

# Merced River Gravel Replenishment and Monitoring Project

## Project Information

1. **Proposal Title:**

Merced River Gravel Replenishment and Monitoring Project

2. **Proposal applicants:**

David Vogel, Natural Resource Scientists, Inc.

3. **Corresponding Contact Person:**

David Vogel  
Natural Resource Scientists, Inc.  
P.O. Box 1210 Red Bluff, CA 96080  
530 527-9587  
dvogel@resourcescientists.com

4. **Project Keywords:**

**At-risk species, fish  
Habitat Restoration, Instream  
Sediment Generation, Movement, and Accumulation**

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:**

Channel Dynamics and Sediment Transport

8. **Type of applicant:**

Private for profit

9. **Location - GIS coordinates:**

Latitude: 37.496

Longitude: -120.465

Datum: NAD27

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

Merced River between Snelling, CA and the J59 Bridge

10. **Location - Ecozone:**

13.3 Merced River

11. **Location - County:**

Merced

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:**

18

15. **Location:**

**California State Senate District Number: 12**

**California Assembly District Number: 26**

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

2

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: 40

Total Requested Funds: \$180,905

b) Do you have cost share partners already identified?

Yes

If yes, list partners and amount contributed by each:

**Merced Irrigation District \$5000**

c) Do you have potential cost share partners?

**No**

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

**No**

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

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

**No**

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

**Yes**

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

**ERP-01-N48      Juvenile Salmon Migratory Behavior Study in the North, Central and South Delta      ERP**

**Unknown      Delta Cross Channel Studies      Unknown**

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

**Yes**

If yes, identify project number(s), title(s) and CVPIA program (e.g. AFRP, AFSP, b(1) other).

**FWS Agreement      Merced River Wing Dam Monitoring,      AFRP  
#113320J027      2000-2002**

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

Yes

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

**2001-K203 Merced River Water Temperature Management Feasibility Study AFRP**

**Report Title: Losses of young anadromous salmonids at water diversions on the Sacramento and Mokelumne Rivers AFRP**

**Report Title: Juvenile Chinook Salmon Radio-Telemetry Study in the Northern Sacramento-San Joaquin Delta, January-February 2000 AFRP**

**Report Title: Juvenile Chinook Salmon Radio-Telemetry Study in the Southern Sacramento-San Joaquin Delta, December 2000-January 2001 AFRP**

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)**

<b>Rhonda Reed</b>	<b>California Department of Fish and Game</b>	<b>559-243-4017 ext. 242</b>	<b>rreed@dfg.ca.gov</b>
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<b>Clarence Mayott</b>	<b>California Department of Fish and Game</b>	<b>559-243-4017 ext. 225</b>	<b>cmayott@dfg.ca.gov</b>
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21. **Comments:**

**17a: Overhead is 40% of charge-out rate.**

# Environmental Compliance Checklist

## Merced River Gravel Replenishment and Monitoring Project

### 1. CEQA or NEPA Compliance

a) Will this project require compliance with CEQA?

No

b) Will this project require compliance with NEPA?

No

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

This is a monitoring project.

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

CEQA Lead Agency:

NEPA Lead Agency (or co-lead):

NEPA Co-Lead Agency (if applicable):

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

#### CEQA

-Categorical Exemption

-Negative Declaration or Mitigated Negative Declaration

-EIR

**X**none

#### NEPA

-Categorical Exclusion

-Environmental Assessment/FONSI

-EIS

**X**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?

Not Applicable

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

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

## **LOCAL PERMITS AND APPROVALS**

Conditional use permit

Variance

Subdivision Map Act

Grading Permit

General Plan Amendment

Specific Plan Approval

Rezone

Williamson Act Contract Cancellation

Other

## **STATE PERMITS AND APPROVALS**

Scientific Collecting Permit

CESA Compliance: 2081

CESA Compliance: NCCP

1601/03

CWA 401 certification

Coastal Development Permit

Reclamation Board Approval

Notification of DPC or BCDC

Other

## **FEDERAL PERMITS AND APPROVALS**

ESA Compliance Section 7 Consultation

ESA Compliance Section 10 Permit

Rivers and Harbors Act

CWA 404

Other

## **PERMISSION TO ACCESS PROPERTY**

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

Agency Name:

Permission to access state land.

Agency Name:

Permission to access federal land.

Agency Name:

Permission to access private land.

Landowner Name:

**6. Comments.**

# Land Use Checklist

## Merced River Gravel Replenishment and Monitoring 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).

monitoring only

4. **Comments.**



# **Conflict of Interest Checklist**

## **Merced River Gravel Replenishment and Monitoring 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):**

David Vogel, Natural Resource Scientists, Inc.

### **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):

**Keith Marine    NRS, Inc.**

**Russ Liebig    NRS, Inc.**

### **Comments:**



**Grand Total=180905.00**

**Comments.**

# Budget Justification

## Merced River Gravel Replenishment and Monitoring Project

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

YEAR 1 Principal Investigator: 72 Field Biologist: 200 Field Tech: 40 Data Entry/Clerical: 24 YEAR 2 Principal Investigator: 80 Field Biologist: 144 Field Tech: 40 Data Entry/Clerical: 40

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

YEAR 1 Principal Investigator: \$48.91/hour Field Biologist: \$17.45/hour Field Tech: \$13.28/hour Data Entry/Clerical: \$16.88/hour YEAR 2 Principal Investigator: \$50.38/hour Field Biologist: \$17.98/hour Field Tech: \$13.68/hour Data Entry/Clerical: \$17.39/hour

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

YEARS 1 & 2 Principal Investigator: 20% of salary Field Biologist: 20% of salary Field Tech: 20% of salary Data Entry/Clerical: 20% of salary

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

Travel costs entail travel to and from field sites and include mileage, fuel, meals and lodging. Estimated cost for both years: \$3,540.

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

Supplies & expendables costs pertain primarily to field supplies. Estimated cost for both years: \$4,743.

**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.

A service contract to purchase and deliver new spawning gravel (Task 2, Year 1) will be acquired utilizing CALFED's procedure for competitive bid contracting. Estimated cost \$135,000.

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

None.

**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 presentations, response to project specific questions and necessary costs directly associated with specific project oversight.

Project management tasks and associated costs (based on percentage of time) include: reporting requirements (\$3,949), report preparation (\$5,923), project meetings (\$2,962) and overall project oversight (\$6,910).

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

\$6,000 for 30 radio tags.

**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.

Overhead rate is 40% of charge-out rate and includes workers compensation, office rent, phones, commercial general liability insurance, state disability insurance, utilities, computer hardware and software, furniture, office equipment and supplies, accounting payroll, and unbillable labor of support staff.

# **Executive Summary**

## **Merced River Gravel Replenishment and Monitoring Project**

Construction of dams on the Merced River has impeded the movement of coarse gravels through the river system. Consequently, areas downstream of dams lack recruitment of salmon spawning gravels from areas upstream of the present dam sites. Historic gravel mining operations within the river channels and active lower flood plains have added an additional stressor to the coarse sediment recruitment and transport needs of the river by depleting the natural supply to downstream sites, altering the migration corridor, and creating juvenile salmon predator habitat. Within the principal salmon spawning grounds, there are several riparian diversions that are operated by the construction of temporary wing deflectors in late spring. These wing deflectors are like peninsulas of riverbed material that extend partially across the river to direct water into the riparian canals. The wing deflectors typically wash out with winter and spring runoff flows, carrying the wing deflector material downstream. The diversion operators build the wing deflectors with miscellaneous fill or from material from past wing deflectors that has washed downstream into the river channel. The riparian diverters normally use any fill material available, including fine material which can adversely impact downstream spawning areas. If provided with spawning-sized gravel, some of the riparian diverters will use it for wing deflector construction. Annual provisions of clean, spawning-size gravel at these sites may serve as an effective gravel reintroduction measure to benefit anadromous salmonids. The goal of this project is to improve the quantity and quality of salmon spawning habitat in the Merced River. The objective is to determine if gravel supplementation at riparian wing deflectors is an effective measure for spawning habitat improvements. For this project, we will test the hypothesis of determining if spawning-sized gravel replenishment at several key locations will increase the quantity and quality of spawning habitat in the Merced River. By replenishing gravel at different locations of the Merced River within the spawning reaches, the project may direct future supplements for a more widespread dispersal of suitable gravel for spawning.

# **Proposal**

**Natural Resource Scientists, Inc.**

**Merced River Gravel Replenishment and Monitoring Project**

David Vogel, Natural Resource Scientists, Inc.

## Merced River Gravel Replenishment and Monitoring Project

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### A. Project Description: Project Goals and Scope of Work

#### 1. Problem

Construction of dams on the Merced River has impeded the movement of coarse gravels through the river system. Stressors facing the Merced River system include a series of four dams, including the largest and most upstream, New Exchequer Dam. The reservoir behind New Exchequer (Lake McClure), traps natural sediment sources. Consequently, areas downstream of dams lack recruitment of salmon spawning gravels from areas upstream of the present dam sites. Chinook salmon require these coarse gravels for successful spawning. As a second stressor, the regulated reduction of the magnitude and duration of peak flows of winter and spring runoff flows decrease the ability for the river to transport coarse sediment entering lower sections of the Merced River. Historic gravel mining operations within the river channels and active lower flood plains have added a third stressor to the coarse sediment recruitment and transport needs of the river by depleting the natural supply to downstream sites, altering the migration corridor, and creating juvenile salmon predator habitat (CDFG 1993). Current studies being conducted by the California Department of Fish and Game (CDFG), funded by CALFED, are developing models to simulate sediment input needs and transport rates appropriate for the flows of the Merced River.

On the Merced River within the principal salmon spawning grounds, there are several riparian diversions that are operated by the construction of temporary wing deflectors in late spring. These wing deflectors are like peninsulas of riverbed material that extend partially across the river to direct water into the riparian canals. The wing deflectors typically wash out with winter and spring runoff flows, carrying the wing deflector material downstream. The diversion operators, or riparian diverters, build the wing deflectors with miscellaneous fill or from material from past wing deflectors that has washed downstream into the river channel. The riparian diverters normally use any fill material available, including fine material which can adversely impact downstream spawning areas. If provided with spawning-sized gravel, some of the riparian diverters will use it for wing deflector construction. Annual provisions of clean, spawning-size gravel at these sites may serve as an effective gravel reintroduction measure to benefit anadromous salmonids.

The goal of the project is to improve the quantity and quality of salmon spawning habitat in the Merced River. The objective is to determine if gravel supplementation at riparian wing deflectors is an effect measure for spawning habitat improvements. For this project, we will test the hypothesis of determining if spawning-sized gravel replenishment at several key locations will increase the quantity and quality of spawning habitat in the Merced River. By replenishing gravel at different locations of the Merced River within the spawning reaches, the project may direct future supplements for a more widespread dispersal of suitable gravel for spawning. This project will provide data to enhance

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## Merced River Gravel Replenishment and Monitoring Project

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modeling and restoration efforts and to evaluate the use of wing deflectors as gravel introduction sites.

### **2. Justification**

Addition of appropriately-sized gravel in riffles immediately below Crocker-Huffman Dam has shown an immediate response in spawning activity by fall-run chinook salmon (CDFG 1994, as cited in Kondolf et. al. 1996). One strategy for increasing natural production of salmon on the Merced River is to replenish spawning gravel at key locations. As the river periodically carries this coarse sediment downstream, replenishment of spawning gravels is an ongoing need. The species most likely to benefit from this project are fall-run chinook salmon, an at-risk fish species in the Central Valley. Expected benefits to natural production from this project are evaluation of wing deflectors as effective sites for gravel introduction to enhance and increase the quantity and quality of the spawning areas in the Merced River, and to refine sediment management strategies.

This proposed study will address issues related to natural production habitat restoration in ecological zone 13.3 of the San Joaquin region to allow for future development of spawning gravel restoration projects on the Merced River. As a Next Phase, Research and Restoration project, we expect to determine the productivity return, measured in spawning use by chinook salmon, of clean, spawning-sized gravel introduced at several locations to provide a basis for implementation of restoration actions for replenishing gravel beds. Existing data collected by CDFG under the Central Valley Project Improvement Act (CVPIA) will be analyzed during this project. The analysis and comparison of previous years spawning surveys performed by CDFG, along with surveys done during the monitoring of the gravel replenishment, are expected to demonstrate an increase in spawning use. As part of the vision of the 1988 Ecosystem Restoration Program Plan (ERPP)(CALFED v.1), when natural supplies of gravel and sediment are inadequate, natural supplies should be restored where possible. Where supplies cannot be restored naturally, a feasibility analysis of artificially maintained sediment supplies will be conducted with an objective (CALFED v1) of artificially maintaining sediment supplies below the dams that block natural sediments in rivers. Gravel infusions at the base of dams attempt to replace the natural ecological processes interrupted by dams. This project aims to increase the number of locations of these gravel infusions in an attempt to accelerate the dispersal to natural processes which have been missing since the construction of the lower-most large diversion blocking sediment transport (i.e, Crocker-Huffman Dam, closed in 1910).

### **Conceptual Model**

There is a shortage of spawning gravel in the lower Merced River caused by lack of recruitment from areas upstream of dams and past mining operations within the active river channel. A need for gravel supplementation has been identified (ERP PSP, San Joaquin Priority 1), and the gravel wing deflectors provide possible locations. The gravel

## Merced River Gravel Replenishment and Monitoring Project

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wing deflectors are located below the lower-most impassible dam, Crocker-Huffman, and occur within the reach of the river where a majority of chinook salmon spawn. By using the current design of the wing deflectors with the diverters building their deflectors with the new materials, the result is multiple gravel infusions that occur within the spawning reach of the river. Because of the distribution of coarse gravel and sediment problems hampered by regulated peak flows, the ERPP identified a need for increased magnitude and duration of flows. However, because the river lacks significant gravel recruitment a cost-effective restoration approach may be with multiple, smaller injections of gravel suitable for dispersal under the current flow regime (Figure 1).

After the initial infusions of high quality gravel into the river in the spring, subsequent high flows (e.g., scheduled pulse flows) washes the gravel downstream. Consecutive annual infusions then reestablish the natural downstream gravel movement. It is anticipated that approximately 1,200 to 1,500 tons of clean spawning-size gravel will be added to each of three to five diversions during a CDFG "Merced River Wing Deflector Gravel Replenishment" project in early spring of 2002 funded by the Four Pumps Advisory Committee. It is expected that in the spring of 2002, CDFG will coordinate the acquisition and delivery of gravel and partner with riparian diverters to provide the labor for installing the gravel.

Merced ID, funded by the Anadromous Fish Restoration Program (AFRP), is currently conducting a study of gravel wing deflectors on the Merced River identifying distribution of wing dam material over two years project without the consecutive addition of new spawning sized gravel. Natural Resource Scientists, Inc. is performing the project on behalf of Merced ID. This latter study utilizes tracer rock and telemetered rock to monitor gravel movements and will be completed in 2002. However, the study was limited to distribution of a single washout followed by the diversions being rebuilt with the same material by the diverters who push the gravel back upstream. The deflectors are then subsequently redistributed downstream with high flows. Missing study factors that are of value are centered on the premise of consecutive years of gravel introduction to avoid artificial movements of tracer and telemetered rock.

This proposed project builds on and expands work performed to date by monitoring downstream gravel movement over a two-year period with the addition of new gravel on the second year to ensure the tracer and telemetry gravel continue their downstream path (Figure 1), thereby avoiding the complications of artificial movements caused by wing deflector material being pushed back upstream.

Continuing with CDFG's gravel replenishment project, and the Merced ID AFRP project, this project, with the addition of two years of supplemental gravel, would provide the necessary monitoring of the gravel for effectiveness of the strategy and begin to restore depleted gravel beds at important areas in the Merced River.

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## Merced River Gravel Replenishment and Monitoring Project

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### Hypothesis Addressed and Adaptive Management Considerations

Our proposal addresses bed mobility and substrate management questions associated with supplementation of desired substrate components compatible with natural production of Central Valley salmonids. The primary hypothesis to be evaluated by this study is that spawning-size gravel replenishment at several key locations will effectively increase the quality and quantity of the spawning areas in the Merced River. Though the distribution of the gravel to be monitored is dependent on the magnitude and duration of flow during the project, there is likely to be at minimum, some downstream distribution based on recent experience with the Merced ID AFRP study and anticipated pulse flows. This project proposes monitoring three wing deflectors through two winter and spring runoff seasons. The hypothesis will be tested by: 1) measuring the distribution and bed mobility thresholds of the infused gravel for significant downstream movement and 2) by comparing the site-specific data of spawning use, relative to the total escapement, of these sites during the study to years prior to the gravel infusions. This project will address the uncertainties associated with the feasibility and effectiveness of this type of gravel infusion using the wing deflectors as gravel replenishment locations. Results of this project will be used in an adaptive feedback loop by using research from this pilot project to determine future appropriate salmon habitat restoration actions on the Merced River.

**Hypothesis:** Spawning-size gravel supplementation / replenishment at several key locations will effectively increase the quality and quantity of the spawning areas in the Merced

### 3. Approach

The monitoring in this project will evaluate how spawning-size gravel moves from the wing dam sites utilizing two techniques: painted tracer rocks and radio-tagged (telemetered) rocks. It is anticipated that at least three diversions will be selected for use in the study. This information can be used to assess whether these diversions are suitable locations for gravel introductions. The downstream movement and distribution of spawning-sized gravel in the wing deflectors will be monitored by placing tracer gravel in the wing deflectors prior to high-flow periods. Tracer gravel will be composed of painted rocks and thirty rocks will be tagged with radio transmitters. Tracer rocks will be of a comparable size used by chinook salmon for spawning. A known number of rocks will be painted with a durable paint to allow for later identification. Spawning-sized rocks will also be tagged with radio transmitters by drilling holes inside the rocks and cementing the radio tags in place. Each radio tag will have a unique frequency to allow for later identification of individual rocks. The transmission pulse rate for each radio tag will be set to allow the tag to transmit for at least two years. Both the painted rocks and the radio-tagged rocks will be used to observe patterns of bed movement, document wing-dam substrate mobilization, and estimate travel distribution to downstream areas. The tracer gravel will be monitored after significant flow events, generally greater than 3,000 cfs, for

## Merced River Gravel Replenishment and Monitoring Project

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a period of two years (the expected duration of the tag), or earlier if the power source of the tags expires. Specific locations of painted and radio-tagged rocks will be mapped with GPS during the surveys. These results will assist in determining appropriate sites for future gravel replenishment projects in the Merced River.

Biological effectiveness will be assessed using CDFG salmon spawning ground surveys to determine how salmon respond to the gravel introductions. Because these surveys have been conducted annually and with regularity in recent years, pre-project data have already been collected.

***Task 1 Prepare, install, and monitor tracer and telemetry rocks into each of three diversion wing deflectors.*** Preparation and installation of the tracer and telemetered rocks will be performed in September and early October of 2002. Monitoring will occur following riverbed scouring flow events (Table 1). An initial survey will be completed after the first scouring flow and after the incubation season for fall-run chinook salmon. This survey will also serve as the first performance measure check. Subsequent surveys will occur with each high flow event (est. 3,000 cfs or greater). Data on salmon spawning near each site prior to and during the monitoring period will be obtained from ongoing CDFG surveys. With the compilation of the biological data collected by CDFG to the physical data of the spawning gravel distribution, there will be a comparison, across several years, of the spawning usage of gravel near each study site.

***Task 2 Purchase spawning-size gravel for year two of the project and deliver to each of the three selected diversions.*** This task will be done in early spring of 2003. The continuance of the project into a second year depends on the addition of a second supply of gravel. The information sought by the monitoring task of this project is the distribution and bed mobility threshold of successive gravel infusions. Without the supply in early spring of the second year, the previous years gravel, including the monitoring gravel, may be pushed upstream by the diverters in order to rebuild their deflectors, in effect, removing a large portion of the previously supplied replenishment gravel from the river bed. Included in this task, would be an excess of material needed to erect the deflectors twice in the spring. Because of the chance of no high winter and spring runoff which would create a high scouring effect, the scheduled fall attraction flows, and spring Vernalis Adaptive Management Plan (VAMP) flows would still break the mobility threshold of the gravel in the dam distributing it downstream. However, the schedule pulse flows are unlikely to carry the bulk of the deflectors a great distance. Therefore the material would likely be reused by the diverters to rebuild their deflectors if no additional material was provided. Having an excess of material on hand to reinforce their deflectors after incomplete washouts, would prevent the disruption of the monitoring gravel with the previous replenishment. It is expected that this task will require the purchase and delivery of approximately 9,000 tons of spawning gravel (i.e., approximately 3,000 tons per site or twice that historically delivered to compensate for short-term reconstruction of the wing deflectors attributable to scheduled spring pulse flows).

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## Merced River Gravel Replenishment and Monitoring Project

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### ***Task 3 Project Management***

The Project Manager will manage the project cost and schedule, coordinate and communicate with landowners and agency staff, solicit three competitive bids according to CALFED guidelines for gravel purchases and delivery, and provide fiscal and programmatic reports to the CALFED Grant Manager. The Project Manager will prepare quarterly reports summarizing degree of completion, activities during the reporting period, costs incurred, and project milestones and a final peer-reviewed report at the end of the project.

### **4. Feasibility**

Cooperation and coordination for resource management between Merced ID, CDFG, and the riparian diverters downstream of Crocker Huffman Dam have been established. All work for this project will be coordinated between Merced ID, CDFG, and the diverters. All necessary permits are in place for the gravel addition. Merced ID will act as coordinator between the diverters and CDFG and holds the necessary permits needed to construct, operate, and maintain the gravel wing deflectors. The project team has the expertise and support services necessary (see Qualifications) to perform the proposed tasks within the proposed time line. The loan of a radio telemetry receiver and antennae for the project has been established from CDFG.

Project success is partially dependant of river flow, which is a factor of weather, though we do know that the current wing deflectors wash out at under 1,300 cfs; our proposed surveys follow 3,000+ cfs flows. In a case of two years of consecutive dry seasons, or low flow years of less than 2,000 cfs, data will still be obtained.

The technical feasibility of the project design is simply that the gravel to be used for this study needs to be purchased and transported to each wing deflector study location. The actual installation of the material to build each individual deflector will be managed by the diversion operator as has been done historically. The construction evaluation and engineering capabilities will be left to the diverters who perform the tasks annually. The objective is not to change how the diversions are built, but only the material installed in the wing deflectors. The justification for the proposed alternative installation practices of the wing deflectors are two fold. First, eliminate fines contained in current fill material used which can adversely impact existing spawning habitats. And second, replenish coarse sediment supply to the Merced River. The cost of monitoring and analyzing, the data is justified by the importance of the information that will be gained. The cost of the materials used to build the wing deflectors out of clean spawning gravel can be justified by the need for these gravel infusions. The question remaining is whether or not this procedure is the most effective approach. The surveys proposed to monitor the gravel additions will determine the efficacy of these habitat restoration measures.

### **5. Performance Measures**

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## Merced River Gravel Replenishment and Monitoring Project

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Performance measures for this project will be in the form of peer-reviewed written technical documentation of the gravel replenishment project describing design, protocols, a quality assurance program plan, data collected, analyses performed, and final results in a technical report. The written technical report will be peer reviewed by CALFED staff. Additionally, a technical presentation to CALFED will be provided, if requested.

During the first season after gravel installation, there occurs a moderate level pulse flow which is followed by the fall-run chinook salmon spawning season. An initial survey done after the spawning season would determine whether or not the replenishment / supplemental gravel dispersed as expected. Gravel dispersal will provide a measurable quantity (movement) of survey materials (tracer and telemetry rocks) and would establish the pattern of movement prior to a high scouring flow. Because this is a restoration and research project, the monitoring survey results, over the two-year project, would serve as performance measures in showing progress toward the objective of assessing distribution of the gravel introductions and the bed mobility thresholds. Analysis of the initial survey will provide the necessary feedback to our conceptual model to allow for, and identify, any adaptive measures that need be taken.

### **6. Data Handling and Storage**

Data sheets will be examined by investigators in the field prior to leaving a site to ensure that all data are recorded and measurements look reasonable. Any deficiencies will be addressed at the site. All data will be subjected to double data entry verification. All raw data sheets will be photocopied with one set kept on file with Natural Resource Scientists, Inc. for archival purposes. Graphical data plots will be used to examine data sets for aberrant data and outliers and corrective actions will be taken. Computed values will be calculated twice to ensure accuracy. Data and information gathered through the monitoring of gravel dispersal and bedload movement will be compiled and maintained in an electronic database. That data will be made available in the appendices of the final report. Time series data will be maintained in a data base, while physical data will be maintained in tables. All data will be available on electronic media both during the project, as data become available, as well as upon project completion. All figures, tables, and data sets generated during the study will be reviewed by the Project Manager prior to submission to CALFED. Computer files will be backed up weekly and redundant backup tapes will kept in a fire proof safe. Copies of all final computer data files and hard copies of data submissions will be provided to CALFED if requested.

### **7. Expected Products/Outcomes**

Quarterly fiscal and programmatic reports will be prepared and provided according to CALFED guidelines. The Project Manager will submit a draft and final CALFED-approved Monitoring Plan/QAPP. At the end of the project, technical peer-reviewed draft and final reports will be completed describing all work performed and study results, including methodologies, data acquired during the project, and the analyses of results.

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## Merced River Gravel Replenishment and Monitoring Project

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Reports and data will be submitted in electronic format for entry into the CALFED database. In addition to a written report, one formal technical presentation on the project may be given to CALFED following the field study, if requested.

### **8. Work Schedule**

This project would occur over a two-year period, September 2002 through July 2004 (Table 1). Task 1 would occur from September 2002 through May 2004. Task 2 would occur in the spring of 2003. Task 3, Project Management would occur from September 2002 through July 2004. None of the tasks are separable. The final report would be completed by July 2004 (Table 1).

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

#### **1. ERP, Science Program and CVPIA Priorities.**

As identified in the Revised Draft Restoration Plan for the Anadromous Fish Restoration Program (AFRP1997), this project supports Merced River Action 3, Evaluation 2, a high priority action and a medium priority evaluation in a high priority watershed.

As identified in the Draft Stage One Implementation Plan for the Ecosystem Restoration Program 2002 PSP, this project supports the San Joaquin Region Priority, Restoration Priority 1, Strategic Goal 2, Channel Dynamics and Sediment Transport using Gravel Augmentation Projects. This project addresses fluvial geomorphology correlated with hydrological bed mobility transport processes within given flow regimes. The primary stressor to the Merced River that this proposal addresses is the loss of sediment and bedload from watershed sources upstream of dams. Under the current flow regime which is moderated by the dams upstream, the proposed gravel infusions are at several locations instead of one to partially compensate for the loss of very large pulse flows regulated by the dams.

#### **2. Relationship to Other Ecosystem Restoration Projects.**

Our proposal will provide information on biological and physical restoration that is expected to be beneficial to the Merced County's Merced River Corridor Restoration Project (funded by CALFED during 1998). Integration of the shaded riparian habitat and channel maintenance benefits expected from stream corridor restoration projects that will emerge from this project's assessment will be important for achieving a coordinated sediment and gravel bed management solution for the Merced River. The creation of habitat results from this project will directly benefit both California Department of Water Resources's and CDFG's CALFED and AFRP funded salmon habitat enhancement projects. Our proposed project will primarily benefit fall-run chinook salmon. The project complements efforts toward the USFWS's AFRP goal to double the natural anadromous fish production in the system (CALFED v2). This proposed project will also complement

## Merced River Gravel Replenishment and Monitoring Project

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additional Merced River corridor projects planned at locations upstream of the wing deflectors near the town of Snelling (pers. comm., Rhonda Reed, CDFG, Anadromous Fish Habitat Coordinator).

Merced ID is a signatory to the San Joaquin River Agreement which, among other things, implements the Vernalis Adaptive Management Plan (VAMP). Under the VAMP, effects of flow and export from the Sacramento/San Joaquin River Delta upon salmon will be investigated. As part of that agreement, increased flows in the spring and fall will be provided in the Merced, Tuolumne, and Stanislaus Rivers, more than 50 percent of which is to be supplied by Merced Irrigation District. Such flows are to be provided during an April/May pulse flow and during October. Based on previous years observations of the CDFG and Merced ID, CVPIA and AFRP projects of gravel augmentation, the managed fall attraction pulse flows and the spring VAMP flows are expected to contribute to the distribution of the injected gravel.

### **3. Request for Next-Phase Funding.**

With CVPIA AFRP funding, NRS, Inc., on behalf of Merced ID, began monitoring three gravel diversion deflectors constructed out of clean, spawning-size gravel supplied by CDFG in 2000 and will be completed in 2002 (see attached summary). That two-year project (*Merced River Wing-Dam Monitoring, 2000-2002*) is similar to this proposed two-year project with the exception of an additional supply of gravel for the second year and a final analysis of all data.

### **4. Previous Recipient of CALFED Program or CVPIA Funding.**

Natural Resource Scientists, Inc. has received CALFED and CVPIA funding for Central Valley projects. In 1995, a final contract peer-reviewed report entitled: "*Losses of young anadromous salmonids at water diversions on the Sacramento and Mokelumne Rivers*" was completed by NRS, Inc. under a subcontract with CVPIA AFRP funding (prime contract number is unknown). In May 2000, a contract peer-reviewed report entitled: "*Juvenile Chinook Salmon Radio-Telemetry Study in the Northern Sacramento - San Joaquin Delta, January - February 2000*" was completed for the CVPIA AFRP (open contract, order no. 101810M102). In August 2001, a draft CVPIA AFRP contract report entitled: "*Juvenile Chinook Salmon Radio-Telemetry Study in the Southern Sacramento - San Joaquin Delta, December 2000 - January 2001*" was submitted to the IEP for peer review (Contract No. 101811D027). Results of a CALFED field study of juvenile salmon at the Delta Cross Channel (DCC) during November 2000 were presented at the IEP 2001 Asilomar conference and a written report is in progress (CALFED DCC study contract no. unknown). An expanded version of the DCC studies for 2001 was recently approved by the CALFED Science Panel and funding was approved in September 2001; no funds have been expended to date. Three research projects, "*Juvenile Salmon Migratory Behavior Study in the North, Central, and South Delta*" was recently approved by CALFED (CALFED Project No. ERP-01-N48) and a contract was executed with the

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## Merced River Gravel Replenishment and Monitoring Project

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National Fish and Wildlife Foundation in September 2001; no funds have been expended to date. A project on the initial phase of a “*Merced River Water Temperature Management Feasibility Study*” (2001-K203) was recently approved by CALFED and a USFWS CVPIA contract is being developed with the USFWS; no funds have been expended to date. As described above, NRS, Inc. is working on the AFRP project “*Merced River Wing-Dam Monitoring, 2000-2002*” on behalf of Merced ID.

### **5. System-Wide Ecosystem Benefits.**

Two stressors the ERPP identifies on the Merced River include large dams, which block natural recruitment of coarse sediment, and previous gravel mining operations in the stream channel which have removed large quantities of spawning gravel. The natural ecological process missing is sediment supply, including gravel recruitment, transport, and cleansing. This project evaluates a method of injecting gravel using the commonly employed practice of constructing wing deflectors to divert water into riparian canals. A resulting feasibility review may find this practice applicable to other San Joaquin systems.

The CVPIA requires that all reasonable efforts to ensure that by the year 2002 natural production of anadromous fish in Central Valley rivers will be sustainable on a long-term basis, at levels not less than twice the average levels attained during the period 1967-1991. The CVPIA authorizes the Bureau of Reclamation to obtain additional flows on the Stanislaus, Tuolumne, Merced, and lower San Joaquin rivers that will facilitate migration, attraction, production, and survival of anadromous fish on these rivers in accordance with specific fish, wildlife, and habitat restoration purposes of the Act.

### **C. Qualifications**

Natural Resource Scientists, Inc. will manage the project and administer the budget. NRS, Inc. has performed numerous investigations of freshwater habitat requirements and factors limiting fish populations and the development of measures to improve river and stream conditions for fishery resources. Additionally, NRS, Inc. is thoroughly familiar with the Merced River and has been working on Merced River fishery and water resource issues for the past decade. The CDFG, USFWS, and the National Marine Fisheries Service will provide technical assistance with data acquisition and resource guidance. Merced ID will collaborate and coordinate with the riparian diverters, NRS, Inc., and the latter three agencies throughout the project. NRS, Inc. will perform the data acquisition, processing, and analyses, project oversight and coordination, and project reporting requirements, including technical report writing. A subcontractor, to be selected through a competitive bid process according to CALFED guidelines, will provide the salmon spawning gravels to the wing deflector sites.

### **David A. Vogel, Project Manager**

*Natural Resource Scientists, Inc., Senior Scientist*

*M.S., 1979, Natural Resources (Fisheries), University of Michigan*

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## Merced River Gravel Replenishment and Monitoring Project

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*B.S., 1974, Biology, Bowling Green State University*

Mr. Vogel will serve as Project Manager for this project. Mr. Vogel specializes in aquatic resource assessments and resolution of fishery resource issues associated with land and water development. His 25 years of work experience in fisheries has included large-scale assessments in river systems, lakes and reservoirs, and estuaries. Most of his experience has been associated with restoration of western United States fishery resources. Mr. Vogel has worked as a biological consultant for the U.S. Bureau of Reclamation to define interrelationships of salmon resources and Central Valley Project water project operations. He was the Task Manager for the Biological Assessment of the 1992 operations of the Central Valley Project (CVP) and was the principal biologist in charge of developing the long-term Biological Assessment for the CVP. Mr. Vogel has been working on Central Valley fishery resource research and management projects and interrelationships with water project operations for 20 years. He has been working on Merced River fishery and water resource issues for the past decade.

### **Russell L. Liebig, Fishery Biologist**

*Natural Resource Scientists, Inc., Fishery Biologist*

*B.S., 1998, Wildlife, Fisheries, and Conservation Biology, University of California, Davis*

Mr. Liebig is employed by NRS, Inc. as a Fishery Biologist working on multiple anadromous fishery resource monitoring projects. These intensive field projects have included monitoring of juvenile and adult salmon and steelhead migration on the Mokelumne River and juvenile salmonid downstream migration on Merced River. Mr. Liebig is very knowledgeable and experienced in the methods and equipment used for this project. Mr. Liebig served as the primary field biologist performing the evaluations and monitoring of Merced River wing deflectors for the past two years.

## **D. Cost**

### **1. Budget**

Total budget for this project is given in the 2002 PSP web forms.

### **2. Cost-Sharing**

It is anticipated that Merced Irrigation District will contribute up to \$5,000 as in-kind contributions to this project. The contributions will be in the form of access and use of equipment at the agency's Franklin Yard, technical and support staff for information, permitting, and coordination with riparian diverters. Additionally, CDFG will provide the telemetry receiver and antenna necessary for this project.

## **E. Local Involvement**

The gravel wing deflectors to be used as the replenishment locations will continue to be

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## Merced River Gravel Replenishment and Monitoring Project

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constructed by the diverters, or diversion operators. The initial purchase of replenishment gravel will be supplied by CDFG in the spring of 2002. The subsequent supply of replenishment gravel will be purchased from a local materials company with local transport units.

Merced ID and CDFG have jointly developed and agreed upon a 10-year study program to determine the potential factors that may limit salmon production in the Merced River. This program is designed to evaluate the habitats necessary for increased salmon production by assessing the needs for each freshwater salmon life stage (i.e., upstream migration, spawning, egg incubation, fry and juvenile rearing, and outmigration). The joint study program defines the objectives, basic experimental design, and the responsibilities for study implementation. The studies and instream flow scheduling will be coordinated with other studies throughout the San Joaquin basin and the Delta. Components of this program are presently underway. The completion of the 10-year program is intended to identify the long-term instream flow and other needs of salmon in the Merced River. To facilitate the studies, CDFG and Merced ID have established the Merced Management and Technical Advisory Committees; the latter committee establishes and coordinates study protocols, study amendments, funding issues, and information sharing and exchange. Merced ID, CDFG, USFWS, and NMFS have participated in the Merced Technical Advisory Committee. This project will be coordinated with the Merced Technical Advisory Committee.

With funding from the USFWS AFRP and the CALFED Bay-Delta Program, the Merced County Planning and Community Development Department, with cooperation from Merced ID, have embarked on a collaborative effort to develop a restoration strategy for the Merced River corridor. This program will seek to join input from community stakeholders with a scientifically-based understanding of current river conditions and processes to identify a feasible corridor restoration strategy. Public involvement will play a key role in the restoration planning process, and public coordination will continue through the life of the project. To establish this role, the County, with Merced ID's assistance, convened a Merced River Stakeholder Group. The Stakeholder Group represents a broad array of public and private interests, including local business and property owners; state, local, and federal agencies; fish and environmental groups; and other groups or individuals. In addition to working with his Stakeholder Group, the County also conducted regular workshops to keep the public informed of the project's progress. These groups will be kept informed of this gravel replenishment project.

No third-party impacts are anticipated. Land use changes will not occur as a result of this project. Those parties who support restoration of San Joaquin fall-run chinook salmon that would benefit from the proposed project would also benefit.

### **F. Compliance with Standard Terms and Conditions**

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## Merced River Gravel Replenishment and Monitoring Project

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Natural Resource Scientists, Inc. will comply with the standard State and Federal contract terms described in Attachments D and E of the CALFED 2002 Proposal Solicitation Package.

### **G. Literature Cited**

CALFED Bay-Delta Program. 1998 v1. Ecosystem Restoration Program Plan; Visions for Ecosystem Elements. Draft Programmatic EIS/EIR Technical Appendix. March 1998.

CALFED Bay-Delta Program. 1998 v2. Ecosystem Restoration Program Plan; Ecological Zone Vision. Draft Programmatic EIS/EIR Technical Appendix. March 1998.

California Department of Fish and Game. 1993. Restoring Central Valley Streams: A Plan for Action. November 1993.

Kondolf, G.M., Vick, J.C., and T.M. Ramirez. 1996. Salmon Spawning Habitat Rehabilitation on the Merced River, California: An Evaluation of Project Planning and Performance. Transactions of the American Fisheries Society 125:899-912, 1996.

Figure 1. Conceptual model of current and proposed methods of replenishing gravel at wing deflectors on the Merced River.

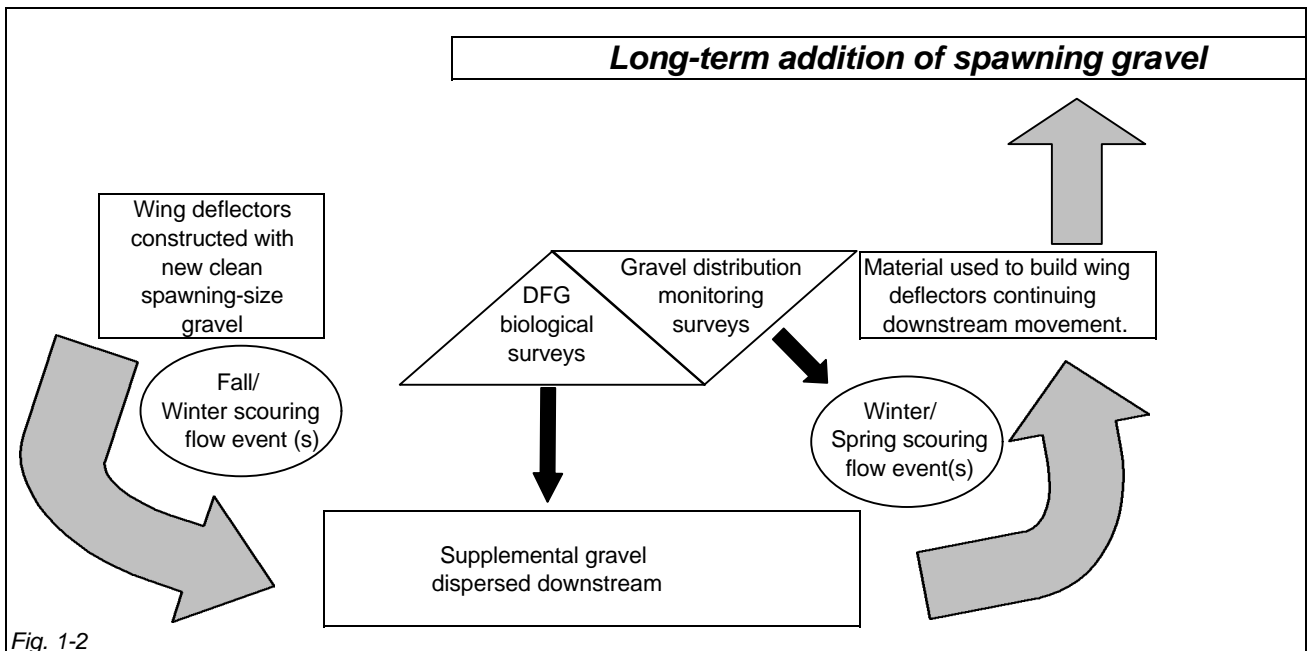
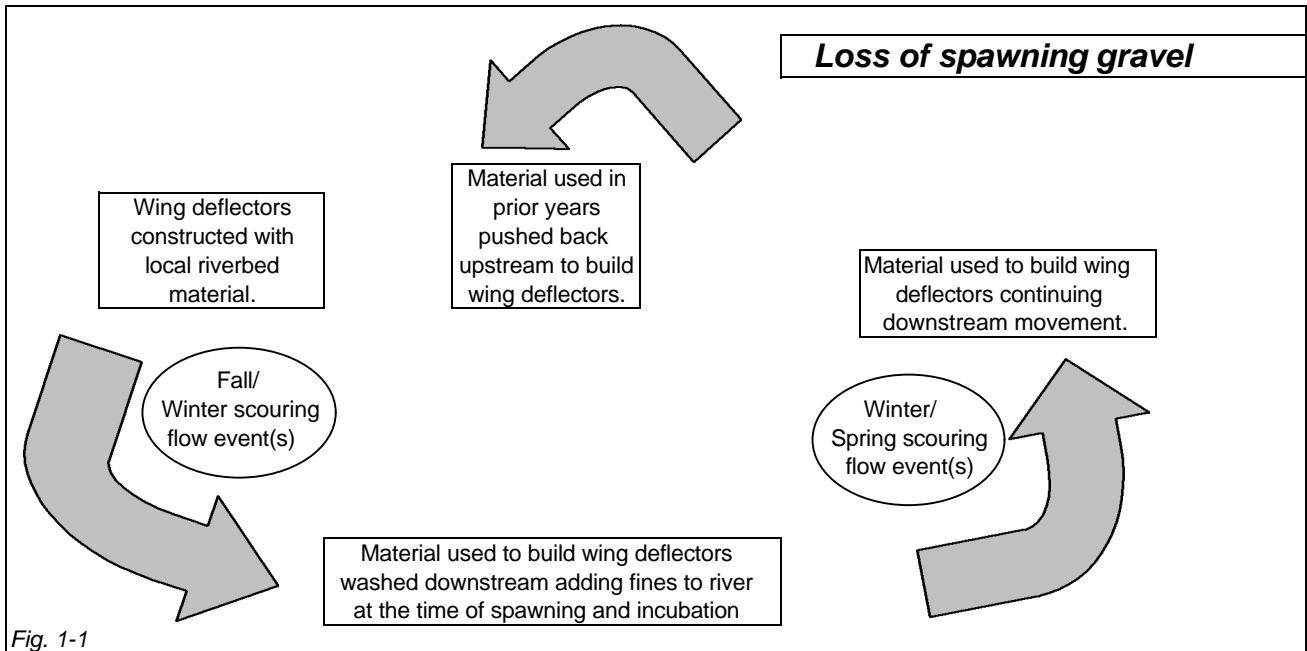


Figure 1-1: Conceptual model of the current practice of construction of wing deflectors.

Figure 1-2: Conceptual model of proposed method of construction of wing deflectors.

Table 1. Schedule for Merced River Gravel Replenishment and Monitoring Project.

Task Name	2002												2003												2004					
	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	
<b>Task 1: Tracer and Telemetry Rock Installation and Monitoring</b>																														
<b>Task 2: Purchase and Deliver New Spawning Gravel*</b>																														
Potential Scouring Flows																														
<b>Task 3: Project Management</b>																														
Quarterly Reports																														
Final Report																														

\* CDFG to purchase and deliver gravel in the spring of 2002.

**Merced River Wing Deflector Gravel Monitoring**  
**U.S. Fish and Wildlife Service**  
**Anadromous Fish Restoration Program**

**Introduction/Background**

The previous phase of the project, which began in September of 2000, is currently entering the second and final year of that portion of the monitoring project. With AFRP funding, NRS, Inc., on behalf of Merced ID, began monitoring three gravel wing deflectors constructed out of clean, spawning-size gravel supplied by DFG. The current two-year project funded by AFRP to monitor how spawning-sized gravel moves from wing deflector sites, is similar to the proposed two-year project with the exception of an additional supply of gravel for the second year and a final analysis of all data. The resulting products of the combined efforts of DFG, Merced ID, CVPIA, AFRP and CALFED over the four years of the two projects would include three gravel infusions at each of three to five locations, monitoring of distribution and bed mobility thresholds for the two different projects combined with biological monitoring of spawning and habitat use by DFG under CVPIA into one final analysis.

**Monitoring**

In November 2000, a flow of 1,300 cfs lasting approximately two weeks, partially scoured each of the three gravel wing deflectors included in the study. At each study site, the sections of the wing deflector where the telemetry and tracer rocks were placed had been partially scoured. As part of the study, the average diameter of each tracer rock located was recorded along with its location downstream of the transect line. These data are presented in Figures 1-3 of this attachment. After the spring VAMP flows of 2001 at about 1,400 cfs, there appeared to be no additional distribution of these gravels and the diverters then rebuilt their deflectors with the material within the stream channel, including the tracer and telemetry gravel. The next portion of phase one will monitor the distribution once again of this gravel after scouring flows. The data to date show the distribution and bed mobility thresholds of the gravel in the deflectors at relatively low flow conditions. A second season under the same conditions will show the distribution under slightly different downstream conditions, now that the gravel has been pushed back upstream, but with the continued possibility of monitoring through a high scouring flow.

**Wing Deflector #3**

Under the 1,300 cfs flows, the entire portion of the wing deflector containing the tracer and telemetry rocks was scoured washing that portion of the wing deflector downstream up to 122 feet. The survey of the tracer gravel yielded an average downstream movement of 88 feet with 29 rocks located as summed in Table 1.

**Wing Deflector #4**

The two portions of wing deflector #4 containing the telemetry and tracer rocks were also scoured washing those rocks downstream up to 186 feet. This wing deflector washed out in a fan pattern in which the gravel from the wing deflector initially traveled downstream and distributing within a pre-existing, large riffle. The survey of the telemetry rocks yielded an average

downstream movement of 87 feet with all telemetered rocks located. The survey of the tracer gravel yielded an average downstream movement of 86 feet with 39 rocks located as summed in Table 2.

### **Wing Deflector #5**

As with wing deflector #4, the telemetry and tracer rocks were split into two groups at placement, however only one group was completely scoured with the 1,300 cfs flow event. The other group was partially scoured and exhibited very little downstream movement. The survey of the telemetry rocks yielded an average downstream movement of 50 feet with all telemetered rocks located. The survey of the tracer gravel yielded an average downstream movement of 34 feet with 317 rocks located. 216 of the 317 rocks located were of the group that was partially scoured and moved to only 18 feet. The average downstream movement of tracer gravel excluding that group was 76.5 feet, as summed in Table 3.

### **Total Project Expenditures**

Labor:	\$ 8,359.32	
Expenses:	<u>\$ 7,489.14</u>	
Total:	\$15,847.46	With 75% of work completed.

### **Next Phase**

The progress on the current project has shown that the spawning-sized gravel, placed in wing deflectors, has a mobility threshold of less than 1,300 cfs. With that mobility, the progress on the current AFRP project has also shown a significant distribution with moderate flows of under 2,000 cfs. The current project has also demonstrated that if the material to build each deflector is not completely scoured, it will be reused by the diverters to construct the next years diversion. The next phase of this project will show these results with consecutive gravel injections allowing for a continued migratory path of the gravel. The combined information gathered from these two projects and the biological monitoring conducted by DFG, will give the adequate tools in which to base future gravel replenishment decisions for the Merced River.



<b>Table 1. Wing deflector #3 downstream gravel movement</b>			
<b>Distance (ft)</b>	<b>Telemetry</b>	<b>Tracer</b>	
<b>Min</b>	<b>33</b>	<b>43</b>	
<b>Max</b>	<b>81</b>	<b>122</b>	
<b>Mean</b>	<b>65</b>	<b>88.2</b>	
<b>Standard Deviation</b>	<b>18.1</b>	<b>22.3</b>	
<b>N</b>	<b>6 / 6</b>	<b>29 / 2618</b>	<b>1.1%</b>

<b>Table 2. Wing deflector #4 downstream gravel movement</b>			
<b>Distance (ft)</b>	<b>Telemetry</b>	<b>Tracer</b>	
<b>Min</b>	<b>36</b>	<b>57</b>	
<b>Max</b>	<b>162</b>	<b>186</b>	
<b>Mean</b>	<b>86.9</b>	<b>86.2</b>	
<b>Standard Deviation</b>	<b>51.12</b>	<b>42.4</b>	
<b>N</b>	<b>7 / 7</b>	<b>39 / 2805</b>	<b>1.4%</b>

<b>Table 5. Wing deflector #5 downstream gravel movement</b>			
<b>Distance (ft)</b>	<b>Telemetry</b>	<b>Tracer</b>	
<b>Min</b>	<b>11</b>	<b>7</b>	
<b>Max</b>	<b>81</b>	<b>130</b>	
<b>Mean</b>	<b>50.3</b>	<b>34.3*</b>	
<b>Standard Deviation</b>	<b>28.2</b>	<b>33.4</b>	
<b>N</b>	<b>7 / 7</b>	<b>317 / 2638</b>	<b>12.0%</b>

\* 216 tracer rocks were found within 18 feet of their original location representing one entire placement group. Excluding those rocks yields an average movement of 76.5 ft.

Figure 1. Tracer rock data for wing dam #3

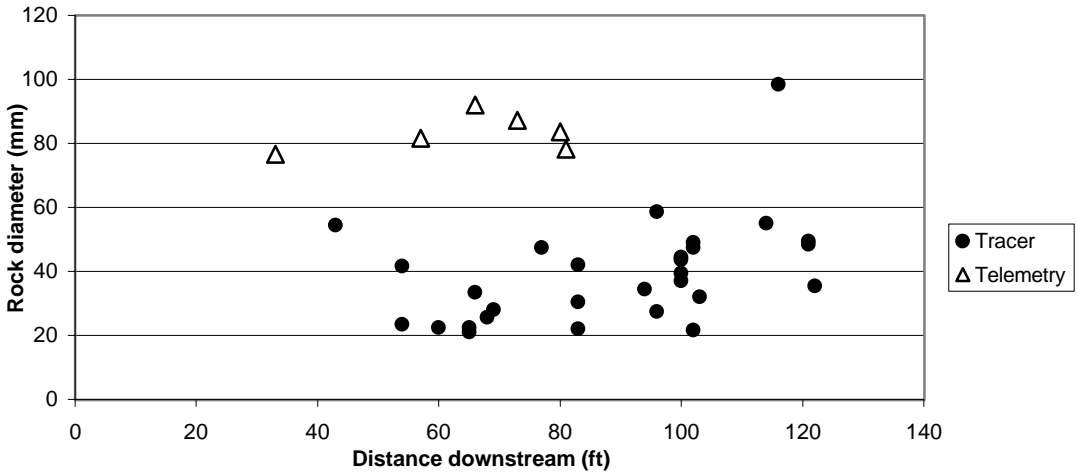


Figure 2. Tracer rock data for wing dam #4

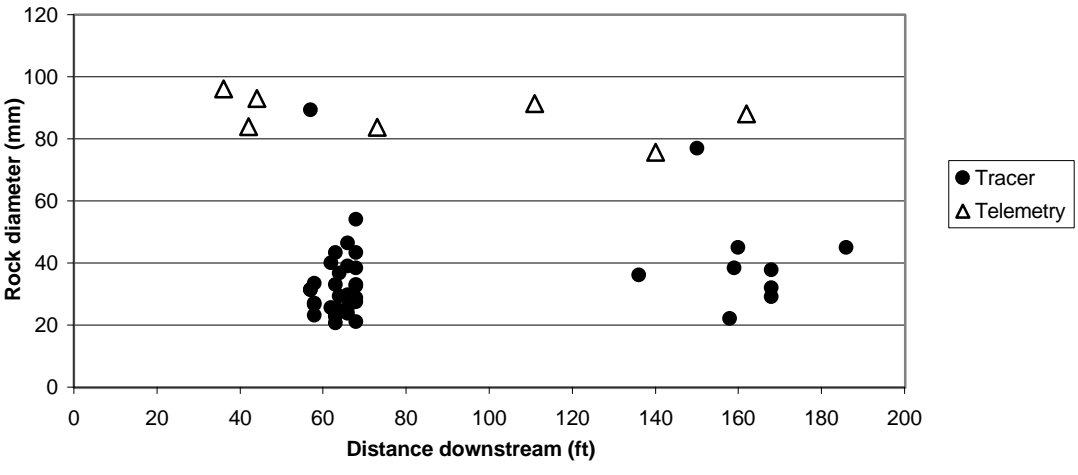


Figure 3. Tracker rock data for wing dam #5

