



**DRAFT POLICY DOCUMENT
LOWER AMERICAN RIVER FLOW MANAGEMENT STANDARD**

Prepared for:



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INTRODUCTION

The American River is the second largest tributary to the Sacramento River, a critical component of the San Francisco Bay/Sacramento-San Joaquin Delta system that provides drinking water to two-thirds of the state and irrigation water to half of California's agriculture industry. The lower American River (**Figure 1**) is a particularly valuable asset within the Sacramento region, providing important fish and wildlife habitat, a high-quality water source, a critical floodway, and a spectacular regional recreational parkway.

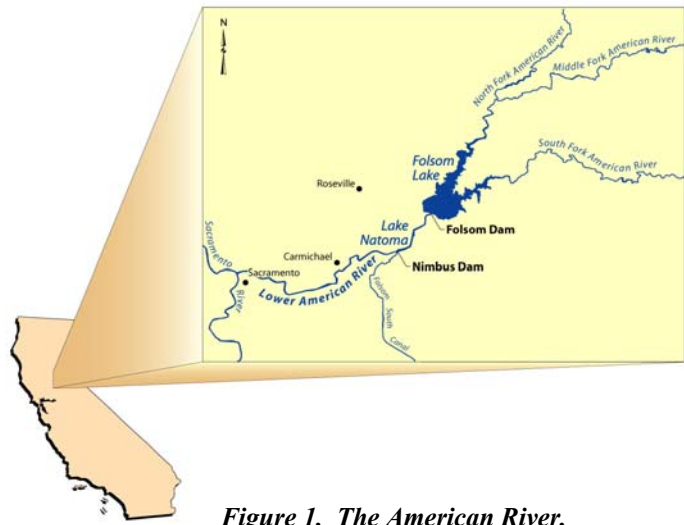
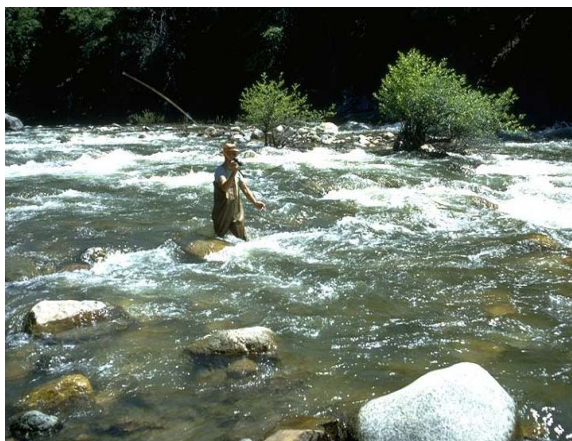


Figure 1. The American River.

The U.S. Bureau of Reclamation (Reclamation) operates Folsom Dam and Reservoir to provide water for irrigation, municipal and industrial uses, hydroelectric power, recreation, water quality, flood control, and fish protection. Reclamation operates under a state water right permit and fish protection requirements that were adopted in 1958 as State Water Resources Control Board (SWRCB) Decision 893 (D-893). This decision allows flows at the mouth of the American River to fall as low as 250 cubic feet per second (cfs) from January through mid-September, with a minimum of 500 cfs required between September 15 and December 31. Biological, socioeconomic, legal, and institutional conditions have changed substantially since the SWRCB adopted D-893 in 1958. The SWRCB and many diverse stakeholders involved in various American River actions have agreed that the conditions specified in D-893 are not sufficiently protective of the fishery resources within the lower American River.

PURPOSE OF THE FLOW MANAGEMENT STANDARD



Development of the Flow Management Standard implements a portion of the *Water Forum Agreement*, which is a comprehensive package of linked actions to achieve two coequal objectives:

- Provide a reliable and safe water supply for the region's economic health and planned development to the year 2030; and
- Preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River.

Development of the proposed Flow Management Standard is a critical component in achieving the Water Forum objectives, which will be accomplished through implementation of seven major complementary elements. One of these seven elements is an *“Improved Pattern of Fishery Flow Releases from Folsom Reservoir.”* Development of the Flow Management Standard also

implements the Fisheries and In-stream Habitat Plan (FISH Plan), which constitutes the aquatic habitat management plan for the lower American River. The FISH Plan was developed as part of another Water Forum element, the “*Lower American River Habitat Management Element*.” Development of the habitat management element is necessary to comply with the California Environmental Quality Act (CEQA), as described in the *Water Forum Agreement* Environmental Impact Report (EIR). The FISH Plan is consistent with the mitigation described and certified in the *Water Forum Agreement’s* EIR and associated mitigation, monitoring, and reporting plan.

The Flow Management Standard is intended to result in improved conditions for fish in the lower American River, particularly fall-run Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*O. mykiss*). In addition, it is anticipated that the Flow Management Standard will comply with California Department of Fish and Game (CDFG) Code 5937, which requires that lower American River fish resources be maintained in “*good condition*.” The Flow Management Standard also is intended to be consistent with the National Oceanic and Atmospheric Administration/National Marine Fisheries Service’s (NOAA Fisheries) *Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units* (2000). This NOAA Fisheries document provides an explicit framework for identifying attributes of viable salmonid populations so that parties may assess the effects of management and conservation actions, and ensure that their actions promote the listed species' survival and recovery. NOAA Fisheries and the U.S. Fish and Wildlife Service (USFWS) define recovery under the Endangered Species Act as “*improvement in the status of a listed species to the point at which listing is no longer appropriate*” under the ESA (50 CFR 5402.02). In the lower American River, the standard of “*promoting recovery*” would only be applicable to federally protected species, in this case the Central Valley steelhead Evolutionarily Significant Unit (ESU).

The primary purpose of the proposed Flow Management Standard is to maximize the annual production and survival of the anadromous fall-run Chinook salmon and steelhead in the lower American River, within water availability constraints and in consideration of Reclamation's obligation to provide for multi-purpose, beneficial uses of the project. With improved habitat conditions for salmonids, the proposed Flow Management Standard also is expected to benefit other fish species within the lower American River. Development of an improved flow standard will:

- Improve currently required flow, water temperature, ramping rate, and flow fluctuation criteria;
- Establish a river management process for Folsom Reservoir and lower American River operations; and
- Monitor, evaluate, and report the resultant hydrologic and biologic conditions.

Thus, the proposed Flow Management Standard consists of three separate elements: *Required Flows and Water Temperatures*; *River Management*; and *Monitoring and Evaluation*.

PROCESS AND PARTICIPANTS

The need to update the lower American River flow standard stems from several efforts to improve conditions for fish in the lower American River that began in the early 1990s. The SWRCB acknowledged the need to protect public trust resources in the lower American River in its 1990 "*Report of Referee*" in the *Environmental Defense Fund et al. v. East Bay Municipal Utility District* case.

In September 1993 the Water Forum, a diverse group of business and agricultural leaders, citizens groups, environmentalists, water managers, and local governments in the Sacramento Region, was formed to evaluate water resources and future water supply needs of the Sacramento metropolitan region. The resulting *Water Forum Agreement* was approved in 2000. In December 1994, the Water Forum began development of an improved lower American River flow standard with the convening of the Fish Biologists Working Group. In January 1999, the Water Forum, the USFWS, and Reclamation agreed to continue working on a proposal to be presented to the SWRCB with the intent to recommend an improved flow standard for the lower American River. A technical committee was tasked with developing this proposal, consisting of individuals representing Reclamation, USFWS, NOAA Fisheries, CDFG, the City of Sacramento, and the Water Forum.

The proposed lower American River Flow Management Standard has been developed on behalf of the 40* signatories to the Water Forum Agreement, including water purveyors dependent on the American River for water supply, Sacramento region environmental organizations, members of the business community, and public interest groups. Input also was provided by resource agencies with management responsibilities along the river, including USFWS, NOAA Fisheries, and CDFG.

* The Water Forum Agreement was signed separately by Northridge Water District and Arcade Water District, which subsequently merged to form Sacramento Suburban Water District.

WATER FORUM STAKEHOLDERS

Water Interests

Arden-Cordova Water Service
Carmichael Water District
California-American Water Company
Citrus Heights Water District
City of Folsom
City of Roseville
Clay Water District
Del Paso Manor Water District
El Dorado County Water Agency
El Dorado Irrigation District
Fair Oaks Water District
Florin County Water District
Galt Irrigation District
Georgetown Divide Public Utility District
Natomas Mutual Water Company
Omochumne-Hartnell Water District
Orange Vale Water Company
Placer County Water Agency
Rancho Murieta Community Services District
Regional Water Authority
Rio Linda/Elverta Community Water District
Sacramento County Farm Bureau
Sacramento Suburban Water District
San Juan Water District

Business Interests

Associated General Contractors
Building Industry Association
Sacramento Association of Realtors
Sacramento Metro Chamber of Commerce
Sacramento-Sierra Building & Construction Trades Council

Environmental Interests

Environmental Council of Sacramento
Friends of the River
Save the American River Association, Inc.
Sierra Club-Mother Lode Chapter

Public Interests

City of Sacramento
County of Sacramento
League of Women Voters of Sacramento
Sacramento County Alliance of Neighborhoods
Sacramento County Taxpayers League
Sacramento Municipal Utility District

Development of the proposed Flow Management Standard builds on prior lower American River management efforts, as well as the following documents:

- ❑ Water Forum Agreement aquatic habitat management element, which includes the FISH Plan;
- ❑ Sacramento Area Flood Control Agency's Floodway Management Plan for the Lower American River;
- ❑ The Lower American River Corridor Management Plan developed by 18 governmental agencies, 17 non-governmental stakeholders, and 3 partnerships;
- ❑ CALFED Bay-Delta Program's Ecosystem Restoration Program Plan (ERPP);
- ❑ Central Valley Improvement Act (CVPIA) and the USFWS' Anadromous Fish Restoration Program (AFRP);
- ❑ CDFG's Steelhead Restoration and Management Plan for the Lower American River and Restoring Central Valley Streams: A Plan for Action;
- ❑ NOAA Fisheries' Technical Memorandum (NMFS-MWFSC-42) Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units; and
- ❑ CDFG's Lower American River Flow Fluctuation Study.

In addition to the management efforts described above, numerous regulations, management plans, water rights hearing administrative records, studies and tools were reviewed and considered in developing the Flow Management Standard. Specific major tools that were used to develop the Flow Management Standard include:

- ❑ **Reclamation and DWR's CALSIM II Model-** This model is currently Reclamation and the California Department of Water Resources' (DWR) primary operations and planning model for Central Valley Project (CVP) and State Water Project (SWP) operations. The model simulates CVP and SWP system operations on a monthly timestep, and the hydrology effects of those operations within the geographic area affected by CVP and SWP facilities.
- ❑ **Reclamation's Water Temperature Models-** These models are the primary water temperature models for the major northern California rivers. The models simulate reservoir release and instream water temperatures on a monthly basis for the Sacramento and American rivers.
- ❑ **Reclamation's Chinook Salmon Mortality Models-** These models produce a single estimate of each Chinook salmon run's early lifestage mortality for each year of the simulation based on output from Reclamation's water temperature models. These models have been developed for the Sacramento and American rivers.
- ❑ **USFWS 2003 Instream Flow Incremental Methodology (IFIM) for Steelhead and Fall-run Chinook Salmon Spawning in the lower American River-** The IFIM was developed under the leadership of the USFWS to help natural resource managers and their constituencies determine the benefits or consequences of different water management

alternatives. The IFIM is composed of a library of linked analytical procedures that describe the spatial and temporal features of habitat resulting from a given river regulation alternative.

The Lower American River Flow Management Standard report is currently being prepared, and will include the detailed analyses and associated discussion required to fully support the three elements contained within the proposed Flow Management Standard. It is anticipated that the Lower American River Flow Management Standard report will be completed in June 2004.

In addition to participating in the development of the Flow Management Standard, in 1996 Reclamation established an operational working group for the lower American River, known as the lower American River Operations Group (AROG). Although open to anyone, AROG meetings generally include representatives from several agencies and organizations with on-going concerns regarding management of the lower American River, including:

- | | |
|---|--|
| <input type="checkbox"/> Reclamation | <input type="checkbox"/> Water Forum |
| <input type="checkbox"/> USFWS | <input type="checkbox"/> City of Sacramento |
| <input type="checkbox"/> NOAA Fisheries | <input type="checkbox"/> County of Sacramento |
| <input type="checkbox"/> CDFG | <input type="checkbox"/> Western Area Power Administration |
| <input type="checkbox"/> Sacramento Area Flood Control Agency | <input type="checkbox"/> Save the American River Association |

The AROG generally convenes monthly, or more frequently, with the purpose of providing input to Reclamation regarding the management of Folsom Reservoir for fish resources in the lower American River, within the confines of water availability and other operational considerations.

NEED FOR UPDATED FLOW STANDARD

FISH SPECIES AND HABITAT CONSIDERATIONS

Historically, over 125 miles of riverine habitat were available for anadromous fish (fish that return from the ocean as adults to spawn in fresh water) in the American River system. It has been estimated that prior to the Gold Rush era, the American River aquatic ecosystem may have supported spring and fall-run Chinook salmon runs of over 100,000 fish annually. However, completion of Folsom and Nimbus dams in 1955 permanently blocked upstream access for anadromous fish. Chinook salmon and steelhead are now restricted to the lower American River, which is the 23-mile portion of the river that extends from Nimbus Dam to the confluence of the American and Sacramento rivers. Nimbus Hatchery was constructed to mitigate for the loss of spawning grounds which resulted from the construction of Nimbus and Folsom dams. Naturally occurring anadromous fish populations in the lower American River presently are supplemented by Nimbus Hatchery operations.



The lower American River currently supports at least 40 species of fish, including fall-run Chinook salmon and steelhead. Although development and dam construction extirpated spring-run Chinook salmon, the lower American River continues to function as spawning and rearing habitat for relatively large numbers of fall-run Chinook salmon, and fewer numbers of steelhead. Central Valley steelhead are listed as

a "threatened" species under the federal Endangered Species Act (ESA), and fall-run Chinook salmon are considered a "candidate" species under the ESA. From 1991 to 2001, an estimated average of 58,000 fall-run Chinook salmon returned to the American River each year to spawn. In the last decade, about one-fourth (25 percent) of all of the salmon produced in the Central Valley have come from the American River. A run of approximately 1,310 steelhead has been estimated in the lower American River for the year 2003.

Development of the American River watershed over the past two centuries, from hydraulic mining during the Gold Rush era to more recent levee and bank protection projects, has significantly altered the aquatic habitat of the lower American River. The closure of Nimbus Dam in 1955 blocked access to approximately 70 percent of the spawning habitat historically used by Chinook salmon, and all of the spawning habitat historically used by steelhead in the American River Basin. Operation of Folsom and Nimbus dams continues to affect downstream flow and water temperature regimes. The resultant flow and water temperature patterns are sometimes not consistent with the life cycle needs of anadromous salmonids in the lower American River. In addition, the need to meet water supply requirements south of the Sacramento-San Joaquin Delta (Delta) and Delta water quality standards has resulted in fluctuating flow patterns that can dewater spawning areas, or strand and isolate juvenile fish.



Water temperature is one of the primary factors affecting fall-run Chinook salmon and steelhead production in the lower American River. Prior to dam construction, fall-run Chinook salmon and steelhead could migrate to the upper reaches of the American River, unabated by physical barriers. Under such conditions, adult fish were only exposed to the warm water temperatures of the Delta and the lower reaches of the Sacramento and American rivers for short periods, before ascending to cooler upstream reaches of the American River where they would spawn.

Today, with upstream access blocked by physical barriers, fall-run Chinook salmon must spawn in the lower American River, where they are exposed to relatively warm water temperatures.



Flows and water temperatures needed for fall-run Chinook salmon spawning in the fall are provided by the operation of Folsom and Nimbus dams, and are dependent on the availability of cold water in Folsom Reservoir. Depending on the volume of the Folsom Reservoir coldwater pool, and export quantities of water needed for south-of-Delta uses and Delta water quality standards compliance, the

coldwater pool in Folsom Reservoir can be depleted by late summer or early fall. Thus, relatively warm water temperatures generally occur downstream of Nimbus Dam during the

early part (September to November) of the adult fall-run Chinook salmon upstream migration and spawning period.

High water temperatures during the fall can delay the onset of spawning by Chinook salmon and result in fewer fish spawning, less eggs spawned per female, lower egg fertilization rates, and increased mortality of eggs in the spawning nests (“redds”). In addition, relatively low October and November flows, when they occur, reduce the amount of available spawning habitat and tend to increase the amount of fall-run Chinook salmon redd superimposition (multiple nest building in one location that results in decreased egg survival), thereby potentially limiting initial year-class strength (the number of surviving fish). Flow fluctuations can expose redds to the atmosphere, causing redd dewatering and egg mortality.



After the eggs hatch, juvenile fall-run Chinook salmon begin their seaward migration the same year in which they were spawned. By contrast, juvenile steelhead may remain in the lower American River a year or more prior to their seaward migration. The environmental factor believed to be most limiting to the survival of steelhead in the lower American River is high water temperatures during the summer and early fall. In their biological opinion on the operation of the Central Valley Project (CVP), NOAA Fisheries specified a water temperature of 65°F or less to protect rearing juvenile steelhead in the lower American River.

Water temperatures in the lower American River during summer months exceed the upper range of water temperatures reported to be suitable for juvenile steelhead rearing. Summer water temperatures often exceed 65°F, and can exceed 70°F particularly during the months of July and August. Water temperatures higher than the suitable range can affect the growth and survival of juvenile steelhead. In addition to water temperature effects, large fluctuations in flow can strand fry and juvenile steelhead, as well as juvenile fall-run Chinook salmon, near the river edges and in shallow pools, or prevent their access to the main river channel from the side channels in which they rear.

CURRENT OPERATIONS

Currently, the 1958 SWRCB Decision (D-893) specifies the legally required minimum flows in lower American River for all months of the year (500 cfs between September 15 and December 31, and 250 cfs at all other times). From today’s perspective, D-893 is based on outdated information and assumptions about available water supplies and operational constraints. For example, D-893 standards do not address requirements of the Central Valley Project Improvement Act, the 1995 Bay-Delta Plan, or biological opinions to protect Central Valley anadromous salmonids. These and other mandates drive current decision-making associated with CVP operations.

Reclamation operates Folsom Dam to meet these more recent flow recommendations, as well as those consistent with other relevant habitat management plans geared toward the protection and enhancement of anadromous fish resources. Under recent CVP operations, flows in the lower American River have been well in excess of the D-893 minimum flow requirements (**Figure 2**).

Folsom Dam and Reservoir is operated by Reclamation to meet CVP-wide multi-purpose beneficial uses, while taking into consideration input received from the AROG. Reclamation provides the AROG with information such as flows in the river during the previous several months, reservoir storage, projected reservoir inflow, water temperature data, and projected outflows. The AROG uses this information to plan and develop flow release schedules for Folsom Dam. During this iterative process, the AROG adapts and refines the projected flow

release schedule for the next month, making necessary adjustments for the remainder of the year.

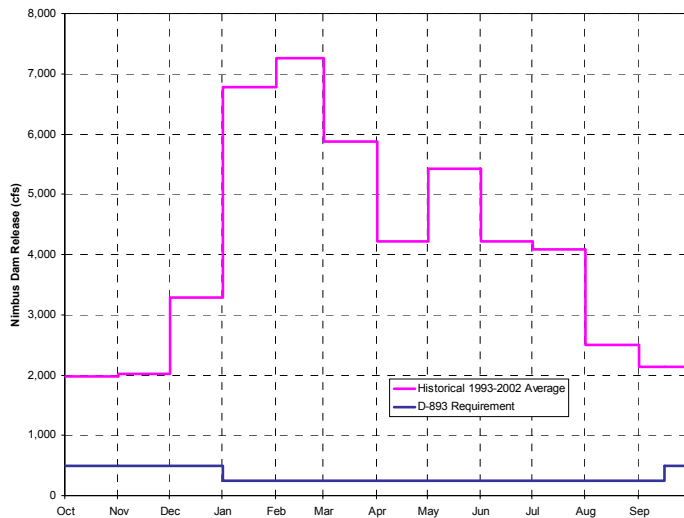


Figure 2. Comparison of D-893 Minimum Instream Flow Requirements with Average Monthly Flows Released from Nimbus Dam (1993-2002).

The AROG not only provides input into the flow release schedule for Folsom Dam, but also into management of the coldwater pool in Folsom Reservoir. The coldwater pool is influenced by numerous factors including inflow, inflow water temperatures, diversions, storage, and the volume of cooler, hypolimnetic waters in the reservoir. Water temperatures in the lower American River also are

influenced by these factors, as well as by decisions about the elevation from which to draw water for release from Folsom Reservoir into the Nimbus and American River Fish Hatcheries, and down the lower American River. The AROG provides regular input regarding how best to configure the shutters on the power penstocks at Folsom Dam to most effectively manage the coldwater pool reserves, and provide maximal thermal benefits to downstream aquatic resources, specifically anadromous salmonids.



The AROG has been voluntarily implementing adaptive management of lower American River flows since 1996. Although the AROG recommendations are advisory and the group has no authority to oversee Folsom and Nimbus dam releases, Reclamation currently manages releases from Folsom and Nimbus dams according to AROG recommendations to the fullest extent feasible, given its existing obligations. There is consensus among the AROG members and the many other diverse

stakeholders involved in the lower American River that a comprehensive river management process is the most productive and effective approach to managing lower American River flows for instream benefits (**Figure 3**).

| <i>What is not working on the lower American River?</i> | <i>How the proposed Flow Management Standard addresses these issues</i> |
|---|---|
| <input type="checkbox"/> Inappropriate Flow Pattern <ul style="list-style-type: none"> ▪ Flow volumes are too high or too low ▪ Timing of flow does not always coincide with the needs of fish ▪ Flow fluctuations can cause redd dewatering and juvenile salmonid stranding | → |
| <input type="checkbox"/> Warm Water Temperatures <ul style="list-style-type: none"> ▪ Limited cold water supply and accessibility - need cold water in summer for steelhead rearing, and in fall for Chinook salmon spawning | → |
| <input type="checkbox"/> Lack of comprehensive river management <ul style="list-style-type: none"> ▪ Need comprehensive river management to balance the operation of Folsom Dam and Reservoir for all beneficial uses | → |
| | <input type="checkbox"/> Improved Regulatory Flows (Element One) <ul style="list-style-type: none"> ▪ Required flow standard ▪ Ramping rate standard ▪ Flow fluctuation objectives |
| | <input type="checkbox"/> Required water temperature standards (Element One) |
| | <input type="checkbox"/> Formulation of a River Management Group (Element Two) and required monitoring, evaluation, and reporting procedures (Element Three) |

Figure 3. Need for Updated Flow Management Standard.

ELEMENT ONE – REQUIRED FLOWS AND WATER TEMPERATURES

The required flow, water temperature, ramping rate, and flow fluctuation standards discussed below together comprise the first element of the Flow Management Standard, *Required Flows and Water Temperatures*. Detailed discussion and analyses supporting development of these standards will be included in the Lower American River Flow Management Standard report currently under preparation.

The primary objective of the *Required Flows and Water Temperature* element of the Flow Management Standard is to sustain increased habitat availability, while concurrently minimizing flow fluctuations and reductions, within the context of hydrologic uncertainty. Specifically, the required flow, water temperature, ramping rate, and flow fluctuation standards intend to:

- Provide the best possible flow and temperature based on water availability;
- Maximize the occurrence of target Chinook salmon and steelhead spawning flows;
- Stabilize flows during the Chinook salmon and steelhead egg incubation periods;
- Reduce month-to-month flow reductions to minimize juvenile salmonid stranding and isolation; and
- Manage flow releases and reservoir storage to effectively utilize coldwater pool availability.

REQUIRED FLOW STANDARD

The required flow, as measured by the total release at Nimbus Dam, would vary throughout the year depending on the hydrology of the Sacramento and American rivers. As used in the flow standard, the term “required flow” is meant to describe the minimum required flow and does not



preclude Reclamation from making higher releases at Nimbus Dam. Except for extremely dry conditions, from October through May required flows would be established between 800 cfs and 2,250 cfs. During June through September, required flows would be established between 800 cfs and 1,750 cfs. Actual required flow would be determined by specified conditions at

biologically significant times of the year. For instance, during wetter years, the required flow would generally be higher, but not so high as to substantially reduce the coldwater pool volume in Folsom Reservoir by the end of summer. During drier years, the required flow would be reduced to most effectively utilize the limited availability of Folsom Reservoir storage and coldwater pool.

During the October through December period, the required flow would be based on an index of American River Basin carryover storage conditions. This index, referred to as the FRI (Four Reservoir Index), is calculated as the combined end-of-September storage in four reservoirs – French Meadows, Union Valley, Hell Hole, and Folsom. If, for example, the combined carryover storage in Folsom Reservoir and the upstream American River reservoirs was low, the required flow would be near 800 cfs; if carryover conditions were high, the required flow would be near 2,250 cfs. During October of each year, flows would be “stepped-up” until the required flow is met, at different rates depending on the magnitude of the required flow, as follows:

❑ **Required Flows equal to 2,250 cfs**

- 250 cfs step increases from 1,500 cfs on October 1 to 2,250 cfs on November 9
 - ◆ Oct 1 to Oct 24 1,500 cfs
 - ◆ Oct 25 to Oct 31 1,750 cfs
 - ◆ Nov 1 to Nov 8 2,000 cfs
 - ◆ Nov 9 to Dec 31 2,250 cfs

❑ **Required Flows between 2,250 cfs and 1,500 cfs**

- Incremental step increases from 1,500 cfs on October 1 to Required Flows on November 9
 - ◆ Oct 1 to Oct 15 Required Flows = 1,500 cfs
 - ◆ Oct 16 to Oct 31 Required Flows -500 cfs, or 1,500 cfs, whichever is greater
 - ◆ Nov 1 to Nov 8 Required Flows -250 cfs, or 1,500 cfs, whichever is greater
 - ◆ Nov 9 to Dec 31 Required Flows

❑ **Required Flows less than or equal to 1,500 cfs**

- Implemented on October 1
- Continue at same level through December 31

This “stepping-up” of flow, or increasing flow progression, was developed to maximize flow release utilization efficiency based on analysis of the last decade of fall-run Chinook salmon spawning distribution. In other words, more water is provided when more fish are expected to be spawning. In addition, the increasing flow progression is intended to minimize the incidence of redd superimposition.

During January and February, adjustments to the required flows would be based on the Sacramento River Index (SRI), an index of water year runoff for the entire Sacramento River Basin that is updated monthly. During this time, the fall-run Chinook salmon spawning period is completed, and the first part of the steelhead spawning period has begun. Based on the early January SRI, the January flow requirement may be modified from the December value. If the SRI predicts a critically dry year, then the January flow requirement would be set as 85 percent of the December requirement or 800 cfs, whichever is greater. If the SRI predicts a dry or normal year, then the January flow requirement remains the same as December. If the SRI predicts an above normal or wet year, the required flow would be set at 2,250 cfs. In February, the calculation is the same as the January routine, except the January flow is used as the basis.

Generally, by March, water supply availability and snow-pack conditions are reasonably certain for the remainder of the water year. At this time, knowledge of the actual available water supply can be used to make flow management decisions. Early in the spring, tradeoffs must be made between maintaining flows to sustain current habitat conditions *versus* reserving water supply for future releases to ensure that sufficient coldwater is available during both the steelhead over-summer rearing period and Chinook salmon spawning in the fall. From March through September, the required flow is based on the Impaired Nimbus Inflow Index (INI). The INI is defined as the May through September Folsom Reservoir inflow, minus May through September Folsom Reservoir diversions, minus May through September Folsom Reservoir evaporation, minus May through September Folsom South Canal diversions. Using the INI as an index, the flow requirement for the entire March through May period is established between 800 and 2,250 cfs. The same flow requirement is used for June through September, except the maximum flow requirement is capped at 1,750 cfs.

Preliminary model results associated with the Flow Management Standard required flows are presented in **Appendix A**.

Conference Year Principles

Implementation of the required flows discussed above facilitates the release of available water for aquatic resources during all types of water years. The Flow Management Standard also recognizes agreements for water diversions, which are necessary because of the wide variation in runoff, ranging from over 6 million acre-feet (AF) in one year to less than 400,000 AF in the driest water year on record. As defined in the *Water Forum Agreement*, “conference years” are those years when the projected March to November unimpaired inflow to Folsom Reservoir is less than 400,000 AF. It is during times of low runoff that demands on the available water supply are the greatest. Therefore, special provisions for conference years are included in the Flow Management Standard. A summary of these provisions is provided below. For a more detailed discussion regarding conference year principles, please refer to the *Water Forum Agreement*.

- ❑ During conference years, water availability is insufficient to meet the lower American River instream needs, and provide the quantities of diversions specified in purveyor-specific agreements. Special provisions are necessary to deal with water management in these extremely dry years. Therefore, stakeholders agree to meet in these years to confer on how the available water supply should be managed to achieve, to the extent possible, both of the Water Forum’s two co-equal objectives. The guiding principle will be for both instream and consumptive users to bear an equitable burden.
- ❑ Reclamation’s water rights permit for operation of Folsom and Nimbus dams would include a minimum flow requirement of 190 cfs at the mouth of the American River. In extraordinary circumstances, the 190 cfs could be relaxed if reallocating that volume of water to another time in the year would be more beneficial for the fishery.
- ❑ In conference years, water purveyors agree to implement the highest level of conservation/rationing in their drought contingency plans.
- ❑ The River Management Group can recommend that the Water Forum Successor Effort, as defined in the *Water Forum Agreement*, meet and confer on operations in any year if called for by extraordinary circumstances.

These Conference Year Principles are intended to be included in the diversion agreements between Reclamation and purveyors signatory to the *Water Forum Agreement* that divert upstream of Nimbus Dam.

“Off-ramp” Criteria

Recent hydrologic modeling has identified some water years wherein total American River runoff is not as low as in conference years, yet the temporal distribution of runoff is such that the required flow in the lower American River below Nimbus Dam, identified in the proposed Flow Management Standard, could jeopardize other water right entitlements within the American River Basin. By the same token, during these years, subsequent water availability for appropriate instream flows and water temperatures could be reduced, thereby threatening adequate fish protection. To avoid: (1) infringement on other water rights; and (2) subsequent reductions of fish protection, “off-ramp” criteria were developed to allow relaxation of the required flow within the lower American River below Nimbus Dam.

The off-ramp criteria included as part of the Flow Management Standard allow the required flow to be less than 800 cfs (but greater than or equal to D-893 levels) if certain conditions are forecasted to occur. For the Flow Management Standard, Folsom Reservoir storage is used as a surrogate for other water rights. The off-ramp criteria is triggered if, at any time, Folsom Reservoir storage is forecasted to be less than 100,000 AF. Application of the off-ramp criteria is as follows:

- ❑ If, at any time between and including September 16 through December 31, Folsom Reservoir storage is forecasted to be less than 100,000 AF, then the required flow for the remainder of the period may be reduced to as low as 500 cfs, to preclude depletion of Folsom Reservoir storage; and

- ❑ If, at any time between and including January 1 through September 15, Folsom Reservoir storage is forecasted to be less than 100,000 AF, then the required flow for the remainder of the period may be reduced to as low as 250 cfs.

WATER TEMPERATURE STANDARDS

The proposed Flow Management Standard includes the following water temperature standards:

- ❑ *Reclamation shall operate Folsom Dam and Reservoir and Nimbus Dam to meet daily average water temperatures of 60°F or less, striving to achieve 56°F or less as early in the season as possible, in the lower American River at Watt Avenue from October 16 through December 31 for fall-run Chinook salmon spawning and egg incubation; and*
- ❑ *Reclamation shall operate Folsom Dam and Reservoir and Nimbus Dam to maintain daily average water temperatures that do not exceed 65°F in the lower American River at Watt Avenue from June 1 through October 15 for juvenile steelhead over-summer rearing.*

Although the standards specify Watt Avenue as the location where water temperature compliance must be met, the proposed Flow Management Standard allows for alternative upstream compliance locations (up to Nimbus Dam) on occasions when the coldwater pool at Folsom Reservoir is insufficient to provide target water temperatures for fish. On these occasions, achieving the water temperature standard could jeopardize fish survival by causing a further depletion of the coldwater pool. Therefore, during these occasions, alternative locations can be designated by Reclamation after consultation and concurrence with the River Management Group.

There may be some instances in which factors beyond Reclamation's reasonable control may preclude the ability to meet the specified water temperatures during the indicated time periods, even at an alternative upstream location. Factors considered beyond the reasonable control of Reclamation include the amount of water in storage at Folsom Reservoir, the volume of the coldwater pool, ambient air temperatures, tributary inflow, and natural events such as prolonged droughts. On these occasions, the starting date of the specified water temperatures may need to be delayed. Reclamation shall immediately report instances when it is necessary to meet the daily water temperature requirements at alternative locations or time periods to the Chief of the Water Rights Division of the SWRCB (Chief of Division), and shall file an operation plan showing Reclamation's strategy to meet the water temperature requirements.

This element of the proposed Flow Management Standard would work in conjunction with other projects designed to improve water temperatures in the lower American River that have been completed, are in progress, or are planned for completion. One such project is the installation of a water temperature control device for municipal and industrial water at Folsom Dam, completed by Reclamation in 2003. Additionally, the El Dorado Irrigation District plans to install a water temperature control device at its pumping plant on the south fork of the American River arm of Folsom Reservoir. These devices will allow operators to draw water from various elevations in Folsom Reservoir, thereby most effectively conserving the coldwater pool. Also, the Sacramento Area Flood Control Agency is in the implementation phase of a project that will upgrade the shutter configuration serving the power penstocks at Folsom Dam to allow for increased operational flexibility.

RAMPING RATE STANDARD

A ramping rate is the rate at which flows, released from a dam, are increased or decreased in a river. Because the majority of medium and low gradient gravel bars in the lower American River are inundated at about 4,000 cfs, the greatest threat of beach stranding occurs at flows less than or equal to 4,000 cfs. Decreases from relatively high flows that result in flows remaining above 4,000 cfs would be less likely to result in salmonid beach stranding.

The proposed Flow Management Standard includes the following ramping rate standards:

- ❑ *Decreases in flow shall not exceed 100 cfs per hour when flows are less than or equal to 4,000 cfs during December through June to prevent possible stranding of fry-sized fall-run Chinook salmon and steelhead in the lower American River.*



This ramping rate standard is directed toward preventing salmonid fry from stranding due to changes in water surface elevation (river stage). Information on the rate of water surface elevation change relative to flow provided by CDFG indicates that stage can decrease more than one inch per 100 cfs change in flow, when flows are less than or equal to 4,000 cfs. The gradual reduction of flows is intended to minimize "beach stranding" and provide conditions that are more conducive to the survival of fry-sized fall-run Chinook salmon and steelhead.

FLOW FLUCTUATION OBJECTIVES

The release of relatively stable flows into the lower American River will help provide conditions that are more conducive to the protection of fall-run Chinook salmon and steelhead. Thus, the Flow Management Standard includes the flow fluctuation objectives described below. The flow fluctuation objectives would apply to the extent that lower American River flow fluctuations are controllable. Depending upon the amount of water in storage at Folsom Reservoir, tributary inflow, and other factors (e.g., flood events), flow fluctuations are not always controllable.

- ❑ *Avoid flow increases to 4,000 cfs or more, year-round, to avoid significant losses of juvenile Chinook salmon and steelhead due to isolation.*

Juvenile Chinook salmon and steelhead can become stranded, or isolated from the main channel of the river, when flows increase to levels that inundate side-channel or off-channel depressions and subsequently recede, trapping the fish in unconnected pockets of water. The actual effect of an isolation event appears to be directly related to the relative abundance of juvenile salmonids in the river, and the timing and duration of a potential isolation flow. According to CDFG, flow increases above 4,000 cfs, with subsequent decreases in flow to less than 4,000 cfs, have resulted in large numbers of juvenile salmonids stranded in isolated areas. Accomplishing the flow fluctuation objective is intended to minimize the loss of juvenile anadromous salmonids due to potential isolation events.

- ❑ *Minimize flow reductions during the spawning and incubation periods of late October through May to prevent possible dewatering of fall-run Chinook salmon and steelhead redds in the lower American River.*

The greatest potential for fall-run Chinook salmon and steelhead redd dewatering exists at the lower flow levels, due to stage-discharge relationships in the lower American River. In other words, for a given increment of flow reduction, water surface elevation decreases more at lower flow levels. Operations which minimize flow reductions, after spawning nests have been constructed and eggs are incubating, will minimize the potential for Chinook salmon and steelhead egg mortality in the lower American River.

ELEMENT TWO – RIVER MANAGEMENT

The *River Management* element of the proposed Flow Management Standard is a systematic process of continually improving management policies and practices by learning from the outcomes of prior operational actions. The formal incorporation of river management into Reclamation’s SWRCB water right permit will facilitate beneficial management of the lower American River on a continuing basis. Additional detailed discussion and analyses supporting development of the proposed *River Management* element will be included in the Lower American River Flow Management Standard report currently under preparation.

Implementation of the proposed Flow Management Standard will require management of the lower American River based on operational decisions that must take into account multiple factors and objectives. In operating Folsom Dam and Reservoir, Reclamation must meet:

- ❑ Flood control, water, and energy supply obligations;
- ❑ Requirements of the CVPIA, the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1995 Bay-Delta Plan), the federal ESA, and California Fish and Game Code Section 5937 (which requires Reclamation to operate Folsom Dam and Reservoir to maintain lower American River fish resources in “good condition”); and
- ❑ Terms and conditions of its water right permits.

Real-time operations to meet these regulatory objectives must be based on consideration of many factors, including current and anticipated hydrological conditions, water supply forecasts, demand for water and electricity, the location, movement, and condition of fish, water temperature, coldwater pool availability, and water quality conditions in the Delta.

Reclamation’s implementation of the proposed Flow Management Standard will be guided by an annual operations plan prescribing operations affecting the lower American River. The operations plan will include a description of the decision-making considerations, parameters, and actions necessary to implement the Flow Management Standard, including average monthly flows in the lower American River, end-of-month storage in Folsom Reservoir (specifically including end-of-month storage for September), and water temperature in the lower American River from Nimbus Dam to Watt Avenue, consistent with the temperature requirements of the Flow Management Standard. The operations plan will include a range of operating flexibility consistent with Reclamation’s ability to meet the requirements of the Flow Management

Standard. The initial operations plan prepared by Reclamation will be based on its April 15 delivery forecast and will describe projected operations for the 12-month period beginning May 1. The operations plan will be reviewed and updated each month to describe operations for the following 12-month period, to incorporate any changes needed to address new information or changed conditions.

RIVER MANAGEMENT GROUP

To ensure that operational decisions are based on the most complete information available and take into account the effect of flows on the overall needs of the system, the proposed Flow Management Standard includes an obligation that Reclamation will consult with and be assisted by a River Management Group (RMG). The RMG will consist of representatives from Reclamation, USFWS, NOAA Fisheries, CDFG, DWR, and the County of Sacramento. The Executive Director of the City-County Office of Metropolitan Water Planning will represent the County of Sacramento on the RMG. The RMG will replace the existing AROG, which has been voluntarily carrying out adaptive management of lower American River flows since 1996.

The primary function of the RMG will be to consult with Reclamation on operations affecting the lower American River, with the intent of achieving the goals and objectives of the proposed Flow Management Standard. Prior to adopting the operations plan or any amendments to the operations plan in effect, Reclamation will consult with the RMG and consider any changes to the plan recommended by the RMG. Recommendations from the RMG may be initiated by a proposal from Reclamation or any other member of the RMG. Recommendations of the RMG are to be developed by consensus, which means that no member voices an objection to a recommendation. The RMG also will collaborate with Reclamation in establishing and implementing a monitoring program to provide information on short- and long-term effects of actions taken under the proposed Flow Management Standard. The monitoring program will document the actions taken pursuant to the Flow Management Standard, the resultant effects of the actions on fish and other aquatic resources within the lower American River, and the ability of Reclamation to operate Folsom Dam and Reservoir to meet its multiple obligations.

The RMG will hold regularly scheduled meetings, and may meet in person or by telephone, to address issues that may arise between regularly scheduled meetings. Regularly scheduled meetings of the RMG will be open to the public, and advance notice of the meetings will be provided to any person requesting such notice. Notice to the public and the opportunity to attend other meetings of the RMG will be provided to the extent consistent with practical constraints. Members of the public may comment on matters under consideration by the RMG, and the RMG will consider public comment in developing its recommendations to Reclamation.

RMG POLICY GROUP

In the event that consensus is not reached on a recommendation developed by the RMG, the RMG will immediately refer the matter to the policy-level decision makers of Reclamation, USFWS, CDFG, and DWR (the RMG Policy Group). The RMG Policy Group will review, as expeditiously as practicable, the issues that resulted in the failure to reach consensus and will seek to formulate a consensus recommendation on the issues before it. The RMG Policy Group may meet at the convenience of its members, and may meet by telephone, consistent with the need for timely consideration of an issue.

Reclamation will adopt the operations plan and any amendments to the operations plan, and will make operational decisions, consistent with consensus recommendations of the RMG or the RMG Policy Group, as applicable. In the event that Reclamation objects to a recommendation of the RMG or the RMG Policy Group, or there is no consensus recommendation based on an objection from another member, Reclamation may make and implement operational decisions consistent with its responsibility to comply with the Flow Management Standard. Reclamation will promptly prepare and provide to the RMG a written report containing a determination of the need for its action, an analysis of the effects of the action on parameters affecting lower American River flows and water temperature, and a demonstration that operations in accordance with the Reclamation action will result in compliance with the Flow Management Standard. Other members of the RMG may provide their individual views on any of the issues addressed in the Reclamation report (**Figure 4**).

ANNUAL REPORT

By February 1 of each year, Reclamation, in consultation with the RMG, will prepare an annual report describing the implementation of the Flow Management Standard during the preceding year. The report will describe fishery and flow conditions, operations affecting lower American River flows and water temperature, and the effects of implementing the Flow Management Standard on fishery resources within the lower American River. In addition, the report will summarize the recommendations of the RMG during the previous year, describing any issues on which consensus was not reached, the actions Reclamation took in such situations, and the effects of those actions. The report also will include a summary of the monitoring results from the previous year and a description of the monitoring plan for the next year.

ELEMENT THREE – MONITORING AND EVALUATION

The third element of the proposed Flow Management Standard, *Monitoring and Evaluation*, includes preparation of a monitoring and evaluation plan. The purpose of the monitoring and evaluation plan is to provide information that can be used by the RMG for real-time operational decisions, as well as in the on-going evaluation of whether the long-term goals and objectives of the Flow Management Standard are being met. The monitoring and evaluation plan will allow the RMG to learn from previous management actions and decisions, build on successes, and adjust operations simultaneously with changes in fishery resources and associated habitats. In addition, monitoring the outcomes of previous management decisions provides early warning of potential problems, allowing corrective actions to be taken before adverse impacts to lower American River fishery resources occur.



Source: USBR and CDFG 2003

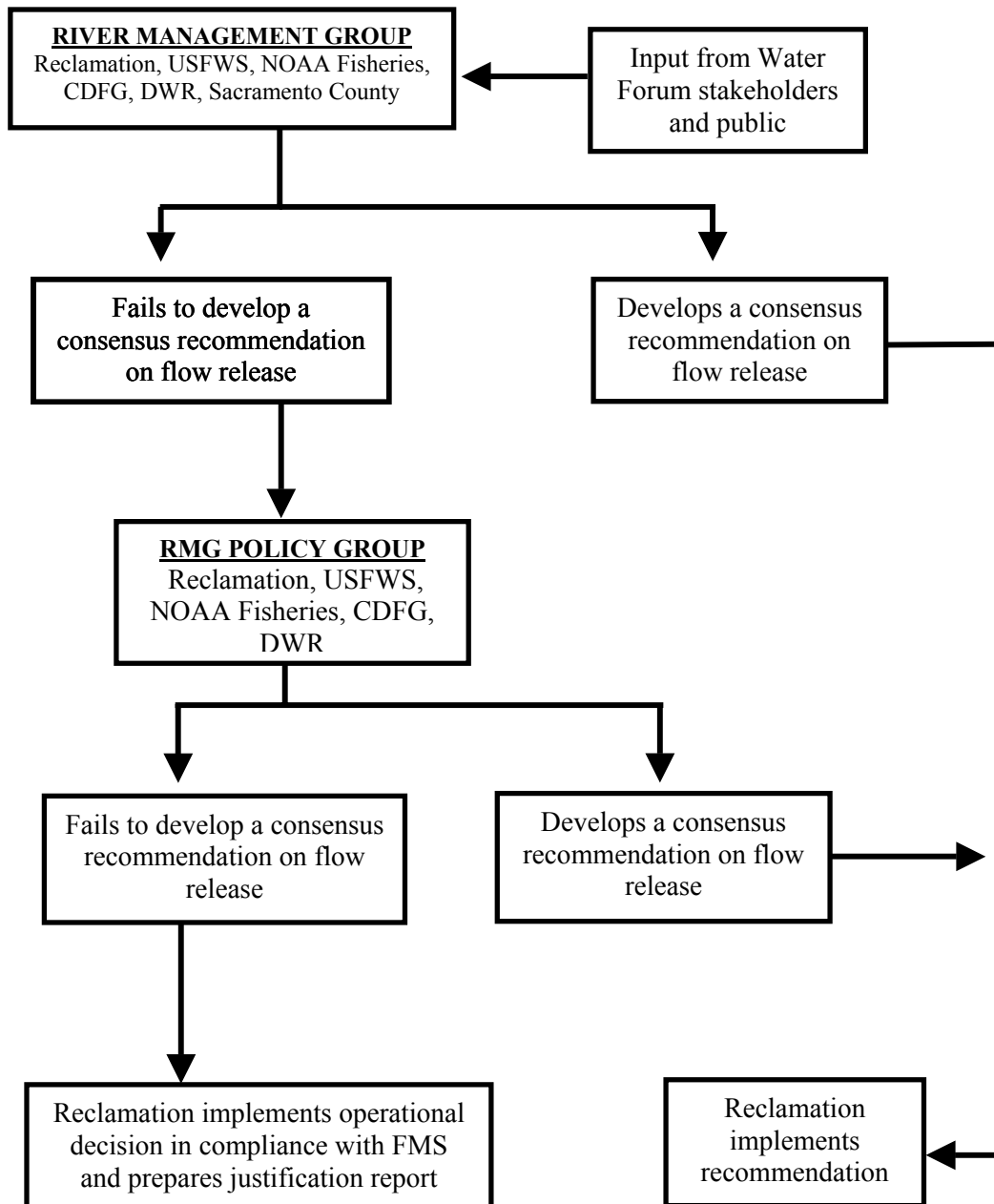


Figure 4. Lower American River Management Group (RMG) Process.

A draft *Lower American River Monitoring and Evaluation Plan* has been prepared and presented for discussion at a public workshop held on July 1 and 2, 2003. This draft Plan includes detailed discussions regarding measurable and specific objectives; rationale; experimental design, including survey locations, procedures, and sampling frequency; data quality control, reporting, and storage; analysis methods; equipment; reporting procedures; and personnel. The draft *Lower American River Monitoring and Evaluation Plan* will be included as part of the Lower American River Flow Management Standard report currently under preparation.

The factors and key indicators that will be monitored in the lower American River include:

- River hydrology
- Water temperature
- Adult Chinook salmon population
- Chinook salmon spawning (redd surveys)
- Steelhead spawning
- Juvenile Chinook salmon and steelhead rearing
- Juvenile Chinook salmon emigration

The monitoring and evaluation plan will allow the RMG to continue to add to existing data sources, and to build a comprehensive database that can reveal long-term trends in response to river hydrology and water temperature changes. Such a database would provide information about the effects of floods, droughts, and average, one-time, or short-term events. Results of the monitoring plan will be evaluated to determine whether existing theories and assumptions remain appropriate, whether the RMG flow recommendations are providing the intended benefits to lower American River fish and their habitats, and whether recommended management actions should be altered.



Source: USBR and CDFG 2003

Two of the primary responsibilities of the RMG are to oversee fisheries management on the lower American River, and to cooperate in the preparation and submittal of an annual report to the SWRCB. The RMG will review the results of monitoring activities, evaluate the health and productivity of the Chinook salmon and steelhead fisheries, and provide policy, biological, engineering, or other recommendations in a quarterly report to the RMG Policy Group and other interested stakeholders.

To ensure that the RMG can fulfill these responsibilities, the researchers conducting the monitoring will report major findings and conclusions to the RMG on a real-time basis, or as otherwise needed. In turn, the RMG will provide feedback on additional monitoring, analyses, or evaluations needed to respond to questions from members of the RMG and other interested stakeholders. Funding sources to support the *Monitoring and Evaluation* element are continuing to be identified.

NEXT STEPS

It is anticipated that the Lower American River Flow Management Standard report will be completed in June of 2004. Following completion of the Lower American River Flow Management Standard report, the next step for the Water Forum stakeholders is to work with Reclamation and other regulatory agencies with management responsibilities on the lower American River (i.e., USFWS, NOAA Fisheries, and CDFG) to prepare a formal petition to the SWRCB to adopt the proposed Flow Management Standard.

APPENDIX A

FLOW MANAGEMENT STANDARD PRELIMINARY RESULTS
