Lake Natoma Temperature Curtains Pilot Project

Project Information

1. **Proposal Title:**

   Lake Natoma Temperature Curtains Pilot Project

2. **Proposal applicants:**

   Leo Winternitz, The Water Forum
   Tim Washburn, Sacramento Area Flood Control Agency

3. **Corresponding Contact Person:**

   Leo Winternitz
   The Water Forum
   660 J Street, Suite 260 Sacramento, CA 95814
   (916) 264-1999
   lwinternitz@sacto.org

4. **Project Keywords:**

   Anadromous salmonids
   Hydrodynamics
   Monitoring

5. **Type of project:**

   Implementation_Pilot

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

   No

7. **Topic Area**:

   Ecosystem Water and Sediment Quality

8. **Type of applicant:**

   Local Agency

9. **Location - GIS coordinates:**

   Latitude: 38.632

   Longitude: -121.216

   Datum:

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

Lake Natoma is 540 surface acres within Sacramento County. Within the Lower American River, the lake is located approximately 23-miles upstream of the American River's confluence with the Sacramento River.

10. **Location - Ecozone:**

    9.2 Lower American River

11. **Location - County:**

    Sacramento

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:**

    4th District

15. **Location:**

    California State Senate District Number: 1st District

    California Assembly District Number: 5th District

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

    3 years

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:	60% of salary
Total Requested Funds:	$1,960,196

b) Do you have cost share partners already identified?

No

c) Do you have potential cost share partners?

Yes

If yes, list partners and amount contributed by each:

Sacramento Flood Control Agency $150,000

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?

Yes

If yes, identify project number(s), title(s) and CALFED program.

99-N21 River Corridor Management Plan Ecosystem Restoration

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)

Bruce Oppenheim	**National Marine Fisheries Service**	**(916) 930-3603**	**bruce.oppenheim@noaa.gov**
Perry Johnson	**Consultant**	**(303) 697-1989**	**MKPLJ@aol.com**
Russ Brown	**Jones & Stokes Associates**	**(916) 737-3000**	**russb@jsanet.com**

21. **Comments:**

Environmental Compliance Checklist

Lake Natoma Temperature Curtains Pilot Project

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

      Yes
   b) Will this project require compliance with NEPA?

      Yes
   c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

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

   CEQA Lead Agency: The Water Forum, City/County of Sacramento
   NEPA Lead Agency (or co-lead:) U.S. Bureau of Reclamation
   NEPA Co-Lead Agency (if applicable):

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

   CEQA
   -Categorical Exemption
   XNegative Declaration or Mitigated Negative Declaration
   -EIR
   -none

   NEPA
   -Categorical Exclusion
   XEnvironmental Assessment/FONSI
   -EIS
   -none

   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?

      No

      If the CEQA/NEPA process is not complete, please describe the dates for completing draft and/or final CEQA/NEPA documents.

      Draft CA and Neg Dec will be submitted as a joint document by January 2003.

   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 Required

CWA 401 certification Required

Coastal Development Permit

Reclamation Board Approval Required

Notification of DPC or BCDC

Other

FEDERAL PERMITS AND APPROVALS

ESA Compliance Section 7 Consultation Required

ESA Compliance Section 10 Permit

Rivers and Harbors Act

CWA 404 Required

Other

PERMISSION TO ACCESS PROPERTY

Permission to access city, county or other local agency land. Agency Name:	
Permission to access state land. Agency Name: Department of Parks and Recreation	Required
Permission to access federal land. Agency Name: U.S. Bureau of Reclamation	Required
Permission to access private land. Landowner Name:	

6. **Comments.**

5. Permission: The Water Forum is working with both the U.S. Bureau of Reclamation and the State Department of Parks and Recreation on this project and anticipates no difficulty in securing permission to access property.

Land Use Checklist

Lake Natoma Temperature Curtains Pilot Project

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).

   The installation of two temperature curtains and subsequent temperature monitoring will not impact land use. The temperature monitoring devices are currently in place, and design/engineers are working with recreation providers to accommodate recreational access and safety.

4. **Comments.**

Conflict of Interest Checklist

Lake Natoma Temperature Curtains Pilot Project

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):

Leo Winternitz, The Water Forum
Tim Washburn, Sacramento Area Flood Control Agency

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):

Leo Winternitz The Water Forum

Rod Hall U.S. Bureau of Reclamation

Greg O'Haver U.S. Bureau of Reclamation

Tracy Vermeyen U.S. Bureau of Reclamation

Laura Svendsgaard Consultant

Comments:

All those listed as helping with the proposal development currently work for agencies that will actively participate in the design and implemention of the project; with the exception of Laura Svendsgaard, who is a consultant retained by the Sacramento Area Flood Control Agency for grant writing purposes.

Budget Summary

Lake Natoma Temperature Curtains Pilot Project

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.

Federal Funds

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 Management & Administration	600	22680	3742	1000	0	0	0	0	27422.0	13608	41030.00
2	Design & Specifications	800	23664	3905	10000	10000	25000	0	0	72569.0	14198	86767.00
3	Environmental Review & Permits	600	17748	2928	2000	5000	40000	0	0	67676.0	10649	78325.00
		2000	64092.00	10575.00	13000.00	15000.00	65000.00	0.00	0.00	167667.00	38455.00	206122.00

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**
4	Project Management & Administration	750	28920	4772	1000	0	0	0	0	34692.0	17352	52044.00
5	Prepare & Solicit Bids	700	21119	3485	3000	5000	20000	0	0	52604.0	12671	65275.00
6	Fabricate Curtains	0	0	0	0	0	0	880000	0	880000.0	0	880000.00
7	Install Curtains	0	0	0	0	0	0	275000	0	275000.0	0	275000.00
8	Curtain Adjustments	0	0	0	0	0	0	30000	0	30000.0	0	30000.00
9	Contract Administration	3000	90510	14934	45375	2000	0	0	0	152819.0	54306	207125.00
10	Public Outreach & Signage	80	2414	398	500	2000	5000	12000	0	22312.0	1448	23760.00
11	Temperature Monitoring	200	6034	996	2000	15000	0	0	0	24030.0	3620	27650.00
		4730	148997.00	24585.00	51875.00	24000.00	25000.00	1197000.00	0.00	1471457.00	89397.00	1560854.00

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**
12	Project Management & Administration	500	19665	3245	500	0	0	0	0	23410.0	11799	35209.00
13	Curtain Removal	0	0	0	0	0	0	80000	0	80000.0	0	80000.00
14	Contract Administration	500	15385	2539	7563	1000	0	0	0	26487.0	9231	35718.00
15	Analysis & Reports	300	9231	1523	1000	5000	20000	0	0	36754.0	5539	42293.00
		1300	44281.00	7307.00	9063.00	6000.00	20000.00	80000.00	0.00	166651.00	26569.00	193220.00

Grand Total=1960196.00

Comments.

Budget Justification

Lake Natoma Temperature Curtains Pilot Project

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

Tasks 1/4/12 = 1,850 direct labor hours by one individual Tasks 2/3/5/9/10/11/14/15 = 6,1080 direct labor hours by the best qualified individuals available at the time the project commences or soon thereafter.

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

Tasks 1/4/12 salary is $37.80/hr increased 2% per year Tasks 2/3/5/9/10/11/14/15 salary is $29.58/hr increased 2% per year (GS-12/5)

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

Federal benefit rate for all categories above is 16.5% of salary.

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

Sacramento Federal per diem rate is $121/day. A majority of the travel costs relate to the oversight and inspection of construction activities. U.S. Bureau of Reclamation staff are based out of Willows, California and will be overseeing all construction activities.

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

$30,000 is for general office, printing and copies. $15,000 is for temperature monitoring data collection supplies.

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.

$25,000 to design engineer for final design specifications $40,000 to environmental planning consultant for environmental review and permits $20,000 to design/engineer to develop contractor bid package $5,000 to graphic artist to develop educational brochure and interpretive signage. $20,000 to scientific and engineering consultant to analyze data and assist in the development of reports.

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.

$880,000 for the fabrication of two temperature curtains, which includes: Lower boom weighted tanks (70@$1,000) = $70,000 Upper boom tanks (70@$1,200) = $84,000 Surface stabilizing tanks (18@$1,500) = $27,000 Lake anchors (18@$2,500) = $45,000 Shore anchors (3@$5,000) = $15,000 Dam anchor (1@$1,000) = $1,000 Chains and shackles (7,000 ft.@$10/ft.) = $70,000 Hoses and fittings (2,500 ft.@$20/ft.) = $50,000 Hypalon fabric (17,500 sq. ft.@$10/sq.ft.) = $175,000 Boat passage structure = $35,000 Contractor's profit @ 10% = $88,000 Contingency @ 25% = $220,000

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.

Tasks 1/4/12 provide overall project management, administrative and financial oversight. Staff involved in the overall management of the project will likely be the same staff providing project presentations. $128,283 over 3 years. Tasks 9/14 provide for contract management, inspections and construction oversight. $242,842 over 2 years. Task 15 provides for both staff and consultant analysis of data and report preparation. $42,293.

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

No "Other Direct Costs" are indicated

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.

Federal indirect overhead costs are 60% of salary.

Executive Summary

Lake Natoma Temperature Curtains Pilot Project

Lake Natoma Temperature Curtains Pilot Project is located in Sacramento County, within the Lower American River (LAR), approximately 23-miles upstream of the American River's confluence with the Sacramento River. The goal of this pilot project is to reduce LAR water temperatures in order to improve survival of rearing young anadromous salmonids in summer, conserving cold water stores at Folsom Reservoir for fall spawning. To achieve this goal, the Water Forum and it's project partners (the U.S. Bureau of Reclamation and the Sacramento Area Flood Control Agency) will design, construct, install, monitor and assess the effectiveness of two portable temperature curtains to be installed at strategic locations in Lake Natoma. Temperature monitoring currently indicates that out-flow temperatures at Lake Natoma are up to 5 degrees warmer than in-flow temperatures. Two major factors contribute to the excessively high temperatures: a) only the warmer surface water flows from the Nimbus Dam's power plant intake into the LAR; and b) temperature mixing. The curtains essentially provide three means for reducing temperatures. 1) Creation of a barrier allowing only the desired colder water to proceed downstream to prime anadromous salmonid spawning and rearing habitat. 2) Reduction in the mixing of temperature layers caused by turbulence or differences in thermal layer velocities. 3) Efficient utilization and preservation of cold water at Lake Natoma, allowing for the conservation of cold water stores in Folsom Reservoir for fall release during spawning. Two factors also serve as the rationale for moving this project forward as a pilot project. One: Hydrodynamic and thermodynamic variables are so numerous that determing the curtains' optimum design from laboratory tests would be impractical and nearly the cost of fabrication. Two: Design modifications may also be required in order to minimize the impacts of recreation and safety accommodtions. The desired net result of the curtains is a 1 to 2 degree average reduction in May to October temperatures flowing into the LAR. The pilot curtains would be installed in May and tested to October, at which time the curtains would be removed and stored to avoid impacting winter and spring flood events. Assuming success, the curtains would thereafter be installed and removed each year. Several temperature reduction measures have been considered. Analysis indicates that temperature curtains provide the most immediate and economically feasible temperature reduction aide. Temperature curtains installed in 1992 at Lewiston and Whiskeytown Reservoirs provide operating examples of the curtains' success. This project is believed to contribute directly to ERP Goals 1, 2, 3 and 4.

Proposal

The Water Forum

Lake Natoma Temperature Curtains Pilot Project

Leo Winternitz, The Water Forum
Tim Washburn, Sacramento Area Flood Control Agency

A. Project Description: Project Goals and Scope of Work

Goal: *Reduce Lower American River water temperatures in order to:*

1. *Improve survival of rearing anadromous salmonids in summer, and*

2. *Conserve cold water stores at Folsom Reservoir for spawning in fall.*

Scope of Work

This project is sponsored by the Water Forum and the Sacramento Area Flood Control Agency (SAFCA) in collaboration with the U.S. Bureau of Reclamation (who holds jurisdictional authority over the project site). If funded, the Water Forum will oversee the administration and general management of the project. SAFCA is a cost share partner and will also oversee general project management. The Bureau, through a Memorandum of Understanding, will oversee design, construction, installation, monitoring and assessment of two portable temperature curtains. The curtains will be installed at strategic locations in Lake Natoma for the purpose of determining the curtains' effectiveness in reducing water temperatures in critical anadromous salmonid spawning and rearing habitat in the Lower American River (LAR). Reducing water temperatures during the warmer summer months (generally May through October) will result in improved survival of rearing anadromous salmonids, and the conservation of cold water in Folsom Reservoir will aide fall spawning.

Temperature monitoring indicates that out-flow temperatures at Lake Natoma are up to 5°F warmer than the in-flow temperatures (from Folsom Reservoir). There are two major factors contribute to the excessively high water temperatures entering the LAR:

One factor is that the surface water temperatures at Lake Natoma can be 5 to 10°F higher than colder deep water from late spring through early fall. Because of Lake Natoma's shallow depth and a concrete debris wall around the dam's power plant intake, warm surface water (above the debris wall's 105 feet msl elevation) can flow into the LAR. In other words, during summer and fall, only the warmer surface water from Lake Natoma flows into the spawning and rearing habitat of the LAR. (Jones & Stokes 2001, Cited Literature #3, pg 6-17.)

The second factor is mixing, created when the cold water released through Folsom Dam intersects the warm surface water in Lake Natoma.

The proposed pilot temperature curtains are designed to allow the colder, denser water released from Folsom Dam in warmer months to flow under the curtains' orifice and into the LAR. Additionally, the curtains are designed to reduce turbulence when the velocity

of flowing water overcomes the buoyancy of the warmer water layer. The curtain system is designed to maintain underflow velocities less than one foot per second and preferably less than 1/2 foot per second in order to adequately reduce the mixing effects and maintain the integrity of the cold water layer. At this velocity, the curtain can easily accommodate the normal flows of up to 4,000 CFS into the power plant intake.

1. Problem

Location

The project is located in the Sacramento Region, Ecological Management Zone 9.2; 38° 38' 982", 121° 11' 599". The temperature management curtains would be located at Lake Natoma in Sacramento County, within the Lower American River (LAR), approximately 23-miles upstream of the River's confluence with the Sacramento River.

Lake Natoma and the LAR's watershed originate in California's central Sierra Nevada. The North and Middle Forks of the American River join near the city of Auburn before emptying into Folsom Reservoir. The South Fork of the American River also discharges into Folsom Reservoir, where flows are impounded by Folsom Dam. Folsom Dam releases enter Lake Natoma, and are impounded by Nimbus Dam (located approximately 7-miles downstream from Folsom Dam) before being discharged into the Lower American River.

The Lower American River includes 23 river miles (RMs) between Nimbus Dam and the river's confluence with the Sacramento River. Flood protection levees begin at the confluence with the Sacramento River and extend upstream to approximately RM 14 on the north bank and RM 11 on the south bank.

Problem

Numerous agencies with jurisdiction over the Lower American River have been involved in assessing and evaluating habitat restoration opportunities in an effort to restore ecosystem function. Research strongly indicates that high summer and early fall water temperatures in the primary spawning and rearing habitat, from Nimbus Dam downstream to Ancil Hoffman Park, are the most important stressors impacting the spawning and survival rate of young steelhead and chinook salmon. The temperature curtains, could effectively and efficiently reduce water temperatures where needed, increasing the spawning success and survival of targeted species.

Historically, anadromous salmonids had access to over 125-miles of riverine habitat within the 2,100 square mile American River Basin watershed. However, since the early 1900s access has been impeded by dams constructed for mining debris containment, flood control, and diversions. Construction of Folsom and Nimbus Dams in 1955 permanently blocked upstream fish passage past river mile 23, and reportedly blocked

approximately 70% of the spawning habitat historically used by chinook salmon and all of the spawning habitat historically used by steelhead. Anadromous fish are now restricted to the lower 23-miles of the American River from Nimbus Dam to the confluence with the Sacramento River. (Surface Water Resources, Inc. 2001, Cited Literature #2, pg 5.)

The Lower American River, a federally designated Wild and Scenic River, is now used by approximately 40 fish species, including numerous resident native and introduced species and several anadromous species. A number of species are of primary management concern because of their declining status or their importance to recreational and/or commercial fisheries. Steelhead within the Central Valley Evolutionary Significant Unit (which includes the Lower American River) was listed by the National Marine Fisheries Service (NMFS) as threatened on May 18, 1998; Sacramento Splittail was listed as threatened by U.S. Fish and Wildlife Service effective March 10, 1999; and fall-run Chinook salmon remain a candidate species for NMFS effective November 15, 1999. A goal of the 1992 Central Valley Project Improvement Act is to double (from 1967 to 1991 baseline period) the natural production of anadromous salmonids in the Central Valley, including the LAR. (Jones & Stokes 2000, Cited Literature #2, pg 2.)

Current fall-run chinook salmon and steelhead production in the lower 23-miles of the American River is believed to be limited, in large part, by high water temperatures in spawning and rearing habitat during critical stages of the species' freshwater residency. Managing the temperature of water flowing into the LAR upstream from Nimbus Dam is a critical component to restoring healthy anadromous salmonid populations. (Jones & Stokes 2000, Cited Literature #2, pg 2.)

The NMFS issued a Biological Opinion for operation of the Central Valley Project (CVP), which includes an objective not to exceed a daily average water temperature of 65° F in the LAR for maintenance of steelhead habitat. Surveys conducted by the California Department of Fish and Game over the last 10 years show that the fall-run Chinook salmon do not begin spawning until temperatures decrease to 60°F or less in fall (October or November). Numerous laboratory studies conducted throughout the West Coast show that chinook salmon embryo incubation success declines when constant water temperatures increase above 56°F or less for chinook salmon embryo incubation. Therefore, index temperatures used by state and federal resource agencies and the Bureau of Reclamation for the LAR are 65°F or less for all life stages of steelhead, 60°F or less for fall run chinook salmon spawning, and 56°F or less for chinook salmon embryo incubation. (Surfaces Water Resources, Inc. 2001, Cited Literature #4, pg 23)

While the desired index temperature for the LAR is 65° or less (NMFS Biological Opinion), current temperatures in the most critical spawning and rearing habitat (the uppermost 9 RM) can exceed 70°F. Water temperatures exiting Folsom Reservoir are generally within those considered optimal for salmonid recruitment, however several

factors contribute to the downstream increases. The two primary factors contributing to the higher water temperatures entering the LAR, described previously and believed can be controlled, are: (1) the withdrawal of warm surface waters from Lake Natoma into the LAR, and (2) the mixing of cold and warmer waters due to turbulence and the varying velocities of thermal layers. It is also important to note that summer water temperatures continue to rise as flows continue down the LAR. Temperature monitoring studies, currently being conducted by the U.S. Bureau of Reclamation, indicate that temperatures between river miles 23 and 10 can increase in excess of 5°F.

Adult salmon migrate up the Sacramento-San Joaquin Delta and into the LAR generally from July-January. Spawning extends from as early as the beginning of October, and peak spawning typically occurs from mid- to late November. The timing of all-run chinook salmon spawning is responsive to temperature changes, which are affected in large part by cold-water pool management. Initiation of spawning can vary by one month or more (early October to mid-November), depending on the prevailing water temperature regime. Relatively high water temperatures at the beginning of the fall-run chinook salmon spawning season can delay the onset of spawning. Spawning typically does not occur until mean daily water temperatures decrease to about 60°F. Also, Nimbus Hatchery data suggest that egg fertilization success significantly increases when daily median temperatures decline below 60°F. In the last 10 years, mean daily water temperatures at or below 60°F in the upper reaches of the LAR have typically not occurred until the end of the first week of November. (Jones & Stokes 2001, Cited Literature #2, pg 8.)

In the past, relatively little attention has been given to studying the efficient transport of cold water from Folsom Reservoir to the LAR. The Lake Natoma Temperature Curtains Pilot Project can help to efficiently and effectively provide water temperature reductions in strategic portions of the LAR during critical life cycle stages, helping to increase natural spawning and egg fertilization, and the survival and emigration of egg, fry, juvenile and yearling steelhead and chinook salmon.

It should also be noted that Lake Natoma is a popular recreation destination managed by California State Parks. Boating, fishing and swimming are important activities take place at Natoma. Meetings with recreation stakeholders have provided unanimous support for this project, with the understanding that the Water Forum, SAFCA and the Bureau of Reclamation will work with the groups to include adequate access and safety features in the final designs.

Relevant Past Studies (References)

Johnson, P., Vermeyen, T., and O'Haver, G., 1995. "Managing Water Temperatures Below Hydroelectric Facilities," *Hydro Review*, Vol. 14 No. 3, May 1995.

Johnson, P.L., and Vermeyen T.B., 1993. "A Flexible Curtain Structure for Control of Vertical Reservoir Mixing Generated by Plunging Inflows," American Society of Civil Engineers National Hydraulic Engineering Conference, San Francisco, California.

Jones & Stokes. April 2000. Draft Program Environmental Impact Report on Flood Control Improvements Along the Mainstem of the American River.

Jones & Stokes. April 2000. Draft Program Environmental Impact Report on Flood Control Improvements Along the Mainstem of the American River.

Jones & Stokes, in partnership with the California Center for Public Dispute Resolution, and Surface Water Resources, Inc. July 2001. Draft River Corridor Management Plan for the Lower American River.

Surface Water Resources, Inc. June 2001. Draft Initial Fisheries and Aquatic Habitat Management and Restoration Plan for the Lower American River.

U.S. Bureau of Reclamation. January 2000. Lower American River Temperature Improvement Study.

Vermeyen, T.B., "Use of Temperature Control Curtains to Control Reservoir Release Water Temperatures," Report No. R-97-07, U.S. Bureau of Reclamation, Denver, Colorado, December 1997.

Vermeyen, T.B., 1995, "Use of Temperature Control Curtains to Modify Reservoir Release Temperatures – Prototype Observations," Proceedings, ASCE's First International Conference on Water Resources Engineering, San Antonio, Texas.

Vermeyen, T.B., Application of Flexible Curtains to Prevent Mixing and Allow Selective Withdrawal in Reservoirs, IAHR, Proceedings from the 5th International Symposium on Stratified Flows, Vancouver, Canada, July 2000.

Water Resources Research Laboratory. September 2001. Draft Executive Summary, Performance of the Temperature Control Curtains in Lewiston and Whiskeytown Reservoirs, California. Denver, Colorado

Goals, Objectives and Hypotheses

Goal: To increase the spawning, and survival of rearing anadromous salmonids by reducing the temperature of water from Lake Natoma into the Lower American River, and conserving cold water stores in Folsom Reservoir during periods critical to optimal salmonid recruitment.

Objectives:

1. Design, secure permits, bid, construct and install two surface suspended Hypalon (reinforced rubber) curtains at strategic sites and times within Lake Natoma for the purpose of reducing water temperatures flowing into the Lower American River;
2. Compile and summarize existing thermal monitoring and biological information for the Lower American River;
3. Monitor temperatures for a six-month period following curtain installation to determine impact;
4. Assess the conservation of cold water stores in Folsom Reservoir to determine curtains' impact;
5. Assess impacts on recreation, and work with stakeholders to implement appropriate remedies;
6. If desired temperature reduction occurs, pursue modifications to achieve optimal reductions;
7. Evaluate benefits relative to adverse effects; and
8. Provide recommendations on whether to commence annual program to install and maintain curtains.

2. Justification and selection of project type

The hypothesis to be evaluated by the construction, installation and monitoring of this **pilot project** is that ***strategically placed temperature curtains can reduce LAR inflow temperatures from Lake Natoma.***

An aerial view of the project site, depicting the location of the proposed curtains appears on page 8. A plan view of Curtain #1 is found on page 9, and an elevation view on page 10. The plan view for Curtain #2 is found on page 11, with the elevation view on page 12.

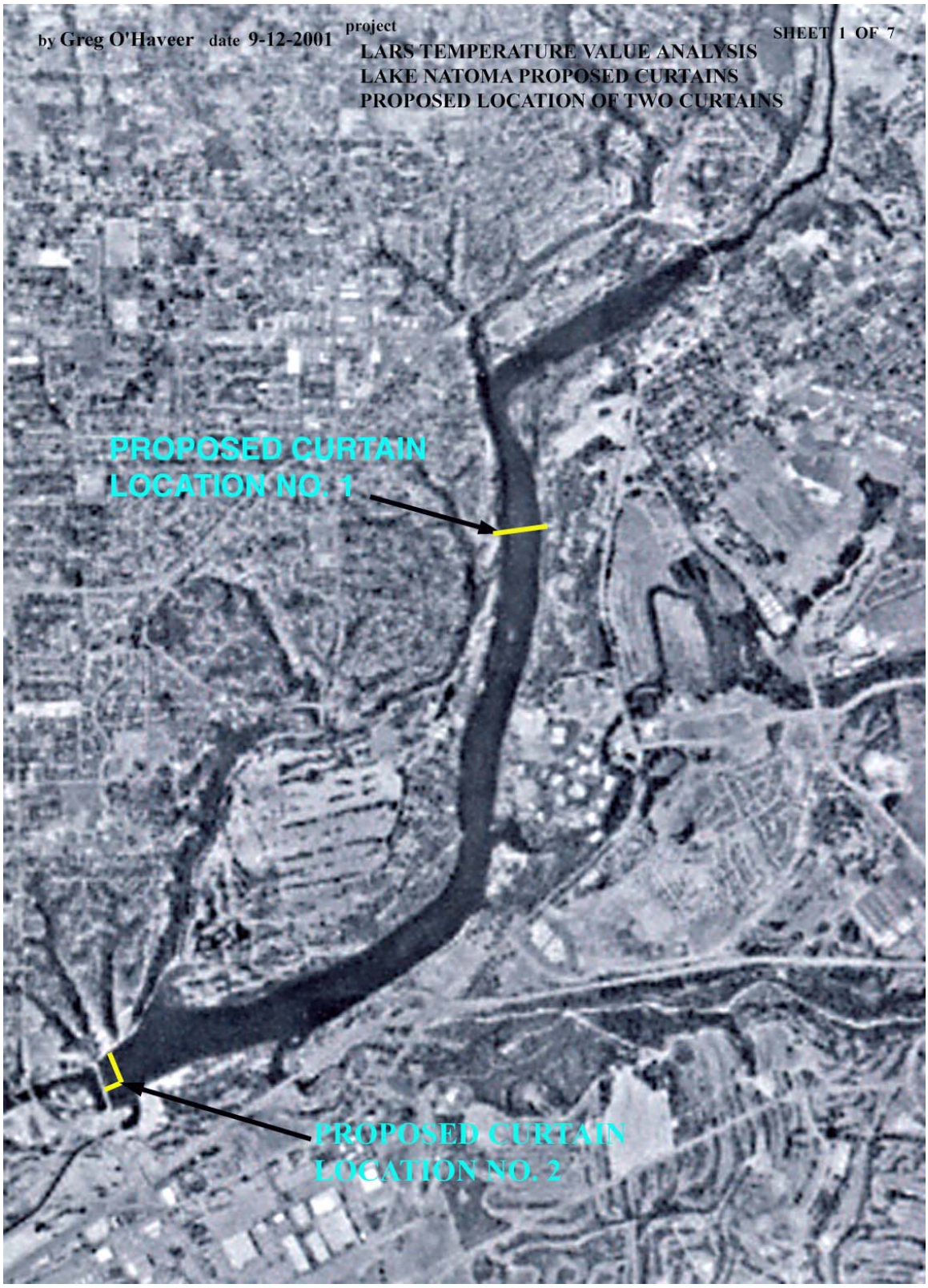
The curtains essentially provide three means for reducing temperatures:

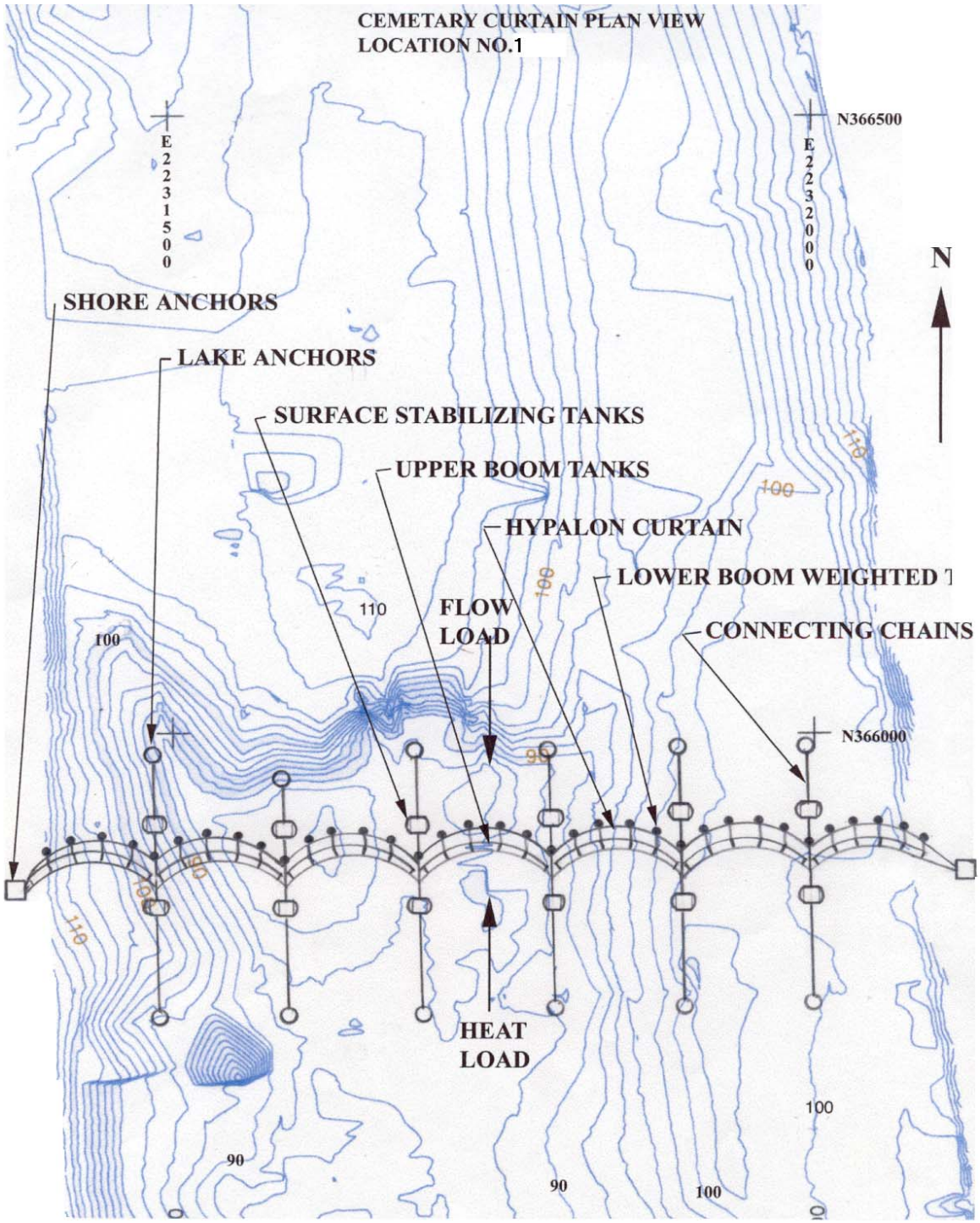
1. Creation of a barrier allowing only the desired colder, denser waters to proceed downstream to prime anadromous salmonid spawning and rearing habitat.
2. Reduction of the mixing of temperature layers caused by turbulence or differences in thermal layer velocities. The curtain system is designed to maintain underflow velocities of less than one foot per second and preferably less than 1/2 foot per second in order to adequately reduce the mixing and maintain the integrity of the lower cold water layer.
3. Efficient utilization and preservation of the cold water at Lake Natoma, allows for the conservation of cold water stores in Folsom Reservoir for fall release during spawning.

Temperature curtain effectiveness in reducing water temperatures is proven, however what needs to be tested in this project are some of the design and site specific variables that will likely impact optimal performance. The hydrodynamic and thermodynamic variables existing in Lake Natoma are so numerous that determining the curtains' optimum design from laboratory tests would be impractical. Additionally, laboratory test costs are estimated to be nearly equal to the construction and installation costs. Therefore this test project proposes the construction and installation of full-scale portable curtains that will allow:

1. Relatively quick installation and removal (initial installation would take approximately 2-weeks, thereafter installation and removal would take 2-4 days);
2. Determination of project success, including adjustments needed to obtain optimal performance within 6-months of installation;
3. Ability to adjust the orifice size "in place" to maximize the curtain's benefits; and
4. The ability to use the curtains for test purposes at other sites outside the scope of this project.

The desired net result of the curtains is a 1 to 2°F reduction in temperatures flowing into the LAR. Following is an aerial photo of Lake Natoma indicating the placement of the two curtains, and concept drawings of the curtains:

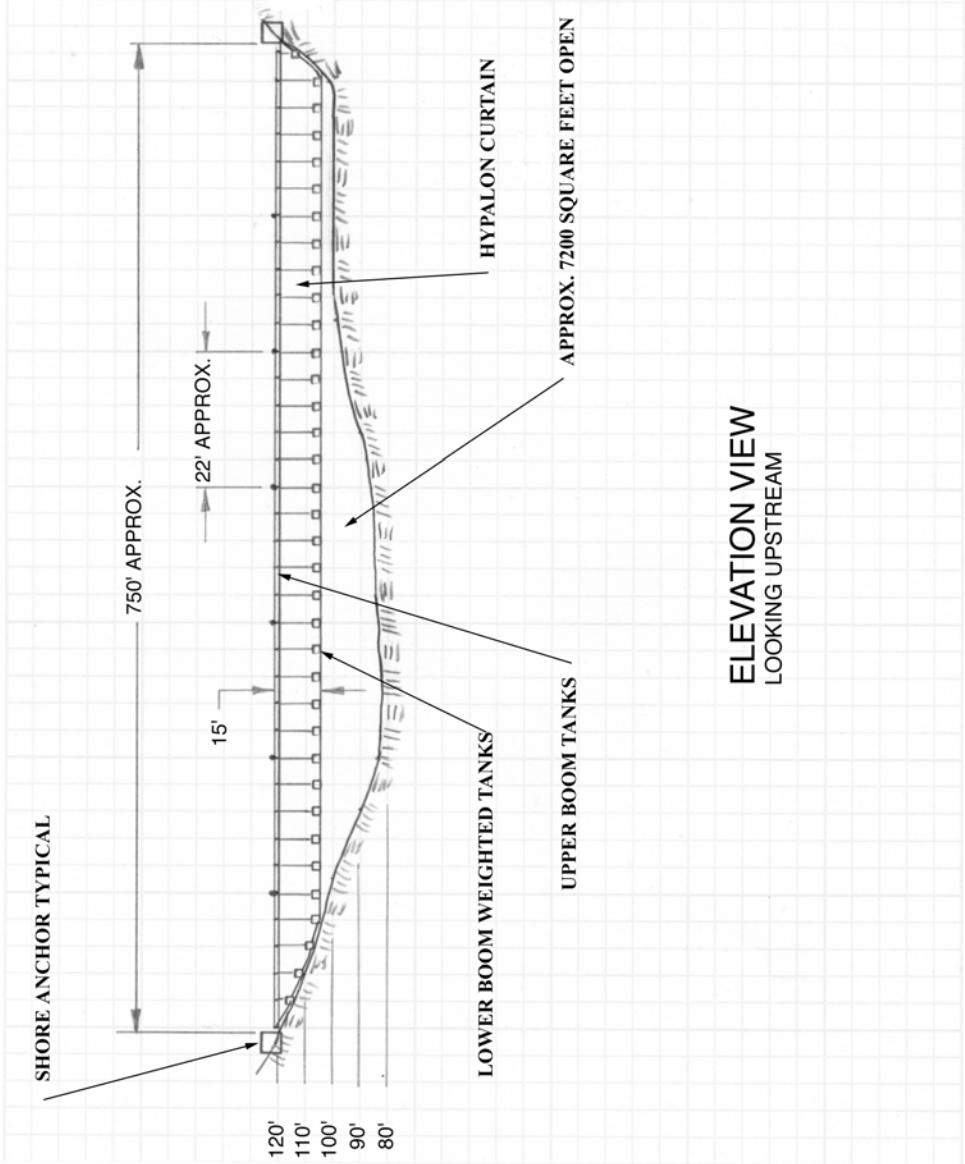

by Greg O'Haveer date 9-12-2001
project
LARS TEMPERATURE VALUE ANALYSIS
LAKE NATOMA PROPOSED CURTAINS
PROPOSED LOCATION OF TWO CURTAINS
SHEET 1 OF 7
PROPOSED CURTAIN
LOCATION NO. 1
PROPOSED CURTAIN
LOCATION NO. 2

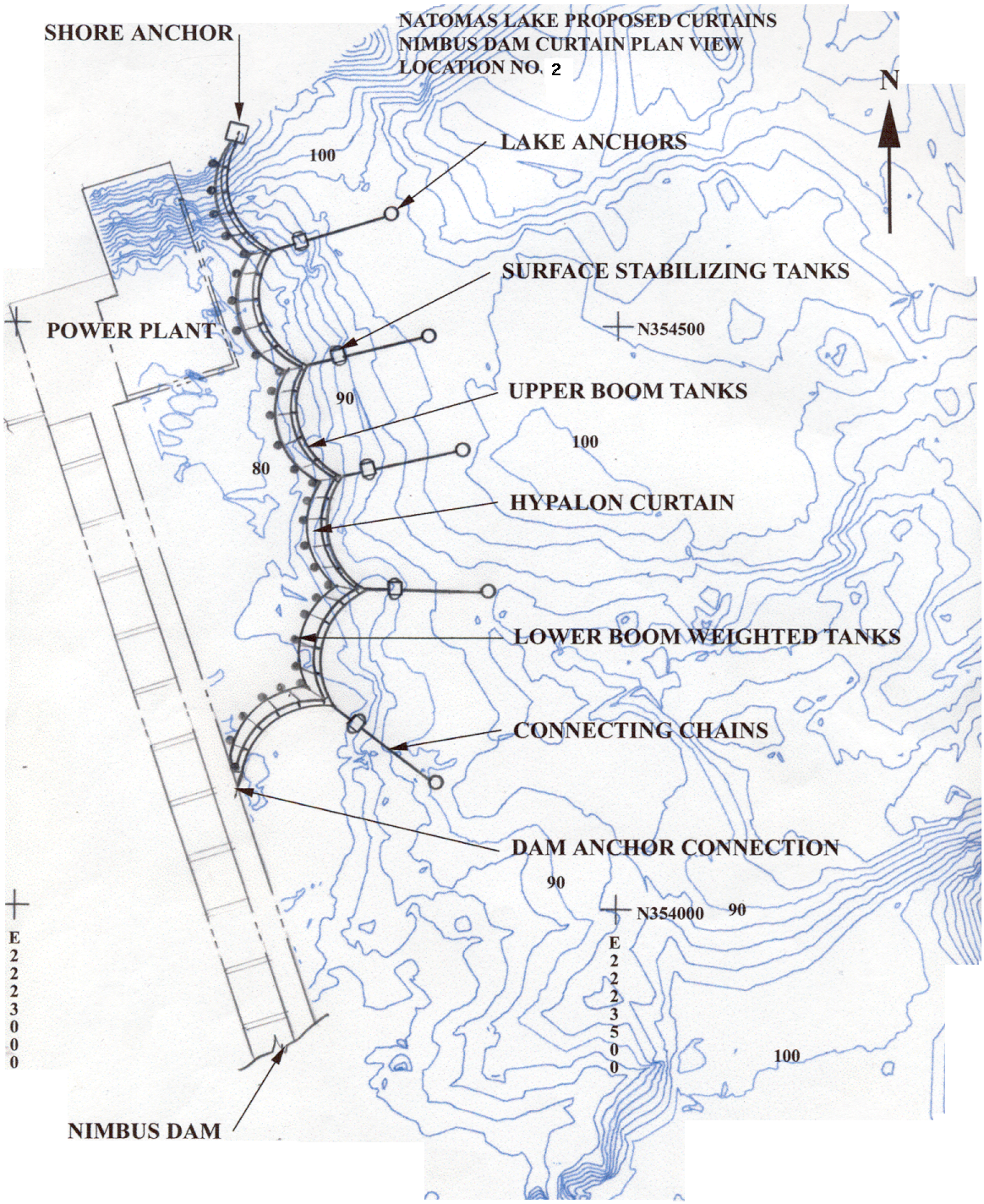

CEMETARY CURTAIN PLAN VIEW
LOCATION NO.1
E2231500
N366500
E2232000
N
SHORE ANCHORS
LAKE ANCHORS
SURFACE STABILIZING TANKS
UPPER BOOM TANKS
HYPALON CURTAIN
LOWER BOOM WEIGHTED
FLOW LOAD
CONNECTING CHAINS
N366000
HEAT LOAD
110
100
90

7-1654 (11-94)
Bureau of Reclamation

COMPUTATION SHEET

BY **Greg O'Haver**	DATE **9-12-2001**	PROJECT **LARS TEMPERATURE VALUE ANALY**	SHEET 3 OF 7
CHKD BY	DATE	FEATURE **LAKE NATOMA PROPOSED CURTAINS**	
DETAILS **CEMETARY CURTAIN--ELEVATION VIEW--PROPOSED CURTAIN NO. 1**			

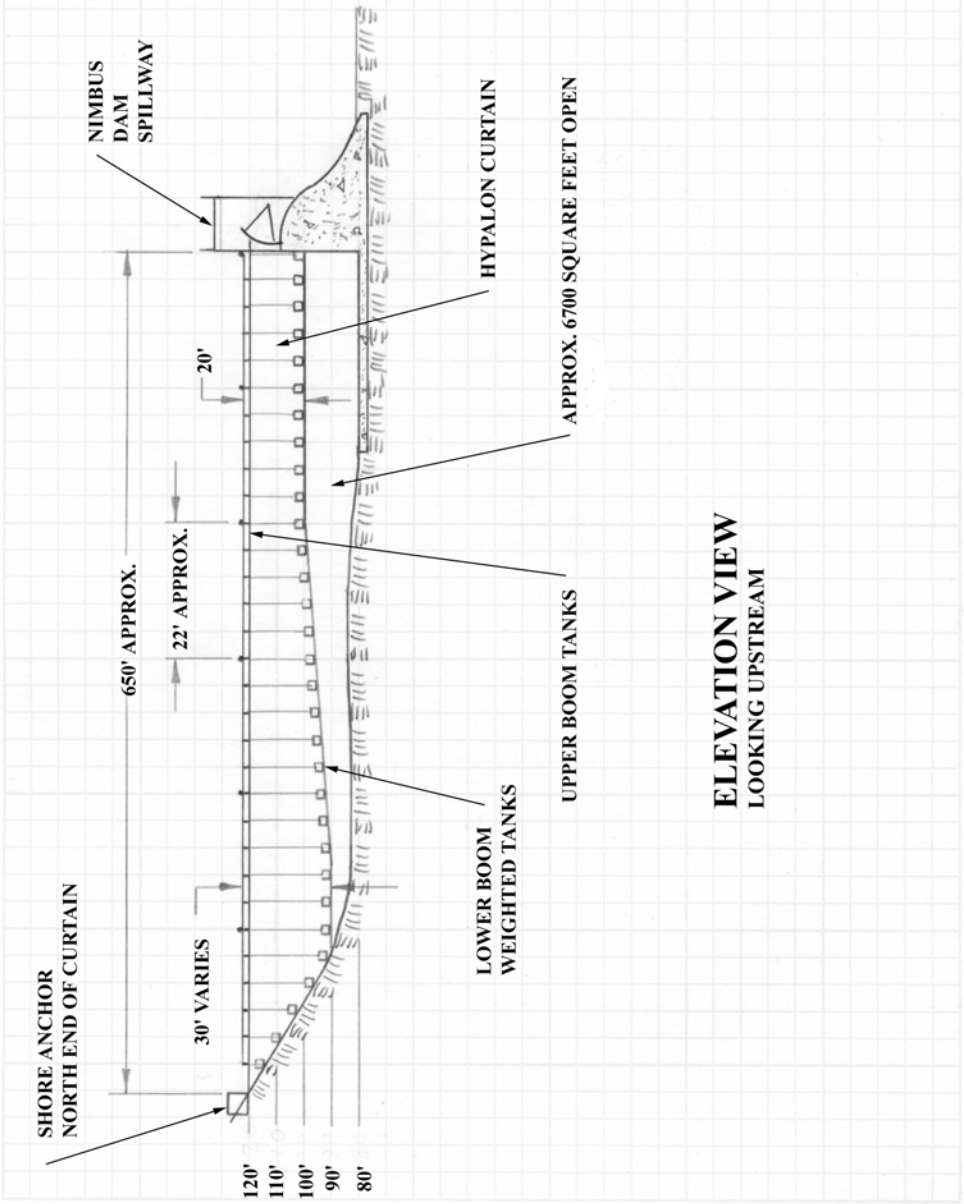



NATOMAS LAKE PROPOSED CURTAINS
NIMBUS DAM CURTAIN PLAN VIEW
LOCATION NO. 2
N
SHORE ANCHOR
LAKE ANCHORS
SURFACE STABILIZING TANKS
POWER PLANT
N354500
UPPER BOOM TANKS
HYPALON CURTAIN
LOWER BOOM WEIGHTED TANKS
CONNECTING CHAINS
DAM ANCHOR CONNECTION
NIMBUS DAM
100
90
80
100
90
90
100
E2223000
N354000
E2223500

7-1654 (11-94)
Bureau of Reclamation

COMPUTATION SHEET

BY Greg O'Haver	DATE 9-12-2001	PROJECT LARS TEMPERATURE VALUE ANAL.	SHEET 5 OF 7
CHKD BY	DATE	FEATURE LAKE NATOMA PROPOSED CURTAINS	
DETAILS NIMBUS DAM CURTAIN--ELEVATION VIEW PROPOSED CURTAIN NO. 2			



Temperature Curtain Examples

Other sites in California employing curtains as a means of reducing temperatures are the Clear Creek Tunnel Intake, Spring Creek Power Plant Intake, and the Carr Power Plant tailrace. The Clear Creek Tunnel Intake takes water from Lewiston Reservoir and delivers water to Carr Power Plant which discharges into Whiskeytown Reservoir. Two flexible curtains, a tailrace curtain at Carr Power Plant and an intake curtain surrounding the Spring Creek Tunnel Intake were installed at Whiskeytown Reservoir. The U.S. Bureau of Reclamation engineers designed and installed the curtains to manage water temperatures downstream of hydroelectric facilities at these Central Valley Project facilities.

The Clear Creek Tunnel curtain is 830-feet long and 35-feet deep, and was constructed and installed in 1992. Analysis of data collected near the Clear Creek Tunnel Intake showed the effectiveness of the reservoir curtain in reducing the temperature of water entering the intake. The average temperature of water released through the Carr Power Plant was reduced by 1 to 2.5° F. The results were based on similar operational conditions such as flows, duration, and time of year.

Though 1 to 2.5°F may appear small, Sacramento River temperatures were approaching critical levels in 1992, the year the curtain was installed. These slightly lower temperatures are believed to have helped sustain viable spawning and rearing habitat for threatened salmon populations. But, even lower temperatures were needed. So, in 1993, crews installed two additional flexible curtains at the Carr and Spring Creek Power Plants.

A tailrace curtain was installed at Carr Power Plant. This 600-feet long, 40-feet deep curtain was designed to hold back the warm surface water and allow cold water inflow to the cold water zone, essentially reducing the thermal mix. The Spring Creek Power curtain is 2,400-feet long and 100-feet deep. Like the Clear Creek curtain, the Spring Creek curtain was designed to retain warm surface water while allowing only the colder water from lower levels to flow downstream.

Though only limited monitoring data was initially collected at Whiskeytown Reservoir, preliminary data indicates that the temperatures of water released from Spring Creek's Power Plant is from 3 to 5°F cooler after installation of the curtains than in prior years with similar operating conditions.

(Above information from Cited Literature #1, 5 and 6.)

Consideration of Other Measures

The draft "Ecosystem Restoration for Fisheries/Aquatic Resources through Water Temperature Reduction in the Lower American River" was released in July 2001. The

report was prepared under contract with Sacramento Area Flood Control Agency by Jones & Stokes, with technical assistance from Surface Water Resources, Inc., and HDR Engineering. Ten water temperature reduction measures were considered for restoring fisheries/aquatic habitat in the LAR, including the temperature curtains. Other measures under consideration included: shutter modifications, upstream water purchases, cold-water isolation, and bypass turbines.

While analysis indicates that other methods may generate higher temperature reductions, analysis also indicated that the curtains offer the most immediate and economically feasible temperature reduction aide. Rigid structures have a significantly higher cost and much longer start-up timelines. Temperature curtains are passive and require no energy input once installed. Using design principles and standard construction methods, curtains are relatively easy to fabricate, install and maintain; they are not harmed by overloading, are designed to relieve excess loads; and are versatile, requiring little modification for changing conditions or locations.

Recreational Issues
Concern has been expressed regarding the potential negative impacts on recreation safety and access at the project site. Lake Natoma is a popular passive recreation site, hosting year-round boating, fishing and swimming activities. Members of the project team have met with recreation providers and community interest groups to discuss the project's impact and measures for reducing impacts. While the curtain at Nimbus Dam is not anticipated to impact recreationalists, the upstream plunge point curtain will require design elements that will allow the passage of boats, along with signage and safety lighting. If funded, recreation stakeholders have been assured we will work with them during the final design/engineering phase to ensure that their needs are fully accommodated. Stakeholders were unanimous in their support of this project, felt strongly that two openings (dimensions to be determined), signage and safety lighting would likely satisfy their concerns, and agreed to work with us during the final design phase to accommodate recreation safety and access.

3. Approach

This project would construct two portable surface-suspended Hypalon rubber test curtains (Curtains #1 and #2) that would restrict the flow of warmer surface waters, while leaving an open adjustable orifice at the bottom to maximize the cold water flow through Lake Natoma and into the LAR. The curtains consist of the following components:

1. A *nylon reinforced Hypalon curtain*, heat welded into a single panel with pockets at the bottom for enclosing the bottom horizontal chain;
2. Air-filled *upper boom tanks* of approx. 18 inches in diameter and 20 feet long, linked together to support the curtain at the lake's surface;

3. *Lower boom tanks* of approx. 600 pounds each, spaced 20 feet apart, constructed of concrete and zinc-coated steel hang from the upper boom tanks and help stabilize the curtain. Using injected compressed air, these tanks can also be floated to adjust the size of the orifice;
4. Concrete *shore anchors* weighing 8,000 pounds each will secure the curtains to shore;
5. *Steel brackets* bolted to the dam and grouted-in-place anchor bolts will secure the upper floating boom chain forces;
6. Steel and concrete *lake anchors* weighing approx. 5,000 pounds each, spaced every 100 feet along the upstream side of Curtain A, and both the upstream and downstream side of Curtain B will secure the curtain to lake bottom;
7. Air-filled *surface stabilizing tanks* constructed of zinc-coated steel will carry the loads from the lake anchors to the upper boom;
8. High strength *galvanized chains* will connect all tanks and booms, forming a net-like structure that will stabilize the curtains and carry all loads to the anchors and between components.

Curtain #1 would be approximately 700 feet long, suspended from the surface to a depth of 15 to 20 feet, leaving an open orifice area of approximately 7,200 square feet to meet the ideal .5 feet per second velocity requirement. Installation would occur approximately ½ mile south of Negro Bar.

Curtain #2 would be approximately 600 feet long, suspended from the surface to a depth of 20 to 25 feet, and installed just upstream of Nimbus Dam spillway gates around the Nimbus Power Plant intake structure. Summer flows through Lake Natoma rarely exceed 4,000 CFS (cubic feet per second), thus Curtain #2's orifice size of 8,000 square feet would meet the ideal .5 feet per second velocity requirement.

While the primary purpose of Curtain #2 is to supply cold water to the Nimbus Dam spillway, Curtain #1 is intended to reduce plunge point mixing. A study by AG-RECON in September 2000, reveals that the position of the existing plunge point moves up and down Lake Natoma daily over a distance of about one-mile due to variable releases from Folsom Dam, and the daily fluctuations of solar radiation and ambient temperatures. Installation of a plunge point curtain would confine the plunge point to one location minimizing the mixing.

Curtain #1 would also help contain the warm water layer and serve to insulate the colder bottom water. More heat could then be lost to the atmosphere, especially at night, due to increased evaporation and radiation, further improving cold water storage and conveyance.

Temperature monitoring equipment is currently in place, is owned and operated, and will be made available for the purposes of this project, by the U.S. Bureau of Reclamation. Some adjustments to the position of the temperature monitoring equipment may need to occur once the curtains have been positioned. The Bureau has agreed to assess the positioning, make whatever adjustments may be required, and continue the task of monitoring and analyzing the data.

4. Feasibility

Temperature control curtains have been successfully employed to reduce water temperatures at Lewiston and Whiskeytown Reservoirs. Temperature monitoring, mapping, flow analysis, and preliminary design/engineering research strongly indicates that temperature reduction will occur at Lake Natoma following installation of the proposed curtains.

Cooperation and coordination with partnering agencies will help guide and assure that the temperature management curtains are designed, constructed, installed, maintained and monitored to the highest standards. The Water Forum, by its very nature, has a solid working relationship with SAFCA and the U.S. Bureau of Reclamation, and will be working closely with the Bureau to ensure adequate design/engineering and overall project guidance. The California Department of Fish and Game, U.S. Fish and Wildlife Service, National Marine Fisheries Service and SAFCA will also provide guidance, particularly with permitting, and monitoring both temperature and potential recreational impacts. The Project Team (see Biographies) has the expertise and support services necessary to perform the tasks within the proposed timeline.

The Project Team is comprised of Water Forum, SAFCA and U.S. Bureau of Reclamation staff. Two of the Bureau's staff (G. Greg O'Haver and Tracy Vermeyen, P.E.) are consider leading authorities on temperature curtains and have worked closely with the Water Forum in the assessment and development of this project (concept design, implementation, timeline and costs).

All compliance and permits will be secured prior to the project going to bid. All applications will be submitted as a "test project," with the understanding that upon determination that the test is successful, permanent approvals will be pursued. The project requires compliance with CEQA and NEPA, Sections 401 and 404 of the Clean Water Act, Section 1601 of the State Fish and Game Code, and Reclamation Board Approval. Permission to access the property by the U.S. Bureau of Reclamation and the California State Department of Parks and Recreation is expected prior to the award of this grant.

5. Performance Measures

In spring 2001, temperature monitoring devices were placed at six strategic locations within Lake Natoma. Each location has a single line containing separate temperature measuring units spaced at 5-foot depth intervals. The "temperature data loggers" record the temperature of each unit every 15 minutes. In addition, permanent stations are located downstream of Folsom and Nimbus dams that record water temperatures released from these facilities at 15 minute intervals. The data from these stations provides a critical foundation for the analysis of the temperatures following installation of the curtains.

Following installation, temperature monitoring, data collection and analysis will continue in the same manner in order to assess the curtains' temperature reduction impacts.

The goal of this project is to improve the spawning and survival of rearing anadromous salmonids by reducing water temperatures in the lower American River and conserving cold water stores at Folsom Reservoir. It is anticipated that lower American River temperatures may be reduced an average of 1° F over the 6-month period, with a temperature reduction range of from .5 to 3°F.

Additionally, the reduction of water temperatures flowing into the lower American River will conserve Folsom's early to mid-summer cold water stores. The preserved Folsom cold water stores may then be made available for late summer/early fall release when the possible threat of Lake Natoma's deepening warm water thermal layer generates a need for an infusion of cold water from Folsom Lake. Reducing early to mid-summer cold water demand from Folsom Reservoir is conservatively estimated to preserve 30,000 acre feet of cold water over a four month period, which is (at 1,500 acre feet per day) the equivalent of a 20-day extension of cold water supplies.

This year, September/October 2001, a 20-day supply of cold water would have been crucial. Cold water supplies at Folsom are depleted. The current high air temperatures have pushed water temperatures beyond sustainable limits. In the words of Project Team member Russ Yaworksy, who has been monitoring the subject temperatures and Folsom releases, "a 20-day supply of cold water now would have made a significant impact in maintaining desired temperatures in the lower American."

6. Data Handling and Storage

All temperature, flow and other physical data collection will be done by appropriate professional staff under the direction of the U.S. Bureau of Reclamation. Data will be analyzed and evaluated to determine their support of the proposal's operating hypotheses. Results of the analysis will be posted in The Water Forum's website for easy access. The website's URL is http://www.waterforum.org

7. Expected Products/Outcomes

Annual reports of the curtains' temperature monitoring data and analyses will be made available upon request. Program managers involved in the planning, construction, monitoring and evaluation of this project will be available to provide presentations and reports are requested. Tours of the temperature curtain sites can be arranged for those considering similar applications.

8. Work Schedule

The tasks and timeline for the Lake Natoma Temperature Curtains Pilot Project is provided in the spreadsheet found on page 24.

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

1. ERP, Science Program and CVPIA Priorities.

The Lake Natoma Temperature Management Curtains Pilot Project contributes directly to ERP Goals 1, 2, 3, and 4 by improving natural processes and aquatic habitats that will enhance populations of selected, at-risk native species dependent on the Bay-Delta estuary and its watershed with minimal ongoing human intervention.

2. Relationship to Other Ecosystem Restoration Projects.

This proposal is submitted with the support of and compliments other proposed improvements recommended in the draft River Corridor Management Plan for the Lower American River (RCMP). The RCMP addresses the Water Forum's co-equal objectives of protecting and enhancing the fish and wildlife resources of the LAR while also providing a reliable and safe regional water supply, as described in the Water Forum Agreement. In addition, the RCMP builds on prior efforts to manage the river for multiple beneficial uses, including the Sacramento Area Flood Control Agency's *Floodway Management Plan for the Lower American River*, CalFed's *Ecosystem Restoration Program Plan*, the Central Valley Project Improvement Act, the U.S. Fish and Wildlife Service's Anadromous Fish Restoration Program, and the California Department of Fish and Game's *Steelhead Restoration and Management Plan for the Lower American River.*

3. Requests for Next-Phase Funding.

Based upon findings, the Water Forum may seek additional funds for the modification of the trial curtains in order to maximize water temperature benefits, and reduce recreational or other impacts.

4. Previous Recipients of CALFED Program or CVPIA funding.

In January 2000, CalFed awarded Contract #99-N21, in the amount of $250,000 to the Water Forum. The funds were allocated for the development of a River Corridor Management Plan (RCMP) for the Lower American River consistent with water management and flood control plan. The draft RCMP was issued in July 2001, and is currently undergoing public review. The final document is expected to be released before the end of this year.

5. System-Wide Ecosystem Benefits.

The success of this project will provide almost an immediate, sustainable, and cost effective means of restoring target fisheries populations dependent upon the Lower American River for spawning and rearing. The success of this project will further validate the effectiveness of temperature curtains.

6. Additional Information for Proposals Containing Land Acquisition.

Not Applicable

C. Qualifications

The Water Forum and SAFCA will serve as the lead agencies and administer the project budget. The U.S. Bureau of Reclamation, Sacramento Office, has agreed to manage and coordinate the project. USBR staff at the Denver research facility will also represent the Project Team.

Leo H. Winternitz, Project Administrator
Executive Director, Sacramento City-County Office of Metropolitan Water Planning (Sacramento Water Forum)
M.S., 1992, Environmental Management (Water Resources), University of San Francisco
B.A., 1975, Biology, Gonzaga University, Spokane, Washington

As Executive Director of the Water Forum, Mr. Winternitz plans and manages the activities of the City-County Office of Metropolitan Water Planning on behalf of the Water Forum, a diverse group of 40 stakeholder organizations representing business, agriculture, citizens groups, environmentalists and water managers who have

collaboratively negotiated a regional water supply and environmental protection agreement to the year 2030. Prior to this position, Mr. Winternitz served as Assistant to Chief Deputy Director of the California Department of Water Resources**.** In that capacity he advised and assisted the Chief Deputy Director in developing and implementing Department policies and programs in areas that included project operations, environmental management, CALFED Program development, and human resources management. Mr. Winternitz's other work responsibilities have included developing the CALFED Program's Environmental Water Account; developing the CALFED Program's Comprehensive Monitoring, Assessment and Research Program; and managing the water quality and Interagency Ecological Program's offices within DWR's Environmental Services Office. Mr. Winternitz has also worked for the Water Resources Control Board, serving as the staff specialist on Bay-Delta water quality and water right issues.

Timothy N. Washburn
Sacramento Area Flood Control Agency, Agency Counsel
B.A. 1983, History, University of California, Berkeley
J.D. 1986, University of California, Davis, King Hall School of Law

Mr. Washburn was an attorney from Weintraub, Genshlea, Hardy, Eirich and Brown from 1986 to 1988; served as Deputy City Attorney for the City of Sacramento from 1988 to 1990; and has been Agency Counsel for the Sacramento Area Flood Control Agency since 1990. As counsel for SAFCA, Mr. Washburn oversees numerous planning, environmental review, acquisition, development and collaborative projects relating to land and water resources within Sacramento's flood plain areas. Projects include levee improvements, river and stream bank protection, habitat restoration, and acquisitions. Mr. Washburn has also overseen the development of numerous studies, including the American River Watershed Investigation, the River Corridor Management Plan for the Lower American River

Roderick Hall, Project Manager
U.S. Bureau of Reclamation, Environmental Specialist
M.S. 1970, Mechanical Engineering (Ocean Engineering), University of Miami
B.S. 1965 , Mechanical Engineering, University of Maryland

Mr. Hall has over 30 years in the field of water resource management with the Department of the Interior, developing expertise in program management and administration, and environmental planning, policy, and compliance. As an Environmental Specialist for the Bureau of Reclamation since 1982, Mr. Hall has developed a strong working knowledge and expertise in the analysis and implementation of projects relating to flow and temperature issues specifically in Lower American River. He has managed large studies leading to construction of a temperature control device on the Municipal and Industrial water supply intake on Folsom Dam, and is presently overseeing the replacement of the fish diversion structure at the Nimbus Fish Hatchery.

Mr. Hall is founder and chair of the American River Operations Group, which continually evaluates the operations of the Lower American River. He is also the Bureau's representative on the Water Forum and the LAR Task Force. Mr. Hall's experience in coordinating multi-agency projects, assessing and monitoring environmental compliance, coupled with his working knowledge of the issues affecting Lake Natoma, the Lower American River and anadromous salmonids, renders him ideally suited to the management of this project.

G. Greg O'Haver, Mechanical Engineer
U.S. Bureau of Reclamation, Shasta Dam
B.S., 1970, Mechanical Engineering, University of California, Los Angeles
Registration: Professional Engineer, Mechanical, California #18231

Mr. O'Haver will serve as Design Engineer for this project due to his expertise, knowledge and success in the engineering the temperature curtains at both Whiskeytown and Lewiston Reservoirs. Mr. O'Haver was employed with Lockheed Aircraft Corp. for 6-years, and CH2M-Hill Consulting Engineers for 7-years, before joining USBR over 20 years ago. During that time he has had extensive design experience in developing and monitoring: fish screens (patented the USBR flat plate fish screen), temperature control curtains (4 currently installed in California), fish hatcheries (Livingston Stone Hatchery project leader), dams and power plant maintenance (USBR Shasta Dam office), hydro generation equipment (9 major rewinds and overhauls), buildings and other structures, and mechanical and electrical systems. Mr. O'Haver has also developed working knowledge and design capabilities in the following subjects: water hydraulics, fluid flow and hydraulics; compressed air systems and compressors; buoyancy systems and flotation; cranes, lifting systems and rigging; instrumentation and control of hydro equipment; solar heating systems, passive solar design; materials testing and analysis; environment laws and NEPA documentation; government procurement and contract regulations; and value analysis and value engineering.

Russ Yaworsky, Modeler/Hydraulic Engineer
U.S. Bureau of Reclamation, Mid-Pacific Region, Division of Planning
B.S., 1978, Geological Sciences, Pennsylvania State University

Mr. Yaworsky has 22 years of federal work experience in water resources. Most of his experience (20 years with the Corps of Engineers) has been associated with flood hydrology and reservoir operations in California, Nevada, and the upper Colorado River basin. As a member of the American River Operations Work Group for the past year and a half, Mr. Yaworsky has performed periodic water temperature forecasts for the lower American River. He has also performed annual temperature forecasts for the Stanislaus and Feather Rivers, and has had limited experience with temperature forecasting for the Sacramento River below Shasta Dam, as a participant in the Sacramento River

Temperature Task Group. He is involved with the CALSIM II modeling effort, a water resources model under joint development by the California Department of Water Resources (DWR) and the Bureau of Reclamation, Mid-Pacific Region. The model is being developed for water resources planning and management applications of the State Water Project and Central Valley Project.

Tracy Vermeyen, Research Hydraulic Engineer
M.S., 1986, Hydraulic Engineering, Civil Engineering, Colorado State University
B.S., 1985, Civil Engineering, Colorado State University

Tracy Vermeyen is a research hydraulic engineer with the Water Resources Research Laboratory at Reclamation's Technical Service Center in Denver, Colorado. Since joining the Bureau of Reclamation in 1989, Mr. Vermeyen has been involved with hydraulic modeling, design evaluation of selective withdrawal structures, application of acoustic flow measurements systems, and development of alternative methods for providing emergency spillway capacity for embankment dams. Some of the many professional papers and reports authored or co-authored by Mr. Vermeyen include: Application of Flexible Curtains to Prevent Mixing and Allow Withdrawal in Reservoirs, IAHR, Proceedings from the 5th International Symposium on Stratified Flows, Vancouver, Canada, July 2000; "Review of Past Studies and Data Related To Temperature Management Options for the Columbia River Below Grant Coulee Dam, Washington.," Memorandum Report, U.S. Bureau of Reclamation, Technical Service Center, Denver, Colorado, March 2000; "Use of Temperature Control Curtains to Modify Reservoir Release Temperatures – Prototype Observations," Proceedings, ASCE's First International Conference on Water Resources Engineering, San Antonio, Texas, August 1995; and "A Flexible Curtain Structure for Control of Vertical Reservoir Mixing Generated by Plunging Inflows," American Society of Civil Engineers National Hydraulic Engineering Conference, San Francisco, California, 1993.

D. Cost

1. Budget

The total estimated project cost is $1,960,196 over three years. Total costs for the project in: Year 1 = $206,122, Year 2 = $1,560,854, and Year 3 = $193,219.

The service contract for fabrication and installation will be awarded on a competitive bid basis in accordance with CalFed's guidelines. Details of the contract work as described in the project Approach.

2. Cost-Sharing

The Sacramento Area Flood Control Agency has preliminary offered to provide $150,000 towards this project. The funding request has been submitted for approval and a commitment of the funds is anticipated prior to notification of CalFed grant award.

The U.S. Bureau of Reclamation is contributing temperature monitoring equipment for use in determining the curtains' impacts. Estimated cost of the equipment is $30,000. The monitoring equipment is in place at eight locations within the project area. The equipment and process used to assess current temperatures will be the same following installation of the curtains.

E. Local Involvement

The Water Forum is a diverse group of over 40 business and agricultural leaders, citizens groups, environmentalists, water managers, and local governments in Sacramento County. For over six years environmental agencies and citizens groups have been working on behalf of the Forum to develop, analyze, and implement measures that will provide a reliable and safe water supply for the region's economic health and planned development, and preserving the fishery, wildlife, recreational and aesthetic values of the Lower American River. Numerous agencies and citizens groups have participated in developing and/or reviewing the reports and analyses that led to this proposal. Of primary significance is involvement and support from the Lower American River Task Force's Fisheries and In-Stream Habitat Work Group, and a work group created specifically for this project comprised of Lake Natoma recreation providers and interest groups. Members of the Project Team have also met with recreation stakeholders and have received unanimous support from those groups.

F. Compliance with Standard Terms and Conditions

The terms and conditions as described in Attachment D of the Ecosystem Restoration Program 2002 Proposal Solicitation Package are acceptable to the applicant. Applicant further accepts applicable State of California standard clauses as set forth in Table D-1.

G. Literature Cited

(1) Johnson, P., Vermeyen, T., and O'Haver, G., 1995. "Managing Water Temperatures Below Hydroelectric Facilities," *Hydro Review*, Vol. 14 No. 3, May 1995.

(2) Jones & Stokes. July 2001. Draft Ecosystem Restoration for Fisheries/Aquatic Resources through Water Temperature Reduction in the Lower American River.

(3) Surface Water Resources, Inc. June 2001. Draft Initial Fisheries and Aquatic Habitat Management and Restoration Plan for the Lower American River.

(4) Surface Water Resources, Inc. July 2001. Temperature and Fishery Analysis of Mechanical Temperature Control Device at Folsom Dam.

(5) Vermeyen, T.B., "Performance of the Temperature Control Curtains in Lewiston and Whiskeytown Reservoirs, California, Water Resources Research Laboratory, Denver, Colorado, January 2001.

(6) Vermeyen, T.B., "Use of Temperature Control Curtains to Control Reservoir Release Water Temperatures," Report No. R-97-07, U.S. Bureau of Reclamation, Denver, Colorado, December 1997.

Lake Natoma Temperature Curtains Pilot Project
Tasks, Estimated Costs and Timeline Spreadsheet

Task	Description	Estimated Cost	Timeline
Year 1			
1	Project Management/Administration	$41,030	Oct 2002 to Sep 2003
2	Engineering/Specifications	$86,767	Oct/Nov 2002
3	Permitting and Environmental Review	$78,325	Oct 2002 to Mar 2003
	Year 1 Costs	***$206,122***	
Year 2			
4	Project Management/Administration	$52,044	Apr 2003 to Dec 2003
5	Prepare Bid Package, Solicit Bids, Review and Award Contract	$65,275	Mar 2003
6	Contract Administration	$207,125	Apr 2003 to Sep 2004
7	Fabricate Curtains (includes 10% Contractor Profit and 15%Contingency) (estimate 6 months)	$880,000	May to Nov 2003
8	Signage and Educational Outreach	$23,760	Jan to Sept 2004
9	Install Curtains (includes 10% Contractor Profit and 15%Contingency)	$275,000	May 2004
10	Temperature Monitoring	$27,650	May to Sep 2004
11	Curtain Adjustments	$30,000	May to Sep 2004
	Year 2 Costs	***$1,560,854***	
12	Project Management/Administration	$35,209	Oct 2004 to Jan 2005
13	Contract Administration	$35,718	October 1, 2004
14	Curtain Removals	$80,000	Oct 2004
15	Analysis, Reports and Presentations	$42,293	Oct 2004 to Jan 2005
	Year 3 Costs	***$193,220***	
	TOTAL	**$1,960,196**	