AFRP- Annual Workplan 2000

Initial Scope of Work for:

Tuolumne River sediment management and implementation plan

AMOUNT REQUESTED FROM THE AFRP: $ 205,200

A Proposal Submitted by:

Agency	**Turlock Irrigation District for the Tuolumne River Technical Advisory Committee**
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Type of Organization: Irrigation District
Tax status

I SCOPE OF THE PROJECT

Project description. The purpose of this project is to develop and implement a comprehensive sediment management plan (Sediment Plan) for the alluvial reach of the Tuolumne River between La Grange Dam (RM 52) and Basso Bridge (RM 47.5). A general strategy for sediment management was presented in the *Draft Tuolumne River Corridor Restoration Plan*, and identified four critical tasks for restoring and maintaining a balanced sediment budget in the gravel-bedded reaches: (1) greatly increase coarse sediment storage in the channel with a large "transfusion" of coarse sediment to provide alluvial deposits immediately available for chinook salmon spawning, and for eventual downstream transport and redeposition; (2) maintain this restored coarse sediment storage by periodic augmentation of coarse sediment supply equal to the rate of downstream sediment transport; (3) implement remedial actions to prevent further extensive fine sediment input into the Tuolumne River from Gasburg Creek (located at the upstream end of the spawning reaches); and (4) implement actions to reduce fine sediment storage in the mainstem Tuolumne River.

Project location. The project is located in the approximately four-mile long alluvial reach downstream of La Grange Dam. This reach has been impacted by over a century of flow and sediment regulation, dredger mining, and removal of dredger materials during the construction of New Don Pedro Dam. These impacts have eliminated coarse sediment supply, eliminated entire riffles, armored the channelbed surface, and degraded aquatic habitat in critical salmon spawning reaches. Additionally, Gasburg Creek has been identified as a chronic source of fine sediment input to the mainstem Tuolumne River that has greatly reduced juvenile salmon production.

The primary biological/ecological objectives: To increase coarse sediment storage in the spawning reaches and reduced fine sediment storage in the mainstem channel. Coarse sediment will be available for immediate use as chinook spawning habitat and for transport and deposition at high flows. Combined with high flows, coarse sediment management will allow revitalization of geomorphic processes that create and maintain a healthy ecosystem and high quality habitat for native aquatic and riparian species.

Project approach and tasks: This project will implement one of the recommendations in the *Draft Tuolumne River Corridor Restoration Plan* (McBain & Trush 1998) by developing and implementing a comprehensive sediment management plan (Sediment Plan) for the Tuolumne River. The Restoration Plan recommended a four-phased strategy for managing coarse and fine sediment: (1) restore coarse sediment storage in the channel with a large "transfusion" of cobbles and gravels to recreate riffles and gravel bars, providing immediate habitat for chinook salmon spawning, and for eventual downstream transport and deposition; (2) maintain this coarse sediment storage by periodic coarse sediment augmentation (re-create supply) at a rate equal to the rate of downstream transport; (3) implement remedial actions to prevent further extensive fine sediment input into the Tuolumne River from Gasburg Creek (located at the upstream end of the spawning reaches); and (4) once this fine sediment source is treated, implement actions to reduce fine sediment storage in the mainstem Tuolumne River.

From this basic strategy, the Tuolumne River Technical Advisory Committee (TRTAC) has developed a conceptual framework for implementing sediment management (Figure 1). Several

tasks within this framework will be implemented by the California Department of Fish and Game (CDFG), either through projects already funded or through a parallel proposal submitted to CALFED requesting FY1999 funding. Other tasks will be implemented by consultants, with TID project administration and TRTAC technical supervision. This arrangement is similar to several ongoing restoration and monitoring projects on the Tuolumne River, and assures the most timely and efficient implementation of the proposed tasks while utilizing the technical expertise of TRTAC participants. Additionally, this framework and implementation strategy is consistent with other efforts to restore the Tuolumne River.

- **Task 1** will develop a sediment management and implementation plan that includes design, implementation, adaptive management, and the monitoring required for adaptive management. Task 1 also includes refinement of a chinook salmon juvenile production model developed by TID that can be used to predict the benefits of sediment management on salmon production.
- **Task 2** will initiate a program for coarse sediment augmentation, including refinement of proposed introduction sites, introduction volumes, and monitoring protocols that were originally developed for the Restoration Plan.
- **Task 3** will initiate a program for fine sediment reduction, first greatly reducing fine sediment supplied to the upper river from the Gasburg Creek watershed, then evaluating alternative methods for fine sediment reduction/removal in the mainstem Tuolumne River, and lastly implementing fine sediment removal from the mainstem channel.
- **Task 4** will develop an adaptive management and monitoring program for quantifying coarse sediment transport to provide volume estimates for annual augmentation to maintain coarse sediment storage in the mainstem channel. This task will also initiate and/or complete several monitoring protocols for evaluating spawning habitat quantity, quality, and use by spawning salmon.

Participants and collaborators: This proposal is prepared and submitted by the Turlock Irrigation District on behalf of the Tuolumne River Technical Advisory Committee (TRTAC). The TRTAC is composed of the signatories of the New Don Pedro Proceedings 1995 FERC Settlement Agreement, and include the Turlock and Modesto Irrigation Districts (TID/MID), the City and County of San Francisco (CCSF), the Bay Area Water Users Association (BAWUA), resource agencies including CA Department of Fish and Game (CDFG), and US Fish and Wildlife Service (USFWS), and environmental organizations including the Tuolumne River Preservation Trust (TRPT), and Friends of the Tuolumne Trust (FOTT).

Local support and involvement: The project is a product of efforts of the TRTAC, and has their support and participation for technical supervision. The TRTAC has prepared a conceptual version of the Tuolumne River Corridor Restoration Plan for presentation to the public, and convened a public workshop and several outreach meetings to share information and seek input from the public. A public workshop was held on June 23, 1999.

The Stanislaus County Planning Department (County) has received copies of the *Draft Tuolumne River Corridor Restoration Plan,* and participated, along with City of Modesto Planning staff, in a one-day presentation of the Restoration Plan organized by the TRTAC. In addition, the TID project administration staff for the Gravel Mining Reach and SRP 9/10 restoration projects has

worked closely with the County to implement those projects. Attached letters were submitted to Ron Freitas, Director of Stanislaus County Department of Planning, and Ray Simon, Chairman of Stanislaus County Board of Supervisors, formally notifying them of the sediment management project proposal.

The lands adjacent to the project, including the river channel and floodplain from Old La Grange Bridge downstream to Basso Bridge, are owned primarily by Stanislaus County. CALFED has funded the acquisition of three parcels of land totaling 42 acres between La Grange Bridge and Basso Bridge (*Basso Ecological Reserve Land Purchase*), that will connect adjacent large tracts of County-owned properties. This land purchase project is near completion, and combined with other County parcels will provide good access to future project sites.

Private property owners identified within the project reach will be notified of the project activities once the Sediment Management Plan (Task 1a) is started, and as river access needs are identified.

Funding: Total Project cost is $414,500; The AFRP is proposing to fund **$205,200**. In-kind funding from the TRTAC totals $33,000. Calfed will be asked to fund the remaining tasks at $176,300.

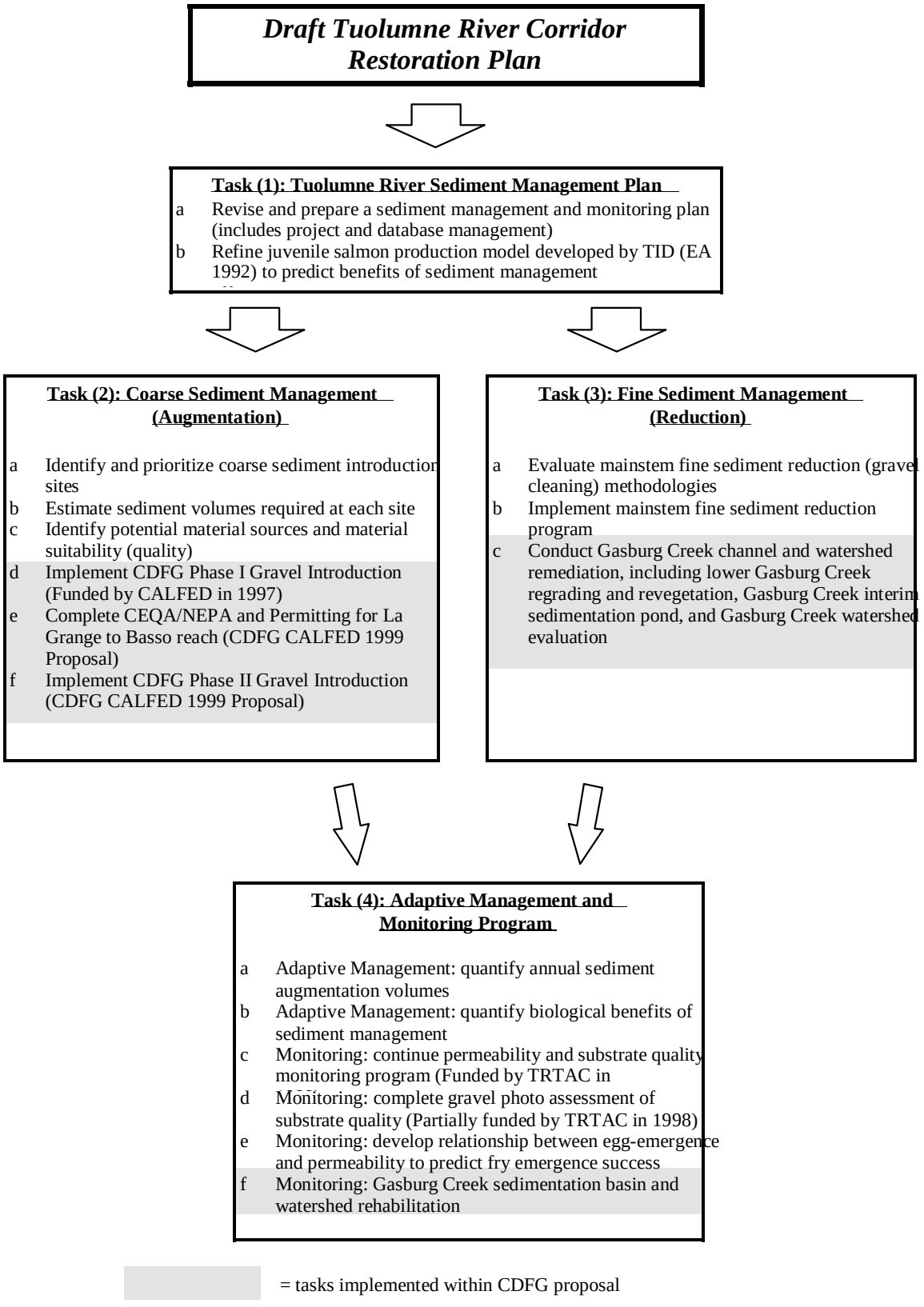

Figure 1. Conceptual framework for sediment management and implementation on the Tuolumne River.

II JUSTIFICATION FOR THE PROJECT

Background: As with nearly all rivers in the Central Valley, dams on the Tuolumne River have eliminated the coarse sediment supply from the upstream watershed. Because much of the habitat in mainstem alluvial rivers is associated with coarse sediment deposits (gravel bars and riffles), supplementing coarse sediment storage below dams is essential to restore these habitats for native aquatic and riparian organisms, including fall-run chinook salmon. Continued lack of sediment supply will result in further degradation of riverine habitats, potential further declines in the salmon and other native populations, and limit the success and longevity of other restoration projects currently being funded and implemented on the Tuolumne River.

The sediment regime in the lower Tuolumne River corridor has been altered for more than a century, beginning with construction of Wheaton Dam in 1871. Dams eventually eliminated the delivery of coarse sediment from the upper watershed. This loss, combined with infrequent high flow releases capable of transporting coarse sediment, has armored the channelbed surface and degraded aquatic habitat in critical salmon spawning reaches downstream of La Grange Dam. In addition, gold dredging systematically excavated the river channel and floodplain, creating extensive tailings resistant to transport. Removal of the tailings to construct New Don Pedro Dam in 1970 virtually eliminated even this resistant source of coarse sediment. Since then, infrequent high flow releases (> 8,000 cfs) have scoured the channelbed and entrenched the channel within confining riparian berms. Spawning riffles have coarsened, armored, and/or have been completely scoured away, culminating in poor quality and reduced quantity of spawning and rearing habitat.

The Tuolumne River is the largest of three major tributaries (the Tuolumne, Merced, and Stanislaus Rivers) of the San Joaquin River and drains about 1,900 square miles of the Sierra Nevada. La Grange Dam is the lowermost dam on the river; therefore the need for sediment management immediately downstream of the dam is most urgent. The geographic boundary of this proposal focuses on the primary salmon spawning reach within the first five miles downstream of LaGrange Dam (RM 52 to 47.5), and will eventually extend further downstream as priority sediment management needs are met in the primary spawning reach.

Ecological/Biological Objectives: The goal of this project is to develop and implement a sediment management plan that (1) increases the storage and long-term supply of coarse sediment (gravel and cobble) to the mainstem Tuolumne River, and (2) decrease the supply and storage of fine sediment (sand) in the mainstem Tuolumne River. Achieving these two fundamental restoration strategies will provide direct collateral benefits to a broad range of ecosystem components, including dynamic geomorphic processes, chinook salmon, and other native aquatic and riparian species and their habitats. Objectives of the sediment management plan include:

- Increase spawning and rearing habitat availability for chinook salmon by introducing appropriately sized coarse sediment (1/4” to 6”) in the most heavily used spawning reaches between La Grange Dam (RM 52) and Basso Bridge (RM 47).
- Improve spawning and rearing habitat quality by introducing coarse sediment that can be transported and redeposited more frequently by the contemporary (and future) flow regime.

- Reverse historic trends in coarse sediment depletion by introducing sediment as natural morphologic features and in-river storage sites (short-term sediment augmentation)
- Maintain sediment storage by introducing coarse sediment (gravel and cobble) at a rate greater than downstream transport during high flows (long-term sediment supply maintenance).
- Rehabilitate fundamental fluvial processes by improving the river's ability to transport coarse sediment, create and maintain dynamic channel morphology and associated habitat complexity. Indicators of this improvement include increased number of exposed gravel bars, a more variable channel width, active floodplain formation, increased channel migration, and bedload routing throughout the reach.
- Reduce fine sediment supply to the Tuolumne River from the Gasburg Creek watershed.
- Develop a cost-effective and environmentally sound methodology (i.e., minimize negative impacts) for maintaining high quality spawning and rearing habitat in the upper Tuolumne River
- Reduce fine sediment storage in the Tuolumne River by mechanical removal of sand from spawning riffles and remaining remnant dredger tailing pits.

Basis for expected benefits: Restored coarse sediment supply and reduced fine sediment input will significantly improve habitat conditions, including the quantity, quality, and complexity of habitat, by recreating a natural channel morphology and allowing geomorphic and ecological processes to function across the restored channel, gravel bars, and floodplain.

System-wide benefits are not limited to the immediate geographical scope of the project, nor to chinook salmon spawning and rearing habitats. The most important benefit of coarse sediment augmentation will be to provide one of two essential components necessary to restore geomorphic processes (the other key component being high flows capable of reworking this coarse sediment). An adequate coarse sediment supply is critical for restoring dynamic geomorphic processes in the upper river and restoring the ability of the river to readjust its dimensions. Given high flows exceeding geomorphic thresholds, coarse sediment will route downstream, extending its durability and longevity as habitat as it is transported to successive depositional features. Coarse sediment introduced to upstream reaches will eventually supply reaches further downstream

The primary stressors that this project seeks to alleviate include gold mining, dams, and the removal of dredger tailings, all of which have altered the coarse sediment regime, inhibited sediment supply and transport, eliminated alternate bar sequences, and reduced streamflow access to floodplains; **the primary species** targeted by this project is the San Joaquin River Basin fall-run chinook salmon population; **the primary habitats** include freshwater fish habitat and riparian and riverine habitat.

Linkages: The Restoration Plan (McBain & Trush, 1998) provides general recommendations for restoring ecological processes to the Tuolumne River, and includes a framework for sediment management. This proposal will provide a more detailed sediment management plan upon which future sediment management decisions, adaptive management and monitoring will be organized. The coarse sediment augmentation phase implemented by CDFG (Phase I funded by CALFED in 1997, Phase 2 funding requested by CDFG in CALFED FY1999 PSP), and the Gasburg Creek

rehabilitation and fine sediment reduction project (funding requested by CDFG in CALFED FY1999 PSP) were all developed within the sediment management strategy proposed in the Restoration Plan and the framework contained in this proposal.

Other large-scale restoration projects are currently being implemented on the Tuolumne River with similar ecosystem-based objectives of restoring channel morphology, restoring dynamic fluvial processes, and restoring and maintaining habitat for native species. The sediment management program will aid those projects by providing coarse sediment supplies (in the distant future) to downstream project reaches. Additionally, gravel cleaning techniques developed within this project can be used to improve fine sediment conditions in other river reaches of the Tuolumne River, and other Central Valley rivers as well.

Compatibility with AFRP and CALFED restoration objectives: This project supports Tuolumne River Action 2 "Improve watershed management and restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel and performing an integrated evaluation of biological and geomorphic processes" in the Revised Draft Restoration Plan for the AFRP. It also addresses Goal 2 of the CALFED Strategic Plan for Ecosystem Restoration (Table 5-1) specifically recommending restoring "coarse sediment supplies to sediment-starved rivers downstream of reservoirs." The project also addresses the vision for the Tuolumne River Ecological Management unit of "restoring more natural channel configurations; restoring gravel recruitment, transport, and cleansing processes; and restoring a balanced fine sediment budget"(ERPP Vol. II, p.419). The project will help CALFED achieve the objective of developing a sediment management demonstration program on one of the three designated demonstration rivers, and provide the framework for sediment management as well as other methods/techniques that can be applied to other Central Valley river ecosystems.

III MONITORING AND DATA EVALUATION

Adaptive management and monitoring is an integral component of this project, for both coarse sediment augmentation and fine sediment reduction. Monitoring tasks will allow managers to estimate coarse sediment export as a function of discharge, which will allow managers to predict how much coarse gravel to introduce to maintain alluvial deposits. Other monitoring tasks will assess the biological benefits of fine sediment reduction, utilizing a chinook salmon juvenile production model, conduct permeability and fry emergence studies, and other empirical assessments of chinook salmon habitat.

The adaptive management and monitoring program is an integral part of the sediment management plan, and a primary component of the framework presented in Figure 1. Three primary goals of monitoring are:

1. *Quantify the annual volume of coarse sediment augmentation needed to maintain sediment supplies stored in the channel*. We will develop a bedload transport rating curve to help quantify the volume of coarse sediment transported downstream during high flows. Based on previous bedload monitoring experience on the Tuolumne River, we recommend Riffle 4B (RM 48.3) as a monitoring site for establishing a seasonal cableway to provide attachment

for a cataraft and Helley-Smith bedload sampling equipment. Bedload transport measurements will be sieved for particle size distribution, and the transport rate of coarse sediment (>1/4 inch) will be related to discharge to develop a coarse sediment transport rating curve.

2. *Assess the effects of sediment management on the river channel form and geomorphic processes*. The Restoration Plan hypothesized that the fundamental attributes of river ecosystem integrity are defined by the physical processes that create and maintain a natural channel morphology. Based on this hypothesis, the Restoration Plan presented the "Attributes of Alluvial Ecosystem Integrity" as quantifiable objectives for restoring and maintaining the ecosystem. The CALFED ERP Vol. II (p.420) suggests the Attributes as a "basis for the Tuolumne River restoration vision…[and]…for selecting actions for CALFED Stage 1 Implementation. Several of these Attributes will be used in monitoring to assess the status of geomorphic processes, including:

Attribute 1: Spatially Complex Channel Shape.
Monitoring will employ habitat mapping techniques using GIS based aerial photographs and field mapping to assess changes in the channel planform, habitat quantity/quality, and habitat use by native and non-native species.
Attribute 3: Frequently mobilized channelbed surface.
Bed-surface mobility will be monitoring by placing painted tracer rocks on riffle and gravel bar cross sections, and measuring the distance they are transported by high flows.
Attribute 4: Periodic channelbed scour and fill:
Subsurface bed scour and deposition will be monitored using scour cores, scour chains or other techniques to quantify the depths of scour and redeposition at several high flow stages.
Attribute 5: Balanced fine and coarse sediment budgets:
Monitoring will focus considerable energy toward assessing if this attribute is met. In addition to the permanent bedload monitoring station at Riffle 4B, several cross sections will be established at riffles and gravel bar features to determine channel responses to seasonal high flow events.

3. Assess the r*esponse of biological resources to changes in habitat conditions*. We hypothesize that a restored coarse sediment supply (and properly functioning geomorphic attributes) and reduced fine sediment storage will improve habitat conditions for native aquatic, wildlife, and riparian species, including the fall-run chinook salmon population. Monitoring will focus on quantifying spawning habitat use by chinook salmon and improvements in gravel quality permeability that lead to increased survival to emergence of salmon fry.

Table 1. Monitoring and data collection information

Hypothesis/Question to be Evaluated	Monitoring Parameters and Data Collection Approach	Data Evaluation Approach	Comments/Data Priority
What is the volume of coarse sediment transported during high flow events?	Volume (in cubic yards) of sediment transported per unit time; measured with Helley-Smith bedload sampler at seasonal cableway station.	Develop coarse sediment transport rating curve for estimating annual sediment transport volumes.	Bedload sampling station located at Riffle 4B at downstream end of primary spawning reach.
Hypothesis: coarse sediment augmentation will increase spatial channel complexity by allowing formation of alluvial deposits and associated microhabitat features.	Aerial photo analysis and field habitat mapping, relating specific microhabitat features (chinook salmon spawning and rearing habitat) to alluvial bar units and other geomorphic features.	Compare time trends in planform change; relate chinook salmon use to specific spatial habitat features.	These techniques are being implemented in other Tuolumne River restoration projects.
Coarse sediment augmentation will lower thresholds for initiation of surface particle mobility.	Painted tracer rocks including the D_{31}, D_{50}, and D_{84}, placed on cross sections across riffles and alluvial deposits, monitored before and after discreet high flow events.	Comparing changes in thresholds over time.	Will depend on getting an adequate range of high flows.
Coarse sediment augmentation can maintain a balanced (or slightly surplus) coarse sediment budget	Sediment transport measurements to quantify transport rates and cross sections through alluvial deposits to document changes in coarse sediment storage.	Compare estimates of sediment transport to volumes of annual sediment augmentation to determine net change.	Initial phases of sediment augmentation will store coarse sediment supplies until alluvial storage deposits are saturated.
The decreased particle size distribution of introduced coarse sediment will improve geomorphic processes under the post-NDPP flow regime.	Tracer gravels and scour cores to measure bed mobility and bed scour thresholds as a function of discharge.	Compare thresholds with nearby control sites.	Control sites will be downstream of the Basso Bridge, but as introduced sediment begins to route downstream, control sites will no longer be.
The volume of fine sediment stored in the channel bed will be reduced with improvements in Gasburg Creek watershed.	Permeability and bulk sediment sampling to determine sediment composition of bed substrates.	Compare trends over time.	Gravel quality monitoring is currently funded by TRTAC river-wide monitoring program.
Fine sediment can be economically removed from in-channel storage by mechanical methods or other methods.	Pilot program to assess the feasibility and efficacy of different fine sediment removal methodologies	Evaluation of costs and the relative efficacy of different techniques.	

IV WORK TO BE PERFORMED AND DELIVERABLES

Highlighted tasks indicate those that are being considered for AFRP funding.

Task 1. Develop a Tuolumne River Sediment Management Plan.

Task 1 will consist of turning the sediment management strategy recommended in the Restoration Plan into a sediment management plan that includes design, implementation, adaptive management, and the monitoring required for adaptive management. Task 1 will include:

1a. Develop a sediment management and monitoring plan (implementation will occur in Tasks 2-4). The plan will be presented in a report and will summarize all components that are necessary to implement coarse sediment augmentation and fine sediment reduction, including description of coarse sediment augmentation sites and volumes, identifying mainstem fine sediment storage sites, and outlining a strategy for assessing fine sediment storage reduction methodologies (i.e., riffle ripping, flushing, suction dredging, riffle replacement, gravel cleaning machine). Overall project management by TID will also be included in this task.

1b. Refine the juvenile production model developed by TID/MID (EA 1992) to predict benefits to chinook salmon fry production resulting from sediment management efforts (this will aid the evaluation of Task 4b). **TID will provide cost-share contribution for completion of this subtask.**

Task 2. Coarse Sediment Management (Augmentation)

Task 2 will refine coarse sediment augmentation recommendations, including: proposed introduction sites, introduction volumes, and monitoring protocol that were originally developed for the Restoration Plan. The Restoration Plan also identified specific gravel introductions sites, provided preliminary estimates of gravel volumes needed at each site, prioritized sites, and suggested specific methods for gravel placement in the stream. However, these estimates and introduction locations were developed from reconnaissance level surveys; therefore, coarse sediment introduction sites and volumes need additional field verification and surveying to assist CDFG implement the coarse sediment introduction phases. Task 2 includes:

2a. Identify proposed coarse sediment introduction sites and re-evaluate introduction site priorities.

2b. Refine sediment volume estimates at each site with surveyed cross sections and aerial photography (this will also be used as pre-implementation conditions in Task 4).

2c. Identify material sources for suitability (quantity/quality/haul distance) for use in sediment augmentation.

CALFED has funded CDFG (FY1997) to begin gravel augmentation (Task 2d), and those funds will provide at least 10,000 yd^3 of gravel to the upstream sites located near La Grange Bridge. CDFG is currently submitting a parallel proposal to CALFED for FY1999 funding to continue the gravel augmentation phase (Task 2b), with augmentation of an additional 10,000 to 20,000 yd^3 of gravel. This (TID) proposal does not request funding for the actual gravel augmentation tasks presented in the framework (Tasks 2d – 2f), but only references them as an integral part of the overall sediment management program.

Task 3. Fine Sediment Management (Reduction).

The Restoration Plan recommended a two-phased fine sediment management approach: reducing/eliminating fine sediment input into the mainstem Tuolumne River in the primary spawning reach, then reducing fine sediment storage in the channel, either by mechanical methods (suction dredging, etc), channel maintenance flows, or other methods. Many efforts have been made on other rivers to reduce fine sediment storage in the channel; however, no quantitative evaluation of cost and/or biological effectiveness has been performed to evaluate different fine sediment removal mechanisms. Task 3 would provide this by:

3a. Evaluating alternative methods for fine sediment reduction/removal in the mainstem Tuolumne River (e.g., suction dredging, fluvial entrainment) to determine the effectiveness of each method for broader application. This task will also include completing an evaluation of mechanical gravel cleaning techniques initiated by TID/MID in 1991-93 that was not completed. This evaluation will be used in adaptive management by comparing costs per-unit-sand removed with benefits to juvenile salmon using the juvenile salmon production model developed by TID/MID (see Task 1b).

3b. Implementing a mainstem fine sediment reduction program within the critical spawning reaches in the Tuolumne River, based on the findings in task 3a. Because this task is dependent on the evaluation phase in task 3a, a block of funding is requested to implement a yet undetermined fine sediment removal location and procedure.

CDFG is working to secure funding to decrease fine sediment generation in the Gasburg Creek watershed (Task 3c) in a parallel CALFED FY 1999 proposal; therefore, this proposal does not request funding for this task (Task 3c), but references it as an integral part of the overall sediment management program.

Task 4. Implement Adaptive Management and Monitoring Program.

To implement coarse sediment adaptive management, monitoring must be able to quantitatively estimate volumes of gravel transported out of the primary spawning reach. Additionally, the TID/MID juvenile salmon production model will be used in coarse and fine sediment adaptive management to predict benefits and evaluate different management techniques. Task 4 includes:

4a. Quantify annual sediment augmentation volumes using sediment transport monitoring at permanent stations, including: (1) a bedload transport sampling station to measure bedload transport rates during high flows; (2) benchmarked cross section surveys at proposed gravel augmentation sites (established in task 2b); and (3), bed surface particle mobility and subsurface scour experiments to document alluvial feature evolution to increased coarse sediment supply (we hypothesize a lowered bed mobility threshold and a more dynamic channel morphology).

4b. Quantify the benefits of sediment management to chinook salmon population. Task will apply juvenile salmon production model in conjunction with empirical studies (habitat mapping of channel planform and adult spawning utilization, egg survival-to-emergence studies, smolt survival and outmigration).

4c. Continue the TRTAC program for monitoring permeability and particle size distribution in chinook salmon spawning riffles. This pilot program was initiated in 1998 to establish a correlation between particle size (determined by McNeil samples) and permeability (using standpipes), and then use permeability an inexpensive surrogate for quantitative evaluation of

spawning gravel quality. This program is currently funded by the TRTAC as part of the FERC Settlement Agreement, thus **no funding is requested**.

4d. Complete the photo-documentation of spawning gravel quality in chinook salmon spawning riffles in the upper Tuolumne River spawning reaches. This pilot study was initiated in 1998 by the TID/MID to determine if photo-documentation of spawning gravels could be used as an unbiased, replicable method for assessing gravel quality. Additional funds are requested to complete the photo analysis. **TID will provide cost-share contribution for completion of this subtask.**

4e. Develop/evaluate anticipated relationship between egg survival-to-emergence of salmon fry and permeability of spawning gravels. The TRTAC has funded the permeability and gravel quality portion of the evaluation (Task 4b), but CALFED funding is requested to conduct the egg-to-emergence monitoring in order to develop this relationship. TID currently owns 30 emergence traps, so costs would be limited to labor and analysis associated with emergence trapping only. Permeability monitoring will be implemented in conjunction with TRTAC permeability program for cost-sharing benefits.

4f. Monitor Gasburg Creek and interim sedimentation basin to determine effectiveness of fine sediment trapping efforts. This task is included in a parallel proposal submitted to CALFED by CDFG, thus **no funding is requested**.

Schedule: The Phase I of sediment augmentation (CDFG Task 2d) is scheduled to begin in August 1999, with the "La Grange Gravel Addition" project. The Sediment Management Plan will be developed during fall and winter of 1999/2000, in time to begin implementing Tasks 2-4 during summer of 2000. Task 2f (CDFG Phase II sediment augmentation) will depend on completion of Tasks 2a-2c, which are necessary preparatory phases for subsequent sediment augmentation. Development and implementation of fine sediment reduction methods (Tasks 3a and 3b) are interdependent and should proceed only after Gasburg Creek watershed remediation (CDFG task 3c) is implemented. Monitoring (Tasks 4a, b and f) will be implemented after Tasks 2 and 3 are complete; Tasks 4c,d and e will be completed as currently scheduled by TRTAC consultants.

V BUDGET

The total cost for this project, including project management, planning, and implementation is $414,500. The proposed budget breakdown for Tasks 1-4 is provided in Table 2. The budget for this project was developed by assessing costs for each task and subtask, and assumes the institutional framework discussed in the project description (TRTAC supervision, TID administration, Consultant implementation). TID imposes indirect costs of 3% of the total costs for project management overhead, and 5% contingency for service contracts.

The ARRP proposes to fund elements 1a, 2a, 2b, 2c, 4a, and 4b and associated project management and contingency costs for a total of **$205,200**.

TABLE 2. Estimated costs for each task and the total amount of funding to be provided by the AFRP.

Task	Service Contracts	TRTAC	AFRP Cost	Un-met need
Task 1				
1a (AFRP)	$26,900		($29,600)	
1b (TRTAC)	$20,600	$20,600		
Task 2				
2a (AFRP)	$3,500		($3,500)	
2b (AFRP)	$13,500		($13,500)	
2c (AFRP)	$14,500		($14,500)	
Task 3				
3a (AFRP)	$30,700		($30,700)	
3b (un-funded)	$104,500			$104,500
Task 4				
4a (AFRP)	$80,000		($80,000)	
4b (AFRP)*	$18,200		$18,200	
4d (TRTAC)	$10,000	$10,000		
4e (un-funded)	$58,600			$58,600
subtotal	$381,000	$30,600	($190,000)	$163,100
Project Management (3%)		$900	($5,700)	$5,000
Contingency (5%)		$1,500	($9,500)	$8,200
TOTAL	$414,500	$33,000	($205,200)	$176,300

* amount may be reduced if juvenile survival component of the plan is not funded.

Cost sharing: Several components of the project include cost-sharing potential with current TRTAC funding.

The gravel permeability study has received $56,000 in funding from the TRTAC, and implementation of this program began in November 1998. The additional funding requested for

chinook salmon fry emergence studies will complement the permeability studies and incorporates costs saved by using TID fry emergence traps.

The gravel quality photo assessment has received $8,000 in funding from the TRTAC, and implementation of the field component of this program was completed in January 1999. The additional funding requested from CALFED will complement the TRTAC funds.

Additionally, the project management Task 1a of this proposal includes $7,200 of funding for database management. The TID has provided an additional $10,000 for a systematic evaluation and compilation of past sediment management information generated through previous TID/MID studies. This information will be relevant and useful for the project proposed herein.