



SOUTH FEATHER WATER & POWER

TO: Board of Directors

FROM: Kathy Petersen, Power Division Manager

DATE: August 17, 2005

RE: Additional Scope of Work - Engineering Services for PMF Crest Modifications
August 23, 2005 Board of Directors Meeting

Our engineering consultants from DMJM+HARRIS have continued to make progress on developing plans for modifying the crests of Sly Creek, Lost Creek and Ponderosa dams to accommodate the probable maximum flood. PG&E has informed us that they are not prepared to move ahead with construction until we have further discussions about how the costs of the project can be amortized over the remaining life of our contract (or any subsequent contract). However, they have authorized continuing with the preliminary engineering in order to get a clearer idea of the scope of future costs. Therefore, DMJM+HARRIS has submitted the attached work plan to provide the 30 percent design for Sly Creek and Lost Creek dams, and the conceptual design for Ponderosa Dam.

Total expenditures to date (2004-2005) are \$118,294. Included have been the preliminary investigations of potential mitigation solutions, performing an analysis of the probable maximum precipitation for Ponderosa Dam, performing a laser scan of the downstream face of Lost Creek Dam, developing the conceptual design for Sly Creek and Lost Creek dams, and meeting with FERC, Division of Safety of Dams and PG&E.

The attached budget for the next phase of work indicates significantly greater effort with a total estimated budget of \$934,396. However, the Site Specific PMP Study for the entire drainage will not be done until 2006. Therefore, I recommend approving expenditures not to exceed \$785,000 in 2005. This will keep us within our PG&E authorized budget of \$930,000 for 2005.

Tom Barnard from DMJM+HARRIS will be at the Board meeting and will provide a brief presentation of the work done so far. He will be happy to answer any additional questions you might have.

The recommended form of action is:

"I move approval for the Power Division Manager to authorize the scope of work and budget submitted by DMJM+HARRIS to complete the 30 percent design for Sly Creek and Lost Creek dams, and the conceptual design for Ponderosa Dam, with additional expenditures not to exceed \$785,000 in 2005."

No.	Task Description		
		Hrs	Cost
	SLY CREEK DAM - 30% DESIGN	1,200	\$ 127,029.00
1	Design Criteria & Site Investigations	188	\$ 21,771.00
	Prepare Project Work Plan	10	\$ 610.00
	detailed scope of work	88	\$ 10,377.00
	quality control/assurance plan	6	\$ 954.00
	establish & document criteria that will form basis of design	8	\$ 1,374.00
	prepare schedule for 30% design & estimate for PG&E & construction	20	\$ 2,540.00
	Geotechnical investigation	24	\$ 3,258.00
	Update to available topographic survey	32	\$ 2,658.00
2	Gate & Spillway Design Assessment & Analysis	639	\$ 67,860.00
	Initial evaluation of the existing gate	4	\$ 244.00
	review configuration & geometry of existing gate	84	\$ 9,534.00
	Gate assessment & analysis	0	\$ -
	hydraulic analyses	52	\$ 4,772.00
	field inspection of gate	60	\$ 7,660.00
	mechanical/electrical analyses	18	\$ 2,390.00
	structural analyses	286	\$ 28,218.00
	cost analyses	37	\$ 4,110.00
	Spillway channel design modifications	98	\$ 10,932.00
3	MSE Wall Design and Layout	314	\$ 32,059.00
	Dam stability analysis of selected alternative	147	\$ 14,991.00
	Reservoir freeboard analysis	29	\$ 3,054.00
	Design & layout of MSE wall	138	\$ 14,014.00
4	Approach Roadway & Spillway Bridge Modifications	59	\$ 5,339.00
	Plan, profile & typical sections for conforming crest raise to existing roadway and adjacent facilities	41	\$ 3,713.00
	Design raise of abutment seat & bridge deck to accommodate new profile	18	\$ 1,626.00
	LOST CREEK DAM - 30% DESIGN	2,164	\$ 271,757.00
5	Design Criteria & Site Investigations	158	\$ 16,902.00
	Prepare project work plan	0	\$ -
	detailed scope of work	92	\$ 10,125.00
	quality control/assurance plan	5	\$ 744.00
	establish & document criteria that will form basis of design	5	\$ 744.00
	prepare schedule for 30% design & estimate for PG&E & construction	15	\$ 1,632.00
	Geotechnical investigation	11	\$ 1,419.00
	Update to available topographic survey	30	\$ 2,238.00
6	Gate and Spillway Design Assessment	215	\$ 24,203.00
	Gate layout and design of gate control system	134	\$ 15,534.00
	Gate control vault layout	81	\$ 8,669.00
7	Bridge Deck, Pier Design & Crest Modification	129	\$ 15,980.00
	Establish design criteria	26	\$ 3,524.00
	Structure layout and type selection	2	\$ 346.00
	design of crest modification	52	\$ 6,304.00
	coordinate Obermeyer gates w/pier layout & pier shape	49	\$ 5,806.00
8	Dam Analysis	1,483	\$ 193,588.00
	Establish design criteria	32	\$ 4,516.00
	FEM modeling of existing concrete arch dam	171	\$ 23,038.00
	1. Create the Basic Model (linear material properties, static loading, and bridge modeled as additional weight). Check against previous 1988 & 1993 (uncracked) analyses – 7 weeks	532	\$ 69,892.00
	2. Add the bridge to the Basic Model – 1 week	74	\$ 9,644.00
	3. Run basic model and identify areas of potential cracking, then modify the basic model to account for cracking by introducing gap link elements at crack locations. Validate model with links – 2 weeks	148	\$ 19,288.00
	4. Modify the model to include dynamic loading, and iteratively run SAP, adding gap elements where necessary – 1.5 week	108	\$ 13,836.00
	5. Parametric study for section loss / bridge type & support conditions – 1.5 weeks.	108	\$ 13,836.00
	6. Write Report – 2 weeks	310	\$ 39,538.00
9	Evaluate Downstream Face	94	\$ 12,822.00
	Non-Destructive testing	52	\$ 7,312.00
	Drilling program	42	\$ 5,510.00
10	Hydraulic & Hydrologic Analyses	85	\$ 8,262.00
	Routing analysis with selected gate design	54	\$ 4,862.00
	Reservoir freeboard analysis	31	\$ 3,400.00

No.	Task Description		
		Hrs	Cost
	PONDEROSA DAM - CONCEPTUAL DESIGN	525	\$ 67,689.00
11	Agency Coordination	102	\$ 15,694.00
	Powerpoint presentation	70	\$ 10,110.00
	Agency discussion on viable options	32	\$ 5,584.00
12	Site Investigations	86	\$ 11,918.00
	Geotechnical investigation	40	\$ 6,320.00
	Update to available topographic survey	46	\$ 5,598.00
13	Gate & Spillway Design Assessment	337	\$ 40,077.00
	Alternatives evaluation	80	\$ 13,812.00
	modifications to existing spillway, gate & controls	64	\$ 6,432.00
	additional ungated spillways	45	\$ 4,641.00
	additional gated spillways	45	\$ 4,641.00
	overtopping protection/embankment spillways	29	\$ 2,955.00
	dam crest increase	29	\$ 2,955.00
	tunnel spillway	45	\$ 4,641.00
14	PROJECT COORDINATION		
	Meetings	348	\$ 47,096.00
15	DELIVERABLES		
	Reports	479	\$ 54,825.00
	Sly Creek Dam	223	\$ 25,673.00
	geotechnical investigation	10	\$ 1,336.00
	MSE wall & dam global stability	47	\$ 5,199.00
	Gate Inspection	18	\$ 2,082.00
	Bridge Raise and Foundation Modification	52	\$ 7,948.00
	Summary of Overall Design	96	\$ 9,108.00
	Lost Creek Dam	159	\$ 18,613.00
	geotechnical investigation	15	\$ 2,349.00
	evaluate dam d/s face - NDT, core testing	40	\$ 5,876.00
	Summary of Overall Design	104	\$ 10,388.00
	Ponderosa Dam	97	\$ 10,539.00
	geotechnical investigation	11	\$ 1,509.00
	summary of alternatives; anticipated costs; recommendations	86	\$ 9,030.00
	Hours	4,716	\$ 568,396.00
		weeks	
		months	
	Cost	\$ 568,396.00	

Subcontractor Costs	Amount
Survey & Topography Update for Sly Creek, Lost Creek and Ponderosa Dam	\$45,000
Geotechnical Investigation for Sly Creek, Lost Creek and Ponderosa Dam	\$65,000
Sly Creek MSE Wall Design	\$15,000
Lost Creek Downstream Face Testing Program	\$50,000
Site Specific PMP Study (Entire drainage)	\$150,000
Cost	\$325,000

Direct Costs	Amount
Reproduction	\$3,500
Misc.	\$2,500
Travel	\$35,000
Cost	\$41,000

Total Estimated Costs: \$934,396

Per our discussions, the following work breakdown describes the tasks required for the next phase of work related to Sly Creek, Lost Creek, and Ponderosa Dams. This work phase will consist of 30% design for Sly Creek Dam and Lost Creek Dam and conceptual design of Ponderosa Dam.

We believe that this is the most effective way to proceed in order to clarify the basis of design for each of the projects. Our current opinions of construction costs are based on the level of detail to which the design has progressed. After completing this next phase of the work we will be able to reduce the 25% contingency factor to within the 10 to 15% range, rendering a much better picture of the fiscal impacts to the agency and providing a solid basis for decisions by you, your management and your Board.

A brief description of each task is summarized below:

SLY CREEK DAM – 30% DESIGN

Task 1. Design Criteria and Site Investigations

- 1.1 Prepare Project Work Plan – A project work plan will be developed with the following contents:
 - Detailed scope of work
 - Quality control/assurance plan
 - Establish and document criteria that will form basis of design
 - Prepare schedule for 30% design and estimate for PG&E and construction
- 1.2 Geotechnical investigation and report – To date an initial review of existing information and reports has been performed. At the onset of the next work phase, a more detailed review will be performed to determine the existing information that can be used going forward. Additional geotechnical field investigations will be performed to supplement the existing information. A detailed plan for geotechnical investigations will be prepared after further review of existing documents.

At a minimum, we anticipate that geotechnical investigations will be required to establish material borrow areas for the Sly Creek embankment raise, to determine existing foundation conditions at the dam and spillway abutments, and to determine and/or confirm existing embankment material properties and foundation conditions for dam stability analyses. The attached fee estimate includes an estimated amount to perform borings, test pits, and laboratory analyses at Sly Creek Dam.

A geotechnical report will be prepared to document the investigation findings.
- 1.3 Update to available topographic survey – Detailed topographic information for the dam and surrounding area, particularly the abutments, will be required for design. Topographic surveys will be performed to establish 1 foot contour maps. The survey limits will be roughly 200 feet upstream and downstream of the existing dam, and up to 1500 feet beyond the left and right abutments, as needed.

Task 2. Gate and Spillway Design Assessment and Analysis

- 2.1 Initial Evaluation of the Existing Gate - Our studies to date indicate that the revised PMF during both the local and general storm significantly impact the existing gate. The flow barely clears the bottom of the existing gate when fully open during the general PMF, and during the local PMF, the flow overtops the fully closed gate with an increased head that is above the current dam crest. The two alternatives to resolve this issue are (1) to modify the existing gate or (2) install a new gate. During 30% design the following will be evaluated:
 - The configuration and geometry of the existing gate will be studied in detail to determine if it can be used for the new conditions.

- 2.2 Gate Assessment and Analysis – If it is determined initially that the present gate can be used, an assessment of required modifications to gate configuration and geometry to provide adequate freeboard during the general PMF and to safely allow overtopping during the local PMF will be completed.
- In evaluating the feasibility for using the existing gate, relocation of the gate trunnions, hoisting equipment, appurtenances, and the required spillway crest modifications will be considered. This may include the following activities:
 - 1) Hydraulic Analyses – hydraulic modeling will be performed to establish the hydraulic operating characteristics of the modified gate.
 - 2) Field inspection – existing reports and our previous field visits indicate that the existing gate is in good condition. A detailed field inspection will be performed to document the details of the existing gate configuration and any deficiencies so that modifications and/or corrective measures can be designed. A gate inspection team will perform the inspection with coordination by the project manager.
 - 3) Mechanical / Electrical Analyses – An evaluation of existing gate controls will be made to determine potential modifications as the operating requirements for a modified gate become more apparent. Once the specific requirements become clearer we will refine the scope and budget as needed.
 - 4) Structural Analyses – A structural analysis to determine the adequacy of the existing gate components for the new loading conditions and design requirements will be performed.
 - Cost Analysis – If the modifications are feasible, an estimate of the probable cost to modify the existing gate geometry and configuration will be completed and compared to the probable cost to replace the gate. The study will be carried out for both alternatives to a level that a reasonable cost benefit analysis can be made. Based on this analysis, a determination will be made to use the existing gate or provide a new gate following consultation with the client.
 - If use of the existing gate ultimately is not feasible, a replacement gate or gates will be necessary. Our fee estimate is based on the assumption that the existing gate can be reused. If replacement is required, a revised budget will be provided as necessary.
- 2.3 Spillway channel design modifications – Hydraulic profile calculations will be performed for the modified/new gate and/or crest to confirm the PMF flows will be contained within the existing spillway channel walls. A structural design check of the spillway walls will be performed for its capability to withstand higher gate loads, flows and velocities.

Task 3. MSE Wall Design and Layout

- 3.1 Dam stability analysis of selected alternative – Using information gathered from field investigations, we will update our preliminary model calculations and verify that the modified dam is stable for all applicable loading conditions.
- 3.2 Reservoir Freeboard analysis – To meet FERC and DSOD guidelines, wave run-up calculations will be performed as part of a reservoir freeboard analysis. These calculations will be used to set the final elevation for the embankment raise.
- 3.3 Design and layout of MSE wall – Once the freeboard requirements have been confirmed, the design requirements will be established to provide an MSE wall raise to Sly Creek Dam. Analyses will be performed to establish the wall footing and anchoring requirements and to design the tie-in to existing embankment and materials. Tie-ins to the dam and spillway abutments will also be developed. A typical cross-section will be developed showing the major features of the MSE wall raise, including the dam crest roadway and vehicle barriers. A plan for modifying the existing boat ramp, parking, and picnic to accommodate the dam raise will be prepared.

Task 4. Approach Roadway and Spillway Bridge Modification

- 4.1 Plan, profile and typical sections for conforming crest raise to existing roadway and adjacent facilities. – Design requirements for the roadway will be coordinated with the design and layout of the MSE wall where it will tie into the abutments.
- 4.2 Design raise of abutment seat and bridge deck to accommodate new profile

LOST CREEK DAM – 30% DESIGN**Task 5. Design Criteria and Site Investigations**

- 5.1 Prepare Project Work Plan – A project work plan will be developed with the following contents:
 - Detailed scope of work
 - Quality control/assurance plan
 - Establish and document criteria that will form basis of design
 - Prepare schedule for 30% design and estimate for PS&E and construction
- 5.2 Geotechnical investigation and report – To date an initial review of existing information and reports has been performed. At the onset of the next work phase, a more detailed review will be performed to determine existing information that can be used going forward. The review will also be used to establish additional geotechnical field investigation requirements for design of Lost Creek Dam modifications.

We anticipate that geotechnical investigations will be required to establish foundation conditions at the dam abutments for the bridge tie-in. Once we have completed our review of existing information we will develop a detailed plan for geotechnical investigations and will identify additional requirements.

- 5.3 Update to available topographic survey – Detailed topographic information for the dam and surrounding area, particularly the abutments, will be required for design. We will perform topographic surveys to establish 1 foot contours. The survey limits will be roughly 200 feet upstream and downstream of the existing dam, and up to 500 feet beyond the left and right abutments, as needed.

Task 6. Gate and Spillway Design Assessment

- 6.1 Gate layout and design of gate control system – We will continue to work with Obermeyer to refine the layout for Lost Creek Dam.
- 6.2 Gate control vault layout – The best location for the Obermeyer gate control equipment will be determined. A layout for a control vault and control systems will be prepared.

Task 7. Bridge Deck, Pier Design and Crest Modification

- 7.1 Establish Design Criteria
- 7.2 Structure Layout and Type Selection
 - The design and layout of the replacement gates and their operational requirements will be coordinated with the design requirements for the modified bridge, piers and dam crest.

Task 8. Dam Analysis

- 8.1 Establish Design Criteria
- 8.2 FEM Modeling of existing concrete arch dam
 - Site investigations / determination of existing concrete material properties
 - Create the Basic Model (linear material properties, static loading, and bridge modeled as additional weight)
 - Compare results against previous 1988 & 1993 (uncracked) analyses
 - Add the bridge to the Basic Model

- Run basic model and evaluate results
- Include dynamic loading, iterate, and evaluate results
- Parametric study for section loss / bridge type & support conditions

Task 9. Evaluate Downstream Face

A testing program to evaluate the dam structure, including the downstream face of the dam, will be completed to provide information on the current conditions and physical properties of the concrete in the dam. The results can be used in conjunction with the dam structural analyses to refine and/or confirm data used in the model. The testing methods will consist of:

- 9.1 Non-Destructive Testing – This defines the characteristics of the concrete throughout the dam. Results can be used to define the remaining thickness of the dam for comparison with original design and to estimate the amount of concrete loss. The NDT testing methods envisioned are listed as follows:
- Ultrasonic and Sonic Pulse Velocity (UPV/SPV) Testing – generates a series of 2-D tomographic images of the interior of the dam. The results provide data on variations in concrete strength and density, location and extent of low density areas, and the presence of cracks or un-bonded lift areas.
 - Spectral Analysis of Surface Waves (SASW) Testing – Evaluates the depth of surface degradation and depth to sound core concrete from the downstream face. The data should allow testing of concrete to a depth of approximately two feet from the downstream face.
 - Use in conjunction with High Definition 3D Digital Scanning (HDS) which has defined the current geometry of the downstream face of the dam. This tracks the concrete deterioration as compared to the initial dam cross sections from the design drawings and/or as-built drawings.
- 9.2 Drilling Program – An exploratory drilling program, consisting of drilling 3-inch to 6-inch concrete core samples to be taken in various locations throughout the dam will be implemented if results of the NDT demonstrate deterioration of the dams concrete section dictates the additional work. The core samples will be tested as follows:
- Petrographic Analysis – Analyze concrete core segments to provide information on the physical characteristics of the concrete in the dam.
 - Laboratory Testing – Determine the concrete compressive and tensile strengths, modulus of elasticity and dam to foundation contact strength properties to assist in assessing the concrete quality and overall stability analyses.

Task 10. Hydraulic and Hydrologic Analyses

- 10.1 Routing analysis with selected gate design - hydraulic modeling will be performed to establish the hydraulic operating characteristics of the selected gate system.
- 10.2 Reservoir Freeboard analysis – To meet FERC and DSOD guidelines, wave run-up calculations will be prepared as part of a reservoir freeboard analysis. These calculations will be used to set the final bridge elevation.

PONDEROSA DAM – CONCEPTUAL DESIGN

Task 11. Agency Coordination

- 11.1 A brief PowerPoint presentation will be prepared listing potential alternatives for Ponderosa Dam. A presentation will be made to CA DSOD to promote discussion and early determination of agency sensitivity. This presentation will be made prior to analysis of the alternatives.
- 11.2 Based on results of meeting with DSOD, coordinate with FERC and PG&E to determine consensus of opinion regarding viable options.

Task 12. Gate and Spillway Design Assessment

12.1 Alternatives evaluation – Following meetings with DSOD, FERC, and PG&E, alternatives will be evaluated to accommodate the PMF at Ponderosa Dam. Subject to Agency input, the following alternatives will be considered:

- Modifications to existing spillway, gate and controls
- Additional ungated spillway(s)
- Additional gated spillway(s)
- Overtopping protection / embankment spillways
- Dam crest increase
- Tunnel Spillway

Each option will be conceptualized and modeled using HEC-1. Anticipated probable costs will be developed for feasible options. A comparison matrix will be prepared to weigh the alternatives against selected criteria.

PROJECT COORDINATION**Task 13. Meetings**

Biweekly progress meetings will be conducted during the 30% design phase. We also anticipate that a few face-to-face meetings will be required. As such, we have included an estimated amount for travel expenses and meeting time (charges to be based on actual expenditures). A scope and budget will be provided should additional requirements arise.

DELIVERABLES**Task 14. Reports**

- 14.1 Sly Creek Dam – A preliminary (30%) design report will be prepared to document the design analyses performed to date, alternatives considered, major findings, and costs. The report will include location and vicinity maps; plan, profile, and section drawings for the dam raise; a layout drawing for the spillway and gate(s); and plan and elevation drawings for the spillway bridge. The report will contain a list of technical specifications anticipated and an update of anticipated probable construction costs, as well as a summary of the alternatives considered and initial recommendations. The report will contain a documentation of the various analyses performed for the different task items.
- 14.2 Lost Creek Dam – A preliminary (30%) design report will be prepared to document the design analyses performed to date, alternatives considered, major findings, and costs. The report will include location and vicinity maps; plan, profile, and section drawings for the dam raise; a layout drawing for the spillway and gate(s); and plan and elevation drawings for the spillway bridge. The report will contain a list of technical specifications anticipated and an update of anticipated probable construction costs, as well as a summary of the alternatives considered and initial recommendations. The report will contain a documentation of the various analyses performed for the different task items.
- 14.3 Ponderosa Dam – A conceptual design report will be prepared to document the alternatives considered, anticipated probable costs, and provide recommendations. The report will include design sketches of the alternatives considered.