January 19, 2024

By email

Joaquin Esquivel, Chair
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

RE: DRAFT STAFF REPORT ON PROPOSED SACRAMENTO/DELTA UPDATES

Dear Chairman Esquivel,

This letter is submitted as the comments of San Francisco Baykeeper, the Bay Institute, the Golden State Salmon Association, Defenders of Wildlife, Institute for Fisheries Resources, and the Pacific Coast Federation of Fishermen's Associations (SF Baykeeper et al) regarding the State Water Resources Control Board's (Board's) September 2023 Draft Staff Report (Draft Staff Report) in support of potential Sacramento/Delta Updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan).

In summary, neither the proposed project nor the Voluntary Agreement (VA) alternative:

- comply with federal and state mandates to restore and maintain the chemical, physical and biological integrity of the nation's waters, reasonably protect fish and wildlife beneficial uses of those waters, and protect the public trust;
- adequately define viability as called for in their respective proposed narrative

objectives;
- establish objectives and/or targets relating to fisheries, estuarine habitat, and other beneficial uses;
- include a detailed program of implementation (POI) capable of attaining Plan objectives;
- adequately analyze the potential effects of alternatives on fish, wildlife, habitats, and associated beneficial uses, including the effects of climate change;
- adequately analyze how alternative water supplies can offset impacts of flow improvements.

Indeed, under the VA alternative current status quo conditions of species decline towards extinction, fisheries closures, increasing impacts of harmful algae blooms, and ecosystem collapse would not improve and would likely worsen.

Acronyms and Abbreviations[1]

7DADM	7-day average daily maximum
°C	degrees Celsius
°F	degrees Fahrenheit
µS/cm	microSiemens per centimeter
AB	Assembly Bill
AF	acre-feet
AF/yr	acre-feet per year
AFRP	Anadromous Fish Restoration Program
Bay Area	San Francisco Bay Area
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta Estuary
Bay-Delta Plan	*Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary*
BDMEP	Bay Delta Monitoring and Evaluation Program
BiOp	biological opinion
BIPOC	black, Indigenous, and people of color
BLM	Bureau of Land Management
BMP	best management practice
CAISO	California Independent System Operator
CalEPA	California Environmental Protection Agency
CalRecycle	California Department of Resources Recycling and Recovery
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CASGEM	California Statewide Groundwater Elevation Monitoring
CASRAA	California Sub-Regional Agricultural Analysis
Central Valley Basin Plan	*Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin*
CCWD	Contra Costa Water District
CDBW	California Department of Parks and Recreation, Division of Boating and Waterways
CDFW	California Department of Fish and Wildlife
CDEC	California Data Exchange Center
Central Valley Water Board	Central Valley Regional Water Quality Control Board
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cfs	cubic feet per second
cms	cubic meters per second
CNRA	California Natural Resources Agency
CVP	Central Valley Project

[1] Please note this list is predominantly the same as the Acronyms and Abbreviations List included in the "Draft Staff Report : Sacramento/Delta Update to the Bay Delta Plan," September 2023, Table of Contents, for ease of reading and review.

CVPIA	Central Valley Project Improvement Act
CVTEMP	Central Valley Temperature Mapping and Prediction
CWS	community water system
D-1641	State Water Board Water Right Decision 1641
DAC	disadvantaged community
DCC	Delta Cross Channel
DDW	Division of Drinking Water
Delta	Sacramento-San Joaquin Delta
Delta Flow Criteria Report	Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem
Delta Reform Act	Sacramento-San Joaquin Delta Reform Act of 2009
DMC	Delta-Mendota Canal
DPS	distinct population segment
DSC	Delta Stewardship Council
DSM2	Delta Simulation Model II
DSP	Delta Science Program
DUC	disadvantaged unincorporated community
DWR	California Department of Water Resources
DWSRF	Drinking Water State Revolving Fund
EBMUD	East Bay Municipal Utility District
EFH	essential fish habitat
E:I	exports to imports
ESA	Endangered Species Act
ESU	evolutionarily significant unit
EO	executive order
eWRIMS	electronic Water Rights Information Management System
FAS Declaration	Fully Appropriated Stream Declaration
FERC	Federal Energy Regulatory Commission
Final Draft Scientific Basis Report Supplement	Final Draft Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan
GHG	greenhouse gas
GPCD	gallons per capita per day
GSA	groundwater sustainability agency
GSP	groundwater sustainability plan
HAB	harmful algal bloom
HCP	habitat conservation plan
HORB	Head of Old River Barrier
I:E	inflow to export ratio
IEP	Interagency Ecological Program
IID	Imperial Irrigation District
ISB	Independent Science Board

ISR	independent science review
ITP	incidental take permit
km	kilometer
LIRA	Low-Income Rate Assistance
LSJR/SD	Lower San Joaquin River/Southern Delta
LSZ	low salinity zone
LTO	long term operations of the Central Valley Project and State Water Project
MAF	million acre-feet
MAF/yr	million acre-feet per year
MCL	maximum contaminant level
mgd	million gallons per day
mg/l	milligrams per liter
MOU	memorandum of understanding
MRDO	minimum required Delta outflow
MWD	Metropolitan Water District of Southern California
NCCP	natural community conservation plan
NDOI	net Delta outflow index
NMFS	National Marine Fisheries Service
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NWR	national wildlife refuge
OAL	Office of Administrative Law
Ocean Plan	Water Quality Control Plan for the Ocean Waters of California
OMR	Old and Middle Rivers
OSWS	Office of Sustainable Water Solutions
Porter-Cologne Act	Porter-Cologne Water Quality Control Act
PWA	public water agency
R-GPCD	residential gallons per capita per day
RBDD	Red Bluff Diversion Dam
Reclamation	U.S. Bureau of Reclamation
regional water board	Regional Water Quality Control Board
RMP	Regional Monitoring Program
RPA	reasonable and prudent alternative
Sacramento/Delta	Sacramento River watershed, Delta eastside tributaries, and Delta regions
SacWAM	Sacramento Water Allocation Model
SAFER	Safe and Affordable Funding for Equity and Resilience
San Francisco Bay Basin Plan	Water Quality Control Plan for the San Francisco Bay Basin
San Francisco Bay Water Board	San Francisco Bay Regional Water Quality Control Board
SB	Senate Bill

Scientific Basis Report	Scientific Basis Report in Support of New and Modified Requirements for Inflows from the Sacramento River and its Tributaries and Eastside Tributaries to the Delta, Delta Outflows, Cold Water Habitat, and Interior Delta Flows (2017)
SED	substitute environmental document
SDAC	severely disadvantaged community
SDWA	Safe Drinking Water Act
SGMA	Sustainable Groundwater Management Act
SRWTP	Sacramento Regional Wastewater Treatment Plant
SPFC	State Plan of Flood Control
Draft Staff Report	Draft Staff Report /Substitute Environmental Document in support of potential updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta estuary for the Sacramento River and its tributaries, Delta eastside tributaries, and Delta
State Parks	California Department of Parks and Recreation
State Water Board, Board	State Water Resources Control Board
SWAP	Statewide Agricultural Production
SWP	State Water Project
TAF	thousand acre-feet
TAF/yr	thousand acre-feet per year
TBU	Tribal Beneficial Use
TEK	traditional ecological knowledge
TCD	temperature control device
TMDL	total maximum daily load
TUCP	Temporary Urgency Change Petition
UIF	Unimpaired Flow
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VAMP	Vernalis Adaptive Management Plan
VAs	Voluntary Agreements
VA Term Sheet	Memorandum of Understanding Advancing a Term Sheet for the Voluntary Agreements to Update and Implement the Bay-Delta Water Quality Control Plan, and Other Related Actions
Water Boards	State Water Board and Regional Water Quality Control Boards
WEAP	Water Evaluation and Planning
WQCP	water quality control plan
WWTP	wastewater treatment plant

I. OVERVIEW

In the face of a growing and severe ecological crisis, the Board has spent the better part of two decades crafting updates to the Bay-Delta Plan to reasonably protect fish and wildlife beneficial uses. These delayed and too often meager efforts have so far done nothing to reverse the catastrophic path we are on, despite the potential permanent loss of these beneficial uses. The Draft Staff Report's proposed project and the Voluntary Agreement alternatives will not change our course.

First, the Draft Staff Report does not adequately analyze or describe how the proposed water quality objectives will reasonably protect fish and wildlife beneficial uses. It identifies flows that are necessary to protect entire ecosystems, including six fish species listed under the state and federal Endangered Species Acts, then elects not to act to ensure those flows are protected for the benefit of fish and wildlife.

Second, the Draft Staff Report improperly defers a host of legally mandated analyses and requirements. The document lacks any Program of Implementation, defers setting relevant standards, goals, and definitions for what protection of beneficial uses requires, and uses fluctuating baselines.

Third, the proposed VAs are not a serious option for protecting water quality, fish and wildlife, fisheries, communities in the Delta, or for acting as a Program of Implementation for the Bay-Delta plan. The VAs stem from secretive negotiations among powerful interests, not transparency and inclusion of impacted people and organizations. They rely on illusory and incomplete promises with no clear actual requirements, and purport to attain water quality objectives by amending those objectives' (long-overdue) deadlines and relying on scientifically unsupported theories that if only there were more habitat restoration, the negative impacts of too little water in the rivers will somehow vanish. But this *Field of Dreams* theory of water management through habitat restoration is not consistent with the reality of the causes of the crisis before us as amply demonstrated in the scientific record.

Too much coldwater habitat has been made inaccessible behind impassable dams, and too much water is removed from the Sacramento River, the Delta's eastside tributaries, and the Delta. Continuing unchecked, diversions, dams, reservoirs, tunnels, and all manner of other damaging and outdated "infrastructure" will continue to expand and degrade the ecosystems of the Bay-Delta and its tributaries. The proposed project will not adequately reverse the trends we have set in motion. Even worse, the Voluntary Agreements are unlikely to maintain the status quo, let alone improve upon it. And the Draft Staff Report fails to contain the analysis and information necessary to allow the Board to make an informed decision based on the best available science and evidence, nor the public to understand the Board's eventual actions. The Draft Staff Report, like the projects it analyzes, is inconsistent with California law.

In addition to the analysis in this letter and its supporting materials, SF Baykeeper et al. join in and support the separate comments submitted by the Delta Tribal Environmental Coalition regarding (a) the background of the state's water rights system, (b) the historical transformation of the Bay-Delta hydrology, (c) the impacts of the adoption of the proposed project on communities and people in the Delta including the civil rights consequences, (d) the failure of the Board to meaningfully engage in tribal consultation, (e) the need for establishing and protecting tribal beneficial uses, including the failure of existing water quality objectives and beneficial uses to protect those tribal uses, and (f) the emerging public health and environmental dangers posed by Harmful Algal Blooms in the Delta.

The Delta Tribal Environmental Coalition provides a necessary perspective that has been historically disregarded by the state in establishing water rights and water quality standards. The Board should ensure that the failures identified by DTEC on these subjects are rectified, not just in this update to the Bay-Delta Water Quality Control Plan, but throughout the Board's obligations to under state and federal law.

A. Legal Framework and Requirements for an Adequate Update to the Bay-Delta Water Quality Control Plan

California's Water Resources Control Boards have "primary responsibility for the coordination and control of water quality" in the state. (Wat. Code § 13001.) The State Water Resources Control Board (Board) is directly responsible for setting, reviewing, and updating water quality standards for the Bay-Delta through the Bay-Delta Plan Water Quality Control Plan (Bay-Delta Plan). In doing so, the Board must comply with a host of legal mandates under California and federal law.

1. California Environmental Quality Act

The Board is subject to the legal requirements of the California Environmental Quality Act (CEQA) in the update process of the Bay-Delta Plan. The purpose of CEQA is to ensure that agencies regulating activities "that may" affect the environment give primary consideration to preventing environmental damages. *Ross v. California Coastal Com.*, 199 Cal.App.4th 900 (2011). While it is important that the Bay-Delta Plan update process adhere to federal Clean Water Act and Porter Cologne Act requirements, SF Baykeeper et al. also believes that CEQA requirements are important to make sound science-based policy judgments, to encourage public engagement, and ensure accountability for the government's decisions.

Here, the Board has chosen to prepare a substitute environmental document (SED) to meet their legal requirements under CEQA to update the Bay-Delta Plan as part of a certified regulatory program. *See* Pub. Resources Code, § 21080.5(b)(2); Cal. Code Regs., tit. 23, § 3775 et seq.; Pub. Resources Code, § 21080.5; Cal. Code Regs., tit. 14, § 15251(g), § 15252(a). The Board further defines their responsibilities under CEQA, claiming:

> This entire Draft Staff Report can be considered the SED that fulfills the requirements of CEQA and the State Water Board's CEQA regulations (Cal. Code Regs., tit. 23, § 3775 et seq.) to analyze the environmental effects of the proposed regulatory activity. The majority of the environmental analyses and conclusions are presented in Chapters 7 and 9. The Draft Staff Report will inform the State Water Board's consideration of the Sacramento/Delta updates to the Bay-Delta Plan described within this document.

Draft Staff Report at 1-6.

The Board is correct to note that an agency may prepare an SED in lieu of an environmental impact report (EIR) for a certified regulatory program *if* the SED complies with CEQA goals and policies. *See* Cal. Code Regs., tit. 23, § 3775; *see also California Sportfishing Protection Alliance v. State Water Resources Control Bd.* 160 Cal.App.4th 1625 (2008). However, the Board also "must comply with all other requirements of CEQA." *Mountain Lion Found. v. Fish & Game Com.,* 16 Cal. 4th 105, 114 (1997); *see also Ross v. California Coastal Com.,* 199 Cal.App.4th 900, 933 (2011). Therefore, like an EIR, the SED must (among a host of other requirements) include a stable and finite project description, analyze a reasonable range of alternatives to the project, avoid adverse impacts, and impose feasible mitigation measures to reduce a project's significant adverse impacts. Cal. Pub. Res. Code § 21080(c), Cal. Code Regs., tit. 14, §§ 15126.6, 15370.

As written, the Draft Staff Report does not meet these requirements. The Draft Staff Report project description is incomplete and misleading by not including a Program of Implementation, piecemealing project alternatives and biasing analysis to the Voluntary Agreement alternative (VAs). Thus, the public cannot ascertain all potential benefits and impacts of the proposed project, nor assess the "whole of the action." As discussed in more detail below, the Draft Staff Report must be revised and recirculated to comply with CEQA.

2. <u>The Porter-Cologne Act and Clean Water Act</u>

The Porter-Cologne Water Quality Control Act is California's "comprehensive legislative plan" for protecting the quality of California's waters. (*Azusa Land Reclamation Co. v. Main San Gabriel Basin Watermaster* (1997) 52 Cal.App.4th 1165, 1180.) It declares it to be state policy "that the quality of all the waters of the state shall be protected for use and enjoyment by the people of the state." (Wat. Code § 13000.) The Act also declares "that the health, safety and welfare of the people of the state requires [sic] that there be a statewide program for the control of the quality of all the waters of the state; [and] that the state must be prepared to exercise its full power and jurisdiction to protect the quality of waters in the state from degradation originating inside or outside the boundaries of the state . . . ." (Ibid.) The Act aims "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." (*City of Arcadia v. State Water Res. Control Bd.* (2006) 135 Cal. App. 4th 1392, 1405.)

Porter-Cologne also implements the federal Clean Water Act of 1977, 33 U.S.C. § 1251 et seq., which prioritizes protection of fish and wildlife, see 33 U.S.C. § 1251(a)(2), and requires states with water quality control plans to have standards in place for fish and wildlife protection. (See 33 U.S.C. § 1313.)

With respect to the Bay-Delta in particular, the Board has a "duty to provide water quality protection to the fish and wildlife that make up the delicate ecosystem within the Delta." (*United States v. State Water Resources Control Bd.* (1986) 182 Cal.App.3d 82, 98.) A water quality control plan "consists of a designation or establishment for the waters within a specified area of all of the following:

(1) Beneficial uses to be protected [;]
(2) Water quality objectives [; and]
(3) A program of implementation needed for achieving water quality objectives."
Wat. Code § 13050(j).

"Beneficial uses" of state waters to be protected against water quality degradation include 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, tribal beneficial uses (both fishing and cultural uses), and protection of subsistence, recreational, and commercial fisheries. (See Wat. Code § 13050(f).) The Draft Staff Report purports to analyze the impact on fish and wildlife beneficial uses, and then uses that information as a proxy for protection of other related beneficial uses. *See, e.g.,* Draft Staff Report at 7.2-1.

"Water quality objectives" are "the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area." (Wat. Code § 13050(h).) Once the Board has designated beneficial uses for a specified area, it "shall establish such water quality objectives in [the] water quality control plan[] as in its judgment will ensure the reasonable protection of beneficial uses. . . ." (*Id*. § 13241.) Water quality objectives can be numeric or narrative. In establishing water quality objectives, the Board must consider various factors including: "(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. (e) The need for developing housing within the region. (f) The need to develop and use recycled water." (*Ibid*.) The Draft Staff Report proposes a host of new water quality objectives as part of the proposed project and the VAs, and, notwithstanding the lack of a POI, purports to implement the existing narrative protection objective (requiring that the natural production of Chinook Salmon in the Bay-Delta watershed be doubled from a historical baseline)—an objective that was designed to be met over two decades ago.

Once the Board has established the water quality objectives, it must develop a "program of implementation" that will achieve the objectives. (Wat. Code § 13050(j)(3); *United States v. State Water Resources Control Bd.* (1986) 182 Cal.App.3d at 119; see also *State Water Resources Control Bd. Cases* (2006) 136 Cal.App.4th 674, 775 ["Determining what actions were required to achieve the [Salmon Doubling Objective] was part of the Board's obligation in formulating the 1995 Bay-Delta Plan in the first place."].) The POI must include, inter alia, "[a] description of the nature of actions which are necessary to achieve the objectives, including recommendations for appropriate action by any entity, public or private" and "[a] time schedule for the actions to be taken." (Wat. Code § 13242(a)-(b).)

Because the POI must achieve the Plan's objectives, the Board may not consider other factors when establishing the POI—its obligation to the Plan's objectives is absolute. (*San Joaquin River Exchange Contractors Water Authority v. State Water Resources Control Bd.* (2010) 183 Cal.App.4th 1110, 1119-1120 [explaining the consideration of Water Code section 13241 factors occurs only when establishing water quality objectives and not with respect to the POI].)

In short, Porter-Cologne mandates the State Board adopt and "periodically review []," Wat. Code § 13240, a Bay-Delta Water Quality Control Plan which: (1) identifies relevant beneficial uses of water, (2) contains water quality objectives that reasonably protect those beneficial uses, and (3) creates a program of implementation with the measures that <u>will achieve</u> the water quality objectives.

Federal and state law also mandate public participation in the review and update of a water quality control plan. (*See, e.g.*, Wat. Code § 13244; 33 U.S.C. § 1313(c)(1).

3. <u>Public trust</u>

The Board must safeguard public trust resources. This includes "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." (*Nat'l Audubon Soc'y v. Superior Court* (1983) 33 Cal.3d 419, 446; see also Wat. Code § 1243.5.)

"The public trust doctrine, as recognized and developed in California decisions, protects navigable waters from harm caused by diversion of nonnavigable tributaries." (*Audubon, supra*, 33 Cal.3d at 437 [footnotes omitted].) This includes groundwater hydrologically connected to navigable surface waters. (*Id.* at 436-37; see also *S.F. Baykeeper, Inc. v. State Lands Com.* (2015) 242 Cal.App.4th 202, 233; *Envtl. Law Found. v. State Water Resources Control Bd.* (2018) 26 Cal.App.5th 844.)

"Wild fish have always been recognized as a species of property the general right and ownership of which is in the people of the state" – they are quintessential public trust resources. (*Cal. Trout v. State Wat. Res. Control Bd.* (1989) 207 Cal.App.3d 585, 630.) "The title to and property in the fish within the waters of the state are vested in the state of California and held by it in trust for the people of the state." (*Ibid*. [quoting *People v. Monterey Fish Products Co.* (1925) 195 Cal. 548, 563].)

Beyond water and wild fish, the public trust secures a host of other uses and values, including navigation, commerce, fishing, hunting, swimming, and the protection of waters, lands, and wildlife for ecological, aesthetic, and spiritual benefits. (*See, e.g., S.F. Baykeeper*, 242 Cal.App.4th at 233; *Marks v. Whitney* (1971) 6 Cal.3d 251, 259-60). The Delta Reform Act noted the "particular[] importan[ce] and applicab[ility]" of the public trust and other constitutional principles to the Bay-Delta. (Wat. Code § 85023.)

At minimum, in setting water quality objectives, the Board must consider the availability of water supplies from wastewater recycling, improved water use efficiency, urban stormwater capture, and other sources as it relates to the public trust.

4. Fish and Game Code section 5937

California Fish and Game Code section 5937 is part of the statutory expression of public trust protections for wild fish. As early as 1914, the California Fish and Game Commission documented the impacts of dam operations fish in California, leading the Legislature to pass the 1915 Flow Act, which required dam operators to release water to protect fish populations downstream (Grantham and Moyle 2014). California Fish and Game Code section 5937 provides:

> The owner of any dam 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.

Fish and Game Code § 5937.

This mandate evolved from a series of statutory protections for instream flows and fisheries, dating from California's earliest days of statehood. (See Karrigan Bork et al., The Rebirth of California Fish and Game Code § 5937: Water for Fish, 45 U.C. Davis L. Rev. 809 (2012).) These protections pre-date construction and operation of the dams within the Sacramento River and its tributaries, as well as the direct tributaries to the Delta.

Academic literature identifies a three-tiered evaluation to determining whether fish are in good condition: (1) the fish community; (2) the fishes' populations; and (3) the health of individual fish. (See Bork, *supra*, 45 U.C. Davis at 869-872; see also Moyle (1998; 2017). In summary, "in good condition" requires that fish populations below dams be self-sustaining, healthy, and representative of the native species that naturally existed. Similarly, Moyle (2017), explained, "The definition has three tiers, individual, population, and community (Moyle et al. 1998). By this definition, the fish in good condition below the dam should be in good physical health and also be part of self-sustaining populations, supported by extensive habitat for all life history stages. The third level of good condition, community, refers to the presence complex assemblages of native fishes, including runs of salmon and other anadromous fish, as well as fisheries for both native and non-native fishes."

Courts have interpreted fish in "good condition" for purposes of Section 5937 to require the maintenance of historic fisheries. (See *California Trout, Inc. v. Super. Ct.* (1990) 218 Cal.App.3d 187, 210 (1990); see also *NRDC v. Patterson* (E.D. Cal. Aug. 27, 2004) 333 F. Supp. 2d 906, 924; Bork, *supra*, 45 U.C. Davis at 860-869.) And "sufficient water" has been held to require maintaining the "prediversion carrying capacity of fish" in streams, rivers, or creeks. (*California Trout, Inc. v. Super. Ct.*, 218 Cal.App.3d 187, 210 (1990).)

The Bay-Delta Plan and Draft Staff Report must explain how the flow requirements will ensure compliance with the Fish and Game Code by ensuring sufficient flows are provided to maintain fish in good condition. The Draft Staff Report fails to analyze or meet these standards.

5. *Delta Protection Act*

The Board and the Bay-Delta Plan update process are also subject to the requirements of the Delta Protection Act. (Cal. Water Code §§ 12200-12205). The Delta Protection Act gives the Board authority to consider water conservation, water recycling, and other alternative water supplies which are available to municipal, industrial, and agricultural water users in determining the feasibility of protecting public trust resources and the reasonability of water quality objectives that protect instream beneficial uses. (*See* Board Decision 1485 at 16-17). The Draft Staff Report fails to include these elements that are necessary to meet the purposes of the Delta Protection Act.

The court in the *State Water Res. Control Bd. Cases* summarized the Delta Protection Act's fundamental purpose, stating:

> …the Delta Protection Act recognizes the importance of providing salinity control and an adequate water supply in the Delta to serve dual goals: (1) maintaining and expanding agriculture, industry, urban, and recreational development in the Delta; and (2) providing fresh water for export to areas of water deficiency. As between these two goals, however, the Delta Protection Act gives preference to the first. *Thus, no one may divert water from the Delta that is necessary for salinity control or to provide an adequate water supply for users within the Delta.*

136 Cal. App. 4th 674, 768 (2006) (emphasis added).

Specifically, the legislative intent of the Act specifies the Delta Protection Act addresses the need "for the protection, conservation, development, control and use of the waters in the Delta for the public good." (Cal. Water Code §§ 12200).

The Draft Staff Report, and more specifically the Program of Implementation once developed, must address these requirements.

6. Requirements to account for regional climate change

Addressing regional climate change is required by Resolution No. 2017-0012, which requires a "comprehensive response to climate change in all Board actions." Draft Staff Report at 4-37. Climate change is not included in the SacWAM modeling at this time because of "the uncertainty and lack of detailed climate change information required to produce inputs to the model." Draft Staff Report at 6-8. This omission limits the usability of the analysis of water supply impacts, and of how shifting unimpaired flow might change the outcomes of the Plan. Discussions of climate change in Chapter 2, 4.6, and in the environmental analyses do not amount to a "comprehensive response to climate change."

Nonetheless, such uncertainties do not change the urgency of securing significantly higher flows to the estuary to protect fish and wildlife beneficial uses. Section 5.6.2.3 states that in accordance with Resolution 2017-0012, climate effects will be addressed in the proposed objectives and implementation measures. New objectives and a POI based on the percentage of unimpaired flows approach and the application of coldwater habitat criteria are the best way to accommodate climate change.

B. The Degradation and Potential Loss of Identified Fish, Wildlife, and Estuarine Habitat Beneficial Uses Violates Porter Cologne, the Clean Water Act, the Public Trust Doctrine, California Fish and Game Code §5937, and Other Statutory Requirements

Approving the continued degradation and potential loss of identified fish, wildlife, and estuarine habitat beneficial uses violates the Board's legal obligations. Both native fish and wildlife populations, and the estuarine habitats and ecological processes that support them are collapsing in the Bay-Delta and in danger of irreparable damage. Based on review of data and analyses presented in the Draft Staff Report, it is clear that flows under the proposed project cannot support any science-based definition of viability for several key species. Nor is the proposed project likely to sustain commercial and recreational fisheries, protect estuarine habitat, or attain the Plan's narrative salmon protection objective. Moreover, without defining the biological outcomes that represent reasonable protection of fish and wildlife beneficial uses and attainment of the Plan's objectives, the Board cannot demonstrate that the proposed project and its program of implementation (when it is developed) will satisfy various legal requirements including preservation of existing fish and wildlife beneficial uses and the ability to actually achieve its narrative water quality objectives. This violates at least the Porter Cologne Act, the Clean Water Act, the Public Trust doctrine, and California Fish and Game Code section 5937.

The status quo of native fish populations in the Bay-Delta estuary and its watershed is decline (SWRCB 2010; SWRCB 2017). Existing flow requirements contained in the Bay-Delta Plan, federal Endangered Species Act biological opinions, and state Endangered Species Act incidental take permit are inadequate to maintain native species viability, fisheries, or the estuarine habitat upon which fisheries and imperiled fishes rely (SWRCB 2010, 2017; CDFW 2010). Further, as the Board notes, much of the flow into and through the Delta is unregulated—above the Board's requirements but beyond the capacity of current infrastructure to capture. Yet neither required flows nor the higher actual ones have been sufficient to prevent widespread declines in fish and wildlife populations. As the Draft Staff Report states:

> Native species have continued to experience declines in abundance since implementation of Water Right Decision 1641 (D-1641) in 2000, including several species that are protected under the federal Endangered Species Act (ESA) and California Endangered Species Act (CESA). The impaired hydrology of the Bay-Delta watershed has acted through a number of mechanisms to decrease reproductive output and survival of young, including the magnitude and timing of flows needed for adult attraction, transport of larval fish to estuarine rearing habitats, inundation of floodplain spawning and rearing habitat, and maintenance of low-salinity rearing habitat in Suisun Bay and Marsh. Historically, the Delta exhibited higher outflow in winter and spring than in recent years… Reductions in flows during winter and spring have reduced potential recruitment opportunities and the viability of the estuarine- dependent community. Anadromous salmonids, which use habitat in the Bay-Delta estuary and upstream tributaries, have also exhibited substantial declines in population abundance in recent decades.

Draft Staff Report at 7.6.2-4.

The situation has worsened since publication of the Final Scientific Basis Report (SWRCB 2017) upon which the Draft Staff Report's assessment is based. The Board recently acknowledged that "risks of extirpation for multiple fish species are high" (Order Conditionally Approving a Petition for Temporary Urgency Changes, State Water Board, June 1, 2021, at 7, available at https://www.waterboards.ca.gov/drought/tucp/docs/2021/20210601_swb_tuco.pdf).

Current water quality objectives and regulations have failed to maintain viability of numerous native Bay-Delta fish species. Six native fish populations are listed as threatened or endangered under either CESA, the federal ESA, or both, and petitions to list others are pending state and federal review (*See* Attachment: White Sturgeon CESA petition). Numerous other fish species native to the Bay-Delta are listed by the California Department of Fish and Wildlife (CDFW) as species of special management concern (CDFW 2015). Even among fishes that are not officially imperiled, various fisheries have been closed or severely restricted in recent years. The common denominator for these impacts is the reduction and alteration of Central Valley river flow into and through the Delta to San Francisco Bay. This is the primary driver of their decline. Central Valley Steelhead and Chinook Salmon are additionally plagued by water released from impassable dams that is too warm to support spawning, egg incubation, or juvenile rearing (Moyle et al. 2017; SWFSC 2021, 2023).

These outcomes demonstrate that neither the maintenance of existing flow requirements, even assuming the additional unregulated flows that currently exist, nor the maintenance of these requirements plus unregulated flows nor current temperature requirements will prevent the continued decline of native fish populations, much less restore viability, or reasonably protect beneficial uses, including estuarine habitat, commercial, recreational, and subsistence fisheries, or tribal beneficial uses. Furthermore, the marginal increases in the frequency of critical flow levels projected to occur under some alternatives reviewed in the Draft Staff Report is not evidence that these alternatives are sufficient to increase population abundance for target species (as the Draft Staff Report claims at 7.6.2-38), much less attain the Bay-Delta Plan's objectives or reasonably protect fish and wildlife and other beneficial uses.

C. The Draft Staff Report Fails to Analyze Whether the Proposed Project will Reasonably Protect Beneficial Uses or is Likely to Achieve the Bay-Delta Plan's Objectives Because it Fails to Define Key Terms, Outcomes, and Thresholds Consistent with the Best Available Science

1. The Board must define "viability" in the context of its proposed new narrative objective

SF Baykeeper et al. supports the Board's goal to restore and support population viability of native aquatic organisms, especially given that numerous fish species in the Bay-Delta and its watershed are not currently viable. In order to determine whether the proposed project is likely to protect beneficial uses and achieve the Bay-Delta Plan's objectives, the Board must define precisely what "viability" and related terms mean. The Board must also articulate what biological outcomes would reflect viability for populations of a broad array of native aquatic species that are indicators of the status of the estuarine habitat ("EST") beneficial use, or are rare ("RARE"), or support commercial and recreational fisheries ("COMM"), or are related to other critical ecosystem services and designated fish and wildlife beneficial uses. Similarly, the Board must describe what other ecological outcomes (e.g., status, extent, and connectivity of habitats and ecological processes) would represent reasonable protection for these and other identified beneficial uses that are not adequately protected by existing water quality objectives.

The proposed narrative objectives for inflow, outflow, and interior Delta flow all seek to support natural production and maintenance of "viable" native fish populations, as does the proposed VAs' narrative viability objective. However, the Draft Staff Report does not define this term. In ecological parlance, "viability" refers to a low likelihood of population extirpation within a relatively long time-frame. For example, NMFS provides the following definition of viability for Pacific Salmon populations: "...a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100- year time frame." (McElhaney et al. 2000 at 2). Similarly, in the field of conservation biology, the term "minimum viable population" refers to "the smallest isolated population size that has a specified percent chance of remaining extant for a specified period of time in the face of foreseeable demographic, genetic, and environmental [variability], plus natural catastrophes." (Meffe and Carroll 1994 at 562). The Board must define "viability" and, where relevant scientific information is available, should parameterize its definition of viability for each target species identified in Chapter 3 of the Draft Staff Report and the 2017 Scientific Basis Report. The best available scientific evidence is more than sufficient to establish quantitative viability parameters for these species. Indeed, in many cases the Board should not only identify specific quantitative targets for viable populations but consider directly adopting them as Table 3 water quality objectives in the form of biocriteria. Furthermore, parameterizing viability means establishing numeric flow objectives that are quantified on the basis of achieving thresholds and targets for viability.

In contrast, the Board's previous descriptions of the flows that support "viability" during the Phase 1 court proceedings included not causing harm, providing opportunities for survival, avoiding lethal temperatures, or otherwise affirming the Board's independent obligations not to violate state and national laws such as CESA and the federal ESA.

2. <u>The Board must clarify and demonstrate the level of reasonable protection the Bay-Delta Plan will provide to commercial, recreational, and subsistence fisheries</u>

Current water quality objectives do not support Bay-Delta fisheries. For example, the Draft Staff Report states:

> Excluding the near full closure of the ocean salmon fishery from 2008 through 2009, California commercial Chinook salmon catch between 1976 and 2022 varied from approximately 14.4 million pounds (dressed weight) in 1988 to a low of 228 thousand pounds in 2010. Since 2010, average harvests from 2011 through 2022 were 1.8 million pounds, less than one quarter of the 1986–1990 average annual harvest, and less than half of the 1996–2005 average (PFMC 2023a).

Draft Staff Report at 8-105. Other fisheries in the Bay-Delta have faced similar or worse impacts from inadequate flow and water temperature management (SWRCB 2017 Table 4.5-1 at 4-27; *see below*).

The Board must clarify and demonstrate how those beneficial uses will be reasonably protected by Plan updates. However, the Board's narrative and numeric flow objectives do not necessarily support reasonable protection of commercial and recreational fisheries (collectively, COMM), subsistence fisheries, or tribal subsistence fisheries (T-SUB). Maintaining fishing beneficial uses necessarily involves factoring in the permitted occurrence of additional mortality for target fish species, which a minimally viable population would not be able to withstand (i.e., harvest would make the fished populations non-viable). For example, populations of several of the Bay-Delta's endangered species once supported fisheries, but fishing for these species is now prohibited in order to prevent further declines and allow their return to viability.

The Draft Staff Report fails to analyze the long history of lost commercial fisheries for many species in the Bay-Delta (*see below*). This analysis is critical to demonstrating the Board's failure to protect commercial fishing, and to appropriately balance protection of fishing and other beneficial uses. Fisheries that are closed cannot represent reasonable protection of these identified beneficial uses, nor can fisheries that are maintained at minimal levels and constantly at risk of closure and permanent loss. Again, the Board must identify its desired outcomes for beneficial uses – without such a description, it is not possible to determine whether proposed new flow objectives and the yet-to-be-developed program of implementation can support those outcomes.

3. <u>The Board must clarify and demonstrate how Bay-Delta Plan updates will reasonably protect estuarine habitat</u>

Current water quality objectives and regulations have clearly failed to reasonably protect estuarine habitat (EST). Evidence of this failure includes (but is not limited to) the low production of native invertebrates on which fish and wildlife species feed and the increasing number of invasive invertebrate species (Kimmerer et al. 2002; Winder et al. 2011), as well as the proliferation of toxic algal blooms in the Delta (Berg and Sutula 2015; Kudela et al. 2023). Protection of estuarine habitat requires, among other things, levels of food web productivity beyond the levels required to support minimally viable populations of fish and wildlife. Populations of prey items respond positively to freshwater flows into and through the Delta to San Francisco Bay (Kimmerer 2002; Hennessy and Burris 2017a,b; *see below*); invasion by non-native species is more likely during periods of low Delta outflows (Winder et al. 2011), and the Delta's toxic algal blooms respond negatively (improving estuarine conditions) when river flows are well above what current regulations require (Berg and Sutula 2015; Lehman 2020).

For purposes of this Plan update, the Board should revise its proposed narrative flow objective such that "viable" includes reasonable protection of estuarine habitat, and it should modify the proposed numeric flow objectives and include additional objectives as necessary to ensure that the estuarine habitat beneficial use is protected (*see below*).

4. <u>The Board must clarify and demonstrate how Bay-Delta Plan updates will maintain fish "in good condition," per the requirements of Fish and Game Code §5937</u>

The Draft Staff Report fails to analyze whether the proposed project will maintain fish in good condition, as required under §5937. In order to evaluate the effect of proposed water quality updates, and resulting changes in reservoir operations, the Board must describe what outcomes will represent "fish in good condition" for purposes of the Plan.

As early as 1914, the California Fish and Game Commission documented the impacts of dam operations fish in California, leading the Legislature to pass the 1915 Flow Act, which required dam operators to release water to protect fish populations downstream (Grantham and Moyle 2014). This law eventually became §5937 of the state Fish and Game Code, which states:

> The owner of any dam 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.

Courts have adopted a three-tiered definition of "in good condition" offered by Moyle (1998; 2017), which requires that fish populations below dams be self-sustaining and comprised of healthy individuals and representative of an assemblage dominated by native species that persist over time. Moyle (2017) summarized his definition this way:

> The definition has three tiers, individual, population, and community (Moyle et al. 1998). By this definition, the fish in good condition below the dam should be in good physical health and also be part of self-sustaining populations, supported by extensive habitat for all life history stages. The third level of good condition, community, refers to the presence complex assemblages of native fishes, including runs of salmon and other anadromous fish, as well as fisheries for both native and non-native fishes.

5. <u>The Board should use empirical relationships between freshwater flow and attributes of species viability and between flow and estuarine habitat, as available, to identify a flow regime that reasonably protects beneficial uses and achieves Bay-Delta Plan objectives</u>

To evaluate the effect of different flow regimes on native fish species, the Board has identified flow thresholds that affect attributes of viability for each of several target species (SWRCB 2017; Draft Staff Report Chapter 3). For some key species, the flow thresholds previously identified by the Board are out of date and no longer consistent with the best available science. These outdated flow thresholds must be revised to reflect the best available science. SF Baykeeper et al. identifies needed corrections below.

To understand the effect of a given flow regime, the Board needs to evaluate how frequently these flow thresholds are attained and compare these "return frequencies" for each alternative to the frequency needed to reasonably protect beneficial uses and to achieve Plan objectives. Although the Board has analyzed the return frequency of its previously identified threshold flows, the Draft Staff Report fails to describe how frequently these threshold flows must be attained in order to reasonably protect fish and wildlife beneficial uses or to attain plan objectives. Below, we provide science-based guidance for the desired frequency of threshold flows for a variety of species. In addition, the Board must account for the fact that several flow-viability relationships are continuous, meaning that benefits accrue above and below threshold levels (e.g., by limiting declines in viability, or by increasing resilience beyond minimum thresholds). One of the benefits of the Board's percentage of unimpaired flow approach is that it automatically shifts the range of flows, increasing the frequency of higher flows and increasing the magnitude of the lowest flows in the flow range. The Board should document the return frequency of the lowest flows (i.e., in the driest years) that can still be deemed protective for species with linear flow-viability relationships.

D. Current Flow Standards are Inadequate to Maintain Viability of, or Fisheries for, Native Fish Species or Maintain Estuarine Habitat

1. *Species status*

The Draft Staff Report (Chapter 3; *see also* SWRCB 2017) provides ample evidence that fish and wildlife beneficial uses and water quality are not protected adequately by current Bay-Delta Plan objectives. The Draft Staff Report also demonstrates that substantial increases in river flow into and through the Delta to San Francisco Bay will be necessary to provide reasonable protection of fish and wildlife beneficial uses. The Board acknowledges, "[f]low is commonly regarded as a key driver or "master variable" governing the environmental processes in riverine and estuarine systems such as the Bay-Delta and its watershed" (SWRCB 2017 at 3-2).

However, Chapter 3 should be updated to reflect the current status of key fish and wildlife species and the abundant new research concerning critical relationships between flow and viability attributes that has emerged with respect to some of the target species evaluated previously by the Board. Below, SF Baykeeper et al. provides a brief description, status update, and review of relevant literature (with an emphasis on literature published since SWRCB 2017) connecting freshwater flow to metrics of viability and fisheries of several target species and Bay-Delta estuarine habitat. We then review how the proposed project and proposed Voluntary Agreements can be expected to affect fish viability and fish and wildlife beneficial uses.

a) Delta Smelt

Although they were formerly abundant, Delta Smelt are nearly undetectable in the wild. Recent research confirms strong relationships of Delta outflow with survival and/or recruitment of larvae. Because they live only one year and then die, Delta Smelt viability relies on flow and estuarine habitat conditions that support population growth in almost all years. The Board must identify flow targets for the protection of Delta Smelt in spring and revise its flow targets for summer and fall to reflect levels that will protect this species across the full range of annual hydrologies. Specifically, a wealth of recent research demonstrates that in order to prevent extinction of Delta Smelt, flow improvements are urgently needed in the summer and fall[2]. In addition, the Board must evaluate levels of water export/Old and Middle River flow rates that are reasonably protective of Delta Smelt given recent findings that the population is nearly undetectable in the wild and cannot withstand *any* additional loss to entrainment in the CVP and SWP south Delta export facilities (Smith et al. 2001)

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[2] Summer and fall flow levels that are protective of Delta Smelt may exceed unimpaired flows at times, because of physical and biological modifications that frequently make the Delta inhospitable during those seasons (Feyrer et al. 2011)

(1) Description

Delta Smelt are small fish, endemic to the San Francisco Bay estuary – they live nowhere else on Earth. These fish usually live just one year and die after spawning (i.e., they are "semelparous"), making it essential that spawning and rearing conditions necessary to support a viable population occur every year. Their persistence in the San Francisco Bay estuary for thousands of generations demonstrates that historically these fish found adequate food and spawning and rearing habitat every year despite highly variable hydrologic conditions (Moyle 2002).

(2) Status

Viability

Once among the most numerous resident fish in the northern San Francisco Bay estuary (CDFW 2001; Moyle 2002), Delta Smelt are now among the most severely endangered fish species in the world. They were first listed as "threatened" under the federal and state Endangered Species Acts (ESAs) in 1993; the species' conservation status was revised to "endangered" under the California ESA in 2009., Delta Smelt are now rarely detected in various fish community sampling programs. Abundance indices have declined by > 99% since the species was first listed under the ESA. Indeed, since 2017, no Delta Smelt have been caught at index-stations of CDFW's Fall Midwater Trawl (Figure 1), which was formerly the index of record for this fish, or the Interagency Ecological Program's Bay Study.

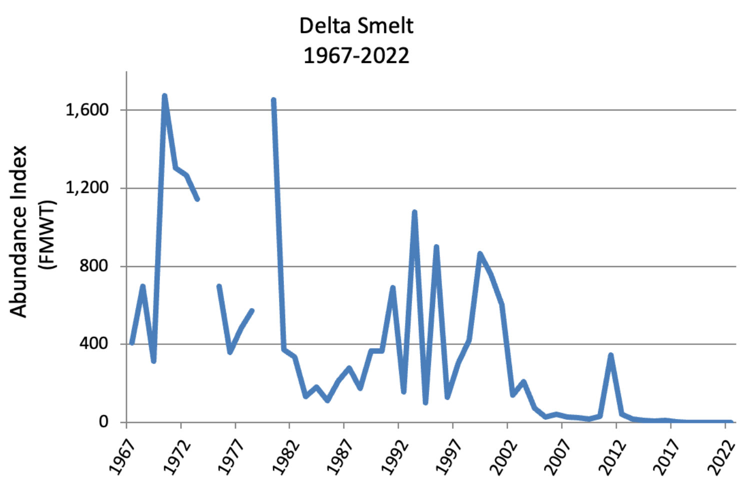


Figure 1: Delta Smelt abundance through time as measured by CDFW's Fall Midwater Trawl (https://apps.wildlife.ca.gov/FMWT). No Delta Smelt have been captured at stations used to produce this index since October 2017, although other surveys and salvage operations at the CVP and SWP water export pumps in the south Delta continue to detect a few Delta Smelt sporadically.

Fishery

CDFW (2001 at 472) reports "In the 19th century, delta smelt *(Hypomesus transpacificus)* and longfin smelt were the object of a commercial fishery that supplied markets in San Francisco. Much of the market seems to have been for dried fish for the Chinese community." The fish remained abundant into the late 1960s, but its current status as an extremely rare and protected fish prevent this species from supporting a fishery currently.

(3) Relationship to flow

Delta Smelt population viability benefits from increased flows into and through the Delta. USFWS (2016 at 2) reported that in most months, higher levels of Delta Outflow were associated with a greater likelihood of Delta Smelt population growth from one year to the next, stating:

> "We find that increasing outflows through the San Francisco Bay-Delta increases the likelihood of Delta Smelt, a fish that only lives one year, surviving to propagate the species ... the results provide strong support for a role of Delta outflow on the population trend of Delta Smelt when its abundance the year prior has been accounted for."

The effect of Delta outflow on Delta Smelt population productivity results from positive effect of flow on survival in various life stages and on recruitment from the adult to the larval phase (*see below*). In addition, Delta outflow is known to affect the distribution of the Delta Smelt population (USFWS 2019 at 162) and USFWS notes: "…even very modest differences in the assumption about [Delta Smelt] spawning distribution can have a large effect on predictions of proportional entrainment." (USFWS 2019 at 153) – entrainment mortality is a significant factor undermining the viability of Delta Smelt. Thus, Delta outflow levels affect at least three attributes of Delta Smelt viability – abundance, productivity, and spatial distribution.

The Board previously determined, based on research from the fisheries agencies (IEP 2015; CDFW 2016; USFWS 2016) that Delta Smelt survival increases with increases in summer Delta outflow (SWRCB 2017 at 3-75). More recently, Polansky et al. (2021) reported strong evidence for an effect of summer Delta Outflow on post-larval survival of Delta Smelt. Other Delta flow variables were significant predictors of survival of different Delta Smelt life stages. In particular, Polansky et al. (2021) found strong evidence for the effect of fall X_2 (a proxy for Delta outflow in the fall) on subsequent Delta Smelt recruitment and Delta. This is consistent with recent findings that abundance of one of the Delta Smelt's chief prey items – the copepod, *Psuedodiaptomous forbesi* – responds positively to Delta outflow in summer (Hennessy and Burris 2017a,b; Kimmerer et al. 2018) and fall (Hassrick et al. 2022). Furthermore, the Interagency Ecological Program (IEP) found a very strong linear relationship between X_2 during Feb-June and abundance of larval Delta Smelt, especially after accounting for the effect of adult abundance (IEP 2015; SWRCB 2017).

The Board fails to identify key Delta outflows necessary to protect Delta Smelt that are consistent with the science showing strong correlations between Delta Smelt viability and Delta outflow in various seasons. The Board documents a very strong linear relationship between winter-spring X_2 (a proxy for Delta outflow) and larval abundance (SWRCB 2017 3.8-2 at 3-74) and Kimmerer and Rose (2018) found that increasing Delta outflow (reducing X_2) increased recruitment of early Delta Smelt life stages such that population growth rate (a key metric of viability) increased substantially. Nevertheless, the Board fails to identify winter-spring flows levels that would restore and be protective of Delta Smelt viability.

Also, although the summer flow-survival relationship is continuous (i.e., within the range of flows studied, each increment of increase in flows produces an increase in Delta Smelt survival) and highly significant statistically (SWRCB 2017 Figure 3.8-3 at 3-75), the Board inexplicably identifies as protective only the highest value of X_2 (equivalent to the lowest Delta outflows) associated with this relationship, corresponding to Delta outflow of ~7,500 cfs. This level of flow is at the low end of the flow-abundance relationship for Delta Smelt's primary summer prey species (*P. forbesi* ; Hennessy and Burris 2017a,b; Kimmerer et al. 2018). To be consistent with the best available science, the Board should identify higher Delta outflows during June through September as necessary to protect Delta Smelt in almost all water years.

Similarly, the Board identifies fall outflow thresholds consistent with fall X_2 values from the USFWS Biological Opinion (USFWS 2008) for Delta Smelt.[3] The fall outflow thresholds are the minimum values previously considered to be protective of Delta Smelt developed in the context of the ESA requirement to avoid "jeopardy"; they are not values of X_2 that are expected to produce population growth and recovery. Even these minimally protective fall flow levels apply only following Wet or Above Normal water years and the Board recommends no fall flow protections in other water year types. Recent studies indicate that fall flow augmentations would likely have a positive effect on availability of *P. forbesi* – a key Delta Smelt prey item – in drier year types as well (Hennessy and Burris 2017a,b; Kimmerer et al. 2018; Hassrick et al. 2023). The Board should identify fall flows protective of the Delta Smelt food supply and its estuarine habitat in fall months of each year type.

Entrainment and "salvage" of Delta Smelt is strongly and exponentially correlated with the magnitude of (tidally averaged) "reverse" or negative flows in the Old and Middle River channels of the San Joaquin River (OMR); i.e., flows away from the Bay. Such flows are caused by high levels of water export at the State Water Project (SWP) and federal Central Valley Project (CVP) export facilities in the south Delta (USFWS 2008; SWRCB 2017 at 3-77 through 3-80). Smith et al. (2021) found that entrainment-related mortality (including, salvage and pre-screen mortality) was a major threat to Delta Smelt viability and that any additional mortality from entrainment/salvage was inconsistent with maintaining the Delta Smelt population in the wild (they also noted that controlling this source of mortality alone would not be sufficient to restore the population). The finding of grave impacts to Delta Smelt from entrainment-related

[3] Curiously, the "Fall X_2" flow value identified for September of Above Normal years is just 7,100 cfs, which is less than the "Summer" flow recommendation for September (7,500 cfs) for all year types (SWRCB 2017 at 3-76). The Board should correct or clarify this internal inconsistency.

mortality caused by CVP and SWP export operations in the south Delta is consistent with the findings of other research efforts (Kimmerer 2008, 2011). Similarly, Polansky et al. (2021) found that OMR flows were among the most powerful predictors of survival for sub-adult Delta Smelt. These results are consistent with earlier studies that found statistically significant negative correlations between Delta Smelt abundance and winter-spring water exports by the CVP and SWP pumps in the south Delta (Thomson et al. 2010; Mac Nally et al. 2010) and with modeling studies that showed very large increases in population growth rate (a key to viability) arose from eliminating entrainment mortality (Kimmerer and Rose 2018).

Recognizing the importance of salvage mortality and other entrainment-related mortality on Delta Smelt viability, the Board found that OMR flows more negative than -1,250 cfs to -5,000 cfs during December-June of all water years would not be protective of Delta Smelt (SWRCB 2017 at 3-76). The 2019 federal ESA Biological Opinion for Delta Smelt (USFWS 2019 BiOp) and 2020 CESA Incidental Take Permit for SWP operations (ITP) allow for OMR flows more negative than what the Board has recommended for these moths (e.g., via the "storm flex" provision; ITP §8.7; at 92). There is no scientific evidence indicating that these more negative OMR flows are protective of Delta Smelt. The Board should specify that OMR flows must be no more negative than -1,500 cfs during Mar-Jun of Dry and Critically Dry water years, as it did previously (SWRCB 2010 at 76-78).

Despite their near absence in fish sampling programs since 2017, Delta Smelt are still detected in "salvage" facilities of the CVP and SWP water export facilities in the south Delta. Estimated "salvage" was over 50 fish in 2023 (*See* Attachment: Smelt Salvage Table 2017 thru 2023). Because the number of fish believed to die in the infrastructure leading to the "salvage" facility screens is far greater than the number detected in salvage (Castillo et al. 2012), the true number of Delta Smelt killed as a result of entrainment in 2023 may have been in the hundreds or thousands. Much of the Delta Smelt "salvaged" in 2023 were detected when OMR flows were more negative than -5,000 cfs. This finding, combined with evidence that OMR restrictions of the 2008/2009 BiOps played a critical role in limiting entrainment-related mortality (though not continued decline) of Delta Smelt (Smith et al. 2021) demonstrates the urgent need for increased restrictions on negative OMR flows caused by high levels of water export.

(4) Effect of "other stressors"

In addition to flow, declining density of prey items, loss of shallow water environments that putatively serve as habitat, predation, and increasing water temperatures have been suggested as drivers of the Delta Smelt's decline (SWRCB 2017). Given the extraordinarily low numbers of Delta Smelt over the past several decades (and particularly since 2017) relative to its prior abundance, it is highly unlikely that they are currently limited by the volume of shallow water environments available in their range (Kimmerer and Rose 2018). However, recent studies provide some evidence that Delta Smelt recruitment is food limited (Kimmerer and Rose 2018; Polanski et al. 2021), particularly with respect to large food items including shrimp and larval fish, and it has been suggested that restored shallow water habitats may increase supplies of Delta Smelt prey items. Hammock et al. (2019a) found that, although Delta Smelt foraging was more successful in the vicinity of shallow water marshes, this was not because food was more abundant in the vicinity of the marshes – these researchers hypothesized that Delta Smelt foraging behavior made them more effective predators in the vicinity of tidal marshes. Thus, the trophic benefits for Delta Smelt of shallow water environments like tidal wetlands are expected to be highly localized (and may be outweighed by negative effects of the same environments, such as the habitat they provide for predators of Delta Smelt). Indeed, with respect to the proposition that restored tidal marshes can supplement food supplies for fish in pelagic waters, Yelton et al. (2022 at 1743) conclude: "...there is little evidence of persistent subsidies of zooplankton from tidal wetlands to open water..." (*see also* Herbold et al. 2014 and Kimmerer and Rose 2018). Hartmann et al. (2022) similarly found lower abundances of zooplankton in shallow water, in contradiction to the conceptual model that restoring shallow tidal wetlands will increase food supplies for imperiled fishes. On the other hand, the density and distribution (i.e., the availability) of key prey items for Delta Smelt respond strongly and positively to increased freshwater Delta outflow during the winter-spring (Kimmerer 2002; Hennessy and Burris 2017a,b) and summer-fall (Hennessy and Burris 2017a,b; Kimmerer et al. 2018; Hassrick et al. 2023).

High water temperatures are likely to reduce Delta Smelt productivity via reductions in recruitment and survival (Polanski et al. 2021). By extension, it is likely that high temperatures limit the geographic range of Delta Smelt in the Delta during late spring and early summer or that they will do so in a future with warmer climates. The Board fails to analyze the effect of alternative flow regimes on water temperatures in the estuarine habitat of Delta Smelt. A mounting body of evidence shows that the volume of water flowing into, through, and out of the Delta affect temperatures in ways that would be expected to benefit Delta Smelt and other native fish species, particularly in the spring and early summer (Vroom et al. 2017; Bashevkin and Mahardja 2022; *see also* Nobriga et al. 2021; Michel et al. 2023). This failure to analyze potential temperature differences among alternatives that differ primarily, and to a great degree, in the volume of flow obscures the likely benefits of higher flow alternatives. The Board should analyze the potential effect of higher flow volumes in improving the quality or quantity of Delta Smelt habitat during spring and summer.

b) Longfin Smelt

Once among the most abundant fishes in the Bay-Delta, the San Francisco Bay estuary Longfin Smelt population remains far below levels consistent with viability. The population has been CESA-listed since 2009. The federal government proposed to list the population as "endangered" under the ESA and has found that existing regulatory mechanisms (including federal and state requirements under ESA and CESA, respectively)) are inadequate to protect future declines and extirpation. The Board has identified the January-June Delta outflow threshold above which the Longfin Smelt population is more likely to grow than decline (i.e., positive productivity). Population growth must occur more frequently than the status quo in order to restore and maintain the viability of this species. Because the flow-productivity relationship is continuous (log-log linear), the Board should also emphasize the importance of shifting the entire flow range to increase flows in most years (i.e., increasing the frequency of flows above the threshold for population growth and increasing the magnitude of minimum flows that occur below the threshold), as it did in its Flow Criteria Report (SWRCB 2010 Table 8 at 69). In addition, the Board must clarify that its current range of OMR flows represents different minima to be applied in different year types. In other words, -1,250 cfs is not a *maximum* protective OMR; rather, it is a minimum to be applied under certain specific conditions. The Board should also explain why the Draft Staff Report's OMR criteria for protecting Longfin Smelt (found in SWRCB 2017) differ from those of its earlier flow criteria report (SWRCB 2010; Table 8 at 69) and why the former are deemed to be reasonably protective of Longfin Smelt.

(1) Description

Longfin Smelt are small forage fish, with populations patchily distributed in estuaries along the Pacific Coast of North America as far north as Prince William Sound. The San Francisco Bay estuary population is the southernmost and one of the largest populations in the species range; the US Fish and Wildlife Service has determined that it is a distinct population segment (DPS) for endangered species act-listing purposes. Gene flow between the Bay-Delta Longfin Smelt DPS and other populations is limited and largely unidirectional, indicating migration from San Francisco Bay to more northerly populations, but not vice-versa (Sağlam et al. 2021). These fish usually spawn and die after two years. As with its distant cousin, the Delta Smelt, the Longfin Smelt's semelparous life history necessitates that spawning and rearing conditions are reliably good. Their persistence in the San Francisco Bay estuary for thousands of generations demonstrates that these fish found adequate food and habitat in most years despite highly variable hydrologic conditions.

(2) Status

Viability
Longfin Smelt have experienced a dramatic population decline since community fish sampling programs began to index their abundance, in the late 1960's (Figure 2). The US Fish and Wildlife Service recently observed that Bay-Delta Longfin Smelt DPS "…has plausibly been declining for over 50 years and that decline is presently at circa 3–4 orders of magnitude" (USFWS 2022a at 37). The population was listed under the California endangered species act in 2009 (CDFW 2009) and as "warranted but precluded" by the USFWS since 2012. In 2022, the USFWS proposed to list the population as "endangered" (Federal Register Vol. 87, No. 194 (Friday, October 7, 2022) at pp. 60957-60974); however, this listing has not yet been finalized.

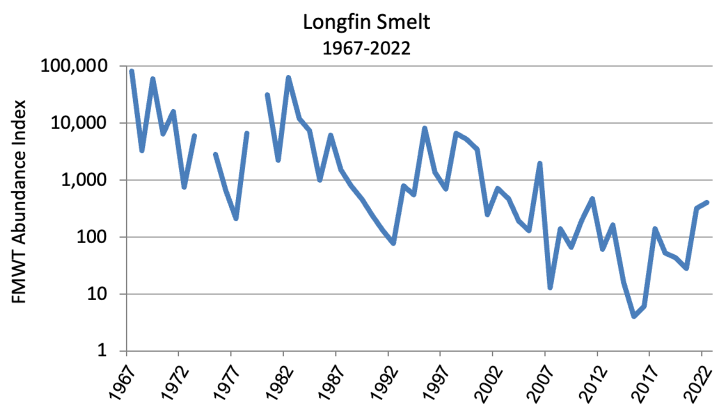


Figure 2: Abundance of Bay-Delta Longfin Smelt through time as measured by CDFW's Fall Midwater Trawl sampling program (https://apps.wildlife.ca.gov/FMWT). The population has declined by 99.5% since sampling began (1967-1971 average vs. 2018-2022 average) and by 96% since the late 1990's (1995-1999 vs. 2018-2022 average). Abundance indices from other sampling programs show similar declines.

The Bay-Delta Longfin Smelt DPS is not currently viable. In their evaluation of extinction risk for this population, USFWS (2022 at 87) found: "the probability of quasi-extinction for the Bay-Delta DPS exceeds 20% for all survey time series over the next five years and reaches 50% by 2040. Applying the same assumptions over a longer time horizon (i.e., 2050–2065), the suite of surveys predicts that the probability of extinction for the Bay-Delta DPS under current conditions is roughly 50-80%." Furthermore, in their proposed rule to list this DPS as endangered, USFWS considered numerous efforts to conserve and regulate biological resources of the San Francisco Bay estuary, including through multiagency collaborations, endangered species listings and incidental take permits under both ESA and CESA, and the Board's current water quality standards. Their conclusion was that "… despite efforts such as those identified above, the current condition of the estuary and continued threats facing the estuary and Bay-Delta longfin smelt, such as reduced freshwater inflow, severe declines in population size, and disruptions to the DPS's food resources have not been ameliorated." (Federal Register Vol. 87, No. 194 (Friday, October 7, 2022) at 60970).

Fishery
CDFW (2001 at 476) reports "Longfin smelt … were once harvested along with delta smelt in the Sacramento-San Joaquin estuary for Chinese markets in San Francisco. There is currently no longfin smelt fishery in California…". Given its current extremely low abundance and persistent decline in productivity (Nobriga and Rosenfield 2016), the Longfin Smelt population clearly cannot support the additional mortality associated with a fishery.

(3) Population response to flow

The strong positive relationship between Longfin Smelt abundance and Delta outflow during the spring and summer is extremely well-documented and durable through time (CDFW 2010; Nobriga and Rosenfield 2016; SWRCB 2010, 2017; for an update, see Figure 3). Most recently, in proposing to list Longfin Smelt as endangered, the US Fish and Wildlife Service declared:

> We consider reduced and altered freshwater flows resulting from human activities and impacts associated from current climate change conditions (increased magnitude and duration of drought and associated increased temperatures) as the main threat facing the Bay-Delta longfin smelt due to the importance of freshwater flows to maintaining the life-history functions and species needs of the DPS. However, because the Bay-Delta longfin smelt is an aquatic species and the needs of the species are closely tied to freshwater input into the estuary, the impact of many of the other threats identified above are influenced by the amount of freshwater inflow into the system (i.e., reduced freshwater inflows reduce food availability, increase water temperatures, and increase entrainment potential).

Federal Register Vol. 87, No. 194 (Friday, October 7, 2022) at 60963.

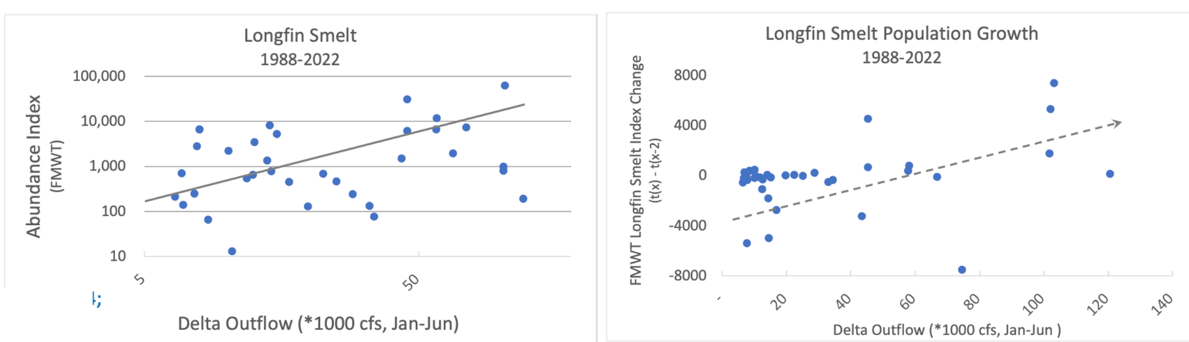


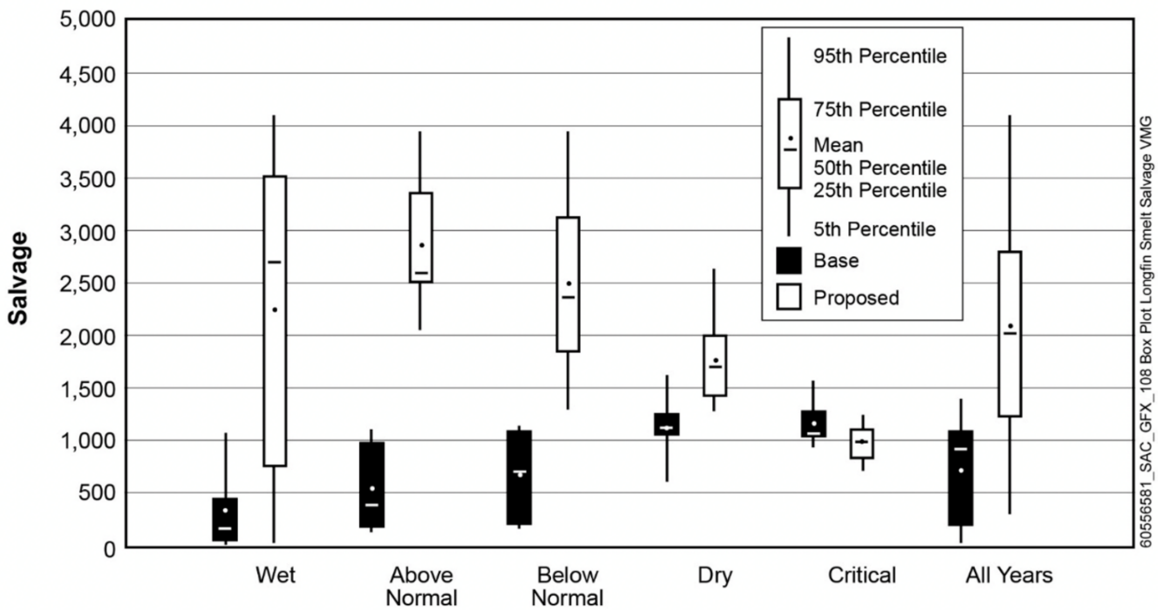
Figure 3: Relationship between metrics of Longfin Smelt viability and winter-spring Delta outflow. The relationship between log(Longfin Smelt abundance) and log(Delta outflow) remains significant and strong (left panel: r=0.514, p<0.01). Similarly, the positive relationship between population growth or decline and Delta outflow is statistically significant (right panel: r=0.432, P<0.01).

The Board identifies a flow threshold associated with Longfin Smelt protection (42,800 cfs average Delta Outflow from January-June; SWRCB 2017 3-60). However, the Board fails to specify how frequently such flows must be achieved to restore viability and the Longfin Smelt fishery. Because the flow-productivity and flow-abundance relationships are continuous (log-log linear), it is also critical to the restoration and maintenance of Longfin Smelt population viability that the entire distribution of Delta outflows shift towards higher Delta outflows for any given natural hydrological condition. The Board represented such a shift towards increased flows in all water year types in its Flow Criteria Report (SWRCB 2010 Table 8 at 69) by providing protective flow ranges within water year hydrological types. Because water year types recur with a known frequency, that presentation identified both flow ranges and the frequency with which different flow levels would recur. The Board should revise the Draft Staff Report to identify the minimum flows and the frequency of flow in certain ranges that would be required to reasonably protect beneficial uses associated with the Bay-Delta Longfin Smelt population.

The magnitude of flow reversal in the south Delta caused by CVP and SWP south Delta water exports is strongly correlated with entrainment of pelagic fishes (USFWS 2008; Grimaldo et al. 2009; CDWR 2019a) and has been implicated as an important factor in the demise of other endangered species in the SFE, including Delta Smelt (Kimmerer 2008, 2011; Smith et al. 2021). Longfin Smelt behavior and distribution differ from those of Delta Smelt such that the region affected by export-related reverse flows typically hosts a small proportion of the Bay-Delta Longfin Smelt population. As a result, Longfin Smelt are expected to be less susceptible to population level impacts of entertainment mortality than Delta Smelt, in most years. However, entrainment of Longfin Smelt adults and juveniles has been high episodically, particularly in years when spring Delta outflows are low or the magnitude of reverse flows is relatively high (Grimaldo et al. 2009; Rosenfield 2010; *see also* Attachment: Smelt Salvage Table 2017 thru 2023). This pattern probably reflects the effect of Delta outflow on Longfin Smelt distribution – as net Delta outflow decreases, the low salinity zone and Longfin Smelt spawning and early rearing also shift to the east, towards the pumps (Dege and Brown 2004; CDFW 2009a; Rosenfield 2010). Elevated direct mortality via entrainment during drier years likely depresses Longfin Smelt productivity in a way that re-enforces the overall flow-abundance relationship (CDFW 2009a; Rosenfield 2010). Given the timing of maximum detection of both adult and juvenile Longfin Smelt at the export facilities, it is highly likely that larval entrainment is elevated during dry years too (Rosenfield 2010).

Kimmerer and Gross (2022) downplay the likely effect of Delta water exports on long-term abundance trends; however, their modeling results likely underestimate the problem in several respects. For example, by assuming that larval Longfin Smelt were only susceptible to entrainment for approximately 7-13 days post hatching, Kimmerer and Gross (2022) understated the period during which water exports may result in direct mortality of larval Longfin Smelt. Otolith data reveal that larval many Longfin Smelt remain in low salinity habitats, which are often within the area affected by water exports, for 100-150 days (Lewis et al. 2019 at 9 and at 48-83 of the PDF). Also, Kimmerer and Gross estimated direct entrainment only during January-March, but larvae remain in the upper estuary through at least May (SWRCB 2010 Table 2 at 45, citing CDFW 2010) and likely into June (Rosenfield 2010; Lewis et al. 2019 at 48-83 of the PDF). The salinity field moves east as the spring progresses because outflows tend to decline during these months, increasing X_2 and likely drawing rearing larvae closer to the export facilities.

Furthermore, Kimmerer and Gross (2022) modelled flow and operational conditions based on rules established in the 2008/ 2009 BiOps, but those rules have now changed in ways that California state agencies expect to increase entrainment-related mortality of Longfin Smelt. Of particular concern, recent revisions to the operation of the SWP (CDWR 2019a) will increase water exports in every year, including in every April and every May, relative to conditions analyzed by Kimmerer and Gross (CDWR 2019a at 4-15 thru 4-16; Figure 4.4-24 at 4-147; CDWR 2019b Table 3.1 at 284 of the PDF; Draft Staff Report Table 9.3.2 at 9-15). As a result, new operational rules for the SWP export facilities are expected to result in very large increases in juvenile Longfin Smelt entrainment (56% to 576%), in most year types (CDFW 2019a Table 4.4-13 at 4-185; Figure 4). And, modeling of the new SWP operating rules likely overestimates any reduction in salvage during Critically Dry years, as it does not account for frequent waivers of Delta outflow requirements granted by the Board via Temporary Urgency Change Orders (TUCOs). Similarly, under SWP operations permitted by the new CESA ITP, CDWR expects large increases in entrainment of larval Longfin Smelt (based on the results of particle tracking studies) in January-March of years with Below Normal, Dry, and Critically Dry hydrology (CDWR 2019a Table 4.4-12a at 4-183). Inexplicably, potential entrainment of larval Longfin Smelt during April-June was not studied during the state's analysis of SWP operational impacts; however, particle tracking studies in the EIR suggest huge increases in entrainment of larval Longfin Smelt are likely during these months (CDWR 2019a Table 4.4-8a at 4-173).



Note: Plot only includes mean responses and does not consider model uncertainty.

Figure 4.4-56. Box Plot of Longfin Smelt April–May Salvage, from the Regression Including Mean Old and Middle River Flows (Grimaldo et al. 2009), Grouped by Water Year Type

Figure 4: Projected change in salvage of Longfin Smelt during two months (April and May) of water export operations of the CVP and SWP under the state's CESA Incidental Take Permit as compared to previous endangered species act constraints on water exports (USFWS 2008, NMFS 2009 and CDFW 2009). This graphic does not depict very large projected increases in larval Longfin Smelt entrainment-related mortality (CDFW 2020). Copied from CDWR 2019a.

Moreover, Kimmerer and Gross (2022) ignore entirely the indirect effects of Delta exports, via their effect on Delta outflow, on larval Longfin smelt success. In drier years, Delta exports during April-June range between 5% and 13% of unimpaired Delta outflow (G. Reis, The Bay Institute, pers. comm). Evaluating the effect of direct entrainment mortality on Longfin Smelt population dynamics will require improved understanding of larval Longfin Smelt distribution and behavior, mapping of potential spawning habitats, and development of a life cycle population model. The indirect effect of water exports on Longfin Smelt larval success, via reduction of outflow, must not be overlooked.

Kimmerer and Gross's (2022) results are consistent with the expectation that Longfin Smelt entrainment increases as Delta outflow decreases, showing a >5-fold increase in maximum estimated daily loss of Longfin Smelt larvae as X_2 moves ~15km eastward (i.e., as Delta outflow decreases). Thus, Kimmerer and Gross (2022) lends support to the Board's recommendation that negative OMR flows be >-1,500 cfs (or >0, when the FMWT population abundance index is very low) in Dry and Critically Dry years (SWRCB 2010 Table 8 at 69).

(4) Effect of "other stressors"

The relationship between net Delta outflow and Longfin Smelt juvenile recruitment has not changed through time (Nobriga and Rosenfield 2016), suggesting that any change in the relationship between flow and larval abundance or survival did not affect abundance at the Longfin Smelt juvenile life stage. However, there is also an unexplained time trend in survival of juvenile Longfin Smelt to subsequent life stages (Nobriga and Rosenfield 2016). Longfin Smelt juveniles are found predominantly in deep, open water habitats, downstream of the Delta (Moyle 2002; Rosenfield and Baxter 2007; Rosenfield 2010; Lewis et al. 2019 at 48-83 of the PDF). Because the transition from juvenile to adult life stages occurs in pelagic waters downstream of the upper estuary, it is highly likely that the force driving declining survival also occurs far downstream of the Delta.

Evidence that Longfin Smelt juvenile survival is limited by a declining food web is scant. Kimmerer (2002) suggested that a step-decline in Longfin Smelt abundance may have been due to grazing of primary productivity by the invasive Amur Clam (*Corbula amurensis*). This suggestion was based only on the observation that Longfin Smelt abundance indices were lower for any given flow after the clam invaded than before the invasion – no other years were investigated as markers of the Longfin Smelt decline and neither was the possibility of a continuous decline in juvenile survival, such as that documented by Nobriga and Rosenfield (2016). We are aware of no subsequent study showing a significant positive relationship between Longfin Smelt population size and measures of food availability (Thomson et al. 2010). In fact, MacNally et al. (2010) found a weak, but significant, *negative* association between Longfin Smelt abundance and their calanoid copepod prey, as compared to a very strong association with spring X_2.

There has been increasing interest in the value of restoring shallow sub-tidal environments for Longfin Smelt. However, the value of restored shallow subtidal habitats remains unknown.

Similarly, there is no evidence that tidal marsh restoration activities in south San Francisco Bay generate a net positive effect for Longfin Smelt Lewis et al. (2019 at 7 of the PDF). Lewis et al (2020 at 3) describe their findings as "...previously undescribed aggregations of Longfin Smelt that were attempting to spawn in restored and underexplored tidal wetlands of South San Francisco Bay." (emphasis added). In fact, Longfin Smelt occupancy of and recruitment in the restored shallow marsh habitats in southernmost San Francisco Bay appears to be dependent on seasonal hydrology across the region. Lewis et al (2019 at 44-45 of the PDF) observed successful recruitment of Longfin Smelt larvae in these marshes only in years of locally high freshwater flow into the Bay. During other years, adult Longfin Smelt returning to and spawning in the vicinity of the South Bay Salt Ponds may have represented an ecological sink. And, regarding their detections of substantial numbers of Longfin Smelt west of Suisun Bay, which occurred primarily during the wet years 2017 and 2019 (and, for restored South Bay salt ponds, only during those two years), they state: "... it is valuable to consider whether, with high Delta outflows, it is feasible and probable that larval and juvenile Longfin Smelt found in high numbers in San Pablo Bay, and even Lower South San Francisco Bay, could have been transported from Delta and Suisun Bay spawning sites by currents, tides, and winds" (Lewis et al. 2019 at 7 of the PDF). USFWS (2022 at 56) summarized the empirical support for loss of shallow water environments as a driver of Longfin Smelt decline this way:

> The loss of tidal marsh habitats may have hampered [Longfin Smelt] productivity, but to date, there are no indications that restoration has been sufficient to stem the decline. Therefore, we cannot conclude whether or not the species has lost resilience due to landscape changes that occurred in the 19th and 20th centuries.

High water temperatures may also impact Longfin Smelt survival from juvenile to adult life stages. During late spring through the summer, temperatures in large portions of their freshwater habitat may exceed thermal limits of post-larval Longfin Smelt (Jeffries et al. 2016). Maunder et al. (2015) found some indication that average April-June temperature was a significant covariate of Longfin Smelt population dynamics; however, Nobriga and Rosenfield (2016) did not detect an effect of temperature (modeled as a principal component of February-May temperatures) on Longfin Smelt recruitment success. Although it has long been assumed that Central Valley river temperatures have no effect on water temperature in the Delta, recent modeling and analyses of field data reveals that increased river flows into the Delta result in cooler temperatures in large portions of the upper estuary from late winter into the summer (Vroom et al. 2017; Bashevkin and Mahardja 2022;). This effect is believed to be related to reduced residence time and increased salinity stratification associated with higher Delta inflow (Vroom et al. 2017). The Board fails to analyze the effect of alternative flow regimes on temperatures in the estuarine habitat of Longfin Smelt. This failure to analyze potential temperature differences among alternatives that differ primarily and to a great degree in the volume of flow obscures the likely benefits of higher flow alternatives. The Board should analyze the potential effect of higher flow volumes in improving the quality or quantity of Longfin Smelt habitat during spring and early summer.

c) Chinook Salmon

Each Sacramento Valley Chinook Salmon population once numbered in the tens or hundreds of thousands of adults. (Yoshiyama et al. 1998) The massive decline and extremely low abundance of all Chinook Salmon life-stages relative to their historic abundance (CDFW 2010; 2015; SWRCB 2010, 2017; Moyle et al. 2017; SWFSC 2023) represents significant impacts to commercial, recreational, subsistence, and tribal fishing and the fish assemblage in the Sacramento River, the Delta, and San Francisco Bay. In recent years, the viability and condition of Central Valley Chinook Salmon runs has continued to decline due to low flows and high river temperatures leading to low egg and juvenile survival. The fall-run Chinook Salmon fishery was closed in 2023, for only the third time in the State's history, and it will likely be closed again in 2024. A wealth of new published research documents strong flow-survival relationships for juvenile life stages of different Chinook Salmon runs in the Sacramento Valley. Several of these studies indicate that the threshold flow for protection of juvenile Chinook Salmon is much greater than that previously identified by the Board. To be consistent with the best available scientific studies, the Board must update the flow thresholds (including flows on mainstem rivers, in-Delta flows and OMR flows) determined to be protective of migrating Chinook Salmon juveniles.

In addition, Central Valley Chinook Salmon eggs, juveniles, and spawning adults are exposed to lethally high water temperatures because dams block access to cold water habitats at higher elevation and because reservoir operations frequently release hot water into salmon spawning and rearing habitats. Temperature-related mortality was probably exceedingly rare historically for these fish. Major advances in the understanding of the relationship between water temperatures, flow, and Chinook Salmon mortality have occurred since 2017. The Board must update the temperature thresholds deemed to be protective of Chinook Salmon eggs and apply these criteria consistently to all Central Valley Chinook Salmon runs (Attachment: PFMC 2022 letter on Central Valley temperature management). In order to restore and maintain viability of Chinook Salmon runs, temperature dependent egg mortality should be close to zero in almost all years. Flows and river temperatures that are consistent with the Chinook Salmon species-wide average egg-smolt survival of ~10% (Quinn 2015) are necessary to restore and maintain Chinook Salmon fisheries.

(1) Description

The San Francisco Bay estuary watershed is home to four unique runs of Chinook Salmon – winter, spring, fall, and late-fall. The runs are named according to the season in which adults begin to return to freshwater from the ocean in preparation for spawning. All four runs currently spawn in the Sacramento River Valley. Both winter-run Chinook Salmon and Central Valley spring-run Chinook Salmon are listed under CESA and ESA. The fall-run and late-fall run are listed as a species of special concern by California Department of Fish and Wildlife (CDFW 2015) and also form the backbone of the California ocean fishery for Chinook Salmon.

(2) Status

Viability

The viability of Central Valley Chinook Salmon runs is extremely precarious (Lindley et al. 2007; NMFS 2014); winter-run Chinook Salmon and Central Valley spring-run Chinook Salmon are now at high risk of extinction in the near-term (SWFSC 2023). Both populations exhibit very low abundance, low productivity, and constricted geographic ranges; high-genetic influence from hatchery-reared fish and degraded life-history diversity also degrade the viability of these species. Fall-run Chinook Salmon have declined precipitously and their productivity and population genetics are increasingly influenced by hatchery production (Johnson et al. 2012; Willmes et al. 2017; Moyle et al. 2017).

The decline in each of these runs is related to degradation of their freshwater environment, including: (1) loss of habitat behind dams and levees; (2) declining suitability of spawning and incubation habitat downstream of dams due to elevated water temperatures that result from impoundment of water and reservoir operations; (3) decreased suitability of juvenile migration and rearing habitat due to reduced flow levels and reduced variability in river flow, which are attributable in large part to operations of Central Valley reservoirs; and (4) altered flow patterns in the Delta – resulting from the combined operations of reservoir operations and the CVP and SWP export facilities in the south Delta – which reduce migratory survival including through direct mortality (NMFS 2009; CDFW 2015; Moyle et al. 2017; SWFSC 2023).

The decline in winter-run Chinook Salmon viability has continued despite existing water quality requirements and CESA/ESA provisions intended to maintain this unique population. In NMFS's most recent viability assessment of endangered salmonids, the agency concluded:

> Until additional [winter-run Chinook Salmon] populations are established, the ESU will remain in the "High" biological extinction risk category. The overall viability of the [winter-run Chinook Salmon] ESU has continued to decline since the 2015 viability assessment (Johnson and Lindley 2016), with the single spawning population on the mainstem Sacramento River no longer at a low/moderate risk of extinction (Table 5.4).

SWFSC 2023 at 141.

Moyle et al. (2017) considers winter-run Chinook Salmon and spring-run Chinook Salmon to be of "critical concern" which means they are at "[h]igh risk of extinction in the wild; abundance critically low or declining; current threats projected to push species to extinction in the wild in 10-15 generations." (Moyle et al. 2017 at 10)

Moreover, the risk of extirpation of spring-run and winter-run Chinook Salmon has increased dramatically since publication of Moyle's report or the Board's Final Scientific Basis Report (SWRCB 2017). For example, during 2021, winter-run Chinook Salmon experienced extraordinarily poor spawning and incubation conditions, largely as a result of high river temperatures throughout their spawning range during most of the incubation period for their eggs. These river temperatures were largely under control of the US Bureau of Reclamation and resulted from failure to store adequate water behind Shasta Dam to preserve the reservoir's coldwater pool. NMFS's hindcast mean estimate of temperature-dependent mortality of winter-run Chinook Salmon eggs in 2021 was 75% (Attachment: SWFSC 2021a Water Year 2021 Winter-Run Chinook Temperature-Dependent Mortality Estimate). In 2022, winter-run Chinook Salmon eggs suffered ~17% temperature dependent egg mortality and overall egg-fry survival was estimated to be only 2.17% (Attachment: NMFS Brood Year 2022 JPE Letter. Available at: at https://www.fisheries.noaa.gov/s3/2023-01/jpe-letter-2022.pdf) This high level of egg and fry mortality resulted in the smallest outmigrant class of surviving juveniles on record and NMFS acknowledges that, "[t]he low production and survival of [winter-run Chinook Salmon] juveniles will likely lead to meager returns of adults in 2025 following their typical 3 years in the ocean" (Attachment: NMFS 2022 Survival of winter-run Chinook Salmon. Available at: https://www.fisheries.noaa.gov/west-coast/climate/survival-endangered-california-winter-run-chinook-salmon-2022).

Similarly, spring-run Chinook Salmon have been devastated in recent years by high river temperatures that killed adults and eggs and low flows that are associated with low survival of migrating juvenile spring-run Chinook Salmon. The remaining populations of Sacramento Valley spring-run Chinook Salmon are declining more than 10% each year and face high risk of extinction, according to NOAA Fisheries' Southwest Fisheries Science Center (SWFSC 2023). Federal and state fisheries management agencies are scrambling to save spring-run Chinook Salmon from extinction after a "cohort collapse" resulted in the fewest returning adults on record. Although final numbers are not available for 2023, CDFW reports: "Mill and Deer Creek — two of the three streams that hold the remaining independent spring-run populations — each saw fewer than 25 returning adults this year. Returns to Butte Creek — the third independent population — were the lowest since 1991 and adults further suffered impacts of a canal failure in the watershed" and NMFS declared "We are running out of options. We want this species to thrive in the wild, but right now we are worried about losing them" (Attachment: CDFW News 2023. Available at: https://wildlife.ca.gov/News/Archive/state-and-federal-fish-agencies-take-urgent-actions-to-save-spring-run-chinook-salmon#gsc.tab=0).

Fall-run Chinook Salmon and late-fall run Chinook Salmon are considered by CDFW to be species of special management concern (CDFW 2015). Despite its status as the largest run in the Central Valley, Moyle et al. (2017) consider fall-run to be of "high concern" (meaning its trajectory is towards extinction in 15-20 generations if no remedial actions are taken) because the spawning population consists mainly of hatchery-origin fish. Moyle et al. (2017) consider Central Valley late-fall run Chinook Salmon to be at even greater risk of extinction than fall-run Chinook Salmon.

The historic and more recent catastrophic decline of winter-run and spring-run Chinook Salmon and the near replacement of naturally spawned fall-run Chinook Salmon by hatchery fish (Johnson et al. 2012; Willmes et al. 2017; Moyle et al. 2017) clearly demonstrate the need for the Board to adopt and implement much stronger protections than currently exist for coldwater habitat below Central Valley dams and river flows in Sacramento Valley rivers and through the

Delta– cold water and adequate river flows are both essential to the persistence and eventual recovery of these imperiled species (NMFS 2014; SWRCB 2017; SWFSC 2023).

Fishery

Fall-run Chinook Salmon have also been devastated by high river temperatures and poor flow conditions for eggs and rearing and migrating juveniles (Friedman et al. 2019). In fact, over the 2002-2020 time period, average egg-to-fry survival of fall-run Chinook salmon in the Sacramento River has been significantly worse (13.4%) than average egg-to-fry survival of winter-run Chinook salmon (23.4%; *see* Attachment: USFWS 2022b Red Bluff Diversion Dam rotary trap abundance estimates). As a result of extremely low egg-to-fry survival (8.1%[4]) in brood year 2020 (USFWS 2022b) and persistent decline in freshwater conditions (Lindley et al. 2009), the fishery was closed in 2023, for only the third time in state history; poor adult returns in 2023, despite a complete shutdown of the ocean fishery, suggest it is extremely likely that the California Chinook Salmon fishery will be closed in 2024 as well. It is important to note that these disastrous returns occurred despite the closure of commercial and recreational fishing in 2023.

When the California fishery for Chinook Salmon is open, it is increasingly supported by fish that originate in salmon hatcheries, rather than naturally produced (wild-spawned) fish (Johnson et al. 2012; Willmes et al. 2017). This means the population is even further from attainment of the existing salmon protection objective than indicated by the declining returns of Chinook Salmon because the Plan objective calls for doubling the *natural production* of Central Valley Chinook Salmon. Hatchery influence is also a major threat to the viability of Central Valley Chinook Salmon (Lindley et al. 2007; SEP 2019).

It is important to remember that both the spring and winter runs of Chinook Salmon once supported commercial, recreational, subsistence, and tribal subsistence fishing (Yoshiyama et al. 1998). These populations no longer support fisheries because they are currently imperiled and ESA-protected. The historic and ongoing decline of Central Valley-dependent Chinook Salmon fisheries represents a massive failure of trustee agencies to protect beneficial uses and the public trust.

The Draft Staff Report understates the economic impacts to the salmon fishing industry caused by excessive water diversions and ineffective regulation. The economic analysis (Chapter 8) does not adequately analyze the decline of the California recreational salmon fishing industry. For example, the average Chinook Salmon harvest in California from 1991-1995 was 215,996 fish (PFMC 2022 at 154). More salmon were harvested in Oregon. Although the Draft Staff Report depicts the decline in Chinook Salmon harvest through 2014 (Chapter 3 figure 3.4-1), it fails to document declines that have occurred since then. The recreational harvest in 2023 and the likely harvest in 2024 are both zero.

[4] Average egg-to-fry survival for Chinook Salmon across their range is ~38% (Quinn 2005), thus both runs are regularly experiencing egg-to-fry survival rates that are not consistent with population viability.

The Draft Staff Report (at 8-105) states that "in the period 2018 through 2022, approximately $65.6 million in personal income annually and 1,283 jobs in California were associated with commercial salmon harvesting and processing and derived from recreational fisheries." This understates economic impacts in three ways:

- *Commercial and recreational landings from 2018-2022 were dramatically reduced in comparison with previous decades.* The 2018-2022 period understates the value of a fully functional salmon fishing industry. A more accurate analysis of the economic value of the salmon fishing industry should be based on years in which salmon runs and landings were robust.

- *The Draft Staff Report fails to analyze economic impacts in Oregon.* The majority of Chinook Salmon caught off the Oregon coast are from the Bay-Delta ecosystem. In 2023, recreational and commercial Chinook Salmon fishing seasons on the Oregon coast were largely closed from Cape Falcon to the California/Oregon border.

- *The analysis does not reflect the full economic value of salmon fishing-related jobs off the water.* Marina operators, equipment manufacturers and retailers, fish brokers and other off the water jobs are dependent on the salmon fishing industry. These parts of the salmon fishing economy have suffered enormous impacts from the decline and closures of salmon fishing in California.

The true economic impact of excessive water diversions in the Bay-Delta is, therefore, far greater than is reflected in the Draft Staff Report. One economic analysis (Southwick and Associates 2012) concludes that, a fully functional California salmon fishing industry produces $1.4 billion in annual economic activity and 23,000 jobs. The economic value of Oregon salmon fishing is additive to this amount. The total economic impact of fisheries closures also does not capture the depth of the effect on fishing businesses; fishing closures mean that individual fishing businesses are completely closed, sometimes for more than a year. Maintaining businesses (e.g., fishing boat, bait shop, ice manufacturing and distributing) that are occasionally closed completely, and severely constrained in years when operations are possible, is very difficult and distressing for the individual businesspeople who run the many small businesses that depend on California's coastal salmon fishery.

(3) Relationship to flow

Since publication of the Final Scientific Basis Report (SWRCB 2017) on which the analyses of the Draft Staff Report are based, numerous research papers have been published that document strong, statistically significant relationships between flow and survival of migrating Chinook Salmon juveniles. Several of these studies also find little evidence that shallow water environments (a.k.a. "habitat"), such as those the proposed Voluntary Agreements promise to create, lead to increased survival of Chinook Salmon in the Bay-Delta watershed or that any lack of such "habitat" limits Chinook Salmon survival currently. These new studies represent the best available science on flow levels necessary to protect and restore Sacramento Valley Chinook

Salmon runs. A few of these studies are summarized below and others are described briefly in an attached matrix (*see* Attachment: Salmon Flow Literature Matrix). The analysis of salmon response to flow alternatives described in the Draft Staff Report must be revised to account for science developed over the past seven years, including (but not limited to) the following studies:

- Hassrick et al. (2022) found that pulse flows contributed significantly to migrating juvenile winter-run Chinook Salmon survival until base flows in the Sacramento River at Bend Bridge reached approximately 24,720 cubic feet per second (cfs); survival increased as baseflows increased above 24,720 cfs as well.
- Hance et al. (2021) found Chinook Salmon survival was strongly correlated with flows at Freeport in the nine reaches for which Freeport flow was used as a predictor of survival, including through the interior Delta. Results suggest that Freeport flows >1,000 to 1,500 m^3/s are needed to optimize survival (*see* Hance et al. 2021 panels 7a, 8a, and 8d).
- Michel et al. (2021) determined that a step-function described the flow-survival relationship for fall-run Chinook Salmon smolt in one reach of the Sacramento River above the Feather River confluence. Survival in this one segment of river varied by flow threshold with survival of 3.0% at flows below <4,259 cfs; 18.9% between 4,259 cfs and < 10,712 cfs); 50.8% between 10,712 cfs and 22,872 cfs; and 35.3% at flows above >22,872 cfs.[5]
- Munsch et al. (2020) found that not all shallow water environments in the Delta that they studied were even occupied by wild-spawned Chinook Salmon fry until flows exceeded ~500 m^3/s (=~17,660 cfs). Fry density in occupied habitat increased dramatically with Sacramento River flows up to ~750 m^3/s (=~26,486 cfs) and continued to increase to flows of ~1,500 m^3/s (=~152,970 cfs).
- Michel (2018) determined that streamflow had an outsized effect on survival to the adult stage of juvenile fall-run, late-fall run, and winter-run Chinook Salmon relative to conditions in the marine environment, where these fish spend a much larger fraction of their lifecycle (Figure 5).
- Perry et al. (2018) found that "…survival decreases sharply and routing into the interior Delta (where survival is low) increases sharply as Delta inflows decline below approximately 1,000 m^3/s [~35,000 cfs].").

[5] All flow thresholds have error bounds; thus, the certainty of achieving any effect of threshold flows increases as flows approach and exceed the high end of these error bounds. For example, achieving levels of survival associated with the 10,712 flow threshold identified by Michel et al. (2021) is much more certain when flows are above 11,030 cfs (C. Michel, UC Santa Cruz, *pers. comm.*) The study also notes that the 22,872 cfs flow threshold is the minimum for overtopping Tisdale Weir and that the paper's estimate of lower survival rates above this threshold may be "an artifact of lower detection efficiencies associated with fish utilizing additional high flow migration routes with less receiver coverage." Also, the available data was not sufficient to distinguish the effects of flows on survival between the thresholds of 10,712 cfs and 22,872 cfs.

- Henderson et al. (2018) documented that survival of radio-tagged late-fall run Chinook Salmon migrating through the Sacramento River was most strongly predicted by inter-annual and inter-reach (segment of a river) flow rates and that habitat availability was not a significant factor for predicting survival of migrating juvenile salmon.
- Pope et al. (2018) detected no significant difference in survival between juvenile Chinook Salmon survival in the mainstem Sacramento River as compared to fish migrating through the inundated floodplains of Yolo Bypass. Whereas, in-river survival increased with increasing flows, survival on floodplain did not increase with flow, but survival on the floodplain was "on par" with in-river survival for the flow range at which the floodplain inundates.
- Takata et al. (2017: Abstract) found "Survival to the ocean fishery was not significantly different between hatchery fish that reared in the Yolo Bypass [inundated floodplain] versus those that reared in the main stem Sacramento River."

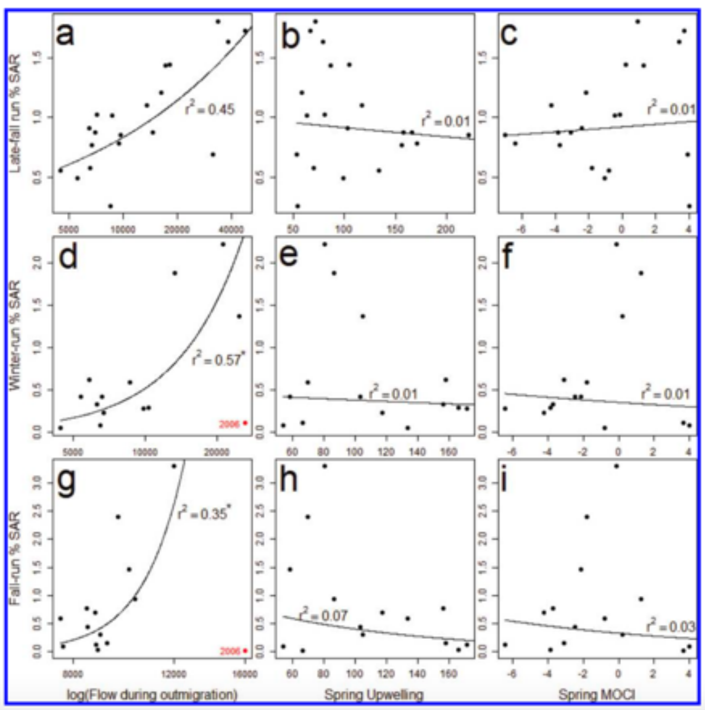


Figure 5: The relationship of flow during outmigration and SAR (smolt-to-adult survival; panels a,d,g) and between two measures of marine conditions and SAR (panels b,e,h and c,f,i, respectively) for three Sacramento River Chinook Salmon runs. Freshwater flow is a highly significant predictor of smolt survival, explaining between 35% and 57% of all variation in the SAR metric. Copied from Michel 2018.

The Board has identified 20,000 cfs average flows at Rio Vista between February and June as protective of emigrating smolt of the four runs of Central Valley Chinook Salmon (SWRCB

2017 at 3-48) and 17,000 cfs as potentially protective of other migrating juvenile Chinook Salmon (at 3-98). However, the scientific studies identified above (*see also,* Attachment: Salmon Flow Literature Matrix) demonstrate that these flow thresholds will not protect migrating juvenile Chinook Salmon. Flows at Freeport of at least ~35,000 cfs are more likely to be the minimum flows protective of Chinook Salmon smolt emigrating through the Delta.[6] Given that Central Valley Chinook Salmon typically have a 3-year life span (after which they spawn and die), protective flows should occur in at least 1 of 3 years, on average, to support and maintain population viability. Higher flows at Fremont are also necessary to enable Chinook Salmon fry to even occupy most existing restored Delta shallow water habitats (~17,660 cfs) and to populate them at relatively high densities (~26,486 cfs; Munsch et al. 2020). In order to support attainment and maintenance of the salmon protection objective, Delta rearing habitats should be relatively well-stocked with developing Chinook Salmon fry in approximately half of years. These criteria and additional flow criteria on the Sacramento River mainstem should be used to evaluate the benefits of any particular flow regime to Central Valley Chinook Salmon.

In addition, the time frame for flow to protect Chinook Salmon should begin in January, not February as indicated. Almost half of winter-run Chinook Salmon juvenile migrants enter the Delta before the end of January (SWRCB 2017 Table 3.4- 2 at 3-18) and it is common for >5% of these fish to have migrated out of the Delta before the end of January (2019 NMFS Biological Opinion Figure 14 at 73).

South Delta water export operations of the CVP and SWP lead to direct entrainment-related mortality of salmon via pre-screen losses and salvage losses and to reduced survival (indirect mortality) of juvenile Chinook Salmon attempting to migrate through and rear in the Delta. According to the Board (2017 at 3-49): “Statistical analyses have also shown that salvage of juvenile salmonids at CVP and SWP export facilities increases with water exports (Kimmerer 2008; NMFS 2009a at 368–371; Zeug and Cavallo 2014).” In the NMFS 2009 Biological Opinion, the agency reported results of CDWR modeling which revealed that monthly loss of juvenile salmon at the CVP and SWP pumping facilities increased exponentially with increasingly negative OMR flows (reverse flows) between December and April. These analyses showed that Chinook Salmon loss accelerated as OMR flows became more negative than - 5,000 cfs (SWRCB 2017 Figures 2.4-15 and 3.4-16 at 3-40). Estimates of salvage and related direct-mortality impacts on salmonid populations indicate that they can be severe, at least periodically (Kimmerer 2008; NMFS 2009 at 341-352).

Moreover, negative OMR flow rates lead to additional, undefined levels of mortality for fish that are not entrained, because of altered Delta flow patterns that lead fish to Delta environments where survival is low (e.g., due to predation or poor water quality). The Board wrote: “More important than direct entrainment effects, however, may be the indirect effects caused by export operations increasing the amount of time salmon spend in channelized habitats where predation is high (USDOI 2010, 29)” (SWRCB 2017 at 3-47).

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[6] For sake of comparison, this translates to roughly flows at Rio Vista of ~32k to 38k cfs. The Bay Institute, *unpublished data*.

The Board must ensure water exports of the SWP and CVP do not alter Delta hydrodynamics in ways that continue to impair the viability of Central Valley Chinook Salmon, or that prevent attainment of the Plan's narrative salmon protection objective. Constraints on SWP and CVP exports related to Delta hydrodynamics found in federal and state ESAs have been weakened since 2009. And, like all provisions of federal biological opinions, they are designed only to prevent jeopardy to the endangered species; they are not intended to protect fall-run or late-fall run Chinook Salmon, nor are they intended to support recovery of endangered runs or attainment of the Board's salmon doubling objective. For example, under both the 2019 Biological Opinions and the CESA ITP, the -5,000 OMR limit may be relaxed (allowing more negative OMR flows) during poorly-defined "storm related events." Similarly, the 2009 NMFS BiOp provision that limited combined SWP/CVP water exports to a fraction of San Joaquin River inflow (the "San Joaquin I:E ratio") does not appear in the CESA ITP or the (now abandoned) 2019 biological opinions. As a result of these changes, Chinook Salmon and other native fish migrating through the Delta are at greater risk of entrainment-related mortality than they were under the 2008/2009 BiOps.

(4) Effect of "other stressors"

Temperature – Improved protection of coldwater habitat upstream is essential to the persistence and eventual recovery of Central Valley Chinook Salmon populations. High river temperatures related to impoundment and heating of water behind Central Valley dams, frequently lead to high levels of mortality for incubating Chinook Salmon eggs and fry (NMFS 2009; Martin et al. 2016; SWRCB 2017; Friedman et al. 2019; SWFSC 2023). High levels of temperature-dependent egg mortality (TDM) and temperature stress to early-stage juvenile fish severely impact winter-run, spring-run, and fall-run Chinook Salmon in the Sacramento River (*see above*) and fall-run and spring-run Chinook Salmon on the Feather River. Salmon spawning in other Central Valley rivers also frequently experience high levels of mortality and stress caused by warm water released from reservoirs (SEP 2019).

The Board's water temperature standard for Central Valley Chinook Salmon spawning (enshrined in the Central Valley Basin Plan and Water Rights Decisions 90-5 and 91-1) is based on an outdated and erroneous understanding of temperature impacts on incubating Chinook Salmon eggs and larvae – very simply, the Board's temperature standard is not protective of the Chinook Salmon. Furthermore, the Board's failure to require the US Bureau of Reclamation (Reclamation) to meet even this inadequate standard, or to take enforcement action when the standard is violated (even with respect to weakened interim requirements that the Board approves) has led to repeated destruction of several spawning populations of Chinook Salmon. Science-based temperature standards, and enforcement of those standards, will be needed to ensure the viability of Central Valley Chinook Salmon populations going forward.

Recent research clarifies and explains the functional relationship between water temperature, river flow, and Chinook Salmon egg survival. Martin et al. (2016) found strong evidence that significant thermal mortality occurs at temperatures greater than 53.5°F and explained why in-river temperatures that are protective of Chinook Salmon incubation are lower in the river than they are in laboratory studies. The Draft Staff Report applies these findings inconsistently; for example, Chapter 3 describes an outdated temperature threshold for Sacramento River Chinook Salmon egg mortality. Temperature modeling for the Feather River also seems to apply an outdated standard. Martin et al. (2020) developed a biophysical model, which they corroborated with laboratory studies, that reinforced and expanded their earlier results to all Chinook Salmon and other fishes The Draft Staff Report must be updated to incorporate Martin et al. (2016, 2020), which provide the best available science on temperatures that lead to Chinook Salmon TDM.

Reservoir management decisions have a significant effect on river temperatures throughout the freshwater habitat of Central Valley Chinook Salmon. How reservoir releases modify temperatures for Chinook Salmon depends on location in the river. Daniels and Danner (2020) demonstrated that upstream (where salmon spawn, incubate, and begin to rear) the temperature of water released from the dam is more important than the volume of water released in determining the water temperature in salmon habitat. However, as salmon migrate downstream, the volume of flow becomes more important in determining local water temperature. Recent studies show that during the winter-spring, when juvenile salmon migrate into and through the Delta, water temperatures in the lower Sacramento River and Delta (a) can cause lethal and sub-lethal negative effects for juvenile Chinook Salmon as waters warm later in the spring (Munsch et al. 2020; Hance et al. 2021; Nobriga et al. 2021) and (b) are negatively correlated with flow volume, such that higher flows can lead to longer duration of tolerable temperatures, extended rearing opportunities, and larger size prior to ocean entry (Munsch et al 2020; Nobriga et al. 2021; Michel et al. 2023; see also Vroom et al. 2017; Bashevkin and Mahardja 2022). As it compares flow alternatives that differ in requirements for both the volume of river flow and protection of coldwater habitats, the Board should account for both upstream and downstream effects of flow on temperature . It is likely that the effect of high river flows on temperatures in the lower rivers and estuary are captured as part of the strong and statistically significant flow-survival relationships described above. Nevertheless, the Board should account for this additional mechanism by which high river flows improve migratory, spawning, and estuarine conditions in its evaluation of the effect of flow alternatives on salmon habitat, in general.

Shallow water environments (physical "habitat") – It should go without saying that river flow is the principal habitat element for riverine life stages of fish species and estuarine flow is the principal habitat element for estuarine life stages of pelagic and anadromous fishes. Nevertheless, Chinook Salmon can benefit from the interaction of water and earthen substrate in shallow water environments during short periods of their juvenile life-stage. These shallow water environments (e.g., inundated floodplains, tidal marshes) have been labelled "habitat," but this use of this term is over-general, simplistic, and laden with many assumptions about the functional benefit of such environments. In general, we support reconnection of historical and newly created shallow-water environments with rivers and tidal waters of the estuary; these environments provide actual habitat for a range of bird and mammal species. However, the benefits to native fish species must be demonstrated on a case-by-case basis, not assumed.

For example, it is commonly assumed that restoring shallow water environments will benefit native salmon populations by supporting juvenile growth and survival. It is not clear that Central Valley Chinook Salmon survival is limited by lack of shallow water environments. Henderson et al. (2018) found that habitat availability along the Sacramento River was not a strong predictor of Chinook Salmon juvenile survival. Munsch et al. (2020) found that shallow tidal environments in the Delta were not even occupied, much less densely occupied) at current typical Sacramento River flow levels; in other words, shallow sub-tidal environments in the Delta are not currently limiting to Central Valley Chinook Salmon populations; adding more of this "habitat" would not provide benefit to Chinook Salmon juveniles until salmon abundance (i.e., number of salmon juveniles) and river flows increase substantially (Munsch et al. 2020).

As described above for Delta Smelt (*see also* NRDC et al. 2023), there is no evidence that restored tidal marshes export food to the open-water environments used by outmigrating salmon smolts. Although salmon have been shown to grow faster on inundated floodplains, at this time there is scant evidence that the growth effect translates into improved survival on large floodplains, such as the Yolo Bypass, as compared to in-river environments at the equivalent flow levels (Takata et al. 2017; Pope et al. 2018; Johnston et al. 2018). Whereas Sturrock et al. (2022) found that inundated floodplains can export salmon prey to the river environment, the magnitude of that effect was directly related to duration of floodplain inundation and the area in which salmon prey density increased was strongly correlated by river flow. In other words, the effect of floodplain inundation on food availability for salmon is inextricably and positively related to river flow levels.

Thus, while SF Baykeeper et al. support further efforts to restore shallow water environments (for many reasons) and to study their potential benefits and potential negative effects on abundance, growth, and subsequent survival of juvenile Chinook Salmon, there is currently no evidence that restoration of these habitats will affect Central Valley salmon viability or attainment of the Board's doubling objective in the near term. We note that "habitat restoration" for Chinook Salmon and other species has been a key focus of major, well-funded management programs like CalFed, the Central Valley Project Improvement Act, and the requirements of various federal biological opinions. Despite these decades-long, multi-million dollar efforts, Chinook Salmon populations continue to decline, likely because river flows have been insufficient to activate restored or remaining historical habitats or to support adequate survival through the riverine migration corridor that connects juvenile Chinook Salmon to the restored shallow water environments.

d) Central Valley Steelhead

Central Valley Steelhead are an imperiled anadromous life-history form of *Oncorhynchus mykiss*; the resident form is known as Rainbow Trout. Both forms of this fish require protection of coldwater habitat and both have in the past provided beneficial uses in the form of recreational fishing. The Board should consider both life history forms as it develops, adopts, and implements new flow standards and coldwater habitat protections for the Bay-Delta and its watershed.

(1) Description

Central Valley Steelhead are indistinguishable from resident *O. mykiss* until they complete smoltification, the metamorphosis that allows freshwater salmonids to survive in brackish and marine habitats. Prior to smoltification, they live in the river environment for at least one summer and fall; they require coldwater habitat to successfully over-summer in freshwater. Smoltification requires prolonged exposure to even colder temperatures than those that are suitable for non-migratory juveniles (Myrick and Cech 2004, 2005; US EPA 2003). As a result, Central Valley Steelhead are an excellent representative of the status of coldwater habitats.

(2) Status

Viability
The Central Valley Steelhead distinct population segment has been listed as threatened under the federal endangered species act since 1998. The National Marine Fisheries Service considers it to be "stable", at "moderate" risk of extinction (SWFSC 2023). Specifically, the agency states: "... the majority (11 of 16) of populations for which there are data are at a high risk of extinction based on abundance and/or hatchery influence, with no population considered to be at a low risk of extinction." In addition, NMFS notes " [t]he lack of improved natural production … [and] low abundances coupled with large hatchery influence in the Southern Sierra Nevada diversity group are causes for continued concern." (SWFSC 2023 at 156). The population's reliance on hatchery production is of particular relevance to Plan updates as the proposed viability objective relates to "natural production" of native fishes (i.e., not hatchery production).

Fishery
Where they are not officially protected as imperiled species, Steelhead support recreationally and economically valuable sport fisheries. Due to low numbers and their imperiled status, California prohibits retention of natural origin Central Valley Steelhead. Harvest of hatchery-origin steelhead (which are marked for identification) is limited to 1fish per angler per day.

(3) Relationship with Flow

Migration success of Central Valley Steelhead from the San Joaquin Valley is strongly correlated with river flow rates during their outmigration (Buchanan 2018; Buchanan et al. 2021) and the same is likely true of Central Valley Steelhead from the Sacramento River basin. Because of their low numbers, complex and plastic life histories, and the difficulty of monitoring their seasonal migrations, little is known about the specific flow needs of Central Valley Steelhead. CVP/SWP water export operations in the south Delta also have a negative effect on Central Valley Steelhead populations, both through the direct effect of salvage mortality (as expanded to account for pre-screen mortality) and indirectly via alterations to Delta hydrodynamics that disorient juvenile fish during their seaward migrations (NMFS 2009 BiOp;2019 NMFS Biological Opinion). A recent publication explained:

> The prevailing conceptual model of how water project operations and river conditions influence [Central Valley Steelhead] survival through the Delta is that survival is higher during periods of higher Delta inflow, lower export rates, higher I:E, and lower water temperatures (SST 2017). The survival estimates from the 2016 six- year study support the conceptual model regarding Delta inflow, exports, and the [San Joaquin Inflow to export] I:E ratio.

Buchanan 2018 at 76.

(4) Effect of "other stressors"

The main stressors on Central Valley Steelhead, in addition to flow levels, are high temperatures and high levels of genetic influence from hatchery produced fish. The latter problem is likely to be a byproduct of poor water quality conditions (temperatures and flows) experienced by wild-spawned fish (i.e., differential selection favors hatchery-reared fish).

Protection of coldwater habitat below Central Valley dams is critical to production and maintenance of life history diversity in *O. mykiss*, and the viability of the Central Valley Steelhead population in particular. Compared to Chinook Salmon, *O. mykiss* require colder temperatures for spawning and incubation; juvenile *O. mykiss* have higher temperatures tolerances than Chinook Salmon (Marine and Cech 2004, Myrick and Cech 2004, 2005) although there is some evidence that variable and elevated water temperatures in the right season promote the anadromous Steelhead life-history pathway over the resident Rainbow Trout life-history strategy (Kendall et al 2014).

The Board should revise its temperature threshold for Steelhead smoltification to reflect the best available science regarding the needs of Central Valley Steelhead; failure to do so may result in unreliable estimates of Steelhead habitat suitability under different water management alternatives. Steelhead are particularly sensitive to high temperatures during smoltification. Central Valley Steelhead require exposure to temperatures <11°C (51.8°F) to successfully complete this metamorphosis (Myrick and Cech 2005); this is colder than temperatures US EPA (2003 at 16) identifies as impairing Steelhead smoltification. Thus, Board staff should reconsider applying the USEPA (2003) 14°C 7DADM criteria (7-day average of daily maxima; *see* Draft Staff Report at 7.6.2-22), which is based on a US EPA's 12°C daily average threshold. Instead, the Board should apply a 7DADM temperature value consistent with 11°C daily average that is the known threshold for Central Valley Steelhead metamorphosis.

e) White Sturgeon

The San Francisco Bay-Delta White Sturgeon population is imperiled and its viability is declining. Petitions to list this species under CESA and ESA have been submitted. The fishery has been repeatedly constrained by declining White Sturgeon abundance and will almost certainly be severely restricted in future years.

A complete description of the life history, conservation status, and environmental needs of White Sturgeon in the Bay-Delta watershed can be found in the recent CESA listing petition to the California Fish and Game Commission (*see* Attachment: White Surgeon CESA petition). Bay-Delta White Sturgeon only reproduce successfully when Sacramento River inflow to the Delta and Delta outflow are relatively high during spring and early summer (Figures 6). Flows that support successful reproduction occur less frequently now than they did just a few decades ago because of diversions and reservoir operations that capture rain and snowmelt runoff in the late spring and summer. As a result, the size of White Sturgeon cohorts has decreased and the time between successful cohorts has increased. Given the reproductive life-history of female White Sturgeon, flows that support spawning, incubation and larval recruitment should recur at least 1 out of 4 years to restore and support viability; and more frequent exceedance of critical flow thresholds may be necessary to restore and maintain harvest in a fishery.

Entrainment in the CVP and SWP south Delta water export infrastructure also impairs the Bay-Delta White Sturgeon population's viability, as does fishing pressure and harmful algal blooms in both the Bay and, separately, in the Delta. Each of these problems must be resolved in order to guarantee the population's persistence, at a minimum, and restoration of the White Sturgeon fishery.

(1) Description

White Sturgeon (*Acipenser transmontanus*) is the largest freshwater fish species in North America. The species as a whole is considered to be "endangered" by the American Fisheries Society (AFS 2008). The only known reproducing population White Sturgeon in California occurs in the Sacramento River and San Joaquin River watersheds. These fish may grow to 6 m fork length (FL), live more than 100 years, and weigh over 600 kg. In California, the largest individual on record – caught in Lake Shasta in 1963 – measured 2.9 m and 225 kg, and was at least 67 years old (CDFW 2015 at 225).

White Sturgeon are iteroparous and facultatively anadromous; they spawn only in freshwater and juveniles soon migrate to brackish water, but true marine migrations are variable among individuals. A small proportion of adults spawn in any given year. Successful reproduction occurs episodically, when spring-summer river flows are high enough to support incubation and early rearing success. In the San Francisco Bay-Delta, females may mature reproductively as early as age 10, but more commonly between ages 12-16 – 50% of females mature by age 14 and all mature by age 19 (CDFW 2015; Blackburn et al. 2019; CDFW 2023). Males mature earlier, generally between 10-12 years of age (75-105 cm FL), and appear to spawn more frequently than females (Willis et al. 2022). Adult White Sturgeon prepare to spawn by moving into the lower reaches of Central Valley rivers during the winter months and migrate upstream into spawning areas. Following maturation, males may spawn every 1-2 years. Females are physiologically capable of spawning every 2-3 years (Hildebrand et al. 2016); they typically wait at least 2-4 years between reproductive events (Moyle 2002)

In the Central Valley, White Sturgeon spawning has been detected during wet and dry years in both the San Joaquin River and the Sacramento River, indicating that adults will attempt to spawn even when flows are low (Jackson et al. 2016). The fact that juvenile recruitment appears to be successful only in years when elevated river flows occur during larval dispersal and early juvenile rearing (i.e., between April and July) suggests that flows during the spring and early summer are essential (SWRCB 2017). CDFW (2015 at 227) states: "The first few months of life are considered to be critical for sustaining populations [of White Sturgeon]."

(2) Status

Viability

White Sturgeon that spawn in the Central Valley and rear and/or migrate through the San Francisco Bay-Delta are regarded as a species of "High" management concern by California Department of Fish and Wildlife (CDFW 2015). Studies indicate that annual recruitment of Bay-Delta White Sturgeon has decreased since the early 1980s. Recent evidence indicates that this decline is continuing (Blackburn et al. 2019; Ulaski et al. 2022; CDFW 2023; California Fish and Game Commission 2023; Figures 6, 7), leading White Sturgeon exports to state recently: "Action needs to be taken now to protect California white sturgeon to assure this ancient population survives long into the future" (Schreier et al. 2022).

Several data sets reveal a decline in White Sturgeon abundance in the Bay-Delta watershed over the past 25 years. For example, catches of Age 0 (YOY) White Sturgeon by the CDFW/IEP's Bay Study reveal a decreasing trend in juvenile abundance over the past 40 years, punctuated by increases in years with high spring-summer freshwater flows out of the Delta and into San Francisco Bay (Figure 6; see also Fish 2010).

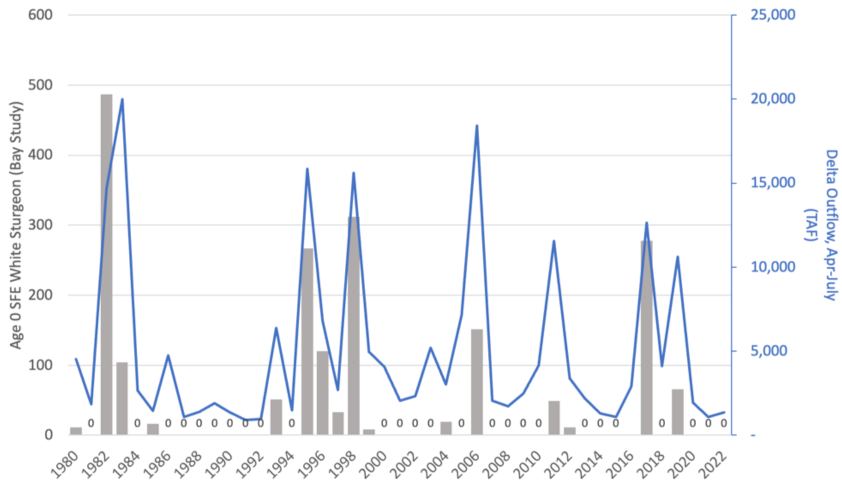

Figure 6: Relationship of spring-summer Delta outflow and White Sturgeon juvenile recruitment in the San Francisco Bay-Delta. Left axis: Abundance index of Age 0 White Sturgeon caught in pelagic waters of the San Francisco Bay-Delta (source: CDFW/Interagency Ecological Program's San Francisco Bay Study otter trawl). Right axis: Average Delta Outflow during April-July, in thousand acre-feet (source: Dayflow; https://data.cnra.ca.gov/dataset/dayflow). Abundance is strongly correlated with April-July Delta outflow (r=0.762, n=42). Zeros indicate no catch as opposed to no sampling (e.g., 2016). White Sturgeon young-of-year production has declined by 89% since the beginning of Bay Study sampling (1980-1984 average index vs. 2018-2022 average index).

Similarly, over the past 25 years, CDFW's mark-recapture studies of sub-adult and adult White Sturgeon reveals a significant population decline. For such a long- lived species, a decline of this magnitude in less than three decades is concerning. CDFW's most recent estimate of the 5-year average of the harvestable (slot-sized) population (33,000 fish; CDFW 2023) does not account for catastrophic losses to the White Sturgeon population resulting from harmful algal blooms in 2022 and 2023. CDFW's Adult Sturgeon Study confirms a substantial decline in Bay-Delta White Sturgeon density from levels commonly observed in the latter half of the 20th century to those observed over the last decade (Figure 7); CDFW reports that, "2022 represented the most survey days with zero catch since the onset of [CDFW's Adult Sturgeon Study]" (California Fish and Game Commission 2023 at PDF p. 49).

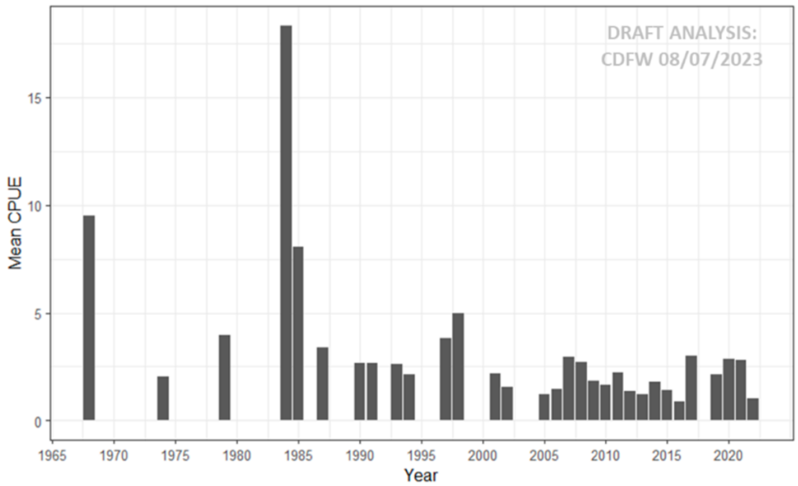

Figure 7: Catch-per-unit-effort (CPUE) of legal-sized White Sturgeon caught in the CDFW's Adult Sturgeon Study (trammel net gear) in the San Francisco Estuary, 1968 to 2022. Sampling was not conducted every year in the early decades of this sampling program; more recently, no sampling occurred in 2018 (Stompe and Hobbs 2023). A unit of effort is 100 net-fathom hours of fishing time. This non-fishery dependent metric of Bay-Delta White Sturgeon abundance has declined 67% (1980-1999 average vs. 2000-2022 average). Copied from California Fish and Game Commission 2023 at Figure 9.

Environmental conditions necessary to support Bay-Delta White Sturgeon population viability are deteriorating (SWRCB 2017; CDFW 2023; California Fish and Game Commission 2023). High levels of water diversion combined with adverse reservoir storage operations generate extremely altered hydrographs throughout the Bay-Delta watershed (TBI 2016; SWRCB 2016, 2017; Reis et al. 2019) – where California White Sturgeon spawn and rear – impairing successful reproduction. The population also suffers from overharvest in the recreational fishery (Blackburn et al. 2019; CDFW 2023; California Fish and Game Commission 2023). Furthermore, a massive harmful algal bloom in San Francisco Bay and San Pablo Bay in 2022 and a smaller bloom that occurred in summer 2023 killed large numbers of adult California White Sturgeon, demonstrating the population's vulnerability to future algal blooms (CDFW 2023; California Fish and Game Commission 2023). Persistent low Dissolved oxygen in the Stockton Deepwater Ship Channel and toxic algae blooms in the Delta are also likely to impede Bay-Delta White Sturgeon migration to and from their spawning grounds in the San Joaquin River watershed.

Existing environmental regulations are inadequate to prevent further decline of Bay-Delta White Sturgeon. The Board has acknowledged that current regulation of river flow and water quality conditions in the Bay-Delta watershed are inadequate to support native fish viability and fisheries, including White Sturgeon (SWRCB 2010, 2017; *see also* CDFW 2010). Several planned water development projects in the Bay-Delta watershed are likely to increase the frequency and severity of inadequate river flow conditions in the future. Meanwhile, water quality conditions in the Delta including low dissolved oxygen and toxic algal blooms, particularly in the San Joaquin River near Stockton, likely impair migration of adult and juvenile White Sturgeon to and from spawning grounds in the San Joaquin basin (CBDA and CVWRQCB 2006).

Each of the major impacts to the Bay-Delta White Sturgeon population— inadequate river flow and water quality conditions, overharvest, and the loss of habitat and potential for catastrophic mortality due to harmful algal blooms — represent a grave threat. These problems are independent of each other – addressing just one or two of these major problems will not eliminate the high risk that White Sturgeon in the Bay-Delta watershed become endangered – that is, experience further declines in viability such that it is in danger of extinction – in the near future.

Fishery
White Sturgeon once supported a commercial fishery in San Francisco Bay (Skinner 1962; Moyle 2002; Attachment: White Surgeon CESA petition). The commercial fishery was closed by the state legislature after 1917 and all possession of White Sturgeon was prohibited until 1953. A recreational Bay-Delta White Sturgeon fishery was opened in 1954 and continues to this day. Because of long-term declines in the Bay-Delta White Sturgeon population and the massive harmful algae bloom-related fish kill in 2022, CDFW staff recently recommended that the fishery be restricted to catch-and-release fishing temporarily (California Fish and Game Commission 2023), however, the Fish and Game Commission rejected CDFW's staff recommendation and adopted emergency fishing regulations that would allow harvest at levels higher than those specified by Blackburn (2019) as necessary to stabilize the population.

(3) Relationship to flow

Recruitment of juvenile California White Sturgeon is positively correlated with high river flows and Delta Outflow during spring and early summer months (Israel et al. 2009; CDFW 2015, 2023; SWRCB 2017; *see also* Parsley and Beckman 1994; AFRP 2001; Moyle 2002; Willis 2022). CDFW's conceptual model for California White Sturgeon life history states:

> The dispersal of larval white sturgeon is dependent on high spring river flows, which optimally consists of multiple large flow pulses and a relationship between the mean monthly outflow from April–July and white sturgeon [young-of-year] has been developed (Kohlhorst et al. 1991). Reduced seasonal flows or flows mismatched ecologically with sensitive early life stages may reduce dispersal of these life stages when they are most vulnerable to native and nonnative predation. Flow reductions may serve to reduce or eliminate [young-of-year] survival even if spawning was successful.

Israel et al. 2009 at 17.

Chronically low river flows and reductions in Delta outflow resulting from water diversion and storage operations have been implicated in the decline of White Sturgeon in the Bay-Delta watershed (Fish 2010; CDFW 2015; Jackson et al. 2016; SWRCB 2017). As a result, successful cohort formation is infrequent for California White Sturgeon, corresponding to years of high spring- summer river flows into and out of the Delta (Figure 6; Moyle 2002; Fish 2010; CDFW 2015; SWRCB 2017). CDFW (2015 at 224) states "Annual recruitment of white sturgeon in California appears to have decreased since the early 1980s." Similarly, Blackburn et al. (2019 at pp. 897-898) observed that "Few age-0 and age-1 White Sturgeon have been sampled since 1998, and only two strong year-classes (2006 and 2011) have been documented in the last 19 years [through 2016]" and concluded that, "Continued poor recruitment has the potential to put the population at risk."

The Board analyzed the relationship between average freshwater Delta outflow in March-July and recruitment of juvenile White Sturgeon and found that recruitment of juvenile White Sturgeon did not occur when March-July average flows were below certain thresholds (SWRCB 2017 Figures 3.6-2 and 3.6-3 at 3-65). The Board determined that monthly average Delta outflows > 37,000 cfs during this period were sufficiently protective of Bay-Delta White Sturgeon. From 1980-1999, average March-July Delta outflows > 37,000 cfs occurred 30% of the time (6 out of 20 years). However, since 1999, flows of this magnitude have occurred only 17.4% of the time (4 out of 23 years). Using an analytical approach similar to that of the Board, we determined that recruitment of YOY White Sturgeon is very low or zero when Sacramento River flows ("SAC" + "YOLO" variables in Dayflow) average < 30,000 cfs between April and July (Figure 8). From 1980-1999, flows of this magnitude occurred in 30% of years; however, since 2000 April-July average Delta inflows from the Sacramento River have exceeded 30,000 cfs in only 17% of years.

Unlike many other flow-viability relationships for Bay-Delta fishes, the relationship between flow and reproductive success for Bay-Delta White Sturgeon is not continuously linear; rather, it takes the form of a "hockey stick" with no response till a threshold is reached and linear response above the threshold. This means there is no benefit to Bay-Delta White Sturgeon reproduction as Delta inflow from the Sacramento River increases but remains < 30,000 cfs (or total Delta Outflow remains < 37,000 cfs) and flows above that threshold produce increasing benefits (Figure 8).

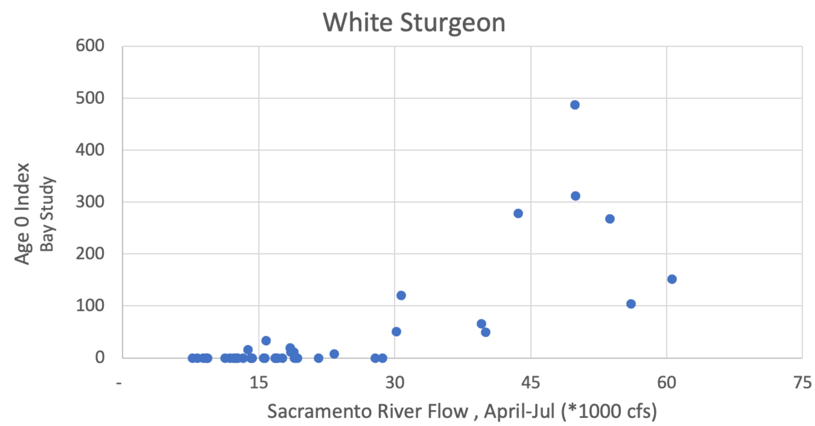

Figure 8: Recruitment of Age 0 Bay-Delta White Sturgeon to the CDFW/Interagency Ecological Program's Bay Study Otter Trawl as a function of Sacramento River flow. Age 0 abundance is strongly correlated with April- July Sacramento River flows (overall r=0.769, n=42, p<0.01), but there is little to no successful reproduction at flows below ~< 30,000 cfs .

Because White Sturgeon females spawn every 2-4 years (Hilderbrand et al. 2016; Moyle 2002), river flows associated with reproductive success should occur on approximately the same time step. Average total April-July Sacramento River inflows to the Delta likely must exceed 30,000 cfs, and March-July Delta outflows must exceed 37,000 cfs in 1 out of 4 years, at a minimum, to maintain population viability.

(4) Effect of "other stressors"

As described above, Bay-Delta White Sturgeon are also impacted by harvest levels and by harmful algal blooms (HABs) in the Bay and Delta. The HABs in the Delta, which likely block migration to and from White Sturgeon spawning and early-rearing grounds in the San Joaquin River valley, co-occur with low dissolved oxygen levels – both of these problems are a function of low flows into the Delta (Berg and Sutula 2015; Lehman et al. 2020; Kudela et al. 2023). HABs in San Francisco Bay-proper are the topic of expected updates to the San Francisco Bay Regional Water Quality Control Board's Nutrient Watershed Permit, but attaining significant nutrient load reductions may take a decade or more. Limiting harvest of White Sturgeon is the subject of forthcoming proposed fishing regulations; however, those regulations are targeted to allow harvest of ~4% of the population, which is more than the "less than 3%" called for by Blackburn et al. (2019) to stabilize, not recover, the population. Blackburn et al.'s analysis and recommendation came prior to catastrophic White Sturgeon die offs in 2022 and 2023, which were associated with "red tide" algal blooms in the Bay (CDFW 2023; California Fish and Game Commission 2023).

Whether and when fishing and harmful algal bloom impacts to the White Sturgeon population are resolved, improving the magnitude of juvenile recruitment and frequency of cohort formation will be necessary to stabilize and recover the population. Without increases in the frequency of river flows and Delta outflows that support their reproduction and recruitment, the Bay-Delta's White Sturgeon population will continue to decline, becoming increasingly less viable and increasingly unable to sustain a recreational fishery.

f) Green Sturgeon

The southern distinct population segment of North American Green Sturgeon (Green Sturgeon) remains imperiled in the Bay-Delta and its watershed (NMFS 2021). A widespread, long-lasting harmful algae bloom in San Francisco Bay killed numerous Green Sturgeon in 2022 – the exact number of fish lost in this catastrophic fish kill is unknown and unknowable (CDFW 2023). Freshwater flow needs of Green Sturgeon are assumed to be similar to those of White Sturgeon (SWRCB 2017). Like White Sturgeon, the reproductive ecology of female Green Sturgeon indicates that flows which support spawning, incubation, and recruitment of larvae must occur on the order of once in four years in order to maintain population viability.

(1) Description

Green Sturgeon (*Acipenser medirostris*) are smaller than White Sturgeon. Females reach ~5 feet at maturity, are iteroparous, and can spawn every 3-4 years. In the San Francisco Bay-Delta, Green Sturgeon spawn primarily in the Sacramento River, although spawning has also been documented recently in the Feather and Yuba Rivers. Until recently, it was believed that they have been extirpated from the San Joaquin River (Moyle 2002; CBDA CVRWQCB 2006; NMFS 2006); however, since publication of the Final Scientific Basis Report (SWRCB 2017), two Green Sturgeon have been confirmed from rivers in the San Joaquin basin (NMFS 2022). Information presented below describing Green Sturgeon ecology is drawn from the most recent Green Sturgeon status review (NMFS 2022).

Green Sturgeon are completely anadromous – all individuals migrate to the ocean prior to spawning for the first time and in-between spawning events. Adults enter San Francisco Bay in late winter through early spring, migrate upstream, and spawn from April through early July. Most Green Sturgeon spawning is believed to occur in deep pool in the upper parts of the Sacramento River, below Keswick Dam. River flow cues spawning migrations. After spawning, adults may remain in the river environment for several months, outmigrating in the fall or winter, migrate out of the river immediately after spawning in the spring or summer.

Green Sturgeon eggs primarily develop on the gravel or cobble substrates to which they adhere Optimal egg development occurs in a temperature range between 14-17°C. Optimal growth of Green Sturgeon larvae occurs at 15°C, while temperatures less than 11°C and temperatures greater than 19°C decreased growth rate.

Green Sturgeon remain in their natal river for 6-24 months before migrating to the estuary – this is much longer freshwater duration than most White Sturgeon. Subadult and adult Green Sturgeon spend most of their life in the coastal ocean and are found in high concentrations in coastal bays and estuaries along the west coast of North America during the summer and autumn.

(2) Status

Viability

The Bay-Delta watershed's population of Green Sturgeon is part of the Southern Distinct Population Segment (DPS) of this species. The DPS was listed as ESA threatened in 2006. NMFS inferred an ongoing decline in abundance of this imperiled fish based on the decline in the number of juvenile Green Sturgeon salvaged annually at the SWP and CVP water export facilities in the South Delta (NMFS 2009). The most recent five-year review indicated no change in the threatened status of this DPS; none of the recovery criteria have been met (NMFS 2022). In other words, the viability is precarious and they continue to be in danger of becoming "endangered" or going extinct in the near future. Furthermore, NMFS considers existing regulatory mechanisms to be inadequate to protect the species, stating (NMFS 2021 at 8):

> Continued improvements are needed to regulatory mechanisms associated with … modification of impoundment operations or facilities to address flow, water temperature, and sediment impacts (e.g., Oroville-Thermalito Complex) [and] screening criteria and regulation for agriculture, municipalities, and industrial water diversions.

These needs reflect, in part, the inadequacy of existing Plan water quality standards and operation of the SWP under the state's 2020 CESA ITP.

Fishery

Although Green Sturgeon are not prized as a game fish or food item like White Sturgeon, there was historically a fishery for Green Sturgeon in the Bay-Delta watershed. In addition, Moyle (2002) points out that the commercial, sport, and tribal fisheries for Green Sturgeon in the Columbia River estuary were likely dependent on fish that migrated from California, as there is no evidence of Green Sturgeon spawning near the Columbia River. Fishing for Green Sturgeon is now prohibited because of its "threatened" listing and its imperiled status.

(3) Relationship to flow

Because so little is known about Green Sturgeon, they are generally assumed to require similar habitat and flow conditions as White Sturgeon (SWRCB 2017).

(4) Effect of "other stressors"

Population viability of this Green Sturgeon DPS is impacted by many of the same factors that now jeopardize White Sturgeon, including chronically impaired river flows that limit opportunities for successful reproduction (NMFS 2006). Green Sturgeon were also killed by the "red tide" in San Francisco Bay during the summer of 2022 (CDFW 2023; California Fish and Game Commission 2023) and their range within the watershed is likely limited by migration barriers related to physical impediments and/or poor water quality conditions, including low dissolved oxygen (CBDA and CV RWQB 2006) and toxic algal blooms.

g) Starry Flounder

Starry Flounder, which contribute to the ocean flatfish fishery, have experienced significant population declines in recent decades. Their abundance as juveniles rearing in the estuary is strongly correlated with freshwater outflow from the Delta. And, the abundance of juvenile Starry Flounder rearing in the estuary is positively correlated to subsequent catches in the ocean fishery. These two statistically significant relationships demonstrate that freshwater Delta outflow during the winter-spring has an important effect on the subsequent ocean fishery for Starry Flounder. Unfortunately, the Draft Staff Report uses a demonstrably inadequate flow threshold to evaluate the effect of the proposed project on Starry Flounder. This flow threshold contradicts and defeats the purpose of the flow criteria established in the Board's Public Trust Flow Criteria Report (SWRCB 2010). Furthermore, the Board must identify how frequently protective flows must recur to reasonably protect beneficial uses associated with Starry Flounder populations.

(1) Description

Starry Flounder (*Platyichthys stellatus*) is the only flatfish found in freshwater on a regular basis. They are primarily marine, but many of their young-of-year migrate (probably carried by currents) into estuaries, where they rear for one or more years. Young-of-year fish are typically found on sandy bottoms of brackish pelagic waters. They gradually migrate to saltier water as they age. The CDFW/Interagency Ecological Program's Bay Study otter trawl catches Age 1+ fish efficiently, so the Bay-Delta Starry Flounder abundance index reflects catches of Age 1+ fish.

(2) Status

As indexed by the CDFW/IEP's Bay Study Otter Trawl, abundance of Age 1+ Starry Flounder rearing in the estuary has declined by >95% since the early 1980's (5-year average 1980-84 (1608) vs. 2018-2022 (76); Figure 9).

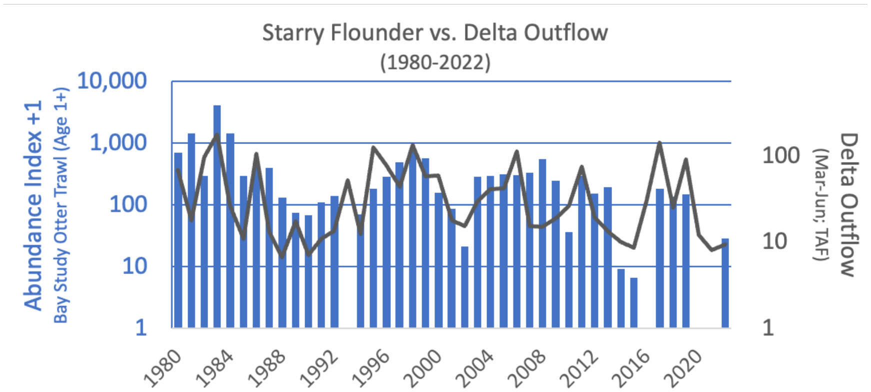

Figure 9: Abundance of Age 1+ Starry Flounder in San Francisco Bay versus Delta Outflow one year earlier. Since 1988, the relationship is statistically significant (Kimmerer 2002; r=0.471, p<0.01). Both axes are log-scaled to allow easier visualization of inter-annual changes. Index values of "1" in the graph correspond to index values of zero in 1993 and 2021; no index value was calculated in 2016 and 2020 due to sampling issues. Index data from CDFW and the Interagency Ecological Program's Bay Study.

Fishery
In the ocean, thousands to tens of thousands of metric tons of Starry Flounder are harvested as part of the California coastal flatfish fishery, but catch has been declining precipitously (Ralston 2005; Figure 10).

Starry Flounder Catch
Port of San Francisco

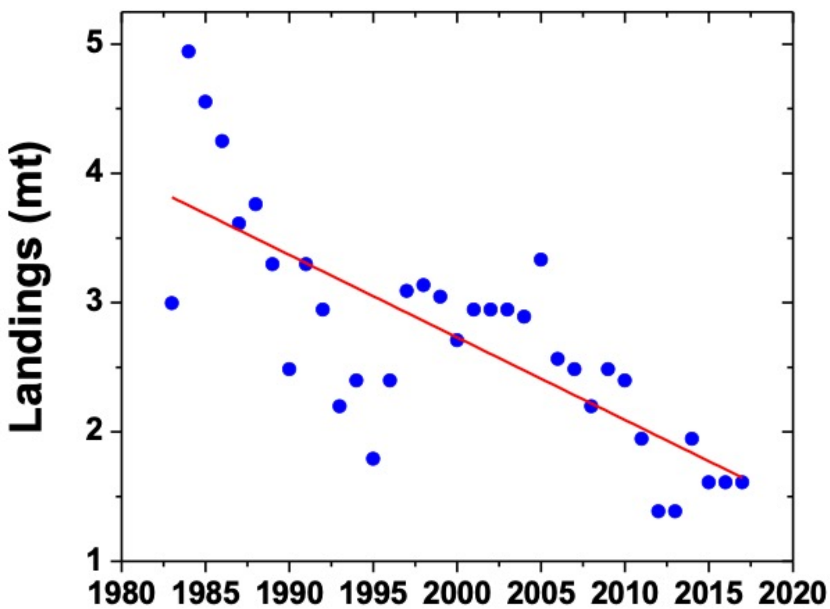

Figure 10: Landings of Starry Flounder to the Port of San Francisco from the ocean fishery; 1983-2015. Index data obtained from the Pacific States Marine Fishery Council, PacFin database (https://pacfin.psmfc.org) – data are not available after 2015.

(3) Relationship to flow

Delta outflow affects two important aspects of viability of Starry Flounder – abundance and spatial distribution – in San Francisco Bay. Abundance of Age 1+ Starry Flounder in the San Francisco Bay-Delta is well correlated with Delta outflow in the prior year during the months of March through June (Kimmerer 2002; Figure 9). Abundance of Starry Flounder in the estuary is correlated with catch of Starry Flounder in the ocean during subsequent years (Ralston 2005; Figure 11), indicating that San Francisco Bay serves as an important nursery for this fish and that conditions in the Bay affect the population as a whole. Also, juveniles occur further up the axis of the estuary (closer to the Delta) under drier conditions. This makes Starry Flounder more vulnerable to entrainment in the CVP and SWP south Delta water export infrastructure and, indeed, more of these fish are salvaged in drier years compared to wet years, even though abundance of Starry Flounder in the estuary is higher in wet years (Moyle 2002).

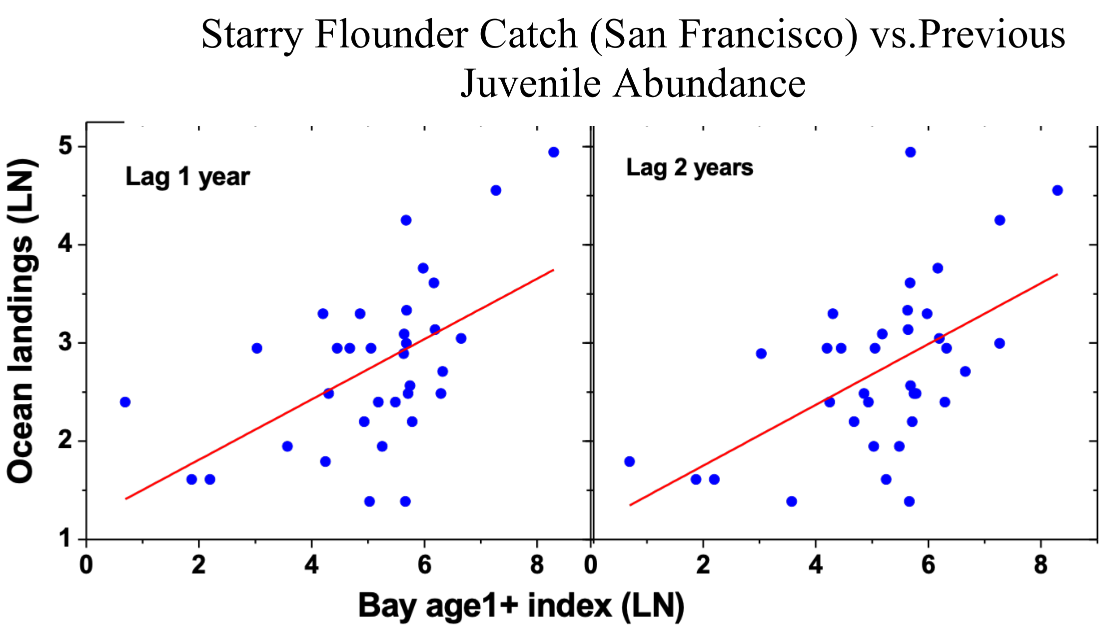

Figure 11: Landings of Starry Flounder to the Port of San Francisco from the ocean fishery (1983-2015; natural logarithm scale) as a function of the natural logarithm of juvenile (Age 1+) Starry Flounder rearing in San Francisco Bay one year earlier (left panel; $r = 0.539$, $p < 0.01$) and two years earlier (right panel; $r = 0.529$, $p < 0.01$). Landing data obtained from the Pacific States Marine Fishery Council, PacFin database (https://pacfin.psmfc.org) – data are not available after 2015. Age 1+ index data from CDFW and the Interagency Ecological Program's Bay Study. Graph and analysis produced by Dr. Bill Bennett for the Bay Institute.

The Draft Staff Report's threshold flow for protection of Starry Flounder is much lower than the flow criteria it previously identified (SWRCB 2010 at 83). As we noted in our comments on the 2017 Scientific Basis Report (*see* Attachment: TBI et al. 2017 comments on final Phase 2 Scientific Basis Report), the Draft Staff Report threshold is based on flawed analysis of Starry Flounder population dynamics and response to flows. The Board's analysis assumes, contrary to the evidence, that recent historic flow levels will result in a stable population. And, the Board's 2017 analysis also incorporates a shifting baseline under which the continued decline of the population begets continued lowering of expectations for protection of this population.

In 2010, the Board set a goal for protection of Starry Flounder equal to the median abundance index for this species from 1980-2009 and identified flow in each year-type that would enable attainment of this goal (SWRCB 2010). In 2017, the Board used a different methodology to estimate flows needed to attain the 2010 goal, basing its new single protective threshold on the median March-June flows during 1994-2013. The Board does not explain why the flows needed to protect Starry Flounder would have declined between its 2010 and 2017 analyses. Identifying the median flow during 1994-2013 as the target for protection ignores (a) that Starry Flounder abundance had already declined significantly by 1994, and (b) the Board's repeated findings that current flow levels during this period were inadequate to maintain native fish populations (SWRCB 2010, 2017, 2018). The assumption that the median abundance of Starry Flounder could be attained by maintaining median flow conditions during a period when the Starry Flounder population was declining denies the evidence that status quo flows between 1994-2013 were associated with and contributed to the ongoing decline of juvenile Starry Flounder abundance in the Bay-Delta and, later, the ocean fishery. Indeed, the time period the Board selected for determination of the critical flow in its 2017 Scientific Basis Report overlaps with the entire period between the adoption and implementation of the Board's current flow objectives and the Board's decision to revise those objectives to be more protective. The Draft Staff Report's flow threshold erroneously suggests that beneficial uses associated with Starry Flounder can be adequately protected by maintaining the same flow regime that contributed to the ongoing decline of this population.

Finally, although the Board's original goal for protecting Starry Flounder was to maintain the Age 1+ Starry Flounder abundance index above 293, the 1980-2008 median index value (SWRCB 2010 at 82-83), the flows identified with Starry Flounder protection in the Draft Staff Report (Delta Outflow 21,000 cfs on average from March-Jun) are consistent with a population that is ~5% lower than this goal (SWRCB 2017 at 3-83 and 3-84). In other words, even if we ignored the fact that Starry Flounder abundance has been declining under the current flow regime, the Board's 2017 flow target flow for Starry Flounder would still be somewhat less than the flows needed to achieve its stated goal.

The Draft Staff Report should be revised to analyze the frequency and magnitude of flows that the best available science indicates will be protective of Starry Flounder. The flow regime previously identified by the Board as protective of Starry Flounder (SWRCB 2010 Table 13 at 83) reflect the best available science on the magnitude and frequency of flows necessary to attain the Board's (somewhat anemic) abundance target for this fish.

(4) Effect of "other stressors"

This population would not be expected to respond to restoration of shallow water environments in the Delta as they are very uncommon in the Delta or in tidal wetland habitats.

2. *<u>Estuarine habitat</u>*

a) Food web

Phytoplankton productivity and densities of common and widespread zooplankton species have declined in the Bay-Delta, particularly in the low salinity zone that serves as a critical nursery area for larvae and juveniles of many native fish species. Although the hypothesis that declines in estuarine food web productivity have caused declines in Bay-Delta fish populations has little empirical support (and no support, in the case of most native fish species), reduced productivity of the estuarine food web is strong evidence that estuarine habitat conditions are deteriorating.

Impaired inflow to the estuary is a major factor.

Declines in phytoplankton productivity in the low salinity zone are strongly linked to the synergistic effect of invasive benthic species and increased freshwater exports (Hammock et al 2019b). Abundance of key zooplankton species in the low salinity zone of the estuary respond positively and strongly to increases in seasonal Delta outflow (Orsi and Mecum 1996; Kimmerer 2002; Mac Nally et al. 2010; Kimmerer et al. 2018; Hassrick et al. 2023) indicating that improvements in seasonal Delta outflow during spring, summer, and fall are essential to protecting and maintaining Bay-Delta estuarine habitat. Clearly flows that stimulate estuarine habitat are needed more frequently than what occurs under current requirements.

Most of the Bay-Delta's estuarine fish species rely on zooplankton prey during at least part of their life-cycle. As a result, many Bay-Delta observers have postulated that the concurrent declines of key zooplankton prey species in the Bay-Delta estuary and the native fish species that prey upon them is evidence of a mechanistic linkage between estuarine food web productivity and native fish abundance (e.g., Sommer et al. 2007). There is little evidence to support this hypothesis. For instance, although Kimmerer (2002) documented declines in phytoplankton and several zooplankton populations, he found scant evidence that reduced food supplies translated into declines in the abundance or survival rates of various pelagic fish species – indeed, Kimmerer found:

> …rather consistent declines in the late 1980s among the lower trophic levels, particularly in summer. Although the specific temporal pattern varied among responses, chl a [phytoplankton] and abundance of 4 zooplankton taxa were lower after 1987 than before. This contrasts with the overall pattern among fish and shrimp. Few of these showed a pattern of annual abundance or survival index that was consistently lower after 1987 than before…

Kimmerer 2002 at 45.

Regardless of their direct effect on pelagic fish species, estuarine zooplankton populations are sensitive indicators of the condition of estuarine habitat. For this reason, the steep decline in density of formerly widespread and abundant zooplankton, such as *Eurytemora affinis*, *Pseudodiaptomous forbesi*, *Acartia spp*., and native mysid shrimp indicates that Bay-Delta estuarine habitat conditions have deteriorated. Abundance of each of these species in the estuarine low salinity zone responds strongly and positively to Delta outflow (or inversely to X_2; Kimmerer 2002; Mac Nally et al. 2010; Hennessy and Burris 2017a,b). For example, increasing Delta outflows transport increasing numbers *P. forbesi* to areas of the Delta and Suisun Bay where they are available to Delta Smelt and other native predators (Kimmerer et al. 2018; Hassrick et al. 2023).By contrast, there is almost no evidence that abundance of estuarine zooplankton available to Bay-Delta pelagic fish can be significantly increased by restoring shallow sub-tidal environments in the Delta (*see* NRDC et al. 2023 and above).

Zooplankton abundance in the estuary's pelagic waters responds positively to increases in Delta outflow during the spring, summer and fall. Research by Hennessy and Burris (2017a,b) demonstrates that populations of key zooplankton indicators of estuarine habitat are extremely low in the spring when average March-June Delta outflow is < ~30,000 cfs (*E. affinis*) or average March-May flows are < ~40,000 cfs (mysid shrimp) and in the summer when Delta outflow is < ~6,500 cfs (*P. forbesi*) (Figure 12). Kimmerer et al. (2018) and Hassrick et al. (2023) confirm the importance of elevated summer and fall flows on abundance of *P. forbesi* in the estuarine low salinity zone. These results suggest that the Delta outflow thresholds identified by the Board as protective of Bay-Delta Zooplankton (20,000 cfs in spring months) will not protect estuarine habitat during spring. Given the results of Hennessy and Burris (2017a,b), Kimmerer et al. (2018), and Hassrick et al. (2023), the Board must revise the spring flow thresholds identified as protective of zooplankton and rectify its failure to identify summer and fall flow levels needed to protect estuarine zooplankton and their estuarine habitat. Finally, the Board must define biocriteria for the reasonable protection of estuarine habitat, including the frequency with which key zooplankton populations will attain target densities. Absent such a definition, it not possible for the Board or the general public to determine whether its proposed project (or any update to Plan objectives and the POI) will provide reasonable protection for estuarine habitat.

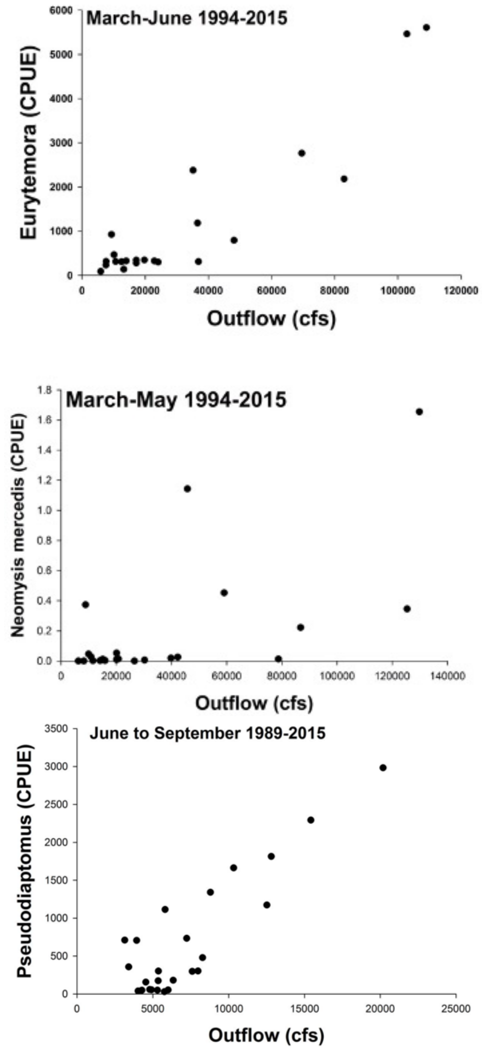

Figure 12: Relationship of Delta outflow to density of three different key zooplankton populations in the low salinity zone of Suisun Bay, in different seasonal periods. Copied from Hennessy and Burris 2017a; *see also* Hennessy and Burris 2017b.

b) Harmful Algae Blooms (HABs)

Declines in the productivity of the estuarine foodweb are not the only indicator of the catastrophic deterioration of estuarine habitat in the Bay-Delta. The emergence of persistent harmful algal blooms (HABs), particularly in the Delta, indicates that the freshwater and low salinity parts of the estuary are becoming inhospitable to aquatic life – i.e., the value of estuarine habitat in the Bay-Delta is greatly diminished. Seasonal blooms of harmful and toxic algal species in the Delta are increasingly common, long-lasting, and widespread. These HABs impair estuarine habitat by killing fish and planktonic organisms, recreational uses of water, and even public health. To form a bloom, HAB-forming organisms require adequate light, water temperatures, nitrogen and phosphorous (e.g., nutrient) concentrations, and low flow (high residence time, low suspended sediment levels). Light levels and water temperatures are almost always adequate to support blooms in the Delta between late spring to mid-fall; nutrient loads are always high enough to support a bloom (Berg and Sutula 2015) despite expensive upgrades to the region's largest water treatment facilities. flows are inadequate to repress HABs in the Delta in all but the wettest years – flow levels that can impede formation, duration, and extent of HABs can be restored by reducing water diversions upstream.

Under the right conditions – including nutrient levels, water temperature, light levels/turbidity, and residence time – several photosynthetic microorganisms can form HABs (Berg and Sutula 2015). In the Delta, the main HAB-forming organisms —cyano-bacteria in the genus *Microcystis*— are toxic to aquatic life, including zooplankton, fish, and mammals, and to people. Toxins from additional bloom-forming algae taxa have been detected more recently (Kudela et al. 2023). The toxins produced by *Microcystis* – microcystins – are found in Delta waters, throughout the Delta food web (Lehman et al. 2010), and in shellfish that live in habitats more saline than *Microcystis* can tolerate (Peacock et al. 2018), and even in the air above water where a bloom has formed (Plaas and Paerl 2022). Other toxic bloom forming algal taxa can have similar or more dramatic negative effects (Kudela et al. 2023). Thus, harmful algal blooms in the Delta compromise numerous beneficial uses of the Bay-Delta, including EST, COMM, SHELL, MIGR, REC-1, REC-2, and tribal beneficial uses.

Although it acknowledges the critical role of river flows on the formation of HABs (Draft Staff Report at 7.12.1-38), the Draft Staff Report fails to analyze the effect of alternative flow regimes on HABs in the Delta. Freshwater flow rates into the Delta are known to have a negative effect on *Microcystis* bloom formation, cell density, as well as total toxin concentration and toxin concentration per cell (Lehman et al. 2008, 2020). Freshwater flows into the estuary control residence time of algal cells (higher flows help disperse the cells before a HAB can form) and also mediate turbidity (faster flows carry higher sediment loads), stratification/mixing of the water column, and water temperatures where blooms typically form (Bashevkin and Mahardja 2022) in ways that impede bloom formation and growth[7]. Kudela et al. (2023 at 14) summarized the effect of flow on *Microcystis*, as follows:

> When mixing is weak, conditions are ideal for the development of *Microcystis* blooms because of their high degree of buoyancy. Conversely, if mixing is relatively strong, *Microcystis* blooms tend not to develop; most likely because they will then have to compete with other, faster-growing, non-cyanobacterial taxa (chlorophytes, diatoms).

[7] Two of the major dischargers of nitrogen and phosphorous into the Delta (the Stockton and Sacramento Sanitation wastewater treatment plants) have been upgraded in recent years –at great expense– in order to reduce nutrient loading into the Delta (Draft Staff Report at 7.12.1-39). Thus, major and expensive "non-flow" mitigations for HABs in the Delta have already been implemented.

Lehman et al. (2013, 2020) identified summertime flows ≥ ~2,825 cfs (80 cms) at Vernalis on the San Joaquin River and Sacramento flow at Rio Vista ≥ ~10,600 cfs (300 cms) as associated with reduced HAB activity in the Delta. The Draft Staff Report should be revised to analyze the frequency of these flow levels during the relevant months for HAB formation in the Delta.

Furthermore, the Draft Staff Report fails to acknowledge the persistence of HABs in the southern Delta, downstream of Vernalis (Draft Staff Report at 7.12.1-33). Although HAB formation in this area is affected by flows from the San Joaquin River, which were covered in Phase I of the Board's Bay-Delta Plan update, that update did not address HABs at all. Therefore, the Draft Staff Report must analyze the effect of the Bay-Delta Plan updates on HABs that form persistently downstream of Vernalis.

3. Other ecological values

Numerous other fish and wildlife species, habitats and ecological processes of the estuary have been adversely impacted by the reduction and alteration of flow amounts and timing. The effect of reduced peak flows on sediment transport has contributed to the degradation and loss of floodplain, wetland and beach habitats throughout the estuary. Coastal populations of forage fish, sea birds, and marine mammals have likely been decreasing due in part to reduced inflow to the estuary and nearshore coastal waters and associated flow-induced changes to the food web. For instance, numerous studies have documented the effect of declining availability of salmon prey on population growth in southern resident orca whale populations (Wasser et al 2017; Hanson et al 2021). Increasing rates of introduction and successful colonization by invasive non-native species are also linked to reduced inflow to the estuary (Winder et al. 2011). Furthermore, water quality conditions in the Bay-Delta have deteriorated such that direct human uses are severely impaired. For a review of a broad range of impacts associated with flow changes, see TBI 2016.

E. Current Flow Standards are Inadequate to Maintain Fish in Good Condition, per the Requirements of Fish and Game Code § 5937

As described above, native fish in the estuary and its watershed are not presently in good condition with respect to any of the three tiers of the definition presented by Moyle (2017). Indeed, several species in the native fish assemblage are at risk of being extinguished permanently. Loss of native fish populations is not consistent with any definition of fish "in good condition."

Failure to attain population viability also indicates that individual fish are not being maintained in good physical health, as required by the Tier 1 of the definition of "fish in good condition" provided by Moyle (2017). In addition, there is direct evidence that individual fish are being stressed and/or killed by high river temperatures and low flows. For example, SWFSC 2023 (at 150) describes direct mortality to adult spring-run Chinook Salmon as a result of high water temperatures in Sacramento River tributaries. In another example, during April and May of 2021, Reclamation released very warm water into the Sacramento River that killed migrating winter-run Chinook Salmon, as part of a disastrous bid to conserve cold water for release later in the incubation season (Reclamation 2021 at 3). CDFW reported high levels of pre-spawn mortality among migrating adult winter-run early in 2021, stating:

> Crews continue to observe live fish that are exhibiting unusual swimming behavior, fish covered with fungus patches, and unspawned fish drifting downstream while still alive but moribund and presumed to die shortly after observation.

CDFW 2023a, "Discussion" tab, Row 24

By the end of the spawning season, CDFW recovered carcasses of approximately 95 winter-run females that had died prior to spawning–5.5% of total female carcass recoveries (CDFW 2021, "winter-run data table" tab, Row 47 available at: https://www.calfish.org/ProgramsData/ConservationandManagement/CDFWUpperSacRiverBasinS%20almonidMonitoring/tabid/357/Agg2208_SelectTab/4/Default.aspx

There is no biological justification for exposing adult Chinook Salmon to temperatures that reduce or eliminate their reproductive success in order to save cold water for later use to protect the eggs of these same fish. Killing adult salmon by releasing hot water from dams is a stark example of failure to maintain fish in good condition and the need for coldwater habitat requirements below Central Valley dams. The Board must adopt, implement, and then enforce water temperature protections for Central Valley Chinook Salmon, consistent with the best available science.

Furthermore, the decline in numerous native fish species, and in particular anadromous salmonids, means that the status of the fish assemblage does not represent "fish in good condition" (per Tier 3 of Moyle's (2017) definition). Restoring the Bay-Delta's fish assemblage to good condition will require changes to dam operations such that flow levels are sufficient to allow native fish to complete their life cycle and reproduce successfully in most years and so that the full assemblage of native species is maintained. Without such changes to operations, the species assemblage will not regain its resilience to myriad other man-made and natural disturbances that this ecosystem faces now and in the future.

F. Pending Projects to Divert More Water from the Bay-Delta Estuary and Watershed will Further Reduce Flows to the Estuary and Accelerate Declines in Native Fish and Wildlife Populations and Water Quality

The proportion of unimpaired runoff from the Central Valley that makes it to and through the Delta to San Francisco Bay has declined dramatically over the past century and over the past 25 years (Hutton et al. 2017; Reis et al. 2019; Figure 13).

One reason this trend persists is that the Plan's existing river and estuarine flow objectives are minimum requirements that do not address changes in the water management system's capacity to divert unregulated flows above the minima. This trend will only be exacerbated by the entirely foreseeable – indeed, imminently pending –increase in diversion of unregulated flows by proposed projects (SWRCB 2017 at pp. 5-22 through 5-23**)**. As the Draft Staff Report explains (at 1-9):

> Total average annual unimpaired (without diversions and dams under current channel and infrastructure conditions) outflows from the Bay-Delta watershed are about 28.5 million acre-feet (MAF). Annual average outflows with diversions are a little more than half this amount at about 15.5 MAF, and outflows during the winter and spring from January through June are less than half. However, average regulatory minimum Delta outflows are only about 5 MAF, or about a third of current average outflows and less than 20 percent of average unimpaired outflows. Existing regulatory minimum Delta outflows would not be protective of the ecosystem, and without additional instream flow protections, existing flows may be reduced in the future, particularly with climate change and additional water development absent additional minimum instream flow requirements that ensure flows are preserved in stream when needed for the reasonable protection of fish and wildlife.

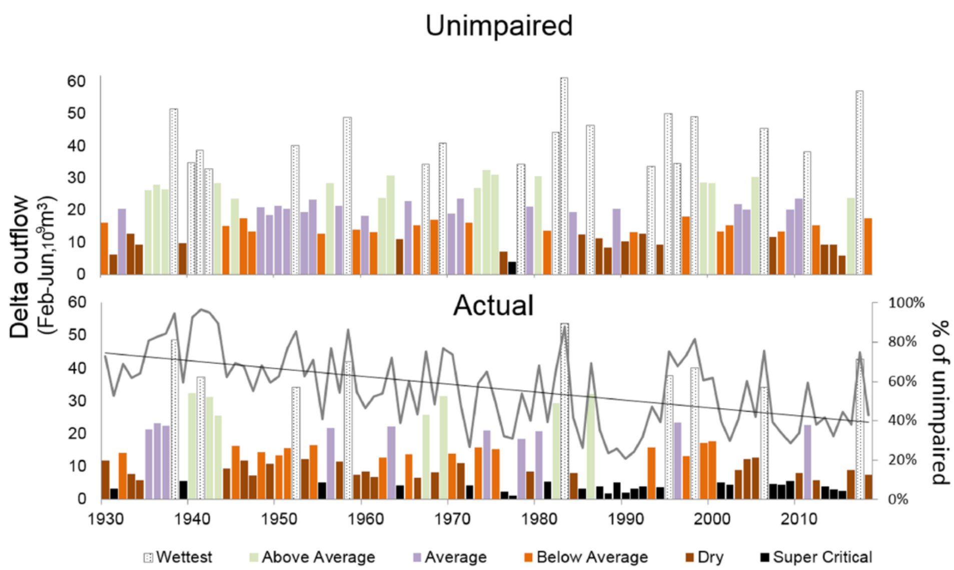

Figure 13: Trends in actual Delta outflow (below) relative to Central Valley unimpaired runoff (above). Coloring of bars represent water year types based on quintiles of unimpaired flow from 1922-2016. The percentage of unimpaired flow reaching San Francisco Bay (line in lower panel; right y-axis) declined significantly during this time-period (Kendall's tau = −0.36, $p < 0.001$), including since 1995 (Kendall's tau = −0.29, $p < 0.05$). Copied from Reis et al. 2019.

Absent Bay-Delta Plan updates that both adopt the percent unimpaired flow approach which allows for more natural flow patterns and set that percentage at levels that reasonably protects fish and wildlife beneficial uses, flows to the estuary will continue to be reduced in volume and altered in timing by several major water development projects that are currently moving forward. This includes ensuring that more than the minimum is required and that currently unregulated flows are protected.

Sites Reservoir is a proposed new off-channel reservoir that would divert water from the Sacramento River during October-June for later delivery to agricultural and urban users. If approved, Sites Reservoir diversion operations are expected to reduce winter-spring flows that many Bay-Delta species rely on to complete their life cycles (e.g., Sites RDEIR/SDEIS Table 5c-9-1c). The Delta Conveyance Project is also designed to capture and divert river flows that are not protected by water quality standards. In this project, CDWR proposes to route Sacramento River flow through an underground tunnel to existing export infrastructure in the southern delta. Operation of the Delta Conveyance Project would substantially reduce flows in the lower Sacramento River (CDWR 2023, Appendix 05C Table 5C-42 at 5c-43). These two projects – operating alone or in tandem – and/or other new diversions will divert flows in a way that negatively affects spawning and recruitment of juvenile White Sturgeon and Green Sturgeon, migration of juvenile Chinook Salmon and Steelhead, and recruitment of Longfin Smelt and Delta Smelt, among other species. Both projects are also likely to further degrade estuarine habitat conditions by denying flows to the Bay that repress HABs and foster productivity of the estuarine food web.

Therefore, it is critical that Bay-Delta Plan updates be based on the analysis of the flows that will actually occur in future because they are protected by the Plan's flow objectives (and the associated benefits), as opposed to the supposed benefits that would accrue from flows that would be surplus to updated Plan objectives but subject to capture as a result of future changes in storage, diversion and conveyance capacity. This is not an academic issue: as demonstrated since the last Bay-Delta Plan update, flows that are not protected by regulation are likely to be diverted or stored in the future. The probable effect on native fish species and estuarine habitat of failure to protect unregulated flows can be seen by comparing the projected frequency with which different flow regimes will achieve the Board's estimate of relevant threshold flows when unregulated flows are not included (SWRCB 2017) versus when unregulated flows are assumed to continue in the future, as in the Draft Staff Report (Figure 14).

II. The Proposed Project is Incomplete and the Available Evidence Indicates that it will Not Provide Reasonable Protection of Fish and Wildlife Beneficial Uses or Achieve Plan Objectives

A. The Draft Staff Report Fails to Provide a Stable Project Description for the Proposed Project

The Draft Staff Report fails to provide a stable and finite project description for the proposed project as required by CEQA. Cal. Code Regs., tit. 23, § 3775 et seq. "An accurate, stable and finite project description is the sine qua non of an informative and legally sufficient EIR." *County of Inyo v. City of Los Angeles*, 71 Cal.App.3d 185, 193 (1977). CEQA requires a clear explanation of the nature and scope of a proposed project, otherwise the required environmental review "is fundamentally inadequate and misleading." *Communities for a Better Environment v. City of Richmond*, 184 Cal.App.4th 70, 84-85 (2010).

The Draft Staff Report's analysis and description of the proposed project is critically deficient due to the missing Program of Implementation (POI). (Draft Staff Report at 5-1; Cal. Water Code § 13242.)[8] Unlike the SED in Phase 1 of the Bay-Delta Plan, the public cannot review the POI for this Draft Staff Report to understand exactly what "actions the State Water Board will take to implement the objectives and protect beneficial uses and the actions that others should take to do so[9]" (Draft Staff Report at 5-2; *see also* Attachment: NRDC et al. 2017 Phase 1 SED Comments). The POI for Phase 2 is fundamental to understanding both the true "nature" and "scope" of the proposed project, and its absence "subverts full consideration of the actual impacts" of the proposed project. (*See Communities for a Better Env't v. S. Coast Air Quality Mgmt. Dist.*, 48 Cal. 4th 310 (2010)).

The failure to provide a POI for the Proposed Project is particularly egregious given the years of delay in this Plan update process. It appears the Draft Staff Report was essentially complete in 2017. The Board noted that the Draft Staff Report was nearing completion over a year ago in Fall of 2022 but was delayed once again by the Voluntary Agreement proposal submission. Draft Staff Report at 7.24-1. Rather than publicly releasing a defined and enforceable POI, the SWRCB instead took another year to produce a deficient Draft Staff Report and legally inadequate Voluntary Agreement proposal, risking further catastrophic damage to the Bay-Delta's rare species, fisheries, and other identified beneficial uses as status quo conditions continue without action from the Board.

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[8] "…the State Water Board will provide additional opportunity for comment on the specific regulatory text changes to the Bay-Delta Plan, including the specific changes to the program of implementation text, ***which has not yet been developed***." Draft Staff Report at 5-1 (emphasis added).

[9] In addition to the SED for Phase I of this Bay-Delta Plan update process, there are other examples of Water Quality Control Plan drafts that included Programs of Implementations in CEQA documents: Water Quality Control Plan for the San Diego Basin (Chapters 4 and 5), Water Quality Control Plan for the North Coast Region (Sections 4 and 5).

Additionally, the Draft Staff Report changes the "nature and scope" of the proposed project by adopting new narrative objectives for flows needed to support and maintain native fish viability, retaining the existing narrative salmon protection objectives but *not* including an accompanying POI. The proposed Plan updates do not articulate these objectives sufficiently to determine whether a hypothetical POI could attain them or to evaluate progress towards the attainment in subsequent, required triennial review processes. CEQA defines a "project" as "the *whole of an action*, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment…" (Cal.Code Regs., tit. 14, § 15378(a) (emphasis added), *see also Tuolumne Cnty. Citizens for Responsible Growth, Inc. v. City of Sonora*, 155 Cal.App.4th 1214, 1221-1222 (2007)).

Here, the narrative objectives are fundamental to the proposed project and the proposed amendments and there is critical information missing that prevents adequate review. For example, the Board does not define the biological outcomes that represent the attainment of its narrative objectives, nor does it set a timeframe for attainment of them. Without such biological outcomes and time-bound attainment criteria must be included in a POI, the public is unable to evaluate the adequacy or environmental impacts of purported improvement to salmon habitat conditions under the proposed project. In other words, the public is unable to truly evaluate the "whole of the action", as required by CEQA. Cal.Code Regs., tit. 14, § 15378(a).

B. The Proposed Project Lacks a Program of Implementation

The Board's mandate under Porter-Cologne includes not only establishing water quality objectives that reasonably protect beneficial uses but also a program of implementation (POI) that describes the actions necessary to achieve those objectives. The POI must adequately consider all factors relevant to the objectives and establish a rational connection between those factors and the actions included in the POI, ensuring that the actions in the POI are sufficient to achieve the objectives. (*See* Western States Petroleum Assn, supra, 9 Cal.4th at 577; Wat. Code §13242(a), *see also* State Water Resources Control Bd. Cases, supra, 136 Cal.App.4th at 775 (citing Wat. Code § 13050(j)(3).)

Because "the specific changes to the Bay-Delta Plan, and specifically the program of implementation, have not been developed yet" (Draft Staff Report at 1-6), the draft is incomplete, and, as discussed above, can neither be "considered as the SED that fulfills the requirements of CEQA" nor as an adequate document to "inform the State Water Board's consideration of the Sacramento/Delta updates to the Bay-Delta Plan" (Draft Staff Report at 1-6).

The Draft Staff Report must be revised to include a POI that contains clear, specific and enforceable criteria to (a) govern potential variations within the permitted adaptive range for the numeric flow objectives and to manage in-Delta hydrodynamics, (b) reduce or eliminate potential conflicts between the implementation of particular objectives, and (c)protect the most sensitive beneficial uses when balancing among competing uses.

The proposed numeric flow objectives include an adaptive range within which flows may be adjusted up or down. We agree with the use of an adaptive flow range, although both the proposed starting point and range of the flow objective must be revised so that the Bay-Delta Plan and its POI can support and maintain the viability of native fishes (which must be defined for all relevant fish) and reasonably protect fish and wildlife and other beneficial uses. Flow variations should only be authorized in order to better achieve specific measurable (quantitative, unless infeasible) biological and ecological targets that define attainment of the fish and wildlife objectives in Table 3. (There is more than sufficient information available to establish targets for almost all aquatic species and other ecological values, and some of these targets can be adopted as enforceable biocriteria in Table 3 itself. Our comments describe in detail specific desired biological and ecological outcomes and thresholds that can and should be used to inform the adoption of both Table 3 biocriteria and POI targets.).

Without specific guidance regarding adjustment within the adaptive flow range, there is a significant danger that discretion in permitting flow variations will be exercised for purposes inconsistent with attainment of the Table 3 objectives. Therefore, the POI must include a complete set of relevant targets for achieving fish and wildlife objectives and a mechanism for ensuring that flow variations are authorized based on the best available scientific evidence for how to better meet these targets, reasonably protect beneficial uses, and achieve Plan objectives. The POI must also ensure that flow variations in the permitted range for the numeric inflow-based outflow objectives are made on the basis of better meeting outflow needs related to fish and wildlife beneficial uses and not on the basis of proposed changes to inflow objectives unless clearly triggered by specific criteria (see below for discussion of coldwater habitat triggers).

Delta outflows must be responsive to estuarine needs, now and in the future. The inflow-based approach to setting Delta outflow requirements will require careful attention in the POI. Future changes to regulations, operational criteria and other factors that apply to areas upstream of the Delta could all reduce flows to the estuary and negatively impact fish and wildlife beneficial uses. The POI must provide safeguards to protect needed levels of Delta outflow associated with expected outcomes for estuary-dependent species, habitats, and processes from flow reductions that are based on changing tributary needs, non-estuarine considerations, and changes in upstream regulations and operational criteria. Changes in ESA protections for endangered species upstream should not automatically trigger reductions in the permitted range, because Porter-Cologne and the federal Clean Water Act hold the Board to a higher standard than the federal or state ESAs.

Similarly, the POI should include relevant biological and ecological targets that will govern implementation of the Plan's narrative and numeric objectives for in-Delta hydrodynamics. (The objectives governing OMR flows and other in-Delta channel flows must be revised to provide and maintain a level of protection above and beyond that under ESA and CESA permit requirements; rather, these objectives should be designed to achieve reasonable protection of fish and wildlife beneficial uses and to achieve the Plan's objectives). The POI should also describe the mechanism for adjusting OMR flows and other in-Delta channel flows based on the best scientific evidence available regarding how to better meet the targets and achieve the objectives.

During extended drought cycles, all beneficial uses are likely to suffer. These drought cycles are reasonably foreseeable and the POI must specify how Bay-Delta Plan implementation will adapt during extended dry periods. The POI must establish a hierarchy of priorities for beneficial use of water, ensuring that uses are impacted in inverse proportion to the risk of life- or ecosystem-threatening effects and to the potential for lasting and irreversible impacts. The POI must prioritize the protection of those most sensitive uses when there is a need to balance impacts on the full range of beneficial uses. Clearly, beneficial uses directly related to public health and safety (including subsistence and ceremonial uses of water and fish and wildlife) and to aquatic life and ecosystems health must be among the highest priorities. The POI must include mechanisms to address the potential impacts of extended drought cycles on these beneficial uses and Plan objectives and to reduce conflict between competing beneficial uses.

The occurrence of extended drought cycles underscores the need for the POI to include actions to navigate potential conflicts in certain years between the coldwater habitat objective, the flow objectives, and consumptive uses. As discussed above, a broad array of species, habitats, and ecological processes are often reliant on reservoir releases to implement requirements for river flow to and through the estuary. Decisions regarding reservoir releases made early in the calendar year regarding both flow objectives and deliveries for consumptive uses affect cold water storage and thus, the ability of reservoir managers to provide adequate coldwater habitat below the dams later in the year. Premature release of reservoir storage represents an irrevocable decision that can lead to high water temperatures and lethal conditions for incubating salmonids during the summer and fall. Therefore, it is essential that reservoir operators plan in the winter and spring and account for coldwater storage needs in the coming summer and fall before making water supply allocation decisions.

Because survival and abundance of numerous species (including migrating juvenile Chinook Salmon) improves significantly at higher river flows into and through the Delta (*see above;* Attachment: Salmon Flow Literature Matrix), these flows should be required, except when their impact on summer and fall river temperatures is outside of bounds that the Board sets in advance. Fortunately, temperature management upstream is amenable to decisions that reflect actual conditions (reservoir storage and snowpack) in the late-winter and spring. Therefore, the POI must establish reservoir carryover storage requirements and specific management triggers for adapting with the range of flow requirements in order to minimize temperature impacts, while maximizing the ability to meet relevant biological and ecological targets. In doing so, the Board can ensure that planning occurs in advance for reasonably foreseeable scenarios, thereby optimizing the effects of the Plan's flow and coldwater habitat requirements, while avoiding situations where stored water necessary for complying with water quality objectives is instead used for for less sensitive consumptive uses.

Finally, the Board should consider requiring physical habitat restoration in the POI as a complement to the flow objectives in Table 3 (rather than as a substitute for meaningful flows, as in the VA alternative). The physical solution doctrine empowers the Board to require physical habitat restoration in order to promoting maximum beneficial use of the State's water resources.

In D-1631 the Board applied the physical solution of compelling the appropriator to restore degraded streams and fisheries:

> In resolving disputes involving competing uses of water, California courts have frequently considered whether there is a "physical solution" available by which competing needs can best be served. (*Peabody v. Vallejo*, 2 Cal.2d 351, 383-384 [40 P.2d 4861 (1935); *City of Lodi v. East Bay Municipal Util. Dist.*, 7 Cal.2d 316 [60 P.2d 4391 (1936).) Adoption of a physical solution is consistent with the constitutional goal of promoting maximum beneficial use of the State's water resources.

SWRCB Decision 1631 at 10.

C. The Narrative Salmon Protection Objective Should be Revised to Remove Confusing Language

The existing narrative salmon protection objective states that "[w]ater quality conditions shall be maintained, along with other measures in the watershed…". The phrase "along with other measures in the watershed" has been the source of much confusion, and the proposed narrative flow objectives rightly do not replicate this poor drafting. Certainly there are measures other than those in Table 3 of the Bay-Delta Plan that can help protect salmon. However, in setting water quality objectives the Board must focus on those water quality parameters, including flow, that are properly included as Bay-Delta Plan objectives in Table 3. The Board can and should include additional actions in the POI that also contribute to salmon protection, including actions that the Board has separate authority to require. Unfortunately, some parties, including at times the Board itself, have used this phrase to confuse and conflate direct implementation of the water quality objective itself with actions in the POI to complement the objective, to the detriment of both.

D. The Proposed Narrative Flow Objectives are Not Adequate to Protect Commercial, Recreational, and Subsistence Fisheries, Tribal Subsistence Fisheries, or Estuarine Habitat; Objectives Should Be Modified or Added to Reasonably Protect these Beneficial Uses

The proposed narrative flow objectives for Delta Inflow, Delta Outflow, Interior Delta Flow, require that that inflow, streamflow, and outflow be "sufficient to support and maintain the natural production of viable native fish populations." But the Board does not describe what a "viable" population is. As described elsewhere, this means that the Board cannot determine whether those narrative water quality objectives (a) reasonably protect fish and wildlife beneficial uses, or (b) whether those objectives are being met and achieved.

But beyond this basic problem, viability as the Board has previously used the term does not ensure that the fisheries (commercial, recreational, tribal, or subsistence) would be reasonably protected. These other beneficial uses are identified for the watershed, and historically, the native fish that thrived in the Bay-Delta supported a host of different fisheries uses. If viability means, as the Board seems to understand the term, the minimum necessary to avoid decline to extirpation or extinction, this definition necessarily forecloses the existence of a sustainable fishery. Pursuing viability as barely avoiding the brink of catastrophe leaves no room for fisheries to exist and be protected.

At simplest, viability requires some assessment, which is absent from the Draft Staff Report, of the abundance and other features of viability that must exist in order for a species to be considered "viable." If, in that assessment, the science demonstrates that abundance estimates for species X need to be 1,000 fish at a certain location, achieving the viability objective would require (at least) meeting that abundance threshold. If the existence of a recreational fishery requires an additional 100 fish in those same measurements, and a commercial fishery would require 250 more, then reasonably protecting fishery uses would require meeting abundance targets that exceed baseline viability.

The Draft Staff Report does not even acknowledge this reality as a possibility. It does not grapple with the relationship between viability and protection of historic fisheries, nor assess the impacts of alternatives analyzed in the Draft Staff Report on those fisheries. The reality demonstrates that fisheries beneficial uses (commercial, subsistence, tribal, and recreational) are (a) no longer in existence (e.g., Delta Smelt), (b) greatly limited from their historic analog (i.e. Sturgeon), (c) currently closed (e.g., Chinook Salmon), and/or (d) have been wholly ignored historically and in the Draft Staff Report (tribal fisheries and related cultural interests).

The Draft Staff Report does not see this as a problem, but as a virtue. In comparing the alternatives, the Draft Staff Report explains that the same beneficial uses are at play, but that protection of the "fish and wildlife" beneficial uses (i.e., RARE, MIGR, COLD, etc.) necessarily protects the fisheries beneficial uses (SHELL, COMM, NAV) and tribal or subsistence beneficial uses (CUL, T-SUB, SUB). (Draft Staff Report at 7.2-1.) But the Draft Staff Report does not support this assumption, nor does it even begin to analyze whether it is justifiable, under what definitions of viability it would be true, or how the existing water quality objectives and proposed flows will ensure that these uses are reasonably protected.

Thus, the Board must (a) analyze the impact of the various proposals on fisheries and fishery beneficial uses, and then either (b) amend the narrative flow objectives so that they ensure fisheries are protected (i.e. maintain the natural production of viable populations after accounting for the impact of historic or existing commercial, recreational, tribal, and subsistence fishing practices"), or (c) establish additional water quality objectives that will protect fishery beneficial uses that go beyond minimum viability.

The Draft Staff Report does none of those. It fails to define viability, it fails to analyze the impact of the various proposals and alternatives on fisheries, it fails to assess whether the fisheries will be protected, it fails to adopt narrative or numeric water quality objectives that would reasonably protect fisheries, and it fails to offer any POI that would ensure that these beneficials uses do not continue to be ignored.

Finally, the same problems exist with respect to estuarine habitat. Because the narrative objective is targeted only on viability as understood by the Board, it does not necessarily protect estuarine habitat beneficial uses absent some analysis of the impacts of flows on estuarine habitat or targeted metrics that serve as a proxy for habitat quantity and quality. The Draft Staff Report does not adequately consider or analyze how native fish population viability and estuarine habitat are (or are not) related and does not demonstrate that the proposed water quality objectives, including the inflow, streamflow, and outflow requirements, will reasonably protect estuarine habitat. The same remedy as for fisheries should be pursued here as well.

E. The Proposed Project Fails to Incorporate the Impacts of Climate Change

As the Draft Staff Report acknowledges (in chapters 2, 4, and 6), climate change is already modifying temperatures, sea level, water demands, and the magnitude and timing of flows in the Bay-Delta watershed, and those effects will continue to be magnified in the future. Draft Staff Report section 6.2.3 acknowledges the necessity of considering climate change in updating the Bay-Delta Plan, and discloses that the downscaled Coupled Model Intercomparison Project Phase 6 global climate projections will be available to incorporate into SacWAM input files in early 2024. More accurate modeling will be helpful in anticipating future water supply impacts and needed changes to operations. However, anticipated changes to hydrology and temperature do not change the flows that the Board needs to provide to the ecosystem today, and the Board must not allow updated analyses and modeling to further delay Plan implementation.

The Board should tie flow requirements to the best available science regarding the needs of Bay-Delta fish and wildlife, estuarine habitat, and other identified beneficial uses. For example, the flow-X_2 relationship is likely to change due to sea level rise. The Board should anticipate the need for periodically updating flow thresholds based on current relationships to ensure the beneficial uses tied to river flows remain protected as the climate shifts.

Similarly, the unimpaired flow-based alternatives are expected to provide species benefits based on an expected recurrence of flows. However as unimpaired flow timing and magnitude become more impaired by climate change, current exceedance frequencies may shift and no longer provide the same protection to beneficial uses at each percentage of unimpaired flow. The Board must periodically update flow requirements based on exceedance analysis when those exceedances shift due to climate change. These updates will be needed regularly; there is no excuse for them to delay Plan updates or their implementation.

A distinct advantage of the Board's flow alternatives is that they are largely immune to errors in runoff forecasting because they do not depend on forecasts—they simply leave undiverted a fixed proportion of the available flow. Errors in runoff forecasting have been larger in recent multi-year droughts (Avanzi et al. 2020). These droughts are expected to become more frequent and intense under climate change. Investments in newer technologies such as Airborne Snow Observatory, and modifications to runoff forecasting techniques have some potential for maintaining forecast accuracy in the future, however in a rapidly-changing climate, flow requirements reliant on forecasting are inferior to an unimpaired-flows-based approach.

Where unimpaired flows may not provide for all the attributes of natural flow functions that would be protective of the ecosystem, adaptive management provisions are proposed. A flow requirement based on a percent of unimpaired flow is intended to ensure that a minimum amount of available supply from a watershed is allocated for the reasonable protection of native fish and wildlife beneficial uses. Adaptive management provisions, including any necessary sculpting of that flow, would provide specific functional flows to improve fish and wildlife protection. Biological goals would be used to help inform adaptive management decisions by informing proposed adaptive management measures and assessing how well they worked.
(Draft Staff Report at 3-100 & 3-101).

The adaptive management provisions are designed to mitigate temperature impacts and strategically use stored water at different times to maximize ecosystem benefits. These approaches are likely to be triggered by runoff-forecast-based assessments and year-type designations. This is a necessary basis for real-time decision-making, however the Board should heed the following cautions in using D1641's Sacramento Valley Index and San Joaquin Index.

> …if current WYT thresholds are maintained (Figure 7), then the burden of climate-driven water scarcity falls entirely on environmental outflow through the Bay Delta (-16%), while the percentage of average annual flow to exports (+2%) and out-of-stream uses (+4%) increase somewhat to preserve relatively constant deliveries in drier years… The WYT framework, and how it could be altered to reflect climate change, directly affects water winners and losers in the state.

Null & Viers 2013.

PPIC 2022 also recommended getting away from year types:

> One central change needed is to pivot from a system based on water year types—where regulatory requirements can change abruptly with subtle changes in conditions—to a system that operates on a continuum based on month-to-month hydrology.

PPIC 2022 at 5.

The unimpaired flow alternatives are structured in a way that achieves these needs. If forecasting and year-types are used in adaptive management, then they must be properly resourced and kept up-to-date as the climate shifts. This means the SVI and SJI must be periodically updated based on recent and forecasted climate in order to maintain the same proportion of years in each year type so that exceedances associated with beneficial uses are maintained.

F. The Draft Staff Report Fails to Utilize Scientifically Sound Analyses Regarding the Effects of Unimpaired Flow Alternatives on Fish and Wildlife Viability, Fisheries, and Estuarine Habitat.

The Draft Staff Report fails to utilize the best available science to analyze the effect of its unimpaired flow alternatives on various native fish and wildlife populations, fisheries, or estuarine habitat. Chapter 3 of the draft report is out of date because it is based on the Scientific Basis Report (SWRCB 2017) which must be updated to reflect relevant and actionable scientific findings from the past 7 years. In particular, the Draft Staff Report fails to incorporate the best available science related to:

- decline and current population status of numerous fish and wildlife populations (e.g., USFWS 2022a; SWFSC 2023; Attachment: White Sturgeon CESA petition);
- flow-viability relationships of Central Valley Chinook Salmon populations and temperature impacts on incubating Chinook Salmon eggs (e.g., Attachment: Salmon Flow Literature Matrix);
- flow-viability relationships and water management impacts on Delta Smelt viability (e.g., Kimmerer and Rose 2018; Polansky et al. 2021; Smith et al. 2021)
- flow-abundance relationships and targets for maintenance of Starry Flounder abundance in the Bay-Delta (*see above;* SWRCB 2010)
- effects of different flow regimes on estuarine temperature conditions that limit Chinook Salmon, Longfin Smelt, Delta Smelt, and other native fish and wildlife species (e.g., Vroom et al. 2017; Munsch et al. 2019; Nobriga et al. 2021; Bashevkin and Mahardja 2022; Michel et al. 2023)
- effect of freshwater flow on productivity of the Bay-Delta estuarine food web (e.g., Hennessy and Burris 2017a,b; Kimmerer et al. 2018; Hassrick et al. 2023)
- status and impacts of harmful algal blooms in the Delta and the effect of freshwater flow rates on formation, persistence, magnitude, and toxicity of HABs (e.g., Peacock et al. 2018; Lehman et al. 2020; Plaas and Paerl 2020; Kudela et al. 2023).

This non-exhaustive list demonstrates that the Draft Staff Report's analysis of flow impacts must be revised to use the best available science. Failure to incorporate these and other recent findings into the scientific basis for analyzing alternative updates to Plan standards and the POI will severely and systematically underestimate the beneficial effects of higher flow requirements on fish and wildlife and related beneficial uses.

G. Flows Under the Proposed Project are Not Adequate to Reasonably Protect Fish and Wildlife Beneficial Uses and Achieve Bay-Delta Plan Objectives

1. <u>The Draft Staff Report fails to define the narrative objectives and/or set numeric criteria that would complement or replace the narrative objectives</u>

The proposed project would adopt new narrative objectives for flows needed to support and maintain native fish viability and retain the existing narrative salmon protection objectives. However, the proposed Plan updates do not articulate these objectives sufficiently to determine whether the POI will attain them or to evaluate progress towards the attainment in subsequent, required triennial review processes. For example, the Board does not define the biological outcomes that represent the attainment of its narrative salmon doubling objective, even though the inter-agency Anadromous Fish Restoration Program defined run-by-watershed salmon production targets that satisfy the "salmon doubling" target of the federal Central Valley Project Implementation Act, PL 102-575 (HR429), in 2001 (AFRP 2001). Furthermore, the proposed project does not define a timeframe for attainment of the narrative salmon doubling objective; without such a time bound, evaluating the adequacy of purported improvements to salmon habitat conditions under the proposed project is not possible.

The proposed Bay-Delta Plan updates do not define "viability" with enough specificity to evaluate whether the proposed project can attain this objective for any of a variety of native fishes. It is possible to articulate the biological outcomes that reflect population viability (McElhaney et al. 2000); in fact, specific, measurable, achievable, and relevant definitions of viability have already been developed for Central Valley salmonids (Lindley et al. 2007; NMFS 2014; SEP 2019) and for native pelagic species (USFWS 1995). The Board may adopt these specific descriptions of viability or define them differently, but it cannot refuse to say what biological outcomes constitute attainment of the narrative viability objective.

The Board must describe whether its definition of "viability" includes the maintenance of fisheries for various species, encompasses maintenance of estuarine habitat, and/or incorporates all elements of the definition of fish "in good condition", as per Fish and Game Code §5937. For instance, if the Board's definition of viability does not anticipate additional mortality related to maintenance of Bay-Delta commercial, recreational, subsistence, and tribal subsistence fisheries, then one or more additional objectives that ensure reasonable protection of those beneficial uses may be necessary. In any case, the Board cannot claim to have analyzed whether flows under the proposed project are adequate to reasonably protect the range of fish and wildlife beneficial uses, achieve Plan objectives, and satisfy the requirements of Fish and Game Code §5937 until it defines biological outcomes associated with success of the Plan. The Board must have benchmarks for attainment, tell the public what it hopes to achieve, and describe the basis for its decisions, and then measure whether the water quality objectives are meeting those benchmarks.

2. *The proposed project will not restore native fish viability, reasonably protect beneficial uses, or maintain fish in good condition*

The Draft Staff Report claims that the proposed project will improve populations of native fish species based on its comparison of flows projected under the proposed project versus flow thresholds identified in Chapter 3 and the Scientific Basis Report (SWRCB 2017). Regarding the flow thresholds, the Draft Staff Report states:

> All of these flows occur at a greater frequency under the proposed Plan amendments compared with baseline conditions and should contribute to increased population abundance for bay shrimp, green and white sturgeon, longfin smelt, Sacramento splittail, and starry flounder.

Draft Staff Report at 7.6.2-38.

This claim is untrue or misleading for at least the following reasons.

First, under current flow conditions, the status quo for native fish species is decline. Simply increasing flows by tiny increments does not demonstrate that the widespread decline of native fish populations and estuarine habitat conditions will be reversed. Moreover, the Draft Staff Report's assertion that flows under the proposed project will contribute to increased population abundance is not the same as finding that the proposed project provides reasonable protection to beneficial uses or is likely to attain Plan objectives. Marginal improvement in the status of native fish species and estuarine habitat conditions (including simply slowing their decline) is not the standard for determining adequacy of Bay-Delta Plan updates under Porter-Cologne. Rather, the Plan updates must identify beneficial uses, craft water quality standards that will reasonably protect those beneficial uses based upon the best available scientific evidence, and then put forth a POI which will necessarily meet those objectives.

Second, as described above, several of the species/habitat-specific flow thresholds identified in Chapter 3 do not represent the best available science and are very likely to underestimate the flows needed to protect the relevant species or habitats. Thus, thresholds that reflect the best available science are likely to be exceeded less frequently than Table 7.6.2-5 reveals.

Third, the flows projected under the Draft Staff Report's modeling of the proposed project assume that unregulated flows continue to reach the Delta and San Francisco Bay to the benefit of native fishes and estuarine habitat. However, the Board acknowledges that unprotected flows are likely to be diverted in the future, and several planned water development projects promise to do exactly that (*see above*). Comparing threshold flow exceedances projected in the Draft Staff Report to the Scientific Basis Report's estimated exceedance of the same flow thresholds (SWRCB 2017 Table 5.3-3 at 5-31; Figure 14) demonstrates that flows that are protective of beneficial uses (to the extent that these are accurately described) will be much less frequent under the proposed project if unregulated flows are diverted. Indeed, unless Delta outflows >55% are protected from diversion and storage, flows deemed to be protective of estuarine habitat, Green Sturgeon, White Sturgeon, Longfin Smelt, and Sacramento Splittail ("high") are likely to occur less frequently in the future than they do currently (Figure 14).

Current flow conditions have led to multiple native Bay-Delta fish species to the brink of extinction, extreme degradation of estuarine habitat, and closure or severe restriction of various commercial, recreational, and subsistence fisheries. The very real prosect that those flow conditions could degrade further under the proposed project is inconsistent with the Bay-Delta Plan's requirement to reasonably protect beneficial uses and achieve water quality objectives, and with the Board's overarching requirement to protect the public trust.

Table 7.6.2-5. Frequency of Meeting Winter–Spring Delta Outflows to Benefit Estuarine Habitat and Species (percent of months)

X2 Position or Species	Baseline	35	45	55	65	75
Collinsville [a]	99	99	99	100	100	100
Chipps Island [b]	81	87	88	95	96	98
Port Chicago [c]	41	43	46	48	55	59
Bay shrimp – High [d]	43	48	49	61	71	75
Bay shrimp – Low [e]	51	59	70	73	82	87
Green and White sturgeon [f]	15	15	15	19	24	28
Longfin smelt [g]	30	31	31	32	34	37
Sacramento splittail – High [h]	25	26	27	29	31	38
Sacramento splittail – Low [i]	40	45	49	54	62	70
Starry flounder [j]	44	49	52	63	72	80

[a] X2 position at Collinsville (81 kilometers [km] from January through June)
[b] X2 position at Chipps Island (75 km from January through June)
[c] X2 position at Port Chicago (64 km from January through June)
[d] 25,000 cubic feet per second (cfs) (March through May)
[e] 20,000 cfs (March through May)
[f] 37,000 cfs (March through July)
[g] 42,800 cfs (January through June)
[h] 47,000 cfs (February through May)
[i] 30,000 cfs (February through May)
[j] 21,000 cfs (March through June)

Table 5.3-3. Summary of Frequency of Meeting Winter-Spring Delta Outflows to Benefit Estuarine Habitat and Species. As discussed above, these frequencies would be higher for the unimpaired scenarios when accounting for unregulated flows, other regulatory flows, etc. Current conditions reflect MRDO flows plus the other regulated and unregulated flows.

Species or X2 Location	MRDO	Current	35%UF	45%UF	55%UF	65%UF	75%UF
Collinsville	86	100	95	97	99	99	100
Chipps Island	1	81	73	86	94	96	97
Port Chicago[9]	0	40	15	30	39	52	58
Bay Shrimp High	0	44	28	44	59	72	75
Bay Shrimp Low	0	53	44	61	73	82	86
Green and White Sturgeon	0	15	1	4	12	16	27
Longfin Smelt	0	28	2	6	17	28	34
Longfin Smelt Spawning	0	27	0	4	11	19	27
Sacramento Splittail High	0	27	2	10	15	27	37
Sacramento Splittail Low	0	40	19	35	45	60	68
Starry Flounder	0	45	32	46	60	72	78

Figure 14: Comparison of tables in the Draft Staff Report (left; at 7.6.2-38) and Scientific Basis Report (right; SWRCB 2017 at 5-31) showing frequency with which different flow regimes would achieve flow targets that the Board considers to be protective of fish and wildlife beneficial uses. The Draft Staff Report bases estimates on modeling that includes unregulated flows (e.g., including flood prevention operations) that are not capturable with current water management infrastructure. By contrast, the Scientific Basis Report based estimates only on those flows required under the identified unimpaired flow regimes. (MRDO = minimum required daily outflow under current regulations; "current" = actual flows resulting from current regulatory and infrastructural constraints).

a) Delta Smelt

The Draft Staff Report claims that the proposed project will benefit Delta Smelt, stating (at 7.6.2-40):

> Modeled outflows over the range of flow scenarios indicate that average summer and fall X2 positions would be equal to or lower (more westward) than the baseline condition in most years (Figure 7.6.2-4 and Figure 7.6.2-5). Overall, these changes in Delta outflows would benefit Delta smelt during summer (July through September) and fall (September through December).

This finding is contradicted by flow modeling in the Draft Staff Report showing that summer flows will be less than baseline under the proposed project on average during July-Sept, including in July of all but Wet years. Conditions will be even worse under the 45% of unimpaired flow regime (Draft Staff Report Appendix A1 Table A1-103).

Because Delta Smelt live just one year and have declined to the point where they are nearly undetectable by fish assemblage sampling programs, failure to provide suitable habitat conditions in almost all years will further devastate the population and severely impair any chance of recovery. Analysis of SacWAM modeling for the Draft Staff Report shows that conditions the Board previously determined to be protective of Delta Smelt during the summer (X_2= 80km; SWRCB 2017 at 3-100) will not occur in ~62% of years under the proposed project (Table 1; *see also* Draft Staff Report at 7.6.2-40). Thus, whether or not the proposed project "improves" Delta outflow conditions for Delta Smelt, the Draft Staff Report's modeling demonstrates that conditions under the proposed project will not support Delta Smelt habitat or population growth (i.e., its viability) in most years. Thus, it is likely that Delta Smelt's population will continue to decline under the proposed project.

The Board should analyze and adopt OMR/export requirements that are more protective of Delta Smelt than those found in the 2019 federal Biological Opinion and 2020 CESA ITP. It is well-established that water exports and entrainment mortality represent grave risks for Delta Smelt (Mac Nally et al. 2010; Thomson et al. 2010; SWRCB 2017; Kimmerer and Rose 2018; Smith et al. 2021). Yet, several provisions of the 2008/2009 BiOps that reduced (but did not eliminate) the threat to Delta Smelt viability posed by SWP/CVP water exports (Smith et al. 2021) were terminated by the 2019 Biological Opinions and 2020 CESA ITP.[10] As a result, SWP and CVP exports are predicted to increase relative to the regime that existed under the 2008/2009 BiOps (Draft Staff Report Appendix g.3.a, for example, at G3a-11).

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[10] For example, the 2008/2009 BiOps required OMR to be less than -5,000 cfs under certain conditions (2008 USFWS BiOp at 353-354) and set salvage triggers for various species, including for Delta Smelt (2008 USFWS BiOp at 145), that would lead to reduced exports, but the ESA-requirements modeled in the Draft Staff Report models contain no such protections. Furthermore, the 2019 Biological Opinion and 2020 CESA ITP allow for exports to produce OMR < -5,000 cfs under a Storm-Related OMR Flexibility" provision (2019 USFWS Biological Opinion at 47-48; 2019 NMFS Biological Opinion at 479).

In 2010, the Board identified OMR flows > -1,500 cfs in March-June as necessary to protected Delta Smelt in Critically Dry and Dry years (SWRCB 2010 at 78). Under the proposed project, OMR flows will remain more negative than -1500 cfs in March of both year types (Draft Staff Report Appendix A1 at A1-175). In general, the proposed project is not expected to substantially improve OMR flow conditions (i.e., make them more positive) during January-May when spawning and early larval Delta Smelt are most vulnerable to entrainment. Under some conditions (e.g., during April) the 55% unimpaired flow alternative would produce OMR flows more negative than the baseline scenario (Draft Staff Report Appendix A1 at A1-173 through A1-175) increasing the risk and magnitude of Delta Smelt mortality resulting from entrainment in the CVP and SWP south Delta export infrastructure.

Table 1: Frequency of flows identified as protective of fish, wildlife, and estuarine habitat when unregulated flows are included. Recreates Table 7.6.2-5 in the Draft Staff Report, updating certain thresholds to account for the best available scientific information, and adds flow thresholds related to additional specific benefits. Data from SacWAM version 2023.06.12; Delta outflow output received 11/27/2023 and Freeport flow output received November 16, 2023. VA is the project described in the Draft Staff Report at 9-18. Flows in this table reflect modeled unregulated flows; frequency of threshold flows are expected to decline as new water storage or diversion facilities begin operations unless the Board acts to protect these flows.

X2 or Species	Protective Flows	Season	Baseline	VA	35	45	55	65	75
Collinsville	81 km; ≥ 7,100 cfs	Jan-Jun	99%	99%	99%	99%	100%	100%	100%
Chipps Island	75 km; ≥ 11,400 cfs	Jan-Jun	81%	84%	87%	88%	95%	96%	98%
Port Chicago	64 km; ≥ 29,200 cfs	Jan-Jun	41%	43%	43%	46%	48%	55%	59%
Zooplankton Flows above which *E. affinis* abundance increases	>30,000 cfs (1)	Mar-Jun	29%	28%	31%	33%	41%	46%	57%
Zooplankton Flows above which Mysid spp. abundance increases	>40,000 cfs (1)	Mar-May	24%	24%	25%	26%	29%	37%	43%
Zooplankton Flows above which *P. forbesi* abundance increases	>6,500 cfs (1)	Jun-Sept	46%	48%	49%	54%	56%	67%	78%
Delta Smelt	≥7,500 cfs (2)	Jun-Aug	38%	39%	42%	53%	56%	63%	76%
White Sturgeon & Green Sturgeon	>37,000 cfs (2)	Mar-July	15%	14%	15%	15%	19%	24%	28%
Longfin Smelt (minimum) Midpoint of Critical range; SWRCB 2010	>14,000 cfs (3)	Jan-Jun	73%	76%	77%	81%	87%	92%	95%
Longfin Smelt (median)	>42,800 cfs (2)	Jan-Jun	30%	29%	31%	31%	32%	34%	37%
Starry Flounder **M**idpoint Below Normal range Apr-May; SWRCB 2010	>35,500 cfs (3)	Apr-May	22%	19%	25%	25%	29%	35%	48%
Starry Flounder	>21,000 cfs (2)	Mar-Jun	44%	45%	49%	52%	63%	72%	80%
Chinook Salmon (smolt) fall-run & spring-run	>35,000 cfs at Freeport (4)	Apr-May	17%	17%	17%	18%	23%	28%	33%
Chinook Salmon (smolt) All runs	>35,000 cfs at Freeport (4,5)	Jan-Jun	24%	24%	27%	28%	28%	33%	38%
Chinook Salmon (fry) Minimal occupancy of most restored Delta habitats	>17,660 cfs at Freeport (6)	Dec-May	67%	71%	71%	74%	76%	84%	87%
Chinook Salmon (fry) Relatively full occupancy of most Delta habitats	>26,500 cfs at Freeport (6)	Dec-May	44%	45%	43%	45%	46%	52%	58%

(1) Hennessy and Burris 2017a,b; (2) SWRCB 2017; (3) SWRCB 2010; (4) Perry et al. 2018 (5) Hance et al. 2023; (6) Munsch et al. 2018

b) Longfin Smelt

There is no evidence that the proposed project will halt the precipitous decline of the Bay-Delta's endangered Longfin Smelt population. Delta outflows that the Board has identified as protective of Longfin Smelt (i.e., those associated with a ≥ 50% chance of inter-generation population growth) are expected to occur with just 2% greater frequency relative to the baseline under the proposed project (1% more frequently under the 45% of unimpaired flow regime), and that is *if unregulated flows remain undiverted in the future* (Figure 14, left panel; Table 1, "Longfin Smelt – median"). On the other hand, as unregulated flows are captured by new infrastructure or water diversion operations in the future, the frequency of flows associated with Longfin Smelt population growth will decrease substantially compared with conditions that have led to the population being endangered (i.e., the baseline, Figure 14, right panel).

The flow-population productivity relationship and flow-abundance relationship for Longfin Smelt are log-log linear, meaning that increasing minimum flows and increasing frequency of high flows will also benefit the species. We assessed the flow alternatives by comparing the frequency with which they exceeded flows that the Board indicated would be protective of Longfin Smelt in Critically Dry years. We analyzed exceedance of the mid-point of the Board's Critically dry year flow range for January-June (SWRCB 2010 at 69). The mid-point of the range for Critically Dry years (~14,000 cfs) should be exceeded in half of Critically Dry years. Given that ~16% of years are Critically Dry, this minimum threshold flow should be exceeded ~92% of the time. Flows under the proposed project would exceed this minimum threshold in 87% of years (Table 1) meaning they would be less frequent (less protective) than the frequency implied by the Critically Dry year flow criteria the Board presented in 2010. The 65% and 75% flow alternatives would exceed the mid-point of the Critical Year type flow range in 92% of years or more.

Increased Delta outflows anticipated under the proposed project are far too meager to halt the catastrophic decline of this native pelagic fish species, much less restore its viability, much less restore the historic fishery for Longfin Smelt. Even under the optimistic, but unsupported, assumption that unregulated flows will continue to contribute to winter-spring Delta outflow, it is simply not credible to assert that increasing the frequency flows associated with Longfin Smelt population growth by 2 out of 100 years is adequate to protect this species. We note that the incremental change in the frequency of threshold flows under the 65% flow alternative is double the improvement projected under the proposed project, assuming no increase in the capture of unregulated flows (Figure 14, left panel) – protecting 65-75% of unimpaired flows would be necessary to guarantee that the current frequency of Longfin Smelt threshold flows are maintained in the face of new water diversion or storage capacity (Figure 14, right panel).

The Board should analyze and adopt constraints on south Delta water exports that provide better protection for Longfin Smelt than those modelled in the Draft Staff Report. As modeled, the Board's proposed Old and Middle River Flow Objective would implement export constraints described in the 2019 federal Biological Opinions and the 2020 CESA ITP. These requirements provide less protection from entrainment-related mortality for Longfin Smelt than those identified in prior CESA ITPs and incidentally through the 2008/2009 BiOps. In its recent draft listing decision, USFWS identified existing regulatory mechanisms, including the 2019 Biological Opinions, CESA ITP, and existing Plan objectives, as inadequate to prevent further decline of Longfin Smelt (Federal Register Vol. 87, No. 194 (Friday, October 7, 2022) at pp. 60957-60974). Indeed, modeling of SWP operations permitted under the CESA ITP shows that they will result in dramatic increases in Longfin Smelt entrainment/salvage in most years (CDWR 2019a at 4-185 to 4-186). The Draft Staff Report's modeling of OMR flows reveals that the proposed project will not substantially improve conditions that lead to episodically high Longfin Smelt entrainment and are not likely to approach OMR flow conditions the Board previously identified as protective of Longfin Smelt (SWRCB 2010; 2017). Therefore, it is likely that the more protective constraints on water exports will be needed to reasonably protect Longfin Smelt.

The Board identified protective OMR requirements for Longfin Smelt in its flow criteria report (SWRCB 2010 at 69), specifying that OMR should be positive or >-1,500 cfs (depending on the previous fall midwater trawl abundance index of this population) during April-May of Critically Dry and Dry years. The Scientific Basis Report indicates that OMR flows should be no more negative than -1,250 cfs during January-June, under certain unspecified conditions. The Board should clarify the conditions under which OMR levels > -5,000 cfs (as identified in SWRCB 2010, 2017) will be required.

c) Chinook Salmon

The Staff Report provides evidence that the proposed project will not halt the decline of Central Valley Chinook Salmon runs, support and maintain their viability, or restore populations to levels required under the Bay-Delta Plan's narrative salmon protection objective. As described above, the flows previously identified by the Board as protective of juvenile Chinook Salmon migrating into and through the Delta do not reflect the best available science and are likely to provide inadequate protection for juvenile salmon as they migrate to the Delta, Bay, and Pacific Ocean. Therefore, the Draft Staff Report's analysis of the frequency of protective flows for Chinook Salmon (Draft Staff Report Table 7.6.2-4 at 7.6.2-37) must be redone and should reflect flow necessary to protect different life stages (e.g., rearing fry versus ocean-ready smolts) and different Chinook Salmon runs. We analyzed the Board's SacWam model outputs (Table 1) and found that average January-June flows ≥ 35,000 cfs at Freeport will occur in less than one-third of years and only marginally more frequently under the proposed project than under the current baseline (four more years out of 100). In flow alternatives ≥65%, these flows occur in one-third of years or more, which is more consistent with maintaining viability of a species with a generation length of ~3 years. Because juveniles of the four runs of Chinook Salmon migrate in different months in the winter-spring, we also evaluated at the frequency of flows > 35,000 cfs during the months when most spring-run and fall-run Chinook Salmon smolt migrate through the Delta (April-May). In these months, only the 75% flow regime produced protective flows in one-third of years Table 1). The 55% flow alternative resulted in protective flows in less than on quarter of years (Table 1). Thus, the proposed project is not likely to provide adequate protection for Chinook Salmon smolt migrating into and through the Delta, particularly for spring-run and fall-run Chinook Salmon.

The Board's evaluation of flows that increase juvenile Chinook Salmon survival and the frequency with which they occur should be set in the context of survival rates necessary to support and maintain viability and those necessary to attain the salmon protection objective in a reasonable time frame. Despite the decline in salmon populations since adoption of the Plan's salmon protection objective, doubling of the natural production of Chinook Salmon remains achievable in just a few salmon generations (an average Central Valley Chinook Salmon generation is ~3 years). Chinook Salmon population growth is explosive when conditions are suitable in their freshwater environment; Quinn (2005 at 254) found that the average freshwater survival of various Chinook Salmon populations across the species' range was approximately 10%; resulting in an estimated average of between 6.4 to 17.5 adults returning to spawn per female spawner in the previous generation. Thus, it is very possible for Chinook Salmon to attain the targets implied by the salmon protection objective (AFRP 2001) in less than a decade, if conditions are suitable throughout their freshwater life-cycle.

The best available science supports the Board's proposal to adopt water quality objectives for interior Delta hydrodynamics as part of the Plan update; however, the specific restrictions contemplated in the proposed project are not likely to provide adequate protection. Restrictions on altered Delta hydrodynamics caused by combined SWP and CVP water exports are obviously needed to protect imperiled species (e.g., NMFS 2008; USFWS 2009; Kimmerer 2008, 2011; Kimmerer and Rose 2018; Polanski et al. 2021; Smith et al. 2021; Attachment: White Sturgeon CESA Petition), non-imperiled fishes (Grimaldo et al. 2009), and large fractions of estuarine primary productivity (phytoplankton; Cloern and Jassby 2012), which form the prey base for native fishes. However, basing these new flow objectives on requirements of existing or past biological opinions and CESA ITPs does not necessarily satisfy the Board's independent obligation to reasonably protect fish, wildlife, estuarine habitat, and associated beneficial uses. As described above, existing ESA-related hydrodynamic criteria are less protective than criteria from the 2008/2009 Biological Opinions and previous state incidental take permits, which themselves were clearly inadequate to prevent further decline of the imperiled species. Moreover, the ESA provisions modeled as part of the proposed project were never intended to protect non-listed species. Furthermore, the ESA-related hydrodynamic provisions were designed only to prevent extinction of imperiled fish populations; they were not intended to restore, support, and maintain fisheries and estuarine habitat conditions. Indeed, it is hard to see how allowing Delta tributary rivers to flow away from the Bay (i.e., negative values of OMR) at high average rates, can represent reasonable protection of estuarine habitat and ecosystem functions.

The Draft Staff Report provides no basis for concluding that the proposed interior Delta flow objectives will provide reasonable protection to Central Valley Chinook Salmon populations, restore them to viability, or allow them to attain levels indicated by the narrative salmon protection objective. As described above for the smelt species, recent revisions to state and federal ESA requirements for in-Delta flow (i.e., the 2019 federal Biological Opinion and 2020

CESA ITP) represent less protection from entrainment-related mortality for fish migrating in or through the Delta than provisions of the 2008/2009 Biological Opinions (and requirements of those Biological Opinions were deemed to be inadequate to protect imperiled smelt and salmon (CDFW 2010; USDOI 2016; SWRCB 2017)). For example, with respect to the "storm-flex" provision that is now part of CVP and SWP operations, NMFS (2019 NMFS Biological Opinion at 531) found:

> …modeling shows that salvage and associated loss increases with exports during months when listed salmonids are present in the Delta. Therefore, if fish are present in the vicinity of the export facilities in the south Delta during a time that storm flex export operations are implemented, NMFS concludes there will be an increase in the number of fish entrained into the salvage facilities above that which would have been seen with no increases in exports. Furthermore, since listed salmonids tend to start migrating downstream in response to elevated flows in the Sacramento River basin and San Joaquin River basin waterways, there is a high probability that more fish will be present in the Delta exactly when the CVP and SWP increase their exports. Besides the fish entering the Delta on the elevated storm flows, listed salmonids (especially winter-run Chinook salmon) may already be present in the Delta due to migration earlier in the year. This overlap in fish presence and the potential for combined exports to reach 14,900 cfs can result in increased entrainment risk as a result of the potentially very negative Old and Middle River flows.

Even without accounting for storm-flex and other ESA-related provisions incorporated into the proposed project (some of which are difficult to model because of their ephemeral nature), modeling conducted for the 2020 CESA ITP found that entrainment mortality increased dramatically for spring-run Chinook Salmon (CDFW 2019a at 214-217), fall-run Chinook Salmon (CDFW 2019a at. 4-230 through 4-232), and late-fall run Chinook Salmon (CDFW 2019a at 243-246) under the SWP operations permitted by the ITP. The Board acknowledges that entrainment, salvage, and loss of Chinook Salmon is strongly and exponentially correlated with increasingly negative OMR flows (SWRCB 2017 Figures 3.4-15 and 3.4-16 at 3-40). Furthermore, the Board acknowledges that negative OMR flow rates lead to additional, undefined levels of mortality for fish that are not entrained, because of altered Delta flow patterns resulting from exports from salmon habitat in the Delta. Referencing testimony by the US Department of Interior, the Board stated:

> More important than direct entrainment effects, however, may be the indirect effects caused by export operations increasing the amount of time salmon spend in channelized habitats where predation is high (USDOI 2010, p. 29).

SWRCB 2017 at 3-47.

Nevertheless, OMR flows under the proposed project are barely different from baseline conditions during January through May, a time period when most Chinook Salmon juveniles are rearing in or migrating through the Delta (Draft Staff Report Appendix A1 Figure A1-54).

Average OMR will be worse under the proposed project than the baseline during April (Draft Staff Report Appendix A1 at A1-175). By contrast, the 65% and 75% unimpaired flow alternatives are projected to produce OMR flows that are substantially less negative than those under the baseline or the proposed project throughout the entire Chinook Salmon migration window– such reductions in negative OMR flows would be expected to dramatically reduce mortality associated with CVP and SWP water exports from the South Delta.

The best available science indicates that survival of migrating juvenile Chinook Salmon increases with increasing flows in both river and estuary environments (*see above*). However, in some years there is an obvious tension between high river flows and reservoir storage upstream. Historically, this tension has been between prioritization of consumptive use demands versus both coldwater habitat and downstream flow needs; as environmental flow needs increase, the tension between coldwater habitat and downstream flow needs emerges under dry conditions. River flow regimes that require increased bypass of reservoir inflow or releases of stored water can reduce reservoir storage which can lead to loss of the ability to control water temperatures downstream of dams during the summer. High water temperatures below Central Valley dams kill Chinook Salmon eggs and juveniles in the late spring through early fall. On the other hand, increased river flows can lead to cooler river temperatures further downstream, along the migratory path of Chinook Salmon to and through the Delta (Daniels and Danner 2020; Michel et al. 2023), which can dramatically improve juvenile salmon survival and rearing success (Munsch et al. 2019; Nobriga et al. 2020). The Draft Staff Report's modeling of temperature suitability for Chinook Salmon in various river segments reveals some of the complex temperature effects associated with different flow alternatives.

For example, the Board's modeling shows that, under reservoir storage and water delivery assumptions employed in the Draft Staff Report, different flow regimes have a mix of month-by-water year types in which they produce better or worse temperature outcomes for different Chinook Salmon life-stages at different locations in the Sacramento River (Draft Staff Report Appendix a.6, Table A6-190). Each alternative flow regime results in projected temperature improvements over current conditions in some month-by-water year type combinations, and each results in worse temperature conditions in other month-by-water year type combinations. The Draft Staff Report syntheses of the temperature results found in Appendix a.6 (e.g., Tables 7.6.2-13, 7.6.2-15, 7.6.2-17, 7.6.2-19, 7.6.2-21) obscure important information by lumping together all results across the life-cycle and migratory path of the species and treat all negative and positive temperature results as though they will have equal effects – this presents a misleading summary of the analysis. In some cases, the 65% and 75% unimpaired flow alternatives outperform alternatives with lower flows for some species life stages in some river locations[11] with respect to temperature (the opposite is also true); this demonstrates that flow requirements ≤55% of

[11] For example, the 65% and 75% flow alternatives are expected to produce much better temperature results than lower flow alternatives in a substantial percentage of month-by-water year type combinations for spring -run Chinook Salmon, fall-run Chinook Salmon, and late-fall run Chinook Salmon juveniles migrating past Hamilton City (at pp. A6-338, A6-339, A6-340, respectively). Similarly, temperatures favorable for spawning and incubating Steelhead (53^{o}F) are expected to occur much more frequently under the 65% and 75% flow regimes, as modelled in this appendix.

unimpaired flow are not universally better at producing favorable temperature regimes for egg and juvenile salmon – for some species-by-life stage combinations, higher flow alternatives will produce more favorable temperature results.

Note that the Board's temperature analysis only shows the projected effect of flow regimes on temperatures that affect Chinook Salmon success (and only as modeled under the suite of assumptions adopted for this modeling). The Draft Staff Report does not model river temperatures near or in the Delta, where high flows have been shown to produce meaningfully cooler temperatures that can benefit migrating Chinook Salmon (Munsch et al. 2019; Nobriga et al. 2020; *see also* Vroom et al. 2017; Bashevkin and Mahardja 2022). Furthermore, the Board fails to analyze expected differences in survival of juvenile Chinook Salmon juveniles related to different river flow regimes, as documented in numerous studies published since 2017. The Draft Staff Report should be revised to compare projected changes in *survival* across Chinook Salmon freshwater life stages under different flow regimes, accounting for the well-documented flow-survival benefits described in the research presented in Attachment: Salmon Flow Literature Matrix.

Nevertheless, according to the Board's temperature modeling, high proportions of unimpaired flows will lead to less beneficial, or even harmful, temperature conditions for egg and juvenile life stages of Chinook Salmon upstream in some month-by-water year type combinations, even as these higher flows generally benefit migrating juvenile Chinook Salmon and the native estuarine pelagic species of concern downstream. Fortunately, as it updates water quality objectives in the Bay-Delta Plan and the POI, the Board does not need to choose between flows that benefit Chinook Salmon incubation (via maintaining adequate coldwater pool in upstream reservoirs) and those that benefit migrating juvenile Chinook Salmon and most other native fish species downstream. Instead, in its POI, the Board must develop and describe mechanisms for resolving tensions between its objectives that may arise in some years, based on the Board's priorities for protecting different beneficial uses. Because of the impairments to migration and river temperatures caused by Central Valley dams, no single percent of unimpaired flow regime will support and maintain viability of Chinook Salmon runs in all years, much less lead to attainment of the salmon protection objective. In this way, the Board's analysis of flow alternatives, and its range of alternatives, are arbitrary. Indeed, the Board has already acknowledged that it will need to adjust nominal percentage of unimpaired flow rates from year to year (and potentially within years) regardless of what adaptive flow range it chooses. The Draft Staff Report (at 7.6.2-103) states:

> Annual operations plans would be required to be developed each year in coordination with the State Water Board and fisheries agencies identifying how temperature protection and related operations for the protection of salmonids and other native species will be achieved each year, including provisions for reservoir carryover storage levels; minimum and maximum flow releases and ramping rates to provide appropriate temperature protection, preserve cold water supplies, and avoid stranding and dewatering concerns; reservoir TCD operations; adaptive management; and other relevant provisions, as well as the

technical basis for those provisions. The annual plans would be subject to approval and potential modification by the Executive Director.

What is missing from this description of annual planning for flow and temperature management under the Plan is a description of the priorities that will govern inevitable choices, in some years, between maintaining coldwater habitat upstream and providing river flows downriver to maintain viability and protect other beneficial uses. The Board can and must provide such an explicit hierarchy and decision pathways in its POI (regardless of which flow alternative is chosen) to ensure that the Bay-Delta Plan reasonably protects all identified fish and wildlife beneficial uses and to guide implementation towards attainment of Bay-Delta Plan objectives. SF Baykeeper et al. refers the Board to an example of such a hierarchy and decision path, developed in the ESA reconsultation for the Long-term Operations of the CVP; some of our organizations helped develop Alternative 3 in the Bureau of Reclamation's forthcoming Biological Assessment (Attachment: Reclamation 2023. Cooperating Agencies Draft Environmental Impact Statement Chapter 3)[12]. Alternative 3 presents a simple hierarchy to guide modeling and management decisions regarding water allocation under a variety of different hydrological conditions (at 3-62). Although the hierarchy in the Plan POI would necessarily be different than that employed for Alternative 3 (e.g., because the Bay-Delta Plan has a wider scope and broader legal requirements than the ESA section 7 reconsultation process), this alternative demonstrates that simple rules, developed in advance, can be used to implement operational plans that are protective of spawning and incubating salmonids upstream and migrating salmonids and estuarine pelagic species downstream. Developing and analyzing flow alternatives that have a realistic chance of attaining Bay-Delta Plan objectives and protecting identified beneficial uses requires a POI that describes explicitly how the Plan will adapt to changing annual hydrology and navigate tensions between coldwater habitat upstream and other beneficial uses downstream. SF Baykeeper et al. encourages the Board to review this new information and future updates of the environmental documentation for the ESA reconsultation on CVP Long Term Operations with Reclamation, NMFS, and USFWS when revising the Draft Staff Report.

d) Central Valley Steelhead

The Draft Staff Report fails to demonstrate that the proposed project will halt the decline of Central Valley Steelhead, support and maintain their viability, or restore populations to levels that can support a recreational fishery for wild Steelhead.

Temperature modeling indicates improved conditions may benefit incubating and early rearing of Steelhead below Shasta Dam and that these benefits are higher under the 65% alternative than under lower flow alternatives (Draft Staff Report Appendix A6 Table A6-190). Spawning, egg incubation, larval rearing are the only life stages that experience significant temperature effects under the baseline (Table 7.6.2-20, Table 7.6.2-37). As noted above, the Draft Staff Report's

[12] The Board should review drafts of Reclamation's Biological Assessments for both aquatic and terrestrial resources to inform the Bay-Delta Plan update process. Please see Reclamation's website for other associated documents published in 2021 and 2022: https://www.usbr.gov/mp/bdo/lto/index.html.

analysis of smoltification temperature exceedances should be revised to incorporate a temperature threshold that reflects the best available science regarding Central Valley Steelhead (i.e., 11oC daily average, Myrick and Cech 2004) or equivalent 7DADM).

The proposed project's OMR flow requirements, which are based in part on the NMFS 2019 Biological Opinion, will provide less protection for Central Valley Steelhead than they received under the 2009 NMFS Biological Opinion. Although modeled OMR rates project improvements under the proposed plan in some months of some year types, this is because of additional inflow to the Delta (which is not reasonably certain to continue into the future as new diversions are approved and operated) not because of improved OMR requirements under the proposed project. [Because Central Valley Steelhead are not listed under CESA, the ITP's OMR provisions are not intended to protect Steelhead]. Specifically, the 2019 NMFS Biological Opinion admits (at 528):

> ... the loss density trigger proposed by Reclamation and DWR is less protective of [Central Valley] steelhead in general and particularly for the populations originating in the San Joaquin River basin. The triggers will be dominated by [Central Valley] steelhead from the Sacramento River basin and typically occur earlier in the season when these fish are present in the Delta system. The higher threshold for the loss density trigger means that the implementation of the Old and Middle River protective actions will only occur about half as frequently (54 percent) as compared to the current protective actions implemented in the current operating scenario conditions. Since it is unlikely that any reductions in exports will occur due to the proposed loss density trigger for CCV steelhead, exports are likely to continue at a rate that manages to an Old and Middle River of no more negative than -5,000 cfs during the spring.

In other words, this OMR management action is unlikely to occur, and is unlikely to be protective of key sub-populations of Central Valley Steelhead (the "southern Sierra Diversity group," NMFS 2014) even if it did occur.

Furthermore, the baseline and proposed project incorporate a San Joaquin River inflow to export ratio (I:E ratio) provision that is less protective than the original I:E ratio from the 2009 NMFS Biological Opinion. Instead, the Board proposes an I:E ratio that is similar to that described in the 2020 CESA ITP, which regulates the total volume of water exported during April-May as a function of the total Delta inflow of water from the San Joaquin River during that period. The original I:E ratio was measured on a finer tine-step, as a multi-day moving average. This approach had the intended effect of regulating exports consistently throughout the April-May migration window for Central Valley Steelhead from the San Joaquin basing. By contrast, the I:E ratio variant the Board proposes would allow exports to exceed the governing requirement on individual days, so long as total flows and exports averaged out over the period (*see*, Conditions 8.17 and 8.18 CESA ITP at 120 available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/State-Water-Project/Files/ITP/ITP-ASR-2021-FINAL-COMPLIANT.pdf). This exposes migrating fish to greater risk of entrainment, on a daily, weekly or even monthly basis.

Moreover, the Board is contemplating excluding proposed interior Delta flow amendments from the proposed project (Alternative 4a). If this alternative is adopted, then future changes to the Biological Opinions and CESA ITP may eliminate entirely the significant protections that the I:E ratio provides to migrating Central Valley Steelhead (Buchanan 2018; Buchanan et al. 2021), and incidentally to Delta Smelt and other Bay-Delta fish species. This outcome is reasonably foreseeable, given that the 2019 Biological Opinion already eliminated the I:E ratio entirely, and the 2020 CESA ITP weakened it significantly.

e) White Sturgeon and Green Sturgeon

The Draft Staff Report provides evidence that the proposed project will not halt the decline of White Sturgeon or Green Sturgeon, will fail to support and maintain their viability, and will not restore populations to levels required to support fisheries for either species.

Assuming that unregulated flows continue to appear as modeled in the Draft Staff Report Draft Staff Report, the frequency of Delta outflows the Board determined to be protective of both sturgeon species will increase relative to baseline by a small amount under the proposed project (to 19% of years, Figure 14 left panel, Table 1), but will still fail to occur with the frequency needed to maintain viability (at a minimum, approximately one in every four years, *see above*). In contrast, if flows that are currently unregulated are diverted in the future[13], then the frequency of flows that support sturgeon productivity are expected to *decline* under the proposed project's 55% of unimpaired flow alternative (Figure 14, right panel). Because sturgeon productivity is negligible in years with flows below the levels identified by the Board, there is no known benefit to the sturgeon species from increases in flows (e.g., in below normal or drier year types) that remain below the threshold. Flows in the 65-75% of unimpaired range provide the frequency of threshold flows that would support and maintain Green Sturgeon and White Sturgeon populations, assuming continuation of unregulated flows (Figure 14 left panel, Table 1).

Direct mortality of sturgeon resulting from combined SWP/CVP water exports in the Delta are also expected to increase under the proposed project relative to requirements that were in place under the 2008/2009 Biological Opinions. Salvage of White Sturgeon and Green Sturgeon are projected to increase under conditions permitted by the state CESA ITP and 2019 Biological Opinion, which are the basis for the in-Delta hydrodynamic and water export restrictions of the proposed project. For example, modeling conducted for the 2020 CESA ITP indicates that White Sturgeon salvage and related mortality will increase dramatically under combined CVP/SWP operations (CDWR 2019a at 4-261). Similarly, entrainment of Green Sturgeon is expected to increase under combined export operations modeled for the 2019 Biological Opinion (NMFS 2019 at 519). Modeling indicates that the proposed project would result in less negative OMR during the summer and fall months (Draft Staff Report Appendix A1 Table A1-54 at A1-173) which might limit entrainment of juvenile sturgeon at those times; however, this is likely due to flow changes under the proposed project that are not reasonably certain to be maintained, not due

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[13] Increased capture of unregulated flows is reasonably likely to occur in the future as a result of proposed water development projects, like Sites Reservoir, the Delta Conveyance Project, and others, that specifically target diversion of high river flows.

to changes in OMR requirements. Modeling of the 65% and 75% of unimpaired flow regimes shows much greater improvement in OMR conditions, in many more months, indicating that those flow regimes would be substantially more protective of larval and juvenile sturgeon.

SF Baykeeper et al. notes that White Sturgeon and Green Sturgeon are expected to be less resilient to poor flow and water quality conditions in the Bay-Delta and its tributary rivers than they were when the Board last evaluated their status (SWRCB 2017). Indices of White Sturgeon population abundance have continued to decline (*see* above; Attachment: White Sturgeon CESA Petition), and NMFS (2021) found no evidence that the conservation status of Green Sturgeon had improved between 2015 and 2020 – i.e., they remain at high risk of becoming endangered with extinction. Both populations were heavily impacted by catastrophic mortality related to summer red tides in San Francisco Bay during 2022 and 2023 (CDFW 2023b; California Fish and Game Commission 2023). As a result, maintenance of currently inadequate conditions or degradation of those conditions represents a greater threat to viability of both Bay-Delta sturgeon populations than previously understood.

f) Starry Flounder

The Draft Staff Report's modeling suggests that Delta outflows under the proposed project will improve conditions for the Bay-Delta Starry Flounder population; however, as described above, the Board's target flows for Starry Flounder are not those actually needed to achieve the Board's goal for protecting this species. SF Baykeeper et al. analyzed the frequency of protective flows for Starry Flounder using the mid-point of the range the Board identified as protective for Below Normal Years (SWRCB 2010 at 83) – this approximates the conditions the Board previously determined would be protective in the median year. SacWAM modeling indicates that April-May flows the Board previously identified as protective of Starry Flounder occur in only 22% of years under the baseline, and would increase to 35-48% of years under the 65% and 75% flow alternatives, respectively. As elsewhere, to evaluate the efficacy of alternative flow regimes, the Board must declare what level of protection it considers reasonable for Starry Flounder and associated beneficial uses.

g) Estuarine habitat

As described above, the Draft Staff Report fails to identify flow thresholds for protection of the estuarine food web or repression of harmful algal blooms that are consistent with the best available science. However, the analysis indicates that the proposed project will fail to maintain decent estuarine habitat conditions in most years.

Modeling produced for the Draft Staff Report reveals that flows needed to maintain abundant populations of the key zooplankton, *E. affinis* (Hennessy and Burris 2017a,b), will occur less in less than half of years under the proposed project in roughly four out of 10 years, even assuming that currently unregulated flows continue to reach San Francisco Bay in the future (Table 1). If unregulated flows are captured by dams and diversions in the future, the frequency of this key flow threshold will decrease (Figure 14, compare left panel to right panel). The 65% and 75%

flow alternatives will be protective of the estuarine food web much more frequently than the proposed project (Table 1).

Similarly, flows needed to produce high levels of zooplankton that are key to the estuarine food web in general, and Delta Smelt in particular, during the late spring and summer (> 6500 cfs June-September, *see above*) occur much more frequently under the 65% and 75% flow alternatives than they would under the proposed project's flow regime (Table 1). Given that Delta Smelt live only one year and that there is little, if any, overlap between generations, and that this population is nearly extirpated in the wild, it is essential for their continued viability that their chief summer prey item (*P. forbesi*) be relatively abundant in Delta Smelt habitat in as many years as possible. Again, the Board should identify biocriteria for protection of estuarine habitat so that flow alternatives can be evaluated against, and implemented to attain, that benchmark.

With respect to HABs, the Draft Staff Report finds a potentially significant impact because "[l]ower summer and fall flows in some Delta channels could result in incremental increased production of HABs and invasive aquatic plants" (at 7.1-40). The related mitigation measures (MM-SW-a,f at 7.1-39-40) deal solely with nutrient discharges into receiving waters. But this directly contradicts the Draft Staff Report's acknowledgement (at 7.12.1-39) of expert reviews conducted by the Central Valley Regional Water Board, which states:

> The Central Valley Water Board assembled panels of HAB and invasive aquatic plant experts to prepare white papers … [which] concluded that nutrient concentrations were not responsible for variability in HAB occurrence and growth of invasive aquatic vegetation in the Delta, although nutrient supply may affect duration and severity of HABs. For both HABs and invasive aquatic vegetation, the experts cautioned, based on their experience elsewhere , that nutrient management might not decrease the impairments and recommended follow-up studies to confirm their hypotheses (Boyer and Sutula 2015; Berg and Sutula 2015).

The Draft Staff Report relies on HAB mitigations that are unlikely to work, while ignoring the need for flow regimes that can protect estuarine habitat from widespread and persistent toxic algal blooms in the Delta. This deficiency must be corrected in the revised final Staff Report.

3. <u>The Draft Staff Report fails to analyze potential adverse environmental impacts of waiving instream flow requirements in future drought emergencies, as under the proposed project</u>

By definition, granting temporary urgency change petitions (TUCPs) reduces flows below the requirements of existing objectives—objectives that have been widely acknowledged to be inadequate. (Draft Staff Report at 7.24-6). TUCP approvals occurred in six out of 10 years in the last decade: 2014, 2015, 2016, 2021, 2022, and 2023. (Draft Staff Report at 7.24-4). Analyses by state and federal agencies have demonstrated that these recent TUC Orders – which reduced flows into and through the Delta to San Francisco Bay below the minimums required by the 2006 Water Quality Control Plan and Water Rights Decision 1641 – have caused significant harm to fish species, further reducing the survival and abundance of species including Delta Smelt, Longfin Smelt, winter-run Chinook Salmon, spring-run Chinook Salmon, and fall-run Chinook Salmon, depending upon the time of year when such TUCPs were granted. (*See, e.g.*, SWRCB 2014, 2016, 2022; Reclamation & CDWR 2021.) Implementation of TUC Orders has also contributed to and exacerbated Harmful Algal Blooms in the Delta, and peer reviewed research has concluded that reduced Delta outflow (shifting X_2 upstream) significantly contributes to the abundance of toxic cyanobacteria in the genus *Microcystis* (Lehman et al 2020, Lehman et al 2022, SWRCB 2021). Following implementation of several TUC orders in 2014 and 2015, the Board found that changes in drought planning were needed:

> …the status quo of the past two years is not sustainable for fish and wildlife and that changes to the drought planning and response process are needed to ensure that fish and wildlife are not unreasonably impacted in the future and to ensure that various species do not go extinct.

SWRCB 2016 at 39.

The Projects then petitioned for and received permission to reduce Delta outflows relative to those specified in D-1641 for June and July 2021 (SWRCB 2021). In granting the 2021 TUCP, the Board stated: "The effects of reduced Delta outflow are expected to negatively impact survival of juvenile Delta smelt June through August [2021]" (*Ibid*. at 19). The 2022 TUCP also acknowledged that reduction in Delta outflows would harm Delta Smelt (Reclamation and DWR 2021).

The Board acknowledged that TUC Orders were a mistake, and that better drought planning is needed. It is incumbent on the Board to exercise the due diligence required to not repeat that mistake. Part of that due diligence is recognizing droughts are a normal part of the California climate, and consecutive dry years can be planned for as readily as single ones. "California law identifies TUCPs as limited to urgencies that cannot otherwise be avoided through the exercise of due diligence (Wat. Code § 1435, subd. (c))." (Draft Staff Report at 7.24-4). Extraordinary drought measures – defined here as changes to water quality objectives, through TUC Orders or other mechanisms – should not be necessary, as the Board should evaluate the effects of the full range of hydrologic conditions and adopt water quality objectives that address that full range. Thresholds should be precisely and quantitatively defined in order to minimize the need for "drought measures" and should have a predefined hydrologic trigger proportional to water availability so that "temporary" violations of water quality objectives are not necessary unless conditions are truly off the scale.

The Modular Drought Alternatives are a starting point for responsible water management in the Bay-Delta. Alternative 5a, the Instream Flow Protection Provision, would apply Term 91 to all water rights holders, instead of applying it to less than 1% of water right holders, as is done now. This type of drought curtailment could avoid TUC Orders and maintain cold water storage. Alternative 5b, the Shared Water Shortage provision, would require all water users to share in the responsibility of contributing to instream flows by conserving water. This also avoids TUC Orders and maintains cold water storage. Alternative 5b could also be applied in non-drought conditions in over-allocated watersheds, so that the burden of new flow requirements is shared equitably among all users. Both of these alternatives should be included in the updated Bay-Delta Plan.

Although broader distribution of responsibility for flow and water quality standards under the flow alternatives will make the conditions leading to TUCPs less frequent, there will still be times when flow and upstream temperature objectives will be in conflict. Water Rights Order 90-5 (WR 90-5) illustrates a mechanism for addressing the tension between flow conflict, although the Board's implementation of WR 90-5 has been abysmal –failing to reasonably protect either coldwater habitat for spawning salmonids or rare species, or estuarine habitat (*see above*; Attachment: PFMC 2022 Letter on CV Temperature Management) – because the Board failed to prioritize protection of the most sensitive beneficial uses.

The Board must describe explicitly how it will protect the most sensitive beneficial uses during drought sequences and other crises. While differing from the Bay-Delta Plan in the scope of fish and wildlife beneficial uses and associated thresholds of protection, the LTO Biological Assessment's (LTO BA) Alternative 3 modeling approach provides a template for such a description (*see* Attachment: Reclamation 2023. Cooperating Agencies Draft Environmental Impact Statement LTO BA Chapter 3). In Alternative 3 of the LTO BA (at p. 3-62), existing water quality, instream flow requirements, and human health and safety are the highest priorities, after which carryover storage targets designed to maintain coldwater habitat are prioritized. Higher river flows are required when storage targets are likely to be met, but before certain deliveries are made to CVP contractors. This approach generated improved frequency of coldwater habitat protection and major improvements in viability of target species in the estuary, including Delta Smelt. An analogous approach in the Plan POI would not only better protect fish and wildlife beneficial uses and water quality but would provide clarity for managers and water diverters regarding the likely impacts to water supply that would occur under an extended drought.

4. The Draft Staff Report fails to consider the Board's legal authority to require water rights holders to invest in habitat restoration and other non-flow measures

As discussed in prior comments, the Board has the legal authority to require water rights holders to invest in habitat restoration and other non-flow measures under the physical solution doctrine (TBI et al. 2013 at 85-86; NRDC et al. 2017 at 40-41). The physical solution doctrine has been adopted numerous times by the Board where "there is a 'physical solution' available by which competing needs can best be served." Decision 1631 at 10; *see* Board Water Rights Order 98-05 (approving habitat restoration measures implementing Decision 1631).[14] SF Baykeeper et al. supports improvements in both physical habitat and flow because the best available science shows both are important for recovery of a broad range of fish and wildlife species and the general health of the estuary and its watershed – provided there is sufficient flow to make habitat functional and support the estuary's many flow-dependent species. As discussed more in Section III, the habitat restoration that has been occurring for the last three decades should continue under the proposed project.

Unfortunately, the Board is inconsistent in its application of the physical solution doctrine in the Draft Staff Report and the Proposed Project alternatives. For example, the Board separates flow alternatives from modular alternatives (Table 2). In "modular" Alternative 4b, the Board is considering requiring replacement of the Head of Old River Barrier (HORB), a specific non-flow action in a modular alternative that could be paired with one of the three standalone "flow" alternatives. (Draft Staff Report at 7.2-3). The Board applies the physical solution doctrine in Alternative 4b, but fails to include non-flow measures in most of the other alternatives (Table 2). Because the Board separates non-flow actions unnecessarily, it forces the public to interpret the alternatives as an a la carte menu rather than a comprehensive plan. The separation also limits comprehensive analysis of combined flow *and* non-flow measures to only the Voluntary Agreements Alternative[15], and with no accompanying POI to determine other comparative combinations of actions, both the Board and the public have no way to compare and assess how non-flow and flow measures together impact the estuary. This renders the Draft Staff Report deficient under both CEQA and the Porter-Cologne Act.

Additionally, the Board undermines its authority to enforce the physical solution doctrine by relying on voluntary implementation plans to implement non-flow measures in the future POI. (Draft Staff Report at 5-9).[16] While Baykeeper et al. agrees that "additional tools to improve ecological conditions can be brought to bear through voluntary measures" (Draft Staff Report at 5-9), relying on such voluntary implementation plans as the primary implementation method to protect beneficial uses is premature, biased towards the Voluntary Agreements Alternative and undermines the Board's clear legal authority to require physical solutions to achieve the Plan's narrative and numeric objectives.

It is appropriate to include habitat restoration and other non-flow measures in the future POI "to protect fish and wildlife and contribute toward implementation of the new and existing narrative objectives." (*See* Draft Staff Report at 5-70). However, we urge the Board to revise the Draft Staff Report to require habitat restoration and non-flow measures across all alternatives as part of

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[14] *See also* Water Rights Order 90-16 (holding that under the physical solution doctrine and section 5937 of the Fish and Game Code, the Board can require releases from a reservoir greater than unimpaired inflow during certain times of the year, in order to keep fish in good condition); Decision 1630 (discussing the physical solution doctrine in the context of the Board's decision finding waste and unreasonable use and mandating water conservation measures in the Imperial Irrigation District); *City of Barstow v. Mojave Water Agency*, 23 Cal.4th 1224, 1249-51 (2000).

[15] There is limited discussion and analysis of the modular alternatives "in combination with the proposed Plan amendments, other flow alternatives, and proposed VAs" in Draft Staff Report Chapter 7.24.

[16] Baykeeper et al. recognizes that the voluntary implementation plans are different than the Voluntary Agreement proposal discussed in the SED's Chapter 9. Draft Staff Report at 5-9.

the Bay-Delta Plan update in order to meet CEQA and Porter-Cologne requirements and give the public the opportunity to fairly assess the impacts of all flow and non-flow measures on the San Francisco Bay-Delta estuary.

Table 2: Alternatives Non-Flow Measures Table

Alternatives	**Description**	**Nonflow Measures**
Alt 1 – No Project Alternative	The continuation of the existing 2006 Bay-Delta plan into the future.	
Alt 2 – Low Flow Alternative	The new numeric inflow objective for the Sacramento/Delta tributaries would require between 35 and 45 percent unimpaired flow.	
Alt 3 – High Flow Alternative	The new numeric inflow objective for the Sacramento/Delta tributaries would require between 65 and 75 percent unimpaired flow.	
Alt 4a – Exclusion of Interior Delta Flow and Fall Delta Outflow Related Amendments	The removal of interior Delta flow and fall Delta outflow constraints that are addressed in BiOps and the ITP for the operations of the SWP and CVP in the Bay-Delta Plan.	
Alt 4b – Head of Old River Barrier Alternative	Requires installation of a Head of Old River Barrier (HORB) or alternative mechanisms to prevent San Joaquin River-origin anadromous fish from being drawn into the Delta export facilities.	**X**
Alt 4c – Extended Export Constraint Alternative	Extend the export constraints based on San Joaquin River flows during the entire February through June time period of the Lower San Joaquin River flow objectives adopted in 2018 to provide additional protection from export related effects to juvenile fish species.	
Al 5a – Instream Flow Protection Provision Alternative	To address water supply shortages during drought, this modular alternative would expand a Term 91-type approach to other more senior water right holders and claimants.	
Alt 5b – Shared Water Shortage Provision Alternative	Specify that all water users have an obligation to contribute to water quality and flow in the Delta, and these obligations would not be the sole responsibility of the Projects as currently required under D-1641. All water right holders and claimants would be required to reduce their consumptive use of water by a specific percentage (e.g., 20 percent) to contribute toward instream flows under drought conditions.	
Alt 6 – Voluntary Agreements Alternative	A combination of proposed flow and non-flow habitat restoration measures on a portion of the Sacramento/Delta tributaries (see Table 7.2-1) that are proposed over 8 years (with the intent to extend the term), including varying amounts of increased flows (depending on water year type) and non-flow habitat restoration actions targeted at improving spawning and rearing capacity for juvenile salmonids, estuarine species, and other native fish and wildlife.	**X**
Alt 6a – Protection of Voluntary Agreement Flows Alternative	Identify as part of the program of implementation additional measures to protect the base upon which the VA flows are intended to be added from new or expanded water diversions.	**X**

5. <u>The Draft Staff Report fails to adequately consider improvements in water use efficiency and alternative water supplies</u>

Native aquatic organisms and other public trust resources in the Bay-Delta must rely exclusively on the waters of the estuary for their existence. In contrast, there are cost-effective, more reliable, environmentally superior alternative water supplies available for municipal, industrial, and agricultural beneficial users of water from the estuary and its watershed. These alternative water supplies come in the form of agricultural water use efficiency, urban water use efficiency, groundwater, recycled water, and urban stormwater capture (also referred to as low impact development), and in many cases can be more cost effective and more reliable in the long term than water diverted from the Bay-Delta system. In addition, many water users have the flexibility to secure water supplies from alternative sources; and/or switch to different activities to maintain economic viability. The Board must take these potential alternative water supplies and strategies into account when balancing competing beneficial uses and determining what level of public trust protection is feasible.

Alternative water supplies and water use efficiency could conservatively result in over 6 million acre-feet of water per year, statewide, by the year 2030. In other words, alternative water supplies could produce significantly more water than current average diversions from the Sacramento-San Joaquin Delta (NRDC/TBI 2012; NRDC/Pacific Institute 2014a, b, c, d).

Investment in alternative water supplies to reduce reliance on the Delta is also State policy, briefly acknowledged in the Draft Staff Report at 7.2-44. In order to provide a more reliable water supply, the Legislature mandated:

> The policy of the State of California is to reduce reliance on the Delta in meeting California's future water supply needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency. Each region that depends on water from the Delta watershed shall improve its regional self-reliance for water through investment in water use efficiency, water recycling, advanced water technologies, local and regional water supply projects, and improved regional coordination of local and regional water supply efforts.

Cal. Water Code § 85021.

While the Draft Staff Report acknowledges alternative water supplies, it stops short of the water code mandate, failing to require affordable and sustainable strategies as components of alternatives and as mitigation measures to offset impacts, claiming:

> While the project cannot be considered the driving impetus for sustainable management and water supply diversification efforts, including the need to develop and use recycled water, the project may accelerate and increase the need for such efforts to manage water sustainably and may promote development of recycled water.

Draft Staff Report at 1-7.

> Some mitigation activities are within the State Water Board's jurisdiction. However, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the project. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied fully to mitigate potentially significant impacts."

Draft Staff Report at 1-19.

> It is not possible to quantify exactly how the various water users that may experience reduced Sacramento/Delta supplies will manage their water supply portfolios in response to reduced supplies, and this type of quantification is beyond the scope of detail required in this planning process.

Draft Staff Report at 6-83.

Nevertheless, it is within the Board's jurisdiction to require development of alternative water supplies. Not only the Water Code, but also the physical solution doctrine compels the Board to consider alternative water supplies a "driving impetus" in promoting maximum beneficial use of the State's water resources (*see* Board Decision 1631 at 10).

In D-1631 the Board applied the physical solution of compelling the appropriator to restore degraded streams and fisheries. The physical solution doctrine should also include consideration of the development of alternative water supplies, such as conservation and recycling, where such a physical solution can be used to reasonably and feasibly advance balancing protection of public trust resources with consumptive uses for water. The Board has broad authority to require the development of alternative water supplies as a physical solution to reduce conflicts between such uses of water. But even if the Board did not directly require physical water supply solutions, it can and should assume that consumptive water users have both the ability and the incentive to develop alternative water supplies pursuant to state policy, as well as a rational and likely growing response to climate change challenges and emerging technologies for more efficient water use.

Thus, state policy compels the Board to consider these alternative supplies in balancing between competing beneficial uses, in determining what measures are feasible to protect public trust resources, in considering the many ways in which alternative supplies can mitigate the impacts of taking action to protect public trust resources and fish and wildlife beneficial uses of water, and in directly (in the POI) or indirectly (in its analytical assumptions) factoring in alternative supplies into its evaluation of water supply impacts and mitigation opportunities.

Unfortunately, the analysis in the Draft Staff Report is cursory, providing neither the necessary detail nor requiring implementation of physical alternative supply projects. Instead, it describes ongoing efforts and focuses on voluntary efforts, funding, and efforts to "encourage and promote" these supplies (Draft Staff Report at 7.4-97). While goals are important, simply setting goals without detailed plans is a strategy that is destined to fail. For example, the Board's goal to increase the use of recycled water in California from 714,000 AF in 2015 to 1.5 MAF in 2020 and 2.5 MAF in 2030 (Draft Staff Report at 7.20-45) appears to be behind schedule, with only 732,000 AF being recycled in 2021 (Draft Staff Report at 6-90)—less than half of the 2020 goal, contrary to the outdated assertion based on 2015 data that projections have held true (Draft Staff Report at 7.4-90). To reach these goals, the Board either needs to consider requiring alternative water supply solutions as part of the POI or needs to assume that progress toward implementing these projects is not a constraint on the Bay-Delta Plan update but rather a default responsibility of consumptive water users.

The following are examples of policies and mandatory requirements the Board should consider requiring of water right holders:

- Funding of water efficiency programs should focus on conversion of land and water intensive agriculture to less intensive and more sustainable practices. For example, the Netherlands uses only 7% as much water as the U.S. to produce a pound of tomatoes, on far less land (Viviano, 2017). The Draft Staff Report states, "On the basis of a review of previous efficiency studies, Pacific Institute and Natural Resources Defense Council (2014) estimated that agricultural water use could be reduced by 5.6 million to 6.6 MAF/yr, or by about 17 to 22 percent, while maintaining productivity and total irrigated acreage." (Draft Staff Report at 6-95.)
- The South and Central Delta diversion reduction program in 2015 was an example of a successful voluntary program. (See https://www.waterboards.ca.gov/water_issues/programs/delta_watermaster/docs/diversion_reduction15.pdf.) Modeled after this success, the Board should develop a long-term fallowing program that is invoked when needed.
- A 2017 study showed that media coverage of drought was an important driver of urban water conservation efforts. (See https://news.stanford.edu/2017/10/25/media-attention-drought-produced-water-savings/.) The Board should continue to release information on each urban water agency's level of conservation effort, with more frequent updates during droughts.
- The success and prominence of the urban water conservation programs are a marked contrast with the absence (with few exceptions) of either voluntary or mandatory agricultural water conservation standards. Given the overwhelming proportion of California's water that is used for agriculture, it is a high priority to implement voluntary and mandatory conservation standards for agriculture, modeled on successful urban programs.

6. *<u>The Draft Staff Report's analysis of water supply impacts is flawed and overestimates likely impacts</u>*

a) *Projected reductions in water supply are not unreasonable, let alone unable to be mitigated for*

Simply by adopting new, more protective flow objectives , the Board will incentivize creative voluntary measures for anyone that would experience a potential reduction in water supply. Table 7.20-8 in the Draft Staff Report shows the estimated reductions in municipal supplies by region for the flow alternatives. These reductions (maximum 27% reduction for the Bay Area under the 75% UIF scenario and 22% under the 65% scenario, and less for all other regions, with costs of municipal response 0.03% and 0.02% of economic output, respectively, and 0.05% and 0.04% in Southern California) are not unreasonable, given similar or greater reductions in water use were observed during the 2012-2016 drought and given the largely untapped potential for alternative water supplies discussed above. (Draft Staff Report at 8-97 to 8-101). For agriculture, Table 8.4-4 shows only a 4.7% reduction in crop revenue under the 65% scenario and 8.2% reduction under the 75% scenario. A less-than-10% reduction of revenue, while likely an overestimate for reasons described below, is not unreasonable, given the leading role of agricultural water diversions in degrading fish and wildlife beneficial uses and the ability of agricultural water users to shift crops and adopt other adaptive approaches. Table 8.4-27 shows a decrease of 9,504 jobs under the 65% scenario and 15,554 under the 75% scenario—compare these reductions to the 23,000 California jobs (not even counting Oregon) supported by a healthy salmon fishery that are at risk if the high-flow alternative is not implemented (Southwick Associates 2012). Compare these numbers also to the rapidly-expanding number of warehouse jobs on former farmland in the San Joaquin Valley—Kern County alone experienced a fivefold increase over the 2009-2019 period to 22,000 jobs. (Los Angeles Times, December 19, 2023, Kern County is poised to become warehousing's next frontier). The Board's economic modeling fails to consider this broader context, in which alternative water supplies and alternative economic activities may largely or entirely offset the impacts of higher flow alternatives. The broader context should be used to guide the Plan update.

b) The water supply and economic effects modeling significantly overestimates impacts

Over the longer term, because of availability of alternative supply tools (and greater price elasticity of water in the longer term), estimates of employment and economic consequences of reduced Bay-Delta diversions will likely be overestimated. This is consistent with observed behavior during drought and in prior proceedings, where water users have utilized water transfers, improved efficiency, and other alternative supplies when diversions were reduced. The use of the SacWAM-driven CALVIN model is an improvement over previous efforts because it incorporates the response of water users to reduced diversions from the Bay-Delta, including investments in conservation, water recycling, and other alternative water supply tools, as well as increased water transfers. However, the model-estimated impacts are still overestimates for the following reasons.

(1) Land fallowing assumptions are unrealistic and misdirected

The Draft Staff Report uses an overly conservative threshold of significance related to land conversion by assuming any reduction in irrigated crop acreage would result in permanent conversion of important farmland to nonagricultural use, resulting in a potentially significant impact. The Draft Staff Report acknowledges this is unlikely to occur:

> Also, the management decisions of individual agricultural producers are more sophisticated and driven by more variables than can be accounted for in modeling. For example, land with less access to irrigation could still remain in agricultural production due to one or more factors, including water conservation efficiency improvements that reduce water demand, crop category, or agricultural use changes to less water-intensive applications, dryland farming, or increased crop rotation.

Draft Staff report at 7.4-53.

In addition, the assumption that all irrigated agriculture is important farmland is incorrect. A significant portion of the state's 8.5 million acres of farmland is unsustainably irrigated, has poor drainage, is flood-prone, or experiences other soil or groundwater conditions that make irrigated agriculture an unsustainable use in the long term. Many of these areas would naturally be wetlands or floodplains and could be restored, and should not be included in the restriction in Mitigation Measure MM-AG-a,e (Draft Staff Report at 7.4-99, item 6) on converting farmland to non-agricultural uses. Restoring floodways with setback levees and floodplain restoration often results in multiple benefits to water supply, flood management, and riverine ecological functions. The application of irrigation water to inappropriate lands and soil types has resulted in great ecological harm, including mobilization and discharge of toxins in drainwater, land subsidence, and limitations on needed flows in rivers in order to protect floodplain crops from naturally high levels of groundwater and seepage. Land fallowing should be focused on these areas where irrigated agriculture is unsustainable and alternative land use would result in public benefits. This type of regional land use planning is long-overdue in the Central Valley, and the Plan update can be a vehicle for promoting these win-win solutions.

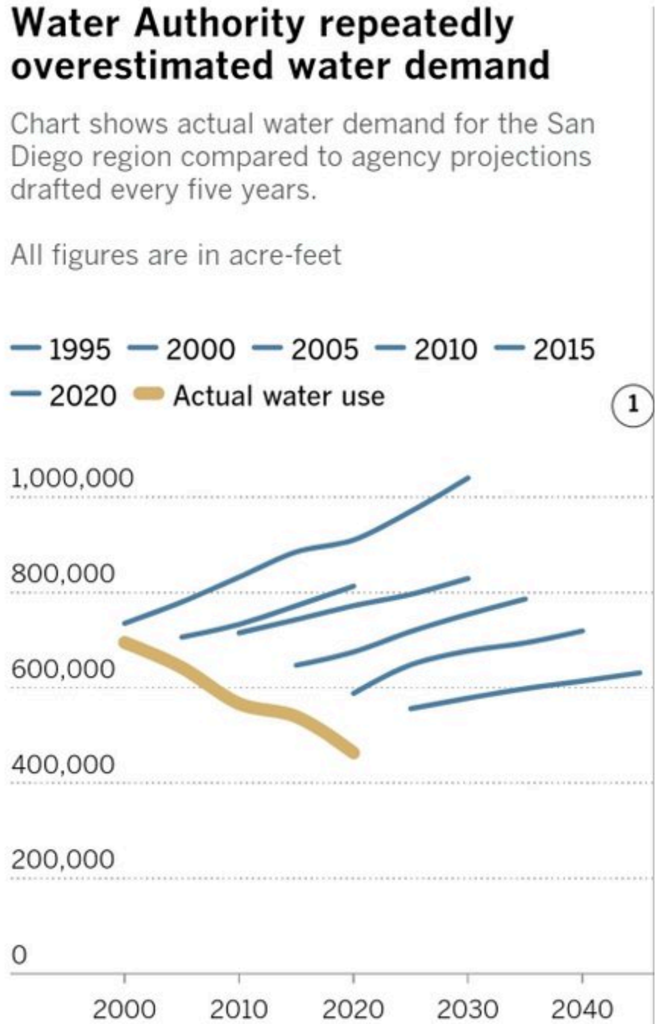
(2) Groundwater impacts are overstated

The discussion concerning impacts to Disadvantaged Communities in the Draft Staff Report from groundwater impacts (at 7.20-29; *see also* section 7.12-2) is irrelevant because it describes impacts that are unlikely to occur because they would be unlawful under SGMA. GSAs have a duty to manage groundwater sustainably and avoid significant and unreasonable undesirable results, and if they fail to adopt adequate GSPs, the State Board has the duty to step in and ensure undesirable results are avoided. Because significant and unreasonable impacts to groundwater sustainability indicators (including lowering of groundwater levels and degradation of water quality) are prohibited under SGMA (DWR 2017), any Board analysis that shows significant and unreasonable impacts relies on assumptions inconsistent with state law.

Assuming that water users shift to groundwater may be an appropriate model assumption that allows the model to function, however this assumption must be corrected in post-processing, and acknowledged to be purely a modeling construct that would not occur in reality. Any increases in groundwater pumping in the model that would result in undesirable impacts would in reality likely be met through efficiency or alternative supplies. Projected unreasonable impacts to groundwater and Disadvantaged Communities simply would not occur due to Bay-Delta Plan updates unless the state fails to enforce SGMA.

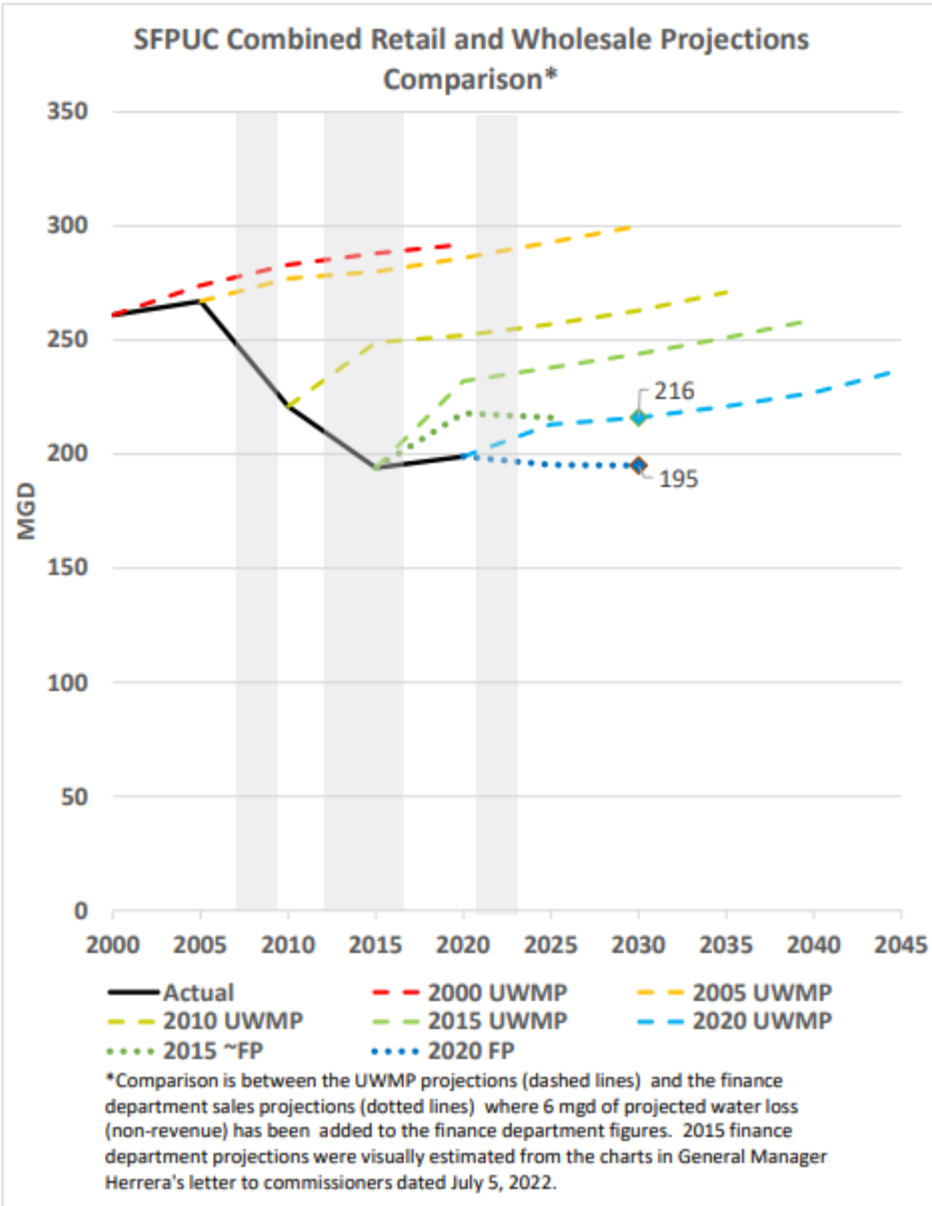
(3) The 5th consecutive dry year analysis is based on unreliable data

Appendix D displays Urban Water Management Plan (UWMP) data for the 5th consecutive dry year. These self-reported demand projections are quite variable in quality, with many agencies taking a conservative approach and overestimating future demand. Los Angeles Department of Water and Power (LADWP), for example, shows an estimated supply and demand of 673,600 acre-feet (Table D-7 at D-6), however LADWP's UWMP shows that the city's water use only reached this high once since 1989, in 2004 (LADWP Urban Water Management Plan, available at https://ladwp.com/cs/groups/ladwp/documents/pdf/mdaw/nzyy/~edisp/opladwpccb762836.pdf), and the average demand has been less than 500,000 acre-feet over the last decade (SWRCB Water Conservation Portal, available at http://www.waterboards.ca.gov/water_issues/programs/conservation_portal/conservation_reporting.shtml). According to a recent analysis, the San Diego County Water Authority "has repeatedly overestimated demand since 1995 — initially predicting regionwide water use would reach 970,000 acre feet by 2020. Today, the region is using about half that, around 450,000 acre feet, down from a peak of roughly 740,000 acre feet in 2007" (San Diego Union-Tribune 2022).



Ibid.

An SFPUC report (SFPUC letter dated July 5, 2022) shows that overestimated future demand is a problem in other UWMPs. The following graph, produced by Tuolumne River Trust from the data in the SFPUC report, shows the Finance Plan projections (dotted lines) were more conservative than the UWMP projections (dashed lines) and more accurate. (*see* Attachment: TRT July 11, 2022 letter re: – Water Enterprise and Finance Bureau Water Demand Projections.).



SFPUC stated regarding the UWMP projections:

> …the projections represent an outside bound of whatever demand will occur in the next 25 years. These demands will likely always be greater than actual demands because not all developments materialize, or they materialize slower than projected.

SFPUC 2022.

Because the UWMP demand data used in the Draft Staff Report (Appendix D) are not representative of likely future demand, the use of UWMP-based analysis should be limited to an upper bound and not characterized as a likely water supply impact, as is found in Draft Staff Report (Chapter 7; e.g., "expected surplus or shortage" in Table 7.20-16 at 7.20-38).

(4) Replacement water cost analysis overestimates costs and is based on unreliable data

The assumption that municipal suppliers would replace reduced deliveries with an unprioritized list of the most-likely options self-reported by agencies overestimates costs because it ignores likely prioritization based on cost within these options. Providers would prioritize least cost options (Draft Staff Report at 8-94).

c) Cuts to refuges as modeled in SacWAM are not accurate or lawful

The Central Valley Project Improvement Act (CVPIA), Pub. L. No. 102-575, makes clear that Congress's purpose in dedicating a permanent water supply for refuges was to provide an "ecologically equivalent habitat" to replace what was destroyed when the CVP was constructed and continued to be operated primarily for the purpose of providing water to agricultural users, including settlement and exchange contractors. (CVPIA § 3406(a)(3).) The CVPIA Level 2 refuge water allocation, which is set forth in § 3406(d)(1), can be reduced by no more than 25%, even in critically dry years. (*See* CVPIA §3406(d)(4)).

Unfortunately, the SacWAM model results presented in Chapter 6 assume that CVPIA Level 2 deliveries to wildlife refuges have the same priority as CVP senior agricultural contractors. Draft Staff Report Table A1-7 shows that the minimum 75% of contract allocation was reduced to as low as 40% under the 65% and 75% scenarios. This results in average reductions in refuge supplies of 47 TAF under the 55% scenario, 89 TAF under the 65% scenario, and 188 TAF under the 75% scenario (Draft Staff Report Table 7.6.1-5). In Critical years these modeled reductions average 114 TAF, 162 TAF, and 229 TAF, respectively. (Draft Staff Report Tables 6.4-7 and 6.4-23). Despite statements in Chapters 5 and 7 promising to prioritize refuge deliveries through either mitigation or in the POI[17], the Board is not properly prioritizing legally-mandated refuge deliveries as required by the CVPIA in the foundational analysis of the Draft Staff Report. (*See* CVPIA §§3406(b), 3406(d), 3404(c)(2); *see also Tehama-Colusa Canal Auth. v. U.S. Dep't of the Interior*, 721 F.3d 1086, 1091 (9th Cir. 2013) (the CVPIA "reallocated priorities for use of CVP water")).

In addition to prioritizing exports for critical health and safety needs, the Board should ensure that Level 2 refuge water supplies are prioritized over agricultural exports and M&I exports.[18] SF Baykeeper et al. thanks the Board for including refuge supplies as a designated beneficial use in

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[17] *See* Draft Staff Report 5-10, 5-12, 5-70, 7.6.1-69 to 70, 7.6.1-84, and 7.6.1-87 (Mitigation Measure MM-TER-a).
[18] *See also Friant Water Auth. v. Jewell (E.D. Cal. 2014)* 23 F.Supp.3d 1130, 1139-1140, 1144-1146 (Court ruled that CVPIA authorizes reductions in refuge water deliveries by no more than 25% and claims that the Bureau of Reclamation cannot deliver refuge water due to senior contractor rights is without merit).

the Bay-Delta Plan, as shown in Draft Staff Report Table 7.12.1-1c (BIOL). Level 2 water supplies are essential for supporting wetland habitat, for listed species like the threatened giant garter snake, and for millions of birds migrating along the Pacific Flyway. In fact, it is "the longstanding state policy that the continued protection, restoration, and enhancement of managed wetlands is critical to the State's public trust wildlife resources."[19] This wildlife beneficial use of Delta water must be protected in all years and under all alternatives. The Draft Staff Report should be revised to acknowledge CVPIA legal mandates consistently across all chapters, mitigation and the future POI.

d) The Draft Staff Report's analysis of refuge impacts of the staff flow alternatives vs. the VA alternative is flawed

Both the staff flow alternatives and the voluntary alternative include mitigation of impacts and prioritization of water for refuges, however only the voluntary alternative presents modeling results and impact analysis consistent with those guarantees. This inconsistent approach to impact analysis is misleading.

Chapter 5 contains assurances about the VAs' ability to mitigate impacts and prioritize refuge supplies:

> The proposed Plan amendments would include measures to reduce or minimize these effects. The proposed program of implementation would require voluntary implementation plans to include provisions for addressing potential impacts on terrestrial species and refuges that may be affected by those plans. …In addition, the proposed program of implementation would include provisions to prioritize water supplies deliveries to refuges.

Draft Staff Report at 5-70.

These guarantees are reflected in the model results showing no reduction in refuge supplies under the VAs, and Chapter 9 concludes there would be no impacts from the voluntary alternative: "…no anticipated change in water supply for wildlife refuges" from the VA (Draft Staff Report at 9-167.)

The flow alternatives take a similar approach to mitigation and prioritization. The Draft Staff Report states:

> Implementation of Mitigation Measures MM-SW-a,f: 6 and MM-SW-a,f: 7 can reduce or avoid water quality impacts on managed wetlands. The proposed program of implementation includes measures to prioritize refuge water supplies.

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[19] *See* Board Resolution No. 2019-0015 (April 2, 2019), available online at: https://www.waterboards.ca.gov/water_issues/programs/cwa401/docs/rs2019_0015.pdf

Draft Staff Report at 7.12.1-100.

Curiously, the VA approach (deferring prioritization to the POI with voluntary implementation plans) results in no modeled refuge supply impacts, but when the flow alternatives address this impact (in mitigation measures and by deferring the prioritization to the POI), the Draft Staff Report shows impacts to refuge supplies. Predicting refuge supply impacts only in the flow alternatives is inappropriate and misleading, given that both approaches are providing similar guarantees.

7. <u>*Other issues*</u>

a) SacWAM modeling indicates that some instream flow requirements will not be met under any alternative

The Draft Staff Report lists unmet instream flow requirements (IFRs) under each alternative (at A1-461). The SacWAM model fails to meet IFRs under every alternative, and some IFRs are not met under any alternative. This indicates conflicting requirements or flawed modeling, since the alternatives and the model should be designed to meet all IFRs. More context on these failures should be provided in the Draft Staff Report, since all flow alternatives should satisfy IFRs. It must be made clear where the model is unable to effectively simulate the proposed alternatives, or where conflicting requirements need resolution. Delta outflow is conspicuously absent from the list of unmet requirements in Table A1-55. Is this because there is no IFR for Delta outflow? The Board must develop a metric that evaluates whether Delta outflow needs are being met, independent of whether upstream IFRs are met, along the lines of Alternative 6A.

b) The Draft Staff Report fails to adequately analyze the effect of agricultural trends on water scarcity for other beneficial uses

The Draft Staff Report does not adequately analyze the changes in agriculture over time, particularly the hardening of demand for water supplies related to overplanting of nut tree crops. For example, the Draft Staff Report presents a summary of agricultural revenue from 2011-2016 (Draft Staff Report Figures 8.4-1 and 8.4-4), but that summary is not focused on irrigated acres or total water use.

In particular, the Draft Staff Report fails to analyze changes in Central Valley agriculture crop patterns over the past three decades, since the Board last updated Bay-Delta standards in 1995. For example, according to the USDA, in 1995, there were 483,700 total acres of almond orchards in California. By 2022, the most recent year in which complete numbers are available, that number had increased to 1,630,000 – 336% of the acreage in 1995 (USDA 2022). Virtually all of California's almond orchards are in the Central Valley. Similar dramatic growth can be seen in other permanent crops, such as pistachios. Some of the more than 1 million new acres of almonds over the past three decades were planted on land formerly farmed in annual crops. In other areas, new acres of almonds were planted on land that was not formerly irrigated. This growth in the acreage of permanent crops stands in stark contrast with the impacts discussed above to the environment and to the commercial and recreational fishing industry.

The growth in almond acreage has had two impacts on water management. First, total water use has been increased as a result of the conversion to nut tree crops. Second, unlike annual crops, almonds and other permanent crops cannot be fallowed during droughts. The increase in water use and decrease in the ability to respond to annual variations in water supply has increased pressure on beneficial uses related to fish and wildlife. The hardening of demand for surface water supplies fueled calls for relaxation of existing water quality requirements throughout the Bay-Delta watershed.

III. The Proposed Voluntary Agreement is Incomplete and the Best Available Evidence Indicates that it Will Not Provide Reasonable Protection of Fish and Wildlife Beneficial Uses or Achieve Plan Objectives

A. The Draft Staff Report Fails to Provide a Stable Project Description by Including the Proposed Voluntary Agreements (VAs)

The Board's inclusion of the proposed Voluntary Agreement (VA or VAs) alternative fundamentally changes the Draft Staff Report's project description. As discussed above, CEQA requires a clear explanation of the nature and scope of the proposed project, otherwise it "is fundamentally inadequate and misleading." (*See Communities for a Better Environment v. City of Richmond*, 184 Cal.App.4th 70, 84-85 (2010)).

First, the VAs change the nature and scope of the project description by proposing new objectives. The Draft Staff Report explicitly states that the VA proposes "1) a *new* narrative objective to achieve the viability of native fish populations; and 2) [provides] the participating parties' share, during implementation of the VAs, to contribute to achieving the existing Narrative Salmon Protection Objective, and *propose doing so by 2050.*" (Draft Staff Report at 9-1 (emphasis added)). The Bay-Delta Plan's objectives are the foundation of the document and this update process. CEQA Guidelines state that an EIR or SED "shall describe a range of reasonable alternatives to the project . . .which would feasibly attain most of the *basic objectives* of the project…" (Cal. Code Regs. tit. 14, § 15126.6 (emphasis added)). As discussed elsewhere in these comments, the best available science clearly demonstrates that the VA's proposed changes to the objectives will fail to protect beneficial uses of the Bay-Delta estuary, including viability of fisheries. By including the VA Alternative in the Draft Staff Report, the Board changes the most "basic" of the project objectives, impermissibly changing the project description and misleading the public. *Id.*

Second, the proposed VA alternative is so drastically different and inconsistent with the proposed project and other project alternatives that it changes the fundamental project purpose and nature of an already unstable project description, which is "an obstacle to informed public participation." (*Washoe Meadows Cmty. v. Dep't of Parks & Recreation*, 17 Cal.App.5th 277, 290 (2017) (the court found the DEIR to be lacking a stable project description because there were five very different alternative projects in the DEIR and therefore was an obstacle to informed public engagement)).

For example, overall, the VA is fundamentally inconsistent with the 2017 Scientific Basis Report, which is the foundation of the Draft Staff Report and the larger Plan update. The 2017 Scientific Basis Report provides ample evidence that fish and wildlife beneficial uses and water quality are not adequately protected by current Bay-Delta Plan objectives and regulations. The report also demonstrates that substantial increases in river flow into and through the Delta to San Francisco Bay will be necessary to provide reasonable protection of fish and wildlife beneficial uses, because, as the Board acknowledges, "[f]low is commonly regarded as a key driver or "master variable" governing the environmental processes in riverine and estuarine systems such as the Bay-Delta and its watershed" (SWRCB 2017 at 3-2).

As discussed elsewhere in these comments, the best available science clearly demonstrates that the habitat restoration benefits of the VAs would not overcome the lack of significant flow improvements. In fact, multiple analyses of related restoration efforts confirm that this reliance on habitat, rather than significant flow improvements, would fail.

For example, in 2020, the National Marine Fisheries Service commissioned a peer review of quantitative models prepared by the SFPUC, MID and TID to describe salmon and steelhead population response to flow and habitat actions on the Tuolumne River. That review concluded that:

> The model, as configured, indicates that the status of the Chinook salmon population is extremely precarious and bold actions will be needed to prevent extirpation. This need, according to the model, would best be met by very substantial increases in flow releases during spring (the period of active smolt outmigration from the river). The model suggests that management actions with the most certainty in providing real benefits would involve increases in flows during smolt outmigration. Other actions would be expected to provide relatively low benefits compared to spring flow increases. These include reductions in predation rates (unless those reductions could be of a significant magnitude) and increases in spawning habitat through gravel augmentation (even if those increases were large).

Anchor QEA 2020.

These models were used to produce the current Tuolumne River VA proposal. This analysis confirms that, on the Tuolumne River, the VA approach of focusing on habitat restoration rather than significant flow improvements would fail. Although this model and the third-party review are for a river addressed in Phase 1, rather than Phase 2 of the Board's Bay-Delta Plan update process, it nevertheless reveals this flaw in the overall VA approach in both Phases 1 and 2.

Furthermore, an evaluation of the benefits of habitat restoration on the Tuolumne River concluded that a major restoration project benefitted salmon only under relatively high flow conditions (McBain and Trush 2016). Thus, even to the extent that restored habitat can provide environmental benefits, the Draft Staff Report fails to adequately analyze the improved flow conditions that are needed to secure those benefits.

Finally, the VA proposal itself is still incomplete and may change in significant ways that will impact the Board's analysis. The VA process has set and failed to meet ten deadlines for releasing a complete VA package, beginning in 2014 (Golden State Salmon Association et al. 2022). The VA process continues to lack essential components, including:

- A global agreement.

- An implementation program, including comprehensive SMART biological goals to make adaptive management decisions regarding the block of water.
- A quantitative flow accounting approach for VA environmental water.
- An enforcement program.
- A funding plan.
- A systemwide governance committee charter.
- A clear and timely proposal to replace the VAs in the event that they fail.
- A clear proposal regarding the requirements that would be in place at the end of the VA term.

The Draft Staff Report established a new, end-of-2023 deadline for a complete package (Draft Staff Report at 9.3.1); as of this writing, we are unaware whether this package was presented to the Board. In any case, this package has not been made available for review by the public. This is par for the course. The Draft Staff Report fails to discuss the long history of the VA process in failing to meet deadlines, or the fact that a "complete package" is needed for adequate CEQA analysis as well as ensure feasibility and enforceability, as discussed more below. (Cal. Pub. Res. Code § 21002). The Board must not delay action to wait for a complete VA package that may never be released.

For all these reasons, in order to comply with CEQA, the Board must revise and recirculate the Draft Staff Report without a VA Alternative.

B. The VAs do not propose reasonably certain or feasible mitigation as required by CEQA.

When imposing mitigation, the Board must ensure there is a "nexus" and "rough proportionality" between the measure and the significant impacts of the proposed project. (CEQA Guidelines § 15126.4(a)(4)(A)–(B), citing *Nollan v. Ca. Coastal Commission,* 483 U.S. 825 (1987), *Dolan v. City of Tigard,* 512 U.S. 374 (1994)). Additionally, all mitigation must be feasible and fully enforceable. (Cal. Pub. Res. Code § 21002; Cal. Code Regs. tit. 14, § 15041).

1. The VA measures are not enforceable because they are uncertain to occur.

The VA measures are not enforceable because they are unlikely to occur. A CEQA lead agency, such as the Board, "'shall provide that measures to mitigate or avoid significant effects on the environment are fully enforceable through permit conditions, agreements, or other measures'" in order to "ensure that feasible mitigation measures will actually be implemented as a condition of development, and not merely adopted and then neglected or disregarded." (*Fed'n of Hillside & Canyon Associations v. City of Los Angeles*, 83 Cal.App.4th 1252, 1261 (2000) (citing Cal. Pub. Res. Code §§ 21081.6 (b), 21002.1 (b)).

In this case, the Staff Report does not analyze the likelihood that the VAs will fail to provide the flows anticipated by the Board staff analysis and VA advocates. For example, the VAs could fail to provide anticipated flow assets if anticipated water transfers do not materialize due to a lack of funds, high water transfer prices, unwilling sellers or other factors. Further, the VA could finalize accounting rules that would undermine anticipated ecosystem flows. Both of these risks have been experienced in similar environmental blocks of water in the past (Defenders of Wildlife 2022).

The idea of creating an environmental block of water is not new. In fact, there have been many attempts to create environmental blocks of water, including many in the Bay-Delta watershed (e.g., CVPIA (b)(2), the Environmental Water Account [EWA] and CVPIA Level 4 refuge supplies). All of the examples examined by Defenders of Wildlife (2022) have encountered major implementation challenges, including reduced environmental benefits that arise as a result of accounting methodologies that are not robust (e.g., CVPIA(b)(2), the EWA), water transfers that fail to materialize (e.g., CVPIA Level 4 refuge supplies), and other problems.

In a water management setting as complex as the Bay-Delta, many questions must be addressed by any accounting methodology for environmental water. Only when these questions are answered can the Board determine if an environmental block of water, including the proposal in the VAs, would provide significant environmental benefits.

The VA term sheet includes general language calling for the Board to protect new environmental water from diversion. Further, the Draft Staff Report states that "[i]t is expected that the accounting developed for the VAs that is required to be approved by the State Water Board will provide for these flows to be bypassed by the SWP and CVP and contribute to Delta outflows." (Draft Staff Report at 9-199). The VA Term Sheet, however, does not clarify the detailed position of the VA parties regarding the diversion of environmental water or VA baseline flows. Defenders of Wildlife (2022) discusses a wide range of key questions related to water accounting that have not been answered by the VAs. Among many others, these questions include:

- Does the program require detailed baseline operations plans by major water users – or all water users – within its geographic scope?
- Does the baseline include all or only some of the different types of in-stream water flowing through the project area, such as flows to meet regulatory requirements, non-regulatory environmental water dedications, flows from unregulated streams, uncontrolled water releases from storage such as flood management releases, water supply deliveries, navigation flows, flood management and dam safety releases and salinity control releases?
- Does the program incorporate into the baseline existing agreements to modify or constrain water project operations that may not represent formal regulatory requirements?
- What will happen if the baseline changes during the term of the program?
- Would the baseline account for waivers of regulatory requirements during droughts? If so, how?
- How does the baseline address surplus or unscheduled water deliveries?

- In settings where multiple projects make releases to meet downstream regulatory requirements or water needs, how would the program prevent environmental water releases from one facility from being "captured" by another water project or user through a corresponding reduction in releases?

The VA proposal does not include specific mechanisms to address these and other questions to ensure that anticipated environmental benefits would be realized.

The risk presented by the possible diversion of environmental and baseline flows, and therefore the failure of the VA's proposed mitigation, is clearly implied by the inclusion in the Draft Staff Report of Alternative 6a. Alternative 6a was specifically designed and included in the Draft Staff Report to prevent the diversion of VA baseline flows. (Draft Staff Report at 9-199.) However, it is worth noting that this attempted solution is not paired with an adequate description of the problem in the Draft Staff Report analysis of the VA. Furthermore, the potential impacts of the risk of the diversion of environmental water under the VA approach is not analyzed in the Draft Staff Report. These deficiencies, paired with the existence of Alternative 6a, send a clear message to the public that there is a risk any VA mitigation measures will be "adopted and then abandoned." (*Fed'n of Hillside & Canyon Associations*, 83 Cal.App.4th at 1261; *see also Anderson First Coal. V. City of Anderson,* 130 Cal.App.4th 1173, 1186–87 (2005)).

2. <u>*The VA proposal unlawfully delays mitigation.*</u>

In addition to delaying attainment of the salmon protection objective as discussed above, the Draft Staff Report also fails to analyze the risk to the Bay-Delta under the VA approach given the lack of a timely program of evaluation and adaptation. Generally, CEQA requires that the formulation of mitigation measures not be deferred until some future time unless under specific circumstances. (Cal. Code Regs. Tit. 14, § 15126.4(a)(1)(B)). The VA term sheet delays any evaluation of the effectiveness of the VA program until year 6 (*see*, VA Term Sheet, Section 7.4.). This delay is also not consistent with the Board's obligation to review implementation of Bay-Delta Plan objectives every three years (per Sections 13240 of the Porter-Cologne Act and 303(c)(1) of the Clean Water Act, respectively).

Given the complexity of the proposed VA and the lengthy delays that have plagued the VA process and at the Board's Bay-Delta Plan updates thus far, it is likely that a full evaluation of the VA might not be completed during the VA program's eight-year timeline. As the court found in *Sacramento Old City Assn. v. City Council*, "[t]his deferral of environmental assessment until after project approval [will violate] CEQA's policy that impacts must be identified before project momentum reduces or eliminates the agency's flexibility to subsequently change its course of action." (229 Cal.App.3d 1011, 1028 (1991)). Clearly, without a timely and complete evaluation program, it would be impossible for the Board to act to address shortcomings in the VA approach in a timely manner.[20] The risk related to a lack of timely evaluation is exacerbated by the lack of a VA enforcement program.

Again, SF Baykeeper et al. requests the Board revise and recirculate the Staff Report without a VA Alternative, in order to comply with CEQA.

C. The VA Is Not Acceptable as a POI for the Bay-Delta Plan

The VA is proposed as an alternative to the proposed project and would serve as the POI for a Bay-Delta Plan with different water quality objectives than included in the proposed project. This proposal is simply not credible on either legal or scientific grounds. Prima facie, the VA does not purport to attempt to achieve the proposed Table 3 objectives in the staff alternative, but is predicated on eliminating the numeric flow objectives and modifying the narrative objectives (see below for further discussion). In doing so, the VA will utterly fail as a POI that is sufficient to provide reasonable protection of fish and wildlife beneficial uses, as required under Porter-Cologne. See below for a detailed discussion of why the proposed VA elements will fail to protect these uses.

The VA also lacks many of the critical elements identified earlier as necessary components of the Draft Staff Report's missing POI, including specific, enforceable criteria for varying flow amounts and timing and in-Delta hydrodynamic conditions based on attainment of relevant biological targets, carryover storage and other criteria for protecting coldwater habitat, criteria for addressing impacts during extended drought periods, and mechanisms for accounting for flow contributions.

D. The VAs Narrative Salmon Protection Objective Is Not Consistent with the Existing Narrative Salmon Protection Objective, and the VA Program of Implementation is Not Likely to Achieve that Objective

1. <u>The VAs change to the salmon protection objective is inconsistent with that objective and with California law</u>

The existing narrative salmon protection (doubling) objective requires that: "Water quality conditions shall be maintained, together with other measures in the watershed, sufficient to

[20] This may prevent the Board from satisfying its legal obligations under both the Clean Water Act and the Porter Cologne Act, rendering the VA alternative and its associated mitigation measures legally infeasible. CEQA Guidelines note that alternatives that conflict with obligations are legally infeasible and need not be analyzed. *See* § 15126.6(a)); *see also Tiburon Open Space Comm. v. Cnty. of Marin*, 78 Cal.App.5th 700, 732 (2022) (court found when conducting environmental review, county properly excluded, as legally infeasible, certain mitigation measures or alternatives).

achieve a doubling of natural production of chinook salmon from the average production of 1967–1991, consistent with provisions of State and federal law."

The VA states that it will represent participating parties' share, during implementation of the VAs, to contribute to achieving the existing Narrative Salmon Protection Objective (Box ES-1), and propose doing so by 2050. This is not consistent with federal law. Section 3406, Fish, Wildlife, Improved Water Management & Conservation (b)(1) requires the Secretary of Interior "*to implement a program which makes all reasonable efforts to ensure that, **by the year 2002**, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991*."

Extending the time frame for attaining the salmon doubling objective for 48 years past the date identified in the statute, itself already two decades past due, is inconsistent with current law and would allow the degradation of flows and water quality to delay achieving the salmon protection objective in ways that are would be harmful and inconsistent with Porter-Cologne and the Clean Water Act.

The VA's target for "contributing" to attainment of the salmon protection objective over its 8-year term violates state law. A legal water quality control plan must both describe objectives that reasonably protect beneficial uses AND contain a POI that identifies exactly how those objectives will be met. The VA's amended salmon protection objective does neither. First, it is not "reasonable protection" of the beneficial uses served by the salmon protection objective to postpone achievement of that goal by 30 years. And second, the VAs, and by necessity the POI for the VAs, contain a description of measures that will occur only during the next eight years, not through 2050 when the VAs assert the objective would be met. That is inconsistent with the requirements of a POI under the law.

2. The Draft Staff Report reveals that the VAs fail to attain even their inadequate "contribution" to the salmon protection objective

The VAs acknowledge that they are intended to be the implementation of the salmon protection objective (VA Term Sheet, March 29, 2022. Section 1.2). Yet the flows that would be provided under the VA proposal would clearly be inadequate to achieve the existing narrative salmon protection objective. Flows provided in all year types would be inadequate to meet multiple ecosystem needs. In critically dry years, the VAs would provide virtually no new environmental water north of the American River. In particular, under the VAs, critical year flow during January-June would be worse than baseline (Draft Staff Report Table 9.5-2).

The VA proposal has an eight-year timeline. The 2050 deadline would not be reached until far after the expiration of the VA proposal. The VA proposal fails to include any requirement or interim milestone to ensure any progress toward the salmon protection objective within the VA timeline.

Winter and spring-run Chinook Salmon are facing a growing extinction risk. The commercially and recreationally important Central Valley fall run is also in decline. The 2023 California salmon fishing season is closed for just the third time in state history. It also appears highly likely that the 2024 fishing season will be closed as well. Simply slowing this rate of decline would fail to meet the narrative salmon protection objective.

Even, assuming for the sake of argument, that the Board were to agree to the water user request to extend the salmon doubling date to 2050, given that the VA proposal is more likely to result in extinction, that alternative would obviously preclude the achievement of the salmon protection objective by the proposed 2050 date.

For these reasons the VA proposal to extend the target date for the salmon protection objective to 2050 would be unlawful.

E. The VAs' proposed narrative viability objective is not adequate to protect fish and wildlife uses and would weaken the Board's proposed objective.

The VA's proposed narrative viability objective is inadequate for the same reasons that apply to the Board's proposed narrative flow objectives, as discussed extensively above. Specifically, both versions fail to adequately define viability in a measurable way or ensure that viability is achieved for commercial, recreational, and subsistence fisheries, estuarine habitat, or other fish and wildlife and tribal beneficial uses.

Furthermore, the VA would weaken the Board's proposed objective by adding the phrase "together with other measures in the watershed." As discussed above, the inclusion of this phrase in the existing narrative salmon protection objective has been the cause of much confusion, served as an impediment to the attainment of the objective, and is inconsistent with the Board's mandate to regulate flow and water quality conditions to achieve reasonable protection of beneficial uses by establishing Table 3 objectives governing specific flow and water quality parameters.

F. The VA alternative fails to incorporate effects of climate change

Errors in runoff forecasting have been larger in recent multi-year droughts (Avanzi et al. 2020), which are expected to become more frequent and intense under climate change. Investments in newer technologies such as the Airborne Snow Observatory and modifying runoff forecasting techniques have some potential for maintaining forecast accuracy in the future, however in a rapidly-changing climate, flow requirements reliant on forecasting are inferior to an unimpaired-flows-based approach. Runoff-forecast-based-problems like the "missing water" in spring 2021 are likely to plague regulatory or voluntary schemes that rely on year-type forecasts. An approach that releases a percentage of unimpaired flow in real-time is far superior to forecast-based approaches where the total volume automatically adjusts based on available flow.

In a rapidly changing climate, a distinct advantage of the flow alternatives is that they are largely immune to errors in runoff forecasting because they do not depend on runoff forecasts—they simply leave undiverted a fixed proportion of the available flow.

The forecasting errors to which the VA alternative is prone would be exacerbated if it relies on using D-1641's Sacramento Valley Index and San Joaquin Index, which inequitably distributes climate change impacts. Null and Viers cautioned:

> …if current WYT thresholds are maintained (Figure 7), then the burden of climate-driven water scarcity falls entirely on environmental outflow through the Bay Delta (-16%), while the percentage of average annual flow to exports (+2%) and out-of-stream uses (+4%) increase somewhat to preserve relatively constant deliveries in drier years… The WYT framework, and how it could be altered to reflect climate change, directly affects water winners and losers in the state.

Null and Viers 2013.

G. The Draft Staff Report Fails to Utilize Scientifically Sound Analyses Regarding the Effects of the VAs on Fisheries and Ecosystems

Problems with modeling of the VAs include:

The multiple Biological Opinion/ITP conditions used in the modeling are noted in multiple places in Chapter 9 of the Staff Report (9-45, 9-117, 9-165), including cautions that the VA would not change exports or OMR:

> …any increases in exports and associated changes in interior Delta flows under the proposed VAs relative to baseline would be the result of differences in the assumed BiOp and ITP constraints under the VAs and baseline and not as a result of the addition of proposed VAs to the Bay-Delta Plan since adding the VAs to the Bay-Delta Plan will not change the existing export or other interior Delta flow constraints in the plan.

Staff Report at 9-165.

The South of Delta Exports section (beginning at 9-44) acknowledges this, and presents the complexity of multiple baselines and multiple VA options, but then goes on to describe how exports might change in 5 paragraphs and 6 tables. This inconsistent, unclear, and confusing presentation of whether exports and Delta hydrodynamics might change does not promote a clear understanding of the likely effects.

Even the modelers do not fully understand the complexity, and thus the bias correction applied to SacWAM results in order to get it to better-match CalSim II may not be appropriate. G3a-11 states: "The differing responses to changed BiOp assumptions observed in SacWAM and CalSim II result from multiple differences between the models that are not fully understood at the time of this writing." It is understandable that the VA modeling is incomplete, since "… changes in hydrology and supply associated with the proposed VAs are relatively small compared with the volume of water in the system, and some details of the VAs such as which reservoirs may be reoperated, which fields will be fallowed, when reservoirs can refill, and when groundwater substitution will occur, have not been fully specified." (Draft Staff Report at G3a-1). The VA modeling and model analysis is incomplete because the project description is incomplete.

In addition, the Staff Report provides a misleading comparison of likely flows under the flow scenarios vs. the VA. The modeling of Delta outflow under the VA includes the 2018 San Joaquin River inflow amendments to the Plan in a higher bookend scenario (Staff Report at G3a-10), however there is no such scenario provided for the flow alternatives. This improperly inflates Delta outflow in the VAs compared to the flow alternatives.

H. Flow and Habitat Assets of the Proposed VAs are Not Adequate to Reasonably Protect Beneficial Uses and Achieve Bay-Delta Plan Objectives

1. <u>The VA fails to define fish in good condition in a way that permits evaluation of the plan's ability to comply with state law</u>

As with the proposed project, the Draft Staff Report fails to analyze whether the proposed VAs comply with Fish and Game Code §5937. Given that conditions below Central Valley dams currently do not maintain fish good condition, and that the status of many native fish populations is declining, and that flow and habitat assets pledged in the proposed VA are wholly inadequate to halt the decline in native fish populations, much less reverse that decline (*see below*), it is extremely unlikely that the VAs will result in reservoir operations that support maintenance of fish in good condition.

2. <u>The Draft Staff Report demonstrates that flows under the VA will not halt the decline of native fishes and estuarine habitat, restore viability, reasonably protect fisheries, or maintain fish in good condition</u>

The flow and habitat assets promised in the VA term sheet represent meager improvements over the status quo, even if we assumed that they are reasonably likely to materialize (which we do not), and even if the habitat assets are as beneficial for native fishes as purported by VA proponents (which they are not), and even if the habitat assets are delivered at the outset of the VA term (which is not physically possible). Indeed, the Draft Staff Report analyses demonstrate that the VA habitat and flow assets will, in many cases, make conditions *worse* than the conditions that led the Board to conclude that its current water quality standards were "insufficient to protect fish and wildlife" (SWRCB 2017 at 1-5; *see also*, SWRCB 2010 at 2, CDFW 2010). Simply put, it is not plausible and not consistent with the best available science, that the VAs will succeed in halting the decline of native fish species and Bay-Delta water quality conditions, let alone support and maintain the viability of those species, much less reasonably protect identified environmental beneficial uses of water.

a) Delta Smelt

The VAs are not likely to recover or reasonably protect Delta Smelt; in fact, the Draft Staff Report indicates that the project may be harmful to this imperiled species.

Delta outflow conditions under the VA will be worse for Delta Smelt than conditions it previously experienced under the 2008/2009 BiOps. Average Delta outflows under the VA are predicted to be lower during April and May (Draft Staff Report Table G3a-76 at G3a-102), despite the scientific evidence that Delta outflow is the strongest predictor of Delta Smelt survival from the post-larval to the juvenile stage (Polansky et al. 2019). Similarly, Delta outflows during the early fall are projected to decline substantially under the VA relative to the 2008/2009 BiOps and the Draft Staff Report's baseline (particularly during wetter years; Draft Staff Report Table G3a-76 at G3a-102), despite the scientific evidence that fall outflows from the Delta (as indexed by X_2) have a strong positive effect on Delta Smelt recruitment in the subsequent spring (Polanski 2019).

Moreover, it is reasonably foreseeable that flows projected to occur under the VAs will decline over time as "unregulated flows" are captured by other water development projects and storage/diversion operations. The potential for future degradation of Delta Smelt habitat is made clear by the Draft Staff Report's description of Modular Alternative 6A, which would protect some of the unregulated flows under the proposed VAs. Without provisions similar to those in Alternative 6A, unregulated flows that contribute to protection of fish and wildlife can and likely will be diverted in the future under the VAs.

The VAs also rely on non-flow projects to increase the availability of shallow water environments (floodplains and tidal marshes) intended to protect native fish and wildlife like Delta Smelt. SF Baykeeper et al. and others have commented extensively elsewhere that the benefits of such so-called "habitat restoration" are speculative, at best, and not borne out by the best available science in most cases (NRDC et al. 2023). To the extent that such "habitat restoration" is relevant to protection of Delta Smelt, the Draft Staff Report's analysis makes clear that the proposed VA is not likely to significantly increase habitat available to Delta Smelt. In fact, the Draft Staff Report finds that "habitat" for Delta Smelt larvae may *decrease* by as much as 11% under the proposed VA relative to the 2008/2009 BiOp reference condition (Draft Staff Report Table 9.6-3 at 9-79).[21]

Available habitat for Delta Smelt under the VAs is likely to decrease in the future faster than it will under the proposed project or "high flow" alternatives (particularly if baseline flows continue to degrade, see above). Under climate change, the areal extent of habitat estimated to result from the VAs is likely to decrease in the future (Draft Staff Report Appendix G.2 at 2-23) because Delta Smelt habitat is believed to be increasingly constrained by high water

[21] Although the analysis also suggests the possibility that Delta Smelt "habitat" will increase, the potential reduction in acreage is much greater than the potential gain in habitat (the column on the far right of table 9.6-3, which reports symmetrical potential habitat change in percentage terms, seems to reflect a calculation error).

temperatures (Draft Staff Report App G.2 at 2-23). The Draft Staff Report does not evaluate the effect of increasing flows on water temperatures in the estuary, even though higher flows under the proposed project and "high flow" alternative would be expected to mitigate increased temperatures (Vroom et al. 2017; Bashevkin and Mahardja 2022) in a way that the VAs –which promise relatively low Delta inflow and outflow– will not.

Baykeeper et al. also note that the VA analysis provides no estimate of Delta Smelt population growth under the VAs, as it does for select other species (Draft Staff Report Figure 9.6-4). Our analysis of SacWam modeling indicates that summer flows the Board has identified as protective for this species will occur 56% of the time under the proposed project, and much more frequently (63-76%) under higher flow alternatives (Table 1). We encourage Board staff to evaluate Delta Smelt population response under the VAs, proposed project, and other unimpaired flow alternatives (with and without proposed interior Delta hydrodynamic requirements) using the USFWS Delta Smelt Life Cycle Model (Polansky et al. 2021; Smith et al. 2021).

b) Longfin Smelt

The Draft Staff Report demonstrates that the proposed VA will continue or even accelerate the decline of the Bay-Delta's endangered Longfin Smelt population. The frequency of seasonal flows that promote Longfin Smelt population growth is projected to decline under the VAs relative to both the baseline and conditions under the 2008/2009 BiOps (Draft Staff Report Table 9.6-4 at 9-80; *see also* Table 1). Furthermore, the VAs are likely to eliminate conditions that currently produce the highest population growth rates because the VAs are expected to result in lower flows during the Wet year-type (Draft Staff Report Tables 9.5-40, 9.5-41). Because the flow-productivity and flow-abundance relationships are log-log linear (Rosenfield and Baxter 2007; SWRCB 2017), flows in Wet years are critically important to the population; high productivity during these years provides some buffer against extirpation in subsequent years with low Delta outflows. We emphasize that the current flow regime is associated with the long-term and catastrophic decline of Longfin Smelt. Decreasing the frequency of flows that promote any population growth and truncating the higher end of the winter-spring Delta outflow (and Longfin Smelt population growth) spectrum can only accelerate their trajectory towards extirpation.

Old and Middle River flow rates are projected to become much more negative under the VAs relative to the 2008/2009 Biological Opinion and the Board's baseline during April and May (Draft Staff Report Appendix G3a Figure G3a-36 at G3a-1113) the two months in which Longfin Smelt are most vulnerable to entrainment and death in the infrastructure of the CVP/SWP export facilities (Grimaldo et al. 2009). Thus, the impact of entrainment and salvage on Longfin Smelt is likely to increase under the VAs. This effect is not accounted for in the Draft Staff Report's effort to model population response to implementation of the VAs.

VA "habitat" restoration actions are not expected to substantially benefit Longfin Smelt. This is because (a) there is no evidence that the extent of shallow water environments or even the volume of the pelagic habitat currently limits the population (Lewis et al. 2019 at 7 and 44-45 of the PDF; Kimmerer et al. 2009, respectively) and (b) because the VAs are expected to produce only meager increases in presumed "habitat," including potential reductions in the habitat available to juvenile Longfin Smelt (Draft Staff Report Table 9.6-3 at 9-79).

Given the Draft Staff Report's projection of decreasing frequency and magnitude of flows that benefit Longfin Smelt, increasingly negative OMR flows that entrain and kill Longfin Smelt, and declines or tiny increases in presumed "habitat" (which is unlikely to be limiting the population and unlikely to materialize during the VA term), it is likely that the Longfin Smelt population's slide towards extinction will accelerate if the proposed VAs are adopted and implemented.

c) Chinook Salmon

The Draft Staff Report provides no evidence that the VAs will halt the decline of Central Valley Chinook Salmon runs, restore their viability, or increase populations to necessary to satisfy the VAs' revised salmon protection objective.

As noted with respect to our review of the proposed project, the Draft Staff Report fails to analyze flow criteria consistent with the best available science regarding what is needed to protect migrating juvenile Chinook Salmon. In general, the VAs are expected to increase Sacramento River inflows to the Delta during Chinook Salmon migration seasons by about 2.2% on average (range: 0.2%-7% depending on year type; Table 9.5-6 at 9-25); this is unlikely to result in a significant change in the frequency or magnitude of Chinook Salmon population growth. Our analysis of flows that recent research demonstrates would be protective of out-migrating Chinook Salmon smolt shows that the VAs will not improve conditions – the frequency of these flows is low and identical when comparing the VA to the Board's baseline (Table 1).

In addition, OMR rates during April and May are projected to be significantly more negative under the VAs than under the 2008/2009 BiOp and the Board's baseline (Draft Staff Report Appendix G3a Figure G3a-36 at G3a-1113)The increase in flows headed towards the export pumps ("reverse flows" or negative OMR) would be expected to increase mortality of juvenile spring-run and fall-run Chinook Salmon attempting to transit the Delta, via direct salvage loss and the indirect negative effects of altered Delta hydrodynamics on Chinook Salmon survival.

Even if the VAs non-flow "habitat" restoration projects materialize during the proposed 8-year term (which we doubt), and even if they provide as much benefit to Chinook Salmon as VA proponents contend (an assertion that is not supported by the scientific record; *see* NRDC 2023) the VAs simply do not plan to substantially increase available Chinook Salmon habitat. Specifically, the VAs will not accomplish their own stated goal – to surpass 25% of the habitat presumed necessary in each relevant river basin to support salmon populations targeted by the salmon protection objective (i.e., natural production that is double the 1967-1991 average; AFRP 2001). Of the six river-by-salmon spawning population combinations studied in the Draft Staff Report's analysis of spawning habitat availability under the VA, all but one (the American River) already exceeds the VAs' habitat target, and that river will not attain the 25% spawning habitat target under the VAs (Figure 9.61. at 9.75).

With respect to in-channel and floodplain rearing "habitat" restoration, the Draft Staff Report analysis shows that the VAs will not accomplish their goal. The analysis shows that VA assets will fail to attain even 25% of the estimated rearing habitat need for fall-run Chinook Salmon in the Sacramento River or the American River (Draft Staff Report Table 9.6-2 at 9-76). Only the Feather River is projected to attain the VAs' goal for rearing habitat as a result of implementing the VA assets. Meanwhile, according to this analysis, the Yuba River and Mokelumne River VAs are expected to add more habitat than is needed for Chinook Salmon populations to attain the narrative salmon protection objective (Figure 9.6-2 at 9-76).

Even though the Draft Staff Report discloses that the VAs will not attain their own goal of ensuring that the relevant tributaries have at least 25% of the physical spawning and rearing habitat needed to support Chinook Salmon populations, the report still overstates the impact of this contribution to attainment of the proposed salmon protection objective. The VAs take credit for non-flow habitat projects that the analysis shows are not needed to attain the salmon protection objective. Table 9.6-3 of the Draft Staff Report indicates that salmon rearing habitat will increase by just 2-3% when all of the VAs proposed habitat restoration is completed. But this includes habitat restoration in river basins where more than the total estimated need already exists. For example, the VAs propose to increase available from 204% of the estimated need to 215% of that need (Table 9.6-2 at 9-76). Similarly, on the Yuba River, the VAs propose to increase available physical spawning habitat beyond the existing 291% of the total needed to support the targeted population of salmon (Table 9.6-1 at 9-75). This raises at least two questions:

- Why are the VAs proposing to spend money on non-flow habitat restoration projects on rivers where that habitat is plainly not needed (and failing to create the habitat where it arguably is needed)?
- If more than the target habitat already exists on certain rivers, why have the Chinook Salmon populations on these rivers never attained the population targets required to achieve the salmon protection objective?

The simple answer is that the VA parties did not systematically analyze the habitat and flow needs of Chinook Salmon before setting the terms of their agreement. Indeed, neither the Draft Staff Report nor VA proponents provide evidence to suggest that spawning habitat limits Chinook Salmon populations. Nor do they acknowledge recent scientific evidence that rearing habitat in the Delta currently exceeds the amount necessary to sustain typical current salmon populations under the current flow regime (Munsch et al. 2020) – an inadequate flow regime that the VAs would largely perpetuate.

Given the certainty and magnitude of the relationships between juvenile Chinook Salmon survival and flow (*see above*; and Attachment: Salmon Flow Literature Matrix), it is not plausible that the VAs' tiny (and uncertain) non-flow actions can compensate for the lack of adequate flows under this proposal. The projected tiny contribution to overall habitat availability –which includes added habitat that is not assumed to be needed on other rivers – cannot plausibly reverse salmon decline or restore viability of the four Chinook Salmon runs, much less double their populations to attain the Plan's narrative salmon protection objective.

d) Central Valley Steelhead

Central Valley Steelhead will be harmed by the proposed VAs. Specifically, the substantial increase in negative OMR flows under the VAs during April and May (Draft Staff Report Appendix G3a Figure G3a-36 at G3a-113) is expected to reduce survival of emigrating juvenile Steelhead, particularly those from the San Joaquin River basin, which is critically important to the recovery of this species (NMFS 2014). The increasingly negative OMR flows under the VAs results from elimination of the San Joaquin I:E ratio. The 2019 NMFS Biological Opinion projected that the greatest increase in loss of Central Valley Steelhead under the operations it permitted would occur during April and May (at 774, and 509–10), the very months when the San Joaquin I:E ratio would be in effect under the 2009 NMFS BiOp. Specifically, the 2019 NMFS Biological Opinion estimated that adverse Delta hydrodynamics resulting from the elimination of the I:E ratio would "…lead to lower survival of steelhead juveniles emigrating from the San Joaquin River basin by up to 20 percent" (*id.* At 776) and that "[d]uring years in which spring-time Vernalis flows do not exceed 5,000 cfs, Reclamation's proposed action could create conditions that would reduce steelhead survival to Chipps Island for the Southern Sierra Nevada Diversity Group, further exacerbating the already diminished status of this diversity group" (*id.* At 777). Old and Middle River flows under the VAs are projected to improve as compared to the 2019 Biological Opinion, but they will remain far more negative than the relevant points of comparison – the 2008/2009 Biological Opinions and the Board's baseline. For this reason alone, the VAs are likely to further degrade viability of Central Valley Steelhead and prevent restoration of the fishery for this storied sportfish.

e) White Sturgeon and Green Sturgeon

The Draft Staff Report demonstrates that the flow regime under the VAs *reduce* the frequency of flows associated with successful White Sturgeon reproduction (Draft Staff Report Table 9.6-4 at 9-80; Table 1). The VAs are projected to reduce Delta outflows during Wet years (Draft Staff Report Tables 9.5-40, 9.5-41) when reproductive success now occurs. As a result, the VAs are likely to further impair the reproductive success and viability of both sturgeon species and accelerate their decline towards extinction. SF Baykeeper et al. reiterate our concern that the flows promised under the VAs (as modeled in the Draft Staff Report) are likely to diminish over time as new dams and diversions capture more of the flow that is not regulated by the 2019 Biological Opinions and the Board's current regulations (D-1641).

f) Starry Flounder

As discussed above, flows that the Board (SWRCB 2017) has identified as "protective" of Starry Flounder replicate flows during the period when abundance of this commercially important fish declined dramatically; this flow regime is unlikely to prevent further declines of Starry Flounder. Our analysis shows that the VAs are projected to increase the frequency of the Board's 2017 target flow by a tiny amount (Table 1; *see also* Draft Staff Report at Table 9.6-4 at 9-80). Increasing the potential for population growth by 4 years out of every 100 is very unlikely to restore the historic productivity of the Starry Flounder fishery. Furthermore, our analysis (Table 1) shows that the VAs will result in a decrease in the level of flows the Board previously identified as protective of Starry Flounder (SWRCB 2010). Board staff should re-analyze the frequency of flows necessary to support and protect Starry Flounder using the flow thresholds the Board identified in its 2010 Public Trust Flow Criteria report, as these remain the best available science on the topic.

g) Estuarine habitat

The Draft Staff Report indicates that the VAs will fail to improve estuarine habitat, including stimulation of the estuarine food web and repression of persistent harmful algal blooms, in most years. Much like the flow-productivity relationship for White Sturgeon and Green Sturgeon, stimulation of the food web in the estuary's pelagic zone does not occur below certain Delta outflow thresholds, which vary by season (Hennessy and Burris 2017a,b; Kimmerer et al. 2018). Thus, Delta outflows projected under the VAs in the spring of Wet years and in the summer and fall during all year types (Draft Staff Report Table 9.5-41 and 9.5-43 at 9-55) are not likely to improve the estuarine food web and the estuarine habitat it represents. The Draft Staff Report's analysis (Draft Staff Report at Table 9.6-4 at 9-80) and our analysis (Table 1) show that the frequency of flows associated with increasing zooplankton abundance in the estuary's pelagic waters will decrease or increase by negligible amounts (-1 to 2%) under the VAs. Moreover, reduction in summer and fall flows under the VAs relative to the 2008/2009 Biological Opinion strongly indicates that the VAs will exacerbate impairment of the estuarine food web, and the incidence of HABs in the Delta in those seasons (Draft Staff Report Table 9.5-43 at 9-55).

I. The Draft Staff Report Fails to Analyze Potential Adverse Environmental Impacts of Waiving Instream Flow Requirements in Future Drought Emergencies, under the VAs

The VA Alternative fails to update existing inadequate water quality standards, and fails to include any mechanisms for avoiding Temporary Urgency Change Orders, which have often been triggered by the inequitable distribution of responsibility for current standards. See our additional comments on TUCPs and TUC Orders above in Section H.3.

J. The VA Alternative Fails to Consider the Board's Legal Authority to Require Water Rights Holders to Invest in Habitat Restoration and Other Non-Flow Measures in a VA

As discussed with regard to the proposed project, the physical solution doctrine empowers the Board to require physical habitat restoration in order to promoting maximum beneficial use of the State's water resources. In D-1631, the Board applied the physical solution of compelling the appropriator to restore degraded streams and fisheries:

> In resolving disputes involving competing uses of water, California courts have frequently considered whether there is a "physical solution" available by which competing needs can best be served. (*Peabody v. Vallejo*, 2 Cal.2d 351, 383-384 [40 P.2d 4861 (1935); *City of Lodi v. East Bay Municipal Util. Dist.*, 7 Cal.2d 316 [60 P.2d 4391 (1936).) Adoption of a physical solution is consistent with the constitutional goal of promoting maximum beneficial use of the State's water resources.

SWRCB Decision 1631 at 10.

Indeed, the consideration of a physical solution approach is not limited solely to the VA but should be considered as part of the POI for a flow alternative-based approach. The Board does not have to rely solely on voluntary implementation for nonflow measures, and by doing so undermines their authority under the physical solution doctrine. Please see above for more detailed analysis.

K. The Draft Staff Report Fails to Adequately Analyze and Contextualize the Impacts of Completed Habitat Restoration in its evaluation of the VAs

The Draft Staff Report's analysis of the VA's habitat restoration proposal lacks critical context. The VAs propose to construct 22,203.65 acres of new spawning, instream rearing and floodplain habitat on upstream tributaries, and an additional 5,227.5 acres of tidal wetlands and floodplain habitat in the Delta (Draft Staff Report at 9-9, 9-10, 9-12.) The Draft Staff Report rightly points out that this represents a very small increase in available habitat compared to the status quo (Draft Staff Report Figure 9.6-1 at 9-74-75). Unfortunately, the Draft Staff Report fails to place the VA's restoration pledges in the context of the past 30 years of habitat restoration efforts.

For the last three decades, there have been ongoing programs to restore spawning, instream and floodplain habitat in the Bay-Delta ecosystem. For example, the expenditure of hundreds of millions of dollars from the CVPIA Restoration Fund has been significantly focused on salmon habitat restoration.[22] Additionally, the 2008-2009 CVP/SWP Biological Opinions required 8,000 acres of Bay-Delta intertidal and subtidal habitat.[23] The Draft Staff Report presents no analysis of the extent of habitat restoration in the Bay-Delta watershed over this period, or its results. Such an analysis would reveal extensive habitat restoration over the past three decades, and that these efforts have not led to the restoration of Bay-Delta native fish species or commercial, recreational, and subsistence fisheries. This raises additional questions about the effectiveness of

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[22] *See* Title 34, Central Valley Project Improvement Act (CVPIA) of Public Law 102-575 Section 3406 - Fish, Wildlife and Habitat Restoration; *see also* U.S. Department of the Interior Bureau of Reclamation Region 10 CVPCP/HRP projects database, available online: https://www.usbr.gov/mp/cvpcp/cvpcp_query.php. For a summary of recent habitat restoration projects, please also see U.S. Department of the Interior Bureau of Reclamation Region 10 CVP Habitat Restoration Fact Sheet, February 2022, available online: https://www.usbr.gov/mp/mpr-news/docs/factsheets/habitat-restoration.pdf.

[23] *See* California Department of Fish and Wildlife Fish Restoration Program Agreement (FRPA) website, available online: https://wildlife.ca.gov/Regions/3/FRPA.

the VAs' modest proposed restoration of habitat. The Draft Staff Report analysis gives no reason why the VA habitat-based approach would succeed, given that it has failed for 30 years without adequate flows.

It is also unclear how many of the VA's proposed restoration acres are already destined to be restored under other existing legal obligations. This further calls into question the actual benefits the VAs will provide the Bay-Delta estuary. It is more than likely that projects for which the VA takes credit will be completed under other programs, with other sources of funding, such as the CVPIA Habitat Restoration Program, the 2020 Central Valley Joint Venture (CVJV) Implementation Plan, DWR's Tidal Wetlands Enhancement Program and/or the Delta Stewardship Council's Delta Plan.[24]

Furthermore, the Draft Staff Report fails to analyze how long it would take to provide the habitat benefits proposed by the VAs. In the past, there have been significant delays in providing habitat restoration related to Bay-Delta regulatory requirements. One example is the long delay in completing habitat restoration requirement in the 2008 and 2009 NMFS and FWS Biological Opinions for the CVP and SWP Operating Criteria and Plan. In fact, realistic delays in achieving the full promised VA habitat restoration could extend beyond the eight-year life of the VA.

Without acknowledgment of these potential delays, the Draft Staff Report is missing critical analysis that is essential for a full evaluation of the proposed VAs. The potential delays in the VA proposal providing habitat benefits, in combination with the lack of adequate VA flow benefits, could easily mean continued devastation of the salmon fishing industry, extinction of CESA and ESA-listed species, and irreversible damage to the Bay-Delta estuary. Given the dire status of the ecosystem, such a delay in delivering benefits is unacceptable. In contrast, improved ecosystem flows could be implemented far more rapidly, and their environmental benefits could be achieved more rapidly and reliably. The Draft Staff Report must be revised and recirculated to include proper context of ongoing and completed habitat restoration and analyze the risks and impacts of lengthy delays in achieving future habitat restoration without an adequate flow regime.

L. The SED's Analysis of Changes in CVP/SWP Water Exports in the VAs is Flawed

The Board's analysis of the potential changes in CVP/SWP water exports and other diversions under the VA fails to analyze the very real potential that the modest proposed additional upstream environmental water releases would be diverted downstream. The VA does not include a detailed set of Delta environmental protections. Instead, the VA proposes to manage a block of

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[24] To be more specific, the 2020 CVJV Implementation Plan calls for an additional 500,337 acres of habitat area, 33,332 acres of that being riparian habitat, which is 6,000 acres more than the VA alternative in even the wettest years. The Plan is available online for reference: https://www.centralvalleyjointventure.org/assets/pdf/CVJV_2020_Implementation_Plan.pdf.

environmental water to improve Delta health. Therefore, the rules governing the management of that block of water are critical to determining whether or not that block of water would provide significant environmental benefits in the Delta.

One key question – among many regarding a VA accounting methodology – is whether environmental water released upstream would become Delta outflow, or whether it would be diverted by the CVP, SWP or other existing water projects. The VA proposal also does not include provisions to ensure that the proposed VA baseline flows are not diverted by existing water projects in the future. Further, the proposed VA does not include provisions to ensure that the baseline flows and the VA's "new environmental water" are not diverted by future water development projects, such as Sites Reservoir or the Delta Conveyance Project.

For example, Sites Reservoir's VA Analysis Tool (Attachment: 20230616B_Sites Historical WAA Tool&VA Analysis.xlsm) shows that the VA flows in some months are equal to proposed Sites Reservoir diversions. Sites Reservoir would nullify any Delta outflow benefit of the VA in these months, and the VA would simply maintain the status quo. Alternative 6A highlights the need to protect unregulated flows, but it does nothing to ensure that flow promised in the VA term sheet actually materialize. Provisions to prevent the diversion of environmental water could include, for example, Section 1707 protections for all new environmental water through the Delta.

Friant contribution: foregone exports of water from the Delta (released from Friant Dam under the San Joaquin River Restoration Program to meet settlement requirements) on behalf of Friant water users is included as a potential element of the VA. Whether restoration water can be recaptured in the Delta is uncertain given that the environmental documentation for the proposed recapture has not yet been completed and that Delta recapture may be inconsistent with paragraph 16(a)1 of the San Joaquin River Restoration Settlement Agreement and with Plan updates as discussed in these comments. Furthermore, even assuming Friant's contribution were to be counted as part of the VA, it cannot be counted as fulfilling any obligation Friant water users have to comply with state or federal law but as a voluntary contribution to the VA parties (and this interpretation is consistent with the view of the Friant Water Authority as we understand it). The restoration flows in the settlement were never intended to represent compliance with the Bay-Delta Plan, the Board has not previously considered flow contributions from the San Joaquin River above its confluence with the Merced, and it would need to evaluate a reasonable range of alternatives in order to do so Finally, nothing in a Plan update involving the VA can or should limit the ability to fully implement the San Joaquin River Restoration Program, to modify flows commencing in 2026 under paragraph 20 of the settlement, or otherwise limit or change settlement obligations or preempt federal law (again, this statement is consistent with Friant 's view).

M. The Draft Staff Report Fails to Adequately Consider the Feasibility of Reasonably Protecting Fish and Wildlife Beneficial Uses and Related Other Beneficial Uses Because it Fails to Adequately Consider Improvements in Water Use Efficiency and Alternative Water Supplies in the VAs

The Draft Staff Report's analysis of the VA suffers from the same flaws in methodology as the proposed project with respect to water efficiency and alternative water supplies. See comments above in Part II.

N. Potential for Abuse of Public Funds for the VAs

The Draft Staff Report does not reveal how much of the public funds proposed by the VAs would be directed to VA participants. The VA term sheet suggests that hundreds of millions in public funds would be used to pay for water purchases from senior agricultural contractors (but not urban users). Most or all of the recipients of public funding would likely be VA signatory agencies or water users who are represented by VA signatories.

The concern that an ineffective environmental block of water could be used to enrich some of the architects of the VA is not theoretical. This problem was seen a decade and a half ago in the CALFED Environmental Water Account (EWA). The EWA proved to be a failure as a tool to protect the Delta environment. However, it did enrich State Water Project agricultural contractors. Those contractors received SWP water at a highly discounted price and then sold that water back to CDWR at highly inflated prices through the EWA (Contra Costa Times 2009). It is worth noting that these SWP contractors are now VA participants.

Given the clear evidence that the VA package would not produce adequate environmental benefits, this proposed use of hundreds of millions in public funds raises significant concerns, heightened by the closed nature of the VA negotiations – which have excluded all of the parties who are directly affected by the decline in ecosystem health. The Board should analyze and disclose how much public funding would go to VA participants.

O. Epilogue

As a recent study of the Voluntary Agreements finds, "In sum, leading with VAs as a solution for balancing human and environmental needs for water in the Bay-Delta watershed—rather than first, or simultaneously, pursuing a regulatory pathway to achieve key biological goals—is a perilous strategy that risks continued environmental degradation and legal noncompliance" (CLEE 2024 at 7).

IV. CONCLUSION

For the foregoing reasons, the Draft Staff Report, the proposed project, and the Voluntary Agreements, fail to meet the requirements applicable to them under state and federal law. The Board should reject these inadequate proposals and ensure that appropriate fish and wildlife and other beneficial uses are identified and their attainment defined, that science-based water quality objectives are set to reasonably protect all of those uses, and that a Program of Implementation containing sufficient information and requirements be prepared to ensure that water quality objectives are met.

Specifically, in order to describe how it will reasonably protect fish and wildlife and other beneficial uses and achieve Bay-Delta Plan objectives, the Board must revise and recirculate the Draft Staff Report to include:

1) a scientifically sound and enforceable Program of Implementation,
2) definitions of key terms in the narrative objectives such as viability,
3) numeric thresholds, targets and biocriteria consistent with the best available science,
4) adequate analysis of the effects of alternatives on fish and wildlife beneficial uses
5) a proposed project that requires nonflow measures, including alternative water supplies and habitat restoration actions
6) SacWam analysis that adheres to CVPIA and other legal requirements,
7) a stable project description,
8) the impacts of climate change,
9) protections for all fish species that are in catastrophic decline, and
10) all other components required to meet legal obligations under CEQA, the Porter-Cologne Act, the Clean Water Act, the public trust doctrine, Fish and Game Code section 5937 and the Delta Protection Act.

Finally, the Board must revise and recirculate the Draft Staff Report without the legally and scientifically inadequate VA Alternative.

Thank you for considering these comments. We look forward to working with you to remedy the deficiencies of the Draft Staff Report and proceed expeditiously toward the adoption of Bay-Delta Plan updates that protect and restore the Bay-Delta estuary's waters.

Sincerely,

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