



MARU STREAM BIOASSESSMENT: 2025 ANNUAL REPORT



Photo: Arroyo Trabuco Creek Sampled in 2025 (Post-fire)

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CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

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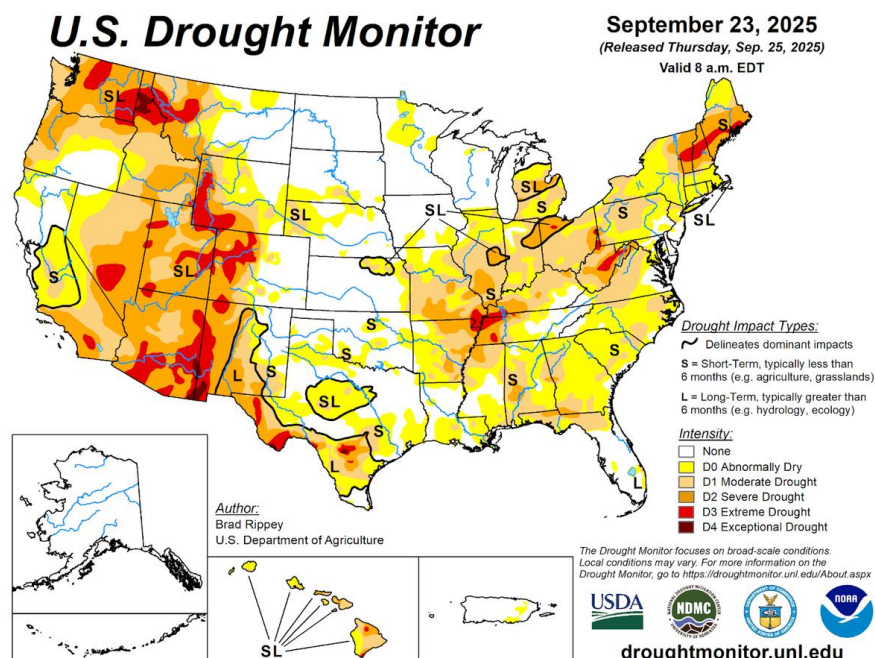
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1. Introduction

This technical report was produced by the California Water Quality Control Board San Diego Region's (San Diego Water Board) Monitoring, Assessment and Research Unit (MARU). The MARU supports San Diego Water Board regulatory and non-regulatory programs by conducting water quality monitoring and data assessment, as well as by guiding and/or conducting scientific research to better protect and restore beneficial uses of the San Diego Region's (Region 9) waters. MARU regularly conducts stream bioassessment at up to 20 stream sites on an annual basis. In some years, the California Department of Fish and Wildlife (CDFW) conducts bioassessments in Region 9 under the statewide [reference condition management program](#) (RCMP). Occasionally, bioassessments are also done in Region 9 as part of the United State Environmental Protection Agency (USEPA) [National Rivers and Streams Assessment](#) (NRSA). Whenever possible, the San Diego Water Board supports the bioassessment efforts of external partners.

This report summarizes 20 bioassessments conducted in 2025 – 16 by MARU, three by CDFW, and one by Trout Unlimited. This report also includes a summary of environmental DNA (eDNA) sampling done by MARU in 2025, most of which was done in conjunction with bioassessment. 2025 represented a return to low precipitation drought conditions, with the San Diego Region classified in severe (D2) or extreme (D3) drought by the end of summer ([Figure 1](#)). Multiple sites MARU targeted for sampling were unable to be bioassessed due to a lack of flow or flows too low to meet sampling requirements.

Figure 1. September 2025 Drought Status for the United States.



2. Bioassessment Background and Purpose

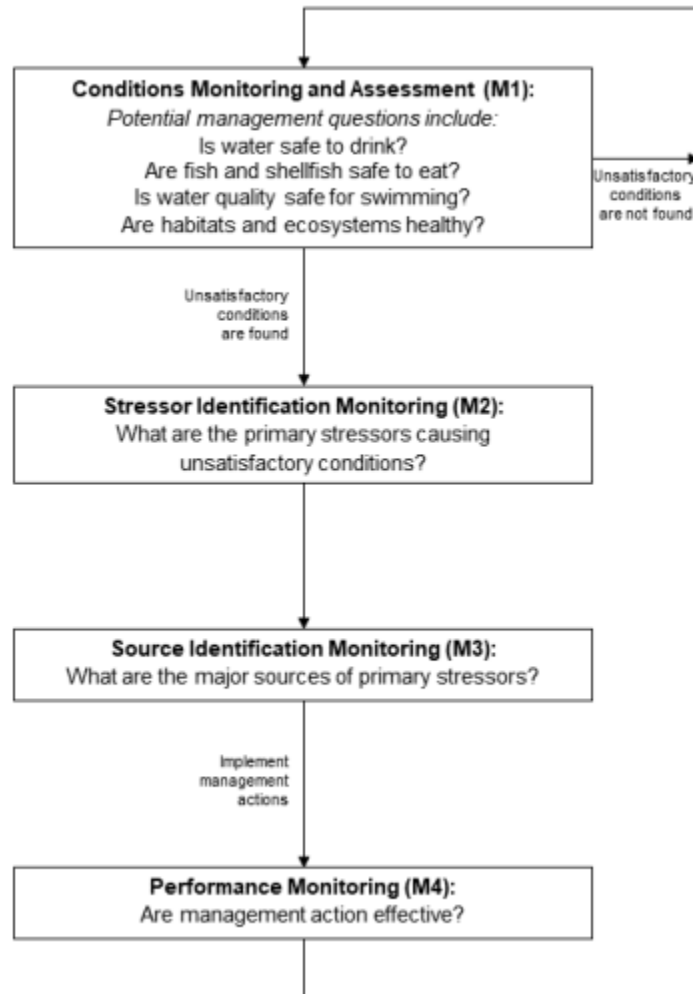
Biological assessment, or bioassessment, is the science of evaluating the health or integrity of an ecosystem by assessing the organisms that live within it. Bioassessment allows for the San Diego Water Board to better protect and restore waters by facilitating a broader evaluation of the cumulative effects of stressors beyond analyzing for individual chemicals. The use of bioassessment is central to the Clean Water Act (CWA), as the CWA goal is to protect and restore the biological integrity of waters (33 U.S. Code § 1251). In addition, the Porter-Cologne Act also relies on the use of bioassessment to protect water quality, which is defined to include chemical, physical, biological, bacteriological, and radiological properties (CWC section 13050).

Unlike traditional chemistry-based monitoring, which provides only limited information about a relatively narrow portion of the environment at a discrete point in time, bioassessment can account for living organisms exposed to multiple chemicals and other stressors such as altered habitats and changes in water-flow patterns over extended time periods. Bioassessment therefore provides a far more integrated view of the condition of an aquatic ecosystem. Bioassessment is also more closely tied to an environmental manager's end-goal focus on ecosystem protection and serves as an important way to monitor and protect populations of endangered species and fisheries. Biological assessment is a critical component of implementation of the San Diego Water Board's [monitoring and assessment framework](#) ("Monitoring Framework", [Figure 2](#)).

Biological assessment can and should be used to conduct waterbody-oriented monitoring and assessment, specifically to:

- 1) Answer the M1 question: "Are habitats and ecosystems healthy?"
- 2) Guide the M2 and M3 Stressor Identification Process, and
- 3) Evaluate M4 performance monitoring to document success.

Figure 2. Water Body-Oriented Monitoring and Assessment



2.1. Stream Bioassessment Background

While bioassessment can and should be used to assess the condition of all surface waterbody types, this report focuses on bioassessment done on perennial and intermittent wadeable streams. The State of California has been conducting bioassessment on wadeable streams in the San Diego region since the 1990s, with early sampling conducted by the San Diego Water Board, the State Water Board's Surface Water Ambient Monitoring Program (SWAMP), and USEPA.

The San Diego Water Board, in December of 2020, adopted biological objectives for streams using stream bioassessment, specifically the California Stream Condition Index (CSCI, see Mazor et al. 2016), discussed in section 2.2.1 below. Stream bioassessment has been used in multiple San Diego Water Board program areas for over two decades, including municipal stormwater, CWA assessment under sections 305(b) and 303(d), ambient monitoring, CWA Section 401 water quality certifications, and waste discharge requirements.

SWAMP has developed standard operating procedures (SOPs) for bioassessment field sampling, laboratory identification of specimens, quality assurance/control, data management, and reporting. These SOPs are on the SWAMP bioassessment website: https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/

Current stream bioassessment includes the following measurements:

- Benthic macroinvertebrates (BMI)
- Benthic algae: diatoms and soft algae, including cyanobacteria
- Physical habitat: instream and riparian
- Water chemistry
- Flow

All San Diego Water Board bioassessment data is available to the public via the California Environmental Data Exchange Network ([CEDEN](#)) database.

2.2. Indices of Integrity and Water Quality Objectives

2.2.1. Biological Indices

To assess bioassessment data, biological scoring tools are needed to translate complex species identification information into a stream condition determination. The development of these biological scoring tools, often referred to as indices or metrics of biological integrity, has been on-going since the 1990s, with various regional indices developed throughout the State. In 2015, the State of California released the peer-reviewed statewide CSCI (Mazor et al. 2016) for assessing the biological condition of wadeable streams throughout the State based on benthic macroinvertebrates. The CSCI uses a combined-reference-site approach to determine the site-specific benthic community expected to be present at any sampled site. In 2020, the peer-reviewed statewide Algal Stream Condition Index (ASCI, Theroux et al. 2020) was released. The ASCI uses an approach that mirrors the CSCI, except multiple indices were developed, with a diatom-specific index (d-ASCI) and combined “hybrid” diatom/soft algae index (h-ASCI).

Both the CSCI and ASCI are indices that have a possible score range of 0 to greater than 1. A score of 1 or above indicates the condition of a sampled stream site is equivalent to conditions at reference sites with similar environmental settings. A lower score indicates deviation from expected condition. The CSCI and ASCI publications calculated thresholds for scores, below which a site could be considered impaired (Table 1). The CSCI threshold of 0.79 was adopted by the San Diego Water Board as a water quality objective in December 2020. A recent evaluation of both the hybrid and diatom index scores at Region 9 reference sites found that meeting either ASCI index would be indicative of a site being similar to reference, and failing both indices (or a single index over multiple samples) would indicate impaired condition (Loflen 2025).

Furthermore, a new molecular ASCI (m-ASCI) has been developed (Theroux et al. 2023) and is being further refined for statewide application. The m-ASCI uses DNA sequencing for taxa identification instead of the traditional microscopy used for the d-ASCI and h-ASCI. The m-ASCI is a valuable new tool for stream bioassessment because DNA methods have the potential to detect a greater diversity of algal taxa and are more time- and cost-effective than traditional methods. The 2025 season m-ASCIs will be available following finalization of the statewide m-ASCI and this report will be updated when scores are available. Until then, ASCI scores for select sites are presented in this report for diatoms only as “d-ASCI (molecular)”, as these were calculated using results from molecular taxonomic identification instead of traditional. These scores should be interpreted with caution, as molecular taxonomic identification does not adequately overlap with traditional taxonomic identification for ASCI application, which can result in an underestimation of scores due to missing or overrepresented taxa (Theroux et al. 2023). However, the molecular d-ASCI scores are still pending for most sites, and this report will be updated once results are received. Due to SWAMP funding cuts, only post-fire sites were analyzed for diatoms using traditional taxonomic methods and are presented as “d-ASCI (traditional)”. The h-ASCI was not assessed for the 2025 season as a result of the method changes.

2.2.2. Physical Habitat Indices

The State of California developed an [Index of Physical Habitat Integrity](#) (IPI) in 2018 that relies on in-stream measures of physical habitat. Like the CSCI and ASCIs, the IPI uses a reference approach to determine what a site's physical habitat expectations are. The IPI is also scored on a 0-1 scale. The IPI should be used for provisional informational purposes only, as the State has identified some needed improvements for the IPI to better reflect conditions and impacts and prevent Type I and II errors.

Table 1. Impairment Thresholds for Bioassessment Indices

Index	Threshold
CSCI	0.79
d-ASCI	0.86
h-ASCI*	0.86
m-ASCI	TBD
IPI	0.84

*Not assessed for 2025 season due to method changes.

2.2.3. Chemical and Physical Water Quality Objectives

While stream bioassessment focuses on the organisms living in the stream, the SWAMP SOP requires a minimum level of sampling for chemical (e.g. nitrogen) and physical (e.g. turbidity) parameters. These grab samples simply provide a baseline assessment of water quality at the time of sampling. They do not include all potential stressors or matrices (e.g. sediment), though additional parameters and matrices can be added to sampling efforts and are noted in this report where conducted. Data for all sites are available on the ([CEDEN](#)) database.

Table 2. Chemical and physical water quality objectives and impairment thresholds

Parameter	Threshold
Temperature	Narrative (Deg C)
Dissolved Oxygen	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	6.5-8.5
Total Nitrogen	1.0 mg/L
Total Phosphorus	0.1 mg/L
Turbidity	20 NTU
Chloride ^e	^b waterbody-specific mg/L, ^c 230 & 860 mg/L
Sulfate ^e	^b waterbody-specific mg/L
Conductivity	^a NA uS/cm
Alkalinity	^a NA mg/L
Dissolved Organic Carbon ^e	^a NA mg/L
Benthic Ash Free Dry Mass (AFDM) ^e	^d 25 g/m ²
Benthic Chlorophyll a (Chl-a)	^d 44 mg/m ²
Benthic Carbon:Nitrogen Molar Ratio (C:N)	^a NA

^a Informational

^b [Basin Plan criteria](#) are specific to non-aquatic use

^c [USEPA recommended freshwater criteria](#) for 4-day and 1-hour exposure, respectively. Assumes an association with sodium.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

^e Dropped from 2025 analysis due to SWAMP funding cuts, except for CDFW sites.

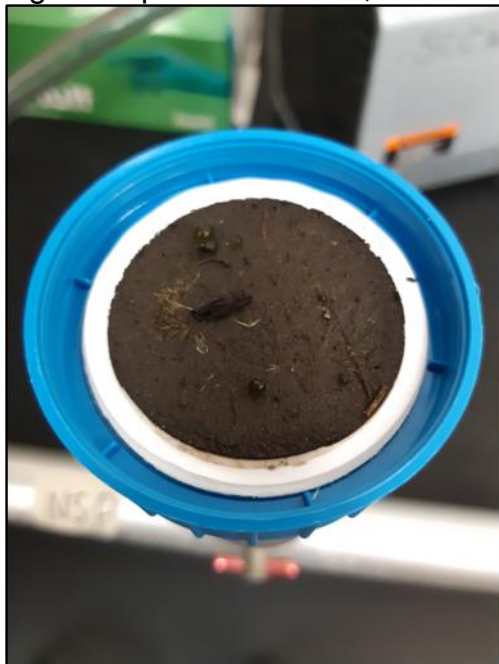
2.3. Supplemental Sampling

The San Diego Water Board often will conduct supplemental sampling or special studies at bioassessment sites. This can allow for efficiencies in testing new methods, to take advantage of existing sampling of reference sites, or be done to support the work of sister agencies (e.g. California Department of Fish and Wildlife). In 2025, MARU conducted several types of supplemental sampling as described below.

2.3.1. **Molecular benthic algal analysis**

Molecular benthic algal analysis is a Region 9 funded SWAMP project to facilitate transition from traditional microscope-based benthic algae analysis to a molecular DNA-based approach. For this analysis, there is no change in the SWAMP collection method for benthic algae; only a small subsample of the collected algal composite is needed ([Figure 3](#)). Molecular algal analysis is being done by SWAMP and partners statewide, with the San Diego Water Board funding the analysis and development of independent or supplemental indices of biological integrity. MARU has conducted this sampling since 2017. In 2025, samples for molecular algal analysis were collected at all but the Trout Unlimited partner-supported site, and m-ASCI scores will be provided in the stream summaries below when available. In the interim, d-ASCI scores using molecular taxonomic identifications are provided for select sites.

Figure 3. A filter for benthic algal molecular analysis. Typically, 15-25 ml of the collected algal composite is filtered, and two replicates are prepared.



2.3.2. Environmental DNA (eDNA)

Sampling for eDNA was done at both bioassessment sites and eDNA-only sites using three different methods ([Table 3](#)).

Table 3. Summary of eDNA sampling methods used in 2025.

Name	Analysis Method	Number of sites sampled
Jonah Ventures	Metabarcoding	16 (14 bioassessment and two eDNA-only sites)
Wilderlab	Metabarcoding	10 (7 bioassessment and three eDNA-only sites)
Smith-Root*	Metabarcoding + targeted ddPCR analysis	16 (14 bioassessment and two eDNA-only sites)

*Results pending.

EDNA sampling was largely consistent with 2024 methods, which used pre-packaged metabarcoding syringe filter kits from Jonah Ventures provided by the statewide SWAMP eDNA Metabarcoding Monitoring and Analysis Project (SeMMAP). In brief, eDNA sampling using these kits involved the filtration of 200-400 ml of stream water through a DNA filter, which was then mailed to a lab for analysis. Metabarcoding does not target single species but looks at the overall community using standard assays. As a result, rare taxa may not be detected by metabarcoding analysis.

New for 2025 was our testing of Wilderlab's six-replicate eDNA kits provided by the State of California Molecular Methods Workgroup. These kits, which come from New Zealand, use a sampling method and analysis that mirrors Jonah Ventures, though the kits use six individual filters instead of one, sample roughly one liter per filter, and results are used to calculate a taxonomy independent IBI called the Taxon-Independent Community Index ([TICI](#)¹, Table 4). The TICI was validated using New Zealand benthic macroinvertebrate scores and has not been validated for use in California. All results are available on the Wilderlab [website map](#).

Table 4. Taxon-Independent Community Index (TICI) categories for Wilderlab eDNA kits

TICI range	Stream condition category
<80	Very poor
80–90	Poor
90–100	Average
100–110	Good
110–120	Excellent
>120	Pristine

Finally, eDNA sampling was done at 16 sites using a Smith-Root pump device in the field ([Figure 4](#)). These eDNA filters can be used for metabarcoding analysis (like Jonah Ventures or Wilderlab) or for species-specific ddPCR, which only looks for certain

¹ As the TICI was developed and calibrated for New Zealand, results are presented simply for comparative informational purposes.

species at a high sensitivity level. The Smith-Root filters are currently being analyzed using metabarcoding for general higher trophic level communities as well as ddPCR for sensitive native and invasive species of concern. Species selected for ddPCR are based on stream type, location, and consultation with other resource agencies, with results pending due to a state lab contract amendment.

Notable eDNA results for higher trophic level species from metabarcoding are presented in the site summaries and section 5.7. Not all detected species are included for each site for metabarcoding results. Presented results focus on aquatic native and non-native species as well as potential anthropogenic pollutant sources (e.g. cattle).

Figure 4. Example collection of eDNA samples using a Smith-Root pump (left) and syringe filter kit (right).



2.3.3. Particulate carbon and nitrogen (PCN)

Particulate carbon and nitrogen (PCN) was sampled at MARU's 16 bioassessment sites. Analysis of PCN was done for the fourth year, having first sampled it in 2022. PCN analysis provides insight into the carbon and nitrogen sources typical of a given waterbody. Specifically, the Carbon:Nitrogen ratio (C:N) tells us about a stream's relative proportions of carbon-rich sources (leaves) or nitrogen-rich sources (algae, animal waste). A higher C:N (>16) indicates a stream is dominated by terrestrial carbon sources, whereas a lower C:N (<8) indicates a stream is dominated by algal sources or external nitrogen loading. A C:N between 8 and 16 indicates a mix of the two. SWAMP has recommended that PCN replace the AFDM parameter. PCN analysis requires no change in the SWAMP collection method for benthic algae; only a small subsample of the collected algal composite is needed. The molar C:N ratio is provided in the site summaries below.

2.3.4. Bacteria

E.coli and total coliform were sampled at 13 bioassessment sites and analyzed using the IDEXX Quantitray method. Though generally not harmful themselves, these bacteria can indicate the presence of illness-causing pathogens in surface waters. Samples were analyzed by the San Diego Water Board, a non-accredited laboratory, and are provided for informational purposes only. While assessed in previous years, sampling was not performed for human-specific fecal contamination (HF183 analysis) in 2025 due to pending implementation of a new molecular contract with the University of California at Santa Cruz.

2.3.5. Taxonomic Richness

Out of interest, the number of notable BMI and algal taxa recorded from each site was compiled by counting taxa in CEDEN's Final ID column. For BMI, Final IDs are at various levels (species, genus, family, group), and "notable taxa" for this report are those in the orders Ephemeroptera, Plecoptera, and Trichoptera (EPT taxa). EPT taxa are relatively sensitive, and their presence is indicative of good stream condition. Each sample from which BMI taxa were recorded was a composite of 11 subsamples (30 x 30 cm), or a total of ~1 m² of stream bed sampled.

For algae, Final IDs are at the level of species or genus, and "sensitive taxa" for this report are those with a California Biological Condition Gradient (BCG) rating of 1 or 2 (Paul et al. 2020). The presence of sensitive algae is indicative of good stream condition. Each sample from which algal taxa were recorded was a composite of 11 subsamples (5.3 or 12.6 cm²), or a total of ~100 cm² of stream bed sampled (actual total areas were between 95 cm² and 131 cm²). In 2025, algal taxa were determined using new molecular methods when available, as described in section 2.2.1.

2.3.6. Laboratories Used for Sample Analyses

The external laboratories used to process supplemental and standard bioassessment samples were:

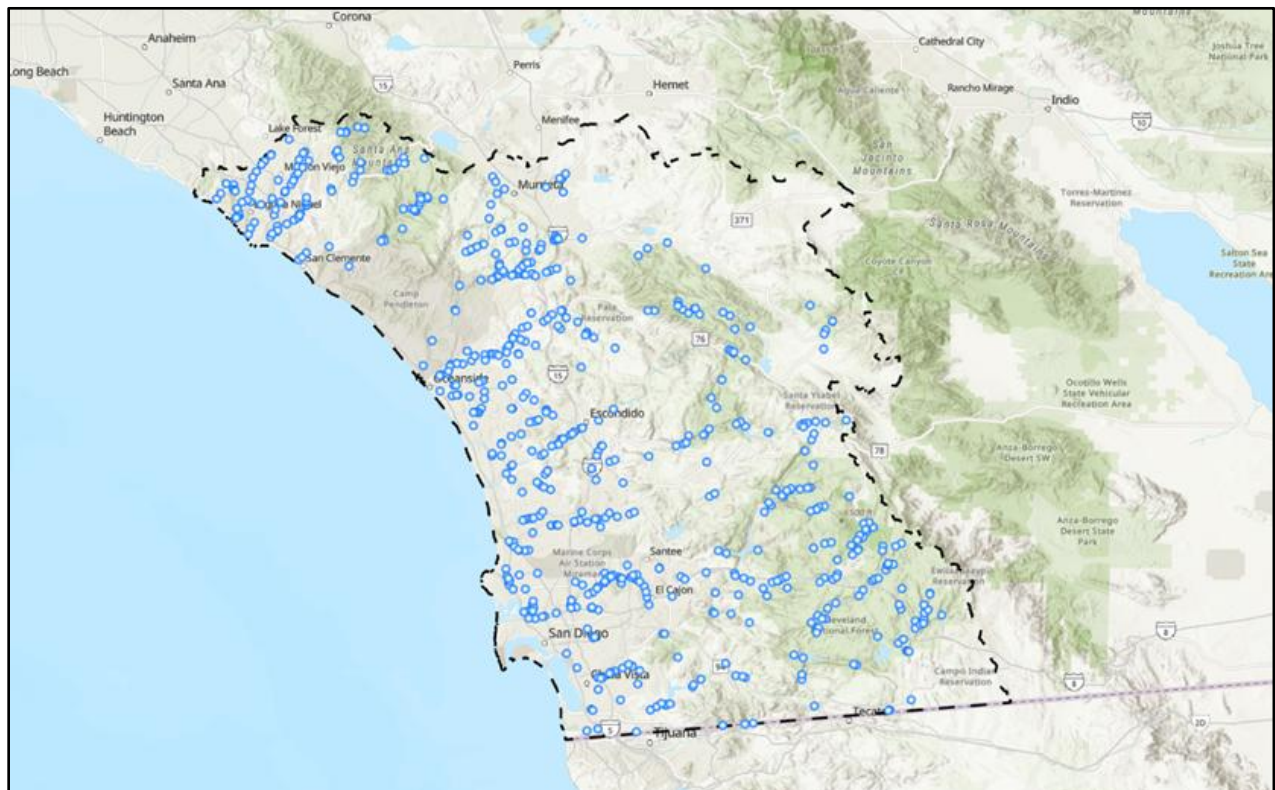
- BMI identification – California State University, Chico
- Algal identification (diatoms) – EcoAnalysts
- Chemistry – Moss Landing Marine Lab
- Molecular algal analyses – Southern California Coastal Water Research Project (SCCWRP)
- ddPCR eDNA Smith-Root filters – University of California, Santa Cruz
- metabarcoding eDNA – Jonah Ventures & Wilderlab
- PCN – University of California, Santa Barbara, Marine Science Institute
- Bacteria –San Diego Water Board (non-accredited, informational only)

3. Bioassessment Site Types

Stream bioassessment has been conducted in the San Diego Region for over two decades, with sampling at over 600 sites ([Figure 5](#)) and with many sites sampled multiple times (1,700+ total samples). Bioassessment samples have been collected by multiple entities and include a mix of site types: reference, non-reference, targeted, probabilistic, trend, and investigation sites. MARU typically conducts stream bioassessment at site types 1 through 5 below:

- 1) Reference Condition Management Program/Reference Sites
- 2) Water Board Program Request Sites
- 3) Causal/Protective Assessment Sites
- 4) Trend Sites
- 5) Coverage Expansion Sites
- 6) Partner Support Sites

Figure 5. Existing bioassessment sampling sites within the San Diego Region.

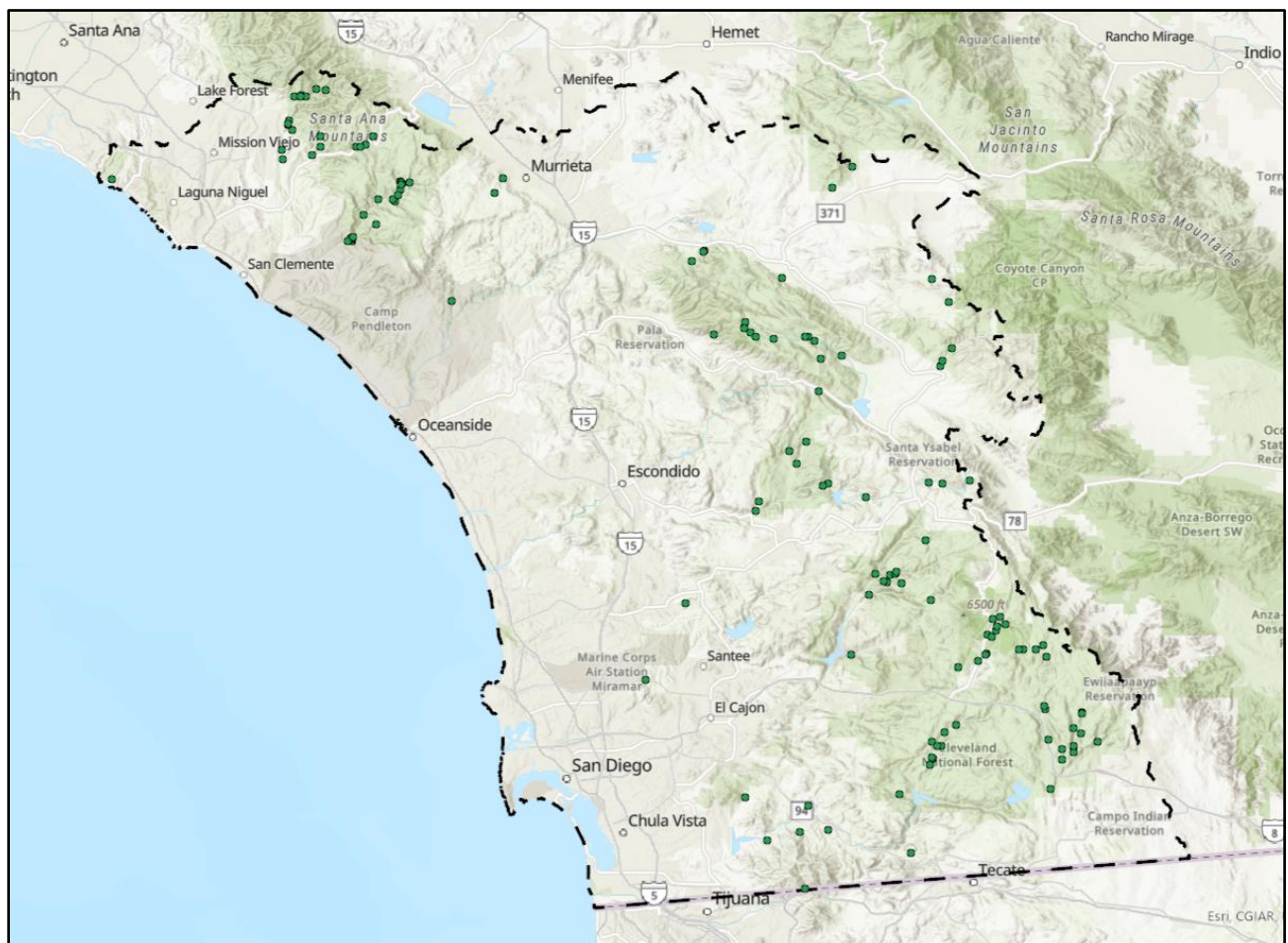


3.1. Reference Condition Management Program Sites/Reference Sites

The SWAMP program conducts long-term monitoring at a set of sites that meet GIS reference screening criteria (Ode et al. 2016) as part of the state's [reference condition management program](#) (RCMP). This network of sites, and their on-going monitoring, is critical for establishing reference conditions, which are “healthy” or “biologically intact” conditions in streams with little to no upstream anthropogenic stressors. In addition, the RCMP helps assess longer-term impacts to California’s streams from large-scale changes, such as those associated with climate change.

The San Diego Water Board supports the RCMP in two ways: MARU conducts repeat sampling at long-term RCMP sites, and MARU identifies new reference sites to add to the potential State reference site pool ([Figure 6](#), also section 3.5).

Figure 6. Stream sites in the San Diego Region that meet reference screens. Reference sites are those that meet GIS screening criteria under Ode et al. 2016.



3.2. Program Request Sites

Program request sites are those that have been identified by internal San Diego Water Board staff/programs as a priority for monitoring to determine condition (M1 of the Monitoring Framework). Monitoring may be done to investigate discharge impacts, determine the success of mitigation measures, monitor trends for CWA section 305(b)/303(d) assessment, etc. In addition, some program request sites include requests from partner agencies who manage sensitive native species, such as the California Department of Fish and Wildlife (CDFW), United States Geologic Survey (USGS), and United States Fish and Wildlife Service (USFWS), and from partner nonprofit organizations such as the San Diego River Park Foundation.

This year's program request sites includes a sub-set of sites that were burned in the 2024 airport fire.

3.3. Causal/Protective Assessment Sites

For stream bioassessment sites that score poorly, determining the likely stressor(s) causing the poor condition allows for actions to be taken to improve biological condition (M2 of the Monitoring Framework). The process for investigating and determining likely stressors is referred to as "causal assessment." This process can also be used to assess whether sites scoring above an index threshold might be at risk from stressors, especially for sites close to the threshold ("protective assessment"). MARU may conduct stream bioassessment revisits, combined with extra stressor-related sampling, to support causal and protective assessment efforts.

3.4. Trend Sites

Trend sites are sites that have been previously sampled and are targeted for re-sampling due to the time since prior sampling or a change in upstream development or management, or for regular monitoring associated with other factors (e.g. sensitive species). These sampling events are typically M1 or M4 of the Monitoring Framework.

3.5. Coverage Expansion Sites

While bioassessment has been conducted at more than 600 sites in the San Diego Region, many streams have never been bioassessed. MARU is working to conduct stream bioassessment at previously unsampled streams (M1 of the Monitoring Framework). Doing so helps clarify the condition of streams across the region, identify new reference sites, and determine baseline condition for anti-degradation purposes (e.g. in the event of a spill).

3.6. Partner Support Sites

The San Diego Water Board is an active participating member of the State of California's SWAMP bioassessment program. As such, the San Diego Water Board has consistently assisted the SWAMP bioassessment program and its partners by funding monitoring and research that promotes and expands the use of bioassessment in the state. Examples include efforts to develop a statewide molecular algal stream condition index (mASCI), develop and pilot bioassessment methods for ephemeral and intermittent streams during their dry phase, and use bioassessment to evaluate restoration success. Our partners in these bioassessment efforts can include other regional boards, local and federal government agencies, and -non-profit organizations.

4. Sites Sampled in 2025

4.1. Site Type and Location

MARU, CDFW, and Trout Unlimited bioassessment site details are in Tables 5, 6, and 7, respectively. Table 8 shows the location of eDNA-only sites. A map displaying all sample locations is provided in [Figure 7](#).

Table 5. Bioassessment sites sampled by MARU in 2025

Site Type	SWAMP Code	Stream	Latitude	Longitude	Date
RCMP	903ACPCT1	Agua Caliente Creek at Pacific Crest Trail	33.29658	-116.63842	5/13
RCMP	903NP9LWF	Lower West Fork San Luis Rey	33.30977	-116.77771	5/12
Program Request: Post-fire	901LIONCN	Lion Canyon Creek above San Juan Creek	33.60251	-117.46001	4/21
Program Request: Post-fire	901ATCTCx	Arroyo Trabuco Creek - Trabuco Cyn	33.67439	-117.544898	5/22
Program Request: Post-fire	901S01705	Hot Spring Canyon Creek ~1.2mi above Hwy 74	33.60369	-117.51000	5/28
Program Request: Post-fire	901BELOLV	Bell Canyon Creek ~1.3 mi above Fox Cyn. Cr.	33.64074	-117.552986	5/30
Program Request	554SCTCPS	Salmon Creek above Horse Meadow Campground at Teacups	35.8953	-118.363	8/05
Program Request	554TRBSLM	Tributary to Salmon Creek at Horse Meadow Campground	35.9037	-118.371	8/05
Trend	909SRAWGL	Sweetwater River Above Wildwood Glen Ln Bridge	32.83707	-116.62033	6/27
Trend	902SCSCRx	Sandia Creek Sandia Creek Dr., 0.7 miles above Rock Mtn. Rd.	33.4249	-117.249	7/09
Trend	911CCH80x	Cottonwood Creek downstream of Old HWY 80 crossing	32.78838	-116.497262	6/24
Trend	907NP9CMC	Coleman Creek	33.09762	-116.662455	5/02

Site Type	SWAMP Code	Stream	Latitude	Longitude	Date
Trend	911TJPVC1	Pine Valley Creek 1	32.83631	-116.542454	6/17
Coverage Expansion	903SFMUCS	South Fork Moosa Canyon along Champagne Upper Concrete Section	33.20685	-117.130404	4/14
Coverage Expansion	903SFMDCS	South Fork Moosa Canyon along Champagne Lower Concrete Section	33.21695	-117.1376	4/14
Coverage Expansion	903WAMCTM	Mainstem We-a-ma Valley Creek from Dyche Valley, at Trail Meadow	33.30198	-116.798964	4/23

Table 6. Bioassessment sites in Region 9 sampled by CDFW in 2025. Streams were sampled as part of SWAMP's Reference Condition Management Plan (RCMP).

Site Type	SWAMP Code	Stream	Latitude	Longitude	Date
RCMP	901DCCSMC	Devils Canyon Creek above San Mateo Cyn. Creek	33.47306	-117.46600	5/07
RCMP	901S04309	San Mateo Canyon Creek above Devil Cyn. Cr.	33.47486	-117.46605	5/07
RCMP	907CCCR02	Cedar Creek 2	33.00222	-116.70889	5/06

Table 7. Bioassessment sites sampled by Trout Unlimited in 2025. Streams were sampled as part of an evaluation of stream improvement projects undertaken to improve biological condition.

Site Type	SWAMP Code	Stream	Latitude	Longitude	Date
Partner Support	554TMDUAR	South Fork Kern River Tunnel Meadow at Upper Airstrip	36.380311	-118.26331	9/06

Table 8. Additional sites sampled for eDNA by MARU in 2025.

Site Type	SWAMP Code	Stream	Latitude	Longitude	Date
eDNA	903PCPMPx	Pauma Creek downstream of Doque Trail at Palomar Mountain Park	33.34881	-116.913	7/01
eDNA	903FCPSPx	French Creek (FCPSP)	33.35017	-116.913	7/01, 12/19
eDNA	903NP9UAC	Upper Agua Caliente	33.3204	-116.623	12/08

Figure 7. Region 9 Sites sampled in 2025 by MARU and CDFW/MLML.



4.2. Overview of Results

The low and high values recorded for indices and other parameters are below. All streams were sampled at base flow condition, except for 903SFMUCS (South Fork Moosa Canyon along Champagne Upper Concrete Section). All were narrow (0.8 – 4.5 meters wetted width, on average) and shallow (2 – 14 centimeters deep, on average). Slope over the 150-meter sampled reach ranged from a low of 1.7% (Pine Valley Creek) to a high of 12.1% (South Fork Moosa Canyon along Champagne, Upper Concrete Section).

Range of index scores from the 2025 bioassessed streams

Index	Results	Threshold
CSCI	0.74 – 1.19	0.79
d-ASCI (traditional) ^a	0.55 – 0.85	0.86
d-ASCI (molecular) ^b	TBD	0.86
m-ASCI ^c	TBD	TBD
IPI	0.72 – 1.22	0.84

^a Traditional d-ASCI scores were calculated for post-fire sites only.

^b Molecular d-ASCI scores were calculated for select sites using DNA sequencing methods and compared to the traditional threshold. Therefore, these scores should be interpreted with caution (see section 2.2.1). Results are still pending for 11 of the 16 bioassessment sites and this report will be updated when scores are available.

^c The 2025 season m-ASCI scores will be available following finalization of the statewide m-ASCI and this report will be updated when scores are available.

Range of chemical and physical water quality results from the 2025 bioassessed streams

Parameter	Results	Threshold
Temperature	9.95 to 23	Narrative (Deg C)
Dissolved Oxygen	6.89 to 11.9	5.0 (WARM BU), 6.0 (COLD BU) mg/L
pH	6.83 to 8.86	6.5-8.5
Total Nitrogen	0.2 to 0.7	1.0 mg/L
Total Phosphorus	ND to 0.05	0.1 mg/L
Turbidity	0.21 to 5.88	20 NTU
Chloride ^e	43 to 68	^b waterbody-specific mg/L, ^c 230 & 860 mg/L
Sulfate ^e	34 to 59	^b waterbody-specific mg/L
Conductivity	56.4 to 1914	^a NA uS/cm
Alkalinity	30 to 310	^a NA mg/L
Diss. Org. Carbon ^e	1.9 to 2.7	^a NA mg/L
Benthic AFDM ^e	5.8 to 11.4	^d 25 g/m ²
Benthic Chl-a	2.11 to 69	^d 44 mg/m ²
Benthic C:N	9.56 to 16.02	^a NA
Total Coliform	307 to >2,419	^a NA MPN/100 mL
E. coli	4.1 to 770	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively

^d Mazon et al. 2022 threshold for obtaining 10th percentile ASCI score

^e CDFW sites only

Range of BMI and algal taxa counts recorded from R9 2025 bioassessed streams

	# Notable or Sensitive Taxa
BMI	3 to 21
Algae	TBD

5. Site Summaries

5.1. RCMP/Reference Sites

5.1.1. 903ACPCT1: Agua Caliente Creek at Pacific Crest Trail



Lower Agua Caliente Creek is a long-term RCMP site located approximately four stream kilometers downstream of Upper Agua Caliente. Unlike Upper Agua Caliente, this stream segment exhibits intermittent flow. This stream has water level and specific conductance loggers deployed. (Photo DW 5/13/25).

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and intact physical habitat.

Index	Result	Threshold
CSCI	1.11	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	1.12	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	14.7	Narrative (Deg C)
Dissolved Oxygen	9.21	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.00	6.5-8.5
Total Nitrogen	0.23	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	1.24	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	576	^a NA uS/cm
Alkalinity	114	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic Chl-a	26.3	^d 44 mg/m ²
Benthic C:N	9.70	^a NA
Total Coliform	1986	^a NA MPN/100 mL
E. coli	461	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazon et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	13
Algae	TBD

Notable BMI:

- Ephemeroptera: *Baetis adonis* and *tricaudatus*, *Dipheter hageni*, *Drunella*, *Ameletus*, *Siphonurus*, *Anafroptilum*, *Callibaetis*
- Plecoptera: *Isoperla denningo*, *Haploperla chilnuala*
- Trichoptera: *Agapetus arcita*, *Ochrotrichia*, *Hydroptila*

eDNA

Method	Detections
Jonah Ventures	Scrub jay (<i>Aphelocoma coerulescens</i>)
Smith-Root	Pending
Wilderlab	NS

California tree frogs (*Pseudacris cadaverina*) were observed while sampling, as well as unidentified tadpoles.

Figure 8. Microscope photo of *Draparnaldia glomerata* from Lower Agua Caliente Creek (photo: DW). The *Draparnalidia* genus is known to be highly sensitive to pollution, making it a good indicator of stream water quality.



5.1.2. 903NP9LWF: Lower West Fork San Luis Rey



Lower West Fork of the San Luis Rey River is an RCMP site located in the Cleveland National Forest above Lake Henshaw (Photo CK 5/12/25). This site exhibits intermittent flows ([Figure 9](#)).

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and intact physical habitat.

Index	Result	Threshold
CSCI	1.13	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	1.22	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	17.1	Narrative (Deg C)
Dissolved Oxygen	8.44	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	7.83	6.5-8.5
Total Nitrogen	0.23	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	1.24	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	325	^a NA uS/cm
Alkalinity	114	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	38.7	^d 44 mg/m ²
Benthic C:N	10.7	^a NA
Total Coliform	>2419	^a NA MPN/100 mL
E. coli	6.3	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	13
Algae	TBD

Notable BMI:

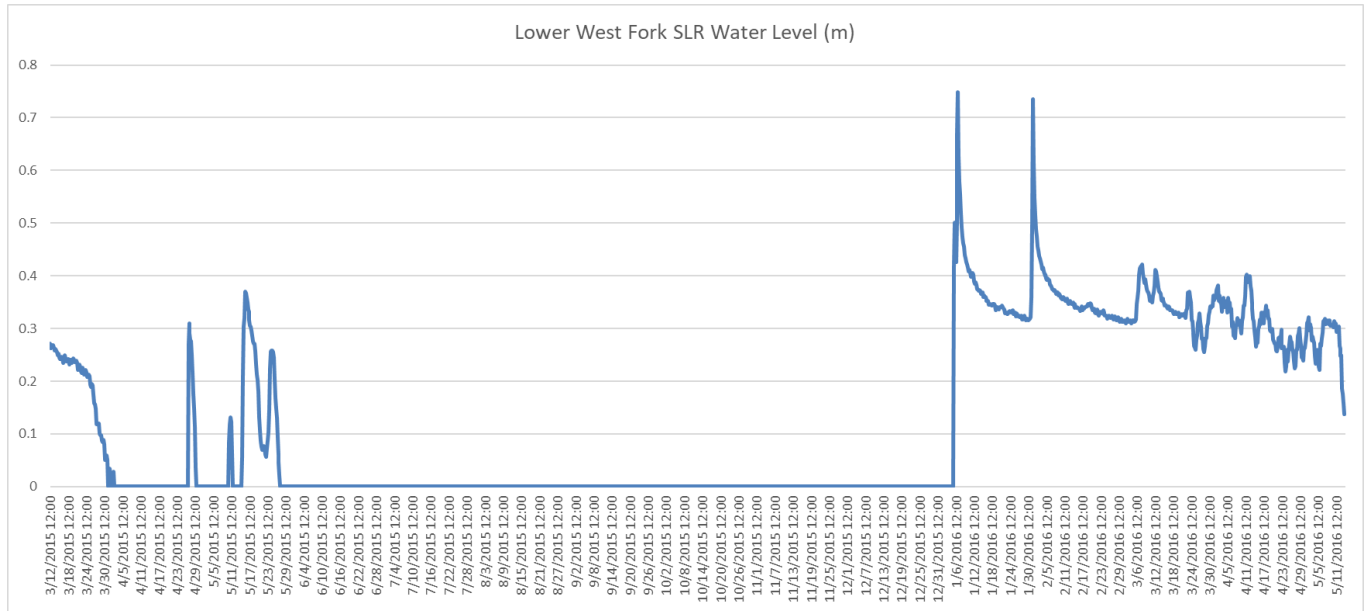
- Ephemeroptera: *Ameletus*, *Baetis adonis*, *Callibaetis*, *Dipheter hageni*, *Drunella*, *Ephemerella maculata*, *Matriella teresa*, *Siphonurus*
- Plecoptera: Nemouridae (family level), *Isoperla denningi*
- Trichoptera: *Micrasema*, *Ochrotrichia*
- Other: *Neohermes filicornis*

eDNA

Method	Detections
Jonah Ventures	Bullhead catfish (<i>Ameiurus</i>); Trout (<i>Oncorhynchus</i>); Sunfish (<i>Lepomis</i>); Common box turtle (<i>Terrapene Carolina</i>)
Smith-Root	Pending
Wilderlab	NS

California tree frogs (*Pseudacris cadaverina*) were observed while sampling.

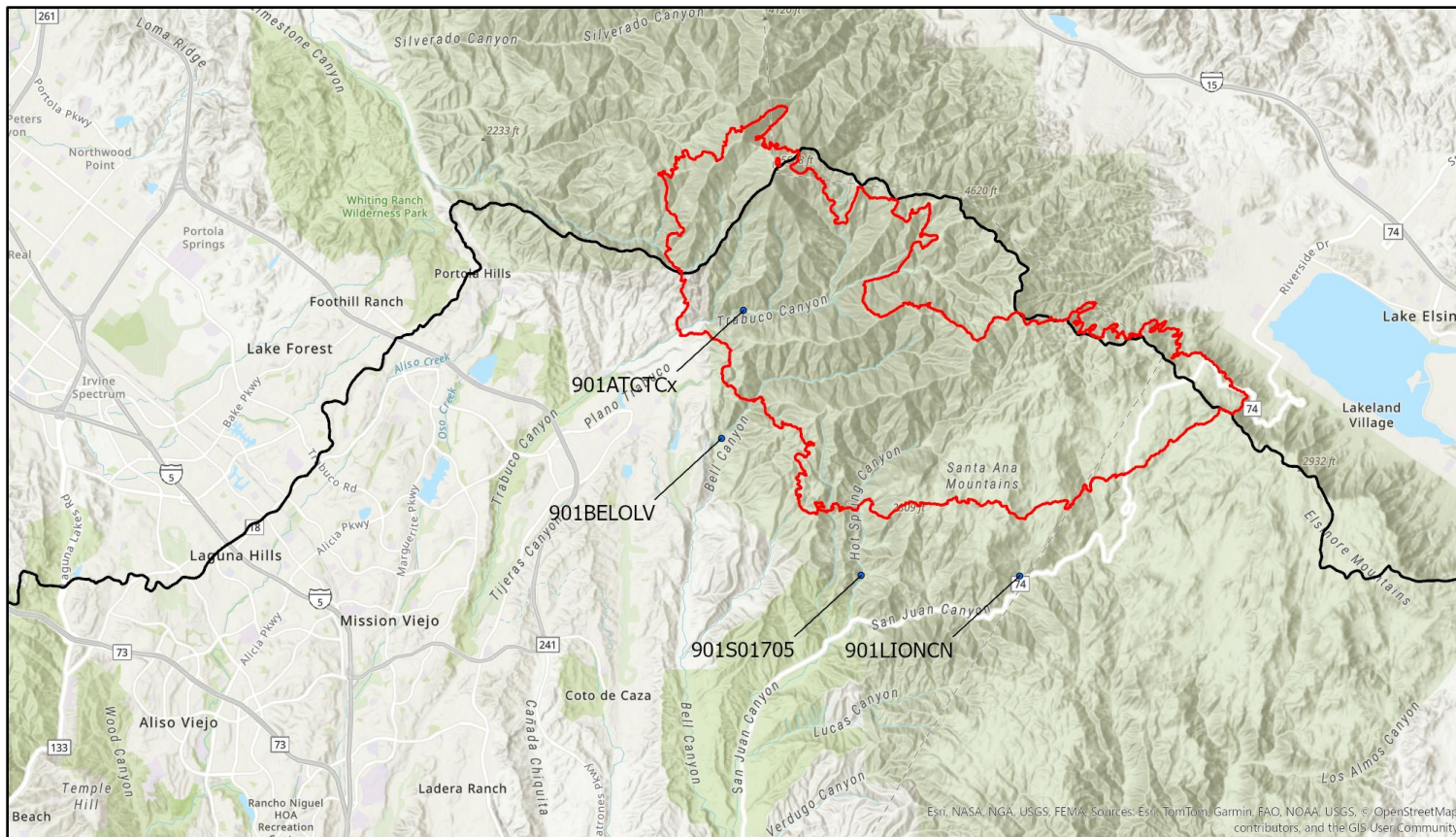
Figure 9. Historic stream flow at Lower West Fork San Luis Rey from 2015-2016. The logger was deployed in spring 2015, downloaded during a May 2016 sampling, and subsequently lost during the 2016/2017 rainfall year during a high flow event. The logger shows dry conditions through summer of 2015. Dry summer conditions were also documented in later water quality and fish survey site visits done with CDFW.



5.2. Program Sites

MARU 2025 bioassessment sampling program request sites focused on post-fire sampling following the Airport Fire. The Airport Fire started on September 09, 2024, and was contained on October 06, 2024. The fire started along Trabuco Canyon Creek, burning 23,526 acres. The State of California has multiple historic bioassessment sites within the burn footprint, and in 2025 sampled 4 of those sites in consultation with the United States Forest Service (USFS) and Audubon Society.

Figure 10. Map depicting Airport Fire perimeter and sampled bioassessment stations within or downstream.



5.2.1. Post-fire 901LIONCN: Lion Canyon Creek above San Juan Creek



This site on Lion Canyon Creek is an intermittent reference stream that was first sampled by the San Diego Water Board in 2024. (Photo CL 04/21/2025). While the sampling site did not burn, the upstream watershed experienced burning from the fire. There was some evidence of some new sediment deposition, though mostly in the floodplain.

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and intact physical habitat. The diatom ASCI scores showed an impacted algal community, including a large decline compared to pre-fire condition.

Index	2025 Post-Fire Result	2024 Pre-Fire Result	Threshold
CSCI	1.11	1.13	0.79
CSCI-O/E	1.23	1.23	N/A
CSCI-pMMI	1.00	1.04	N/A
d-ASCI (traditional)*	0.85	0.99	0.86
m-ASCI	TBD	TBD	TBD
IPI	1.12	1.20	0.84

*Post-fire d-ASCI scores were analyzed using traditional methods.

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	2025 Post-Fire Result	2024 Pre-Fire Result	Threshold
Temperature	14.88	17.6	Narrative (Deg C)
Dissolved Oxygen	9.44	8.8	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.15	7.6	6.5-8.5
Total Nitrogen	0.25	0.09	1.0 mg/L
Total Phosphorus	0.03	ND	0.1 mg/L
Turbidity	0.895	0.9	20 NTU
Chloride	-	35	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	30	^b waterbody-specific mg/L
Conductivity	502	315	^a NA uS/cm
Alkalinity	137	84	^a NA mg/L
Dissolved Organic Carbon	-	8.27	^a NA mg/L
Benthic AFDM	-	39.3	^d 25 g/m ²
Benthic Chl-a	6.32	19.4	^d 44 mg/m ²
Benthic C:N Rep 1, Rep 2	11.01	12.8,13.2	^a NA
Total Coliform	307	2419.6	^a NA MPN/100 mL
<i>E. coli</i>	4.1	6.3	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa 2025 Post-Fire	# EPT or Sensitive Taxa 2024 Pre-Fire
BMI	12	20
Algae*	0	1

*- Diatom results only.

Notable BMI:

- Ephemeroptera: *Paraleptophlebia*, *Baetis tricaudatus*, *Anafroptilum*, *Callibaetis*
- Plecoptera: *Isoperla adunca*, *Paraleuctra*, Taeniopterygidae (family level)
- Trichoptera: *Rhyacophila rayneri*, *Wormaldia*, *Ochrotrichia*
- Other: *Blepharicera*, Megaloptera (presumed *Neohermes*)

Sensitive algae:

- Diatoms: none

eDNA

Method	Detections
Jonah Ventures	Newt (<i>Taricha granulosa</i> , but likely California newt <i>Taricha torosa</i>); Crappie (<i>Pomoxis</i>)
Smith-Root	Pending
Wilderlab	NS

California tree frogs (*Pseudacris cadaverina*) and mating newts (*Taricha torosa*) were observed during sampling.

5.2.2. Post-Fire: 901ATCTCx Arroyo Trabuco Creek - Trabuco Cyn



This site on upper Arroyo Trabuco Creek is an intermittent stream close to the USFS boundary access gate. The stream site itself actively burned as well of a majority of the watershed. There was ample evidence of high sediment loading, including the filling of a previous six-foot invert drop at the Arizona Crossing immediately below the first transect (see above photo). This location was sampled by the Stormwater Monitoring Coalition (SMC) in 2024. (Photo CK 5/22/25)

ASCI scores indicated a degraded algae community both prior to and following the 2024 fire. The CSCI score dropped from 1.07 to 0.84, though it still indicated an intact benthic macroinvertebrate community. Similarly, IPI scores decreased from 2024 but still suggest an intact physical habitat.

Index	2025 Post-Fire Result	2024 Pre-Fire Result	Threshold
CSCI	0.84	1.07	0.79
CSCI-O/E	0.74	1.20	N/A
CSCI-pMMI	0.93	0.87	N/A
d-ASCI (traditional)*	0.67	0.70	0.86
m-ASCI	TBD	TBD	TBD
IPI	0.97	1.08	0.84

*Post-fire d-ASCI scores were calculated using traditional methods.

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	2025 Post-Fire Result	2024 Pre-Fire Result	Threshold
Temperature	19.7	14.3	Narrative (Deg C)
Dissolved Oxygen	8.74	9.75	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.20	8.25	6.5-8.5
Total Nitrogen	0.36	ND	1.0 mg/L
Total Phosphorus	0.05	ND	0.1 mg/L
Turbidity	5.88	0.15	20 NTU
Chloride	-	10.3	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	145	^b waterbody-specific mg/L
Conductivity	735	564	^a NA uS/cm
Alkalinity	190	137	^a NA mg/L
Dissolved Organic Carbon	-	NS	^a NA mg/L
Benthic AFDM	-	0.081	^d 25 g/m ²
Benthic Chl-a	20.9	ND	^d 44 mg/m ²
Benthic C:N	13.2	NS	^a NA
Total Coliform	>2419	NS	^a NA MPN/100 mL
<i>E. coli</i>	9.8	NS	^a NA MPN/100 mL

*Non-detect ^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa 2025 Post-Fire	# EPT or Sensitive Taxa 2024 Pre-Fire
BMI	5	12
Algae*	5	NS

*- Diatom results only.

Notable BMI:

- Ephemeroptera: *Baetis*
- Plecoptera: *Malenka*
- Trichoptera: *Hydropsyche*, *Agapetus*, *Lepidostoma*

Sensitive algae:

- Diatoms: *Achnantheidium alpestre*, *Gomphonema pumilum* var *rigidum* (*Gomphonema pumilum* (Grunow) Reichardt & Lange-Bertalot), *Meridion constrictum* (likely *Meridion circulare* var *constrictum*), *Navicula cryptotenelloides*, *Reimeria uniseriata*

eDNA

Method	Detections
Jonah Ventures	Newt (<i>Taricha granulosa</i> , but likely California newt <i>Taricha torosa</i>); Trout (<i>Oncorhynchus</i>); Chub (<i>Gila</i>); Mourning dove (<i>Zenaida macroura</i>)
Smith-Root	Pending
Wilderlab	NS

A California treefrog (*Pseudacris cadaverina*) and deceased newt (*Taricha torosa*) were observed during sampling.

Notably, the organization California Trout conducted a post-fire survey of upper Trabuco Creek for 2 miles starting at the bioassessment site. The survey occurred from July 7-11 and observed 28 total fish: 27 *Oncorhynchus mykiss* (steelhead trout) and 1 arroyo chub, both of which were detected by eDNA methods.

Figure 11. A dead California newt was observed in the sampling reach.



5.2.3. Post-fire: 901S01705: Hot Spring Canyon Creek ~1.2 mi above Hwy 74



This site on Hot Spring Canyon is a perennial stream located in the Cleveland National Forest. MARU sampled this site in 2024 and 2025 ([Figure 12](#)). Like Arroyo Trabuco, the site had significant sediment loading and loss of habitat heterogeneity, with the habitat becoming a single long gravel riffle. (Photo CK 5/28/25)

CSCI scores indicated a biologically intact benthic macroinvertebrate community. However, ASCI and IPI scores showed a degraded algal community and physical habitat following impacts from the 2024 fire. Notably, the number of EPT species dropped by over 70 percent. This loss was reflected in a drop in the predictive Multi-Metric Index (pMMI) portion of the CSCI, which was off-set by an increase in the observed/expected (O/E) portion (scores essentially reversed, see below Table).

Index	2025 Post-Fire Result	2024 Pre-Fire Result	Threshold
CSCI	1.03	0.96	0.79
CSCI-O/E	1.23	0.76	N/A
CSCI-pMMI	0.84	1.21	N/A
d-ASCI (traditional)*	0.56	1.27	0.86
m-ASCI	TBD	TBD	TBD
IPI	0.83	1.16	0.84

*Post-fire d-ASCI scores were calculated using traditional methods.

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Post-Fire Result	Pre-Fire Result	Threshold
Temperature	19.0	18.5	Narrative (Deg C)
Dissolved Oxygen	8.57	8.3	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.09	7.5	6.5-8.5
Total Nitrogen	0.22	ND	1.0 mg/L
Total Phosphorus	0.05	ND	0.1 mg/L
Turbidity	5.74	0.7	20 NTU
Chloride	-	22	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	96	^b waterbody-specific mg/L
Conductivity	574	466	^a NA uS/cm
Alkalinity	160	142	^a NA mg/L
Dissolved Organic Carbon	-	7.46	^a NA mg/L
Benthic AFDM	-	17.2	^d 25 g/m ²
Benthic Chl-a	4.47	16.8	^d 44 mg/m ²
Benthic C:N Rep 1, Rep 2	16.0	12.4,12.9	^a NA
Total Coliform	>2419	2419.6	^a NA MPN/100 mL
<i>E. coli</i>	88	39.9	^a NA MPN/100 mL

*Non-detect ^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa 2025 Post-Fire	# EPT or Sensitive Taxa 2024 Pre-Fire
BMI	8	26
Algae*	3	4

*Diatom results only.

Notable BMI:

- Ephemeroptera: *Baetis*, *Serratella micheneri*, *Anafroptilum*
- Plecoptera: Capniidae (family level), *Isoperla*, *Malenka*
- Trichoptera: *Hydropsyche*
- Other: Megaloptera (likely *Neohermes*)

Sensitive algae:

- Diatoms: *Gomphonema pumilum var rigidum* (*Gomphonema pumilum* (Grunow) Reichardt & Lange-Bertalot), *Meridion circulare*, *Navicula cryptotenelloides*

eDNA

Method	Detections
Jonah Ventures	Arroyo chub (<i>Gila orcuttii</i>); Newt (<i>Taricha granulosa</i> , but likely California newt <i>Taricha torosa</i>); Crow/Raven (<i>Corvus</i>); Scrub jay (<i>Aphelocoma coerulescens</i>); Cattle (<i>Bovidae</i>)
Smith-Root	Pending
Wilderlab	NS

A California treefrog (*Pseudacris cadaverina*) and pacific treefrog (*Pseudacris regilla*) were observed during sampling. No arroyo chub were observed.

Figure 12. Post (left) and pre (right) fire photos of the same pool. The pre-fire pool was 0.5-1 meter deep and dominated by cobbles and gravels. Post-fire the pool was filled with sediment. Red circles denote the same rock along the stream bank.



5.2.4. Post-fire: 901BELOLV: Bell Canyon Creek ~1.3 mi above Fox Cyn. Cr.



This site on Bell Canyon Creek is an intermittent reference stream located on Audubon Starr Ranch near the Cleveland National Forest boundary. MARU has sampled this site periodically since 2013. Like Arroyo Trabuco and Hot Springs Canyon, the site had significant sediment loading, though the site itself did not burn. (Photo CL 5/28/25)

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate as well as intact physical habitat. However, both scores decreased, with the IPI dropping to just above the threshold. The ASCI shows a degraded algal community. All scores were substantially lower than pre-fire.

Index	2025 Post-Fire Result	2022 Pre-Fire Result	Threshold
CSCI	0.94	1.01	0.79
CSCI-O/E	1.17	1.20	N/A
CSCI-pMMI	0.71	0.80	N/A
d-ASCI (traditional)*	0.55	1.01	0.86
m-ASCI	TBD	NA	TBD
IPI	0.86	1.21	0.84

*Post-fire d-ASCI scores were calculated using traditional methods.

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Post-Fire Result	Pre-Fire Result	Threshold
Temperature	16.9	15.1	Narrative (Deg C)
Dissolved Oxygen	9.42	7.5	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.23	7.3	6.5-8.5
Total Nitrogen	0.26	ND	1.0 mg/L
Total Phosphorus	0.04	ND	0.1 mg/L
Turbidity	3.31	0.2	20 NTU
Chloride	-	23	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	270	^b waterbody-specific mg/L
Conductivity	869	968	^a NA uS/cm
Alkalinity	310	201	^a NA mg/L
Dissolved Organic Carbon	-	1.1	^a NA mg/L
Benthic AFDM	-	22	^d 25 g/m ²
Benthic Chl-a	2.37	0.5	^d 44 mg/m ²
Benthic C:N	11.5	16.1	^a NA
Total Coliform	1986	-	^a NA MPN/100 mL
<i>E. coli</i>	326	-	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa 2025 Post-Fire	# EPT or Sensitive Taxa 2022 Pre-Fire
BMI	7	9
Algae*	3	3

*- Diatom results only.

Notable BMI:

- Ephemeroptera: *Baetis adonis*, *Baetis tricaudatus*, *Fallceon*
- Plecoptera: *Malenka*
- Trichoptera: *Agapetus*, *Hydropsyche*, *Wormaldia*

Sensitive algae:

- Diatoms: *Gomphonema pumilum* var *rigidum* (*Gomphonema pumilum* (Grunow) Reichardt & Lange-Bertalot), *Meridion constrictum* (likely *Meridion circulare* var *constrictum*), *Navicula cryptotenelloides*

eDNA

Method	Detections
Jonah Ventures	Human (<i>Homo sapiens</i>)
Smith-Root	Pending
Wilderlab	NS

No notable higher trophic level aquatic species were observed during sampling.

5.2.5. 554SCTCPS: Salmon Creek above Horse Meadow Campground at Teacups



Salmon Creek is a high Sierra site located within the southern Kern Plateau on the Sequoia National Forest. This site had never been sampled. This site was selected for sampling to assist with site expansion for the statewide mASCI refinement in under-sampled areas². While the site meets reference screens, there is extensive cattle grazing 2 km upstream at Big Meadow (Photo DW 8/5/25).

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community as well as intact physical habitat.

Index	Result	Threshold
CSCI	0.79	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	0.97	0.84

² This sampling effort also serves as a team-building trip for the Monitoring Assessment and Research Unit.

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	10.9	Narrative (Deg C)
Dissolved Oxygen	11.9	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	7.67	6.5-8.5
Total Nitrogen	0.14	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	2.33	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	99	^a NA uS/cm
Alkalinity	55.8	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	39.8	^d 44 mg/m ²
Benthic C:N	11.7	^a NA
Total Coliform	-	^a NA MPN/100 mL
E. coli	-	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	8
Algae*	5

*Diatoms only, calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Notable BMI:

- Ephemeroptera: *Anafroptilum*, *Neoleptophelbia*, *Baetis*
- Plecoptera: *Malenka*
- Trichoptera: *Hydropsyche*, *Hydroptila*, *Rhyacophila*, *Micrasema*

Sensitive algae:

- Diatoms: *Adlafia bryophila*, *Encyonema lunatum*, *Epithemia gibba* (or *Rhopalodia gibba*), *Epithemia sorex*, *Meridion circulare*

eDNA

Method	Detections
Jonah Ventures	Trout (<i>Salmo</i>); Trout (<i>Oncorhynchus</i>); Cattle (<i>Bovidae</i>); Wild boar (<i>Sus scrofa</i>); Human (<i>Homo sapiens</i>)
Smith-Root	Pending
Wilderlab	Stickleback (<i>Gasterosteus</i>); Trout (<i>Salmo</i>); Trout (<i>Oncorhynchus</i>); Cattle (<i>Bos</i>); Dog (<i>Canis lupus</i>)

One unidentified trout was observed during sampling.

Wilderlab TICI results ranged from “Good” to “Excellent”.

5.2.6. 554TRBSLM: Tributary to Salmon Creek at Horse Meadow Campground



This site is an intermittent reference stream that was identified for sampling by the statewide RCMP program as part of efforts to assess the applicability of indices of biotic integrity in intermittent streams outside of southern California. This stream was sampled by CDFW crews in June of 2025, and MARU revisited the site in August to take an additional sample later in the season before drying (Photo CK 8/5/25)

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community as well as intact physical habitat.

Index	June Result	August Result	Threshold
CSCI	0.95	0.93	0.79
d-ASCI (molecular)*	NS	1.16	0.86
m-ASCI	TBD	TBD	TBD
IPI	0.91	0.99	0.84

*Calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	June Result	August Result	Threshold
Temperature	-	23	Narrative (Deg C)
Dissolved Oxygen	-	8.94	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	7.9	7.72	6.5-8.5
Total Nitrogen	-	NR	1.0 mg/L
Total Phosphorus	-	ND	0.1 mg/L
Turbidity	0.19	0.21	20 NTU
Chloride	-	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	-	^b waterbody-specific mg/L
Conductivity	-	56.4	^a NA uS/cm
Alkalinity	14		^a NA mg/L
Dissolved Organic Carbon	-	-	^a NA mg/L
Benthic AFDM	-	-	^d 25 g/m ²
Benthic Chl-a	1.8	19.5	^d 44 mg/m ²
Benthic C:N	-	11.0	^a NA
Total Coliform	-	-	^a NA MPN/100 mL
E. coli	-	-	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	14
Algae*	5

*Diatoms only, calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Notable BMI:

- Ephemeroptera: *Baetis*, *Drunella grandis*, *Callibaetis*, *Anafroptilum*, Leptophlebiidae (family level)
- Plecoptera: *Sweltsa*, *Zapada cinctipes*
- Trichoptera: *Ochrotrichia*, *Micrasema*, *Hydroptila*, *Psychoglypha*, *Rhyacophila*, *Lepidostoma*, *Hydropsyche*

Sensitive Algae:

- Diatoms: *Adlafia bryophila*, *Encyonema lunatum*, *Epithemia gibba* (or *Rhopalodia gibba*), *Epithemia sorex*, *Meridion circulare*

eDNA

Method	Detections
Jonah Ventures	Trout (<i>Salmo</i>); Cattle (<i>Bos</i>)
Smith-Root	Pending
Wilderlab	Stickleback (<i>Gasterosteus</i>); Trout (<i>Salmo</i>); Cattle (<i>Bos</i>)

Multiple young of the year trout were observed during sampling.

Wilderlab TICI results were all “Excellent.”

5.3. Trend Sites

5.3.1. 909SRAWGL: Sweetwater River Above Wildwood Glen Ln Bridge



This site on the Sweetwater River is co-located with a USGS stream gage and exhibits intermittent flows (Figure 15). The site represents a slight upstream relocation and resampling of a historic SWAMP trend site (909SSWR03) that was located approximately 200-300 meters downstream and was sampled from 2004-2009 as part of a study of the impacts of the 2003 Cedar Fire (Rehn, A.C. 2011, see [Figure 14](#)). The site was moved for access purposes and co-location with the stream gage. The site was showing signs of baseflow drying when sampled, with some algae becoming exposed in areas of prior flow ([Figure 13](#)). (Photo CL 6/27/25).

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community as well as intact physical habitat.

Index	Result	Threshold
CSCI	1.13	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	1.09	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	15.9	Narrative (Deg C)
Dissolved Oxygen	6.89	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	7.62	6.5-8.5
Total Nitrogen	0.25	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	2.25	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	680	^a NA uS/cm
Alkalinity	215	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	15.9	^d 44 mg/m ²
Benthic C:N	11.4	^a NA
Total Coliform	613	^a NA MPN/100 mL
E. coli	12	^a NA MPN/100 mL

*Non-detect ^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	14
Algae	TBD

Notable BMI:

- Ephemeroptera: *Serratella micheneri*, *Baetis adonis*, *Fallceon*, *Paraleptophlebia*
- Plecoptera: *Isoperla denningi*, *Malenka*
- Trichoptera: *Agapetus*, *Hydropsyche*, *Lepidostoma*, *Ochrotrichia*, *Hydroptila*, *Wormaldia*, *Micrasema*
- Other: *Neohermes filicornis*

eDNA

Method	Detections
Jonah Ventures	Three-spined stickleback (<i>Gasterosteus aculeatus</i>); Mosquitofish (<i>Gambusia affinis</i>)
Smith-Root	Pending
Wilderlab	Pacific and California tree frogs (<i>Pseudacris hypochondriaca</i> and <i>Pseudacris cadaverina</i> , respectively); Three-spined stickleback (<i>Gasterosteus aculeatus</i>); Mosquitofish (<i>Gambusia</i>); Sheep (<i>Ovis</i>)

Three-spined stickleback (*Gasterosteus aculeatus*) and a two-striped garter snake (*Thamnophis hammondi*) were observed along the reach when sampling.

Wilderlab TICl results ranged from “Average” to “Good.”

Figure 13. The sensitive red algal species, *Paralemanea californica*, growing on rocks in fast turbulent flow in the Sweetwater River. Dark bands of internal reproductive structures give this species a bamboo-like appearance. The exposed algae on some rock faces indicates a drop in stream baseflow condition. (Photo CL 6/27/25)

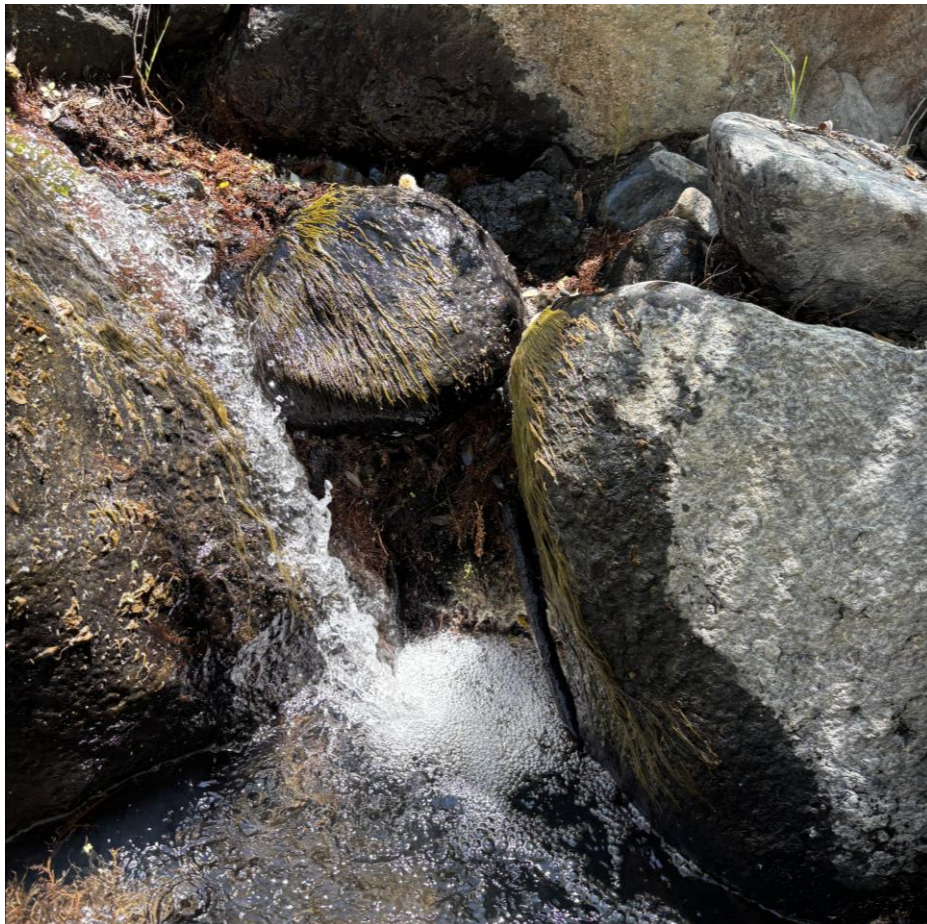


Figure 14. CSCI scores at Sweetwater River collected for the San Diego Water Board's post-fire study to document impacts from the 2003 Cedar fire. Note that BMI for all samples were identified at a SAFIT 1 level, which can underestimate CSCI scores.

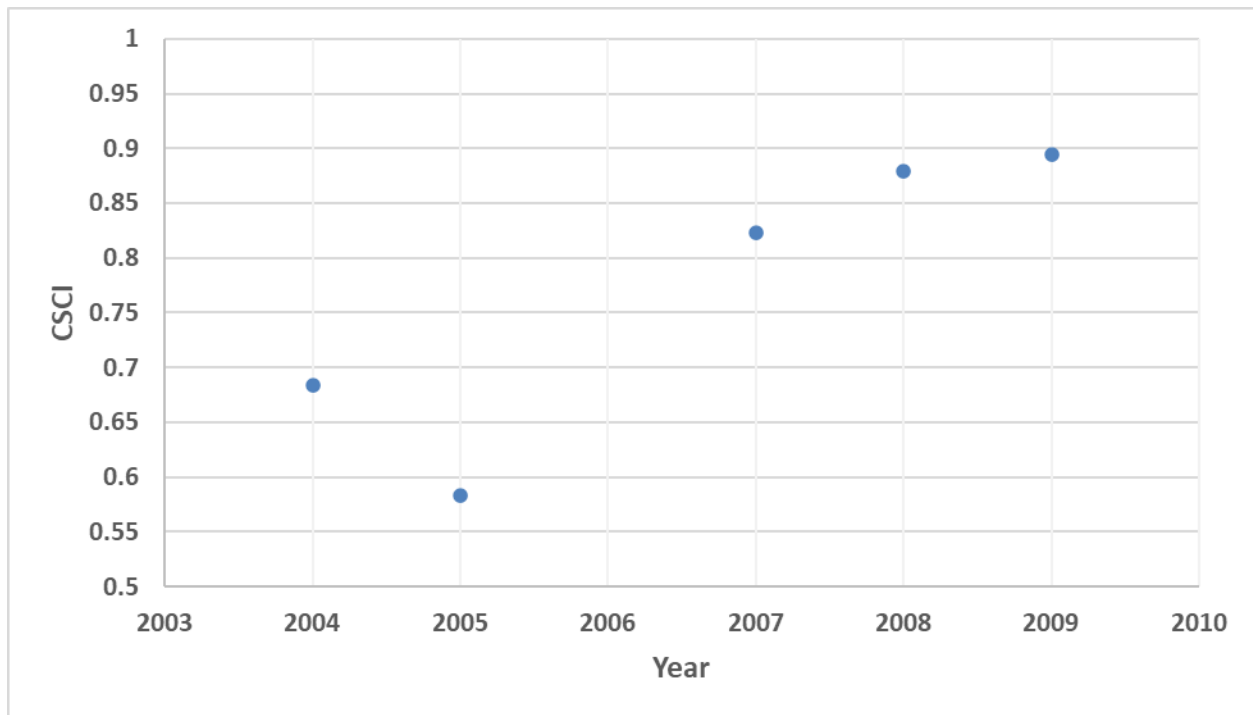
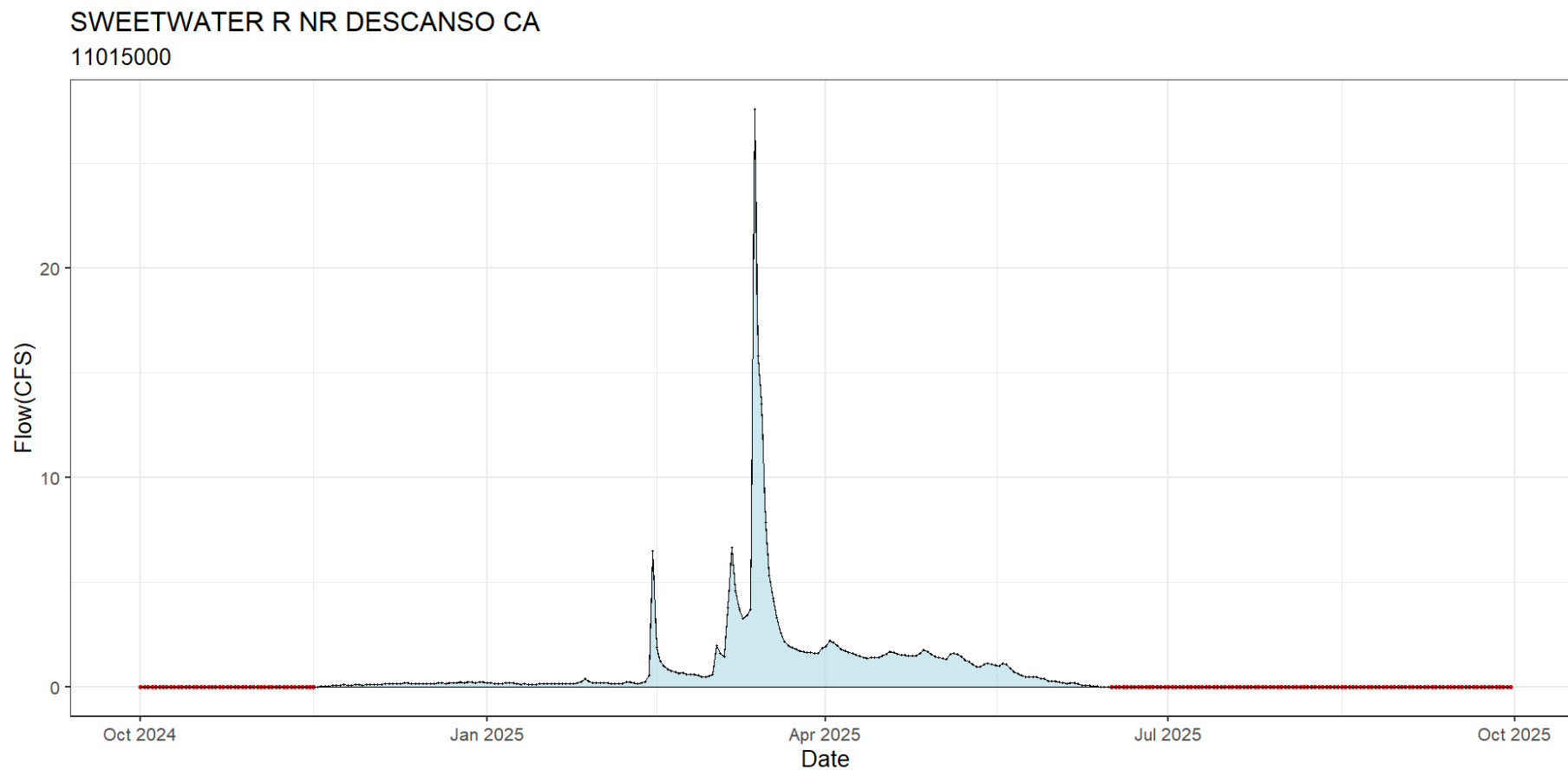


Figure 15. 2025 water year stream flow data from the Sweetwater River USGS gage. Red denotes no flow conditions.



5.3.2. 902SCSCRx: Sandia Creek at Sandia Creek Dr., 0.7 miles above Rock Mtn.



Sandia Creek is a perennial stream that drains a predominantly agricultural area in Riverside and San Diego Counties. This site is sampled as part of monitoring long-term agricultural impacts in the region. In addition, the stream has documented native species of concern, specifically steelhead and arroyo chub. [This site was last sampled by the San Diego Water Board in 2023.](#) (Photo CL 6/17/24)

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and intact physical habitat.

Index	Result	Threshold
CSCI	1.02	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	1.08	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	18.2	Narrative (Deg C)
Dissolved Oxygen	9.27	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.14	6.5-8.5
Total Nitrogen	3.17	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	1.49	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	1671	^a NA uS/cm
Alkalinity	201	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	9.59	^d 44 mg/m ²
Benthic C:N	9.56	^a NA
Total Coliform	>2419	^a NA MPN/100 mL
E. coli	122	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazon et al. 2022 threshold for obtaining 10th percentile ASCI score

^e In-house bacteria measurement (not Alpha Lab)

Taxa

	# EPT or Sensitive Taxa
BMI	16
Algae	TBD

Notable BMI:

- Ephemeroptera: *Baetis adonis*, *Tricorythodes*, *Fallceon*
- Plecoptera: *Malenka*
- Trichoptera: *Agapetus*, *Tinodes*, *Cheumatopsyche*, *Wormaldia*, *Nectopsyche*, *Hydropsyche*, *Helicopsyche*, *Micrasema*, *Helicopsyche*, *Nectopsyche*, *Lepidostoma*, *Neotrichia*

eDNA

Method	Detections
Jonah Ventures	Bass (<i>Micropterus</i>); Arroyo Chub (<i>Gila orcuttii</i>); Trout (<i>Oncorhynchus</i>); Catfish (<i>Ameiurus</i>); Fathead minnow (<i>Pimephales promelas</i>)
Smith-Root	Pending
Wilderlab	Pacific and California tree frog (<i>Pseudacris hypochondriaca</i> and <i>Pseudacris cadaverina</i> , respectively); Catfish (<i>Ameiurus</i>); Stickleback (<i>Gasterosteus</i>); Arroyo Chub (<i>Gila orcuttii</i>); Redeye and Largemouth bass (<i>Micropterus coosae</i> and <i>salmoides</i> , respectively); Trout (<i>Oncorhynchus</i>); Fathead minnow (<i>Pimephales promelas</i>); Crappie (<i>Pomoxis</i>); House rat (<i>Rattus rattus</i>); Cattle (<i>Bos</i>);

Arroyo chub (*Gila orcuttii*) were noted while sampling.

Wilderlab TICI results were all “Good.”

5.3.3. 911CCH80x: Cottonwood Creek downstream of Old HWY



This site on Cottonwood Creek is a long-term SWAMP trend station that was last sampled in 2018. The site was prioritized for sampling due to the time since the last sampling visit. (Photo CL)

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and intact physical habitat.

Index	Result	Threshold
CSCI	1.12	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	1.16	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	12.3	Narrative (Deg C)
Dissolved Oxygen	9.18	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	7.97	6.5-8.5
Total Nitrogen	0.15	1.0 mg/L
Total Phosphorus	0.02	0.1 mg/L
Turbidity	0.73	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	693	^a NA uS/cm
Alkalinity	246	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	13.8	^d 44 mg/m ²
Benthic C:N	14.8	^a NA
Total Coliform	816	^a NA MPN/100 mL
E. coli	4.1	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	14
Algae	TBD

Notable BMI:

- Ephemeroptera: Leptophlebiidae (family level), *Baetis adonis*, *Baetis tricaudatus*, *Dipheter hageni*
- Plecoptera: *Malenka*
- Trichoptera: *Hydropsyche*, *Psychoglypha*, *Micrasema*, *Gumaga*, *Rhyacophila*, *Triaenodes*, *Lepidostoma*, *Tinodes*, Glossosomatidae (family level)

eDNA

Method	Detections
Jonah Ventures	Wild boar (<i>Sus scrofa</i>)
Smith-Root	Pending
Wilderlab	Largemouth bass (<i>Micropterus salmoides</i>)

A small non-native largemouth bass (*Micropterus salmoides*) was observed while sampling. Notably, eDNA sampling occurred under and just downstream of the old highway 80 bridge. High levels of eDNA were picked up from Mexican free-tailed bat, likely from roosting under the bridge. Wilderlab TICI results were all “Good.”

5.3.4. 907NP9CMC: Coleman Creek



This site on Coleman Creek is a newer SWAMP trend station that was first sampled in 2018. This site is located just upstream of the San Diego River confluence and was initially selected for sampling as it drains a mixed land use of rural residential and agriculture, including much of the unincorporated town of Julian. The site was prioritized for sampling due to the time since the last sampling visit. (Photo CK)

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and intact physical habitat.

Index	Result	Threshold
CSCI	1.11	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	1.17	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	14.4	Narrative (Deg C)
Dissolved Oxygen	9.24	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	7.25	6.5-8.5
Total Nitrogen	0.24	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	1.02	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	545	^a NA uS/cm
Alkalinity	102	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	47.6	^d 44 mg/m ²
Benthic C:N	11.9	^a NA
Total Coliform	-	^a NA MPN/100 mL
E. coli	-	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	14
Algae	TBD

Notable BMI:

- Ephemeroptera: *Baetis adonis*, *Paraleptophlebia*, Ephemerellidae (family level)
- Plecoptera: *Isoperla denningi*, Capniidae (family level)
- Trichoptera: *Agapetus*, *Ochrotrichia*, *Rhyacophila rayneri*, Hydroptilidae (family level), *Gumaga*, *Tinodes*, *Wormaldia*, *Micrasema*
- Other: Megaloptera (likely *Neohermes*)

eDNA

Method	Detections
Jonah Ventures	No detections
Smith-Root	Pending
Wilderlab	NS

An unknown fish and a two-striped garter snake (*Thamnophis hammondi*) were observed while sampling.

5.3.5. 911TJPVC1: Pine Valley Creek 1



This site on Pine Creek is a SWAMP trend station that was sampled in 2006, 2021, and 2023. The site was prioritized for sampling due to its perennial flow. (Photo CK 6/25/24)

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and intact physical habitat.

Index	Result	Threshold
CSCI	1.05	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	0.97	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	12.2	Narrative (Deg C)
Dissolved Oxygen	8.61	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	7.65	6.5-8.5
Total Nitrogen	3.16	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	0.65	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	726	^a NA uS/cm
Alkalinity	156	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	12.4	^d 44 mg/m ²
Benthic C:N	14.3	^a NA
Total Coliform	>2419	^a NA MPN/100 mL
E. coli	29.5	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	10
Algae	TBD

Notable BMI:

- Ephemeroptera: *Diphetor hageni*, *Caenis bajaensis*, *Paraleptophlebia*
- Plecoptera: *Malenka*
- Trichoptera: *Gumaga*, *Wormaldia*, *Lepidostoma*, *Micrasema*, *Hydropsyche*, *Agapetus*

eDNA

Method	Detections
Jonah Ventures	Three-spined stickleback (<i>Gasterosteus aculeatus</i>)
Smith-Root	Pending
Wilderlab	Three-spined stickleback (<i>Gasterosteus aculeatus</i>); Cattle (<i>Bos</i>); Dog (<i>Canis</i>); House rat (<i>Rattus rattus</i>)

High numbers (>50) of three-spined stickleback (*Gasterosteus aculeatus*) were observed while sampling.

Wilderlab TICI results were all "Good."

5.4. Coverage Expansion Sites

5.4.1. 903SFMUCS: South Fork Moosa Canyon along Champagne Upper Concrete Section



This site on the South Fork of Moosa Canyon Creek is an intermittent stream that runs along Champagne Road. This site was selected for sampling as it represents a lower order stream that has been artificially hardened from bank to bank. Its location has lower levels of anthropogenic watershed development than most streams with artificially hardened streambeds. It also exhibits intermittent flows. Stream flows at the time of sampling were quite low and did not meet SOP requirements. (Photo CL)

CSCI and IPI scores indicated a biologically degraded benthic macroinvertebrate and degraded physical habitat.

Index	Result	Threshold
CSCI	0.74	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	0.73	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	16.0	Narrative (Deg C)
Dissolved Oxygen	10.6	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.86	6.5-8.5
Total Nitrogen	0.70	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	2.56	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	1739	^a NA uS/cm
Alkalinity	248	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	69.0	^d 44 mg/m ²
Benthic C:N	12.8	^a NA
Total Coliform	>2419	^a NA MPN/100 mL
E. coli	770	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	3
Algae	TBD

Notable BMI:

- Ephemeroptera: *Baetis*
- Plecoptera: None
- Trichoptera: *Hydropsyche*, *Tinodes*

eDNA

Method	Detections
Jonah Ventures	NS
Smith-Root	NS
Wilderlab	NS

Remains of non-native crayfish and unidentified frog tadpoles were observed when sampling.

5.4.2. 903SFMDCS: South Fork Moosa Canyon along Champagne Lower Concrete Section



This site on the South Fork of Moosa Canyon Creek is an intermittent stream that runs along Champagne Road but farther downstream and with more watershed input than the upper site. This site was selected for sampling as it represents a lower order stream that has been artificially hardened from bank to bank. Its location has lower levels of anthropogenic watershed development than most streams with artificially hardened streambeds. It also exhibits intermittent flows. Sampling at this site met SOP requirements. (Photo CL)

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and degraded physical habitat.

Index	Result	Threshold
CSCI	0.91	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	0.72	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	21.5	Narrative (Deg C)
Dissolved Oxygen	9.29	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.40	6.5-8.5
Total Nitrogen	0.34	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	1.45	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	1914	^a NA uS/cm
Alkalinity	270	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	56.3	^d 44 mg/m ²
Benthic C:N	10.8	^a NA
Total Coliform	>2419	^a NA MPN/100 mL
E. coli	14.6	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	5
Algae	TBD

Notable BMI:

- Ephemeroptera: *Baetis tricaudatus*, *Baetis bicaudatus*
- Plecoptera: None
- Trichoptera: *Tinodes*, *Hydroptila*, *Hydropsyche*

eDNA

Method	Detections
Jonah Ventures	NS
Smith-Root	NS
Wilderlab	NS

A California tree frog (*Pseudacris cadaverina*) and pacific tree frog (*Pseudacris regilla*) were observed when sampling,

5.4.3. 903WAMCTM: Mainstem We-a-ma Valley Creek from Dyche Valley, at Trail Meadow



This stream, believed to be perennial, is located in the Cleveland National Forest and drains a southern portion of Palomar mountain. (Photo CL)

CSCI and IPI scores indicated a biologically intact benthic macroinvertebrate community and intact physical habitat.

Index	Result	Threshold
CSCI	1.12	0.79
d-ASCI (molecular)	TBD	0.86
m-ASCI	TBD	TBD
IPI	1.17	0.84

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	9.95	Narrative (Deg C)
Dissolved Oxygen	9.04	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	6.83	6.5-8.5
Total Nitrogen	0.20	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	1.12	20 NTU
Chloride	-	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	-	^b waterbody-specific mg/L
Conductivity	247	^a NA uS/cm
Alkalinity	82	^a NA mg/L
Dissolved Organic Carbon	-	^a NA mg/L
Benthic AFDM	-	^d 25 g/m ²
Benthic Chl-a	10.7	^d 44 mg/m ²
Benthic C:N	13.5	^a NA
Total Coliform	866	^a NA MPN/100 mL
E. coli	36.4	^a NA MPN/100 mL

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazor et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	21
Algae	TBD

Notable BMI:

- Ephemeroptera: *Dipheter hageni*, *Drunella*, *Siphonurus*, *Matriella teresa*, *Caenis bajaensis*, *Ironodes*, *Baetis*, Leptophlebiidae (family level)
- Plecoptera: *Isoperla denningi*, *Taenionema*
- Trichoptera: *Psychoglypha*, *Neophylax*, *Gumaga*, *Lepidostoma*, *Agapetus*, *Hydropsyche*, *Micrasema*, *Wormaldia*, *Tinodes*, Polycentropodidae (family level)
- Other: Megaloptera (likely *Neohermes*)

eDNA

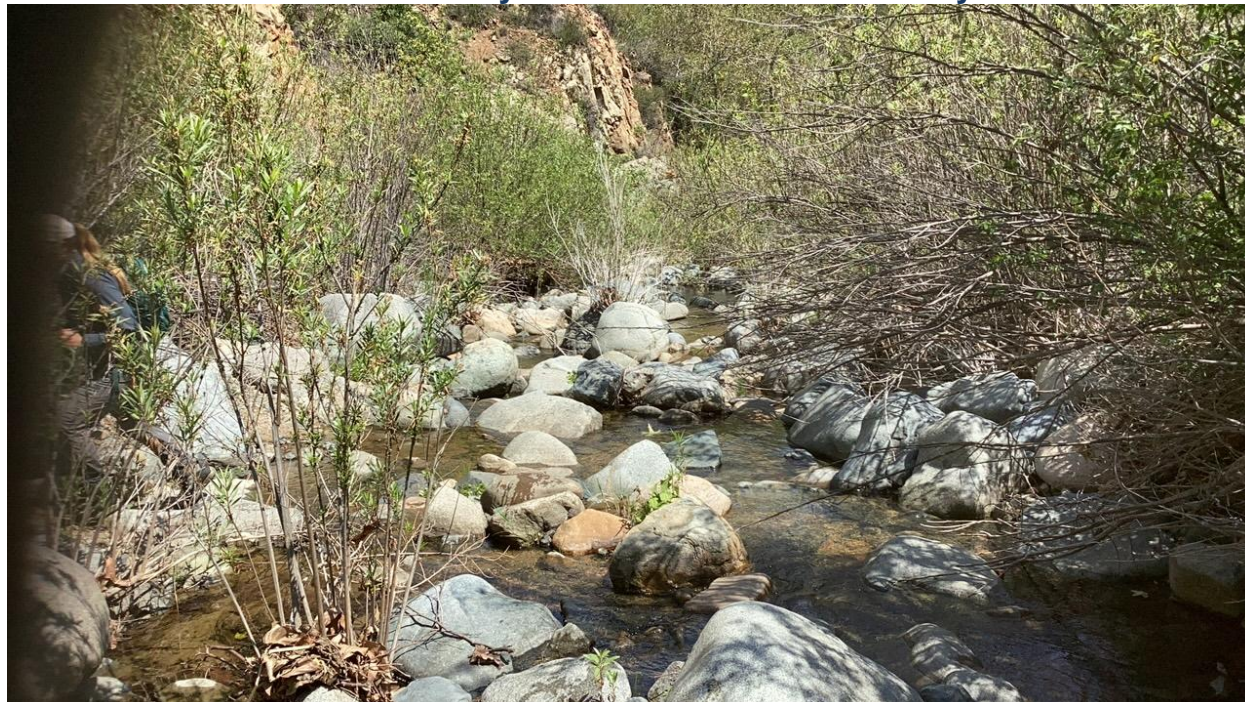
Method	Detections
Jonah Ventures	Crow/raven (<i>Corvus</i>)
Smith-Root	Pending
Wilderlab (sampled 11/20/25)	Cattle (<i>Bos</i>); <i>Ichthyobodo</i> (fish pathogen)

No higher trophic level aquatic life were observed while sampling. Wilderlab TICI Index were all "Average." It is unknown if sampling in the fall or winter impacts TICI scores.

5.5. CDFW RCMP sites

SWAMP's CDFW field crew sampled three RCMP sites in 2025. For 2025, the sites chosen for sampling were predominantly sites that met RCMP screening criteria but had not been sampled in recent years.

5.5.1. 901DCCSMC: Devils Canyon Creek above San Mateo Cyn. Creek



Devils Canyon Creek at this sampling location is an intermittently-flowing RCMP site in the San Mateo Wilderness portion of the Cleveland National Forest. Devils Canyon Creek had not been sampled since 2011 (CSCI: 1.26) as access requires coordination with the United States Marine Corps Camp Pendleton Base.

The CSCI, d-ASCI, and IPI scores indicated a biologically intact benthic macroinvertebrate community, diatom community, and physical habitat.

Index	Result	Threshold
CSCI	1.14	0.79
d-ASCI (molecular)*	1.05 – 1.08	0.86
m-ASCI	TBD	TBD
IPI	0.98	0.84

*Calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	16.4	Narrative (Deg C)
Dissolved Oxygen	9.5	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.3	6.5-8.5
Total Nitrogen	0.16	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	-	20 NTU
Chloride	56	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	34	^b waterbody-specific mg/L
Conductivity	601	^a NA uS/cm
Total Suspended Solids	ND	^a NA mg/L
Alkalinity	218	^a NA mg/L
Dissolved Organic Carbon	1.9	^a NA mg/L
Benthic AFDM	10.8	^d 25 g/m ²
Benthic Chl-a	3.5	^d 44 mg/m ²
Benthic C:N	-	^a NA

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazon et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	19
Algae*	6

*Diatoms only, calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Notable BMI:

- Ephemeroptera: *Baetis bicaudatus*, *Serratella micheneri*, *Tricorythodes*, Heptageniidae (family level), Leptophlebiidae (family level), *Caenis*, *Dipheter hageni*
- Plecoptera: Perlodidae, Nemouridae
- Trichoptera: *Gumaga*, *Tinodes*, *Ochrotrichia*, *Hydropsyche*, *Cheumatopsyche*, *Dolophilodes*, *Micrasema*, *Helicopsyche*, *Agapetus*, Polycentropodidae

Sensitive algae:

- Diatoms: *Denticula tenuis*, *Epithemia gibba* (or *Rhopalodia gibba*), *Epithemia sorex*, *Epithemia turgida*, *Meridion circulare*, *Sellaphora bacillum*

5.5.2. 901S04309: San Mateo Canyon Creek above Devil Cyn. Cr.



The San Mateo Creek is an intermittent stream first sampled as a probabilistic site by the SMC in 2011 (CSCI: 0.95). As the site meets GIS reference screens, it was added to the RCMP site pool for future resampling but had not been resampled due to the same access logistics as Devil's Canyon.

The CSCI, d-ASCI, and IPI scores indicated a biologically intact benthic macroinvertebrate community, diatom community, and physical habitat.

Index	Result	Threshold
CSCI	0.92	0.79
d-ASCI (molecular)*	1.16	0.86
m-ASCI	TBD	TBD
IPI	1.08	0.84

*Calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	19.9	Narrative (Deg C)
Dissolved Oxygen	6.9	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	7.5	6.5-8.5
Total Nitrogen	0.21	1.0 mg/L
Total Phosphorus	0.03	0.1 mg/L
Turbidity	-	20 NTU
Chloride	68	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	59	^b waterbody-specific mg/L
Conductivity	710	^a NA uS/cm
Total Suspended Solids	0.5	^a NA mg/L
Alkalinity	200	^a NA mg/L
Dissolved Organic Carbon	2.7	^a NA mg/L
Benthic AFDM	11.4	^d 25 g/m ²
Benthic Chl-a	28.1	^d 44 mg/m ²
Benthic C:N	-	^a NA

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazon et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	12
Algae*	3

*Diatoms only, calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Notable BMI:

- Ephemeroptera: *Callibaetis*, *Tricorythodes*, *Baetis adonis*, *Serratella micheneri*, *Caenis amica*
- Plecoptera: None
- Trichoptera: *Hydropsyche*, *Tinodes*, *Cheumatopsyche*, *Hydroptila*, *Micrasema*, *Ochrotrichia*, Hydroptilidae (family level)

Sensitive algae:

- Diatoms: *Epithemia sorex*, *Epithemia turgida*, *Sellaphora bacillum*

5.5.3. 907CCCR02: Cedar Creek 2



Cedar Creek is an intermittent stream within the Cleveland National Forest. Cedar Creek has been sampled as part of RCMP since 2001, and was used in 2010 to evaluate the impact of sampling timing and drying on CSCI scores.

The CSCI, d-ASCI, and IPI scores indicated a biologically intact benthic macroinvertebrate community, diatom community, and physical habitat.

Index	Result	Threshold
CSCI	1.19	0.79
d-ASCI (molecular)*	1.01	0.86
m-ASCI	TBD	TBD
IPI	1.12	0.84

*Calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Chemical and physical water quality results met relevant aquatic life water quality objectives in the Basin Plan.

Parameter	Result	Threshold
Temperature	14.5	Narrative (Deg C)
Dissolved Oxygen	9.2	5.0 (WARM BU) or 6.0 (COLD BU) mg/L
pH	8.2	6.5-8.5
Total Nitrogen	0.17	1.0 mg/L
Total Phosphorus	ND	0.1 mg/L
Turbidity	0.01	20 NTU
Chloride	43	^b waterbody-specific mg/L; ^c 230 & 860 mg/L
Sulfate	57	^b waterbody-specific mg/L
Conductivity	508	^a NA uS/cm
Total Suspended Solids	0.6	^a NA mg/L
Alkalinity	180	^a NA mg/L
Dissolved Organic Carbon	2.4	^a NA mg/L
Benthic AFDM	5.8	^d 25 g/m ²
Benthic Chl-a	4.5	^d 44 mg/m ²
Benthic C:N	-	^a NA

*Non-detect

^a Informational

^b Basin Plan criteria are specific to non-aquatic use

^c USEPA recommended freshwater criteria for 4-day and 1-hour exposure, respectively.

^d Mazon et al. 2022 threshold for obtaining 10th percentile ASCI score

Taxa

	# EPT or Sensitive Taxa
BMI	14
Algae*	4

*Diatoms only, calculated using results from molecular taxonomic identification instead of traditional (see Section 2.2.1).

Notable BMI:

- Ephemeroptera: *Baetis tricaudatus*, *Serratella micheneri*, *Caenis bajaensis*, *Anafrptilum*, *Paraleptophlebia*, Heptageniidae (family level)
- Plecoptera: *Isoperla*
- Trichoptera: *Neotrichia*, *Micrasema*, *Lepidostoma*, *Wormaldia*, *Agapetus*, *Ochrotrichia*
- Other: Megaloptera (likely *Neohermes*)

Sensitive algae:

- Diatoms: *Caloneis lewisii* (or *Caloneis schumannian*), *Epithemia sorex*, *Epithemia turgida*, *Meridion circulare*

5.6. Partner supported Trout Unlimited sites

5.6.1. 554TMDUAR: South Fork Kern River Tunnel Meadow at Upper Airstrip

This sampling site on the South Fork of the Kern River was sampled by Trout Unlimited as part of the evaluation of meadow restoration projects on the Kern Plateau within the Golden Trout Wilderness. While there are existing CSCI scores on the South Fork Kern, this meadow had never been sampled and scored using the CSCI.

The CSCI score indicated a biologically intact benthic macroinvertebrate community.

Index	Result	Threshold
CSCI	0.97	0.79

Taxa

	# EPT or Sensitive Taxa
BMI	13

Notable BMI:

- Ephemeroptera: *Dipheter hageni*, *Ameletus*, *Serratella micheneri*, *Paraleptophlebia*, *Drunella*, *Baetis tricaudatus*
- Plecoptera: Capniidae (family level), *Malenka*, *Zapada cinctipes*, Perlodidae (family level)
- Trichoptera: *Psychoglypha*, *Yphria californica*
- Other: *Sialis*

5.7. eDNA-only sites

5.7.1. 903FCPSPx: French Creek (FCPSP)



This site is located on a perennial portion of French Creek and was sampled on 07/01/2025 and 12/19/2025. This site was sampled on 07/01 in conjunction with State Water Board staff using both a Smith-Root citizen science sampler and backpack eDNA sampler. Jonah Ventures and Wilderlab kits were used at this site for the July sampling event. A revisit to the site was done on 12/19 to collect another Wilderlab kit. Analysis on the Smith-Root samples was conducted for the presence of DNA from species-specific probes and ddPCR. (Photo DW)

eDNA

Method	Detections
Jonah Ventures	Trout (<i>Oncorhynchus</i>); Bluegill (<i>Lepomis</i>); California vole (<i>Microtus californicus</i>)
Smith-Root	Pending
Wilderlab 07/01	Pacific and California tree frogs (<i>Pseudacris hypochondriaca</i> and <i>Pseudacris cadaverina</i> , respectively); Stickleback (<i>Gasterosteus</i>); Bluegill (<i>Lepomis</i>); Trout (<i>Oncorhynchus</i>)
Wilderlab 12/19	Trout (<i>Oncorhynchus</i>)

Wilderlab TICI results were all “Good” for 07/01 and 12/19.

5.7.2. 903PCMPx: Pauma Creek downstream of Doque Trail at Palomar Mountain



This site is on Pauma Creek is located just downstream of the junction of French and Doane Creeks. Flows at this site are perennial. This site was sampled on 07/01 in conjunction with State Water Board staff using both a Smith-Root citizen science sampler and backpack eDNA sampler. Jonah Ventures and Wilderlab kits were also used at this site. Analysis was conducted for the presence of DNA from species-specific probes and ddPCR using both a Smith-Root citizen science sampler and backpack eDNA sampler. (Photo CL)

eDNA

Method	Detections
Jonah Ventures	Trout (<i>Oncorhynchus</i>)
Smith-Root	Pending
Wilderlab	Pacific and California tree frogs (<i>Pseudacris hypochondriaca</i> and <i>Pseudacris cadaverina</i> , respectively); Stickleback (<i>Gasterosteus</i>); Bluegill (<i>Lepomis</i>); Trout (<i>Oncorhynchus</i>); Cattle (<i>Bos</i>)

Wilderlab TICI results were all “Good.”

5.7.3. 903NP9UAC: Upper Agua Caliente



Upper Agua Caliente Creek is a long term RCMP site within the Cleveland National Forest. Site visits and water level loggers have documented that Upper Agua Caliente Creek exhibits perennial flow. For 2022 to 2023, the logger was deployed to a new stream location, but it did not accurately depict water level, showing the stream as dry during a portion of deployment. It was moved to a new position in 2024 and deployed with a trail camera to test the feasibility of using photographic images to document flow conditions in locations where logger deployment is a challenge. The new logger location and trail camera documented perennial flow ([Figure 16](#) and [Figure 17](#)). Additional trail cameras will be tested at other stream sites where logger deployment is a challenge. eDNA sampling was conducted at Upper Agua Caliente on 12/08 using a Wilderlab kit (Photo CL 12/16/24).

eDNA

Method	Detections
Jonah Ventures	NS
Smith-Root	NS
Wilderlab	Cattle (<i>Bos</i>); Dog (<i>Canis</i>); Ichthyobodo (fish pathogen)

Wilderlab TICl results were all “Good.” It is unknown if sampling in the fall or winter impacts TICl scores.

Figure 16. Conductivity levels at Upper Agua Caliente Creek (us/cm). Note the conductivity logger was moved in 12/2024 to a location more representative of stream flow (hence the change). The logger showed no stream drying from mid-2023 through the end of 2025.

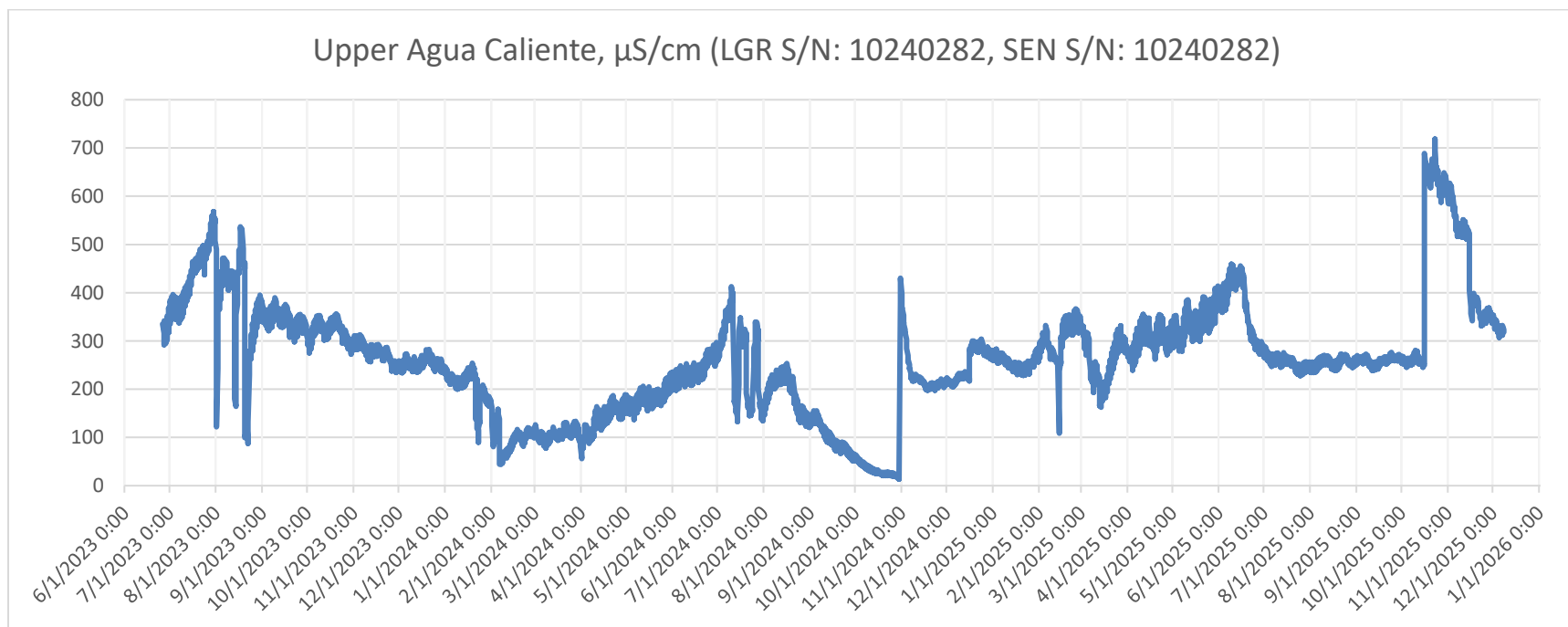


Figure 17. Trail camera photo of high storm flows at Upper Agua Caliente Creek. This high flow event can be seen in [Figure 16](#) as conductivity suddenly drops from approx. 275 to 100 us/cm.



6. Summary

- 2025 marked the 30th year of State of California bioassessment monitoring in Region 9. To date, over 600 sites in the region have been bioassessed at least once, and more than 1,750 bioassessments have been done.
- This report summarizes 20 bioassessments done in 2025 by MARU (16), CDFW (3), and Trout Unlimited (1). These bioassessments covered 20 stream sites.
- **CSCI scores indicated intact macroinvertebrate communities at all but one site.**
 - One site sampled by MARU scored 0.74, indicating poor biological condition (South Moosa Creek Upstream Concrete Section), though flows were low and did not meet the sampling SOP.
- **ASCI scores indicated degraded condition at all four post-fire sites.**
 - Traditional ASCI scores were available only for four sites sampled by MARU (post-fire).
 - Some sites had ASCI scores calculated using molecular identifications, but scores should be interpreted with caution.
 - mASCI scores are pending and will be added to this report when the mASCI is available.
- **IPI scores indicated intact physical habitat at all but three sites.**
 - IPI scores were available only for sites sampled by MARU and CDFW.
 - Sites that did not meet the IPI threshold of 0.84 included one post-fire site (Hot Spring Canyon Creek, IPI: 0.83) and both South Moosa Creek sites (Upstream Concrete Section, IPI: 0.73 and Downstream Concrete Section, IPI: 0.72).
- **Chemistry results met Basin Plan objectives for aquatic life at all but one site.**
 - The pH in the South Moosa Creek Upstream Concrete Section (8.86 units) exceeded the Basin Plan maximum value of 8.5 units for inland surface waters.
 - Benthic chlorophyll-a was reported above the published threshold of 44 mg/m² at both South Moosa Creek sites (Upstream Concrete Section, 69 mg/m² and Downstream Concrete Section, 56.3 mg/m²) and Coleman Creek (47.6 mg/m²). However, this parameter is not an established Basin Plan objective and is documented to have a high degree of variability.

- **Carbon:Nitrogen molar ratios were between 8 and 16 at all 16 sites tested**, indicating the streams had a mix of carbon-rich (leaves) and nitrogen-rich (algae, animal waste) sources.
 - A borderline high ratio (16.0) at the Hot Spring Canyon Creek post-fire site suggests this stream has a predominance of carbon sources.
- **E. coli results exceeded the Basin Plan objective at two of the 14 sites tested.**
 - All sites were below the Basin Plan statistical threshold value (STV) of 320 MPN/100 mL³ with the exception of Agua Caliente Creek (461 MPN/100 mL) and the South Moosa Creek Upstream Concrete Section (770 MPN/100 mL).
 - However, *E. coli* samples were analyzed for in-house, not an accredited laboratory, and results are provided for informational purposes only.
- **eDNA metabarcoding kits detected notable aquatic wildlife at 15 of the 16 sites where they were used.** The Jonah Ventures and Wilderlab eDNA kits detected three sensitive native fish species, seven non-native fish species, three native amphibian species and one non-native reptile species.
 - The native species were arroyo chub (*Gila orcuttii*), three-spined stickleback (*Gasterosteus aculeatus*), trout (*Oncorhynchus*), newt (*Taricha granulosa*, likely truly a California newt *Taricha torosa*), Pacific tree frog (*Pseudacris regilla*), and California tree frog (*Pseudacris cadaverina*).
 - The non-native species were sunfish (*Lepomis* genus), bullhead catfish (*Ameiurus*), fat-head minnow (*Pimephales promelas*), crappie (*Pomoxis* genus), Mosquitofish (*Gambusia affinis*), bass (*Micropterus* genus), trout (*Salmo* genus), and common box turtle (*Terrapene Carolina*).
 - MARU plans to use eDNA metabarcoding kits again in 2026.
- **Results from targeted eDNA analyses using ddPCR are still pending. The San Diego Water Board is transitioning to a new eDNA laboratory and this report will be updated following receipt of results.**

³ The objective units are written as “colony-forming units per 100 mL” (CFU/100 mL), which is considered equivalent to MPN/100mL. There were not a statistically significant number of samples to calculate a six-week geomean for comparison to the 100 CFU/100 mL water quality objective.

- **According to the CEDEN database (searched 9/30/26), a total of 50 bioassessments were done in Region 9 in 2025.** MARU and CDFW did 17, and 33 were done by other entities. Bioassessment data from 2025 can be found in [CEDEN](#) under the following Projects:

# BAs	Project
16	RWB9 Bioassessment 2025*
3	Statewide Ref Condition Management Plan 2025
9	SMC Regional Watershed Monitoring 2025
14	SMC Regional Watershed Monitoring SCCWRP
6	SCCWRP EPA Mitigation Resiliency Project 2025
3	SMC Supplemental Env Project San Diego County 2025
1	SMC Supplemental Environmental Project Poway 2025

* Two of the 16 bioassessments were performed in Region 5.

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