

Management Memo **Extent**

# EXTENT OF CALIFORNIA'S PERENNIAL AND NON-PERENNIAL STREAMS

California's Water Boards are responsible for protecting, enhancing, and restoring water quality in a large network of perennial and non-perennial<sup>1</sup> streams under the authority of the Clean Water Act and Porter-Cologne Water Quality Control Act. Most of the Water Board's resources are devoted to perennial streams because they tend to have many beneficial uses and pollution problems tend to accumulate downstream. However, non-perennial streams make up the majority of California's stream network, are an important interface between land-use activities and downstream impacts, and support a wide variety of aquatic life uses.

The distribution of perennial and non-perennial streams in different regions of the State has direct bearing on several of the State Water Board's current priority initiatives (e.g., biological objectives for perennial streams and rivers, and the Wetland and Riparian Area Protection Policy). However, currently best-available stream maps are replete with inaccuracies about the extent and classification of perennial and non-perennial streams. For example, a recent field study in Southern California demonstrated that the flow status of greater than 50% of streams was misclassified.

The Surface Water Ambient Monitoring Program's (SWAMP) Perennial Streams Assessment (PSA) gives us the ability to assess the magnitude of resource mis-classification in different regions of California. This Management Memo summarizes key findings on the extent of perennial and non-perennial streams and highlights the need for more refined base maps to define the extent of the water resources protected by State and Federal regulations.

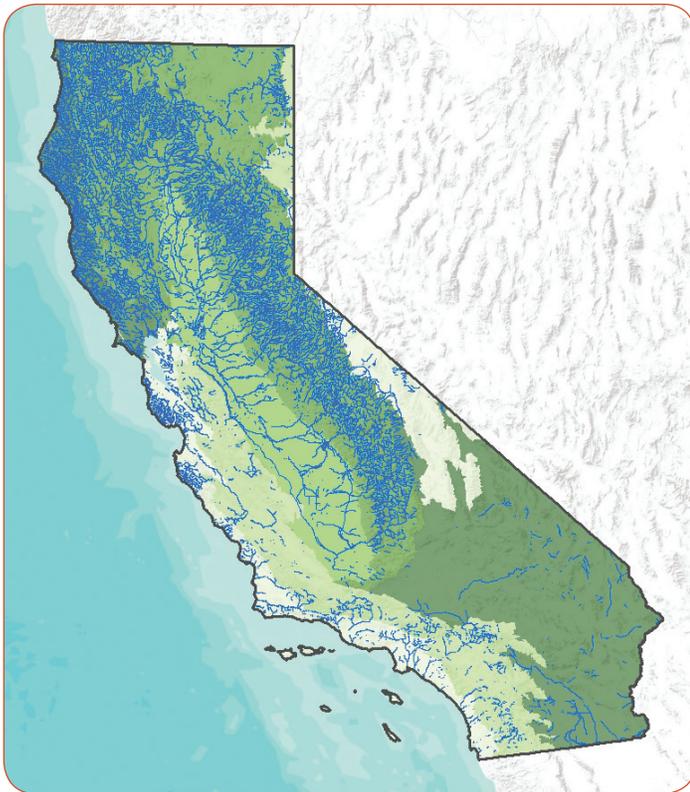
**OBJECTIVE**  
The objective of this memo is to inform management about the extent of California's perennial and non-perennial<sup>1</sup> streams and implications for the management of these aquatic resources.

1. Non-perennial streams include both intermittent and ephemeral streams.



## Description of Resources

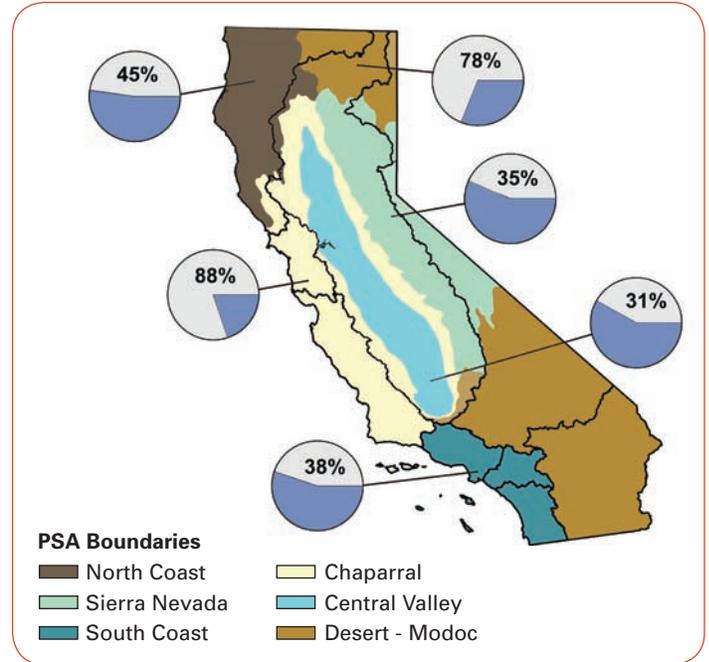
The total length of California’s streams is approximately 284,000 km (Figure 1), according to the National Hydrography Dataset (NHD and its EPA derivative, NHD+). This includes the major and minor rivers, streams, and creeks that flow year-round (perennial) and those that have flow for only a portion of the year (non-perennial). The NHD classifies 206,000 km (73%) of California’s stream network as non-perennial.



**Figure 1. Network of California’s streams resources.** California streams comprise 284,000 km. Based on the National Hydrography Dataset (NHD), both perennial and non-perennial streams are shown here in blue.

Perennial Streams Assessment (PSA) field reconnaissance conducted over the last eight years provides a quantitative estimate of the error rate associated with the NHD mapping in different regions of the State. Based on reconnaissance of over 1000 sites, approximately 66% of the State’s stream network is non-perennial, which is roughly similar to the

proportion in NHD (Figure 2). However, regional proportions often were quite different from NHD.



**Figure 2. Non-perennial Stream Resources In California.** Pie charts show the percent of non-perennial streams (gray), relative to the amount of perennial streams (blue) in each PSA Region. Color overlays delineate the six PSA Regions. Black lines correspond to Regional Water Board boundaries.

Under the PSA, California is divided into six large biogeographic areas (referred to hereafter as PSA regions): a) the North Coast; b) the Chaparral along the Central Coast and foothills of the Central Valley; c) the Sierra Nevada; d) the Central Valley floor; e) Southern California Coastal watersheds; and f) the Desert-Modoc, which combines the Modoc Plateau and southern Desert areas. Figure 2 presents the percent of perennial streams in each PSA region.

Most of the State’s perennial streams (app. 65%) occur in the North Coast and Sierra Nevada PSA regions (Figure 3). Non-perennial streams represent nearly all of the stream network in more arid regions and most of the headwater streams in the more mountainous regions of the State. One

key finding is that arid regions in the State, such as the South Coast and Central Valley PSA regions, had a higher proportion of perennial stream length than anticipated from the NHD. This finding reflects the conversion of many non-perennial streams to perennial streams through flow augmentation from urban runoff and the loss of hydrological complexity due to urban and agricultural development. In the Central Valley, flows from agricultural irrigation have resulted in the conversion of non-perennial streams to non-wadeable perennial rivers.

### Implications

The large proportion of non-perennial stream length across all regions has significant implications for water quality and aquatic life in California’s streams and rivers. Although these ecosystems are non-perennial, they often support rich biotic communities both in the stream channels and in the surrounding riparian zones. In addition, these streams collectively drain large areas of land, which can result in concentrated seasonal impacts from point and nonpoint pollution sources to the downstream perennial flows. During rain events, these non-perennial streams form a conduit for transport of pollutants from the landscape. Development in watersheds may also increase flow to non-perennial streams during both dry and wet periods. Such changes in hydrology can have major impacts on physical habitat, biota, and water quality within those streams, as well as downstream, thereby compromising many beneficial uses in both non-perennial and perennial streams. This is especially true in arid regions of the State (e.g., Chaparral, South Coast, and Desert-Modoc PSA Regions).

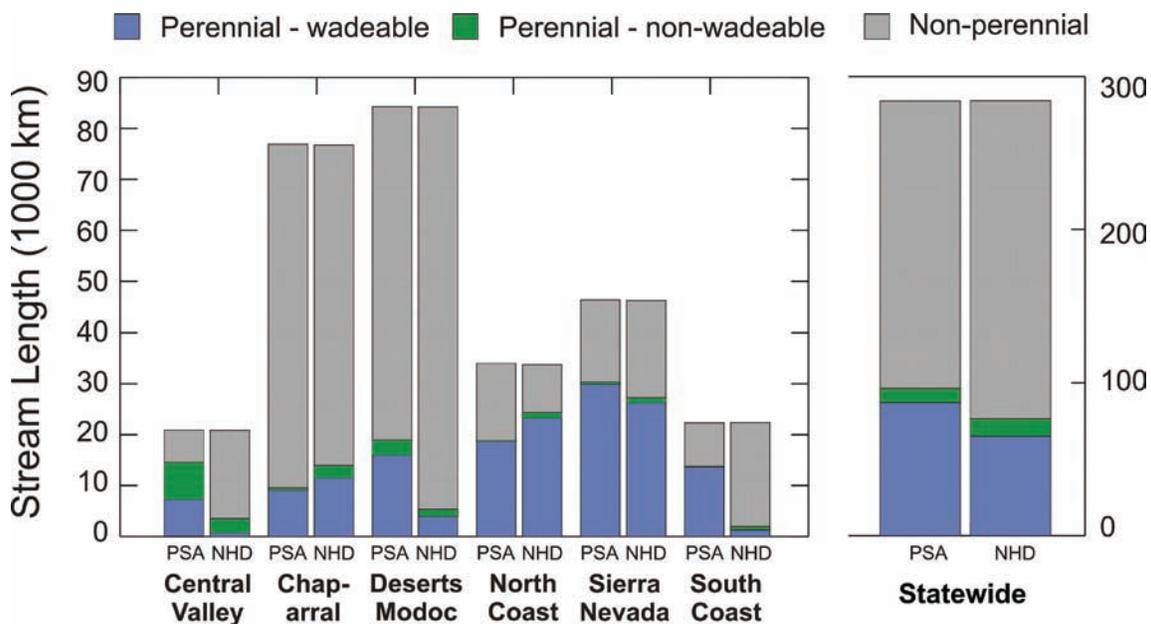


Figure 3. The length and relative proportion of perennial wadeable, perennial non-wadeable and non-perennial streams, in each of the six major Perennial Streams Assessment (PSA) regions. The first bar in each pair represents estimates generated from PSA (this study) and the other bar represents data derived from National Hydrology Database (NHD+). The heights of PSA bars were rescaled to match NHD totals for easier comparisons of flow classes.

Despite the fact that non-perennial streams often comprise the majority of stream length in California's PSA regions, and fall under the jurisdiction of the Water Boards, very few of California's monitoring resources are invested in their assessment. Non-perennial streams are strong candidates for increased monitoring and subsequent assessment and protection. Fortunately, several new State Water Board initiatives are beginning to build the State's capacity to monitor and protect these streams (e.g., Wetlands and Riparian Area Protection Policy and SWAMP's PSA which uses algal and benthic invertebrate bioassessment tools).



## Recommendations for Management

- **The Healthy Streams Partnership being led by SWAMP for the California Water Quality Monitoring Council should form the framework for a coordinated statewide approach to assessing and protecting all the stream resources of the State including non-perennial streams.** Better tools are needed to monitor and assess the condition of non-perennial streams, especially now that the State is increasing its use of biological condition indicators. The SWAMP currently does not have the resources to address non-perennial streams. Coordination with the Wetlands and Riparian Area Protection Policy and the California Wetland Monitoring Workgroup's Wetland and Riparian Area Monitoring Program will be essential to this goal.



- **The California Water Quality Monitoring Council should provide a forum for coordinating GIS stewardship activities statewide to improve the accuracy of perennial and non-perennial flow status designations in GIS layers of California's stream network.** Accurate base maps are essential to the protection of the State's aquatic resources. Inconsistencies between map and field observations highlighted in this memo underscore the need for local stewardship to update base maps, specifically with respect to flow status. This should be well coordinated with the California Wetland Monitoring Workgroup's Wetland and Riparian Area Monitoring Program and their effort to develop a standardized base map of California's wetlands and aquatic resources, which will be maintained by the California Department of Fish and Game.
- **The State Water Board should encourage evaluation of watershed-wide development on the overall stream network. Development in upstream non-perennial streams can have significant impacts in downstream perennial streams.** This is consistent with the requirements of the recent Clean Water Act Section 404 compensatory mitigation rule which calls for using a watershed approach to make regulatory decisions affecting aquatic resources. The State Water Board's Wetlands and Riparian Area Protection Policy should be used to support these evaluations.

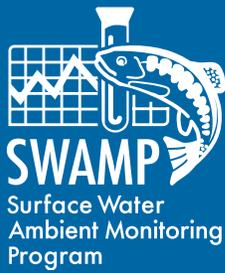
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- **The State Water Board should strengthen the protection of non-perennial streams through the Wetlands and Riparian Area Protection Policy by defining beneficial uses related to riparian area water quality functions (e.g. shading).** While non-perennial streams are protected under Porter Cologne, the level of protection provided to these streams under Clean Water Act authority may vary.

## References

Ode, P.R., T.M. Kincaid, T. Fleming, and A.C. Rehn. 2011. *Ecological Condition Assessments of California's Perennial Wadeable Streams: Highlights from the Surface Water Ambient Monitoring Program's Perennial Streams Assessment (PSA) (2000-2007)*.



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