CARPINTERIA GROUNDWATER BASIN
AB3030 GROUNDWATER MANAGEMENT PLAN

ANNUAL REPORT

WATER YEARS 2018 and 2019

Prepared for:

CARPINTERIA VALLEY WATER DISTRICT

February 2021

February 18, 2021
Project No. 19-0011

Carpinteria Valley Water District
1301 Santa Ynez Avenue
Carpinteria, California 93013

Attention: Brian King
District Engineer

Subject: Carpinteria Groundwater Basin AB3030 Groundwater Management Plan Annual Report; Water Years 2018 and 2019.

Dear Mr. King:

We are pleased to present to you the subject Annual Report for the Carpinteria Groundwater Basin Groundwater Management Plan. The report presents an overview of hydrogeologic conditions associated with the basin for Water Year 2018 and Water Year 2019. The report presents the findings from our assessment of hydrogeologic data, our conclusions regarding the basin conditions; and our recommendations for the continuance and enhancement of the plan and the data collection program.

Thank you for giving Pueblo the opportunity to assist you with this important project.

Sincerely,
Pueblo Water Resources, Inc.

Michael S. Burke
Principal Hydrogeologist, C.Hg. 678

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INTRODUCTION

Assembly Bill 3030 allowed certain defined local agencies to develop groundwater management plans (GWMP) for groundwater basins defined by the California Department of Water Resources (DWR) Bulletin 118. The Carpinteria Valley Water District developed a GWMP for the Carpinteria Groundwater Basin (CGB) and adopted the plan in 1999. Carpinteria's GWMP includes annual reporting on the hydrogeologic conditions of the CGB. This report presents the findings, conclusions and recommendations developed through analysis of data collected through the GWMP for Water Years (WY) 2018 and 2019 (a Water Year is defined as the twelve month period of October 1 for any given year through September 30 of the following year). This report presents the data and analysis of the CGB hydrogeology for the two-year period October 1, 2017 through September 30, 2019.

Prior to the GWMP reporting for WY 2015, annual reports were prepared for calendar year periods. The District desired to revise the reporting period for the GWMP to be on a water year basis starting in WY 2015 to be consistent with standard hydrogeologic practices, and to synchronize the reporting period of the GWMP with the reporting period for hydrologic budget updates prepared annually for the CGB by Pueblo Water Resources, Inc. (Pueblo).

The GWMP is an important tool for the management of the CGB, and includes the ongoing collection, compilation and analysis of precipitation, water-level, groundwater production, and water-quality data in the basin. The purpose of the GWMP is to provide a mechanism for the District to continually monitor groundwater conditions within the CGB and identify trends in groundwater production, water levels, and water quality.

It is noted that a Groundwater Sustainability Agency (GSA) has recently been established for the CGB as required under the Sustainable Groundwater Management Act (SGMA) of 2014. It is envisioned that this GWMP that originated with AB3030 will evolve and eventually be incorporated into a Groundwater Sustainability Plan (GSP) for the basin in compliance with SGMA.

FINDINGS

MONITORING WELL NETWORK AND MONITORING PROGRAM

The CGB GWMP includes the collection of data from 44 wells located throughout the basin. The well network includes the District's groundwater production wells, private production wells, and monitoring wells. The existing monitoring well network was expanded in WY 2019 with the addition of the District's Sentinel Well cluster. The Sentinel Well cluster includes three separate monitoring wells, completed discretely in the three principal water bearing zones within the CGB (A, B, and C Zones). The Sentinel Wells are located at a key strategic location in the southwestern portion of Storage Unit 1, near where the Rincon Creek Thrust Fault projects offshore, and where it is believed that the basin aquifers may be susceptible to seawater intrusion.

Water-level data are collected on a bi-monthly basis (every other month) from approximately 28 wells. Water-quality data are collected on a semi-annual basis (fall and spring of each water year) from approximately 28 wells. Water-quality data are also collected from 6 surface water sampling locations within the basin. Additionally, induction logging is now being performed on the deepest of the three Sentinel Wells (Sentinel Well MW-1) on a quarterly basis. The induction logs allow for assessment and tracking of the electrical conductivity (a measure of salinity) of all of the strata penetrated by the well. The locations of the CGB GWMP wells are shown on **Figure 1**, and basic information associated with each of the wells is provided in a summary table included in **Appendix A**.

The GWMP also includes the collection, compilation, and assessment of precipitation data and groundwater production data. Groundwater production from District owned and operated wells is metered. Private pumping in the basin is not metered and has been estimated on an annual basis by the District since 1984 utilizing land use survey and water delivery information. Precipitation data is collected by the Santa Barbara County Flood Control District at the Carpinteria Fire Station gauge (SBCFCD Gauging Station No. 208).

Water-quality data are derived through the sampling at selected wells throughout the basin. In addition to groundwater samples, surface water samples are collected when surface water flows occur during the sampling periods. The laboratory analytical program for the samples includes total dissolved solids and basic inorganic chemical constituents, including chloride and nitrates.

Water-level data compiled through the GWMP are used to prepare hydrographs for 20 key representative wells. The water-level data are also used to prepare contours of groundwater surface elevations for the fall and spring period of each water year. The hydrographs and contours allow for graphical representation of basin wide water-level conditions and facilitate the identification of trends and patterns with respect to CGB water level conditions. Hydrographs for each of the Sentinel Wells have also been prepared and are presented in this report. The Sentinel Well hydrographs display influence from daily diurnal tidal fluctuations, and show the response in the water-level at each well from pumping at two of the District's production wells; the Headquarters Well and El Carro Well No. 2.

Chemical hydrographs for selected constituents (total dissolved solids [TDS], chlorides, and nitrates) are also prepared as part of the GWMP. The graphical representation of water-quality data allow for easy identification of important trends in basin water quality.

Groundwater production data and precipitation data are also presented graphically in the annual report. These data are presented comparatively along with the water-level and water-quality data to help integrate the data and better understand the relationships between the various hydrogeologic components of the CGB.

While the GWMP was adopted in 1999, the District has been collecting hydrogeologic data from the CGB for many years prior. An update of basin conditions was prepared by Pueblo[1] in 2012 for the period WY 1985 through WY 2005.

Following Pueblo's 2012 update of CGB hydrogeologic conditions, subsequent updates of the water budget for the basin have been completed by Pueblo and presented to the District in Technical Memoranda (TM). The water budget update for WY 2018 and WY 2019 has been

[1] *Carpinteria Groundwater Basin, Hydrogeologic Update and Groundwater Model Project Final Report*, prepared by Pueblo Water Resources, Inc. for Carpinteria Valley Water District, dated June 30, 2012.

completed by Pueblo and is presented and discussed as part of this GWMP annual report. The coordination of the GWMP and the annual updates of CGB water budget conditions achieve the District's goal of synchronizing these two important programs for the purpose of effective basin management.

PRECIPITATION DATA

The Santa Barbara County Flood Control District (SBCFCD) maintains precipitation data from the Carpinteria Fire Station gauge. Data from this station are used for this annual report, and a period of recorded data from 1949 to present exists for that gauge. In 2017 the SBCFCD discovered that the rainfall record for the Carpinteria Fire Station Gauge erroneously included data from the US Forest Service (USFS) Gauge for WY 1985 through WY 1998. Because the USFS Gauge is located further north and at higher elevations than the Fire Station Gauge, the data previously listed for this period were erroneously high. The SBCFCD has since corrected the error, and the corrected data have been adopted and incorporated into the GWMP and updated water budget calculations.

Annual rainfall during the 35-year WY 1985 – WY 2019 period of record is presented on **Figure 2**. As shown, the mean annual rainfall for this 35-year base period is 17.15 inches. Rainfall in WY 2018 was 9.0 inches, approximately 52 percent of the base-period average, and total precipitation in WY 2019 was 18.2 inches, approximately 106 percent of the base-period average.

The cumulative departure of annual rainfall from the long-term mean is also plotted on **Figure 2**. The cumulative departure from mean graph is used to identify climatic trends over the period of record. As shown, the cumulative departure curve exhibits a series of cyclic dry and wet periods in the basin. The cumulative departure curve shows that dry conditions for the CGB have existed since 2012. Precipitation conditions from WY 2012 through WY 2016 were particularly dry, and this period is considered to be one of significant and extended drought, with annual rainfall totals generally less than half of the long-term average. Over the past three years the curve has seemed to flatten, with above average rainfall conditions in WY 2017 and WY 2018.

Monthly precipitation records for the past three water years are presented in **Table 1**.

Table 1. Precipitation Data, Gauge No. 208, Carpinteria Fire Station
WY 2017 through WY 2019

Month	WY 2017	WY 2018	WY 2019
October	0.87	0.00	0.23
November	0.87	0.06	2.02
December	3.05	0.00	0.35
January	7.21	2.47	5.06
February	8.60	0.11	5.88
March	0.62	6.13	2.77
April	0.31	0.05	0.18
May	0.17	0.11	1.43
June	0.05	0.01	0.19
July	0.00	0.00	0.01
August	0.00	0.00	0.04
September	0.01	0.03	0.02
WY Total	**21.8**	**9.0**	**18.2**

The complete record of precipitation data from SBFCD for the Carpinteria Fire Station Gauge is included in **Appendix A**.

GROUNDWATER PRODUCTION

Groundwater extractions from the CGB occur from both District and private production wells. The District produces groundwater to supplement its other sources of supply, including water from the Cachuma and State Water Projects. District pumping is metered, and monthly totals of production from the District wells were compiled for WY 2018 and WY 2019. Private pumping in the basin is not metered and has been estimated on an annual basis by the District since 1984 utilizing land use surveys, water delivery information, GIS mapping, and crop use estimates.

As shown in **Table 2**, average aggregate pumpage for the period WY 1985 through WY 2019 was 4,024 acre-feet per year (afy). Total groundwater production during WY 2018 was 6,790 acre-feet (af), which is the highest annual total over the WY 1985 through WY 2019 period. Of this amount, District pumpage totaled 2,239 af, or about 33 percent of the total for that water year. Aggregate pumpage during WY 2019 was 4,817, with the Districts pumpage totaling 933 af, or approximately 19 percent of the total Pumpage for that water year. The annual District Pumpage has averaged approximately 37 percent of the annual aggregate over the WY 1985 and WY 2019 period of record. Groundwater production from the CGB during WY 1985 through WY 2019 by the District, from private pumpers, and in total, is presented graphically on **Figure 3**.

**Table 2. Summary of Groundwater Pumpage
WY 1985 through WY 2019
(in acre-feet)**

Water Year	CVWD Pumpage	Private Pumpage	Total Pumpage
1985	1836	949	2785
1986	2032	1041	3073
1987	2363	932	3295
1988	2342	1065	3407
1989	2984	1520	4504
1990	3413	1990	5403
1991	3014	2261	5275
1992	1560	2165	3725
1993	1261	2422	3683
1994	1307	2818	4125
1995	1291	2389	3680
1996	1557	2510	4067
1997	1317	2437	3754
1998	575	2428	3003
1999	340	2990	3330
2000	1410	3105	4515
2001	185	3259	3444
2002	558	3103	3661
2003	402	2723	3125
2004	999	2803	3802
2005	1152	2060	3212
2006	1120	2083	3203
2007	1418	2507	3925
2008	661	2806	3467
2009	1628	2284	3912
2010	1053	2566	3619
2011	1236	2502	3738
2012	1015	2451	3466
2013	643	3033	3676
2014	1014	3541	4555
2015	2605	3526	6131
2016	2751	3380	6131
2017	1235	3321	4556
2018	2239	4551	6790
2019	933	3884	4817
Average	**1470**	**2554**	**4024**
High	**3413**	**4551**	**6790**

WATER-LEVEL DATA

Water-level data and the hydrographs prepared using the data are essential elements of the GWMP. Hydrographs help to identify water-level trends, assess aquifer response to various hydrogeologic conditions, and assess changes in groundwater storage between various periods in time.

Water-level data in the basin have historically been collected and maintained by the USGS and the District. The USGS database contains water-level records for 75 wells in the CGB, dating back to as early as 1919 (State Well No. 4N/25W-28J1); however, most records begin in either the 1940s or 1970s. The USGS database does not extend beyond 2001; however, after 2001 the District continued measuring water levels at various wells as part of the GWMP.

Currently, water-level data are collected by District staff on a bi-monthly basis from approximately 25 wells located throughout the CGB (refer to **Figure 1**). As part of the routine collection of water-level data, District staff record observations made in the field regarding well activity to assist in determining whether the measurement made at a particular well represents a static, pumping, or recovering water level. Pumping water levels are typically not measured, but a notation is recorded by District staff on the field regarding the pumping status of a well. Hydrographs are created with measurements that represent as close as possible static water level conditions. Data for wells that are clearly representing recovering water levels are not used in the hydrographs, although it is likely that some of the data used still represents some degree of recovery, but a definitive determination regarding the water level condition could not be made during the analysis because it is not possible to know when an idle well was last operated.

It is also important to note that many of the wells throughout the basin are either relatively shallow or screened across multiple aquifer zones. Water bearing deposits within the CGB include interbedded layers of sand, gravel, silt and clay. The coarser grained units comprise the major aquifer zones within the basin, designated the A zone (youngest and shallowest), the B zone, the C zone, and the D zone (oldest and deepest). These primary water bearing zones are distinct in the central portion of the basin and generally on the order of 50 to 100 feet thick each, are separated by a series of fine-grained aquitards, and within the central portion of the basin occur under confined conditions (i.e., the so-called Confined Area of the basin). Water-level data collected from wells screened across multiple aquifer zones represent composites of the water level conditions of the completed aquifers.

Pueblo has reviewed the water-level data collected by the District staff for WY 2018 and WY 2019 period, and has prepared hydrographs for 20 key wells. These hydrographs are presented on **Figures 4 and 5**. **Figure 4** presents hydrographs for GWMP wells located generally in the western portion of the CGB, and **Figure 5** presents records for wells generally located toward the east. The records for many of the 20 wells were complete dating back to about 1982, so this date was used as the starting point for the hydrographs. Also presented on the hydrographs along with the water-level data are graphical representations of precipitation and groundwater production over the period of record to allow for consideration of these two important hydrogeologic elements when evaluating the water level data.

The hydrographs generally display seasonal and small amplitude annual fluctuations superimposed upon some more enduring, prominent trends. When viewed as a whole, the set of hydrographs presented on **Figures 4 and 5** reveal some notable trends that occurred or are occurring within the CGB. As shown, water levels were relatively high in the early- to mid-1980s, then declined relatively sharply in response to an extended 4-year drought that occurred between 1987 and 1990. Evidence of this drought is also apparent in the precipitation data and the cumulative departure curve shown on **Figure 2**. Maximum water-level declines in many of the wells occurred during the fall of 1991, after which water levels trended upward in response to increased precipitation and subsequent recharge to the basin, and to some extent a moderate decrease in basin pumpage. The peak of this trend of water level recovery occurred in the late 1990's – early 2000's. After that, the hydrographs show a general trend of steady though moderately declining water levels.

The impacts of the extended drought that occurred during WY 2012 through WY 2016 are apparent in the hydrographs as sharp declines in water levels that occurred throughout the basin during this period. Review of the hydrographs indicate that by the end of WY 2016, water levels at some wells remained above the low levels experienced in 1991, but at most other wells, the magnitude of recent decline in WY 2016 equaled or exceeded that of 1991. Since WY 2016, the hydrographs for most of the wells in the CGB show similar trends, with significant water level increases through WY 2017 (generally 10 to 15 feet), steady declines through WY 2018, and partial recovery of water levels through WY 2019.

Hydrographs for wells with relatively complete historical water level records going back to the 1940's are presented on **Figure 6**. The signatures of these hydrographs are similar, with basin low levels occurring between the late 1940's through the early 1960's, and consistent water level recovery into the 1980's with the development of alternative water supplies.

Water-level contours have been prepared for the spring and fall periods of WY 2018 and WY 2019. The purpose of the water-level contours is to help to identify general patterns in the flow regime within the basin. The contours are also useful in identifying recharge and discharge patterns, and help to understand water-level conditions along the margins of the basin, particularly at the coast where the conditions for seawater intrusion may exist. Water-level contours for Spring and Fall of 2018 and 2019 are presented on **Figures 7, 8, 9, and 10**, respectively.

The water-level contours show that groundwater generally flows in a northeast to southwesterly direction in the eastern half of the basin, and north to south in the western half of the basin. The directions of groundwater flow generally reflect the movement of groundwater from the primary sources of recharge to the primary sources of extraction (groundwater pumping) in the confined area in the center of the basin.

The contour maps for the spring and fall of WY 2018 show the continuation of a water-level depression in the central portion the basin that developed during the extended drought period of WY 2012 through WY 2016. This depression persisted through WY 2018, with the center of the depression approximately 60 feet below sea level. The contour maps for WY 2019 indicate that this depression was recovering to some extent, and the pattern of the contours for WY 2019 spring and fall appear to show that recharge was entering the basin from the northeast. All of the contour maps for WY 2018 and WY 2019 indicate that in the western portion of the basin in areas where the CGB is believed to be potentially susceptible to seawater intrusion, water levels were consistently below sea level.

WATER QUALITY DATA

Groundwater quality within the CGB is monitored through the analysis of samples collected from approximately 30 wells located throughout the basin. Water samples are also collected from six surface water stations when surface water is present. The laboratory analytical program for the samples includes total dissolved solids and basic inorganic chemical constituents, including chloride and nitrate. Chemical hydrographs for the 25 wells monitored are presented on **Figures 11 and 12**. **Figure 11** presents water quality data for GWMP wells located generally in the western portion of the CGB, and **Figure 12** presents data for wells located in the eastern portion.

In general, the chemistry of groundwater within the CGB is characterized as calcium-bicarbonate, with concentrations of total dissolved solids within the range of 600 milligrams per liter (mg/L) to 900 mg/L, and chlorides in the range of 40 mg/L to 80 mg/L. There are some notable trends with respect to TDS and chloride concentrations. Among the private wells in the western portion of the basin, TDS and chloride concentration increases have occurred at Wells 19E1 and 19K5. At 19E1, beginning in about 2010, the TDS concentration has increased steadily from approximately 1,100 mg/L to 1,500 mg/L, while the chloride concentration over this same period rose from about 300 mg/L to 500 mg/L, peaking at 600 mg/L in WY 2019. It should be noted that the secondary maximum contaminant level for chlorides in drinking water in California is 250 mg/L. At Well 19K5, the TDS concentration rose from about 1,200 mg/L to 1,370 mg/L between 2008 and the end of WY 2019, with some higher spikes in between. Similarly, the chloride concentration at that well rose from 160 mg/L to 190 mg/L during that period with some spikes in the middle of that period. At well 19M1, the TDS concentration increased from approximately 1,000 mg/L to 2,500 mg/L between 1990 and 2006, but has since declined to about 1,750 mg/L. The chloride concentration at this well showed a similar trend, increasing from 100 mg/L to 500 mg/L between 1990 and 2005. Since 2005, the chloride concentration has been somewhat 'spikey' at 19M1, possibly undergoing a slight decline, with a concentration of 370 mg/L observed in WY 2019.

Increases in TDS and chloride concentrations have also been occurring in private wells in the eastern portion of the basin. TDS and chloride concentration increases have been observed at Wells 27E1, 28H1, and 34B4. Upward trends of these constituents at Well 27E1 began in the late 1990's. In the early 1990's the TDS concentration at this well was approximately 600 mg/L, peaking in 2006, and generally declining since then with a level of 860 recorded in WY 2019. The pattern of chloride concentration at this well was similar, starting at 20 mg/L, peaking at 55 mg/L, with an observed level of about 40 mg/L in WY 2019. At Well 28H1, TDS and chloride concentrations have been steadily increasing since about 2013. In 2013, the TDS at this well was approximately 690 mg/L. The concentration at the end of WY 2019 was 907 mg/L. The chloride concentration in 2013 was about 30 mg/L, and was 55 mg/L at the end of WY 2019. The TDS and chloride concentration at Well 34B4 has also increased since monitoring of this well began in 2005, when the TDS concentration was 650 mg/L and the chloride concentration was 35 mg/L. The TDS and chloride concentrations in Well 34B4 at the end of WY 2019 were 700 mg/L and 76 mg/L, respectively. At well 22R4, while the TDS concentration has remained relatively stable over the monitoring period, the chloride concentration at this well has increased, starting at approximately 20 mg/L in the early 1990's, attaining a level of 88 mg/L at the end of WY 2019.

While the mechanism for these instances in TDS and chloride concentrations are not fully understood, the periods when these increased occurred, or at least some of the period of increases, were coincident with the severe drought of WY 2012 through WY 2016. It is possible that stress on the basin during the drought created conditions whereby lower quality shallow water was impacting deeper water bearing units.

Nitrate concentrations (reported as nitrate) in private wells throughout the basin are tracked through the GWMP. Nitrates are generally lower in wells that are completed in relatively deep aquifer units, and higher in shallow wells located in agricultural areas. Some trends of increasing nitrate concentrations have been identified. In the western portion of the basin, nitrates have been increasing at Wells 19E1 and 19K5 since about 2005, coincident with increasing TDS and chlorides during this same period at each of these two wells. For 19E1, nitrate concentrations were below 10 mg/L during the mid- to late-2000's, and have risen to 56 mg/L by the end of WY 2019. At 19K5, nitrates were at around 170 mg/L in the mid-1980's, peaked at 280 mg/L in WY 2010, and during WY 2019 were reported to be at 190 mg/L.

Nitrate concentration increases have also been occurring at private wells in the eastern portion of the basin, most notably at Wells 27E1 and 28H1. At 27E1, the nitrate concentration at this well was approximately 10 mg/L in 1980, peaked at 63 mg/L in WY 2009, and dropped to 50 mg/L in WY 2019. It should be noted that the secondary Maximum Contaminant Level (MCL) for nitrates in drinking water in California is 45 mg/L. The increases in nitrate concentrations in the noted wells appear to be localized and may be associated with well completion depths and/or agricultural practices. As was the case for increasing trends in TDS and chlorides, periods of increasing nitrates were at least in part coincident with the severe drought of WY 2012 through WY 2016, which may have affected the downward movement of nitrates in the basin.

Water quality at the District's wells are also monitored through the GWMP. Chemical hydrographs for District Wells are also presented in **Figures 11 and 12**. At the District's Headquarters Well (29D8), while the TDS concentration has been relatively stable over the period of record, generally within the range of 640 mg/L to 680 mg/L, the chloride concentration at this well increased slowly from approximately 40 mg/L in 2015, to about 50 mg/L at the end of WY 2018, to 65 mg/L at the end of WY 2019. While the chloride concentration at the Headquarters Well is well under the secondary MCL of 250 mg/L, the steady increase over the past several years is distinct and noteworthy. Unlike other private wells where increases in TDS and chlorides were sometimes accompanied by increases in nitrates, the nitrate concentration at the Headquarters Wells has been stable, and under 10 mg/L over the period of record. The other District well in the western portion of the basin is El Carro Well No. 2 (28D2). Here, there does not appear to be any notable or significant trends in water quality, with concentrations of TDS, chlorides, and nitrates at the end of WY 2019 at 691 mg/L, 38 mg/L, and 12 mg/L, respectively.

The District-owned wells in the eastern portion of the basin are the Lyons Well (28F7) and the Smillie Well (27F2). For the Smillie Well, water quality appears to be stable with no notable trends, and concentrations of TDS, chlorides, and nitrates at the end of WY 2019 of 658 mg/L, 32 mg/L, and 13 mg/L, respectively, very similar to the nearby El Carro Well No. 2. The Lyons well is currently inactive and has not been sampled since WY 2014, however; some notable trends of increasing concentrations of TDS, chlorides, and nitrates are apparent for this well. Prior to WY 2000, the TDS concentration at this well was consistently under 600 mg/L. Since 2005, the TDS concentration at Lyons has ranged between about 730 mg/L and 770 mg/L, although the TDS concentration at this well does not appear to be currently increasing. The chemical hydrograph for chlorides at the Lyons Well generally shows a steady increase from about 25 mg/L in the early 1980's to 62 mg/L in WY 2014. Nitrates have also increased over the period of record at this well, going from concentrations generally below 10 mg/L prior to 2005 to a concentration of 39 mg/L during WY 2013. As noted previously, the MCL for nitrate (as NO_3) is 45 mg/L and linear projection of the available data collected since 2005 to 2020 suggest the nitrate concentration at Lyons may currently be approaching (or possibly exceeding) the MCL. This well has a relatively shallow annular seal, which may enable the migration of poor quality shallow water into deeper water bearing zones completed by this well.

Surface water-quality data are plotted and presented on **Figure 13**. A long-term trend of slightly increasing TDS concentrations for the surface water quality is apparent over the period of record, particularly on Arroyo Paredon Creek, although during WY 2018 and WY 2019, the TDS concentrations were relatively stable if not slightly diminished. Nitrate and chloride concentrations at surface water sampling stations appear to be relatively stable since monitoring began. The locations of the surface water sampling locations are shown on **Figure 14**.

Laboratory reports for samples analyzed during WY 2018 and WY 2019 are included in **Appendix B**, along with complete summaries of compiled water quality data collected since the inception of the GWMP.

WATER BUDGET

In 2012 Pueblo completed an update of hydrogeologic conditions of the CGB for the period WY1985 through WY2008 as part of a DWR Local Groundwater Assistance Fund grant. The project also included development of a calibrated groundwater model of the basin. Integral to the hydrogeologic update and model development project was an update of the water budget of the CGB over the study period. The water budget update includes calculation of each of the various components of inflow and outflow in the basin for each water year, and the resulting cumulative changes in basin storage for each period.

Since completion of the 2012 project, Pueblo has provided the District water budget updates on an annual basis to allow the District to stay up-to-date on basin conditions, in particular, cumulative basin storage conditions. The most recent water budget update for the CGB was recently completed for WY 2018 and WY 2019, the results of which were transmitted to the District in a technical memorandum (TM) dated May 5, 2020 (presented in **Appendix C**).

As described in the TM, the change in the amount of groundwater in storage depends on the annual water supply surplus or deficiency, as expressed by the water balance equation. WY 2017 was the first year since the recent drought began in WY 2012 where a positive accretion of groundwater storage was estimated (923 af); however, further depletion of groundwater storage was estimated for both WY 2018 and WY 2019. In WY 2018, a year of deficient rainfall and basin recharge, the total inflow of groundwater into the CGB was estimated to be 2,595 afy and the total amount of outflow was estimated to be 6,890 afy, which results in a significant estimated storage depletion volume of 4,295 af. In WY 2019, a year of near-normal rainfall and recharge, the inflow into the CGB was estimated to be 4,123 afy and the total amount of outflow was estimated to be 4,917 afy, which resulted in a relatively modest estimated storage depletion of 794 af. The cumulative net storage depletion for WY 2018 and WY 2019 is estimated to be 5,089 af. Over the 35 year period of record starting in WY 1985, an estimated 17,269 af of cumulative storage depletion has occurred relative to starting conditions in WY 1985, with an average annual change in groundwater storage of -493 afy.

SEAWATER INTRUSION SENTINEL WELLS

Evaluation of CGB conditions over the years through the GWMP has led to the identification of gaps in the monitoring well network and in water-level and water-quality data, one of which was a monitoring well suitable for the detection of seawater intrusion into the basin. Accordingly, it had long been a goal of the District, and was a continuing recommendation in the annual GWMP reports, to install a cluster of monitoring wells in the western portion of the basin where the principal aquifer of the CGB projects offshore and is potentially in contact with the ocean. During WY 2018 and WY 2019 the District implemented the CGB Sentinel Well Project, and a cluster of monitoring wells was installed near the northwestern margin of the Carpinteria Salt Marsh, a location considered to be key for the collection of water-level and water-quality data related to evaluating the potential for seawater intrusion. In addition to the construction of the dedicated monitoring wells, the Sentinel Well Project also provided critical information that led to an increased understanding of the stratigraphy and hydrogeologic conditions in this portion of the basin. The Sentinel Wells are the first monitoring well cluster with discrete and isolated completions within the three principal water bearing zones of the CGB.

The drilling and construction of the wells occurred between May 20 and August 1, 2019. The wells are identified as the CGB Sentinel Monitoring Well Nos. 1, 2, and 3, with well completions (screens) within the C, B, and A zones of the CGB, respectively. Well construction and completion details are provided in **Table 3**.

Table 3. Sentinel Well Completion Summary

	MW-1	MW-2	MW-3
Total Drilled Depth, (ft.)	1240	880	350
Casing Depth (ft.)	1130	870	340
Casing Diameter (in.)/PVC Grade	3 / sch. 120	3 / sch. 80	3 / sch. 80
Screened Interval (ft.)	1,020 – 1,120	780 to 860	190 - 330
Depth of Cement Grout Annular Seal (ft.)	955	709	150
Screened Water Bearing Zone	C	B	A

Depictions of well completions with respect to the hydrostratigraphic conditions of the CGB at the Sentinel Well site are provided on **Figure 15**.

The Sentinel Wells have been incorporated into the GWMP, which will ultimately be transitioned into the GSP being developed in response to SGMA. The wells will be routinely monitored and will provide water-level, water-quality, and geophysical data (induction logs), that will allow the District (and the newly formed CGB Groundwater Sustainability Agency) to better understand the dynamics of the aquifer system, the aquifer response to pumping within the CGB, and the susceptibility of the basin to seawater intrusion over time.

The District installed water-level probes in each of the wells to continuously measure and record water levels. Consistent with the current monitoring schedules for the GWMP, water levels will also be manually collected on a bi-monthly basis and water-quality samples will be collected on a quarterly basis. The baseline data collected following the construction of the wells are presented graphically on **Figure 16** (MW-1), **Figure 17** (MW-2), **and Figure 18** (MW-3). The hydrographs on **Figures 16, 17, and 18** also present daily well production data from the Headquarters and El Carro No. 2 wells to provide a holistic presentation of these interrelated hydrogeologic data. As shown on the hydrographs, the baseline chloride concentrations in MW-1 (C zone) and MW-2 (B zone) are somewhat elevated, more so in MW-2.

The baseline induction log for the Sentinel Wells was also recorded following construction of the wells. Induction logs are important tools for monitoring and tracking water-quality conditions in coastal aquifers. The induction tool measures the bulk conductivity of the aquifer materials and pore fluid, and can be performed in a well with a PVC casing, through blank portions of the casing, and through sections where the annulus is filled with either gravel pack or cement grout. The utility of induction surveys when performed on a prescribed schedule, typically quarterly or semi-annually, is that data generated through the each survey is compared to previous surveys to allow for easy identification of bulk conductivity changes in any of the strata penetrated by the well. This report presents the baseline induction survey performed during the WY 2018 and WY 2019 reporting periods. While a formal Monitoring and Reporting Program (MRP) has not yet been developed for the Sentinel Wells (this MRP is under development as of this writing), the District intends to perform induction surveys on a quarterly basis until the MRP has been developed and adopted. Induction survey data collected subsequent to WY 2019 (subsequent to September 30, 2019) will be presented and discussed in future GWMP reports.

In addition to the data acquired from the Sentinel Wells as described above, the District also intends to instrument each Sentinel Well with a probe that measures and records continuous water-quality data (electrical conductivity and temperature) to further enhance the utility of the wells.

CONCLUSIONS AND RECOMMENDATIONS

This annual report presents the findings of Carpinteria Valley Water District's AB 3030 Groundwater Management Plan for the WY 2018 and WY 2019 reporting periods. The conclusions and recommendations developed through assessment of the data collected through the GWMP are as follows:

CONCLUSIONS

- Total rainfall during WY 2018 was approximately 9.0 inches, which is approximately 52 percent of the long-term average of 17.2 inches. Total rainfall during WY 2019 was approximately 18.2 inches, which is approximately 106 percent of the long-term average.
- Extractions from the basin from pumping of CVWD and private wells during WY 2018 and WY 2019 are estimated to be approximately 6,790 af and 4,817 af, respectively. District pumpage during WY 2018 and WY 2019 represented about 33 percent and 19 percent of the aggregate total, respectively. The total pumpage during WY 2018 was the highest total recorded over the WY 1985 to WY 2019 period of record.
- Water levels in the basin declined significantly during the extended drought that occurred between WY 2012 and WY 2016. Significant water-level recovery occurred at most of the wells monitored through the GWMP during WY 2017; however, water levels declined again during the relatively dry WY 2018, but again increased somewhat during WY 2019 as a result of increased precipitation.
- Water-Level contour maps show that during WY 2018, the water level depression that developed during the extended drought period of WY 2012 through WY 2016 persisted, with water levels in the central portion of the basin and at the coast in the southwestern portion of the basin below sea level for the year. With slightly above-average precipitation and recharge in WY 2019, the contours suggest that water levels within the depression were recovering somewhat and recharge was entering the basin from the northeast.
- Total recharge to the CGB during WY 2018 and WY 2019 is estimated to have been approximately 2,595 af and 4,123 af, respectively. The total amount of groundwater storage depletion that occurred in WY 2018 and WY 2019 is estimated at 4,295 af and 794 af, respectively, with storage depletion resulting primarily from high levels of pumping within the basin (particularly in WY 2018).
- Through the GWMP, increases in TDS, chloride, and nitrate concentrations have been identified in localized areas within the basin. It appears that in general, increasing trends in some of all of these constituents began in the early to mid-2000's. Some increases in water quality parameters appear to be coincident with the WY 2012 to WY 2016 drought.

- Chloride concentrations at the District's Headquarters well have increased steadily from approximately 40 mg/L in 2015 to 65 mg/L by the end of WY 2019. Increases in concentrations of TDS and nitrate at this well are not apparent.
- The nitrate concentration in the Lyons Well increased from levels below 10 mg/L to a peak concentration of 39 mg/L in WY 2013. The well became inactive in WY 2015 and has not been sampled since then.
- The District's Sentinel Well Project was successfully executed in WY 2019 and resulted in construction of a monitoring well cluster in the western portion of the CGB where aquifers are believed to be potentially susceptible to seawater intrusion. The three wells comprising the cluster are discretely completed in the A, B, and C zones of the CGB.
- The initial sampling by airlifting of the Sentinel Wells following well construction and development indicated elevated chlorides in the B and C zones. The analysis of the sample from MW-2 (B Zone) showed chlorides above the secondary MCL of 250 mg/L.
- The current AB3030 GWMP has been an excellent tool for the acquisition of important hydrogeologic data that has helped to characterize, understand, monitor, and manage the CGB. The GWMP will ultimately transition into a GSP through SGMA.

RECOMMENDATIONS

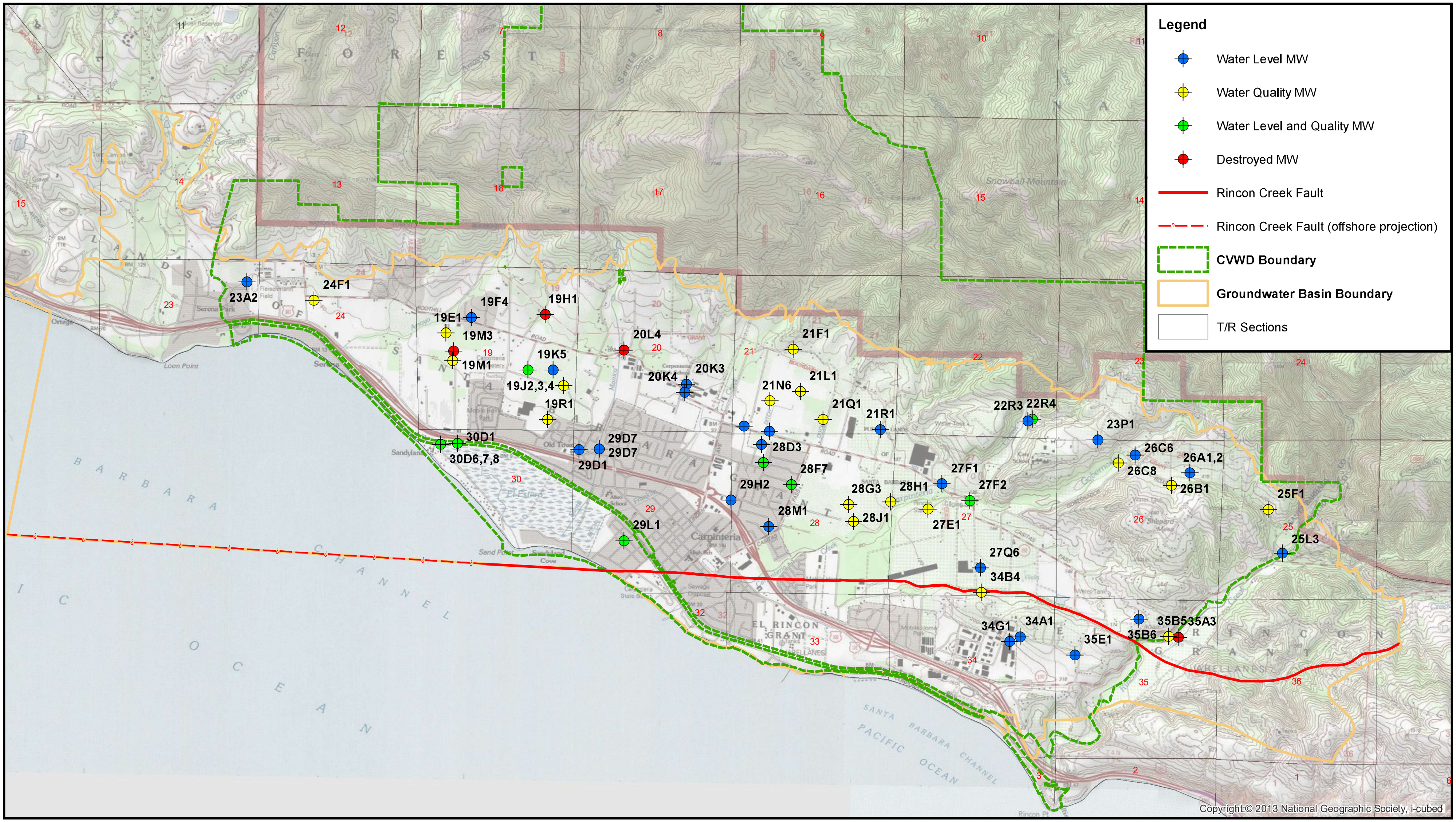
- Continue data collection and analysis as prescribed by the GWMP.
- Develop a formal Monitoring and Reporting Program for the Sentinel Wells. The MRP should prescribe procedures and schedules for the collection of water level and water quality data, and a data analysis methodology for the identification of indications of seawater intrusion.
- Begin more rigorous monitoring of water quality from the District's Headquarters Well, including the analysis of trends in the molar ratio of anions and cations, to try and understand the source for increased chloride concentrations at this well.
- Perform an assessment and rehabilitation of the Lyons well. Install a pump as part of the rehabilitation program and conduct well performance testing and water quality sampling to ascertain the current performance and water quality characteristics of the well.
- Destroy well 30D1, as this well does not provide data that is representative of CGB conditions.
- As a longer term goal, additional monitoring wells, completed in discrete aquifer zones at key locations within the basin, should be installed. These wells would provide valuable information regarding water level and water quality conditions throughout the basin and would serve to satisfy the requirements of a GSP for the CGB, which will eventually likely be required.

CLOSURE

This annual report has been prepared for the exclusive use of the Carpinteria Valley Water District, for specific application to the AB 3030 Groundwater Management Plan for the Carpinteria Groundwater Basin, in Santa Barbara County, California. The findings, conclusions, and recommendations presented herein were prepared in accordance with generally accepted hydrogeologic practices. No other warranty, expressed or implied, is made.

FIGURES

October 2020
Project No. 19-0011



PUEBLO water resources

1 inch = 3,000 feet

0 3,000 6,000 Feet

FIGURE 1. WELL LOCATION MAP
AB3030 Groundwater Management Program
Carpinteria Valley Water District

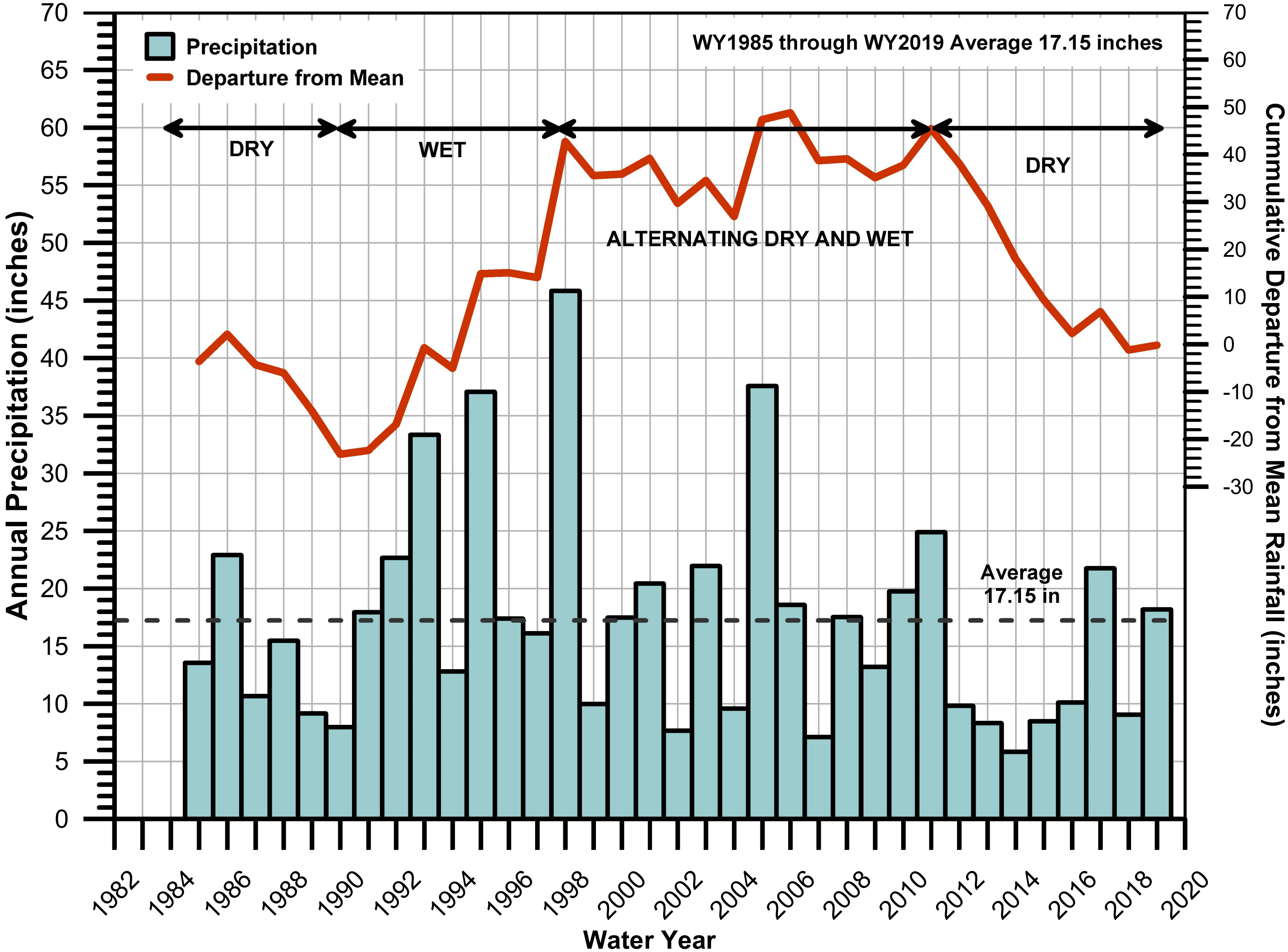
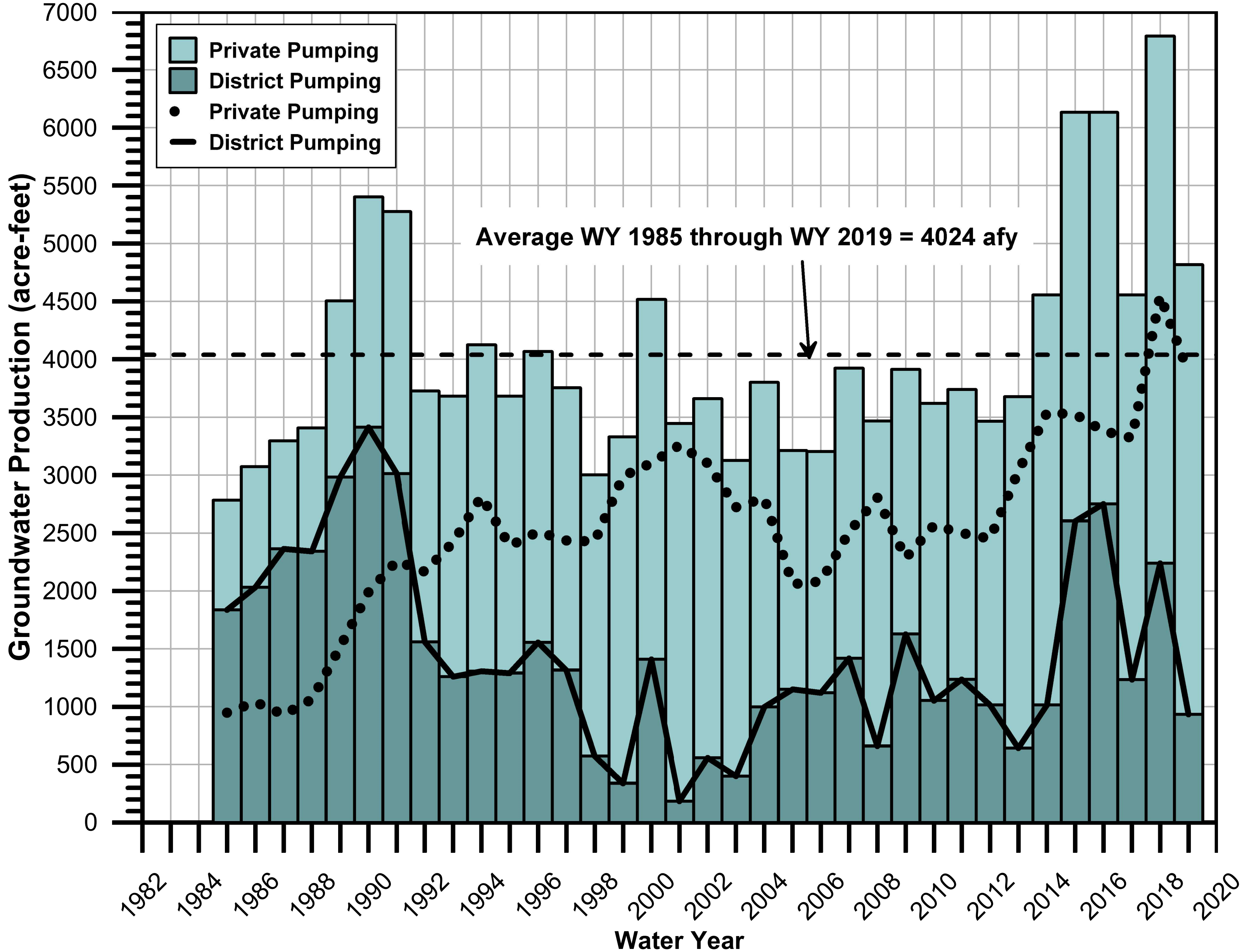


Figure 2. Carpinteria Groundwater Basin Precipitation
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

PUEBLO water resources

October 2020
Project No. 19-0011

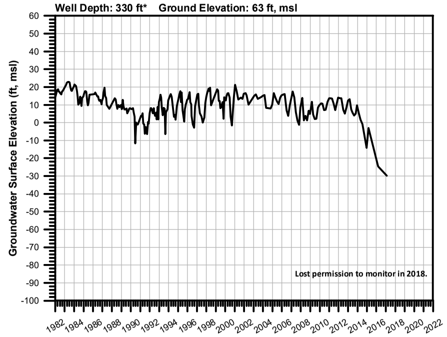


PUEBLO water resources

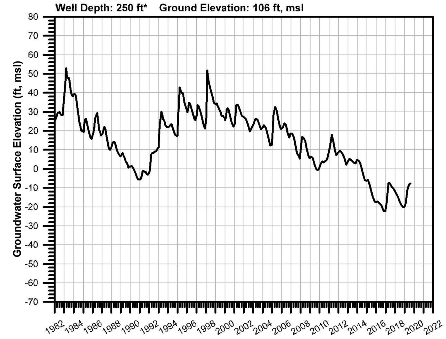
Figure 3. Carpinteria Groundwater Basin Pumpage
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

October 2020
Project No. 19-0011

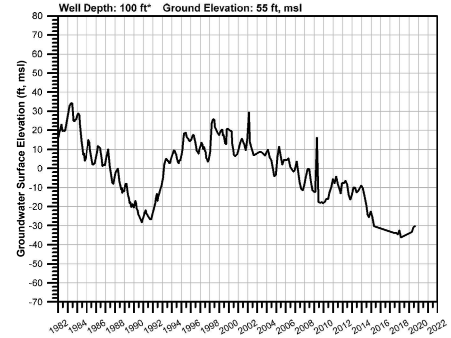
4N/26W - 23A2
Well Depth: 330 ft*   Ground Elevation: 63 ft, msl



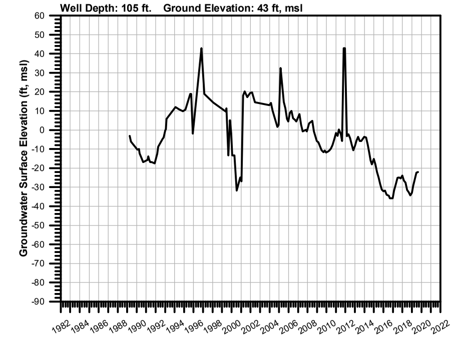
4N/25W - 19F4
Well Depth: 250 ft*   Ground Elevation: 106 ft, msl



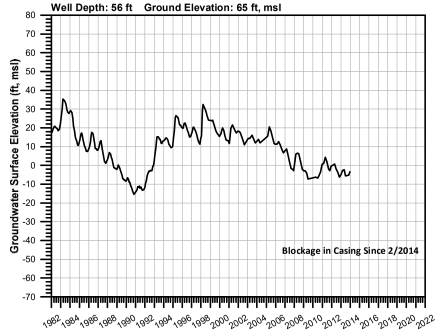
4N/25W - 19J5
Well Depth: 100 ft*   Ground Elevation: 55 ft, msl



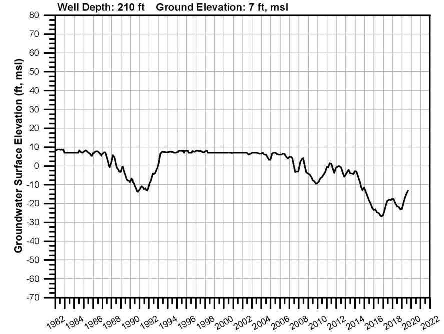
4N/25W - 19K5
Well Depth: 105 ft.   Ground Elevation: 43 ft, msl



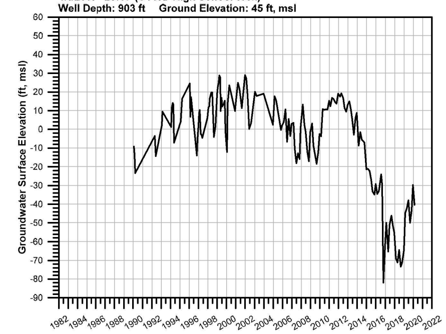
4N/25W - 19M3
Well Depth: 56 ft   Ground Elevation: 65 ft, msl



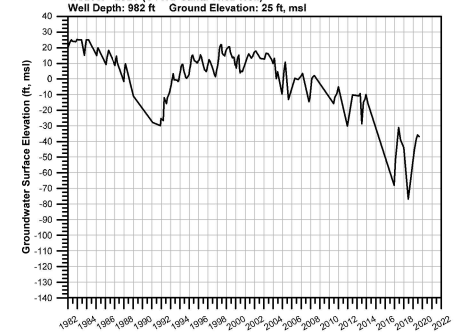
4N/25W - 30D1
Well Depth: 210 ft   Ground Elevation: 7 ft, msl



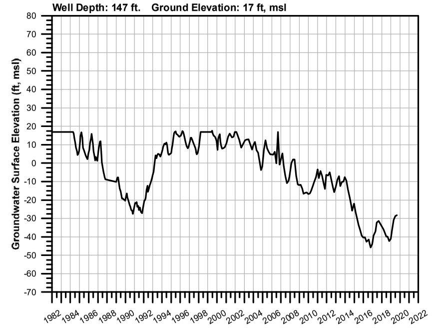
4N/25W - 20K4 (CVWD High School Well)
Well Depth: 903 ft   Ground Elevation: 45 ft, msl



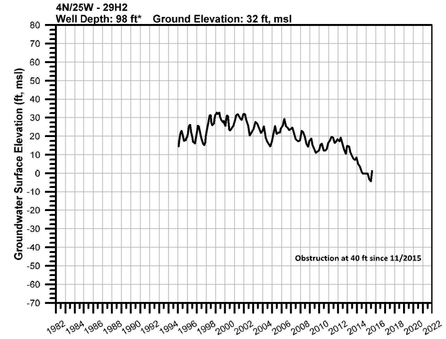
4N/25W - 29D7 (CVWD Santa Ynez Well)
Well Depth: 982 ft   Ground Elevation: 25 ft, msl

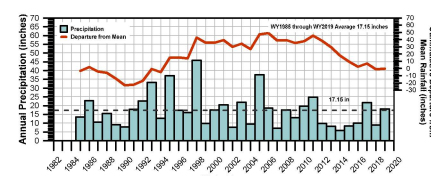


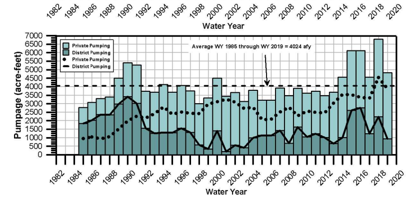
4N/25W - 29D1
Well Depth: 147 ft.   Ground Elevation: 17 ft, msl



4N/25W - 29H2
Well Depth: 98 ft*   Ground Elevation: 32 ft, msl







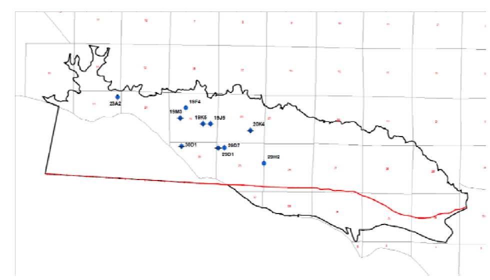
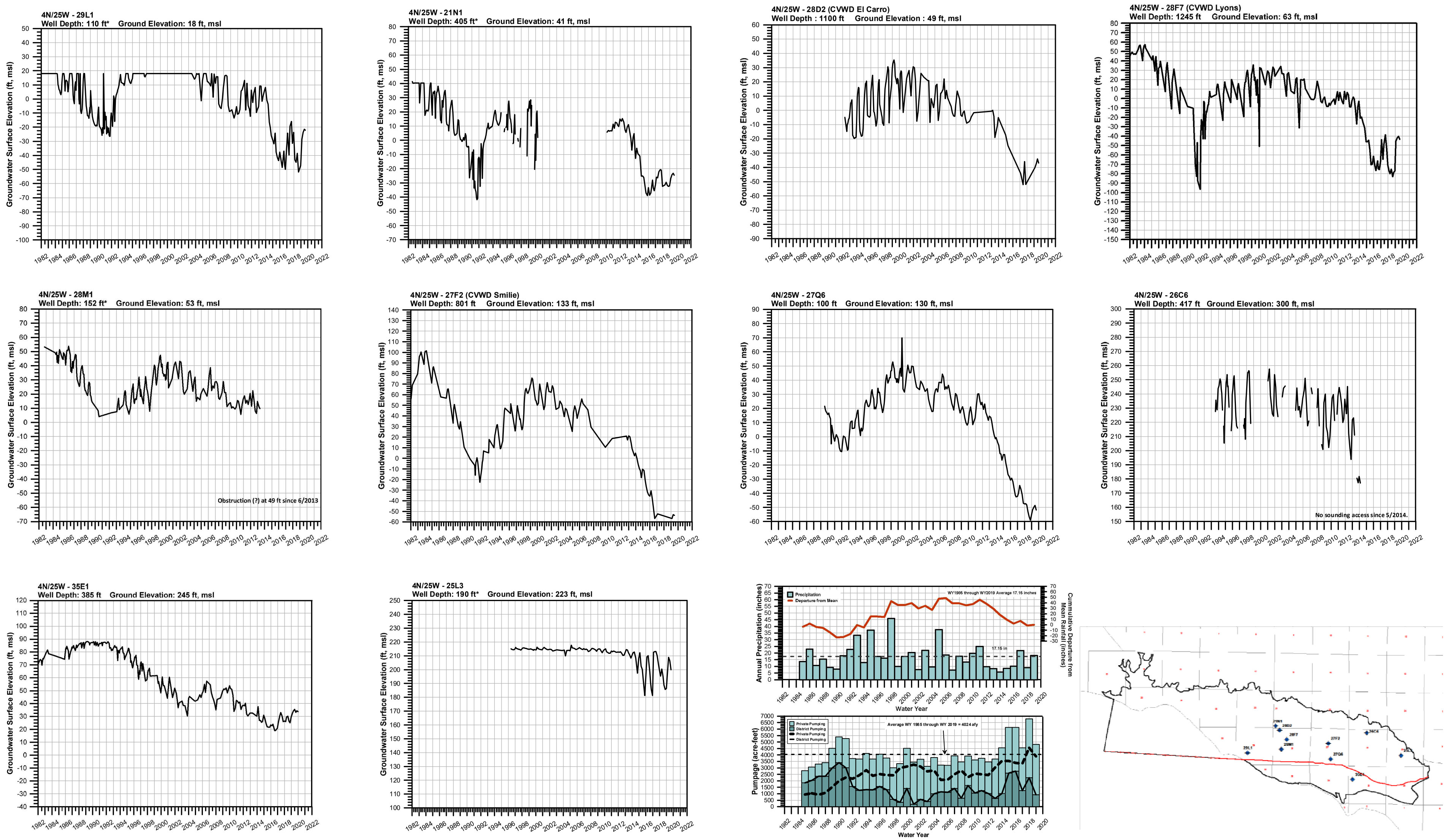


Figure 4. Water Level Hydrographs - West
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

October 2020
Project No. 19-0011

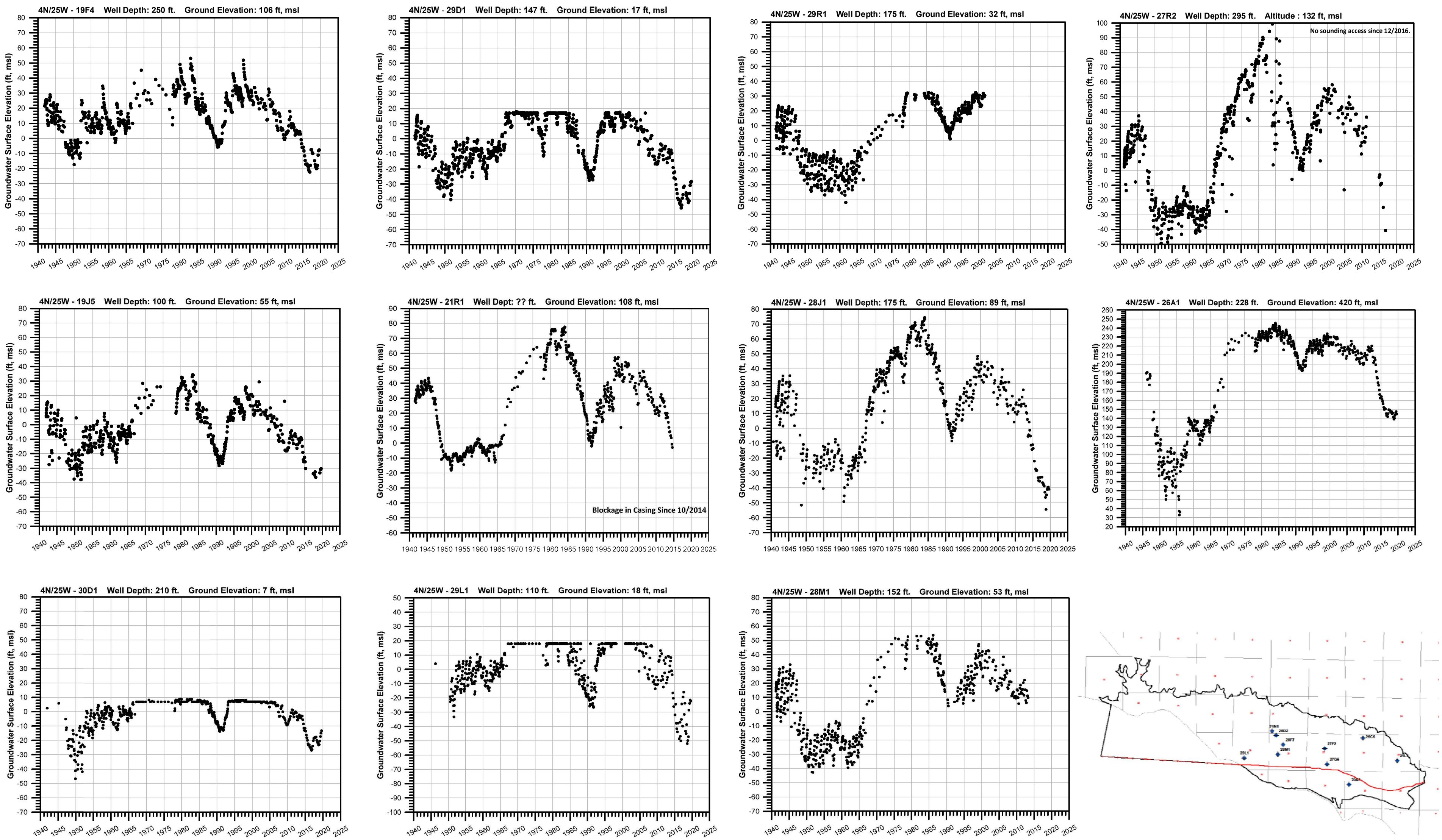


Reference Elevation = Mean Sea Level (MSL)

PUEBLO water resources

Figure 5. Water Level Hydrographs - East
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

October 2020
Project No. 19-0011

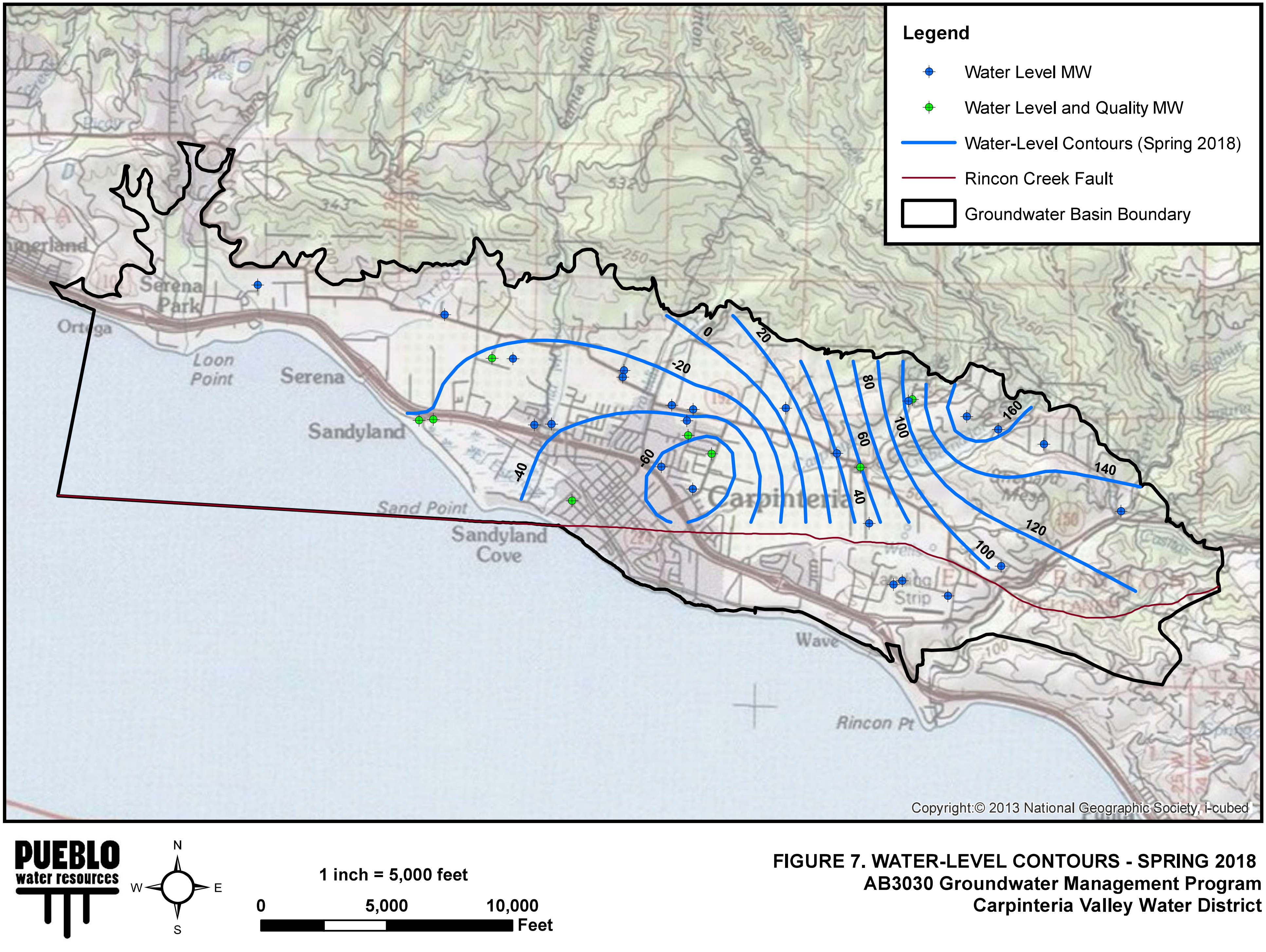


PUEBLO water resources

Reference Elevation = Mean Sea Level (MSL)

Figure 6. Historic Water Level Hydrographs
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

October 2020
Project No. 19-0011



PUEBLO water resources

FIGURE 7. WATER-LEVEL CONTOURS - SPRING 2018
AB3030 Groundwater Management Program
Carpinteria Valley Water District

October 2020
Project No. 19-0011

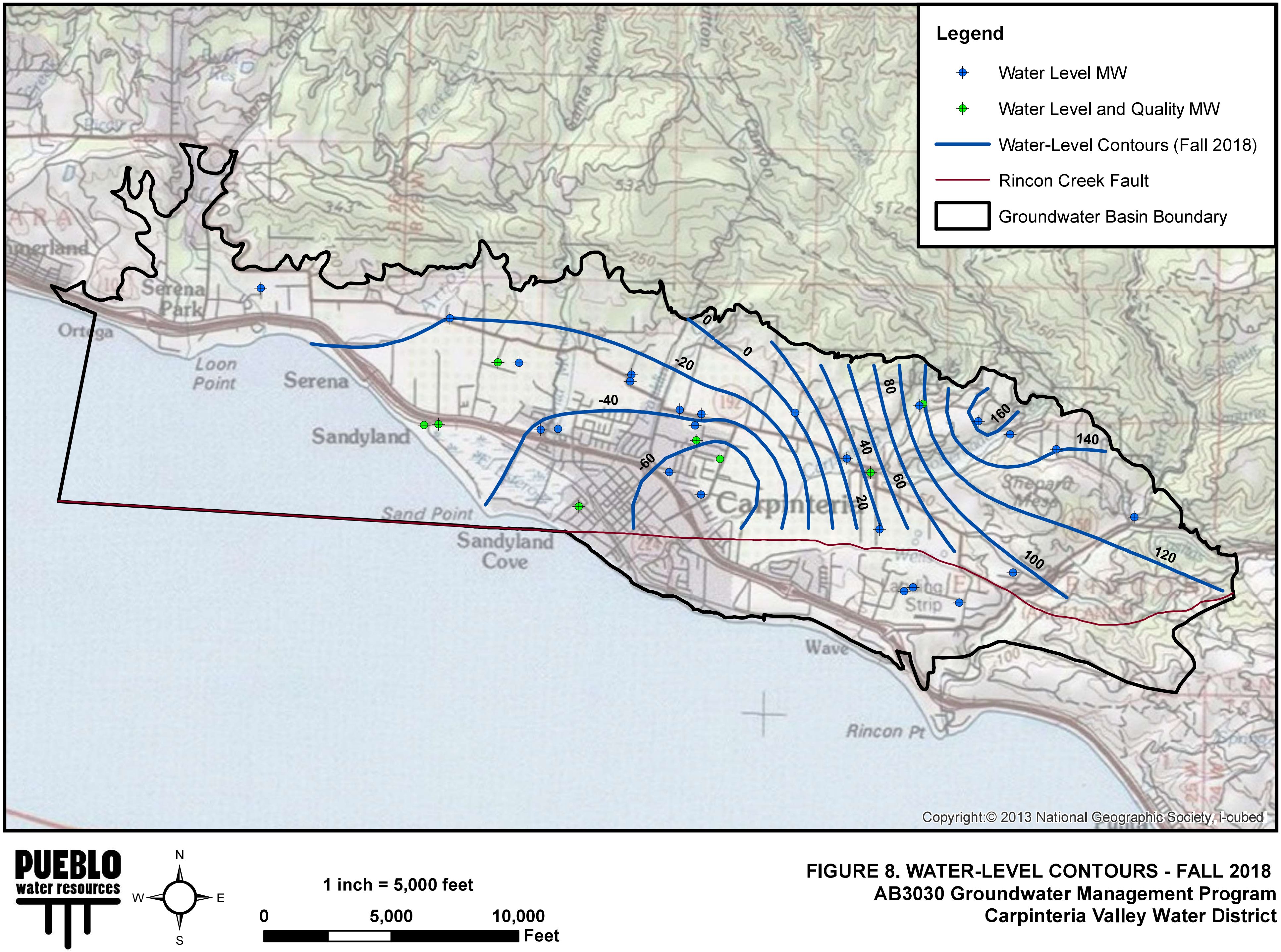


FIGURE 8. WATER-LEVEL CONTOURS - FALL 2018
AB3030 Groundwater Management Program
Carpinteria Valley Water District

PUEBLO water resources

October 2020
Project No. 19-0011

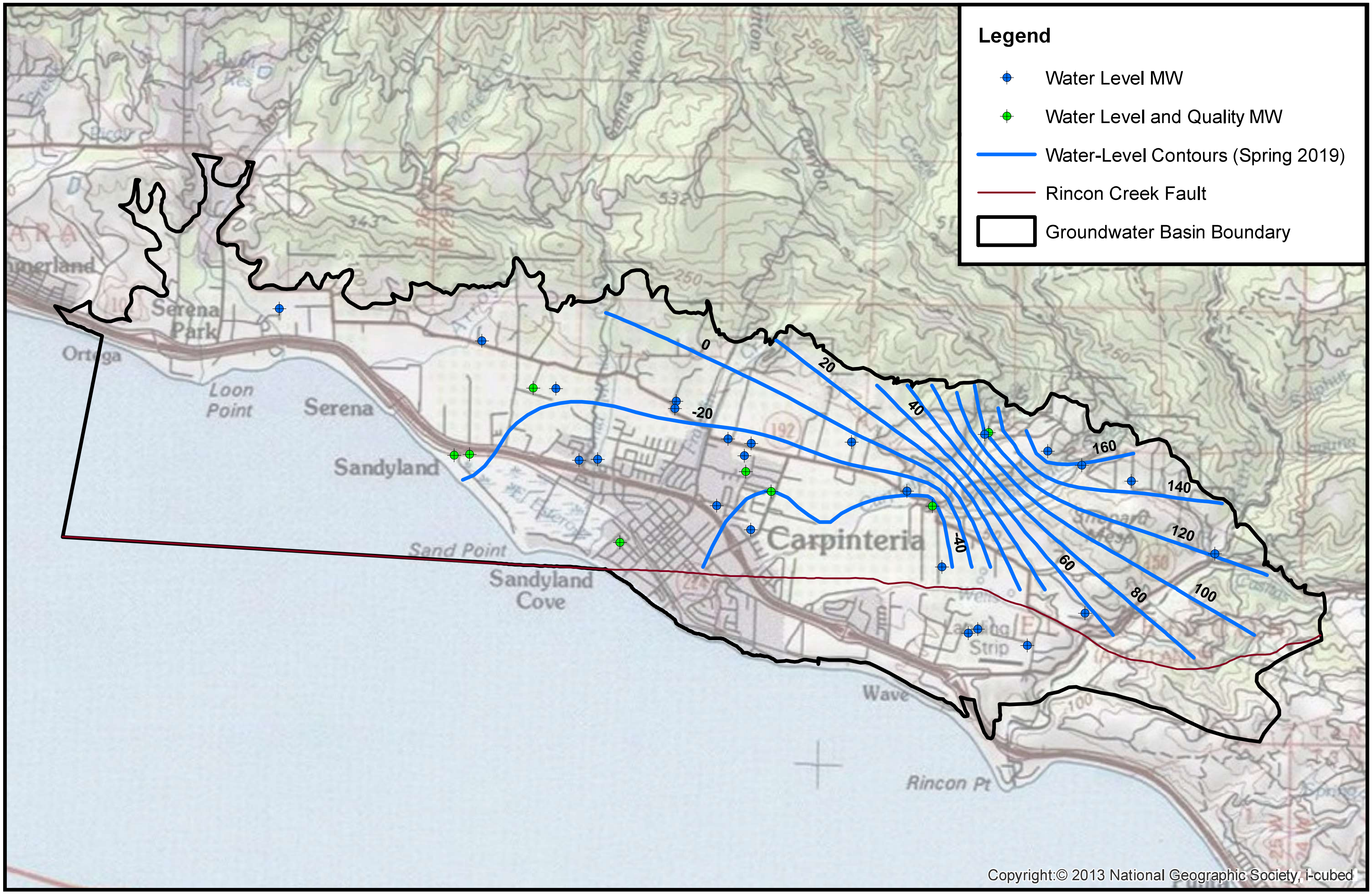
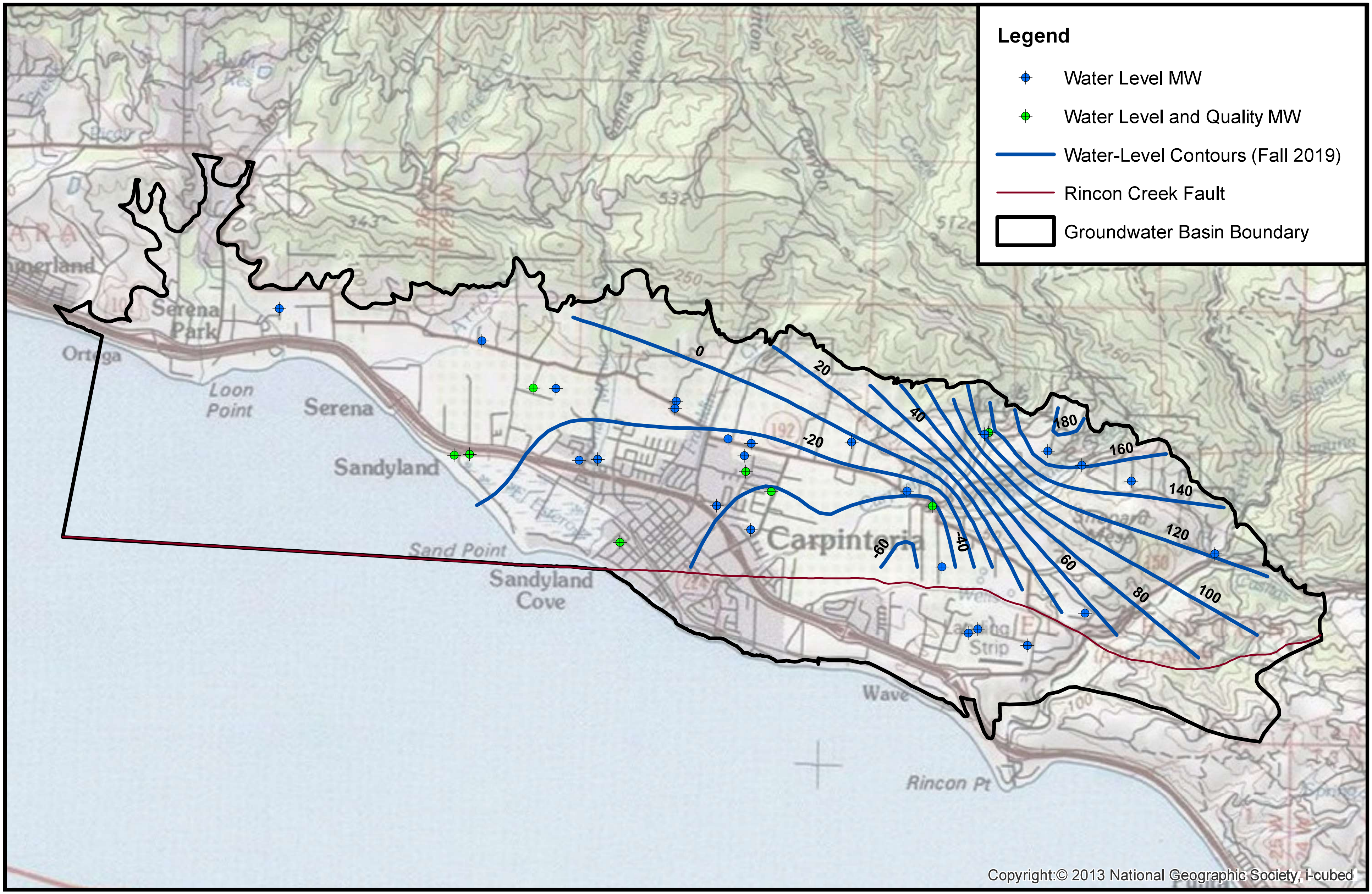


FIGURE 9. WATER-LEVEL CONTOURS - SPRING 2019
AB3030 Groundwater Management Program
Carpinteria Valley Water District

October 2020
Project No. 19-0011



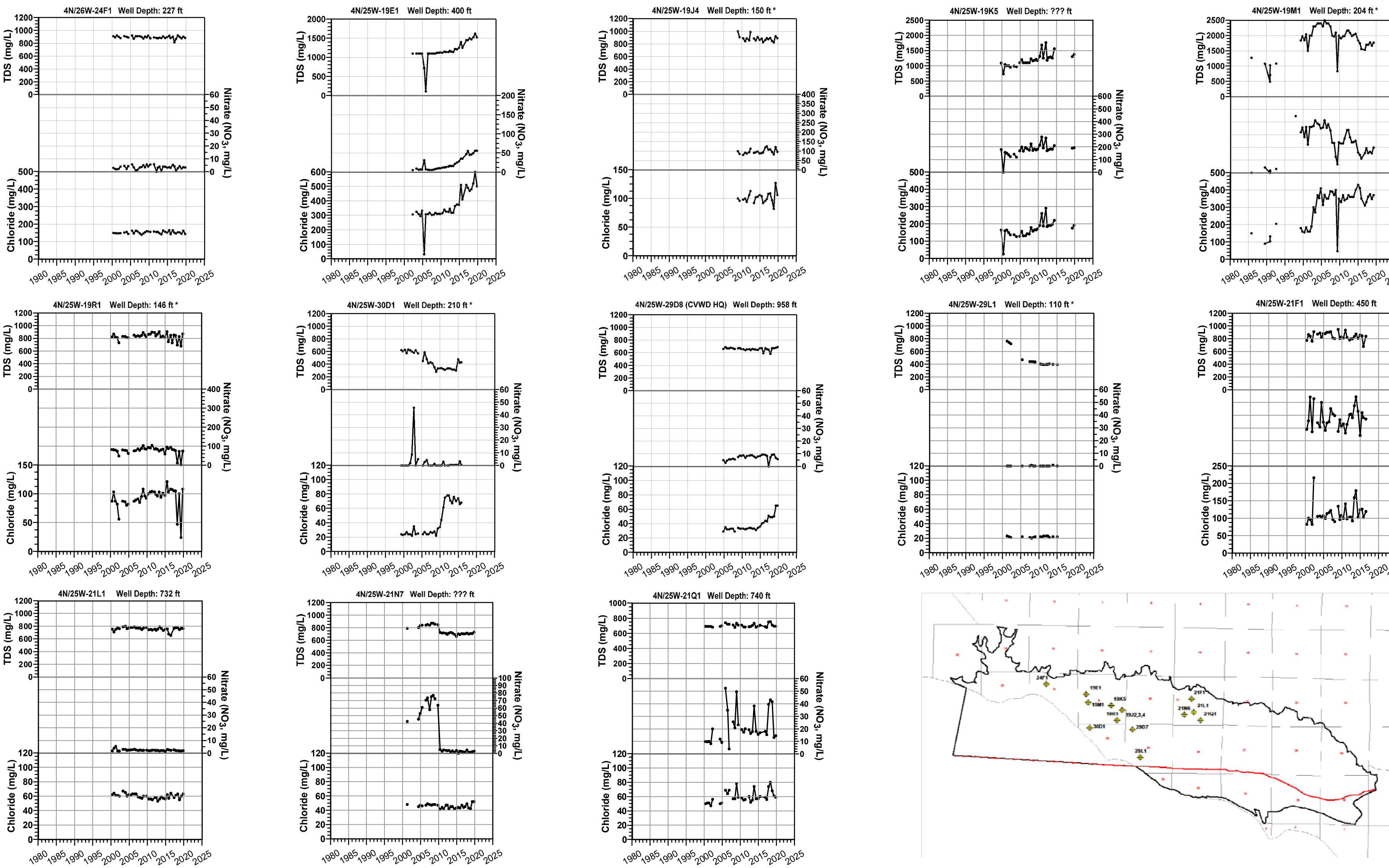
PUEBLO water resources

1 inch = 5,000 feet

0 5,000 10,000 Feet

FIGURE 10. WATER-LEVEL CONTOURS - FALL 2019
AB3030 Groundwater Management Program
Carpinteria Valley Water District

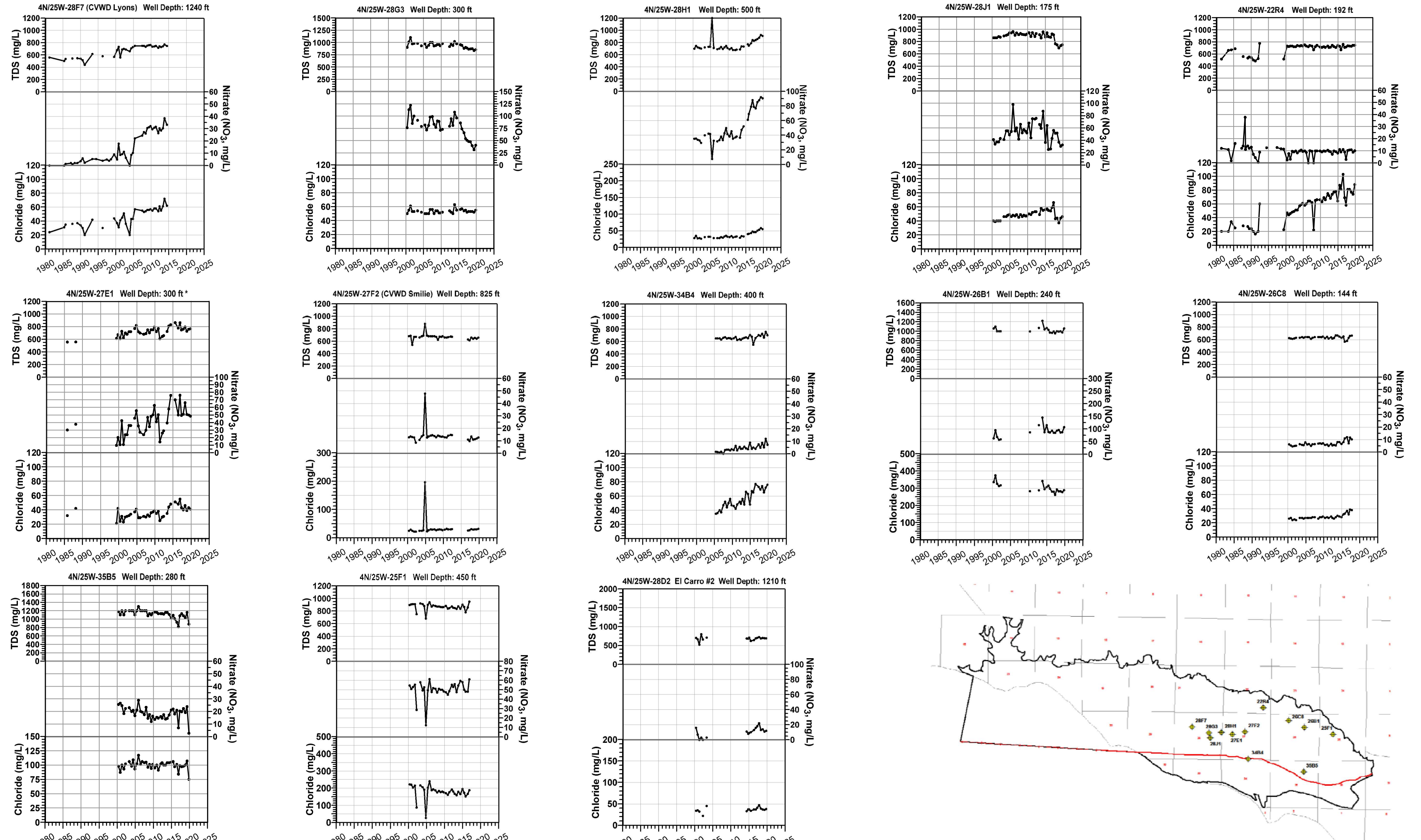
October 2020
Project No. 19-0011



PUEBLO water resources

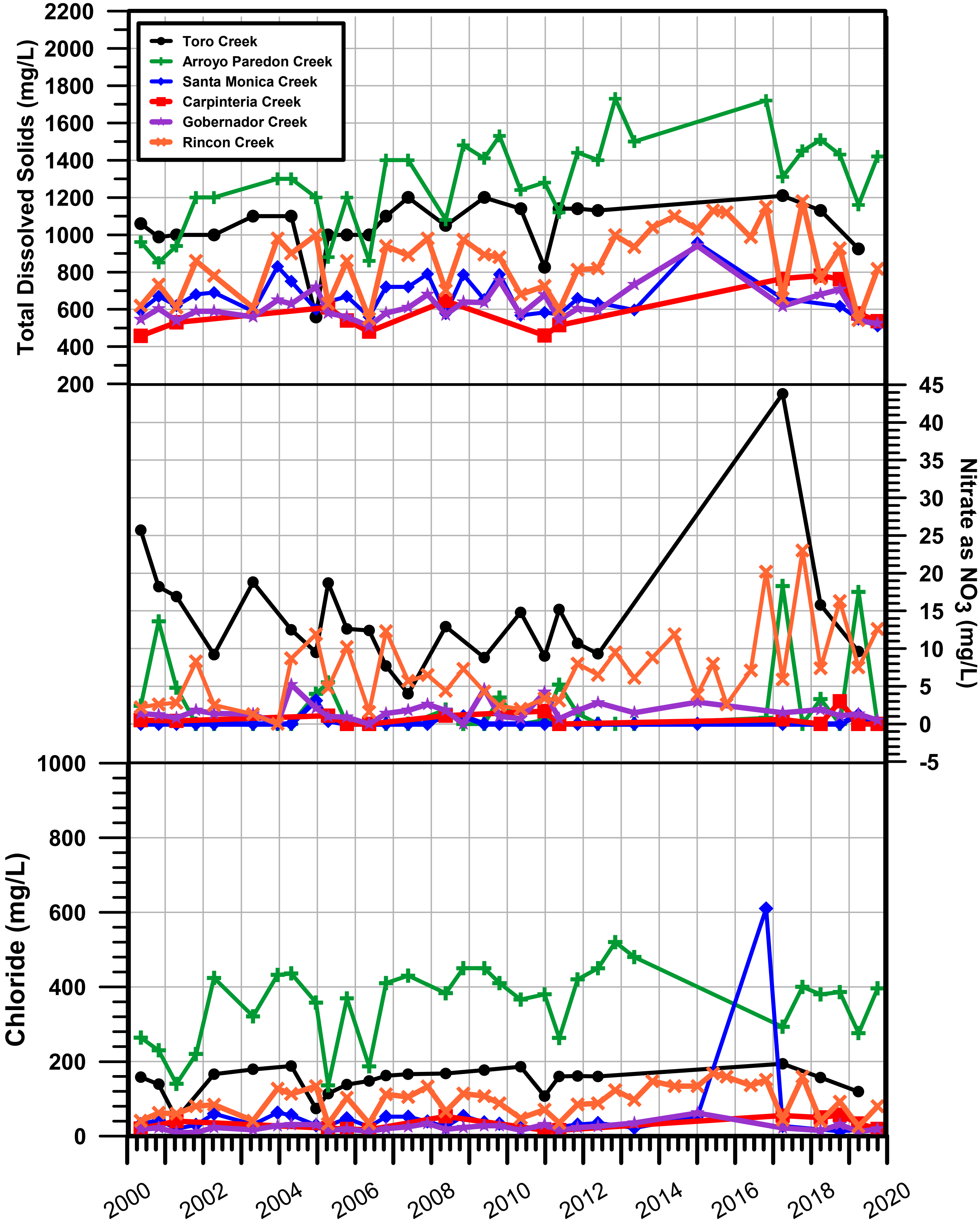
Figure 11. Water Quality Hydrographs - West
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

October 2020
Project No. 19-0011



PUEBLO water resources

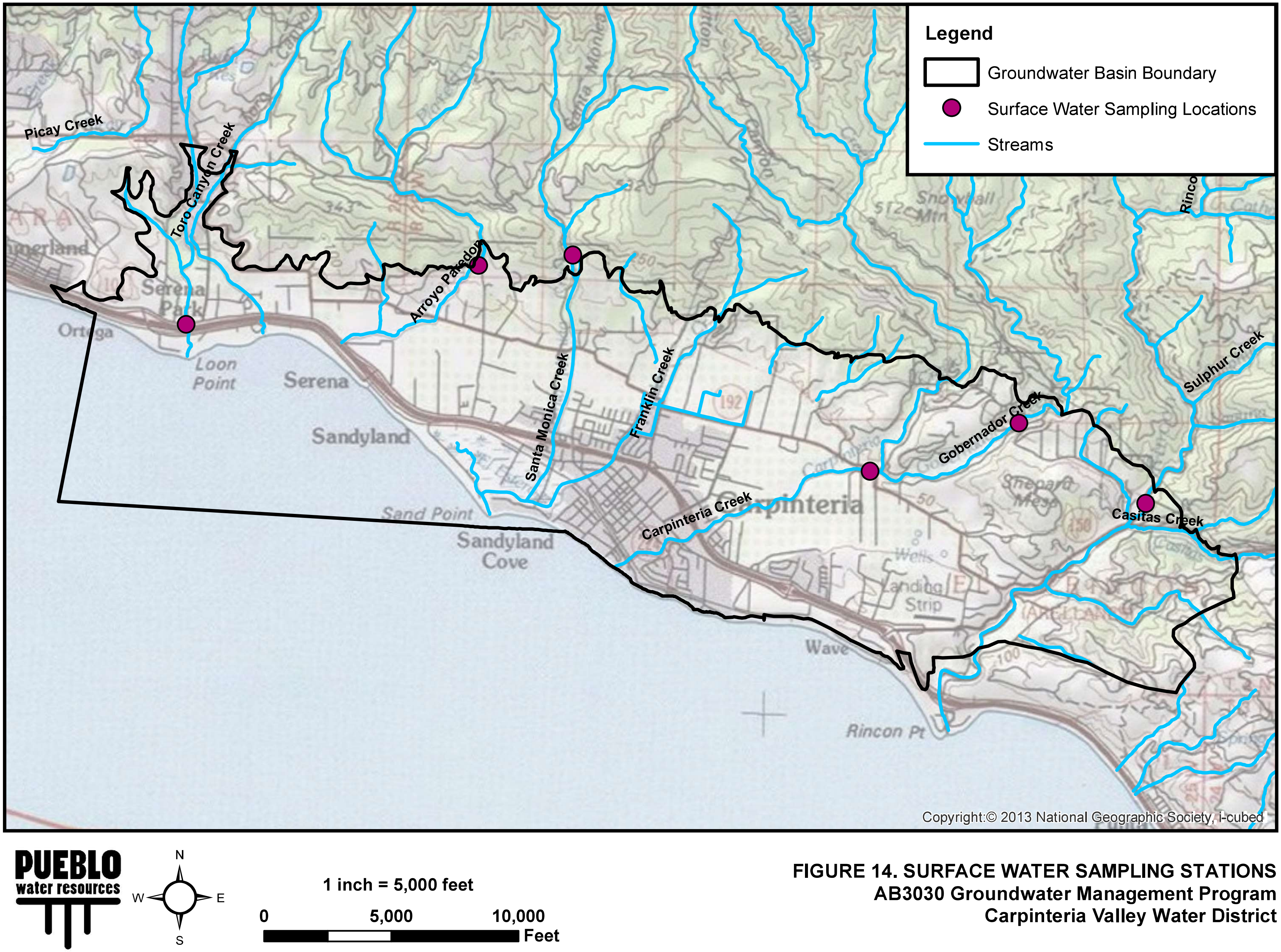
Figure 12. Water Quality Hydrographs - East
AB 3030 Groundwater Management Program
Carpinteria Valley Water District



PUEBLO water resources

Figure 13. Surface Water Quality Hydrographs
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

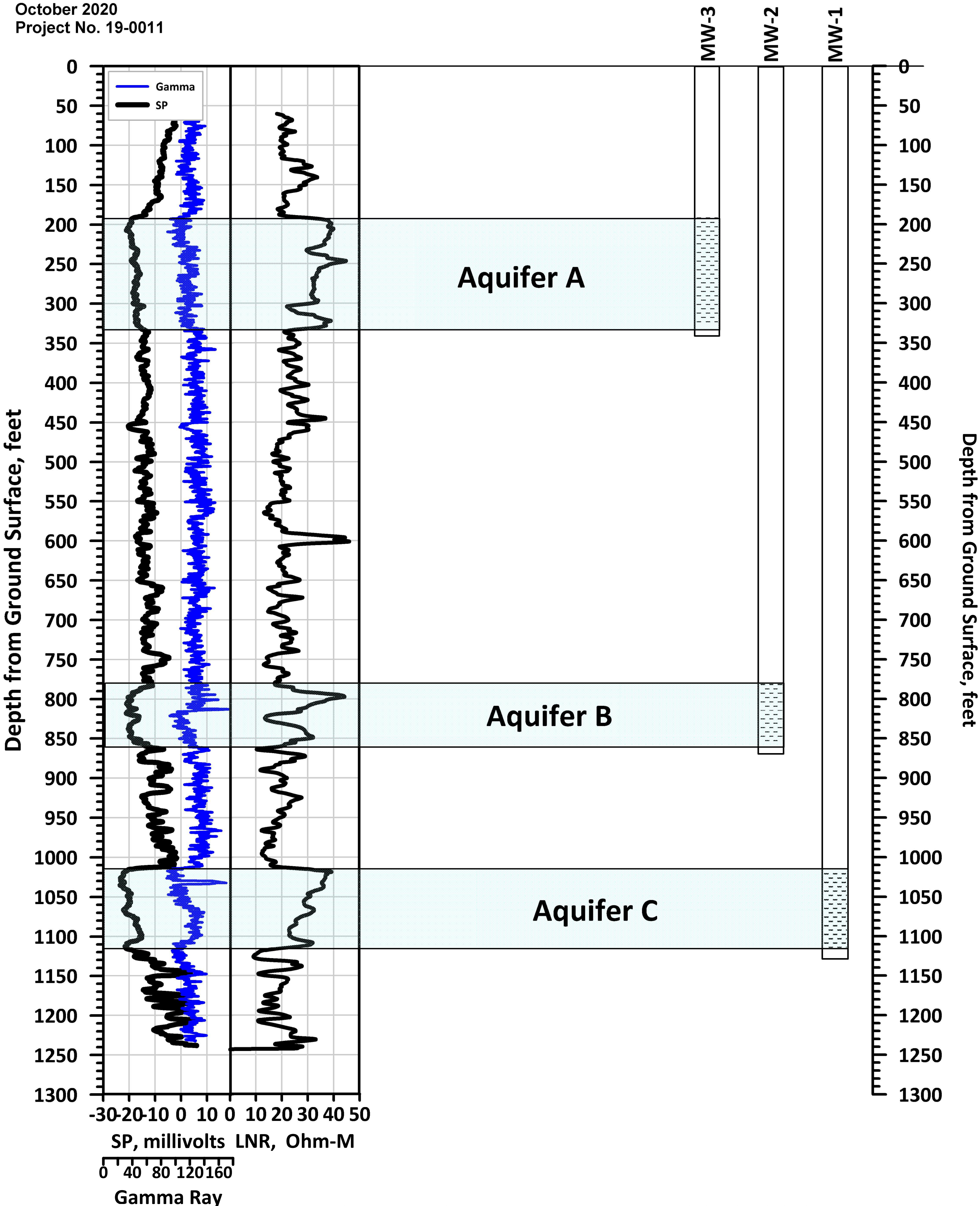
November 2020
Project No. 19-0011



PUEBLO water resources

FIGURE 14. SURFACE WATER SAMPLING STATIONS
AB3030 Groundwater Management Program
Carpinteria Valley Water District

October 2020
Project No. 19-0011



PUEBLO water resources

FIGURE 15. SENTINEL WELL HYDROGEOLOGIC COMPLETIONS
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

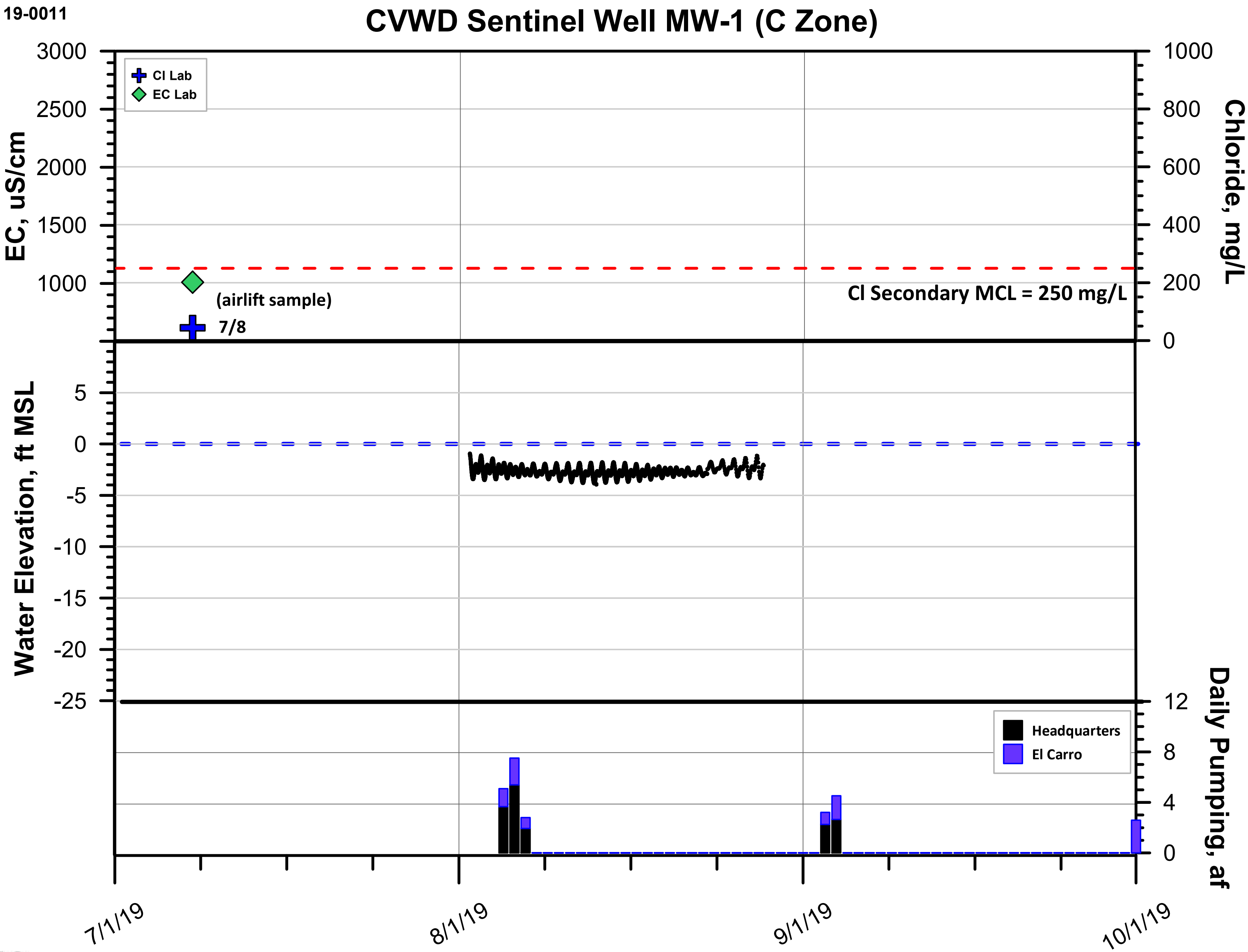


Figure 16. Sentinel Well Hydrograph – MW-1
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

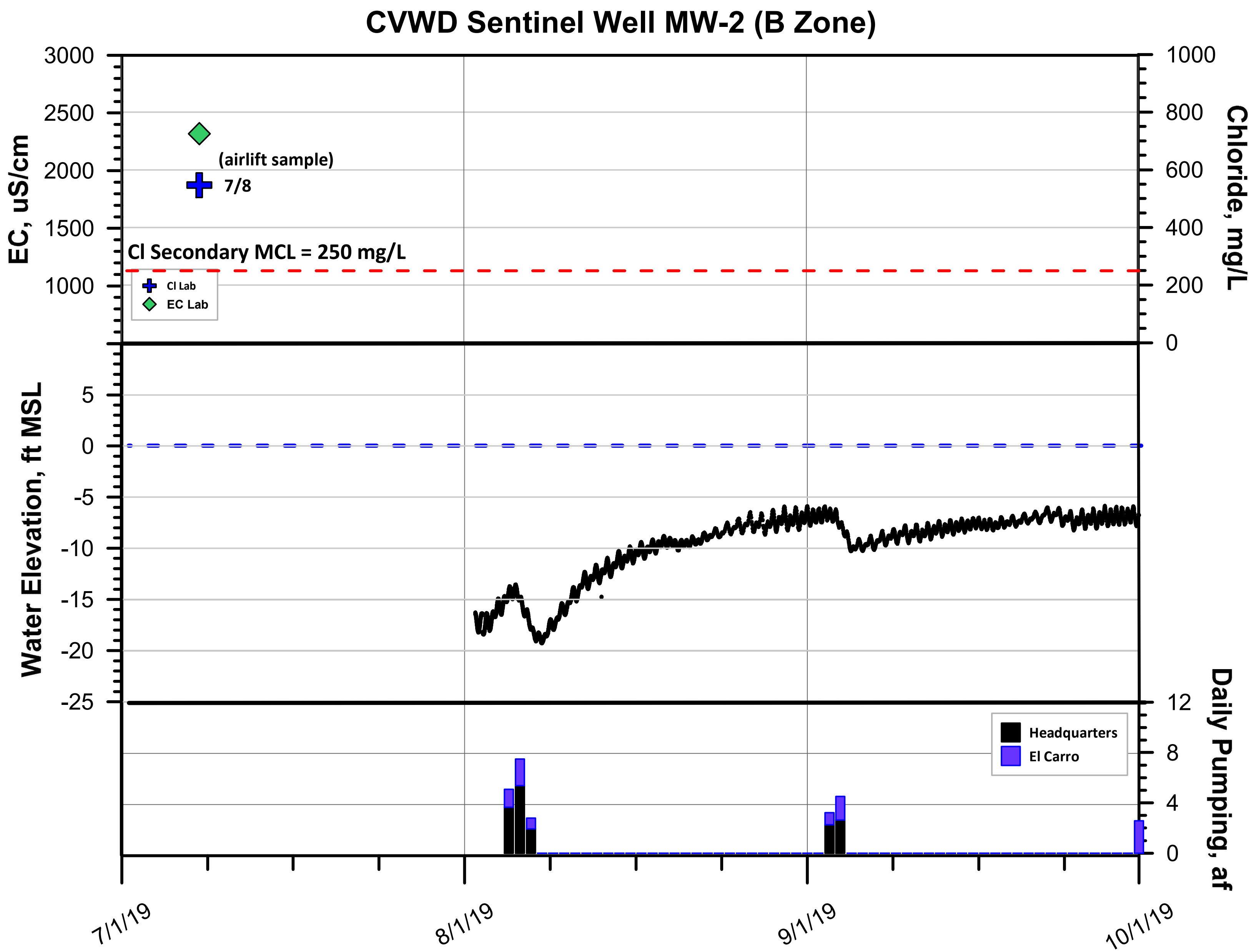


Figure 17. Sentinel Well Hydrograph – MW-2
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

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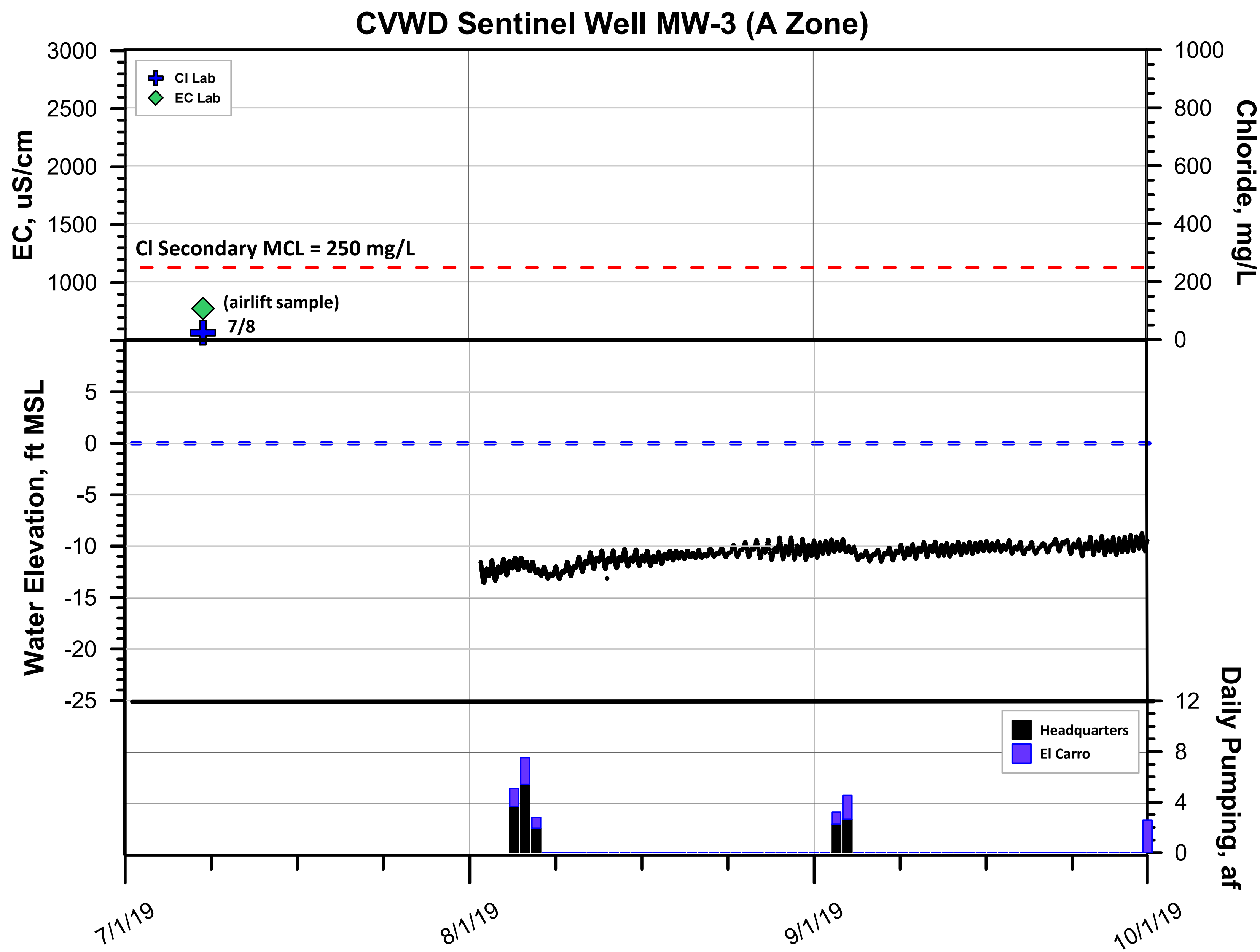

Figure 18. Sentinel Well Hydrograph – MW-3
AB 3030 Groundwater Management Program
Carpinteria Valley Water District

APPENDIX A

HYDROLOGIC DATA

Santa Barbara County - Flood Control District

130 East Victoria Street, Santa Barbara, CA 93101
805.568.3440 - www.countyofsb.org/pwd

Monthly and Yearly Rainfall Record

(Monthly Depth Durations and Average Recurrence Intervals)

Station: 208 **Station Type: Alert, Data Logger w/TB** **Latitude: 342349 Longitude: 1193104**

Station Name: Carpinteria Fire Station **Elevation (ft): 30** **Rainfall (in.)**

WY	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WY
1948-49	0.00	0.00	0.00	2.63	1.43	1.12	1.89	0.18	1.29	0.09	0.00	0.00	8.63
1949-50	0.00	0.00	2.42	3.12	2.24	2.73	1.18	0.38	0.00	0.13	0.09	0.00	12.29
1950-51	0.63	0.61	1.30	0.29	1.89	1.27	0.56	1.46	0.00	0.00	0.00	0.09	8.10
1951-52	0.00	0.80	1.82	4.87	10.75	0.04	6.40	2.02	0.00	0.00	0.00	0.00	26.70
1952-53	0.00	0.00	3.56	4.63	1.51	0.00	1.13	1.53	0.00	0.00	0.00	0.00	12.36
1953-54	0.00	0.00	2.32	0.13	5.57	2.39	3.88	0.34	0.00	0.00	0.00	0.00	14.63
1954-55	0.00	0.00	1.56	1.56	4.41	2.00	0.31	2.71	0.54	0.00	0.00	0.00	13.09
1955-56	0.00	0.00	1.47	5.27	6.94	0.73	0.00	2.52	1.00	0.00	0.00	0.00	17.93
1956-57	0.00	0.07	0.00	0.27	4.10	3.08	0.44	1.57	0.92	0.00	0.00	0.00	10.45
1957-58	0.00	1.52	0.71	4.45	2.75	7.80	5.79	5.05	0.28	0.00	0.00	0.00	28.35
1958-59	1.06	0.00	0.00	0.07	1.96	4.15	0.00	1.18	0.00	0.00	0.00	0.00	8.42
1959-60	0.00	0.00	0.00	0.81	3.21	3.32	1.12	1.94	0.00	0.00	0.00	0.00	10.40
1960-61	0.00	0.05	6.35	0.00	1.16	0.04	0.62	0.00	0.00	0.00	0.00	0.00	8.22
1961-62	0.18	0.00	2.61	1.00	2.33	16.99	1.27	0.00	0.00	0.00	0.00	0.00	24.38
1962-63	0.00	0.49	0.00	0.00	0.89	5.93	3.68	2.57	0.27	1.02	0.00	0.00	14.85
1963-64	1.87	1.02	3.29	0.00	1.51	0.00	1.78	2.29	0.09	0.00	0.00	0.00	11.85
1964-65	0.00	0.78	2.14	4.57	1.02	0.59	2.18	7.44	0.14	0.06	0.00	0.00	18.92
1965-66	0.19	0.00	9.81	3.72	1.76	1.02	0.10	0.00	0.21	0.00	0.00	0.00	16.81
1966-67	0.00	0.00	3.30	6.69	6.00	0.43	2.74	4.27	0.00	0.00	0.00	0.00	23.43
1967-68	0.36	0.00	4.80	1.07	1.79	1.51	3.92	0.93	0.00	0.00	0.00	0.13	14.51
1968-69	0.00	1.21	0.67	2.02	16.30	9.45	0.49	1.81	0.16	0.08	0.00	0.00	32.19
1969-70	0.00	0.00	2.27	0.22	3.02	2.29	5.79	0.00	0.00	0.00	0.00	0.00	13.59
1970-71	0.00	0.05	4.72	5.09	1.17	2.10	0.86	0.56	2.09	0.00	0.00	0.00	16.64
1971-72	0.00	0.13	0.55	6.95	0.63	0.00	0.00	0.16	0.00	0.10	0.00	0.00	8.52
1972-73	0.00	0.22	4.65	0.88	6.17	10.47	3.04	0.05	0.20	0.04	0.00	0.12	25.84
1973-74	0.00	0.57	2.79	1.19	8.70	0.14	4.22	0.25	0.00	0.00	0.00	0.00	17.86
1974-75	0.00	0.89	0.13	7.72	0.00	4.11	4.18	1.15	0.00	0.00	0.00	0.00	18.18
1975-76	0.15	0.18	0.09	0.28	0.00	6.59	2.31	0.90	0.03	0.23	0.00	0.00	10.76
1976-77	5.65	0.00	0.46	0.73	3.87	0.23	1.70	0.00	3.92	0.11	0.00	0.61	17.28
1977-78	0.00	0.00	0.27	6.58	8.83	9.63	11.39	2.44	0.00	0.09	0.00	0.08	39.31
1978-79	1.39	0.09	1.80	2.15	3.23	5.06	7.61	0.00	0.08	0.00	0.00	0.16	21.57
1979-80	0.71	0.65	0.65	1.23	6.78	11.71	3.68	0.76	0.19	0.00	0.04	0.00	26.40
1980-81	0.03	0.00	0.00	1.08	2.84	1.99	5.69	0.81	0.00	0.00	0.00	0.00	12.44
1981-82	0.50	0.00	1.85	0.89	3.10	0.55	5.54	2.70	0.15	0.11	0.00	0.00	15.39
1982-83	1.32	0.58	5.54	3.11	8.89	6.28	7.52	3.73	0.31	0.18	0.00	1.65	39.11
1983-84	0.97	3.93	3.51	3.29	0.04	0.00	0.35	0.24	0.25	0.00	0.00	0.58	13.16
1984-85	0.55	0.45	2.54	5.05	1.49	1.86	1.50	0.12	0.00	0.00	0.00	0.00	13.56
1985-86	0.07	0.65	4.47	0.88	2.07	7.66	5.52	1.60	0.00	0.00	0.00	0.00	22.92
1986-87	1.43	0.00	1.25	0.36	2.08	2.25	3.16	0.13	0.00	0.00	0.00	0.00	10.66
1987-88	0.00	1.36	1.71	3.50	2.58	2.42	0.54	3.35	0.00	0.00	0.00	0.00	15.46
1988-89	0.09	0.00	1.05	2.93	0.44	3.19	0.54	0.71	0.22	0.00	0.00	0.00	9.17
1989-90	0.07	0.96	0.42	0.00	2.79	2.71	0.15	0.09	0.78	0.00	0.00	0.00	7.97
1990-91	0.06	0.00	0.29	0.05	1.60	2.27	13.30	0.04	0.00	0.27	0.02	0.04	17.94
1991-92	0.00	0.55	0.19	5.02	2.76	9.33	3.99	0.00	0.31	0.09	0.42	0.00	22.66
1992-93	0.00	1.74	0.00	5.50	12.35	7.39	5.42	0.00	0.09	0.77	0.07	0.00	33.33
1993-94	0.00	0.09	1.38	1.47	0.98	5.79	2.07	0.65	0.37	0.00	0.00	0.00	12.80
1994-95	0.42	0.40	1.59	1.14	19.08	1.72	10.87	0.35	0.88	0.61	0.00	0.00	37.06
1995-96	0.00	0.00	0.21	3.11	2.03	8.48	2.05	1.14	0.37	0.00	0.00	0.00	17.39
1996-97	0.00	2.70	0.00	6.25	6.97	0.09	0.00	0.00	0.00	0.09	0.00	0.00	16.10
1997-98	0.00	0.08	2.86	7.69	4.42	20.97	3.71	2.13	3.83	0.14	0.00	0.00	45.83
1998-99	0.12	0.00	0.75	0.95	2.26	0.86	3.16	1.87	0.00	0.02	0.00	0.00	9.99
1999-00	0.02	0.00	0.72	0.00	1.43	8.66	2.74	3.90	0.00	0.00	0.00	0.00	17.47
2000-01	0.00	2.18	0.00	0.08	6.30	5.24	4.73	1.67	0.18	0.02	0.03	0.00	20.43
2001-02	0.04	0.49	3.75	1.78	0.59	0.31	0.37	0.11	0.14	0.01	0.05	0.02	7.66
2002-03	0.20	0.01	5.88	4.59	0.09	2.91	4.46	1.90	1.72	0.19	0.02	0.00	21.97
2003-04	0.04	0.09	1.31	1.89	0.42	5.18	0.57	0.01	0.02	0.01	0.03	0.00	9.57
2004-05	0.00	4.46	0.10	8.62	11.20	7.41	3.96	0.74	1.01	0.02	0.00	0.04	37.56
2005-06	0.20	1.08	0.82	0.72	2.82	2.88	3.26	5.88	0.90	0.00	0.00	0.02	18.58
2006-07	0.01	0.09	0.26	0.72	3.24	1.86	0.18	0.70	0.00	0.02	0.01	0.02	7.11
2007-08	0.28	0.28	0.02	3.06	12.00	1.75	0.00	0.08	0.04	0.00	0.00	0.00	17.51

Santa Barbara County - Flood Control District

130 East Victoria Street, Santa Barbara, CA 93101
805.568.3440 - www.countyofsb.org/pwd

Monthly and Yearly Rainfall Record

(Monthly Depth Durations and Average Recurrence Intervals)

Station: 208 **Station Type: Alert, Data Logger w/TB** **Latitude: 342349 Longitude: 1193104**

Station Name: Carpinteria Fire Station **Elevation (ft): 30** **Rainfall (in.)**

WY	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WY
2008-09	0.03	0.06	2.71	2.55	0.63	6.18	0.78	0.15	0.03	0.07	0.00	0.00	13.19
2009-10	0.06	3.61	0.01	2.86	6.14	3.86	0.56	2.45	0.15	0.03	0.02	0.00	19.75
2010-11	0.01	2.45	1.00	9.66	0.59	4.06	6.20	0.05	0.48	0.36	0.00	0.03	24.89
2011-12	0.09	1.06	1.35	0.32	1.59	0.06	2.32	2.93	0.06	0.02	0.02	0.01	9.83
2012-13	0.06	0.04	2.27	3.05	1.32	0.18	0.75	0.26	0.29	0.09	0.02	0.00	8.33
2013-14	0.01	0.02	0.62	0.30	0.00	2.54	1.68	0.48	0.09	0.04	0.00	0.05	5.83
2014-15	0.00	0.00	0.78	3.62	1.69	0.47	0.45	0.24	0.16	0.75	0.32	0.00	8.48
2015-16	0.16	0.48	0.10	0.30	4.60	1.14	3.02	0.26	0.02	0.03	0.00	0.00	10.11
2016-17	0.00	0.87	0.87	3.05	7.21	8.60	0.62	0.31	0.17	0.05	0.00	0.00	21.75
2017-18	0.10	0.00	0.06	0.00	2.47	0.11	6.13	0.05	0.11	0.01	0.00	0.00	9.04
2018-19	0.03	0.23	2.02	0.35	5.06	5.88	2.77	0.18	1.43	0.19	0.01	0.04	18.19
2019-20	0.02	0.01	1.45	4.55	0.42	0.04	3.94	2.30	0.26	0.13	0.01	0.01	13.14
Mean	**0.27**	**0.56**	**1.70**	**2.56**	**3.76**	**3.78**	**2.90**	**1.26**	**0.36**	**0.09**	**0.02**	**0.05**	**17.30**
Max	5.65	4.46	9.81	9.66	19.08	20.97	13.30	7.44	3.92	1.02	0.42	1.65	45.83
StdDev	0.75	0.94	1.85	2.42	3.82	4.03	2.78	1.51	0.73	0.19	0.06	0.21	8.71
Yrs of Rcd	72	72	72	72	72	72	72	72	72	72	72	72	72

Average Recurrence Intervals (in Years)

2	0.00	0.36	1.30	2.22	2.91	3.11	2.45	0.88	0.12	0.00	0.00	0.00	15.93
5	0.45	1.02	2.94	4.20	6.06	6.58	4.79	2.18	0.68	0.16	0.03	0.07	23.01
10	1.01	1.51	4.04	5.45	8.25	8.79	6.28	3.11	1.18	0.36	0.07	0.23	27.50
25	1.87	2.13	5.42	6.95	11.06	11.48	8.10	4.31	1.88	0.66	0.15	0.50	32.99
50	2.59	2.60	6.42	8.03	13.16	13.47	9.44	5.19	2.42	0.91	0.22	0.75	37.02
100	3.34	3.07	7.41	9.06	15.22	15.34	10.70	6.07	2.98	1.17	0.29	1.01	40.83
200	4.13	3.54	8.39	10.08	17.25	17.17	11.93	6.96	3.55	1.43	0.37	1.28	44.56
500	5.71	4.32	9.93	11.54	20.60	19.86	13.75	8.41	4.53	1.96	0.53	1.87	50.04

Santa Barbara County - Flood Control District

130 East Victoria Street, Santa Barbara, CA 93101
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Daily Rainfall Record

Station Number: 208 **Report Produced:** 2/12/2021
Station Name: Carpinteria Fire Station **Record Checked Through:** 8/25/2020
Nearest Landmark: Downtown Carpinteria
Latitude (dms): 342349 **Longitude (dms):** 1193104 **Elevation (ft):** 30
Current Observer: SBCFCD **Gauge Type:** Alert, Data Logger w/TB

Daily Rainfall amounts are recorded as of 8am for the previous 24 hours (PST). Days with no recorded rainfall have been omitted from this report. Rainfall units are expressed in inches. E = Data estimated from nearby gauge, S = Snowfall or snowmelt has affected daily rainfall total, P = Data has been prorated using nearby gauge data, PR = Preliminary data subject to verification, MT = Monthly total only.

Water Year: 2019-20

Day	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1				0.22								0.01
2									0.01			
4				0.51								
5				0.08						0.06	0.01	
6								1.33				
7				0.09			0.26					
8				0.31				0.30				
9				0.08				0.37				
10			0.01					0.28	0.01			
11							0.33	0.01	0.02			
12				0.01			0.46					
13							0.30					
14							0.16					
15							0.26					
16	0.01						0.45					
17					0.37	0.01	1.12					
18		0.01			0.01		0.06		0.19			
20						0.01						
21					0.03					0.01		
22								0.01				
23				1.73		0.02	0.53					
24				0.04	0.01		0.01					
25										0.03		
26	0.01			1.47					0.01	0.01		
27			0.60	0.01								
28			0.64						0.01	0.02		
29			0.19						0.01			
30			0.01									
	0.02	**0.01**	**1.45**	**4.55**	**0.42**	**0.04**	**3.94**	**2.30**	**0.26**	**0.13**	**0.01**	**0.01**

WY Total 13.14

Santa Barbara County - Flood Control District

130 East Victoria Street, Santa Barbara, CA 93101
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Daily Rainfall Record

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Water Year: 2018-19

Day	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1						1.09				0.04		
2						0.71	1.06					
3						1.04	0.34					
4		0.19				0.78		0.01		0.01		
5				0.02		0.29				0.01		
6				0.16	0.85		0.95			0.02		
7				0.05	0.76		0.02		0.03	0.01		
8							0.01			0.01		
9					0.01	0.43						
10	0.01				0.04	0.03						
11						0.15	0.02		0.04			
12					0.71							
13					0.36							
14					0.06	0.32						0.01
15					0.13	0.33						
16	0.01	0.01			0.64	0.26		0.01	0.63			0.01
17				0.01	0.81				0.01	0.02		
18				0.08	0.05							0.01
19	0.01								0.65	0.01	0.01	
20				0.01	0.01		0.20		0.07			
21							0.04	0.02		0.01		0.01
22			0.79				0.06			0.01		
23			0.01	0.01								
24										0.01		
25				0.01						0.03		
26		0.01										
27		0.01						0.04				
28						0.45	0.07	0.01				
29			0.96					0.08				
30		0.01	0.26					0.01				
31					0.63							
	0.03	**0.23**	**2.02**	**0.35**	**5.06**	**5.88**	**2.77**	**0.18**	**1.43**	**0.19**	**0.01**	**0.04**

WY Total 18.19

Santa Barbara County - Flood Control District

130 East Victoria Street, Santa Barbara, CA 93101
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Daily Rainfall Record

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Report Produced: 2/12/2021
Station Name: Carpinteria Fire Station
Record Checked Through: 8/25/2020
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Water Year: 2017-18

Day	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
2							0.51	0.01	0.02			
3							0.35					
4	0.05				0.02							
6									0.01			
8					0.02	0.01						
9					1.98				0.01			
10					0.43							
11	0.05						0.91					
12						0.01	0.01					
13					0.01	0.02	0.06					
14						0.06	0.37					
15							0.36					
16			0.03									
17			0.03				0.17			0.01		
19					0.01			0.04				
21							0.46					
22							1.65					
23							1.27					
24							0.01					
27						0.01						
30									0.05			
31									0.02			
	0.10	**0.00**	**0.06**	**0.00**	**2.47**	**0.11**	**6.13**	**0.05**	**0.11**	**0.01**	**0.00**	**0.00**

WY Total 9.04

APPENDIX B

WATER QUALITY DATA

Summary of Water Quality Data, Spring & Fall 2018
Carpinteria Valley Water District
Groundwater Basin Data Collection Program

Well No.	Owner/Name	Sample Date	Calcium	Magnesium	Potassium	Sodium	Carbonate	Bicarbonate	Sulfate	Chloride	Nitrate	Fluoride	Boron	Copper	Iron	Manganese	Zinc	Field pH	Lab pH	Field EC	Lab EC	SAR	TDS	Alkalinity	Hardness	Ammonia Nitrogen
4N/25W-19E1	Ocean Breeze	4/10/2018	180	51	2	224	<10	340	145	480	46.1	1.3	2	<0.01	0.05	<0.01	<0.02	7.17	6.6	2.240	2.370	3.8	1470	280	659	
		10/9/2018	195	53	2	223	<10	330	147	520	49.7	1.2	2	<0.01	<0.03	<0.01	<0.02	7.37	7.4	2.420	2.540	3.7	1520	270	705	
4N/25W-19J4	Carleton	4/10/2018	133	37	<1	47	<10	300	136	97	96.6	0.3	<0.1	<0.01	3.2	0.02	0.15	7.34	7.2	1.249	1.250	0.9	847	250	484	
		10/9/2018	138	40	2	49	<10	300	128	82	82.3	0.3	<0.1	<0.01	0.06	0.02	0.02	7.61	7.1	1.209	1.230	0.9	822	240	509	
4N/25W-19K5	Westland Floral	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-19K9	Westland Floral	4/10/2018	161	48	1	77	<10	360	214	140	115	0.4	0.5	0.04	<0.03	0.02	<0.02	7.43	8	1.525	1.560	1.4	1120	300	599	
		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4N/25W-19M1	Abbott	4/25/2018	270	73	2	170	<10	420	300	375	166	0.8	1.1	0.02	0.85	0.02	<0.02	7.47	6.9	1.918	2.550	2.4	1780	350	974	
		10/23/2018	278	66	2	156	<10	410	254	347	154	0.7	1.1	0.03	2.6	0.05	<0.02	7.58	7.5	2.350	2.440	2.2	1670	340	965	
4N/25W-19R1	Westland Floral	4/11/2018	92	27	3	61	<10	330	122	47	12.1	0.3	0.1	0.01	<0.03	<0.01	0.06	7.89	7.3	0.913	0.875	1.4	694	270	341	
		10/12/2018	136	36	1	48	<10	300	134	100	72	0.4	<0.1	<0.01	0.05	0.24	<0.02	7.44	7.9	1.162	1.150	0.9	827	240	487	
4N/25W-20C1	Gibson	5/1/2018	89	29	2	77	<10	340	99.9	83	<0.04	0.4	0.2	<0.01	<0.03	0.34	0.06	7.85	7.3	0.993	1.000	1.8	720	280	341	
		10/16/2018	96.5	30.5	1.9	84.9	<10	340	115	87	1.1	0.4	0.2	0.02	0.11	0.37	1.4	7.74	8.2	0.984	1.010	1.9	757	270	366	
4N/25W-20J2	Persoon	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20K4	CVWD (High School, Raw)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20K4	CVWD (High School,Treated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20L2	Westland Floral	4/11/2018	74	21	2	94	<10	380	79.2	58	3	0.4	0.2	<0.01	0.09	0.34	<0.02	7.71	7.1	0.931	0.919	2.5	712	310	271	
		10/11/2018	77	22	2	94	<10	380	84.5	63	3.4	0.4	0.2	<0.01	0.1	0.37	<0.02	7.47	7.9	0.922	0.930	2.4	726	310	283	
4N/25W-20L3	Persoon	4/17/2018	126	47	2	92	<10	350	150	109	149	0.4	0.1	<0.01	<0.03	<0.01	0.1	7.54	7.1	1.299	1.390	1.8	1030	290	508	
		10/16/2018	119	38.8	1.7	94.2	<10	340	132	104	87.8	0.3	0.1	0.2	<0.03	<0.01	0.57	7.43	7.6	1.213	1.250	1.9	918	280	457	
4N/25W-20M1	Ocean Breeze/Foothill	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20Q3	Westland Floral	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20R4	Persoon	4/11/2018	97	30	2	71	<10	390	92.1	55	38	0.3	0.1	<0.01	<0.03	0.04	0.03	7.93	7.3	1.003	1.000	1.6	775	320	365	
		10/16/2018	103	30.7	2	75.6	<10	390	87.3	60	40.4	0.3	0.1	<0.01	<0.03	0.03	0.02	7.94	7.9	1.004	0.994	1.7	789	320	383	
4N/25W-21F1	Rancho Antigua	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-21L1	Bradley	4/25/2018	89	31	2	74	<10	390	121	63	1.9	0.3	0.2	<0.01	<0.03	0.01	<0.02	7.94	7.2	0.990	0.999	1.7	772	320	350	
		10/9/2018	90	31	2	77	<10	390	99.9	55	1.8	0.3	0.1	<0.01	<0.03	0.01	<0.02	7.47	8	0.989	0.944	1.8	747	320	352	
4N/25W-21N7	Ocean Breeze	4/10/2018	81	26	2	68	<10	360	114	43	1.4	0.2	0.1	<0.01	<0.03	0.11	<0.02	7.62	7.2	0.906	0.908	1.7	696	290	309	
		10/9/2018	86	28	2	72	<10	360	114	42	1.5	0.2	0.1	<0.01	<0.03	0.1	<0.02	7.62	7.4	0.901	0.907	1.7	706	290	330	
4N/25W-21N4	Brand Flowers	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-21Q1	Overgaag/Westerlay Roses	4/12/2018	92	35	2	70	<10	350	81.6	80	43	0.4	0.1	<0.01	<0.03	0.19	<0.02	7.83	7.3	0.979	1.000	1.6	754	290	374	
		10/15/2018	83	34	1	71	<10	340	70.5	68	41.5	0.4	<0.1	<0.01	<0.03	0.54	<0.02	7.44	7.4	0.980	0.920	1.7	709	280	347	
4N/25W-22R4	Vedder	4/10/2018	104	31	2	54	<10	300	147	81	10.7	0.2	0.1	<0.01	0.09	<0.01	<0.02	7.37	7.2	1.017	1.010	1.2	730	250	387	
		10/11/2018	109	31	2	54	<10	300	142	77	10.8	0.2	0.1	<0.01	0.82	<0.01	6.1	7.61	7.6	0.995	0.981	1.2	726	250	400	
4N/25W-25F1	Nichols	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-26B1	Dautch/Lewis	5/15/2018	184	41.5	1.7	51.8	<10	240	97	282	95.7	0.1	<0.1	<0.01	<0.03	<0.01	<0.02	7.6	7.3	1.310	1.580	0.9	994	200	630	
		10/26/2018	192	43	2	54	<10	240	101	282	86.1	0.2	<0.1	<0.01	0.08	<0.01	<0.02	8.04	7.7	1.160	1.580	0.9	1000	200	656	
4N/25W-26C8	Thor	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-26P2	Bowtie Orchard	6/7/2018	96	40	2	77	<10	320	113	177	28	0.4	0.1	<0.01	<0.03	<0.01	<0.02	7.87	7.3	0.995	1.270	1.7	853	260	404	
		10/9/2018	129	37	2	82	<10	310	104	199	30.4	0.4	0.1	<0.01	0.09	<0.01	<0.02	7.61	7.4	1.278	1.310	1.6	894	250	474	
4N/25W-27D1	Westland Floral	4/17/2018	116	41	2	69	<10	320	120	137	41.4	0.3	<0.1	<0.01	0.05	<0.01	<0.02	7.81	7.1	1.207	1.180	1.4	847	260	458	
		11/5/2018	101	33	1	56	<10	310	135	80	20.2	0.3	<0.1	<0.01	<0.03	<0.01	<0.02	7.86	7.5	0.981	0.994	1.2	736	250	388	
4N/25W-27E1	Phelps	5/1/2018	121	35	1	43	<10	340	146	46	66.2	0.4	<0.1	<0.01	<0.03	<0.01	<0.02	7.89	7.2	1.058	1.040	0.9	795	280	446	
		10/9/2018	116	32	1	42	<10	320	127	39	50.6	0.3	<0.1	<0.01	<0.03	<0.01	<0.02	7.7	7.5	0.975	0.964	0.9	728	260	461	
4N/25W-27F2	CVWD (Smillie well)	4/5/2018	101	27	1	35	<10	300	136	29	11	0.2	<0.1	<0.01	<0.03	<0.01	<0.02	7.48	7.1	0.856	0.847	0.8	640	250	363	
		10/8/2018	106	28	2	36	<10	300	140	30	11.3	0.2	<0.1	<0.01	<0.03	<0.01	<0.02	7.89	7.2	0.849	0.841	0.8	654	250	380	
4N/25W-27H2	Cate School *New*	5/29/2018	97	27	1	32	<10	290	151	26	7.1	0.3	<0.1	0.02	0.33	0.01	0.82	8.03	7.6	0.651	0.807	0.7	631	230	353	
		10/10/2018	93	26	<1	37	<10	280	146	22	6.1	0.2	<0.1	0.04	<0.03	<0.01	0.24	7.59	7.8	0.788	0.789	0.9	610	230	339	
4N/25W-27R2	Shepard Farms	4/10/2018	124	38	2	104	<10	340	107	214	10	0.5	0.1	<0.01	<0.03	0.25	0.04	7.62	7.3	1.349	1.410	2.1	940	280	466	
		10/15/2018	128	37	2	104	<10	340	102	211	9.7	0.5	0.1	<0.01	<0.03	0.27	0.03	7.78	7.9	1.380	1.420	2.1	934	280	472	
4N/25W-28A1	Moore	4/10/2018	91	33	2	66	<10	360	72.9	72	45	0.4	0.1	<0.01	<0.03	0.02	<0.02	7.81	7.2	0.989	0.953	1.5	742	290	363	
		10/9/2018	93	31	1	62	<10	340	84.2	60	0.9	0.3	<0.1	<0.01	<0.03	0.1	0.02	7.5	7.5	0.961	0.932	1.4	672	280	360	
4N/25W-28D2	CVWD (El Carro,Raw)	4/5/2018	90	26	1	52	<10	330	138	39	13.1	0.3	<0.1	<0.01	0.05	0.09	<0.02	7.54	7.5	0.872	0.909	1.2	689	270	332	
		10/8/2018	97	28	2	55	<10	340	127	37	13.9	0.2	<0.1	<0.01	<0.03	0.09	<0.02	7.6	7.6	0.879	0.905	1.3	700	280	357	
4N/25W-28D2	CVWD (El Carro,Treated)	4/5/2018	92	27	1	54	<10	340	137	41	13.5	0.3	<0.1	0.03	<0.03	<0.01	0.07	7.59	7.4	0.899	0.914	1.3	706	280	341	
		10/8/2018	96	28	2	57	<10	340	129	41	13.9	0.2	<0.1	<0.01	<0.03	<0.01	<0.02	7.72	7.4	0.907	0.900	1.3	707	280	355	
4N/25W-28F7	CVWD (Lyons)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-28G3	Dal Pozzo	4/18/2018	129	37	2	51	<10	380	168	53	47.6	0.3	<0.1	<0.01	<0.03	<0.01	<0.02	7.6	6.6	1.126	1.120	1	868	310	474	
		10/16/2018	136	37.8	1.4	55.1	<10	380	170	53	39.7	0.3	<0.1	<0.01	<0.03	<0.01	<0.02	7.65	7.5	1.091	1.100	1.1	873	310	495	
4N/25W-28H1	Huff	4/25/2018	126	37	2	49	<10	370	137	50	85.2	0.4	<0.1	0.17	<0.03	<0.01	0.08	7.9	7.2	1.129	1.110	1	857	310	467	
		10/22/2018	128	36	2	49	<10	380	142	53	87.8	0.3	<0.1	<0.01	<0.03	<0.01	0.07	7.65	7.5	1.133	1.110	1	878	310	467	
4N/25W-28J1	Catlin (old)	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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ELL #2 (34.399,-119.5) 4N	Catlin *New*	4/30/2018	111	30	2	44	<10	330	132	44	51.8	0.3	<0.1	<0.01	<0.03	<0.01	0.09	7.55	7.1	0.949	0.964	1.0	745	270	400	
		10/15/2018	110	29	1	45	<10	320	117	37	36.9	0.2	<0.1	<0.01	0.10	<0.01	0.28	7.58	7.9	0.974	0.933	1.0	696	270	394	
4N/25W-29D7	Santa Ynez Well (CVWD)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-29D8	H.Q. Well (CVWD Raw)	4/5/2018	89	26	1	61	<10	330	105	49	9.3	0.3	0.1	<0.01	<0.03	0.05	<0.02	7.81	7.8	0.866	0.890	1.5	671	270	329	
		10/5/2018	101	25	<1	64	<10	320	103	50	9.5	0.3	0.1	<0.01	<0.03	0.1	<0.02	7.76	7.4	0.876	0.866	1.5	673	270	355	
4N/25W-29D8	H.Q. Well (CVWD Finish)	4/5/2018	85	26	1	63	<10	330	117	55	9.4	0.3	<0.1	<0.01	<0.03	<0.01	<0.02	7.85	7.7	0.731	0.882	1.5	687	270	319	
		10/5/2018	109	25	<1	66	<10	320	103	52	9.7	0.3	<0.1	0.01	<0.03	<0.01	<0.02	7.59	7.5	0.885	0.867	1.5	685	260	375	
4N/25W-29K2	Perkins	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-29L1	Saragosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-30D1	Sandyland/Slough Well	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-34A1	Abbott	4/27/2018	159	52	3	100	<10	380	336	128	0.9	0.4	0.2	<0.01	27.8	0.23	<0.02	7.79	7.1	1.508	1.540	1.8	1160	310	611	
		10/30/2018	146	44	3	95	<10	380	312	120	<0.4	0.4	0.2	<0.01	1.1	0.18	<0.02	8.02	7.7	1.394	1.460	1.8	1100	310	545	
4N/25W-34G1	Aluminum Filter	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-34B4	Twin Pines	4/17/2018	96	29	2	62	<10	340	113	74	8.8	0.4	0.1	0.01	<0.03	0.03	0.08	7.86	7.3	0.958	0.961	1.4	725	270	359	
		10/9/2018	92	28	2	56	<10	320	93.6	65	5.1	0.3	0.1	<0.01	<0.03	0.04	0.03	7.81	7.9	0.914	0.923	1.3	662	260	345	
4N/25W-35B5	Van der Kar	4/12/2018	146	48	2	87	<10	380	293	98	22.4	0.3	0.2	<0.01	<0.03	<0.01	<0.02	8.09	7.2	1.435	1.430	1.6	1080	310	562	
		10/11/2018	153	50	2	88	<10	370	246	100	19.1	0.3	0.2	<0.01	<0.03	<0.01	<0.02	8.01	7.9	1.370	1.410	1.6	1030	310	587	
4N/25W-35E4	Van der Kar	4/12/2018	160	54	4	159	<10	190	552	168	2.4	0.4	0.2	<0.01	0.2	0.06	<0.02	7.61	7.3	1.787	1.800	2.8	1290	150	621	
		10/11/2018	161	51	3	150	<10	180	485	154	3	0.3	0.1	0.02	0.41	0.08	<0.02	7.59	7.8	1.693	1.800	2.6	1190	150	612	
4N/26W-13R1	Triguiero	4/11/2018	230	49	2	92	<10	430	263	215	0.8	0.4	<0.1	<0.01	0.04	0.16	<0.02	7.23	7.1	1.333	1.770	1.4	1280	360	775	
		10/16/2018	223	44.7	2.4	87.9	<10	430	243	202	1.6	0.4	<0.1	0.02	<0.03	0.16	<0.02	7.29	7.3	1.628	1.680	1.4	1240	350	740	
4N/26W-23A2	Zangger	4/11/2018	57	36	2	166	<10	410	137	136	6.4	0.9	0.4	<0.01	0.66	0.04	0.22	7.76	7.4	1.313	1.320	4.2	951	340	290	
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4N/26W-24F1	Hickey Brothers	5/1/2018	79	36	2	134	<10	450	38.5	153	4.4	1.1	0.3	<0.01	0.22	0.10	<0.02	7.58	7.1	1.225	1.240	3.1	898	370	345	
		10/12/2018	79	35	2	130	<10	440	42	145	2.6	1.1	0.2	<0.01	0.45	0.08	<0.02	7.64	7.5	1.240	1.230	3.1	876	360	341	
Toro Creek		4/2/2018	133	52	6	123	<10	370	275	157	15.8	0.4	0.2	<0.01	<0.03	<0.01	0.04	8.74	8.2	1.478	1.510	2.3	1130	300	546	ND
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Arroyo Paredon Creek		4/2/2018	142	57	7	250	<10	470	198	380	3.3	1.4	1.6	<0.01	0.11	0.46	0.03	8.66	6.7	1.679	2.190	4.5	1510	390	589	ND
		10/8/2018	114	32	4	319	<10	490	79.4	386	<0.4	3.2	3.9	<0.01	0.18	0.10	<0.02	8.51	8.2	2.160	2.260	6.8	1430	410	416	ND
Santa Monica Creek		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		10/8/2018	100	26	2	37	<10	300	139.0	13	<0.4	0.3	0.1	<0.01	0.06	0.03	<0.02	8.53	8.0	0.738	0.755	0.9	617	250	356	ND
Carpinteria Creek		4/2/2018	88	41	6	70	<10	330	196	50	<0.9	0.3	0.2	<0.01	0.05	0.15	0.02	8.59	7.4	0.891	1.000	1.5	781	270	388	ND
		10/5/2018	95	40	6	80	<10	320	161	57	3.0	0.3	0.3	<0.01	0.08	0.02	<0.02	8.63	8.4	0.943	0.927	1.7	762	260	402	ND
Gobernador Creek		4/2/2018	103	31	5	34	<10	340	151	15	1.9	0.2	0.1	<0.01	0.16	0.22	0.02	8.71	7.6	0.848	0.844	0.8	681	280	385	ND
		10/5/2018	99	39	3	57	<10	350	127	31	1.1	0.3	0.1	<0.01	<0.03	<0.01	<0.02	8.60	8.3	0.870	0.855	1.2	707	280	407	ND
Rincon Creek		4/2/2018	107	36	5	49	<10	380	141	40	7.4	0.3	0.2	<0.01	1.6	0.41	0.03	8.7	8.2	0.947	0.899	1	766	310	415	ND
		10/5/2018	110	50	3	112	<10	390	153	92	16.3	0.6	0.6	<0.01	<0.03	<0.01	<0.02	8.57	8.2	1.258	1.290	2.2	927	320	480	ND

Summary of Water Quality Data, Spring & Fall 2018
Carpinteria Valley Water District
Groundwater Basin Data Collection Program

Well No.	Owner/Name	Sample Date	Calcium	Magnesium	Potassium	Sodium	Carbonate	Bicarbonate	Sulfate	Chloride	Nitrate	Fluoride	Boron	Copper	Iron	Manganese	Zinc	Field pH	Lab pH	Field EC	Lab EC (µS/cm)	SAR	TDS	Alkalinity	Hardness	Ammonia Nitrogen
4N/25W-19E1	Ocean Breeze	4/15/2019	181.00	55.00	2.00	218.00	<10	340.00	166.00	600.00	55.90	1.20	1.90	<0.01	<0.03	0.01	<0.02	7.64	6.70	1789.00	2520.00	3.60	1620.00	280.00	678.00	
		10/7/2019	189.00	56.00	2.00	216.00	<10	340.00	164.00	500.00	55.90	1.30	2.00	<0.01	<0.03	0.01	<0.02	7.38	6.90	3340.00	2600.00	3.50	1520.00	280.00	702.00	
4N/25W-19J4	Carleton	4/9/2019	140.00	41.00	1.00	52.00	<10	300.00	139.00	127.00	121.00	0.30	<0.01	<0.01	0.21	<0.01	0.05	7.62	7.40	932.00	1280.00	1.00	921.00	250.00	518.00	
		10/4/2019	136.00	39.00	1.00	48.00	<10	310.00	153.00	106.00	96.40	0.30	<0.1	<0.01	0.08	<0.01	<0.02	7.82	7.30	1240.00	1260.00	0.90	890.00	250.00	500.00	
4N/25W-19K5	Westland Floral	4/19/2019	200.00	59.70	1.90	81.80	<10	390.00	204.00	175.00	189.00	0.30	0.30	0.04	23.90	0.52	0.13	7.52	7.10	2200.00	1760.00	1.30	1300.00	320.00	745.00	
		10/7/2019	167.00	65.00	2.00	93.00	<10	420.00	242.00	192.00	193.00	0.30	0.30	<0.01	<0.03	<0.01	<0.02	7.20	7.00	2700.00	1980.00	1.50	1370.00	340.00	684.00	
4N/25W-19K9	Westland Floral	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
		10/7/2019	141.00	43.00	1.00	72.00	<10	370.00	215.00	126.00	86.70	0.40	0.40	<0.01	1.30	1.00	<0.02	7.76	7.30	1422.00	1510.00	1.40	1060.00	310.00	529.00	
4N/25W-19K10	Westland Floral	4/19/2019	119.00	33.00	1.00	58.00	<10	310.00	151.00	109.00	61.50	0.40	0.30	<0.01	<0.03	0.01	0.23	8.46	7.70	1218.00	1170.00	1.20	843.00	260.00	433.00	
		10/7/2019	124.00	37.00	1.00	55.00	<10	310.00	150.00	100.00	54.40	0.40	0.40	<0.01	<0.03	0.01	0.15	7.68	7.40	1539.00	1170.00	1.10	832.00	260.00	462.00	
4N/25W-19M1	Whitney Abbott	5/17/2019	238.00	66.00	1.00	143.00	<10	420.00	331.00	370.00	199.00	0.80	1.10	<0.01	0.53	<0.01	<0.02	7.74	7.20	3390.00	2590.00	2.10	1770.00	350.00	865.00	
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4N/25W-19R1	Westland Floral	4/11/2019	86.00	34.00	3.00	50.00	<10	230.00	249.00	24.00	2.40	0.40	0.30	0.01	<0.03	<0.01	<0.02	8.45	7.80	704.00	872.00	1.20	679.00	190.00	354.00	
		10/10/2019	133.00	38.00	1.00	49.00	<10	310.00	157.00	108.00	73.60	0.40	<0.1	0.01	0.06	0.19	0.05	7.70	7.10	1171.00	1180.00	1.00	870.00	250.00	488.00	
4N/25W-20C1	Gibson	4/11/2019	83.00	29.00	2.00	78.00	<10	340.00	115.00	85.00	<0.9	0.30	0.20	<0.01	<0.03	0.30	<0.02	7.65	7.70	973.00	1010.00	1.90	732.00	280.00	326.00	
		10/8/2019	87.00	29.00	2.00	76.00	<10	350.00	110.00	88.00	<0.9	0.40	0.20	<0.01	0.06	0.36	1.50	7.81	7.60	1444.00	1030.00	1.80	742.00	290.00	336.00	
4N/25W-20J2	Persoon	5/1/2019	87.00	27.00	1.00	61.00	<10	380.00	88.20	51.00	31.10	0.30	0.10	0.01	0.04	0.08	0.03	8.13	7.80	1366.00	986.00	1.50	727.00	310.00	328.00	
		10/8/2019	91.00	29.00	2.00	65.00	<10	380.00	91.70	55.00	35.60	0.30	0.10	0.19	0.10	0.59	0.06	7.61	7.60	1402.00	997.00	1.50	750.00	310.00	346.00	
4N/25W-20K4	VWD (High School, Ra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20K4	WD (High School,Trea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20L2	Westland Floral	4/8/2019	74.00	21.00	2.00	94.00	<10	380.00	83.90	64.00	2.30	0.30	0.20	<0.01	0.12	0.33	<0.02	7.65	7.50	910.00	909.00	2.50	722.00	310.00	271.00	
		11/18/2019	78.00	22.00	1.00	98.00	<10	390.00	79.90	65.00	1.60	0.30	0.20	<0.01	0.16	0.40	<0.02	6.73	7.50	1335.00	1010.00	2.50	736.00	320.00	285.00	
4N/25W-20L3	Persoon	4/17/2019	113.00	40.00	1.50	83.50	<10	340.00	139.00	102.00	126.00	0.30	0.10	<0.01	<0.03	<0.01	0.04	7.48	7.20	1885.00	1300.00	1.70	945.00	280.00	447.00	
		10/8/2019	118.00	45.00	1.00	87.00	<10	360.00	151.00	102.00	143.00	0.40	0.10	0.20	<0.03	<0.01	0.09	7.65	7.60	1910.00	1380.00	1.70	1010.00	290.00	480.00	
4N/25W-20M1	Ocean Breeze/Foothill	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20Q3	Westland Floral	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-20R4	Persoon	4/5/2019	94.00	27.00	2.00	68.00	<10	380.00	89.00	56.00	33.40	0.30	0.10	<0.01	<0.03	0.03	<0.02	8.15	7.50	956.00	945.00	1.60	750.00	310.00	346.00	
		10/8/2019	92.00	29.00	2.00	65.00	<10	390.00	89.70	54.00	35.20	0.30	0.10	<0.01	<0.03	0.03	<0.02	7.93	7.90	1405.00	9820.00	1.50	757.00	320.00	349.00	
4N/25W-21F1	Terrance Flannery	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-21L1	Brand Farms	4/22/2019	90.20	32.00	1.80	80.90	<10	390.00	111.00	60.00	1.70	0.30	0.20	0.03	<0.03	<0.01	<0.02	7.93	7.90	1397.00	996.00	1.90	768.00	320.00	357.00	
		10/15/2019	84.00	33.00	1.00	72.00	<10	390.00	117.00	63.00	1.90	0.30	0.20	<0.01	<0.03	0.01	<0.02	6.51	7.10	1421.00	994.00	1.70	762.00	320.00	345.00	
4N/25W-21N7	Ocean Breeze	4/5/2019	78.00	27.00	2.00	73.00	<10	370.00	102.00	52.00	2.20	0.30	0.10	<0.01	<0.03	0.03	<0.02	7.70	7.20	898.00	912.00	1.80	706.00	300.00	306.00	
		10/16/2019	78.00	43.00	1.00	72.00	<10	380.00	99.70	52.00	2.80	0.30	0.10	0.84	<0.03	0.07	0.81	6.91	7.40	841.00	975.00	1.60	729.00	310.00	372.00	
4N/25W-21N4	Brand Flowers	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-21Q1	ergaag/Westerlay Ros	4/8/2019	79.00	26.00	1.00	73.00	<10	350.00	90.50	61.00	13.10	0.40	<0.1	<0.01	<0.03	0.48	<0.02	8.15	7.80	608.00	890.00	1.80	694.00	280.00	304.00	
		10/8/2019	78.00	27.00	1.00	70.00	<10	350.00	92.80	59.00	14.50	0.40	0.10	<0.01	<0.03	0.55	<0.02	7.94	7.40	1217.00	915.00	1.70	693.00	280.00	306.00	
4N/25W-22R4	Vedder	4/9/2019	102.00	32.00	2.00	56.00	<10	310.00	158.00	74.00	8.80	0.20	0.10	<0.01	0.05	<0.01	<0.02	7.85	7.10	953.00	965.00	1.20	743.00	250.00	386.00	
		10/4/2019	107.00	32.00	1.00	53.00	<10	300.00	151.00	88.00	10.00	0.20	0.10	<0.01	0.12	<0.01	<0.02	7.91	7.30	1267.00	1040.00	1.20	742.00	250.00	399.00	
4N/25W-25F1	Nichols	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-26B1	Dautch/Lewis	4/19/2019	173.00	41.60	1.80	48.70	<10	240.00	106.00	277.00	87.00	0.20	<0.1	<0.01	0.08	<0.01	<0.02	7.85	7.50	2180.00	1550.00	0.90	975.00	200.00	603.00	
		10/22/2019	182.00	46.00	2.00	58.00	<10	270.00	104.00	289.00	107.00	0.20	<0.1	<0.01	0.15	<0.01	<0.02	6.68	7.40	1794.00	1700.00	1.00	1060.00	220.00	643.00	
4N/25W-26C8	Cate School	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
4N/25W-26P2	Bowtie Orchard	4/24/2019	120.00	37.00	2.00	80.00	<10	330.00	128.00	156.00	26.20	0.30	0.20	<0.01	<0.03	<0.01	<0.02	7.80	7.60	1787.00	1280.00	1.60	880.00	270.00	452.00	
		10/15/2019	119.00	41.00	2.00	72.00	<10	330.00	134.00	160.00	25.60	0.30	0.20	<0.01	<0.03	<0.01	<0.02	6.63	7.00	1789.00	1310.00	1.50	884.00	270.00	466.00	
4N/25W-27D1	Westland Floral	4/11/2019	94.00	33.00	1.00	52.00	<10	310.00	131.00	66.00	18.90	0.20	<0.1	<0.01	<0.03	<0.01	<0.02	7.81	7.20	943.00	921.00	1.20	706.00	250.00	370.00	
		10/28/2019	97.00	36.00	2.00	65.00	<10	320.00	142.00	76.00	28.30	0.30	0.10	<0.01	0.04	<0.01	<0.02	6.84	7.90	1126.00	1060.00	1.40	767.00	260.00	390.00	
4N/25W-27E1	Phelps	4/15/2019	110.00	34.00	1.00	42.00	<10	330.00	149.00	43.00	49.90	0.30	<0.1	<0.01	0.06	<0.01	<0.02	7.86	7.00	1414.00	964.00	0.90	759.00	270.00	414.00	
		10/7/2019	112.00	34.00	1.00	41.00	<10	340.00	148.00	41.00	48.40	0.30	<0.1	<0.01	0.09	<0.01	<0.02	7.65	7.30	1418.00	1000.00	0.90	766.00	280.00	419.00	
4N/25W-27F2	CVWD (Smillie well)	5/7/2019	96.00	27.00	1.00	33.00	<10	300.00	141.00	30.00	11.80	0.20	<0.1	<0.01	<0.03	<0.01	<0.02	8.17	7.80	1012.00	855.00	0.80	640.00	250.00	351.00	
		10/7/2019	97.00	27.00	1.00	34.00	<10	310.00	144.00	32.00	12.70	0.20	<0.1	<0.01	<0.03	<0.01	<0.02	7.80	7.20	1246.00	865.00	0.80	658.00	250.00	353.00	
4N/25W-27H2	Cate School *New*	4/9/2019	92.00	27.00	1.00	35.00	<10	280.00	156.00	24.00	5.40	0.30	<0.1	0.05	<0.03	<0.01	0.11	7.60	7.30	781.00	786.00	0.80	621.00	230.00	341.00	
		10/10/2019	97.00	28.00	<1	34.00	<10	290.00	166.00	25.00	5.90	0.20	<0.1	<0.01	0.08	<0.01	<0.02	6.87	7.40	1175.00	811.00	0.80	646.00	240.00	357.00	
4N/25W-27R2	Shepard Farms	4/5/2019	118.00	34.00	2.00	102.00	<10	340.00	107.00	234.00	8.90	0.50	<0.1	<0.01	<0.03	0.23	0.03	7.93	7.30	1167.00	1380.00	2.10	946.00	280.00	434.00	
		10/4/2019	118.00	38.00	2.00	100.00	<10	340.00	112.00	214.00	9.10	0.50	0.10	<0.01	<0.03	0.26	<0.02	8.19	7.40	1475.00	1440.00	2.00	934.00	280.00	451.00	
4N/25W-28A1	Moore	4/5/2019	87.00	29.00	1.00	62.00	<10	340.00	91.50	61.00	20.50	0.40	<0.1	0.03	<0.03	0.03	0.10	7.85	7.30	660.00	915.00	1.50	692.00	280.00	336.00	
		10/4/2019	88.00	30.00	1.00	59.00	<10	340.00	109.00	56.00	25.50	0.30	<0.1	<0.01	<0.03	0.10	<0.02	7.99	7.70	1307.00	932.00	1.40	709.00	280.00	343.00	
4N/25W-28D2	CVWD (El Carro,Raw)	5/7/2019	95.00	28.00	1.00	53.00	<10	340.00	130.00	36.00	11.30	2.00	<0.1	<0.01	<0.03	0.08	<0.02	7.95	7.60	1282.00	910.00	1.20	694.00	280.00	352.00	
		10/7/2019	89.00	27.00	1.00	51.00	<10	340.00	133.00	38.00	12.10	0.30	0.10	<0.01	0.03	0.09	<0.02	7.83	7.60	1286.00	919.00	1.20	691.00	280.00	333.00	
4N/25W-28D2	VWD (El Carro, Finishe	5/7/2019	87.00	26.00	1.00	50.00	<10	340.00	130.00	39.00	11.70	0.20	0.10	<0.01	<0.03	<0.01	<0.02	8.15	7.70	1299.00	920.00	1.20	685.00	280.00	324.00	
		10/7/2019	91.00	27.00	1.00	53.00	<10	350.00	133.00	41.00	12.10	0.30	0.10	<0.01	<0.03	<0.01	<0.02	7.92	7.70	1318.00	921.00	1.30	708.00	280.00	338.00	
4N/25W-28F7	CVWD (Lyons)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-28G3	Dal Pozzo	4/30/2019	124.00	36.00	1.00	49.00	<10	370.00	173.00	52.00	31.10	0.40	0.10	<0.01	<0.03	<0.01	<0.02	8.03	7.90	1532.00	1100.00	1.00	836.00	300.00	458.00	
		10/7/2019	125.00	37.00	1.00	50.00	<10	370.00	175.00	55.00	40.60	0.30	<0.1	<0.01	<0.03	<0.01	<0.02	7.84	7.60	1275.00	1110.00	1.00	854.00	310.00	464.00	
4N/25W-28H1	Huff	4/15/2019	132.00	41.00	1.00	54.00	<10	390.00	155.00	58.00	92.00	0.30	<0.1	<0.01	<0.03	<0.01	0.08	7.66	7.10	1726.00	1150.00	1.10	923.00	320.00	498.00	
		10/7/2019	132.00	40.00	1.00	51.00	<10	390.00	147.00	55.00	90.40	0.30	<0.1	<0.01	0.22	<0.01	0.28	7.68	7.40	1627.00	1180.00	1.00	907.00	320.00	494.00	
4N/25W-28J1	Catlin (old)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-28J3	Catlin *New*	5/21/2019	103.00	30.00	1.00	40.00	<10	340.00	143.00	44.00	30.30	0.30	<0.1	<0.01	0.10	<0.01	0.99	7.93	7.80	1392.00	992.00	0.90	732.00	280.00	380.00	
		10/8/2019	111.00	32.00	1.00	44.00	<10	340.00	140.00	46.00	32.40	0.30	<0.1	<0.01	0.06	<0.01	0.22	8.10	7.60	1393.00	985.00	0.90	747.00	280.00	409.00	
4N/25W-29D7	anta Ynez Well (CVWD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-29D8	H.Q. Well (CVWD Raw	4/2/2019	92.00	25.00	1.00	56.00	<10	320.00	113.00	65.00	6.80	0.30	0.10	<0.01	<0.03	0.06	<0.02	7.89	7.50	912.00	925.00	1.30	679.00	260.00	332.00	
		10/8/2019	90.00	27.00	2.00	58.00	<10	330.00	112.00	65.00	5.80	0.30	0.10	<0.01	<0.03	0.07	<0.02	7.71	7.60	1317.00	942.00	1.40	690.00	270.00	336.00	
4N/25W-29D8	I.Q. Well (CVWD Finish	4/2/2019	93.00	25.00	1.00	58.00	<10	320.00	110.00	68.00	7.00	0.30	0.10	<0.01	<0.03	<0.01	<0.02	8.04	7.40	893.00	929.00	1.40	682.00	270.00	335.00	
		10/8/2019	90.00	27.00	2.00	61.00	<10	330.00	112.00	68.00	5.80	0.30	<0.1	0.02	<0.03	<0.01	<0.02	7.80	7.60	1235.00	965.00	1.40	696.00	270.00	336.00	
4N/25W-29K2	Perkins	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-29L1	Saragosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-30D1	Sandyland/Slough Wel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-34A1	Abbott	4/11/2019	139.00	46.00	2.00	94.00	<10	380.00	298.00	107.00	<0.9	0.40	0.20	<0.01	1.10	0.17	<0.02	7.56	7.40	1360.00	1410.00	1.80	1070.00	310.00	536.00	
		10/29/2019	141.00	47.00	3.00	102.00	<10	380.00	303.00	104.00	<0.4	0.40	0.20	<0.01	0.90	0.20	<0.02	7.01	7.90	1964.00	1460.00	1.90	1080.00	310.00	545.00	
4N/25W-34G1	Aluminum Filter	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/25W-34B4	Twin Pines	4/9/2019	97.00	30.00	2.00	66.00	<10	340.00	136.00	72.00	12.00	0.30	0.20	<0.01	<0.03	<0.01	0.08	7.82	7.30	986.00	970.00	1.50	755.00	280.00	365.00	
		10/7/2019	91.00	29.00	1.00	56.00	<10	330.00	109.00	76.00	7.20	0.40	0.10	<0.01	<0.03	0.02	<0.02	8.07	7.50	949.00	960.00	1.30	700.00	270.00	346.00	
4N/25W-35B5	Van der Kar	4/9/2019	155.00	53.00	2.00	92.00	<10	400.00	327.00	107.00	23.90	0.30	0.30	<0.01	<0.03	<0.01	<0.02	8.25	7.70	1492.00	1510.00	1.60	1160.00	330.00	605.00	
		11/19/2019	107.00	37.00	2.00	72.00	<10	400.00	183.00	75.00	2.70	0.30	0.20	<0.01	0.75	0.05	<0.02	8.01	7.90	1701.00	1220.00	1.50	879.00	330.00	419.00	
4N/25W-35E4	Van der Kar	4/9/2019	158.00	54.00	3.00	144.00	<10	190.00	596.00	178.00	6.20	0.40	0.20	<0.01	0.28	0.04	<0.02	8.27	7.40	1653.00	1820.00	2.50	1330.00	150.00	616.00	
		11/19/2019	167.00	57.00	3.00	138.00	<10	180.00	581.00	158.00	2.50	0.30	0.20	<0.01	0.42	0.08	<0.02	8.05	7.70	2500.00	1920.00	2.40	1290.00	150.00	651.00	
4N/26W-13R1	Triguiero	4/8/2019	210.00	41.00	2.00	90.00	<10	430.00	272.00	230.00	<0.9	0.40	<0.1	0.03	0.08	0.15	<0.02	7.23	7.20	1489.00	1750.00	1.75	1280.00	360.00	693.00	
		10/7/2019	210.00	45.00	2.00	84.00	<10	440.00	256.00	206.00	0.50	0.50	<0.1	<0.01	<0.03	0.15	<0.02	7.10	6.90	2430.00	1760.00	1.40	1240.00	360.00	709.00	
4N/26W-23A2	Zangger	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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4N/26W-24F1	Hickey Brothers	4/11/2019	76.00	37.00	1.00	129.00	<10	460.00	32.60	163.00	3.60	1.10	0.20	0.01	0.68	0.14	<0.02	7.76	7.20	1191.00	1250.00	1.25	903.00	380.00	903.00	
		10/29/2019	70.00	34.00	1.00	132.00	<10	440.00	57.20	144.00	3.40	1.10	0.20	0.01	1.20	0.10	0.03	6.64	7.70	1253.00	1260.00	3.20	883.00	360.00	315.00	
Toro Creek		4/1/2019	106.00	43.00	2.00	87.00	<10	260.00	298.00	119.00	9.60	0.40	0.10	<0.01	<0.03	<0.01	<0.02	8.87	8.10	1223.00	1230.00	1.80	925.00	210.00	441.00	ND
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Arroyo Paredon Creek		4/1/2019	88.00	47.00	3.00	180.00	<10	300.00	244.00	276.00	17.50	1.00	0.80	<0.01	0.05	0.06	<0.02	8.86	8.00	1586.00	1610.00	3.90	1160.00	250.00	413.00	ND
		10/3/2019	103.00	38.00	4.00	299.00	<10	450.00	131.00	396.00	<0.4	3.00	3.20	<0.01	0.12	0.07	<0.02	8.59	8.20	2980.00	2280.00	6.40	1420.00	370.00	413.00	ND
Santa Monica Creek		4/1/2019	81.00	27.00	2.00	29.00	<10	210.00	181.00	17.00	1.20	0.20	<0.01	<0.01	0.05	0.05	<0.02	8.76	8.20	703.00	723.00	0.70	548.00	170.00	313.00	ND
		10/2/2019	69.00	25.00	2.00	31.00	<10	220.00	149.00	14.00	<0.4	0.30	<0.1	<0.01	0.72	0.26	<0.02	8.59	8.00	963.00	676.00	0.80	510.00	180.00	275.00	ND
Carpinteria Creek		4/1/2019	65.00	31.00	3.00	49.00	<10	230.00	166.00	34.00	<0.4	0.30	0.10	<0.01	<0.03	0.01	<0.02	8.87	8.20	747.00	774.00	1.30	578.00	190.00	290.00	ND
		10/3/2019	64.00	30.00	2.00	37.00	<10	230.00	155.00	19.00	<0.4	0.30	<0.1	<0.01	<0.03	<0.01	<0.02	8.92	8.40	1040.00	730.00	1.00	537.00	190.00	283.00	ND
Gobernador Creek		4/1/2019	82.00	25.00	2.00	26.00	<10	240.00	150.00	12.00	1.30	0.30	<0.1	<0.01	<0.03	0.02	<0.02	8.88	7.50	663.00	664.00	0.60	539.00	200.00	307.00	ND
		10/2/2019	63.00	28.00	2.00	36.00	<10	220.00	155.00	19.00	0.50	0.30	<0.1	<0.01	<0.03	<0.01	<0.02	8.95	8.60	994.00	701.00	0.90	524.00	180.00	272.00	ND
Rincon Creek		4/1/2019	72.00	28.00	2.00	32.00	<10	270.00	104.00	26.00	7.50	0.30	0.10	<0.01	<0.03	0.01	<0.02	8.66	8.30	695.00	712.00	0.80	542.00	220.00	295.00	ND
		10/2/2019	84.00	43.00	2.00	78.00	<10	350.00	167.00	80.00	12.60	0.50	0.40	<0.01	0.03	<0.01	<0.02	8.84	8.40	1487.00	1070.00	1.70	817.00	290.00	387.00	ND

Concentrations in milligrams per liter, except Electrical Conductance (micromhos/cm) and pH.
Non detected concentrations shown as < PQL (Practical Quantitation Limit)
Not Available = --

APPENDIX C

HYDROLOGIC BUDGET UPDATE

Technical Memorandum from Pueblo Water Resources, Inc.

TECHNICAL MEMORANDUM
Pueblo Water Resources, Inc.
4478 Market St., Suite 705 Tel: 805.644.0470
Ventura, CA 93003 Fax: 805.644.0480

To:	Carpinteria Valley Water District	Date:	February 18, 2021
Attention:	Bob McDonald, P.E. General Manager	Project No:	19-0011
Copy to:	Brian King, P.E., District Engineer		
From:	Robert Marks, P.G., C.Hg.		
Subject:	Carpinteria Groundwater Basin Water Budget Update, Water Years 2018 - 2019		

INTRODUCTION

Presented in this Technical Memorandum (TM) is documentation of our findings developed from an update of the water budget for the Carpinteria Groundwater Basin (CGB) for Water Years (WY) 2018 and 2019. A water budget for a groundwater basin is an inventory of the various sources of recharge and outflow in the basin, and is expressed by the following equation:

$$\text{Inflow} - \text{Outflow} = \text{Change in Storage}$$

where Inflow equals:

- Subsurface Inflow
- Streambed Percolation
- Percolation of Precipitation, and
- Percolation of Irrigation Return Water (pumped and imported);

and Outflow equals:

- Subsurface Outflow
- Gross Groundwater Pumpage, and
- Extraction by Phreatophytes.

The water budget for the CGB was updated by Pueblo Water Resources, Inc. (PWR) in 2012 for the period of Water Years (WY) 1985 through 2008 as part of the development of a numerical groundwater flow model of the CGB[1]. PWR has subsequently performed several

[1] *Carpinteria Groundwater Basin, Hydrogeologic Update and Groundwater Model Project Final Report*, prepared by Pueblo Water Resources, Inc. for Carpinteria Valley Water District, dated June 30, 2012.

updates of the water budget covering the periods of WY 2009 through 2017 as part of Carpinteria Valley Water District (CVWD) Annual Reports pursuant to its AB3030 Groundwater Management Plan. The subject update for WY 2018-2019 represents a continuation of the CVWD's ongoing effort to maintain an updated water budget for the CGB.

FINDINGS

The water budget inventory for the CGB for the WY 2018-2019 period was updated utilizing the same methods that were developed for the 2012 hydrogeologic update and groundwater model project. Detailed descriptions of the methodologies used for each component of the water budget are presented in PWR's 2012 report and will not be repeated here. A summary of the updated water budget for the WY 1985 – 2019 period (35 years) is presented in **Table 1**. The values shown in **Table 1** are also presented graphically on **Figure 1**. Summary descriptions for each component of the water budget are presented below.

Rainfall

Revised Rainfall Data. Rainfall is the primary source of inflow/recharge to the basin, whether it falls directly on the basin and percolates vertically downward through the surface soils and into basin sediments or falls on adjacent watershed areas and flows into the basin via streambed percolation or subsurface inflow. The Santa Barbara County Flood Control District maintains precipitation data from the Carpinteria Fire Station with a period of record from 1949 to the present.

In 2017 the County of Santa Barbara Flood Control District (SBCFCD) discovered that the rainfall record for the Carpinteria Fire Station Gauge erroneously included data from the US Forest Service (USFS) Gauge for WYs 1985 through 1998. Because the USFS Gauge is located further north and at higher elevations than the Fire Station Gauge, the data listed for this period was erroneously high, and elements of the water budget dependent on the precipitation data overestimated inflow to the basin.

The SBCFCD has since corrected the error, and the corrected rainfall data has been used to revise and correct the water budget for the period WY 1985 through WY 1998. There are two components of the water budget calculations that are directly based on the rainfall data:

1. Deep percolation of rainfall, and,
2. Subsurface inflow

Table 2 below shows a comparison of the annual rainfall, subsurface inflow and percolation of precipitation totals for both the previous and revised rainfall data. As shown, the previous annual rainfall data averaged 22.7 inches for the WY 1985 – 1998 period, whereas the revised data averages 20.2 inches, representing an average decrease of approximately 11

Table 1. Water Budget Summary, WY 1985 – 2019

		INFLOW (acre-feet per year)							OUTFLOW (acre-feet per year)						
Water Year	Rainfall (in)	Subsurface Inflow	Streambed Percolation	Percolation of Precipitation: Recharge Area	Percolation of Precipitation: Confined Area	Percolation of Irrigation Water: Delivered	Percolation of Irrigation Water: Pumped	Total Inflow	Subsurface Outflow	Groundwater Pumpage: CVWD	Groundwater Pumpage: Private	Extraction by Phreatophytes	Total Outflow	Change in Storage: Year	Change in Storage: Cummulative
1985	13.56	770	57	123	15	58	190	**1,214**	16	1,836	949	100	**2,901**	-1,687	**-1,687**
1986	22.92	1,100	866	3,739	465	80	208	**6,458**	0	2,032	1,041	100	**3,173**	3,285	**1,598**
1987	10.66	606	91	0	0	90	186	**973**	0	2,363	932	100	**3,395**	-2,423	**-825**
1988	15.46	878	112	431	54	103	213	**1,791**	0	2,342	1,065	100	**3,507**	-1,716	**-2,540**
1989	9.17	521	26	0	0	116	304	**967**	0	2,984	1,520	100	**4,604**	-3,637	**-6,177**
1990	7.97	453	4	0	0	246	398	**1,101**	0	3,413	1,990	100	**5,503**	-4,402	**-10,579**
1991	17.94	1,019	758	859	107	166	452	**3,361**	0	3,014	2,261	100	**5,375**	-2,014	**-12,592**
1992	22.66	1,100	1,026	3,727	463	140	433	**6,890**	0	1,560	2,165	100	**3,825**	3,064	**-9,528**
1993	33.33	1,100	1,434	5,499	683	177	484	**9,378**	0	1,261	2,422	100	**3,783**	5,596	**-3,932**
1994	12.80	727	352	90	11	184	564	**1,928**	0	1,307	2,818	100	**4,225**	-2,297	**-6,230**
1995	37.06	1,100	1,746	5,487	660	162	478	**9,632**	231	1,291	2,389	100	**4,011**	5,621	**-609**
1996	17.39	988	894	763	92	162	502	**3,402**	239	1,557	2,510	100	**4,406**	-1,004	**-1,613**
1997	16.10	915	958	547	66	192	487	**3,165**	58	1,317	2,437	100	**3,912**	-747	**-2,360**
1998	45.83	1,100	1,744	5,467	657	149	486	**9,602**	418	575	2,428	100	**3,521**	6,081	**3,721**
1999	9.99	568	434	0	0	292	598	**1,891**	376	340	2,990	100	**3,806**	-1,914	**1,806**
2000	17.47	993	789	740	88	256	621	**3,486**	86	1,410	3,105	100	**4,702**	-1,216	**590**
2001	20.43	1,100	1,096	1,692	205	205	652	**4,950**	202	185	3,259	100	**3,746**	1,204	**1,795**
2002	7.66	435	7	0	0	257	621	**1,319**	196	558	3,103	100	**3,957**	-2,638	**-843**
2003	21.97	1,100	521	2,293	276	245	545	**4,981**	62	402	2,723	100	**3,287**	1,694	**851**
2004	9.57	544	2	0	0	277	561	**1,384**	4	999	2,803	100	**3,906**	-2,522	**-1,671**
2005	37.56	1,100	1,657	5,366	646	289	412	**9,471**	0	1,152	2,060	100	**3,312**	6,159	**4,488**
2006	18.58	1,056	927	930	112	316	417	**3,756**	0	1,120	2,083	100	**3,302**	454	**4,943**
2007	7.11	404	9	0	0	410	501	**1,324**	0	1,418	2,507	100	**4,025**	-2,701	**2,242**
2008	17.51	995	1,041	683	82	317	561	**3,680**	0	661	2,806	100	**3,567**	113	**2,355**
2009	13.19	749	13	108	13	396	457	**1,736**	0	1,628	2,284	100	**4,012**	-2,276	**78**
2010	19.75	1,100	671	1,407	169	335	513	**4,196**	0	1,053	2,566	100	**3,719**	476	**555**
2011	24.89	1,100	1,053	3,515	423	324	500	**6,915**	0	1,236	2,502	100	**3,838**	3,077	**3,632**
2012	9.83	559	7	0	0	397	490	**1,452**	0	1,015	2,451	100	**3,566**	-2,114	**1,518**
2013	8.33	473	0	0	0	436	607	**1,516**	0	643	3,033	100	**3,776**	-2,260	**-742**
2014	5.83	331	11	0	0	463	708	**1,513**	0	1,014	3,541	100	**4,655**	-3,142	**-3,884**
2015	8.48	482	0	0	0	401	705	**1,588**	0	2,605	3,526	100	**6,231**	-4,643	**-8,527**
2016	10.11	574	0	0	0	405	676	**1,656**	0	2,751	3,380	100	**6,231**	-4,575	**-13,102**
2017	21.75	1,100	885	2,214	267	360	753	**5,579**	0	1,235	3,321	100	**4,656**	923	**-12,180**
2018	9.04	514	752	0	0	419	910	**2,595**	0	2,239	4,551	100	**6,890**	-4,295	**-16,475**
2019	18.19	1,034	1,070	799	96	349	777	**4,123**	0	933	3,844	100	**4,877**	-754	**-17,229**
Avg.	17.15	820	600	1,328	161	262	513	**3,685**	54	1,470	2,553	100	**4,177**	-492	
High	45.83	1,100	1,746	5,499	683	463	910	**9,632**	418	3,413	4,551	100	**6,890**	6,159	
Low	5.83	331	0	0	0	58	186	**967**	0	185	932	100	**2,901**	-4,643	
% of Total		22	16	36	4	7	14	**100**	1	35	61	2	**100**		

Table 2. Revised Rainfall and Water Budget Component Comparison, WY 1985 – 1998

Water Year	PREVIOUS					REVISED					Change	
	Rainfall (in)	Subsurface Inflow (af)	Percolation of Precipitation (af)		Total (af)	Rainfall (in)	Subsurface Inflow	Percolation of Precipitation (af)		Total (af)		
			Recharge Area	Confined Area				Recharge Area	Confined Area		(af)	(%)
1985	15.26	867	391	49	1307	13.56	770	123	15	909	-398	-30.4
1986	25.78	1,100	4198	522	5820	22.92	1,100	3,739	465	5304	-516	-8.9
1987	11.99	681	30	4	715	10.66	606	0	0	606	-109	-15.2
1988	17.34	985	731	91	1807	15.46	878	431	54	1363	-444	-24.6
1989	10.27	584	0	0	584	9.17	521	0	0	521	-63	-10.7
1990	8.93	507	0	0	507	7.97	453	0	0	453	-55	-10.8
1991	20.11	1,100	1634	203	2937	17.94	1,019	859	107	1985	-952	-32.4
1992	25.39	1,100	4174	519	5793	22.66	1,100	3,727	463	5290	-503	-8.7
1993	37.45	1,100	5499	683	7282	33.33	1,100	5,499	683	7282	0	0.0
1994	14.43	820	278	35	1132	12.80	727	90	11	828	-304	-26.8
1995	41.59	1,100	5487	660	7246	37.06	1,100	5,487	660	7246	0	0.0
1996	19.55	1,100	1401	168	2669	17.39	988	763	92	1843	-826	-30.9
1997	18.07	1,027	862	104	1993	16.10	915	547	66	1528	-465	-23.3
1998	51.48	1,100	5467	657	7224	45.83	1,100	5,467	657	7224	0	0.0
Avg.	**22.69**	**941**	**2,154**	**264**	**3,358**	**20.20**	**884**	**1,909**	**234**	**3,027**	**-331**	**-15.9**
High	**51.48**	**1,100**	**5,499**	**683**	**7,282**	**45.83**	**1,100**	**5,499**	**683**	**7,282**	**0**	**0.0**
Low	**8.93**	**507**	**0**	**0**	**507**	**7.97**	**453**	**0**	**0**	**453**	**-952**	**-32.4**

percent. The amount of calculated recharge to the basin from subsurface inflow and percolation of precipitation declined by an average of approximately 331 acre-feet per year (afy), or approximately 16 percent for these two components (note: the values shown in **Table 1** reflect the revised data). In addition, it is noted that 331 afy represents approximately 8 percent of the of the estimated long-term perennial yield of the basin of 4,000 afy.

WY 2018 – 2019 Update. Annual rainfall during the 35-year WY 1985 - 2019 period of record (incorporating the recently revised data) is presented on **Figure 2**. As shown, the mean annual rainfall for this 35-year base period is 17.2 inches. Total rainfall in WY 2018 was only 9.04 inches, approximately 53 percent of the long-term mean. Rainfall in WY 2019 was slightly greater than the long-term mean, with a total of 18.2 inches.

The cumulative departure of annual rainfall from the long-term mean is also plotted on **Figure 2**. The cumulative departure from mean graph is used to identify climatic trends over the period of record. As shown, the cumulative departure curve exhibits a series of cyclic dry and wet periods in the basin over the period of record. The five years of the recent extended drought period of WY 2012 through 2016 were particularly dry, with annual rainfall totals generally less than half of the long-term average. Although WY 2017 was slightly (approximately 26 percent) wetter than the long-term average and formally ended the 5-year drought, which resulted in a slight reversal of the downward trend in the curve, WY 2018 was again relatively dry (approximate 53 percent of the mean) and WY 2019 was near normal.

Subsurface Inflow

Subsurface inflow is flow from consolidated rocks in the hill and mountain areas adjacent to the CGB. A direct relationship between subsurface inflow and precipitation has been developed by previous investigators, and seasonal subsurface inflow for the WY 1985 – 2019 base period was estimated using this same relationship. As shown in **Table 1**, for WY 2018 and 2019, **514 and 1,034 acre-feet (af)** of subsurface inflow, respectively, was estimated, compared to the 35-year average of 820 afy for the WY 1985 – 2019 period.

Streambed Percolation

There are four principal streams in the CGB that contribute to groundwater recharge; Carpinteria, Gobernador, Rincon and Arroyo Parida Creeks (Franklin and Santa Monica Creeks have been concrete lined and no longer contribute recharge to the basin). Streambed percolation is assumed to occur only where the streams flow across the Recharge Area. Once streamflow reaches the Confined Area, the amount of deep percolation to the main groundwater system is assumed to be insignificant. Previous studies developed runoff vs. streambed percolation relationships for each individual stream. As shown in **Table 1** above, **752 and 1,070 af** of streambed percolation was estimated for WY 2018 and 2019, respectively.

Percolation of Precipitation

Percolation of precipitation is the most important source of recharge to the basin, accounting for approximately 40 percent of the total inflow. Precipitation recharges the basin principally through deep percolation to the zone of saturation in the Recharge Area. In addition, one of the important findings from calibrating the numerical groundwater flow model of the CGB in 2012 was that approximately 25 percent of precipitation percolation in the Confined Area does appear to reach the deep aquifers (e.g., Aquifer A).

The total volume of deep percolation for each year of the subject period is shown in **Table 1**. As shown, significant deep percolation only occurs in the wetter years. In years when the average annual rainfall is less than approximately 12 inches, no deep percolation is estimated to occur. Accordingly, no deep percolation was estimated to occur during the relatively dry WY 2018, whereas **895 af** of deep percolation was estimated for WY 2019 (799 and 96 af in the Recharge and Confined Areas, respectively).

Percolation of Irrigation Water

Percolation of irrigation return water in the CGB is dependent on a variety of factors, including climatic conditions, crop type, and irrigation practices. Studies by the U.S. Soil Conversation Service for Santa Barbara County indicate irrigation efficiencies range from 65 to 70 percent. For purposes of estimating deep percolation of irrigation return water in the CGB, a conservative estimate is that 20 percent of applied water (both pumped and delivered, which includes imported water) percolates into the basin. As shown in **Table 1,** the annual recharge to the basin during WY 2018 and 2019 from percolation of irrigation water is estimated to be approximately **1,329 and 1,126 afy**, respectively.

Subsurface Outflow

The quantity of subsurface outflow from the CGB is estimated using Darcy's Law, in which the rate of discharge through a given cross section of saturated material is proportional to the hydraulic gradient. The hydraulic gradient is driven by water-levels in the basin, and outflow occurs only when there is a seaward gradient (i.e., when water levels are generally above sea level). The results of the subsurface outflow calculations are shown in **Table 1**. As shown, **0 af** subsurface outflow was estimated during WY 2018 and 2019 because the seaward gradient between the coast and inland portions of the basin was reversed (i.e., water levels were lower inland than at the coast). It is noted that the existing reversal of the naturally occurring seaward gradient creates conditions for the potential for seawater intrusion into the basin to occur.

Groundwater Pumpage

Groundwater extractions from the CGB occur from both CVWD and private production wells. CVWD well production is metered, whereas private pumping in the basin is not metered, and has been estimated on an annual basis by the CVWD since 1984 utilizing land use survey and water delivery information. As shown in **Table 1**, aggregate pumpage during WY 2018 was quite high, estimated at approximately **6,790 af** during WY 2018, which is approximately 69 percent greater than the 35-year long-term average of approximately 4,024 afy. Pumpage during WY 2019 was closer to the long-term average at **4,817 af**.

Extraction by Phreatophytes

Phreatophytes are water loving plants (roots extend into the water table) that live in the vicinity of stream channels and in areas of high groundwater. Groundwater consumed by phreatophytes is dependent on many factors, including plant species, vegetative density, climate, soil types and conditions, and depth to groundwater. Direct measurements of consumptive use by phreatophytes in the CGB do not currently exist. By applying the results of study in San Diego County (Blaney and Criddle, 1963), extractions by phreatophytes have been roughly estimated to be approximately **100 afy** on average. As shown in **Table 1**, phreatophytes consumption is estimated to be a relatively insignificant portion (2 percent) of the overall outflow from the basin.

Changes in Storage

The annual change in the amount of groundwater in storage depends on the annual water supply surplus or deficiency, as expressed by the water balance equation presented above. As shown in **Table 1**, the total inflows during WY 2018 and 2019 were estimated at 2,595 and 4,123 af, respectively, and the total outflows were estimated at 6,890 and 4,917 af, respectively, resulting in a 2-year net **storage depletion volume of 5,089 af**.

Figure 3 presents a comparison of the cumulative departure/change curves for both rainfall and basin storage for the WY 1985 – 2019 base period. As shown, the cumulative change in storage curve understandably trends similarly to the cumulative departure of annual rainfall curve. For example, the plots show the period of the WY 1987 through 1990 drought and the corresponding depletion of storage, followed by the cumulatively wet period of WY 1991 through WY 1998 and the corresponding accumulation of basin storage. The relative lack of rainfall during the recent 5-year drought period of WY 2012 - 2016 corresponds to lower amounts of rainfall and recharge in the basin and a resulting cumulative depletion of storage.

As shown in **Table 1** and on **Figures 1 and 3**, as of WY 2019 the amount of cumulative storage depletion in the CGB is estimated at approximately 17,269 af relative to basin conditions at the start of WY 1985. Compared to the amount of cumulative storage depletion that occurred during the previous extended drought period of WY 1987 – 1990, the recent level of basin depletion has now exceeded historical depletion levels (relative to storage conditions in 1985).

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings developed from the subject update to the CGB water budget for WY 2018 and 2019, we offer the following conclusions and recommendations:

- Total rainfall during WY 2018 was only 9.04 inches, which is approximately 53 percent of the long-term average of 17.2 inches. Rainfall during WY 2019 was close to normal, with a total of 18.2 inches

- The below normal amounts of rainfall and stream runoff during WY 2018 resulted in a relatively low amount of estimated recharge to the CGB of 2,595 af. Total recharge during WY 2019 is estimated at approximately 4,123 af, which is close to the estimated long-term average annual recharge amount of approximately 4,000 afy[2].

- Extractions from the basin from pumping of CVWD and private wells during WY 2018 and 2019 are estimated at approximately 6,790 and 4,560 afy, respectively, which are greater than the long-term average of approximately 4,024 afy.

- Due to the less-than-normal amounts of natural recharge during the two-year period, combined with greater-than-normal levels of extractions, approximately 5,089 af of storage depletion is estimated to have occurred in the WY 2018 – 2019 period. The previous historical levels of basin storage depletion (WY 1991) have now been exceeded as of the end of WY 2019.

- There was no subsurface outflow estimated during the period (indeed, no subsurface outflow from the basin has been estimated to have occurred during the last 15 years) due to depressed water levels in the basin. These conditions present a potential risk for seawater intrusion to occur in the CGB.

CLOSURE

This Technical Memorandum has been prepared exclusively for Carpinteria Valley Water District for the specific application to the Carpinteria Groundwater Basin AB3030 Groundwater Management Plan Annual Report Project. The findings, conclusions, and recommendations presented herein were prepared in accordance with generally accepted hydrogeologic practices. No other warranty, express or implied, is made.

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[2] Pueblo Water Resources, Inc. (2012), *Carpinteria Groundwater Basin Hydrogeologic Update and Groundwater Model Project*, Final Report, prepared for CVWD.

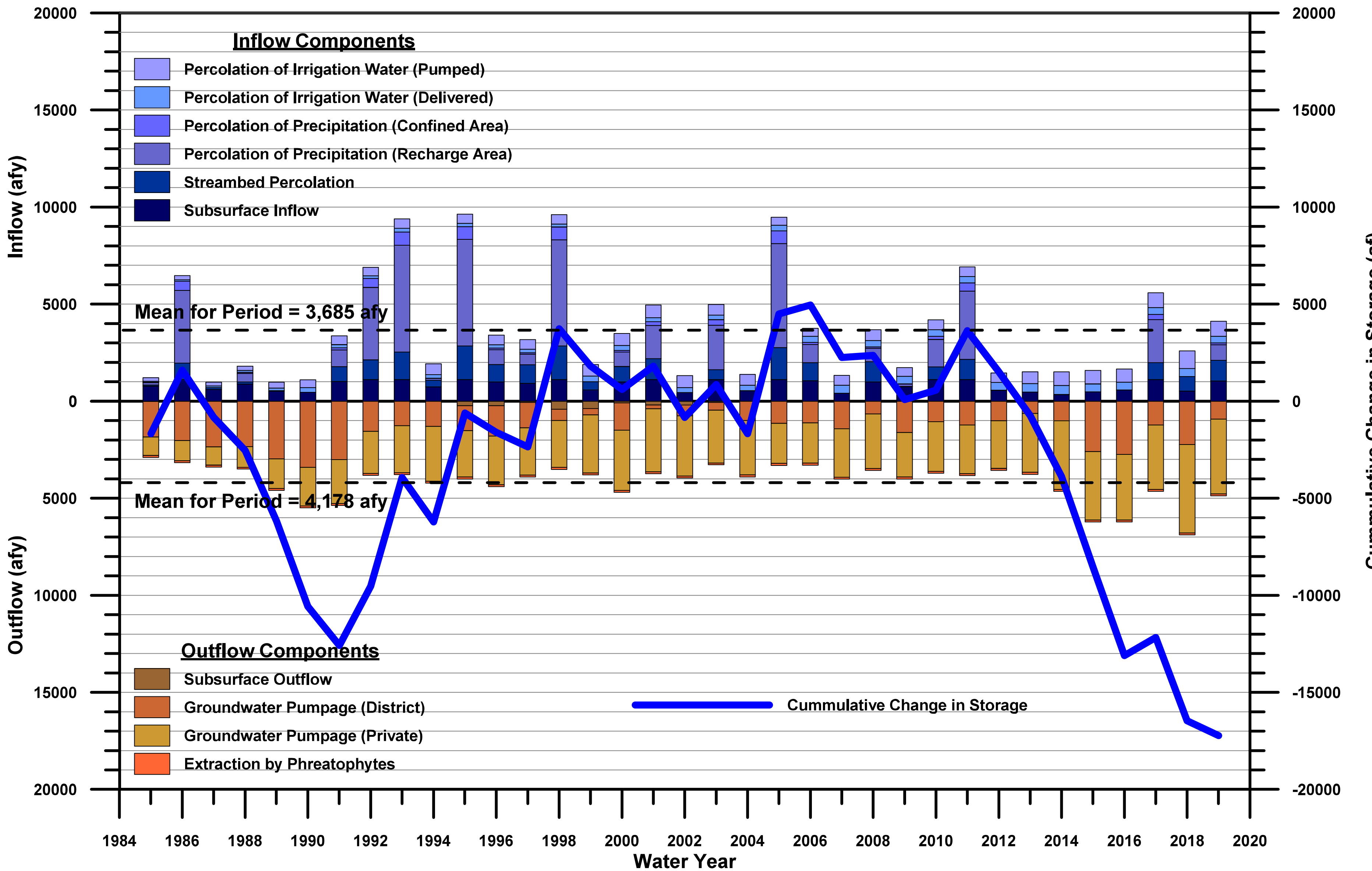

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FIGURE 1. WATER BUDGET SUMMARY FOR WY 1985 - 2019 PERIOD
WY 2018-2019 AB3030 GWMP Annual Report
Carpinteria Valley Water District

February 2021
Project No. 19-0011

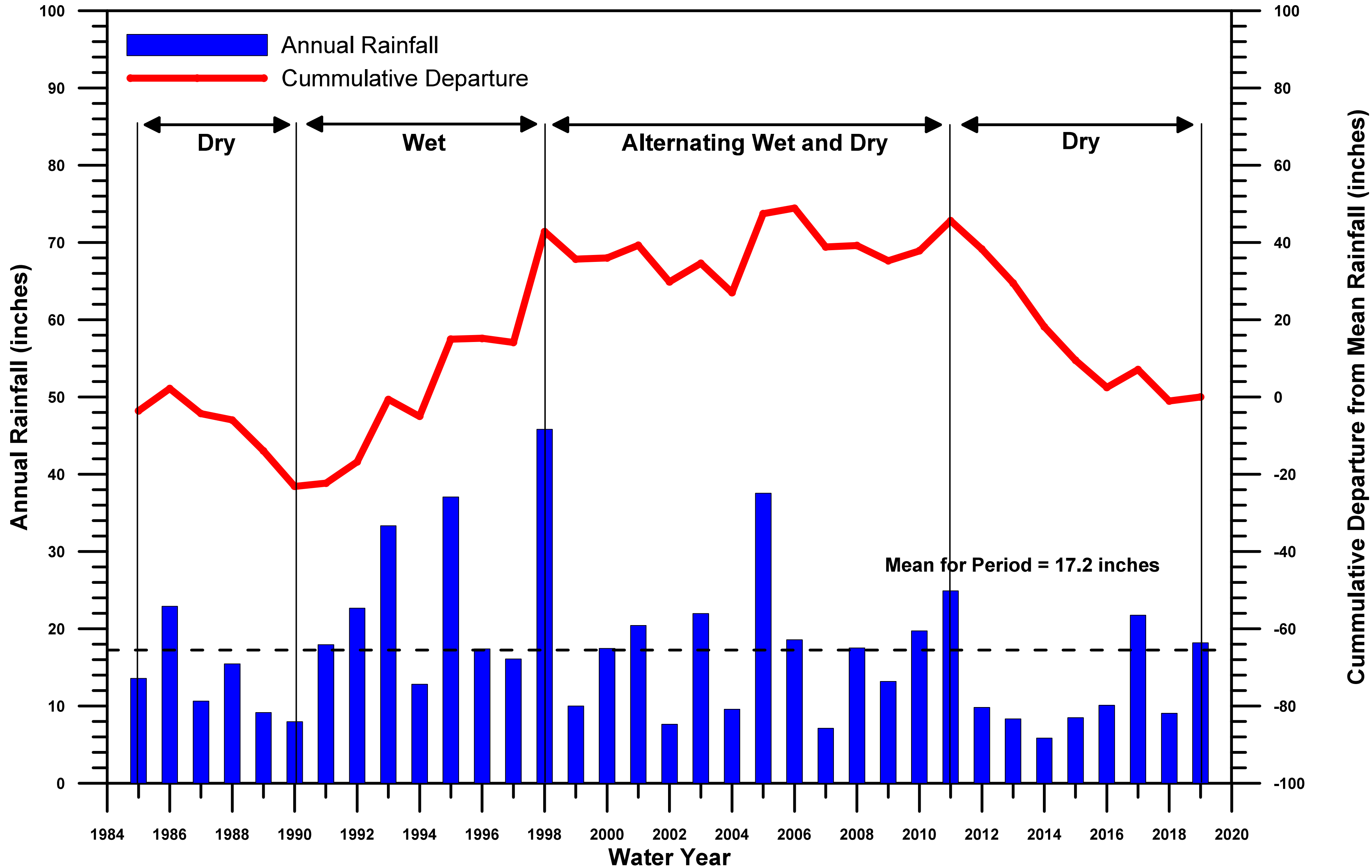

FIGURE 2. CUMULATIVE DEPARTURE OF ANNUAL RAINFALL - CARPINTERIA FIRE STATION (WY 1985 - 2019)
WY 2018-2019 GWMP Annual Report
Carpinteria Valley Water District

February 2021
Project No. 19-0011

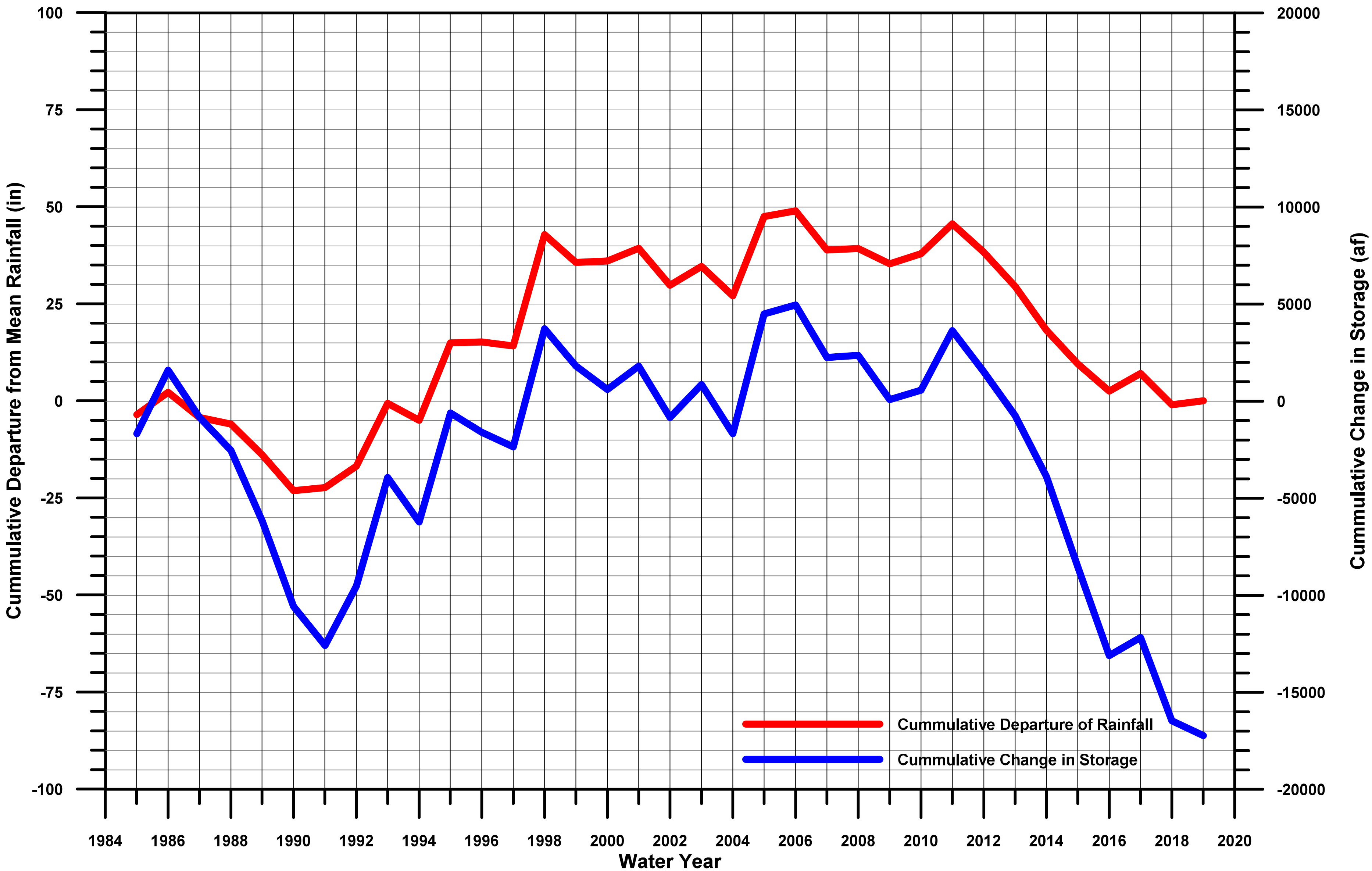

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FIGURE 3. CUMMULATIVE DEPARTURE/CHANGE CURVE COMPARISON FOR WY 1985 - 2019 PERIOD
WY 2018-2019 GWMP Annual Report
Carpinteria Valley Water District