. Current design considers structure as a box culvert. Underseepage may need to be accounted for. - (MC) Method may not be accepted by UPR, or more stringent criteria is applied 	Likely	Marginal	2
CE-12	Remaining Construction Items	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- all the above may lead to possible minor impacts to PED	Possible	Marginal	1
CE-14	Construction Management	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- added years could have marginal effects on CM	Possible	Marginal	1

Quantities for Current Scope

				Max Potential Cost Growth	20%	
Q-1	Fish & Wildlife Facilities	• Confidence level in our generated quantities for current scope?	- Costs were generated as % of construction cost, most areas ranging from 5-15%. Until we have official opinion for mitigation requirements we do not have a good idea of if we're high or low.	Very LIKELY	Marginal	3
Q-2	Earthwork	• Confidence level in our generated quantities for current scope?	- Typical Section used in analysis. Existing geometries would round up to next size so quantities of earthwork should be relatively conservative. Past improvements from RD 404 and RD 17 have also been neglected which would significantly reduce earthwork quantities.	Possible	Significant	2
Q-3	Cutoff Walls	• Confidence level in our generated quantities for current scope?	- Quantities will change in PED but should not exceed total amount. Use of 3x3x3 evaluation and applying fix adjacencies come with risk and the design of walls address that risk to a certain degree.	Very LIKELY	Marginal	3
Q-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
Q-5	Slope/Erosion Protection	• Confidence level in our generated quantities for current scope?	- Quantities from AE 30% design, no drawing supplied, but this is a very small feature	Likely	Significant	3
Q-6	Control Structures	- Quantities were taken from sponsor provided design	- Estimates for original structure were prepared at a higher level of confidence (30% draft) and should be good at this time. Locals are pursuing this design further and more detail and cost confidence will be forthcoming.	Likely	Significant	3
Q-12	Remaining Construction Items	No Design has been done on the the Diversion Structure or Bridges (structures are 60%+ of the Remaining Constr items)	- permitting, and swppp items not quantified for features or at borrow site. These items are likely covered in cost through the unallocated item in PCET - Diversion structure costs are pro-rated based on csts from the Natomas PACR (2010). Bridge costs are based on typical costs per CALTRANS.	Likely	Marginal	2
Q-13	Planning, Engineering, & Design	Design elements have been shifted to PED	- Refinements are being kicked down road to PED. However, portion of study area already has PED development design and can be used in-kind. Big policy issues like veg etl or real estate requirements, if held for this period, could kill progress.	Likely	Significant	3
Q-14	Construction Management	N/A	- based on historical values, not likely to change significantly.	Unlikely	Significant	1

Specialty Fabrication or Equipment

					Max Potential Cost Growth	75%
FE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> • Construction QA/QC concerns • Water side work concerns • Implementing SWPPP 	Potential modifications to closure structures for fish and wildlife.	Possible	Marginal	1
FE-2	Earthwork	Gate structure is not a common design	Features necessary for project to perform may be missing from design.	Likely	Marginal	2
FE-3	Cutoff Walls	<ul style="list-style-type: none"> • uncertainty of cutoff wall methods, different equipment for different methods • availability of special equipment 	- Traditional walls are not a new thing for area and equipment should be readily available to construct. Project quantities do not demand a large fleet or amount of crews to build within 15 year period. Project competition should not be issue.	Likely	Marginal	2
FE-4	DSM (Seismic)	• N/A	N/A	Unlikely	Negligible	0
FE-5	Slope/Erosion Protection	• N/A	N/A	Unlikely	Negligible	0
FE-6	Control Structures	<ul style="list-style-type: none"> • Obermeyer gates and system as proposed are not as common - Reduced amount of contractors that have experience with system - Manufacturer availability - (MC) Radial or tainter gates for structure will likely be custom job 	<ul style="list-style-type: none"> - Manufacturer may be farther distance away, custom gates - Testing and inspection may be more extensive - Training and O&M for locals may pose issues - (MC) limited fabricators, less availability 	Likely	Marginal	2
FE-12	Remaining Construction Items	• N/A	N/A	Unlikely	Negligible	0
FE-13	Planning, Engineering, & Design	• N/A	N/A	Unlikely	Negligible	0
FE-14	Construction Management	• N/A	N/A	Unlikely	Negligible	0

Cost Estimate Assumptions						
					Max Potential Cost Growth	35%
CT-1	Fish & Wildlife Facilities	Underestimate of mitigation requirements.	- Coordination with Resource Agencies may require additional mitigation.	Possible	Marginal	1
CT-2	Earthwork	N/A	N/A	Possible	Significant	2
CT-3	Cutoff Walls	• Assumptions related to prime and subcontractor markups/assignments? • Assumptions regarding crew, productivity, overtime?	- Estimate assumes the prime will construct the cutoff walls. Cutoff wall placement rate considered relatively conservative.	Possible	Marginal	1
CT-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
CT-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
CT-6	Control Structures	- Work crews and production may be affected by tides - No delays regarding the closing of channel to complete structure - Sound emission may restrict impact hammer for sheet piling and cast in steel shell piles - (MC) MC diversion structure and bridges should be built in dry - (MC) Bridges and road closures may not be feasible all at one time	- May require additional efforts in PED phase to identify constructability issues - Phasing may be required instead which will take longer - (MC) Check dam or other assurance feature is necessary to make sure flood waters do not enter into MC during construction. - (MC) May require phasing of bridges which will take longer	Possible	Significant	2
CT-12	Remaining Construction Items	No Design has been done on the the Diversion Structure or Bridges (structures are 60%+ of the Remaining Constr items)	- Diversion structre costs are pro-rated based on csts from the Natomas PACR (2010). Bridge costs are based on typical costs per CALTRANS.	Likely	Marginal	2
CT-13	Planning, Engineering, & Design	Coordination with railroads may increase costs (AK)	- Historical cost percentages are appropriate at this cost level estimate. - Will be determined through negotiation with railroads. Estimate assumes that railroad alignments won't change but service could be disrupted for cutoff wall construction. Unknown how cooperative railroad will be	Possible	Critical	3
CT-14	Construction Management	• N/A	- Historical cost percentages are appropriate at this cost level estimate.	Unlikely	Negligible	0

External Project Risks						
					Max Potential Cost Growth	40%
EX-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Potential for severe adverse weather? Endangered Species Work Windows (TT) 	- Yes, this is a concern. More SWPP monitoring is required.	Possible	Significant	2
EX-2	Earthwork	<ul style="list-style-type: none"> Potential for severe adverse weather? Unanticipated inflations in fuel, key materials? hazardous excavation materials, expensive removal 	<ul style="list-style-type: none"> Estimates were built on excavators used only. For some areas this is not practical and scrapers will be used which are much more efficient at moving earth. HTRW sites should be defined by EA, chance of coming across an unknown large site is not as likely 	Possible	Significant	2
EX-3	Cutoff Walls	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? material availability (bentonite) 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? Can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. 	Possible	Significant	2
EX-4	DSM (Seismic)	N/A	N/A	Unlikely	Negligible	0
EX-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
EX-6	Control Structures	<ul style="list-style-type: none"> Recreational boaters and accessibility issues (MC) water removed from mormon channel/stockton diverting canal may impact fish migration (MC) farmland owners behind diversion structure will want existing water rights 	<ul style="list-style-type: none"> Boat owners and businesses in the slough will be affected by construction (MC) More analysis on operation and duration is necessary in PED. (MC) Just compensation or low flow bypass will be required to deliver, at a minimum, enough water to satisfy their existing rights. 	Likely	Significant	3
EX-12	Remaining Construction Items	<ul style="list-style-type: none"> Political influences, lack of support, obstacles? Unanticipated inflations in fuel, key materials? possible environmental BO, difficult to proceed Potential for market volatility impacting competition, pricing? input from cultural agencies, tribes 	<ul style="list-style-type: none"> Unanticipated inflations in costs of fuel & key materials can occur SPK Planning has identified several areas where Cultural Resources (remains) are very likely 	Very LIKELY	Marginal	3
EX-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Possibility of land prices going up Cultural resources, remains Late construction season, delays 	<ul style="list-style-type: none"> land prices could increase or there may be unwilling sellers several areas have been identified where cultural remains appear likely to be found 	Likely	Critical	4
EX-14	Construction Management	N/A	N/A	Unlikely	Negligible	0

Abbreviated Risk Analysis

Project (less than \$40M): **Lower San Joaquin River Feasibility Study, Alt 9a, N Stockton, Fix B**
 Project Development Stage: **Feasibility (Alternatives)**
 Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = \$ **325,813,366**

	<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
	01 LANDS AND DAMAGES	Real Estate	\$ 79,695,198	28.71%	\$ 22,883,002	\$ 102,578,200.44
1	06 FISH AND WILDLIFE FACILITIES	Fish & Wildlife Facilities	\$ 33,941,435	33.04%	\$ 11,213,304	\$ 45,154,738.58
2	11 01 LEVEES	Earthwork	\$ 93,674,505	44.69%	\$ 41,865,576	\$ 135,540,081.56
3	11 01 LEVEES	Cutoff Walls	\$ 26,171,400	38.21%	\$ 10,000,933	\$ 36,172,332.55
4	11 01 LEVEES	DSM (Seismic)	\$ 130,949,900	47.10%	\$ 61,673,179	\$ 192,623,078.98
5	11 01 LEVEES	Slope/Erosion Protection	\$ 8,213,271	49.44%	\$ 4,060,381	\$ 12,273,652.40
6	15 FLOODWAY CONTROL AND DIVERSION STRUCTURES	Control Structure	\$ 15,598,000	50.70%	\$ 7,907,948	\$ 23,505,948.47
12		Remaining Construction Items	\$ 17,264,855	5.3% 32.88%	\$ 5,676,101	\$ 22,940,956.48
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 48,872,005	63.33%	\$ 30,948,389	\$ 79,820,394.33
14	31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 32,581,337	43.71%	\$ 14,239,742	\$ 46,821,078.90 *

Totals						
		Real Estate	\$ 79,695,198	28.71%	\$ 22,883,002	\$ 102,578,200.44
		Total Construction Estimate	\$ 325,813,366	43.71%	\$ 142,397,423	\$ 468,210,789
		Total Planning, Engineering & Design	\$ 48,872,005	63.33%	\$ 30,948,389	\$ 79,820,394
		Total Construction Management	\$ 32,581,337	43.71%	\$ 14,239,742	\$ 46,821,079
		Total	\$ 486,961,906	46.06%	\$ 210,468,557	\$ 697,430,463

Lower San Joaquin River Feasibility Study, Alt 9a, N Stockton, Fix B

Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 4-Nov-13

Risk Level

Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Significant	Critical	Crisis

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth						
					Max Potential Cost Growth	75%
PS-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Construction QA/QC concerns Water side work concerns Implementing SWPPP Jeporady opinion Enough Mitigation? 	<ul style="list-style-type: none"> Potential modifications to closure structures for fish and wildlife. Additional mitigation features at offsite areas would increase scope and subsequent costs FWS may require additional features to mitigate onsite which may be unaccounted for if they are significant features like gartner snake canals. 	Possible	Significant	2
PS-2	Earthwork	<ul style="list-style-type: none"> Soil testing at borrow sites, endangered species, cultural Have conservative estimates been provided Is there plenty of land for borrow material Is there enough borrow material within 25miles or less? availability of temporary storage areas will influence efficiency of levee construction. material reuse % can significantly swing costs 	<ul style="list-style-type: none"> Scope will likely change in PED for amount of earthwork, reusable material would hopefully increase lowering total amounts Borrow sites are plenty as areas are building subdivisions and need to create water recharge areas. 	Likely	Significant	3
PS-3	Cutoff Walls	<ul style="list-style-type: none"> Investigations sufficient to support design assumptions? type of cutoff wall, SCB, SB, locations Areas w/no geotech data, adjacent fixes assumed 	<ul style="list-style-type: none"> Cutoff wall depth may change with increased PED, however the overall scope or method of wall isn't significant. Quantities are where this risk may be evaluated. 	Likely	Marginal	2
PS-4	DSM (Seismic)	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Sciesmic design criteria is not strictly defined by USACE 	<ul style="list-style-type: none"> Fixes will not be fully continuous, PED will define areas more specifically. Design features could change depending on the seismic design event 	Likely	Significant	3
PS-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? Will need to add landside erosion protection to address levee superiority design criteria Larger or smaller Rock revetment may be necessary for erosion projection along delta from levees. 	<ul style="list-style-type: none"> This is not a risk, small feature in project cost and occurs in dry land levee areas. Levee superiority is a design requirement. However, we have not designed that feature yet. Rock size and extent was based on initial assessment. Larger rock size would increase cost due to increased thickness 	Very LIKELY	Significant	4
PS-6	Control Structure	<ul style="list-style-type: none"> Gate mechanism and control structure may change depending on function and projected OMR&R costs Temporary construction and bypass facilities not fully realized 	<ul style="list-style-type: none"> Obeymeyer gate design is not standard. May not perform well from daily operations, opening and closing with the tide. If different gate mechanism chosen (sluice gates), may require more robust structure 	Possible	Critical	3
PS-12	Remaining Construction Items	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> Permitting, air quality, minor construction items all have minimal sway. SWPPP and restoration of borrow sites may be of concern, however these borrow areas are intended to be water recharge areas and shouldn't need much. Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010) 	Possible	Marginal	1
PS-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 15% may be too much for certain areas but may not be enough for complicated areas like siesmic delta front 	<ul style="list-style-type: none"> Portion of study area has already been evaluated by ULE study and other efforts with subsurface borings. These in-kind materials would significantly lower additional PED efforts and lead to construction sooner. 	Possible	Significant	2
PS-14	Construction Management	<ul style="list-style-type: none"> Potential for scope growth, added features and quantities? 	<ul style="list-style-type: none"> In order to construct such a large project, with many concurrent construction features, the effort may be higher than normal. 	Likely	Significant	3

Acquisition Strategy

					Max Potential Cost Growth	30%
AS-1	Fish & Wildlife Facilities	1. Mitigation lands cannot be acquired by Eminent Domain	- Based on the preliminary information available the real estate acquisition activities may require 2-6 years to complete. - (HCP) Habitat Conservation Plan exists	Possible	Marginal	1
AS-2	Earthwork	N/A	N/A	Unlikely	Negligible	0
AS-3	Cutoff Walls	Contracting Plan has not been firmly established Bid competition is limited	- There will likely be multiple contracts spread out over multiple construction seasons. This work may be performed by a subcontractor. - Prime contractor for the seperable elements will likely have most experience in traditional cutoff walls, sub out DSM work.	Likely	Marginal	2
AS-4	DSM (Seismic)	Contracting Plan has not been firmly established Work is likely to be performed by a subcontractor and competition is very limited for DSM work	- There will likely be multiple contracts spread out over multiple construction seasons. This work typically procceds slowly and the number of contractors capable of doing the work is very limited. - DSM work is the largest most expensive feature in NS. If contracts are broken out by area (NS, CS, RD17) then prime contractor for NS should be DSM Contractor. This would reduce costs overall instead of having prime add additional OH and profit onto the Sub's cost.	Likely	Marginal	2
AS-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
AS-6	Control Structure	- Control structure will likely to be sub-contractor that specializes in type of work.	- Higher overheads may result	Possible	Significant	2
AS-12	Remaining Construction Items	N/A	N/A	Unlikely	Negligible	0
AS-13	Planning, Engineering, & Design	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there will likely be increased time and costs for project development.	Very LIKELY	Significant	4
AS-14	Construction Management	Contracting Plan has not been firmly established	- Because there will be multiple contracts over multiple construction seasons there may be more personnel required to provide quality assurance/control than on a more typical project.	Likely	Significant	3

Construction Elements						
					Max Potential Cost Growth	25%
CE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> - future changes to requirements - additional requirements to meet models, SRA habitat quotas, and planting densities * Work windows (TT) 	- future changes to requirements possible	Likely	Marginal	2
CE-2	Earthwork	<ul style="list-style-type: none"> QC at the borrow sites • Potential for construction modification and claims? • Discovery of buried Cultural Resources (TT) 	- Borrow sites are to facilitate ground water recharge and may benefit local interests in development as well. Quantities are large, but PED should refine how much is needed and what borrow sites are appropriate.	Likely	Significant	3
CE-3	Cutoff Walls	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	<ul style="list-style-type: none"> - staging areas and available real estate may affect progress. - SF quantities are large and fixes assumed continuous cutoff wall for all reaches. Depths may be deeper or more shallow, or no wall needed. Unlikely that cutoff wall quantities are going to exceed 15% over. 	Possible	Significant	2
CE-4	DSM (Seismic)	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-5	Slope/Erosion Protection	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-6	Control Structure	<ul style="list-style-type: none"> - Accelerated schedule - Water quality control plan, SWPPP, BMPs - Temporary bypass facilities 	<ul style="list-style-type: none"> - Limited window of working in wet and on levees per CCR title 23. Special agreements are likely necessary to complete construction. - Environmental impacts and water quality procedures may be more restrictive. - Water bypass may need to be more robust to account for tides and storms 	Likely	Marginal	2
CE-12	Remaining Construction Items	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- Yes, feature of work may take many years to build. Availability of materials, costs, etc can change and affect this feature which is a major cost contributor.	Likely	Significant	3
CE-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- all the above may lead to possible minor impacts to PED	Possible	Marginal	1
CE-14	Construction Management	<ul style="list-style-type: none"> • Potential for construction modification and claims? • Unique construction methods? • Accelerated schedule or harsh weather schedule? 	- added years could have marginal effects on CM	Possible	Marginal	1

Quantities for Current Scope

				Max Potential Cost Growth	20%	
Q-1	Fish & Wildlife Facilities	• Confidence level in our generated quantities for current scope?	- Costs were generated as % of construction cost, most areas ranging from 5-15%. Until we have official opinion for mitigation requirements we do not have a good idea of if we're high or low.	Very LIKELY	Marginal	3
Q-2	Earthwork	• Confidence level in our generated quantities for current scope?	- Typical Section used in analysis. Existing geometries would round up to next size so quantities of earthwork should be relatively conservative. Past improvements from RD 404 and RD 17 have also been neglected which would significantly reduce earthwork quantities.	Possible	Significant	2
Q-3	Cutoff Walls	• Confidence level in our generated quantities for current scope?	- Quantities will change in PED but should not exceed total amount. Use of 3x3x3 evaluation and applying fix adjacencies come with risk and the design of walls address that risk to a certain degree.	Very LIKELY	Marginal	3
Q-4	DSM (Seismic)	• Confidence level in our generated quantities for current scope?	- Fix applied throughout reach length, which may be conservative when evaluated in PED. Depth and grid spacing are appropriate for design level at this time.	Possible	Marginal	1
Q-5	Slope/Erosion Protection	• Confidence level in our generated quantities for current scope?	- Based on typical section methodology and blanket thickness, quantity exceedance is not expected.	Unlikely	Significant	1
Q-6	Control Structure	- Quantities were pro-rated from sponsor developed design'	- Estimates for original structure were prepared at a higher level of confidence (30%) and should be good. Pro-rate has limitations and may not account for all site specifics which contribute cost.	Likely	Significant	3
Q-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 25% of the Remaining Constr items)	- permitting, and swppp items not quantified for features or at borrow site. These items are likely covered in cost through the unallocated items in PCET - Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010)	Likely	Marginal	2
Q-13	Planning, Engineering, & Design	Design elements have been shifted to PED	- Refinements are being kicked down road to PED. However, portion of study area already has PED development design and can be used in-kind. Big policy issues like veg etl or real estate requirements, if held for this period, could kill progress.	Likely	Significant	3
Q-14	Construction Management	N/A	- based on historical values, not likely to change significantly.	Unlikely	Significant	1

Specialty Fabrication or Equipment

					Max Potential Cost Growth	75%
FE-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> • Construction QA/QC concerns • Water side work concerns • Implementing SWPPP 	- Potential modifications to closure structures for fish and wildlife.	Possible	Marginal	1
FE-2	Earthwork	Gate structure is not a common design	- Features necessary for project to perform may be missing from design.	Likely	Marginal	2
FE-3	Cutoff Walls	<ul style="list-style-type: none"> • uncertainty of cutoff wall methods, different equipment for different methods • availability of special equipment 	- Traditional walls are not a new thing for area and equipment should be readily available to construct. Project quantities do not demand a large fleet or amount of crews to build within 15 year period. Project competition should not be issue.	Likely	Marginal	2
FE-4	DSM (Seismic)	<ul style="list-style-type: none"> • availability of special equipment 	- PED will drive how extensive the seismic fix will need to be. Multiple DSM rigs should be available, however, competition between other Corps and Sponsor projects may drive costs.	Likely	Marginal	2
FE-5	Slope/Erosion Protection	• N/A	N/A	Unlikely	Negligible	0
FE-6	Control Structure	<ul style="list-style-type: none"> • Obermeyer gates and system as proposed are not as common - Reduced amount of contractors that have experience with system - Manufacturer availability 	<ul style="list-style-type: none"> - Manufacturer may be farther distance away, custom gates - Testing and inspection may be more extensive - Training for locals on how to operate may pose issues 	Likely	Marginal	2
FE-12	Remaining Construction Items	• N/A	N/A	Unlikely	Negligible	0
FE-13	Planning, Engineering, & Design	• N/A	N/A	Unlikely	Negligible	0
FE-14	Construction Management	• N/A	N/A	Unlikely	Negligible	0

Cost Estimate Assumptions

				Max Potential Cost Growth		35%
CT-1	Fish & Wildlife Facilities	Underestimate of mitigation requirements.	- Coordination with Resource Agencies may require additional mitigation.	Possible	Marginal	1
CT-2	Earthwork	<ul style="list-style-type: none"> Reliability and number of key quotes? Site accessibility, transport delays, congestion? Assumptions regarding crew, productivity, overtime? 	- Site access may be limited, construction along major highways has been ongoing for some years	Possible	Significant	2
CT-3	Cutoff Walls	<ul style="list-style-type: none"> Assumptions related to prime and subcontractor markups/assignments? Assumptions regarding crew, productivity, overtime? 	- Estimate assumes the prime will construct the cutoff walls. Cutoff wall placement rate considered relatively conservative.	Possible	Marginal	1
CT-4	DSM (Seismic)	- Type of fix/methodology is not common for district. Design unknowns or construction sequencing may affect rates and subsequently cost.	- Costs were gut checked with DSM values from Marysville. Materials or construction may not change, but seismic grid methodology may be different that what DSM contractors are used to.	Possible	Significant	2
CT-5	Slope/Erosion Protection	N/A	N/A	Unlikely	Negligible	0
CT-6	Control Structure	<ul style="list-style-type: none"> Work crews and production may be affected by tides No delays regarding the closing of channel to complete structure Sound emission/environmental impact may restrict impact hammer for sheet piling and cast in steel shell piles 	<ul style="list-style-type: none"> May require additional efforts in PED phase to identify constructability issues phasing may be required instead which will take longer 	Possible	Marginal	1
CT-12	Remaining Construction Items	No Design has been done on the the Diversion Structure (structure is roughly 25% of the Remaining Constr items)	- Diversion structure costs are pro-rated based on costs from the Natomas PACR (2010)	Likely	Marginal	2
CT-13	Planning, Engineering, & Design	Coordination with railroads may increase costs (AK)	<ul style="list-style-type: none"> Historical cost percentages are appropriate at this cost level estimate. Will be determined through negotiation with railroads. Estimate assumes that railroad alignments won't change but service could be disrupted for cutoff wall construction. Unknown how cooperative railroad will be 	Possible	Critical	3
CT-14	Construction Management	• N/A	- Historical cost percentages are appropriate at this cost level estimate.	Unlikely	Negligible	0

External Project Risks						
					Max Potential Cost Growth	40%
EX-1	Fish & Wildlife Facilities	<ul style="list-style-type: none"> Potential for severe adverse weather? *Endangered Species Work Windows (TT) 	- Yes, this is a concern. More SWPP monitoring is required.	Possible	Significant	2
EX-2	Earthwork	<ul style="list-style-type: none"> Potential for severe adverse weather? Unanticipated inflations in fuel, key materials? hazardous excavation materials, expensive removal 	<ul style="list-style-type: none"> Estimates were built on excavators used only. For some areas this is not practical and scrapers will be used which are much more efficient at moving earth. HTRW sites should be defined by EA, chance of coming across an unknown large site is not as likely 	Possible	Significant	2
EX-3	Cutoff Walls	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? material availability (bentonite) 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? Can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. 	Possible	Significant	2
EX-4	DSM (Seismic)	<ul style="list-style-type: none"> DSM rig availability, competition construction issues - blow outs, fractures 	<ul style="list-style-type: none"> Unanticipated inflations in fuel, key materials? can occur - There are large quantities of bentonite available in Wyoming, but needs early coordination to verify amounts required each season. DSM rig availability, competition – Limited availability, frequent breakdown Construction Issues - Concern about pathways of the slurry material going into backyards and into the river (blowouts). Concerns about water side staging. Competition from other projects may drive up bids. 	Possible	Significant	2
EX-5	Slope/Erosion Protection	<ul style="list-style-type: none"> Availability of rocks and quarries available to manufacture it Water traffic 	- Quarry availability should not be a problem. Size of rock will not be for velocity but rather for wave impact. Quantity is not significant for general area.	Possible	Marginal	1
EX-6	Control Structure	<ul style="list-style-type: none"> Recreational boaters and accessibility issues Yacht club may want just compensation 	- Boat owners and businesses in the slough will be affected by construction	Likely	Significant	3
EX-12	Remaining Construction Items	<ul style="list-style-type: none"> Political influences, lack of support, obstacles? Unanticipated inflations in fuel, key materials? possible environmental BO, difficult to proceed Potential for market volatility impacting competition, pricing? input from cultural agencies, tribes 	<ul style="list-style-type: none"> Unanticipated inflations in costs of fuel & key materials can occur SPK Planning has identified several areas where Cultural Resources (remains) are very likely 	Very LIKELY	Marginal	3
EX-13	Planning, Engineering, & Design	<ul style="list-style-type: none"> Possibility of land prices going up Cultural resources, remains Late construction season, delays 	<ul style="list-style-type: none"> land prices could increase or there may be unwilling sellers several areas have been identified where cultural remains appear likely to be found 	Likely	Critical	4
EX-14	Construction Management	N/A	N/A	Unlikely	Negligible	0

ATTACHMENT B – PRELIMINARY COST ESTIMATES (PROJECT COST SUMMARIES)

FOUO

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-7A
PROJECT NO: 105785
LOCATION: Stockton CA

DISTRICT: SPD South Pacific Division
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 7/22/2015

This Estimate reflects the scope and schedule in report; Draft Feasibility Report (Alternatives)

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14				Spent Thru: 1-Oct-14 (\$K) K	L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
						ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J					
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)	\$0	\$0	44%	\$0	-	\$0	\$0	\$0	\$0		\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$40,045	\$13,837	35%	\$53,882	0.0%	\$40,045	\$13,837	\$53,882	\$0		\$40,045	\$13,837	\$53,882
11	LEVEES & FLOODWALLS	\$335,898	\$152,331	45%	\$488,229	0.0%	\$335,898	\$152,331	\$488,229	\$0		\$335,898	\$152,331	\$488,229
15	FLOODWAY CONTROL & DIVERSION STRU	\$29,785	\$13,279	45%	\$43,064	0.0%	\$29,785	\$13,279	\$43,064	\$0		\$29,785	\$13,279	\$43,064
18	CULTURAL RESOURCE PRESERVATION	\$11,767	\$5,331	45%	\$17,098	0.0%	\$11,767	\$5,331	\$17,098	\$0		\$11,767	\$5,331	\$17,098
CONSTRUCTION ESTIMATE TOTALS:		\$417,496	\$184,777		\$602,273	0.0%	\$417,496	\$184,777	\$602,273	\$0		\$417,496	\$184,777	\$602,273
01	LANDS AND DAMAGES	\$102,147	\$28,824	28%	\$130,971	0.0%	\$102,147	\$28,824	\$130,971	\$0		\$102,147	\$28,824	\$130,971
02	RELOCATIONS	\$16,618	\$7,399	45%	\$24,016	0.0%	\$16,618	\$7,399	\$24,016	\$0		\$16,618	\$7,399	\$24,016
30	RELOCATIONS - PED	\$2,493	\$1,110	45%	\$3,602	0.0%	\$2,493	\$1,110	\$3,602	\$0		\$2,493	\$1,110	\$3,602
31	RELOCATIONS - CM	\$1,662	\$740	45%	\$2,402	0.0%	\$1,662	\$740	\$2,402	\$0		\$1,662	\$740	\$2,402
30	PLANNING, ENGINEERING & DESIGN	\$62,624	\$27,716	44%	\$90,340	0.0%	\$62,624	\$27,716	\$90,340	\$0		\$62,624	\$27,716	\$90,340
31	CONSTRUCTION MANAGEMENT	\$41,749	\$18,477	44%	\$60,226	0.0%	\$41,749	\$18,477	\$60,226	\$0		\$41,749	\$18,477	\$60,226
PROJECT COST TOTALS:		\$644,788	\$269,044	42%	\$913,832		\$644,788	\$269,044	\$913,832	\$0		\$644,788	\$269,044	\$913,832

CHIEF, COST ENGINEERING, Jeremiah Frost

PROJECT MANAGER,

CHIEF, REAL ESTATE, Sharon Caine

CHIEF, ENGINEERING, Rick Poepelman

ESTIMATED TOTAL PROJECT COST: \$913,832,000

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-7A
 LOCATION: Stockton CA
 This Estimate reflects the scope and schedule in report: Draft Feasibility Report (Alternatives)

DISTRICT: SPD South Pacific Division
 PREPARED: 7/22/2015
 POC: CHIEF, COST ENGINEERING, Jeremiah Frost

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
		Estimate Prepared: 6/9/2014				Program Year (Budget EC): 2015								
		Effective Price Level: 41913				Effective Price Level Date: 1 OCT 14								
		RISK BASED												
WBS	Civil Works	COST	CNTG	CNTG	TOTAL	ESC	COST	CNTG	TOTAL	Mid-Point	ESC	COST	CNTG	FULL
NUMBER	Feature & Sub-Feature Description	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	Date	(%)	(\$K)	(\$K)	(\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
N Stockton, Fix B														
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)		\$0	46%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$33,941	\$11,214	33%	\$45,156	0.0%	\$33,941	\$11,214	\$45,156	2014Q1	0.0%	\$33,941	\$11,214	\$45,156
11	LEVEES & FLOODWALLS	\$259,009	\$119,300	46%	\$378,309	0.0%	\$259,009	\$119,300	\$378,309	2014Q1	0.0%	\$259,009	\$119,300	\$378,309
15	FLOODWAY CONTROL & DIVERSION STRU	\$15,598	\$7,184	46%	\$22,782	0.0%	\$15,598	\$7,184	\$22,782	2014Q1	0.0%	\$15,598	\$7,184	\$22,782
18	CULTURAL RESOURCE PRESERVATION	\$8,885	\$4,092	46%	\$12,977	0.0%	\$8,885	\$4,092	\$12,977	2014Q1	0.0%	\$8,885	\$4,092	\$12,977
			\$0				\$0							
	CONSTRUCTION ESTIMATE TOTALS:	\$317,433	\$141,791	45%	\$459,224		\$317,433	\$141,791	\$459,224			\$317,433	\$141,791	\$459,224
01	LANDS AND DAMAGES	\$79,569	\$22,852	29%	\$102,421	0.0%	\$79,569	\$22,852	\$102,421	2014Q1	0.0%	\$79,569	\$22,852	\$102,421
02	RELOCATIONS	\$8,378	\$3,859	46%	\$12,237	0.0%	\$8,378	\$3,859	\$12,237	2014Q1	0.0%	\$8,378	\$3,859	\$12,237
30	RELOCATIONS - PED	\$1,257	\$579	46%	\$1,835	0.0%	\$1,257	\$579	\$1,835	2014Q1	0.0%	\$1,257	\$579	\$1,835
31	RELOCATIONS - CM	\$838	\$386	46%	\$1,224	0.0%	\$838	\$386	\$1,224	2014Q1	0.0%	\$838	\$386	\$1,224
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	\$3,174	\$1,418	45%	\$4,592	0.0%	\$3,174	\$1,418	\$4,592	2014Q1	0.0%	\$3,174	\$1,418	\$4,592
1.0%	Planning & Environmental Compliance	\$3,174	\$1,418	45%	\$4,592	0.0%	\$3,174	\$1,418	\$4,592	2014Q1	0.0%	\$3,174	\$1,418	\$4,592
6.0%	Engineering & Design	\$19,046	\$8,507	45%	\$27,553	0.0%	\$19,046	\$8,507	\$27,553	2014Q1	0.0%	\$19,046	\$8,507	\$27,553
0.5%	Reviews, ATRs, IEPRs, VE	\$1,587	\$709	45%	\$2,296	0.0%	\$1,587	\$709	\$2,296	2014Q1	0.0%	\$1,587	\$709	\$2,296
0.5%	Life Cycle Updates (cost, schedule, risks)	\$1,587	\$709	45%	\$2,296	0.0%	\$1,587	\$709	\$2,296	2014Q1	0.0%	\$1,587	\$709	\$2,296
1.0%	Contracting & Reprographics	\$3,174	\$1,418	45%	\$4,592	0.0%	\$3,174	\$1,418	\$4,592	2014Q1	0.0%	\$3,174	\$1,418	\$4,592
3.0%	Engineering During Construction	\$9,523	\$4,254	45%	\$13,777	0.0%	\$9,523	\$4,254	\$13,777	2014Q1	0.0%	\$9,523	\$4,254	\$13,777
1.0%	Planning During Construction	\$3,174	\$1,418	45%	\$4,592	0.0%	\$3,174	\$1,418	\$4,592	2014Q1	0.0%	\$3,174	\$1,418	\$4,592
1.0%	Project Operations	\$3,174	\$1,418	45%	\$4,592	0.0%	\$3,174	\$1,418	\$4,592	2014Q1	0.0%	\$3,174	\$1,418	\$4,592
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	\$20,633	\$9,216	45%	\$29,849	0.0%	\$20,633	\$9,216	\$29,849	2014Q1	0.0%	\$20,633	\$9,216	\$29,849
1.5%	Project Operation:	\$4,761	\$2,127	45%	\$6,888	0.0%	\$4,761	\$2,127	\$6,888	2014Q1	0.0%	\$4,761	\$2,127	\$6,888
2.0%	Project Management	\$6,349	\$2,836	45%	\$9,185	0.0%	\$6,349	\$2,836	\$9,185	2014Q1	0.0%	\$6,349	\$2,836	\$9,185
	CONTRACT COST TOTALS:	\$486,831	\$204,913		\$691,744		\$486,831	\$204,913	\$691,744			\$486,831	\$204,913	\$691,744

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-7A
 LOCATION: Stockton CA
 This Estimate reflects the scope and schedule in report; Draft Feasibility Report (Alternatives)

DISTRICT: SPD South Pacific Division
 PREPARED: 7/22/2015
 POC: CHIEF, COST ENGINEERING, Jeremiah Frost

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
		Estimate Prepared: 6/9/2014				Program Year (Budget EC): 2015								
		Effective Price Level: 41913				Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	ESC (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
C Stockton, Fixes B & C														
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)		\$0	43%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$6,104	\$2,622	43%	\$8,726	0.0%	\$6,104	\$2,622	\$8,726	2014Q1	0.0%	\$6,104	\$2,622	\$8,726
11	LEVEES & FLOODWALLS	\$76,889	\$33,031	43%	\$109,920	0.0%	\$76,889	\$33,031	\$109,920	2014Q1	0.0%	\$76,889	\$33,031	\$109,920
15	FLOODWAY CONTROL & DIVERSION STRU	\$14,187	\$6,095	43%	\$20,282	0.0%	\$14,187	\$6,095	\$20,282	2014Q1	0.0%	\$14,187	\$6,095	\$20,282
18	CULTURAL RESOURCE PRESERVATION	\$2,883	\$1,238	43%	\$4,121	0.0%	\$2,883	\$1,238	\$4,121	2014Q1	0.0%	\$2,883	\$1,238	\$4,121
			\$0				\$0							
CONSTRUCTION ESTIMATE TOTALS:		\$100,063	\$42,987	43%	\$143,049		\$100,063	\$42,987	\$143,049			\$100,063	\$42,987	\$143,049
01	LANDS AND DAMAGES	\$22,578	\$5,972	26%	\$28,550	0.0%	\$22,578	\$5,972	\$28,550	2014Q1	0.0%	\$22,578	\$5,972	\$28,550
02	RELOCATIONS	\$8,240	\$3,540	43%	\$11,780	0.0%	\$8,240	\$3,540	\$11,780	2014Q1	0.0%	\$8,240	\$3,540	\$11,780
30	RELOCATIONS - PED	\$1,236	\$531	43%	\$1,767	0.0%	\$1,236	\$531	\$1,767	2014Q1	0.0%	\$1,236	\$531	\$1,767
31	RELOCATIONS - CM	\$824	\$354	43%	\$1,178	0.0%	\$824	\$354	\$1,178	2014Q1	0.0%	\$824	\$354	\$1,178
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	\$1,001	\$430	43%	\$1,431	0.0%	\$1,001	\$430	\$1,431	2014Q1	0.0%	\$1,001	\$430	\$1,431
1.0%	Planning & Environmental Compliance	\$1,001	\$430	43%	\$1,431	0.0%	\$1,001	\$430	\$1,431	2014Q1	0.0%	\$1,001	\$430	\$1,431
6.0%	Engineering & Design	\$6,004	\$2,579	43%	\$8,583	0.0%	\$6,004	\$2,579	\$8,583	2014Q1	0.0%	\$6,004	\$2,579	\$8,583
0.5%	Reviews, ATRs, IEPRs, VE	\$500	\$215	43%	\$715	0.0%	\$500	\$215	\$715	2014Q1	0.0%	\$500	\$215	\$715
0.5%	Life Cycle Updates (cost, schedule, risks)	\$500	\$215	43%	\$715	0.0%	\$500	\$215	\$715	2014Q1	0.0%	\$500	\$215	\$715
1.0%	Contracting & Reprographics	\$1,001	\$430	43%	\$1,431	0.0%	\$1,001	\$430	\$1,431	2014Q1	0.0%	\$1,001	\$430	\$1,431
3.0%	Engineering During Construction	\$3,002	\$1,290	43%	\$4,292	0.0%	\$3,002	\$1,290	\$4,292	2014Q1	0.0%	\$3,002	\$1,290	\$4,292
1.0%	Planning During Construction	\$1,001	\$430	43%	\$1,431	0.0%	\$1,001	\$430	\$1,431	2014Q1	0.0%	\$1,001	\$430	\$1,431
1.0%	Project Operations	\$1,001	\$430	43%	\$1,431	0.0%	\$1,001	\$430	\$1,431	2014Q1	0.0%	\$1,001	\$430	\$1,431
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	\$6,504	\$2,794	43%	\$9,298	0.0%	\$6,504	\$2,794	\$9,298	2014Q1	0.0%	\$6,504	\$2,794	\$9,298
1.5%	Project Operation:	\$1,501	\$645	43%	\$2,146	0.0%	\$1,501	\$645	\$2,146	2014Q1	0.0%	\$1,501	\$645	\$2,146
2.0%	Project Management	\$2,001	\$860	43%	\$2,861	0.0%	\$2,001	\$860	\$2,861	2014Q1	0.0%	\$2,001	\$860	\$2,861
CONTRACT COST TOTALS:		\$157,957	\$64,131		\$222,088		\$157,957	\$64,131	\$222,088			\$157,957	\$64,131	\$222,088

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-8A
PROJECT NO: 105785
LOCATION: Stockton CA

DISTRICT: SPD South Pacific Division
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 7/22/2015

This Estimate reflects the scope and schedule in report; Draft Feasibility Report (Alternatives)

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14				Spent Thru: 1-Oct-14 (\$K) K	L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
						ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J					
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)	\$0	\$0	46%	\$0	-	\$0	\$0	\$0	\$0		\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$45,200	\$20,708	46%	\$65,908	0.0%	\$45,200	\$20,708	\$65,908	\$0		\$45,200	\$20,708	\$65,908
11	LEVEES & FLOODWALLS	\$396,985	\$181,209	46%	\$578,194	0.0%	\$396,985	\$181,209	\$578,194	\$0		\$396,985	\$181,209	\$578,194
15	FLOODWAY CONTROL & DIVERSION STRU	\$29,785	\$13,522	45%	\$43,307	0.0%	\$29,785	\$13,522	\$43,307	\$0		\$29,785	\$13,522	\$43,307
18	CULTURAL RESOURCE PRESERVATION	\$13,743	\$6,274	46%	\$20,017	0.0%	\$13,743	\$6,274	\$20,017	\$0		\$13,743	\$6,274	\$20,017
	CONSTRUCTION ESTIMATE TOTALS:	\$485,713	\$221,714		\$707,427	0.0%	\$485,713	\$221,714	\$707,427	\$0		\$485,713	\$221,714	\$707,427
01	LANDS AND DAMAGES	\$116,166	\$31,936	27%	\$148,102	0.0%	\$116,166	\$31,936	\$148,102	\$0		\$116,166	\$31,936	\$148,102
02	RELOCATIONS	\$23,797	\$10,796	45%	\$34,592	0.0%	\$23,797	\$10,796	\$34,592	\$0		\$23,797	\$10,796	\$34,592
30	RELOCATIONS - PED	\$3,569	\$1,619	45%	\$5,189	0.0%	\$3,569	\$1,619	\$5,189	\$0		\$3,569	\$1,619	\$5,189
31	RELOCATIONS - CM	\$2,380	\$1,080	45%	\$3,459	0.0%	\$2,380	\$1,080	\$3,459	\$0		\$2,380	\$1,080	\$3,459
30	PLANNING, ENGINEERING & DESIGN	\$72,855	\$33,256	46%	\$106,111	0.0%	\$72,855	\$33,256	\$106,111	\$0		\$72,855	\$33,256	\$106,111
31	CONSTRUCTION MANAGEMENT	\$48,572	\$22,172	46%	\$70,744	0.0%	\$48,572	\$22,172	\$70,744	\$0		\$48,572	\$22,172	\$70,744
	PROJECT COST TOTALS:	\$753,052	\$322,571	43%	\$1,075,623		\$753,052	\$322,571	\$1,075,623	\$0		\$753,052	\$322,571	\$1,075,623

CHIEF, COST ENGINEERING, Jeremiah Frost

PROJECT MANAGER,

CHIEF, REAL ESTATE, Sharon Caine

CHIEF, ENGINEERING, Rick Poeppelman

ESTIMATED TOTAL PROJECT COST: \$1,075,623,000

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-8A
 LOCATION: Stockton CA
 This Estimate reflects the scope and schedule in report; Draft Feasibility Report (Alternatives)

DISTRICT: SPD South Pacific Division PREPARED: 7/22/2015
 POC: CHIEF, COST ENGINEERING, Jeremiah Frost

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
		Estimate Prepared: 6/9/2014				Program Year (Budget EC): 2015								
		Effective Price Level: 41913				Effective Price Level Date: 1 OCT 14								
		RISK BASED												
WBS	Civil Works	COST	CNTG	CNTG	TOTAL	ESC	COST	CNTG	TOTAL	Mid-Point	ESC	COST	CNTG	FULL
NUMBER	Feature & Sub-Feature Description	(\$K)	(\$K)	(%)	(\$K)	(%)	(\$K)	(\$K)	(\$K)	Date	(%)	(\$K)	(\$K)	(\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
N Stockton, Fix F														
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)		\$0	46%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$36,818	\$16,966	46%	\$53,784	0.0%	\$36,818	\$16,966	\$53,784	2014Q1	0.0%	\$36,818	\$16,966	\$53,784
11	LEVEES & FLOODWALLS	\$276,611	\$127,462	46%	\$404,074	0.0%	\$276,611	\$127,462	\$404,074	2014Q1	0.0%	\$276,611	\$127,462	\$404,074
15	FLOODWAY CONTROL & DIVERSION STRU	\$15,598	\$7,188	46%	\$22,786	0.0%	\$15,598	\$7,188	\$22,786	2014Q1	0.0%	\$15,598	\$7,188	\$22,786
18	CULTURAL RESOURCE PRESERVATION	\$9,616	\$4,431	46%	\$14,047	0.0%	\$9,616	\$4,431	\$14,047	2014Q1	0.0%	\$9,616	\$4,431	\$14,047
			\$0				\$0							
	CONSTRUCTION ESTIMATE TOTALS:	\$338,644	\$156,047	46%	\$494,691		\$338,644	\$156,047	\$494,691			\$338,644	\$156,047	\$494,691
01	LANDS AND DAMAGES	\$88,701	\$24,907	28%	\$113,608	0.0%	\$88,701	\$24,907	\$113,608	2014Q1	0.0%	\$88,701	\$24,907	\$113,608
02	RELOCATIONS	\$11,921	\$5,493	46%	\$17,414	0.0%	\$11,921	\$5,493	\$17,414	2014Q1	0.0%	\$11,921	\$5,493	\$17,414
30	RELOCATIONS - PED	\$1,788	\$824	46%	\$2,612	0.0%	\$1,788	\$824	\$2,612	2014Q1	0.0%	\$1,788	\$824	\$2,612
31	RELOCATIONS - CM	\$1,192	\$549	46%	\$1,741	0.0%	\$1,192	\$549	\$1,741	2014Q1	0.0%	\$1,192	\$549	\$1,741
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	\$3,386	\$1,560	46%	\$4,946	0.0%	\$3,386	\$1,560	\$4,946	2014Q1	0.0%	\$3,386	\$1,560	\$4,946
1.0%	Planning & Environmental Compliance	\$3,386	\$1,560	46%	\$4,946	0.0%	\$3,386	\$1,560	\$4,946	2014Q1	0.0%	\$3,386	\$1,560	\$4,946
6.0%	Engineering & Design	\$20,319	\$9,363	46%	\$29,682	0.0%	\$20,319	\$9,363	\$29,682	2014Q1	0.0%	\$20,319	\$9,363	\$29,682
0.5%	Reviews, ATRs, IEPs, VE	\$1,693	\$780	46%	\$2,473	0.0%	\$1,693	\$780	\$2,473	2014Q1	0.0%	\$1,693	\$780	\$2,473
0.5%	Life Cycle Updates (cost, schedule, risks)	\$1,693	\$780	46%	\$2,473	0.0%	\$1,693	\$780	\$2,473	2014Q1	0.0%	\$1,693	\$780	\$2,473
1.0%	Contracting & Reprographics	\$3,386	\$1,560	46%	\$4,946	0.0%	\$3,386	\$1,560	\$4,946	2014Q1	0.0%	\$3,386	\$1,560	\$4,946
3.0%	Engineering During Construction	\$10,159	\$4,681	46%	\$14,840	0.0%	\$10,159	\$4,681	\$14,840	2014Q1	0.0%	\$10,159	\$4,681	\$14,840
1.0%	Planning During Construction	\$3,386	\$1,560	46%	\$4,946	0.0%	\$3,386	\$1,560	\$4,946	2014Q1	0.0%	\$3,386	\$1,560	\$4,946
1.0%	Project Operations	\$3,386	\$1,560	46%	\$4,946	0.0%	\$3,386	\$1,560	\$4,946	2014Q1	0.0%	\$3,386	\$1,560	\$4,946
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	\$22,012	\$10,143	46%	\$32,155	0.0%	\$22,012	\$10,143	\$32,155	2014Q1	0.0%	\$22,012	\$10,143	\$32,155
1.5%	Project Operation:	\$5,080	\$2,341	46%	\$7,421	0.0%	\$5,080	\$2,341	\$7,421	2014Q1	0.0%	\$5,080	\$2,341	\$7,421
2.0%	Project Management	\$6,773	\$3,121	46%	\$9,894	0.0%	\$6,773	\$3,121	\$9,894	2014Q1	0.0%	\$6,773	\$3,121	\$9,894
	CONTRACT COST TOTALS:	\$526,905	\$226,831		\$753,736		\$526,905	\$226,831	\$753,736			\$526,905	\$226,831	\$753,736

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-8A
 LOCATION: Stockton CA
 This Estimate reflects the scope and schedule in report; Draft Feasibility Report (Alternatives)

DISTRICT: SPD South Pacific Division
 PO: CHIEF, COST ENGINEERING, Jeremiah Frost
 PREPARED: 7/22/2015

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
		Estimate Prepared:		6/9/2014		Program Year (Budget EC):		2015						
		Effective Price Level:		41913		Effective Price Level Date:		1 OCT 14						
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	ESC (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
C Stockton, Fix D + Duck Cr														
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)	\$0	\$0	45%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$8,382	\$3,742	45%	\$12,124	0.0%	\$8,382	\$3,742	\$12,124	2014Q1	0.0%	\$8,382	\$3,742	\$12,124
11	LEVEES & FLOODWALLS	\$120,374	\$53,747	45%	\$174,121	0.0%	\$120,374	\$53,747	\$174,121	2014Q1	0.0%	\$120,374	\$53,747	\$174,121
15	FLOODWAY CONTROL & DIVERSION STRU	\$14,187	\$6,334	45%	\$20,521	0.0%	\$14,187	\$6,334	\$20,521	2014Q1	0.0%	\$14,187	\$6,334	\$20,521
18	CULTURAL RESOURCE PRESERVATION	\$4,127	\$1,843	45%	\$5,970	0.0%	\$4,127	\$1,843	\$5,970	2014Q1	0.0%	\$4,127	\$1,843	\$5,970
					\$0				\$0					
	CONSTRUCTION ESTIMATE TOTALS:	\$147,070	\$65,667	45%	\$212,736		\$147,070	\$65,667	\$212,736			\$147,070	\$65,667	\$212,736
01	LANDS AND DAMAGES	\$27,465	\$7,028	26%	\$34,493	0.0%	\$27,465	\$7,028	\$34,493	2014Q1	0.0%	\$27,465	\$7,028	\$34,493
02	RELOCATIONS	\$11,876	\$5,303	45%	\$17,178	0.0%	\$11,876	\$5,303	\$17,178	2014Q1	0.0%	\$11,876	\$5,303	\$17,178
30	RELOCATIONS - PED	\$1,781	\$795	45%	\$2,577	0.0%	\$1,781	\$795	\$2,577	2014Q1	0.0%	\$1,781	\$795	\$2,577
31	RELOCATIONS - CM	\$1,188	\$530	45%	\$1,718	0.0%	\$1,188	\$530	\$1,718	2014Q1	0.0%	\$1,188	\$530	\$1,718
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	\$1,471	\$657	45%	\$2,128	0.0%	\$1,471	\$657	\$2,128	2014Q1	0.0%	\$1,471	\$657	\$2,128
1.0%	Planning & Environmental Compliance	\$1,471	\$657	45%	\$2,128	0.0%	\$1,471	\$657	\$2,128	2014Q1	0.0%	\$1,471	\$657	\$2,128
6.0%	Engineering & Design	\$8,824	\$3,940	45%	\$12,764	0.0%	\$8,824	\$3,940	\$12,764	2014Q1	0.0%	\$8,824	\$3,940	\$12,764
0.5%	Reviews, ATRs, IEPRs, VE	\$735	\$328	45%	\$1,063	0.0%	\$735	\$328	\$1,063	2014Q1	0.0%	\$735	\$328	\$1,063
0.5%	Life Cycle Updates (cost, schedule, risks)	\$735	\$328	45%	\$1,063	0.0%	\$735	\$328	\$1,063	2014Q1	0.0%	\$735	\$328	\$1,063
1.0%	Contracting & Reprographics	\$1,471	\$657	45%	\$2,128	0.0%	\$1,471	\$657	\$2,128	2014Q1	0.0%	\$1,471	\$657	\$2,128
3.0%	Engineering During Construction	\$4,412	\$1,970	45%	\$6,382	0.0%	\$4,412	\$1,970	\$6,382	2014Q1	0.0%	\$4,412	\$1,970	\$6,382
1.0%	Planning During Construction	\$1,471	\$657	45%	\$2,128	0.0%	\$1,471	\$657	\$2,128	2014Q1	0.0%	\$1,471	\$657	\$2,128
1.0%	Project Operations	\$1,471	\$657	45%	\$2,128	0.0%	\$1,471	\$657	\$2,128	2014Q1	0.0%	\$1,471	\$657	\$2,128
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	\$9,560	\$4,269	45%	\$13,829	0.0%	\$9,560	\$4,269	\$13,829	2014Q1	0.0%	\$9,560	\$4,269	\$13,829
1.5%	Project Operation:	\$2,206	\$985	45%	\$3,191	0.0%	\$2,206	\$985	\$3,191	2014Q1	0.0%	\$2,206	\$985	\$3,191
2.0%	Project Management	\$2,941	\$1,313	45%	\$4,254	0.0%	\$2,941	\$1,313	\$4,254	2014Q1	0.0%	\$2,941	\$1,313	\$4,254
	CONTRACT COST TOTALS:	\$226,147	\$95,740		\$321,887		\$226,147	\$95,740	\$321,887			\$226,147	\$95,740	\$321,887

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-9A
PROJECT NO: 105785
LOCATION: Stockton CA

DISTRICT: SPD South Pacific Division
POC: CHIEF, COST ENGINEERING, Jeremiah Frost
PREPARED: 7/22/2015

This Estimate reflects the scope and schedule in report; Draft Feasibility Report (Alternatives)

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14				Spent Thru: 1-Oct-14 (\$K) K	L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
						ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J					
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)	\$0	\$0	46%	\$0	-	\$0	\$0	\$0	\$0		\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$40,970	\$18,848	46%	\$59,818	0.0%	\$40,970	\$18,848	\$59,818	\$0		\$40,970	\$18,848	\$59,818
11	LEVEES & FLOODWALLS	\$340,510	\$156,570	46%	\$497,080	0.0%	\$340,510	\$156,570	\$497,080	\$0		\$340,510	\$156,570	\$497,080
15	FLOODWAY CONTROL & DIVERSION STRUCTURES	\$39,968	\$18,329	46%	\$58,297	0.0%	\$39,968	\$18,329	\$58,297	\$0		\$39,968	\$18,329	\$58,297
18	CULTURAL RESOURCE PRESERVATION	\$12,198	\$5,608	46%	\$17,806	0.0%	\$12,198	\$5,608	\$17,806	\$0		\$12,198	\$5,608	\$17,806
CONSTRUCTION ESTIMATE TOTALS:		\$433,646	\$199,354		\$633,000	0.0%	\$433,646	\$199,354	\$633,000	\$0		\$433,646	\$199,354	\$633,000
01	LANDS AND DAMAGES	\$105,180	\$29,287	28%	\$134,468	0.0%	\$105,180	\$29,287	\$134,468	\$0		\$105,180	\$29,287	\$134,468
02	RELOCATIONS	\$16,928	\$7,769	46%	\$24,696	0.0%	\$16,928	\$7,769	\$24,696	\$0		\$16,928	\$7,769	\$24,696
30	RELOCATIONS - PED	\$2,539	\$1,165	46%	\$3,704	0.0%	\$2,539	\$1,165	\$3,704	\$0		\$2,539	\$1,165	\$3,704
31	RELOCATIONS - CM	\$1,693	\$777	46%	\$2,470	0.0%	\$1,693	\$777	\$2,470	\$0		\$1,693	\$777	\$2,470
30	PLANNING, ENGINEERING & DESIGN	\$65,044	\$29,902	46%	\$94,946	0.0%	\$65,044	\$29,902	\$94,946	\$0		\$65,044	\$29,902	\$94,946
31	CONSTRUCTION MANAGEMENT	\$43,365	\$19,936	46%	\$63,301	0.0%	\$43,365	\$19,936	\$63,301	\$0		\$43,365	\$19,936	\$63,301
PROJECT COST TOTALS:		\$668,395	\$288,190	43%	\$956,585		\$668,395	\$288,190	\$956,585	\$0		\$668,395	\$288,190	\$956,585

CHIEF, COST ENGINEERING, Jeremiah Frost

PROJECT MANAGER,

CHIEF, REAL ESTATE, Sharon Caine

CHIEF, ENGINEERING, Rick Poeppelman

ESTIMATED TOTAL PROJECT COST: \$956,585,000

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-9A
 LOCATION: Stockton CA
 This Estimate reflects the scope and schedule in report; Draft Feasibility Report (Alternatives)

DISTRICT: SPD South Pacific Division
 POC: CHIEF, COST ENGINEERING, Jeremiah Frost
 PREPARED: 7/22/2015

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
		Estimate Prepared: 6/9/2014		Program Year (Budget EC): 2015		Effective Price Level: 41913		Effective Price Level Date: 1 OCT 14						
		RISK BASED												
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	ESC (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
N Stockton, Fix B														
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)	\$0	\$0	46%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$33,941	\$15,633	46%	\$49,575	0.0%	\$33,941	\$15,633	\$49,575	2014Q1	0.0%	\$33,941	\$15,633	\$49,575
11	LEVEES & FLOODWALLS	\$259,009	\$119,300	46%	\$378,309	0.0%	\$259,009	\$119,300	\$378,309	2014Q1	0.0%	\$259,009	\$119,300	\$378,309
15	FLOODWAY CONTROL & DIVERSION STRU	\$15,598	\$7,184	46%	\$22,782	0.0%	\$15,598	\$7,184	\$22,782	2014Q1	0.0%	\$15,598	\$7,184	\$22,782
18	CULTURAL RESOURCE PRESERVATION	\$8,887	\$4,093	46%	\$12,980	0.0%	\$8,887	\$4,093	\$12,980	2014Q1	0.0%	\$8,887	\$4,093	\$12,980
		\$0												
CONSTRUCTION ESTIMATE TOTALS:		\$317,436	\$146,211	46%	\$463,646		\$317,436	\$146,211	\$463,646			\$317,436	\$146,211	\$463,646
01	LANDS AND DAMAGES	\$79,695	\$22,880	29%	\$102,576	0.0%	\$79,695	\$22,880	\$102,576	2014Q1	0.0%	\$79,695	\$22,880	\$102,576
02	RELOCATIONS	\$8,378	\$3,859	46%	\$12,237	0.0%	\$8,378	\$3,859	\$12,237	2014Q1	0.0%	\$8,378	\$3,859	\$12,237
30	RELOCATIONS - PED	\$1,257	\$579	46%	\$1,835	0.0%	\$1,257	\$579	\$1,835	2014Q1	0.0%	\$1,257	\$579	\$1,835
31	RELOCATIONS - CM	\$838	\$386	46%	\$1,224	0.0%	\$838	\$386	\$1,224	2014Q1	0.0%	\$838	\$386	\$1,224
30 PLANNING, ENGINEERING & DESIGN														
1.0%	Project Management	\$3,174	\$1,462	46%	\$4,636	0.0%	\$3,174	\$1,462	\$4,636	2014Q1	0.0%	\$3,174	\$1,462	\$4,636
1.0%	Planning & Environmental Compliance	\$3,174	\$1,462	46%	\$4,636	0.0%	\$3,174	\$1,462	\$4,636	2014Q1	0.0%	\$3,174	\$1,462	\$4,636
6.0%	Engineering & Design	\$19,046	\$8,773	46%	\$27,819	0.0%	\$19,046	\$8,773	\$27,819	2014Q1	0.0%	\$19,046	\$8,773	\$27,819
0.5%	Reviews, ATRs, IEPs, VE	\$1,587	\$731	46%	\$2,318	0.0%	\$1,587	\$731	\$2,318	2014Q1	0.0%	\$1,587	\$731	\$2,318
0.5%	Life Cycle Updates (cost, schedule, risks)	\$1,587	\$731	46%	\$2,318	0.0%	\$1,587	\$731	\$2,318	2014Q1	0.0%	\$1,587	\$731	\$2,318
1.0%	Contracting & Reprographics	\$3,174	\$1,462	46%	\$4,636	0.0%	\$3,174	\$1,462	\$4,636	2014Q1	0.0%	\$3,174	\$1,462	\$4,636
3.0%	Engineering During Construction	\$9,523	\$4,386	46%	\$13,909	0.0%	\$9,523	\$4,386	\$13,909	2014Q1	0.0%	\$9,523	\$4,386	\$13,909
1.0%	Planning During Construction	\$3,174	\$1,462	46%	\$4,636	0.0%	\$3,174	\$1,462	\$4,636	2014Q1	0.0%	\$3,174	\$1,462	\$4,636
1.0%	Project Operations	\$3,174	\$1,462	46%	\$4,636	0.0%	\$3,174	\$1,462	\$4,636	2014Q1	0.0%	\$3,174	\$1,462	\$4,636
31 CONSTRUCTION MANAGEMENT														
6.5%	Construction Management	\$20,633	\$9,504	46%	\$30,137	0.0%	\$20,633	\$9,504	\$30,137	2014Q1	0.0%	\$20,633	\$9,504	\$30,137
1.5%	Project Operation:	\$4,762	\$2,193	46%	\$6,955	0.0%	\$4,762	\$2,193	\$6,955	2014Q1	0.0%	\$4,762	\$2,193	\$6,955
2.0%	Project Management	\$6,349	\$2,924	46%	\$9,273	0.0%	\$6,349	\$2,924	\$9,273	2014Q1	0.0%	\$6,349	\$2,924	\$9,273
CONTRACT COST TOTALS:		\$486,960	\$210,467		\$697,427		\$486,960	\$210,467	\$697,427			\$486,960	\$210,467	\$697,427

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feas Study - Alt LS-9A
 LOCATION: Stockton CA
 This Estimate reflects the scope and schedule in report; Draft Feasibility Report (Alternatives)

DISTRICT: SPD South Pacific Division
 PREPARED: 7/22/2015
 POC: CHIEF, COST ENGINEERING, Jeremiah Frost

Civil Works Work Breakdown Structure		ESTIMATED COST (in \$1000s)				PROJECT FIRST COST (Constant Dollar Basis) (in \$1000s)				TOTAL PROJECT COST (FULLY FUNDED) (in \$1000s)				
		Estimate Prepared: 6/9/2014				Program Year (Budget EC): 2015								
		Effective Price Level: 41913				Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	ESC (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
C Stockton, Fixes B & C + Duck Cr & M Ch														
ALL	COMPOSITE INDEX (WEIGHTED AVERAGE)	\$0	\$0	46%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
06	FISH & WILDLIFE FACILITIES	\$7,029	\$3,214	46%	\$10,243	0.0%	\$7,029	\$3,214	\$10,243	2014Q1	0.0%	\$7,029	\$3,214	\$10,243
11	LEVEES & FLOODWALLS	\$81,501	\$37,270	46%	\$118,771	0.0%	\$81,501	\$37,270	\$118,771	2014Q1	0.0%	\$81,501	\$37,270	\$118,771
15	FLOODWAY CONTROL & DIVERSION STRU	\$24,370	\$11,144	46%	\$35,514	0.0%	\$24,370	\$11,144	\$35,514	2014Q1	0.0%	\$24,370	\$11,144	\$35,514
18	CULTURAL RESOURCE PRESERVATION	\$3,311	\$1,514	46%	\$4,825	0.0%	\$3,311	\$1,514	\$4,825	2014Q1	0.0%	\$3,311	\$1,514	\$4,825
		\$0					\$0							
	CONSTRUCTION ESTIMATE TOTALS:	\$116,211	\$53,143	46%	\$169,354		\$116,211	\$53,143	\$169,354			\$116,211	\$53,143	\$169,354
01	LANDS AND DAMAGES	\$25,485	\$6,407	25%	\$31,892	0.0%	\$25,485	\$6,407	\$31,892	2014Q1	0.0%	\$25,485	\$6,407	\$31,892
02	RELOCATIONS	\$8,550	\$3,910	46%	\$12,460	0.0%	\$8,550	\$3,910	\$12,460	2014Q1	0.0%	\$8,550	\$3,910	\$12,460
30	RELOCATIONS - PED	\$1,282	\$586	46%	\$1,869	0.0%	\$1,282	\$586	\$1,869	2014Q1	0.0%	\$1,282	\$586	\$1,869
31	RELOCATIONS - CM	\$855	\$391	46%	\$1,246	0.0%	\$855	\$391	\$1,246	2014Q1	0.0%	\$855	\$391	\$1,246
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	\$1,162	\$531	46%	\$1,693	0.0%	\$1,162	\$531	\$1,693	2014Q1	0.0%	\$1,162	\$531	\$1,693
1.0%	Planning & Environmental Compliance	\$1,162	\$531	46%	\$1,693	0.0%	\$1,162	\$531	\$1,693	2014Q1	0.0%	\$1,162	\$531	\$1,693
6.0%	Engineering & Design	\$6,973	\$3,189	46%	\$10,162	0.0%	\$6,973	\$3,189	\$10,162	2014Q1	0.0%	\$6,973	\$3,189	\$10,162
0.5%	Reviews, ATRs, IEPRs, VE	\$581	\$266	46%	\$847	0.0%	\$581	\$266	\$847	2014Q1	0.0%	\$581	\$266	\$847
0.5%	Life Cycle Updates (cost, schedule, risks)	\$581	\$266	46%	\$847	0.0%	\$581	\$266	\$847	2014Q1	0.0%	\$581	\$266	\$847
1.0%	Contracting & Reprographics	\$1,162	\$531	46%	\$1,693	0.0%	\$1,162	\$531	\$1,693	2014Q1	0.0%	\$1,162	\$531	\$1,693
3.0%	Engineering During Construction	\$3,486	\$1,594	46%	\$5,080	0.0%	\$3,486	\$1,594	\$5,080	2014Q1	0.0%	\$3,486	\$1,594	\$5,080
1.0%	Planning During Construction	\$1,162	\$531	46%	\$1,693	0.0%	\$1,162	\$531	\$1,693	2014Q1	0.0%	\$1,162	\$531	\$1,693
1.0%	Project Operations	\$1,162	\$531	46%	\$1,693	0.0%	\$1,162	\$531	\$1,693	2014Q1	0.0%	\$1,162	\$531	\$1,693
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	\$7,554	\$3,454	46%	\$11,008	0.0%	\$7,554	\$3,454	\$11,008	2014Q1	0.0%	\$7,554	\$3,454	\$11,008
1.5%	Project Operation:	\$1,743	\$797	46%	\$2,540	0.0%	\$1,743	\$797	\$2,540	2014Q1	0.0%	\$1,743	\$797	\$2,540
2.0%	Project Management	\$2,324	\$1,063	46%	\$3,387	0.0%	\$2,324	\$1,063	\$3,387	2014Q1	0.0%	\$2,324	\$1,063	\$3,387
	CONTRACT COST TOTALS:	\$181,435	\$77,723		\$259,158		\$181,435	\$77,723	\$259,158			\$181,435	\$77,723	\$259,158

ATTACHMENT C – COST ESTIMATE FOR RECOMMENDED PLAN

FOUO

CWE

Title Page

Level of Estimate: Feasibility

The purpose of this project is to improve erosion, seepage and stability concerns with portions of the levee system in the Stockton area. Specific improvements include construction of one or more of the follow features: Seepage cutoff wall; raised levee; slope flattening; erosion protection (riprap). Additionally improvements at utilities are recommended. Some of these utilities include pipe penetrations (domestic water, interior drainage water, sewer, gas, etc.), power lines, and power poles. The recommended plan includes addressing the various utilities or encroachments so that the seepage and stability problems can be addressed. Project scope also includes: (1) right-of-way acquisition to facilitate long-term operation and maintenance activities; and (2) modifications to existing interior drainage facilities to bring the facilities in compliance with Corps criteria for penetrations through levees (upgrading discharge lines, pumps, etc. to raise the drainage over the top of levee or to provide positive closure for penetrations through levees).

Estimated by CESPk-ED-SC

Designed by USACE (Sacramento District)

Prepared by Robert Vrhoticky (916) 557-7336

Preparation Date 12/5/2017

Effective Date of Pricing 10/2/2017

Estimated Construction Time Days

This report is not copyrighted, but the information contained herein is For Official Use Only.

CWE

Constr Cost w/o Esc Page 1

Description	Quantity	UOM	CostToPrime	JOOH_PRM	HOOH_PRM	Profit_PRM	Bond_PRM	ContractCost
Constr Cost w/o Esc								
LSJRF5	1.00	EA	397,051,587	33,569,685	29,721,592	34,457,831	5,549,493	562,090,797
North Stockton (Conventional SB Cutoff Walls)	1.00	LS	397,051,587	33,569,685	29,721,592	34,457,831	5,549,493	562,090,797
02 Relocations	1.00	LS	44,836,127	3,892,468	3,453,566	3,767,479	626,855	56,576,495
06 Fish and Wildlife Facilities (Env Construction)	1.00	LS	3,585,511	466,116	405,163	445,679	58,830	4,961,299
06 Fish and Wildlife Facilities (Env Habitat Mitigation)	1.00	LS	2,620,715	0	0	0	0	2,620,715
11 Levees and Floodwalls	1.00	LS	1,091,015	0	0	0	0	1,091,015
Delta Front (DSM Cutoff Walls - 3 configurations, SB Cutoff Wall)	19,100.00	LF	37,538,886	3,426,351	3,048,403	3,321,800	568,025	47,903,466
02 Relocations	1.00	LS	163,473,870	12,756,601	11,337,290	14,344,289	2,353,262	204,265,313
06 Fish and Wildlife Facilities (Env Construction)	1.00	LS	5,769,831	750,078	651,991	717,190	94,669	7,983,759
06 Fish and Wildlife Facilities (Env Habitat Mitigation)	1.00	LS	2,620,715	0	0	0	0	2,620,715
11 Levees and Floodwalls	1.00	LS	3,186,153	0	0	0	0	3,186,153
Fourteen Mile Slough Closure Structure (Delta Front)	21,600.00	LF	151,897,171	12,006,523	10,685,299	13,627,099	2,258,593	190,474,686
06 Fish and Wildlife Facilities (Env Construction)	1.00	LS	0	0	0	0	0	35,147,814
06 Fish and Wildlife Facilities (Env Habitat Mitigation)	1.00	LS	0	0	0	0	0	2,766,965
15 Floodway Control - Diversion Structure	1.00	LS	0	0	0	0	0	16,210,000
Calaveras River (RB) (Conventional SB Cutoff Walls)	1.00	EA	0	0	0	0	0	16,170,849
02 Relocations	1.00	LS	54,515,604	4,968,184	4,380,644	4,790,838	747,216	69,402,486
06 Fish and Wildlife Facilities (Env Construction)	1.00	LS	13,005,193	1,685,114	1,465,021	1,611,403	213,201	17,979,931
06 Fish and Wildlife Facilities (Env Habitat Mitigation)	1.00	LS	2,620,715	0	0	0	0	2,620,715
11 Levees and Floodwalls	1.00	LS	3,766,549	0	0	0	0	3,766,549
Calaveras River (LB) and North Port San Joaquin River (Conventional SB Cutoff Walls)	23,000.00	LF	35,123,147	3,283,070	2,915,623	3,179,435	534,015	45,035,291
02 Relocations	1.00	LS	52,135,530	4,761,385	4,184,898	4,604,867	693,124	66,379,804
06 Fish and Wildlife Facilities (Env Construction)	1.00	LS	2,837,442	0	0	0	0	2,837,442
06 Fish and Wildlife Facilities (Env Habitat Mitigation)	1.00	LS	2,620,715	0	0	0	0	2,620,715
11 Levees and Floodwalls	1.00	LS	2,468,209	0	0	0	0	2,468,209
Smith Canal Closure Structure	24,500.00	LF	44,209,164	4,761,385	4,184,898	4,604,867	693,124	58,453,437
06 Fish and Wildlife Facilities (Env Construction)	1.00	LS	0	0	0	0	0	26,592,795
06 Fish and Wildlife Facilities (Env Habitat Mitigation)	1.00	LS	0	0	0	0	0	2,766,965
11 Levees and Floodwalls	1.00	LS	0	0	0	0	0	130,000
15 Floodway Control - Diversion Structure	1.00	EA	0	0	0	0	0	1,328,563
RD 404 and Duck Creek (Conventional SB Cutoff Walls)	1.00	EA	0	0	0	0	0	22,367,267
02 Relocations	1.00	LS	82,090,456	7,191,047	6,365,194	6,950,357	1,129,036	103,726,091
06 Fish and Wildlife Facilities (Env Construction)	1.00	LS	20,178,375	2,591,107	2,253,818	2,478,505	330,022	27,831,827
06 Fish and Wildlife Facilities (Env Habitat Mitigation)	1.00	LS	2,620,715	0	0	0	0	2,620,715
11 Levees and Floodwalls	1.00	LS	5,889,974	0	0	0	0	5,889,974
	30,400.00	LF	53,401,392	4,599,939	4,111,377	4,471,852	799,015	67,383,575

ATTACHMENT D – TOTAL PROJECT SCHEDULE (INCLUDING CONSTRUCTION)

FOUO

ATTACHMENT E – COST AND SCHEDULE RISK ANALYSIS REPORT

FOUO



**US Army Corps
of Engineers®**

Lower San Joaquin River Feasibility Study Cost and Schedule Risk Analysis Report

Prepared for:

U.S. Army Corps of Engineers,
Sacramento District

Prepared by:

U.S. Army Corps of Engineers
Cost Engineering Technical Center of Expertise, Walla Walla, WA

December 11, 2017

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
MAIN REPORT	1
1.0 PURPOSE	1
2.0 BACKGROUND	1
3.0 REPORT SCOPE	1
3.1 Project Scope	1
3.2 USACE Risk Analysis Process	2
4.0 METHODOLOGY / PROCESS	3
4.1 Identify and Assess Risk Factors	4
4.2 Quantify Risk Factor Impacts	5
4.3 Analyze Cost Estimate and Schedule Contingency	5
5.0 PROJECT ASSUMPTIONS	6
6.0 RESULTS	6
6.1 Risk Register	7
6.2 Cost Contingency and Sensitivity Analysis	7
6.2.1 Sensitivity Analysis	8
6.2.2 Sensitivity Analysis Results	8
6.3 Schedule and Contingency Risk Analysis	9
7.0 MAJOR FINDINGS/OBSERVATIONS/RECOMMENDATIONS	10
7.1 Cost and Schedule	10
7.2 Recommendations	13

LIST OF TABLES

Table ES-1. Construction Contingency Results	ES-2
Table 1. Construction Cost Contingency Summary	7
Table 2. Schedule Duration Contingency Summary	9
Table 3. Project Cost Comparison Summary (Uncertainty Analysis)	12
Table 4. Construction Schedule Comparison Summary	14

LIST OF FIGURES

Figure 1. Cost Sensitivity Analysis	8
Figure 2. Schedule Sensitivity Analysis	10

LIST OF APPENDICES

Risk Register	APPENDIX A
---------------------	------------

EXECUTIVE SUMMARY

The US Army Corps of Engineers (USACE), Sacramento District, presents this cost and schedule risk analysis (CSRA) report regarding the risk findings and recommended contingencies for the Lower San Joaquin River Feasibility Study. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, a *Monte-Carlo* based risk analysis was conducted by the Project Development Team (PDT) on remaining costs. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommended 80% confidence level of successful execution to project completion.

The goal of the Lower San Joaquin River Feasibility Study was to identify flood control and related natural resources problems within the primary study area, to formulate potential solutions to those problems, and to recommend a plan for implementation. The Study focused on reducing flood risk to people, property and the State's infrastructure along the Lower San Joaquin River and major creeks and streams within the Study area.

With the exception of some proposed closure structures and set-back levees, the predominant project recommendation was fix-in-place of existing structures. The measure chosen to mitigate areas of poor performance include a mix of slurry cutoff walls and deep soil mixing, pending seismic concerns for the various locations. Included will be an added cost portion dedicated to environmental construction for wildlife habitat.

Specific to the Lower San Joaquin River, the current project base cost approximates \$780M pre-contingency and expressed in FY 2018 dollars. This CSRA study included all estimated construction costs, Planning, Engineering, Design and Construction Management costs. It excluded Real Estate Costs, where contingencies were provided by the Real Estate office. Based on the results of the analysis, the Cost Engineering Mandatory Center of Expertise for Civil Works (MCX located in Walla Walla District) recommends a contingency value of \$272.5M or approximately 38% of base project cost at an 80% confidence level of successful execution.

Cost estimates fluctuate over time. During this period of study, minor cost fluctuations can and have occurred. For this reason, contingency reporting is based in cost and percent values. Should cost vary to a slight degree with similar scope and risks, contingency percent values will be reported, cost values rounded.

Table ES-1. Construction Contingency Results

Base Construction, Design and Management Cost Estimate	\$717,153,000 *		
Confidence Level	Construction Value (\$\$) w/ Contingencies	Contingency (%)	Contingency \$
50%	\$953,813,000	33%	\$236,660,000
80%	\$989,671,000	38%	\$272,518,000 *
90%	\$1,011,186,000	41%	\$294,033,000

* Excludes 01 – Lands and Damages Costs, Provided by Others

KEY FINDINGS/OBSERVATIONS/ASSUMPTIONS & RECOMMENDATIONS

The PDT worked through the risk register in January 2016. Due to design changes, the PDT met again in September and October 2017. The key risk drivers identified through sensitivity analysis suggest a cost contingency of \$272.5M and schedule growth of 188 months; both at an 80% confidence level.

Cost Risks: From the CSRA, the key or greater Cost Risk items of include:

- TL14 Deep Soil Mixing (DSM) – The majority of the design includes standard slurry cut-off wall construction which is a common approach in the region. At the current level of investigations and design, further study could result in replacing the trenching with DSM in order to better address potential seismic concerns as geotechnical studies proceed. DSM processes are less common as are the construction companies and crews that perform these activities.
- ET6 Level of Estimate - Detailed crews and construction methodology have been used in development of the feasibility estimate, but typical cost variations associated with a Class 3 estimate should still be anticipated, especially for higher risk construction activities such as slurry trench and DSM cutoff walls. Crews, assemblies, productivities, and methodologies in the current estimate, while acceptable and reasonable, may not adequately capture ultimate actual contractor technique and costs.
- CO1 Modifications and Claims – There is inherent risk of construction modifications and claims that arise after contract award due to issues such as weather, schedules dictated by O&M cycles, differing site conditions, user directed changes or omissions, inaccurate surveys, and variations in estimated quantities.
- TL2 Exploratory Borings – Related to TL14, exploratory borings could cause further design changes. PDT feels the current design is somewhat conservative, so the risk variance is an addition or reduction in costs.

- CO6 Specialized Construction Limiting Competition – Currently some 5 contractors in the area can perform slurry wall construction. DSM has even more limited competition. Multiple contracts between this project and others will be competing for the limited number of construction contractors capable of performing the work. This could limit competition and result in less competitive contractor bidding.

Schedule Risks: The high value of schedule risk indicates a significant uncertainty of key risk items, time duration growth that can translate into added costs. Over time, risks increase on those out-year contracts where there is greater potential for change in new scope requirements, uncertain market conditions, and unexpected high inflation. The greatest risk is:

- PR2 – Federal Funding Stream – The current Schedule assumes some combined \$75M per year in funding. A reasonable assumption would be \$50M per year in combined annual funding. Part of this consideration includes specialized contractors available and the ability to complete the work based on available funding, also referred to as a reasonable “burn rate.”

Moderate risks, when combined, can also become a time and resulting cost impact.

- PR7 – Local Political Support – Multiple Local Public Agencies and Citizen Groups have voiced concern with the current project formulation. It is likely litigation may be pursued by multiple parties with signature of the Chief’s Report.
- PM1 – Agency Coordination and Review – Multiple outside agency reviews remain outstanding and could have significant impacts on project scope. Multiple SPK USACE projects are going through similar review processes by outside agencies resulting in resource bottlenecks. Each Phase or contract will also require outside resource agency reviews. Typical review timelines may no longer be accurate. It is anticipated schedules could slip 2-3 years or more over the life of the project due to delays in outside agency reviews. As contracts are delayed, it places greater burden on protracted design activities and potential design changes.

Recommendations: The CSRA study serves as a “road map” towards project improvements and reduced risks over time. The PDT must include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the project life-cycle is important in support of remaining within an approved budget and appropriation.

MAIN REPORT

1.0 PURPOSE

Within the authority of the US Army Corps of Engineers (USACE), Sacramento District, this report presents the efforts and results of the cost and schedule risk analysis for the Lower San Joaquin River Feasibility Study. The report includes risk methodology, discussions, findings and recommendations regarding the identified risks and the necessary contingencies to confidently administer the project, presenting a cost and schedule contingency value with an 80% confidence level of successful execution.

2.0 BACKGROUND

The goal of the Lower San Joaquin River Feasibility Study was to identify flood control and related natural resources problems within the primary study area, to formulate potential solutions to those problems, and to recommend a plan for implementation. The Study focused on reducing flood risk to people, property and the State's infrastructure along the Lower San Joaquin River and major creeks and streams within the Study area.

With the exception of some proposed closure structures and set-back levees, the predominant project recommendation was fix-in-place of existing structures. The measure chosen to mitigate areas of poor performance include a mix of slurry cutoff walls and deep soil mixing, pending seismic concerns for the various locations. Included will be an added cost portion dedicated to environmental construction for wildlife habitat.

3.0 REPORT SCOPE

The scope of the risk analysis report is to identify cost and schedule risks with a resulting recommendation for contingencies at the 80 percent confidence level using the risk analysis processes, as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for cost risks for construction features. The CSRA does not include consideration for life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the Micro

Computer Aided Cost Estimating System (MCACES) cost estimate, project schedule, and funding profiles using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

The project technical scope, estimates and schedules were developed and presented by the District. Consequently, these documents serve as the basis for the risk analysis.

The scope of this study addresses the identification of concerns, needs, opportunities and potential solutions that are viable from an economic, environmental, and engineering viewpoint.

3.2 USACE Risk Analysis Process

The risk analysis process for this study follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering MCX. The risk analysis process reflected within this report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analysis should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, this risk analysis was performed to meet the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008.
- Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

4.0 METHODOLOGY / PROCESS

The Cost Engineering MCX performed the Cost and Schedule Risk Analysis, relying on local District staff to provide expertise and information gathering. The District PDT conducted initial risk identification via meetings with the Walla Walla Cost Engineering MCX facilitator in January 2016. Follow-on discussions were performed in 2017 with a smaller group. The initial risk identification meeting also included qualitative analysis to produce a risk register that served as the draft framework for the risk analysis.

Participants in the risk identification meeting in January 13, 2016 included:

Name	Office	Representing
Cameron Sessions	Cost Engineer	SPK - USACE
Dave Peterson		Sponsor Representative
Peter Blodgett	Hydraulic Engineering	SPK - USACE
William Doyle	Civil Design	SPK - USACE
James Elsberry	Civil Design	SPK - USACE
Shellie Sullo	Cultural Resources	SPK - USACE
Eric Martinez	Project Manager	State of California – DWR
Robert Vrchoticky	Cost Engineer	SPK - USACE
Russ Thorne	Construction	SPK - USACE
Elizabeth Youn	Real Estate	SPK - USACE
Josh Garcia	PD-RA	SPK - USACE
Nicole Ortega Jewell	Project Manager	SPK - USACE
Stacy Samuelson	Planning	SPK - USACE

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve the desired level of cost confidence. Per regulation and guidance, the P80 confidence level (80% confidence level) is the normal and accepted cost confidence level. District Management has the prerogative to select different confidence levels, pending approval from Headquarters, USACE.

In simple terms, contingency is an amount added to an estimate to allow for items, conditions or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost MCX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk averse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level. The selection of contingency at a particular confidence level is ultimately the decision and responsibility of the project's District and/or Division management.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format. The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results are provided in Section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

A formal PDT meeting was held with the District office for the purposes of identifying and assessing risk factors. The meeting included capable and qualified representatives from multiple project team disciplines and functions, including project management, cost engineering, design, environmental compliance, real estate, construction, contracting and representatives of the sponsoring agencies.

The initial formal meetings focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Additionally, numerous conference calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment. An update meeting was held for finalization of the risk register, resulting CSRA model, findings and results.

4.2 Quantify Risk Factor Impacts

The quantitative impacts (putting it to numbers of cost and time) of risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were quantified using probability distributions (density functions) because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involved multiple project team disciplines and functions. However, the quantification process relied more extensively on collaboration between cost engineering and risk analysis team members with lesser inputs from other functions and disciplines. This process used an iterative approach to estimate the following elements of each risk factor:

- Maximum possible value for the risk factor
- Minimum possible value for the risk factor
- Most likely value (the statistical mode), if applicable
- Nature of the probability density function used to approximate risk factor uncertainty
- Mathematical correlations between risk factors
- Affected cost estimate and schedule elements

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT.

Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the baseline cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach

results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

5.0 PROJECT ASSUMPTIONS

The following data sources and assumptions were used in quantifying the costs associated with the project.

- a. The District provided MII MCACES (Micro-Computer Aided Cost Estimating Software) files electronically. The MII and CWE files transmitted and on September 9, 2015 and resulting independent review, served as the basis for the final cost and schedule risk analyses.
- b. The cost comparisons and risk analyses performed and reflected within this report are based on design scope and estimates that are at the feasibility level of design.
- c. Schedules are analyzed for impact to the project cost in terms of delayed funding, uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs and/or languishing federal administration costs incurred throughout delay.
- d. The Cost Engineering MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk averse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to capture actual project costs.
- e. Only high and moderate risk level impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Low level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list”.

6.0 RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The actual risk register is provided in Appendix A. The complete risk register includes low level risks, as well as additional information regarding the nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

6.2 Cost Contingency and Sensitivity Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Table 1 provides the construction cost contingencies calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P5, P50 and P90 confidence levels are also provided for illustrative purposes only.

Table 1. Construction Cost Contingency Summary

Base Construction, Design and Management Cost Estimate	\$717,153,000 *		
Confidence Level	Construction Value (\$\$) w/ Contingencies	Contingency (%)	Contingency \$
50%	\$953,813,000	33%	\$236,660,000
80%	\$989,671,000	38%	\$272,518,000 *
90%	\$1,011,186,000	41%	\$294,033,000

* Excludes 01 – Lands and Damages Costs, Provided by Others

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers and the respective value variance are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to project cost. Figure 1 presents a sensitivity analysis for cost growth risk from the high level cost risks identified in the risk register. Likewise, Figure 2 presents a sensitivity analysis for schedule growth risk from the high level schedule risks identified in the risk register.

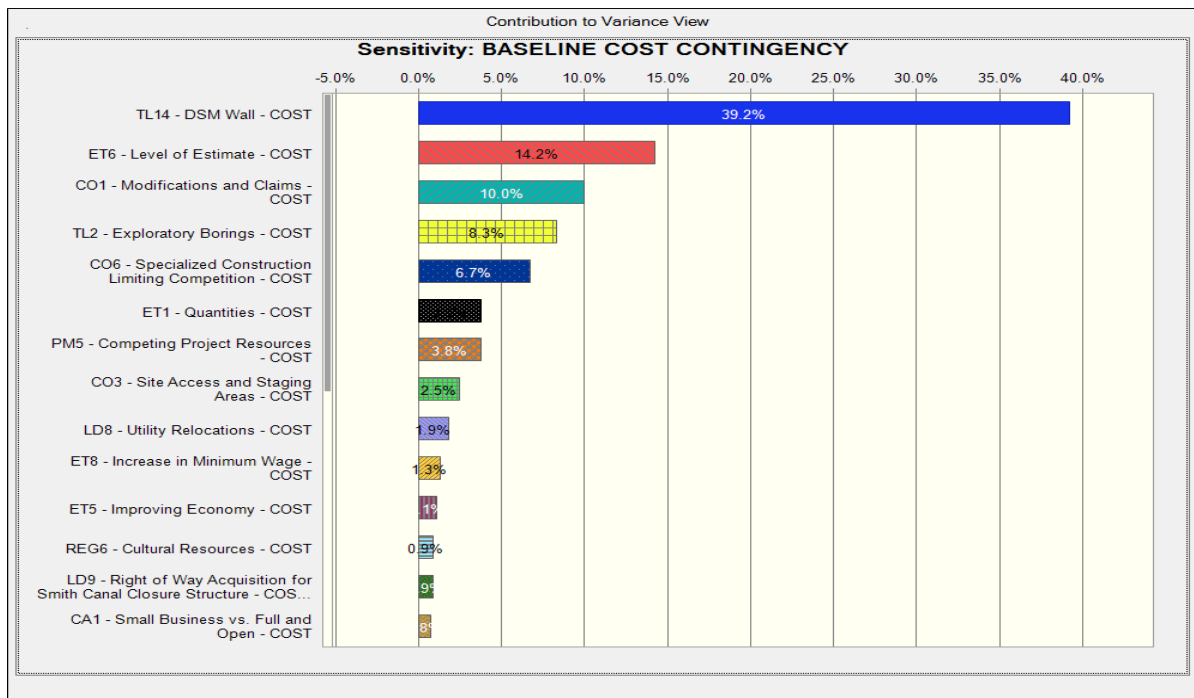


Figure 1. Cost Sensitivity Analysis

6.3 Schedule and Contingency Risk Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project duration at intervals of confidence (probability).

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P90 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was quantified as 191 months based on the P80 level of confidence. These contingencies were used to calculate the projected residual fixed cost impact of project delays that are included in the Table 1 presentation of total cost contingency. The schedule contingencies were calculated by applying the high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

The schedule was not resource loaded and contained open-ended tasks and non-zero lags (gaps in the logic between tasks) that limit the overall utility of the schedule risk analysis. These issues should be considered as limitations in the utility of the schedule contingency data presented. Schedule contingency impacts presented in this analysis are based solely on projected residual fixed costs.

Table 2. Schedule Duration Contingency Summary

Risk Analysis Forecast (base schedule of 162 months)	Duration w/ Contingencies (months)	Contingency (months)
50% Confidence	313	151
80% Confidence	350	188
90% Confidence	369	207

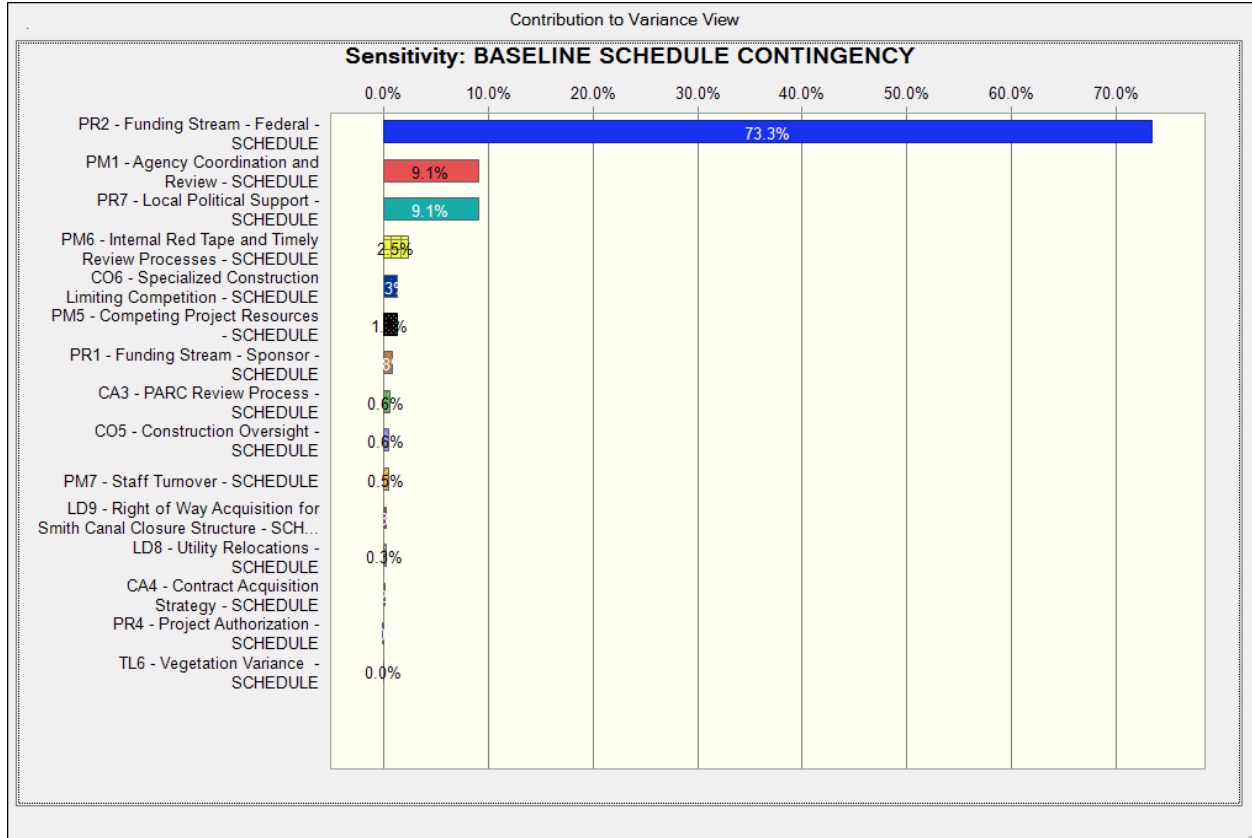


Figure 2. Schedule Sensitivity Analysis

7.0 MAJOR FINDINGS/OBSERVATIONS/RECOMMENDATIONS

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

The PDT worked through the risk register in January 2016. Due to design changes, the PDT met again in September and October 2017. The key risk drivers identified through sensitivity analysis suggest a cost contingency of \$272.5M and schedule growth of 188 months; both at an 80% confidence level.

7.1 Cost and Schedule

Cost Risks: From the CSRA, the key or greater Cost Risk items of include:

- TL14 Deep Soil Mixing (DSM) – The majority of the design includes standard slurry cut-off wall construction which is a common approach in the region. At the current level of investigations and design, further study could result in replacing the trenching with DSM in order to better address potential seismic concerns as geotechnical studies proceed. DSM processes are less common as are the construction companies and crews that perform these activities.
- ET6 Level of Estimate - Detailed crews and construction methodology have been used in development of the feasibility estimate, but typical cost variations associated with a Class 3 estimate should still be anticipated, especially for higher risk construction activities such as slurry trench and DSM cutoff walls. Crews, assemblies, productivities, and methodologies in the current estimate, while acceptable and reasonable, may not adequately capture ultimate actual contractor technique and costs.
- CO1 Modifications and Claims – There is inherent risk of construction modifications and claims that arise after contract award due to issues such as weather, schedules dictated by O&M cycles, differing site conditions, user directed changes or omissions, inaccurate surveys, and variations in estimated quantities.
- TL2 Exploratory Borings – Related to TL14, exploratory borings could cause further design changes. PDT feels the current design is somewhat conservative, so the risk variance is an addition or reduction in costs.
- CO6 Specialized Construction Limiting Competition – Currently some 5 contractors in the area can perform slurry wall construction. DSM has even more limited competition. Multiple contracts between this project and others will be competing for the limited number of construction contractors capable of performing the work. This could limit competition and result in less competitive contractor bidding.

Schedule Risks: The high value of schedule risk indicates a significant uncertainty of key risk items, time duration growth that can translate into added costs. Over time, risks increase on those out-year contracts where there is greater potential for change in new scope requirements, uncertain market conditions, and unexpected high inflation. The greatest risk is:

- PR2 – Federal Funding Stream – The current Schedule assumes some combined \$75M per year in funding. A reasonable assumption would be \$50M per year in combined annual funding. Part of this consideration includes specialized contractors available and the ability to complete the work based on available funding, also referred to as a reasonable “burn rate.”

Moderate risks, when combined, can also become a time and resulting cost impact.

- PR7 – Local Political Support – Multiple Local Public Agencies and Citizen Groups have voiced concern with the current project formulation. It is likely litigation may be pursued by multiple parties with signature of the Chief’s Report.
- PM1 – Agency Coordination and Review – Multiple outside agency reviews remain outstanding and could have significant impacts on project scope. Multiple SPK USACE projects are going through similar review processes by outside agencies resulting in resource bottlenecks. Each Phase or contract will also require outside resource agency reviews. Typical review timelines may no longer be accurate. It is anticipated schedules could slip 2-3 years or more over the life of the project due to delays in outside agency reviews. As contracts are delayed, it places greater burden on protracted design activities and potential design changes.

Table 3. Construction Cost Comparison Summary (Uncertainty Analysis)

PROJECT FIRST COST BASE ESTIMATE	Base Cost \$717,153,000		
	Confidence Level	Project First Cost	Contingency
5%	\$882,098,190	\$164,945,190	23.00%
10%	\$896,441,250	\$179,288,250	25.00%
15%	\$903,612,780	\$186,459,780	26.00%
20%	\$917,955,840	\$200,802,840	28.00%
25%	\$925,127,370	\$207,974,370	29.00%
30%	\$932,298,900	\$215,145,900	30.00%
35%	\$932,298,900	\$215,145,900	30.00%
40%	\$939,470,430	\$222,317,430	31.00%
45%	\$946,641,960	\$229,488,960	32.00%
50%	\$953,813,490	\$236,660,490	33.00%
55%	\$960,985,020	\$243,832,020	34.00%
60%	\$960,985,020	\$243,832,020	34.00%
65%	\$968,156,550	\$251,003,550	35.00%
70%	\$975,328,080	\$258,175,080	36.00%
75%	\$982,499,610	\$265,346,610	37.00%
80%	\$989,671,140	\$272,518,140	38.00%
85%	\$996,842,670	\$279,689,670	39.00%
90%	\$1,011,185,730	\$294,032,730	41.00%
95%	\$1,025,528,790	\$308,375,790	43.00%

Table 4. Construction Schedule Comparison Summary (Uncertainty Analysis)

Base Schedule Duration	Base Schedule 162.0 Months		
Confidence Level	Duration	Contingency	Contingency %
5%	256.0 Months	94.0 Months	58.00%
10%	265.7 Months	103.7 Months	64.00%
15%	272.2 Months	110.2 Months	68.00%
20%	277.0 Months	115.0 Months	71.00%
25%	283.5 Months	121.5 Months	75.00%
30%	288.4 Months	126.4 Months	78.00%
35%	294.8 Months	132.8 Months	82.00%
40%	301.3 Months	139.3 Months	86.00%
45%	306.2 Months	144.2 Months	89.00%
50%	312.7 Months	150.7 Months	93.00%
55%	317.5 Months	155.5 Months	96.00%
60%	322.4 Months	160.4 Months	99.00%
65%	327.2 Months	165.2 Months	102.00%
70%	333.7 Months	171.7 Months	106.00%
75%	341.8 Months	179.8 Months	111.00%
80%	349.9 Months	187.9 Months	116.00%
85%	359.6 Months	197.6 Months	122.00%
90%	369.4 Months	207.4 Months	128.00%
95%	385.6 Months	223.6 Months	138.00%

7.2 Recommendations

Risk Management is an all-encompassing, iterative, and life-cycle process of project management. The Project Management Institute's (PMI) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 4th edition*, states that "project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project." Risk identification and analysis are processes within the knowledge area of risk management. Its outputs pertinent to this effort include the risk register, risk quantification (risk analysis model), contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The Cost and Schedule Risk Analysis (CSRA) produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not substitute a formal risk management and response plan.

The CSRA study serves as a “road map” towards project improvements and reduced risks over time. The PDT must include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the project life-cycle is important in support of remaining within an approved budget and appropriation.

Risk Management: Project leadership should use of the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk’s likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions	Project Cost			Project Schedule		
				Likelihood*	Impact*	Risk Level*	Likelihood*	Impact*	Risk Level*
PROJECT & PROGRAM MGMT									
PM1	Agency Coordination and Review	Multiple outside agency reviews remain outstanding and could have significant impacts on project scope.	Multiple SPK USACE projects are going through similar review processes by outside agencies resulting in resource bottlenecks. Each Phase or contract will also require outside resource agency reviews. Typical review timelines may no longer be accurate. It is anticipated schedules could slip 2-3 year or more over the life of the project due to delays in outside agency reviews.	Very Unlikely	Marginal	LOW	Likely	Significant	HIGH
PM2	Public Review	Public Review process could result in schedule delays or changes in project scope requirements.	Public review comments have been received and were incorporated into the project. It's unlikely schedule delays or scope changes will be experienced.	Unlikely	Negligible	LOW	Unlikely	Marginal	LOW
PM3	Vertical Team Coordination and Review	System Wide Improvement Framework (SWIF) approval and review by the vertical team.	Vertical team review and approval of the SWIF plan will be required when submitted. SPK has already received SWIF approval for similar projects. It is likely SWIF approval will not experience schedule delays. A LOI has been submitted for a portion of the existing federal levees within the study, but not all. If certain reaches do encounter issues (environmental or public impacts) design and award of other reaches would proceed while issues are resolved. Individual reaches could be delayed but overall schedule would not slip. Schedule has two years for real estate acquisitions.	Likely	Negligible	LOW	Likely	Negligible	LOW
PM4	Pressure to Compress and Accelerate Schedule	The baseline project assumes an approximate 10 year construction schedule. This deadline came together as a conglomerate of political pressure, anticipated funding levels, staffing levels and managerial judgment.	Schedule is aggressive. All risks of schedule delay have been captured elsewhere in the risk model.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
PM5	Competing Project Resources	SPK District has multiple high profile ongoing projects all competing for limited resources both in house and in the vertical chain.	LSJR resourcing has not been a major district priority. If funding is made available district would probably have to coordinate with outside districts and/or A/E support to meet schedule. In all likelihood , funding will control (schedule risk is captured in funding risk) and any shortages for resources will be addressed with A/E support or other districts.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE
PM6	Internal Red Tape and Timely Review Processes	Project has already experienced delays due to timeliness of leadership decisions and direction.	As an example, EO 11988 (development in floodplain) has already resulted in 6 month in determining project limits. It's anticipated this will continue to be ongoing issue. Schedule could slip another 12 to 24 months over the life of the project.	Very Unlikely	Negligible	LOW	Likely	Significant	HIGH
PM7	Staff Turnover	Both PDT and Vertical Chain turnover will be an issue resulting in potential project delays as new team members must be brought on board.	Turnover will continue to be an issue. Learning curves will result in inefficiencies and project delays.	Very Unlikely	Negligible	LOW	Likely	Marginal	MODERATE

PM8	Clear Scope Definition	Conceptual level scoping has been developed for the project. As design continues to develop scope will continue to evolve.	<p>It is felt by the sponsor the study design is robust and has erred on the side of conservatism.</p> <p>Sponsor has geotechnical investigations that were not included in the USACE study and have independently evaluated the results to determine many reaches should not require the fixes currently included in the scope of work.</p> <p>The risk of additional scope growth is very unlikely.</p>	Very Unlikely	Marginal	LOW	Unlikely	Negligible	LOW
CONTRACT ACQUISITION RISKS									
CA1	Small Business vs. Full and Open	Estimate and Estimate Markups assume competitive full and open contracting approach.	Project consists of large heavy specialized construction and is not conducive to small business contracts.	Likely	Significant	HIGH	Very Unlikely	Negligible	LOW
CA2	Numerous Contracts	Contracts have been assumed by geographical location with some consideration to type of work (assumed 7 contracts).	Funding constraints and restricted construction windows will determine the number of construction contracts. Estimate currently assumes minimal number of contracts. Assume costs could increase marginally due to additional contracts with additional mob/demob, inefficiencies and contract administration costs.	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
CA3	PARC Review Process	Several of the construction contracts may be large enough to require PARC review.	<p>PARC review could delay schedules to allow significant time for review. PARC will review to insure that large contracts contain all the same types of work and are bundled projects and full and open procurement is justified.</p> <p>Contracting Market Research and submittal to the PARC should begin at or before 90% design to insure enough time for sufficient review.</p> <p>CONFIRM WITH PM/PLANNER IF PARC REVIEW WOULD BE REQUIRED</p>	Unlikely	Marginal	LOW	Likely	Marginal	MODERATE
CA4	Contract Acquisition Strategy	Concerns exist for awarding contracts of this magnitude on LPTA / IFB. Contracting Officer reserves the rights to enter into discussions with Offerors to gain a thorough understanding of the contractors approach.	<p>Trade Off approach opens the contract to subjective judgment and can result in potential higher costs and schedule delays. From experience Best Value / Trade Off can extend the contract award 4 months and could result in protest.</p> <p>CONFIRM WITH CONTRACTING BEST VALUE APPROACH</p>	Likely	Marginal	MODERATE	Unlikely	Significant	MODERATE
CA5	Continuing Contracts Clause Waiver	Continuing Contracts Clause waiver will not be pursued for this project.	<p>Lack of Continuing Contracts Clause will likely result in award of additional smaller contracts.</p> <p>Risk Captured in CA2 - Numerous Contracts. Not modeled here.</p>	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW

TECHNICAL RISKS									
TL1	HTRW	HTRW could be encountered during site excavation and construction.	<p>It is likely HTRW may be encountered during construction, especially in RD404 north of Highway 4.</p> <p>Borings will be done in a proactive attempt to locate any HTRW. Estimate currently assumes no HTRW is located.</p> <p>It can be assumed 5 to 8 sites could be discovered at a cost of \$500K EA at the sponsor's expense. If sites are encountered, individual areas will be skipped, remediated and then completed under existing contract or a follow-on contract. This approach has been taken on other sites in ARCF and has worked effectively. No schedule impacts are anticipated.</p>	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
TL2	Exploratory Borings	Limited exploratory borings have been taken. Additional geotechnical investigation will be required.	Depending on exploratory results, site specific design could change. Current design assumptions are thought to be very conservative. If anything, design requirements could be reduced (scope currently assumes cutoff wall along entire levee reaches and substantial seismic mitigation). Design changes are anticipated to be marginal. (Opportunity)	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
TL3	Borrow/Fill Sources	Potential borrow sites have been located and/or assumed. It is the responsibility of the contractor to procure borrow material. Borrow material costs in the construction estimate captures all incidental costs to procure real estate.	Non-Federal Sponsor has verified that suitable borrow material is obtainable within 25 miles. The ARCF borrow study confirmed that material would be available in Courtland which confirms the Sponsor's statement. Estimate has effectively conservatively assumed commercial procurement of selective fill material and haul distances. If the contractor chooses to pursue their own material, local borrow sites or greater reuse of existing levee material, it is assumed costs would only decrease.	Likely	Negligible	LOW	Very Unlikely	Negligible	LOW
TL4	Design Criteria and Assumptions	Given extended project timeline (15yrs or more) revised criteria could result in update design requirements.	<p>Design criteria changes have led to changes for projects put "on the shelf".</p> <p>Given the types of mitigation fixes (seepage cutoff walls and deep soil mixing) it's unlikely that any upcoming criteria changes would result in substantive construction cost changes.</p>	Unlikely	Marginal	LOW	Very Unlikely	Negligible	LOW
TL5	Design Assumptions	Current design assumes seepage cutoff walls along all reaches of construction. Seismic areas have all assumed a substantial grid pattern feature.	Design is assumed to be very conservative. It is likely scope and costs will only be reduced. (Opportunity costs have been modeled elsewhere).	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
TL6	Vegetation Variance	Project will require a Vegetation Variance to allow riverside vegetation.	<p>A Vegetation Variance has been presented for multiple other SPK projects and its likely will be approved for this project.</p> <p>It is thought a balance has been achieved with the Vegetation Variance, balancing the vegetation removal requirements while minimizing environmental impacts.</p>	Unlikely	Negligible	LOW	Unlikely	Crisis	HIGH
TL7	Design Development	<p>Typical cross sections were developed for reaches. Overall the design is believed to be conservative.</p> <p>It is thought, as a whole, the design requirements are much more likely to decrease as opposed to increase.</p>	There is an uncertainty level inherent with feasibility level designs. Expect negligible scope/cost changes as designs are further refined.	Likely	Negligible	LOW	Very Unlikely	Negligible	LOW
TL8	As Built Design	Existing Construction was an issue on previous American River construction.	Current design does not rely on existing features and this will not be an issue for this project. In areas where construction projects will overlap, learning from the past, every effort will be made to insure accurate as-builts are created.	Likely	Negligible	LOW	Very Unlikely	Negligible	LOW

TL9	Closure Structures	Design has progressed to some 35% design level for one of the two closure structures.	Complex feature of construction that may not be typical USACE standard design. While all USACE criteria will be followed, design is not atypical and has yet to be vetted with design. Operations and navigation considerations have yet to be finalized for closure. Design changes are anticipated within ranges of 35% design.	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
TL10	Floodwall at Dad's Point	Current USACE design includes 5-10ft floodwall at Dad's Point. Sponsor would prefer earthen levee to minimize impacts to local park.	Given small size, if levee is required, cost changes would be negligible.	Likely	Negligible	LOW	Very Unlikely	Negligible	LOW
TL11	Closure Structure Operations	Water studies have shown that operation would not result in water quality issues.	Operations should not be impacted by operation of the closure gates.	Likely	Negligible	LOW	Very Unlikely	Negligible	LOW
TL12	Levee Superiority of Mosher Slough	Current plan does not include raises or mitigation along the right bank of Mosher Slough.	It is thought that raise of the left bank of Mosher Slough would not induce additional flooding on the right bank.	Likely	Negligible	LOW	Very Unlikely	Negligible	LOW
TL13	Ground Water Impact	There is concern that groundwater could be impacted by installation of cutoff walls	The risk of impacting or significantly impacting the ground water pool is considered exceptionally low based on the relatively shallow depths (no greater than 50') of cut-off walls. No walls continuously encircle a basin.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
TL14	DSM Wall	Additional DSM Wall in Delta Front	Additional analysis by NFS indicates that DSM can be greatly reduced from the original project assumptions. It is possible, upon further investigation, that some areas would require DSM treatment and would have to be added back into the project (up to the limits previously included in the estimate). This would result in additional costs, but based on the overall project duration of 14 years, there would be no additional impact to the schedule. The probability of occurrence for this risk is estimated and modeled at 20%	Unlikely	Crisis	HIGH	Very Unlikely	Negligible	LOW
LANDS AND DAMAGES RISKS									
LD1	Borrow Sites	Potential borrow sites have been located and/or assumed but Real Estate costs do not include procurement costs. It is the responsibility of the contractor to procure borrow material. Borrow material costs in the construction estimate captures all incidental costs to procure real estate.	Estimate has effectively conservatively assumed commercial procurement of selective fill material. If the contractor chooses to pursue their own material, local borrow sites or greater reuse of existing levee material, it is assumed costs would only decrease. The Sponsor has confirmed that suitable borrow material is available within 25 miles. This is confirmed by the borrow material study conducted for ARCF.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
LD2	Railroad involvement	A single RR bridge will be in the project.	Design intends to add under seepage berms on either side of the RR. It is possible temporary construction easements will be necessary to accommodate construction. Project will have sufficient lead time to address any permitting requirements. CONFIRM EASEMENT COSTS/SCHEDULE INCLUDED IN REAL ESTATE	Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW

LD3	Relocations and Real Estate Acquisitions may not happen in time	Relocations can be delayed by unwilling sellers.	Objections to appraisals take more time and funding. If sellers choose to hire attorney and go to court and with judge and jury can delay relocations by over 6 months. With proper management, individual acquisitions may slip schedule but the overall project schedule should not be delayed. Construction would occur in areas where real estate does not hinder project schedule.	Very Unlikely	Negligible	LOW	Unlikely	Negligible	LOW
LD4	Staging Areas	Staging areas in heavily urban areas will present challenges.	Real Estate has included costs at a ratio of 1 acre staging area for every 1 mile of levee. Pumping equipment for some cutoff wall construction may need to occur on riverside of levee. Real Estate estimate also includes cost for re-establishment of parks after construction has completed. CONFIRM STAGING AREA COSTS INCLUDED IN REAL ESTATE	Unlikely	Marginal	LOW	Unlikely	Negligible	LOW
LD5	Right of Way Requirements	As design develops real estate right of way requirements may change.	Real Estate has made conservative assumption that any potentially impacted properties would need to be relocated. It is unlikely any additional real estate acquisitions would be required.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW
LD6	Vagrancy and Loitering Issues	Several homeless encampments will be encountered.	From experience, it is reasonable to assume loitering issues will be encountered. Law enforcement may need to be called and coordinated. For individual contracts this may present a minimal issue, but for overall project costs and schedules, this will be a non-issue.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW
LD7	I-5 Freeway Real Estate	Levee will intersect I-5 in four separate locations. In those locations either relief wells or seepage berms in the road medians will be sufficient.	It is likely temporary construction easements will be necessary to accommodate construction. Project will have sufficient lead time to address any permitting requirements. CONFIRM EASEMENT COSTS/SCHEDULE INCLUDED IN REAL ESTATE	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW
LD8	Utility Relocations	Over 100 known utility relocations have been discovered. From experience, utility relocations can be problematic to cost and schedule.	Real Estate has identified eligible utilities/facilities for compensation and their costs. Changes to the project's utilities/facilities inventory during PED and construction could impact cost and schedule. All known utilities have been included in the cost estimate assuming they are fully compensable. It is likely that some additional utilities will be discovered during construction and for the sake of this risk analysis, they are assumed to be compensable. Utility fixes in coordination with levee fixes may cause construction delays or the need for increased phasing.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE
LD9	Right of Way Acquisition for Smith Canal Closure Structure	Atherton Cove Property Association has contested the ability of the sponsor to procure easements across Smith Canal	Questions remain on the sponsor or Federal authority to obtain rights of way across Smith Canal. This issue must be resolved prior to the Sponsor's self-performance of Smith Closure. Worst case, after project has authorized sponsor will then be able to proceed with Smith Canal construction.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE

REGULATORY AND ENVIRONMENTAL RISKS									
REG1	Endangered Species Act	It is possible resource agencies could provide an opinion that proposed mitigation areas are inadequate and additional will be required. In addition, species could be added to ESA.	It is unlikely additional mitigation will be required beyond what has already been provide in the Biological Opinion, unless a new species is discovered. The addition of species could also result in additional mitigation costs or design adaptations and changes. Review periods and iterative processes could result in negligible impacts to schedule.	Likely	Negligible	LOW	Likely	Negligible	LOW
REG2	Offsite Mitigation	Additional offsite mitigation could be required.	The mitigation approach is considered a somewhat conservative worst case approach. Mitigation requirements are likely to only decrease unless a new species is added. (Opportunity).	Likely	Marginal	MODERATE	Unlikely	Negligible	LOW
REG3	Air Quality	Construction could require air quality credits. Air quality is legislated by local California Resource Board by county and program will overlap multiple regions.	In order to accommodate aggressive schedule, multiple sites could be constructed concurrently. Early coordination with the Air Resource Board and possible inclusion in State Implementation Plan could mitigate schedule delays. Minimal additional construction cost impacts (\$20K/MO) could be encountered.	Likely	Negligible	LOW	Unlikely	Negligible	LOW
REG4	Water Quality	Construction could be limited due to water quality impacts.	Water quality for rock placement in the water would only have minimal potential cost impacts. Placement may require some additional costs (i.e. turbidity monitoring and potential decreased production rates) and are captured in our baseline cost estimate.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
REG5	Onsite Mitigation	Depending on Agencies, additional onsite mitigation could be required.	Resource agency requirements for onsite mitigation continue to evolve, resulting in additional onsite mitigation requirements. ESA consultations have occurred but Biologic Opinions have not been received. Until opinions have been received, restoration ratios have not been established. Additional offsite mitigation may be required. This risk has been modeled in REG2	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
REG6	Cultural Resources	Only a limited number of surface surveys have been conducted. It is likely cultural resources could be encountered during levee construction. It is known that cultural sites were buried during initial levee construction.	Extensive additional surveys and historical records searches will be required. It is anticipated additional cultural sites will be encountered. Cultural sites encountered during construction will be much more costly than those mitigated prior to construction. By completing sufficient cultural resource identification during PED and prior to construction schedule impacts should be mitigated. It is known that burial sites occur in the levees (but locations have not been physically located). If cultural resources are encountered, construction schedules could be impacted 12months or more per contract, but it is unlikely Project completion date will not be impacted. Tribal consultations will take additional time. Levees were originally constructed in 1850's and beyond. It is likely historical SHIPO artifacts may also be encountered. Individual construction contracts may slip to accommodate NHPA consultations, but overall project schedule is unlikely to slip. Additional costs could experience 1% to 3% cost growth. As an example, Sutter Basin experienced \$15M in costs for a \$300M construction project.	Very Likely	Marginal	MODERATE	Likely	Negligible	LOW

REG7	Noise and Vibration Controls	Construction could be impacted by noise and vibration monitoring near occupied areas.	Levee construction will be in populated urban/residential areas. It is possible additional costs will be experienced, but potential impacted areas have been captured in real estate costs. Construction schedule has been developed based on constraints work schedule.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
REG8	Native American Consultation - Section 106 Compliance and Government to Government	Native American tribes may challenge USACE opinions during either PED or construction.	<p>If sensitive sites are encountered, schedule could be delayed.</p> <p>It is hoped that with due diligence the risk may be mitigated. Construction methodology could also dictate how many sites are found.</p> <p>It is considered likely a challenge will occur, resulting in a potential construction schedule delay of up to 1 month, for up to 10 separate contracts over the life of the project but are unlikely to affect overall project duration.</p> <p>It is recommended an IDIQ be established for site investigation and documentation services and construction contracts include CLINS for contract relocations when sites are encountered.</p>	Likely	Negligible	LOW	Likely	Negligible	LOW
REG9	Sacramento San Joaquin Delta Regulatory Criteria Changes	Sacramento San Joaquin Delta has its own special regulatory and environment considerations. Over the course of the project (15years or more) it is possible additional constraints may be added to the project.	<p>Multiple species have been declining and may be added to the protected list or invasive species may become an issues.</p> <p>Amendments to Delta requirements could likely to result in marginal cost increases.</p>	Likely	Marginal	MODERATE	Likely	Negligible	LOW
REG10	HTRW	Several Low to Moderate potential HTRW sites have been located for the site.	In addition to the known minimal HTRW sites other HTRW sites could potentially be encountered. If HTRW is encountered sponsor would be responsible for clean-up costs but schedule may be impacted.	Very Unlikely	Negligible	LOW	Unlikely	Marginal	LOW
CONSTRUCTION RISKS									
CO1	Modifications and Claims	Modifications will be experienced on any construction project. Project Construction is heavily dependent on geotechnical design solutions.	<p>Modifications are to be expected.</p> <p>Inherent with any geotechnical design comes the possibility of differing site conditions such as constructed depth of cutoff wall due to change in key in layer elevation and site geology which would not have previously been noted due to the density of explorations in a given area, groundwater chemistry issues affecting curing of the cutoff wall etc.</p> <p>Most cutoff wall is 50' depth or less. Few reaches go as deep as 70'. Conventional cutoff wall construction can go as deep as 80'-85' therefore risk of change in construction approach is minimal. It would become vastly more expensive if additional depth could require a different construction method (i.e. standard cutoff wall to deep soil mixing).</p>	Very Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
CO2	Unknown Utilities	A large number of utilities have already been located. Its very likely additional utilities will be located both during site investigations and even during construction.	Many of these levees are older and have multiple unknown existing utilities. It's likely that moderate cost growth will be experienced due to location of unknown utilities. Assume some 10% additional utility costs will occur.	Likely	Marginal	MODERATE	Unlikely	Marginal	LOW
CO3	Site Access and Staging Areas	Availability of Staging areas will vary by reach. Portions of work will be construction in heavily congested dense urban environment and residential streets with constricted sites.	<p>Estimator has attempted to take into account the availability of potential staging areas and longer haul distances.</p> <p>Potential exists for marginal increases due to site access.</p>	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW

CO4	Construction Windows	All in water work must be completed between August 1 to Nov 30 for control structures. Levee construction is limited between 1 April and 30 October (CCR Title 23). Depending on contract award dates, durations, and inefficient contractors some contracts could be limited or delayed to the following construction season.	In general this has been a minimal risk, with worst case a one season schedule slip may occur, impacting local contract schedule but not does not impact overall project schedule. Flood season defined in CCR is generally followed but special permits allow extended construction beyond this window. Construction work window is already factored into baseline schedule.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW
CO5	Construction Oversight	Given the large number of potential sites/contracts per year, submittal turn-around times and construction oversight could be an issue.	Based on previous experience, mods and claims have been experienced as a result of review delays (either from Construction or Engineering) leading to cost increases. It is being discussed to possibly stand up a Project Office to handle these projects and/or additional resources will be provided to limit slippage.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE
CO6	Specialized Construction Limiting Competition	Currently some 5 contractors in the area can do slurry wall construction. Deep Soil Mixing has even more limited competition. Multiple contracts between this project and others will be competing for the limited number of construction contractors capable of performing the work.	Limited contractor availability and competition could result in higher construction costs and even project delays if no qualified contractors are available. It's also possible that future levee improvement projects in the area may help increase contractor pool.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE
CO7	Constrained Site	Multiple locations will have tight site footprints which could constrain construction.	Multiple levee sites will require degradation of tops of levee to ensure sufficient working platform. High water tables could also impact levee restoration construction. Design approaches may have to be made to accommodate site limitations and constraints. Tidal influences along the Delta Front Levee could have marginal cost impact.	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
CO8	Deep Soil Mixing	Deep soil mixing is fairly specialized construction feature.	Assumed Estimate Production rates appear reasonable and limited contractor competition has been accounted for elsewhere	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
CO9	Haul Road Resurfacing	Levee access for many locations will be through multiple residential locations.	CONFIRM Street resurfacing costs need to be added into the estimate.	Likely	Negligible	LOW	Very Unlikely	Negligible	LOW
CO10	Utility Relocations	All impacted utilities will be left constructed in a policy compliant manner (existing deficient utilities will not be left in place). Some utility relocations will require temporary bypasses to maintain operation.	Utility relocations will require coordination with affected parties. From experience, relocations of KNOWN utilities is not a major issue. Relocations only become problematic when unknown utilities are encountered which has been accounted for in Unknown Utilities Risk (LD8) and not modeled here.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
CO11	Seepage Cutoff Windows	Some windows may be left in the seepage cutoff walls requiring a "window" to be filled in later.	Based on experience previous American River projects, seepage cutoff windows were difficult and problematic to go back and fill after the fact. Every effort will be made to minimize the number of windows but is likely a few "windows" will remain that must be filled at additional cost.	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
CO12	Bentonite Availability	The Sutter Basin Project had to stockpile bentonite.	Concern exists a shortage of bentonite may impact project schedules and costs.	Likely	Marginal	MODERATE	Very Unlikely	Marginal	LOW

ESTIMATE AND SCHEDULE RISKS									
ET1	Quantities	Quantities could vary significantly. Earthwork and cutoff wall quantities are probably conservative and are likely to be reduced during PED.	No PED level survey is available. No specific designs/quantities based on surveyed cross sections has been developed. Quantities were calculated using tables with typical cross sections generated to capture the types of fixes needed along the levee as well as the existing geometry of the levee. These sections were then referenced into a spreadsheet where the type of fix, hydraulic data, and existing levee geometry were identified. Many fixes with varying levee geometry were developed and quantities did not interpolate between the fixes, but used the next larger fix (taller levee, higher floodwall, deeper cutoff wall, etc.).	Likely	Significant	HIGH	Very Unlikely	Negligible	LOW
ET2	Utility Relocations	Large number and variety of requirements for utility relocations.	Variable nature of relocation requirements is difficult to quantify. Potential unknown utilities remain.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
ET3	Fuel Variations	Fuel Costs are a major cost driver for any large earthwork project.	Assume fuel prices could decrease 10% and increase 15%.	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
ET4	Project Complexity	A majority of this project is relatively simple consisting of mass earthwork, rock placement, DSM/slurry cutoff walls and floodwall construction.	For contractors familiar with this type of construction, minimal cost variation or uncertainty should be anticipated. Seismic fix is the unknown mitigation measure with regards to design and construction methodology.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
ET5	Improving Economy	Local economy has been improving and Government Work is becoming less attractive.	Much of this work is specialized (DSM and conventional slurry walls) mitigating some of this concern. But there is the issue other construction features could experience higher prices.	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
ET6	Level of Estimate	Feasibility level estimates have been developed.	Detailed crews and construction methodology have been used in development of the feasibility estimate, but typical cost variations associated with a type 3 estimate should still be anticipated.	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
ET7	Limited Bidder Competition	Specialized Construction (Seepage Cutoff Walls) along with Seismic Mitigation could limit the availability of qualified contractors.	Limited bidder competition could result in higher cost proposals. Modeled in CO6	Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
ET8	Increase in Minimum Wage	Increase in Minimum Wage could result in higher overall labor prices for skilled labor.	2016 min wage in CA was \$10/HR. It appears to have increased to \$10.50/HR for 2017. Indication is that minimum wage will increase to \$15/HR over the next several years which is a 43% increase from 2017. Assume that union wages will increase 10-20% above inflation based on the change in minimum wage.	Very Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW

PROGRAMMATIC RISKS									
(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)									
PR1	Funding Stream - Sponsor	Sponsor may begin to apply transferable credits from other projects.	Federal funding may be the limiting schedule driver. State portion of cash has been coming from Bond Funds. It is possible bond funds will have expired by the time this project begins construction. 2018 start date could be uncertain as local funds are contingent on local district election. An assessment district will have to be formed to establish funding. State and local funding could be uncertain.	Very Unlikely	Negligible	LOW	Likely	Marginal	MODERATE
PR2	Funding Stream - Federal	Schedule assumes some combined \$75M per year in funding.	National Civil Works Budget for Flood Risk Reduction is some \$250M to \$300M per year. A reasonable assumption would be \$50M per year in annual funding. A schedule delay of this magnitude would result in a less efficient PDT. Costs are assumed to be impacted at 10% of PED.	Very Likely	Significant	HIGH	Very Likely	Critical	HIGH
PR3	Weather Delays	Weather events could impact in water construction or delay start of construction windows.	It is possible construction seasons could be delayed or postponed with storm or other weather events resulting in additional construction costs but minimal overall project schedule impacts.	Likely	Marginal	MODERATE	Very Unlikely	Negligible	LOW
PR4	Project Authorization	With submittal of Chief's Report, the project will be awaiting authorization.	Chief's Report is scheduled for 2018. Next WRDA is scheduled for 2018 but realistically could slip 5 years or more based on current authorization cycle.	Very Unlikely	Marginal	LOW	Unlikely	Crisis	HIGH
PR5	Local Sponsor Support	Local Sponsor is very supportive of the project but is of the opinion feasibility level design is overly conservative.	Local Sponsor is of the opinion scope and cost may be overstated significantly. If scope and costs are not refined support may not be as forthcoming.	Very Unlikely	Negligible	LOW	Unlikely	Critical	MODERATE
PR6	Public Support	Study currently has some 100 or more property acquisitions which may not be palatable for local sponsor and public support.	Flood Risk Reduction may not be perceived as "worth" the 100 property takings. USACE will attempt to make every effort to optimize designs and reduce the number of property acquisitions. It is hoped that as design evolves number of acquisitions will be reduced.	Very Unlikely	Negligible	LOW	Unlikely	Critical	MODERATE
PR7	Local Political Support	Multiple Local Public Agencies and Citizen Groups have voiced concern with the current project formulation.	It is likely litigation may be pursued by multiple parties with signature of the Chiefs Report.	Very Unlikely	Negligible	LOW	Likely	Critical	HIGH
PR8	Climate Change/Sea Level Rise	Climate Change could negatively impact the project's effectiveness	Ground subsidence and sea level rise could result in additional maintenance requirements to raise the levees on a periodic basis over the 100 year life of the project. This effort would be considered an O&M cost and is not considered under the construction cost and schedule risk. O&M costs will be updated to reflect the cost of this O&M.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW

ATTACHMENT F – TOTAL PROJECT COST SUMMARY

FOUO

WALLA WALLA COST ENGINEERING (MCX)

COST AGENCY TECHNICAL REVIEW CERTIFICATION STATEMENT

For Project No. 105785

SPK – Lower San Joaquin Feasibility Study
Stockton, CA

The Lower San Joaquin River Feasibility Study & cost update, as presented by Sacramento District, has undergone a Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of December 8, 2017, the Cost MCX certifies the estimated total project cost:

FY18 Project First Cost: \$1,070,309,000
Fully Funded Costs: \$1,385,283,000

Note: Cost ATR was devoted to remaining work. It did not review spent costs, which requires an audit process. It remains the responsibility of the District to correctly reflect these cost values and to implement effective project management controls and implementation procedures including risk management through the period of Federal participation.



NEUBAUER.JA
MES.GERARD.
1153289898

Digitally signed by
NEUBAUER.JAMES.GERARD.1153
289898
DN: c=US, o=U.S. Government,
ou=DoD, ou=PKI, ou=USA,
cn=NEUBAUER.JAMES.GERARD.1
153289898
Date: 2017.12.08 09:11:40 -08'00'

For: Kim C. Callan, PE, CCE, PM
Chief, Cost Engineering MCX
Walla Walla District

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feasibility Study
PROJECT NO: P2# 105785
LOCATION: Stockton, CA

DISTRICT: SPK Sacramento District
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 12/8/2017

This Estimate reflects the scope and schedule in report

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)					TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Program Year (Budget EC): Effective Price Level Date: 2018 1 OCT 17		INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
										Spent Thru: 1-Oct-17 (\$K)	TOTAL FIRST COST (\$K)				
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
02	RELOCATIONS	\$61,594	\$23,406	38.0%	\$85,000	0.0%	\$61,594	\$23,406	\$85,000	\$0	\$85,000	27.7%	\$78,637	\$29,882	\$108,519
06	FISH & WILDLIFE FACILITIES	\$18,638	\$7,082	38.0%	\$25,720	0.0%	\$18,638	\$7,082	\$25,720	\$0	\$25,720	26.3%	\$23,541	\$8,945	\$32,486
06	FISH & WILDLIFE FACILITIES - Habitat	\$32,742	\$12,442	38.0%	\$45,184	0.0%	\$32,742	\$12,442	\$45,184	\$0	\$45,184	22.6%	\$40,152	\$15,258	\$55,410
11	LEVEES & FLOODWALLS	\$410,579	\$156,020	38.0%	\$566,599	0.0%	\$410,579	\$156,020	\$566,599	\$0	\$566,599	25.2%	\$514,135	\$195,371	\$709,506
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	\$38,538	\$14,644	38.0%	\$53,183	0.0%	\$38,538	\$14,644	\$53,183	\$0	\$53,183	25.8%	\$48,485	\$18,424	\$66,909
CONSTRUCTION ESTIMATE TOTALS:		\$562,091	\$213,595		\$775,685	0.0%	\$562,091	\$213,595	\$775,685	\$0	\$775,685	25.4%	\$704,949	\$267,881	\$972,829
01	LANDS AND DAMAGES (From Fed REP Table 4)	\$7,907	\$2,768	35.0%	\$10,675	0.0%	\$7,907	\$2,768	\$10,675	\$0	\$10,675	19.8%	\$9,475	\$3,316	\$12,791
01	LANDS AND DAMAGES (From Non-Fed REP Table 4)	\$51,836	\$18,143	35.0%	\$69,979	0.0%	\$51,836	\$18,143	\$69,979	\$0	\$69,979	19.8%	\$62,113	\$21,740	\$83,853
30	PLANNING, ENGINEERING & DESIGN	\$88,010	\$33,444	38.0%	\$121,454	0.0%	\$88,010	\$33,444	\$121,454	\$0	\$121,454	36.4%	\$120,085	\$45,632	\$165,718
30 & 31*	PED & CONSTRUCTION MANGEMENT (02 ONLY)	\$16,991	\$6,456	38.0%	\$23,447	0.0%	\$16,991	\$6,456	\$23,447	\$0	\$23,447	67.5%	\$28,453	\$10,812	\$39,265
31	CONSTRUCTION MANAGEMENT	\$50,050	\$19,019	38.0%	\$69,069	0.0%	\$50,050	\$19,019	\$69,069	\$0	\$69,069	60.5%	\$80,309	\$30,517	\$110,826
PROJECT COST TOTALS:		\$776,885	\$293,424	37.8%	\$1,070,309		\$776,885	\$293,424	\$1,070,309	\$0	\$1,070,309	29.4%	\$1,005,384	\$379,898	\$1,385,283

REYNOLDS.JOELEROY.1383621085

Digitally signed by REYNOLDS.JOELEROY.1383621085
DN: c=US, ou=U.S. Government, ou=DoD, ou=PR, ou=USA
ou=TPCS, cn=REYNOLDS.JOELEROY.1383621085
Date: 2017.12.08 13:33:51 -0800

CHIEF, COST ENGINEERING, Jeremiah Frost

HOWELL.PATRICK.JR.1280351047

Digitally signed by HOWELL.PATRICK.JR.1280351047
DN: c=US, ou=U.S. Government, ou=DoD, ou=PR, ou=USA, ou=USA, cn=HOWELL.PATRICK.JR.1280351047
Date: 2017.12.08 14:02:38 -0800

PROJECT MANAGER, Patrick Howell

SIMPSON.DIANE.M.1513090800

Digitally signed by SIMPSON.DIANE.M.1513090800
DN: c=US, ou=U.S. Government, ou=DoD, ou=PR, ou=USA, ou=SIMPSON.DIANE.M.1513090800
Date: 2017.12.08 14:14:02 -0800

CHIEF, REAL ESTATE, Diane Simpson

CALL.BRADLEY.ALLAN.1153342080

Digitally signed by CALL.BRADLEY.ALLAN.1153342080
DN: c=US, ou=U.S. Government, ou=DoD, ou=PR, ou=USA, ou=CALL.BRADLEY.ALLAN.1153342080
Date: 2017.12.11 10:25:51 -0800

CHIEF, ENGINEERING, Rick Poepelman

ESTIMATED TOTAL PROJECT COST: \$1,385,283

PREVIOUS TPCS: \$ 1,552,634

DATED: 3-May-16

THE TPCS REFLECTS A PROJECT COST CHANGE OF: \$ (167,351)

THE 902 COST LIMITS ARE

AUTHORIZED COST PLUS INFLATION: \$ -

902 LIMIT: \$ -

DATED:

O&M OUTSIDE OF TOTAL PROJECT COST: N/A

* Non-Fed 30 and 31 Account Costs associated with Relocations

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feasibility Study
LOCATION: Stockton, CA
This Estimate reflects the scope and schedule in report;

Draft Final Feasibility Report (September 2017)

DISTRICT: SPK Sacramento District
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 12/8/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		5-Dec-17 1-Oct-17		Program Year (Budget EC): Effective Price Level Date:		2018 1 OCT 17						
WBS NUMBER	Civil Works Feature & Sub-Feature Description	RISK BASED			TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
		COST (\$K)	CNTG (\$K)	CNTG (%)										
A	B	C	D	E	F	G	H	I	J					
	North Stockton (LSJRFS-CE Rev1-20171107.mlp)													
02	RELOCATIONS	\$4,961	\$1,885	38.0%	\$6,847	0.0%	\$4,961	\$1,885	\$6,847	2027Q4	21.4%	\$6,022	\$2,288	\$8,310
06	FISH & WILDLIFE FACILITIES	\$2,621	\$996	38.0%	\$3,617	0.0%	\$2,621	\$996	\$3,617	2027Q4	21.4%	\$3,181	\$1,209	\$4,390
06	FISH & WILDLIFE FACILITIES - Habitat	\$1,091	\$415	38.0%	\$1,506	0.0%	\$1,091	\$415	\$1,506	2027Q4	21.4%	\$1,324	\$503	\$1,827
11	LEVEES & FLOODWALLS	\$47,903	\$18,203	38.0%	\$66,107	0.0%	\$47,903	\$18,203	\$66,107	2027Q4	21.4%	\$58,144	\$22,095	\$80,239
	CONSTRUCTION ESTIMATE TOTALS:	\$56,576	\$21,499	38.0%	\$78,076		\$56,576	\$21,499	\$78,076			\$68,671	\$26,095	\$94,766
01	LANDS AND DAMAGES (Fed)	\$468	\$164	35.0%	\$632	0.0%	\$468	\$164	\$632	2025Q2	15.5%	\$541	\$189	\$730
01	LANDS AND DAMAGES (Non-Fed)	\$3,070	\$1,075	35.0%	\$4,145	0.0%	\$3,070	\$1,075	\$4,145	2025Q2	15.5%	\$3,546	\$1,241	\$4,787
30	PLANNING, ENGINEERING & DESIGN													
1.6%	Project Management	\$826	\$314	38.0%	\$1,140	0.0%	\$826	\$314	\$1,140	2024Q2	28.5%	\$1,061	\$403	\$1,464
2.2%	Planning & Environmental Compliance	\$1,128	\$429	38.0%	\$1,557	0.0%	\$1,128	\$429	\$1,557	2024Q2	28.5%	\$1,449	\$551	\$2,000
8.2%	Engineering & Design	\$4,232	\$1,608	38.0%	\$5,840	0.0%	\$4,232	\$1,608	\$5,840	2024Q2	28.5%	\$5,437	\$2,066	\$7,503
0.3%	Reviews, ATRs, IEPs, VE	\$155	\$59	38.0%	\$214	0.0%	\$155	\$59	\$214	2024Q2	28.5%	\$199	\$76	\$275
0.7%	Life Cycle Updates (cost, schedule, risks)	\$361	\$137	38.0%	\$498	0.0%	\$361	\$137	\$498	2024Q2	28.5%	\$464	\$176	\$640
1.0%	Contracting & Reprographics	\$516	\$196	38.0%	\$712	0.0%	\$516	\$196	\$712	2024Q2	28.5%	\$663	\$252	\$915
2.0%	Engineering During Construction	\$1,032	\$392	38.0%	\$1,424	0.0%	\$1,032	\$392	\$1,424	2027Q4	49.2%	\$1,540	\$585	\$2,125
0.3%	Planning During Construction	\$155	\$59	38.0%	\$214	0.0%	\$155	\$59	\$214	2027Q4	49.2%	\$231	\$88	\$319
1.3%	Project Operations	\$671	\$255	38.0%	\$926	0.0%	\$671	\$255	\$926	2024Q2	28.5%	\$862	\$328	\$1,190
	02 Relocations (30 + 31)	\$1,369	\$520	38.0%	\$1,889	0.0%	\$1,369	\$520	\$1,889	2027Q4	49.2%	\$2,042	\$776	\$2,818
31	CONSTRUCTION MANAGEMENT													
7.0%	Construction Management	\$3,613	\$1,373	38.0%	\$4,986	0.0%	\$3,613	\$1,373	\$4,986	2027Q4	49.2%	\$5,390	\$2,048	\$7,439
1.3%	Project Operation:	\$671	\$255	38.0%	\$926	0.0%	\$671	\$255	\$926	2027Q4	49.2%	\$1,001	\$380	\$1,381
1.7%	Project Management	\$877	\$333	38.0%	\$1,210	0.0%	\$877	\$333	\$1,210	2027Q4	49.2%	\$1,308	\$497	\$1,806
	CONTRACT COST TOTALS:	\$75,720	\$28,668		\$104,388		\$75,720	\$28,668	\$104,388			\$94,406	\$35,752	\$130,158

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feasibility Study
LOCATION: Stockton, CA
This Estimate reflects the scope and schedule in report;

Draft Final Feasibility Report (September 2017)

DISTRICT: SPK Sacramento District
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 12/8/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		5-Dec-17 1-Oct-17	Program Year (Budget EC): 2018 Effective Price Level Date: 1 OCT 17									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
02	RELOCATIONS	\$7,984	\$3,034	38.0%	\$11,018	0.0%	\$7,984	\$3,034	\$11,018	2027Q3	20.8%	\$9,642	\$3,664	\$13,306
06	FISH & WILDLIFE FACILITIES	\$2,621	\$996	38.0%	\$3,617	0.0%	\$2,621	\$996	\$3,617	2027Q3	20.8%	\$3,165	\$1,203	\$4,368
06	FISH & WILDLIFE FACILITIES - Habitat	\$3,186	\$1,211	38.0%	\$4,397	0.0%	\$3,186	\$1,211	\$4,397	2027Q3	20.8%	\$3,848	\$1,462	\$5,310
11	LEVEES & FLOODWALLS	\$190,475	\$72,380	38.0%	\$262,855	0.0%	\$190,475	\$72,380	\$262,855	2027Q3	20.8%	\$230,045	\$87,417	\$317,463
CONSTRUCTION ESTIMATE TOTALS:		\$204,265	\$77,621	38.0%	\$281,886		\$204,265	\$77,621	\$281,886			\$246,701	\$93,746	\$340,447
01	LANDS AND DAMAGES (Fed)	\$2,660	\$931	35.0%	\$3,591	0.0%	\$2,660	\$931	\$3,591	2023Q2	11.0%	\$2,953	\$1,034	\$3,987
01	LANDS AND DAMAGES (Non-Fed only)	\$17,437	\$6,103	35.0%	\$23,540	0.0%	\$17,437	\$6,103	\$23,540	2023Q2	11.0%	\$19,359	\$6,776	\$26,135
30	PLANNING, ENGINEERING & DESIGN													
1.6%	Project Management	\$3,141	\$1,194	38.0%	\$4,335	0.0%	\$3,141	\$1,194	\$4,335	2022Q2	18.4%	\$3,720	\$1,414	\$5,134
2.2%	Planning & Environmental Compliance	\$4,288	\$1,629	38.0%	\$5,917	0.0%	\$4,288	\$1,629	\$5,917	2022Q2	18.4%	\$5,079	\$1,930	\$7,009
8.2%	Engineering & Design	\$16,095	\$6,116	38.0%	\$22,211	0.0%	\$16,095	\$6,116	\$22,211	2022Q2	18.4%	\$19,063	\$7,244	\$26,307
0.3%	Reviews, ATRs, IEPRs, VE	\$589	\$224	38.0%	\$813	0.0%	\$589	\$224	\$813	2022Q2	18.4%	\$698	\$265	\$963
0.7%	Life Cycle Updates (cost, schedule, risks)	\$1,374	\$522	38.0%	\$1,896	0.0%	\$1,374	\$522	\$1,896	2022Q2	18.4%	\$1,627	\$618	\$2,246
1.0%	Contracting & Reprographics	\$1,963	\$746	38.0%	\$2,709	0.0%	\$1,963	\$746	\$2,709	2022Q2	18.4%	\$2,325	\$883	\$3,208
2.0%	Engineering During Construction	\$3,926	\$1,492	38.0%	\$5,418	0.0%	\$3,926	\$1,492	\$5,418	2027Q3	47.6%	\$5,793	\$2,201	\$7,994
0.3%	Planning During Construction	\$589	\$224	38.0%	\$813	0.0%	\$589	\$224	\$813	2027Q3	47.6%	\$869	\$330	\$1,199
1.3%	Project Operations	\$2,552	\$970	38.0%	\$3,522	0.0%	\$2,552	\$970	\$3,522	2022Q2	18.4%	\$3,023	\$1,149	\$4,171
	02 Relocations (30 + 31)	\$2,202	\$837	38.0%	\$3,039	0.0%	\$2,202	\$837	\$3,039	2027Q3	47.6%	\$3,250	\$1,235	\$4,484
31	CONSTRUCTION MANAGEMENT													
7.0%	Construction Management	\$13,740	\$5,221	38.0%	\$18,961	0.0%	\$13,740	\$5,221	\$18,961	2027Q3	47.6%	\$20,274	\$7,704	\$27,977
1.3%	Project Operation:	\$2,552	\$970	38.0%	\$3,522	0.0%	\$2,552	\$970	\$3,522	2027Q3	47.6%	\$3,766	\$1,431	\$5,196
1.7%	Project Management	\$3,337	\$1,268	38.0%	\$4,605	0.0%	\$3,337	\$1,268	\$4,605	2027Q3	47.6%	\$4,924	\$1,871	\$6,795
CONTRACT COST TOTALS:		\$280,711	\$106,067		\$386,778		\$280,711	\$106,067	\$386,778			\$343,422	\$129,831	\$473,252

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feasibility Study
LOCATION: Stockton, CA
This Estimate reflects the scope and schedule in report;

Draft Final Feasibility Report (September 2017)

DISTRICT: SPK Sacramento District
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 12/8/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 5-Dec-17		Effective Price Level: 1-Oct-17		Program Year (Budget EC): 2018		Effective Price Level Date: 1 OCT 17						
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
Fourteenmile Slough Control Structure (Fourteen Mile Closure Budget Estimate Rev3_201711107.mlp)														
06	FISH & WILDLIFE FACILITIES	\$2,767	\$1,051	38.0%	\$3,818	0.0%	\$2,767	\$1,051	\$3,818	2026Q1	17.2%	\$3,244	\$1,233	\$4,476
06	FISH & WILDLIFE FACILITIES - Habitat	\$16,210	\$6,160	38.0%	\$22,370	0.0%	\$16,210	\$6,160	\$22,370	2026Q1	17.2%	\$19,002	\$7,221	\$26,223
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	\$16,171	\$6,145	38.0%	\$22,316	0.0%	\$16,171	\$6,145	\$22,316	2026Q1	17.2%	\$18,957	\$7,204	\$26,160
CONSTRUCTION ESTIMATE TOTALS:		\$35,148	\$13,356	38.0%	\$48,504		\$35,148	\$13,356	\$48,504			\$41,203	\$15,657	\$56,860
01	LANDS AND DAMAGES (Fed)	\$5	\$2	35.0%	\$7	0.0%	\$5	\$2	\$7	2023Q2	11.0%	\$6	\$2	\$8
01	LANDS AND DAMAGES (Non-Fed only)	\$33	\$12	35.0%	\$45	0.0%	\$33	\$12	\$45	2023Q2	11.0%	\$37	\$13	\$50
30	PLANNING, ENGINEERING & DESIGN													
1.6%	Project Management	\$562	\$214	38.0%	\$776	0.0%	\$562	\$214	\$776	2022Q2	18.4%	\$666	\$253	\$919
2.2%	Planning & Environmental Compliance	\$768	\$292	38.0%	\$1,060	0.0%	\$768	\$292	\$1,060	2022Q2	18.4%	\$910	\$346	\$1,255
8.2%	Engineering & Design	\$2,882	\$1,095	38.0%	\$3,977	0.0%	\$2,882	\$1,095	\$3,977	2022Q2	18.4%	\$3,413	\$1,297	\$4,711
0.3%	Reviews, ATRs, IEPRs, VE	\$105	\$40	38.0%	\$145	0.0%	\$105	\$40	\$145	2022Q2	18.4%	\$124	\$47	\$172
0.7%	Life Cycle Updates (cost, schedule, risks)	\$246	\$93	38.0%	\$339	0.0%	\$246	\$93	\$339	2022Q2	18.4%	\$291	\$111	\$402
1.0%	Contracting & Reprographics	\$351	\$133	38.0%	\$484	0.0%	\$351	\$133	\$484	2022Q2	18.4%	\$416	\$158	\$574
2.0%	Engineering During Construction	\$703	\$267	38.0%	\$970	0.0%	\$703	\$267	\$970	2026Q1	38.3%	\$972	\$370	\$1,342
0.3%	Planning During Construction	\$105	\$40	38.0%	\$145	0.0%	\$105	\$40	\$145	2026Q1	38.3%	\$145	\$55	\$200
1.3%	Project Operations	\$457	\$174	38.0%	\$631	0.0%	\$457	\$174	\$631	2022Q2	18.4%	\$541	\$206	\$747
31	CONSTRUCTION MANAGEMENT													
7.0%	Construction Management	\$2,460	\$935	38.0%	\$3,395	0.0%	\$2,460	\$935	\$3,395	2026Q1	38.3%	\$3,403	\$1,293	\$4,696
1.3%	Project Operation:	\$457	\$174	38.0%	\$631	0.0%	\$457	\$174	\$631	2026Q1	38.3%	\$632	\$240	\$872
1.7%	Project Management	\$598	\$227	38.0%	\$825	0.0%	\$598	\$227	\$825	2026Q1	38.3%	\$827	\$314	\$1,141
CONTRACT COST TOTALS:		\$44,880	\$17,053		\$61,934		\$44,880	\$17,053	\$61,934			\$53,586	\$20,362	\$73,948

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feasibility Study
LOCATION: Stockton, CA
This Estimate reflects the scope and schedule in report;

Draft Final Feasibility Report (September 2017)

DISTRICT: SPK Sacramento District
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 12/8/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		5-Dec-17 1-Oct-17	Program Year (Budget EC): 2018 Effective Price Level Date: 1 OCT 17				FULLY FUNDED PROJECT ESTIMATE					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Calaveras River RB (LSJRFS-CE Rev1-20171107.mlp)													
02	RELOCATIONS	\$17,980	\$6,832	38.0%	\$24,812	0.0%	\$17,980	\$6,832	\$24,812	2030Q2	27.5%	\$22,929	\$8,713	\$31,643
06	FISH & WILDLIFE FACILITIES	\$2,621	\$996	38.0%	\$3,617	0.0%	\$2,621	\$996	\$3,617	2030Q2	27.5%	\$3,342	\$1,270	\$4,612
06	FISH & WILDLIFE FACILITIES - Habitat	\$3,767	\$1,431	38.0%	\$5,198	0.0%	\$3,767	\$1,431	\$5,198	2030Q2	27.5%	\$4,803	\$1,825	\$6,629
11	LEVEES & FLOODWALLS	\$45,035	\$17,113	38.0%	\$62,149	0.0%	\$45,035	\$17,113	\$62,149	2030Q2	27.5%	\$57,432	\$21,824	\$79,257
CONSTRUCTION ESTIMATE TOTALS:		\$69,402	\$26,373	38.0%	\$95,775		\$69,402	\$26,373	\$95,775			\$88,507	\$33,633	\$122,140
01	LANDS AND DAMAGES (Fed)	\$877	\$307	35.0%	\$1,183	0.0%	\$877	\$307	\$1,183	2027Q2	20.2%	\$1,053	\$369	\$1,422
01	LANDS AND DAMAGES (Non-Fed only)	\$5,746	\$2,011	35.0%	\$7,758	0.0%	\$5,746	\$2,011	\$7,758	2027Q2	20.2%	\$6,906	\$2,417	\$9,323
30	PLANNING, ENGINEERING & DESIGN													
1.6%	Project Management	\$823	\$313	38.0%	\$1,136	0.0%	\$823	\$313	\$1,136	2026Q2	39.8%	\$1,150	\$437	\$1,587
2.2%	Planning & Environmental Compliance	\$1,123	\$427	38.0%	\$1,550	0.0%	\$1,123	\$427	\$1,550	2026Q2	39.8%	\$1,570	\$596	\$2,166
8.2%	Engineering & Design	\$4,217	\$1,602	38.0%	\$5,819	0.0%	\$4,217	\$1,602	\$5,819	2026Q2	39.8%	\$5,894	\$2,240	\$8,133
0.3%	Reviews, ATRs, IEPRs, VE	\$154	\$59	38.0%	\$213	0.0%	\$154	\$59	\$213	2026Q2	39.8%	\$215	\$82	\$297
0.7%	Life Cycle Updates (cost, schedule, risks)	\$360	\$137	38.0%	\$497	0.0%	\$360	\$137	\$497	2026Q2	39.8%	\$503	\$191	\$694
1.0%	Contracting & Reprographics	\$514	\$195	38.0%	\$709	0.0%	\$514	\$195	\$709	2026Q2	39.8%	\$718	\$273	\$991
2.0%	Engineering During Construction	\$1,028	\$391	38.0%	\$1,419	0.0%	\$1,028	\$391	\$1,419	2030Q2	66.7%	\$1,713	\$651	\$2,364
0.3%	Planning During Construction	\$154	\$59	38.0%	\$213	0.0%	\$154	\$59	\$213	2030Q2	66.7%	\$257	\$98	\$354
1.3%	Project Operations	\$668	\$254	38.0%	\$922	0.0%	\$668	\$254	\$922	2026Q2	39.8%	\$934	\$355	\$1,288
	02 Relocations (30 + 31)	\$4,960	\$1,885	38.0%	\$6,844	0.0%	\$4,960	\$1,885	\$6,844	2030Q2	66.7%	\$8,266	\$3,141	\$11,407
31	CONSTRUCTION MANAGEMENT													
7.0%	Construction Management	\$3,600	\$1,368	38.0%	\$4,968	0.0%	\$3,600	\$1,368	\$4,968	2030Q2	66.7%	\$6,000	\$2,280	\$8,280
1.3%	Project Operation:	\$668	\$254	38.0%	\$922	0.0%	\$668	\$254	\$922	2030Q2	66.7%	\$1,113	\$423	\$1,536
1.7%	Project Management	\$874	\$332	38.0%	\$1,206	0.0%	\$874	\$332	\$1,206	2030Q2	66.7%	\$1,457	\$554	\$2,010
CONTRACT COST TOTALS:		\$95,168	\$35,965		\$131,134		\$95,168	\$35,965	\$131,134			\$126,257	\$47,739	\$173,995

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feasibility Study
LOCATION: Stockton, CA
This Estimate reflects the scope and schedule in report;

Draft Final Feasibility Report (September 2017)

DISTRICT: SPK Sacramento District
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 12/8/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		5-Dec-17 1-Oct-17		Program Year (Budget EC): Effective Price Level Date:		2018 1 OCT 17		FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
Calaveras River LB plus North Port (LSJRFS-CE Rev1-20171107.mlp)														
02	RELOCATIONS	\$2,837	\$1,078	38.0%	\$3,916	0.0%	\$2,837	\$1,078	\$3,916	2033Q2	35.3%	\$3,840	\$1,459	\$5,299
06	FISH & WILDLIFE FACILITIES	\$2,621	\$996	38.0%	\$3,617	0.0%	\$2,621	\$996	\$3,617	2033Q2	35.3%	\$3,547	\$1,348	\$4,894
06	FISH & WILDLIFE FACILITIES - Habitat	\$2,468	\$938	38.0%	\$3,406	0.0%	\$2,468	\$938	\$3,406	2033Q2	35.3%	\$3,340	\$1,269	\$4,610
11	LEVEES & FLOODWALLS	\$58,453	\$22,212	38.0%	\$80,666	0.0%	\$58,453	\$22,212	\$80,666	2033Q2	35.3%	\$79,107	\$30,061	\$109,168
CONSTRUCTION ESTIMATE TOTALS:		\$66,380	\$25,224	38.0%	\$91,604		\$66,380	\$25,224	\$91,604			\$89,834	\$34,137	\$123,971
01	LANDS AND DAMAGES (Fed)	\$2,831	\$991	35.0%	\$3,823	0.0%	\$2,831	\$991	\$3,823	2030Q2	27.5%	\$3,611	\$1,264	\$4,875
01	LANDS AND DAMAGES (Non-Fed only)	\$18,562	\$6,497	35.0%	\$25,058	0.0%	\$18,562	\$6,497	\$25,058	2030Q2	27.5%	\$23,671	\$8,285	\$31,956
30	PLANNING, ENGINEERING & DESIGN													
1.6%	Project Management	\$1,017	\$386	38.0%	\$1,403	0.0%	\$1,017	\$386	\$1,403	2029Q2	59.3%	\$1,620	\$616	\$2,236
2.2%	Planning & Environmental Compliance	\$1,388	\$527	38.0%	\$1,915	0.0%	\$1,388	\$527	\$1,915	2029Q2	59.3%	\$2,212	\$840	\$3,052
8.2%	Engineering & Design	\$5,210	\$1,980	38.0%	\$7,190	0.0%	\$5,210	\$1,980	\$7,190	2029Q2	59.3%	\$8,301	\$3,155	\$11,456
0.3%	Reviews, ATRs, IEPRs, VE	\$191	\$73	38.0%	\$264	0.0%	\$191	\$73	\$264	2029Q2	59.3%	\$304	\$116	\$420
0.7%	Life Cycle Updates (cost, schedule, risks)	\$445	\$169	38.0%	\$614	0.0%	\$445	\$169	\$614	2029Q2	59.3%	\$709	\$269	\$978
1.0%	Contracting & Reprographics	\$635	\$241	38.0%	\$876	0.0%	\$635	\$241	\$876	2029Q2	59.3%	\$1,012	\$384	\$1,396
2.0%	Engineering During Construction	\$1,271	\$483	38.0%	\$1,754	0.0%	\$1,271	\$483	\$1,754	2033Q2	91.5%	\$2,434	\$925	\$3,358
0.3%	Planning During Construction	\$191	\$73	38.0%	\$264	0.0%	\$191	\$73	\$264	2033Q2	91.5%	\$366	\$139	\$505
1.3%	Project Operations	\$826	\$314	38.0%	\$1,140	0.0%	\$826	\$314	\$1,140	2029Q2	59.3%	\$1,316	\$500	\$1,816
	02 Relocations (30 + 31)	\$783	\$297	38.0%	\$1,080	0.0%	\$783	\$297	\$1,080	2033Q2	91.5%	\$1,499	\$569	\$2,068
31	CONSTRUCTION MANAGEMENT													
7.0%	Construction Management	\$4,448	\$1,690	38.0%	\$6,138	0.0%	\$4,448	\$1,690	\$6,138	2033Q2	91.5%	\$8,517	\$3,236	\$11,753
1.3%	Project Operation:	\$826	\$314	38.0%	\$1,140	0.0%	\$826	\$314	\$1,140	2033Q2	91.5%	\$1,582	\$601	\$2,183
1.7%	Project Management	\$1,080	\$410	38.0%	\$1,490	0.0%	\$1,080	\$410	\$1,490	2033Q2	91.5%	\$2,068	\$786	\$2,854
CONTRACT COST TOTALS:		\$106,084	\$39,670		\$145,753		\$106,084	\$39,670	\$145,753			\$149,055	\$55,822	\$204,878

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feasibility Study
LOCATION: Stockton, CA
This Estimate reflects the scope and schedule in report;

Draft Final Feasibility Report (September 2017)

DISTRICT: SPK Sacramento District
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 12/8/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 5-Dec-17				Program Year (Budget EC): 2018				FULLY FUNDED PROJECT ESTIMATE				
		Effective Price Level: 1-Oct-17				Effective Price Level Date: 1 OCT 17								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
Smith Canal Closure Structure (Smith Canal Closure structure Budget Estimate Rev3_20171107.mlp)														
06	FISH & WILDLIFE FACILITIES	\$2,767	\$1,051	38.0%	\$3,818	0.0%	\$2,767	\$1,051	\$3,818	2032Q1	32.0%	\$3,653	\$1,388	\$5,041
06	FISH & WILDLIFE FACILITIES - Habitat	\$130	\$49	38.0%	\$179	0.0%	\$130	\$49	\$179	2032Q1	32.0%	\$172	\$65	\$237
11	LEVEES & FLOODWALLS	\$1,329	\$505	38.0%	\$1,833	0.0%	\$1,329	\$505	\$1,833	2032Q1	32.0%	\$1,754	\$666	\$2,420
15	FLOODWAY CONTROL & DIVERSION STRUCTURE	\$22,367	\$8,500	38.0%	\$30,867	0.0%	\$22,367	\$8,500	\$30,867	2032Q1	32.0%	\$29,528	\$11,221	\$40,749
CONSTRUCTION ESTIMATE TOTALS:		\$26,593	\$10,105	38.0%	\$36,698		\$26,593	\$10,105	\$36,698			\$35,107	\$13,341	\$48,447
01	LANDS AND DAMAGES (Fed)	\$183	\$64	35.0%	\$246	0.0%	\$183	\$64	\$246	2029Q2	25.0%	\$228	\$80	\$308
01	LANDS AND DAMAGES (Non-Fed only)	\$1,196	\$419	35.0%	\$1,615	0.0%	\$1,196	\$419	\$1,615	2029Q2	25.0%	\$1,496	\$524	\$2,019
30	PLANNING, ENGINEERING & DESIGN													
1.6%	Project Management	\$425	\$162	38.0%	\$587	0.0%	\$425	\$162	\$587	2028Q2	52.5%	\$648	\$246	\$894
2.2%	Planning & Environmental Compliance	\$581	\$221	38.0%	\$802	0.0%	\$581	\$221	\$802	2028Q2	52.5%	\$886	\$337	\$1,223
8.2%	Engineering & Design	\$2,181	\$829	38.0%	\$3,010	0.0%	\$2,181	\$829	\$3,010	2028Q2	52.5%	\$3,325	\$1,264	\$4,589
0.3%	Reviews, ATRs, IEPRs, VE	\$80	\$30	38.0%	\$110	0.0%	\$80	\$30	\$110	2028Q2	52.5%	\$122	\$46	\$168
0.7%	Life Cycle Updates (cost, schedule, risks)	\$186	\$71	38.0%	\$257	0.0%	\$186	\$71	\$257	2028Q2	52.5%	\$284	\$108	\$391
1.0%	Contracting & Reprographics	\$266	\$101	38.0%	\$367	0.0%	\$266	\$101	\$367	2028Q2	52.5%	\$406	\$154	\$560
2.0%	Engineering During Construction	\$532	\$202	38.0%	\$734	0.0%	\$532	\$202	\$734	2032Q1	80.7%	\$961	\$365	\$1,326
0.3%	Planning During Construction	\$80	\$30	38.0%	\$110	0.0%	\$80	\$30	\$110	2032Q1	80.7%	\$145	\$55	\$199
1.3%	Project Operations	\$346	\$131	38.0%	\$477	0.0%	\$346	\$131	\$477	2028Q2	52.5%	\$528	\$200	\$728
31	CONSTRUCTION MANAGEMENT													
7.0%	Construction Management	\$1,861	\$707	38.0%	\$2,568	0.0%	\$1,861	\$707	\$2,568	2032Q1	80.7%	\$3,362	\$1,278	\$4,639
1.3%	Project Operation:	\$346	\$131	38.0%	\$477	0.0%	\$346	\$131	\$477	2032Q1	80.7%	\$625	\$238	\$863
1.7%	Project Management	\$452	\$172	38.0%	\$624	0.0%	\$452	\$172	\$624	2032Q1	80.7%	\$817	\$310	\$1,127
CONTRACT COST TOTALS:		\$35,308	\$13,376		\$48,683		\$35,308	\$13,376	\$48,683			\$48,938	\$18,545	\$67,483

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Lower San Joaquin River Feasibility Study
LOCATION: Stockton, CA
This Estimate reflects the scope and schedule in report;

Draft Final Feasibility Report (September 2017)

DISTRICT: SPK Sacramento District
POC: CHIEF, COST ENGINEERING, Jeremiah Frost

PREPARED: 12/8/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		5-Dec-17 1-Oct-17		Program Year (Budget EC): Effective Price Level Date:		2018 1 OCT 17		FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	RD 404 and Duck Creek (LSJRFS-CE Rev1-20171107.mlp)													
02	RELOCATIONS	\$27,832	\$10,576	38.0%	\$38,408	0.0%	\$27,832	\$10,576	\$38,408	2031Q2	30.1%	\$36,203	\$13,757	\$49,960
06	FISH & WILDLIFE FACILITIES	\$2,621	\$996	38.0%	\$3,617	0.0%	\$2,621	\$996	\$3,617	2031Q2	30.1%	\$3,409	\$1,295	\$4,704
06	FISH & WILDLIFE FACILITIES - Habitat	\$5,890	\$2,238	38.0%	\$8,128	0.0%	\$5,890	\$2,238	\$8,128	2031Q2	30.1%	\$7,662	\$2,911	\$10,573
11	LEVEES & FLOODWALLS	\$67,384	\$25,606	38.0%	\$92,989	0.0%	\$67,384	\$25,606	\$92,989	2031Q2	30.1%	\$87,652	\$33,308	\$120,959
	CONSTRUCTION ESTIMATE TOTALS:	\$103,726	\$39,416	38.0%	\$143,142		\$103,726	\$39,416	\$143,142			\$134,926	\$51,272	\$186,197
01	LANDS AND DAMAGES (Fed)	\$883	\$309	35.0%	\$1,193	0.0%	\$883	\$309	\$1,193	2028Q2	22.6%	\$1,083	\$379	\$1,462
01	LANDS AND DAMAGES (Non-Fed only + all Staging areas)	\$5,791	\$2,027	35.0%	\$7,818	0.0%	\$5,791	\$2,027	\$7,818	2028Q2	22.6%	\$7,098	\$2,484	\$9,583
30	PLANNING, ENGINEERING & DESIGN													
1.6%	Project Management	\$1,214	\$461	38.0%	\$1,675	0.0%	\$1,214	\$461	\$1,675	2027Q2	45.9%	\$1,771	\$673	\$2,444
2.2%	Planning & Environmental Compliance	\$1,658	\$630	38.0%	\$2,288	0.0%	\$1,658	\$630	\$2,288	2027Q2	45.9%	\$2,419	\$919	\$3,338
8.2%	Engineering & Design	\$6,223	\$2,365	38.0%	\$8,588	0.0%	\$6,223	\$2,365	\$8,588	2027Q2	45.9%	\$9,080	\$3,450	\$12,530
0.3%	Reviews, ATRs, IEPRs, VE	\$228	\$87	38.0%	\$315	0.0%	\$228	\$87	\$315	2027Q2	45.9%	\$333	\$126	\$459
0.7%	Life Cycle Updates (cost, schedule, risks)	\$531	\$202	38.0%	\$733	0.0%	\$531	\$202	\$733	2027Q2	45.9%	\$775	\$294	\$1,069
1.0%	Contracting & Reprographics	\$759	\$288	38.0%	\$1,047	0.0%	\$759	\$288	\$1,047	2027Q2	45.9%	\$1,107	\$421	\$1,528
2.0%	Engineering During Construction	\$1,518	\$577	38.0%	\$2,095	0.0%	\$1,518	\$577	\$2,095	2031Q2	74.5%	\$2,649	\$1,007	\$3,655
0.3%	Planning During Construction	\$228	\$87	38.0%	\$315	0.0%	\$228	\$87	\$315	2031Q2	74.5%	\$398	\$151	\$549
1.3%	Project Operations	\$987	\$375	38.0%	\$1,362	0.0%	\$987	\$375	\$1,362	2027Q2	45.9%	\$1,440	\$547	\$1,987
	02 Relocations (30 + 31)	\$7,677	\$2,917	38.0%	\$10,595	0.0%	\$7,677	\$2,917	\$10,595	2031Q2	74.5%	\$13,397	\$5,091	\$18,488
31	CONSTRUCTION MANAGEMENT													
7.0%	Construction Management	\$5,313	\$2,019	38.0%	\$7,332	0.0%	\$5,313	\$2,019	\$7,332	2031Q2	74.5%	\$9,271	\$3,523	\$12,794
1.3%	Project Operation:	\$987	\$375	38.0%	\$1,362	0.0%	\$987	\$375	\$1,362	2031Q2	74.5%	\$1,722	\$654	\$2,377
1.7%	Project Management	\$1,290	\$490	38.0%	\$1,780	0.0%	\$1,290	\$490	\$1,780	2031Q2	74.5%	\$2,251	\$855	\$3,106
	CONTRACT COST TOTALS:	\$139,014	\$52,625		\$191,639		\$139,014	\$52,625	\$191,639			\$189,720	\$71,848	\$261,569