Attachment D

Appellant WAC Witness List

WATER AUDIT CALIFORNIA

A PUBLIC BENEFIT CORPORATION
952 SCHOOL STREET #316 NAPA CA 94559
VOICE: (707) 681-5111
EMAIL: LEGAL@WATERAUDITCA.ORG

October 10, 2023

To: Napa County Board of Supervisors
1195 Third Street, Ste. 310
Napa, CA 94559

Submitted via email to: Laura.Anderson@countyofnapa.org, Chris.apallas@countyofnapa.org, Clerkoftheboard@countyofnapa.org, acm@cbcearthlaw.com, jdmilesm@comcast.net, jjdm1@icloud.com, adam@keatslaw.org, anglin@htralaw.com

Water Audit California Appeal of the Duckhorn Vineyards Winery - May 3, 2023, decision of the Napa County Planning Commission's to adopt the Mitigated Negative Declaration and Mitigation Monitoring and Reporting Program, and approve Use Permit Major Modification Application P19-00097-MOD.

2nd Appellant Order of Go - Appellant Water Audit California intends to call the following witnesses, in the following order, to testify at the time of the appeal hearing, scheduled on November 7, 2023.

Order	Witness Name	Subject Matter	Length of Testimony
1	William McKinnon	Legal Requirements	6 minutes
2	Dr. Peter B. Moyle	See attached Exhibit A	2 minutes
3	Dr. Kerrigan Börk	See attached Exhibit B, in particular re SGMA	5 minutes
4	Dr. Graham Fogg	See attached Exhibit C	5 minutes
5	Dr. Ted Grantham	See attached Exhibit D	5 minutes
6	Rebuttal		7 minutes

William McKinnon
Attorney for Water Audit California

The Napa River as Habitat For Native Fishes and Shrimp
Dr. Peter Moyle
August 18, 2023

Napa River views. Upper left: Below Oakville Crossroad bridge, August 12, 1993. The river was flowing at about 5 cfs - 7 species of native fishes were abundant in deep pools. R.A. Leidy; Upper right: Zinfandel Lane Bridge at Calistoga, June 8, 2021. Coastal roach were observed in concrete-lined pools. A. Manfree; Lower left: Dry Napa River below the Pope Street bridge, St Helena, June 8, 2021. This was a drought year and only a few juvenile native fishes (2 species) were found in a small bedrock pool. It is doubtful they survived the summer. A. Manfree; Lower right, Flood Management Project Bypass in Napa, February 27, 2019. A. Manfree.

The Napa River is a defining element of the Napa Valley and the health of its assemblage of native fishes is a key indicator of the health of the river. Fishes and other biota have declined as the surface flows have been depleted and channels have been altered (Napolitano, Potter, and Whyte 2007). The river and its tributaries nevertheless still support native fishes where year-round flowing water is present. Here we first briefly describe the river as it is today, discuss the effects on stream flows of dams, groundwater pumping, and geomorphic change, and then review the status of native fishes. Finally, we discuss ways to improve conditions for native fishes (and shrimp) in the Napa watershed, recognizing that thriving native fishes require a healthy, flowing river, which is good for people as well.

The Napa River

The Napa River is a relatively small and short [89 km] stream flowing into the San Francisco Estuary. Historically, it was perennial, given the lack of historical accounts of a dry river, with the lowest flows in late summer and fall. In winter, however, when heavy rains pound the surrounding Coast Range, the river carries high flood waters water that once spread across its floodplains on the Valley floor. The annual hydrology is naturally highly variable, given its dependence on rain fall and water stored in aquifers as dictated by the region's Mediterranean climate. See concurrently filed memorandums of Drs. Graham Fogg and Ted Grantham.

Most of the time, the Napa River was, and is, a pleasant, productive, and permanent component of the Napa Valley ecosystem. Having avoided the draconian flood control measures, such as the monster levees implemented in many other US streams and rivers, the river still manages to meander through the Valley, lined with a thin band of riparian trees, despite having a deeply incised channel. It still has flows that support native fish populations in places.

But the water that keeps the river flowing is in high demand and much of it is diverted, stored behind dams, or pumped from the ground. So, when the river stops flowing, as it does at times, the native fishes must leave the dry areas or die. Reaches with low flows in late summer/fall may also become too warm to be suitable for steelhead and freshwater shrimp. The decline in habitat for native fishes is related to large-scale changes in the Napa watershed, especially those associated with dams, geomorphic alterations, and groundwater pumping.

Dams and geomorphic constraints

There are over 400 dams in the Napa River watershed that are located on tributary or river channels and that capture winter precipitation in the watershed and store precipitation for later use (Napolitano et al. 2007). Most of these dams are small and create ponds whose water is often important for individual vineyards or farms. About thirty percent of the watershed land area is behind both large and small dams, with reservoirs that provide water for cities as well as vineyards. The dams are needed for storage because most precipitation comes in a few large winter storms (via atmospheric rivers), from which high flows become floods.

The larger dams primarily provide water for municipal use but can also be important for providing flows to streams below, which then provides habitat for fish, including steelhead. However, some of the larger dams in the watershed block access to cool water habitat in streams on the east side of the Valley (e.g., dams on Bell Canyon, Conn [Hennessey Reservoir], Rector, and Milliken creeks). Habitat for fishes is also present in tributaries to the reservoirs above the dams.

Presumably, the historic seasonal floods of the river were important for recharging the ground water and providing wetland habitat, but as the Napa Valley became more developed and the river more constrained, seasonal flooding became regarded as a serious problem, rather than an asset. Once catastrophic flood flows became managed by infrastructure, authorized in 1998, that is famous because it leaves ‘room for the river’ (Opperman et al. 2017). The river and its tributaries nevertheless still suffer from the geomorphic constraints of old, ‘grey’ (concrete) infrastructure, fish passage barriers, and the conversion of floodplain to agricultural and urban uses. The Napa River and its tributaries have deeply incised channels over much of their lengths. In many places, channels are lined with rip-rap and banks feature small rock levees. Such features tend to move high flows out of the system rapidly, reducing flow benefits to fish and wildlife (e.g. a broad riparian zone).

Ground water

Although reliable statistics seem to be lacking (See Fogg and Graham, supra), well pumps that suck up groundwater are an important source of water for the Napa region. Although the Napa County Sustainable Groundwater Management Plan has set a sustainable limit of 15,000 acre-feet a year, up to 24,000 acre-feet of water per year are extracted to irrigate 48,000 acres of vineyards, putting the watershed outside of sustainable limits for five of the last seven years. Most of this water comes from pumping groundwater; agricultural demands constitute 85% of groundwater. Potable water pumping from the City of St. Helena’s Stonebridge wells account for all but a fraction of the remaining extractions.

Although the systematic collection and analysis of well data for the Napa Valley is lacking, it seems logical to assume that wells for all purposes, especially those located close to a stream, can deprive the river of the underground inflow that historically maintained summer surface flows. In recent years, the abundance, location, and size of such wells is associated with the cessation of flows in some reaches (e.g. Napa River above and through St. Helena, lower Conn Creek).

For native fishes and other aquatic organisms to thrive in the Napa River, they need a flow regime that contains features of the natural (historic) flow regime (refs). A key component of streams in a Mediterranean climate region, such as the Napa Valley, is a ‘living stream’, from headwaters to estuary, with perennial flows. Historically, the best evidence indicates that the Napa River was a perennial stream. Data from the stream flow gauge on the Napa River at St. Helena, maintained by the US Geological Survey from 1929 to present, show that years with no summer flows began at the turn of the century when the second Stonebridge well was drilled. (See Graham, supra.)

But despite ongoing changes, even during the severe droughts of the 1930s, the river flowed until recent years. The reduced flows in the river and its tributaries and the long-term decline of the fishes, especially listed steelhead, coincide with the construction of wells.

Napa Fishes

There are records of 36 species of native fishes from the Napa River and its upper estuary (Leidy 2007, Napa RCD 2008, 2020) but only 15 are found today on a regular basis in the river and tributaries. These include 4 anadromous (sea-run) species that use the river in most years for spawning and the rearing of young (Pacific lamprey, western river lamprey, rainbow trout/steelhead, and Chinook salmon). Another 11 are freshwater fishes that are year-round residents in the watershed (brook lamprey, resident rainbow trout, Pomo riffle sculpin, prickly sculpin, coastal roach, Sacramento pikeminnow, Sacramento blackfish, hardhead, Sacramento sucker, tule perch, and threespine stickleback). This memorandum report focuses primarily on resident and anadromous fishes, plus the California freshwater shrimp.

The following fish species are of greatest interest because they are most likely to be affected by water management:

- **Central California Coast steelhead** (*Oncorhynchus mykiss*) is federally listed as a threatened species (1997, re-affirmed in 2006 and 2014). They are a Distinct Population Segment of rainbow trout (*Oncorhynchus mykiss*) that are anadromous, with spawning and juvenile rearing in the river, especially, its larger tributaries. They are managed separately from resident rainbow trout that are primarily found above barriers in tributaries, and do not go to sea. There has been no change in status since listing, so a continued decline to extinction is likely if present trends continue. Neapolitano et al (2007) state (p 7): *"We reviewed available information to conclude that there has been a significant decline in the distribution and abundance of steelhead and coho salmon in the Napa River and its tributaries since the late 1940s"* (U.S. Fish and Wildlife Service, 1968; Anderson, 1969; and Leidy et al., 2005). The U.S. Fish and Wildlife Service (1968) estimates that the Napa River watershed once supported runs of 6,000–8,000 steelhead, and 2,000–4,000 coho salmon, and that by the late 1960s, coho salmon were extinct in the watershed, and the steelhead run had reduced to about 1,000 adults. At present, the steelhead run is estimated at less than a few hundred adults (Emig sand Rugg, pers. com., 2000 and Leidy et al., 2005). This statement still holds today, although steelhead spawners may be even fewer than reported.

- **Fall-run Chinook salmon (***O. tshawytscha*) spawn and rear in the Napa River in most years, if flows are adequate. There is debate about whether these fish represent the southernmost population of Southern Oregon-Northern California Evolutionary Significant Unit (ESU) of this species (listed by federal government as threatened) or are strays from Central Valley ESU hatcheries. Either way, they *are* ecologically and aesthetically important to the river and are likely to disappear under present management.

- **Pacific lamprey** (*Entosphenus tridentatus*) are also anadromous and spawn in the Napa River, where the larvae live in silty backwaters for up to seven years.

They are considered a Species of Special Concern by the California Department of Fish and Wildlife (CDFW). Their status in the Napa watershed is poorly understood.

- **Coastal roach** (*Hesperoleucus venustus subditus*) is a newly re-described species/subspecies that lives only in San Francisco Bay tributaries and the Russian River. It is highly tolerant of poor water quality and appears to be still common in the Napa watershed (NRCD 2020).

- **Hardhead** (*Mylopharodon conocephalus*) is a large (up to 50+ cm) soft-rayed fish that is endemic to Central California, including the Russian and Napa Rivers. It was once common in the deep pools of the middle reaches of the main river (Leidy 2007), but its current status is uncertain. The Napa River and Russian River populations are the only ones known outside of the Central Valley. It is listed as a *Species of Special Concern* by CDFW.

- **Pomo riffle sculpin** (*Cottus ohlone pomo*) is a newly described species and subspecies that occurs mainly in cool headwater streams tributary to northern San Francisco Bay and the Russian River (Moyle et al. 2022). It is presumably still locally common in the upper Napa River, especially in small, cool tributaries (Leidy 2007). Its current status is not well-documented, but it is considered a *Species of Special Concern* (as *C. gulosus*) by CDFW.

- **California freshwater shrimp** (*Syncaris pacifica*) is listed as *Endangered* by the U.S. Fish and Wildlife Service (USFWS) (1988). They are/were known from the mainstem upper Napa River and from Huichica Creek, a tributary to the estuary, but their current status is not well documented. "*Syncaris pacifica* occurs only in lowland freshwater streams, in pool areas away from the mainstream flow, often among roots, branches, or undercut banks. They have never been found at elevations higher than 380 feet (125 m)" (Martin and Wicksten 2004) Considering its endangered status, information on the current status of this species in the Napa watershed is badly needed.

The Napa Valley has been thoroughly domesticated in the past 150 years (Grossinger 2011). Little remains of the original wild landscape on the Valley floor, whether aquatic, riparian, or terrestrial, although some relatively unaltered habitat remains in the upper reaches of tributary streams. The river's water is in high demand due to the expanding vineyards and tourism, and due to growing direct human use, from drinking to washing wine bottles. It is therefore quite surprising that remnants of the native fish fauna are still present, an assemblage of species that need clear, cool flowing water and deep pools to persist. That small numbers of anadromous salmon, steelhead, and lampreys still use the river and its tributaries to complete their life histories is a positive sign. However, numbers are much reduced from historic abundance, given their decline statewide and condition of potential habitat (e.g., dry reaches of tributaries). This decline was recognized by the California Regional Water Quality Control Board in 1990 when it classified the Napa River as *impaired* because of sediment, noting that habitat for steelhead and Chinook salmon had been degraded by sedimentation of spawning and rearing habitat, by channel incision, by low summer base flows, and by poor access to suitable habitat (Napolitano, Potter, and Whyte 2007). Habitat quality continues to be relatively poor for most native fishes.

Causes of native fish decline

Providing habitat for fish has been a secondary consideration. The most important ingredient for stream fish habitat is often lacking or in short supply: flowing water. Dry or non-flowing sections of riverbed are present during many years.

This makes it urgent to systematically determine the factors contributing to loss of flows and to find ways to increase summer/fall flows. Without a systematic program to determine causes of fish decline and ways to stabilize or increase native fish populations, the further decline and extirpation of native fishes is certain. One thing we also know for sure: the native fishes need water to survive.

Here are some suggestions for actions to reverse trends:

1. Immediately begin a systematic *annual* monitoring program for fishes and aquatic invertebrates to determine status and trends, using Leidy (2007) as the starting point. This effort would have to include developing a stable funding source.

2. Conduct special investigations throughout the watershed to demonstrate habitat benefits to fish from restoration projects, including those related to flood management. Such evaluations seem to be largely lacking, even for listed steelhead and freshwater shrimp.

3. Implement an active adaptive management program to benefit aquatic species. Such a program would involve habitat improvements to tributary streams (including flows and removal of barriers) as well as in the mainstem Napa River.

4. Monitor to the greatest extent possible groundwater extraction and levels and surface water flows.

5. Develop and implement a *Share the Water* plan through a water district that maximizes efficiency of use of existing water throughout the watershed, without increasing total use.

6. Recognize that improving aquatic habitats throughout the watershed will require a long-term commitment to engage in many, often small, habitat restoration projects, following the example of Water Audit California (see Appendix) and based on Public Trust obligations.

Conclusions

The Napa River and tributaries still provide habitats that support native fishes and, presumably, shrimp. A monitoring program is needed that evaluates, among other things, the efficacy of restoration projects on fish and shrimp populations and the determination of factors that affect flow in the river and its tributaries, especially ground water pumping (wells). The presence of two endangered species is a cause for action; steelhead and freshwater shrimp maintain small populations that could disappear from the watershed within a few years, absent improved habitat, fish passage, and flows.

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For steelhead, improving habitat for in-migrating adults and out-migrating juveniles in the mainstem is essential to increase survival. In addition, removing or modifying barriers in 30-40 tributary streams would greatly improve access to long-lost spawning and rearing areas. A flow regime that would benefit steelhead and other fishes would first include preserving natural high winter/spring flows to attract adult spawners and move juveniles out to sea. But for shrimp and steelhead, and other fishes, the most significant need is to improve flows in summer/fall low-flow period. These flows are what the river needs to be a year-round 'living stream' from headwaters to the estuary, even during periods of drought, along with management of diverse habitat to support resident native fishes and for juvenile rearing of salmon, steelhead, and lamprey.

Having an actual living stream would mean, among other things, improving the flow regime in many places, including tributaries, in part by reducing diversions from the Napa River and tributary streams. Particularly important is developing fish-friendly summer flows; this would require restoring stream inflows from tributaries and from reducing groundwater pumping in or near the river's riparian zone. A thorough understanding of the relationship between groundwater pumping and surface flows, through measuring and monitoring, is needed to create a balance of flows for the river ecosystem vs. water for commercial purposes.

The presence of recent and ongoing restoration projects demonstrates that there is some movement, if often reluctant, towards a healthier river and sustainable populations of native fishes. Nevertheless, a systematic, multi-faceted program of habitat restoration, monitoring, and maintenance is needed if native fishes and shrimp are to survive through coming years, and then thrive, especially in the face of climate change.

Napa River just below Evey Lane, above the City of Calistoga.
August 31, 2018. Amber Manfree

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Appendix: Water Audit California and Fish

Water Audit California [https://waterauditca.org/] has been aware of the threats to the native fishes and other Public Trust issues in the Napa watershed for some time. Water Audit has been using legal actions to have local governments pay more attention these issues, especially on tributaries to the Napa River, which provide water that increases flows of the Napa River itself. This is part of a larger effort to remediate the effects of commercial development in the entire Napa River watershed. Recent examples of Water Audit’s work are listed below (Börk and Manfree 2023). A common theme of these actions is to ensure that Public Trust requirements are followed in protecting these streams, no matter how small, and their biota, especially steelhead and other fish.

- 2016. An agreement was signed to release environmental water from Bell Canyon to Bell Canyon Creek, a tributary to the Napa.
- 2016. An agreement was signed to provide water releases from Rector Dam to Rector Creek, for fish habitat.
- 2020. Water Audit facilitated the removal of York Creek, restoring access to steelhead habitat.
- 2021. An agreement was signed to rewater Cayetano Creek with releases from Lake Marie dam.

Each of these agreements/actions benefits fish and reflects an obligation for local governments to provide environmental water under the Public Trust Doctrine, primarily as codified under Section 5937 of the Fish and Game Code (Börk and Manfree 2021).

Groundwater Pumping and Napa River Low Flows
Dr. Graham Fogg
August 18, 2023

Groundwater Pumping

Groundwater data together with low flow data in the Napa River ("River") near St. Helena (USGS Gage Station 11456000) strongly indicate detrimental effects of groundwater pumping on the River in recent decades. Specifically, the gage data demonstrate a dramatic and somewhat abrupt increase in low flow events circa 2000, with the minimum 7-day flows reducing uniformly to zero during 2006-2022, and a steady and massive increase in the number of annual zero-flow days after 2000. These post-2000 increases in low flow occurrences are consistent with post-1998 increases in Napa Valley Subbasin pumping from wells, as illustrated in Fig. 7-13 from the basin GSP (Fig. 1).

Groundwater pumping (Fig. 1, purple line) clearly increased post ~1998.[1] Importantly, the increase in groundwater production does not coincide with a decrease in precipitation in the basin. Precipitation exhibits no systematic or statistically significant decrease during the decades in question. Hence, the pumping trends are not simply a climate change response.

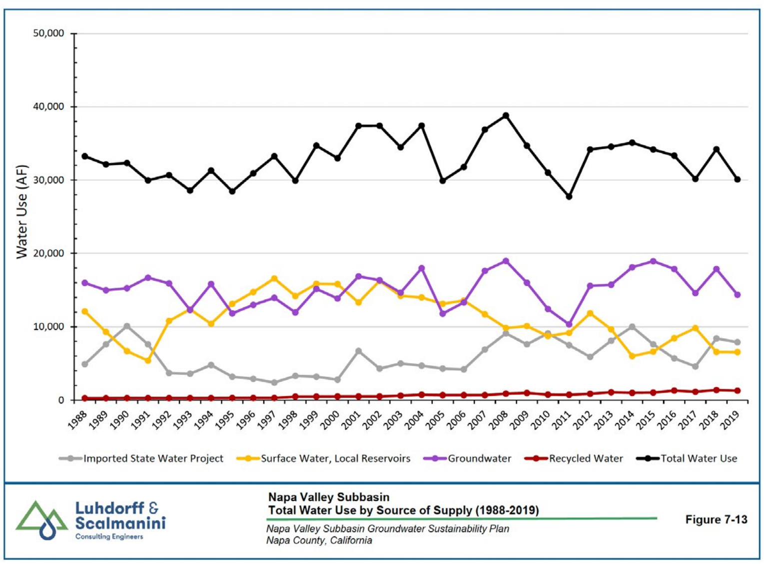

Figure 1. Napa Valley Subbasin water use by source of supply.

[1] In particular, note the extended period of lower pumping in the decade preceding 2000, and the big increases in pumping during post-2000 drought periods.

Cause-Effect Relationship

The streamflow and groundwater data clearly point to a cause-effect relationship between river flows and groundwater pumping that is relevant in the context of Sustainable Groundwater Management Act (SGMA) and the Napa Subbasin Groundwater Sustainability Plan (GSP). This suggests the need for a tighter cap on pumping to protect the Napa River groundwater dependent ecosystem (GDE) . Furthermore, there is a need for additional data and analysis to identify specific subregions where the problems are most acute. However, some, but not all, of the needed data is already provided in the GSP.

For example, Figure 6-123a from the GSP (Fig. 2 below), compares groundwater levels near the river with elevation of the river thalweg (channel bottom), providing an excellent way of identifying areas with the greatest potential for surface water loss to groundwater. There are numerous unmapped reaches in Figure 2 due to lack of groundwater level data, however, demonstrating the need to improve upon the analysis by adding more groundwater data, which should be obtainable from the numerous wells in the basin. In Figure 2, dark blue and dark green river reaches means the groundwater levels at the river are likely above the thalweg, indicating potentially gaining conditions. Light green, tan and red means the groundwater levels at the river are likely below the thalweg, indicating potentially losing conditions.

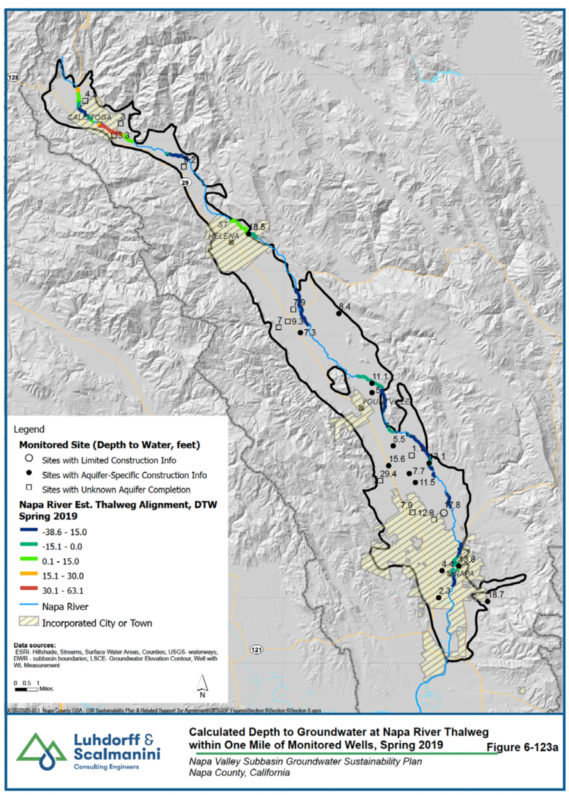

Figure 2. Partial mapping of the difference between near-river groundwater elevations and the river thalweg elevation. Long river reaches lacking any of the bold blue- to red-colors are due to lack of groundwater level data.

In and upstream of St. Helena three things stand out in Figure 2[2]: (1) losing reaches in and around Calistoga (light green, tan, red), (2) a losing reach in northern St. Helena (light green), and (3) a general lack of groundwater data on this map between St. Helena and Calistoga. There are also long reaches lacking groundwater data downstream of St. Helena. Additional monitoring of wells near the river, including both shallow and deep wells, would help fill in the blanks in maps like Figure 2, greatly facilitating an effective and transparent management of groundwater and river flows.

Maps of depth to groundwater (depth to the water table), such as Figure 6-6 of the 2022 Annual Report (Fig. 3 below), also provide important insight into areas where groundwater impacts are likely most acute. Similar to Figure 2, however, this map shows major stretches of the river lacking the necessary groundwater level data.

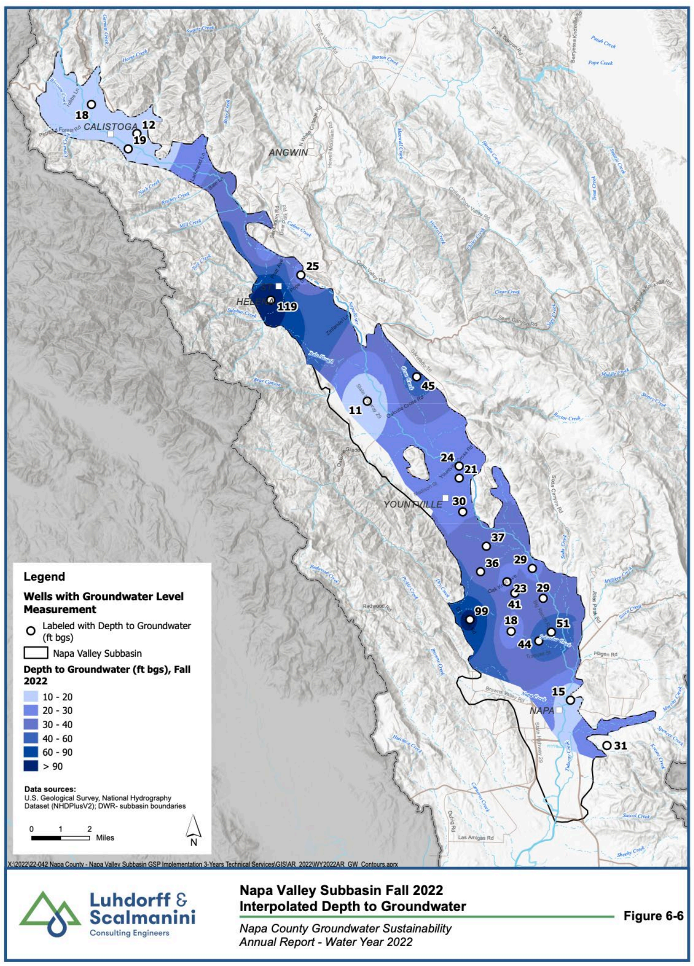

Figure 3. Interpolated depth to groundwater, Fall 2022.

[2] The GSP has maps for other years, but the 2019 map is the most recent.

Conclusion

In conclusion, both shallow and deep groundwater pumping in this basin, including pumping from deep, so-called confined aquifer wells, can each significantly affect the river flows. Specifically, groundwater pumping is adversely affecting the Napa River, particularly during low flow periods.

An expanded groundwater monitoring program that makes transparent both the groundwater levels and groundwater pumping amounts is needed to effectively manage and protect both the groundwater and the Napa River GDE.

Flow Analysis for Napa River Streamflow Gauge at St. Helena, California
Dr. Ted Grantham
August 18, 2023

Station Information

The U.S. Geological Survey has monitored streamflow on the Napa River at Pope Street in St. Helena since 1929 (Gauge Station #11456000). The gauge has operated continuously to the present day except for two notable breaks in the period of record: between 1932 and 1939 and between 1995 and 2000 (**Figure 1**). This gauge is the closest historical record to the proposed Duckhorn project at Lodi Lane and the Napa River, and the proposed Hunter subdivision in the City of St. Helena.

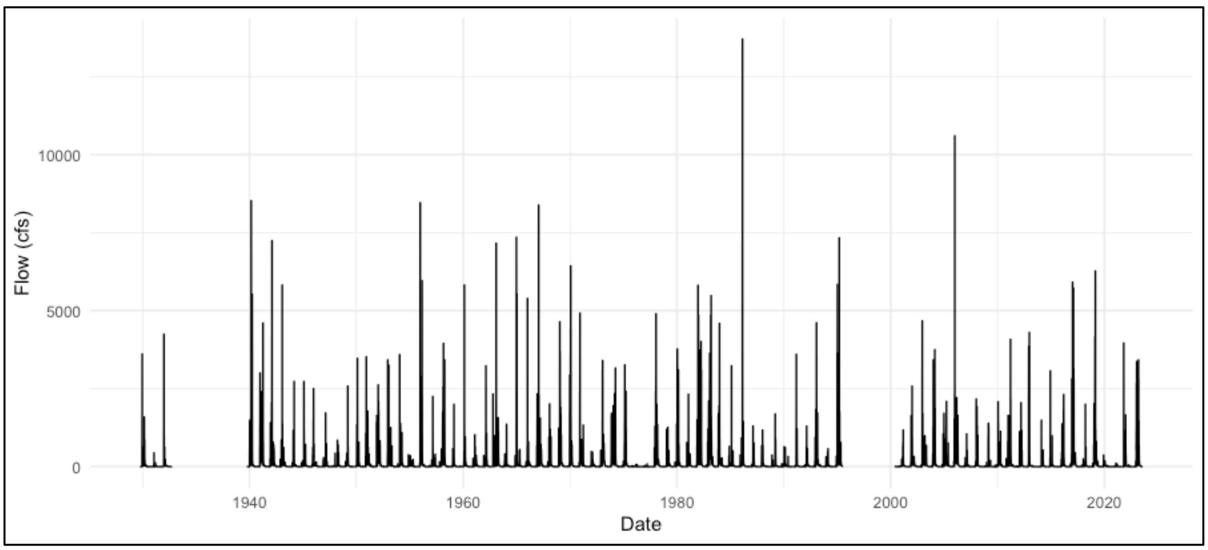

Figure 1. Daily streamflow in the Napa River
Near St. Helena (USGS Gauge Station # 11456000) between 1929 and 2023.

There are several metrics that are used to characterize low flows in streams. One is average 7-day minimum flows, calculated as the 7-day rolling-average of the lowest flows observed each year. Another common metric used is the number of zero flow days, calculated as the number of days in the dry season in which flows fall below 0.1 cfs, which is considered the limit of measurement accuracy for streams during low-flow conditions.

Minimum 7-day flows observed in the Napa River near St. Helena vary over the historical period of record but show a distinctive decline in the past 20 years (**Figure 2**).

The minimum 7-day flow has consistently been zero since 2006, indicating that the Napa River at the gauge now runs dry every year. Although the Napa has ceased to flow in the past, these occurrences have been rare and have never occurred in more than two consecutive years prior to 2006. Statistical analyses confirm that there is a significant negative trend in minimum 7-day flows.

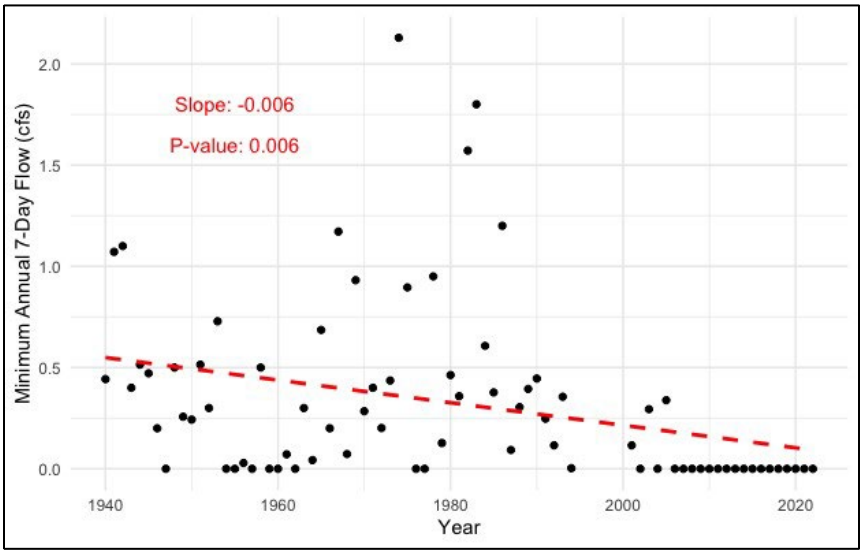

Figure 2. Minimum 7-day flows at the Napa River Near St. Helena (USGS Gage Station # 11456000) between 1940 and 2022.

For minimum 7-day flows there is a negative (downward) slope that is statistically significant. We can therefore state that there is a significant decreasing trend in minimum 7-day flows, although that is also evident by the extended period of zero flows.

The observed record of zero-flow days shows similar patterns of river drying since 2000 (**Figure 3**). For most of the period record, zero flows rarely occurred, with the exception of drought years in the late 50's and in 1976-77. Since 2005, there have been 20 or more zero-flow days occurring in the river. There is a significant, increasing trend in the number of zero-flow days observed in the river. Since 2001, the number of zero days has been increasing at an average rate of 7 days per year.

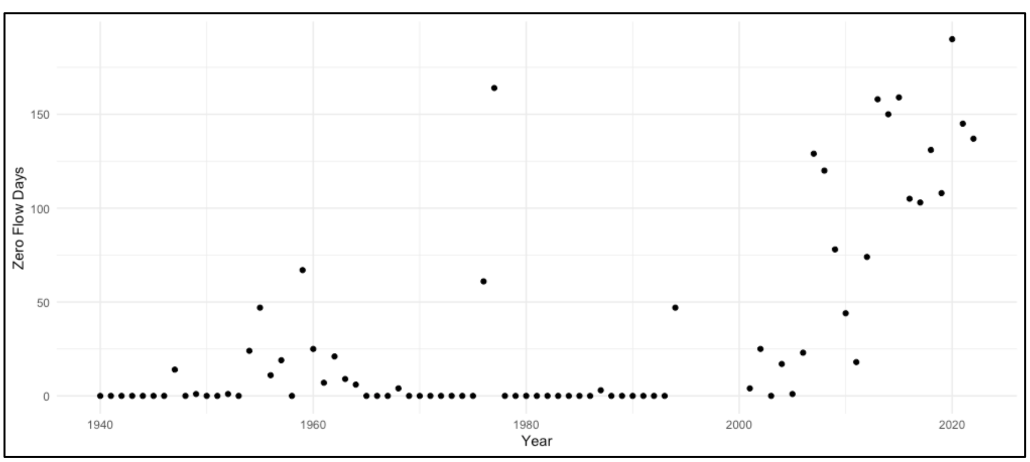

Figure 3. Annual, zero-flow days at the Napa River near St. Helena (USGS Gauge Station # 11456000) between 1940 and 2022.

While recent drought is likely contributing to low-flow conditions, regional climate does not explain observed drying of the Napa River. **Figure** 4 is a record of total annual precipitation in the region since 1940:

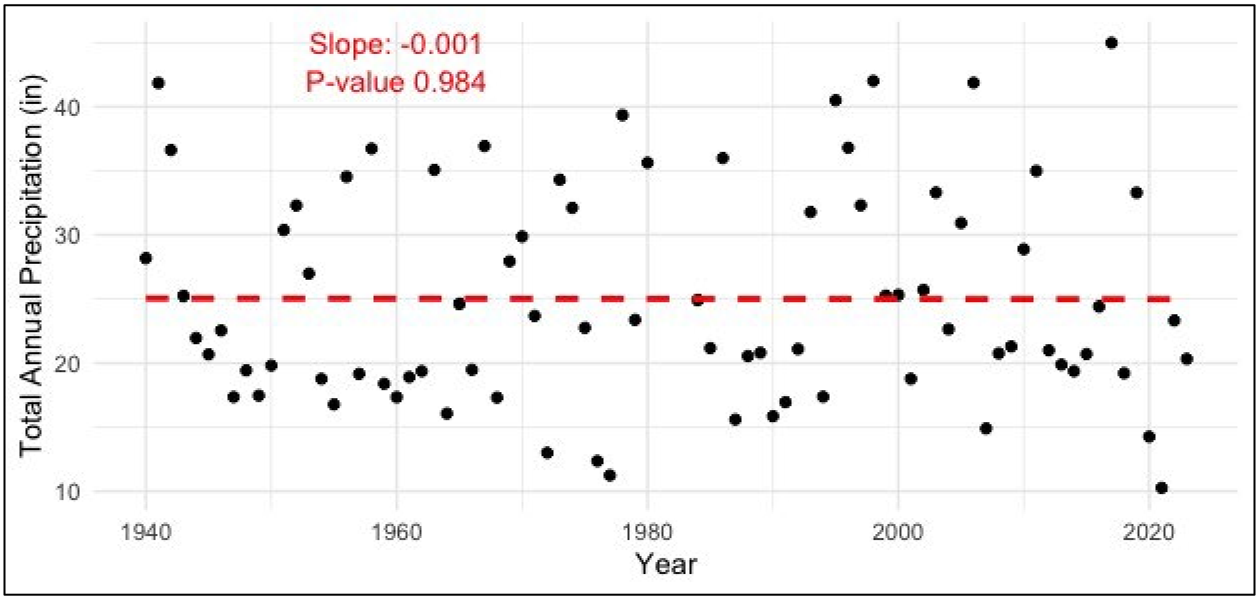

Figure 4. Total annual precipitation recorded in Napa Valley
Between 1940 – 2022, measured at the Napa Fire Department station.

This chart sets annual precipitation by year with slope and p-value. If the p-value is less than 0.05 the slope can be interpreted as a statistically significant trend. Here the relationship is not statistically significant and there is no trend in the data (i.e. over the study period precipitation is unchanged).

Unlike Napa River streamflow, there is not a significant trend in precipitation. Total precipitation is highly variable over the period record, but is not decreasing. Prior to 2000, Napa River low flows are positively correlated with annual precipitation. In wet years, minimum-7 days flows are higher and there are fewer zero flow days than in dry years. But after 2000, streamflow is decoupled from precipitation: despite the fact that the region has experienced several wet years since 2000, minimum flows are consistently zero.

Conclusion

Collectively, these results suggest that water withdrawals at or near the streamflow gauge at Pope Street in St. Helena are dewatering the Napa River. The effects of these withdrawals on dry-season flows are evident around 2000 and appear to be increasing in magnitude since that time. This gauge is the closest historical record to the proposed Duckhorn project at Lodi Lane and the Napa River, and the proposed Hunter subdivision in the City of St. Helena.