

CONSIDERATIONS FOR UNDERSTANDING WATER AVAILABILITY IN WEST MAUI

JANUARY 21, 2024



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Control of water resources throughout Hawai'i, Maui County, and in particular West Maui has been at the center of political and economic power struggles since at least the mid-19th century, when surface water diversions for commercial agriculture and increased groundwater extraction reduced, or eliminated, available water for traditional crop cultivation and subsistence lifeways with collateral damage to native forests, species, and streams (Fig 1) (Scheuer & Isaki, 2021). In June 2022, the State Commission on Water Resource Management (CWRM) designated the Lahaina Aquifer Sector Area as both a ground and surface water management area. This meant that all new and existing water uses must apply for a Water Use Permit from CWRM, which can involve a sometimes lengthy approval process by the 7-member Water Commission. This piece intends to highlight some of the inherent tradeoffs that make managing water in this area especially challenging. In particular, subtracting current/authorized use from "sustainable yield" as defined by the State Water Code and interpreted by CWRM may not be a reliable way to determine remaining water resources available for use. This methodology fails to fully take into account the connection between surface water and groundwater, the fact that permitted/authorized use may be counted towards sustainable yield even though is not currently being used, uncertainty regarding future land use, as well as a number of problems with the existing estimates of sustainable yield, in particular, lack of public trust protections (Burnett et al., 2020)¹. The State Water Code (HRS Chapter 174C, 1987) defines a number of protections under the public trust doctrine to determine what is considered "reasonable and beneficial use." The State recognizes five public trust uses of water: (1) the exercise of traditional and customary Hawaiian rights, (2) the maintenance of waters in their natural state, (3) reservations of water for Hawaiian Home Lands, (4) appurtenant rights, and (5) domestic water use of the general public, particularly drinking water. We hope summarizing what is currently understood about resource availability and potential tradeoffs associated with using these resources will help inform policy and management discussions of this challenging issue.

¹ We understand that CWRM is currently considering revising their estimates of sustainable yield in order to better incorporate public trust protections.



Figure 1. Enduring scars from the haphazard trenching and draining of the Pu'u Kukui bog by a West Maui plantation company around the turn of the 19th century, in an attempt to obtain more water (Rock, 1917, 1919). (Screenshot: Maui County Tax Assessor's Office)

Surface Water and Groundwater Designation

Members of the West Maui community have long voiced concerns over the lack of available streamflow and water to cultivate lo'i kalo, to exercise traditional and customary Native Hawaiian practices, and for basic domestic water needs. In 2022, the Water Commission determined that water resources in the Lahaina area were threatened by existing and proposed withdrawals and diversions of water (CWRM, 2022). The Commission found that criteria for surface water and groundwater designation were met such that it was obligated under the State Water Code (HRS Ch. 174C) to designate the Lahaina Aquifer Sector Area (ASA) "to ensure reasonable-beneficial use of the water resources in the public interest" (HRS § 174C-41(a)) (Cerizo, 2022). The ASA includes the Honokōhau, Honolua, Honokahua, Kahana, Honokōwai, Wahikuli, Kahoma, Kaua'ula, Launiupoko, Olowalu, and Ukumehame Surface Water Hydrologic Units, as well as the Honokōhau, Honolua, Honokōwai, Launiupoko, Olowalu, and Ukumehame Groundwater Hydrologic Units (Fig 2).

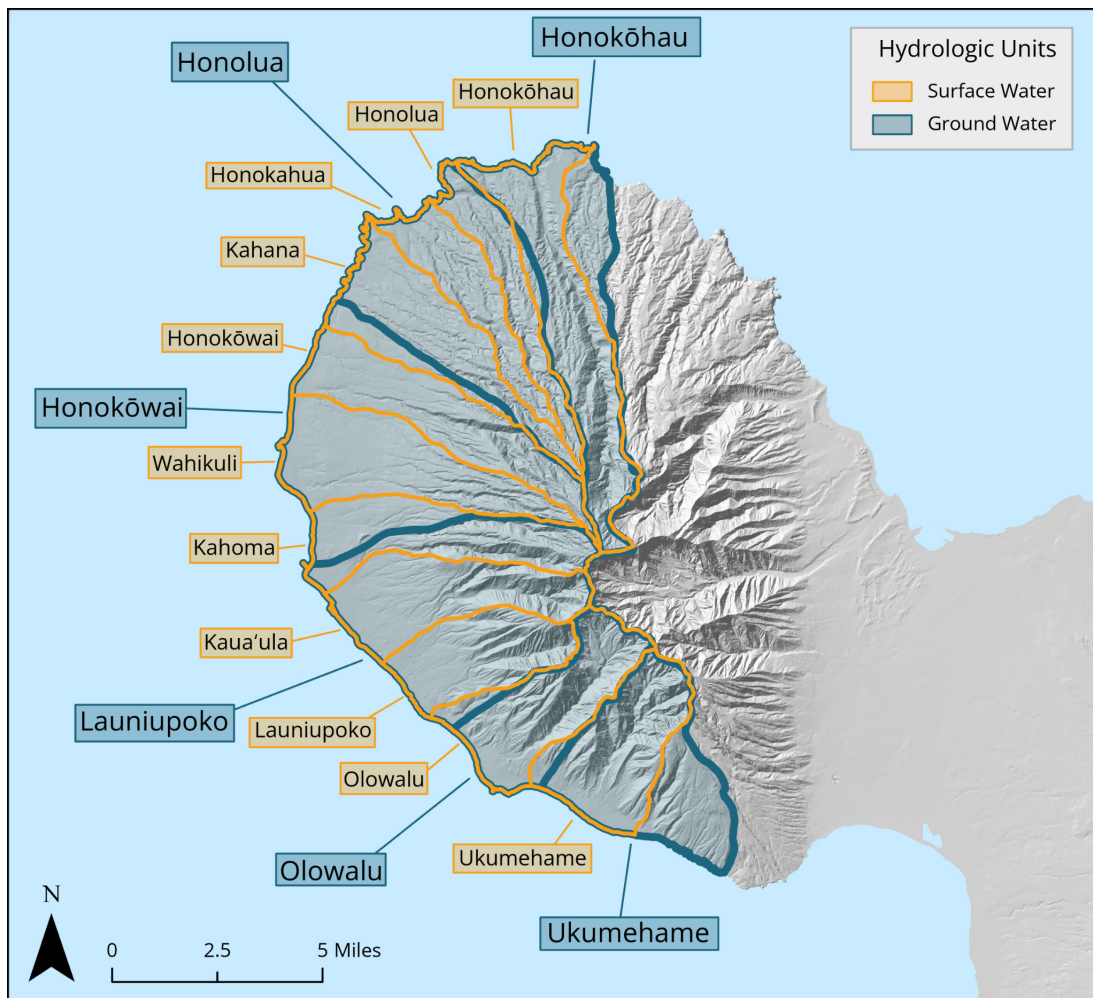


Figure 2. Ground Water and Surface Water Hydrologic Units in the Lahaina ASA. Note: This map was generated by C. Newfield using data from the Commission on Water Resource Management (n.d.).

Surface Water Designation Criteria (HRS § 174C-45) include: excessively declining surface water levels unrelated to rainfall variations or increasing/proposed diversions of surface waters, reductions in the ability of streams to assimilate pollutants, and occurrence of serious disputes of surface water resources. For example, with significantly reduced rainfall in much of West Maui during 1983-2012 (Frazier and Giambelluca, 2017), the area has already experienced significant declines in stream flow. This decline is forecast to worsen (CWRM, 2022) with projected reductions in mid to late-century recharge in the Lahaina ASA ranging between 6.8-68.0% under various climate change scenarios (Kāne et al., 2024) (Fig 3).

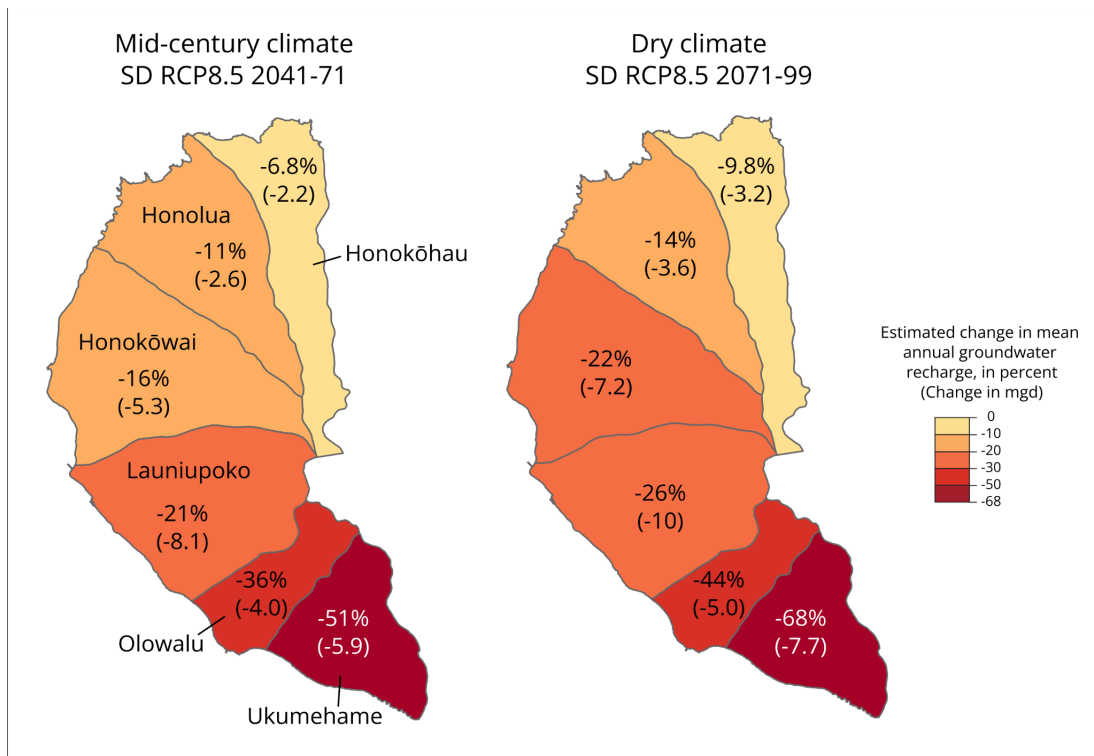


Figure 3. Change in recharge for Lahaina ASA under statistical downscaling (SD) of RCP8.5 for mid- and late-century. Note: This figure was generated by C. Newfield using data from Kāne et al. (2024).

Groundwater Designation Criteria (HRS § 174C-44) include: water use nearing sustainable yield, actual or threatened degradation of water quality, diminishing groundwater supply (in part due to climate change), threats to the groundwater body from upconing or encroachment of saltwater, reduction of existing well uses from excessive chloride, excessive preventable waste of groundwater, incidents of serious disputes over groundwater resources, and whether approved water development projects receiving public funds may result in any of the preceding conditions. For example, several existing wells in the Lahaina ASA had reported chloride levels above 250 ppm, beyond EPA and DOH safe water drinking limits, forcing their discontinuation or reduced pumping. On the other hand, limited data from a single deep monitoring well did not point to excessive declines in groundwater levels during the past 10 years (i.e. the thin basal aquifer has been stable). However, out of precaution and after thorough evaluation of the other designation criteria, the Commission found water management area designation was necessary “to preserve the diminishing groundwater supply for future needs.”

Limitations of Sustainable Yield

Sustainable yield (SY) is defined as “the maximum rate at which water may be withdrawn from a water source without impairing the utility or quality of the water source” (HRS § 174C-3), in a hypothetical scenario where wells are optimally placed, recharge is evenly distributed, wells pump at the same rate and are at equal depth, and recharge is time invariant (CWRM, 2022). Traditionally the chosen method for estimating SY in Hawai‘i has been the Robust Analytical Model (RAM), a one-dimensional groundwater flow analytical model (Mink, 1980). While a full discussion of the limitations and uncertainties of RAM is beyond the scope of this piece, its history of underestimating water level declines under predicted groundwater withdrawals (i.e. overestimating SY) (Oki & Meyer, 2001) calls into question its continued use when two-dimensional numerical models have been developed by the USGS with more refined estimates. Launiupoko, Honolua, and Honokōwai aquifers had or experienced pumpage from many wells

resulting in excessive chloride, suggesting local upconing and associated saltwater intrusion of groundwater resources, even under net groundwater use that was just exceeding, in the case of Honokōwai, or below, in the case of Laniupoko and Honolulu, SY estimates. The spatial heterogeneity of existing well locations and variance in pumping rates, along with the legal protections required by the public trust doctrine, suggests a lower SY for the Lahaina ASA may be warranted.

Complex Relationship Between Groundwater and Surface Water

Groundwater and surface water are inextricably linked. In the Lahaina ASA, among others, dike-impounded groundwater largely feeds streams (Cheng, 2014). This creates an initial gaining of surface flow at high elevation that continues to recharge the underlying aquifer as it moves towards lower elevation. Under adequate flow, some of that freshwater eventually reaches the coast and discharges to the ocean (Fig 4A). Excessive diversion of streams (Fig 4B) and development tunnels removing dike-impounded (ground) water (Fig 4C) disrupt natural streamflow losses into the ground that would otherwise recharge the basal lens. This, along with disputes over who actually has the rights to surface water in the region, has led to the recent establishment of interim instream flow standards (IIFS) for many Lahaina ASA streams. To meet non-potable needs under these new standards, groundwater pumpage (Fig 4D) has increased. Yet, in 2022, IIFS were still not met in Kaua’ula, Olowalu, and Kanahā streams, which are separately controlled by private entities and the County of Maui (CWRM, 2022).

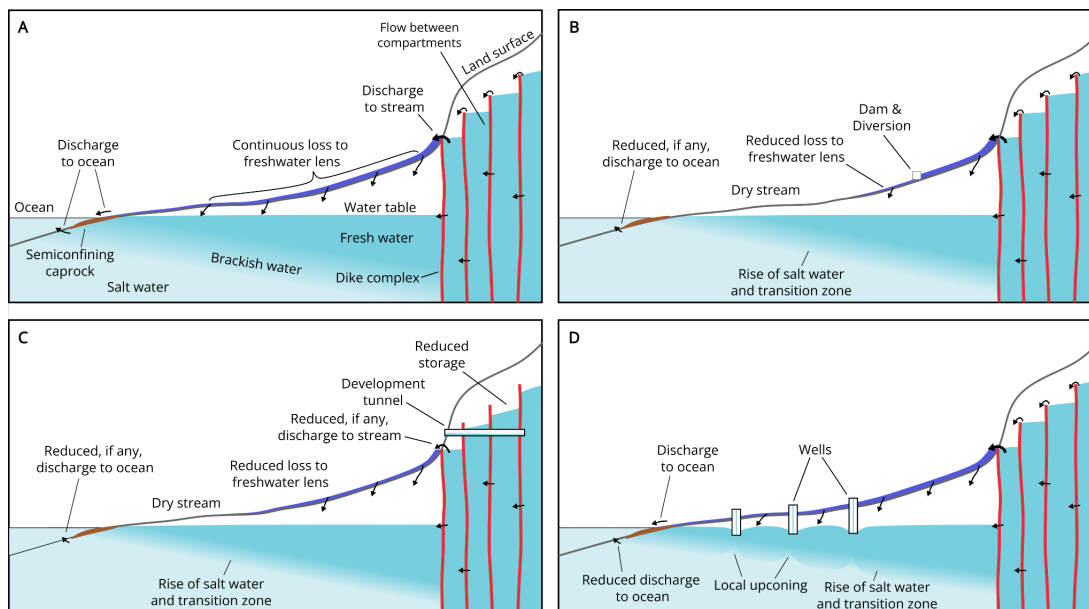


Figure 4. Conceptual diagrams of the interplay between surface and groundwater under withdrawal and diversion. Note: This figure was generated by C. Newfield, adapted from figures in Cheng (2014), Gingerich and Engott (2012), and Izuka and Rotzoll (2023).

Water Permitting Process

Designation of an area under the State Water Code means that all current and potential water users must apply for a water use permit. This special State permitting process (see <https://files.hawaii.gov/dlnr/cwrm/forms/dgwup.pdf> for illustration of the potentially complex process) allows the public to weigh in on the process for water allocation by CWRM. The five public trust purposes (outlined above) must also be considered in the accounting and allocation of permits,

which is especially challenging given that the State Water Code offers no clear guidance on how CWRM should prioritize among the five purposes. In areas that are not designated, stream channel alteration, stream diversion works, and well construction/pump installation permits are required, but are typically not subject to public review. As long as the applicant meets the legal requirements, these various types of permits can be approved by CWRM in a relatively more streamlined manner. While this shorter process may be good for future development of much needed housing outside of designated areas on Maui and elsewhere in the State, it is important to consider the tradeoff between speed and the ability to fully account for all of the legally protected public trust freshwater uses when issuing well and surface water permits.

Supporters of the decision to designate the Lahaina ASA argued that more State oversight was needed to manage the area's increasingly constrained water resources, which provide, in addition to direct human consumption, a number of cultural, ecological, recreational, and other services that are part of the legally protected public trust. Opponents contended that the additional oversight will make implementation of Maui County's ambitious Water Use and Development Plan (WUDP) (Maui County Department of Water Supply, 2019) more challenging. They also raised concerns that these additional permitting requirements would delay affordable housing projects, which already face significant "regulatory burdens" relative to other states in the US (Inafuku et al., 2022).

What the Numbers Say

According to CWRM's Findings of Fact, total water use - comprised of pumpage, tunnel discharge, and authorized planned use - in the Lahaina ASA was 18.7 mgd, 55% of the estimated 34 mgd SY. Given this apparent buffer, Maui developers collectively raised concerns with CWRM's designation of the Lahaina ASA, noting, among other issues, the slow pace of the permit process for existing and especially new water use permits in some areas it had previously designated, such as Nā Wai 'Ehā. Even in a long-term drought scenario, with SY falling to 26 mgd, there appears to be a buffer where, assuming adequate infrastructure to move a combination of groundwater and surface water between hydrologic units, new permits may be issued. However, this apparent buffer is calculated based on SY estimates that fail to consider many of the legally protected public trust uses. In light of the projected impacts of climate change and the importance of improving or at least maintaining streamflow to protect those public trust water uses, increasing surface water diversions is unlikely to be viewed as a feasible strategy to supply any future demand that cannot be met using available groundwater resources in combination with supplemental resources such as recycled wastewater.

This challenge is further complicated by uncertainties regarding future agricultural and domestic water consumption by existing water users. UHERO is currently working with the Maui County Planning Department to update population growth projections, which will likely reduce estimated future water use to some extent. This will not necessarily change authorized planned use, however, which is already counted toward the "total water use" that is being compared with SY. Given the large number of stakeholders, it is also clear that comprehensive water resources planning is needed, which is challenging when roughly 75% of the water systems in West Maui are privately owned.

In conclusion, by focusing on surface water and groundwater resources available for competing uses such as increasing housing in West Maui, this commentary brings to light the competing considerations in the Water Commission's perhaps out-dated approach to estimating SY. While CWRM acted in line with its duty to protect public trust resources in designating the Lahaina ASA and exhibits acute awareness of the coming climate impacts, the SY model used by the Commission may not be up to the bureaucratic challenge of expeditious permits for water use in West Maui especially to meet the demand for new housing. To move forward, we also support the

Commission's plan to undertake a comprehensive update to the calculation of sustainable yield. In addition to updated data on instream traditional and customary uses that may show increased need, the Commission should consider prospects for reduced municipal demand through better coordination of and increased infrastructure for recycled water, stormwater catchment systems, desalination, enhanced green plumbing standards, and more enforcement of non-potable water use for irrigation (Hawai'i Community Foundation, 2015). The conversation about providing water for housing in West Maui should include the potential for reuse from increased integration of treated wastewater (R1) into the municipal water system, especially in light of changes underway after the U.S. Supreme Court ruling regarding Maui County's injection wells (Dobbyn, 2024). Although many of these supply side alternatives require large upfront investments and generate operation and maintenance costs over time, this forward-thinking approach could incentivize water conservation that frees up water for critical priorities like housing, especially important after the devastation of the Lahaina fires. Regardless of the different approaches to view and revise sustainable yield estimates, everyone involved in the allocation of water in Hawai'i must recognize that freshwater is a finite resource on our islands that is projected to decline with climate change. We must explore new ways to equitably share water among many competing demands such as housing while recognizing the priority for the public trust purposes.

Acknowledgements: We thank several anonymous reviewers for helpful feedback, edits, and comments on this brief.

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