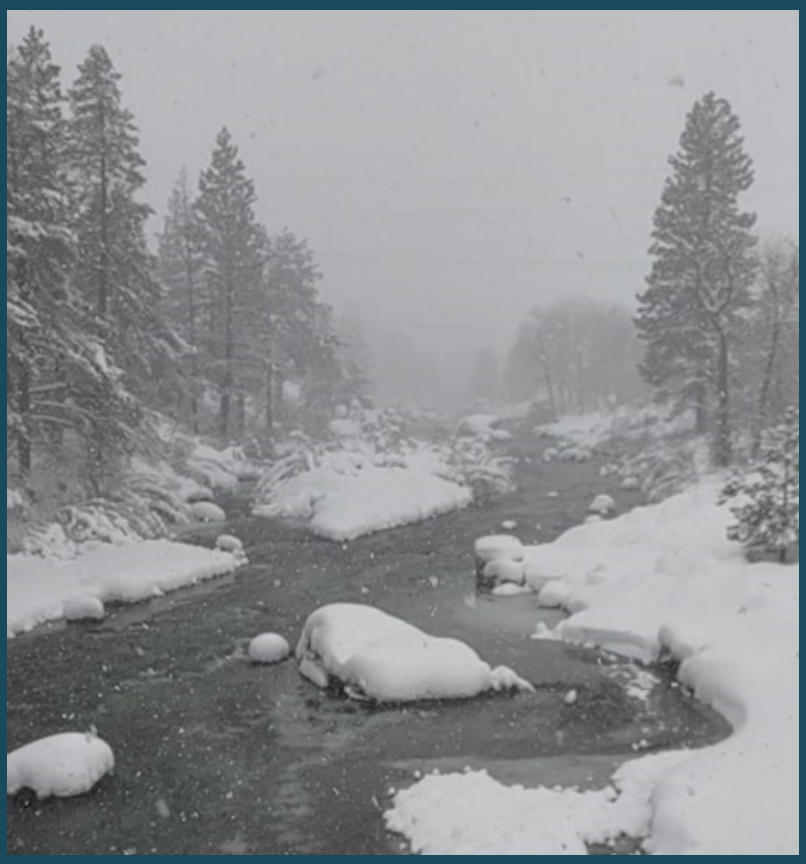
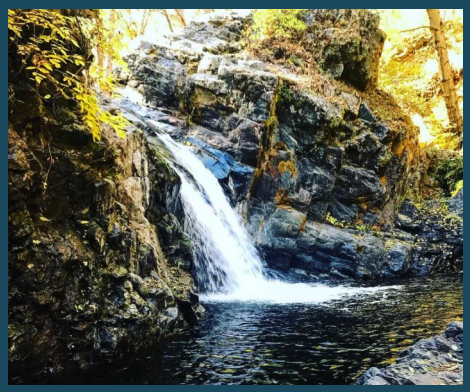


2022 Year in Review

The California Department of Fish & Wildlife

INSTREAM FLOW PROGRAM



2022 Year in Review

The California Department of Fish and Wildlife (Department) Instream Flow Program (IFP) conducts instream flow studies and develops ecological flow criteria needed for long-term protection, maintenance, and effective stewardship of fish and wildlife resources.

Table of Contents

Figure 1. The five riverine components (from Annear 2004).

All photographs in this report are owned by the Department or Department staff.
Cover page (clockwise from top left): Lake Eleanor in Trinity County, Truckee River in Nevada County, Shackleford Creek in Siskiyou County, and Big Springs Creek in Siskiyou County.

Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarrestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jobsis, J. Kauffman, J. Marshall, K. Mayes, G. Smith, R. Wentworth and C. Stalnaker (2004). Instream flows for riverine resource stewardship. Revised edition. Instream Flow Council, Cheyenne, WY.

Fieldwork Activities

Fieldwork activities, including developing site-specific analyses and models, are an important and necessary component of an instream flow study for identifying flows to protect fish and wildlife. All non-essential field work activities were postponed to help slow the spread of COVID-19 during the statewide emergency.

In 2022, the IFP resumed field work activities and continued to make progress on conducting instream flow analyses and studies towards the Public Resources Code (PRC) § 10001 and the California Water Action Plan (CWAP) priority streams. The IFP held several public meetings outlining the CWAP instream flow reports and their findings. Moving into 2023, the IFP looks forward to resuming field work activities on priority streams.

Truckee River, Nevada County

Priority Streams Update

In order to protect public trust resources and fulfill legislative mandates put forward in the CWAP and PRC § 10000–10005, the IFP develops flow criteria for use in water management planning and decision-making processes.

In 2022, the IFP continued studies that will provide flow criteria to support fish, wildlife, and water management goals for streams and rivers throughout California.

For more information on CWAP and PRC priority streams, visit the IFP website at: https://wildlife.ca.gov/Conservation/Watersheds/Instream-Flow.

PRC Streams

Due to the Department's response to COVID- 19, any previously scheduled fieldwork was postponed. Watershed Criteria Report development is underway for the following watersheds:

- Carpinteria Creek
- Dos Pueblos Creek
- Mattole River
- Mojave River
- Navarro River
- San Gregorio Creek
- Santa Ana River
- Santa Margarita River

CWAP Streams

Data collection is complete, and reports are complete for the following watersheds:

- Mark West Creek
- South Fork Eel River (Redwood Creek)
- Ventura River

See Figure 2 for a map of priority streams.

Silver King Creek, Mono County

Figure 2. PRC and CWAP priority stream watersheds map.

South Fork Eel River Watershed

Redwood Creek Technical Report

Located in southern Humboldt County, Redwood Creek flows through stands of redwood forest into the South Fork Eel River. Redwood Creek provides critical habitat for Coho Salmon, Chinook Salmon, and steelhead to spawn and rear annually. While the South Fork Eel River watershed is one of the largest producers of wild salmonids in the state (CDFW 2014), all three species native to this system have undergone major declines in their populations from historical numbers. In addition, the CWAP identified the South Fork Eel River as a priority stream to enhance flows and protect anadromous salmonids. The Department determined that Redwood Creek was a tributary of significant value for salmonid recovery within the South Fork Eel River watershed and launched a data-intensive technical study to determine flows needed to protect salmonid habitat.

The Redwood Creek technical study aimed to:

- ⇒ Produce one-dimensional models using field-collected data and modeling programs.
- ⇒ Combine data on river hydraulics, species and life-stage specific habitat preference, and physical habitat modeling.
- ⇒ Determine instream flow needs for rearing anadromous salmonids and long-term stream ecosystem health.

This past year, Redwood Creek data analyses and reporting were completed by the IFP and regional staff which culminated in the online release of the technical report *Instream Flow Evaluation: Juvenile Steelhead and Coho Salmon Rearing in Redwood Creek, Humboldt County*. To accompany the release of this report and the South Fork Eel River Watershed-Wide Instream Flow Criteria report, an online public meeting took place on June 28, 2022, where IFP staff provided an overview of the technical study and results to members of the public. The IFP encourages readers to delve further into the details by reading the technical report available online: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=202536&inline.

The Redwood Creek technical report was completed with essential contributions and support from the Department's Northern Region 1, Law Enforcement Division, Conservation Engineering Branch, and Fisheries Branch. The IFP would also like to express gratitude to the landowners for sharing their access to the stream during the study.

South Fork Eel River Watershed Criteria Report

In June, the *Watershed-Wide Instream Flow Criteria for the South Fork Eel River* report (Watershed Criteria Report) was presented at a public meeting and made publicly available on the Instream Flow Program's website (CDFW 2021). The Watershed Criteria Report provides instream flow information for the watershed using a combination of desktop analyses and field-based methods.

As part of this report, 55 reaches were assessed, and 13 site-specific field surveys were conducted. Flow criteria were then developed for three reaches: (1) the mainstem South Fork Eel River near the town of Miranda (Figure 3), (2) Salmon Creek, and (3) Tenmile Creek. Criteria provide a set of flow values that may be used to develop a flow regime and can be used as a tool for consideration in water management planning.

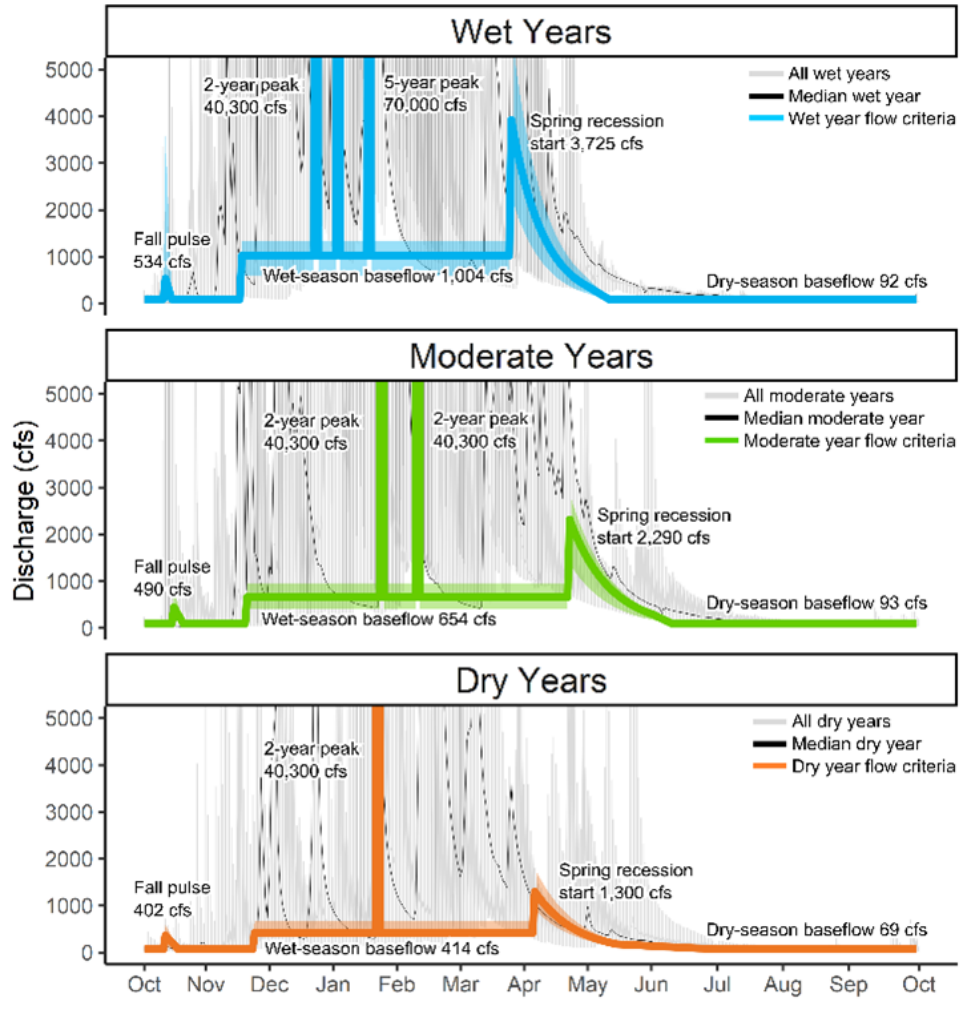


Figure 3. Example flow regimes presented in the Watershed Criteria Report for the South Fork Eel River at Miranda. Example flow regimes are provided for three water year types (i.e., wet, moderate, and dry).

References:

CDFW (2014). South Fork Eel River watershed assessment. California Department of Fish and Wildlife, Northern Region, Coastal Watershed Planning and Assessment Program, Fortuna Field Office (CDFW), Fortuna, CA. Available: https://www.calfish.org/ProgramsData/HabitatandBarriers/CoastalWatershedAssessments-NorthCoast.aspx.

CDFW (2021). Watershed-wide instream flow criteria for the South Fork Eel River. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Watershed Criteria Report 2021-02.

Mark West Creek Watershed

A priority stream under the CWAP, Mark West Creek provides important habitat for a variety of aquatic species, including federally listed Central California Coast Coho Salmon and steelhead. The IFP conducted two studies in the Mark West Creek watershed to evaluate the relationship between streamflow and aquatic habitat: a multi-year, site-specific study focused on juvenile salmonid rearing habitat in upper Mark West Creek and a watershed-wide criteria report that covered Mark West Creek, the Laguna de Santa Rosa watershed, and main tributaries.

With two total stations in the field, IFP staff collected almost 18,000 topographic survey points across the three study sites in order to develop the digital terrain models used in the analyses.

The technical report for the site-specific upper Mark West Creek study, *Instream flow evaluation: Juvenile rearing of steelhead and Coho Salmon in upper Mark West Creek, Sonoma County* (Carlin et al. 2022), was released in August 2022 following an online public presentation to interested parties. The public presentation covered both the site-specific technical report and the watershed criteria report.

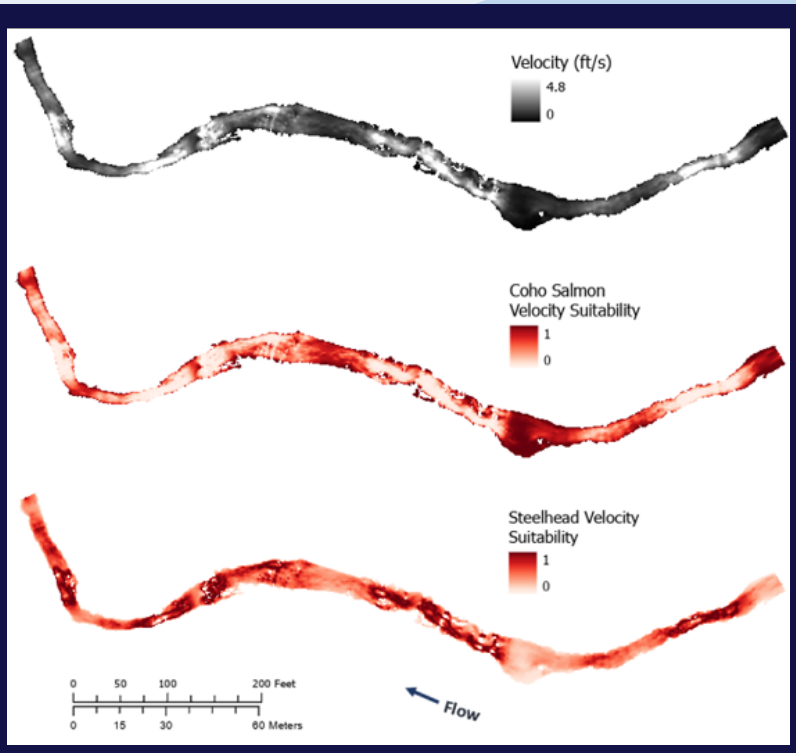


Figure 4. Example of 2D model velocity output and corresponding velocity suitability maps for Coho Salmon and steelhead at a simulation flow of 10 cubic feet per second.

The site-specific study assessed three reaches of upper Mark West Creek above the 2017 Tubbs Fire burn area. A digital terrain model and two-dimensional (2D) habitat model were developed for one representative study site within each of the three reaches to estimate how hydraulic habitat parameters (i.e., depth and velocity) would vary at different streamflow magnitudes. These 2D simulation outputs were then analyzed in the context of juvenile Coho Salmon and steelhead habitat preferences (Gephart et al. 2020) to identify suitable rearing habitat (Figure 4).

The IFP would like to express gratitude to the landowners for sharing their access to the stream during the study.

The watershed criteria report, *Watershed-wide instream flow criteria for Mark West Creek* (CDFW 2022), was released in June 2022 and presents watershed-wide instream flow criteria based on desktop data analyses and field-based surveys. The report focuses on a hydrology assessment of functional flows and development of flow criteria to support broad ecosystem functions within Mark West Creek, Santa Rosa Creek, the Laguna de Santa Rosa, and important tributaries to those streams. For more information on the studies and to view the reports, please visit: https://wildlife.ca.gov/Conservation/Watersheds/Instream-Flow/Studies/Mark-West-Creek-Study.

References:

Carlin, T., W. Cowan, B. Stanford, J. Allen and N. Gephart (2022). Instream flow evaluation: Juvenile rearing of steelhead and Coho Salmon in upper Mark West Creek, Sonoma County. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Stream evaluation report 2022-01.

CDFW (2022). Watershed-wide instream flow criteria for Mark West Creek. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Watershed criteria report 2022-01.

Gephart, N., H. Casares, D. Haas, J. Hwan and R. Holmes (2020). Habitat suitability criteria for juvenile salmonids in the South Fork Eel River watershed, Mendocino and Humboldt counties. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Stream evaluation report 2020-01.

Mark West Creek, Sonoma County

Cannabis Program Support

In 2022, the IFP continued its role participating in the development of the California Environmental Monitoring and Assessment Framework (CEMAF). The framework is a collaborative effort between Department Cannabis Program staff in Fisheries, Water, and Wildlife branches with the goal of assessing the direct and indirect effects of cannabis cultivation and other ecological drivers on terrestrial and aquatic species and their habitats in California.

Moving into 2023, the IFP will broaden its role by providing policy coordination and technical expertise during the development of the State Water Resources Control Board's Regional Cannabis Instream Flow Policy. Additionally, the IFP will continue to provide technical support for regional Cannabis Program staff as it relates to streamflow enhancement and Water Rights applications, petitions, and permitting.

The CEMAF has five objectives focused on understanding several key ecological components in different geographic areas of the state:

1. Habitat: Understand how aquatic, riparian, and terrestrial habitats are influenced by cannabis cultivation and other ecological drivers, and assess how these effects vary spatially, temporally, and in relation to site attributes.
2. Community: Understand how cannabis cultivation and other ecological drivers influence community composition and structure.
3. Species: Understand the relationship between presence or abundance of regionally relevant species and cannabis cultivation or other ecological drivers.
4. Hydrology: Understand how the timing and duration of biologically relevant instream flow and water quality parameters are affected by water diversions for cannabis cultivation and other land uses.
5. Cumulative Effects: Understand the degree to which cumulative effects are causing significant adverse impacts in specific drainage areas.

For more information on the Department's Cannabis Program, visit: https://wildlife.ca.gov/Conservation/Cannabis/Environment.

Assessment of Native Fish Sensitivity to Changes in Baseflows

The lack of a comprehensive stream gage network and limitations of existing hydrologic models reduces understanding of changing baseflow conditions across the state and their impact on native fish species. In 2020, the IFP, in partnership with staff from Fisheries Branch, implemented a contract with the University of California, Davis and the University of California, Berkeley to assess the resiliency of native fish in California to changes in wet- and dry-season baseflows. This work builds on the California Environmental Flows Framework (CEFF) and its associated tools that model functional flow conditions across the state.

The primary goals of this study are to:

⇒ Improve and refine statewide hydrologic models that predict wet- and dry-season baseflows.

⇒ Assess the sensitivity of native fish species to alterations in baseflow conditions.

The outcomes of this study will support the implementation of the CEFF and will advance efforts to better manage stream flows for native fish recovery. Additionally, the information generated by this effort will aid in the Department's understanding of effects of climate change and other streamflow alteration on California's native fish species and will help inform future fish and streamflow management efforts. The final study will be completed in 2023. Using data derived from various Department datasets, 29 unique water bodies and 74 sampling locations are represented as part of this dataset (Figure 5). Several sites include more than 30 years of fisheries monitoring data.

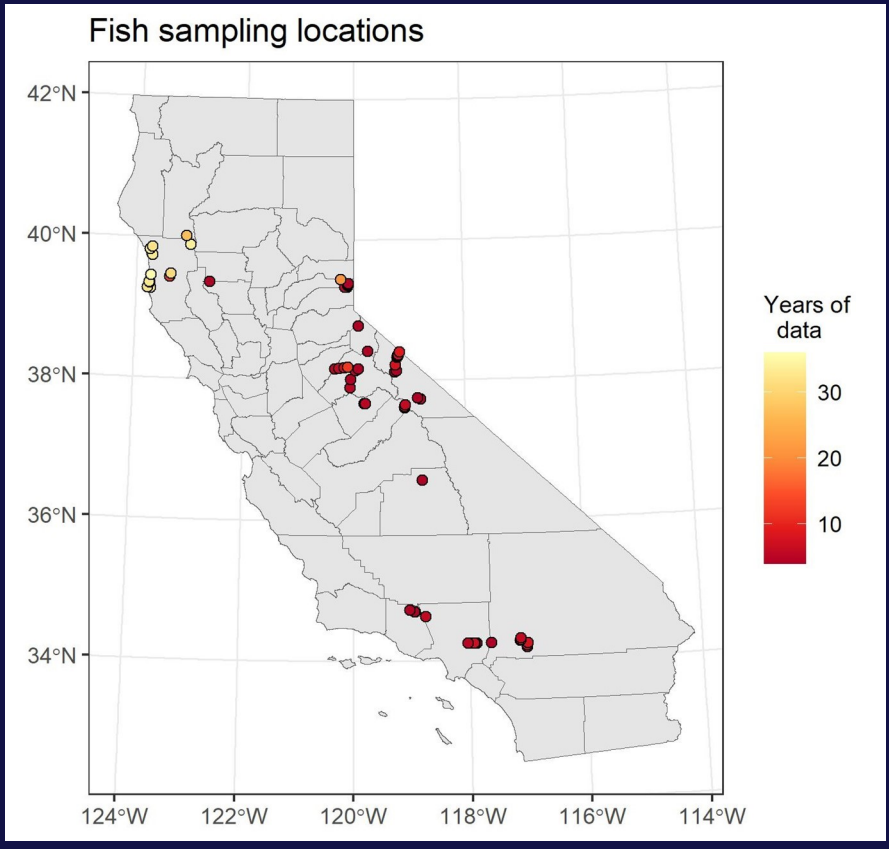


Figure 5. Sites included in the assessment of native fish species sensitivities to alterations in baseflow.

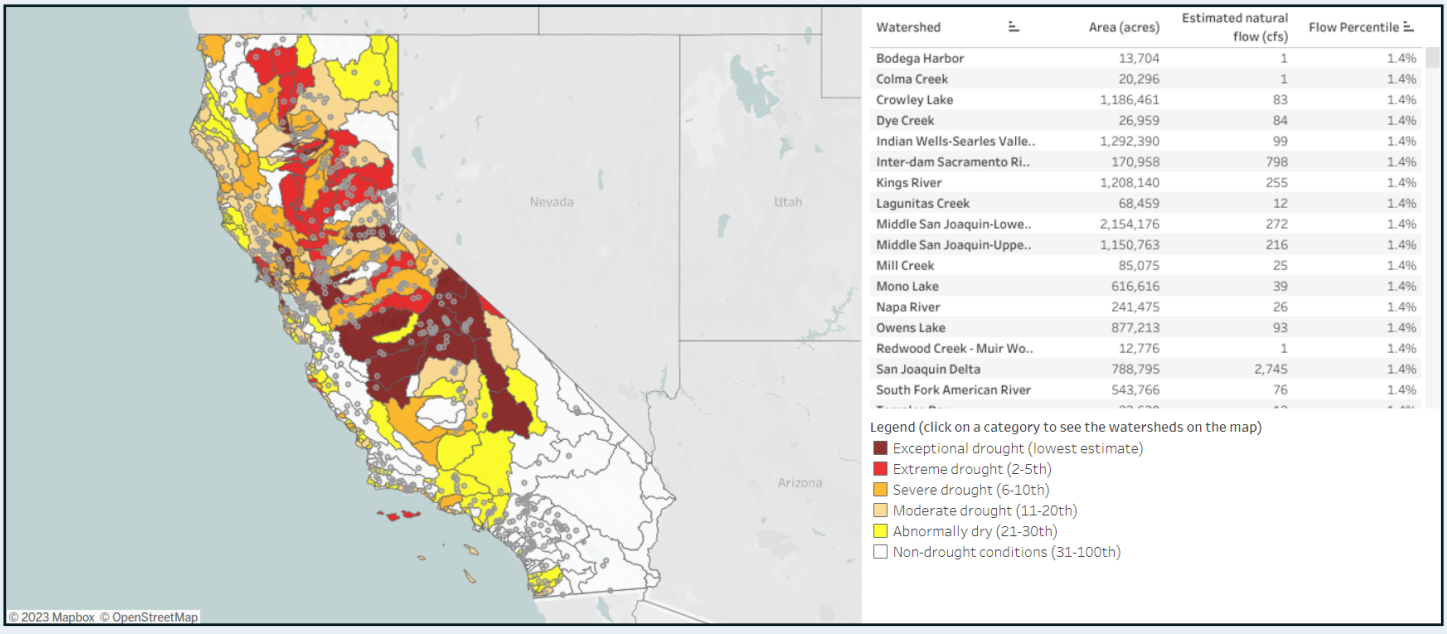
Drought Action

The statewide drought persisted in water year 2022 and into 2023. In response, IFP staff are continuing to support the Department's regional staff by conducting hydrologic analyses and providing flow information to inform drought related water management decisions. Staff in IFP are using existing datasets and hydrologic tools, including ranges of unimpaired natural and functional flows during dry months and years to evaluate flows (CEFWG 2021; Zimmerman et al. 2022). These datasets and tools are being compared with current hydrologic conditions to assess drought impacts on streamflow.

The Drought Flows Monitor Tool is a spatial dataset and online mapping tool that shows locations where modeled natural streamflow conditions are drier than past conditions (Figure 6). This tool is updated monthly with the preceding month's modeled natural flows. The online mapping tool allows users to explore drought conditions at the watershed scale.

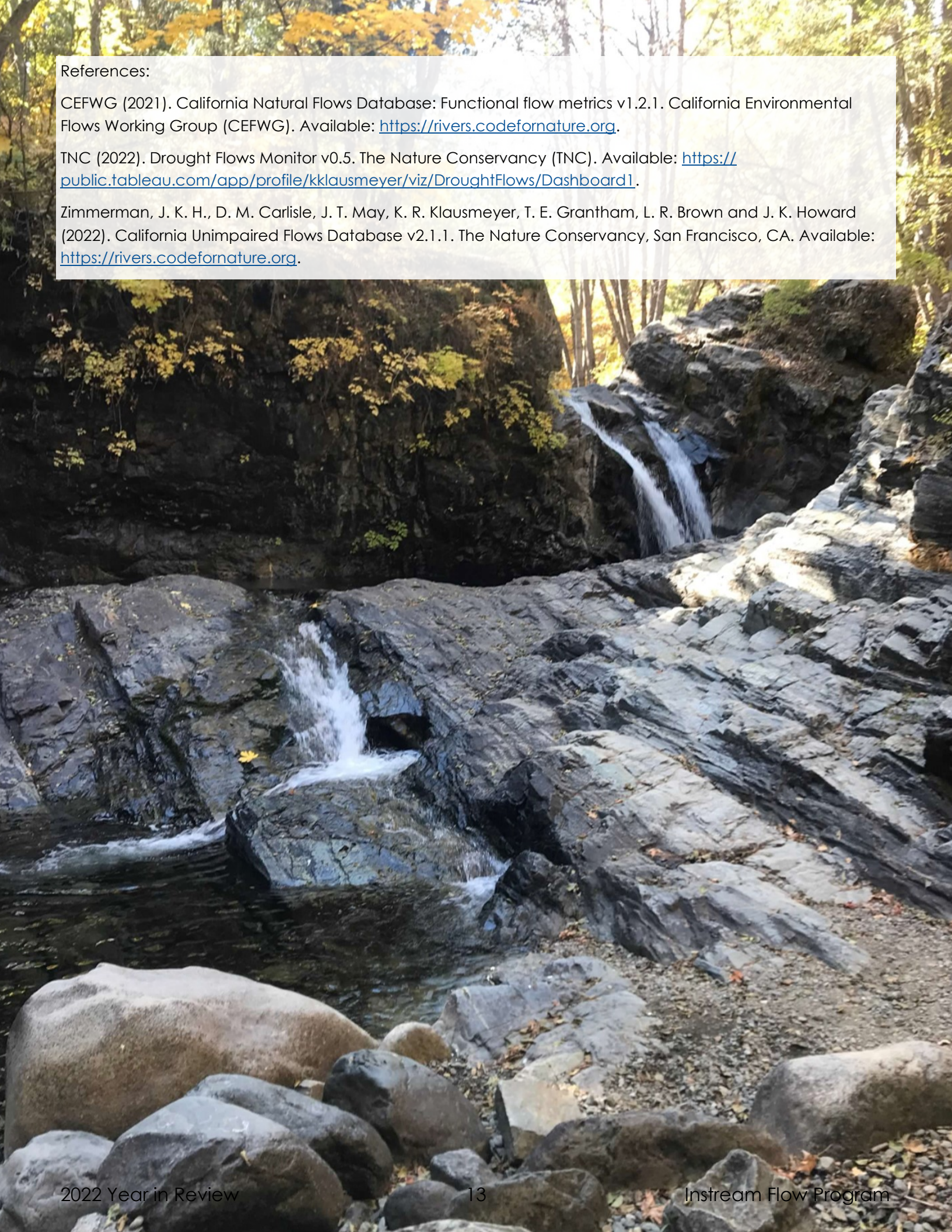
Staff in IFP are also providing additional drought-related support as needed. Staff have provided technical review on drought-related grant applications and potential drought projects. Additionally, IFP staff have been involved with the development of The Nature Conservancy's Drought Flows Monitor Tool by providing technical input on tool methods and results (TNC 2022).

As drought conditions persist and recur, IFP staff will continue to assist Department regional staff with technical support on hydrology and flows as well as provide additional drought support as needed.



Watershed	Area (acres)	Estimated natural flow (cfs)	Flow Percentile
Bodega Harbor	13,704	1	1.4%
Colma Creek	20,296	1	1.4%
Crowley Lake	1,186,461	83	1.4%
Dye Creek	26,959	84	1.4%
Indian Wells-Searles Valle..	1,292,390	99	1.4%
Inter-dam Sacramento Ri..	170,958	798	1.4%
Kings River	1,208,140	255	1.4%
Lagunitas Creek	68,459	12	1.4%
Middle San Joaquin-Lowe..	2,154,176	272	1.4%
Middle San Joaquin-Uppe..	1,150,763	216	1.4%
Mill Creek	85,075	25	1.4%
Mono Lake	616,616	39	1.4%
Napa River	241,475	26	1.4%
Owens Lake	877,213	93	1.4%
Redwood Creek - Muir Wo..	12,776	1	1.4%
San Joaquin Delta	788,795	2,745	1.4%
South Fork American River	543,766	76	1.4%

Figure 6. The Nature Conservancy's Drought Flows Monitor Tool online mapping interface.



References:

CEFWG (2021). California Natural Flows Database: Functional flow metrics v1.2.1. California Environmental Flows Working Group (CEFWG). Available: https://rivers.codefornature.org.

TNC (2022). Drought Flows Monitor v0.5. The Nature Conservancy (TNC). Available: https://public.tableau.com/app/profile/kklausmeyer/viz/DroughtFlows/Dashboard1.

Zimmerman, J. K. H., D. M. Carlisle, J. T. May, K. R. Klausmeyer, T. E. Grantham, L. R. Brown and J. K. Howard (2022). California Unimpaired Flows Database v2.1.1. The Nature Conservancy, San Francisco, CA. Available: https://rivers.codefornature.org.

Quality Assurance and Training

Quality Assurance and Quality Control

In 2022, the IFP developed internal program-wide Quality Assurance and Quality Control Guidelines as part of efforts to uphold best practices in quality assurance and streamline related processes. The guidelines support the IFP's collection of transparent, accountable, and scientifically defensible data. This document presents guidelines for verifying data collected in the field, entered into electronic workbooks, analyzed in the office, and presented in reports. Roles and responsibilities, calibration and validation, data management, data retention, and a QA/QC log template are also included. This document was reviewed by the Marine Pollution Studies Laboratory (MPSL) QA Team.

A Quality Assurance Program Plan (QAPrP) is also under development with the MPSL QA Team. The QAPrP will provide comprehensive documentation of the IFP QA system associated with project management, data generation and acquisition, assessment and oversight, and data validation and usability. The QAPrP follows the scope and format used by the US Environmental Protection Agency, promoting comparability with other agencies using QAPrPs and wider application than internal documentation, and improving defensibility.

Additionally, the IFP completed numerous data management plans (DMPs) in 2022 to meet the Department's Scientific Data Governance Policy, which requires the Department to manage scientific data internally. A data management plan is a brief document that describes the data process with how the data are managed, described, and stored. Quality assurance and quality control processes or other standards are briefly described as well. The IFP generated 18 data management plans for the various projects completed across the program's legacy. The data and metadata for each of these projects was inventoried, centralized, and secured on the Department Scientific Data Governance Policy SharePoint. Each of these DMPs are critical for the Department to comply with Assembly Bill 1755.

California Environmental Flows Framework and Functional Flows Trainings

In January and February 2022, the IFP led virtual training sessions for Department staff on the functional flows approach, the California Environmental Flows Framework (CEFF), and associated tools. Trainings were customized for each region and included water rights, fisheries, Federal Energy Regulatory Commission (FERC), and Habitat Conservation Program staff. The training provided an in-depth look at the functional flows approach and the five functional flow components, an overview of the CEFF and associated tools, and example applications of the CEFF and functional flows tools. The virtual trainings also involved an interactive component with breakout rooms and a group activity.

Presentations and Publications

Carlin, T. Evaluation of streamflow and juvenile steelhead and Coho Salmon rearing habitat in upper Mark West Creek, Sonoma County, California. Virtual presentation at the California Department of Fish and Wildlife Science Symposium. March 2022.

Carlin, T., Cowan, B., Drescher, B., Haas, D., Milward, A. The Mark West Creek watershed technical and criteria reports. Virtual presentation during the online public meeting for the South Fork Eel River watershed. August 25, 2022.

Carlin, T., W. Cowan, B. Stanford, J. Allen, and N. Gephart (2022). Instream flow evaluation: Juvenile rearing of steelhead and Coho Salmon in upper Mark West Creek, Sonoma County. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Stream evaluation report 2022-01.

Casares, H., Drescher, B., Haas, D., and Obester, A. The South Fork Eel River watershed technical and criteria reports. Virtual presentation during the online South Fork Eel River watershed public meeting. June 28, 2022.

CDFW (2022). Watershed-wide instream flow criteria for Mark West Creek. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Watershed Criteria Report No. 2022–01.

CDFW (2021). Watershed-wide instream flow criteria for the South Fork Eel River. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Watershed Criteria Report No. 2021–02.[1]

CDFW (2021). Watershed-wide instream flow criteria for the West Fork San Gabriel River. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Watershed Criteria Report No. 2021–01.[1]

Cowan, W. (2021). Hydraulic model calibration report for instream flow evaluation: Juvenile steelhead and Coho Salmon rearing in Redwood Creek, Humboldt County. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Stream evaluation report 2021-03.[1]

Maher, M., H. Casares, P. Uttley, B. Stanford, W. Cowan, and D. Haas (2021). Instream flow evaluation: Juvenile steelhead and Coho Salmon rearing in Redwood Creek, Humboldt County. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Stream evaluation report 2021–04.[1]

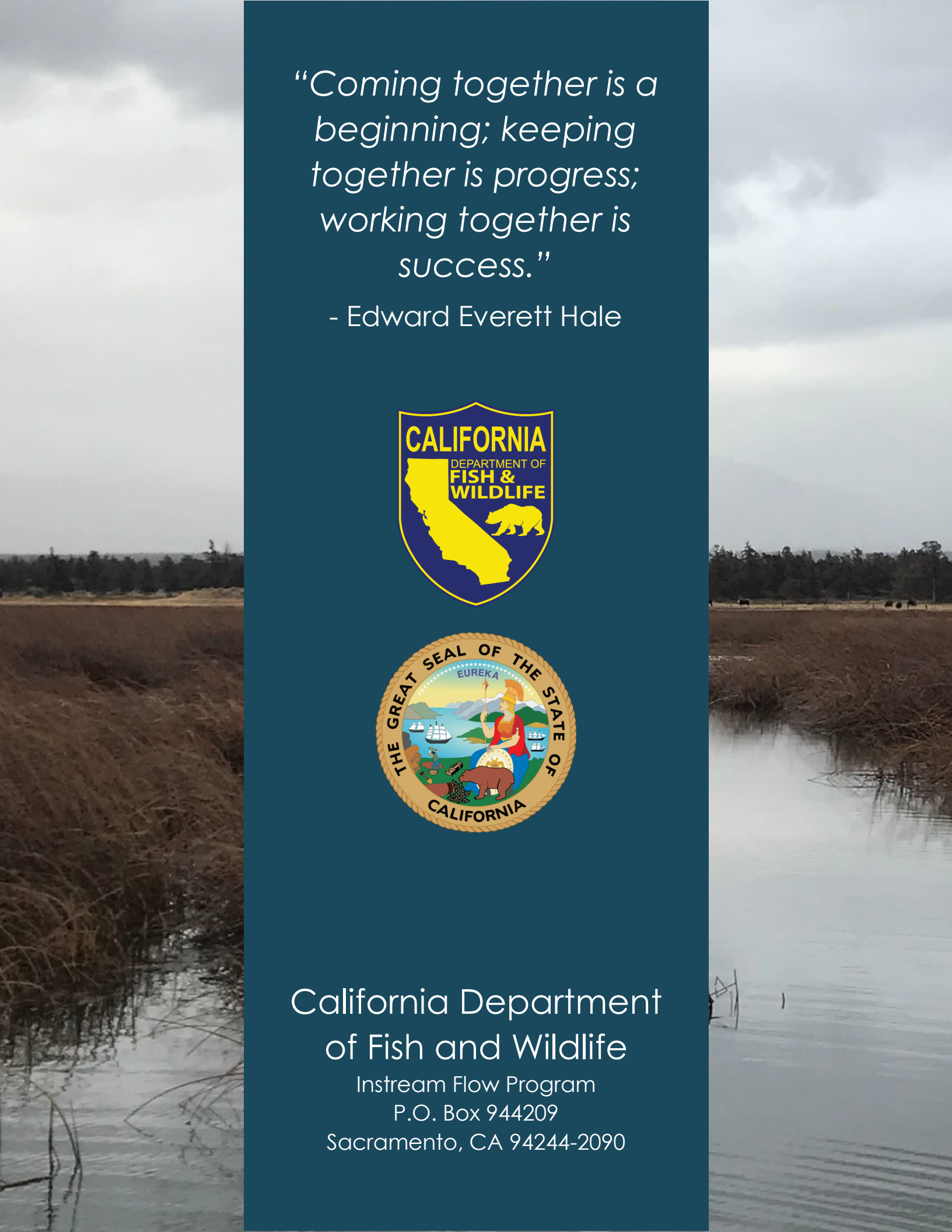
[1] These publications were completed in 2021 and released in 2022.

2023 Performance Objectives

Instream Flow Program activities in 2023 will focus on completing studies already underway, continuing efforts to develop watershed-scale flow criteria for priority streams and providing regional support in the face of climate uncertainty. Continued coordination with regional staff, stakeholders, and other project collaborators will be critical to completing ongoing projects.

- ⇒ Continue IFP activities for the CWAP and PRC § 10000–10005 priority stream studies.
- ⇒ Conduct instream flow analyses to protect and enhance public trust values consistent with the California Water Resilience Portfolio.
- ⇒ Perform instream flow assessments to support watersheds impacted by cannabis through the California Environmental Monitoring and Assessment Framework (CEMAF) pilot study.
- ⇒ Provide hydrological and flow-related technical support to regional staff during drought and climate uncertainty.
- ⇒ Continue to participate in the California Environmental Flows Framework (CEFF) workgroup and partnership to further refine available instream flow tools and application of the CEFF statewide.
- ⇒ Maintain quality assurance activities, document generation, and training in support of consistent, comparable, and defensible flow studies and information development.
- ⇒ Continue coordination and outreach efforts with the State Water Resources Control Board, National Marine Fisheries Service, US Fish and Wildlife Service, the Regional Water Quality Control Board, and other agencies.
- ⇒ Support public and stakeholder engagement by continuing outreach efforts.
- ⇒ Participate in and present instream flow study findings at meetings and workshops across the state.

Navarro River, Mendocino County



"Coming together is a beginning; keeping together is progress; working together is success."

- Edward Everett Hale

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