



Topic: **Reservoir Committee Agenda Item 3-4** **2018 July 20**

Subject: **Phase 2 Work Plan**

Requested Action:

Consider approval to utilize the Phase 2 Work plan for the following activities;

- Development of the Phase 2 Finance Plan,
- Developing an Exhibit to the Phase 2 Reservoir Project Agreement,
- Developing an Exhibit to include in the Phase 2 Procurement Request for Qualifications, and
- Developing the FY2019 budget

The Sites Project Authority approved the Phase 2 Work Plan at its July 16, 2018 Board of Directors meeting.

Detailed Description/Background:

The Draft Phase 2 Workplan consists of pre-construction activities that would be conducted to support the engineering design, finalization of the EIR/EIS, and securing environmental permits for project construction.

The Draft Phase 2 Work Plan will continue to be refined over the remainder of 2018, however the draft version (as presented) will be used to further develop the Phase 2 Financing Plan, used to develop an exhibit to the Phase 2 Reservoir Project Agreement and Phase 2 Request for Qualifications, and used as the basis to develop the FY2019 budget.

Prior Reservoir Committee Action:

None.

Fiscal Impact/Funding Source:

None.

Staff Contact:

Jim Watson

Attachments:

Attachment 5-1A: Workplan and Monthly Cashflow Analysis for Phase 2 of the Sites Reservoir Project, July 7, 2018.

Workplan and Monthly Cashflow Analysis for Phase 2 of the Sites Reservoir Project

Sites Project Authority

Version Date: July 7, 2018

Released solely for the following uses:

- Development of the Phase 2 Finance Plan,
- Developing an Exhibit to the Phase 2 Reservoir Project Agreement,
- Developing an Exhibit to include in the Phase 2 Procurement Request for Qualifications, and
- Developing the FY2019 budget.

Table of Contents

Executive Summary	3
1. Introduction	4
2. Baseline Cashflow Curves (without Risk)	5
3. Cost Estimate	6
4. Schedule	7
5. Activities	7
5.1 Project/Program Administrative (WBS 01-099)	7
5.2 Project/Program Management Functions (WBS 10)	7
5.3 Ancillary and Support Functions (WBS 11-19)	8
5.4 Environmental Planning and Permitting (WBS 20 to 29)	8
5.5 Engineering (WBS 30 to 39)	11
5.6 Property Acquisition and Land Management (Real Estate)	14
5.7 Procurement of Equipment (WBS 50 to 59)	14
5.8 Procurement Construction (WBS 60 to 69)	15
6. Baseline Budget Adjustment for Risk Considerations	15
7. Service Area Budgets	22

Appendices

Not Included with agenda package

Appendix A	Preliminary WBS	(8 pages)
Appendix B	Estimated Monthly Cashflow	(55 pages, 11x17)
Appendix C	Current MS Project Schedule	(64 pages, 11x17)
Appendix D	Preliminary Investigation Area and Preliminary Staging	(1 page)

Tables

Table 1. Implementation Phases for Sites Reservoir Project	4
Table 2. Base Costs by Phase (2015 Dollars Excluding Risk Adjustment and Mitigation Contingency)	6
Table 3. Unmitigated Risk Assessment Results for Total Project Cost (2015 Dollars)	15
Table 4. Mitigated Risk Assessment Results for Total Project Cost (2015 Dollars)	16
Table 5. Total Project Cost by Phase in 2015 Dollars with Contingency for Mitigated and Unmitigated Risk	16

Figures

Figure ES-1. Cost Estimation Process	3
Figure 1. Project Baseline Cashflow (2017 Direct Costs – IDC excluded)	5
Figure 2. Phase 2 Baseline Cashflow (2017 Direct Costs)	5
Figure 3. Total Project Cost with Including Risk and Environmental Mitigation Contingency	17

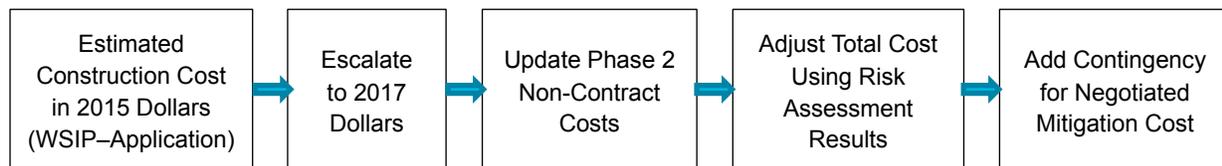
Executive Summary

The implementation of Sites Reservoir is a large capital project that will be completed in a series of phases. Each phase will achieve important milestones and there will be an opportunity to reassess the requirements and costs of the subsequent phase prior to proceeding. Project participants will have an opportunity for rebalancing at the conclusion of each phase. This memorandum provides the following information:

- The duration and activities for future phases
- The overall budget for completion of the project
- A work breakdown structure (WBS)
- The schedule for future phases
- A description of the Phase 2 activities
- A monthly cashflow required for Phase 2 activities
- A risk-adjusted cashflow for Phase 2 activities to provide a reasonable contingency for planning purposes

Figure ES-1 shows the process used to estimate the cost used as a basis for the required cashflow.

Figure ES-1. Cost Estimation Process



The WSIP application included a Basis of Estimate Report with a detailed estimate for construction costs (see Section 3). Non-contract costs were estimated as percentages of the total construction cost. Per the WSIP regulations, all costs in the application were provided in 2015 dollars.

The first step in the development of this estimate was to escalate the construction costs to fourth quarter 2017 dollars.

Phase 2 consists of pre-construction activities. These non-contract (outside of the construction contract) costs were previously estimated as a percentage of the construction cost estimate. This memorandum (see Section 5) provides a much more detailed breakdown and estimate of the non-contract costs than was previously available. This breakdown of Phase 2 costs is needed to understand the cashflow.

The next step in updating the estimate was the application of the risk assessment results to adjust the costs. The previous cost estimate included contingencies. The risk assessment results provide an improved basis for estimating the appropriate construction contingency rather than simply applying a typical percentage. The statistical analysis in the risk assessment determined a likely cost growth with an 80% confidence limit. This cost growth was applied to the field cost and design contingency (a contingency that covers items that are, as yet, not designed). No other adjustments were made to the costs for Phases 3 and 4 in this memorandum. The engineering design will be advanced during Phase 2 and the results to confirm the cost estimate will be used at the completion of Phase 2.

Finally, the cost estimate was adjusted with a contingency for mitigation costs (see Section 6). CH2M HILL reviewed the previous mitigation costs based on the latest version of the mitigation plan in the EIR/S. Mitigation costs will ultimately depend on negotiated permit requirements. Additional contingency was provided in the estimate to account for the potential range of mitigation costs that could be incurred.

Phase 2A will have a duration of 24 months with an average risk-adjusted cashflow of \$7.8M/month. Phase 2B has a duration of 18 months with an average cashflow of \$11.2M/month.

This memorandum does not make any attempt at cost assignment or propose a financing approach. As a result, the interest during construction is not included in the estimate. The estimated cashflow does not include due diligence by the participants (including State and Federal agencies).

1. Introduction

This memorandum provides an initial concept for organizing imminent Phase 2 work for the Sites Reservoir Project and an estimate of the associated cashflow. Based on current planning, implementation of the project has generally been organized into phases as follows:

Table 1. Implementation Phases for Sites Reservoir Project

Phase	Dates	Activities
1	2016-2018	WSIP application and draft environmental document
2A	2019-2020	Final EIR (certified)/NOD, Phase 2A geotechnical investigations and studies, surveying and mapping, preliminary engineering, develop performance specification for major equipment, agency coordination for permitting, biological assessment, system impact and facility studies by utilities
2B	2021-2022	Complete permits, obtain water rights, Final EIS/ROD, Phase 2B geotechnical site investigations and studies, final design of critical facilities (north bypass/construction road, I/O tunnel, Holthouse, Sites PGP), selection of pump/turbine equipment vendor(s), and modeling of major equipment, design of Delevan Intake and Fish Screen, finalize agreements with utilities for power/generation, develop Principles of Agreement with Reclamation and DWR
3	2022-2024	Final design for main and saddle dams, construct alternate roadway/bridge to Lodoga, real estate acquisition for the inundation area, demolition in inundation area, begin dam construction, major equipment manufactured and tested (ongoing), acquire real estate for Delevan pipeline and power transmission
4	2024-2030	Completion of construction, major equipment delivered, commissioning plan, begin filling reservoir
5	2030-2122	Operation, maintenance, and replacement

The budget and schedule estimates provided in this memorandum are best defined for Phase 2A. Updated estimates for subsequent phases should be developed prior to the conclusion of each active future phase and sub-phase.

The estimates has been organized according to a preliminary work breakdown structure (WBS) recommended by the Sites Project Authority (Authority). The WBS will be refined as necessary and will become the structure for tracking costs and schedule as the project moves into future phases. The preliminary WBS is attached in Appendix A.

Project activities in Phase 2A and Phase 2B have been assigned to the latest possible starts where possible to help manage the cashflow during the early portion of the project.

2. Baseline Cashflow Curves (without Risk)

Approximate cashflow curves (Figures 1 and 2) have been developed for the overall project and for Phase 2 activities. The cashflow estimates are most accurate for the early phases of the project. Appendix B provides a detailed cashflow for Phases 2A and 2B that is organized according to the WBS.

Additional discussion addressing risk considerations and incorporating risk into the budget is provided in Section 6.

Figure 1. Project Baseline Cashflow (2017 Direct Costs – IDC excluded)

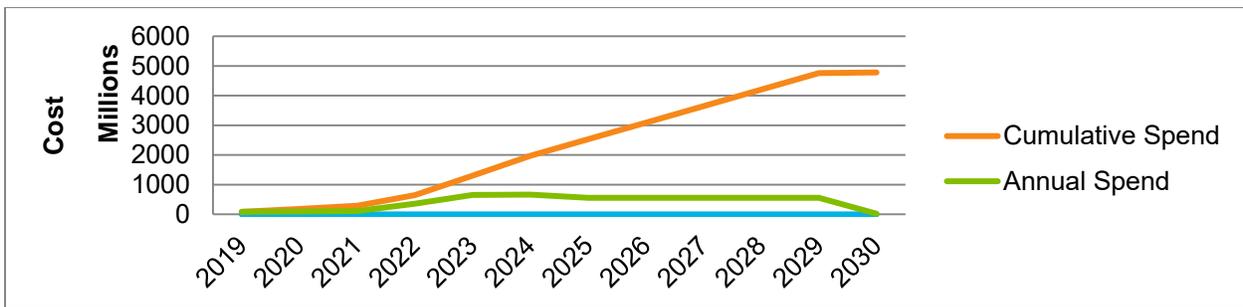
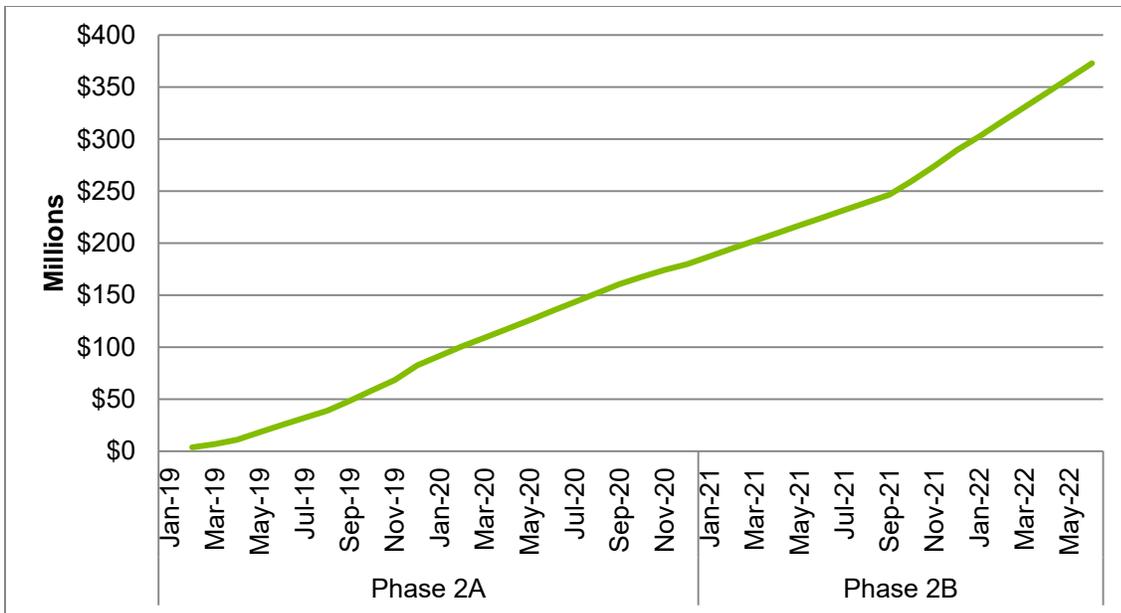


Figure 2. Phase 2 Baseline Cashflow (2017 Direct Costs)



3. Cost Estimate

This Basis of Estimate (BOE) Report included in the WSIP application provides brief descriptions for the major project components and supporting information for the Project cost estimate and preliminary construction schedule. Appendices to the WSIP application contain the cost estimate and preliminary construction schedule.

As stated in the WSIP Technical Reference, the Project cost estimate must be a Class 4 estimate or better as defined by the Association for the Advancement of Cost Estimating (AACE), International. Overall, the Project cost estimate presented in this BOE represents a mid-range Class 4 estimate. The current level of design for the various project features varies. Some of the more costly facilities (like the dams and portions of the pipelines) are at a level of geotechnical investigation and design that would support a higher Class 3 estimate. The design for other facilities is less advanced, but still well enough defined to support preparing Class 4 estimates.

All costs were originally provided in October 2015 dollars to satisfy the requirements for the WSIP application. The total project cost in 2015 dollars was estimated at \$4,776M with an additional \$50M allowance for power utility upgrades to provide service to the new pumping plants.

Table 2. Base Costs by Phase (2015 Dollars Excluding Risk Adjustment and Mitigation Contingency)

Phase 2A	Phase 2B	Phase 3	Phase 4	Total
\$180M	\$194M	\$1,257M	\$3,199M	\$4,830M

The WSIP cost estimates reflect:

- All construction costs, including, but not limited to, mobilization and demobilization, labor, construction equipment, supply and installation of permanent materials and equipment with an expected useful life of 2 years or more, contractor indirect overhead costs and profit, including bonds and insurance.
- Initial environmental mitigation or compliance obligations.
- Land acquisition, including legal, administrative, and relocation costs.
- Modifications to existing canal headworks structures to be able to reliably supply water to the Project.
- Contingencies for engineering (10 percent) and construction (15 percent), and a non-contract cost allowance (17 percent).

Owner costs beyond the construction costs were covered in the WSIP application by applying the non-contract cost allowance of 17 percent to the construction cost (the allowance is reduced for mitigation and real estate). This estimated costs directly related to construction or acquisitions, including planning, geotechnical site investigations, engineering and design, construction management, environmental mitigation and compliance, permitting, and other Authority costs directly related to project construction. Section 5 of this memorandum provides a much more detailed listing of activities that were used to develop an updated estimate for Phase 2 in this memorandum.

4. Schedule

Appendix C provides a preliminary Microsoft Project™ schedule for all phases of the project. This schedule will be refined and become increasingly detailed as the project progresses.

5. Activities

This section provides a brief description of the anticipated activities that are included in the budget and schedule with cross reference to the WBS.

5.1 Project/Program Administrative (WBS 01-099)

This captures Authority costs, including rent; utilities; information technology hardware, software, and support; facilities; rentals; dues and subscriptions; and office supplies.

5.2 Project/Program Management Functions (WBS 10)

Program startup activities will include the following:

- Establish the Master Program Schedule and Budget – includes establishing the program WBS and the baseline program schedule and budget
- Management Plan and Program Standards and Procedures- includes defining program business processes, establishing program standards and procedures, and developing reporting requirements
- Financial Planning and Funding Implementation – includes optimizing funding sources and their timing and preparing loan applications, grant applications, and other materials to receive funds
- Management System Deployment - Evaluate and select system platform and define and configure system functionality
- Resource Evaluation and Program Organization Development - Define program organization and governance. Evaluate resource needs and develop work plan for program management support.
- Establish the Program Management Office
- Throughout Phase 2A/2B, the following program management functions will be required.

Integration Management: Effort includes project planning. Document management and controls includes filing all correspondence, documents, etc. in accordance with the file structure developed during Program Start-up. Costs for the General Manager, Deputy General Manager, Environmental Manager, Engineering Manager, Program Operations Manager, and Administrative Assistance are captured under this category.

Communications Management: Includes internal and external (agency and landowner outreach and government affairs) correspondence. At a minimum, weekly program progress and coordination meetings are anticipated. Reporting is a significant function that will develop and produce program and project status reports and other reports as necessary.

Human Resources Management: Includes management of Authority staff, identification and hiring of review board participants, and staff augmentation support (internal for Authority or to assist agency staff with permit review).

Life Safety Plan: The Authority will develop a life safety plan for the program, including requirements for field work coordination and contractor requirements.

Procurement Support: Evaluation of contracting packages and procurement alternatives, development of design procurement documents, assistance with professional service procurement, and assistance with construction procurement.

Scope Management: Includes developing scopes of work, monitoring progress, and reviewing invoices from engineering, environmental, outreach, and real estate, and other contractors. Manage project scope changes and claims avoidance

Schedule Management: Project controls will manage and track budgets and schedules.

Cost Management: Includes coordination of program financial management and reporting and producing financial cash flow reports

Quality Management: Requires Program QA/QC System development, definition and monitoring consultant QA/QC requirements. Also includes developing review board objectives and coordination of the review board that will be required by key permitting agencies.

Risk (and Insurance) Management: This includes tracking mitigation actions identified in the current risk assessment and periodically updating the program risk assessment.

5.3 Ancillary and Support Functions (WBS 11-19)

Legal and Regulatory: Includes legal counsel to the Authority, as well as additional support for water rights; NEPA/CEQA compliance; bond counsel; regulatory permitting; and real estate acquisition.

Engagement: Includes external engagement and government affairs, industry/association engagement, and public engagement. The effort includes developing a stakeholder coordination and public outreach plan, providing technical support and program coordination with stakeholder/public outreach, and maintaining the project website and engagement through social media.

5.4 Environmental Planning and Permitting (WBS 20 to 29)

5.4.1 Operations Modeling

Operations Modeling: Includes modeling and operations scenario development assistance as part of Authority participation/agreements development and modeling/coordination required to obtain federal and state permits and authorizations.

5.4.2 Impact and Effect Analysis:

CEQA Documentation: Completion of the final EIR (and EIS) will require responding to all comments received on the public draft. Responses are anticipated to include thematic responses for comments provided by multiple commenters, individual responses, and additional analysis (including modeling specific to the EIR/EIS) per comments. Preparation of supplemental information will be determined by the Authority and Counsel. Completion of the CEQA portion of the environmental documentation process is anticipated to be completed in Phase 2A to support acquisition of state permits. Findings and NOD also anticipated in Phase 2A. NEPA documentation cannot be finalized until Phase 2B.

NEPA Documentation: Completion of the final NEPA (EIS) portion of the EIR/EIS will generally be concurrent with the EIR and will include coordination with Reclamation related to approach and content as was done in the preparation of the public draft. Completion of the NEPA portion of the environmental documentation process and associated ROD is anticipated to be completed in Phase 2B once federal permits are acquired.

5.4.3 Permitting

Clean Water Act of 1972 Section 404, Rivers and Harbors Act of 1899 Section 10 (33 USC 403):

Includes development of application package (including relevant project description, design drawings figures/maps), required surveys/delineations, and associated coordination and data requests/submittals.

Rivers and Harbors Act of 1899 Section 14 (33 USC 408): Includes development of application package (including relevant project description, design drawings figures/maps), hydrologic and hydraulics system performance analysis, geotechnical analysis, sediment transport modeling and bathymetric surveys, and associated coordination and data requests/submittals.

Least Environmentally Damaging Practicable Alternative (CWA Section 404(B)(1) Review: Includes development of 404(b)(1) application package (including relevant project description, design drawings figures/maps), alternatives analysis, and associated coordination and data requests/submittals.

National Historic Preservation Act of 1966 (NHPA) Section 106: Includes consultation meetings coordination, preparation, and participation; follow-up and ongoing communication (includes review of USBR-prepared programmatic agreement and research design), records search, field surveys, DPRs, technical reports, evaluation excavations, ethnographic studies, tribal input and coordination, and repatriation evaluations and process.

Endangered Species Act of 1973 Section 7: Includes coordination assistance in the development of the federal biological assessment by Reclamation and biological opinions to be developed by the National Marine Fisheries Service (federal special status anadromous species) and U.S. Fish and Wildlife (federal special status resident fish and terrestrial/botanical species), application package and development, consultation/meeting coordination, preparation, and participation; analyses (new and follow up to evaluations conducted to support CEQA/NEPA process, follow-up requests and ongoing communication; necessary surveys (in addition to those required by USACE 404/10 and CDFW 2081 approval processes), aquatic studies to support consultation, and BA development assistance.

Bald Eagle Protection Act of 1940: Includes consultation meetings/coordination, preparation and coordination of required eagle management and monitoring plans; follow-up requests and ongoing communication; necessary surveys including golden eagle satellite telemetry studies and survey plan development.

Navigability Determination (33 CFR 329.14): Includes consultation meeting(s) coordination, application/materials preparation, and participation; follow-up requests and ongoing communication

Warren Act Contracts: Includes consultation meeting coordination, modeling (if required), application/materials preparation, and participation; follow-up requests and ongoing communication

Federal Energy Regulatory Commission: Includes FERC pre-application document and consultation/coordination, FERC Hydropower License (Integrated Licensing Process [ILP]) application package including project description; design drawings; maps and figures, geotechnical data reports, construction monitoring, QA plans, environmental survey/analysis results and operational approach, coordination/meetings, follow-up requests and ongoing communication.

Caltrans Encroachment Permits and Detour and Transportation Plans: Includes permit application package and fee, project description, design drawings, maps and figures, necessary environmental resources reports and survey results (as applicable), meetings/coordination, follow-up requests and ongoing communication.

State Lands Commission: Includes application package (including survey information) and fee, project description; design drawings; maps and figures, meetings/coordination, follow-up requests and ongoing communication; as-built drawings; surveys; internal and external inspection program.

Central Valley Flood Protection Board Encroachment: Includes encroachment Permit 3615 and 3615a application package for modifications to existing non-urban levees (including required mapping and deeds) and fee, project description; design drawings; maps and figures, hydrologic and hydraulics system performance analysis, Section 408 Permit application package, Local Maintaining Agency endorsement and concurrence with USACE. Meetings/coordination, follow-up requests and ongoing communication.

State Water Resources Control Board Water Rights Permit: Includes application package (including fee), development of required Water Availability Analysis and supplemental information and research, project description; design drawings; maps and figures; required operations modeling; cooperative operations coordination, meetings/coordination, follow-up requests and ongoing communication, water rights hearings preparation and testimony.

State Water Resources Control Board National Pollutant Discharge Elimination System and Clean Water Act Section 402: Includes Construction General Permit application package and fee, project description; design drawings; maps and figures, development of Stormwater Pollution Prevention Plan (in anticipation of contractor submittals, meetings/coordination, follow-up requests and ongoing communication.

State Water Resources Control Board Waste Discharge Requirements: Includes waste discharge application package and fee, project description; design drawings; maps and figures, meetings/coordination, follow-up requests and ongoing communication.

Clean Water Act Section 401 Water Quality Certification: Includes application package and fee, project description; design drawings; maps and figures, environmental survey and analysis results, Section 404 Pre-Construction Notification application package, meetings/coordination, follow-up requests and ongoing communication.

Department of Water Resources Division of Safety of Dams: DWR will need to review the geotechnical investigation plan, geotechnical data report, geotechnical engineering report, preliminary engineering plans, draft and final design, specifications, and basis of design. Costs include both contractor costs for coordination and fees paid to DWR. The DSOD permit will not be obtained until Phase 4. However, a portion of the fee would be paid in Phase 2A and Phase 2B to facilitate DSOD participation in site investigation work and preliminary planning for the dams and reservoir.

California Occupational Safety and Health Administration Permits: Initial work to prepare permits for the construction of facilities.

California Department of Fish and Wildlife Streambed Alteration: Includes Lake and Streambed Alteration Agreement Notification Package and fee, project description; design drawings; maps and figures, biological resources reconnaissance survey and biological assessment, aquatic resources (wetlands and waters of the U.S.) delineation and aquatic resources delineation report, meetings/coordination, follow-up requests and ongoing communication.

California Department of Fish and Wildlife Section 2081: Includes Sections 2081 (b) and (c) Incidental Take Permit application package and fee, project description; design drawings; maps and figures (separate GIS maps assumed), operations plan and evaluation (modeling assumed above as part of operations modeling support), biological resources reconnaissance surveys (per CDFW protocols), Mitigation Monitoring and Reporting Plan, meetings/coordination, follow-up requests and ongoing communication.

Native American Heritage Commission/Local Tribes AB 52 Consultation: Includes consultation meetings; coordination; development of mitigation measures, and development of monitoring program related to California Native American tribes.

State Historic Preservation Office Section 106: Includes SHPO consultation meetings/coordination, follow-up and ongoing communication specific to SHPO requirements/coordination in addition to Section 106 activities identified above.

Colusa and Glenn County Air Districts: Includes Authority to Construct, Permit to Operate, and Notification of Operation application packages and fees (for each county), project description; design drawings; maps and figures, meetings/coordination, follow-up requests and ongoing communication, including annual inspection approach follow-up requests and communication.

Colusa and Glenn County Public Works – Encroachments: Includes Encroachment Permit application packages and fees (for each county), project description; design drawings; maps and figures, meetings/coordination, follow-up requests and ongoing communication.

Colusa and Glenn County Transportation: Includes Transportation Permit application packages and fees (for each county), project description; design drawings; maps and figures, meetings/coordination, follow-up requests and ongoing communication.

Building, Street Improvement, and Grading Permits: Includes permit application packages and fees (for each county), project features; design drawings; maps and figures, meetings/coordination, follow-up requests and ongoing communication.

Colusa County General Plan and Zoning: Includes working with Colusa County on required language and supporting documentation, project description; design drawings, maps and figures, meetings/coordination, follow-up requests, and ongoing communication as needed.

5.5 Engineering (WBS 30 to 39)

5.5.1 Preliminary Engineering

Meetings and Coordination: Weekly coordination calls, agency coordination meetings, monthly progress reports.

Preliminary Engineering Workplan: The Preliminary Engineering Contractor will submit a workplan describing planned field work and deliverables for approval by the Authority prior to mobilizing to the field. In addition to ensuring the work products satisfy all project needs, the workplan will provide the schedule for field activities and support landowner coordination for temporary right of entry.

Preliminary Engineering Standards: The Contractor will prepare the following standards to support Preliminary Engineering:

- Project Description (existing – import from draft EIR/S)
- Preliminary Project Operations
- Reference Documents, Codes and Standards
- Procedures and criteria for:
 - Surveying, Mapping, and Bathymetry
 - Utility Coordination
 - Geotechnical Engineering
 - Civil, Structural, Mechanical, and Electrical
 - Seismic Design
 - Hazardous Materials Assessment
 - Program GIS Database

- Project CAD Standards
- Calculations Standards
- Right-of-Way Requirements
- Construction Access
- EIR/EIS Mitigation Measures
- Estimating Standards

Preliminary Engineering Quality Control Plan: The Quality Control Plan will include the following principal subjects:

- Organization & Responsibility
- Summary and Schedule of Preliminary Engineering Reviews
- Summary and Schedule of Independent Reviews and Board of Consultant Reviews
- Value Engineering
- Requirements for Subconsultants
- Procedural Requirements
- Special Requirements for Calculations, CAD, and GIS
- Engineering Quality Management Audits
- Engineering Review Process
- Design for Safety

Contracting Strategy: The Contracting Strategy will be prepared near the end of the preliminary engineering effort and will evaluate conventional and alternative delivery alternatives for each project facility. Recommendations will also be made for how to best bundle individual facilities together into packages to facilitate a smooth construction process.

Project Optimization Study: Decisions are needed on several project facilities prior to initiating preliminary engineering. Key issues include:

- Bridge versus alternative access road to Ladoga
- Location of Holthouse Reservoir
- Configuration of Delevan Pipeline at Colusa Basin Drain (including a possible pumping plant for the Colusa Basin Drain)
- Status of hydropower generation facilities
- Location of power transmission lines
- Length of tunnel segments for pipelines
- Managing emergency releases
- Probable maximum flood update and spillway need
- Emergency reservoir drawdown criteria and Evaluation for tunnel sizing

The Project Optimization Study will evaluate alternative costs and provide recommendations for how to best address these features in preliminary engineering.

Project Hydraulic Model: For WSIP, all facilities were designed using a monthly time-step consistent with the results from CalSim II modeling. A monthly time-step does not provide an adequate basis of design for early procurement of pumps and valves. The Contractor will develop complete system models for the entire project to support the sizing of reservoirs and pumping/generating equipment selections and to ensure that the project works seamlessly between individual facilities. This model will be provided to the Final Design Contractors and equipment vendors.

System Impact Study and Facility Study Coordination: The Preliminary Engineering Contractor will develop scopes of work, respond to questions, attend progress meetings, and evaluate the results of independent analysis by power providers (Pacific Gas and Electric and Western Area Power Administration).

Hydropower Strategy: A strategy will be provided for the development of hydropower, permitting of hydropower facilities, and integration with the grid.

Phase 2A Map Book: A GIS map book is needed to locate and display potential conflicts with public and landowner utilities, canals, ditches, crop types, and other features, as well as environmentally sensitive areas. The map book will support real estate acquisition and easements needed. It will also be used to more precisely define the alignment (one of the primary goals of Phase 2A).

Phase 2A Drawing Set: An updated and expanded set of CAD drawings will be developed for all project facilities. The drawing set will be needed to support final design and the development of quantities for the cost estimate.

Phase 2A Basis of Design Report: This report will comprehensively address the entire project and explain how all of the facilities will function together. Subsequent design reports in Phase 2B and Phase 3 will be facility specific and will not comprehensively address the integration of facilities and coordination of construction efforts. This report will establish the base assumptions that the final designers will be required to incorporate into their designs.

Geotechnical Engineering Report (GER): This report will provide the interpretation of the information in the Geotechnical Data Report, which is described in the next section, and geotechnical engineering based on the data. The report will include development of design parameters, engineering analysis (e.g., seepage analysis, stability analysis, seismic analysis, material balances, etc.), needed to support permitting, recommendations for dewatering, recommendations for fill, etc.

Phase 2A Basis of Estimate Report: The report will document all of the assumptions used in cost estimating, including quantity development, basis for unit and lump sum rates, the estimates for non-contract costs and interest during construction. The report will include a detailed cost estimate and construction schedule incorporating the findings from the map book, drawing set, basis of design report, and GER. Modeling for the new Delevan intake facility, including potential effects on the Moulton Weir, will be included in the report. The report will include an adjusted budget for Phase 2B.

Phase 2A List of Specifications: A list of engineering specifications will be developed that will need to be produced in Phase 2B.

Phase 2A Risk Management Plan: An initial risk assessment was developed in Phase 1. At the end of Phase 2, the findings from preliminary engineering will be used to adjust contingencies and the risk will be recalculated to better define potential budget and schedule impacts.

Aerial Mapping and Surveying: Aerial topography and imagery and land surveying will be needed to develop the base maps for the design and environmental efforts.

Bathymetry: Bathymetry will be needed at the Delevan intake/outfall location to map the river bottom in support of the Delevan pipeline outfall and fish screen design. Bathymetry may also be required for Funks Reservoir to identify how much accumulated sediment needs to be removed.

Base Map Development: The aerial mapping, land surveying, and bathymetry results will be integrated into topographic base maps that will support all Phase 2, Phase 3 and Phase 4 activities.

5.5.2 Technical and Modeling Studies

Geotechnical Studies Meetings and Coordination: Weekly coordination calls, agency coordination meetings, monthly progress reports.

Geotechnical Studies Field Work Plan: The Geotechnical Studies Contractor will develop a work plan specifying methods and sampling locations. A schedule will be prepared to coordinate right of entry during the field program (see preliminary staging in Appendix D).

Investigation (Phased): The field investigation will be phased consistent with rights of entry obtained by the real estate team. The field investigation will include drilling, pump tests, sample collection, and laboratory testing.

Geotechnical Data Report: The Contractor will develop a geo-referenced database for all investigation results. The report will include all field logs and testing results.

Seismicity Evaluation: An updated seismic evaluation will be prepared to serve as the basis for the seismic design of the project facilities.

5.5.3 Facility Design (Plans, Specifications, and Estimate)

Contract packages will be developed in accordance with the contracting strategy developed in Preliminary Engineering. Many packages are expected to be developed for alternative delivery. Regardless of the contracting strategy, design activities will be underway for critical path facilities during Phase 2B. These facilities include the following:

- Clearing and demolition of the Sites Reservoir inundation area
- Construction access roads and laydown areas
- Golden Gate Dam
- Sites Dam
- Holthouse Reservoir
- Inlet/Outlet structure and associated tunnel
- Sites Pumping Generating Plant
- Utility transmission line interconnections
- General property (construction office)

5.6 Property Acquisition and Land Management (Real Estate)

Real estate/ROW acquisition support will be focused on temporary entry permits for geotechnical investigation activities and biological assessment for Phase 2A. Efforts will begin to shift to property acquisitions during Phase 2B. Real estate contractors are expected to provide technical support for land and easement acquisition (tools, processes, procedures).

5.7 Procurement of Equipment (WBS 50 to 59)

Specification of Pumps, Valves, and Turbines: Performance specifications will be developed for custom made equipment to support early procurement.

Award: Bid packages will be developed, bid, and evaluated to select equipment vendors.

Modeling and Testing: The selected vendors will be required to model and then factory test equipment to demonstrate compliance with performance criteria prior to fabrication releases.

5.8 Procurement Construction (WBS 60 to 69)

Mitigation: Some early procurement of environmental mitigation lands is likely to be required in advance of early construction for construction access roads and other facilities needed to support the investigation and construction efforts.

6. Baseline Budget Adjustment for Risk Considerations

All analysis in this report is based on the baseline budget prepared for the WSIP application. In accordance with the WSIP requirements, all results were provided in 2015 dollars. Financing costs (interest during construction) is not included in this estimate. Financing costs will vary for individual reservoir participants (i.e., state and federal agencies versus Authority participants).

The Sites Project Authority performed a Quantitative Risk Assessment (QRA) for the Sites Reservoir Project (AECOM, 2018). The primary objective of the QRA is to provide Sites Project Authority with actionable recommendations to help control the cost and schedule of the project. The report used standard industry practices for risk assessment to present findings and unmitigated and mitigated risks.

A risk workshop was held on February 6-7, 2018 with representatives from the Project Team, California Department of Water Resources (DWR), U.S. Bureau of Reclamation, CH2M Hill, AECOM design teams, and AECOM's Risk Management Group. Information derived from the workshop along with preparatory and follow-up discussions were used to generate a risk register for the project. An integrated cost and schedule model was developed and a Monte Carlo simulation was used to quantify and develop cumulative distribution curves for Program Cost and Schedule impacts relative to Confidence Levels. An 80% confidence level is the industry standard, and is thus the value reported in this analysis. An 80% confidence level is considered a conservative value to compare the allocations in cost and schedule contingency budgets and determine their appropriateness.

The Total Project Cost includes the Total Contract Cost, Construction Contingency, and Non-Contract Costs, including all probable changes or modifications after award of the contracts. Results from the Quantitative Risk Assessment (2015 dollars) indicate that the Total Project Cost is likely to be between \$4,420 million and \$5,314 million. At an 80% confidence level, the total contract cost will not exceed \$4,966 million, as such these risks represent a \$269 million increase from the Base Case Total Project Costs.

Table 3. Unmitigated Risk Assessment Results for Total Project Cost (2015 Dollars)

	Risk Results by Confidence Levels (C.L.)			
	Base Scenario	Best Case	80% C.L. Recommended	Worst Case
Total Project Cost	\$4,697 million	\$4,420 million	\$4,966 million	\$5,314 million
Delta		-\$277 million	+\$269 million	+\$617 million

Results from the mitigated QRA indicate that the Total Contract Cost is likely to be between \$4,333 million and \$5,130 million. At an 80% confidence level, the total contract cost will not exceed \$4,829 million, as such these risks represent a \$130 million increase from the Base Case Total Project Costs.

Table 4. Mitigated Risk Assessment Results for Total Project Cost (2015 Dollars)

	Risk Results by Confidence Levels (C.L.)			
	Base Scenario	Best Case	80% C.L. Recommended	Worst Case
Total Project Cost	\$4,697 million	\$4,398 million	\$4,894 million	\$5,183 million
Delta		-\$299 million	+\$197 million	+\$486 million

The unmitigated 80% cost growth of 5.7% and mitigated cost growth of 4.2% were applied to the estimate in 2015 dollars in Table 5. Table 5 also includes a contingency of \$150M for additional mitigation (CH2M HILL, 2017) that may be required in the permitting process.

Table 5. Total Project Cost by Phase in 2015 Dollars with Contingency for Mitigated and Unmitigated Risk

	Phase 2A	Phase 2B	Phase 3	Phase 4	Total	Escalated to 2018-Q1
Base Cost (2015) with Power Upgrade (\$50M)	\$180M	\$194M	\$1,257M	\$3,199M	\$4,830M	\$5,023M
Unmitigated	\$191M	\$205M	\$1,328M	\$3,381M	\$5,105M	\$5,309M
Mitigated	\$188M	\$202M	\$1,309M	\$3,535M	\$5,234M	\$5,443M
Mitigated with Contingency for Environmental Mitigation	\$188M	\$202M	\$1,309M	\$3,484M	\$5,184M	\$5,390M

The mitigated risk with contingency for environmental mitigation is recommended for budgetary purposes. Phase 2A will produce a more advanced engineering design and cost estimate and the engineering consultant should work with the Authority's Municipal Financial Advisor to develop the most appropriate forecast of future costs, including escalation, in the Phase 2A Basis of Estimate Report.

Figure 3 provides the cashflow including the cost associated with the unmitigated risk and the Authority's contingency from the WSIP application.

As the project proceeds, activities are needed to reconfirm the estimated level of risk and to mitigate or avoid the risks that have already been identified. Table 6 summarizes these actions based on the May 2018 mitigated risk assessment report (note that some actions address more than a single risk). In some cases, risks are accepted and no mitigation has been identified. In many cases, no separate action is identified to address a risk. Instead, mitigating the risk can be folded into the planned engineering, permitting, or management tasks by changing the approach without increasing costs. There are also some risks where no mitigation action is currently identified or budgeted for Phase 2. Some of these actions may be better defined and included in subsequent phases of the project. A few items have been identified as **Missing?** and require further discussion to ensure they are covered.

Figure 3. Total Project Cost with Including Risk and Environmental Mitigation Contingency

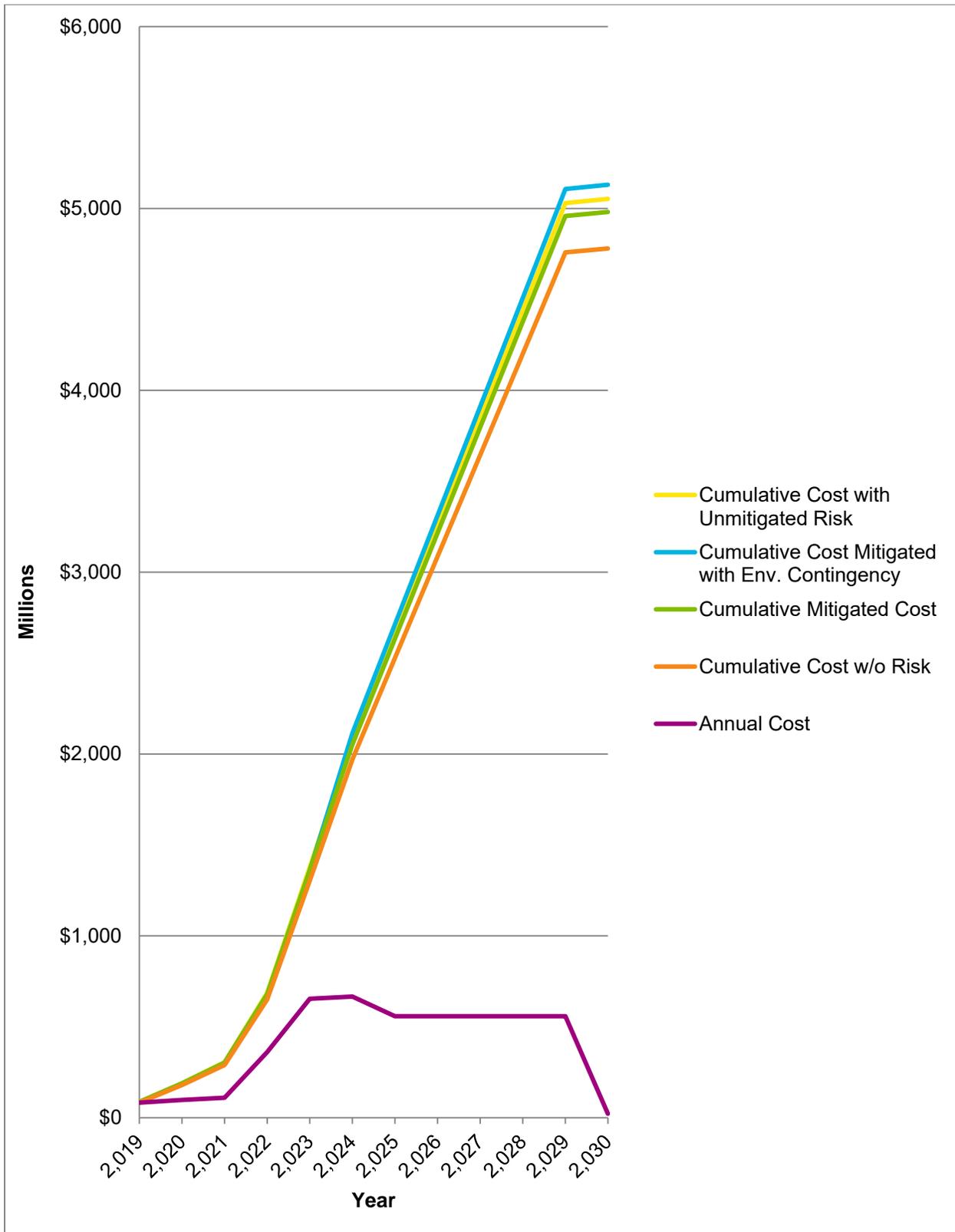


Table 6. Risk Reduction Actions

Risk Register #	Risk Description	Workplan WBS	Budget
1-001	Inadequate Authority staffing resources	10.1	\$8,783,000
1-002	Timely decision making – Authority agreement amendments		
1-003	Independent project consultant delays	10.421	\$1,750,000
1-004	Version control problems with key documents	11.0	
1-005	Consultant interface	10.111	\$3,423,000
2-001	Administration changes	14.000	\$630,000
2-002	public support	16.000	\$1,428,000
2-003	2030 deadline for public benefits – reduce schedule with alternative delivery	32.130	\$300,000
2-004	Interruption in State funding	Not included (requires further discussion)	
2-005	Interruption in Federal funding	Not included (requires further discussion)	
2-006	State funding could affect stakeholder participation	Mitigation in Phase 1	
2-007	Federal funding could affect stakeholder participation	Mitigation in Phase 1	
2-008	Reduced South-of-the-Delta participation	Mitigation in Phase 1	
2-009	Reduced Sacramento Valley participation	Mitigation in Phase 1	
3-001	Delivery strategy – schedule savings opportunity	32.130	\$300,000
3-002	Delivery strategy – owner procured equipment	32.130	\$300,000
3-003	Delivery strategy – State and Federal constraints	32.130	\$300,000
3-004	Unacceptably high bids	10.701?	Establish reserve in Phase 3?
3-005	Basis of award – best value versus low cost – causes delay	32.130	\$300,000
3-006	Delivery strategy – international contractors	32.130	\$300,000
4-003	Delayed approval of NEPA/CEQA document	25.100	\$3,025,000
4-004	Delay in implementing hydropower strategy	32.144	\$400,000
4-005	Project changes resulting from geotechnical investigation could impact finalizing the NEPA/CEQA document		-
4-006	Potential for unfavorable water rights conditions	28.240	\$4,500,000
4-007	Voluntary settlement schedule impact	Not included (requires further discussion)	
4-008	Voluntary settlement cost impacts	Not included (requires further discussion)	
4-009	Change in hydropower development Strategy	32.144	\$400,000

Risk Register #	Risk Description	Workplan WBS	Budget
4-010	Operational uncertainties		Phase 3
4-012	Interruption to golden eagle habitat	28.155	\$723,000
4-013	Interruption to giant garter snake habitat	28.150	\$6,100,000
4-014	New endangered species identified	28.150	\$6,100,000
4-015	Finding cultural resources could delay schedule		
4-016	Unanticipated impacts from ridge cut for east end of bridge	28.340	\$200,000
4-017	Requirement for emergency spillway by DSOD	28.250	\$3,185,000
4-018	Delay in DSOD approval	28.250	\$3,185,000
5-001	No local source of aggregate material	33.122	\$12,000,000
5-002	Variability in geologic conditions could increase the excavation for foundations	33.122	\$12,000,000
5-003	Encountering unexpected hazardous materials	28.105	\$1,000,000
5-004	Stability of the downstream I/O tunnel portal	33.122	\$12,000,000
5-005	Stability of the I/O tower	33.122	\$12,000,000
5-006	Stability of the tunnel during excavation	33.122	\$12,000,000
5-007	Potential need for additional isolation valves at the Sites PGP	32.230	\$19,200,000
5-008	Potential need for multiple I/O tunnels for O&M and permitting	32.230	\$19,200,000
5-009	Potential for east rim seepage	33.122	\$12,000,000
5-010	Potential for damage to Funks Creek from emergency release	32.230	\$19,200,000
5-011	Potential leakage of water from tunnel during operation	32.230	\$19,200,000
5-012	Difficulty in adequately treating the alkali springs in the north reservoir area	32.230	\$19,200,000
5-013	Additional excavation may be required for the Holthouse to Sites PGP canal	32.230	\$19,200,000
5-014	Changed conditions could increase requirements for bridge pier foundations	33.122	\$12,000,000
5-015	Final resolution of the bridge concerns	32.230	\$19,200,000
5-016	Protection of public safety and maintaining public roads during construction	32.230	\$19,200,000
6-001	Change in site seismicity would impact design	33.140	\$500,000
6-002	Potential need for betterment project to compensate for reservoir induced seismicity	32.230	\$19,200,000
6-003	Changed conditions could increase cost of dam foundations – use geotechnical investigation to manage risk	32.240	\$5,200,000

Risk Register #	Risk Description	Workplan WBS	Budget
6-004	Dam axis may not be in optimal location to minimize cost – use geotechnical investigation to optimize	32.230	\$19,200,000
6-005	Potential rock toppling issues – address through drilling and geologic mapping of rock outcrops	33.122	\$12,000,000
7-001	Inefficient coordination between contracts – develop bidding strategy and schedule to manage work interfaces	32.230	\$19,200,000
7-002	Contractor/consultant performance issues – rigorous pre-qualification	10.531	\$3,240,000
7-003	Accident or security issue during construction – implement safety by design	32.230	\$19,200,000
7-004	Financial instability of general contractors	10.531	\$3,240,000
7-005	Financial instability in the supply chain – identify alternative suppliers	10.531	\$3,240,000
7-006	Miscellaneous construction delays		Phase 3?
7-007	Availability of resources (equipment, labor) due to competition with other projects	32.250	\$7,800,000
7-008	Delays due to insufficient pipe fabrication – develop plan using multiple suppliers	32.230	\$19,200,000
9-001	Discharging water to the river may require studies	10.467	\$1,750,000
9-002	Agreements with SWP and CVP		
9-003	Utility connections	32.143	\$200,000
9-004	Need for currently undefined operations	32.141	\$455,000
9-005	Williamson Act Fee	28.220	\$300,000
9-006	Increased cost of operation	Defer to Phase 3/4	
9-007	Protection of SWP and CVP water rights		
9-008	Post-construction grouting to address reservoir seepage – create reserve	Defer to Phase 3	
10-001	Potential savings from relocation of Holthouse Reservoir	32.141	\$455,000
10-002	Additional pumping station required if Holthouse Reservoir is relocated	32.141	\$455,000
10-003	Lack of geotechnical investigation for Holthouse Reservoir	33.122	\$12,000,000
10-004	Potential need for a larger siphon connection for the TC Canal across Holthouse Reservoir	32.141	\$455,000
10-005	Delays due to conflict with high voltage lines	32.141	\$455,000
10-006	Increased cost of sediment handling in Funks	33.122	\$12,000,000
10-007	Potential impacts to adjacent alkaline wetland	10.467	\$2,750,000
11-001	High groundwater could increase reservoir footprint	33.123	\$3,000,000
11-002	Liner failure due to insufficient liner	32.230	\$19,200,000
11-003	TRR pump station foundation may be insufficient	33.123	\$3,000,000

Risk Register #	Risk Description	Workplan WBS	Budget
12-001	Potential requirement to add a third pipeline to convey water from the Delevan	32.141	\$455,000
12-002	Potential savings from open cut installation of Delevan pipeline at I-5	32.230	\$19,200,000
12-003	Competition with other projects for critical equipment (pumps, valves, etc.)	50.100	\$750,000
12-004	Improved topographic mapping could indicate higher costs	32.250	\$7,800,000
12-005	Limited geotechnical information along pipeline	33.123	\$3,000,000
12-006	Optimizing tunnel length for Colusa Basin Drain and I-5 crossings	32.230	\$19,200,000
12-007	Encountering unanticipated utilities	32.210	\$360,000
12-008	Excessive flooding during construction	37.610	Phase 3
13-001	Seasonal impacts to construction on the river	32.230	\$19,200,000
13-002	Changes in fish screen configuration	37.540 (Discussion in 32.230)	Phase 3
13-003	Potential need to relocate MID diversion	32.230	\$19,200,000
13-004	Intake and fish screen foundations	32.124	\$2,000,000
13-005	Upgrades for existing Sacramento River levees	37.530	Phase 3
13-006	Increasing flood elevation to 200 year protection	37.530	Phase 3
14-001	Constrained access for geotechnical and environmental investigations	45.0	\$100,000
14-002	Higher appraisal/acquisition costs for Sites Reservoir	43.1	\$216,000
14-003	Higher appraisal/acquisition costs for Holthouse and TRR	43.1	\$216,000
14-004	Higher appraisal/acquisition costs for Pipelines	43.1	\$216,000
14-005	Failure to acquire property for environmental mitigation in a timely manner could cause delays	43.1	\$216,000
14-006	Community betterments	10.461	\$550,000
15-001	Power for construction and operations	32.143	\$200,000
16-001	Insufficient definition of facility details	37	\$21,000,000
16-002	Insufficient allowances	32.250	\$7,800,000
16-003	Insufficient documentation and use of lump sum allowances	32.250	\$7,800,000
16-004	Underestimation of non-contract costs	32.250	\$7,800,000
16-005	Authority's lack of construction contract experience could result in higher bids	32.250	\$7,800,000
16-006	Project labor agreement and owner controlled insurance program	10.969	
16-007	Insufficient information to evaluate types of dams	32.230	\$19,200,000
16-008	Selection of pumping/generating equipment could result in cost increase	50.100	\$750,000

7. Service Area Budgets (Order of Magnitude)

The following budgets are included in the budget for service areas during Phase 2 (excludes Authority staff).

- Legal - \$3,720,000
- Integration - \$14,481,000
- Project Controls - \$2,520,000
- Operations - \$7,000,000
- Impact Analyses (EIR/S) - \$4,025,000
- Permitting - \$51,542,000
- Geotechnical Investigation - \$68,000,000 (some portion could go into the final design contracts)
- Preliminary Engineering - \$70,652,000
- Final Design - \$21,070,000 (could be incorporated into alternative delivery)
- Outreach - \$2,268,000
- Real Estate - \$316,000

Some of the above service areas will continue into Phases 3 and 4. Construction management services is an additional service area that will be added in Phase 3.