Potential State Strategies for Protecting Communities and Fish and Wildlife in the Event of Drought

Executive Summary

Throughout history, California has experienced drought. Tree ring studies indicate that historic droughts may have extended for 20 or more years. Climate change is altering California's hydrology, bringing hotter, drier weather that leaves less water to meet needs and intensifies droughts. Naturally occurring periods of drought will continue on top of a trend of increased water scarcity caused by climate change.

To ensure California's communities and environment have sufficient water during times of drought, the state needs to continue to adapt to extreme weather that swings from intense drought to large floods in a short period of time. Being able to endure the next severe drought is dependent upon making forward-looking water management decisions during non-drought years.

While the impacts of severe or prolonged drought may be felt across all sectors of California, small, rural communities and the natural environment are particularly vulnerable to drought. Small, rural communities often suffer from insecure water systems and wells that go dry or are at increased risk of contamination. For fish and wildlife already impacted by human water development, lack of water during drought can threaten extinction. Frequently, due to how water is managed, fish and wildlife do not have time to recover between droughts.

The 2020 Water Resilience Portfolio (Portfolio) calls for a "set of actions to meet California water needs through the 21st century." Within the Portfolio, Action 26.3 relates to protecting communities and the fish and wildlife during drought. The California Water Commission (Commission), at the request of the Secretaries for Agriculture, Environmental Protection, and Natural Resources, gained a wide perspective about managing drought and, based on this perspective, developed a set of potential strategies that the State may opt to pursue to protect communities and fish and wildlife in the event of drought. These strategies build on the State's Report to the Legislature on the 2012–2016 Drought, which was published in 2021.

Over the course of 18 months, the Commission talked with hundreds of people from Tribes, local government, water districts, communities, non-profit organizations, academia, special districts, local and State agencies, agriculture, environmental groups, and other states and countries to develop and inform four key strategies for augmenting California's communities' and fish and wildlife species' drought resilience.

1. Scale Up Groundwater Recharge
2. Conduct Watershed-level Planning to Reduce Drought Impacts to Ecosystems
3. Better Position Communities to Prepare for and Respond to Drought Emergencies
4. Support Improved Coordination, Information, and Communication in Drought and Non-drought Years

These strategies and their related actions build on work underway by California's State agencies and suggest ways to help California better protect communities and fish and wildlife from the impacts of the state's inevitable droughts. This white paper is presented to the Secretaries who requested the Commission's engagement for their consideration.

Introduction

California is a drought-prone state. Drought is not simply a lack of precipitation: It is a period of constrained supply when demand for water outstrips its availability. Within California, the lived experiences of drought vary widely. For instance, communities reliant on wells that go dry during drought face drought impacts far sooner than large urban water districts with many sources of water on which to rely. The relationships of individuals and communities, and of plants, animals, and ecosystems, with water systems—be they natural, built, or political – heavily influences the lived experience of drought.

Drought Impacts to Communities and Fish and Wildlife

Small, rural communities and fish and wildlife are particularly vulnerable to drought. Many small, rural communities suffer from insecure water systems and wells that go dry or are at increased risk of contamination during drought. For aquatic species already threatened by human water development, lack of water during drought can be catastrophic. During periods of drought, water for the environment is even more drastically constrained due to less overall supply, changing use patterns that leave less run-off or effluent in streams for environmental uses, and emergency exceptions to regulations that are intended to protect fish and wildlife.

The factors that make small communities and the natural environment vulnerable to drought exist outside the periodic stressor of drought. Wells go dry in some areas because of the continued depletion of groundwater, which is exacerbated by increasingly unreliable surface water supplies due to climate change. Small water systems contend with failing infrastructure, long-standing water contamination, and inadequate financial, technical, and managerial resources to address these problems, which become more acute during drought emergencies. Similarly, fish and wildlife in California, while drought-adapted, suffer from the magnifying impacts of a changing climate overlying unrelenting systemic harm related to the way people alter habitats, water availability, and water quality. For instance, the lack of water for fish – the right amount, at the right time, and of sufficient quality – is a challenge in most years due to the way water is managed in California, causing fish populations to suffer outside of drought. Strategies to protect communities and fish and wildlife during times of drought include emergency responses *and* planning and preparedness to ease on-going stressors.

Climate change exacerbates drought conditions in California. Climate change creates hotter and drier baseline conditions, which lead to less water availability in non-drought years and to more intense droughts. Additionally, climate change is creating the conditions for “weather whiplash” – a phenomenon California experienced in the 2022-2023 water year, swinging rapidly from severe drought to record-breaking precipitation events and flooding. Scientists tell us we can expect periods of drought to continue *on top* of the hotter and drier conditions wrought by climate change and in quick succession with flood events.

As the climate changes, droughts will change. In turn, drought management must evolve. In recent California history, droughts have been treated as episodic emergencies to endure until an eventual return to water abundance. Historically, California’s decision-makers, practitioners, and the public have been generally reactive to drought, but 21st century droughts are forcing California to take a more proactive approach. Modern droughts are hotter, leading to worsening wildfires; they are regional, spanning the entire American West; and they are drastically impacting critical parts of California’s water

systems: groundwater and the Sacramento-San Joaquin Delta. To ensure that California can continue to prosper in the face of droughts, it must plan ahead and account for climate change in its plans.

Managing Drought

There are two main approaches for managing drought: demand management and supply management. Demand management refers to lessening the amount of water used through urban water efficiency (such as installing more efficient appliances and repairing leaks), urban water conservation (such as foregoing watering landscaping), agricultural water efficiency (such as installing drip irrigation), and agricultural water conservation (such as fallowing crops). Demand management strategies are considered fast and inexpensive ways to "free up" water during drought. Supply management refers to augmenting the amount of water available for use or changing how, when, and where it is used. Supply management includes surface water and groundwater storage and management, wastewater reclamation and recycling, stormwater and flood water capture, and brackish water and seawater desalination. Many of these approaches require the use of infrastructure to develop and move water supplies, and generally take more time and money to develop than demand management strategies. California has invested in supply management actions for over a century through the development of infrastructure such as dams, reservoirs, and canals. Additional investments will be needed as climate change accelerates.

During drought, especially prolonged drought, both demand and supply management likely will be necessary. Preparing for California's recurring droughts requires considering how to advance both approaches outside of drought, too. This means identifying and initiating supply management approaches that have longer ramp-up times, and it means answering important questions about how to manage the water that is "freed up" by demand management, such as: When should it be drawn on during drought? How can sectors share in that use? How can it be used to protect vulnerable fish and wildlife or communities? Can it be moved to the places where it is needed most? Unless water conservation and efficiency during non-drought times is paired with a mechanism to support vulnerable water users/uses during drought, the "extra" water that is freed up via demand management may be claimed elsewhere, failing to protect California's fish and wildlife and communities when they need it most. Further, when efficiency measures are implemented outside of drought periods, water demand is hardened and cannot be easily reduced to navigate temporary periods of water scarcity, making water use reductions in times of drought a less effective tool.

In July 2020, the Newsom Administration released its water policy blueprint, the Water Resilience Portfolio (Portfolio), which includes 142 actions to be taken by state agencies to improve California's capacity to endure disruptions, including drought, and to support regional water resilience. One of the Portfolio actions calls on agencies to "develop strategies to protect communities and fish and wildlife in the event of drought lasting at least six years." [1]

In December 2021, the Secretaries for Agriculture, Environmental Protection, and Natural Resources asked the California Water Commission (Commission) to use its public forum to investigate potential

[1] While researching drought in California, the Commission, with support from the California Natural Resources Agency, made a decision to eliminate the part of the action referring to "drought lasting at least six years" and instead focus on droughts of any duration. This decision was informed by research and conversations with experts and representatives from interest groups and interested parties.

strategies to protect communities and fish and wildlife in the event of drought. The Secretaries' letter to the Commission was sent as State agencies were managing the impacts of two years of severe drought and preparing for a third. "Our hope is that in 2022, the Commission can begin to investigate potential strategies for managing long-term drought while coordinating with state agencies to develop a framework to advance this work without disrupting immediate drought response efforts," wrote the Secretaries, who added, "The experience of the current drought, which may be entering its third year, should shape that guidance." The Secretaries expressed their desire that the Commission's work "result in the distillation of a set of investments and policies that would better position the state to manage severely constrained water supplies."

In August 2022, at the height of drought, State leaders created the California's Water Supply Strategy: Adapting to a Hotter, Drier Future (Water Supply Strategy), which distilled a set of actions in the Portfolio to offset long-term losses to a hotter, drier climate that could, in one planning scenario, diminish water supplies by 10 percent by 2040. The Commission's work aligns with the Water Supply Strategy and other State efforts included in *Appendix 1: Related California Water Planning*. State agencies carrying out the Portfolio and Water Supply Strategy have already taken significant actions and invested billions of dollars that will help protect communities and fish and wildlife in the event of drought. *Appendix 2: Overview of State Drought Actions* outlines some of these efforts. Drought-resilience work also continues within the context of implementation of California's human right to water law,[2] the Sustainable Groundwater Management Act of 2014 (SGMA), SB 552 of 2021 (Drought Planning for Small Water Suppliers, State Small Water Systems, and Domestic Well Communities), the State Water Resources Control Board (Water Board) initiative to modernize water right data, implementation of State and federal endangered species laws, and many other laws and initiatives.

Starting in December 2022, a stream of atmospheric river storms ended the drought that had begun in 2020 – and triggered destructive floods. In the context of this weather whiplash, the Commission conducted extensive research and outreach, described in *Appendix 3: Overview of the Commission's Process*, to fulfill the Secretaries' request. These themes came up nearly universally, across geographies and interest groups:

- Drought crisis can and should be used to take bold action to improve water management.
- The capacity to endure a severe drought depends upon water management decisions during non-drought years.
- Climate change requires adapting water infrastructure, water rights, watersheds, groundwater, and all aspects of water systems, as well as protecting the fundamental value of ecosystems benefits.
- Addressing drought requires collaboration and collective action, avoiding an "us versus them" dynamic in times of scarcity.
- Californians need to be engaged, educated, and encouraged to take individual action to support the greater good.

The Commission's work on drought is forward-looking. The Commission's focus is to anticipate and prepare for the next drought by building on work already underway in California, as well as in other

[2] The human right to water, as codified in section 106.3 of the California Water Code, specifies that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes."

drought-prone countries. After conducting a literature review and interviews with experts in the Western United States, Australia, Chile, and Israel, the Commission released a document that captures its learning, entitled Long-term Drought in California: Overview and Global Context. The Commission finds that California can draw on lessons learned from other countries, but notes that there is no template approach to drought management: The challenges of water scarcity are unique and context-specific, dependent on physical constraints, political frameworks, and cultural attitudes and behaviors towards water. Universally, a portfolio approach is needed to address drought. When protecting communities and the natural environment from the impacts of drought, California will have to do many things, but will not be able to do them all at once: Policymakers and water leaders need to prioritize the most efficient actions with the biggest return on investment while using far-sighted incrementalism to address difficult problems.

The Commission's work intends to inform the Secretaries as they prepare for and navigate future droughts and to position the State to better protect some of its most vulnerable water users: fish and wildlife and communities. The strategies proposed by the Commission integrate months of conversations with State agencies, experts, water users, interest groups, interested parties, Tribes, and the public. The Commission has taken the input it received and charted a through-line, developing potential strategies that are generally well-supported by diverse parties. The strategies and actions outlined in this paper are additive to the important work already underway by State agencies. The Commission expects State decision-makers to weigh whether and when to move forward with these suggested strategies.

Potential Drought Strategies

The Commission proposes four inter-related potential strategies for State decision-makers to consider embracing in order to protect communities and fish and wildlife in the event of drought.

1. Scale Up Groundwater Recharge
2. Conduct Watershed-level Planning to Reduce Drought Impacts to Ecosystems
3. Better Position Communities to Prepare for and Respond to Drought Emergencies
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Nested under each strategy is a suite of potential actions that the State could consider. Based on its investigation into the topic, the Commission concludes that the suggested potential actions will help the State implement the Portfolio by protecting communities and fish and wildlife in the event of drought. It would require time, effort, and funding to carry out these actions. The pace of implementation would depend upon the feasibility and availability of resources and on competing priorities. Notable considerations, captured for each strategy, include sensitivities, opportunities, and challenges surrounding implementing the potential actions.

A crucial overarching consideration is that water sectors, users, and managers must work together to move forward. In particular, counties have essential responsibilities and play an important role in drought emergency response. Counties need resources to foster their ability to engage across sectors, plan ahead, and protect vulnerable water users.

Each strategy also must be informed by consistent, accessible public engagement, especially with Tribes and members of vulnerable, under-resourced, and/or underrepresented communities. Consistent, accessible public engagement extends beyond planning and includes implementation, operation, and maintenance; it requires establishing trust and investing in building relationships; and it is dependent

upon inviting all sectors and groups to the table for important discussions. Public engagement best practices are described in the Commission's white paper, A State Role in Supporting Groundwater Trading with Safeguards for Vulnerable Users: Findings and Next Steps, as Finding 6.[3] Notably, engagement comes with the responsibility for action: Planning efforts that draw on people's time and resources but are not implemented discourage future involvement in planning and coordination. Participants are looking to the State for accountability and follow-through.

Success Stories in the Central Valley

California's Central Valley is home to an expansive agricultural industry. Of the total water supply directly used by people, 80 percent is used to grow food and fiber. Building drought resilience for fish and wildlife and communities necessarily involves considering how people manage water for agriculture. The two case studies below showcase ideas that could be models for other areas.

Sacramento Valley

In the Sacramento Valley, environmental groups, agricultural groups, water managers, and community representatives have developed a culture of collaboration across various agencies and organizations to manage water for multiple benefits, including efforts to protect communities and fish and wildlife in dry years. For many years, farmers and water managers have worked with conservation groups to maximize migratory bird habitat on rice fields, providing critical habitat to waterfowl and shorebirds traveling the Pacific Flyway. During times of drought, Sacramento Valley interests get creative about finding water to flood farmland and wetlands. The Floodplain Forward Coalition leverages these partnerships to provide a similar safety net for fish by applying water to the landscape to generate salmon food and refugia.

To better prepare for dry years and facilitate coordination and communications, the Sacramento Valley Dry Year Task Force provides a venue for cross-sectoral, transparent engagement on drought issues. California's Secretaries for Agriculture, Environmental Protection, and Natural Resources drop into these meetings, and the meetings have active participation by the directors of State and federal agencies, local water agencies, farm organizations, and conservation partners. During the 2020-2022 drought, the task force actively conducted scenario planning for different hydrologic conditions, which allowed for a better response to increasing drought severity.

Kings River

The Kings River service area, covering approximately 1.1 million acres, is in the Central San Joaquin Valley and has a long history, dating back to the 1920s, of managing groundwater and surface water together (conjunctive use) to prepare for drought. Conjunctive use of surface water and groundwater ramped up after enactment of the Sustainable Groundwater Management Act (SGMA) in 2014. These efforts left the area well-suited to take advantage of drought-breaking storms in the winter of 2023. Initial estimates indicate that 500,000 acre-feet or more of surface water was intentionally recharged in the Kings River service area. Advancements in flood and water supply data collection and forecasting, such as the Airborne Snow Observatory (ASO) and improved run-off modeling, have assisted in maximizing

[3] Page 18 – "…provide sufficient information to stakeholders for them to understand the potential risks and benefits of a trading program, provide information in layperson terms, provide information in the languages commonly spoken in the area, provide adequate notice via a variety of distribution methods for public meetings, hold public meetings at times and venues when stakeholders are able to attend, and convene a stakeholder advisory group with diverse representation to guide and inform decision-making."

conjunctive use. In the Kings River watershed, advancements in forecasting are the result of a highly collaborative process between State, local, and federal entities. Locals provide ground-truthing data and detailed knowledge of the watershed. The State provides the contracting, administration, and analysis of the ASO data products. Federal agencies provide some funding and additional analysis of the data products. Accurate forecasts of when and how much water is going to run off the landscape into reservoirs allowed water managers to initiate conjunctive use activities at least three weeks earlier than usual during the wet winter and spring of 2023, and resulted in capturing approximately 75,000 acre-feet of water that would have been lost to flood control operations.

Strategy 1: Scale Up Groundwater Recharge

Protecting communities and the natural environment during times of drought requires wisely managing water during wet periods. Groundwater basins can store large amounts of water underground and serve as a water supply savings account for dry years if they are well-managed. During flood events, when all other water rights and environmental needs are met, channeling excess flows to groundwater recharge allows California to build drought reserves.

Beginning in December of 2022, in the midst of the Commission's drought work, California was hit by a succession of atmospheric river storms that delivered enormous amounts of precipitation, shifting Californians' focus from drought to flood. With those flood waters came an opportunity to capture excess water and use it to recharge groundwater basins by letting it percolate or injecting it into the ground. State agencies – namely, the Water Board, Department of Water Resources (DWR), and California Department of Fish and Wildlife (CDFW) – leaned into that opportunity. Thanks to rapid, innovative actions taken by State agencies, California already has taken great strides to scale up groundwater recharge as the Commission collected information for this paper. Now, the State must continue to help local agencies plan, permit, and install the necessary infrastructure to capture future high flows.

Recent Groundwater Recharge Accomplishments

In the summer of 2022, as directed by the Water Supply Strategy, the Water Board, DWR, and CDFW began working together, collaborating with local agencies, and laying the groundwork for capturing future high flows for groundwater recharge to alleviate drought impacts. Starting in December of 2022, California experienced a series of atmospheric river storms that led to widespread flooding, further accelerating these efforts to capture and store high flows via groundwater recharge.

During the 2022-23 wet season, the Water Board authorized more than 1.2 million acre-feet of groundwater recharge. The Water Board issued nine 180-day permits and its first five-year permit to the Omochumne-Hartnell Water District, enabling the district to divert 2,444 acre-feet from the Cosumnes River in Sacramento County. In addition to these temporary permits, the Water Board approved a request from the U.S. Bureau of Reclamation to temporarily divert 600,000 acre-feet from its San Joaquin River water rights at Friant Dam to manage flood flows.

The Water Board began streamlining permits to allow for short-term seasonal diversions and lowered fees for applicants during the 2012-2016 drought. While standard water right permits can take several years to process, the Water Board can typically issue 180-day permits within four months and five-year permits take approximately one year. All permits are subject to environmental review and public noticing.

In addition to streamlined permitting and lower fees for applicants, the Water Board provided $1.2 billion to support 34 projects that will bring a total of 115,000 acre-feet to the state's groundwater supplies annually. DWR provided $102.2 million for recharge projects that could yield an additional 263,000 acre-feet per year in storage. The Water Board, DWR, and CDFW also provided technical assistance to help applicants complete their forms and expedite recharge actions.

DWR helped to arrange for 30 temporary pumps to facilitate movement of floodwaters into recharge basins from the Kings, Kaweah, Kern, Tule, and San Joaquin rivers, helping to recharge approximately 50,000 acre-feet of water that would have otherwise resulted in further inundation of flooded regions. DWR is also working with San Joaquin Valley water suppliers to permanently remove orchards and vineyards from nearly 1,000 acres of land in order to establish recharge land and enhance the rates at which floodwaters recharge aquifers.

Additional recharge has been facilitated by the Governor's Executive Orders N-4-23 and N-7-23, which clarified how flood flows can be identified and diverted without water rights and facilitated the diversion of nearly 400,000 acre-feet of flood water to underground aquifers. In July 2023, the Legislature and Governor enacted legislation to make permanent some aspects of the Governor's Executive Orders that facilitate future capture of high flows and expand groundwater recharge projects.

Climate change heightens the need for groundwater recharge. California depends upon snowpack in the Sierra Nevada and Cascade mountains to store water and release it during the dry season, as snow melts. Models indicate that, as the climate continues to warm, the average historical snowpack will shrink sharply by mid-century, and annual snowpack levels already have begun to decline. Additional groundwater recharge can help compensate for lost water storage in mountain peaks.

It is incumbent upon water managers to act long before high-flow events. Administrative and physical structures need to be in place before rainfall and snowmelt. Engaging and working with flood managers is an indispensable component of scaling up groundwater recharge efforts. Partnerships with flood agencies can advance multi-benefit projects that reduce flood risk, improve drought resilience, and offer protections for communities and fish and wildlife. This strategy complements the Water Supply Strategy, which calls for expanding average annual groundwater recharge by at least 500,000 acre-feet.

Water Storage Investment Program

In 2014, California voters passed a bond, Proposition 1, that dedicated $2.7 billion for investments in water storage projects. The California Water Commission is administering the Water Storage Investment Program (WSIP) to fund the public benefits associated with these projects. The seven locally led projects being considered for WSIP funding range from expanding existing reservoirs to boosting groundwater storage to building new surface storage facilities. As called for in the Water Supply Strategy, the State assembled an interagency strike team to facilitate permitting and support completion of these projects. The Commission is responsible for awarding funding to these projects once they have obtained all the necessary permits, documents, and contracts. If completed, these seven projects would increase the state's overall capacity to store water by 2.77 million acre-feet.

Potential State Actions:

1. Prepare for opportunities for groundwater recharge by working with partners, especially the flood management community, to identify flood water diversion and recharge opportunities.
    a. Identify areas in California where recharge is likely to:

i. improve ecosystem function and/or benefit groundwater-dependent ecosystems;
ii. improve groundwater levels near wells at risk of going dry or improve water quality of drinking water wells; or
iii. rapidly attenuate floods and recharge groundwater basins.

b. Work with local agencies to identify landowners willing to accept and hold flood flows for groundwater recharge.

2. Promote recharge efforts through education and outreach and financial incentives.
   a. Conduct coordinated, multi-agency education and outreach targeted to groundwater recharge practitioners that describes the types of groundwater recharge permits available, the permitting process, and the financial incentives available for willing participants.
   b. Support local flood agencies to implement the streamlined floodwater diversion rules captured in the 2023 budget trailer bill.
   c. Explore financial incentives to applicable jurisdictions to spur recharge that will:
      i. advance priority recharge efforts as identified in 1(a) above;
      ii. provide ecosystem and/or equity co-benefits; or
      iii. benefit small, under-resourced communities and Tribes.
   d. Support the California Department of Food and Agriculture (CDFA) Healthy Soils Program for practices that better prepare soils on working lands to infiltrate and hold water.
   e. Work with federal, State, and local water managers to develop a best practice for leaving some recharged water within the basin to support ecosystem and aquifer health.
3. Continue to support efficient permitting to maximize groundwater recharge while protecting the natural environment and communities.
   a. Support resources for timely permit application preparation and review.
   b. Prioritize recharge permits for projects that would benefit domestic well supplies and/or groundwater-dependent ecosystems.
   c. Require regular monitoring of drinking water well water quality near recharge zones, with immediate corrective action required if recharge efforts are correlated with declining water quality.
4. Working with the flood management community, support and align the construction and operation of water infrastructure to advance groundwater recharge that specifically protects fish and wildlife and communities during drought.
   a. Support critical conveyance infrastructure for groundwater recharge, in line with the suggestions made in the Commission's white paper *A State Role in Financing Conveyance to Meet Climate Change Needs: Findings and Conclusions*.
   b. Support local and regional surface storage projects that can store water for recharge.
   c. Consider cost share or grant programs to install fish screens at points of diversion based on public benefits provided by using the point of diversion to increase recharge opportunities.
   d. Integrate groundwater recharge opportunities with federal- and State-operated reservoir management by employing forecast-informed reservoir management, managed aquifer recharge, and reservoir re-operation to improve the capture and storage of flood waters for recharge of groundwater basins.
   e. Facilitate opportunities to better manage local and regional water infrastructure to benefit groundwater recharge.

5. Review recent drought and flood response actions to clarify lessons learned and identify on-going improvements and efficiencies.

Considerations:

Currently, there is widespread political support for and public interest in this strategy. Respondents to the Commission's survey (more information in *Appendix 3: Overview of Commission's Process*) expressed marked support for efficient permitting and infrastructure investment. Permitting and funding are seen by many as two of the biggest constraints to scaling up groundwater recharge. The 2023 enactment of SB 122, which designates aquifers as natural infrastructure that provides ecosystem services with public benefits, strengthens the case for public investment in groundwater recharge. There is some opposition from environmental organizations to building new gray infrastructure, such as canals to facilitate recharge. Tribal representatives expressed some concern about recharge projects disrupting natural cycles by capturing flows that otherwise would flow to the ocean.

Groundwater recharge will look different in different areas – it may be accomplished through spreading basins, flooding up agricultural land, or injection wells, through large-scale or distributed efforts. Some parts of the state are not well-suited for groundwater recharge. All groundwater recharge projects should account for community and environmental needs upstream and downstream of points of diversion; doing so requires time on the part of project proponents and State regulators to ensure that all impacts are considered.

Groundwater recharge as a drought strategy is only effective when paired with effective implementation of SGMA, which calls on local agencies to sustainably manage groundwater basins over the long-term. Well-managed groundwater allows local water users to tap into groundwater supplies during drought without causing undesirable results or basin overdraft that cannot be recovered over future wet periods. While important, groundwater recharge alone is unlikely to lead to sustainable groundwater management. Managing groundwater demand is also likely to be necessary to ensure that communities and the natural environment have sufficient water during times of drought.

Groundwater recharge benefits communities with access to groundwater by providing a drought-resilient water supply, and helps support agricultural water supply, which makes local economies more drought-resilient. To support the environment, however, recharged groundwater must stay in the ground during drought, where it supports groundwater-dependent ecosystems and interconnected surface waters that rely on healthy aquifers for their drought water supply. Another option can also benefit fish and wildlife: Through "conjunctive use," water users draw from well-managed groundwater basins during times of drought, leaving surface water in rivers and streams to support fish and wildlife. While groundwater recharge supports overall basin health, groundwater extraction during drought needs to be carefully considered if it is to benefit communities and fish and wildlife.

Strategy 2: Conduct Watershed-level Planning to Reduce Drought Impacts to Ecosystems

Drought stress on native plants and animals and the ecosystems that support them contribute to a decline in native biodiversity. This is due to a loss of ecological resilience stemming from current and historic water and land use practices and exacerbated by climate change and increasing drought intensity. Further, most wildlife management is driven by static, single-species management. Increasing the resilience of fish and wildlife to drought requires managing for entire ecosystems rather than single species.

To enable fish and wildlife to be more resilient to drought, the State must support fish and wildlife during drought *and* work to recover ecosystem function during non-drought periods, supporting viable populations that can weather the next drought period. The time to do this is now: Climate change is outpacing plant and animal species' ability to adapt to changing conditions and many face catastrophe. Further, during this period of transition – as water supplies diminish and humans scramble to adapt to California's changing hydrology – it is both timely and imperative to act on behalf of ecosystems, pushing forward with existing and novel approaches to ensuring that California's iconic biodiversity and natural systems can flourish into the future.

To survive, California's fish and wildlife need water – both during and outside of drought. California's water rights system is more than 100 years old and, when established, did not fully account for environmental water needs. Setting minimum instream flow requirements, a process conducted by the CDFW together with the Water Board, can identify the volume and timing of flows needed to maintain healthy conditions for plants and animals that live in and along waterways. Those requirements can be embedded into water quality control plans or implemented through regulations.

1. Water Quality Control Plans, administered by the State and Regional Water Boards, contain water quality standards designed to protect the beneficial uses of California's waters. In setting these standards, the Water Boards are required by law to consider competing water uses to determine reasonable protection for fish and wildlife.
2. Where there is not enough water to support all the water needs in a watershed, the Water Board can limit water use through a process called curtailment. Curtailments are implemented through regulations and are based on water rights priority.

Setting instream flows and developing water quality control plans is slow and controversial work that involves public participation and formal, regulatory processes. This work is hampered by incomplete, inaccurate, and outdated information about water rights and water use; the Water Board is in the process of digitizing paper water right records and modernizing its water right data management system. To better protect fish and wildlife during drought, California needs to strengthen its commitment to establishing and enforcing environmental flows through existing mechanisms, and it needs to explore and advance nimble, collaborative environmental water management. Both will take significant, concerted, and sustained political support.

Improving ecosystem management during drought requires advanced planning at a watershed scale, with emergency response when necessary to ensure the viability of priority fish and wildlife during drought. Ideally, this planning will improve overall ecosystem management during drought, so that single-species emergency drought responses are less frequent. Drought planning should include ensuring that habitat and water are available when fish and wildlife are at their most vulnerable. Restoration and conservation of priority physical habitat offers a network of places where native fish and wildlife can find refuge to endure drought. Water should be managed to ensure viable conditions for fish and wildlife in these biological strongholds even through times of constrained supply. The State also has an opportunity to bring forest management into its ecosystem planning, addressing the underlying causes of the catastrophic wildfires that are so destructive to species and communities.

Importantly, planning sets priorities for actions, rather than attempting to meet all objectives all the time. Funding constraints will always exist, and this strategy seeks to help the State set priorities and

decide where to focus limited resources in order to complement the Water Supply Strategy, which does not directly address environmental protections in times of water scarcity.

Drought and Wildfire

While drought does not cause wildfire, it increases the risk of extraordinarily destructive wildfire by drying vegetation and soils and stressing forests, reducing trees' ability to resist insect infestations. Fire damages water quality, air quality, habitat integrity, forest economies, recreational access, and water infrastructure. Damage likely will get worse as the climate continues to get hotter and drier. Costs from wildfires are typically the largest economic and public health impact of drought, enduring long after drought ends.

Before the 1850s, mountain trails and ridges were kept open by Tribes' burning practices. Now, dense tree canopies exacerbate the wildfire threat. Cultural burning – or "good fire" – helps bring back some defensible space. Cultural fire is a cyclic process, centered in Tribal culture and focused on return and renewal. Some California Tribes are engaging in selective burning and tree removal. These efforts help restore mountain meadows, which are important water sinks, improve soils, augment plant vitality, create habitat for diverse insect and animal species, and improve access to traditional food sources. Tribes apply traditional ecological knowledge to forest management with the intent of restoring the health of the whole forest.

It is impossible to protect all of California's forested landscape from wildfire, but thoughtful forest management shows promise in offsetting the worst of California's growing wildfire problem, providing near-term climate and water benefits. It may be the best rallying cry to spur investment in and collaborative management of the State's wildlands. Forest management requires dedicated attention, strong partnerships, and commitment to targeted treatment of critical areas and ongoing maintenance of those areas.

Potential State Actions:

1. Analyze ecosystem water supply needs to understand the amount of water required to sustain functioning ecosystems as water scarcity increases.
2. For priority rivers and streams, advance the establishment of instream flows that protect fish and wildlife in a changing climate as called for in the California Water Action Plan[4] and the Portfolio[5].
3. Evaluate the application of environmental water planning, as described in the box below.
    a. Consider drawing on DWR's Watershed Resilience Program to pilot the development of an environmental water plan in a priority, salmon-bearing stream.
4. Consider identifying and securing assets for the environment that can be flexibly deployed, assigning a trustee to manage those assets, and integrating them into environmental water plans that allow for flexible management of water resources to benefit ecosystems broadly. Protecting water for fish and wildlife could be done through regulation, negotiated general agreements as part of regulations (e.g., water quality control plans or Habitat Conservation Plans), or water purchase agreements.

[4] See action 4: Protect and Restore Important Ecosystems, which includes Enhance Water Flows in Stream Systems Statewide.

[5] See action 9.2: Conduct and utilize instream flow analyses to further develop instream flow recommendations for ecologically important streams to protect public trust values. (Water Board, CDFW)

Environmental Water Plans

An "environmental water plan" anticipates the potential for drought conditions during the coming water year. In concept, this plan would be fully vetted with regulators, the water user community, and other interested parties, would describe and prioritize the ecological objectives for the coming water year, and would identify important contingencies. The plan would be structured like a decision tree in which an array of actions (e.g., functional flow timing and magnitude, triggered water trading or curtailment agreements, hatchery actions, fish and wildlife translocations, etc.), are to be taken depending upon existing and projected hydrologic conditions. In most basins, this would involve monthly adjustments guided by the decision tree.

The concept of an environmental water plan comes from two places. First, it underlies all environmental water management in Victoria, Australia.[6] Here, a minister called the Victorian Environmental Water Holder maintains a portfolio of water supplies, including water stored in reservoirs, for allocation to the environment and trading of water to meet environmental objectives. These efforts are codified in an annual environmental water plan and supported by a more general plan that describes biological goals and objectives. The water plan describes the actions to be taken depending on hydrologic conditions throughout the year. A second example comes from the Restoration Administrator (RA) of the San Joaquin River Restoration Program. The RA manages a block of water set aside for the environment in Millerton Reservoir near Fresno. This water is managed to support spring-run Chinook salmon. The RA develops annual plans for environmental allocation depending on the water year type. However, throughout the winter and spring, the RA, in consultation with the U.S. Bureau of Reclamation and the water user community, adjusts allocations depending on hydrologic conditions.

The goal of environmental water plans is to anticipate actions that might take place and to communicate these potential actions in advance. An environmental water plan allows for negotiating key agreements in advance, clearly identifying regulatory options, evaluating the scientific basis for actions before action is needed, and informing water users and interested parties of actions that could be taken depending on hydrologic conditions. The latter reduces uncertainties for all interested parties since actions are planned in advance and there are fewer controversial surprises. Since this approach is guided by a decision tree based on real-time hydrologic conditions, it could be much nimbler and respond to changes that occur on biologically meaningful time scales. The historic use of water year type to guide regulatory actions fails to take annual variability into account, becoming rigid. Reliance on emergency drought declarations is also not as effective since Governors typically declare a statewide drought emergency only after widespread damage from drought is documented, long after the environmental damage occurred or the opportunity to correct course has been lost. To be most effective, the water set aside for the environment must be paired with investments in physical habitat that restore connections between land and water.

5. Continue to modernize the water rights data system and improve the Water Board's capacity to administer water rights during drought conditions.
6. Implement key fish and wildlife protection projects and habitat restoration and conservation projects that provide drought resilience and refugia.

[6] More information about Victoria's approach can be found here: Managing Water for the Environment During Drought: Lesson from Victoria, Australia (ppic.org)

   a. Support projects that augment fish and wildlife species' drought resilience by improving ecosystem function during non-drought years, such as reconnecting and reactivating floodplains with rivers and streams, restoring wetlands, restoring mountain meadows, and clearing barriers to fish spawning grounds in upper watersheds.
   b. Consider the potential of State Conservancies and other appropriate jurisdictions to mitigate drought; to leverage place-based knowledge; to lead habitat restoration and conservation work that prioritizes the most impactful projects for fish and wildlife and drought resilience; to engage partners, Tribes, and interested parties in the planning process (including stipends for engagement); to integrate Tribal culture-bearing practices into restoration efforts; and to test and study outcomes with the intention of advancing projects that build drought resilience.
   c. Promote CDFW's Voluntary Drought Initiative before and during times of drought to engage landowners, water users, and communities in watershed conservation and management actions by securing agreements that can help reduce the effects of the drought on salmon and steelhead.
7. Integrate fire/forest management into drought planning and projects.
   a. Encourage the integration of water supply and drought management considerations into the California Wildfire and Forest Resilience Task Force action plan.
   b. Develop and deploy an equitable and sustained funding approach that gives State funders the administrative authority to operate flexibly, pool funding, and work at the landscape scale to collaboratively advance wildfire risk reduction and habitat restoration and conservation projects.
   c. Support Tribal cultural burning projects and Tribes' ability to develop and share Tribal knowledge of cultural burning practices in order to benefit the landscape and to help counteract public misconceptions of cultural burning.
8. Catalog State actions taken to protect fish and wildlife during the 2020-2022 drought, identify lessons learned, and create a cross-agency emergency action plan for protecting fish and wildlife during severe drought. The plan should consider:
   a. in-stream water purchases;
   b. seasonal flooding of agricultural lands to improve habitat for fish and/or birds;
   c. temporary land fallowing to improve groundwater levels for groundwater-dependent ecosystems and to reduce water use to protect wildlife and water quality;
   d. water provisioning for federal wildlife refuges and State wildlife areas;
   e. infrastructure improvements for fish hatcheries and other State-managed wildlife facilities;
   f. relocation of salmon species above rim dams;
   g. monitoring efforts to track the efficacy of the plan's actions; and
   h. support for Tribes, local districts, and organizations doing critical drought work.

Considerations:

Protecting the natural environment during drought demands comprehensive solutions, funding, political support, and State leadership. Respondents to the Commission's survey expressed support for integrating fire/forest management into drought planning, followed closely by developing environmental water plans.

Environmental water planning is not required by statute, and it is not clear how these plans would work with other regulatory efforts. Voluntary participation by water users in environmental water planning could be improved by aligning such efforts with Endangered Species Act requirements so that water users' environmental water contributions support endangered species. Environmental water planning likely would face opposition from water users who are concerned about creating assets for the environment and from some environmental organizations concerned about the potential for an overall loss of water for the environment. Assessing ecosystem water supply needs and establishing instream flows are data-intensive processes that also require resources and may face opposition from water users.

Investing in modernizing water rights data and enforcement and in habitat restoration and conservation, aligning forest management with ecosystem drought planning, and developing an emergency action plan for protecting fish and wildlife during severe drought are underway or could begin immediately. Implementing forest management projects requires on-going capacity and resources to treat large swaths of land repeatedly, and it takes time for the benefit of these treatments to be maximized.

Strategy 3: Better Position Communities to Prepare for and Respond to Drought Emergencies

California's communities need State support during drought and in advance of droughts. During drought, communities need resources to ensure that vulnerable community members are safe in times of crisis. In advance of drought, they need support to help abate future vulnerabilities to water scarcity by improving water systems and integrating water use into land use planning. The State needs to promote and utilize diverse approaches to address unique community needs, engaging and supporting counties so that local governments can better prepare for and respond to drought.

As California's hydrology changes, communities will face increased instances of weather that swings from drought to flood conditions in record time. California's communities will face back-to-back emergencies and need State funding to help address varying impacts: dry wells, water contamination, levee breaches, loss of livelihoods and property. Local agencies hold primary responsibility for emergency response, and local entities turn to the State when disasters exceed their capacity to manage them. State emergency funding needs to be deployed efficiently to prevent a delay in aiding vulnerable community members. Farmworkers and small farm operators, in particular, are hit hard by drought, as their ability to make a living vanishes when crops cannot be planted and harvested.

Outside of emergencies, communities need support to advance resilience to drought. Under Senate SB 552, signed in September 2021, State and local governments share the responsibility for preparing and acting in the case of a water shortage event. The State developed a tool to identify communities that are vulnerable to drought and water shortage and is supporting counties' drought resilience planning through financial and technical assistance. The Safe and Affordable Funding for Equity and Resilience (SAFER) program, administered by the Water Board, utilizes funding tools and collaborates directly with water systems and communities to provide solutions to those lacking safe water, including support for regionalization of water supplies through consolidations[7] and other approaches. In addition to supporting water supply systems, supporting integrated land and water planning helps local landowners and agencies to build drought resilience.

[7] Consolidation is the joining of two or more water systems, which commonly includes a smaller system being absorbed into a larger water system. For more information: Drinking Water Partnerships and Consolidation | California State Water Resources Control Board.

Potential State Actions

1. For small and/or rural, disadvantaged communities and Tribes, design climate disaster funding that allows for nimble, efficient response to on-the-ground emergencies.
    a. Support Tribes', local governments', and non-governmental organizations' drought response capacity.
    b. Support resources to address climate disasters broadly (e.g., both drought and flood) to resolve immediate and imminent emergencies, such as the need for bottled or hauled water and levee repairs, and to ensure protections for farmworkers and small farm operators.
    c. Encourage counties to enter into agreements in advance of emergency situations and ensure that agreements include provisions for local governments to work with surrounding Tribes.
    d. Allow delegation of funding management to local assistance providers with expedited State sign-off for pre-approved categories of activities and dollar thresholds to nimbly address system needs.
2. Ramp up efforts to improve water system resiliency and actions to increase supply reliability for communities and encourage regional approaches to water resource management.
    a. Support collaborative conversations, relationship building, and coordination between communities to advance efficient, resilient water supply solutions, positioning counties as key parties in these efforts and integrating flood managers to promote better water management across wet and dry years.
    b. Provide clear direction to counties on how SB 552 drought resilience plans should be developed in order to ensure drought resilience plans serve as a blueprint for how counties will identify local drought impacts and successfully respond in the interim and long-term.
    c. Consider amending SB 552 to mandate plan development in a timely manner and empower State review of plans to ensure that they are adequate.
    d. Begin to bring relevant plans, such as groundwater sustainability plans and drought contingency plans, together at the regional level to advance regionally comprehensive planning.
    e. Set, track, and meet timelines that expedite proactive drought resilience projects for vulnerable communities.
    f. Further a better understanding of Tribal water needs and consider including Tribal lands on State maps of hydrological regions.
3. Support integrated land and water planning to facilitate improved water demand management, and water conservation and efficiency.
    a. Expand the Department of Conservation's Multi-Benefit Land Repurposing Program and CDFA's State Water Efficiency and Enhancement Program to advance long-term water efficiency and demand management projects that help California alleviate the impacts of water scarcity, particularly during drought.
    b. During times of drought, support temporary land fallowing to improve groundwater levels near drinking water wells, following the example set by DWR's LandFlex program.
    c. Provide guidance to counties regarding integrating water use considerations with land use planning with the intent of augmenting regional resiliency and self-sufficiency through improved groundwater management and consolidated water systems.

d. Partner with local groups and agencies to encourage – through education and incentive programs – the application of holistic, localized water conservation measures, such as water capture and reuse at the neighborhood or residential scale.

Considerations:

In general, respondents to the Commission's survey agreed with the high-level actions bundled under this strategy, and encouraged the State to ensure accountability and transparency, work with communities, and establish priorities for action. Respondents expressed concern about the ongoing viability of these approaches related to governance, capacity, and costs.

Counties bear much of the responsibility for responding to emergencies, planning for drought contingencies, and approving land use. In many cases, counties lack the capacity to comprehensively address water supply and drought preparedness and response issues. State guidance and support will be critical to counties integrating water management and land use planning.

Tribes and Drought

The Commission hosted a two-part series of Tribal discussions on drought: one to understand Tribal drought impacts and another to solicit feedback on the Commission's preliminary drought strategies. Through Tribal discussions and presentations given to and by Tribal representatives, the Commission gained a better understanding of how Tribes experience and respond to drought. While Tribes are individual sovereign governments with varying perspectives and approaches, the following summary explains some of the themes that emerged from the Commission's engagement with Tribes.

Tribes experience the impacts of drought both on current Tribal lands and Tribal ancestral homelands. Drought impairs Tribal cultural resources, threatens access to sacred sites and traditional gathering areas for procuring food and other resources, and limits Tribes' ability to conduct ceremonies. It decreases water quality, further impacting culturally important plants and animals that Tribes rely upon for food sovereignty and affecting health of both humans and non-humans within the system.

Each Tribe has unique cultural perspectives, practices, lived experiences, and ancestral connections that tie Indigenous peoples to their ancestral homelands. Tribes are stewards of their ancestral homelands who manage ecological landscapes using Tribal knowledge, also referred to as traditional ecological knowledge, to build cultural and environmental resilience. Tribes are subject matter experts of their ancestral homelands with a deep place-based knowledge that can help address drought comprehensively through practices like cultural burning, which helps manage forest overgrowth while restoring soils and plant life. Cultural burning is a traditional practice that has been passed down through generations. To prevent knowledge extraction and misappropriation, it is critical that Tribal communities lead the implementation of these efforts, with support from the State.

Protecting culturally important resources is fundamental to supporting and protecting Tribes during times of drought. In practice, this requires meaningful investments in ecosystem restoration that includes resilience for culturally important resources. It also means incorporating Tribal beneficial uses into large water projects. Importantly, this work starts by engaging Tribes meaningfully and efficiently – through State alignment on key issues – to avoid additional demands on overloaded Tribal leaders, staff, and representatives. Supporting Tribes' capacity-building also augments these efforts.

Strategy 4: Support Improved Coordination, Information, and Communication in Drought and Non-drought Years

In California, droughts need to be dealt with as a chronic phenomenon and not an occasional emergency. Attention to drought should be consistent, not sporadic. The State needs to continue to align its staff capacity, improve its data collection, and contextualize its drought communication, moving from a crisis mindset to recognizing drought as a natural and inevitable element of the state's hydrologic cycle. In the words of one interested party representative, "Every time there's a drought, we don't want it to be an emergency: We want to plan in advance so that we can be prepared to weather a drought."

Addressing drought at the State level requires sustained staff capacity to prepare for and respond to drought – and to deal with drought recovery, or the enduring impacts to the natural environment and communities caused by drought that persist after the emergency itself has passed. Currently, during a drought emergency, State staff are pulled from their regular positions to respond to the emergency and return to their regular positions once the emergency ends. Institutionalizing drought response would create the capacity to adaptively manage the State's drought response.

To prepare for drought requires wisely managing water during wet years and during flood periods, which means the State must manage droughts and floods together, integrating flood management departments, such as the Central Valley Flood Protection Board and DWR's Division of Flood Management, into drought planning. This requires putting in place the staffing and governance structures needed to enhance collaboration and break barriers between flood and drought management.

Doubling down on collecting the data needed to know how to manage water on a seasonal basis also promotes collaboration, as water managers consider how best to store or release water given projected hydrology. Advances in sub-seasonal-to-seasonal forecasting extend the accuracy of conventional weather forecasts from a week or two to six weeks (sub-seasonal) to seven months (seasonal). Forecasting these longer time periods better informs water resource allocation decisions and drought preparedness activities.

The State cannot prepare for drought alone. Everyone plays a role in managing water, particularly during drought – and all Californians need to better understand how to think about water demand, supply, and management in an era of changed hydrology, when extreme wet periods punctuate extended drought. By communicating clearly and consistently – during all water year types – about current water demand, supply, and how water is being used, the State can foster a deeper water ethic that supports drought-related policies, investments, and emergency responses. Doing so will lay the groundwork for public support of bold action on protecting the natural environment and communities from the impacts of drought, as well as individual and collective commitments to sustainable water use.

Potential State Actions:

1) Support staffing at State agencies to address drought issues and engage in and oversee on-going collaboration and adaptive drought management that integrates flood management.
    a. Establish ongoing State interagency collaboration, such as standing extreme weather working groups, that:
        i. foster collaboration between State decision-makers, managers, and rank-and-file staff; and
        ii. integrate flood planning and flood planners into drought work.

   b. Work collaboratively across agencies to identify lessons learned after drought emergencies and to create a dynamic planning framework for the next drought emergency.
   c. During and between droughts, collect and share consistent information on vulnerable communities and fish and wildlife to inform drought response.
   d. Align State and local communication about drought issues through the Drought Resilience Interagency and Partners (DRIP) Collaborative (more information in *Appendix 1: Related California Water Planning*) and consider providing stipends to Tribes and environmental and community groups doing critical drought work.
   e. Work with universities and industry groups to drive research and advancements in science and technology that improve California's ability to protect fish and wildlife and communities during drought, including innovations in water conservation and demand reduction.
2) Support sub-seasonal and seasonal forecasting to anticipate drought by working with local, federal, academic, and industry partners to advance enhanced forecasting at longer timescales.
   a) Work with federal representatives to ensure that the National Ocean and Atmospheric Administration implements sub-seasonal and seasonal forecasting requirements called for in the Weather Research and Forecasting Innovation Act.
3) Develop a consistent public information campaign to support local messaging, educate Californians about water, and spur behavioral changes that support drought resilience.
   a. Continue to engage local water agencies and coordinate an inventory of drought communication campaigns by local agencies and State agencies and departments.
   b. Partner with leading educators, media experts, and social scientists to develop an ongoing statewide information campaign that:
      i. develops and deploys educational and informational tools with the intent of increasing Californians "water IQ" and spurring behavioral change;
      ii. leverages current efforts to develop an on-going water communication approach;
      iii. provides an umbrella campaign that can be customized to meet local needs;
      iv. uses clear and compelling messages to share information about water demand, supply, and management in California's changing hydrology, with the intent of creating a go-to information portal for public water information, particularly during times of drought;
      v. revisits the use of the terms "drought" and "drought emergency" in the context of extended dry years and altered climate and introduces terms and concepts such as "aridification" and "water scarcity."
   c. Develop metrics and track the campaign's impact.

Considerations:

Respondents to the Commission's survey strongly supported identifying lessons learned from prior droughts and planning for future droughts.

Conclusion

The State has taken important steps toward preparing for water scarcity, improving drought resilience, and efficiently responding to drought emergencies. Implementation of the strategies above would better position California to protect its vulnerable communities and fish and wildlife during times of drought, and to deal with the increasing aridity and drought intensity wrought by climate change.

Appendix 1: Related California Water Planning

The Commission's work is aligned with other efforts to address water management in California's increasingly arid climate.

California's Water Supply Strategy, Adapting to a Hotter, Drier Future (Water Supply Strategy), released in August of 2022, describes a suite of actions to increase water supply and adapt to more extreme weather patterns caused by climate change. These actions include developing new water supplies through water recycling and desalination; expanding water storage above and below ground; reducing water demand in urban areas and through implementation of the Sustainable Groundwater Management Act (SGMA); improving forecasting, data, and water management; and modernizing water rights administration.

Commission Drought Strategy	Aligned Water Supply Strategy Actions
1. Scale Up Groundwater Recharge	2.1 Expand average annual groundwater recharge by at least 500,000 acre-feet. Outreach: • DWR and the State Water Board will conduct a series of outreach activities to highlight temporary permitting pathways in advance of winter, to assess the status of proposed recharge projects, and to better align state and local agencies to advance groundwater recharge. The outreach would focus on the use of an existing 180- day temporary permit process and would note that permit applications should be received no later than October 1 to be ready for diversions in January. • By December 2022, DWR will evaluate a process whereby it files for 180-day temporary permits in certain watersheds on behalf of local agencies, in order to advance the development of the permit terms and conditions. DWR also would pay the filing fee, which could help facilitate local willingness to participate. Technical Assistance: • DWR will provide outreach and assistance to help connect potential diverters with State Water Board permitting staff to answer specific questions and provide information that enables effective permit applications. • By October 2022, the State Water Board water right permitting staff will prioritize groundwater recharge permits. Incentives: • The State will weigh immediate and long-term incentives for recharge project applicants to pursue the State Water Board's streamlined recharge permitting pathway. Incentives could include: • Waiving of application costs partially or fully for a two-year period.

Commission Drought Strategy	Aligned Water Supply Strategy Actions
	• Connecting infrastructure funding to applications that use the State Water Board's streamlined underground storage permitting approach. • Prioritization of State funding for groundwater recharge projects that target high-flow events, which raise fewer concerns about the environment and other water right holders than projects that seek to capture water in "shoulder" seasons of spring, summer, and fall. • DWR will expand its watershed modeling tools to better assess water available for recharge on a watershed basis. Regulatory Streamlining: • The State Water Board will develop permanent regulations for water availability analyses that specify methodologies, data, and alternatives for conducting such analyses. • The Administration will pursue legislation to revise the water right application process to deliver decisions more quickly.
2. Conduct Watershed-level Planning to Reduce Drought Impacts to Ecosystems	4.3: Modernize water rights administration for equity, access, flexibility, and transparency • Support enforcement staff to help address illegal and unauthorized diversions during dry conditions.
3. Better Position Communities to Prepare for and Respond to Drought Emergencies	3.2: Help stabilize groundwater supplies for all groundwater users, including a more drought-resilient agricultural economy • Support local water demand management that includes changes to cropping patterns and fallowing by building upon this year's investment of $40 million in grants to regional organizations working to reduce groundwater reliance and create local environmental and economic opportunities through land-use changes. • Continue to support conservation and water efficiency practices by agricultural producers. • Support flexibility in local land use decisions to protect beneficial uses and users. • Continue direct investment and technical assistance in drought relief for agriculture with dedicated funding to assist socially disadvantaged and underserved populations.

Commission Drought Strategy	Aligned Water Supply Strategy Actions
4. Support Improved Coordination, Information, and Communication in Drought and Non-drought Years	3.1 Build upon the conservation achievements of the last two decades to reduce annual water demand in towns and cities by at least half a million acre-feet by 2030 • The State-run Save Our Water campaign will continue to educate Californians about the severity of the current drought and the need to make water conservation a permanent, daily practice. 4.1 Improve data collection and modernize forecasts for a changed climate • Continue to invest in the human and technical resources needed to improve predictions and forecasting for water supply planning. • Advance a multi-agency effort to install 430 new stream gages and upgrade or reactivate 200 more across the state. These gages provide real-time surface water data for enhanced drought management and flood response. • Work with the U.S. Army Corps of Engineers leadership to accelerate the pace at which the manuals guiding reservoir operations are updated to reflect a changed climate.

The Drought Resilience Interagency and Partners (DRIP) Collaborative, which includes state and non-state agency members, is a standing drought and water shortage interagency task force that will facilitate proactive State planning and coordination for pre-drought planning, emergency response, and post-drought management, consistent with Senate Bill 552.

Commission Drought Strategy	Aligned DRIP Collaborative Engagement
1. Scale Up Groundwater Recharge	The DRIP Collaborative expressed interest in informing groundwater recharge implementation and helping to advance projects.
3. Better Position Communities to Prepare for and Respond to Drought Emergencies	The DRIP Collaborative expressed interest in leading efforts to streamline requirements and maximize the efficiency of State drought-related funding programs.
4. Support Improved Coordination, Information, and Communication in Drought and Non-drought Years	The DRIP Collaborative expressed interest in serving as a hub for coordinating between agencies, Tribes, and local governments to identify and champion drought response solutions; inventorying domestic well data for informed decision making; and reframing public messaging about drought to improve awareness of long-term changes towards a hotter, drier climate.

The California Water Plan, updated every five years, is the State's strategic plan for sustainably and equitably managing and developing water resources for current and future generations. The 2023 update to the California Water Plan will be released in XXXX. A public review draft is currently available.

Commission Drought Strategy	Aligned California Water Plan Update 2023 Actions
1. Scale Up Groundwater Recharge	Action 2.1.1: Modernize Backbone Conveyance Systems Action 2.2.1. Maximize Operation of Systems for Changing Climate Action 2.2.2. Expand SWP (State Water Project) Storage and Conveyance Capacity Action 2.5.2. Support and Integrate California Department of Food and Agriculture Climate-Smart Agriculture Programs Action 3.1.2. Manage Aquifers as Natural Infrastructure Having Ecosystem Services to Accelerate Replenishment and Remediation Actions Action 3.3.1. Increase Opportunities for Managed Aquifer Recharge Action 4.2.2. Continue to Implement the Drinking Water Well Principles and Strategies Framework Action 6.2.1. Explore Broader Application of Flexible Regulatory Approaches
2. Conduct Watershed-level Planning to Reduce Drought Impacts to Ecosystems	Action 3.1.1. Expand and Accelerate Ecosystem Restoration Action 3.1.3. Improve Wildfire Resilience in California's Watersheds Action 6.2.3. Enable DWR to Acquire or Manage Water Rights to Facilitate Sustainability and Resiliency Action 5.1.2. Support Tribal Engagement in Programs, Projects, and Activities Respectful of Tribal Beneficial Use Designations Action 5.3.1. Support Tribal Lifeways and Cultural Practices Action 5.3.2. Continue Co-Management Agreements with Tribes Action 6.1.1. Improve Data for Regulatory Decision-Making Action 6.2.3. Enable DWR to Acquire or Manage Water Rights to Facilitate Sustainability and Resiliency Action 6.3.1. Modernize Water Rights Data to Facilitate Adaptive and Real-time Decisions Action 6.3.2. Facilitate Collaborative Approaches toward Meeting Regulatory Objectives Action 7.1.3. Improve Grant Application Requirements

Commission Drought Strategy	Aligned California Water Plan Update 2023 Actions
3. Better Position Communities to Prepare for and Respond to Drought Emergencies	Action 1.3.1. Identify the Regions of the State with High Climate Vulnerabilities and Preparedness Challenges Action 1.3.2. Prioritize Implementation Actions and State Assistance to Critically Challenged Region Action 2.3.1. Identify Opportunities for System Integration Action 2.5.2. Support and Integrate California Department of Food and Agriculture Climate-Smart Agriculture Programs Action 2.6.1. Continue to Support Urban and Agricultural Water Use Efficiency Efforts Action 3.3.3. Increase Coordination with Land Use Planning Action 4.2.2. Continue to Implement the Drinking Water Well Principles and Strategies Framework Action 4.2.4. Incentivize Efficient and Equitable Land Use Practices Action 4.2.5. Support Targeted Resources to Support Frontline Community Members Action 4.3.1. Evaluate Barriers to State Financial Assistance Action 4.3.5. Accelerate Consolidations for Consistently Failing or At-Risk Systems Action 7.1.4 Provide State Assistance for Small Community Water Systems
4. Support Improved Coordination, Information, and Communication in Drought and Non-drought Years	Action 1.1.1. Align State Agencies to Support Watershed Resilience Action 1.4.1. Develop and Integrate Watershed Data and Performance Tracking Hub Action 1.4.2. Improve Water Plan Data and Analytical Tools Action 2.4.2. Continue Use of State-of-the-Art Monitoring and Forecasting Action 3.3.4. Enhance Existing Groundwater-Level Data Collection Programs Action 4.2.3. Expand Dedicated Positions for Coordination and Cooperation Action 4.2.6. Improve Community Understanding of Social and Climate Vulnerabilities Action 5.2.5. Increase Tribal Involvement in State Agency Activities

The Groundwater Management and Drinking Water Well Principles and Strategies (Principles and Strategies) document is intended to help ensure that potential drought impacts on communities that rely on groundwater for drinking water are anticipated and proactively addressed.

Commission Drought Strategy	Aligned Principles and Strategies
1. Scale Up Groundwater Recharge	6.8 Promote the availability of drinking water and water rights data to assess the feasibility of recharge projects near shallow aquifers to benefit drinking water well users. 6.9 Incentivize recharge projects, including in-lieu recharge, flood flows, and other waters as appropriate – designed to improve conditions or protect drinking water well users where there are emerging or existing hot spots where drinking water wells are impacted by drought.
3. Better Position Communities to Prepare for and Respond to Drought Emergencies	1.1 Establish a standing interagency drought and water shortage task force, in partnership with interested parties, to facilitate proactive state planning and coordination, both for predrought planning and post-drought emergency response, including but not limited to needs of drinking water well users, as intended by SB 552. 1.2 Coordinate available assistance, including from federal agencies and work with the Governor's Office of Emergency Services and the local Offices of Emergency Services within county jurisdictions, to provide drinking water well protections and relief through emergency funding, loans, grants, and other assistance programs. 1.3 Engage with counties and water systems to complete drought assessments and water shortage contingency plans in alignment with the 2018 Water Conservation and Drought Planning legislation and the 2021 Drought Planning legislation, analyzing drought risks for drinking water well users, and encourage alignment with general plans, other local hazard mitigation plans (LHMP) and Emergency Operations Plans, and ensure that water systems under 1,000 service connections are monitored and addressed as part of these planning efforts. 1.5 Ensure long-term groundwater sustainability planning and implementation, including projects and actions supporting drinking water well users, can minimize the impacts of future droughts, through the implementation of SGMA. 1.6 Provide assistance, support, and oversight through state drinking water and water quality programs and continue considering, where feasible and appropriate, consolidation and water partnerships to develop technical, managerial, and financial capacity of water systems and communities. 2.2 Develop programs to support and protect the reliability of wells or facilitation of interties, when feasible, appropriate, and as needed, to allow for emergency operations of water supplies during times of limited groundwater supply.

Commission Drought Strategy	Aligned Principles and Strategies
	2.10 Recognize the state's policy that domestic water use is the highest use of water (California Water Code §106) and reflect this policy in drought plans and programs to avoid disproportionate impacts of drought on domestic well users. 3.2 Efficient Water Use: Encourage counties to establish ordinances and requirements in areas not served by a water system to further address water use restriction needs and define appropriate water use during droughts; coordinate with local jurisdictions to identify and enforce where there are inappropriate uses of groundwater. 3.3 Coordinated Land Use Planning: Engage with the Office of Planning and Research, counties, groundwater sustainability agencies (GSAs), and water agencies to align land use planning in general plans and groundwater sustainability planning efforts to promote access to safe, affordable, and reliable water supply for drinking water well users as land use changes occur. 3.4 Informed Well Permitting: Engage with relevant land use and county environmental health divisions, and groundwater sustainability agencies to develop guidance for how locals should implement well permits and avoid water supply or water quality issues when permitting new wells or new housing development. 5.1 Recognize community members as experts about their own community and encourage opportunities for drinking water well users to meaningfully engage in the development of solutions. 6.4 Encourage regionalization and consolidation of drinking water systems as a potential solution to avoid future impacts and improve economies of scale to provide a more resilient water supply for drinking water well users.
4. Increase Staff Capacity, Coordination, Information, and Communication in Drought and Non-drought Years	4.1 Improve data acquisition and monitoring of groundwater level, subsidence, and water quality conditions, including degradation from both natural and anthropogenic sources, in all basins and non-basin areas year-round to track current drought impacts and identify hot spot drought areas to help direct funding to local entities or non-governmental organizations to minimize drought impacts.

Appendix 2: Overview of State Drought Actions

In addition to the successes noted throughout this paper, State Departments and Agencies have made great strides in building drought resilience in California. October 2023 progress reports on the Water Resilience Portfolio and Water Supply Strategy capture this work.

In January 2023, the Commission hosted an expert panel of State representatives who explained the State response to the 2020-2022 drought. The Commission heard from representatives at the Department of Water Resources, Department of Fish and Wildlife, State Water Resources Control Board, and the Department of Conservation. From this panel, the Commission learned of the great number of drought response actions happening within the State. In response to the 2020-2022 drought, State agencies:

- Provided funding for land fallowing; planning for land repurposing; recycling, wastewater, and stormwater projects; drinking water projects (consolidations); and emergency response for communities.
- Supported planning and water management through county drought planning; runoff and seasonal/sub-seasonal forecasting; snowpack monitoring; and forecast-informed reservoir operation.
- Managed water by decreasing State Water Project allocations; installing a drought barrier in the Delta; conveying water transfers; and submitting a temporary urgency change permit to allow management of reservoir releases on a pattern that conserves upstream storage for fish and wildlife protection and Delta salinity control while providing critical water supply needs.
- Regulated water supplies by implementing emergency curtailments; water conservation standards; and water use prohibitions and reductions.
- Supported species through terrestrial and aquatic monitoring and rescues; hatchery improvements; restoration and fish passage efforts (such as relocation of winter-run Chinook); guiding water operations and permitting; resiliency measures on state-owned and partnership lands; responding to human-wildlife conflict; and law enforcement on State lands.

More information about these presentations, along with a recording of them, is available at this link: Long-term Drought: Overview of State Drought Actions - January 2023, Item 13

Appendix 3: Overview of Commission's Process

California's Water Resilience Portfolio Action 26.3 directs the State to develop strategies to protect communities and fish and wildlife in the event of drought lasting at least six years. A December 14, 2021 letter from the Secretaries for Agriculture, Environmental Protection, and Natural Resources asked the Commission to use its public forum to investigate potential strategies for managing long-term drought while coordinating with State agencies to develop a framework to advance this work without disrupting immediate drought response efforts. The Commission was asked to gain a wide perspective about potential strategies for managing drought by engaging experts, interested parties, and the public to develop a comprehensive understanding of the ways in which communities and fish and wildlife are likely to be impacted by long-term drought and ideas for mitigating those impacts, and then to develop a set of investments and policies that would better position the State to manage constrained water supplies. As part of this work, the Commission was asked to look to other countries that have dealt with long-term drought conditions to understand how they approached and dealt with the issue.

In March of 2022, the Commission approved a workplan for its engagement on this topic. The workplan outlines three steps, described below. Throughout this work, the Commission hosted expert panels on relevant topics at its regular Commission meetings, summarizing the panels in a presentation to the Commission in August of 2023[8]. These include:

- Six-Year Drought: California Droughts of the Past, Present, and Future Expert Panel - July 2022, Item 9
- Long-term Drought: Expert Panel on Protecting Communities and Species - November 2022, Item 10
- Long-term Drought: Overview of State Drought Actions - January 2023, Item 13
- Long-term Drought: Expert Panel on Drought Preparedness and Response Strategies - February 2023, Item 10
- Long-term Drought: Expert Panel on Wildfire and Forest Management - April 2023, Item 10
- Long-term Drought: Expert Panel on Desalination – May 2023, Item 13

The Commission also engaged and briefed partner agencies, including the California Department of Fish and Wildlife, the California Department of Food and Agriculture, the Department of Water Resources, the State Water Resources Control Board, and the Office of Emergency Services.

Step 1. Research: Explore How Long-term Drought Has Been Managed Elsewhere & Align Effort with Current State Drought Work

As part of this first phase of work, the Commission conducted a literature review and held conversations with experts in California, and representatives from other western states and drought-prone countries. Commission staff presented this work to the Commission in October of 2022[9]. The following documents capture information from this step.

- Framework
- Long-term Drought in California: Overview and Global Context
- Annotated Bibliography of Drought Resources

[8] Drought Strategies: Expert Panel Recap – August 2023, Item 9

[9] Six-Year Drought: Presentation of Initial Interviews and Framework - October 2022, Item 10

Step 2. Outreach: Engage Stakeholders, Experts, and the Public to Explore Potential Strategies for Managing Drought in California

The Commission started its second phase of work by hosting Tribal listening sessions (see box on page 17: *Tribes and Drought*) and assembling a drought working group, as described in the Framework above. With the drought working group (see Appendix 4: Drought Working Group Overview), the Commission developed a set of preliminary drought strategies that became the basis of its continued outreach to interested parties and the public. These initial strategies were presented to the Commission in April of 2023[10]. In the spring and summer of 2023, Commission staff presented preliminary drought strategies to groups with representatives from the following interested parties.

- Environmental
- Agriculture
- Water districts
- Local agencies
- Special districts
- Community-based organizations
- Groundwater managers
- Tribes
- State agencies
- Academia
- Local electeds
- Floodplain managers

In July of 2023, the Commission hosted three public workshops to solicit additional feedback on its preliminary drought strategies. Prior to hosting workshops, the Commission conducted a survey to provide another venue for providing feedback on the strategies. Survey results were discussed at the workshops, and a recap of both the workshops and the survey was presented to the Commission in August of 2023[11]. The following materials were used at the workshop.

- Workshop Flyer
- Workbook
- PowerPoint Presentation

Outreach by the Numbers

• Experts consulted during Step 1:	**62**
• Resources cited in drought annotated bibliography:	**70**
• Tribal discussions participants/Tribes represented:	**38/30**
• Workshop participants:	**269**
• Survey respondents:	**233**
• Outreach presentations given during Step 2:	**21**

The Commission was also invited to guest edit two issues of the American Water Resources Association's IMPACT Magazine on drought in California. The January/February issue is open access and can be downloaded for free. The March/April issue is available for purchase.

Step 3. Record: Develop White Paper

This white paper is the output of the Commission's work on this effort and will be delivered to the Secretaries for Agriculture, Environmental Protection, and Natural Resources for their use when implementing Action 26.3.

[10] Long-term Drought: Drought Working Group Report-out - April 2023, Item 9
[11] Drought Strategies: Public Workshop Report-out – August 2023, Item 10

Appendix 4: Drought Working Group Overview

Commission staff assembled a working group comprised of interested parties and partner agencies to help develop a comprehensive understanding of the ways in which fish and wildlife and communities are likely to be impacted by long-term drought; the tools available to manage drought; a suite of potential strategies for the State to use to protect fish and wildlife and communities during drought events; and proposed next steps for the State. The intent of assembling this group was to collaboratively develop drought strategies that the Commission could use as the basis of its further outreach. The Drought Working Group's foundational efforts helped Commission staff identify drought strategies that were likely to be supported widely and provided initial concepts for interested parties and the public to respond to during the Commission's outreach.

Working Group Members

- Jessica Bean, Assistant Deputy, Division of Water Rights, State Water Resources Control Board
- Don Bransford, Owner, Bransford Farms
- Heather Cooley, Director of Research, Pacific Institute
- Catherine Freeman, Legislative Representative, California State Association of Counties
- Maiya Greenwood, Associate Director of California Conservation on the Headwaters Conservation Program, American Rivers
- Virginia Jameson, Deputy Secretary for Climate and Working Lands, California Department of Food and Agriculture
- Anthony Navasero, Drought Coordinator, California Department of Water Resources
- Soren Nelson, Regulatory Advocate, Association of California Water Agencies
- Jeff Mount, Senior Fellow, Water Policy Center, Public Policy Institute of California
- Eddie Ocampo, Director of Community Sustainability, Self-Help Enterprises
- James Sarmento, Executive Director of Cultural Resources, Shingle Springs Band of Miwok Indians
- Brycen Swart, Statewide Drought Coordinator, California Department of Fish and Wildlife

The Commission convened four, half-day meetings of the working group and, using a structured, consensus-seeking process, worked with the group to identify draft preliminary strategies to protect communities and fish and wildlife in the event of drought. Initially, working group members developed straw proposals for consideration by the group. The group presented, discussed, combined, and refined straw proposals, which Commission staff then modified, turning them into the preliminary drought strategies used during subsequent outreach. The Commission advanced only those proposals with full support from the group. The final strategies produced by the Commission and captured in this paper are a modified version of the initial concepts that came out of the Drought Working Group and do not necessarily have the full support of working group participants.

Prior to developing straw proposals, the working group developed a charter to govern its work together, responded to a survey to assess topics of interest, created a vision statement, and discussed the assumptions and drivers behind their perspectives, as well as the informal decision criteria to guide their discussion of straw proposals.

Working Group Vision

Produce bold, actionable, consensus-driven drought strategies that reflect the needs of California's diverse communities and natural resources, as well as the long-term, overarching needs of the state.