# OWENS VALLEY MONITOR

2022-2023 Annual Report of the Inyo County Water Department

#### **Director's Note**

I am so pleased to be writing my first annual report note as the new Inyo County Water Director. I came to the Water Department in December 2022 as Deputy Director to learn from and be guided by Director Aaron Steinwand as he transitioned into retirement. While I have a 20-year background in studying water resources in the Eastern Sierra, learning the intricacies of the Long Term Water Agreement and its myriad applications has been a daunting challenge. The 50-year history of the struggle between Inyo and LA is precedent-setting in the world of Western water.

The first few months in this new position have been a time of great learning for me. Along with getting to know the people, the workflow, and the documents of the Water Department, the wettest winter in California's recorded history started a mere few weeks after I began work at the County. Several people commented to me that 2023 would be an "easy" year because of the plentiful water, and while it is good to be out of drought (however temporarily), a big water year comes with its own challenges. For me, the lesson of early 2023 is that we will continue to experience more extreme extremes – both wet and dry – with climate change.

Most of the 2022-23 reporting period was marked by drought, and we observed corresponding impacts to groundwater levels, soil water, and vegetation. Yet by early 2023, the situation was changing. Large amounts of precipitation, in-

cluding significant rain-on-snow events, recharged groundwater and soil moisture, leading to overall shallower water tables by spring 2023 and a reduction of permanent vegetation monitoring sites in OFF status from 11 to six. The question now is, how will groundwater-dependent vegetation respond? We will be looking closely at the results from our 2023 monitoring to understand which areas are still trending below goals despite the record precipitation.

You'll see we're trying a new (but old) format for the annual report. For the first 15 years or so of the Water Department, the annual report was published in a newsletter format – the Owens Valley Monitor. The newsletter contained short articles covering the various activities of the Water Department and conditions seen on the ground. In later years, and with advancement of technology, the annual report grew in size and was primarily housed on the internet. Starting this year, we will take a hybrid approach: a return to the Owens Valley Monitor newsletter, with executive summary-type articles, and longer-form report sections and background information that will be posted to the website in their usual location (<u>https://www.inyowater.org/documents/reports/inyo-county-water-dept-annual-report/</u>). Let us know what you think! —Holly



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## **Hydrologic Conditions**

#### Runoff and pumping

For the 2022-23 runoff year (April 1, 2022 – March 31, 2023), the reported measured runoff was 240,277 acrefeet (ac-ft), approximately 59% of the 1971-2020 average. This runoff was an increase from the prediction of 46% of average runoff due to the substantial precipitation experienced in the latter part of the runoff year. Total Los Angeles Department of Water and Power (LADWP) pumping within the Owens Valley from Laws to Lone Pine for 2022-23 was 66,306 ac-ft, which was 77% of LADWP's planned maximum pumping amount of 86,300 ac-ft. Owens Valley water uses for 2022-23 were 89,800 ac-ft, including 39,500 ac-ft of irrigation, and Eastern Sierra water exports were approximately 93,880 ac-ft, which is 20% of LADWP's 2022-23 anticipated annual demand (470,000 ac-ft).

#### Depth to groundwater

The average change in depthto-water (DTW) in the 46 Indicator monitoring wells from April 2022 to April 2023 was an increase of 2.0 feet, with a median increase of 1.6 feet. The largest increases were observed in Laws (4.6 ft), Thibaut-Sawmill (3.1 ft), Independence-Oak (2.2 ft), and Bairs-Georges (1.7 ft) wellfields. Big Pine (1.0 ft), Taboose-Aberdeen (0.6 ft), and Symmes-Shepherd (0.8 ft) wellfields saw more moderate increases. Groundwater levels declined in six of the 46 Indicator monitoring wells. Groundwater levels are below levels of the mid-1980's vegetation baseline period in about 48% (22 of 46) of the Indicator wells.

The very wet 2017, strong 2019, and record 2023 winter contributed to water table recovery from the recent

drought periods. In April 2022, DTWs in many wellfields were at or slightly below baseline levels. The record wet 2023 winter and moderate pumping during the preceding year has increased groundwater levels, on average, in all wellfields. Yet despite these gains, the majority of wellfields are below baseline as of April 2023 based on a larger set of approximately 175 monitoring wells that have measurements from the mid-1980s to the present. Most wells in Taboose-Aberdeen, Independence-Oak, Symmes-Shepherd, and Bairs-Georges were below baseline. Average groundwater levels in Laws, Big Pine, and Thibaut-Sawmill are above or near baseline. More wellfield-specific information can be found in the full report.

#### 2023-24 LADWP Operations Plan

Predicted runoff from the Owens River watershed during the 2023-24 runoff-year is forecast to be 955,600 acre-feet (ac-ft) or 233% of the 50-year (1971-2020) average. The actual runoff value will be available in 2024. Planned pumping for 2023-24 is between 40,130 and 51,470 ac-ft. LADWP is predicting 111,390 ac-ft of water will be used in the Owens Valley, 55,690 ac-ft of which is planned for irrigation. The 2023-24 water exports from the Eastern Sierra (Inyo and Mono Counties) are planned to be higher than 2022-23 exports at 395,000 ac-ft, or 73% of LADWP anticipated annual need.

> For most years, Inyo County Water Department (ICWD) recommends reduced pumping amounts below LADWP's minimum proposed pumping. However, with the abundance of surface water due to the extreme high runoff forecast for 2023-24, LADWP's minimum proposed pumping is below ICWD's estimated in-valley uses so ICWD recommended that LADWP pump their proposed minimum.

> Average groundwater levels are expected to increase in all wellfields under LADWP's 2023-24 maximum proposed pumping, benefitting groundwater-dependent vegetation and springs. The average groundwater level change in the 46 Indicator wells is predicted to be an increase of 2.9 ft under LADWP's maximum pumping scenario, an increase of 2.9 ft with in-valley minimum pumping, and an increase of 3.2 ft under LADWP's minimum pumping scenario. By April 2024, under LADWP's maximum pumping scenario, average predicted water levels will be above baseline in all wellfields except Independence-Oak (-0.3 ft) and Symmes-Shepherd (-2.2 ft). In Laws, Big Pine, Taboose-Aberdeen, Thibaut-Sawmill, and Bairs-Georges, average water levels are predicted

to be 1.5 to 8.6 feet above baseline.

Independence

Lone Pine

LADWP Wellfields nd Production Wel

Big Pine

1

BIG PINE

TABOOSE-ABERDEEN

THIBAUT-SAWMILL

INDEPENDENCE-OAK

SYMMES-SHEPHERD

BAIRS-GEORGES

LONE PINE

**DMD Production Malle** 

#### Evaluation of 2022-2023 Depth to Water Predictions

ICWD routinely uses models to predict the effects of pumping on DTW as part of its analysis of LADWP's annual Operations Plans. ICWD staff conducts an annual audit which examines the accuracy of these models by comparing the predictions with DTW measurements collected the following year on April 1. Model performance in 2022-23 was much less accurate than previous years due to the combination of more runoff, significantly less pumping than planned, and the record wet 2023 winter. Actual groundwater levels were shallower in all 46 wells. The average absolute difference between 2022 water level predictions and 2023 measured water levels was 3.9 feet. Only around one-fourth of the predictions were within 1.5 ft of the actual deviation.

## **Soil Water Conditions**

The Long Term Water Agreement establishes procedures to determine which LADWP pumping wells can be operated based on soil water and vegetation measurements. Through this program, termed On/Off, ICWD regularly measures depth to groundwater (DTW) and soil water content at 25 monitoring sites in wellfields and eight sites in control areas. The purpose for monitoring soil water and the On/Off procedures is to manage pumping to protect plant communities that require periodic access to the water table for long-term survival. Generally, the sites with "On" status have wet soil and shallow water tables, and sites in "Off" status have dry soil and relatively deep water tables.

To assist in the evaluation of LADWP pumping proposals, the Water Department examined the DTW and soil water data to determine whether groundwater was accessible to plants at the permanent monitoring sites at the beginning of the 2023 growing season. At the beginning of the 2022-23 runoff year (April 1, 2022), 14 sites were in "On" status. At the end of the runoff



Diagram of soil water measurement site

year (March 31, 2023), 19 sites were in "On" status as groundwater tables rose. Most sites experienced some level of groundwater recharge into the rooting zone of plants (2-4m deep) in 2022-23. Soil moisture amounts increased in all seven wellfields as measured from April 1, 2022, to April 1, 2023. Control area soil moisture also increased year-to-year.

At the beginning of the 2023 growing season (April), the water table had supplied or was capable of supplying water to the root zone at 16 of the 25 wellfield monitoring sites. The trend from 2022-23 was for soil moisture at monitoring sites to become more connected to the water table as groundwater levels became shallower. Nine wellfield sites are now disconnected from the water table and have low soil moisture levels; four of these sites were mapped as Alkali Meadow vegetation during the baseline vegetation inventory of the mid -1980s. The eight control sites had groundwater supplied to their respective root zones.

## **Vegetation Conditions**



Example of a vegetation transect near Independence

Annually, Inyo County and LADWP collaborate to monitor groundwater-dependent plant communities in areas potentially influenced by groundwater pumping. Green Book (the technical appendix to the Water Agreement) methods are employed to analyze data, with the annual objective of identifying statistical deviations from the vegetation goals set by the 1984-87 vegetation baseline.

During the summer of 2022 (from June to the end of July), ICWD and LADWP conducted measurements on 1667 vegetation transects across 136 vegetation parcels, including 43 control parcels and 93 wellfield parcels. While there were marginal increases in vegetation cover in 2022 compared to 2021, the third consecutive year of below-average runoff largely negated the gains in

vegetation recovery made in recent wet years in 2017 and 2019.

In 2022, approximately 30% of the wellfield parcels had some type of total vegetation cover or composition characteristics that deviated from the vegetation goals of the Water Agreement. This included statistically significant declines in total perennial cover, perennial grass cover, or both. Some of these statistical deviations from baseline are commonplace in drought years, and recovery to baseline is expected during wet years. However, a noteworthy trend for some parcels dating back to the early 1990s, when the monitoring began, is the decline in perennial grass cover and the increase in shrub cover. Though composition change doesn't necessarily result in a difference in total perennial cover, such conversions from shallow-rooted grasses and forbs to deeper-rooted shrubs are associated with changes in groundwater regimes, which the Water Agreement aims to prevent. The Inyo/LA Technical Group's responsibility includes assessing whether these changes would have occurred in the absence of pumping and whether mitigation is required under Water Agreement provisions. Given that similar changes can also occur in control areas unaffected by pumping, each parcel necessitates a case-by-case analysis to disentangle the effects of various factors, such as fire, flood, grazing, natural successional processes, plant disease, surface water management, and changes in groundwater regime.

Anticipating an above-average runoff year in 2023-24 (April 2023-March 2024), it is expected that groundwater elevation will rise and reconnect the shallow root zone with groundwater in areas that experienced a deepening water table. This should lead to some level of reversal of vegetation declines that occurred during the recent drought years (2020, 2021, 2022). However, it's important to acknowledge that some persistent changes relative to the baseline are likely to remain.

Efforts are underway to enhance the way ICWD makes data available to the public, including the development of several data dashboards. These dashboards will feature interactive maps of the locations of plant communities deviating significantly from the baseline goals and they will allow users to explore data at various levels, including changes in species composition, transect photo comparisons between years, parcel-level histories of line point data, and remote sensing timeseries going back to 1985 for each groundwater-dependent parcel (see figure below).

The level of recovery observed during the 2023 growing season will significantly inform the approach of the Technical Group. Vegetation parcels that do not recover to baseline even with a rising water table and above average precipitation will need an analysis detailing the characteristics of change, evaluating the relative importance of pumping-induced drawdown on those changes, and formulating solution-oriented recommendations. These recommendations will focus on bracketing groundwater regimes to align with Green Book goals and ensuring that land management and mitiga-



tion options are in place if groundwater recovery isn't sufficient. This approach will aid in implementing the Water Agreement in a manner that prioritizes the protection of ecosystem resources as the primary objective as the Agreement intended, with corrective measures taken if pumping plans and land and surface water management are found to be chronically incompatible with Agreement vegetation goals.

Mapping dashboard providing bookmarks to wellfields, permanent monitoring sites, Green Book vegetation parcels, line point intercept field data, and remote sensing time series for each parcel (access at: <u>https://experience.arcgis.com/experience/2b36047f23ee43d892a78da16cd5825b?</u> data\_id=49624ea472fa43c293de6e0876afad45-all ndvi plots 2022 3910%3A12)

## **Rare Plants**

The Inyo County Water Department monitors populations of Owens Valley checkerbloom (*Sidalcea covillei*) and Inyo County star-tulip (*Calochortus excavatus*) each year in accordance with Long Term Water Agreement goals to manage rare plants in a manner consistent with State and Federal laws. *S. covillei* is listed as endangered by the state of California and is a US Fish and Wildlife species of concern. Both species are listed under California Native Plant Society List 1B.1 (rare, threatened, or endangered in CA and elsewhere).

The Water Department has monitored, in total, up to 31 *S. covillei* sites and up to 33 *C. excavatus* sites from 1993-2022. In 2022, ICWD monitored six *S. covillei* sites and 31 *C. excavatus* sites. Abundance estimates can be found in the full Rare Plants report at <u>https://www.inyowater.org/documents/reports/inyo-county-water-dept-annual-report/</u>.



Along with *C. excavatus* and S. covillei, the presence or absence of a few additional endemic perennial forbs and shrub species are regularly documented including: Silverleaf Milkvetch (Astragalus argophyllus var. *argophyllus*; present at expected locations south of Laws), Hall's Meadow Hawksbeard (Crepis runcinata ssp. Hallii; present at 18 sites). White Flowered Rabbitbrush (Ericameria albida; present at two sites), Torrey's Blazing Star (Mentzelia torrevi; present at five locations), Frog's-bit Buttercup (Ranunculus hvdrocharoides; present at

Inyo County star-tulip

two locations), and Alkali Cordgrass (Spartina gracilis; present at six locations).

Due to the lack of winter precipitation, many annuals did not grow in 2022, and Inyo County staff did not survey rare or endemic annual species that are only found in the wetter years.

## **Type D Study**

The Inyo County Water Department continued a Type D, or riparian vegetation, study during summer 2022



along the Middle & Lower Owens River. This project has two purposes. First, it prescribes and tests methods to establish a long-term riparian (Type D) monitoring program to fulfill Green Book requirements, since the Green Book did not include a monitoring plan for this community type. Second,

Riparian transect along Lower Owens River

it aims to understand mechanisms that promote tree seedling establishment and growth (also known as recruitment) in order to maintain riparian woodland as a component of the riparian vegetation community. Full rationale and field methods are described in Appendix 1 of the draft plan (https://www.inyowater.org/ documents/reports/inyo-county-water-dept-annualreport/).

Natural riparian tree recruitment processes are understood to require flooding, mechanical disturbance, and seed exposure to bare, wetted soils just above the frequent flood stage. It has also been demonstrated that surface water management can alter riparian tree recruitment and survival. It appears within the Owens Valley that trees have established under a variety of circumstances. By aging individual trees in the river corridor, and relating a tree's topographic elevation to river stage, we can identify the range of hydrologic conditions (e.g. flow regime) that have permitted riparian tree reproduction, germination, and survival.

By sampling trees present on transects and coring a subset of them, it is possible to reconstruct tree ages by counting growth rings, which allows a general understanding of whether populations in various sections, or reaches, of the Owens River are expanding, stable, or diminishing. This information will be used to develop a proposal for incorporating a riparian monitoring program into the Green Book. In addition, this could inform recommendations about flow regimes that would support riparian woodland persistence and management actions such as tree plantings.

During summer 2022, 34 transects were sampled, for a total of 128 complete. Vegetation under trees was sampled, along with tree stem and canopy density, and tree diameter and height, and tree cores were collected. During three field seasons, 309 trees were sampled for age estimation. A projected ideal quantity to adequately represent age distribution at the reach-scale is approximately 600, so about 50% of the total number of anticipated trees have been sampled. This dataset is ongoing and is not yet sufficient to answer study questions including the relationship of tree recruitment to river flows, fire impacts, or primary water source (adjacency to the river). Data collection is expected to be completed in 2024. See Table 2 of the full report (https:// www.inyowater.org/documents/reports/inyo-countywater-dept-annual-report/) for a list of data collected.

## **Bishop Cone Audit**

The Bishop Cone Audit (Audit or BCA) is an annual comparison between LADWP's water usage on Los Angeles-owned lands on the Bishop Cone and its amount of groundwater extraction from wells on the Bishop Cone (Cone). The Bishop Cone Audit is required by the Inyo County/Los Angeles Long Term Water Agreement. The "Bishop Cone" is a reference to the legally defined area in the 1940 Hillside Decree which incorporates most of the Bishop Creek alluvial fan along with a portion of the northern Owens Valley from Bishop south towards Big Pine. The Water Agreement and the Green Book define the terms, conditions, and procedures of the Bishop Cone Audit. ICWD staff compiles the Bishop Cone Audit from data provided by LADWP. The Audit sums pumping and flowing well amounts and compares those totals to water use on Los Angeles-owned land during a given runoff year (April 1 to March 31) to determine whether LADWP's groundwater extractions exceed its surface water uses on the Bishop Cone. The annual Audit reports are available on the ICWD website: https:// www.inyowater.org/documents/reports/bishop-cone/.

For runoff year 2021-22, LADWP extracted 16,081 acft of groundwater (10,969 ac-ft from pumped wells and 5,112 ac-ft from flowing wells). For runoff year 2022-23, LADWP extracted 14,453 ac-ft of groundwater (9,566 ac-ft from pumped wells and 4,887 ac-ft from flowing wells). LADWP groundwater extractions on the Bishop Cone for the 2022-23 runoff year decreased by 1,628 ac-ft compared to the previous year. Both years were below average runoff. For runoff year 2021-22, LADWP used 26,259 ac-ft of water on Los Angeles-owned lands, which is more than the amount extracted. For runoff year 2022-23, LADWP used 27,339 ac-ft of water, more than the amount extracted. The Water Agreement provides that, during any runoff year, total groundwater extraction by LADWP on the Bishop Cone shall not exceed water usage on Los Angeles-owned land on the Cone. Therefore, LADWP was in compliance with the above provision for runoff years 2021-22 and 2022-23 as the total uses on the Bishop Cone exceeded the total groundwater extractions for each year.

## Mitigation

The Annual Mitigation Report outlines the progress, and challenges, surrounding mitigation projects in the Owens Valley, emphasizing the need for science-based assessments, ongoing monitoring, and collaboration between agencies to meet long-term mitigation goals.

The report provides an overview of the status of mitigation efforts undertaken by LADWP as it complies with the Long Term Water Agreement, stipulations and orders, MOU, and other guiding and governing documents. Rather than cover the entirety of all 64 projects, this report focuses on unfinished, underperforming, and insufficiently achieving mitigation projects as indicated in the Mitigation Project Status Table (<u>https://</u><u>www.inyowater.org/projects/mitigation/</u>). This table, created in collaboration with LADWP in 2017, tracks project progress and highlights differences in views on project status between the agencies.

The report also reintroduces the interactive Mitigation Projects Map, accessible on the ICWD website (<u>https://experience.arcgis.com/</u> experience/44b652a16c4b443b9b4a2e7dc3fcbb91/?

data\_id=dataSource\_1-17d49adeefc-layer-4% 3A3&draft=true&org=inyocounty). This map offers a comprehensive view of all mitigation obligations in the Owens Valley. Users can explore project details, site photos, and related files, enhancing an understanding of the projects and assisting research.

This year's report highlights the status of projects created through an ad-hoc process of the MOU parties, including Freeman Creek, Hines Spring Well 355, and Hines Spring Aberdeen Ditch. In combination, these 11 projects should be supplied 1,600 acre-feet of water annually, but challenges include Freeman Creek falling short of that goal due to an inconsistent water supply. An ongoing investigation aims to understand the complexities of Freeman Creek's variable water flow. In contrast, the Hines Spring Aberdeen Ditch and Well 355 projects appear to trend toward goal attainment. Inyo County has embarked on biological studies of the Hines Springs projects to fully assess the effectiveness of restoration of spring vegetation communities.

The full report also addresses revegetation projects, with LADWP claiming completion of several projects that are described in the 1991 EIR and governed under the 1999 Revegetation Plan. The County is concerned about lack of evidence for natural recruitment and the reliance on measurements from unusually wet years. Collaborative efforts between ICWD and LADWP aim to establish a monitoring framework that aligns with revegetation sustainability objectives.



Hines Aberdeen Ditch, looking south (July 18, 2023)



Inyo County Water Department Staff

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