

Building Blocks

Tools and Lessons for Designing a Block of Water for the Environment



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Introduction and Acknowledgements

In California, across the Western United States and in many locations around the globe, competition for freshwater resources has increased and impacts on aquatic ecosystems are growing. In response to this situation, and as an alternative to traditional environmental regulation, many programs have been established or proposed to create a block of water dedicated to the environment – sometimes called an environmental water budget.

The focus on environmental blocks of water is often driven, at least in part, by the perception that flexible management of water for the environment can create more meaningful ecosystem improvements using less water than more rigid regulatory approaches.

Yet conversations about creation of blocks of water for the environment often remain at a high level and lack detail. To move beyond general discussions, this paper provides a guide for efforts seeking to create an environmental block of water. It does so by laying out a series of questions that should be answered—or at least contemplated and discussed—in the process of creating a new environmental water program. The guide is not prescriptive—i.e., it does not opine on how the questions should be answered. Rather, it seeks to provide a tool to ensure key aspects of a program are addressed and to help participating entities reach a shared understanding of how the program could work. The paper is not focused on presenting recommendations, because the author believes there are multiple ways to answer these questions to produce a successful outcome in different settings.

The questions were developed through review of relevant literature, analysis of past and current efforts to create environmental blocks of water, and extensive interviews with water management experts in a range of sectors. In addition to the questions, the paper includes brief summaries of examples of environmental water programs across the West and elsewhere, including key characteristics and challenges.

This paper does not seek to define an environmental block of water with great precision. The programs examined generally include two key characteristics: a specified amount of water dedicated to the environment and some opportunities for flexible management of that water.

This effort provides significant detail on California and particularly the San Francisco Bay-Delta and its watershed (Bay-Delta) because of the experience of the author, the number of relevant examples in California, growing concerns about California's aquatic ecosystems, and ambitious proposals to create new environmental blocks of water in the Bay-Delta. Although many of the examples and questions are focused around the particularities of the Bay-Delta system, most will also be relevant for other watersheds in California and beyond. Indeed, because the Bay-Delta system is so complex, it provides a good setting to examine a full range of key challenges and opportunities.

The questions included in the eleven categories identified are imperfect. Some questions are arguably redundant, there are likely additional relevant questions, and they could be grouped and categorized differently. Despite these imperfections, this effort to grapple seriously with these questions, is intended to advance a more coherent, comprehensive, and meaningful environmental block of water program in the Bay-Delta watershed and elsewhere.

Dozens of interviews for this document were conducted with individuals associated with agricultural and municipal water users, environmental organizations, tribal communities, state and federal regulatory agencies, legislators, think tanks, academic institutions, and others. This document does not include a comprehensive list of interviewees, as some individuals preferred to remain anonymous. The author greatly appreciates the time and thoughtfulness interviewees brought to this discussion. There was remarkably broad agreement among interviewees regarding key questions and challenges, although there was more divergence regarding how those questions might be answered.

This document was written in close collaboration with Defenders of Wildlife staff. The guidance of staff from East Bay Municipal Utility District and Grassland Water District, which supported this document, is also greatly appreciated. Their guidance was particularly valuable because both agencies have experience managing environmental blocks of water in different settings with different environmental goals.

We hope this document distills key lessons from the examples presented here and does justice to the thoughtful input from the many interviewees. Most importantly, we hope those lessons and that input will increase the likelihood of success in future efforts to create blocks of water for the environment.

This document is intended to be read electronically, so that readers can take advantage of the extensive included hyperlinks.

Key Questions to Be Considered in Creating an Environmental Block of Water

1. Equity and Representation in Program Development

The questions in this section address how the program itself is developed – prior to implementation. A block of water for the environment could be created through a traditional, public regulatory or legislative process, or through private negotiations among stakeholders. Discussions regarding a block of water in any of these forums should address questions regarding equity and representation. These questions may be most relevant for programs developed through private negotiations.

1. Who should be involved in the process to develop the program?
 - a. How will all interested parties be identified?
 - b. Does the scope of the program address the interests of all relevant parties?
 - c. Does the process provide opportunities for perspectives from disadvantaged, traditionally underrepresented or marginalized communities with a stake in the program? If so, how? What resources are needed to provide full participation?
 - d. To the extent that Native American interests are involved, how will the process incorporate government-to-government consultation requirements?
2. Will the public and stakeholder communities perceive the process through which the program is being developed as equitable and appropriately inclusive?
3. Will the program be developed through an open or closed process?
 - a. Will any communications that occur during program development be deemed confidential?
 - b. What, if any, open meeting notice requirements will the process be subject to?
4. Does the program include a communication plan to ensure adequate communication with and participation by stakeholders?

2. Environmental Goals and Geographic Scope

The questions in this category focus on the program's goals. They inquire about the environmental outcomes the program will seek to achieve through provision of a block of environmental water and address the geographic location of the desired environmental benefits.

The questions presume that the program will have specific ecosystem and/or biological goals. Such goals are helpful for creating shared expectations, determining how much water will be provided, assessing success, and managing adaptively. It would be possible to create a block of water for the environment without explicitly identifying detailed environmental goals up front, allowing for those goals to be developed as the program is developed. This approach, however, may face challenges in settings where regulatory compliance is a goal.

Although the questions focus on ecosystem and biological goals—as this document is focused on environmental blocks of water—they also recognize that a water program may have other goals. The questions seek to explore what non-environmental outcomes a program may seek to achieve, and to clarify the relationships between the environmental and non-environmental goals.

These questions should be among the first addressed by those seeking to establish an environmental block of water. Creating a shared expectation of what the program seeks to achieve will inform how the remaining questions are addressed.

1. What environmental or biological outcomes is the program trying to achieve?
 - a. Is the program designed to meet the needs of one species, several species, and/or broader ecosystem needs?
 - b. If the program has a biological goal for a particular species, does it focus on all life stages or only one or some?
 - c. Are the goals or objectives Specific, Measurable, Achievable, Relevant and Time-bound (SMART)?
 - d. If the program focuses on salmon, does it distinguish between hatchery fish and naturally spawning fish? Do the biological goals account for ocean conditions, harvest, reintroduction, and/or hatcheries?
 - e. Do the desired environmental or biological outcomes change in different hydrological conditions?
 - f. To what extent is the program designed to meet well-understood and measurable objectives at the species or ecosystem level? To what extent is it designed to address uncertainty based on experimentation?

2. What is the geographic scope of the program?
 - a. What watersheds or other geographic areas will gain biological and/or ecological benefits?
 - b. What type of water body will the program benefit (riverine, wetland, freshwater, estuarine, perennial, ephemeral, etc.)?
 - c. Does the program involve improvements in forest health, upper watersheds, or riparian habitats?
 - d. How does the program's geographic scope relate to the desired biological and/or ecological outcomes? Are there different biological/ecological goals for each major portion of the program's geography?

3. Does the program also seek to achieve non-ecosystem benefits, such as water supply enhancement or reliability for agriculture or municipalities, provision of safe and affordable drinking water, improved groundwater management within a defined groundwater basin, reduced flood risk, improved access to nature, meeting tribal water supply needs, etc.?
 - a. If so, what is the relationship between the environmental goals and the other goals? Are they co-equal or are some prioritized over others?

3. Program Term

These questions focus on the program's duration. In addition to covering logistics like the program's start and end dates, the questions seek to ensure the program's duration makes sense considering the desired outcomes and other potential constraints.

The questions also highlight end-of-term issues. For programs that are purely voluntary and that do not contribute to compliance with legal requirements, it might be fine for the program to simply cease to exist at the end of its term. In contrast, a program that contributes to meeting a legal

requirement will likely need to include consideration of how the legal requirement will be met when the program ends.

1. When will the program implementation begin?
 - a. Will implementation of all project components begin at the same time? If not, what is the timeline for initiation of each component?
2. How long will the program last?
 - a. If the program is designed to achieve a particular environmental or biological outcome, what is the relationship between the program term and the desired outcome? Is the program term long enough to assess progress towards biological goals considering target species' lifecycles and other factors?
 - b. Does the program term account for the time it will take to permit and implement projects associated with the program?
 - c. Are there funding limitations, legal requirements, capacity-building needs, infrastructure changes, challenges obtaining water, or political constraints that must be considered when selecting a program term?
 - d. If the program will last until specific outcomes are accomplished, are the metrics sufficiently clear so that attainment can be determined unambiguously?
 - e. Will all project components have the same duration? If not, what is the duration of each project component?
 - f. Have the parties considered the possibility of a short-term trial or pilot program?
3. What occurs at the end of the program's term?
 - a. Is the program being implemented to meet a legal requirement such that it cannot terminate without implementation of an alternative method of compliance?
 - i. If so, what is the alternative method of compliance?
 - b. Is there an option to renew the program if it is successful?
 - i. If so, must the program stay the same?
 - ii. If the program can change, when do discussions about the next term commence?
 - iii. If there will be a new term, are there any limitations on the contents of the renewed program?
 - iv. For a program that is being implemented to comply with a legal requirement, how would the requirement be met if the program is not renewed? Will the parties have incentive to renew the program?
 - c. What if the program is unsuccessful in achieving some or all SMART goals or objectives?
 - i. Can the term or components be changed or extended?
4. Have the parties considered whether climate change is likely to modify conditions during the term of the program and have they accounted for that possibility?

4. Relationship to Legal Obligations

The questions in this category focus primarily on the relationship between the environmental block of water that is under development and legal requirements that govern in-stream flows or other

environmental water allocations. The first group of questions explore the legal relationship between the program and in-stream flow requirements, including consideration of whether the program is intended to contribute to attainment of a legal requirement or fully satisfy the requirement. The second group of questions explore the physical relationship between flows or allocations that are already required by law and the new block of water, including whether there are opportunities for coordination. These questions are particularly relevant for programs that seek to provide in-stream flows in a watershed like that of the Bay-Delta, where the Bay-Delta Water Quality Control Plan and other state and federal requirements may mandate particular flows.

The questions also highlight other legal requirements that may be relevant, including those related to mitigation obligations, changes in law necessary to implement the program, and potentially applicable permitting requirements.

The legal landscape into which a particular program must fit will be unique, and these questions do not seek to comprehensively explore that landscape. Rather, they strive to encourage those who are creating a block of water for the environment to have candid, detailed conversations about how the program will interact with regulatory and other legal requirements.

1. Is the program designed to meet a legal obligation? If so, what?
 - a. Is the program designed to meet an existing legal obligation or a new one? If the legal obligation is new, is the standard being established externally or are program participants negotiating over the standard?
 - b. Is the program designed to fully achieve the legal requirement or to contribute to achievement? If the program is contributing to compliance, what is the extent of the program's contribution and what else is occurring to fulfill the legal obligation?
2. What is the relationship between the program's block of water and environmental flows that are required by existing law?
 - a. Does the new block of water include water that is already dedicated to the environment through existing requirements? Or is the new water additional to existing regulatory flows?
 - b. If the block of water includes water that is currently used to meet regulatory requirements, will the program ensure compliance with those requirements? If so, how?
 - c. If the block of water is entirely separate from flows that are currently used to meet regulatory requirements, would the program have any input regarding management of the baseline regulatory water? Will it be possible to coordinate management of the regulatory water and the program's block of water?
 - d. What happens to the program if legal requirements change? For example, what if in-stream flow requirements that are distinct from the program but that apply to the same geography either increase or decrease during the program's term?
3. Does the program require changes to existing legal requirements to be implemented (e.g., water quality control plan objectives, water rights, etc.)? If so, what are the timelines for those processes and how could those timelines impact program success?
4. How will the program's environmental flows be protected from diversion by others?

5. Is the program intended to serve as mitigation for current water project operations or future water development?
 - a. If so, are there any limitations on the program related to mitigation requirements?
6. Will the program need to meet standard permitting requirements (e.g., NEPA, CEQA) and if so, what is the timeline?
7. If the program is a voluntary agreement designed to meet regulatory requirements, what requirements would apply to non-participants?

5. Water Volume and Source

The questions in this category focus on the volume of water that will be provided for the environment, details about how, when and where the water will be provided, and the incidental impacts of creation of the block of water.

The first set of questions focus on the size of the block of water and the relationship between the volume of water and the program's environmental goals. Although one could design a block of water for the environment that lacks a scientific basis or clear connection to the program's environmental goals, such a program could be difficult to defend to regulatory agencies and members of the public and would be more difficult to manage adaptively. These questions also focus on how the block of water would be defined, as there are a variety of possible approaches including using a percentage of unimpaired flow, identifying a specific volume of acre-feet (AF) of water to be dedicated, or dedicating a percentage of newly developed supply.

Additional questions cover important details that must be considered, including how, where, and when the water will be made available to the environment and any requirements regarding the quality of the water. Critically, the questions focus on dry years and extended drought to elicit conversation about the role of the program during dry times and about the reliability of the promised water supplies.

Finally, these questions encourage exploration of the incidental impacts of dedicating water for the environment. There is no "new" water. As a result, developing additional water supplies for the environment or reallocating water from other uses could have impacts to water users or the environment. The questions encourage parties to consider those impacts and opportunities for mitigation.

1. What volume of water would be provided?
 - a. What is the methodology for determining the volume of water? How does it relate to the program's environmental goals, as well as its geographic scope?
 - b. How is the volume of water defined – i.e., number of acre-feet, percentage of unimpaired flow, yield from dedicated storage capacity, something else?
 - c. Would the volume of water be set once, or revisited and changed over time? If revisited over time, how would additional water, if needed, be provided?

2. How would the water be made available?
 - a. Would there be a change in existing water use and operations patterns, such as changes in consumptive use, rescheduling of existing storage releases or a reduction in storage?
 - b. Would water for the environment be developed through new storage projects, water recycling or other tools?
 - c. Would water for the program be purchased or made available without compensation?
 - d. Will the water be provided through modifications to water rights, long-term transfers, annual spot market purchases, contractual agreements, regulatory requirements or some other method? Will all sources be provided using the same method?
 - e. Does the allocation of responsibility to provide environmental water or to pay for environmental water address water rights seniority?
3. When would the water be available?
 - a. Will the full volume of water be dedicated immediately? If not, who is responsible and what are the mechanisms for providing additional water in the future? Are there assurances regarding the water that will be made available in the future?
 - b. Is the water to be provided in all water-year types, or only some? At what times of year will water be made available? Does the volume of water vary based on water-year type? Does the timing of the release of environmental water change based on water-year type?
 - c. Is the water supply reliable and adequate in dry years? For example, is the entity providing the environmental water sufficiently senior to ensure that water will be available in dry years?
 - d. Does the program include provisions for extended drought?
 - e. Will the water be provided at the times necessary to meet the program's ecological goals?
 - f. Is water available in a single year or over multiple years?
4. Where would the water be made available?
 - a. Is the source substantially upstream or downstream of the area targeted for environmental benefits? Is the source from another watershed?
5. Are there requirements regarding the quality of the water that will be provided?
 - a. Must the water provided be within a particular temperature or dissolved oxygen range?
 - b. Are there other water quality-related requirements or constraints, such as nutrient concentrations?
6. Does making the water available have other impacts, and if so, is mitigation required?
 - a. If water is provided by reductions in currently stored water, would the dam operator be allowed to refill the emptied storage space later in the season?
 - b. Does making the water available or storing it to meet temperature requirements negatively impact other water users or the environment? If so, is mitigation required?

- c. If additional water would be developed for the program, would the program account for the environmental impacts of the water's development when assessing the program's benefits?
- d. Will the program account for interactions between surface water and groundwater supplies? For example, will the program drive water users to increase groundwater use? Will that increased use have an impact on surface waters and the performance of the program? Will increased groundwater pumping impact other water users or the environment?

6. Accounting and Baseline

This category focuses on the baseline of environmental water to which the program's block of water would be added and the rules for accounting and tracking that additional environmental water.

In some settings, answering these questions may be relatively straightforward. However, in systems like the Bay-Delta, addressing questions related to baseline and accounting will likely be challenging because operations are complex and under the control of many different entities. In addition, the system includes two large water projects, numerous smaller projects, hundreds of dams and thousands of diversions. Some storage facilities and diversions may not have well developed operating plans. Some existing regulatory requirements may be adaptable or flexible, making the baseline for and measurement of "additional" water more challenging. Water flows through the Bay-Delta for multiple reasons, including regulatory and non-regulatory environmental water dedications, agriculture and urban water uses, flood management, Delta salinity control and uncontrolled natural flows, all of which should be contemplated when establishing a baseline for an environmental block of water in a complex water management system.

Similarly, in complex systems, there is a wide range of questions regarding how a block of water should be accounted for and tracked. For example, if flows provide multiple benefits in different locations, interesting accounting questions may emerge.

How a new block of water program answers these questions has important implications for water users and is central to determining how much additional water, if any, a program will contribute to environmental restoration.

1. What is the regulatory and operational baseline to which the program's flows would be added?
 - a. Does the baseline include all current and expected future state and federal requirements, or requirements as of a certain date?
 - b. Are there non-regulatory environmental water dedications that should be incorporated into the baseline? (e.g., Level 2 refuge supplies.)
 - c. If the existing baseline includes regulatory requirements that are flexible or adaptable, how are they accounted for?
 - d. Does the program require detailed baseline operations plans by major water users – or all water users – within its geographic scope? Does the program require smaller water users to demonstrate historical use, and if so how?
 - e. Does the baseline include all or only some of the different types of in-stream water flowing through the project area, such as flows to meet regulatory requirements,

non-regulatory environmental water dedications, flows from unregulated streams, uncontrolled water releases from storage such as flood management releases, water supply deliveries, navigation flows, flood management and dam safety releases and salinity control releases?

- f. For programs that provide off-stream environmental benefits, how would existing off-stream environmental water use, such as water delivered to wetlands or existing agricultural water use with environmental benefits, such as winter rice field flooding for shorebirds or waterfowl, be treated in the baseline?
 - g. Does the program incorporate into the baseline existing agreements to modify or constrain water project operations that may not represent formal regulatory requirements?
 - h. What will happen if the baseline changes during the term of the program?
 - i. Does the baseline account for existing groundwater infiltration losses/gains, or incremental infiltration losses/gains caused by implementation of the block of water? In cases where groundwater overdraft is increasing, how would the baseline address the potential that groundwater losses may grow in the future?
 - j. Would the baseline account for waivers of regulatory requirements during droughts? If so, how?
 - k. How does the baseline address surplus or unscheduled water deliveries?
2. Does the program need to define or maintain a baseline?
- a. Can the need for defining a baseline be avoided entirely by focusing on a percentage of unimpaired flow or another approach?
 - b. Do baseline and accounting issues matter if all biological objectives are being met?
 - c. At some point, for example if new operational rules using a block of water are later incorporated into regulatory requirements, is there an ongoing need for a baseline and an accounting system?
3. What are the accounting rules for the block of water?
- a. Would the program track baseline flows to ensure the program's water is additional to the baseline, or will it assume that baseline flows are being provided?
 - b. Does environmental water committed, but not yet provided, pursuant to baseline agreements or requirements, count as "new" water when it is provided?
 - c. If an acre-foot of water is used to meet multiple environmental needs in different locations (e.g., used for temperature control in a reservoir, then for spawning and outmigration flows downstream, then for wetland/waterfowl needs and finally Delta outflow), is that acre-foot of water counted once or multiple times? (Another way of asking this is whether the block of water will be treated as a consumptive right that can be used by the environment multiple times until it is exhausted.)
 - d. Under what, if any, circumstances can the program's environmental water be recaptured for other uses? If it is recaptured, is the environment credited for that water?
 - e. Can the block of water be developed through reoperation or does it need to be a new dedication of water?
 - i. If environmental water is released from storage early in the water year, and then that empty storage refills after subsequent rain or snowmelt, does the released environmental water "count" as dedicated environmental water?

- ii. Does there need to be an impact on an existing water user for water to “count” as part of the program’s environmental water? For example, does reshaping baseline flood releases – by a single day or by months – count as new environmental water?
 - f. How will the program’s environmental flows in a river or through the Delta be measured and tracked separately from the many other reasons water flows through the system?
 - g. If the program’s environmental water may be stored, for example to provide releases later in the season or to ensure adequate water temperatures for cold water species, how would the program address evaporative losses from surface storage or the loss of water stored in groundwater aquifers?
 - h. How does the program account for any conveyance losses?
 - i. Does the program account for additional benefits that can accrue from the provision of environmental water, like groundwater recharge or the creation of wetland habitat?
 - j. Under what circumstances, if any, can ecosystem water be sold, transferred or exchanged?
- 4. Is the accounting system clear, transparent and compatible with real world project operations?
 - a. To what extent is the accounting and management system based on real world monitoring vs. modelling? If the latter, are the models accurate enough? Who determines the model validity or accuracy?
 - b. Is there an adequate existing monitoring and accounting system upon which to build a new accounting system for the block of water? Does the existing accounting system address key flow-related factors including natural runoff, diversions, storage and evaporative losses, groundwater losses and gains by stream reach, and return flows?
- 5. Will regular audits of the accounting system be undertaken to ensure that it is accurate and improved over time?

7. Governance and Adaptive Management

The questions in this category focus on how decisions about the block of water program will be made once the program is operational. The questions first focus on what decisions a governance entity will have authority to make, including what aspects of the block of water are fixed versus flexible. Next, the questions focus on who will be making decisions, including questions about whether there will be a stakeholder group, an individual program administrator, or both. After exploring the “what” and “who” of decision making, the questions focus on the “how.” The questions seek to explore rules of decision making, how possible trade-offs will be assessed and managed, and more.

The questions also explore whether the program will have an adaptive management component, with a focus on what program participants hope to learn through adaptive management and how any adaptive management relates to the program’s governance and monitoring plans.

1. What decisions would the governance entity make?

- a. Will the governance entity make decisions about management of the block of water?
 - i. If so, can the governance entity make decisions about the entire block of water, or are some aspects fixed?
 - ii. What is the range of decisions the governance entity can make with respect to the timing, location, duration and volume of flows?
 - iii. Does the governance entity have authority to sell, transfer, or exchange water?
 - iv. Does the governance entity have authority to manage water across water years?
 - b. Will the governance entity have authority to modify the program's goals?
 - c. Will the governance entity make decisions about non-flow aspects of the program, such as decisions related to funding, habitat restoration, monitoring, or adaptive management?
2. Who will participate in the governance entity?
- a. Will the governance entity be comprised of a stakeholder group?
 - i. If so, what groups or individuals will have a seat at the table?
 - b. Will there be an individual—e.g., a program administrator or water master—who has decision making authority? If so, how will the individual be selected?
 - c. Will there be an opportunity for individuals or groups that do not have a seat at the table to provide input for consideration by the governance entity?
 - d. Will the governance entity have a facilitator?
 - e. Will there be a single governance entity for the program, or multiple governance entities that each cover a specific geographic region? If there is more than one governance entity, how do they relate to each other?
3. How will the governance entity make decisions?
- a. If a stakeholder group makes decisions, will it do so by consensus, by a majority vote, or by some other method? Will all participants have equal power, or will some have a greater or lesser say in decision making?
 - b. If there is both a stakeholder group and a program administrator, what is the relationship between the group and the administrator with respect to decision making? For example, is the administrator entirely independent or does the stakeholder group oversee some or all decisions?
 - c. What is the timeline for water management decisions, both at the start of the year and within the year? If decisions are made at the start of a year, will there be opportunities to make changes?
 - d. What inputs, such as modeling and operations expertise, will the governance entity have at its disposal when making decisions?
 - e. Will the governance entity have to articulate a rationale for its decisions? If so, will the rationale be made available to the public?
 - f. How will decisions be made among potentially competing uses of environmental water? For example, in the Bay-Delta system, how would water management decisions be made if Delta needs differed from tributary needs?
 - g. If a program has water supply or other goals in addition to its environmental goals, how will decisions be made if there are trade-offs between achieving ecosystem objectives and non-environmental program goals?

- h. Would there be any independent scientific review of management decisions and outcomes? How would the results of such reviews be integrated into future management?
 - i. Will there be a structured decision-making process?
 - j. How often will the governance entity meet?
 - k. Will there be a dispute resolution process? If so, what is it?
 - l. Are there additions to the governance process that could help build trust among participants and create a space for meaningful conversations, experimentation and creative problem solving?
4. Will the governance entity manage adaptively?
 - a. If so, are there specific hypothesis that will be tested through experimentation?
 - b. What monitoring and science inputs will be used for evaluation?
 - c. How, and when, would new information from experimentation be integrated into governance decisions about the block of water?
 - d. How frequently would monitoring data and scientific information that could inform management of the block of water be provided to the governance entity? Is the governance entity required to change its water management based on new information from the program?
 - i. Would the program's science process integrate with the science programs of regulatory agencies, project operators, academics, NGOs, tribes and others?
 5. How much time should the program be given before it is evaluated for success or failure?

8. Operational Considerations

In a complex water management environment with multiple water projects and hundreds or thousands of water diverters, integrating a new environmental block of water into ongoing water operations can present challenges. This can be the case both because the management of a block of water can interact with the operations of existing projects serving water users and because the management of water projects can have an impact on an environmental block of water. In complex systems, coordination with existing water users will be essential to implement priority actions with dedicated environmental water.

Additionally, in some cases, it may not be physically possible to move environmental water freely through a program's entire geography. This may be particularly true in drier years, when operations are highly constrained.

The questions in this section go beyond the volume of water or the baseline and accounting to focus on how the management of an environmental block of water would physically interact with the operations of existing water projects and users.

1. Does the program require coordination of operations at different reservoirs?
 - a. In settings where multiple projects make releases to meet downstream regulatory requirements or water needs, how would the program prevent environmental water releases from one facility from being "recaptured" by another water project or user through a corresponding reduction in releases?

- b. Can reoperation agreements be used to “move” water through exchanges from one storage facility to another?
- 2. If the program allows for or requires the storage, diversion, or conveyance of environmental water, are the relevant agreements in place?
 - a. Do program participants have access to or control the necessary storage, diversion or conveyance facilities? If not, how will the program ensure the environmental water will be stored, diverted, and delivered according to the program’s terms?
 - b. How would management decisions be made regarding any asset shared with other projects or users (e.g., storage, conveyance or diversion facility)?
 - c. Will agreements related to the storage, diversion, or conveyance of the program’s environmental water include any circumstances under which facility operators can refuse to, deprioritize or modify the release, storage or movement of the program’s water?
 - d. How can the program incentivize the cooperation of project operators?
 - e. What happens if unforeseen impacts or disagreements about impacts related to storage, delivery, or conveyance arise?
- 3. Are there particular constraints on the ability to divert or convey water during dry years that need to be considered?
- 4. Under what circumstances may the block of water program operations require reduced diversions by a group of water users or a single user?
 - a. Will the program seek to ensure that it is implemented equitably, from the perspective of water users, and if so, how?

9. Accountability

The questions in this category cover program components that are essential for tracking the program’s impacts and ensuring success. They focus on monitoring, reporting, oversight by a responsible agency or administrator, enforcement of program terms, and more.

These questions have linkages to issues highlighted in several other categories. For example, a program’s monitoring plan should be crafted to allow assessment of progress toward achieving the program’s environmental outcomes. Reporting requirements will relate to the program’s plans for adaptive management. Enforcement mechanisms and treatment of withdrawing participants or non-participants could be affected by the program’s relationship to existing or new legal obligations. Because of these and other relationships, it will likely make sense to finalize answers to the questions in this category after making substantial progress towards addressing questions in the categories that appear earlier in this document.

- 1. Will the program include a monitoring plan?
 - a. What will the monitoring plan seek to measure—e.g., flows, water quality, environmental conditions, biological outcomes?
 - b. Who will be responsible for monitoring?
 - c. How often will monitoring occur?
 - d. Where will monitoring occur?

- e. Is the monitoring plan adequately funded?
 - f. Does the program's monitoring plan meet the needs of any anticipated adaptive management?
 - g. If the program is focused on fish species with natural and hatchery populations, does the monitoring plan distinguish between hatchery and naturally spawning fish?
 - h. Is there a plan for determining the adequacy of the monitoring plan for assessing progress towards goals and adjusting if necessary?
 - i. Along with monitoring the program's environmental impacts and benefits, will program participants track the program's implications for water supply, water quality, local economies, or anything else?
2. Does the program include reporting requirements?
 - a. Will there be reports to a responsible agency or stakeholder group? Who else will receive monitoring data and will it be made publicly available?
 - b. How frequently will the reporting occur?
 3. Will the program be overseen by a regulatory agency or program administrator?
 - a. If there is regulatory agency oversight, how frequently will the agency assess the program's progress? Will the agency have authority to recommend or require changes?
 - b. If oversight is provided by an administrator, how frequently will the administrator report on the program's progress?
 4. How will the program's terms be enforced?
 - a. What program terms or obligations will be enforceable? For example, will environmental outcomes be enforceable, or will enforcement focus solely on provision of required volumes of water?
 - b. What mechanism exists for enforcement? For example, will water rights be modified to implement the program? Will the obligations be contractual?
 - c. Who is charged with enforcing the program's terms? Will the public have a role in enforcement?
 - d. What are the consequences if the anticipated water, habitat, or funding is not provided?
 - e. If a block of water does not emerge at the required time and location, will sufficient information be available to ascertain who is responsible for the failure?
 - f. Will there be accountability for all failures or only willful failures?
 5. What happens if a program participant seeks to withdraw from the program?
 - a. May participants withdraw from the program? If so, under what circumstances? Are there any aspects of the program from which a participant cannot withdraw?
 - b. Will the withdrawing participant be subject to alternative requirements or to any continuing program requirements?
 - c. Will the program continue without the withdrawing participant?
 6. Is there an "off ramp" or backup/alternative plan if the program fails to perform? Under what conditions would the backup plan be implemented?

7. Who will bear the risk of unforeseen circumstances or factors outside of the program's influence?
 - a. Will the program include a force majeure clause that excuses participants from compliance with program terms if unforeseen circumstances occur? If so, will participants ever be excused from compliance because of drought or flooding?
 - b. Are there factors outside of the influence of the program that could affect its implementation? If so, how does the program account for those factors?

10. Funding

For many environmental programs, securing adequate and reliable funds is a major challenge. Securing funding for specific needs, such as ongoing operations and maintenance, can be particularly difficult. State bond funds and federal appropriations can be unpredictable and difficult to ensure, particularly over the life of a program with a longer term. Additionally, funding – like water allocations – can raise concerns among water users and others regarding benefits and equity.

The following questions are designed to help a block of water program evaluate funding challenges and design an effective strategy to meet funding needs.

1. What level of funding is required for all program elements? For example, how much funding will be required for water acquisitions, habitat restoration, operations and maintenance, conveyance costs, administrative costs, governance, and science and monitoring? What other program elements may require funding and how much?
 - a. Would all program elements be funded in the same way?
 - b. How would these costs be allocated over the term of the program? Does this allocation account for up-front costs versus ongoing funding needs?
 - c. If water would be purchased or developed, is there certainty about those costs and the stability of the costs over the term of the program?
2. What are the potential sources of funding and how reliable are they?
 - a. Could state general funds be dedicated or “hard wired” to provide secure annual appropriations?
 - b. Are the funds “new” or would funds be reallocated from other environmental or water programs? If the latter, what impact would there be to those programs?
3. If water agencies are contributing to program funding, how would their levels of contribution be determined?
 - a. Would water rights seniority be considered in allocating financial contributions?
 - b. Would contributions be the same or different for agricultural and municipal users?
 - c. Would environmental users be expected to contribute?
 - d. Would non-participants (e.g., water users that do not sign an agreement) be required to contribute?
 - e. Would existing contributions to related environmental programs be treated as contributions to the program?
 - f. Would contributions be voluntary or mandatory?
 - g. Would a broad water use/diversion fee be appropriate?
 - h. Would contributions expire at the end of the program term? Or at some other time?

4. Would funding be adjusted over time to reflect inflation and changes in the program's needs?
 - a. How would decisions about changed funding needs be made, and on the basis of what criteria?
5. Would the program be audited for the effectiveness of its expenditures?
6. If water can be sold, transferred or exchanged, who controls the funds that will enable those transactions?
 - a. Could environmental water be sold to pay operations and maintenance costs or other program expenses? If so, how would this affect the program's anticipated environmental benefits?
7. Does the program include funding to ensure all stakeholders have the capacity to participate in the program, including the governance and adaptive management programs?

11. Legislation and Litigation

The questions in this category explore external processes that could have a major impact on a program's success—legislation and litigation. Both processes are unpredictable and will generally be outside of the program's control, but answering some basic questions can help to ensure program participants are aware of and plan for different possible outcomes.

1. Does the program require new legislation?
 - a. Is state or federal legislative authorization required for any project component?
 - b. Is legislation required regarding funding, operations, or other aspects of the program?
 - c. If legislation is required, how will the program deal with the uncertainties of the legislative process? What if legislation is delayed or if a bill's text is modified? What happens if the legislation fails?
 - d. Will program participants agree to refrain from advocating for legislation that could undermine the program?
 - e. Could a short-term program be implemented without legislative authorization?
 - f. Have program participants conducted an exhaustive exploration to understand whether participating agencies truly need new authorities to execute the program?
2. Could existing or anticipated lawsuits affect program implementation?
 - a. Would the program require settlement of existing litigation? If so, are all parties to the existing litigation participating in the program's development?
 - b. How could the program be affected by litigation in the future?
 - c. Will there be restrictions or requirements related to program participants' engagement in future litigation?

Learning from the Past and Planning for the Future

The following section provides an overview of a range of programs and projects that include an environmental block of water, presented in chronological order. In addition to a brief description of each program, these summaries identify key program features, highlights and implementation challenges.

It is important to note that some environmental blocks of water are part of larger programs with important additional components, including habitat restoration, water management components and more. In some cases, those components have played an important role in the program's success or failure. Those additional components, however, are not examined in detail here.

These summaries are not intended as either a comprehensive description of the projects or a comprehensive analysis of their performance. Rather, they provide a brief introduction, highlighting real-world application of many of the issues and questions discussed in the previous section. During the research for this project, interviewees referred to many of these examples to illustrate important challenges or solutions.

In investigating these examples, it appears that none of the efforts included a thorough examination of related efforts to create an environmental block of water. This document is intended to begin to fill that need, to allow future efforts to benefit from the successes and challenges of previous related programs.

The majority of the identified examples focus on the Bay-Delta system. However, this document is not intended solely for use in Bay-Delta policy discussions. Additional examples outside of that complex watershed—in California and elsewhere—also provide important insights.

Examples of Environmental Blocks of Water

California

Humboldt County Trinity River Contract - 1955

In 1955, when Trinity Reservoir was authorized by Congress, the authorizing legislation included a dedication for Humboldt County of 50,000 AF of water annually. (Also see the Trinity River Record of Decision block of water program below.) The resulting 1959 contract between the Bureau of Reclamation (Reclamation) and Humboldt County did not include substantial detail regarding the use of that water. The water in the contract was not explicitly dedicated to the environment in the authorizing legislation. However, Humboldt County has long maintained that this water can be called on to serve as a block of water to protect and restore the Trinity River ecosystem. The program can be considered an early example of a block of water program.

Key Features, Highlights and Challenges

Water Volume and Source

- The contract includes 50,000 AF of water from the Central Valley Project (CVP) Trinity River facilities.

Environmental Goals and Geographic Scope

- In 2002, there was a dramatic fish kill on the Klamath River, into which the Trinity River flows. Since that time, Humboldt County has sought to use the congressionally-mandated contractual block of water to benefit the Trinity River ecosystem, as well as the Klamath River below its confluence with the Trinity.

Implementation Challenges

- The most noteworthy challenge related to this block of water is that the County has been unable to access it. To date, despite requests by the County, Reclamation has not released the contract water for the benefit of the Trinity and Klamath River ecosystem. The U.S. Department of the Interior (Interior) has released several memos explaining Interior's position on its contractual obligation. In 2014, the Interior Solicitor issued an opinion that reaffirmed Reclamation's obligation to release the water. The Solicitor offered recommendations regarding additional analysis to facilitate the implementation of this requirement.
- Although Reclamation has not delivered water pursuant to this contract, in some years following the 2002 fish kill, it has released "Augmentation Flows" on the Trinity River to address Klamath River environmental problems.
- The 2000 Trinity River Record of Decision (ROD), which authorized the release of additional water to restore the river environment, did not include a well-developed or enforceable carry-over storage requirement. As a result, Trinity River advocates are concerned that Reclamation might draw down the reservoir to a level at which the flows required by the ROD, as well as the Humboldt County contract water, might not be physically available. This risk could be highest in successive dry years. The ROD is discussed further below.

Funding

- In April of 2021, California’s Wildlife Conservation Board approved a grant of \$574,890 to Humboldt County to support the development of a management plan for the Trinity River contract.

Sources

Interior [Solicitor’s Opinion](#), 2014

[North Coast Journal Article](#), January 2, 2015

[Wildlife Conservation Board Grant to Humboldt County](#)

Reclamation [Record of “Augmentation” Releases for the Klamath River](#)

Central Valley Project Improvement Act Sections (b)(1), (b)(2) and (b)(3) - 1992

The 1992 Central Valley Project Improvement Act (CVPIA), which was authored by Congressman George Miller and Senator Bill Bradley, included a number of environmental policies and programs. The Act included several tools to achieve this and other environmental goals, including three programs to provide environmental water. The most well-known of these tools is the 800,000 AF block of water created by Section 3406(b)(2) – often referred to as the B2 program.

The CVPIA also created two other mechanisms to provide additional environmental water – the B1 and B3 programs. The B1 program was designed to produce additional water and environmental benefits through the reoperation of CVP facilities in a manner that could generate additional environmental benefits without uncompensated water supply costs to CVP contractors. The B1 program has produced few results.

The B3 program allows the CVPIA Restoration Fund to be used to purchase additional environmental water. This capacity has been used to purchase environmental water for the Vernalis Adaptive Management Program. (See discussion below.)

Key Features, Highlights and Challenges

Volume of Water

- B2 water is defined as CVP “yield.” (Yield is a term traditionally used to describe the capacity of a water project to deliver a long-term supply, with a specified level of deliveries in dry years.) Interior may reduce the quantity in dry years, provide reductions are no greater, in percentage terms, than the reductions imposed upon CVP agricultural water service contractors. In addition, the B2 water may not be reduced to a level below 600,000 AF per year.
- Court rulings regarding the B2 accounting system required changes that reduced the environmental water generated by the program by approximately 300,000 AF.
- From 2016-2020, all of the B2 water was used to meet the requirements of the State Water Resources Control Board’s (SWRCB) 1995 Bay-Delta Plan requirements and the Endangered Species Act (ESA) biological opinions for operation of the CVP and State Water Project (SWP). No actions were taken using B2 water that are not related to SWRCB or ESA requirements.

- In some years, far less B2 water was used than was dedicated by the Act, including 502,300 AF in 2019, 220,600 AF in 2017, 224,300 in 2016, and 402,000 AF in 2014.
- In addition to the Vernalis Adaptive Management Program (see discussion below), the B3 program has acquired limited amounts of water for salmon restoration.

Environmental Goals and Geographic Scope

- The CVPIA states that B2 water is dedicated “for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized by this title; to assist the State of California in its efforts to protect the waters of the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and to help meet such obligations as may be legally imposed upon the Central Valley Project under state or federal law following the date of enactment of this title, including but not limited to additional obligations under the federal Endangered Species Act.”
- The Act established a goal of doubling the natural production of anadromous fish in the Bay-Delta watershed, measured against a 1967-1992 baseline. The Act has not achieved this doubling goal. In fact, anadromous fish populations continue to decline, including the first ever closure of salmon fishing in California in 2008-2009, and two salmon runs threatened by extinction.

Baseline

- Interior’s development of an implementation program included an extensive debate about whether water would be counted as B2 water if it was recaptured downstream, as well as whether water released from CVP storage early in the year would count as B2 water even if the emptied storage space refilled later in the wet season. These two accounting decisions are described as “offset” and “reset.” Interior decided in 1999 that offset and reset operations would be considered actions under the B1 program, as they have no impact on CVP yield. (The debate was so protracted that the “offset” and “reset” issues were clarified again in the 2000 CALFED Record of Decision – nearly 8 years after the passage of the CVPIA.) However, a 2002 federal court ruling ordered Interior to charge both “offset” and “reset” actions to the B2 account.
- Interior decided that a pre-CVPIA informal operational agreement on the American River would not be considered part of the B2 baseline. (This baseline consists of the pre-CVPIA operations that B2 water is added to, to achieve the Act’s environmental goals.) In this informal agreement, Reclamation agreed to provide additional environmental flows on the American River. However, that understanding was neither a formal agreement nor a regulatory requirement. Interior continued to implement this agreement. However, it counted the water required to implement the agreement as B2 water. Therefore, although the informal agreement continued, Reclamation merely continued past operational practices, while the water was counted toward the B2 requirement.

Implementation Challenges

- In “Listen to the River,” a 2008 review of the CVPIA’s fisheries program, reviewers, consisting of independent scientists, stated that they were “flabbergasted” that Interior has not “identified a system-wide flow regime and a set of system flow objectives” to guide the management of B2 water. Further, reviewers concluded that “Reclamation does not dedicate and manage 800,000 AF of water from headwaters storage through the Delta.” The review concluded that “the agencies need to rethink completely their water management authorities” and included specific recommendations. Interior has not responded to the

review but has undertaken recent efforts to better coordinate its Anadromous Fish Restoration Program.

- The discussion over the definition of “yield,” as well as baseline and accounting for the B2 block of water, was extensive, contentious and litigated. The debate delayed Interior’s decision regarding the implementation of the B2 program until 1999.
- There were several efforts in Congress to repeal portions of the CVPIA.

Other

- The CVPIA also created a \$50 million annual Restoration Fund, to be invested in specified restoration actions to achieve the Act’s environmental goals.
- CVP contractors agreed to support the 1994 Bay-Delta Accord in significant part because the Accord required CVP water used to meet the new Bay-Delta flow requirements to be counted as B2 water.

Sources

Reclamation’s [B2 Program web page](#) (including court rulings)

Reclamation’s [Central Valley Operations Office accounting web page](#) (including B2 accounting)

Reclamation’s [Water Acquisition Summary](#), 1994-2015.

Department of the Interior [Decision on Implementation of Section 3406\(b\)\(2\) of the CVPIA](#). May 9, 2004

[Listen to the River](#), An Independent Review of the CVPIA Fisheries Program, December 2008

[Finding the Water](#), Environmental Defense Fund, 2005

CVPIA Refuge Water Supply - 1992

Section 3406(d) of the 1992 Central Valley Project Improvement Act guarantees “firm water supplies of suitable quality to maintain and improve wetland habitat areas” in the Central Valley. The CVPIA Refuge Water Supply Program is managed and overseen by Reclamation, in consultation with wildlife refuge managers and the Central Valley Joint Venture.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- The purpose of the program is to mitigate for the loss of wetland habitat as a result of the construction and operation of the CVP. Approximately 95% of the Central Valley’s four million acres of historical wetlands have been lost. The remaining acres are carefully managed through scheduled water deliveries for migratory birds and other species.
- There are 19 CVPIA refuges located in the Sacramento and San Joaquin valleys, comprised of National Wildlife Refuges, State Wildlife Areas, and the privately managed Grassland Resource Conservation District.

Water Volume and Source

- CVPIA refuge water volumes are based on a biological study that identified the volume of water historically delivered to the refuges (Level 2) and the volume needed for optimal habitat management (Level 4).
- The CVPIA identifies a full Level 4 refuge water supply of 555,515 AF of water, based on biological objectives for the 19 refuges, which Reclamation was directed to deliver by 2002.

Interior may reduce the quantity of Level 2 water in critically dry years by up to 25%. The majority of total refuge water supply is Level 2 water to be provided from CVP supplies immediately upon the enactment of the CVPIA. The remainder is Incremental Level 4 water to be acquired, in equal annual increments between the 1992 signing of the CVPIA and 2002, by Reclamation from willing sellers and other voluntary sources.

- Sources of Incremental Level 4 water have included temporary water transfers and permanent dedications, groundwater, recycled water, recirculated refuge water, and reservoir storage and reoperation projects with ecosystem benefits. Incremental Level 4 water is often scarce in dry years and more plentiful in wet years.
- Each refuge has its own ratio of Level 2 and Incremental Level 4 water. For example, the Colusa National Wildlife Refuge supply is all Level 2, the Los Banos State Wildlife Area is two-thirds Level 2 and one-third Incremental Level 4, and the Kern National Wildlife Refuge is one-third Level 2 and two-thirds Incremental Level 4. Due to the variability of Incremental Level 4 water, this creates unequal water distributions and problems in dry years for refuges that depend substantially on Incremental Level 4 water.
- In 2016, Reclamation reached an agreement to fund the North Valley Regional Recycled Water Program, to convey recycled water from Modesto and Turlock across the San Joaquin Valley to be shared between agricultural users and refuges – with the refuge supply reaching a maximum of 16,000 AF annually. This represents the largest single contribution to Incremental Level 4 supplies since the passage of the CVPIA.
- See the Los Vaqueros Expansion and Sites Reservoir sections below for more information about additional possible Incremental Level 4 supplies.

Funding

- The CVPIA Restoration Fund is the primary source of funding for the Refuge Water Supply Program. CVP water and power users pay environmental mitigation and restoration fees into this fund. Variable annual CVP water and power allocations result in significant fluctuations in funding. Other funding sources anticipated for the Restoration Fund have not materialized. The Fund receives approximately half of what was projected.
- The CVPIA directs the State of California to contribute 25% of the costs of acquiring and delivering Incremental Level 4 refuge water but the State has historically directed funding and in-kind services to other CVPIA programs as part of a holistic funding agreement with Reclamation.
- State bond funds and federal appropriations for water-storage ecosystem benefits are typically directed toward capital construction costs, without long-term conveyance and other operational funding for refuge deliveries.

Implementation Challenges

- On average, Reclamation has delivered only 70% of the refuge water supplies required under the CVPIA. Level 2 deliveries are fairly stable for most refuges, but Incremental Level 4 supplies are not. Requirements to meet the environmental program goals have not been enforced.
- In 2022, Interior made a decision that it would reduce North of Delta Level 2 refuge allocations to well below the 75% minimum established in the CVPIA. (As this document was being finalized, estimates ranged from “less than half” to as low as 18%.)
- The cost of water acquisition and conveyance is increasing over time, highlighting the need for more permanent refuge water investments and delivery agreements.

- Although the CVPIA authorizes the construction of water conveyance facilities necessary to deliver refuge water, several refuges cannot receive CVP water because they are physically separated from the CVP. As a result, Reclamation has not yet made full Level 2 or Level 4 deliveries.

Sources

[Text of CVPIA](#)

Bureau of Reclamation's [Refuge Water Supply Environmental Documents Page](#)

California Department of Fish and Wildlife's [Refuge Water Supply Program Page](#)

Central Valley Joint Venture's [2020 Implementation Plan](#)

San Luis Delta Mendota Water Authority [fact sheet re. the North Valley Regional Water Recycling Program](#), 2018

[CalMatters article](#) about 2022 water allocations, May 23, 2022

Bay-Delta Accord - 1994

The Bay-Delta Accord (Accord), which was signed on December 15, 1994, represented a landmark agreement among the U.S. Environmental Protection Agency (EPA), the California Department of Fish and Game (now the California Department of Fish and Wildlife (CDFW)), water agencies and environmental NGOs regarding new water quality standards to protect fish and wildlife in the Bay-Delta estuary. The Accord was negotiated in response to a clear regulatory deadline. In 1987, EPA rejected the previous SWRCB Bay-Delta Water Quality Control Plan (Decision 1485, adopted in 1978) as inadequate to meet federal Clean Water Act requirements. Following the EPA rejection, the SWRCB had tried twice to set new standards, only to be asked by Governors Deukmejian and Wilson to withdraw those proposals and begin again. In response to this delay, NGOs sued EPA to force action. In a settlement to that litigation, EPA agreed to give the SWRCB until December 15, 1994 to set new water quality standards. Water users and state agencies were highly motivated to prevent EPA from stepping in to take control of setting water quality standards for the Bay-Delta. It is not a coincidence that the Accord was signed on the EPA deadline.

In May of 1995, the Accord was adopted by the SWRCB in its update to the Bay-Delta Water and in the subsequent Water Right Decision 1641.

Key Features, Highlights and Challenges

Program Term

- The protections in the Accord “are intended to be in force for three years, at which time they may be revised.” This duration is consistent with the Clean Water Act’s requirement that water quality standards be reviewed every three years. The Accord’s requirements, except as modified by the Vernalis Adaptive Management Program (VAMP) agreement (see summary below), remain in effect after more than 26 years.

Relationship to Regulatory Requirements or Legal Obligations

- An agreement by the Department of Water Resources (DWR) and Reclamation to provide the environmental water required by the Accord meant that the agreement could be implemented without a watershed-wide SWRCB water rights decision.

- The Accord established a narrative water quality objective to “achieve a doubling of production of Chinook salmon, consistent with the mandates of State and Federal law.”
- EPA agreed to withdraw proposed federal water quality standards under the Clean Water Act when the SWRCB adopted a final Bay-Delta Plan consistent with the Accord.
- The Accord was intended to provide tools adequate to comply with the take requirements of applicable biological opinions with “no additional loss of water supply annually.”
- The parties to the Accord intended to avoid the need for additional ESA listings for at least three years. Further, the agreement strived to ensure that any additional fish listings would not require additional uncompensated water from water users.
- The Accord provided that the CVP’s share of the additional water required to meet the new SWRCB flow standards would come from the CVPIA’s B2 block of water.
- The Accord triggered, and explicitly called for, a new ESA section 7 consultation and resulted in new biological opinions for listed Bay-Delta species.

Water Volume and Source

- The package of requirements in the Accord increased flows to the estuary by 400,000 AF in average years and up to 1.1 million AF in dry years.
- The Accord created a new metric for protecting Delta species called “X2” – which refers to the location of the point in the estuary where average salinity is 2 parts per thousand. Although the location of X2 is highly influenced by tides, Delta outflow is the variable that controls the average location of X2. The idea of using X2 as a metric for protecting the health of the estuary was developed by a group of scientists, convened and funded by the San Francisco Estuary Project.
- In addition to the new X2 standard, the Accord included the following additional requirements, among others:
 - Requirements regarding the percentage of Delta inflow that can be exported by the state and federal pumps, ranging from 35% to 65%, during three different periods. (February, March-June and July-January).
 - CVP and SWP export limits during the 30-day San Joaquin River pulse flow. (See VAMP discussion below).
 - Removal of a Delta fish barrier and the transport of fish.
 - Closure of the Delta Cross Channel for a maximum of 45 days from November to January and rotating closures from May 21-June 15.
- If additional water was required to meet ESA requirements, beyond that in the Accord, the federal government committed to finance water purchases using federal funds. No such water has been provided under the Accord.

Governance and Adaptive Management

- The Accord directed the Operations Group, consisting of agency staff and stakeholders, to develop operational flexibility procedures that would require “no additional water cost” to coordinate implementation of the Bay-Delta Plan and ESA requirements. Although this language is discussed as operational flexibility regarding the implementation of regulatory standards, in many ways, this resembles a flexible block of water similar to that in the CVPIA’s B1 program.
- The Accord allowed the Operations Group to exercise operational flexibility in implementing the new standards above, including increasing or decreasing water supplies “in any month,” as long as there is no annual impact.

- The negotiations that led to the Accord continued and evolved into the CALFED program, a cooperative state-federal planning effort involving those involved in the Accord, as well as additional interests.

Funding

- Water users agreed to provide \$10 million annually for three years to fund non-flow measures, with the screening of unscreened diversions established as the highest priority.

Sources

[Bay-Delta Accord](#), 1994

State Water Resources Control Board 1995 [Bay-Delta Water Quality Control Plan](#)

Congressional Research Service Bay-Delta [timeline](#)

Lower Mokelumne River Joint Settlement Agreement - 1998

The 1998 Lower Mokelumne River Joint Settlement Agreement (JSA) was negotiated among East Bay Municipal Utility District (EBMUD), CDFW, U.S. Fish and Wildlife Service (FWS) and NGOs. EBMUD, CDFW, and FWS are signatories to actions under the agreement and comprise the Lower Mokelumne River Partnership (Partnership). The settlement included a “gainsharing” agreement, which commits EBMUD to dedicate a percentage of additional water developed by EBMUD for use by its customers back to the Mokelumne River to support fisheries.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- The agreement was intended to improve conditions for anadromous fish on the Lower Mokelumne River below Camanche Dam.
- There has been a significant increase in adult salmon returns to the Mokelumne River since the agreement. The Mokelumne is one of few Bay-Delta tributary rivers to see significant increases in adult returns over the past 20 years, including a modern record of nearly 20,000 returning adults in 2017, contributing to both the river and at the Mokelumne River Hatchery. From 1964-1997, an average of 3,636 adult fall-run returned to the Mokelumne, spawning both in-river and at the hatchery. From 1998-2021, this average increased to 9,598. During this same period, the number of in-river spawning fish increased from averages of 2,503 to 3,305.

Volume of Water and Source

- The gainsharing agreement required EBMUD to commit to the Mokelumne River 20 percent of any supplemental supply yield from water developed through specified water management activities, such as diversions made using EBMUD’s Freeport Project facility on the Sacramento River. The volume is capped at 20,000 AF.
- Gainsharing water is managed as a block of water to further improve conditions on the Mokelumne River. This environmental share is determined on the basis of water actually delivered or diverted by EBMUD, not as a modelled amount.
- In 2014 and 2015, 16,236 AF of gainsharing water was generated for the environment. That was used in the spring and fall of 2014-2016. From October 2021-February 2022, 5,300 AF of additional gainsharing water was generated, and 1,800 AF of that was used for 2021 fall attraction flows for salmon.

Relationship to Regulatory Requirements or Legal Obligations

- The agreement was incorporated into Decision 1641 and resulted in significant increases in environmental flows on the Mokelumne, particularly during dry years.
- The agreement was negotiated as a voluntary agreement to meet Federal Energy Regulatory Commission (FERC) relicensing requirements. It was incorporated into the EBMUD FERC license renewal issued in 1998.

Governance and Adaptive Management

- The agreement created a formal collaboration – including a Steering Committee and a stakeholders group – among stakeholders and agencies to implement the agreement and manage the gainsharing block of water.
- The agreement provides for collaborative adaptive management, governed by a Partnership Steering Committee (EBMUD, CDFW and FWS), to flexibly implement the negotiated flow standards, such as by reducing flows in one month to provide an increased pulse flow in another. Decisions require unanimous agreement.
- The agreement also created a Lower Mokelumne River Stakeholders Group, including but not limited to Amador, Calaveras and San Joaquin counties, Woodbridge Irrigation District, the City of Lodi, North San Joaquin Water Conservation District, the Committee to Save the Mokelumne and other interested environmental groups, Native Americans and private property owners. The group encourages broad participation in Mokelumne River restoration, recommends ecosystem priorities to the Steering Committee and provides a forum for open communication.

Operational Considerations

- Gainsharing water has been carried over into future water years. For example, some water generated in 2015 was carried over and used in 2016. Gainshare water can only be carried over for one drought cycle. Upon the first spill event, any remaining gainshare accounting water is the first released.
- Given the modest volume of water in the gainsharing program, in general, its operation is not coordinated with the operations of the SWP and CVP. However, EBMUD seeks to coordinate the Mokelumne pulse flow with Delta Cross Channel gate closures, to improve adult salmon returns to the Mokelumne in the fall.

Funding

- The agreement included a \$2 million endowment fund. Interest from the fund, which is invested by EBMUD, is available to fund proposals for science, education or habitat improvements (e.g., gravel augmentation) presented to the Steering Committee. The agreement also provided funding for \$12.5 million in hatchery improvements.

Implementation Challenges

- Because alternative water supplies that are included in the agreement are shared with the environment, it effectively raises the cost of those supplies, as tools to provide new water for EBMUD customers.
- Some agricultural water transfers require a portion of water to be left on fallowed agricultural land to avoid environmental impacts. If such transfers are moved through

EBMUD's Freeport facility, and are thus subject to the gainsharing requirement, this can result in two requirements to dedicate water to the environment, effectively raising the cost of transfers.

Related Environmental Blocks of Water

- The Agreement also includes an adaptive management provision, to allow the Partnership to flexibly manage total required releases to meet fisheries needs, with approval from the SWRCB. This provision provides another block of water to manage for environmental purposes.
- EBMUD has also adaptively managed fall flood releases from its reservoir. Those releases, which were formerly released on an averaged, "flat line" basis, are now managed flexibly to benefit the environment, which allows an improved fall pulse flow. Thus, the quantity of water EBMUD must spill in the fall is also managed as a flexible environmental block of water. Although this is not required by the Lower Mokelumne River Agreement, the agreement provides a framework to guide the management of this additional environmental water.

Sources

[Mokelumne River Agreement](#), 1998

EBMUD/CDFW/FWS Lower Mokelumne River Agreement [10 Year Review](#), 2008

EBMUD [press release](#) on Mokelumne River salmon defying drought, 2015

EBMUD [PowerPoint presentation](#) on the Mokelumne River Agreement

EBMUD [press release](#) regarding record Mokelumne River salmon returns, 2019

Vernalis Adaptive Management Program - 1998

The Vernalis Adaptive Management Program (VAMP) was a 1998 agreement to provide improved flows on the San Joaquin River. The agreement was designed to implement the San Joaquin River flow requirements included in the 1994 Bay-Delta Accord. (See discussion above.) Signatories included the California Natural Resources Agency, Interior, San Joaquin River Group Authority (a group of eight water districts that use water from the San Joaquin River watershed), SWP/CVP Delta export interests and two environmental NGOs.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- VAMP was an experimental management program designed to protect juvenile Chinook salmon migrating through the San Joaquin River and the Delta. The experiment was designed to determine how juvenile fall-run salmon survival rates change in response to alterations in San Joaquin River flows and Delta exports, along with the installation of a Head of Old River Barrier.

Program Term

- The agreement had a 12-year term.
- The VAMP experiment was not renewed at the end of the term of the agreement.

Relationship to Regulatory Requirements or Legal Obligations

- VAMP was negotiated following the adoption of the 1995 Bay-Delta Plan as an alternative to the spring pulse flow requirements in that plan. The SWRCB subsequently approved VAMP and incorporated it into a modified Water Right Decision 1641.

Water Volume and Source

- The spring flows required by the VAMP experiment were implemented for a 31-day period during April and May, and included flows at Vernalis varying between 3,200 and 7,000 cubic feet per second (cfs) and exports varying between 1,500 and 3,000 cfs. In addition, Vernalis flows were to be maintained at 1,000 cfs in October. Supplemental environmental water, up to 28,000 AF, was also to be released in October of all water years, to maintain a monthly average flow of 2,000 cfs. Additional flow was not required in a critical year following a critical year.
- Water users were paid to release water to implement the VAMP agreement.

Governance

- The VAMP agreement created a Management Committee, consisting of one representative from each signatory, and a Technical Committee. The Management committee was charged with resolving disputes and made decisions by a unanimous vote.
- The Technical Committee was charged with determining how best to manage flow releases during the pulse flow period, as well as related monitoring activities.

Funding

- Funding for the VAMP agreement came from the CVPIA 3406(b)(3) water purchase program.

Implementation Challenges

- A 2010 independent peer review of the VAMP program concluded that there is “a strong positive relation between estimated [juvenile salmon] survival rates and Vernalis flow.” However, the review also stated that “there has been an apparent substantial decline in downstream migrant survival rates over the past ten years at very low flows, low VAMP flows, medium VAMP flows and at high (exceeding VAMP) flows.”
- Jay Lund (UC Davis), Ellen Hanack (PPIC) and Brian Gray (UC Hastings School of Law) concluded in a blog post about adaptive management that VAMP “appears to have been more successful for these various individuals and entities (e.g., farmers, agency scientists and water agencies) than for the salmon. Millions of dollars were spent, yet little synthetic modeling or experimental design was conducted to evaluate the effects on fish or to improve performance over time.”

Sources

SWRCB [Decision 1641](#), as Modified in March of 2000.

Peer Review of Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, November 21, 2011 (No available link.)

The Vernalis Adaptive Management Program (VAMP) – [Report of the 2010 Review Panel](#), Delta Science Program, May 11, 2010

[California WaterBlog Post](#) re. VAMP and Adaptive Management , July 21, 2011

[State Board Scientific Basis Report](#) (includes a description of VAMP)

[The San Joaquin River Agreement and the Vernalis Adaptive Management Plan](#), William R. Johnston, PE. 1998

Bay-Delta Environmental Water Account - 2000

The Environmental Water Account (EWA) was created in the 2000 CALFED Bay-Delta Program Record of Decision. The EWA goal was to create a flexible block of environmental water that could reduce environmental impacts of the CVP and SWP Delta pumps “at no uncompensated water cost” to the projects’ water users. The approach required the acquisition of water, as well as water obtained through the water project flexible operations, called “EWA Assets.” That environmental water was used to modify Delta exports to provide fisheries benefits. More specifically, EWA water stored south of Delta was used to provide alternative water supplies to compensate for Delta pumping reductions.

There is some debate regarding whether the EWA represents an environmental block of water. Some see the program as creating a block of water that allowed additional Delta pumping restrictions that would not require additional water to be involuntarily reallocated from users. Others see the program as merely compensating Delta export water users for pumping restrictions that were already required by the pre-existing ESA Biological Opinions.

Key Features, Highlights and Challenges

Program Term

- The EWA was approved as a four-year experiment. It was renewed for three years in a limited form and was formally ended in 2007.

Environmental Goals and Geographic Scope

- The EWA was designed to assist in the implementation of pre-existing federal ESA biological opinions, particularly the 1995 FWS Delta smelt Biological Opinion.

Water Volume and Source

- New Tier 2 EWA assets (see baseline discussion below) were anticipated to be developed through flexible operations and water purchases. Those assets were anticipated to average 380,000 AF annually. Different levels for different water year types were not specified. (CALFED ROD, Pg. 55)
- In 2001 and 2002, the EWA had, respectively, 287,000 AF and 297,000 AF of Tier 2 water available to compensate from reduced deliveries, approximately 80% of the amount anticipated by the CALFED ROD.
- In 2001, the variable assets, anticipated to be generated through flexible project operations, produced only 12% of average projected amounts. Over the life of the program, these variable assets generated far less than anticipated.
- In January of 2001, managers reported that 678,000 AF of EWA Tier 2 water was available. But by September, it became clear that far less water was actually available.
- By 2005, the Environmental Defense Fund concluded that environmental managers in the Bay-Delta had 400,000 AF less per year than were included in the CALFED ROD.
- The program included a “Tier 3” that would provide additional water if the assets in Tier 1 and Tier 2 proved to be inadequate. Tier 3 never generated additional water, despite the reduction in Tier 1 water, shortfalls in Tier 2 assets and evidence of serious environmental need.

Baseline

- The program defined a specific “Baseline Level of Protection,” and then treated the pre-existing ESA requirement as providing “fishery protection actions that are supplemental” to that baseline. This Baseline Level of Protection was referred to as Tier 1 of the EWA’s assets. (In this way, the baseline was treated in the EWA context as part of the environmental block of water, i.e., Tier 1. In other settings, as in the CVPIA’s B2 water, the baseline is treated as entirely separate from a new block of water.) New EWA assets were referred to as Tier 2 and, if needed, Tier 3. In exchange for the EWA’s commitments, fishery agencies committed that it would not be necessary to require additional pumping reductions to meet ESA requirements.
- Court rulings in 2001 and 2002 reduced, by approximately 300,000 AF, the amount of water available for environmental protection through the CVPIA B2 block of water. Because the CVPIA’s B2 water was part of the EWA’s baseline, this reduced the water provided by the EWA Tier 1 assets.

Operational Issues

- Developers of the EWA did not anticipate that DWR would increase deliveries of surplus SWP water in a manner that would have significant impacts on the EWA and ecosystem health.
- In March of 2002, EWA water stored in San Luis Reservoir was “spilled” and lost to the EWA program. A south of Delta contractor agreed to accept 40,000 AF of EWA water in exchange for 20,000 AF later in the season. Thus, although the agreement did allow EWA water to be carried over into a future year, the terms of the agreement meant that the carryover quantity was substantially reduced.
- The EWA faced heavy demands in 2001, and the need for environmental water outstripped the program’s rate of water acquisition.

Funding

- Funding for the program came largely from state bonds, with some federal appropriations. Funding for 2001 was \$67.5 million and \$40.8 million in 2002. The EWA was never funded at a level that allowed the program to reach full Tier 2 assets. Federal funding in particular proved to be far below anticipated levels.
- The *Contra Costa Times* (now *East Bay Times*) reported that the SWP sold surplus water for \$28/AF and bought that water back for the EWA at up to \$200/AF.

Implementation Challenges

- In 2001, winter-run Chinook salmon were killed at the Delta pumps at levels 300% of ESA-mandated take limits.
- The *Contra Costa Times* reported that:
 - “[T]axpayers paid nearly \$100 million to a Kern County water wholesaler for an environmental protection program that was largely ineffective.”
 - The program “delivered discounted Delta water in a way that now appears to have been particularly harmful to the environment.”
 - “Some researchers believe that increased pumping of Delta water...may have contributed significantly to the ongoing collapse of Delta smelt.”

Sources

[CALFED Record of Decision, 2000](#)

Contra Costa Times articles – [8-9-2008](#), [5-24-2009](#), [5-23-2009](#) and [3-19-2009](#).
State of the Environmental Water Account Reports of [2001](#) and [2002](#), The Bay Institute
[Finding the Water](#), Environmental Defense Fund, 2005
[Disappearance of the CALFED Environmental Water Budget](#), 2020

Trinity River Record of Decision - 2000

Following the construction of Trinity Dam and Whiskeytown Dam, Reclamation diverted Trinity River water into the Central Valley. Those diversions, which at times amounted to 90% of Trinity River flows, damaged the river ecosystem including a salmon population decline of up to 96%.

Pursuant to the CVPIA's requirements related to the Trinity River, the Trinity River Restoration Program was formally created by Interior in 2000. The program includes environmental flows, mechanical channel restoration, gravel augmentation, sediment management, watershed restoration, infrastructure improvements, adaptive assessment and monitoring, and environmental compliance and mitigation.

Key Features, Highlights and Challenges

Water Volume and Source

- In the CVPIA, congress set minimum instream flows at no less than 340,000 AF on average. The Trinity River Record of Decision, consistent with the CVPIA, established final Trinity River flows, ranging from 369,000 AF in critically dry years to 815,000 AF in extremely wet years.
- Reclamation's 1999 Trinity River Flow Evaluation Study investigated the flow needs of the river and laid the groundwork for the final flow numbers.

Governance and Adaptive Management

- The water dedicated to the Trinity River is managed flexibly and annually through the Trinity Management Council, which includes five state and federal agencies, Trinity County, the Hoopa Valley Tribe and the Yurok Tribe.
- The Trinity River Record of Decision established a variable flow regime, based on five water year types, as determined by forecasted hydrology as of April 1 of each year.

Implementation Challenges

- See the discussion above regarding the lack of a well-developed and enforceable carry-over storage requirement. As a result, Trinity River advocates are concerned that the Trinity River Record of Decision might allow Trinity Reservoir to be drawn down for water deliveries to a level at which the flows required by the Record of Decision might not be physically available.

Sources

[Trinity River Record of Decision](#), 2000

[Trinity Management Council](#)

[Trinity River Flow Evaluation Final Report](#), US Fish and Wildlife Service and Hoopa Valley Tribe, 1999

Mill Creek – 2006

In 2006, The Nature Conservancy (TNC) began purchasing water rights on Mill Creek. This project is far smaller and, from an operational perspective, far simpler than the other California examples in this document.

Environmental Goals and Geographic Scope

- The Mill Creek water rights purchases are designed to provide benefits for the ESA listed spring run Chinook salmon, with additional benefits for fall run Chinook and other species. Because Mill Creek is spring fed, cold and supports the highest elevation spawning grounds for Chinook salmon on the continent, the creek is an important part of a salmon climate resilience program.
- This project is part of a larger TNC effort to protect creeks, woodlands, grasslands and vernal pools in the Lassen Foothills.

Water Volume and Source

- Together, TNC's water rights give them control of 21 cfs when Mill Creek flows are above 200 cfs – measured above the two major diversions, which are controlled by the Los Molinos Mutual Water Company (LMMWC). The amount of water TNC controls decreases as flows drop, according to the terms of the Mill Creek Decree.
- This water was acquired through three separate water rights purchases from landowners served by the LMMWC.

Adaptive Management and Operational Considerations

- TNC has some limited flexibility to manage this water to achieve maximum environmental benefit. That flexibility is constrained by the absence of significant storage on Mill Creek. However, with a year's advance notice, there is some potential to arrange exchanges with LMMWC to adaptively manage this water to maximize environmental benefits.
- Originally, TNC reached an agreement with LMMWC to allow the water district to divert TNC's water during the irrigation season in exchange for an agreement to release water during the peak salmon migration season. That agreement expired in 2019.
- Because Mill Creek frequently runs dry in the summer before it reaches the Sacramento River, in 2020 and 2021, TNC decided to leave their water instream year-round.
- In 2021, a portion of this water was acquired by Woodland-Davis Clean Water Agency, whose diversion point on the Sacramento River is 120 miles downstream from Mill Creek.
- In the future, some Mill Creek water could be captured downstream for use by wildlife refuges or migratory bird habitat.

Relationship to Legal Obligations

- TNC is seeking protection under Water Code Section 1707, which requires water dedicated to environmental purposes to be left instream.

Funding

- Funds for these water rights purchases came from a combination of funds from private donors, including a loan, and from the Wildlife Conservation Board's Streamflow Enhancement Grant program.

- Funds from the water purchase by Woodland-Davis are being used to help repay the loan for the original purchase of one of the Mill Creek water rights.

Implementation Challenges

- See discussion above re. the limited flexibility for adaptively managing this water.
- The Mill Creek Decree states that Mill Creek water rights can be used “in any manner, at any place, or for any purpose.” Nevertheless, TNC has faced challenges in complying with state and federal water transfer requirements, particularly including Reclamation’s and DWR’s Draft Water Transfer White Paper.

Sources

[TNC Mill Creek project update](#)

[Woodland-Davis Water Purchase](#), 2021

San Joaquin River Restoration Program (SJRRP) - 2006

Background: Before completion of Friant Dam in 1942, the San Joaquin River was California’s second largest salmon producing river. The construction and operation of Friant Dam resulted in the dewatering of 60 miles of the San Joaquin River and the extirpation of the river’s spring-run Chinook salmon. In 1988, the Natural Resources Defense Council (NRDC) and a coalition of environmental and fishing groups filed a lawsuit seeking the restoration of flows and salmon to the river. In 2006, a settlement of the litigation was reached among the NRDC coalition, the Friant Water Users Authority and Reclamation.

The settlement included two goals:

Restoration Goal: To restore and maintain fish populations in “good condition” in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.

Water Management Goal: To reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement.

The most high-profile components of the settlement are the restoration of flows and salmon below Friant Dam.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- The settlement addressed 153 miles of the San Joaquin River from Friant Dam to the confluence with the Merced River.
- The program was designed to restore a naturally reproducing and self-sustaining population of spring run Chinook salmon to the San Joaquin River below Friant Dam.
- The settlement provided for the reintroduction of listed spring-run Chinook salmon using a population that was listed by National Marine Fisheries Service (NMFS) as an experimental population under Section 10(j) of the ESA. The settlement also included a timeline and

required restoration activities, including restoring channel conveyance capacity and modifying existing infrastructure.

- In 2019, spring run Chinook salmon spawned in the San Joaquin River for the first time in 65 years.

Water Volume and Source

- The amount of water dedicated to San Joaquin River restoration varies by specifically-defined water year types, including:
 - 247,000 AF per year of additional releases from Friant Dam in years drier than normal.
 - 356,000 AF per year in years wetter than normal.
 - No water in “low critical” years.
- The amount of water accounts for estimates of seepage losses along the river.
- The settlement also provides for the purchase of water from willing sellers, if needed, of up to 22,000 AF of additional environmental water. This provision has never been implemented.

Funding

- Dedication of future capital repayment payments by Friant water users.
- Dedication of contributions from Friant water users to the SJRRP Restoration Fund.
- Continuation and dedication of the CPVIA’s Friant “surcharge” contributions to the SJRRP Restoration Fund. (Under the CPVIA, those surcharge contributions would have stopped once flows to the San Joaquin River were restored).
- Federal appropriations.
- State bond acts.

Governance and Adaptive Management

- The management of the hydrograph in any given year includes significant flexibility.
- The settlement created a Restoration Administrator selected by the settling parties to manage the restoration program. Restoration flows are based on a hydrograph included in the settlement. However, the Restoration Administrator is responsible for recommending to Reclamation a specific release schedule each year – subject to the limitations on modifications to the hydrograph in the settlement. Final decisions regarding the management of that water are made by Interior.
- The settlement included the creation of a Technical Advisory Committee (TAC) to “assist and advise the Restoration Administrator.” The TAC consists of two representatives selected each by the Friant Water Users and environmental signatories, with two additional members selected jointly. Federal employees are barred from serving as members of the TAC.

Legislation

- Implementing the settlement required the passage of federal authorizing legislation – the San Joaquin River Restoration Settlement Act. That Act was negotiated among the settling parties and other stakeholders, and was authored by Senator Dianne Feinstein. In 2009, the Act was signed into law beginning the San Joaquin River Restoration Program.
- The settlement included an “offramp” that would have allowed parties to void the settlement and return to court if the authorizing legislation was not passed by a deadline.
- The negotiations regarding the implementing federal legislation produced an agreement among stakeholders to support the legislation and to oppose any amendments to the

legislation that were not agreed to by all parties. This agreement became known as the “blood oath.”

Operational Considerations

- The settlement includes developing a plan to recapture some restoration flows, if such recapture would have “no adverse impact on the Restoration Goal, downstream water quality or fisheries.” Since 2009, when implementation began, a total of over 400,000 of restoration flows have been recaptured at downstream diversion points along the San Joaquin River. No restoration flows have been recaptured in the Delta.
- During extremely dry years, a group of water users known as the San Joaquin River Exchange Contractors have taken delivery of water from Friant Dam. Because of seepage and channel capacity constraints, these deliveries have limited restoration flow releases.
- In some circumstances, the need to make flood flow releases from Friant Dam has also emerged as a constraint on restoration flow releases.

Implementation Challenges

- The slow pace of some improvements, such as channel improvements, retrofitting Mendota Dam and addressing levee seepage along the San Joaquin River, have delayed the release of full restoration flows.
- As of the completion of this report, full restoration flows have not been released in any single water year.
- The above challenges have required upstream and downstream migrating salmon to be trucked during this interim period. However, during a wet 2019, approximately 400 adult salmon successfully swam upstream to habitat below Friant Dam.
- As of the completion of this report, there is still some ongoing debate about the final alignment of the river channel down which restoration flows will be released.

Sources

San Joaquin River Restoration Program [web page](#) regarding the settlement

San Joaquin River Restoration Program [web page](#) regarding the 2009 authorizing legislation

NOAA Fisheries San Joaquin River [web page](#)

DWR [web page](#) regarding the return of spring-run Chinook salmon to the San Joaquin River

Lower Yuba River Accord - 2008

The 2008 Lower Yuba River Accord is an agreement among water agencies, state and federal agencies and NGOs, including the Yuba County Water Agency and seven other water agencies, PG&E, CDFW, DWR, Reclamation, FWS, South Yuba River Citizens League, Friends of the River, The Bay Institute and Trout Unlimited. The purpose was both to improve instream flow conditions on 24 miles of the lower Yuba River and to generate water supply benefits south of the Delta. Negotiations leading to the Accord began following an NGO petition to the SWRCB, asking it to require improved flow and temperature conditions for the lower Yuba River.

In 2003, the SWRCB adopted a revised Water Right Decision 1644, following an extensive administrative process. That decision, which applied to the water rights of the Yuba County Water Agency, required interim and long-term instream flow improvements for the Yuba River. The Yuba Accord was reached after the SWRCB adopted final instream flow requirements for the Yuba River.

The agreement was later adopted as a substitute for the SWRCB's original flow requirements. In March of 2008, the SWRCB approved the Yuba Accord.

Key Features, Highlights and Challenges

Relationship to Legal Obligations

- In 2008, the SWRCB revised Water Rights Decision 1644 to incorporate the Yuba Accord's provisions.

Water Volume and Source

- The Yuba Accord included a Fisheries Agreement that provided improved instream flows for the Yuba River. That agreement ensured approximately 100,000 AF of flows for the Yuba on average. Increases ranged from 25,000 AF in a dry year to over 170,000 AF in a wet year, over the requirements in place prior to the Yuba Accord.
- The agreement included an initial pilot program, during which additional environmental flows were released prior to SWRCB action on the full agreement.

Governance and Adaptive Management

- The agreement allowed a River Management Team and its Planning Group (including each party to the agreement) to temporarily alter the instream flow agreement subject to several requirements, including not reducing the amount of stored water in New Bullards Bar Reservoir at the end of the calendar year during which the temporary alteration occurs. In this manner, the agreement allowed a negotiated set of flow requirements to be managed, within some constraints, as an environmental block of water.
- The agreement includes a dispute resolution process and remedies for material and non-material violation of the negotiated river flows.

Operational Considerations

- The Yuba Accord included a Conjunctive Use Agreement to provide additional groundwater supplies to increase the water supply reliability for water users in the Yuba County area.
- The agreement included a Water Purchase Agreement for the purchase of the increased Yuba River flows when that water reached the Delta. Until December 31, 2015, the program provided for 60,000 AF of water purchases per year for the Environmental Water Account and up to 140,000 AF of water in dry years for the SWP and the CVP. The agreement provided reduced water transfer guarantees from 2016-2025.

Funding

- The agreement included a \$6 million fisheries monitoring and studies program, financed by Yuba County Water Agency, with funds to come from the sales of water provided by the Yuba Accord.
- The funds generated by water purchases were also used to fund flood protection investments for the Yuba County area.

Implementation Challenges

- In general, the flows provided by the Accord are not integrated with the flow requirements of restoration projects on the Lower Yuba.
- The Accord provides limited benefits in dry years.
- The Accord does not fully address water temperature issues.

- Initially, NGOs were compensated for participation in the River Management Team. However, that is no longer the case.

Sources

Yuba Water Agency Lower Yuba River Accord [web page](#)

Lower Yuba River Accord [FAQ](#)

State Board 2003 Water Right Decision 1644 [web page](#)

State Board [web page](#) regarding adoption of the Accord

Public Policy Institute of California [blog post](#)

YCWA [video](#) regarding the Lower Yuba River Accord

Chino Basin Program and the Feather River - Proposed

The Chino Basin Program (CBP) is an innovative groundwater recycling, water storage and salmon restoration program developed by the Inland Empire Utility Agency. It was submitted to compete for funding from the Proposition 1 Water Supply Investment Program. It has not yet been constructed.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- The program is intended to help improve spring flow conditions for fish, particularly for listed spring-run Chinook salmon, as well as fall-run Chinook salmon, on the Feather River.

Water Volume and Source

- The CBP would lead to the dedication of 50,000 AF of environmental water, stored in Oroville Reservoir. The water would be available to meet salmon needs in dry and critical water years, when existing conditions are most degraded.

Operational Considerations

- The CBP would dedicate environmental water through a complex series of exchanges. The CBP plans to recycle wastewater in Riverside County in Southern California and store that water in local aquifers. That water would be made available to Southern California water agencies which would, in exchange, correspondingly reduce their SWP water deliveries from the Metropolitan Water District of Southern California. Metropolitan Water District would then correspondingly reduce their deliveries from the SWP's Oroville Dam. That reduction in SWP deliveries would allow additional water to be stored in Lake Oroville. Thus, the CBP is designed to secure Northern California environmental benefits through investments in Southern California water recycling and storage.

Funding

- The CBP was conditionally awarded \$215 million in funding from Proposition 1 by the California Water Commission. Those funds were awarded largely for anticipated benefits to salmon.

Implementation Challenges

- The CBP requires a series of operating and water agreements to be implemented, including agreements with DWR, the State Water Contractors, the Metropolitan Water District and individual Southern California water agencies.
- The CBP has limited time to meet the California Water Commission requirements to secure the funding conditionally awarded to the project. A final California Water Commission award hearing is anticipated in early 2024. Projects must meet a series of deadlines regarding feasibility, cost share agreements and release of a draft environmental document.

Other

- The project has attracted support from environmental and fishing NGOs that are active in the protection of Central Valley rivers and salmon.
- For Southern California, the CBP would essentially trade locally recycled and stored water for SWP water – financed by the State. That locally supplied water is more reliable, particularly during droughts and emergencies, than SWP water. Thus, the project would provide Southern California water supply reliability, as well as environmental benefits.

Sources

Inland Empire Utilities Agency Chino Basin Program [web site](#)

California Water Commission Chino Basin Project [web site](#)

Hakai Magazine [article](#), 2019

Podship: Earth [podcast](#)

Los Vaqueros Expansion and Central Valley Wetlands - Proposed

The Los Vaqueros Reservoir Expansion Project (LVE) is a proposal by the Contra Costa Water District (CCWD) to expand an existing off-stream reservoir in Eastern Contra Costa County. It was submitted to compete for funding from the Proposition 1 Water Supply Investment Program. It has not yet been constructed. The project would provide water supply for water users, particularly Bay Area urban water agencies, during dry years – thus increasing their climate resilience. In wetter years, half of the water from the project would be delivered to Central Valley wetlands and wildlife refuges.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- The environmental component of the project is designed to provide water supply for public and privately held wetlands in the San Joaquin Valley to meet the objectives of optimum refuge habitat management and incremental Level 4 supplies described in the CVPIA. (See discussion above.)

Water Volume and Source

The project would expand the existing Los Vaqueros Reservoir from a capacity of 160,000 AF to 275,000 AF. CDFW confirmed that the project would produce an average of 46,000 AF of Incremental Level 4 Central Valley wildlife refuge water supply annually. CCWD analysis suggests average wet year incremental Level 4 supply of 58,000 AF and dry year average

Level 4 deliveries of 27,000 AF. In wet years, those wetland supplies would represent 50% of project yield, dropping to 36% in dry years.

Relationship to Regulatory Requirements or Legal Obligations

- As described above with respect to the CVPIA Refuge Water Supply Program, Interior has not yet provided the full Incremental Level 4 water supplies required by the CVPIA. The refuge water supplies provided by LVE would be Incremental Level 4 supplies and would represent the largest contribution of Incremental Level 4 since the passage of the CVPIA.

Operational Considerations

- LVE would provide the bulk of its benefits for wildlife refuges during non-dry years. During dry years, the project would prioritize deliveries to the primarily urban water agencies that will help finance the project. Thus, the project provides high priority environmental benefits as well as high value dry year water supply benefits.
- In addition to raising the dam, the project requires the construction of a new pumping station to move a larger volume of water into the reservoir, and investments in interties to allow the operations of the project to be integrated into the operations of projects serving the many partnering water agencies.
- Given the large number of potential water agency partners, developing a final operating plan will require consideration of the varying needs of many individual water districts.

Funding

- The California Water Commission has conditionally awarded LVE \$477 million to finance the environmental benefits of the project. A final California Water Commission award hearing is anticipated in mid-2023.
- Proposition 1 bond funding is dedicated to the capital costs of construction. This requires additional efforts by the project participants to identify funding for the ongoing costs of refuge water conveyance.
- The project is also competing for federal funds, for example, under the 2016 Water Infrastructure Improvements for the Nation Act (WIIN Act). The remainder of the project would be funded by water agencies, to pay for the dry year benefits described above.

Other

- The project has attracted support from NGOs active in Central Valley wetlands issues.

Sources

CCWD LVE Expansion [web site](#)

California Water Commission LVE Expansion [web site](#)

2017 *Mercury News* [op-ed](#) by Former Congressman George Miller

Sites Reservoir - Proposed

Sites Reservoir is a proposed off-stream reservoir on the West Side of the Sacramento River Valley that has been proposed by the Sites Project Authority, which is led by a board consisting of north of Delta water agencies and one county supervisor. The project would divert water from the Sacramento River. Stored water would be delivered to urban and agricultural water users, both north and south of the Delta. The project would also provide a block of water for the environment.

It was submitted to compete for funding from the Proposition 1 Water Supply Investment Program. It has not yet been constructed.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- CDFW determined that the project would provide ecosystem benefits by dedicating additional water for Central Valley wildlife refuges and by augmenting flows through the Yolo Bypass to benefit Delta smelt.

Water Volume and Source

- CDFW determined in 2018 that the project would provide an average of 35,000 AF of Incremental Level 4 refuge supply north of the Delta and 34,000 AF of Incremental Level 4 refuge water supply south of the Delta.
- CDFW also determined in 2018 that the project would provide an average of 40,000 AF of additional flow into the Yolo Bypass from August through October to benefit Delta smelt.
- In March of 2021, Sites Authority staff indicated that the project size was being reduced and that the environmental block of water from the project would be reduced to approximately 50,000 AF, with the management of that water to be determined.

Funding

- The project has been conditionally awarded \$875 million in funding by the California Water Commission. A final award hearing is anticipated in mid-2023.
- As of 2020, the project had received approximately \$10 million in federal appropriations.
- In 2022, EPA invited an application for a \$2.2 billion Water Infrastructure Finance and Innovation Act (WIFIA) loan, which will lower the financing costs for the project.
- Interested agricultural and urban water agencies are also contributing to finance the study and permitting phase of the project. Agencies that agree to be final project partners will contribute to construction and operating costs.
- Proposition 1 bond funding is dedicated to the capital costs of construction. This requires additional efforts by the project participants to identify funding for the ongoing costs of delivering environmental benefits, including refuge water conveyance.

Operational Considerations

- Like the Los Vaqueros Expansion, the Sites Project is conceived as a project to provide both water supply and environmental benefits. It would require integration into the existing operation of multiple water projects. However, because the project is less advanced than the LVE project, the full extent of these operational considerations is not yet clear.
- It is possible that operations of the Sites Reservoir could be coordinated with Reclamation's operation of Shasta Dam. Such joint operations have not been clearly identified. Joint operations could have complex implications for the yield, environmental benefits and environmental impacts of the Sites project.
- Delivering water to south of Delta wildlife refuges will require coordination with CVP Delta operations and will depend on available export capacity.

Implementation Challenges

- One key constraint on the project is the "bypass flows" that would apply to the project's operations and could reduce the project's yield. Bypass flows refer to the volume of water

required to flow past the intake facility and remain in the river before the Sites project would be allowed to divert. Bypass flow requirements are largely designed to protect outmigrating salmon and steelhead. The Sites Project Authority is continuing to adjust their proposed bypass flows, in discussion with of CDFW.

- The project has attracted opposition from NGOs working to protect Central Valley rivers and salmon.
- The project proponents have recently reduced the size of the project, in response to environmental and financing considerations.

Sources

California Water Commission Sites Project [web page](#)

Sites Project Authority [web site](#)

NRDC [blog post](#)

[EPA announcement](#) of the Sites WIFIA loan invitation decision, 2022

Other States and Nations

Klamath River Environmental Water Account - 2019

Background: There has been a long history of conflict over water and salmon issues on the Klamath River. To address these issues, an Environmental Water Account (Klamath EWA) was developed to provide environmental flows for the river. The Klamath EWA is included in the 2019 NOAA Fisheries Biological Opinion for the operations of Reclamation's Klamath Project.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- The Klamath EWA is comprised of the volume of water available to the Klamath River from upper Klamath Lake for use from March through September. Klamath EWA volumes were developed with consideration of the needs of Coho salmon, including critical habitat and disease outbreaks.
- The Klamath EWA provides mitigation for the impacts of the operation of current Reclamation facilities on the river. The 2019 Biological Opinion, which includes the Klamath EWA, does not include authorization for proposed removal of four dams now owned by the Klamath River Renewal Corporation.

Water Volume and Source

- The volume of water in the Klamath EWA varies by year type, from a minimum of 400,000 AF in dry years to a maximum of over 1,000,000 AF in wet years. According to NOAA Fisheries:

The Klamath EWA is calculated monthly from March through June based on hydrologic conditions, including upper Klamath Lake storage, upper Klamath Lake net inflow, and Natural Resources Conservation Service's upper Klamath Lake inflow forecasts.

Distribution of the Klamath EWA is based on equations that use upper Klamath Lake net inflow as a hydrologic indicator to determine Link River Dam releases. Link River Dam releases and tributary accretions below Link River Dam comprise the total flow released at Iron Gate Dam.

- Flood releases are considered part of the Klamath EWA.
- In 2018, the Klamath EWA was augmented by 20,000 AF. That increase remained in effect following a 2020 litigation settlement.

Governance and Adaptive Management

- Reclamation runs the Klamath EWA, with input from NMFS and the Flow Account Scheduling and Technical Advisory Team (FASTA). The FASTA team is a team of technical specialists selected by Reclamation and includes staff from NMFS and FWS. FASTA meetings are scheduled by the Klamath River Manager.
- There is no inter-annual carry over of Klamath EWA water.
- The Biological Opinion allows some real time management to vary from scheduled water releases.

Sources

[Klamath River Biological Opinion](#), NOAA Fisheries, 2019

[Klamath River Water Management](#), NOAA Fisheries

[Implementation of Klamath Project Operating Procedures](#), 2019-2024. Reclamation, April 2019

[Bureau of Reclamation Releases Klamath River Interim Project Plan](#), Argent Communications, 2020

[2020 Litigation Settlement](#)

[Summary of Litigation Settlement](#), California Waterfowl Association, 2020

Freshwater Trust

Background: This example is not a single project, but rather the combined instream flow work of The Freshwater Trust, formerly the Oregon Water Trust, which is the nation's oldest water trust.

Key Features, Highlights and Challenges

- As of 2021, The Freshwater Trust had conducted 238 flow restoration projects since 1992, including over 650 transactions from landowners, primarily agricultural operations.
- These projects include multiple strategies to improve instream flows, including moving diversion points, improving water use efficiency, shortening the irrigation season, and leasing water. Some of these strategies resemble a block of water for the environment.
- The Freshwater Trust's projects provide instream flows ranging from 98-163 million gallons per minute during the irrigation season.
- From 1994-2004, the average price paid by The Freshwater Trust to lease water was \$18/AF, and an average of \$140/AF to purchase water.
- Most of The Freshwater Trust's instream flow projects are relatively small and in comparatively uncomplicated water management environments. As of 2004, the largest single water acquisition by The Freshwater Trust was for 12 cfs.

Sources

[Water Quantity Program](#), Freshwater Trust

[The Good, The Bad and The Ugly: The First 10 Years of the Oregon Water Trust](#). Janet Neuman, Nebraska Law Review, 2004

Similar Flow Augmentation Programs in other locations include:

[Manastash Creek](#), Washington (Also [here](#).)

Colorado River Delta Minute 319 - 2012

Background: A 1944 US-Mexico treaty determined the amount of Colorado River water that the United States must deliver to Mexico each year. That agreement provided water for consumptive use in Mexico, but left the Colorado River dry from the US-Mexico border to the Sea of Cortez. Minute 319, a 2012 amendment to the treaty, included several important water management provisions, including the first-ever dedication of a block of Colorado River water to the river south of the border in the form of a pilot river restoration project.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- The goal of the pilot project was to provide “environmental benefits on a temporary basis” to improve understanding of water management alternatives for ecosystem restoration along the Colorado River from the border to the Sea of Cortez.
- The project inundated 4,000 acres of river channel and riparian land, and 70 miles of river, reconnecting the river with its estuary for the first time since 1997. Prior to the project, the Colorado River had not reached the sea on a continuous basis since the 1960s, following the construction of dams upstream.
- The project included riparian habitat restoration efforts, as well as environmental flows. It showed that environmental improvements are possible, even with a limited amount of water.

Program Term

- The pilot project provided environmental flows from March 23 to May 18, 2014, to simulate a spring flood.

Water Volume and Source

- The agreement generated 158,088 AF of environmental water, of which 105,000 AF of water was used for a one-time pulse flow.
- 50% of the pulse flow was generated by canal lining and repair projects, which were implemented using the funding provided by the agreement.

Accountability

- Monitoring of the pilot project revealed encouraging but mixed results.
 - There was more groundwater infiltration than expected, resulting in a smaller area of inundation and riparian plant germination than expected.
 - Although the pilot project led to successful germination of riparian vegetation, such as willows, the lack of sustained streamflow meant that many of those seedlings did not survive.
 - Limited groundwater data meant that the fate of the infiltrated water is not clear. In particular, it is not clear how much of that water was recaptured by groundwater pumping.
 - Less than 1% of the pulse flow reached the sea. Yet the restoration project led to increased recreation and a large amount of media and public attention.

Funding

- The US provided \$21 million for infrastructure and environmental projects under the agreement.
- The agreement called for subsequent negotiations between both nations to determine how the two nations would allocate the cost of the \$700,000 needed for riparian restoration.

Governance

- The plans for implementing, accounting for and evaluating the environmental flow requirements in the agreement were developed through a binational Consultative Council and Environmental Work Group. The effort included participation by US and Mexican environmental NGOs.
- A binational team monitored instream flow, stream topography, salinity, groundwater, vegetation, birds, and aquatic species.

Implementation Challenges

- Dedicating a block of water to the Colorado River environment is difficult because the river's water is overallocated as a result of the 1922 Colorado River Compact and the US-Mexico treaty.
- Addressing the needs of the Colorado River Delta is also made more difficult because most of the Colorado's water is consumed in the US, while the dry portion of the Colorado is in Mexico. Because of this fact, a binational agreement and extensive cross border collaboration was required even for a relatively modest pilot project.
- Prior to the pilot project, it was not known how the river ecosystem would respond, or how much water would be lost to groundwater infiltration.
- To date, there has been no subsequent project to restore Colorado River flows to its delta. Reaching agreement on a subsequent binational environmental flow project may be more difficult now that the Colorado River has entered what may be a sustained and possibly increasing era of shortages that will require consumptive use of the river's water to be reduced.

Sources

[Minute 319](#), November 20, 2012

[Minute 319 Fact Sheet](#), International Boundary and Water Commission, 2012

[Sharing the Colorado River and the Rio Grande: Cooperation and Conflict](#), Congressional Research Service, December 12, 2018

[Water budget for agricultural and aquatic ecosystems in the delta of the Colorado River, Mexico: Implications for obtaining water for the environment](#), *Ecological Engineering*, October 2013

[Historic "Pulse Flow" Brings Water to Parched Colorado River Delta](#), *National Geographic*, March 24, 2014

[Bringing the River Back to the Sea](#), Environmental Defense Fund

[Water to Flow in Colorado River Delta Again](#), Audubon Society, September 4, 2019

[Leveraging Environmental Flows to Reform Water Management Policy: Lessons Learned from the 2014 Colorado River Delta Pulse Flow](#), *Ecological Engineering*, September 2017

Australian Environmental Water Program - 2007

Background: Most of Australia is a very dry landscape and extensive human water use has caused serious impacts to river and wetland ecosystems. To address these impacts, the Australian government has created an ambitious environmental water program. This discussion focuses on the Murray Darling Basin, because that large basin in Southeast Australia represents one seventh of the continent's land mass, includes Australia's longest River (the Murray) and supports 40% of the nation's agricultural production.

Key Features, Highlights and Challenges

Environmental Goals and Geographic Scope

- The Australian program includes water entitlements in 17 watersheds across the nation that are managed flexibly to protect and restore rivers and wetlands. First Nations' environmental and cultural objectives are also considered in the use of this water.

Water Volume and Source

- As of October 2021, the Commonwealth's environmental water holdings total 2.3 million AF (MAF) of registered entitlements with a long-term average annual yield of 1.6 MAF.
- In the Murray-Darling Basin, environmental water represents approximately 15% of managed water, excluding flood flows. Average annual runoff in the basin is 19.3 MAF.
- Environmental water is secured through purchases and investments in improving the efficiency of water infrastructure. Availability varies by year type and environmental water is subject to the allocation/shortage and related rules that apply to other water users.

Accounting and Baseline

- Environmental water may be traded, sold or carried over into a subsequent year.

Funding

- Total cost for the Murray-Darling Basin Plan, which includes multiple elements, is US\$9 billion. Funding is provided by the Commonwealth of Australia.
- Total cost of Murray-Darling Basin surface water purchases for the environment from 2008 to 2020 was US\$2 billion. Groundwater purchases for the environment cost US\$51 million.

Governance

- Several entities hold environmental water in the Murray-Darling Basin. The Environmental Water Holder is an agency under the Australian government responsible for holding and managing environmental water. In the Murray-Darling Basin, the Environmental Water Holder was created by statute in 2007. Environmental water is also held by the Murray Darling Basin Authority, as well as by state agencies including the New South Wales Office of Environment and Heritage, the Victoria Environmental Water Holder, and the South Australia Department of Environment, Water and Natural Resources.

Implementation Challenges

- Providing water for the environment has been a challenge because water resources have been overallocated in many basins. In addition, there is tremendous year to year variation in precipitation in Australia, including record drought in recent years. These factors both increase environmental damage and increase competition for limited water supplies.

- Conveyance agreements with private landowners are required for environmental water to reach targeted ecosystems. An analysis in 2020 concluded that only 2 percent of all the wetlands throughout the Murray-Darling basin that could be inundated with environmental water controlled by the Federal Government actually received water each year. The analysis found that thousands of conveyance agreements have not been reached and that environmental water is being blocked by towns and private farms from reaching targeted ecosystems.
- Some environmental water has been captured by agricultural operations, rather than being used for the environment.

Sources

[Intergovernmental Agreement on Implementing Water Reform in the Murray-Darling Basin](#),

Revised 2019

[Australian environmental water program](#), Commonwealth Environmental Water Office (CEWO)

[Water from Murray-Darling Basin plan not being delivered to wetlands](#), ABC News, November 30, 2020

[Australian environmental water holdings](#), CEWO

[Managing the environmental water portfolio](#), CEWO

[2020-2021 Murray-Darling planning overview](#), CEWO

[Pocket Guide to water for the environment](#), CEWO

[Water purchasing in the Murray-Darling basin](#), CEWO

[Who is Managing our Environmental Water](#), Erin O'Donnell, *Australian Environmental Review*, Jan. 2013

[Taxpayer-purchased water intended for rivers harvested by irrigators](#), ABC, July 25, 2017

[Murray-Darling Basin Water Resources Fact Sheet](#), Murray-Darling Basin Commission, July 2006

[Water for the Environment](#), South Australia

[Murray-Darling Basin Environmental Water Holders Report 2013](#)

[History and Context of Managing Water for the Environment](#), New South Wales, June 13, 2019

Sources

Most of the sources for this document are listed in the examples above. However, this section contains additional resources, many of which address an environmental block of water in more general terms. Many of the sources below discuss the potential for an environmental block of water in the Bay-Delta watershed. However, Bay-Delta “voluntary agreement” discussions have not yet produced a clear, comprehensive proposed approach. As a result, they are not included as an example in the previous section.

California Department of Water Resources

[Comprehensive Water Budget. A Story of Innovations for Water Accounting](#)

California Resources Agency

[Memorandum of Understanding Advancing a Term Sheet for the Voluntary Agreements to Update and Implement the Bay-Delta Water Quality Control Plan, and Other Related Actions](#), March 2022

California State Water Resources Control Board

[Bay-Delta Water Quality Control Plan, Phase 1 Response to Comments](#), 2018 (Pg. 2)

Maven’s Notebook

[Ecosystem Water Budgets: A Novel Approach to Managing Water for the Environment](#), 2019

Northern California Water Association

[Reimagining our Water System: Ecosystem Water Budgets](#), 2019

Point Blue

[Managing California’s Freshwater Ecosystems: Lessons from the 2012-2016 Drought](#), 2017

Public Policy Institute of California

[A Path Forward for California’s Freshwater Ecosystems](#), 2019

[A Path Forward for California’s Freshwater Ecosystems, Technical Appendices](#), 2019

[Setting Aside Environmental Water for the San Joaquin River](#), 2020

[A Water Budget for the Environment](#), 2018

[Reforming Water Management for the Environment](#), 2017

[A New Approach to Accounting for Environmental Water](#), 2017

[California’s Environment Needs a Water Budget](#), 2015

[Managing California’s Freshwater Ecosystems](#), 2017

[Making the Most of Water for the Environment](#), 2020

[Policy Brief: Tracking Where Water Goes in a Changing Sacramento-San Joaquin Delta](#), May 2022

San Francisco Estuary and Watershed Science

[Water Budgets for the Delta Watershed: Putting Together the Many Disparate Pieces](#), 2019

University of California at Davis, California WaterBlog

[A Water Right for the Environment](#), 2017

Water Deeply

[A Water Right for the Environment](#), 2017