Annual Investigation and Report of Groundwater Conditions Within United Water Conservation District

A summary of findings for the previous water year (2022-2023), current water year (2023-2024), and ensuing water year (2024-2025)

Prepared by
Water Resources Department

UNITED WATER CONSERVATION DISTRICT

March 2024

United Water
CONSERVATION DISTRICT

I, Catherine P. Keeling, Secretary/Treasurer of the Board of Directors of United Water Conservation District, do certify that I am in receipt of the Annual Investigation and Report of Groundwater Conditions within United Water Conservation District – *A summary of findings for the previous water year (2022-2023), current water year (2023-2024), and ensuing water year (2024-2025).*

Catherine P. Keeling

03/07/2024
Date

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ANNUAL INVESTIGATION AND REPORT
OF
GROUNDWATER CONDITIONS WITHIN
UNITED WATER CONSERVATION DISTRICT

A SUMMARY OF FINDINGS FOR THE
PREVIOUS WATER YEAR (2022-2023),
CURRENT WATER YEAR (2023-2024),
AND ENSUING WATER YEAR (2024-2025)

PREPARED BY
WATER RESOURCES DEPARTMENT
UNITED WATER CONSERVATION DISTRICT

Cover Photo: Santa Clara River, looking upstream of Freeman Diversion
Photo by Luke Bryden, February 05, 2024

MARCH 04, 2024

INTRODUCTION

Background

United Water Conservation District (UWCD or the District) is organized and operates pursuant to the Water Conservation District Law of 1931, which is set forth in Division 21 of the Water Code. [Section 74000 et seq.]

The District may establish and levy groundwater extraction charges against persons operating groundwater producing facilities within zone(s) of the District. Such groundwater charges are in furtherance of the District's activities in the protection and augmentation of the water supplies for users within the District or its zone(s) which are necessary for the public health, welfare and safety of the people of the State of California. In connection with the establishment and levying of such charges, Section 75560 of the Water Code provides that "The district shall annually cause to be made an engineering investigation and report upon the groundwater conditions of the district." The annual groundwater conditions report is provided to the District's Board of Directors (Board) to assist the Board in evaluating the nature and extent of groundwater overdraft within the District.

Definitions

Several terms are defined here to minimize confusion as to their meaning within the context of this report. The following definitions are provided from the California Water Code:

> *Water Year* means July 1st of one calendar year to June 30th of the following calendar year. (**§** 75507)
>
> *Annual Overdraft* means the amount, determined by the Board, by which the production of water from groundwater supplies within the district or any zone or zones thereof during the water year exceeds the natural replenishment of such groundwater supplies in such water year. (**§** 75506)
>
> *Accumulated Overdraft* means the amount of water necessary to be replaced in the intake areas of the groundwater basins within the district or any zone or zones thereof to prevent the landward movement of salt water into the fresh groundwater body, or to prevent subsidence of the land within the district or any zone or

> zones thereof, as determined by the Board from time to time. (§ 75505)

The management of the basins within the District has required artificial recharge to be an integral part of annual replenishment. Therefore, this report includes both artificial recharge and natural recharge in all calculations of overdraft. The above definition of "accumulated overdraft" for water conservation districts differs significantly from the definition in the Water Code used for water replenishment districts, where "accumulated overdraft" is an accumulated total of annual overdrafts. The District has historically tracked this accumulated total of annual overdrafts. Data analysis via the District's Geographic Information System (GIS) and use of the modified Ventura Regional Groundwater Flow Model (UWCD, 2006; as adapted from the USGS RASA Model, [Hanson et. al, 2003]) has informed the calculation of "accumulated overdraft" under the meaning of Section 75505; however, though these calculated figures were informed by the older Ventura Regional Groundwater Flow Model, it was not specifically used in calculating the figures presented in this report. In this report, we use the term "**total of annual overdrafts**" for the running total of accumulated annual overdrafts, and the term "**accumulated overdraft**" for the long-term increase of the average annual replenishment that is necessary to prevent landward movement of salt water and to prevent land subsidence. Techniques for these calculations and differences between the overdraft totals are described in the sections "Data and Methods" and "Discussion".

Groundwater Basins of the District

All or portions of seven groundwater basins lie within the District. These basins are defined by their hydrologic, geologic and physiographic interconnectivity, which influence the quantity and quality of groundwater available in each of the basins. Three ground water basins are located completely or almost completely within the boundaries of the District. These three basins include two along the upstream reaches of the Santa Clara River (Fillmore and Santa Paula basins), as well as one basin in the coastal plain area (Oxnard basin). In addition to these three groundwater basins, most of the Mound Basin in the Ventura area and portions of the Pleasant Valley and Las Posas Valley groundwater basins also lie within the District. A majority of the Piru basin is within the District; however, some eastern areas of the Piru basin with minimal groundwater pumping extend beyond the boundaries of the District. The locations of these basins are shown on Figure 1.

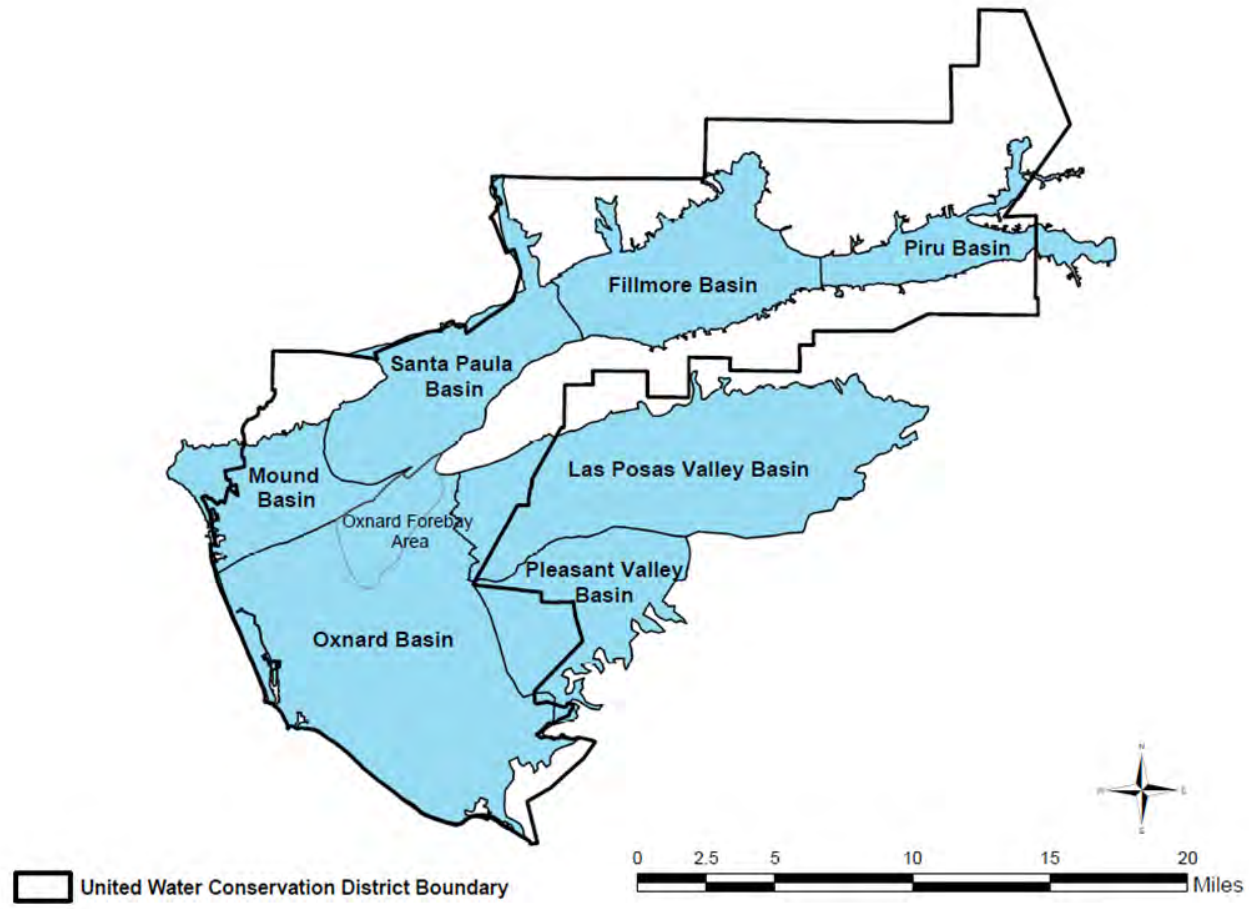

Figure 1. Groundwater basins of United Water Conservation District.

PURPOSE AND SCOPE OF REPORT

This report provides the Board with updated information on groundwater overdraft so that the Board may consider that information when deciding: 1) whether to levy a groundwater charge or charges, and 2) whether a zone or zones should be established within which groundwater charges should be levied.

The District compiles and evaluates hydrologic data to promote efficiency in its water conservation operations and to assist in planning for future water needs. The District also uses these data to prepare a district-wide water balance to evaluate the occurrence and extent of groundwater overdraft. This report presents those findings concerning the occurrence and extent of groundwater overdraft, and other related issues, as outlined in section 75574 of the Water Code.

DATA AND METHODS

The methods used by the District to estimate "Annual Overdraft" were modified in the water year 2022-2023 annual report. The District has invested significant time and effort in developing and refining a number of modeling tools and methods in recent years, and these tools provided an opportunity to improve the calculations within this report. The overall methodology and approach remained similar to before; the updates were largely related to the calculation of basin recharge from surface water percolation in the upper Santa Clara River basins (UWCD, 2021c) and the Forebay Area of the Oxnard basin (R2 Resource Consultants, 2016). The method compares estimates of annual recharge to reported groundwater extractions. Precipitation and surface water data compiled by federal, state, and local agencies are used to evaluate groundwater recharge. Appendix A includes details regarding the updated methodology.

The methods used by the District to compute "Annual Overdraft" have been updated over time as new data and technologies have become available. Prior to 1991 it was assumed that overdraft only occurred in the Oxnard basin, and the amount of overdraft was calculated using groundwater elevation data. Beginning in 1991, the District began using a District-wide water balance method to evaluate and report "Annual Overdraft". The annual overdraft calculations were then updated beginning in the reporting for water year 2022-2023 that maintained a similar approach for the District-wide calculations as before, but the tools for estimating basin inflows and outflows were improved, and the

improvements were incorporated into the updated methodology (see Appendix A).

Utilizing the modified Ventura Regional Groundwater Flow Model (UWCD, 2006; as adapted from the USGS RASA Model, [Hanson et. al, 2003]), Geographic Information System (GIS) and its extensive historic data bases of groundwater levels, groundwater extractions, artificial recharge and water chemistry, local water resource managers have been able to document and model the response of the hydrologically interconnected basins to varying climatic cycles and, subsequently, to variations in the seasonal amounts of natural and artificial groundwater recharge. The District relies on that analysis to help inform the "Accumulated Overdraft" estimate which is the long-term increase of the average annual replenishment that is necessary to prevent landward movement of salt water and to prevent subsidence (see FCGMA and others, 2007).

FINDINGS AS REQUIRED BY SECTION 75574 OF WATER CODE

(a) The average annual overdraft for the immediate past 10 water years is estimated to be approximately **44,000 acre-feet**.

(b) The annual overdraft for the current water year is estimated to range up to **-118,000 acre-feet**. This **negative** number implies that replenishment will exceed extractions for the District, as a whole for this current water year, ending on June 30, 2024.

(c) The annual overdraft for the ensuing water year is estimated to be between **0 and 44,000 acre-feet**.

(d) The accumulated overdraft as of the last day of the preceding water year, ending on June 30, 2023, is estimated to range between **20,000 and 25,000 acre-feet**.

(e) The accumulated overdraft as of the last day of the current water year, ending on June 30, 2024, is estimated to range between **20,000 and 25,000 acre-feet.**

(f) The estimated amount of agricultural water to be withdrawn from the groundwater supplies of the District for the ensuing water year is approximately **102,000 acre-feet**.

(g) The amount of water for municipal and industrial (M&I) purposes to be pumped from the groundwater supplies of the District for the ensuing water year is estimated to be approximately **36,000 acre-feet**.

(h) The estimated amount of water necessary for surface distribution for the ensuing water year is expected to be at least the long-term average of **58,000 acre-feet**.

(i) The amount of water, which is necessary for the replenishment of the groundwater supplies of the District for the ensuring year, is estimated to be at least **781,000 acre-feet**, as of the last day of the current water year, ending on June 30, 2024.

(j) The District is not obligated by contract to purchase any amount of water for the ensuing water year, from July 1, 2024 to June 30, 2025, except

State Water Project water, ordered for and reimbursed by the Port Hueneme Water Agency. This amount of water is not to exceed **1,850 acre-feet** per year.

(k) The total production of water from the groundwater supplies of the District during the preceding water year, ending on June 30, 2023, was approximately **137,500 acre-feet** [WC Section 75561 (c)].

An additional finding, which was incorporated in the required findings, is that the "total of annual overdrafts" for the District as of the end of the current water year, ending on June 30, 2024, is estimated to be approximately **977,000 acre-feet**. For completeness, the "total of annual overdrafts" for the District as of the end of the proceeding water year, ending on June 30, 2023, is estimated to have been **1,095,000 acre-feet.**

These findings have also been included in tabular format on Table 1.

Table 1: Findings as Required by Section 75574 of Water Code

Finding Item	Value (acre-feet)	Description	Water Code Reference
a	44,000	The average annual overdraft for the immediate past 10 water years. Positive value means overdraft; negative value means surplus.	Section 75574 (a)
b	-118,000	The estimated annual overdraft for the current water year.	Section 75574 (b)
c	0 - 44,000	The estimated annual overdraft for the ensuing water year.	Section 75574 (c)
d	20,000 - 25,000	The accumulated overdraft as of the last day of the preceding water year.	Section 75574 (d)
e	20,000 - 25,000	The estimated accumulated overdraft as of the last day of the current water year.	Section 75574 (e)
f	102,000	The estimated amount of agricultural water to be withdrawn from the ground water supplies of the District for the ensuing water year.	Section 75574 (f)
g	36,000	The amount of water other than agricultural water (i.e. municipal and industrial) to be drawn from the ground water supplies of the District for the ensuing water year.	Section 75574 (g)
h	58,000	The estimated amount of water necessary for surface distribution for the ensuing water year.	Section 75574 (h)
i	781,000	The amount of water which is necessary for the replenishment of the ground water supplies of the District for the ensuing water year, as of the end of the current year.	Section 75574 (i) Section 75561 (e)
j	1,850	The amount of water the District is obligated by contract to purchase during the ensuing water year .	Section 75574 (j) Section 75561 (e)
k	137,500	The total production of water from the ground water supplies of the District for the preceding water year.	Section 75561 (c)
Additional	1,095,000	The estimated “total of annual overdrafts” of the District for the current water year, as of the end of the preceding water year.	Section 75574 (b, i) Section 75561 (e)
Additional	977,000	The estimated “total of annual overdrafts” of the District for the ensuing water year, as of the end of the current year.	Section 75574 (b, i) Section 75561 (e)

Notes:
Preceding Water Year: July 1, 2022 to June 30, 2023 (Water Code Section 75507 (c))
Current Water Year: July 1, 2023 to June 30, 2024 (Water Code Section 75507 (b))
Ensuing Water Year: July 1, 2024 to June 30, 2025 (Water Code Section 75507 (d))
“Annual overdraft”: The amount, determined by the board, by which the production of water from ground water supplies within the District or any zone or zones thereof during the water year exceeds the natural replenishment of such ground water supplies in such water year. (Water Code Section 75505) Positive value means overdraft, negative value means surplus.
“Accumulated overdraft”: The amount of water necessary to be replaced in the intake areas of the ground water basins within the District or any zone or zones thereof to prevent the landward movement of salt water into the fresh ground water body, or to prevent subsidence of the land within the District or any zone or zones thereof, as determined by the board from time to time. (Water Code Section 75506)
“Total of Annual Overdrafts”: This additional finding is a cumulative total of each water years’ annual overdraft (item b), up to the last day of the preceding and current water year.

Description of Findings as Required by Section 75574 of Water Code

(a) The annual overdraft (explained in item b) of the preceding ten years is averaged to derive the average annual overdraft. The average annual overdraft of **44,000 acre-feet** means that over the last ten years the average pumping has exceeded the average recharge, both natural and artificial, on a District-wide basis.

(b) Although the annual overdraft for the previous year can be calculated, the **annual overdraft** for the current water year must be estimated. This is because only a portion of the year has passed. At best, the appropriate data are available for the period July 1 through February 28/29 of the current water year. To standardize this prediction for current year overdraft, water resources staff developed a regression curve fit that compares overdraft for previous years to rainfall through February for each of the years 1982-1983 through 2022-2023 (Figure 2). The goal is to be able to predict the annual overdraft for the current year, based on the percentage of normal rainfall as of the end of February. Normal rainfall refers to the updated long-term average from 1890-1891 through the previous year (2022-2023). The prediction is considerably improved by weighting in the prior year precipitation[i]. This regression methodology serves to recognize antecedent conditions, which influences how readily the Santa Clara River, streams, and precipitation can recharge to groundwater.

As of February 29, of this current water year (2023-2024), precipitation was approximately **193%** of normal. The previous year (2022-2023) precipitation was approximately **181%** of normal at the end of February. The overdraft for the current water year is predicted to be approximately **-118,000 acre-feet**. The **negative** number implies a net **surplus** to the aquifers. A review of overdraft data from 1982-1983 to 2022-2023 suggests that a net District-wide surplus of water will occur when the weighted precipitation, of the current year through February and the prior year, equals or exceeds approximately **108%** of normal (Figure 2). For the 2023-2024 water year the weighted precipitation is **189%**, therefore suggesting the estimated surplus for the current year.

[i] Weighted percent of normal precipitation = [current year + (previous year * 0.5)]/1.5

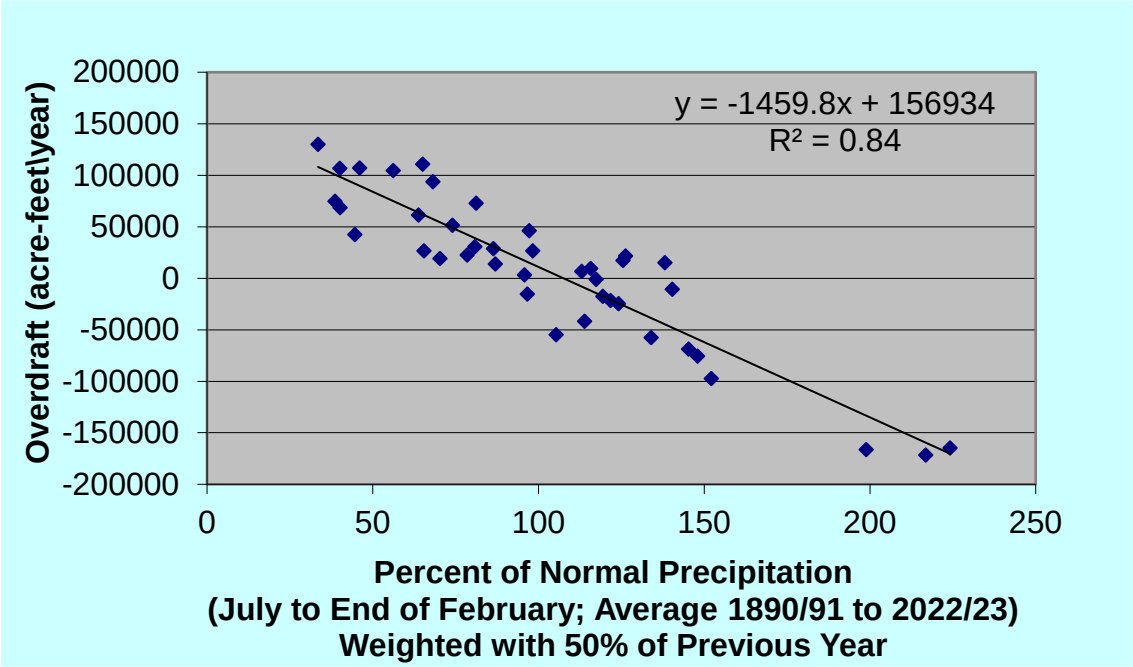

Figure 2. District-Wide Overdraft vs. Percent of Normal Precipitation.

The prior year overdraft is calculated once all the data are available for the period July 1 to June 30. In this manner, the actual overdraft is calculated approximately eight months in arrears. This calculated overdraft for the prior year is then used with the nine preceding years to determine the ten-year average annual overdraft.

Last year, the regression correlation was used to predict an overdraft District-wide of approximately **-69,000 acre-feet** (surplus) for the period July 1, 2022 through June 30, 2023. After receiving data for the entire year, the actual annual overdraft was determined to be approximately **-75,500 acre-feet** (surplus). Therefore, the projected annual overdraft was overestimated by approximately **6,500 acre-feet**. In addition to the exceptionally wet year over 2022-2023, the District was also able to coordinate with State storage facilities to release additional flood capture waters, which helped to increase total diversions during this period and create a larger net surplus than would normally occur. A basic summary of the methodology for determining the hydrologic balance for the groundwater basins is included in Appendix A of this report.

(c) The annual overdraft for the ensuing water year is difficult to forecast. It projects the hydrologic balance 16 months in advance. The projected District-wide overdraft is assumed to be between 0 acre-feet and the ten-year average

annual overdraft, which is approximately 44,000 acre-feet from water years 2013-2014 to 2022-2023.

(d) "Accumulated Overdraft" means the amount of water necessary to be replaced in the intake areas of the groundwater basins within the District to prevent the landward movement of salt water into the fresh groundwater body, or to prevent subsidence of the land within the District or any zone(s) thereof (**§** 75505, California Water Code).

Past efforts to estimate long-term overdraft utilized the Ventura Regional Groundwater Flow Model and Best Management Objective (BMO) groundwater level goals to inform the calculation of "Accumulated Overdraft". Groundwater modeling efforts for the 2007 Fox Canyon Groundwater Management Agency (FCGMA) Management Plan update included simulating pumping reductions in the Oxnard and Pleasant Valley basins. Modeling efforts included calculating the amount of pumping reduction in the southern Oxnard and Pleasant Valley basins required to raise groundwater levels so that on average over a complete hydrologic cycle (1944 to 1998) there would not be net landward movement of seawater (FCGMA and others, 2007). This pumping reduction is the "Accumulated Overdraft" and was estimated to be 20,000 to 25,000 acre-feet, mostly in the Lower Aquifer System (LAS).

The Fox Canyon Groundwater Management Agency adopted Groundwater Sustainability Plans in December 2019 (FCGMA 2019a, 2019b, and 2019c). The plans were prepared in compliance with the Sustainable Groundwater Management Act (SGMA) and based upon estimated sustainable yield for the Oxnard and Pleasant Valley basins. The "Accumulated Overdraft" or the necessary reduction in pumping, if no new water supply projects are completed, may be as high as 40,000 acre-feet to 45,000 acre-feet.

(e) The "Accumulated Overdraft" does not change from year to year unless new water supply projects are brought online or unless there is a long-term change in pumping or climate.

(f) The amount of agricultural water likely to be withdrawn for the ensuing water year should be reported as the same as the previous year unless there is overriding information that pumping will change. Because the Annual Groundwater Conditions Report is finished in early March before the year's rainfall can be accurately predicted, it is more conservative to use the previous year's pumping. The number comes from semi-annual groundwater extraction

statements reported by well owners to the District's Finance Department, where the water usage is reported as either agricultural or M&I and extraction fees are calculated.

(g) As in (f), it is more conservative to use the previous year's pumping. The amount of M&I water likely to be withdrawn for the ensuing water year should be reported as the same as the previous year unless there is overriding information that pumping will change The number comes from the previous year's semi-annual groundwater extraction statements.

(h) The estimated amount of water necessary for surface distribution for the ensuing water year is estimated to be at least the long-term average diversion rate for the Freeman Diversion. From January 1991 to June 2023, this long-term average is approximately 58,000 acre-feet per year.

(i) The total replenishment necessary for replenishment of groundwater supplies of the District comes from the equation: Total Replenishment = 0.80 * Total Annual Overdrafts. The 80% factor comes from the USGS RASA groundwater flow model simulation results (Hanson et. al, 2003), which estimated that about 20% of the annual overdraft is water derived from the compaction and dewatering of fine-grained sediments (and subsequent subsidence). Water cannot be forced back into the sediments, the storage space lost forever, and thus should be subtracted from the total water needed to replenish the aquifer. However, thick deposits of fine-grained sediments are not common to all the basins within District boundaries, and the 20% reduction in all the basin storage capacity based on presumed subsidence may be excessive.

(j) The District is not obligated by contract to purchase any amount of water, except State Project water, ordered for and reimbursed by the Port Hueneme Water Agency. This amount of water is not to exceed 1,850 acre-feet per year.

(k) The preceding year's water production comes from the District's Finance Department records of reported pumping from the semi-annual statements of groundwater extraction and pumping charges.

"Total of Annual Overdrafts" – this additional finding is a cumulative total of each years' annual overdraft (item b). It is derived through multiple steps that are informed by the finalized annual overdraft for the previous year as well as the estimated annual overdraft for the current year. First, once all complete records are available for the previous water year, the annual overdraft for the previous water year is finalized and added to last year's "total of annual overdrafts" at the

end of the preceding water year. Then, to estimate the "total of annual overdrafts" for the ensuing water year, the estimated annual overdraft of the current year is added to the recently finalized "total of annual overdrafts" for the preceding year. In the wettest years when there is a surplus of water, this total will be reduced. In average and dry years, the total will increase. Even in some wetter-than-average years, there exists a District-wide overdraft and the total will increase, as discussed in (b). In 2022-2023, when a revised methodology used to calculate annual overdraft for the period since 1992-1993, the annual overdrafts and the "total of annual overdrafts" were recalculated for each year, and the "total of annual overdrafts" at the end of 2020-2021 was estimated to be 1,109,000 acre-feet. The "total of annual overdrafts" as of the end of the preceding water year, ending on June 30, 2023, has now been updated to be approximately **1,095,000 acre-feet**. With the annual overdraft of the current water year, ending on June 30, 2024, estimated to be **-118,000 acre-feet**, the "total of annual overdrafts" as of the end of the current water year, ending on June 30, 2024, is estimated to be approximately **977,000 acre-feet**.

DISCUSSION

The occurrence of overdraft in a groundwater basin is often controversial. This is due in part to the definition of the term. Overdraft has been defined as "*the condition of a groundwater basin or aquifer in which the amount of water extracted exceeds the amount of water that recharges the basin over a period of many years (during which hydrologic conditions do not significantly change)*" (Bachman et al., 2005). Within the District, the withdrawal of groundwater is known through reporting by pumpers. The recharge within the District by artificial means is also known through measurements of diversions, spreading, and pipeline deliveries (e.g., State water deliveries and Conejo Creek diversions as discussed in Appendix B). Natural recharge, however, must be determined through indirect measurements. This natural recharge occurs primarily along the rivers and streams within the District, but also occurs by direct infiltration from rainfall and by leakage through adjacent bedrock and alluvial units.

The District calculates the natural recharge in its basins using measured data for precipitation, stream flow, and groundwater elevations. The value reported as annual overdraft compares the natural and artificial annual recharge to annual groundwater withdrawals. The average annual overdraft varies over the long-term with fundamental changes in both historic pumpage and artificial recharge facilities. Year-to-year, however, the annual District-wide overdraft varies widely with the climatic cycle. Wet years may produce a surplus of replenishment whereas average and dry years result in an overdraft.

Long-term overdraft is more serious than an annual overdraft. Long-term overdraft occurs when recharge is less than extraction over a period of many years. Long-term overdraft has resulted in both landward migration of saline ocean water in the Oxnard basin and dewatering of salt-rich clays surrounding the aquifers; this dewatering has resulted in saltwater moving from the clays to the aquifer and in compaction of the clays (UWCD, 2016). These conditions continue to persist in the coastal areas, with areas of increasing chloride concentrations in recent years (UWCD, 2021b). The majority of this saline ocean water is likely contained in the extensive offshore portions of the aquifers of the Oxnard basin. It is in the areas of the submarine canyons that this seawater is drawn into onshore portions of the aquifer and poses a hazard. It is also in these areas where it is imperative that an offshore gradient be maintained to prevent further intrusion. Thus, the calculation of "accumulated overdraft" for water conservation districts in the Water Code is very appropriate to the District's situation – it is the replenishment water necessary to prevent landward movement of saltwater and to prevent subsidence. This is an inherently important aspect of the District's efforts to protect and augment water supplies for users within the District or its zone(s) which are necessary for public health, welfare and safety.

Two calculated values related to long-term overdraft are presented in this report: 1) the amount of water necessary for the total replenishment of the groundwater supplies of the District for the ensuing water year, which is calculated from the total of annual overdrafts, with a value of **781,000 acre-feet** estimated as of the end of the current water year, ending on June 30, 2024; and 2) the accumulated overdraft, as per the Water Code, which represents the amount of additional replenishment water that is needed on a continuing basis in the future to prevent further salt water intrusion. Past estimates suggest that a minimum of approximately **20,000 to 25,000 acre-feet** of additional replenishment water per year is required to prevent further saltwater intrusion; however, more recent estimates suggest as much as 40,000 to 45,000 acre-feet may be required. A large proportion of this saltwater intrusion is associated with seawater intrusion of the offshore extension of the aquifers and onshore seawater intrusion in the vicinity of Port Hueneme and Point Mugu. The remainder is from poor-quality water derived from the compaction of clays.

There is evidence for the occurrence of long-term overdraft in at least two of the groundwater basins of the District. Groundwater levels have generally been declining or depressed for periods of several decades in the Oxnard and Pleasant Valley basins. While the factors causing declining groundwater trends may have varied among these two basins, long-term replenishment rates have not kept up

with long-term extraction rates in either of them. Thus, these basins are considered by the District to be in the condition of long-term overdraft.

In the past, the Santa Paula basin had been considered in a state of potential long-term overdraft. A basin yield study (UWCD, 2003) by experts for the City of Ventura, Santa Paula Basin Pumpers Association, and the District suggested that the yield of the basin is probably near the historic pumping amount. In 2017, Daniel B. Stephens & Associates, Inc., estimated that safe yield of the Santa Paula basin is in the range from 24,000 to 25,500 acre-feet per year, slightly less than the long-term-average pumping rate of 25,800 acre-feet per year (Daniel B. Stephens & Associates, 2017).

The stresses that cause long-term overdraft in a particular basin may be occurring only within that basin, or they may be occurring in several connected basins. For example, the seawater intrusion that has occurred in a portion of the Oxnard basin can be aggravated by increases in pumping from that basin, but it can also be aggravated by decreases in the replenishment supply coming from the upstream basins. This is caused by the hydraulic continuity between the aforementioned groundwater basins.

The California Department of Water Resources (DWR) recognized the hydraulic continuity of the District's several groundwater basins, and in 1980 DWR concluded that these basins should be considered as one groundwater basin, the Ventura Central Basin (DWR, 1980). The Ventura Central Basin was identified by the DWR as "subject to critical conditions of overdraft." The Bulletin 118 Update (DWR, 2003) did not re-evaluate the conditions of critical overdraft in the Ventura Central Basin and other California groundwater basins because the task was not identified by the State Legislature, nor was there sufficient funding. More recently, DWR has confirmed that all the groundwater basins within the District boundaries are high-priority basins, with the exception of the Santa Paula basin, which is adjudicated (DWR, 2021). DWR has also confirmed that the Oxnard and Pleasant Valley basins remain subject to critical overdraft (DWR, 2021).

Mauricio E. Guardado, Jr., General Manager — Date: 3/7/24

Maryam A. Bral, Ph.D., P.E., Chief Engineer — Date: 3/4/2024

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Appendix A

Methodology for Hydrologic Balance

United Water Conservation District prepares an Annual Investigation and Report of the Groundwater Conditions within the United Water Conservation District. The report is specifically written to meet the requirements included in the Water Code 75560-75561.

In reporting for the water year 2022-2023, staff improved the methodology for determining the groundwater conditions within the District's boundaries. The updated methodology determined annual hydrologic balance in a similar, and relatively simple, manner to the prior methodology. However, the calculated components to the hydrologic balance were informed with improved modeling tools. The hydrologic balance incorporates precipitation, streamflow percolation, artificial recharge and extracted groundwater return flows as recharge components and groundwater extraction and phreatophyte consumptive use as discharge components.

The District has invested significant efforts in developing multiple models in recent years that have been used for water resource planning by both the District and other local agencies and consultants. These models have been used in this methodology to inform recharge and discharge components of the hydrologic balance.

The calculated balance for each component is determined individually for each basin, where possible. The hydrologic balance for the entire District is the net sum of the balance for each basin (a total of seven basins). The data acquired for each basin, where applicable, includes:

- Annual rainfall (ft);
- Total area of each basin (acres); the calculated area of each basin has been updated in this report to reflect the more recent California Department of Water Resources (DWR) basin boundary modifications (2019).
- Mean daily surface flows (cfs);
- Daily artificial recharge (ac-ft);
- Mean daily diversions (cfs);
- Consumptive use rate (percent of groundwater pumping);
- Annual groundwater extractions (ac-ft); and
- Modeled average phreatophyte consumptive use over 30-year period (1985-2015) (ac-ft).

Precipitation

Recharge by precipitation on valley alluvium or aquifer outcrop is held constant at 10% for all the unconfined groundwater basins. Rain gauges at Lake Piru, Fillmore, Santa Paula, and El Rio are used to calculate the amount of recharge to the corresponding basin. Final data approved for publication are used, when possible, but due to the timing of this report, some provisional data are included.

Area

The areas for the unconfined groundwater basins (Piru basin, Fillmore basin, Santa Paula basin, and the Forebay area of the Oxnard basin) were calculated using a Geographic Information System and were based on recently updated (2019) DWR basin boundaries (DWR, 2021). The updated basin boundaries resulted in an increase in areal extent of approximately 33% for the unconfined basin compared methodology used previously to the 2023 report, and this increase was largely due to the addition of outcrop areas of the production formations.

Surface Flows

Infiltration and percolation of surface flows was estimated using the Upper Basins Surface Water Model (UWCD, 2021c). This model, developed by United, calculates surface flows, recharge, and rising groundwater for the Santa Clara River reaches overlying the Piru, Fillmore, and Santa Paula basins. Model inputs include gaged flow in the Santa Clara River and its tributaries and historical available storage in the Piru and Fillmore basins; final data approved for publication are used, when possible, but due to the timing of this report, some provisional data are included. The model also includes estimates for surface flow losses in Santa Paula basin. Available data suggest that water percolation rates from the Santa Clara River within the Santa Paula basin is limited and difficult to quantify (UWCD, 2013). For this report, 12% of estimated Santa Clara River losses within the Santa Paula basin were estimated as recharge (percolation) to groundwater, on an annual basis, based on the model outputs from the Upper Basins Surface Water Model. From 1992-1993 to 2021-2022, this method results in an average annual percolation total of approximately 2,180 acre-feet per year. Additionally, the streamflow percolation within the Oxnard Forebay area was estimated using the Hydrological Operations Simulations System (HOSS; R2 Resource Consultants, 2016), which uses correlations between groundwater elevations in nearby monitoring wells and observed percolation rates within the portion of the Santa Clara River of the Oxnard Forebay area.

Artificial Recharge

The off-channel annual recharge to the District's Recharge Facilities (Piru, Saticoy, Noble, Rose and El Rio basins) are allocated to respective groundwater basins. It is assumed that there exists 100% efficiency in the recharge (i.e., no losses).

Groundwater Extractions

The groundwater extractions for each basin within the District boundaries are tabulated through pumping reported to the District by well owners and operators.

Consumptive Use

A consumptive use factor is used for all the unconfined groundwater basins. Pressure basins have 0% return flow that effectively recharge the Upper Aquifer System (UAS). However, within the pressure groundwater basins, leakage from the Semi-perched aquifer to the UAS is considered using the previously estimated 1985-2015 average values (UWCD, 2021a), and adjusting for areal extent of the basin that is within the District boundaries.

The estimation of return flow from groundwater pumped in the unconfined basins is based on a representative three-year period as calculated by United (UWCD, 2013). This report accounts for "typical" return flows of over-application of water for salt-leaching requirements, as well as special-use cases by particular pumpers (i.e., recycled water percolation from Municipal and Industrial pumping) within the basins.

The three-year average (2010, 2011, and 2012) was chosen as a reasonable period of climatically wet and dry years. Climatic conditions in 2011 were slightly wetter than normal, 2012 was drier than normal, and 2010 is believed to be more representative of "normal climatic conditions" (UWCD, 2013). The average percentage of agricultural pumping as return flow was calculated as 40.8%, and the average of the percent of municipal and industrial pumping as return flow was calculated as 64.4% for the unconfined basins. Some pumped groundwater is exported from the Forebay area via pipeline to users in the confined Oxnard basin, and as such they are not included in estimates of return flows (i.e., they are considered in this report as 100% consumptive use).

Phreatophyte consumptive use is estimated in this report using the more recently updated Ventura Regional Groundwater Flow Model (UWCD, 2021a) modeled average riparian evapotranspiration over the period from calendar years 1985-2015, adjusted for the extent of the simulated riparian vegetation within the District boundaries. This period captures various climatic and riparian conditions, and the annual average evapotranspiration was used to estimate the District phreatophyte consumptive use.

Groundwater Basin Water Balance

Groundwater Basin Water Balance =

[(Groundwater Extractions Consumptive Use + Phreatophyte Consumptive Use) –

(Total Percolated Rainfall + Percolated Surface Water + Artificial Recharge + Return Flow + Leakage)]

Note: Positive values represent overdraft and negative values represent surplus

Appendix B

Additional Water Resources Utilized within the District

State Water

The District has a State Water Project maximum annual Table A amount of 5,000 acre-feet. The District contracts out 1,850 acre-feet of this amount to Port Hueneme Water Agency where it displaces an equal amount of groundwater pumping on the Oxnard Plain. The District receives up to 3,150 acre-feet per year of its Table A amount in Lake Piru via Pyramid Lake. Following a conservation release from Lake Piru, this water flows down the Santa Clara River within the District where it contributes to streamflow and groundwater recharge.

The California Department of Water Resources determines what percentage of the annual Table A amount is allocated to State Water Contractors each year, based on hydrological conditions and project water use. During most years, the Table A allocation is less than 100%, and it has been as low as 5% during periods of drought. The District historically has not always purchased its full allocation of State water in very wet years due to the lack of available storage.

Conejo Creek Diversion

The Conejo Creek diversion, located near U.S Highway 101 and operated by Camrosa Water District, was used for diversion of approximately 8,400 acre-feet per year of water from Conejo Creek on average from 2002 – 2019. Over that same period, approximately 4,500 acre-feet per year of water was delivered by Camrosa to Pleasant Valley County Water District, where it replaces groundwater pumping in the Pleasant Valley basin.