SCCWRP FACT SHEET

Balancing competing demands on limited flow resources

The science of ecohydrology is helping watershed managers take an informed, integrated approach to setting flow patterns that protect ecosystem health while balancing human uses for flowing water

Humans have made dramatic modifications to how water flows across landscapes statewide. These modifications bring drinking water and irrigation water to communities, power hydroelectric dams, provide cultural and recreational benefits, and promote the growth of diverse plant and animal life. But these flow modifications also can harm aquatic ecosystems. Against this backdrop, California's water resources management community is turning to the science of **ecohydrology** to identify solutions that balance the many human uses for flowing water with the need to protect ecosystem health.

Treated wastewater effluent is discharged into the Los Angeles River from a nearby water reclamation plant. These year-round flows support plant and animal life, but in drought-prone California, there's pressure to recycle some of these discharges for human uses instead.

What is ecohydrology?

This relationship between flow patterns and ecological health is an area of study known as ecohydrology. This relationship, which is complex and site-specific, is shaped by flow patterns at a given site over the course of the year, local topographic and environmental conditions, and the composition of aquatic life. Watershed managers use the science of ecohydrology to understand what flow patterns are necessary to protect the health of aquatic life that are sensitive to changes in flow patterns.

Flow alterations: A major source of ecological stress

The wide range of ways that humans have altered how water flows naturally through California has become a major source of ecological stress on waterways – a bigger stressor than common pollutants like heavy metals, pesticides and excess nutrients that degrade water quality.

Altered flows are the No. 1 cause of degradation to aquatic life in Southern California streams, according to foundational work published in 2015 by the Southern California Stormwater Monitoring Coalition (SMC).

California Environmental Flow Framework

California uses a standardized scientific approach known as the California Environmental Flows Framework (CEFF) to help managers make decisions about how to allocate limited flow resources that balance both human and ecosystem needs for flowing water.

- Unveiled in 2021, the approach consists of a methodical, multi-step process for determining the magnitude, duration and frequency of stream flows needed to protect ecological integrity, recreational opportunities and other beneficial uses.
- Instead of focusing narrowly on a single species at a specific life stage or a single beneficial use that may not be representative of overall ecosystem functioning, CEFF focuses on protecting the most ecologically significant attributes of a water body's flow patterns over the course of a year, such as the annual recessional flow patterns generated by snow melt in the early spring that support breeding and migration. Researchers refer to the range of flow patterns necessary to support sensitive aquatic life and other uses for water as **environmental flows**.
- Among CEFF's key benefits is it gives managers a systematic, structured way to incorporate climate change, changing land-use practices, and changing water-use practices into long-term flow management planning.

Diverting flows via 1211 wastewater change petitions

As drought-prone California looks for opportunities to recycle and reuse more water, wastewater effluent that's being discharged into the coastal ocean and inland waterways is increasingly viewed as a strategic target. But diverting wastewater discharges can have ecological consequences – especially when this treated water for much of the year is the predominant source of flows supporting plant and animal life. That's why California requires wastewater treatment agencies to seek regulatory approval, under **State Water Code Section 1211**, to begin recycling effluent discharges. Ecohydrology modeling plays a key role in helping managers evaluate how much effluent, if any, can be diverted from streams without jeopardizing ecosystem health and other beneficial uses.

Applying CEFF to make flow management decisions

The California Environmental Flows Framework (CEFF) enables water resources management agencies to take a standardized, agreed-upon approach to determining the flow patterns needed to sustain the health of aquatic ecosystems. Since its unveiling in 2021, CEFF has helped managers work through multiple complex flow management decisions.

Diverting wastewater and stormwater discharges to the Los Angeles River

In an early CEFF pilot study, SCCWRP examined if flows in the Los Angeles River can be reduced for water-recycling purposes while simultaneously protecting the ecological and recreational benefits provided by the river's flows – a scenario that is expected to become commonplace in Southern California as a result of climate change. Following the study:

- The City of Los Angeles in 2021 applied for regulatory approval, under State Water Code Section 1211, to begin recycling more wastewater effluent that has historically been discharged to the Los Angeles River. The application is pending; a supplemental environmental impact report was submitted in 2024.
- The County of Los Angeles developed the Stormwater Capture Parks Program to capture more stormwater in the greater Los Angeles basin via specially designed underground structures – instead of allowing stormwater from these areas to run off into the L.A. River.

Eliminating unnatural dry-weather flows in southern Orange County watersheds

Photo credit: U.S. Fish and Wildlife Service

The endangered arroyo toad is among the aquatic life vulnerable to changes in flow patterns.

In 2022, SCCWRP used CEFF to help watershed managers in southern Orange County optimally balance two competing interests: A desire to eliminate unnatural, ecologically harmful dry-weather flows that come from irrigation and other discharges, and a recognition that eliminating these flows could trigger adverse ecological effects of their own.

- Based on these analyses, multiple stream restoration and flow diversion projects are underway or under consideration.

Optimizing groundwater management practices

Groundwater sustainability agencies across California are using CEFF to determine if groundwater pumping is adversely affecting the environmental flows that sustain vulnerable aquatic life in surface-level waterways. Groundwater pumping can adversely affect interconnected surface-level flow patterns.

- The California Department of Water Resources (DWR) is exploring the framework to inform strategies for implementing flood managed aquifer recharge (Flood-MAR), in which certain areas are deliberately flooded to recharge underground aquifers. The goal is to reduce the need for low-flow diversion by diverting high flows for aquifer recharge.

Co-occurring stressors: Temperature and other water-quality parameters

While most ecohydrology research to date has focused on understanding the ecological effects of human-caused alterations to flow patterns, flow alterations are part of an interconnected set of stressors affecting watershed health; the most dominant of these co-occurring stressors are **water temperature** and other **water-quality** parameters like pollution. To evaluate the synergistic effects of these stressors, researchers are integrating CEFF with models that predict the effects of changes to water-quality parameters.

- In recent years, SCCWRP has been exploring how ecosystem health is affected when treated wastewater effluent is discharged into Southern California streams at temperatures that are different than the stream's own. Researchers also are looking at the ecological consequences of these wastewater discharges being warmed by sunlight, especially in shallow urban streams.
- Improved understanding of the relationship between water temperature and ecological health has numerous potential management implications, including for setting permissible temperature ranges for discharges, deciding how to design stream restoration projects, and determining how groundwater could be used to offset rising surface water temperatures.

More reading

California Environmental Flows Framework (CEFF) website

Overview of SCCWRP's Ecohydrology research theme