



**PPIC**

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# A Path Forward for California's Freshwater Ecosystems

## Technical Appendices

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# Appendix A. A Legal Analysis of Ecosystem-Based Management and Recommendations for Reform

Water quality regulation and fisheries protection traditionally have focused on individual stressors, individual beneficial uses, and individual species. Although the standards and operational constraints that derive from these policies often overlap, they do not apply in an integrated manner that recognizes hydrological, biological, and chemical relationships that exist within aquatic ecosystems. Nor do they account for conflicts and tensions that may arise when regulations designed to protect one aquatic species may differ from those focused on another.

The main report proposes a new management strategy that would facilitate integrated and holistic management of California’s freshwater resources based on ecosystem structure and function.

In this appendix, we analyze whether the State Water Resources Control Board and other agencies could incorporate principles of ecosystem-based management into their regulatory policies and apply those principles consistent with existing law. We conclude that they could do so.<sup>1</sup> We then propose two policy changes that would enhance the ability of regulators and water managers to implement ecosystem-based strategies. Interspersed are several brief studies of ecosystem-based management in individual watersheds. These examples demonstrate that integrated and holistic management is already occurring, even as the flexibilities in existing law may not be fully appreciated.<sup>2</sup>

## Legal Opportunities and Constraints

The principal laws that govern water quality, water rights, fish and wildlife, and other beneficial uses are consonant with ecosystem-based water management and grant regulators broad authority to decide which blend of strategies is best suited to achieve defined ecological, public health, and water supply goals. These include general laws—such as the California Porter-Cologne Act, the federal Clean Water Act, the public trust doctrine, and the reasonable use mandate of Article X, Section 2 of the California Constitution—as well as more specialized laws that govern dam operations and hydroelectric power facilities, including section 5937 of the California Fish and Game Code and the Federal Power Act. In varying degrees, each of these laws requires integrated decision making and adaptive management of dynamic freshwater ecosystems.

A few other statutes—most notably the state and federal endangered species acts—may impose some constraints. These laws are more flexible than is commonly understood, however, and they do not pose insuperable barriers to ecosystem-based management. Indeed, if the state of ecological science supports multifaceted and integrative strategies, ecosystem-based management could be the regulatory approach best-suited to the directives of these statutes.<sup>3</sup>

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<sup>1</sup> We focus on the State Water Board, because it is the primary administrator of the laws that govern freshwater ecosystems in California—viz. the state and federal water quality laws, as well as California’s water rights system. In addition, the board plays an essential role in integrating other regulatory policies into the state’s overall system of water management, including fish and wildlife protections, federal hydroelectric power licenses, and state and federal endangered species requirements. As such, the board would be *the* key player in any effort to bring ecosystem-based management strategies into California’s water policies.

<sup>2</sup> In providing this overview of the myriad ways in which the existing laws can facilitate ecosystem-based management, we do not mean to suggest that the agencies that administer these laws are actually employing ecosystem-based principles. Although there are examples of these strategies in practice today, most regulatory actions are focused on several important beneficial uses (viz. agricultural, municipal, and industrial water supplies and fish and wildlife), a few listed species, and several key stressors; and they generally do not take a broader ecological perspective. Nor do we suggest that the laws described in this appendix are perfect or are being implemented as well as they might be. We do believe, however, that the existing laws are more than adequate to the task of incorporating ecosystem-based management principles into the various regulatory strategies and that such a change can be accomplished without amending the state and federal statutes that now govern California’s water systems.

<sup>3</sup> The laws discussed in the text are, of course, not the only laws that govern California’s freshwater ecosystems; nor do they include all of the regulatory and permitting programs that may apply to the implementation of ecosystem-based strategies. We have therefore included brief descriptions of “Other Important Laws for Ecosystem-Based Management” as an Addendum.

## Water Quality and Water Rights Laws

The state and federal water quality laws would be the foundation of ecosystem-based management—just as they provide the foundation for the existing regulation and management of the state’s freshwater ecosystems. These laws grant the State Water Resources Control Board authority (acting alone or in concert with the nine Regional Water Quality Control Boards) to set water quality standards for all of California’s surface water systems and to enforce those standards through the water rights and pollutant discharge regulatory systems.

### The Porter-Cologne Act

California’s Porter-Cologne Act both implements section 303 of the federal Clean Water Act and establishes the state’s own water quality goals and implementation strategies.<sup>4</sup> The State Water Board and the regional boards have wide-ranging authority under these laws to define ecological objectives, establish priorities and implementation strategies, and regulate the principal stressors (including water diversions and discharge of pollutants).<sup>5</sup>

In *United States v. State Water Resources Control Board* (1986), a case challenging the State Water Board’s 1978 Water Quality Control Plan for the Sacramento-San Joaquin River Delta and Suisun Marsh, the California Court of Appeal explained the breadth and flexibility of these powers:

In formulating a water quality control plan, the Board is invested with wide authority “to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.” (§ 13000.)<sup>6</sup> In fulfilling its statutory imperative, the Board is required to “establish such water quality objectives...as in its judgment will ensure the reasonable protection of beneficial uses....” (§ 13241), a conceptual classification far-reaching in scope. “‘Beneficial uses’...include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.” (§ 13050(f))<sup>7</sup> Thus, in carrying out its water quality planning function, the Board possesses broad powers and responsibilities in setting water quality standards. (California Court of Appeal 1986a, emphasis added)<sup>8</sup>

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<sup>4</sup> Clean Water Act § 303(c) requires each state to adopt water quality standards that define “designated uses” of the “waters of the United States” within its boundaries, as well as the “water quality criteria for such waters based upon such uses.” These standards must “protect the public health or welfare, enhance the quality of water and serve the purposes of [the Clean Water Act].” With a breadth that is similar to the California Porter-Cologne Act described in the text, the statute directs that “standards shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes . . . .” (33 U.S.C. § 1313(c)(2)(A)) The Clean Water Act recognizes the primary authority of the states to set and implement water quality standards. These state standards are subject to review by EPA, however, to ensure that they are at least as stringent as necessary to comply with CWA requirements. EPA has authority to set its own standards if a state fails to comply with federal law. (33 U.S.C. § 1313(c)(3) & (4); 40 C.F.R. § 131.5)

<sup>5</sup> The Porter-Cologne Act applies to all waters of the state, surface and underground. In contrast, the Clean Water Act authorizes federal regulation of activities that may affect the “waters of the United States”—a jurisdictional limitation that has been expanded and contracted by administrative rulemaking and judicial interpretation. For a summary of the current state of federal law, see USEPA 2019.

<sup>6</sup> All citations are to the California Water Code.

<sup>7</sup> For a complete list of the beneficial uses recognized by the state and regional boards, see SWRCB n.d.

<sup>8</sup> The Porter-Cologne Act’s delegation of authority to the regional boards is similarly broad. It states that the factors each board shall consider in setting water quality standards that provide reasonable protection to all designated beneficial uses include, but are not necessarily limited to:

- (a) Past, present, and probable future beneficial uses of water.
- (b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.
- (c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.
- (d) Economic considerations. . . . (Water Code § 13241)

The regional boards thus have authority to consider the aggregate effects of pollution loading within a watershed, chemical and biological interactions among pollutants, the assimilation capacity of the receiving waters (as affected by other discharges and diversions), and the risks of varying levels of each pollutant to public health and safety, agricultural and commercial uses, fish and wildlife, and other beneficial uses. This type of integrative analysis is consistent with the principles of ecosystem-based management described in the main report.

The board’s discretion is not unlimited. For example, federal and state regulations generally prohibit changes to water quality criteria that would allow for diminution of water quality below existing levels.<sup>9</sup> Federal law also requires state water quality plans that designate multiple beneficial uses to contain water quality criteria that “support the most sensitive use.” (40 C.F.R. § 131.11(a)) This is an important limitation for California where most of the state’s waters supply municipal and industrial uses, provide water for irrigation, and serve as habitat for fish and wildlife.

Nevertheless, the principles of ecosystem-based management fit nicely within the contours of the existing water quality laws. These laws promote multi-benefit water management and sustainable biodiversity, and they recognize human beneficial uses in the context of overall ecological functions. In addition, the state and regional boards must review water quality criteria every three years and revise the standards as they deem appropriate to fulfill their statutory obligations. (33 U.S.C. § 1313(c)(1)) This allows for adaptive management in response to (and in anticipation of) changed conditions and new scientific information—including the actual and predicted effects of climate change.

Moreover, the state and regional boards have discretion to set water quality standards and compliance measures at a workable scale. For example, the Central Valley Basin Plans divide the valley into three main parts (the Sacramento, San Joaquin, and Tulare sub-basins). The plans set water quality standards for each sub-basin and consider interactions among them. Yet, they also address special problems (e.g., toxic drainage from west-side agriculture, salmon recovery in the San Joaquin River system, and nitrate pollution from concentrated animal feeding operations) on a regional and watershed scales. (CVRWQCB 2018a & 2018b)

The Water Quality Control Plan for the Central Coast sets general effluent limitations for individual categories of dischargers, while supplementing these with specific total maximum daily load (TMDL) limitations for individual pollutants and individual watersheds within the region. (CCRWQCB 2019) The San Francisco Bay Basin Plan focuses on water quality and beneficial uses in the bay and adjacent coastal waters. It also divides the basin into seven hydrologic planning areas, however, which allows the regional board to tailor its discharge limitations and other regulations to address specific regional problems (e.g., high salinity and poor circulation in the south bay, wetlands habitat in Suisun Marsh, and agricultural runoff affecting Tomales Bay shellfish) and to set specific TMDLs for individual stream systems. (SFBRWQCB 2017)

These flexibilities would enable ecosystem-based strategies, which depend on integrated management across landscapes and specialized regulation to address the unique characteristics of individual watersheds and sub-regions.

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<sup>9</sup> The federal regulations require that “existing instream water uses and the level of water quality necessary to support the existing uses shall be maintained and protected.” They also provide, however, that where water quality exceeds the “levels necessary to support the propagation of fish, shellfish, and wildlife and recreation, . . . the quality of water shall be maintained and protected unless the State finds that lower water quality is necessary to accommodate important economic or social development.” (40 C.F.R. § 131.12(a)) California’s anti-degradation policy declares that “water quality will be maintained unless it has been demonstrated that a change: (1) is consistent with the maximum benefit to the people of the State, (2) does not unreasonably affect present and anticipated beneficial uses of the waters, and (3) does not result in water quality less than that prescribed in the Basin Plan.” (SWRCB 1968)

## Box 1: Flexibility in Water Quality Planning and Regulation: Piru Creek

A 2009 decision illustrates how the State Water Board may exercise its discretion under the water quality laws to address an increasingly important aspect of ecosystem-based management—a conflict between the needs of individual species.

This case arose in the context of the board’s water quality certification (see below) of an application for an amendment to a license issued by the Federal Energy Regulatory Commission (FERC) for the reoperation of Pyramid Dam. Although Pyramid Reservoir serves primarily as terminal storage for the State Water Project, the dam also releases water into Piru Creek, whose waters ultimately flow to the Pacific Ocean. The creek is home to several species of fish, including rainbow trout, and amphibians. One of these species, the arroyo toad, is listed as endangered under the federal Endangered Species Act.

The proposed amendment reduced instream flows during times when those flows exceeded natural levels to prevent harm to prevent flooding of the arroyo toad’s breeding pools. The reduction in flows was opposed by anglers, however, because the change was likely to detrimental to the rainbow trout—a popular sport fish. The board approved the amendment, reasoning:

“Piru Creek is designated for multiple uses, including habitat for fish and habitat for endangered toads . . . To the extent the scientific evidence indicates that these uses require conflicting parameters, the State Water Board should adopt certification conditions that protect the species that are more vulnerable to harm from changes in flow or other water quality conditions.

“Changing flows to protect the arroyo toad may have a detrimental effect on trout, but this must be weighed against the harm that would be caused to the arroyo toad by maintaining flows for trout. Assuming that we must choose between the two species, the proper course is to protect the more sensitive native endangered toad rather than the non-endangered trout.”

After explaining that this was consistent with anti-degradation policies, the board concluded:

“Environmental protection may constitute important social development, justifying a change in water quality, even if no other social or economic benefits to the community are demonstrated. It would be inconsistent with the policies of the Clean Water Act and the Porter-Cologne Water Quality Control Act if economic concerns could warrant reductions in water quality, but conflicting water quality concerns could not.

“Where there are two conflicting uses, the quality of water for one use may be reduced where the change improves water quality for the other, in appropriate circumstances. . . . Absent the ability to balance conflicting uses in this way, it would be difficult to synthesize the requirements for Clean Water Act water quality standards.” (SWRCB 2009)

The Piru Creek case confirms the board’s broad and nuanced authority to set water quality standards that encompass the types of choices that arise within the context of ecosystem-based management. The board’s decision to protect the more sensitive (and legally protected) species also shows how endangered species requirements may be integrated into the broader ecological perspectives of the water quality laws.

## Water Rights Permitting and Waste Discharge Requirements

The primary means of implementing water quality standards is through water rights permits and licenses issued by the State Water Board and waste discharge requirements (i.e., pollutant discharge permits) granted by the regional boards. As described in the next section, the board also has significant authority under the public trust and reasonable use doctrines to ensure that other water users also comply with applicable water quality standards.

## Water Rights Permits and Licenses

The state board has permitting and licensing jurisdiction over appropriations of surface water that were commenced after December 14, 1914 (the effective date of the Water Commission Act).<sup>10</sup> Pursuant to this authority, the board has issued permits and licenses to California’s largest water projects—including the State Water Project and the federal Central Valley Project—and to a panoply of other facilities that supply water to municipal, industrial, and agricultural users throughout the state. (Littleworth and Garner 2019)<sup>11</sup>

The board’s permitting and licensing powers are broad and multifaceted. The legislature has directed the board to “allow the appropriation for beneficial purposes of unappropriated water under such terms and conditions as in its judgment will best develop, conserve, and utilize in the public interest the water sought to be appropriated.” (Water Code § 1253) In making this public interest determination, the board must “consider the relative benefit to be derived from...all beneficial uses of the water concerned including, but not limited to, use for domestic, irrigation, municipal, industrial, preservation and enhancement of fish and wildlife, recreational, mining and power purposes, and any uses specified to be protected in any relevant water quality control plan.” (Water Code § 1257) The board’s water rights powers are thus directly linked to its water quality jurisdiction. Moreover, the scope of those powers to weigh and accommodate the various beneficial uses is as capacious as its water quality planning authority.<sup>12</sup>

Based on these criteria, the board has authority to grant permits and licenses subject to “such terms and conditions as in its judgment will best develop, conserve, and utilize in the public interest, the water sought to be appropriated.” (Water Code § 1257) It is common for these to include conditions that require appropriators to limit diversions to prevent harm to aquatic species, to release water to aid spawning and migration, and manage project operations to comply with water quality standards that protect both instream and extractive uses. (Gartrell and Gray 2017; Mount et al. 2017)

The board occasionally includes conditions requiring habitat restoration and regulation of potentially harmful land use activities as it did in modifying Los Angeles’ water rights licenses in the Mono Basin (Box 2). The board generally leaves these types of water quality implementation measures to other agencies, however, or to the permittees and licensees themselves.

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<sup>10</sup> The Water Commission Act of 1913 exempted riparian rights, pre-1914 appropriative rights, and groundwater rights from the board’s permitting and licensing jurisdiction. (Littleworth and Garner 2019) Although there is no hydrologic justification for these exemptions—and the exclusion of these water rights from the board’s permitting jurisdiction has caused a variety of problems with its supervision of California’s water resources systems—the statutory exemptions exist to this day. (Gray et al. 2015; Mount et al 2017)

<sup>11</sup> Federal law recognizes the board’s authority to require permits for the operation of federal water projects. Section 3406(b) of the Central Valley Project Improvement Act requires the Bureau of Reclamation to operate the CVP “to meet all obligations under state and federal law, including but not limited to . . . all decisions of the California State Water Resources Control Board establishing conditions on applicable licenses and permits for the project.” Other federal reclamation projects must comply with the terms of water rights permits and licenses granted by the State Water Board unless compliance with a specific term or condition on project operations would conflict with an express congressional directive. (U.S. Supreme Court 1978)

<sup>12</sup> The legislature has instructed the board to “be guided by the policy that domestic use is the highest use and irrigation is the next highest use of water” when acting on applications to appropriate water.” (Water Code § 1254) The courts have noted, however, that “[n]onconsumptive or ‘instream uses,’ too, are expressly included within the category of beneficial uses to be protected in the public interest.” (California Court of Appeal 1986a) For example, the legislature also has directed the board to “take into account, whenever it is in the public interest, the amounts of water needed to remain in the source for protection of beneficial uses, including any uses specified to be protected in any relevant water quality control plan.” (Water Code § 1243.5) These beneficial uses include “preservation and enhancement of fish and wildlife resources.” (Water Code § 1243(a)) The California Supreme Court has held that neither instream uses nor extractive uses “can claim an absolute priority.” (California Supreme Court 1983)

## Waste Discharge Requirements

The waste discharge requirement (WDR) system is the primary means by which the state regulates the entry of pollutants into California's waters.<sup>13</sup> In contrast to the water rights permitting system, the nine regional boards have principal authority to issue WDRs, while the state board plays a supervisory role.<sup>14</sup> When granting WDRs, the regional boards must ensure that all discharges are consistent with applicable water quality standards and do not unreasonably affect designated beneficial uses. (Water Code § 13263(a)) WDRs also must comply with federal and state anti-degradation policies.

The regional boards typically include terms and conditions in each WDR to ensure compliance with these requirements, including limitations on the volume, timing, and location of discharge. The boards also have authority to require changes in land and water management to reduce the volume of pollutants entering the waters of the state. For example, the Central Valley Regional Board has ordered commercial dairies to construct wastewater retention ponds to contain polluted runoff, install drains in barns and production facilities to direct wastewater into these ponds and to alter waste fertilization practices to ensure that neither groundwater nor crops grown for human consumption are contaminated. (CVRWQCB 2013)

Consistent with principles of adaptive management, the Porter-Cologne Act stipulates that “discharges of waste into waters of the state are privileges, not rights,” and that the discharge of waste—whether made pursuant to a WDR or otherwise—shall not “create a vested right to continue the discharge.” (Water Code § 13263(g)) This expressly reserves the boards' authority to apply principles of adaptive management and to alter discharge limitations as needed to address changing water quality conditions.

## The Public Trust and Reasonable Use Doctrines

California's authority to implement ecosystem-based management of its freshwater systems is augmented by two other important laws: the common law public trust doctrine and the reasonable use mandate of Article X, Section 2 of the California Constitution. These laws also recognize the dynamic nature of aquatic ecosystems and emphasize the state's responsibility to update management and regulatory decisions in response to changing hydrological and ecological conditions.

### The Public Trust Doctrine

The public trust doctrine derives from English and American common law. Traditionally, the public trust protected certain public uses of navigable waters—including water-based commerce, navigation, and fishing. In two 20th century decisions, however, the California Supreme Court broadened the scope of the trust to include recreational uses and protection of ecological functions.

In *Marks v. Whitney* (1971), the court declared that the public trust doctrine is “sufficiently flexible to encompass changing public needs,” and it recognized fishing, hunting, swimming, boating, and other recreational activities as public trust uses. The court also defined the doctrine to include preservation of trust resources “so that they may serve as ecological units for scientific study...and as environments which provide food and habitat for birds and marine life and...favorably affect the scenery and climate of the area.”

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<sup>13</sup> The WDR program includes authority to implement the federal NPDES permitting program that governs discharges of pollutants from “point sources” (such as industrial facilities, municipal sewage treatment plants, and other conduits) to the waters of the United States. For point source discharges to these waters, the state and regional boards have authority to issue combined WDR/NPDES permits. (SWRCB 2019b)

The WDR program also applies to discharges from “non-point sources,” including agricultural drainage and return flows—although most drainage from irrigated lands is governed by general discharge standards, rather than individual permits. These “waivers” are part of a broader Irrigated Lands Regulatory Program. (SWRCB 2019a)

<sup>14</sup> Although the state board has directly issued some WDRs, the vast majority are granted by the nine regional boards. On petition by the permittee, the state board has jurisdiction to review a WDR issued by a regional board. The state board also has authority to resolve conflicts between WDRs promulgated by different regional boards. (Water Code § 13320)

The court then applied these principles in *National Audubon Society v. Superior Court* (1983) to affirm the state’s authority to limit diversions from tributary streams to protect the ecological integrity and other public trust uses in Mono Lake. It held that the state—acting through the State Water Board, the courts, and other agencies—“has an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible.” (California Supreme Court 1983)

The California courts also have recognized that the doctrine applies to activities that may affect public trust uses of navigable waters, but which are not themselves in or on a navigable river or lake. For example, in *Audubon*, the Supreme Court held that diversions from non-navigable streams could be limited to the extent that they adversely affect public trust uses in downstream navigable waters. (California Supreme Court 1983). In a more recent decision, *Environmental Law Foundation v. State Water Resources Control Board* (2018), the court of appeal ruled that the doctrine may limit the extraction of groundwater that harms public trust uses in hydrologically connected surface water systems. (California Court of Appeal 2018)

The modern public trust doctrine is wholly consonant with the principles of ecosystem-based management. In its *Audubon* decision, for example, the Supreme Court described the state’s responsibility to implement the public trust in terms that recognize the integrated and dynamic nature of aquatic ecosystems, as well as uncertainties that are inherent in the understanding and administration of aquatic ecosystems.<sup>15</sup> It held that the “state as sovereign retains continuing supervisory control over its navigable waters and the lands beneath those waters. This principle, fundamental to the concept of the public trust. . . . prevents any party from acquiring a vested right to appropriate water in a manner harmful to the interests protected by the public trust.” The court also declared that, “in exercising its sovereign power to allocate water resources in the public interest, the state is not confined by past allocation decisions which may be incorrect in light of current knowledge or inconsistent with current needs. (California Supreme Court 1983)

### **The Reasonable Use Doctrine**

The California Supreme Court also held in *Audubon* that “[a]ll uses of water, including public trust uses, must now conform to the standard of reasonable use” set forth in Article X, Section 2 of the California Constitution. (California Supreme Court 1983) This important mandate governs the exercise of all water rights—including riparian rights, pre-1914 appropriative rights, and groundwater rights exempted from the State Water Board’s permitting and licensing jurisdiction. (California Supreme Court 2000; California Court of Appeal 1986b and 2014)

Article X, Section 2 declares that, “because of the conditions prevailing in this State, the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare.”

These directives are the foundation of California water resources law, and the courts’ interpretation of the reasonable use mandate reinforces the broad and flexible authority of the State Water Board to set and enforce ecosystem-based water quality standards. Four important themes run through their opinions:

First, effectuation and enforcement of the reasonable use doctrine must be based on a comprehensive assessment of water use—including ecological uses—rather than focusing narrowly on the water rights and water uses at issue in the litigation before the court. In *City of Barstow v. Mojave Water Agency* (2000), for example, the Supreme Court reiterated that determination of ““what is a reasonable use of water depends on the circumstances

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<sup>15</sup> The decision arose from the Mono Lake litigation described below in Box 2.

of each case, [and] such an inquiry cannot be resolved *in vacuo* from statewide considerations of transcendent importance.” (California Supreme Court 2000)

Second, the goals of the reasonable use directive include efficient use and efficient allocation of available water to serve multiple competing uses—including instream uses and reliable water supply. Thus, in *Environmental Defense Fund v. East Bay MUD* (1980), the Supreme Court’s recognition of the reasonable use doctrine to protect instream flows led to a “physical solution” that allowed water to be diverted for municipal water supplies, but under a flow and release schedule that provided water for water quality, fish, and recreational uses downstream. (California Superior Court 1990)

Third, all water rights must be exercised consistent with contemporary standards of reasonable use, which may change as hydrologic and other conditions change. In *United States v. SWRCB* (1986), for example, the court of appeal explained that the State Water Board had “determined that *changed circumstances revealed in new information about the adverse effects of the projects upon the Delta necessitated revised water quality standards*. Accordingly, the Board had the authority to modify the projects’ permits to curtail their use of water on the ground that the projects’ use and diversion of the water *had become unreasonable*.” (California Court of Appeal 1986a, emphasis added)

Fourth, the board’s authority under the reasonable use doctrine to set ecological objectives and to determine the appropriate strategies to protect the various beneficial uses of California’s water resources is as broad as its water quality authority. As Justice Racanelli explained in the Bay-Delta cases:

Obviously, some accommodation must be reached concerning the major public interests at stake: the quality of valuable water resources and transport of adequate supplies for needs southward. *The decision is essentially a policy judgment requiring a balancing of the competing public interests, one the Board is uniquely qualified to make in view of its special knowledge and expertise and its combined statewide responsibility to allocate the rights to, and to control the quality of, state water resources.* (California Court of Appeal 1986a, emphasis added)

## **Water Quality and Water Rights Laws: Conclusion**

The water quality and water rights laws vest abundant authority in the State Water Board and regional boards to adopt an integrated, comprehensive, and multi-benefit approach when they create or revise water quality standards for California’s rivers and estuaries. Indeed, the text of the Porter-Cologne Act and the courts’ interpretations of the public trust and reasonable use doctrines match the rubric of multi-benefit ecosystem management more precisely than do single species- or single stressor-focused strategies. These opinions also establish that the boards have a responsibility to respond to hydrologic, ecologic, and other changes and to incorporate new scientific information into their decision making. It is for these reasons that the legislature declared in 2014 that the public trust and reasonable use doctrines “shall be the foundation of state water management policy.” (Water Code § 85023)

Moreover, the expansiveness of the boards’ authority is matched by the reach of their jurisdiction. Although the State Water Board’s permitting and licensing authority is limited by statute, the public trust and reasonable use doctrines effectively extend its regulatory jurisdiction to *all* water rights and uses of water that affect freshwater ecosystems. There are situations in which the board must engage with other agencies to achieve fully integrated ecosystem-based management—e.g., to control invasive species and to regulate land use activities that may influence down-gradient freshwater conditions. The state board’s supervisory authority over the regional boards

WDR permitting program and its ability to collaborate with other state and federal agencies can help to achieve this type of integration.<sup>16</sup>

## Special Laws that Apply to Waters Affected by Dam Operations

Although the state and regional boards would have principal authority to adopt and implement ecosystem-based management strategies, several other laws may affect the boards' jurisdiction—at least on some river systems. The most important of these are section 5937 of the California Fish and Game Code—which directs dam owners to bypass or release water to protect fish downstream—and the Federal Power Act—which requires generators of hydroelectric power to comply with licenses issued by the Federal Energy Regulatory Commission (FERC).

These constraints apply directly to water project operators, rather than to the State Water Board. The board must account for the operational restrictions, however, because dams alter the volume and flow of water in California's river systems and therefore affect other beneficial uses of those waters. In addition, the terms of FERC licenses often include their own water quality, flow, and discharge requirements that must be harmonized with the state and regional boards' water quality plans and implementing decisions.

### California Fish and Game Code § 5937

Section 5937 of the California Fish and Game Code declares that dam owners “shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam.” The state and federal courts have held that section 5937 requires the dam owner to “release sufficient water...to reestablish and maintain the fisheries which existed in [the river] prior to its diversion of water.” (California Court of Appeal 1990 [Mono Lake Tributaries]; U.S. District Court 2004 [San Joaquin River]) Other cases have adopted a broader view of the “good condition” standard based on the recognition that the historic fishery may be impossible to replicate and that the contemporary ecosystem may support a variety of native and non-native species. (Bork et al. 2012)<sup>17</sup>

Section 5937 creates a more focused regulatory mandate than those set forth in the water quality statutes, and it establishes a priority for protection of fish and their habitat. As the court of appeal has explained, “the function of balancing of the public interest between contending uses ordinarily performed by the Water Board is not applicable because the balancing has already been accomplished by the Legislature” in its enactment of section 5937. (California Court of Appeal 1990)<sup>18</sup>

This statutory shift toward one beneficial use—viz. fish—is nevertheless consistent with the broader principles of ecosystem-based management. Although section 5937 began as a stand-alone statute,<sup>19</sup> the contemporary law is a component of the California Department of Fish and Wildlife's overall stewardship responsibilities. These include a 2013 legislative directive that the department “use ecosystem-based management informed by credible science

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<sup>16</sup> As described in more detail in the concluding section, the state board also can make better use of its authority require habitat improvements and protection as part of its water rights administration and to expand its water quality regulation to include endangered species standards.

<sup>17</sup> The California Department of Fish and Wildlife and the courts have concurrent authority to enforce section 5937. The State Water Board also has authority to consider section 5937 in its water quality and water rights decision making, and it must ensure that all water right holders—including those that are exempt from its permitting and licensing authority—comply with the statutory mandates. (SWRCB 1995) In addition, the legislature has directed the board to include conditions in all water rights permits or licenses in Mono and Inyo Counties to ensure “full compliance with” section 5937. (Water Code § 5946)

<sup>18</sup> Indeed, in a 1995 order that required the Big Bear Municipal Water District to release water from Bear Dam and Big Bear Reservoir to support the downstream fishery, the board concluded that section 5937 must be applied consistent the flexible principles of reasonable use. After noting the court of appeal's holding that section 5937 is a legislative expression of the public trust, the board concluded that the statute “legislatively establishes that it is reasonable to release enough water below any dam to keep fish that exist below the dam in good condition.” It noted, however, that “[a] release of water that is much in excess of the amount needed to keep the fish in good condition . . . could be unreasonable within the meaning of California Constitution Article X, section 2 if there would be adverse effects on other beneficial uses of the water.” (SWRCB 1995)

<sup>19</sup> The antecedents of section 5937 date back to the earliest days of statehood. A series of statutes enacted between 1852 and 1915 (when the legislature adopted the modern version of the law) created civil and criminal penalties for obstructing fish passage. (Bork et al. 2012)

in all resource management decisions to the extent feasible.” (Fish and Game Code § 703.3) Consonant with the principles set forth in the main report, the legislature has defined ecosystem-based management as “an environmental management approach relying on credible science...that recognizes the full array of interactions within an ecosystem, including humans, rather than considering single issues, species, or ecosystem services in isolation.” (Fish and Game Code § 43)

Section 5937’s requirement to maintain fish in good condition must be interpreted in the context of this directive to employ ecosystem-based science. On those rivers to which the statute applies, neither the state nor local water managers can ignore or minimize the fisheries needs in favor of other beneficial uses. The State Water Board (in consultation with CDFW) has broad power, however, to decide how best to restore and protect the various fish species, and it may employ multi-benefit analysis to make this determination.

## Box 2: Ecosystem-Based Management in Practice: The Mono Lake Case

The Mono Lake case illustrates the State Water Board's use of section 5937—in combination with the public trust, the reasonable use doctrine, and its general water rights powers—to facilitate integrated management of water and lands for the benefit of multiple species and multiple beneficial uses.

The litigation began when the National Audubon Society and other environmental organizations challenged Los Angeles' diversions from four of the five tributary streams that supply Mono Lake with freshwater. Although the lake itself is highly saline and alkaline, its waters support brine shrimp, a variety of migratory waterfowl and shorebirds, terrestrial wildlife, and recreational uses. Flows from the tributaries maintain both the water quality and surface area of the lake. They also support the trout that inhabit the tributary streams themselves. The plaintiffs alleged that the city's diversions jeopardized the public trust resources of Mono Lake. (California Supreme Court 1983)

As noted above, in *National Audubon Society v. Superior Court* (1983), the California Supreme Court held that the public trust doctrine is an integral part of California's water rights law and that Los Angeles and the State Water Board must protect the public trust uses of Mono Lake to the extent feasible. On remand, the trial court stayed the litigation pending completion of administrative proceedings by the board. Following extensive hearings, the board amended Los Angeles' water rights permits to protect the beneficial uses of the waters of the Mono Lake ecosystem and to comply with the directives of the public trust, Article X, Section 2, and section 5937.

In its water rights decision, the board considered the entirety of the Mono Lake ecosystem, including the effects of Los Angeles's diversions on the brine shrimp that inhabit the lake, the trout fishery in the tributary streams, migratory birds and local waterfowl, terrestrial species that depend on the wetlands and riparian areas within the ecosystem, air and water quality, recreational boating and swimming, access to the lake, and aesthetics. The board also considered the human element associated with Los Angeles' needs for water for municipal and industrial supply, including alternatives to the Mono Basin sources. (SWRCB 1994)

Based on this analysis, the board set ecological objectives for the lake and its tributary streams and limited Los Angeles's diversions to levels that both would accomplish these objectives over time and would be feasible for the city to comply with—given conservation, efficiency, and alternative sources of supply. The order required Los Angeles to provide stream flows in the tributary streams to support the historic trout fishery and to restore and maintain the level of Mono Lake at 6,931 feet above sea level. It also directed the city to make structural habitat improvements to the streambeds (including placement of gravel to aid spawning), to restore wetlands and riparian areas for shorebirds and other wildlife, and to limit the grazing of cattle in riparian corridors to protect trout habitat. (SWRCB 1994, 1998)

The Mono Lake decision (and subsequent settlement) incorporated all of the important principles of ecosystem-based management. It provided flows to improve ecosystem function and connecting these flows to habitat improvements. It also addressed ecological functions at a watershed scale, linking flow standards in the tributaries to water quality objectives in the lake. And it recognized the human factor of municipal water supply requirements. The case stands as a blueprint for ecosystem-based management.

## The Federal Power Act and FERC Licensing

The Federal Power Act requires the owners of dams and other facilities that generate hydroelectric power to obtain a license from the Federal Energy Regulatory Commission (FERC). These licenses contain a variety of conditions, including approval of design and construction, limitations on the volume and timing of diversions and return flows, operational standards for flood control, and regulation of the transmission of electricity produced by the project.<sup>20</sup>

A number of California's important river systems—including the Feather, Yuba, Mokelumne, Tuolumne, and Ventura—are governed in part by dam and reservoir operation conditions set forth in their FERC licenses. Although the grant and renewal of these licenses require an additional layer of regulatory review, the FERC licensing process nonetheless can provide a forum for implementation of ecosystem-based water management.<sup>21</sup>

The Federal Power Act requires FERC to give “equal consideration” to power production, energy conservation, “protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.” (16 U.S.C. § 797(e)) This is an explicit directive to the commission to employ an ecosystem-based perspective when placing conditions on hydroelectric projects within its jurisdiction.

The Federal Power Act vests exclusive authority in FERC to issue the operating license. Yet, federal law also grants the State Water Board significant authority to impose its own water quality requirements on FERC-licensed projects. The board thus retains substantial power to ensure that federally licensed projects operate in a manner that fulfills comprehensive and integrated state management policies for the river system.

Section 401(a) of the federal Clean Water Act requires applicants for federal permits and licenses—including FERC licenses—to obtain state certification that the licensee will comply CWA § 303 (including state water quality and flow standards). Section 401(d) then makes these water quality and flow standards conditions of the federal license. (33 U.S.C. § 313(a) & (d)); U.S. Supreme Court 2006) Thus, if the State Water Board were to adopt water quality standards (or other project-specific requirements) that incorporate ecosystem-based management principles, these conditions would be included in the FERC license and would be binding on the federal licensee.

The state certification process is not a perfect substitute for direct application of California's water quality standards (and other operational requirements) to FERC-licensed projects. The Federal Power Act authorizes the commission to grant licenses for up to 50 years. (16 U.S.C. § 797(e)) The State Water Board's opportunity to impose its own water quality requirements on the licensee exists only at the licensing (or relicensing) stage, however, and federal law does not provide an opportunity for recertification if hydrologic, ecologic, or other conditions change. Thus, unless amended by FERC, the terms of the federal license (including the conditions set forth in the state's § 401 certification) are fixed throughout its term. (U.S. Supreme Court 1990)

California has addressed this limitation in two ways. First, section 27 of the Federal Power Act recognizes state jurisdiction to regulate the appropriation water for “irrigation, municipal or other uses.” 16 U.S.C. § 821. The courts have held that this preserves the State Water Board's authority to regulate the aspects of FERC-licensed projects that relate to irrigation, municipal, and other water supply purposes. (California Court of Appeal 1999)

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<sup>20</sup> Federal dams and hydroelectric power facilities are exempt from FERC licensing, except where a third party seeks to use the facility for its own power production. (16 U.S.C. § 797(e))

<sup>21</sup> Although FERC issues licenses in its regulatory capacity, most FERC licensing proceedings are comprised of elaborate and lengthy negotiations among the commission, the license applicant, the State Water Board, the state and federal fish agencies, other water users, environmental NGOs, affected counties, Native American communities, and other interested parties. The operating conditions and flow requirements set forth in the FERC license, therefore, are usually based on negotiated agreements among these parties. (Levine, Curtis and Shields 2018)

As described in Box 3, the board relied on this authority in amending the Yuba County Water Agency’s water rights to require increased stream flows to protect the lower Yuba River fishery.

Second, the board now includes in its § 401 certifications a term that authorizes it to reopen certification and to adopt revised conditions where there are significant changes in water quality standards or project operations. Conditions of certification also may include continuing oversight or adaptive management. For example, the 2016 water quality certification for a Pacific Gas and Electric Co. project on Butte Creek and the West Branch of the Feather River requires PG&E to submit plans for board approval of fish passage improvements, ramping rate schedules, reductions in thermal loading, fish and wildlife monitoring, and streamflow contingencies for extreme dry year operations. (SWRCB 2016)

The preemptive aspects of the Federal Power Act fragment the otherwise unified authority of the State Water Board. The statute’s “equal consideration” mandate of directs FERC to set ecosystem-based operational and flow standards, however, and federal law (at least indirectly) preserves the board’s broad and flexible authority to ensure that FERC licensees comply with California’s water rights and water quality laws. Full integration of regulatory authority in the State Water Board would be better. But the existing regulatory regime nonetheless affords a workable means of effectuating ecosystem-based management on those river systems that are affected by FERC-licensed hydroelectric facilities.<sup>22</sup>

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<sup>22</sup> A recent decision by the U.S. Court of Appeals for the D.C. Circuit has cast some doubt on the future efficacy of states’ § 401 certification authority. The case arose from the implementation of the 2010 Hydroelectric Settlement Agreement, which provides for the removal of a series of hydroelectric power dams on the Klamath River for the purpose of restoring salmon habitat and migratory access. The owner of the dams asked FERC to approve the transfer of its licenses to the Klamath River Renewal Corporation, which would decommission and remove the dams. The court held that FERC had unlawfully failed to find that California and Oregon had waived their certification authority for the relicensing of the existing project by delaying decision for more than the one-year period specified in § 401. The parties to the settlement had attempted to evade this requirement by having the petitioner withdraw and resubmit its request for § 401 certification before the one-year limit expired. (U.S. Court of Appeals 2019) Although this interpretation of § 401 will place severe time pressures on the State Water Board (and other state water quality agencies), it does not preclude state certification. The decision does create a strong incentive, however, for the board to have current water quality standards in place for all rivers downstream of FERC-licensed projects so that the board can quickly update and tailor the standards to the specific context of the proposed federal licensing. Whether the court’s interpretation of § 401 renders negotiated settlements in FERC licensing proceedings impossible, remains an open (and important) question.

### Box 3: State Water Quality Objectives and FERC Licensing: The Yuba River Project

The ongoing FERC licensing proceedings for the Yuba River Development Project provides a useful example of how ecosystem-based management strategies may be incorporated into the FERC license and subsequent project operations. The renewed FERC license will be based in part on the agreements set forth in the 2007 Lower Yuba River Accord, which the State Water Board incorporated into its 2008 order amending the Yuba County Water Agency's (YCWA) water rights permits for the project. (SWRCB 2008)

The order established a functional flow regime below Englebright Dam to protect five species of fish (three of which are listed as threatened under state or federal Endangered Species Acts), while also allowing municipal and irrigation water supply, hydroelectric power production, recreation, and flood control. It also included conjunctive use, water banking, and water transfer programs that provide operational flexibility for implementation of the flow requirements. In addition, to facilitate adaptive management, the order created a River Management Team with representatives from YCWA, PG&E, state and federal fish agencies, NGOs, DWR, and the Bureau of Reclamation. (SWRCB 2008)

FERC has issued a final environmental impact statement for its relicensing of the project, which includes the flow regime set forth in the Yuba Accord and the State Water Board's 2008 water rights order as part of the environmental baseline for the project. YCWA has not yet completed its environmental impact report on its relicensing application, however, and the board therefore has not issued its final § 401 certification. (FERC 2019)

The board also has anticipated that the terms of the FERC license may not adequately protect the fish and other public trust resources in the lower Yuba River over its 40-50 year term, and it therefore has reserved jurisdiction to amend the YCWA's water rights permits if changes "are necessary or appropriate in light of any changes [made by FERC] to the release, bypass, reservoir capacity, fish protection or related requirements." (SWRCB 2008) It also has reserved authority "to add to or modify the conditions of this certification... to implement any new or revised water quality objectives and implementation plans adopted [under] the Porter-Cologne Water Quality Act or section 303 of the Clean Water Act." (FERC 2009, Appendix E) According to the board, the exercise of this reserved jurisdiction would not be preempted by federal law because it would "involve modification of YCWA's water rights for irrigation and other non-hydroelectric power uses." (SWRCB 2008)

Although the Yuba Accord does not embrace all of the principles of ecosystem-based management, the Yuba Project relicensing does show how these principles may be infused into the delicate balance of federal and state regulation of rivers that contain hydroelectric power facilities within FERC's jurisdiction. To the extent that state water quality standards (and implementing water rights decisions) are ecosystem-based, they can both shape FERC's own balancing of interests and apply independently through state certification.

## The State and Federal Endangered Species Acts

The California and federal Endangered Species Acts have profoundly influenced water use and water management in California. The federal fisheries agencies—the National Marine Fisheries Service (NMFS) for anadromous fish (including salmon, steelhead, and sturgeon), and the U.S. Fish and Wildlife Service (USFWS) for pelagic fish and terrestrial species—have listed 42 fish and amphibian species as endangered or threatened.<sup>23</sup>

<sup>23</sup> The California ESA defines endangered species, threatened species, conservation, and recovery in Fish and Game Code §§ 2061, 2062, 2064.5 & 2067. The federal ESA defines these terms in 16 U.S.C. §§ 1532(3), 1532(6), 1532(20) and 1533(f).

They also have listed 76 species of birds, mammals, reptiles, and invertebrates, as well as 188 plant species, for protection under the Act. Many of these species (such as fairy shrimp, crayfish, and various grasses and flowering plants) also are dependent on the state's freshwater ecosystems. (California Biologist's Handbook 2019a) In addition, the California Department of Fish and Wildlife (CDFW) has listed 21 species of fish and 12 amphibian species as endangered or threatened, along with 54 other species of fauna and 194 flora species. (California Biologist's Handbook 2019b)<sup>24</sup> These species are located throughout California's aquatic ecosystems and across is myriad landscapes.

The state and federal fisheries agencies are the principal administrators of the endangered species acts. The agencies have authority to place terms and conditions on water project operations, development, land use, and other activities. Although the State Water Board does not have statutory responsibility for ESA policy and administration, the state and regional boards must consider ESA requirements in setting and enforcing water quality standards. Endangered and threatened species are among the beneficial uses that the state and regional boards are charged with protecting under the water quality laws. Moreover, the operational limitations set by the fisheries agencies to avoid jeopardy or unlawful takings of listed species necessarily affect the volume and flow of water and therefore must be integrated into overall ecosystem management.

This section addresses the question whether ecosystem-based management strategies could be employed consistent with the endangered species acts. The concluding section includes a recommendation that the State Water Board more explicitly incorporate endangered species standards into its general water quality planning and implementation.

The state and federal ESAs pose more difficult questions for ecosystem-based management than do the laws described in the preceding sections, because they contain more rigid directives than do the water quality, water rights, and related laws. These strictures include the "take" prohibitions of both statutes, and the "no jeopardy" and adverse habitat limitations that arise from interagency consultation requirements of the federal ESA.

The categorical species protection standards of the endangered species acts are, of course, binding on the state and federal regulators and on those whom they regulate; and all implementation and compliance decisions must comport with those statutory directives. In most circumstances, however, the policies of the state and federal ESAs could be implemented consistent with the principles of ecosystem-based management.

### **Take, Jeopardy, and Critical Habitat**

The purposes of the state and federal Endangered Species Acts are to conserve and recover species that are at risk of extinction or that are likely to become at risk in the near future unless corrective actions are taken. Both statutes also expressly emphasize the need to restore and protect the habitat on which endangered and threatened species depend for their survival and propagation.

The California ESA declares that "it is the policy of the state to conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat and...consistent with conserving the species, to acquire lands for habitat for these species." (Fish and Game Code § 2052) Similarly, the federal ESA states that

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<sup>24</sup> Sixteen of the 19 state-listed fish species, and 5 of the 12 state-listed amphibians, are also listed under the federal ESA. (California Biologist's Handbook 2019a and 2019b) State and federal law also recognizes that there are species that do not yet qualify for listing (or which have not been listed) whose populations and habitat should be closely monitored. These are known as "candidate species" and "species of special concern" under the California ESA and "candidate species" and "species of concern" under the federal act. (Fish and Game Code § 2068; California Biologist's Handbook 2019c; USFWS 2017a; NOAA Fisheries 2011) CDFW has designated 58 species of fishes, 21 species of amphibians, and 170 other animal species as species of special concern. (California Biologist's Handbook 2019c)

the purposes of the statute are “to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.” (16 U.S.C. § 1531(b))

In furtherance of these goals, both the state and federal ESAs prohibit the unauthorized “taking” of any protected species. (Fish and Game Code § 2080; 16 U.S.C. § 1538(a)(1)(b))<sup>25</sup> In addition, section 7 of the federal statute requires federal agencies, such as the Bureau of Reclamation, to engage in an “interagency consultation” to ensure that their actions are not likely to jeopardize the continued existence of any listed species or adversely modify their critical habitat. (16 U.S.C. § 1536(a)(2)) These consultations culminate in the issuance of a “biological opinion” in which the USFWS or NMFS describes the terms and conditions pursuant to which the project must operate to avoid violation of the no jeopardy/adverse modification prohibition and to minimize the effects of project operations on listed species. (16 U.S.C. § 1536(b)(3))<sup>26</sup>

Both the state and federal ESAs allow for the “incidental taking” of listed species subject to criteria designed to ensure that the authorized takings do not violate the paramount statutory purposes of conserving and recovering the species. Thus, the USFWS and NMFS may include “incidental take statements” in their biological opinions. These statements typically place a numeric limit on the protected species that may be taken as a result of project operations. NMFS and the USFWS may not grant incidental take authorization, however, if such takings would be likely to jeopardize the continued existence of the protected species or adversely modify its critical habitat. (16 U.S.C. § 1536(b)(4))

Non-federal actors may qualify for “incidental take permits.” The California ESA authorizes incidental take only if the activity would not “jeopardize the continued existence of the species.” It also stipulates that the impacts of the authorized take must be “minimized and fully mitigated.” (Fish and Game Code § 2081(b) & (c))<sup>27</sup> The federal statute requires those who receive incidental take permits to prepare habitat conservation plans (HCPs) that will ensure that the authorized taking “will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.” The plans also must, “to the maximum extent practicable, minimize and mitigate the impacts of [the incidental take].” (16 U.S.C. § 1539(a)(2))

On many of California’s important river systems, the consultation, critical habitat, and take requirements of the state and federal ESAs have significantly altered the ways in which water projects are operated and water is allocated. (Mount et al. 2017) This is especially true in the Sacramento-San Joaquin and Delta Ecosystem, where the biological opinions that govern coordinated Central Valley Project and State Water Project operations have

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<sup>25</sup> Section 9(a)(1) of the federal ESA directly prohibits the taking of endangered species. (16 U.S.C. § 1538(a)(1)(b)) Section 4(d) of the statute provides that the USFWS and NMFS “may by regulation prohibit with respect to any threatened species any act prohibited under section 9(a)(1).” (16 U.S.C. § 1533(f)) Pursuant to this authority, NMFS has prohibited the taking of several California fish species, including Central Valley spring-run salmon, California steelhead, Central Coast and South-Central Coast steelhead, and green sturgeon. The take rules contain a variety of exemptions for specific actions that may benefit the threatened species or facilitate human uses of the resource. These include limited harvesting pursuant to NMFS-approved fisheries management plans, takings for scientific research, limited take of hatchery-reared fish, and incidental takings associated with state-certified habitat restoration projects. (NMFS 2000) Along with the incidental take permits described below in the text, the section 4(d) rules thus provide some flexibility in the fisheries agencies’ administration of the federal ESA’s take prohibition. Until recently, threatened species (including the Delta smelt) that are subject to USFWS jurisdiction were automatically made subject to the take prohibition of section 9(a)(1). (USFWS 1993) In September 2019, the Trump Administration rescinded this rule. The change applies only to future listings, however, so (at least at the time of this writing) the Delta smelt remains protected by the take restrictions of section 9(a)(1). (USFWS 2019a)

<sup>26</sup> The state ESA does not have an equivalent consultation requirement. It does provide, however, that if a water project operator or other person has obtained incidental take authorization or an incidental take permit from the USFWS or NMFS, “no further authorization or approval is necessary.” (Fish and Game Code § 2080.1)

<sup>27</sup> In addition, California law designates 37 species (including 10 fishes and 3 amphibians) as “fully protected species” for which CDFW may not issue incidental take permits. (California Biologist’s Handbook 2019d) As described below, however, the department may “authorize the taking of a fully protected fish for necessary scientific research, including efforts to recover fully protected, threatened, or endangered species. (Fish and Game Code §§ 3511, 4700, 5050, 5515) The legislature also has granted special exemption authorizing limited take of several fully protected species in the context of highway repair, dam removal, water project maintenance, and habitat restoration. (Fish and Game Code §§ 2081.4-2081.12)

created water quality and flow standards that differ in several key respects from the water quality criteria adopted by the State Water Board. (Gartrell and Gray 2017)<sup>28</sup>

Unlike the state and federal water quality standards, the requirements of the biological opinions and take limitations are not based on a multifactor analysis that seeks to provide “reasonable protection” for all beneficial uses. Rather, all actions governed by the state and federal endangered species acts must neither contravene nor undermine the overriding conservation and recovery mandates. Although the fish and wildlife agencies may authorize incidental takings, they may do so only if the taking would not jeopardize the continued existence of listed species or, under the federal act, adversely modify their critical habitat. Indeed, the take prohibitions of the federal statute are so pointed that the U.S. Supreme Court has recognized that they exert “a powerful coercive effect” on the agencies and project operators to whom they are directed. (U.S. Supreme Court 1977)

The state and federal ESAs thus create a categorical imperative that water project operations shall not take or jeopardize the existence of listed species (or adversely modify their critical habitat), which in turn may constrain other regulatory and water management decisions. State water quality standards based on principles of ecosystem management would have to recognize these preemptive standards even if the board’s preferred approach would emphasize other species or rely on different conservation strategies.

Yet, considerable regulatory flexibility remains within these strictures, and both statutes can accommodate ecosystem-based management. Although the focus of the endangered species acts is on individual species and their critical habitat, there is nothing in the statutes that would preclude the fish and wildlife agencies from adopting a more integrated and holistic approach. The courts have emphasized that the regulatory agencies have substantial latitude to decide how best to fulfill their statutory obligations to avoid jeopardy, protect critical habitat, and limit unlawful take. As the U.S. Court of Appeals described in its review of the USFWS’s 2008 biological opinion governing CVP and SWP operations:

the agency must base its actions on evidence supported by “the best scientific and commercial data available.” The determination of what constitutes the “best scientific data available” belongs to the agency’s “special expertise.... When examining this kind of scientific determination, as opposed to simple findings of fact, a reviewing court must generally be at its most deferential.” (U.S. Court of Appeals 20014)

The question whether the regulatory agencies have authority to incorporate ecosystem-based strategies into their decision making therefore may be framed in a relatively simple way: “What are good scientific metrics for predicting and assessing ecosystem functions (e.g., food web productivity) on which each species relies for its survival and recovery, and are these better expressed as ecological system metrics, rather than through the salinity, flow, and temperature metrics that are currently employed?” (Gray, Stelle and Szeptycki 2018) If the agencies conclude—based on the best available science—that ecosystem-based strategies provide an effective means of conserving and recovering each listed species, they would have discretion to include this strategy as part of their incidental take and interagency consultation processes.

This same analysis would apply to regulatory and management strategies that include specialization of habitat within the broader ecosystem. For example, fisheries biologists and other scientists have proposed to create a “North Delta Habitat Arc” that would recognize Suisun Marsh, the northern Delta, and restored floodplain and wetlands of the lower Sacramento River and Yolo Bypass as the area within the Delta ecosystem that is best suited to the conservation and recovery of a variety of listed species. These include winter-run Chinook salmon,

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<sup>28</sup> Other aquatic ecosystems significantly affected by ESA limitations include the Klamath, Trinity, Russian, and Ventura river systems. (National Research Council 2004; Mount 2017; Brown 2013)

Central Valley steelhead, Delta smelt, and long-fin smelt.<sup>29</sup> The habitat arc would be managed to harness freshwater flows and tidal energy, take advantage of existing and future landscape improvements, and improve food web productivity. (Mount 2018a, 2018b, 2018c)

Although the proposal would reduce the current regulatory emphasis on the central and south Delta as critical habitat for some species, it nevertheless could be implemented consistent with the endangered species acts. Neither the state nor federal ESA requires conservation and recovery of listed species throughout their entire range of existing or potential habitat. The laws also afford the fish agencies considerable flexibility in setting priorities for habitat types and locations—e.g., focusing on the North Delta Habitat Arc as the best means of protecting a multiplicity of species—as long as this conservation and recovery strategy would satisfy the no jeopardy/critical habitat directives and take limitations for each listed species. (Gray, Stelle and Szeptycki 2018)<sup>30</sup>

Moreover, the state and federal ESAs authorize the fisheries agencies to alter take limitations for several purposes that could facilitate ecosystem-based water management. For example, section 10(a) of the federal act allows the USFWS and NMFS to permit the taking of listed species “for scientific purposes or to enhance the propagation or survival of the affected species.” (16 U.S.C. § 1539(a)(1)(A)) The California ESA incorporates this take authorization by exempting any person who holds a federal “enhancement of survival permit” from the take prohibitions of state law. (Fish and Game Code § 2080.5)<sup>31</sup>

Although these permits are narrowly focused and would not provide general authority for ecosystem-based management strategies, they could be useful in specific contexts. For example, the North Delta Habitat Arc would shift species conservation and recovery efforts from the Delta as a whole and concentrate them in the more productive and manageable habitat along the northern arc. The fisheries agencies could facilitate this by granting research and enhancement permits that would allow the relocation and assisted migration of species into the northern Delta (including the Yolo Bypass). They also could reduce incidental take restrictions in the central and south Delta where the habitat is less productive and even harmful to some species. If the best available science supported such a strategy as a means of enhancing the propagation or survival of the species, the agencies would have authority to approve it under section 10(a).<sup>32</sup>

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<sup>29</sup> The Delta smelt population has fallen to such low numbers that the species may be functionally extinct in the wild. Some scientists therefore have recommended that the North Delta Habitat Arc serve as a managed refuge for wild smelt, whose survival is “critical for maintaining the genetic diversity of the captive population” at the UC Davis Fish Culture and Conservation Laboratory. The scientists recognize that the Delta Smelt remain vulnerable to warming waters and diminished flows, but conclude that intensive management of the sheltered population within the North Delta Habitat Arc could provide: (1) invasive species control, (2) reduction in contaminant levels, (3) flows from the Sacramento River “at crucial times of year to promote environmental variability and transport of larvae,” (4) high-quality habitat for spawning, (5) “production of the right food organisms in the right places for rearing,” (6) separation of the smelt from the Central and South Delta where they are vulnerable to predation, entrainment, pollution, and poor habitat, and (7) thermal regime management. They also note that this management program also could provide “major benefits to declining anadromous fishes such as Longfin Smelt, Chinook Salmon, and Green Sturgeon.” (Moyle et al. 2016)

<sup>30</sup> Nor would the North Delta Habitat Arc strategy be constrained by the U.S. Supreme Court’s recent decision in *Weyerhaeuser v. U.S. Fish and Wildlife Service*. The court held that section 4 of the federal ESA limits the definition of “critical habitat” to areas that are actually habitat for the species, rather than other areas that may be transformed into habitat. All of the waters embraced within the North Delta Arc are within the historic and current range of habitat of the various species described in the text. Moreover, the Supreme Court recognized that “habitat can, of course, include areas where the species does not currently live, given that the statute defines critical habitat to include unoccupied areas.” (U.S. Supreme Court 2018)

In August 2019, partly in response to the *Weyerhaeuser* decision, the USFWS and NMFS revised their rules for designating critical habitat. Under the new regulations, before the services may define an unoccupied area as critical habitat, they must determine that the area is essential to survival of the listed species and the occupied habitat of the species is inadequate to ensure its conservation. The services must also determine that there is a “reasonable certainty” that the unoccupied area will contribute to the conservation of the species and that it contains one or more physical or biological features essential to the conservation of the species. (USFWS 2019a; Congressional Research Service 2019) For the reasons stated in the preceding paragraph, these changes would not limit the authority of the USFWS and NMFS to participate in an ecosystem-based management strategy for the North Delta Habitat Arc.

<sup>31</sup> The state ESA also independently authorizes the taking of listed species for “scientific, educational, or management purposes.” (Fish and Game Code § 2081(a)) As noted previously, this includes the taking of fully protected species for scientific research and recovery purposes. (Fish and Game Code §§ 3511, 4700, 5050, 5515)

<sup>32</sup> NMFS has granted the USFWS a research and enhancement permit to capture, breed, and reintroduce Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead in the Livingstone National Fish Hatchery on the Sacramento River. (NOAA Fisheries 2017)

Section 10(a) of the federal ESA also authorizes the fisheries agencies to exempt from the take restrictions “acts necessary for the establishment and maintenance of experimental populations” of listed species. This authority is more limited than the scientific research permit and “enhancement of survival” exemptions, however, as experimental populations (including offspring) must be “wholly separate geographically from the non-experimental populations of the same species” and “outside the current range of such species.” (16 U.S.C. § 1539(j)(1) & (2))<sup>33</sup>

The National Marine Fisheries Service has authorized the release and management of an experimental population of San Joaquin River spring-run Chinook salmon as part of the San Joaquin River Restoration Program approved by Congress in 2009. NMFS concluded that reintroduction would further the conservation of the species, which was extinct in the wild, and that the experimental population is essential to the continued existence of the species. The service adjusted the incidental take permits for the CVP and SWP south Delta export facilities to account for the migration of fish from the experimental population in the vicinity of the pumps. NMFS prohibited direct takings of the species by anglers, but it exempted a variety of unintentional activities that might harm or kill individual fish, including water management, agricultural and municipal use, recreation, and flood control. (NMFS 2013) Although some proponents of San Joaquin River restoration have criticized these exemptions, they nonetheless demonstrate flexibilities that are available within the confines of endangered species administration.

Ecosystem-based water management therefore could be implemented consistent with the jeopardy, critical habitat, and take criteria of the state and federal ESAs. The fish agencies have substantial authority—consistent with the best available science—to craft appropriate conservation and recovery strategies, to set incidental take limits, and to define and regulate critical habitat. This includes discretion to manage for a multiplicity of (listed and non-listed) species and other beneficial uses and to set priorities that focus on specialized areas of critical habitat and ecological function that in their judgment will best conserve and recover the listed species.

Of course, each river and estuarine system will present its own specific hydrologic, biologic, and habitat-related characteristics, and water regulators and managers must address each system in a manner that meaningfully grapples its ecological nuances. The best conservation and recovery strategies for one system may not be appropriate in another. Where the best available science indicates that ecosystem-based objectives and metrics would be an effective means to fulfill the purposes of the endangered species acts, however, the decision to include such strategies is well within the regulatory agencies’ professional expertise and discretion.

### **Habitat Conservation Plans, Natural Community Conservation Plans, and Safe Harbor Agreements**

If the take, jeopardy, and adverse modification strictures of the endangered species acts may be administered to *accommodate* ecosystem-based management, other important aspects of endangered species policy *encourage* the use of ecosystem-based strategies. These programs include Habitat Conservation Plans (HCPs) authorized under the federal ESA, Natural Community Conservation Plans (NCCPs) developed in accordance with California law, and Safe Harbor Agreements authorized under both federal and state law.

These programs allow state and federal regulators to approve comprehensive plans for the integrated management of waters, lands, and multiple species within a watershed or region. Land and resource development are usually the catalyst for specific HCPs, NCCPs, and Safe Harbor Agreements, because the laws provide clarity about the scope and conduct of the permitted activities and offer assurances that actions authorized by the plan or agreement will comply with the endangered species acts. But these programs also provide a forum in which the ecological needs of multiple species (listed and non-listed) can be evaluated and protected. As such, the programs often are a

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<sup>33</sup> The California ESA recognizes the federal experimental population designation and generally waives incidental take requirements for those who comply with the terms of the federal permit. (Fish and Game Code § 2080.4)

better means of conserving and recovering listed species and their critical habitat than are the more specific and reactive policies of limiting take and avoiding jeopardy.

For example, the federal ESA requires incidental take permittees to operate pursuant to an approved conservation plan that minimizes and mitigates the effects of their actions on listed species. These HCPs must ensure that the permittee’s activities (including the authorized incidental taking) “will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.” (16 U.S.C. § 1539(a)(2)) “HCPs can apply to both listed and non-listed species...Conserving species before they are in danger of extinction or are likely to become so can...provide early benefits and prevent the need for listing.” (USFWS 2011) As described in the main report, the ability to anticipate future risks to aquatic species and their habitat is an important aspect of ecosystem-based management.

Similarly, the California Natural Communities Conservation Act authorizes CDFW to sign agreements with individuals and public entities to create NCCPs.<sup>34</sup> The purposes of these plans are to “provide comprehensive management and conservation of multiple wildlife species” (including species listed for protection under the state or federal ESA) and to “identify and provide for those measures necessary to conserve and manage natural biological diversity within the plan area while allowing compatible and appropriate economic development, growth, and other human uses.” (Fish and Game Code § 2810(a)) NCCPs also are designed to “provide an early planning framework for proposed development projects within the planning area in order to avoid, minimize, and compensate for project impacts to wildlife,” including non-listed species. (Fish and Game Code §§ 2801(b) & (g)) Again, this type of proactive stewardship is a key feature of ecosystem-based management.

Both laws contemplate multi-species conservation, multi-benefit resource use, and specialized habitat management. Indeed, the state statute closely tracks the principles of ecosystem-based management described in the main report. The criteria that govern the department’s approval of NCCPs declare, for example, that the plan must protect “habitat, natural communities, and species diversity on a landscape or ecosystem level through the creation and long-term management of habitat reserves or other measures that provide equivalent conservation of covered species appropriate for land, aquatic, and marine habitats.” They also require the plan to integrate adaptive management strategies that “will assist in providing for the conservation of covered species and ecosystems within the plan area.” (Fish and Game Code § 2820(a)(2) and (3))<sup>35</sup>

In addition, Safe Harbor Agreements—which are available under both federal and California law—can help to encourage landowners and water users to participate in HCPs, NCCPs, and other resource management agreements. California’s safe harbor program allows landowners to manage their lands for the benefit of endangered or threatened species, as well as candidate species and “declining or vulnerable species,” with protections against the imposition of additional restrictions on land or water use if species populations increase or other protected species are attracted to the property. (Fish and Game Code § 2089.2(a)) CDFW may approve a safe harbor agreement—including incidental take authorization associated with management of the protected species and their habitat—if it determines that “implementation of the agreement is reasonably expected to

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<sup>34</sup> In contrast with the federal HCPs, NCCPs are not necessarily linked to incidental take permits, as the state statute authorizes any person or public agency to “undertake natural community conservation planning” (Fish and Game Code § 2809). The NCCP Act provides, however, that specified NCCPs may include incidental take authorization. (Fish and Game Code § 2830)

<sup>35</sup> The federal ESA requires that HCPs “minimize and mitigate” the impacts of the project or activity for which the incidental take permit was granted. (16 U.S.C. § 1539(a)(2)) In contrast, state law requires NCCPs to include “methods and procedures within the plan area that are necessary to bring any covered species to the point at which the measures provided [in the California ESA] are not necessary.” (Fish and Game Code § 2805(d)) Although the law also states that an NCCP must include “provisions to ensure that implementation of mitigation and conservation measures on a plan basis is roughly proportional in time and extent to the [project’s] impact on habitat or covered species authorized under the plan” (Fish and Game Code § 2820(b)(9)), some have argued that the department may not approve an NCCP unless it concludes that the plan will achieve full recovery of covered species. For an analysis of this question, see Mount et al. 2014.

provide a net conservation benefit to the species” and that the agreement “is of sufficient duration and has appropriate assurances to realize these benefits.” (Fish and Game Code § 2089.6(a))

The federal safe harbor program, which was created by regulation, offers similar protections. “In exchange for actions that contribute to the recovery of listed species on non-federal lands, participating property owners receive formal assurances from the [USFWS or NMFS] that if they fulfill the conditions of the [agreement], the Service will not require any additional or different management activities by the participants without their consent.” (USFWS 2018a) Under both the state and federal programs, at the conclusion of the term of the agreement the landowner may return the enrolled property to the “baseline conditions” that existed before the safe harbor program began.<sup>36</sup>

During the past 25 years, the fish and wildlife agencies have signed HCPs, NCCPs, and Safe Harbor Agreements throughout California that protect a variety of species that inhabit common or overlapping ecosystems. (CDFW 2019a & 2019b; NOAA Fisheries 2019a; USFWS 2019b) Many of these plans are structured to integrate land use and water resources management, while also accommodating development and water use. They include the Kern Water Bank HCP/NCCP (1997), the Lower Colorado River Multi-Species Conservation Program (2004), the Green Diamond Aquatic HCP/SHA (2007 & 2018), Rock Creek Upper Pool and Rock Creek SHAs (2015 & 2016), the South Sacramento HCP and Aquatic Resources Plan (2018), the Eel River Estuary Preserve SHA (2018), the Santa Clara River Seven Species HCP (pending), the Upper Santa Ana River HCP (under development), and the Solano Multi-Species HCP (also under development)<sup>37</sup>

Each aquatic ecosystem plan is tailored to the specific needs and circumstances of the species they are designed to protect and to the land and water uses that they regulate. But these and other regional conservation agreements demonstrate that state and federal endangered species policies can be implemented in a way that is conducive to integrated ecosystem-based management.<sup>38</sup>

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<sup>36</sup> Federal law authorizes similar protective arrangements for species that qualify for listing and other “at-risk” species. The USFWS may enter into Candidate Conservation Agreements by which landowners and resource users “voluntarily commit to implement specific actions designed to remove or reduce threats to covered species, so that listing may not be necessary.” To allay concerns that the protection of candidate species may become listed and cause restrictions to be placed on the participating parties’ ability to use their land or resources, the USFWS also may sign a Candidate Conservation Agreement with Assurances. These assurances agreements provide that if a covered species is listed, “additional land, water, or resource use limitations will not be imposed on them, unless they consent to such changes.” (USFWS 2017b)

<sup>37</sup> Several of these plans are described in more detail in Technical Appendix B.

<sup>38</sup> Negotiation of HCPs, NCCPs, and Safe Harbor Agreements can be lengthy and expensive. For this reason, the California Legislature recently authorized CDFW and other public agencies to create Regional Conservation Investment Strategies (RCIS). See Other Important Laws below.

## Box 4: Endangered Species Protection with Ecosystem-Based Management: The Upper Santa Ana River HCP

The Upper Santa Ana River HCP, currently under development, provides a useful model for ecosystem-based management under the endangered species laws. The catalyst for the HCP was a proposal by the San Bernardino Valley Municipal Water District (SBVMWD) to capture up to 198,000 af per year of stormwater and use it for groundwater recharge. Because the project could affect the Santa Ana sucker, which is listed as threatened under the federal ESA, the district requested an incidental take permit from the USFWS.

Pursuant to the draft HCP, the SBVMWD and several other agencies will restore aquatic habitat in four tributaries to the Santa Ana River in Riverside County. The habitat improvements will focus on the Santa Ana sucker and the arroyo chub, a species of special concern under California law. In addition, the proposed HCP will cover 20 other plant and animal species—including the arroyo toad and five other species of amphibians and reptiles, eight bird species, and two mammals. Ten of these other species are listed as endangered or threatened under state or federal law. (SBVMWD 2019a)

The draft HCP contains a variety of structural habitat changes, which include “improving conditions in existing channels, excavating new channels, [and] restoring associated floodplain surfaces and habitats.” The plan also will provide reliable clean flows by directing stormwater and treated wastewater discharges into the tributaries. Additional actions include removal of non-native vegetation and monitoring programs to limit human disturbance of the restored habitat while also encouraging recreational uses within the project area. (SBVMWD 2019b)

The restoration program will extend across the full range of relevant landscapes, “creating functional spawning and refugia habitat within tributaries hydrologically connected to the mainstem Santa Ana River, preventing backwater habitat from developing within or at the mouth of the tributaries . . . to reduce the habitat suitability for nonnative predator fishes, . . . and restoring the hydrologic connection with historic floodplains to provide additional areas to where overbank flows can spread into riparian zones.” It also will establish a “Mitigation Reserve Program that will “create an ecologically functional, self-sustaining mosaic of aquatic and riparian habitats that are resilient to a range of natural disturbances (drought, flood, fire, etc.)” (SBVMWD 2019b)

Finally, the draft HCP has served as a framework for integrated planning, analysis, and permitting. The SBVMWD is lead agency for a consortium of 11 other water agencies and conservation districts (including the City of Rialto), and the HCP negotiations include two NGOs and six state and federal regulators and resource managers. (SBVMWD 2019c) Based on the draft plan and the accompanying environmental impact report, the proponents of the HCP are seeking a 50-year incidental take permit from the USFWS, a 35-year Lake and Streambed Alteration Agreement from CDFW, and two 20-year § 404 permits from the U.S. Army Corps of Engineers. They also will ask the Santa Ana Regional Water Quality Control Board to use the HCP as the basis for new water quality standards for the Upper Santa Ana River.

The Upper Santa Ana River is a highly altered, urban watershed, and the draft HCP has yet to be approved or tested. It incorporates the essential features of ecosystem-based management, however, and thus may serve as a promising template for integrated, multi-benefit management in other developed and relatively undeveloped watersheds that are home to endangered and threatened species.

## Recovery Planning

Section 4(f) of the federal Endangered Species Act requires the USFWS and NMFS to “develop and implement plans...for the conservation and survival” of listed species. (16 U.S.C. § 1533(f)(1)) The USFWS has promulgated eight recovery plans for endangered or threatened species in California, although most are for terrestrial species. (USFWS 2018b)<sup>39</sup> NMFS has published four recovery plans for anadromous fish that spawn in California rivers: Southern California Coast Steelhead (2012); South-Central California Coast Steelhead (2013); Southern Oregon/Northern California Coast Coho Salmon (2014); and the Sacramento River Winter-Run Chinook Salmon, Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead. (NOAA Fisheries 2013 & 2014; NMFS 2014)<sup>40</sup>

These recovery plans bear many of the hallmarks of ecosystem-based management—including multi-species conservation and recovery strategies, a broad landscape or watershed focus, benefits to other beneficial uses, structural habitat improvements, water quality and flow standards, and control of stressors—and they provide useful lessons for ecosystem-based management in other river systems. The best examples of ecosystem-based strategies in the context of recovery planning, however, are in the Sacramento River basin where water users and landowners have joined with state and federal regulators, scientists, environmental NGOs, fishing advocates, and other interested parties to devise a comprehensive program to protect fish, waterfowl, terrestrial wildlife, and economic uses of the region’s rivers and wetlands.

The Sacramento Valley Salmon Recovery Program is part of the broader federal recovery plan for Sacramento River salmonids. (NMFS 2014) It is a voluntary cooperative effort to help implement the 2014 federal recovery plan on a watershed scale by setting conservation and recovery priorities based on the best available science and integrating those priorities into land use and water management decisions. The program also is designed to effectuate the policies of the state’s Delta Smelt and Sacramento Valley Salmon Resiliency Strategies. (Natural Resources Agency 2016 & 2017) Along with these fisheries benefits, the program accommodates agricultural and other economic uses of water in the Sacramento River basin. It has therefore gained the support of all of the major water districts and farming groups in the Sacramento Basin. (NCWA 2019b)<sup>41</sup>

Integrated salmon recovery efforts are also underway on several of the tributaries, which are especially important because they provide the last remaining salmon spawning habitat. The most advanced and successful tributary restoration is the Butte Creek Salmon Recovery Program—a cooperative partnership among farmers, water managers, and environmental NGOs. Since 1995, the program has removed four dams (which opened 25 river miles to unimpaired fish passage), installed fish ladders on the remaining four dams upstream, restored spawning beds and riparian habitat, and provided functional flows to aid salmon migration. The program also has connected Butte Creek to the Sutter Bypass, which allows juvenile salmon access to the shallow, slow moving, and nutrient-rich waters that they need for early development. (NCWA 2017)<sup>42</sup>

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<sup>39</sup> Two of the recovery plans include aquatic species—the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005) and the Recovery Plan for Tidal Marsh Ecosystems in Northern and Central California (USFWS 2013).

<sup>40</sup> NMFS is preparing two other recovery plans for California fish species: the California Coastal Chinook Salmon and Northern California Steelhead (NOAA Fisheries 2014) CDFW also has prepared recovery plans for steelhead (1996) and coho salmon (2004). (CalFish 2018) These plans are out-of-date, however, and the state law that authorized recovery planning expired in 2017.

<sup>41</sup> In addition, the “Nigiri Project”—an experimental program spearheaded by scientists at UC Davis and California Trout—is testing whether post-harvest flooded rice fields in the Yolo Bypass also can be used to support captive juvenile salmon that could be released into the wild after they feed from the nutrient-rich waters of the bypass. If the pilot project is successful, it could serve as a management template for other agricultural lands in the lower Sacramento River basin. (California Trout 2019)

<sup>42</sup> Other important tributary streams include Cow, Battle, Antelope, Mill, and Deer Creeks. During the 2012-16 drought, CDFW signed agreements with water right holders along Antelope and Mill Creeks to provide water for base and pulse flows to support spawning and out-migration. When negotiations with users along Deer Creek failed, the board issued curtailment orders to achieve the same purposes. (Mount et al. 2017)

## Box 5: Ecosystem-Based Strategies to Promote Multiple Benefits: The Sacramento Valley Salmon Recovery Program

The Salmon Recovery Program covers six species of anadromous fish (four of which are listed under either the state or federal ESAs, as well as the Delta Smelt). Habitat restoration, wetlands enhancement, and other water management actions implemented under the program also provide incidental benefits to a variety of migratory waterfowl and terrestrial wildlife.

The program seeks to protect the anadromous species through all stages of their freshwater life cycles. For example, it divides the Sacramento River Basin below Shasta Dam into three segments:

- In the upper river and its tributaries, the program focuses on structural habitat improvements and coldwater releases from Shasta and Whiskeytown Reservoirs to protect spawning adults and their eggs and fry. “Projects implemented to benefit fish in the upper river include adding spawning gravel beds and riffles, developing side channels, refugia projects and other safe habitat for fry and juvenile fish.” (NCWA 2019a)
- The middle river serves as a migratory corridor for spawning adults and out-migrating juveniles. The program includes removal of barriers to in-migration and pulse flows to reduce straying from the main channel. It also includes fish screens to reduce entrainment of juveniles and projects to remove “predator hotspots.”
- The program recognizes that, before water development, the lower river would create a vast floodplain during the winter and spring months, which provided rearing habitat and abundant nutrients for out-migrating juveniles. Consequently, the program includes several structural improvements (such as fish weirs, screens, and diversion gates) that encourage juvenile salmon to migrate through and linger in the Sutter and Yolo Bypasses. The nutrient rich waters of the Yolo Bypass also form part of the North Delta Habitat Arc described above and may serve Delta Smelt that migrate into (or are cultivated in) the Bypass. (NCWA 2019a)

These and other strategies may be incorporated into the State Water Board’s revised Water Quality Control Plan for the Delta through voluntary agreements with the Sacramento River basin water users. The agreements present the opportunity to integrate upstream habitat restoration and water management reforms with the other portions of the Sacramento-San Joaquin River and Delta ecosystem. (NCWA 2019b)

Despite its many salutary features, the Sacramento Salmon Recovery Program will always be limited by the ability (and willingness) of the Bureau of Reclamation to deliver sufficiently cold water releases from Shasta and Whiskeytown Reservoirs to enable salmon spawning and to protect the juveniles on their migratory path downriver to the ocean. And the catastrophic events of 2014 and 2015—when warm water releases from Shasta Reservoir contributed to the death of more than 90 percent of chinook salmon eggs and fry—certainly serves as a cautionary tale. (Mount et al. 2017) But the creativity and constructive collaboration on which the program is founded is strong evidence that the recovery planning process can serve to foster comprehensive water management and reform.

### Endangered Species Acts: Conclusion

The state and federal Endangered Species Acts—which are too often characterized as impediments to ecosystem-based management—are in fact conducive to multi-species and multi-benefit strategies. Although the fundamental goal of both statutes is to conserve and recover listed species, there is room within these strictures to engage in broader and integrative strategies that set ecological priorities and that employ habitat specialization and multifaceted implementation programs to accomplish them. Indeed, if the best available science supports ecosystem-based approaches, it would be incumbent on the state and federal fisheries agencies to include these strategies in their analysis and decision making.

In addition, there are important features of both the state and federal ESAs that expressly embrace ecosystem-based policies. HCPs, NCCPs, safe harbor agreements, recovery plans, and other freshwater resource programs are now guiding integrated and multifaceted species conservation across California. They too demonstrate that ecosystem-based management is consonant with the existing structure and policies of the endangered species acts.

## Recommendations for Reform

Although we conclude that the laws governing water quality, water rights, dam operations, and endangered species are consistent with ecosystem-based management, there are two aspects of the State Water Board's regulatory practice that could be improved to effectuate the strategies outlined in the main report. Thus, in this final section, we recommend that the board more explicitly incorporate endangered species protections into its water quality planning and, where necessary, employ its water quality powers to set additional, complementary standards to ensure the reasonable protection of listed species. We also urge the board more systematically to integrate structural habitat considerations into its water rights decision making.

### Water Quality Planning and Endangered Species Protection

As described throughout this appendix, the existing laws may incorporate the principles of ecosystem-based management in two fundamental respects. First, the State Water Board (with the assistance of the regional boards) has authority to engage in ecosystem-based management under the multifaceted and flexible directives of the water quality, water rights, and related laws. Second, in contexts in which the board does not have primary regulatory authority—such as FERC licensing and administration of the state and federal endangered species acts—the agencies charged with implementing and enforcing those laws also have considerable discretion to incorporate ecosystem-based principles into their regulatory decisions.

For the reasons described above, section 5937 review and FERC licensing are reasonably well integrated into the board's water quality and water rights authority. In both contexts, the board incorporates the project bypass and discharge standards required under the other regulatory regimes into its water quality planning, and it has authority to enforce those water quality and flow requirements against project operators through its water rights authority.

There is a greater disconnect, however, between endangered species management and the state and regional boards' water quality responsibilities. On most rivers with listed species, the boards do not establish their own species protection standards or explicitly incorporate those set by the fisheries agencies into the water quality control plans. Rather, they consider the terms and conditions set forth in biological opinions and incidental take authorizations as parameters for their own water quality regulation. As one member of the State Water Board's staff described, "We try to avoid conflict with the federal government to the extent possible."

This policy presents several risks. First, tensions between regulatory strategies for listed species and the boards' regulatory strategies for non-listed species and other beneficial uses may not be adequately addressed. This is especially true for potential conflicts between federal endangered species requirements and state water quality objectives. During the last two years of the 2012-16 drought, for example, the

severity and breadth of the drought ... made it extremely difficult for the CVP and SWP to meet the requirements of D1641 and the 2009 BiOps. In particular, there was grave concern that use of stored water to meet outflow requirements in the spring would deplete cold water in Shasta Reservoir to the degree that it would threaten winter-run Chinook salmon eggs and fry development. There also was a significant risk that reservoir storage would fall so low that the projects would no longer be able to control salinity in the Delta. (Gartrell and Gray 2017)

Although the State Water Board issued a series of temporary urgency change orders that relaxed Delta salinity and outflow standards to allow the Bureau of Reclamation to retain water in Shasta Reservoir for salmon, these changes came close to allowing salinity in the Delta to exceed the levels needed to support in-Delta farming and export uses. Unfortunately, they also failed to protect the salmon whose mortality rates exceeded 95 percent in 2014 and 2015. (Mount et al. 2017) Better integration of planning and management of endangered species and water quality strategies will be needed to reduce the risk of these types of future conflicts.

Second, separation of endangered species and water quality responsibilities can mean that synergies between regulatory and management strategies are missed, as are opportunities for ecological specialization. For example, the North Delta Habitat Arc would require collaboration among the State Water Board, the state and federal fisheries agencies, the Delta Stewardship Council (see below), local governments, and a variety of stakeholder groups. As described in the main report, the board's water quality and water rights authority could serve as the regulatory umbrella for these types of collaborative efforts to approach integrated problems in a more creative manner.

Third, deference to federal endangered species standards can render the board unprepared to step into the breach to protect listed species and their habitat—through its water quality and water rights authority—if the federal standards and operational requirements are not adequate to provide “reasonable protection” as required by state law. The uncertainty surrounding the on-going revisions to the Delta smelt and salmonid biological opinions for the CVP/SWP operations shows that this is no longer a hypothetical concern.<sup>43</sup>

To address these risks, we recommend that the State Water Board create a program to set its own water quality criteria for listed species, candidate species, and species of special concern in the context of setting water quality criteria for *all* aquatic species and *all* beneficial uses. This program would apply to all rivers and aquatic systems that provide habitat for one or more species listed under state or federal law or whose water quality standards may be affected by endangered species policies. The board would establish these water quality criteria in consultation with CDFW, the appropriate regional water quality control board, and (to the extent possible) the federal fisheries agencies.<sup>44</sup>

The state water quality standards for endangered and threatened species should not conflict with the species-protection objectives of the applicable biological opinions and incidental take authorizations, but they could be more protective than the federal standards and operating criteria. The state standards also would serve as a backstop if the federal standards are diminished.

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<sup>43</sup> In October 2018, President Trump directed the USFWS and NMFS to “work together to facilitate the designation of one official to coordinate the agencies’ ESA and NEPA compliance responsibilities” in California and “to the extent practicable and consistent with law, promulgate joint biological opinions for CVP and SWP operations. (The White House 2018) The revised BiOps must incorporate the mandates of the Water Infrastructure Improvements for the Nation Act, which President Obama signed into law December 2016. The WIIN Act requires the federal fisheries agencies to “provide the maximum quantity of water supplies practicable” to CVP and SWP contractors “by approving, in accordance with applicable Federal and State laws (including regulations), operations or temporary projects to provide additional water supplies as quickly as possible, based on available information.” The statute also specifies a variety of regulatory and operational changes to maximize project exports. (Pub. L. No. 114-322, 130 Stat. 1628, §§ 4004 & 4005(b)(3))

The draft revised BiOps were published on October 21, 2019, and immediately engendered significant controversy. The draft opinions require a variety of changes to protect Delta smelt, salmon, and steelhead—including increased population monitoring and a conservation hatchery for the smelt and more storage in Shasta Reservoir dedicated to cold-water releases to aid salmonid spawning and migration. The draft opinions also are likely to allow for greater CVP and SWP exports, determinations that conflict with earlier drafts prepared by USFWS and NMFS biologists that concluded that increased exports would jeopardize the various listed species. (Boxall 2019a & 2019b, Davenport 2019)

<sup>44</sup> Section 6 of the federal ESA requires the federal fish agencies to “cooperate to the maximum extent possible with the states,” and it authorizes the federal agencies to enter into “management agreements” that allow the states to manage specific areas established for species conservation. It also authorizes “cooperative agreements” with states that have “an adequate and active program for the conservation of endangered . . . and threatened species.” (16 U.S.C. § 1535(a)-(c)). These processes could be used to foster greater collaboration between federal and state regulators. To date, however, section 6 has been used only sparingly. In 2009, NMFS and CDFW entered into a “limited cooperative agreement” that covers 19 ocean species and one anadromous species (green sturgeon). The agreement provides federal financial assistance and pledges cooperation in “law enforcement, research, management, and public information and education activities.” (NOAA Fisheries 2019b)

Although some aspects of this proposal are new, there are several recent examples of the State Water Board using its water quality and water rights authority to engage in comprehensive ecosystem-based regulation in systems where there is a significant federal regulatory presence.<sup>45</sup>

As described above in Box 1, the board exercised its Clean Water Act § 401 certification powers to set water quality and flow standards in Piru Creek to protect the arroyo toad, which is a federally listed endangered species and a species of special concern under state law. These standards filled a regulatory gap left by the USFWS, which had listed the toad for protection and designated the creek as critical habitat but had not placed conditions on DWR's operation of Pyramid Dam to protect the toad. (SWRCB 2009)

The board also recently published a draft water rights order amending the Bureau of Reclamation's water rights permits for the Cachuma Project on the Santa Ynez River based on its determination that the governing biological opinion is inadequate to protect Southern California steelhead, a federally listed endangered species. The order directs the bureau "to provide higher flows under an adaptive management process during wet and above normal years when the water supply impacts of such flows would be minimized." The board concluded that "higher flows are likely to benefit steelhead by providing additional spawning and rearing habitat as well as increasing passage opportunities in the lower mainstem river." According to the board, this long-term habitat enhancement is necessary because the hearing record "supports the conclusion that the population is unlikely to be restored to a sustainable level unless the amount of suitable spawning and rearing habitat to which the steelhead have access is increased."<sup>46</sup> The board relied on its authority under the public trust, section 5937, and Article X, Section 2 to set these new state law requirements that it believes will augment the inadequate federal standards. (SWRCB 2019c)

Finally, in its 2018 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Ecosystem, the board established new water quality criteria and flow requirements that complement existing state and federal endangered species standards. For example, the plan contains a directive that water right holders on the Stanislaus, Tuolumne, and Merced Rivers maintain a 40 percent average outflow to the San Joaquin River (with a 30% to 50% adaptive range) from February through June of each year to facilitate salmon spawning and migration.<sup>47</sup> In addition, the board is considering revised water quality objectives that would include minimum Sacramento River, San Joaquin River, and Delta outflow requirements, limits on CVP/SWP exports, and operational restrictions on the Delta Cross-Channel (an important transfer point that directs Sacramento River water into the interior channels of the Delta to facilitate project exports). (SWRCB 2018) As described in the main report, the board has encouraged water users within the Sacramento and San Joaquin River watersheds to negotiate voluntary agreements to create water management regimes that would comply with and implement these standards. (Mount et al. 2019)

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<sup>45</sup> Two key regulations underscore the board's authority to protect endangered and threatened species through water quality planning. First, the board's definition of beneficial uses includes: cold and warm freshwater habitat; migration of fish and other aquatic organisms; spawning, reproduction, and early development; inland saline water and marine habitat; wetlands and wildlife habitat; preservation of biological habitats of special biological significance; and protection of rare, threatened, or endangered species. (SWRCB n.d.) Second, for waters that support multiple beneficial uses (such as municipal and industrial supply, irrigation, and listed and non-listed species), federal regulations require the board to set water quality criteria that "support the most sensitive use. 40 C.F.R. § 131.11(a).

<sup>46</sup> The board acknowledged that although the augmented flow requirements apply only in wet and above normal years, they "may increase to some extent projected water supply shortages during critically dry periods for those who rely on Cachuma Project water. These shortages are in addition to those already caused by implementation of the 2000 Biological Opinion." It therefore directed the bureau, in consultation with CDFW and NMFS, "to study the effects of the increased flows on steelhead to verify the amount of additional habitat provided by the flows and determine whether a different release schedule would be more beneficial to the fishery. In the unlikely event the results of the study demonstrate that the flows do not provide benefit to the steelhead fishery or are likely to harm the fishery, this order reserves the Board's authority to reduce the required instream flows." (SWRCB 2019c)

<sup>47</sup> The plan contains a number of specific features of ecosystem-based management. For example, the narrative standard for San Joaquin River outflow requires flows that "more closely mimic the natural hydrographic conditions to which native fish species are adapted, including the relative magnitude, duration, timing, and spatial extent of flows as they would naturally occur. Indicators of viability include population abundance, spatial extent, distribution, structure, genetic and life history diversity, and productivity." Similarly, the criteria for Suisun Marsh include water quality conditions that are "sufficient to support a natural gradient in species composition and wildlife habitat characteristic of a brackish marsh throughout all elevations of the tidal marshes bordering Suisun Bay." (SWRCB 2018)

The 2018 water quality control plan illustrates the breadth and flexibility of the board’s water quality powers. As the board explained, it set the new water quality and flow standards “based on a subjective determination of the reasonable needs of all the consumptive and non-consumptive demands on the waters of the Estuary.” (SWRCB 2018) The plan also shows, however, that the board can use its water quality and related powers to protect endangered and threatened species (and their habitat) through measures that complement and enhance the standards and operational constraints set forth in the biological opinions that protect the same listed species.

Based on these precedents, we urge the board to adopt a policy for all rivers and aquatic systems that are habitat to one or more listed species that (1) examines how endangered species standards and operational requirements imposed by the state and federal fish and wildlife agencies may influence water quality, and (2) integrates these standards and restrictions into its own water quality planning. In addition, where it is necessary to provide “reasonable protection” of all beneficial uses—and to fulfill the obligations of section 5937 and the public trust—the board should set its own water quality objectives and flow requirements to complement and enhance ESA-based standards. These aspects of integrated water management will be essential to the coordinated regulation of California’s water systems and to the infusion of ecosystem-based strategies into state water policies.

### **Water Rights, Water Quality, and Structural Habitat**

As noted above, the State Water Board seldom includes structural habitat restoration and management in its water rights decision making—even in cases where key habitat is within the control of the water right holder and the relevant water quality planning control plan calls for habitat management as a means of protecting water quality, fish, and other beneficial uses.

In its 2018 revised Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, for example, the board stated that it will implement the new water quality objectives through its water rights authority, including conditions governing river flows, Delta outflow, and export limits. It also recognized that “[r]estoration of fish and wildlife habitat in the Delta would benefit many species of the Bay-Delta Estuary” and that a variety of “non-flow actions” would complement the flow objectives for the protection of fish and wildlife.<sup>48</sup> The board deferred these structural habitat improvements, however, to other state and federal agencies, water users, and landowners. (SWRCB 2018)

This decision reflects the board’s understanding that its water rights and water quality authority is limited and that cooperation and coordination with other agencies and stakeholders is often necessary to address multifaceted ecological problems.<sup>49</sup> Yet, habitat improvements and protections are often necessary to effective restoration and management of aquatic systems. As explained in the main report:

To improve ecosystem conditions, it is necessary to connect functional flows to landscapes and to reintroduce variability. By eroding and depositing sediment and vegetative debris, functional flows also help shape and diversify reconnected structural habitat, improving its performance. These flows also drive chemical and biological processes that are essential to the health of the overall ecosystem. (Mount et al. 2019)

Thus, if the State Water Board is to incorporate ecosystem-based principles into its water quality administration, it will need to establish clear policies on where, and under what conditions, habitat rehabilitation, protection, and

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<sup>48</sup> Recommended habitat measures include: restoration and protection of marsh, riparian, and upland habitat in the Delta; levee setbacks; conversion of low-lying Delta islands to habitat areas; creation of shallows and shoals within the Delta channels; restoration of floodplain and riparian habitat along the lower San Joaquin River and its tributaries; control of vegetation; provision of coarse sediment to aid salmon spawning and rearing; and enhancement of channel complexity. (SWRCB 2018)

<sup>49</sup> The board stated, for example, that it “will use its authority, as needed and appropriate, under section 13165 of the California Water Code to require that the following actions and studies be conducted.” (SWRCB 2018) This section provides that the board “may require any state or local agency to investigate and report on any technical factors involved in water quality control.” (Water Code § 13165)

management may be included in water rights decisions and other implementing actions. The Mono Lake case, described earlier as a “model for ecosystem-based management,” provides a useful example.

In its amendments to Los Angeles’ licenses to divert water from the tributary streams to Mono Lake, the board determined that the loss and degradation of aquatic habitat had placed undue stress on rainbow and brown trout that inhabit the streams, shorebirds that nest and feed around Mono Lake, migratory waterfowl, and other wildlife in the ecosystem.<sup>50</sup> To repair this damage, and to prevent it from recurring, the board ordered the city to undertake a variety of measures involving structural habitat. These included placement of gravel in the streams to aid spawning, restoration of wetlands and riparian vegetation, and limitations on cattle grazing and vehicular use to protect trout habitat. The structural habitat conditions were complementary to the more conventional water-related terms that the board also imposed as conditions of Los Angeles’ water rights—such as minimum stream flows in the tributaries, channel maintenance and flushing flows, and restoration of the volume and quality of water in Mono Lake itself. (SWRCB 1994 & 1998)

The board explained that these integrated conditions were necessary for the restoration and sustainable management of the Mono Lake ecosystem, because the interrelationships between ecosystem structure and function extended across the waters and adjacent landscapes:

Habitat quantity and quality are critical to the algae, alkali flies and brine shrimp that form the foodweb that supports overall productivity of the Mono Lake ecosystem...The loss of the linkage of hypopycnal lenses (i.e., fresh water overlying saline lake waters) with fresh water marshes and lagoons has resulted in reduced wildlife habitat, particularly for waterfowl.”

[Moreover,] the diversion of tributary streams and the fall of Mono Lake [has] resulted in stream incision, erosion, and other geomorphic changes. The direct impacts to terrestrial wildlife habitats were the loss of complex multi-storied riparian forest, fragmentation of the riparian corridors, and draining of wetlands, overflow channels, delta marshes, ponds and lagoons. The result has been a reduction in habitat diversity and complexity, and an increase in lower valued wildlife habitats such as willow scrub, unvegetated floodplain, and Great Basin scrub. (SWRCB 1994)

The board concluded that it had authority to include structural habitat rehabilitation and protection in its amendments to Los Angeles’ water rights licenses under the public trust, Fish and Game Code § 5937, Article X, Section 2, and the physical solution doctrine.<sup>51</sup>

Mono Lake was an extraordinary case, and we do not suggest that the detailed ecological analysis that underlay the board’s water rights determinations should be replicated in every decision that implements water quality standards. For those settings where habitat enhancement and protection are essential components of integrated ecosystem-based management policies, however, the board should exercise its jurisdiction to place conditions on the exercise of water rights that include appropriate management of structural habitat.<sup>52</sup>

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<sup>51</sup> The physical solution doctrine is grounded in Article X, Section 2. It allows the board (and the courts) to require water right holders to make physical changes to their water and land use practices to achieve a reasonable accommodation of the competing interests. (California Supreme Court 2000) In its Mono Lake decision, the board explained that it had “examined the relationship between flows and fishery habitat, as well as the availability of other measures which would help restore the fishery while allowing diversion of some water for municipal use.” It also observed that, “in examining the use of water at Mono Lake for providing waterfowl habitat, this decision acknowledges that there are alternative ways of restoring a portion of the lost waterfowl habitat without requiring a return to the pre-1941 lake elevation.” Under these circumstances, inclusion of habitat restoration to complement the minimum stream flow and lake level restoration requirements would be “consistent with the constitutional goal of promoting maximum beneficial use of the State’s water resources.” (SWRCB 1994)

<sup>52</sup> The board’s long-standing legal policy has been to require structural habitat restoration and protection as a condition of the exercise of a water right only where such habitat would substitute for water that otherwise would be dedicated to stream flows and aquatic habitat. Thus, in its Mono Lake decision, the board was careful to note that “habitat restoration can serve to restore public trust uses while requiring a smaller commitment of water.” (SWRCB 1994) The board’s caution is understandable, yet there is nothing in the governing statutory law that limits the board’s discretion in this area. Moreover, as long as the required habitat restoration and management addresses the external costs of water development and use—or will prevent future habitat degradation—and the habitat conditions are “roughly proportional” to the

In some cases, the key habitat will be under the control of the water right holder. Under these circumstances, the board has authority to require the water right holder to rehabilitate habitat that it has degraded or destroyed and to maintain the habitat as an integral means of complying with water quality standards and other legal requirements.

In other situations, the habitat may be under the control of a third party. The board's ability to integrate structural habitat into the water rights decision therefore may be limited if it lacks authority to place conditions on the third-party property owner's use of its land or water resources. Under these circumstances, however, the board could use its water rights jurisdiction to create incentives for the parties (the water right holder and third parties) to collaborate.

For example, the board might encourage the water right holder to seek to acquire (or enter into agreements to improve) habitat that—if properly managed and integrated into the aquatic system—could reduce or offset flow requirements. Indeed, the board did this in the Mono Lake case. Although some of the habitat that it required Los Angeles to restore and maintain was on property owned by (or under the control of) the city, other crucial habitat was owned by the U.S. Forest Service. The board determined that irrigation of these areas could provide high quality waterfowl habitat. It therefore ordered the city to provide financial assistance up to \$275,000 to the Forest Service “for repairs and improvements to surface water diversion and distribution facilities...to restore or improve waterfowl habitat improvements on USFS land.” (SWRCB 1998)

The board has included a similarly flexible habitat policy in its 2018 Delta water quality control plan. In urging water users to negotiate voluntary agreements that would define their obligations to fulfill the new flow standards, the board explained that if the agreements “include non-flow actions recommended in this Plan or by DFW, the non-flow measures may support a change in the required percent of unimpaired flow, within the range prescribed by the flow objectives, or other adaptive adjustments otherwise allowed in this program of implementation.” (SWRCB 2018)

Habitat protection and restoration are not always vital aspects of water quality regulation, but they are likely to be important components of ecosystem-based management. In those situations where managed habitat could provide structural or functional linkages that are essential to integrated ecological management, the board should include this tool in its regulatory strategies.

## Conclusion

Incorporation of ecosystem-based management into the regulation of California's rivers and estuaries could be accomplished consistent with existing law. Integrated and multifaceted regulation is the touchstone of contemporary water quality management, and the water rights laws that implement water quality standards are also sufficiently flexible to facilitate this new approach. The state and federal laws that protect endangered species are more single-purpose focused, but they too allow for more holistic ecosystem-based strategies within the confines of their overarching directives to conserve and recover listed species.

The legal questions, though not straight-forward, are subsidiary to the questions that arise from science. If, in a particular aquatic system, the science justifies broader and more nuanced strategies such as those described in the main report, both the water quality and endangered species laws can accommodate them. And where ecosystem-based principles offer a better means of achieving the objectives of these laws than do current regulatory practices, the state and federal regulators may even be compelled to adopt them.

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water right holder's contribution to such harm, a broader habitat policy would comply with constitutional constraints on permitting and other regulatory conditions. (U.S. Supreme Court 1994, 2013; California Supreme Court 2016)

## Addendum: Other Important Laws for Ecosystem-Based Management

In addition to those described above, a variety of other laws and regulatory programs will be essential (or at least useful) to the implementation of ecosystem-based management strategies. Some of these laws create broad water and resource management programs that embody many of the principles of ecosystem-based management. Others create permitting programs that may apply to specific actions to implement ecosystem-based management, such as structural habitat restoration. Here are a few of the most important:

### **The Sacramento-San Joaquin Delta Reform Act (Water Code §§ 85000-85350)**

The Delta Reform Act of 2009 declares it to be state policy that the Sacramento-San Joaquin Delta, including its fisheries and wildlife, be restored “as the heart of a healthy estuary and wetland ecosystem. The statute also created the Delta Stewardship Council (DSC) and directed it to prepare a Delta Plan that would accomplish a multiplicity of purposes. These include: restoration and maintenance of flows to support a healthy estuary; improvement of water quality to meet drinking water, agriculture, and ecosystem goals; restoration and protection of fish habitat and migratory corridors; promotion of statewide water conservation, water use efficiency, and sustainable use of water; and evaluation of storage and conveyance infrastructure to help achieve the coequal goals of “providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem.” The legislature required the DSC to take a long view—one hundred years into the future—and to update the Delta Plan at least every five years.

The Delta Plan also must include measurable assessments of the status and trends in (1) the “health of the Delta’s estuary and wetland ecosystem for supporting viable populations of aquatic and terrestrial species, habitats, and processes, including viable populations of Delta fisheries and other aquatic organisms,” and (2) the “reliability of California water supply imported from the Sacramento River or the San Joaquin River watershed.” In undertaking these responsibilities, the DSC is assisted by the Delta Independent Science Board, which is “a standing board of nationally and internationally prominent scientists with appropriate expertise to evaluate and provide oversight of a broad range of scientific research, monitoring, and assessment programs that support adaptive management of the Delta.” The council also receives advice from the Delta Plan Interagency Implementation Committee, which is composed of representatives from 18 state and federal agencies with jurisdiction over water, land, and species management in the Delta ecosystem.

In addition, the Delta Reform Act grants the DSC authority to determine whether individual projects within the Delta are consistent with the Delta Plan. This includes construction of water facilities and other infrastructure, levee repair, habitat restoration projects, and land and resource management plans (e.g., general plans, HCPs, and NCCPs). To date, the council has considered 24 such “covered actions” and has approved a variety of tidal and wetlands restoration projects, HCPs/NCCPs, and invasive plan control programs. The DSC’s consistency jurisdiction is limited to the Delta, however, and does not extend to actions that occur upstream in the Sacramento and San Joaquin River basins. (DSC 2019)

The Delta Reform Act and the Delta Plan are exemplary models for ecosystem-based management. They include comprehensive analysis of ecological structures and processes, provide an integrated evaluation of beneficial uses and stressors, incorporate science into policymaking, recognize the need for responsiveness and adaptation to change, and provide a forum for consultation and coordination among agencies with jurisdiction over one or more aspects of the ecosystem. The DSC therefore will play an important role in helping to effectuate the policy recommendations described in the main report.

## **The Central Valley Flood Protection Act (Water Code §§ 9600-9625)**

The Central Valley Flood Control Act of 2008 directs the Department of Water Resources to modernize California’s flood control planning and management in light of revised assessments of the risk of catastrophic flood events, contemporary scientific understanding of natural flood control processes, and the projected effects of climate change. These directives incorporate many of the principles of ecosystem-based management.

The Act requires the Central Valley Flood Protection Plan to meet multiple, integrated objectives. These include: reducing risk to human life, health and safety, and property; identifying “opportunities for reservoir reoperation in conjunction with groundwater flood storage; creating linkages between “the flood protection system and the water supply system”; promoting “natural dynamic hydrologic and geomorphic processes”; improving and expanding the “quantity, diversity, and connectivity of riparian, wetland, flood plain, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands”; and promoting the “recovery and stability of native species populations and overall biotic community diversity.”

DWR’s most recent flood plans, published in 2012 and updated in 2017, implement these objectives through a variety of site-specific measures. In addition to the traditional management strategies of reservoir capture of floodwaters and levees to protect against flooding, the contemporary plans include levee setbacks and floodplain restoration, structural habitat improvements for fish and wildlife, reconnection of habitat with surface streams and floodplains, land acquisition and flood easements, and groundwater recharge. (DWR 2017)

The Central Valley Flood Protection Plan may help to guide ecosystem-based management in individual watersheds in the Sacramento-San Joaquin River basins by providing a template for specific structural habitat reforms—especially those that cross multiple landscapes extending from river corridors to floodplains to wetlands and uplands areas—and conjunctive water management programs that seek to provide multiple benefits, such as flood control, wetlands habitat, and groundwater replenishment. The plan also may serve as a vehicle to facilitate funding of programs that are consistent with its ecosystem-based objectives.

## **The Sustainable Groundwater Management Act (Water Code §§ 10720-10737.8)**

The Sustainable Groundwater Management Act of 2014 (SGMA) requires users in medium- and high-priority groundwater basins to form Groundwater Sustainability Agencies (GSAs) and to prepare Groundwater Sustainability Plans (GSPs). These plans must enable each GSA to achieve sustainable groundwater management by 2040 or 2042, depending on the severity of existing overdraft. The Act exempts adjudicated basins from these requirements.

The statute defines sustainability as “the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.” One of these undesirable results is “[d]epletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.” The Act also requires GSPs to include measures to address the effects of groundwater extraction on “groundwater dependent ecosystems.”

SGMA’s recognition of the hydrologic connection between groundwater use and surface water resources incorporates several important principles ecosystem-based management, including integrated decisionmaking across landscapes and the need for sustainable management strategies that embrace both *in situ* and extractive demands on the resource. One of the important challenges in SGMA implementation will be the creation of sustainability plans that embrace this broader perspective and manage groundwater use and recharge to protect stream flows and wetlands—along with extractive uses—in those systems where the hydrological connection persists or feasibly can be reestablished. (Hall et al. 2018)

## **Clean Water Act § 404 (33 U.S.C. § 1344)**

This federal statute requires a permit, issued by the U.S. Army Corps of Engineers, for the discharge of dredged or fill material into the “waters of the United States,” which include rivers, lakes, estuaries, tributary streams, adjacent wetlands, and other waters. Section 404 permits include individual permits, which are tailored to specific lands, waters, and project activities, and general permits that authorize categories of activities if the permittee conforms to certain criteria set forth in federal regulations. The Corps of Engineers consults with the USFWS, NMFS, and CDFW on permit applications that may affect fish and wildlife. Section 401 of the Clean Water Act also requires permit applicants to obtain state certification and requires the Corps of Engineers to include state water quality criteria and other conditions imposed by the State Water Board in the § 404 permit.

Although habitat restoration projects require a § 404 permit, the permitting process is relatively expedited as the Corps of Engineers has adopted a general permit for Aquatic Habitat Restoration, Enhancement, and Establishment Activities. The advance approval includes removal of dams, levees, and other structures; channel and streambed reconstruction; construction or rehabilitation of aquatic habitat and small nesting islands; reestablishment of floodplains and wetlands, and planting of native vegetation. Unlike other § 404 permits, compensatory mitigation is not required, because “these activities must result in net increases in aquatic resource functions and services.” (USACE 2017)

## **Lake and Streambed Alteration Agreements (Fish and Game Code §§ 1600-1616)**

California law also requires a permit known as a Lake and Streambed Alteration Agreement for a variety of changes to aquatic systems. These include diversions and obstruction of natural flow, changes to river channels and lake beds, use of material from a river or lake, and the deposit or disposal of material into a river or lake. The agreements contain terms and conditions needed to protect fish and wildlife resources, including their habitat.

LSA agreements are required for most structural habitat restoration activities, unless the project is authorized under the Habitat Restoration and Enhancement Act (see below). Unlike projects governed by HREA, an LSA agreement does not contain incidental take authorization under the California Endangered Species Act. (CDFW 2019e)

## **Habitat Restoration and Enhancement Act (Fish and Game Code §§ 1650-1657)**

This statute, which the California Legislature enacted in 2014, provides an alternative and expedited approval process for voluntary small-scale habitat restoration projects that would otherwise require an LSA agreement or an incidental take permit under the California Endangered Species Act. Applications must include a detailed description of restoration and enhancement methods, an estimate of temporary restoration- or enhancement-related disturbances, a schedule of project actions, as well as an explanation of “how the project is expected to result in a net benefit to any affected habitat and species.” Qualifying projects must be voluntary—i.e., not the result of a regulatory order or other directive requiring environmental mitigation.

Before CDFW may approve a project under HREA, the State Water Board must certify that the project qualifies under its § 401 General Water Quality Certification for Small Habitat Restoration Projects and the applicant must demonstrate compliance with CEQA (see below). The Department also must determine that the project is consistent with “best available restoration and enhancement methodologies,” as described in federal or state species recovery plans, CDFW and NMFS fish screening criteria or fish passage guidelines, CDFW’s California Salmonid Stream Habitat Restoration Manual, or other approved methodologies. Approval under HREA also can include incidental take authorization *in lieu* of a permit under the California ESA. (CDFW 2019f)

Although HREA is a relatively new law, it is likely to be a key component of many future habitat restoration actions as it affords proponents quick project review and approval (30-60 days) and safe harbor protection under

CESA. CDFW approval also can help habitat restoration and enhancement projects qualify for funding under CDFW's Fisheries Restoration Grant Program and other grant initiatives.

### **Regional Conservation Investment Strategies Act (Fish and Game Code §§ 1850-1861)**

In 2016, California Legislature authorized CDFW and other public agencies to create Regional Conservation Investment Strategies. The purpose of an RCIS is “to inform science-based nonbinding and voluntary conservation actions and habitat enhancement actions that would advance the conservation of focal species, including the ecological processes, natural communities, and habitat connectivity upon which those focal species depend.” These are all essential components of ecosystem-based management.

RCISs also can guide the structure and implementation of voluntary conservation and habitat improvement strategies, including identification of goals and priorities; investments in resource improvements and related infrastructure, and “identification of areas for compensatory mitigation for impacts to species and natural resources.”

As noted in the text, RCIS agreements may become increasingly popular as they represent less costly and complex alternatives to HCPs, NCCPs, and Safe Harbor Agreements. The current RCIS statute allows only eight RCISs, however, unless a state water or transportation infrastructure agency asks CDFW to exceed the statutory cap. CDFW 2019g)

### **NEPA and CEQA (16 U.S.C. §§ 4321-4335; Public Resources Code §§ 21100-21189.57)**

The National Environmental Policy Act (NEPA) requires an analysis of proposed actions that are undertaken, permitted, or funded by an agency of the United States. The statute directs the action agency to prepare an environmental impact statement (EIS) for “major federal actions” that may “significantly affect the quality of the human environment.” The EIS must analyze the likely environmental effects of, and feasible alternatives to, the proposed action and recommend a preferred alternative that includes reasonable measures to avoid or mitigate harm to the environment. For other actions, the agency must prepare a less detailed environmental assessment (EA) accompanied by a “finding of no significant impact.”

The California Environmental Quality Act (CEQA) is the state counterpart to NEPA. It requires state and local agencies to evaluate the potentially significant effects of their proposed actions, including permitting and funding of private activities, on the environment. The statute directs the action agency to prepare an environmental impact report (EIR) “to identify the significant effects on the environment of a project, to identify alternatives to the project, and to indicate the manner in which those significant effects can be mitigated or avoided.” If a proposed project is not likely to have significant environmental effects, the agency may file a “negative declaration” to that effect.

Where a proposed action involves both the federal and state governments (including actions that require federal and state permits) it is common for the agencies to publish a consolidated EIS/EIR. The two laws have many similarities, but they differ in one important respect. CEQA states that the action agency “shall mitigate or avoid the significant effects on the environment of projects that it carries out or approves whenever it is feasible to do so.” In contrast, NEPA only requires the action agency to *consider* mitigation measures with no mandate that it actually implement them.

Both statutes play an important and pervasive role in land and water resources regulation and management. This would not change with a shift to ecosystem-based management strategies. The state and regional boards prepare programmatic EIRs to accompany their water quality plans. Water rights permitting includes environmental review, either in the form of an EIR or “mitigated negative declaration.” FERC licensing and § 401 certification usually entail voluminous EIS and EIR analyses respectively. Habitat restoration projects also trigger environmental review because of the federal and state permitting requirements described above. CEQA does

provide an exemption, however, for small habitat restoration projects (5 acres or smaller) that do not involve hazardous materials and would not adversely affect endangered, rare, or threatened species or their habitat.

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# Appendix B. Profiles of Freshwater Ecosystem Management in California

## Introduction

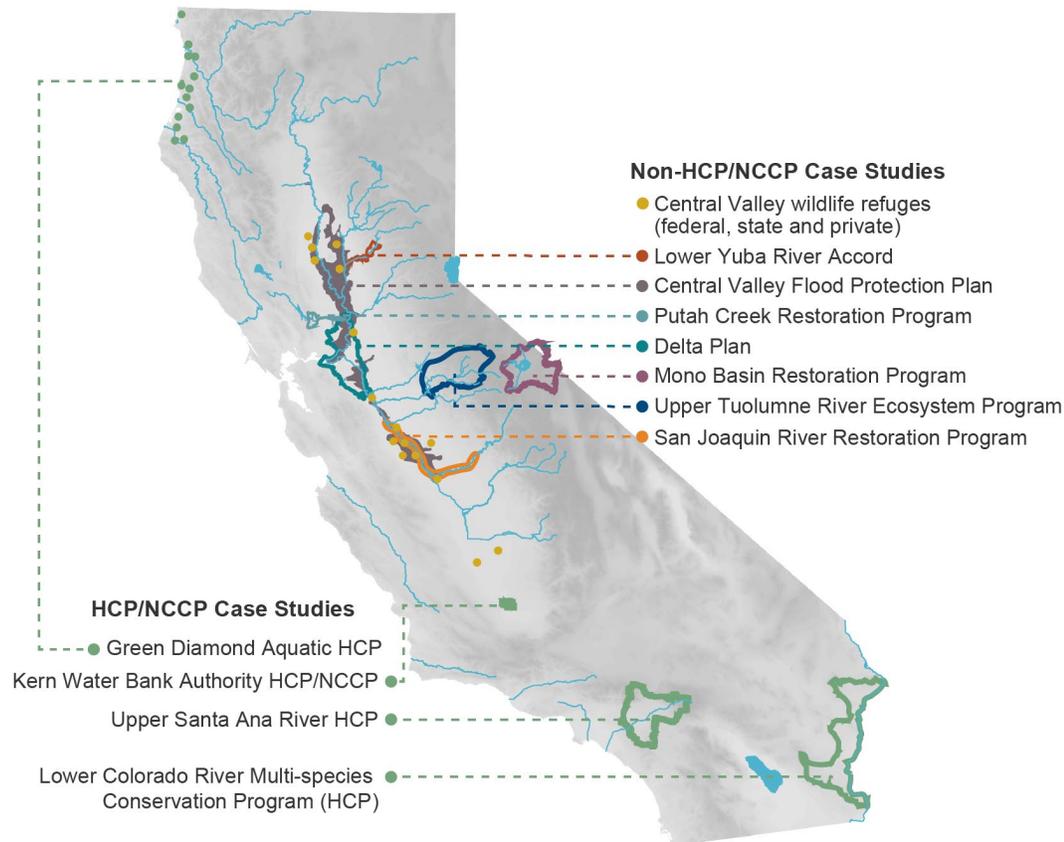
We reviewed 12 programs in California and compared them to the planning and governance framework and management actions and principles set forth in the main report. These programs fall into three categories:

- programs developed to meet permitting requirements for species listed under federal and state ESAs;
- programs developed to meet water quality control plan regulations; and
- programs mandated by state legislation.

Several fall into both of the first two categories. Most involve settlement agreements following litigation.

The programs are listed here in alphabetical order. Figure B.1 shows their locations—highlighting those that are managed under Habitat Conservation Plans (HCPs) and Natural Communities Conservation Plans (NCCPs) or through other mechanisms. Sources for the case studies are provided in the reference list.

**FIGURE B.1**  
Locations of case studies in ecosystem-based management



SOURCE: Developed by the authors from multiple sources.

## Central Valley Flood Protection Plan (2017)

The 2008 Central Valley Flood Protection Act required extensive planning to reduce flood risk in the Central Valley and to integrate improvements in ecosystem function with flood management through multi-benefit projects. The 2017 update of the plan is oriented toward an ecosystem-based approach.

### Planning and governance framework:

- **Desired ecosystem condition:** The 2017 update includes goals and objectives that integrate human uses of the floodplains with ecosystem improvements by prioritizing multi-benefit projects. There is a strong emphasis on improving ecosystem function rather than targeted species.
- **Metrics and performance measures:** Planning documents do not prescribe performance measures, but offer guidance on metrics.
- **Scientific support:** The plan incorporates existing best available science, but does not prescribe a structured science program for implementation.
- **Transparent governance and administration:** There was well-organized and extensive stakeholder input into development of the plan. The Central Valley Flood Protection Board will oversee implementation.
- **Reliable funding:** Costs and potential sources of funding are identified in the plan, with heavy reliance on uncertain future bond funding, fees, and federal support.

### Management actions and principles:

- **Ecosystem water budgets:** The plan does not address flows, ascribing responsibilities to other agencies. This is a significant weakness.
- **Functional flows:** The plan prescribes extensive reconnection and improvement of riparian, floodplain, and wetland habitat.
- **Manage water quality and water volume together:** The plan pays limited attention to water quality issues other than noting benefits of reconnection with floodplain and wetland habitat.
- **Native and non-native species management:** Emphasis is on management of invasive, non-native plants.
- **Management at the proper scale:** The plan is of sufficient scale to have major benefits when fully implemented.

## Central Valley Wildlife Refuges (1992)

A management program for wetlands in the Central Valley, involving federal, state, and local agencies and environmental groups, focused primarily on waterbirds.

### Planning and governance framework:

- **Desired ecosystem condition:** The effort focuses on resident and migratory waterbirds, with objectives for ecosystem conditions that support a range of bird species through cooperative use of water and farmland for habitat.
- **Metrics and performance measures:** Although still being developed, there are strong, scientifically-supported conservation objectives that guide management of this program.
- **Scientific support:** The effort is supported by a highly collaborative multi-agency and stakeholder-based science program.
- **Transparent governance and administration:** There is broad cooperation among the many partners in this effort, including a management board that sets goals and objectives and coordinates actions.

- **Reliable funding:** Although challenging at times, the effort is reasonably well-funded. This stems in part from federal allocations from multiple sources, most specifically from the 1992 Central Valley Project Improvement Act (CVPIA) and funds from the U.S. Fish and Wildlife Service.

### Management actions and principles:

- **Ecosystem water budgets:** The program has one of the most sophisticated ecosystem water budgeting systems in the state, although there is limited flexibility to trade and store water.
- **Functional flows:** The program emphasizes the flexible timing and geographic allocation of water to improve ecosystem condition, principally in wetlands. Because this is water is principally for wetlands, however, it does not involve functional river flows.
- **Manage water quality and water volume together:** Poor water quality in some wetlands influences the amount and sources of water used.
- **Native and non-native species management:** The emphasis is on managing both native and non-native wetland plants to improve wetland function that supports waterbirds.
- **Management at the proper scale:** Because the program is coordinated throughout the Central Valley, it operates at a scale that creates the greatest benefit. However, the amount of managed wetlands is small relative to historical conditions and is vulnerable during drought.

## Delta Plan (2019)

A comprehensive management plan for the Sacramento-San Joaquin Delta required by the 2008 Delta Reform Act. It seeks to balance water supply reliability with ecosystem health. The ecosystem plan update is in draft form and has not been formally adopted as of this writing (fall 2019).

### Planning and governance framework:

- **Desired ecosystem condition:** Draft plan amendments provide a sophisticated description of desired ecosystem conditions in the Delta and integrate human uses of the ecosystem.
- **Metrics and performance measures:** The draft plan prescribes a suite of metrics and performance measures, focused principally on administrative actions.
- **Scientific support:** The draft plan effectively summarizes current scientific understanding of the Delta. The overall Delta plan addresses the coordination of science.
- **Transparent governance and administration:** Governance and coordination of ecosystem investments remain a work in progress in the Delta. It is unclear how the Delta Plan will ultimately achieve this under the limited authorities of the Delta Stewardship Council.
- **Reliable funding:** The Draft Plan provides no funding mechanisms for achieving ecosystem objectives.

### Management actions and principles:

- **Ecosystem water budgets:** The draft plan does not identify how to procure or manage ecosystem water budgets.
- **Functional flows and structural habitat:** The draft plan has a strong emphasis on improvement of structural habitat and connection to flows, but it does not prescribe how to acquire ecosystem water budgets.
- **Manage water quality and water volume together:** The overall Delta Plan recognizes the importance of improving water quality, but it does not prescribe actions, leaving that to the State Water Board.
- **Native and non-native species management:** The draft plan addresses invasive plant and animal management, but not direct management of native species.

- **Management at the proper scale:** The Delta Reform Act limited planning to the legal Delta, although planning documents recognize the importance of managing conditions in the greater watershed.

## Green Diamond Aquatic HCP (2007)

A conservation plan to support habitat restoration and reduce impacts of logging on North Coast rivers containing multiple listed species of fish and amphibians.

### Planning and governance framework:

- **Desired ecosystem condition:** The HCP identifies a range of geomorphic and water quality conditions necessary to support listed species fish and amphibians and to protect species that are candidates for listing.
- **Metrics and performance measures:** The plan sets standards for management of erosion from slopes and roads, along with recruitment of large woody debris to improve in-stream habitat.
- **Scientific support:** Plan implementation includes monitoring of erosion and stream conditions, designed to feed into an adaptive management program.
- **Transparent governance and administration:** Governance is managed solely through the timber company (Green Diamond Resource Company) and the two federal regulatory agencies (National Marine Fisheries Service and US Fish and Wildlife Service).
- **Reliable funding:** All funding is provided by the timber operator.

### Management actions and principles:

- **Ecosystem water budgets:** There is no direct management of water.
- **Functional flows and structural habitat:** The HCP emphasizes improving water quality and structural habitat, principally for salmonids, with no direct water management.
- **Manage water quality and water volume together:** The focus is on improving water temperature and reducing turbidity, and reducing sediment input to streams.
- **Native and non-native species management:** An experimental fish passage program seeks to move migrating salmonids around natural barriers.
- **Management at the proper scale:** The program's very large area (>400,000 acres) improves the likelihood of success, however, the effort is not integrated into overall watershed planning.

## Kern Water Bank Authority HCP/NCCP (1997)

A joint HCP/NCCP to manage wetlands and terrestrial habitat within the area of the Kern Water Bank to support multiple listed species.

### Planning and governance framework:

- **Desired ecosystem condition:** The project is focused principally on improving upland and intermittent wetland habitat for both listed and unlisted species. It integrates these activities with groundwater banking by the Kern Water Bank Authority (KWBA).
- **Metrics and performance measures:** The plan establishes broad guidelines for activities, rather than specific performance measures and metrics.
- **Scientific support:** KWBA, principally through consultants, conducts annual surveys, but has no well-defined science program.
- **Transparent governance and administration:** KWBA manages all aspects of governance and administration, with activities recorded in an annual report.

- **Reliable funding:** KWBA provides all financial support for activities. In addition to funding from banking partners, a conservation bank on a portion of the property—which makes mitigation habitat available to other parties within Kern County—provides some revenues.

### Management actions and principles:

- **Ecosystem water budgets:** Efforts to conduct groundwater recharge are used to promote intermittent wetland function based on water availability. There is no ecosystem water budget.
- **Functional flows and structural habitat:** Intermittent wetlands are managed to maximize benefits of recharge activities while promoting listed species habitat.
- **Manage water quality and water volume together:** Although the banking project must manage water quality for water users, no efforts are required to manage water quality for habitat.
- **Native and non-native species management:** The project includes intensive management of non-native vegetation to maintain habitat quality.
- **Management at the proper scale:** The focus is on upland habitat and intermittent wetland at the scale of the water bank. The effort promotes waterbirds but is not integrated into broader regional habitat management efforts.

## Lower Colorado River Multi-species Conservation Program (2005)

An HCP led by the US Bureau of Reclamation that seeks to recover multiple federally-listed aquatic and terrestrial species and prevent future listings.

### Planning and governance framework:

- **Desired ecosystem condition:** The program focuses principally on improving habitat for specific listed and sensitive species in ways that are compatible with hydropower and water supply operations. The emphasis is on riparian plants and animals, but includes conservation and reintroduction measures for several listed species of fish.
- **Metrics and performance measures:** The plan describes specific measures of habitat improvement and species management goals with a schedule for implementation
- **Scientific support:** There is strong scientific support through federal, state and local partnerships.
- **Transparent governance and administration:** The program is managed by a steering committee made up of 57 entities that include a wide range of agencies, tribes, and stakeholders.
- **Reliable funding:** Half of the program is funded by the US Bureau of Reclamation, and the other half principally by water user groups.

### Management actions and principles:

- **Ecosystem water budgets:** A modest amount of water is allocated to inundate channel margin, floodplain and backwater sites, depending on water year type. This water can be flexibly managed, depending upon objectives and conditions.
- **Functional flows and structural habitat:** The focus is on using allocated water to reconnect the main stem river to high-quality channel margin and off-channel habitat.
- **Manage water quality and water volume together:** The program addresses selenium impacts associated with rewetting of some habitat; otherwise this is not a major issue.
- **Native and non-native species management:** The program includes intensive management of native species—including rearing of two listed native fishes with the intention of reintroduction—and management of invasive plants.

- **Management at the proper scale:** Although the HCP applies to 400 miles of the Lower Colorado River, the actual scale of management—approximately 8,000 acres—is small relative to the watershed.

## Mono Basin Restoration Program (1998)

A program to restore ecosystems in the Mono Basin, based on court orders, a settlement agreement, and a State Water Board decision.

### Planning and governance framework:

- **Desired ecosystem condition:** Decision 1631 of the State Water Board sets an array of conditions for the operations of the Los Angeles Department of Water and Power (LADWP) in the Mono Basin. These are largely focused on stream ecosystem condition to support fisheries, waterfowl, and inflows to Mono Lake.
- **Metrics and performance measures:** The board’s order sets out a suite of conditions and actions that must be met, along with a timeline for implementation.
- **Scientific support:** LADWP organizes and conducts monitoring and scientific reviews, either directly or through consultants, and has some independent scientific oversight.
- **Transparent governance and administration:** Management of the program is conducted by LADWP under orders from the board, and includes annual reports. Interested parties—such as the Mono Lake Committee—have input but do not share in governance and administration.
- **Reliable funding:** LADWP provides the bulk of the funding, based on the State Water Board’s order.

### Management actions and principles:

- **Ecosystem water budgets:** Actions in the Mono Basin are focused on allocation of flows from storage facilities or bypassing of facilities to improve specific ecosystem function and restore a more natural hydrograph.
- **Functional flows and structural habitat:** Extensive efforts are made to pair flows with modifications both in-channel and off-channel to improve structural habitat.
- **Manage water quality and water volume together:** Flows take into account the need to maintain low water temperatures during summer to support trout.
- **Native and non-native species management:** The program includes non-native riparian plant management and grazing management efforts, along with plantings to improve stream cover and recruitment of woody debris.
- **Management at the proper scale:** The scale of the management program is large relative to stream size, and is sufficient to manage water levels in Mono Lake.

## Putah Creek Restoration Program (2000)

Based on a settlement agreement, this program seeks to improve ecosystem conditions in lower Putah Creek through changes in flow regime and habitat management.

### Planning and governance framework:

- **Desired ecosystem condition:** The original settlement focused on improving flow conditions for native fishes, but actions led to overall improvement in aquatic and riparian habitat, benefitting a wide range of species.
- **Metrics and performance measures:** The settlement set flow standards, which have been met and exceeded in subsequent years.

- **Scientific support:** There is strong local scientific support from UC Davis, citizen science groups, and the Solano County Water Agency.
- **Transparent governance and administration:** Planning, implementation, and oversight involve a diverse array of parties that represents local interests well.
- **Reliable funding:** Although costs of water delivery are born entirely by the water agency, restoration and administration costs depend largely upon state grants.

### Management actions and principles:

- **Ecosystem water budgets:** Minimum release schedules mimic historic flow variation at a diminished level. This accomplishes many of the ecological functions necessary to support native plants and animals.
- **Functional flows and structural habitat:** There are no large-scale habitat reconnections, but there are significant in-channel and channel margin restoration efforts to improve function.
- **Manage water quality and water volume together:** Water quality is not actively managed under this program.
- **Native and non-native species management:** There is extensive effort to manage invasive riparian plants and to improve spawning habitat.
- **Management at the proper scale:** The project focuses on a relatively small segment of the watershed below major storage and diversion structures, but it forms an important link to the Yolo Bypass and the Sacramento-San Joaquin Delta.

## San Joaquin River Restoration Program (2012)

Based on a settlement, the program seeks to improve ecosystem conditions on the San Joaquin River, principally for spring-run Chinook salmon.

### Planning and governance framework:

- **Desired ecosystem condition:** The settlement had two narrow goals: maintaining fish in good condition with the goal of reintroducing spring-run Chinook salmon, and reducing regulatory impacts on water users. In the beginning it did not focus on ecosystem conditions, but it has expanded to include broader ecosystem objectives.
- **Metrics and performance measures:** The settlement set timelines for actions, general flow standards, and governance and administrative metrics.
- **Scientific support:** The program has strong federal and state agency support and oversight from interested parties.
- **Transparent governance and administration:** The program is administered by state and federal agencies, but has input and oversight from settlement parties as well as the general public.
- **Reliable funding:** A diverse, but incomplete array of funds are available for the program, including federal funds, state bond funds, and surcharges on water use.

### Management actions and principles:

- **Ecosystem water budgets:** The settlement allocates a portion of the unimpaired runoff and gives leeway to a water manager to release that water to meet restoration goals and to reduce impacts on water users (for instance with a program where water users can repurpose restoration flows downstream once they have been used).
- **Functional flow and structural habitat:** The program will involve extensive channel and floodplain modifications to improve structural habitat enhanced by increased flows.

- **Manage water quality and water volume together:** There is extensive effort to manage flow and water quality together, both for temperature-sensitive species and the impacts of increased flows on groundwater quality.
- **Native and non-native species management:** The program has efforts to reintroduce native species, notably spring-run Chinook salmon. Extensive management of non-native fishes and invasive aquatic and terrestrial plants will be required to meet ecosystem objectives.
- **Management at the proper scale:** The program focuses on the reach of river from Friant Dam to the confluence with the Merced River. This fails to integrate management with the lower San Joaquin River, which may interfere with the program's goals (particularly for fish passage).

## Upper Santa Ana River HCP

A coalition of 11 agencies responsible for water supply, wastewater, stormwater and habitat management are preparing a comprehensive HCP to cover all water management related actions in the Upper Santa Ana River Watershed. Draft documents released in 2019 seek to coordinate all federal and state water-related permitting under the proposed HCP. If successful, this program may become a model for ecosystem-based management of water in heavily urbanized watersheds.

### Planning and governance framework:

- **Desired ecosystem condition:** The draft plan identifies a range of desired ecosystem functions and conditions for the upper watershed, principally within four tributaries, to support a wide range of listed and non-listed species. Restoration will be integrated with water management and take advantage of opportunities to improve ecosystem condition using treated wastewater and stormwater.
- **Metrics and performance measures:** Timelines, responsibilities, and metrics are identified in draft documents and will be part of programmatic state and federal permits for covered actions.
- **Scientific support:** The program includes extensive independent scientific assessments of the HCP and development of baseline information. An official science program has yet to be established.
- **Transparent governance and administration:** Management will be conducted by a joint powers authority (JPA) comprised of the 11 regulated agencies, with extensive involvement of agencies and stakeholders.
- **Reliable funding:** The JPA will fund all activities. A unique cost-sharing arrangement has been established that assesses proportional financial responsibility to each JPA member, but pools resources flexibly to meet overall project objectives.

### Management actions and principles:

- **Ecosystem water budgets:** The program specifies water budgets to meet basic instream flow requirements and ecological flows, and allows for flexible storage and geographic allocation of treated wastewater.
- **Functional flows and structural habitat:** Extensive efforts are underway to restore tributary streams to take advantage of improved instream flows and flow flexibility.
- **Manage water quality and water volume together:** The program will use treated wastewater and stormwater to improve ecosystems and to meet water quality standards.
- **Native and non-native species management:** The program envisages extensive species management, including translocation of listed species to improved habitat and management of invasive plants.
- **Management at the proper scale:** The program manages the entire upper watershed.

## Upper Tuolumne River Ecosystem Program (2006)

A program to integrate ecosystem restoration with water and hydropower management below Hetch Hetchy reservoir.

### Planning and governance framework:

- **Desired ecosystem condition:** The program sets objectives to improve aquatic and riparian ecosystem conditions below water supply and hydropower facilities and to balance multiple uses of the watershed, including recreation.
- **Metrics and performance measures:** The program emphasizes adaptive management to meet goals, rather than specific metrics and performance measures, although it includes well-described metrics for management of snowmelt.
- **Scientific support:** The San Francisco Public Utilities Commission (SFPUC) runs a monitoring program, but there is no formal science program. There is, however, strong cooperation with scientists from federal partner agencies.
- **Transparent governance and administration:** Although run principally by SFPUC, the project has regular stakeholder briefings and input from state and federal agency partners.
- **Reliable funding:** The program is reliably funded by SFPUC ratepayers.

### Management actions and principles:

- **Ecosystem water budgets:** The adaptive management program sets aside water for minimal flow releases and pulse flows to mimic natural seasonal changes in hydrology.
- **Functional flow and structural habitat:** There has been significant experimentation with flows to connect to and improve structural habitat for multiple species, but no restoration of structural habitat to date.
- **Manage water quality and water volume together:** Flow experimentation efforts measure impacts on water temperature for sensitive species, principally trout.
- **Native and non-native species management:** There are small amounts of non-native vegetation management. Flow releases are used to suppress non-native trout spawning.
- **Management at the proper scale:** The overall program focuses on response to changes in releases from hydropower and water supply infrastructure. Federal partners—such as the National Park Service and the National Forest Service—focus on watershed-scale processes, including undammed tributaries and the upper watershed.

## Lower Yuba River Accord

In 2008 the Yuba County Water Agency entered into settlement agreements—approved by the State Water Board—to achieve three goals: improve conditions for salmon and steelhead on the lower Yuba River, promote conjunctive or coordinated use of surface water and groundwater along the river, and allow for sale of water to support ecosystem water needs in Sacramento-San Joaquin Delta and water supply needs in regions dependent on Delta water exports.

### Planning and governance framework:

- **Desired ecosystem condition:** The accord prescribed improved flow and water quality, principally to support salmon and steelhead.
- **Metrics and performance measures:** The accord set a series of flow release standards, with some flexibility for adaptive management. It also required actions to improve fish passage.
- **Scientific support:** Yuba Water Agency does most of the data collection and reporting.

- **Transparent governance and administration:** The program is overseen and advised by a River Management Team made up of multiple agencies, water users, and stakeholders.
- **Reliable funding:** Yuba Water Agency supports most of the activities of the accord through fees and revenues from water transfers, but additional support comes from state bond funds.

### Management actions and principles:

- **Ecosystem water budgets:** Depending on water year type, the program sets aside a volume of water available to maintain flow and water quality for fisheries in the lower Yuba, with modest flexibility. This includes conjunctive use of groundwater, which is novel.
- **Functional flow and structural habitat:** The original accord focused narrowly on flows, but recent efforts are seeking to improve structural habitat and link it with flow.
- **Manage water quality and water volume together:** The accord directly addresses flow and water quality together, with an emphasis on temperature to support salmonids.
- **Native and non-native species management:** Currently there is no direct species management, but proposals for improved fish passage at upstream dams are under consideration.
- **Management at the proper scale:** The accord focused on the lower 24 miles of the Yuba River. The Yuba Water Agency is expanding its management to the entire watershed, including headwater forests.

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