WATER SUPPLY AND DEMAND MODELING IN THE SALMON CREEK WATERSHED

INFORMATIONAL FACT SHEET

The State Water Resources Control Board is developing tools to better understand water supply and demand in select watersheds across California. The project involves several watersheds of interest, including the Salmon Creek watershed.

Background

The State Water Board is responsible for allocating surface water through California's water rights priority system. Watershed-specific supply information from year to year is generally lacking, making water management planning difficult, especially in times of water shortage. Recent droughts (2013-2016, 2021-2023) highlight the need for specialized data and tools to assess water availability and demand and evaluate how limited water resources are allocated.

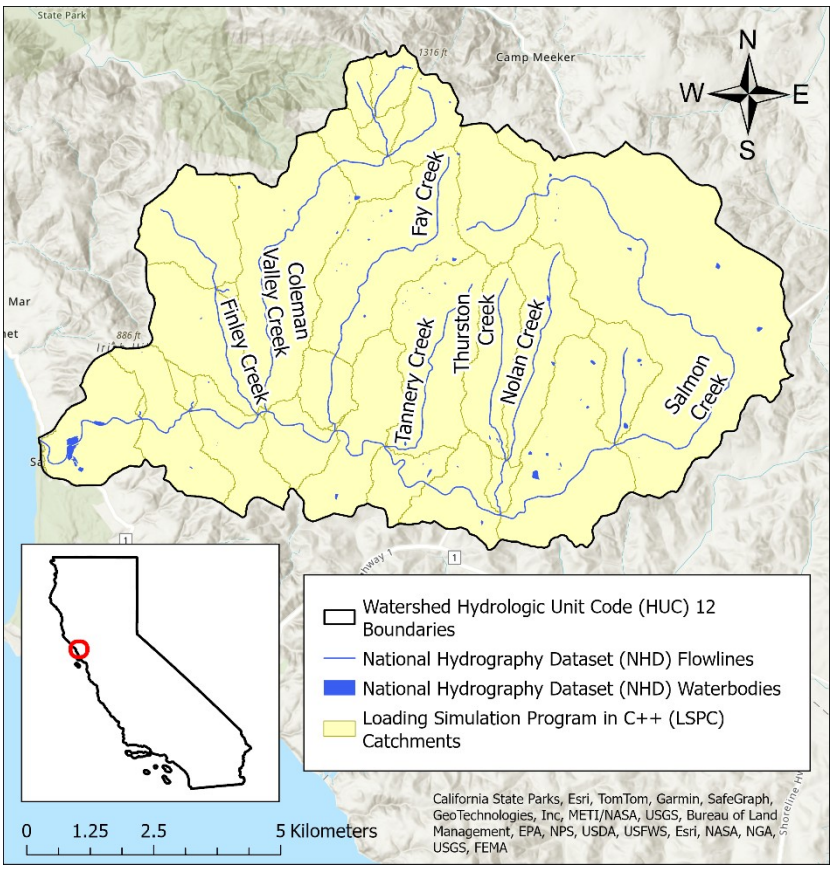

Figure 1. The Salmon Creek Watershed Subbasins and Flowlines

In 2021, in response to the drought emergency in Sonoma and Mendocino Counties, the State Water Board developed tools and information to better understand water supply and demand in the Russian River watershed. Staff developed a water supply model and evaluated water diversion data to estimate watershed demand. Staff also used a tool to allocate water to right holders based on the modeled available surface water supply, water demand data, and water right priorities. The supply and demand data, when integrated into the water allocation tool, was a key component in the board's implementation of drought emergency actions in the watershed.

The State Water Board established the Supply and Demand Assessment Unit in 2022 to develop supply models and demand assessments for new watersheds using an approach similar to that used for the Russian River during the most recent drought. This effort will enable the board to prepare for future dry conditions in other watersheds and provide data to help local water managers better

understand supply constraints, develop local responses and plan for droughts. The work could also inform future curtailments, if needed.

Water Supply and Demand Modeling

Evaluating water supply and demand in a watershed enables improved comparison of the amount of water available in the system with the demands associated with different water uses. State Water Board staff are working with Paradigm Environmental, Inc. to develop water supply (hydrologic) models that assess surface water availability in select watersheds where low flows and drought conditions may threaten water supplies, impair critical habitat, and create uncertainty for water users. Water supply modeling tasks are underway in Butte Creek (tributary to the Sacramento River), the Napa and Navarro Rivers, and six additional watersheds, including Salmon Creek. These watersheds were selected because: 1) Water demand in the watersheds is highly dependent on surface water and any board decisions regarding future curtailment would benefit from the modeling analysis; and 2) The watersheds contain areas of salmonoid habitat and important fisheries. In addition, the hydrologic modeling will provide details regarding watershed characteristics and conditions that will inform future work and outreach and engagement protocols.

Modeling watershed-specific scenarios improves our understanding of water availability based on available surface water, water demands, and water right priority. All tools developed and data produced as part of this effort will be open source and available to the public so local water managers and other interested parties can assess surface water availability conditions and evaluate potential management options.

Salmon Creek Watershed

Watershed Background

The Salmon Creek watershed is located in southwestern Sonoma County and has a drainage area of approximately 35 square miles. Salmon Creek originates near the town of Occidental and includes multiple smaller tributaries (including Nolan Creek, Thurston Creek, Tannery Creek, Fay Creek, and Finley Creek) that flow into Salmon Creek before it drains into the Pacific Ocean. The Salmon Creek watershed varies in elevation from near sea level at the town of Bodega to over 1300 feet near Freestone Valley, the northernmost portion of the watershed. The annual mean precipitation of the watershed is 47.5 inches, with distinct wet and dry seasons. In the valley floor, the primary land cover of the watershed is evergreen forest and shrubland. Outside of the valley, the watershed's land cover is mostly grassland and mixed forest. The Bureau of Land Management and California Department of Parks and Recreation have jurisdiction over a large portion of the Salmon Creek watershed.

Salmon Creek provides important habitat for steelhead trout and other anadromous fish, in addition to other native aquatic species. However, the watershed has experienced substantial losses in salmonid populations over time. Changes in sediment transport and rising water temperatures during the low-flow, dry seasons have been linked to declines in anadromous fish and the extirpation of coho salmon in the watershed. As a result, the Salmon Creek Water Conservation Program (SCWCP) was implemented.

Model and Data Specifications

The water supply model utilizes a large library of publicly available data from state and federal agencies, including the following data types:

- Meteorological: Historical weather data such as precipitation, evapotranspiration (the amount of water evaporated, or used, by plants), air temperature, vapor pressure, and wind speed are input to model conditions that affect water supply.
- Hydrological: Current and historical data on the river's streamflow rate is used for calibration and validation of the model.
- Water use and diversion: Data showing how much water has been taken out of the river in the past serves as a proxy for watershed demand and how it affects streamflow.
- Geospatial: Data that describes where the boundaries and channels of the watershed are, as well as its physical properties (such as soil type, land cover type, and topography). Geospatial datasets are important for understanding characteristics that influence how water moves through and is absorbed by the landscape.

All datasets used in the water supply model are subject to extensive quality assurance and quality control procedures that ensure their accuracy. This is particularly important when it comes to incorporating required water use and diversion data that is self-reported by water right holders. The cleaned data is then used to run the water supply model to simulate hydrological processes in the watershed at the scale of small tributaries (small catchments), allowing for water management decisions to be made at a very fine geographic scale.

The Loading Simulation Program in the programming language C++ (LSPC) is the water supply (hydrologic) model that was selected for this watershed. LSPC has been used extensively in California to model and manage the state's unique watersheds. Calibration of the LSPC model of the Salmon Creek watershed involves analyzing critical hydrology parameters. The calibrated model will then be validated using observed streamflow that was not incorporated during the calibration phase. Data produced by the LSPC model will be used as an input for the Drought Water Rights Allocation Tool (DWRAT, or Allocation Tool) to allocate water within each catchment based on the amount of available surface water, water demands, and water right priorities. Further details on the model are available in the Salmon Creek Watershed Model Work Plan, submitted by Paradigm Environmental, Inc.

Additional Resources

For more information, see the Supply and Demand Assessment Salmon Creek webpage. To receive email updates, please visit bit.ly/swb-subscribe and select the Water Rights "Watershed Supply & Demand Allocations" email subscription list.

With additional questions, please contact State Water Board project staff at DWR-SDA@waterboards.ca.gov.