TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

Project Information

1. **Proposal Title:**

   TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

2. **Proposal applicants:**

   Peter Rabbon, California State Reclamation Board

3. **Corresponding Contact Person:**

   Peter Rabbon
   California State Reclamation Board
   1416 Ninth Street, Room 1601 Sacramento, CA 95814
   (916) 653-5434
   prabbon@water.ca.gov

4. **Project Keywords:**

   Flood Plain and Bypass Management
   Hydrodynamics
   Modeling

5. **Type of project:**

   Planning

6. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

7. **Topic Area**:

   Floodplains and Bypasses as Ecosystem Tools

8. **Type of applicant:**

   State Agency

9. **Location - GIS coordinates:**

Latitude: 38.545

Longitude: -121.614

Datum:

Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.

The targeted location of this proposal is the 59,000-acre Yolo Bypass, which is located in eastern Yolo and Solano Counties and lies in a general north to south direction extending from Fremont Weir downstream to Egbert Tract. Its leveed northern reach lies west of the Sacramento River and is bisected by Interstates 5 and 80. Its southern reach is bounded to the east by the Sacramento River Deep Water Ship Canal levee.

10. **Location - Ecozone:**

    10.1 Cache Creek, 10.2 Putah Creek, 10.3 Solano, 10.4 Willow Slough

11. **Location - County:**

    Solano, Yolo

12. **Location - City:**

    Does your project fall within a city jurisdiction?

    No

13. **Location - Tribal Lands:**

    Does your project fall on or adjacent to tribal lands?

    No

14. **Location - Congressional District:**

    3

15. **Location:**

    California State Senate District Number: 4

    California Assembly District Number: 8

16. **How many years of funding are you requesting?**

    3

17. **Requested Funds:**
    a) Are your overhead rates different depending on whether funds are state or federal?

No

If no, list single overhead rate and total requested funds:

Single Overhead Rate: 163 (Composite Overhead--see comments box)

Total Requested Funds: 635,382

b) Do you have cost share partners already identified?

No

c) Do you have potential cost share partners?

No

d) Are you specifically seeking non-federal cost share funds through this solicitation?

No

If the total non-federal cost share funds requested above does not match the total state funds requested in 17a, please explain the difference:

18. **Is this proposal for next-phase funding of an ongoing project funded by CALFED?**

No

Have you previously received funding from CALFED for other projects not listed above?

No

19. **Is this proposal for next-phase funding of an ongoing project funded by CVPIA?**

No

Have you previously received funding from CVPIA for other projects not listed above?

No

20. **Is this proposal for next-phase funding of an ongoing project funded by an entity other than CALFED or CVPIA?**

No

Please list suggested reviewers for your proposal. (optional)

21. **Comments:**

Question 17a: Composite Overhead Rate = DWR/Corps Indirect Costs divided by DWR/Corps Direct Labor Costs. Direct Labor Costs = Total Direct Costs less Services & Consultants and less Other Direct Costs. All benefits are accounted for in indirect costs. (Also see Form VI)

Environmental Compliance Checklist

TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

1. **CEQA or NEPA Compliance**
   a) Will this project require compliance with CEQA?

      No
   b) Will this project require compliance with NEPA?

      No
   c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

      This proposal will result in no state or federal dicretionary action that would be considered a project under CEQA or any action under NEPA.

2. **If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies).** *If not applicable, put "None".*

   CEQA Lead Agency:
   NEPA Lead Agency (or co-lead:)
   NEPA Co-Lead Agency (if applicable):

3. **Please check which type of CEQA/NEPA documentation is anticipated.**

   CEQA
   -Categorical Exemption
   -Negative Declaration or Mitigated Negative Declaration
   -EIR
   Xnone

   NEPA
   -Categorical Exclusion
   -Environmental Assessment/FONSI
   -EIS
   Xnone

   If you anticipate relying on either the Categorical Exemption or Categorical Exclusion for this project, please specifically identify the exemption and/or exclusion that you believe covers this project.

4. **CEQA/NEPA Process**
   a) Is the CEQA/NEPA process complete?

      Not Applicable

b) If the CEQA/NEPA document has been completed, please list document name(s):

5. **Environmental Permitting and Approvals** (*If a permit is not required, leave both Required? and Obtained? check boxes blank.*)

LOCAL PERMITS AND APPROVALS

Conditional use permit

Variance

Subdivision Map Act

Grading Permit

General Plan Amendment

Specific Plan Approval

Rezone

Williamson Act Contract Cancellation

Other

STATE PERMITS AND APPROVALS

Scientific Collecting Permit

CESA Compliance: 2081

CESA Compliance: NCCP

1601/03

CWA 401 certification

Coastal Development Permit

Reclamation Board Approval

Notification of DPC or BCDC

Other

FEDERAL PERMITS AND APPROVALS

ESA Compliance Section 7 Consultation

ESA Compliance Section 10 Permit

Rivers and Harbors Act

CWA 404

Other

PERMISSION TO ACCESS PROPERTY

Permission to access city, county or other local agency land.
Agency Name:

Permission to access state land.
Agency Name:

Permission to access federal land.
Agency Name:

Permission to access private land.
Landowner Name:

6. **Comments.**

No permits are required for this proposed project.

Land Use Checklist

TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

1. **Does the project involve land acquisition, either in fee or through a conservation easement?**

   No

2. **Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal?**

   Yes

3. **Do the actions in the proposal involve physical changes in the land use?**

   No

   If you answered no to #3, explain what type of actions are involved in the proposal (i.e., research only, planning only).

   This proposal involves the refinement and update of a two-dimensional hydraulic model that proponents of ecoystem restoration projects within the Yolo Bypass can use to evaluate the hydraulic impact of their proposed projects on the flood conveyance capacity of the system.

4. **Comments.**

   Question #2: Access across public or private property within the Yolo Bypass may be required for field check to support the development and refinement of the proposed model.

Conflict of Interest Checklist

TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

Please list below the full names and organizations of all individuals in the following categories:

- Applicants listed in the proposal who wrote the proposal, will be performing the tasks listed in the proposal or who will benefit financially if the proposal is funded.
- Subcontractors listed in the proposal who will perform some tasks listed in the proposal and will benefit financially if the proposal is funded.
- Individuals not listed in the proposal who helped with proposal development, for example by reviewing drafts, or by providing critical suggestions or ideas contained within the proposal.

The information provided on this form will be used to select appropriate and unbiased reviewers for your proposal.

Applicant(s):

Peter Rabbon, California State Reclamation Board

Subcontractor(s):

Are specific subcontractors identified in this proposal? No

Helped with proposal development:

Are there persons who helped with proposal development?

Yes

If yes, please list the name(s) and organization(s):

Mark Charlton U.S. Corps of Engineers, Sacramento District

Johnnie A. Mack U.S. Corps of Engineers, Sacramento District

John Carroll U.S. Corps of Engineers, Sacramento District

Gregory Kukas U.S. Corps of Engineers, Sacramento District

Stein Buer Department of Water Resources, Division of Flood Management

Steve Yae ger Department of Water Resources, Division of Flood Management

Comments:

Additional Names/Organization: 7. Ricardo Pineda-DWR DFM 8. Steve Gold-DWR DFM 9. Boone Lek-DWR DFM 10.Steve Bradley-California State Board of Reclamation

Budget Summary

TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

Please provide a detailed budget for each year of requested funds, indicating on the form whether the indirect costs are based on the Federal overhead rate, State overhead rate, or are independent of fund source.

Independent of Fund Source

Year 1												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
1	Project Coordination: Corps	200	5629				12000			17629.0	10258	27887.00
2	Topography Acquisition	44	1238					80000		81238.0	2257	83495.00
3	Model Development	60	1689				30000			31689.0	3077	34766.00
4	Model Calibration, Verification, and Optimization									0.0		0.00
5	Case Study Application									0.0		0.00
6	Documentation and Production	20	563				10000			10563.0	1026	11589.00
7	Quality Control	100	2814				5000			7814.0	5129	12943.00
8	Revisions and Release									0.0		0.00
9	Project Management and Oversight: DWR	250	7345							7345.0	9255	16600.00
10	Public Outreach: YBF*						3000			3000.0		3000.00
11	Workbook Development									0.0		0.00
		674	19278.00	0.00	0.00	0.00	60000.00	80000.00	0.00	159278.00	31002.00	190280.00

Year 2												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
1	Project Coordination: Corps	150	4222							4222.0	7693	11915.00
2	Topography Acquisition									0.0		0.00
3	Model Development	20	563				23000			23563.0	1026	24589.00
4	Model Calibration, Verification, and Optimization	120	3377				95000			98377.0	6155	104532.00
5	Case Study Application									0.0		0.00
6	Documentation and Production	40	1126				20000			21126.0	2052	23178.00
7	Quality Control	100	2814				5000			7814.0	5129	12943.00
8	Revisions and Release									0.0		0.00
9	Project Management and Oversight: DWR	250	7345							7345.0	9255	16600.00
10	Public Outreach: YBF*						3500			3500.0		3500.00
11	Workbook Development									0.0		0.00
		680	19447.00	0.00	0.00	0.00	146500.00	0.00	0.00	165947.00	31310.00	197257.00

Year 3												
Task No.	**Task Description**	**Direct Labor Hours**	**Salary *(per year)***	**Benefits *(per year)***	**Travel**	**Supplies & Expendables**	**Services or Consultants**	**Equipment**	**Other Direct Costs**	**Total Direct Costs**	**Indirect Costs**	**Total Cost**
1	Project Coordination: Corps	200	5629							5629.0	10258	15887.00
2	Topography Acquisition									0.0		0.00
3	Model Development	44	1238							1238.0	2257	3495.00
4	Model Calibration, Verification, and Optimization									0.0		0.00
5	Case Study Application	120	3377				100000			103377.0	6155	109532.00
6	Documentation and Production	60	1689				30000			31689.0	3077	34766.00
7	Quality Control	200	5629				5000			10629.0	10258	20887.00
8	Revisions and Release	40	1126				15000			16126.0	2052	18178.00
9	Project Management and Oversight: DWR	250	7345							7345.0	9255	16600.00
10	Public Outreach: YBF*						3500			3500.0		3500.00
11	Workbook Development						25000			25000.0		25000.00
		914	26033.00	0.00	0.00	0.00	178500.00	0.00	0.00	204533.00	43312.00	247845.00

Grand Total=635382.00

Comments.

NOTES: -Corps Salary: GS 12 04 Hourly Salary = $28.14 -DWR Salary: Range D Avg Hourly Salary = $29.38 -Benefits: All Benefits Accounted For In Indirect Costs -Indirect Costs: Direct Labor Hours x Hourly Overhead Rate -Corps Hourly Overhead Rate: Corps Engineering Division Overhead Multiplier x Indirect Cost Multiplier x Salary = $51.29 -DWR Hourly Overhead Rate: State Combined Benefits and Indirect Costs = $37.02 *The Yolo Basin Foundation to provide meeting facilities and conduct

public outreach for the model.

Budget Justification

TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

Direct Labor Hours. Provide estimated hours proposed for each individual.

Corps Staff(GS-12-04): 1518 Hours DWR Staff(Avg Range D): 750 Hours

Salary. Provide estimated rate of compensation proposed for each individual.

Corps Staff(GS-12-04) Hourly Salary: $28.14 DWR Staff(Avg Range D) Hourly Salary: $29.38

Benefits. Provide the overall benefit rate applicable to each category of employee proposed in the project.

Benefits are accounted for in indirect costs.

Travel. Provide purpose and estimate costs for all non-local travel.

Non-local travel not needed.

Supplies & Expendables. Indicate separately the amounts proposed for office, laboratory, computing, and field supplies.

Purchase of supplies and expendables not needed.

Services or Consultants. Identify the specific tasks for which these services would be used. Estimate amount of time required and the hourly or daily rate.

Total Services or Consultants: 1. Model Development-$53,000 2. Model Calibration, Verification, and Optimization-$95,000 3. Case Study Application-$100,000 4. Documentation-$60,000 5. Quality Control-$15,000 6. Model Revision and Release-$15,000 7. Technical Workbook Development-$25,000

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than $5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items.

Acquisition of new equipment, costing more than $5,000 per unit, is not expected.

Project Management. Describe the specific costs associated with insuring accomplishment of a specific project, such as inspection of work in progress, validation of costs, report preparation, giving presentatons, reponse to project specific questions and necessary costs directly associated with specific project oversight.

Project Management costs are factored in with the direct labor costs.

Other Direct Costs. Provide any other direct costs not already covered.

Acquisition of new topographic data-$80,000

Indirect Costs. Explain what is encompassed in the overhead rate (indirect costs). Overhead should include costs associated with general office requirements such as rent, phones, furniture, general office staff, etc., generally distributed by a predetermined percentage (or surcharge) of specific costs.

-Indirect Costs: Direct Labor Hours x Hourly Overhead Rate -Corps Hourly Overhead Rate: Corps Engineering Division Overhead Multiplier x Indirect Cost Multiplier x Salary = $51.29 -DWR Hourly Overhead Rate: State Combined Benefits and Indirect Costs = $37.02

Executive Summary

TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

EXECUTIVE SUMMARY Project Title: Two-Dimensional Detailed Hydraulic Model For Determining Flood Conveyance Impacts of Ecosystem Restoration Projects in the Yolo Bypass Amount Requested: $635,382 Geographic Location: The targeted location of this proposal is the 59,000-acre Yolo Bypass (Bypass) located in CALFED ERP Sacramento Region and Ecozone 10 (Yolo Basin). Project Type: This proposal is for the development of a computer model dedicated specifically for the Bypass. Project Objective: The objective of this proposal is to produce a computer model with the capability to analyze the hydraulic impact of any future projects on existing designed conditions in and upstream the Bypass. The model will provide ecosystem restoration or other project proponents and the California State Reclamation Board (the Board) with a tool to effectively evaluate the hydraulic impacts due to a proposed project in the Bypass. As the regulating agency, the Board requires applicants to provide a hydraulic analysis of any proposed restoration or any land-use modification project, which demonstrates that the proposal does not adversely impact the flood conveyance capacity. Additionally, a User Manual and technical workbook will also be developed to provide guidelines for application of the proposed model. Approach: The finalization of the proposed model will require: 1) acquisition of more accurate and best available geometry data, 2) calibration, verification, and optimization using past flood data, 3) application of case studies, and 4) documentation with the Users Manual and technical workbook. Department of Water Resources and Board staff will coordinate and manage the project, while U.S. Army Corps of Engineers (Corps) staff and private contractors perform the technical work. Expected Outcome: This project is expected to produce: 1) an end-user hydraulic model developed specifically for the Bypass, 2) a User Manual that includes documentation of case studies, and 3) a technical workbook to provide model usage guidelines. Relationship to CALFED ERP and/or CVPIA Goals: This project will support the Yolo Bypass Management Strategy, a CALFED ERP funded project. The proposed model will augment future ecosystem restoration projects, resulting from the Management Strategy or other sources, by providing a tool to effectively analyze and evaluate flood conveyance impacts of post-project conditions on pre-project conditions.

Proposal

California State Reclamation Board

TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

Peter Rabbon, California State Reclamation Board

TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

A. Project Description: Project Goals and Scope of Work

1. Background

The Yolo Bypass: The Yolo Bypass (Bypass) is a leveed floodplain covering an area of approximately 59,000 acres and located in eastern Yolo and Solano Counties (Figure 1). It lies in a general north to south orientation and spans approximately 43 miles from Fremont Weir downstream to Egbert Tract. As an integral part of the Sacramento River Flood Control Project (SRFCP), the primary purpose of the Bypass is to contain floodwaters between its levees and provide flood protection for the nearby Cities of Sacramento, West Sacramento, Davis, and Woodland. The Bypass was designed to divert primary floodwaters out of the Sacramento and American Rivers via the Fremont and Sacramento Weirs, respectively, and channel the flows pass Interstates 5 and 80 and down to the Delta. The Bypass also accepts secondary floodwater contributions from Cache Creek, Willow Slough Bypass, Putah Creek, and Knight's Landing Ridge Cut. During design conditions, 343,000 cubic feet per second (cfs) passes over the Fremont Weir. The Sacramento Weir is design to divert another 112,000 cfs into the Yolo Bypass. The Bypass design discharge is 480,000 cfs downstream of Interstate 80 crossing and 490,000 cfs downstream of the Putah Creek tributary.

To implement the SRFCP, flowage easements were purchased on lands in the Bypass and levees were constructed in the northern reaches to contain the flow. The California State Reclamation Board (the Board) was given the responsibility of ensuring that the flood conveyance capacity of the Bypass remains sufficient to pass the flood flows of the system and that the flood control system continues to operate as originally designed. Consequently, the Board regulates land use in the Bypass and requires proposal applicants for land use modification, such as ecosystem restoration projects, to obtain a permit or enter into an agreement with the Board. Applicants for a Board permit are required to provide a hydraulic model result, which demonstrates that the proposal does not adversely impact flood conveyance capacity. Proposals in the Bypass are hampered by the lack of a detailed hydraulic model to evaluate this very complex system.

RMA-2 Model: RMA-2 is a two-dimensional depth averaged finite element hydrodynamic numerical model. It computes water surface elevations and horizontal velocity components for subcritical, free-surface flow in two-dimensional flow fields. One-dimensional hydraulic models rely on composite cross-section conveyance and produce a single water surface elevation result per cross-section. In contrast, RMA-2 explicitly addresses laterally varying roughness conditions and produces laterally varying water surfaces. RMA-2 provides greater resolution of computed water surfaces and therefore allows more accurate determinations of water surface impacts. This benefits both restoration proponents and the Board.

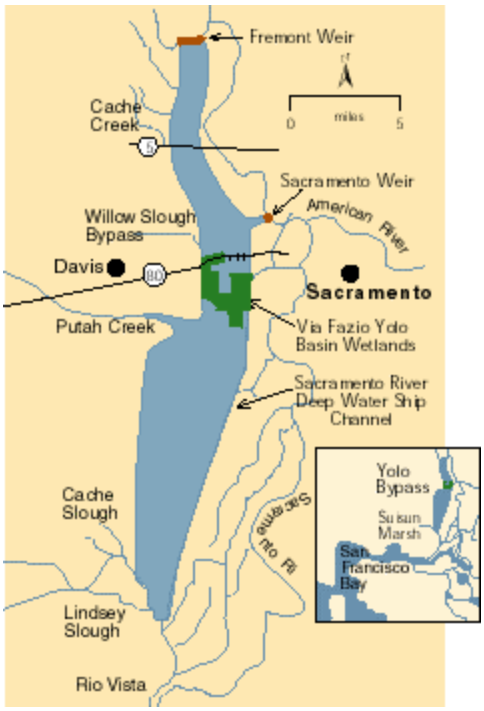

Figure 1. The Yolo Bypass (Courtesy of www.calacademy.org/calwild/fall99/flood.htm)

RMA-2 is supported by the pre- and post-processing program SMS, or Surface-water Modeling System. SMS is an intuitive, graphically based platform for developing RMA-2 input files and viewing RMA-2 solutions. SMS supports raster image backgrounds and allows users to import digital drafting drawings, facilitating both model development and interpretation of results.

2. Problem

The Yolo Bypass is a substantial ecosystem restoration opportunity. However, its primary flood control purpose requires strict regulation of land use changes to avoid flood conveyance impacts. Restoration project proponents must demonstrate negligible impact to flood stages before they are issued a necessary permit. This requirement usually dictates that a hydraulic impact modeling effort be performed, at the project sponsor's expense. The modeling effort cost often overwhelms project planning, design and sometimes even construction budgets, rendering the potential restoration project unfeasible.

A hydraulic impact assessment requires that all physical and hydraulic boundary conditions be accurately represented or accounted for. This basic requirement usually dictates that an area well beyond the physical boundaries of a proposed restoration project be modeled. Additionally, an existing conditions definition, from which impacts are measured, is also required. These requirements represent a substantial burden on restoration proponents. Available hydraulic models that satisfy these requirements are limited by the precision and accuracy of their results and/or their usability.

In 1995, the U.S. Army Corps of Engineers (Corps) successfully developed and utilized an RMA-2 model to determine the hydraulics impacts of the proposed Yolo Basin Wetlands Project. A plan to create a comprehensive Yolo Bypass Model (the model) by expanding coverage of the Yolo Basin project model to cover the entire Yolo Bypass was enacted shortly thereafter. The purpose of the model was to facilitate evaluation of potential hydraulic impacts associated with proposed environmental restoration projects and/or proposed land use modifications in the Yolo Bypass. Due to diminished interest, limited funding availability, insufficient computing capacity, and other unforeseen circumstances, the model was not fully developed. Additionally, superior topographic data are currently available to support significantly improved model accuracy. The lessons learned from the previous effort and the substantially faster run-times afforded by current computer processor capabilities assure the feasibility of the proposed model effort. Also, planned activities such as extensive reliability testing and case study application ensure that the resulting product will maximize end-user operability.

3. Objective

The model will provide the Board and restoration proponents with a common tool to effectively evaluate the hydraulic impacts to flood conveyance capacity of the Yolo Bypass. The objective of this proposal is to refine and update the existing model, which was initially developed by the Corps in 1995. The goal is to update the model based on newly available topography and produce a product with improved end-user operability. Additionally, the User's Manual will also be revised and updated once the model is finalized. Furthermore, a technical workbook will be developed to provide permit applicants with a guideline for model usage. This workbook will assist applicants to assess whether the proposed model is applicable or whether alternative or more simplified models will be adequate to analyze the impacts of their proposed ecosystem restoration or other projects.

4. Justification

The model allows a more precise definition of the flood conveyance impact by land use and bypass configuration modification proposals within the Yolo Bypass than other available hydraulic models. The model's utility is limited to flood-level flow simulations, and currently requires a substantial modeling effort performed by a relatively sophisticated modeler. This model is intended to be a comparative, impact assessment tool to compare pre and post flood stages of a project and is not intended as a stand-alone tool for designing top of levee profiles. It is expected that most users of the model will be focusing on a relatively small area within the total model boundary.

Along with other future projects, the proposed model will support the CALFED ERP funded Yolo Bypass Management Strategy (Management Strategy), which was finalized in August 2001 by the Yolo Basin Foundation (YBF). This project will provide an essential tool for future restoration project proposal with the Bypass. The proposed model can be utilized to aid in the complex hydraulic impact analyses of future restoration or land use modification projects proposed as part of CALFED or other programs. The model can also be used to analyze alternative measures to mitigate for the impact caused by the proposed project. Due to the complexity of the hydraulics

within the Bypass, the applicability of the proposed model will be key for obtaining a permit from the Board.

5. Approach

Coordination between DWR, the Board, the Corps, and others will be carried out during the project. The Board will oversee the project, DWR will manage and coordinate the project, and the Corps and private contractors will perform the technical work. The Corps was involved in the development of the existing model for the Yolo Bypass. With its history and experience in hydraulic modeling, the Corps has the most expertise to perform the technical work for this project. For additional expertise, contractors will be determined and hired once funding is established. Contractor personnel will perform a substantial portion of the model finalization and documentation effort. An approach whereby contractor personnel are co-located in the Corps Engineering Division offices will facilitate required flexibility and oversight.

The work plan outlined below is based on the Corps' current assessment of the functional requirements of developing the model and resultant limitations and impacts on model usage. Ultimately, all efforts to improve end-user model operability will be included to the extent feasible.

Work plan phases are described below.

Phase 1: Coordination. The objective of the coordination phase is to achieve consensus on feasible model usage based on consideration of the Board permit requirements, end-user needs and operability, and inherent model limitations. An understanding of potential and feasible model usage is of primary importance in identifying both the model and User's Manual requirements. Coordination between the Reclamation Board and its permit review/approval staff, the Sacramento and San Joaquin River Basins Comprehensive Study (Comp Study), CALFED, and the Yolo Bypass Hydraulic Modeling Technical Advisory Committee (YBHMTAC) will be carried out.

Phase 2: Acquisition of Topography. Existing digital topographic data will be used as a basis for most of the model geometry. Topography data recently acquired in support of the Comp Study will serve as the basis for updating model geometry. The Comp Study data has a contour interval of 2 feet (=1 foot vertical accuracy), far surpassing the accuracy of previously used data. It is anticipated that additional topography will be acquired in select locations where existing topography is of limited accuracy (i.e. USGS Quadrangle sheet source) or of insufficient precision (i.e. at height-restricted levees and other relevant features). The primary location where additional data is required is in the vicinity of the Vic Fazio Yolo Wildlife Area, just south of the Interstate 80 causeway. In this location, existing topography data does not account for project-related modifications.

Phase 3: Model Development. Model geometry will be updated based on the best available source data, including that acquired directly for this effort. Computer Aided Design and Drafting (CADD) technology will be used extensively to update and refine the model geometry. Optimal CADD methodology will be determined and documented

for inclusion in the User's Manual. Optimal element size and configuration parameters will be identified and utilized.

Phase 4: Calibration, Verification and Optimization. This phase features a sizable modeling effort to ensure both acceptable accuracy of computed baseline conditions and functional reliability of the model. Model calibration will rely on both measured data from the 1986 flood event, as well as synthetic data from the Comp Study UNET model simulations. Calibration will be performed in a sub-mesh fashion rather than on the entire mesh. The model will also be verified by comparing computed results against measured 1997 flood data. The resolution of surface roughness definitions (i.e. 'n' values) will be limited to a somewhat large (i.e. regional) scale. A land-use GIS database would support improved and updated roughness definition and therefore improved baseline condition accuracy as a result. Use of a land-use GIS database will be investigated and implemented if determined feasible. Extensive troubleshooting and refinement efforts will be implemented in order to accomplish calibration and ensure functional reliability for the end-user. Sensitivity analyses are proposed to determine standard model usage parameters including, but not limited to, minimum mesh coverage, optimum boundary condition locations, and optimum momentum exchange coefficients.

Phase 5: Case Study Application. Application of the proposed model will be demonstrated on a real or fictional case study. A proposed restoration project will be modeled. Its conveyance impacts will be measured by comparing proposed project condition model results against baseline conditions model results. A step-by-step procedure will be followed based on Board permit requirements. The case study will provide a useful example for restoration project proponents. The case study will be documented in the User's Manual.

It is proposed that the Glide Properties be used as an initial case study for the model. Glide Properties, collectively named for the Causeway, Geiberson, Los Rios and Tule ranches, covers more than 12,000 acres of land in the Yolo Bypass (Figure 2). The State of California Wildlife Conservancy Board is purchasing Glide Properties on behalf of the State of California Department of Fish and Game. Escrow is expected to close in November 2001. It is anticipated that habitat restoration and preservation opportunities are likely to result from this land acquisition.

Phase 6: Documentation and Production. Documentation will include a Corps Office Report describing the overall effort and the User's Manual. A CD-ROM will be produced containing the User's Manual, the model, and associated supplementary items. Items to be provided with the model and manual include but are not limited to:

- Boundary condition files and index.
- Topographic base of the model.
- Digital aerial photographic images of the bypass.

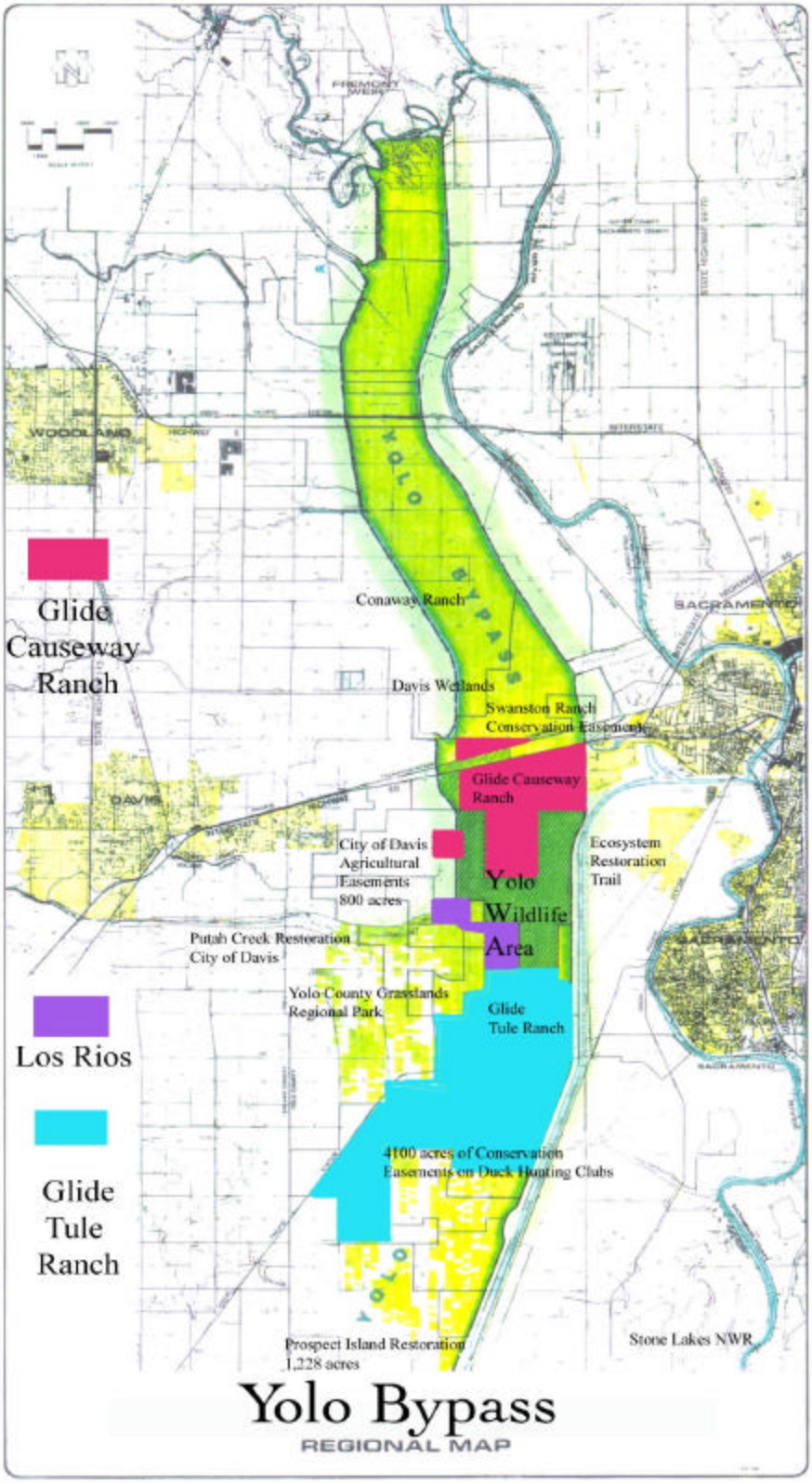

Figure 2. Glide Properties with approximate boundaries.
(Courtesy of the Department of Fish and Game)

Phase 7: Quality Control. Quality Control (QC) and Quality Assurance (QA) activities will include seamless, peer and final Independent Technical Review performed by Corps personnel or contractors. Extensive review by DWR, the Board, the YBHMTAC, and other involved and interested parties is also anticipated. QC participation by the Corps' Waterways Experiment Station, which currently provides technical support to users of RMA-2, will be investigated and implemented. QC/QA will be discussed during the initial coordination phase.

Phase 8: Revisions and Release. This phase features the revision of the model and manual and release of the CD-ROM.

Phase 9: Technical Workbook. A technical workbook will be developed to provide a protocol for usage of the proposed model. This workbook will provide a guideline that will specify when it is applicable to use the proposed model and when alternative or more simplified model will be sufficient. Additionally, the workbook will outline the Board permit process and data requirements for the model. Details of model administration and maintenance will also be addressed in the workbook. Once determined, other essential guidelines will also be added to the workbook.

6. Feasibility

This proposed project is feasible in that it does not rely on contingencies or external requirements. A working model has been prepared in the past and only needs the described effort and required funding to provide a more accurate and usable product. Model refinement and updating are needed in order to achieve a functional and reliable end-user product with improved operability.

The model resulting from this project is expected to provide a win-win situation for all interested parties. Ecosystem restoration proponents will have a tool to efficiently and effectively model the hydraulic impacts of proposed projects in the Bypass. Alternative scenarios can also be modeled to mitigate the impacts predicted by the model. On the other hand, the Board will have the same tool to evaluate and analyze applicants' hydraulic impacts on the flood conveyance capacity of the Bypass. Coupled with guidelines from the workbook, the proposed model should help enhance the hydraulic modeling process of future projects, thus leading to approvals and establishments of ecosystem restoration areas within the Yolo Bypass.

7. Data Handling and Storage

The finalized model, its User's Manual, and the technical workbook will be burned on a CD-ROM, which will include documentation of case studies.

It is currently proposed that the Corps maintain and update the model; provide review of results for major projects and provide some limited technical support to end-users.

8. Expected Product/Outcomes

The expected product is a baseline Yolo Bypass RMA-2 Hydraulic Model of the existing conditions. The model will be accompanied by a User's Manual and a technical workbook that will provide guidelines for usage of the model.

9. Work Schedule

As shown on Table 1, the proposed project is scheduled to start in October 2002. Work and products of this proposed project is expected to be completed by September 2005.

Table 1. Proposed Work Schedule

ID	Task Name	October 1, 2002	November 1, 2002	December 1, 2002	January 1, 2003	February 1, 2003	March 1, 2003	April 1, 2003	May 1, 2003	June 1, 2003	July 1, 2003	August 1, 2003	September 1, 2003	October 1, 2003	November 1, 2003	December 1, 2003	January 1, 2004	February 1, 2004	March 1, 2004	April 1, 2004	May 1, 2004	June 1, 2004	July 1, 2004	August 1, 2004	September 1, 2004	October 1, 2004	November 1, 2004	December 1, 2004	January 1, 2005	February 1, 2005	March 1, 2005	April 1, 2005	May 1, 2005	June 1, 2005	July 1, 2005	August 1, 2005	September 1, 2005
1	Project Coordination and Management																																			
2	Acquisition of Topography																																			
3	Development of Model																																			
4	Model Calibration, Verification, and Optimization																																			
5	Case Study Application																																			
6	Documentation and Production																																			
7	Quality Control																																			
8	Revisions and Release																																			
9	Development of Technical Workbook																																			

B. Applicability to CALFED ERP and Science Program Goals and Implementation Plan and CVPIA Priorities

1. ERP Priorities and Goals

This proposal addresses the CALFED Ecosystem Restoration Program (ERP) priorities for the Sacramento Region, specifically the Yolo Bypass. All species of fish and wildlife that are part of the Bypass ecosystem are encompassed by this proposal. Therefore, all future CALFED related projects within the Bypass tie in to and can potentially benefit from having the proposed model. The model will provide a tool to effectively analyze the complex hydraulic impacts posed by future ecosystem restoration projects in the Bypass. Once this analysis show insignificant impact to the existing flood conveyance capacity, the Board can issue its permit for the proposed project. As a result, future projects, such as habitat restoration, can be implemented, thus helping to attain goals prioritized in the Draft Stage 1 Implementation Plan.

2. Relationship to Other Ecosystem Restoration Projects

This proposal will support the hydraulic modeling portion of the Management Strategy, a CALFED ERP funded project. Any fish and wildlife habitat restoration projects, resulting from the Management Strategy or other sources, will likely require the capability of the proposed model for analyzing the project impact on the flood conveyance capacity of the Yolo Bypass. Having an existing and a functional end-user model is more crucial for smaller scale projects with limited budget for hydraulic modeling. Therefore, the CALFED Bay-Delta Program potentially will benefit greatly from the applicability of the proposed model.

C. Qualifications

This project team will be composed of staff from the Corps, DWR, the Board, and private contractors. The team has in depth knowledge and experiences with hydraulic modeling and program coordination and management, including CALFED Bay-Delta Programs.

Summary of Qualification for Key Participants

Peter D. Rabbon. Since becoming General Manager of the Board in 1997, Mr. Rabbon has overseen issues regarding flood control issues throughout the Central Valley. Prior to being General Manager, Mr. Rabbon was Program Manager to the Board for 7 years. Mr. Rabbon's recent assignments include Construction Project Engineer for the $470 million Coastal Branch II project in San Luis Obispo and Santa Barbara Counties. Prior to that, he worked almost 10 years in DWR's Division of Flood Management. Mr. Rabbon received his Bachelor of Science and Master of Science degrees from U.C. Davis and is a practicing Professional Civil Engineer (P.E) registered in California, Nevada, and Oregon.

Stein Buer. As Chief of DWR's Division of Flood Management (DFM), Stein has an extensive management experience. In 1988, Stein began managing the North Delta Program for DWR. During the next 8 years, Stein directed the completion of a draft

EIR/EIS for the North Delta Program, conducted the Georgiana Slough Temporary Barrier Program, directed a wide range of technical studies, and managed the acquisition of Delta lands for various project purposes. Stein has served as Chief of the Technical Services Branch for the CALFED Bay-Delta Program and was responsibility for CALFED's engineering and hydrologic studies. While with CALFED, he also served as Assistant Director and Program Implementation Coordinator. Stein holds a Bachelor of Science degree in Zoology and a Master of Science in Civil Engineering from U.C. Davis.

Steve Yaeger. Steve recently rejoined DWR, returning to DFM to assume the duties as the State Study Manager for the Comp Study. During his last assignment in the Executive Division, he served as Deputy Director for the CAL-FED Bay-Delta Program after serving as Deputy Director for BDOC—the predecessor to CALFED. Steve initially joined DWR after 15 years working in local agencies and with private consulting firms—focusing on local water and flood control issues. Steve has served in various capacities in the Divisions of Planning and Flood Management, working on the State Water Project and the American River Flood Control Program.

Johnnie A. Mack. As Chief of the Civil Design Branch for the Sacramento District, U.S. Army Corps of Engineers, Mr. Mack provides direction and oversight for technical analyses, studies and designs which support the District's Water Resources Development Mission in California and all or portions of 7 other western states. All Hydrologic, Hydraulic, and Water Management functions accomplished by Sacramento District are performed by personnel within his Branch. Mr. Mack has over 30 years of varied experience in the planning, design, project management, and construction of a wide range of water resource development and flood control projects in California. His experience includes 5 years as a journeyman and senior Hydraulic Engineer utilizing numerical models to support analyses and designs. Mr. Mack received his Bachelor of Science degree in Civil Engineering from California State University at Sacramento in 1970. He has been a registered P.E. in California since 1972.

John Carroll. John is a registered P.E. with 9 years of experience with the Corps in hydraulic model development and analysis. John served as principal hydraulic designer for a variety of flood control and environmental restoration projects in Florida, the Everglades, and Puerto Rico. John has 11 years of experience coordinating Corps design study efforts with interdisciplinary technical teams, other government agencies, and private firms for hydrologically complex federal water resource projects. John received a Bachelor of Science degree in Civil Engineering from the University of Southern California in 1980, and a Master of Science in Civil Engineering from Colorado State University in 1995. He received his P.E. certification in 1992.

Gregory Kukas. Greg is a registered P.E. with over 7 years of experience with the Corps in hydraulic modeling development and analysis. Greg has performed numerous one- and two-dimensional hydraulic modeling simulations, including RMA-2 modeling of the Napa River flood control and restoration project that is currently under construction. Additionally, Greg has worked on previous Yolo Bypass RMA-2 modeling efforts and has benefited from many of the lessons learned therein. His previous experience also includes hydraulic (flood conveyance) impact assessments of proposed riparian restoration projects and hydraulic analyses and designs in support of stream corridor

restoration projects. Greg also has extensive experience in developing and managing contracts for hydrologic, geomorphologic, and hydraulic analyses performed by consultants. Greg has represented the Corps at meetings of the Yolo Bypass Hydraulic Modeling Technical Advisory Committee and also in meetings with the US Fish and Wildlife Service on their planned North Delta National Wildlife Refuge. Greg received his Bachelor of Science degree in Civil Engineering from Cal Poly in San Luis Obispo, California, in 1994, and received his P.E. certification in 1999.

Ricardo S. Pineda. Ricardo is Chief of DWR's Floodplain Management Branch. Part of his management responsibilities includes DWR's Floodway Protection and Floodway Enforcement Sections, which are responsible for the Board permitting and enforcement processes. Mr. Pineda has over 21 years of experience with DWR, including 7 years as a water resources systems modeler, 8 years in flood forecasting, hydrologic and hydraulic studies, and as project engineer and manager on the planning, design and construction of flood control projects jointly sponsored by the State of California and the Corps, and 5 years as Chief Engineer to the Board. Ricardo has a Bachelor of Science degree in Civil Engineering from Santa Clara University 1980 and Master of Science in Civil Engineering from California State University Sacramento 1986. He has been a registered P.E. since 1983.

Steve Bradley. As Chief Engineer to the Board, Steve is responsible for ensuring the safety and reliability of flood control systems, including the Yolo Bypass, regulated by the Board. Steve oversees the analyses and evaluations of Board permit applications. Steve has more than 20 years of varied experience in water resources engineering and flood control in California. His experience includes 10 years as a senior water resources engineer and project manager with Boyle Engineering Corporation, 9 years as a hydraulic engineer with the U.S. Bureau of Reclamation, and 1 year as a design engineer with the U.S. Fish and Wildlife Service. Steve received his Bachelor of Science degree in Civil Engineering from the University of Colorado in 1978 and is a registered P.E. in California.

Steve Gold. As Chief of DFM's Floodway Enforcement Section, Steve currently manages floodway enforcement actions against illegal encroachments into regulated floodways under the Board jurisdiction. His previous hydraulic experience includes 5 years supervising production of over 75 state highway bridge hydraulic design reports and 2 years floodplain analysis for the Board's Designated Floodway Program. Steve received his Bachelor of Science and Master of Science degrees from U.C. Berkeley and has been a registered Professional Civil Engineer since 1981.

Boone Lek. Boone recently joined DFM's Floodplain Mapping and Technical Services Section. His current responsibilities mainly include conducting floodplain mapping studies related to the Board's Designated Floodway Program and the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP). Boone also participates in providing technical assistance to the proposed Governor's Floodplain Management Task Force as a limited-term assignment. Previously, Boone worked for DWR's San Joaquin District and spent 3 years developing floodplain mapping studies for FEMA's NFIP. Boone holds a Bachelor of Science degree in Civil Engineering from U.C. Davis.

D. Cost

The total budget for the proposed project is $635,382. A detailed budget breakdown of the estimated cost is shown on Table 2. This budget information was also submitted in Forms VI and VII via the web.

No cost sharing agreement with other agencies or entities was procured for this proposal. If approved, the project is expected to be funded by the CALFED Ecosystem Restoration Program, CALFED Science Program, or Central Valley Project Improvement Act.

E. Local Involvement

Coordination with local organizations such as the YBF, YBHMTAC, and Yolo Basin Working Group is anticipated in order to optimize feedback and support for this project. Funding requested for this proposal including money for the YBF to conduct public outreach regarding application and promotion of the proposed model.

F. Compliance with Standard Terms and Conditions

This proposal requests that funding be paid up front preferably on an annual basis. Federal law has an anti-deficiency clause stipulating that funds be secured in an account prior to work performed by the Corps. Otherwise, participants will comply with the rest of the standard State and Federal contract terms as described in Attachment D and E of the Ecosystem Restoration Program 2002 Proposal Solicitation Package.

Table 2a. Cost Estimate: Year 1 (Oct 2002 to Oct 2003)

	Task	Direct Labor Hours	Salary	Benefits	Travel	Supplies & Expenditures	Services or Consultants	Equip.	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Costs
1	Project Coordination: Corps	200	$28.14				$12,000			$17,629	$10,258	$27,887
2	Topography Acquisition	44	$28.14						$80,000	$81,238	$2,257	$83,495
3	Model Development	60	$28.14				$30,000			$31,689	$3,077	$34,766
4	Model Calibration, Verification, and Optimization		$28.14									$0
5	Case Study Application		$28.14									$0
6	Documentation and Production	20	$28.14				$10,000			$10,563	$1,026	$11,589
7	Quality Control	100	$28.14				$5,000			$7,814	$5,129	$12,943
8	Revisions and Release		$28.14									$0
9	Project Management and Oversight: DWR	250	$29.38							$7,345	$9,255	$16,600
10	Public Outreach: YBF*						$3,000			$3,000		$3,000
11	Workbook Development											$0
	Total	674					$60,000		$80,000	$159,278	$31,002	$190,280

Notes:		
Corps Salary:	GS 12 04 Hourly Salary	$28.14
DWR Salary:	Range D Avg Hourly Salary	$29.38
Benefits:	All Benefits Accounted For In Indirect Costs	
Indirect Costs:	Direct Labor Hours x Hourly Overhead Rate	
Corps Hourly Overhead Rate:	Corps Engineering Division Overhead Multiplier x Indirect Cost Multiplier x Salary	$51.29
DWR Hourly Overhead Rate:	State Combined Benefits and Indirect Costs	$37.02

*The Yolo Basin Foundation to provide meeting facilities and conduct public outreach for the model.

Table 2b. Cost Estimate: Year 2 (Oct 2003 to Oct 2004)

	Task	Direct Labor Hours	Salary	Benefits	Travel	Supplies & Expenditures	Services or Consultants	Equip.	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Costs
1	Project Coordination: Corps	150	$28.14							$4,222	$7,693	$11,915
2	Topography Acquisition		$28.14									$0
3	Model Development	20	$28.14				$23,000			$23,563	$1,026	$24,589
4	Model Calibration, Verification, and Optimization	120	$28.14				$95,000			$98,377	$6,155	$104,532
5	Case Study Application		$28.14									$0
6	Documentation and Production	40	$28.14				$20,000			$21,126	$2,052	$23,178
7	Quality Control	100	$28.14				$5,000			$7,814	$5,129	$12,943
8	Revisions and Release		$28.14									$0
9	Project Management and Oversight: DWR	250	$29.38							$7,345	$9,255	$16,600
10	Public Outreach: YBF*						$3,500			$3,500		$3,500
11	Workbook Development											$0
	Total	680					$146,500			$165,947	$31,310	$197,257

Notes:		
Corps Salary:	GS 12 04 Hourly Salary	28.14
DWR Salary:	Range D Avg Hourly Salary	29.38
Benefits:	All Benefits Accounted For In Indirect Costs	
Indirect Costs:	Direct Labor Hours x Hourly Overhead Rate	
Corps Hourly Overhead Rate:	Corps Engineering Division Overhead Multiplier x Indirect Cost Multiplier x Salary	51.29
DWR Hourly Overhead Rate:	State Combined Benefits and Indirect Costs	37.02

*The Yolo Basin Foundation to provide meeting facilities and conduct public outreach for the model.

Table 2c. Cost Estimate: Year 3 (Oct 2004 to Oct 2005)

	Task	Direct Labor Hours	Salary	Benefits	Travel	Supplies & Expenditures	Services or Consultants	Equip.	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Costs
1	Project Coordination: Corps	200	$28.14							$5,629	$10,258	$15,887
2	Topography Acquisition		$28.14									$0
3	Model Development	44	$28.14							$1,238	$2,257	$3,495
4	Model Calibration, Verification, and Optimization		$28.14									$0
5	Case Study Application	120	$28.14				$100,000			$103,377	$6,155	$109,532
6	Documentation and Production	60	$28.14				$30,000			$31,689	$3,077	$34,766
7	Quality Control	200	$28.14				$5,000			$10,629	$10,258	$20,887
8	Revisions and Release	40	$28.14				$15,000			$16,126	$2,052	$18,178
9	Project Management and Oversight: DWR	250	$29.38							$7,345	$9,255	$16,600
10	Public Outreach: YBF*						$3,500			$3,500		$3,500
11	Workbook Development						$25,000			$25,000		$25,000
	Total	914					$178,500			$204,533	$43,312	$247,845

Notes:		
Corps Salary:	GS 12 04 Hourly Salary	28.14
DWR Salary:	Range D Avg Hourly Salary	29.38
Benefits:	All Benefits Accounted For In Indirect Costs	
Indirect Costs:	Direct Labor Hours x Hourly Overhead Rate	
Corps Hourly Overhead Rate:	Corps Engineering Division Overhead Multiplier x Indirect Cost Multiplier x Salary	51.29
DWR Hourly Overhead Rate:	State Combined Benefits and Indirect Costs	37.02

*The Yolo Basin Foundation to provide meeting facilities and conduct public outreach for the model.

Table 2d. Cost Estimate: Summary (Oct 2002 to Oct 2005)

	Task	Direct Labor Hours	Salary	Benefits	Travel	Supplies & Expenditures	Services or Consultants	Equip.	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Costs
1	Project Coordination: Corps	550	$28.14				$12,000			$27,480	$28,209	$55,689
2	Topography Acquisition	44	$28.14						$80,000	$81,238	$2,257	$83,495
3	Model Development	124	$28.14				$53,000			$56,490	$6,360	$62,850
4	Model Calibration, Verification, and Optimization	120	$28.14				$95,000			$98,377	$6,155	$104,532
5	Case Study Application	120	$28.14				$100,000			$103,377	$6,155	$109,532
6	Documentation and Production	120	$28.14				$60,000			$63,378	$6,155	$69,533
7	Quality Control	400	$28.14				$15,000			$26,257	$20,516	$46,773
8	Revisions and Release	40	$28.14				$15,000			$16,126	$2,052	$18,178
9	Project Management and Oversight: DWR	750	$29.38							$22,035	$27,765	$49,800
10	Public Outreach: YBF*						$10,000			$10,000		$10,000
11	Workbook Development						$25,000			$25,000		$25,000
	Total	2268					$385,000		$80,000	$529,758	$105,624	$635,382

Notes:		
Corps Salary:	GS 12 04 Hourly Salary	28.14
DWR Salary:	Range D Avg Hourly Salary	29.38
Benefits:	All Benefits Accounted For In Indirect Costs	
Indirect Costs:	Direct Labor Hours x Hourly Overhead Rate	
Corps Hourly Overhead Rate:	Corps Engineering Division Overhead Multiplier x Indirect Cost Multiplier x Salary	51.29
DWR Hourly Overhead Rate:	State Combined Benefits and Indirect Costs	37.02

*The Yolo Basin Foundation to provide meeting facilities and conduct public outreach for the model.

G. Literature Cited

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