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UNIVERSITY OF CALIFORNIA, DAVIS

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April 16, 1999

CALFED Bay-Delta Program Office
1416 Ninth Street, Suite 1155
Sacramento, CA 95814

Proposal Title: "Hydraulic Testing Facility for Fish Screens at Small Diversions in the Delta"
Principal Investigator – M.L. Kavvas

Dear Colleague:

It is a pleasure to present for your consideration the referenced proposal.

It is our understanding that for purposes of determining applicant category, The Regents will be classified as "State" thereby resulting awards will only include the terms identified in Attachment D of the 1999 Proposal Solicitation Package as "Terms and Conditions for State (CALFED) Funds" and "Standard Clauses-Interagency Agreements".

The University takes exception to clauses pertaining to Substitution, Rights in Data and Indemnification as detailed in Attachment D. On behalf of The Regents of the University of California, we hereby reserve the right to negotiate said clauses as detailed in the Proposal Solicitation Package should this proposal result in a subsequent award.

Please call on the principal investigator for scientific information. Administrative questions may be directed to me or to Rene Domino by telephone, facsimile or electronic mail at the numbers specified above. We request that correspondence pertaining to this proposal and a subsequent award be sent to the Office of Research and to the principal investigator.

Sincerely,

Sandra M. Dowdy
Contracts & Grants Analyst

Enclosures

I -013247

I-013247

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4.5 PSP Cover Sheet (Attach to the front of each proposal)

Proposal Title: Hydraulic Testing Facility for Fish Screens at Small Diversions in the Del
Applicant Name: M. Levent Kavvas
Mailing Address: Department of Civil & Environmental Engineering, Univ. of Calif, Davis,
Telephone: (530) 752-2518
Fax: (530) 753-9584
Email: mlkavvas@ucdavis.edu

Amount of funding requested: $ $558,394 for 2 years

Indicate the Topic for which you are applying (check only one box).

- [x] Fish Passage/Fish Screens
- [ ] Habitat Restoration
- [ ] Local Watershed Stewardship
- [ ] Water Quality
- [ ] Introduced Species
- [ ] Fish Management/Hatchery
- [ ] Environmental Education

Does the proposal address a specified Focused Action? ✓ yes _____ no

What county or counties is the project located in? Yolo

Indicate the geographic area of your proposal (check only one box):

- [ ] Sacramento River Mainstem
- [ ] Sacramento Trib: _____
- [ ] San Joaquin River Mainstem
- [ ] San Joaquin Trib: _____
- [x] Delta: entire Bay-Delta region
- [ ] East Side Trib: _____
- [ ] Suisun Marsh and Bay
- [ ] North Bay/South Bay: _____
- [ ] Landscape (entire Bay-Delta watershed)
- [ ] Other: _____

Indicate the primary species which the proposal addresses (check all that apply):

- [ ] San Joaquin and East-side Delta tributaries fall-run chinook salmon
- [x] Winter-run chinook salmon
- [ ] Late-fall run chinook salmon
- [x] Delta smelt
- [x] Splittail
- [ ] Green sturgeon
- [ ] Migratory birds
- [ ] Other: _____
- [ ] Spring-run chinook salmon
- [ ] Fall-run chinook salmon
- [ ] Longfin smelt
- [ ] Steelhead trout
- [ ] Striped bass
- [x] All chinook species
- [x] All anadromous salmonids

Specify the ERP strategic objective and target (s) that the project addresses. Include page numbers from January 1999 version of ERP Volume I and II:

The strategic objective of this proposal is to identify the hydraulic and mechanical problems of the small diversion fish screens which are in current use in the Bay-Delta region. (page 17 of the Proposal Solicitation package)

I. TITLE PAGE

A. Title of project: HYDRAULIC TESTING FACILITY FOR FISH SCREENS AT SMALL DIVERSIONS IN THE DELTA

B. Principle Investigator: M. Levent Kavvas, Professor
Department of Civil and Environmental Engineering
University of California, Davis
One Shields Avenue
Davis, CA 95616
(530) 752-2518, FAX (530) 752-2385,
mlkavvas@ucdavis.edu

C. Type of Organization and Tax Status: State assisted public research and educational institution

D. Tax Identification Number: 94-603-6494

E. Participants/Collaborators in Implementation:
California Department of Water Resources
California Department of Fish and Game
National Marine Fisheries Services

II. EXECUTIVE SUMMARY

The decline of fish population at the Sacramento-San Joaquin Delta and river system has been attributed mainly to fish losses caused by water diversion and entrainment at water intake facilities. Fishes are known to be lost to entrainment at unscreened diversions, and impingement on fish screens. Installation of fish screens and improvements to existing fish screens have been identified by CALFED as activities that provide direct benefits to fish resources, habitats, and ecosystem processes by reducing stressors associated with water diversions (ERPP, Vol. 1, p. 425). The failures of fish screens at small diversions have occurred frequently in the Sacramento-San Joaquin Delta and river system. In order to identify the causes of failures of the small diversion fish screens and to improve effectiveness of fish screens at small diversions, we propose to utilize our hydraulic testing facility for fish screens at small diversions in the Delta and to conduct hydraulics testing on the failed fish screens. The testing facility will be prepared for these tests by modifying an existing large flume facility (Monster Flume) in the UC Davis Hydraulics Laboratory. The proposed facility is designed to be able simulate the river flow condition near a small diversion fish screen. It could be used for the purposes of design, operation, and maintenance of screened water diversions so that Sacramento-San Joaquin watershed fish resources are more effectively protected. Unlike field-based studies, investigations with the proposed fish screen testing facility allow detailed observations on fish screen performance under controlled flow and environmental (e.g., debris and sediment) conditions. For each screen type, results of experiments will be applied to determine optimal screen design and optimal operating conditions.

CALFED funding is requested to support the construction of the hydraulic testing facility for small diversion fish screens at UCD Hydraulics Laboratory, and implementation of the hydraulic studies of failed small diversion screens. The proposed small diversion fish screen testing facility should be funded by CALFED because it addresses a major stressor, water diversions, and is specifically designed to produce the scientific information necessary for CALFED to reduce the adverse impacts of the stressor by installation of protective fish screens. Results of this project will provide benefit to anadramous fishery in the entire Bay/Delta and mainstream rivers and to farmers who divert water from the rivers in the Sacramento-San Joaquin Delta Ecological Management Zone.

Total funding requested from CALFED is $558,394 for 2 years. This amount includes funds for equipment, supplies, and labor for flume modifications, salaries and benefits of personnel, travel, publication costs, and overhead rate of 46% ~ 48%. Additional support will be provided by our funding partners, including UC Davis, DWR and DFG.

Dr. M. Levent Kavvas is a professor at University of California, Davis. He has been responsible for many research projects in the areas of hydraulic and hydrologic engineering, in collaboration with different state agencies. He is currently a principal investigator on the Fish Treadmill study, an extensive study of the performance and behavior of Delta fishes exposed to 3-D flow fields near large flat plate fish screens.

Project results will be reported in regularly submitted quarterly, annual and final reports. Results will also be submitted for publication in peer-reviewed scientific journals, presented at interagency workgroup meetings, and will be available for public review.

This project complements several ongoing field and laboratory based projects investigating fish responses to fish screens, fish screen effectiveness, and fish screen hydraulic performance, including the fish treadmill project (DWR contract #B-80898), a detailed investigation of the behavior and performance of Delta fishes exposed to large flat-plate fish screens.

II. PROJECT DESCRIPTION

A. Project Description and Approach

1. Introduction and Backgroud

The decline of fish population at the Sacramento-San Joaquin Delta and river system has been attributed mainly to fish losses caused by water diversion and entrainment at water intake facilities. A number of Delta fish are thought to be adversely affected by screened barriers. Fishes are known to be lost to entrainment at unscreened diversions, and impingement on fish screens. Installation of fish screens has been shown to exclude fishes from diverted water (i.e., reduce entrainment losses of fishes >5mm in length, IEP Technical Report 37, 1994). A fish screen at small diversions can prevent fish from being drawn in. Small diversion fish screens suffer from various mechanical and hydraulic problems that influence their effectiveness in screening fish. Usually debris and sediment will accumulate on the screen without a continuously operational self screen cleaning system. Failures of the screen cleaning system cause the fish screen failure and the diversion failure.

Recently, Natural Resources Conservation Service of USDA (NRCS) has designed and installed several small fish screens for farmers on their diversions along Sacramento River according to the current NMSF and CA DFG fishscreen criteria. However, there have been several failures of these small agricultural diversion fish screens, (e.g., H&A Andreotti Farms fish screen and Butte Creek Farms fish screen). Currently, NRCS is doing the field engineering evaluations of the failures. Generally, small fish screens have their own self screen cleaning system to remove the debris and sediment that clog the screen. Most of the failures of small diversion fish screens are due to the mechanical failures of the cleaning system. The mechanical failures of the cleaning systems may be caused by some particular unknown hydraulic conditions. The presence of debris and sediment near a small fish screen increases the hydraulic complexity of the flow fields near the screen and inside the screen. The flow through a screen depends not only on the hydraulic gradient across the screen, but also on debris and sediment accumulation on the screen. Design of the cleaning system for the small diversion fish screen can be improved through better understanding the hydraulic conditions under various possible flow conditions and debris conditions with a particular screen type. Just field engineering evaluations alone are not sufficient to identify the causes of the failures. Laboratory evaluations are required to identify the problems with the current design of small diversion fish screens.

In order to identify the causes of failures of the small diversion fish screens and to improve these problem-prone fish screens at small diversions, we propose to set up a small diversion fish screen testing facility and to conduct hydraulics testing on the failed fish screens. The testing facility will be constructed by modifying the existing Monster Flume in the UC Davis Hydraulics Laboratory.

This project will provide answers to the following questions: what are the hydraulic conditions around small diversion fish screens, how do they work with high sediment loads and with debris in the water, and how well do the screens work with different cleaning systems, e.g., backwash, air-burst, brushed, etc. This hydraulic test facility will provide controlled hydraulic and environmental conditions, and small diversion fish

screen apparatus can be installed in the facility to simulate the river flow conditions of the potential installation sites of small diversions.

Description of the Hydraulic Testing Facility: The monster flume is located at the UC Davis Hydraulics Laboratory. The current design of the flume is 59 ft long, 12 ft wide and 6 ft high. It rests on a reinforced concrete slab of 59 ft long and 40 ft wide, as shown in Figure 1. The monster flume is connected to 24" diameter steel pipes and pumps that are capable of moving 60-90 cubic feet per second of water. Discharge to the flume is controlled using a bypass valve on the circulation pipes. Different river flow conditions in the river section of the flume can be simulated through the flow control structure at upstream end of the river section, as shown in Figure 1. The purpose of the flow control structure is to effectively guide the water coming from the pumps into the river flow direction, and to allow water from the diversion outlet and the return flow to reenter the river flow section. The diversion takes a portion of the water flow in the river section of the flume. At the downstream end of the river section, a portion of the water enters the return channel as return flow and a portion of the water flows to the water storage pool. Different water depths in the flume channel will be achieved using a control gate at the downstream end of the river section of the flume. A diagram of the proposed design and experimental setting is given in Figure 1. There is sufficient space in the center of the concrete slab in order to accommodate small diversion and fish screen structure.

Other Facilities in UC Davis Hydraulics Laboratory include: a dedicated 265 ft deep well which provides non-chlorinated, air-equilibrated water, a temperature controlled fish holding facility, analytical equipment including 3-D velocimeter with downward and side looking probes, computers, and staff experienced in construction and hydraulic testing.

2. *Objectives and approaches*

The overall objective of this project is to identify the hydraulic and mechanical problems of small diversion fish screens that have failed and/or that are to be installed in the Bay Delta region. This testing facility will provide services that are essential to the normal operations of small diversion fish screens and to the survival of anadramous fishery in the Bay Delta region. It will be used to identify the hydraulic problems that are associated with the failures of various small diversion fish screen apparatus in Sacramento River, and to evaluate and improve the design of the screen cleaning systems of the failed small diversion fish screen apparatus under various hydraulic conditions.

Objective 1: to create an experiment facility for testing small diversion fish screens. It will be able to generate a wide range of independently controlled river flow conditions and environmental conditions.

Approach: to modify the existing monster flume. A return flow channel will be added in order to increase the river flow velocity and to recycle debris and sediment without damage to the circulation pump. The height of the flume will increase to 8 ft in order to simulate large variation in river water surface elevation. A flow

control structure which is capable of guiding the water flow and capable of allowing debris and sediment to pass through will be constructed. A variable speed motor will be needed for the diversion pump.

Objective 2: to identify the hydraulic and mechanical problems that are associated with the currently installed small diversion fish screens.

Approach: to test the selected small diversion fish screens under various combinations of river flow condition, and various diversion pump operation conditions. A diversion with cylindrical wedge-wire screens and backwash self-cleaning system will be installed in the river section of the modified monster flume. The river flow velocity will be controlled by the circulation pump and the flow control structure at the upstream end of the river section and the flume water depth. Various debris and sediment will be add to the water to create various hazardous conditions for the screen. The velocity distribution around the fish screen will be measured using 3-D SonTek Accoustic Doppler Velocimeters, which are capable of measuring turbulent velocities at a rate of up to 25 samples per second, measure velocity in three directions and allow for qualitative assessment of turbulence structures in the flow field near the fish screens. The performance of the fish screen and its backwash self cleaning system will be monitored. Air-burst and brushed type of self cleaning system will then be tested.

3. Proposed Work and Schedule

We propose to construct a hydraulic testing facility for small diversion fish screens and to use this facility for identifying the hydraulic and mechanical problems of small diversion fish screens that have failed and/or that are to be installed in the Bay Delta region. After completion of the construction work, we propose to conduct hydraulic experiments to evaluate the small diversion fish screens that have failed along Sacramento River to identify the hydraulic conditions which associate with these failures.

It is important to test small diversion fish screens with different possible field configurations of these screens under various flow conditions before the field construction. The testing facility will be able to determine under what field configuration such screening apparatus are appropriate and under what field configuration they are not.

The proposed project has two major tasks:

Task 1 – Preparation of a small diversion fish screen testing facility within an existing large flume at UC Davis Hydraulics Laboratory. A hydraulic testing facility for small diversion fish screens is necessary in order to test various configurations of small diversion fish screen apparatus under different controlled flow conditions. A diagram of the proposed flume design and experimental setting is given in Figure 1.

Task 2 – Hydraulic studies of small diversion of fish screens with various self cleaning systems under different flow and environmental conditions.

Task 1 involves the design of the hydraulic testing facility and the associated modification and construction. Redesign and modification of the water circulation system in the Monster Flume are required. The platform for small diversion structure needs a brand-new design. The Monster flume redesign includes a river section, a return flow channel, a flow control structure, and a diversion support system. Steel plates, steel bars, steel pipes, valves, and electric equipment are needed for the modification. Testing the flume and establishing operation rules are also included in Task 1. The three engineers and two mechanical technicians will carry the work of design, modification and testing.

Task 2 includes a) installation of a small fish screen with different self-cleaning systems; b) hydraulic control and operation of the flume, the diversion and the screen; c) hydraulic measurement for hydraulic experiments, such as flow velocity field measurements; d) evaluation of the flow fields around various fish screens in small diversions; e) evaluation of the pressure load on the fish screen structure which is being tested. Operation of the Monster Flume and the diversion apparatus for hydraulic experiments of the small diversion fish screen is part of the Task 2. It demands simultaneous and continuous adjustments by three engineers for incoming flow and discharge, water depth, velocities near the fish screen and in the river section. Task 2 also includes maintenance and repair of the Monster Flume and its water circulation system; regular calibration of instruments used in the Monster Flume; and report writing and presentation of results. The two mechanical technicians are needed for regular maintenance and repair of the Monster Flume.

Schedule

Task 1

October 1st, 1999	Funding begins Final design modifications, acquisition of equipment and materials, modification of the flume and water circulation system, testing of the flume and water circulation system,
September 30th, 2000	completion of the modification work.

Task 2

October 1st, 2000	Installation of fish screens and fish screen cleaning systems, Conduct experiments with different combinations of screens and screen cleaning system, Water velocity measurements near the screen, Final data analysis and interpretation Report writing
September 30th, 2001	Submit final report.

Project management task will be conducted by the Principal Investigator.

B. Location and Geographic Boundaries

The stressors, habitats, and species addressed by this project are located in 11 of the 14 Sacramento-San Joaquin watershed Ecological Management Zones identified by

CALFED to contain screened and unscreened water diversions, proposed new water diversions (e.g., for new off-stream storage, Sacramento River), and/or existing water diversions for which new or upgraded fish screens are proposed (e.g., Clifton Court Forebay at the SWP, Tracy Fish Facility at the CVP) (ERPP, Vol. 1, p 424). The quantitative data generated by this laboratory-based project will be immediately applicable and complementary to ongoing and proposed field evaluations of screened small diversions (e.g., H&A Andreotti farms fish screen and Butte Creek farms diversions). In addition, the results of this project will be broadly applicable to IEP agency and CALFED decision makers to assess and predict the beneficial effects of various screening strategies for proposed CALFED alternatives.

IV. ECOLOGICAL/BIOLOGICAL BENEFITS

A. Ecological/Biological Objectives

Fish screens at small diversions can prevent fish from being drawn in. Installation of fish screens and improvements to existing fish screen facilities have been identified by CALFED as activities that provide direct benefits to fish resources and the ecosystem by reducing stressors associated with water diversions. The Ecosystem Restoration Program Plan (ERPP, Vol. 1, p. 425) contends that a "well-designed fish screen based on proven technology is effective in reducing entrainment and impingement losses of many species of juvenile fish". However, small diversion fish screens frequently suffer from various mechanical and hydraulic problems that influence their effectiveness in screening fish.

This Small Diversion Fish Screen project is specifically proposed and designed by cooperative, multi-agency partners to address these information gaps for small diversion fish screens to provide timely, relevant, and comprehensive data that could be applied to design, operate, and adaptively manage screened water diversions that more effectively protect Sacramento-San Joaquin watershed fish resources. Since this design study is performed at a large laboratory flume, various field configurations can be tested and optimal field configuration can be identified for the available set of small diversion fish screening apparatus for minimizing mechanical failure. It can then be applied at any particular diversion location. The results from this project will assist CALFED and other environmental and resource managers to make decisions regarding small diversion screening and operation of water diversions in ways which truly protect fish, and enhance ecosystem quality, and contribute to fish doubling goals mandated by the CVPIA. The results of this project will also help farmers to choose the fish screen apparatus that is the best for their specific field condition.

The primary ecological/biological objective and benefit of the Small Diversion Fish Screen project is to provide the data necessary to develop the "proven technology" for protective positive barrier fish screens for priority native fishes in the Sacramento-San Joaquin watershed. These data will be useful to design or refine fish screen design, screen site selection, and operation and maintenance of small diversion fish screens. Secondary objectives and benefits include: providing complementary data for field fish screen evaluations; providing an experimental platform for further studies, for example, evaluations of the effects of debris and/or screen cleaning methods on fish performance and behavior.

The experimental approach and use of this facility will provide direct benefit to compliment field fish screen studies in several aspects.

1. The Testing facility is uniquely capable of testing prototype-size small diversion fish screens under a wide range of flow combinations (e.g., high approach velocity combined with low sweeping velocity or low approach velocity combined with high sweeping velocity) and thus provides opportunities for detailed examinations of the interactive effects of river flow and diversion flow.

2. Detailed observations of the performances of the screen and screen cleaning system provide valuable information on important aspects of flow fields and the responses of the screens and screen cleaning system to different flow fields. Field observations of flow fields near fish screens installed at water diversions in the Delta or on rivers are logistically and technically difficult because turbid water conditions limit visibility for human or video observations.

3. Hydraulic (e.g., stream velocity and water depth) and environmental (e.g., debris, sediment) conditions in the field are inherently uncontrolled and cannot be replicated. On the other hand, they can be controlled and reproduced in the Testing facility, enabling the replication of experiments to isolate and detect significant effects of specific factors.

B. Linkages

By establishing a small diversion fish screen testing facility and developing a technology to reduce failures of screen water diversions, the project has links to other ecosystem elements and CALFED goals, including native species recovery and conservation (CALFED Goal 1), improving recreational and commercial fisheries (CALFED Goal 3), and rehabilitation and protection of natural processes (CALFED Goal 2), successful implementation of the CVPIA and of recovery measures for ESA listed species, and non-ecosystem benefits like water supply reliability.

Since this design study is performed at a large laboratory flume, various field configurations can be tested and optimal field configurations can be identified for the available set of small diversion fish screening apparatus for minimizing mechanical failure. It can then be applied at any particular diversion location.

C. System-wide Ecosystem Benefits

This project addresses fish screen problems in the Sacramento-San Joaquin Delta and tributaries. This apparatus, once developed, will also be useful for studies on the effects of other environmental and biological conditions (e.g., temperature, turbidity, salinity, fish size, other species) and different screen types. This testing apparatus is not site specific but it can be easily adapted to a specific site so that various fish screening alternatives can be tested and evaluated.

D. Compatibility with Non-Ecosystem Objectives

Results from this study could have impact on the operational guidelines for fish screens and water diversions by suggesting techniques and approaches for better protection of endangered Delta and riverine fishes. Application of the results of this proposed project could have impacts on sport, commercial and native Californian

fisheries by improving protection of fishes at small water diversions throughout the Delta and river systems and thus enhancing fish populations.

V. TECHNICAL FEASIBILITY AND TIMING

The small fish screen testing facility and the proposed research program are the most appropriate and comprehensive approach to address questions relating to specific aspects of fish screen design, flow criteria, site selection and operation. This project, with highly qualified staff, and maintenance facilities, is a large scale fish screen test program capable of testing delicate, high priority native species like delta smelt under a wide range of realistic, controlled flow and environmental conditions. The project will produce the detailed quantitative data necessary for development of fish screen criteria that protect native priority fishes of the Sacramento-San Joaquin watershed. There are no alternatives presently available or in place to meet the stated objectives.

Much of the required laboratory hydraulic facilities and infrastructure are in place and available. This project capitalizes on a number of existing and new cooperative and collaborative arrangements between our hydraulic engineering research group, applied environmental biology research group, state and federal resource agencies (e.g., DWR, DFG, USFWS, NMFS). It also complements several ongoing and proposed projects, including the Fish Treadmill project (DWR contract # B-80898).

This project will occur in a laboratory setting and requires no CEQA, NEPA, or other environmental compliance documents. No zoning regulations, planning ordinances or other constraints that could impact the schedule and implementability of the project are known. Required permits for water use, discharge, and construction are on file or being processed. There are no laws, regulations, land use conditions, hazardous materials concerns, etc. which would delay or preclude implementation of this project.

Collaborative arrangements:
California Department of Water Resources (DWR): Consultation and assistance in design, and testing of the fish screen configurations.
California Department of Fish and Game (DFG): Consultation in the design of fish screen configurations.
National Marine Fisheries Services (NMFS): Consultation in the design of fish screen configurations and fish behavior experiments.

VI. MONITORING AND DATA COLLECTION

Hydraulic Measurements: Three dimensional water flow velocity field measurements of the river sections will be performed without diversion structure, with diversion installed in the river section and with different diversion discharge. Water velocity will be measured using the SonTek Acoustic Doppler Velocimeter. This instrument is capable of measuring turbulent velocities at a rate of up to 25 samples per second. It measures velocity in three directions and allows for qualitative assessment of turbulence structures in the flow field near the fish screens.

Environmental Conditions: Experiments will be conducted with clear water, water with debris, and water with sediment.

Project results will be reported in regularly submitted quarterly, annual and final reports. The final technical written report will be submitted by October 1, 2001. Results will also be submitted for publication in peer-reviewed scientific journals in the appropriate fields, presented at interagency workgroup meetings, and will be available for public review. Data collection, acceptability, quality control, and evaluation will be described thoroughly in a Quality Assurance Project Plan prepared by the principal investigator, collaborating scientists, and research staff (including research collaborators from state and federal agencies) and reviewed and approved by one or more experts from these collaborating agencies who are not directly involved in the project. The Principal Investigator will store all data for five years after project completion.

VII. LOCAL INVOLVEMENT

The Fish Treadmill project is an ongoing University-based, laboratory program. All required notifications and approvals (e.g., water discharge permit) to UCD, local governments, landowners, environmental groups, and other interested organizations are in place. Public outreach to interested parties (including academics, state and federal agency personnel, local and state media, and the general public) is accomplished through scheduled quarterly meetings, IEP Newsletter articles, journal articles in the scientific and technical press, and related UCD press releases.

VIII. COST AND COST SHARING

A. Budget

Total funding requested from CALFED is $558,394 for 2 years (see Table 1.). Budget costs include salaries and benefits of 2 part-time Hydraulics Laboratory shop technicians, 3 part-time hydraulics engineers who will redesign and modify flume and water supply system and install necessary fish screens, and the principal investigator for one summer month per year. The budget cost for modifications and installations include fish screens, necessary plumbing and valves for water supply system, electrical installation and control devices, observation structure and a car-port type structure to cover the apparatus. The first year budget includes the construction material and equipment. Construction and installation of this type of apparatus at a facility without the water handling infrastructure available at the UCD Hydraulics Laboratory would be significantly more expensive.

Table 1. Total Budget (CALFED funds only)

Task	Direct Labor Hours	Direct Salary and Benefits	Services Contracts	Material and Acquisition Costs	Miscellaneous and other Direct Cost	Overhead and Indirect Costs	Total Cost
Task 1	5400	122972		100000	9707	59697	292377
Task 2	5450	130190		5000	13942	64723	213855
Project Management	390	33497			2000	16665	52162

Grand Total Cost = $558394

Table 2. Quarterly Budget (Year 1)

Task	Oct-Dec 1999	Jan-Mar 2000	Apr-Jun 2000	Jul-Sep 2000
Task 1	148095	48094	48094	48094
Task 2				
Project Management	6521	6521	6520	6520

Year 1 Total = $318459

Table 3. Quarterly Budget (Year 2)

Task	Oct-Dec 2000	Jan-Mar 2001	Apr-Jun 2001	Jul-Sep 2001
Task 1				
Task 2	53464	53464	53464	53463
Project Management	6520	6520	6520	6520

Year 2 Total = $239935

B. Cost-Sharing

Collaborating agencies are expected to provide us with the part-time services of their personnel for different tasks. California Department of Water Resources will provide us with a biologist to consult and assist with the design, construction and testing of fish screen configurations, and to assist with the preparation of the QAPP. California Department of Fish and Game will provide assistance in design of fish screen configurations and preparation of QAPP.

VI. APPLICANT QUALIFICATIONS

A. Organization of the Project

For over thirty years, the University of California Hydraulics Laboratory in Davis has been conducting hydraulic investigations through simulations and scaled models. The present and future research interests of the Hydraulics Laboratory are focused towards meeting the needs for the solution of the ecological, environmental and hydraulic engineering problems existing in the overall Delta region. Currently, the Laboratory is conducting a Fish Treadmill study in order to determine how Delta fish species of various sizes and swimming abilities behave if subjected to a flat plate fish screen, and what are the suitable approach and sweeping velocities and screen exposure duration for various fish species.

The project will be under the direction and supervision of the principal investigator, Dr. M. Levent Kavvas, Professor in the Department of Civil and Environmental Engineering, University of California, Davis. The research engineer Dr. Z.Q. Chen will provide day to day project management, data analysis and interpretation, and report writing. Two post-graduate research engineers will assist with design, construction, operation, and data collection and analysis. Two quarter-time shop technicians will assist in the construction of the related structures, as well as with the daily routine maintenance. Collaborating engineers and biologists from DWR, DFG and NMFS will work with the principal investigators and managing hydraulic engineers and biologists.

B. Collaborating Scientists

Dr. M. Levent Kavvas is a professor at UC Davis, Civil and Environmental Engineering Department since 1985. He has been responsible for many related research projects in collaboration with different state agencies. He is an author of more than 87 journal and proceedings publications in the areas of hydraulic and hydrologic engineering. He has been a member of the Editorial boards of several engineering journals, and is currently the Editor of ASCE Journal of Hydrologic Engineering. He is currently a principal investigator on the Fish Treadmill Study (DWR contract # B-80898), an extensive study of the performance and behavior of Delta fishes exposed to 3-D flow fields near large flat plate fish screens.

Dr. Z.Q. Chen is a Research Engineer with the UCD Hydraulics Laboratory. He has worked on various hydraulic modeling studies, and currently is a lead engineer for the Fish Treadmill Project. He was also involved in the hydraulic modeling study of the Fish Treadmill 1:2.5 scale model. Dr. Chen specializes in computer models in hydrology, hydraulic analysis of rivers and solute transport, and physical hydraulic models.

Mr. Ted Frink, a biologist with the Environmental Services Office, California Department of Water Resources, will advise and assist the project term on design of different fish screen configurations, data analysis and interpretation of results.

Mr. Robert Fujimura, a biologist with California Department of Fish and Game, will assist and advise with us on experimental design, data analysis and implementation of the experiments.
Mr. Rick Wantuck with National Marine Fisheries Services will the project term on the design of fish screen configurations and fish behavior experiments.

C. Conflict of Interest

There are no existing or potential conflicts of interests for any of the personnel involved in this project.

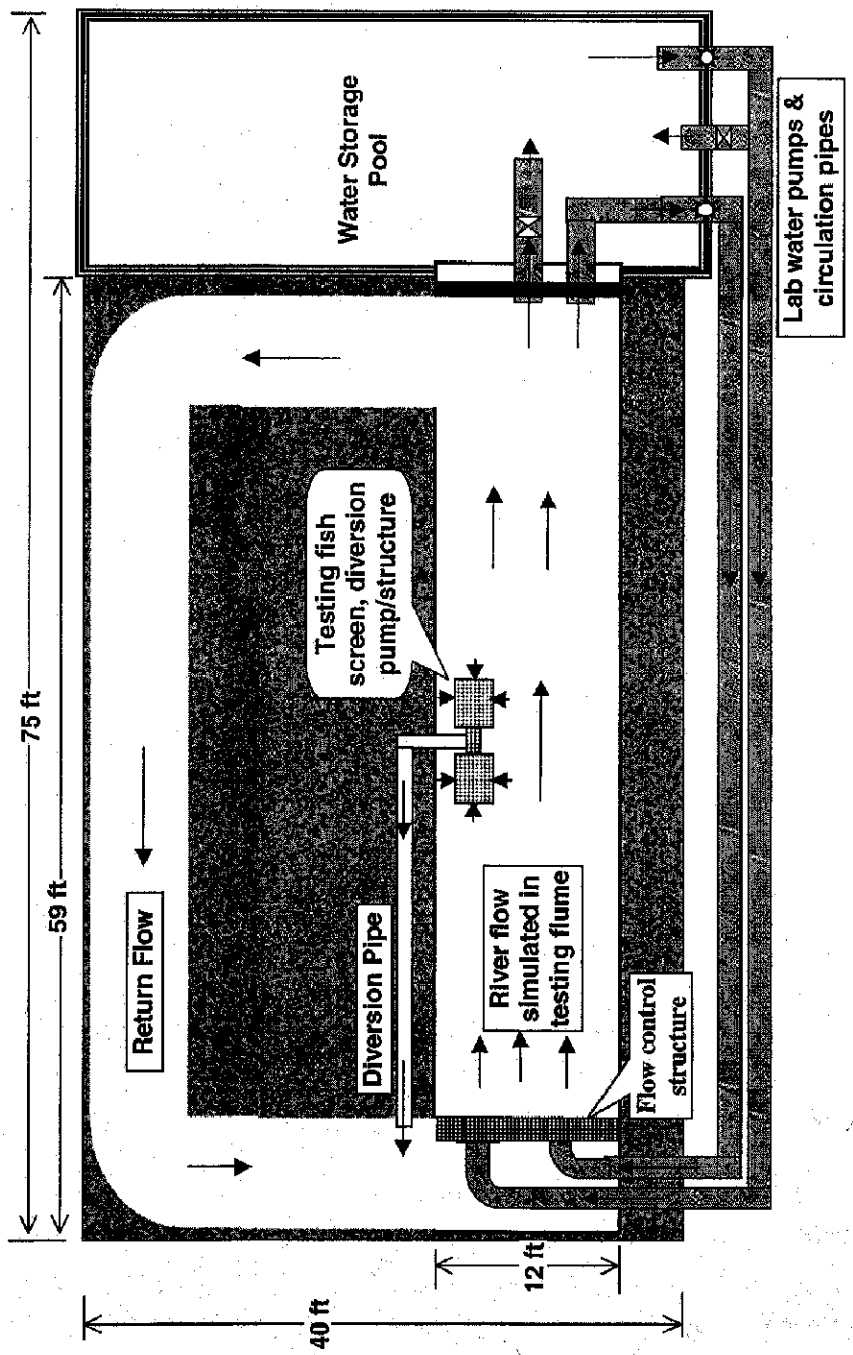

Figure 1. Hydraulics Testing Facility for Small Diversion Fish Screen

I-013264

I-013264

OMB Approval No. 0348-0044

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. CALFED		$	$	$ 239,680	$	$ 239,680
2. CALFED				238,693		238,693
3. CALFED				80,021		80,021
4.						
5. Totals		$	$	$ 558,394	$	$ 558,394

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1)	(2)	(3)	(4)	Total (5)
a. Personnel	$ 73,998	$ 123,356	$ 46,361	$	$ 243,715
b. Fringe Benefits	13,449	21,788	7,707		42,944
c. Travel		2,000			2,000
d. Equipment	100,000	5,000			105,000
e. Supplies	5,000	9,000			14,000
f. Contractual					
g. Construction					
h. Other	4,707	4,942			9,649
i. Total Direct Charges (sum of 6a-6h)	197,154	166,086	54,068		417,308
j. Indirect Charges	42,526	72,607	25,953		141,086
k. TOTALS (sum of 6i and 6j)	$ 239,680	$ 238,693	$ 80,021	$	$ 558,394
7. Program Income	$	$	$	$	$

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	$	$	$	$
9.				
10.				
11.				
12. TOTAL (sum of lines 8 - 11)	$	$	$	$

SECTION D - FORCASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 239,680	$ 140,455	$ 49,613	$ 49,612	$
14. NonFederal					
15. TOTAL (sum of lines 13 and 14)	239,680	140,455	49,613	49,612	

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.	$	$	$	$
17.				
18.				
19.				
20. TOTAL (sum of lines 16-19)	$	$	$	$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:
yr 1 - 239,680 yr 2 - 238,693 yr 3 - 80,021

22. Indirect Charges:
yr 1- 46%, yr 2 - 46.5%, and yr 3 - 48% of MTDC

23. Remarks:

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APPLICATION FOR FEDERAL ASSISTANCE

OMB Approval No. 0348-0043

2. DATE SUBMITTED	Applicant Identifier
04-16-99	
3. DATE RECEIVED BY STATE	State Application Identifier
4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier

1. TYPE OF SUBMISSION:

Application	Preapplication
☐ Construction	☐ Construction
☒ Non-Construction	☐ Non-Construction

5. APPLICANT INFORMATION

Legal Name: The Regents of the University of California

Organizational Unit: College of Engr: Civil & Env. Engr.

Address *(give city, county, State, and zip code)*:
University of California, Davis
Sponsored Projects Office
410 Mrak Hall, Yolo Cty, Davis, CA 95616-8671

Name and telephone number of person to be contacted on matters involving this application *(give area code)*:
M. Levent Kavvas, (530) 752-2518

6. EMPLOYER IDENTIFICATION NUMBER *(EIN)*:
94 - 6036494

7. TYPE OF APPLICANT: *(enter appropriate letter in box)* I

A. State
B. County
C. Municipal
D. Township
E. Interstate
F. Intermunicipal
G. Special District
H. Independent School Dist.
I. State Controlled Institution of Higher Learning
J. Private University
K. Indian Tribe
L. Individual
M. Profit Organization
N. Other (Specify) _____

8. TYPE OF APPLICATION:

☒ New ☐ Continuation ☐ Revision

If Revision, enter appropriate letter(s) in box(es) ☐ ☐

A. Increase Award B. Decrease Award C. Increase Duration
D. Decrease Duration Other *(specify)*:

9. NAME OF FEDERAL AGENCY:
CALFED Bay-Delta Program

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER:
☐☐ - ☐☐☐

TITLE: N/A

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:
Hydraulic Testing Facility for Fish Screens at Small Diversions in the Delta

12. AREAS AFFECTED BY PROJECT *(Cities, Counties, States, etc.)*:
United States

13. PROPOSED PROJECT		14. CONGRESSIONAL DISTRICTS OF:	
Start Date	Ending Date	a. Applicant	b. Project
10/1/99	9/30/01	III	III

15. ESTIMATED FUNDING:

a. Federal	$ 239,680.00
b. Applicant	$ .00
c. State	$ .00
d. Local	$ .00
e. Other	$ .00
f. Program Income	$ .00
g. TOTAL	$ 239,680.00

16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

a. YES. THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:

DATE _____

b. No. ☐ PROGRAM IS NOT COVERED BY E. O. 12372
☐ OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?

☐ Yes If "Yes," attach an explanation. ☐ No

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT, THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.

a. Type Name of Authorized Representative	b. Title	c. Telephone Number
	Sandra M. Dowdy Contracts and Grants Analyst	
d. Signature of Authorized Representative		e. Date Signed
Sandra M. Dowdy		APR 16 1999

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PART E: **Certification Regarding Lobbying**
Certification for Contracts, Grants, Loans, and Cooperative Agreements

CHECK__ IF CERTIFICATION IS FOR THE AWARD OF ANY OF THE FOLLOWING AND THE AMOUNT EXCEEDS $100,000: A FEDERAL GRANT OR COOPERATIVE AGREEMENT, SUBCONTRACT, OR SUBGRANT UNDER THE GRANT OR COOPERATIVE AGREEMENT.

CHECK__ IF CERTIFICATION IS FOR THE AWARD OF A FEDERAL LOAN EXCEEDING THE AMOUNT OF $150,000, OR A SUBGRANT OR SUBCONTRACT EXCEEDING $100,000, UNDER THE LOAN.

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

As the authorized certifying official, I hereby certify that the above specified certifications are true.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL

TYPED NAME AND TITLE

DATE