DRAFT
Chapter 5

Salinas Valley Basin
Integrated Sustainability Plan

Prepared for:
SVBGSA

January 2019

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SECTION 5 GROUNDWATER CONDITIONS

This chapter describes the current and historical groundwater conditions in the Salinas Valley Groundwater Basin. In accordance with the SGMA emergency regulations §354.16, current conditions are any conditions occurring after January 1, 2015. By implication, historical conditions are any conditions occurring prior to January 1, 2015. The chapter focuses on information required by the GSP regulations and information that is important for developing an effective plan to achieve sustainability.

This chapter provides a description of current and historical groundwater conditions at a scale and level of detail appropriate for basin-wide planning. Additional detail will be provided at an appropriate scale for each subbasin within their individual GSPs.

The organization of Chapter 5 aligns with the six sustainability indicators, including:

1. Chronic lowering of groundwater elevations
2. Changes in groundwater storage
3. Seawater intrusion
4. Subsidence
5. Depletion of interconnected surface waters and
6. Groundwater quality

5.1 GROUNDWATER ELEVATIONS

5.1.1 DATA SOURCES

The following assessment of groundwater elevation conditions is largely based on data collected by MCWRA from 1944 through the present. MCWRA has monitored water levels at 760 unique locations during this period. At the time of this report, MCWRA regularly collects groundwater level measurements from 368 locations for various monitoring programs. The distribution of these wells is as follows:

- 180/400-Foot Aquifer Subbasin 166 wells
- Eastside Subbasin 80 wells
- Forebay Subbasin 72 wells
- Upper Valley Subbasin 23 wells
- Langley Subbasin 3 wells
- Monterey Subbasin 24 wells

The water level data are primarily obtained from private well owners that have provided data on a confidential basis. Therefore, the contoured water levels are available for public release but the underlying data and well locations are not publicly available and are not used as a basis for the ISP or GSPs.

MCWRA collects groundwater elevation data at specific times of the year to understand seasonal changes and monitor longer term trends. Of the 368 wells actively monitored for water levels, 23 wells are equipped with pressure transducers that take automated measurements hourly, 113 wells are measured monthly, 343 wells are measured for the Fall measurement program, and 130 wells are measured for the August trough measurement program (MCWRA, 2018a).

From mid-November to mid-December, MCWRA conducts their Fall measurement program to observe groundwater levels after the irrigation season ends but before the rainy season begins (Brown and Caldwell, 2015). The Fall measurements are intended to provide the most representative year-to-year comparison because the water levels are not greatly influenced by either the cones of depression due to irrigation or the rise in water levels associated with each variable wet season. The Fall measurements provide insight into long-term storage trends in the aquifers (Brown and Caldwell, 2015).

During August, MCWRA conducts a localized August Trough measurement program in the northern portion of the Basin. The August Trough measurements are discussed in the GSPs for the 180/400-Foot Aquifer Subbasin and the Eastside Aquifer Subbasin.

In addition to the Fall and August Trough groundwater level measurement programs, MCWRA recently became the primary local Monitoring Entity for the Salinas Valley Basin under the California Statewide Groundwater Elevation Monitoring Program CASGEM). Created by the State in 2009, CASGEM is a statewide program to collect groundwater elevations and make the data accessible to the public.

In the Salinas Valley Basin, 64 wells are monitored through the CASGEM program. Their locations are shown in Figure 5-1. Wells were selected for the CASGEM program based on their distribution throughout Monterey County, the availability of detailed and reliable well construction data, and relative ease of data collection (MCWRA, 2015). Some wells are equipped with transducers that record groundwater levels on an hourly basis; others are manually monitored on a monthly or biannual frequency (MCWRA. 2015). The average period of record for these wells is 8 years. The earliest groundwater elevations were recorded in 2003.

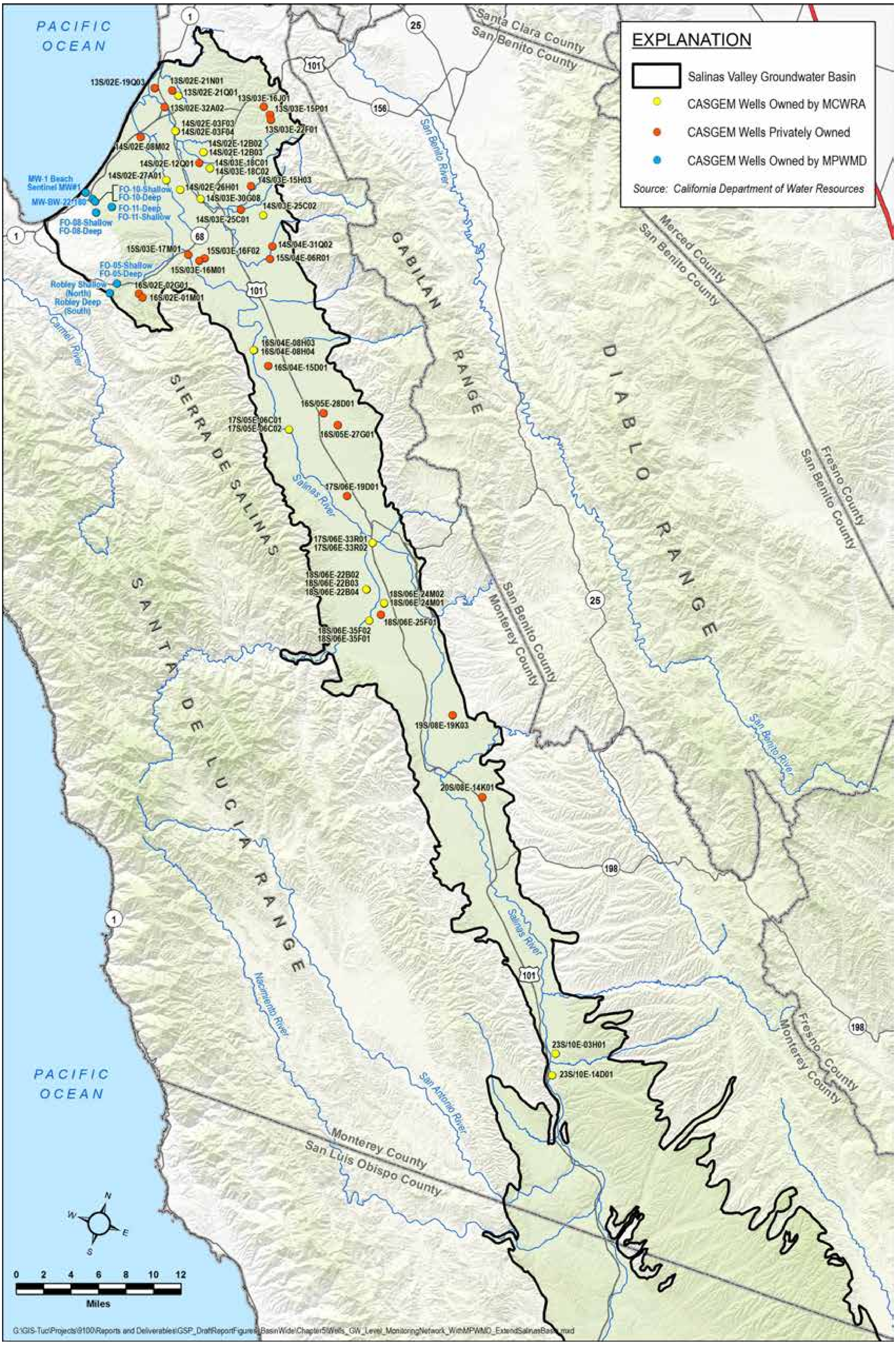


Figure 5-1: CASGEM Wells

As described in Chapter 4 groundwater levels in the Salinas Valley are highly dependent on two sources of climatic variability.

- Annual variation between wet season and dry season that is reinforced and amplified by agricultural irrigation.
- Wet and dry climatic cycles, characterized by multi-year drought and wet cycles, with a complete cycle often lasting a decade or more.

The groundwater level at any well can also be strongly influenced by local processes such as pumping from nearby wells which lower groundwater levels. Given the various regional and local influences on groundwater levels, it is illustrative to characterize the Basin groundwater elevation conditions through at least three distinct methodologies:

- Maps of groundwater level contours that show the lateral distribution of groundwater levels at a specific time. These contours represent the elevation above sea level of the groundwater levels in the Subbasin. The contour interval is 10 feet, meaning each blue line represents an area where groundwater levels are either 10 feet higher or 10 feet lower than the nearby blue line.
- Hydrographs in individual wells that plot the variation in groundwater level at that well over an extended period.
- Vertical hydraulic gradients in a single location to assess vertical groundwater flow direction and magnitude.

For this ISP, all three approaches are used to develop the following descriptions of current and historical water level conditions in terms of maps, vertical gradients, and temporal trends. Sections 5.1.1, 5.1.2, and 5.1.3 provide the background information that are used to develop the Sustainable Management Criteria (SMC) for water levels in Section 8.

5.1.2 Groundwater Elevation Contours and Horizontal Groundwater Gradients

MCWRA produces groundwater elevation contour maps for the Salinas Valley Groundwater Basin in odd-numbered years using data from the Fall measurement programs (MCWRA, n.d.). In the portion of the Basin where the 180-Foot and 400-Foot Aquifers are distinguishable as separate aquifers, MCWRA produces separate contour maps for each aquifer. In this ISP, data from wells monitoring groundwater levels in the 180-Foot Aquifer are used to develop groundwater level contour maps for the entire

Basin. Groundwater level contours for the 400-Foot Aquifer are presented separately. The contours on each of these maps originated from contours developed by MCWRA. Therefore, the contours only cover the portions of the basin monitored by MCWRA. Contours do not always extend to the basin margins; nor do they cover the entire Basin. This is a data gap that will be addressed during GSP implementation.

Current (Fall 2017) groundwater elevation contours developed by MCWRA for the entire Basin, including the 180-Foot Aquifer, are presented on Figure 5-2. Current groundwater elevation contours developed by MCWRA for the 400-Foot Aquifer are presented on Figure 5-3. Historical (Fall 1995) groundwater elevation contours developed by MCWRA for the entire Basin, including the 180-Foot Aquifer, are presented on Figure 5-4. Fall 1995 groundwater elevation contours developed by MCWRA for the 400-Foot Aquifer are presented on Figure 5-5.

Under both current and historical conditions, groundwater flows generally northwest along the axis of the Valley from the south end of the Basin toward Monterey Bay (Figure 5-2and Figure 5-4). Throughout most of the length of the Valley, the general groundwater flow direction is approximately parallel to the Valley's long axis, with local irregularities and variations. This flow parallel to the Valley's axis is only due to the linear shape of the Salinas Valley, with the natural hydrogeologic discharge point at the Valley's north end. The generalize flow direction does not imply that the groundwater is a subterranean stream. The average hydraulic gradient over the length of the valley from San Ardo to Chualar is approximately 0.0015 ft/ft, or 8 ft/mile.

In the northern portion of the Valley, there is an apparent pumping trough centered north of Salinas in the Eastside subbasin. In this area, groundwater flow gradients are not parallel to the Valley's long axis, but rather are cross-valley towards the pumping trough. The hydraulic gradient steepens in the vicinity of the pumping trough, with observed gradients of approximately 0.003 ft/ft, or 16 ft/mile.

A comparison of the historical and current groundwater level maps indicates that there has not been an appreciable change in the overall groundwater flow pattern or groundwater gradients between 1995 and 2017. A discussion of historical groundwater level changes is presented in Section 5.1.3

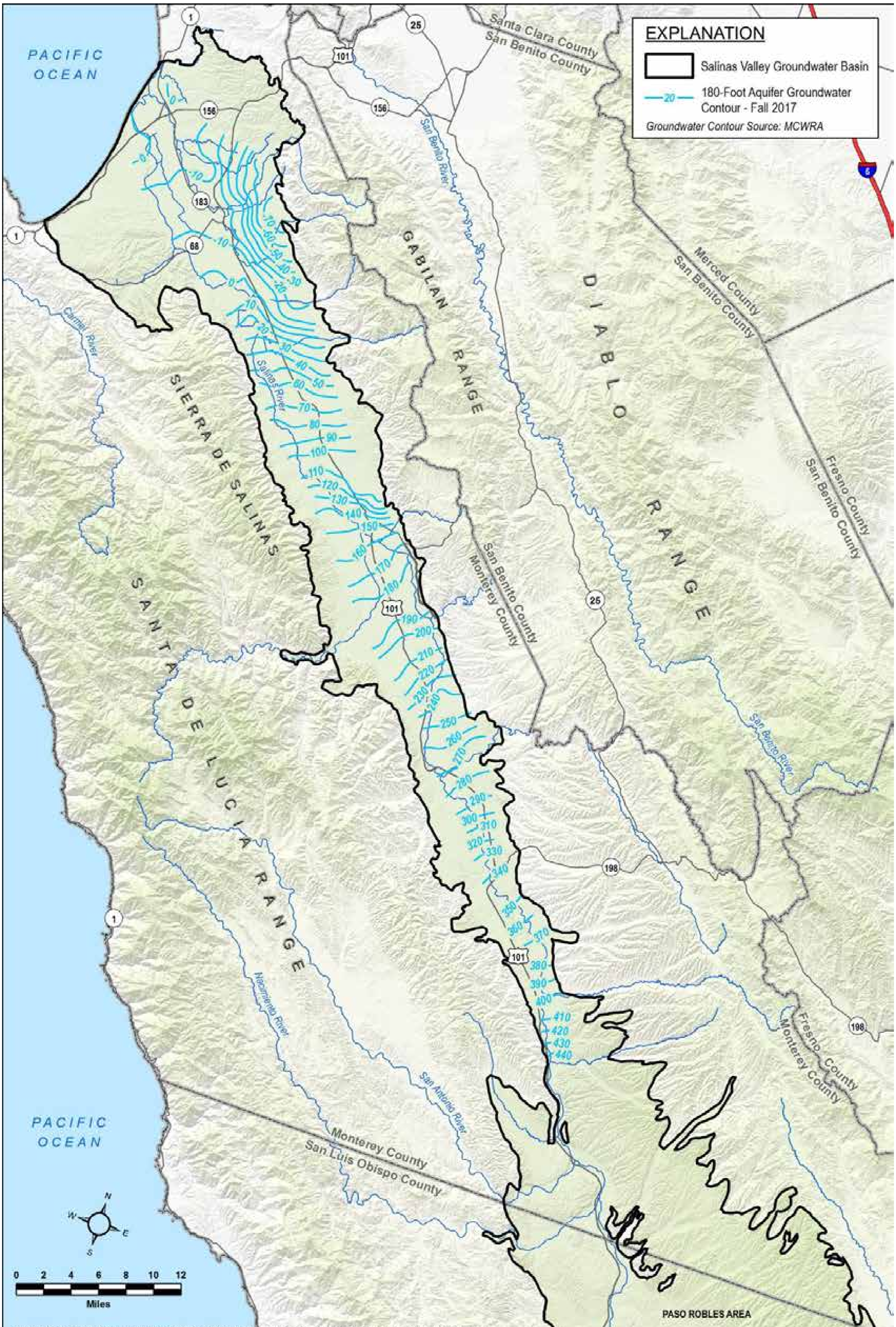


Figure 5-2: Fall 2017 Basin-Wide Groundwater Level Contours

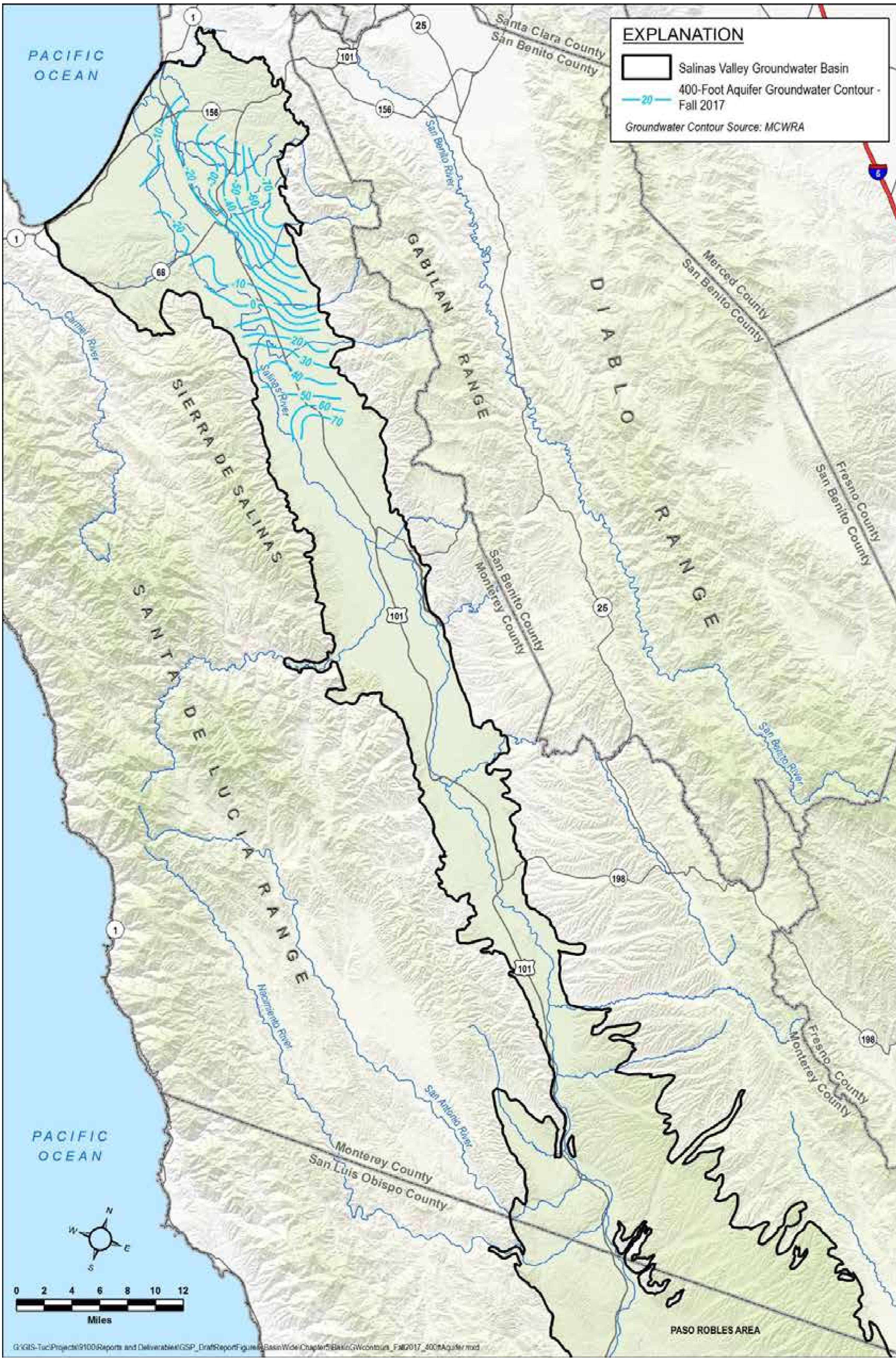


Figure 5-3: Fall 2017 Groundwater Level Contours for the 400-Foot Aquifer

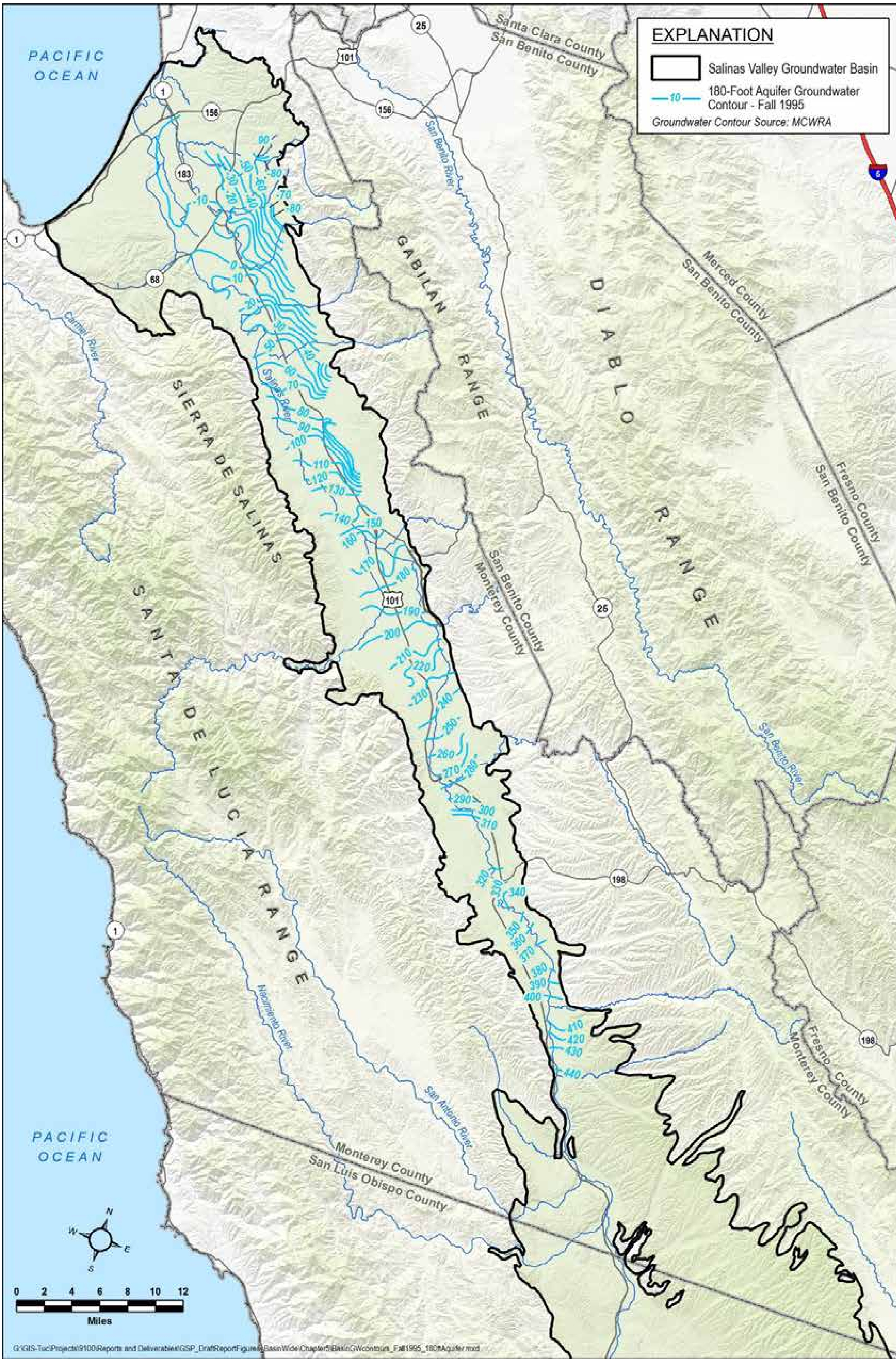


Figure 5-4: Fall 1995 Basin-Wide Groundwater Level Contours

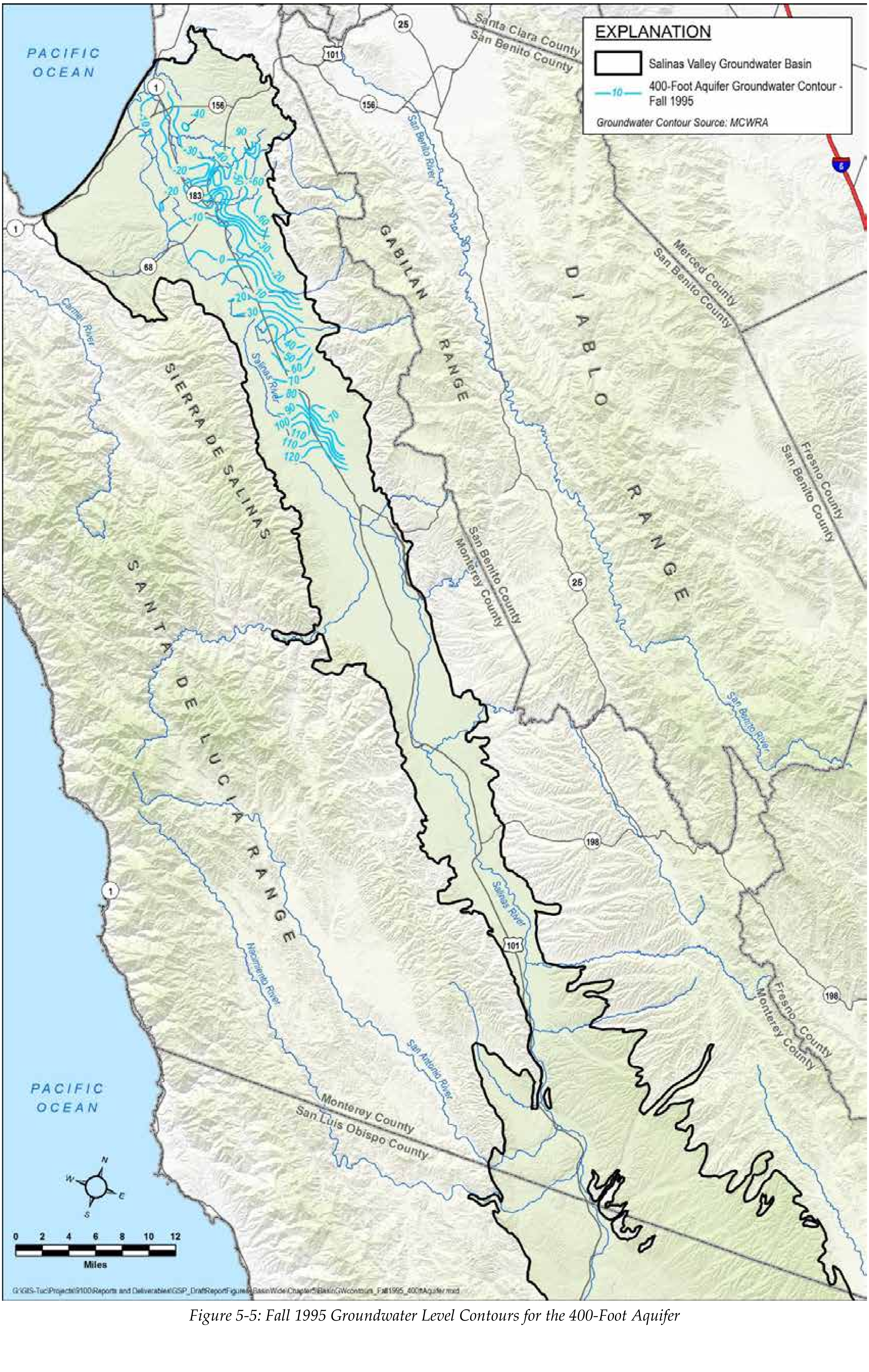


Figure 5-5: Fall 1995 Groundwater Level Contours for the 400-Foot Aquifer

5.1.3 SALINAS VALLEY AQUIFER HYDROGRAPHS

Representative temporal trends in groundwater levels can be assessed with hydrographs – graphs that plot changes in groundwater levels over time. Groundwater level data from wells within the Basin are available from monitoring conducted and reported by MCWRA. Figure 5-6 depicts the locations of 11 wells monitored by MCWRA within the Basin and their hydrographs. Larger versions of the hydrographs shown on Figure 5-6 are included in Figure 5-7 through Figure 5-10. These wells were selected based on their distribution throughout Salinas Valley, and the length and continuity of their monitoring records. These wells are shown simply to illustrate the variability in hydrographs across the Valley. Hydrographs for wells monitored by MCWRA that are not limited by confidentiality agreements are included in Appendix 5A. The locations of all of these wells are shown on Figure 5-11. Hydrographs are not available for wells completed in the Deep Aquifer. This is a data gap that will be filled during the GSP implementation.

In addition to the hydrographs of individual wells, there is value in looking at representative average water level trends at a subarea scale. Figure 5-12 presents the graphs of cumulative groundwater level change for the MCWRA-designated subareas. These subareas are approximately coincident with five of the Valley's Subbasins as shown in Figure 5-13. Notable differences between the MCWRA-designated subareas and the SVBGSA subbasins include

- The Pressure subarea overlaps with the 180-400 Foot Aquifer Subbasin and includes most of the Monterey Subbasin and a part of the adjudicated Seaside Subbasin;
- The Langley Subbasin is included as a part of the Eastside Subbasin;
- Small parts of the Forebay and Upper Valley Subbasins are not included; and
- The current Upper Valley Subbasin is approximately double the size of the Upper Valley sub area due to the Subbasin extension to the Monterey County line.

The plots in Figure 5-12 are based on calculations by MCWRA where the annual change in water level is averaged for all wells in each subarea each year, beginning in 1945. These cumulative groundwater level change plots are therefore an estimation of the average hydrograph for each subarea. Although these plots do not reflect the water level change at any specific location, they provide a clear illustration of the average water level change within the Basin in response to the historical changes in climatic cycles, groundwater extraction, and water-resources management at the Basin scale.

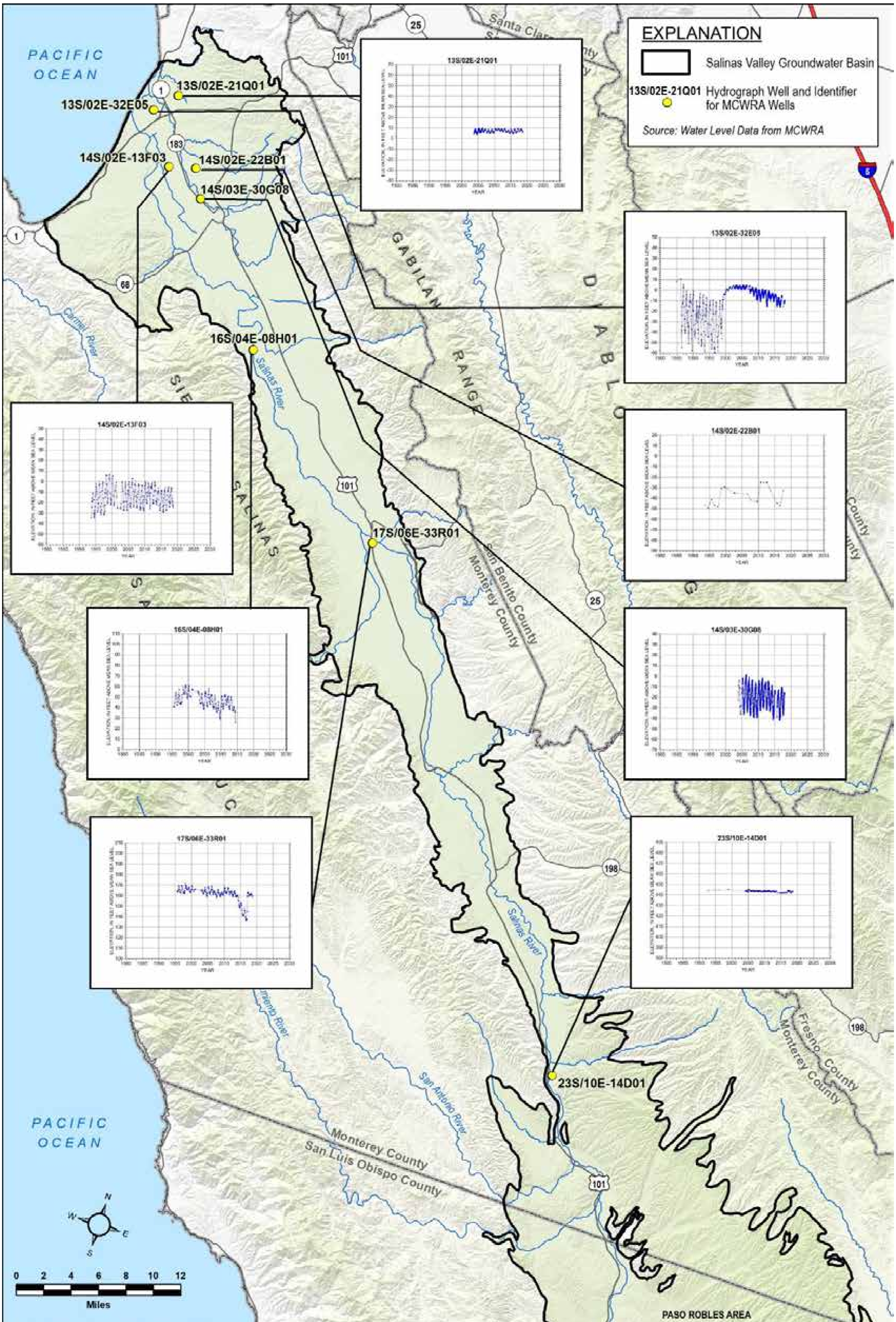
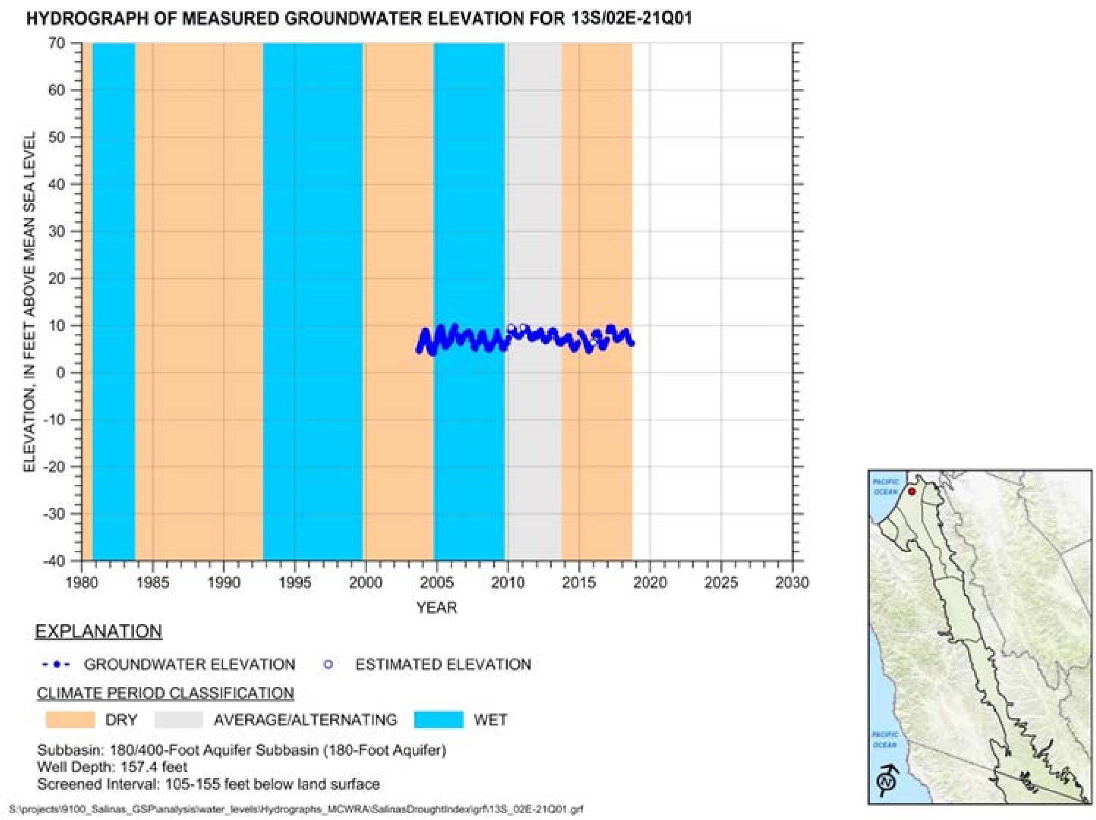


Figure 5-6: Representative Hydrographs in the Salinas Valley



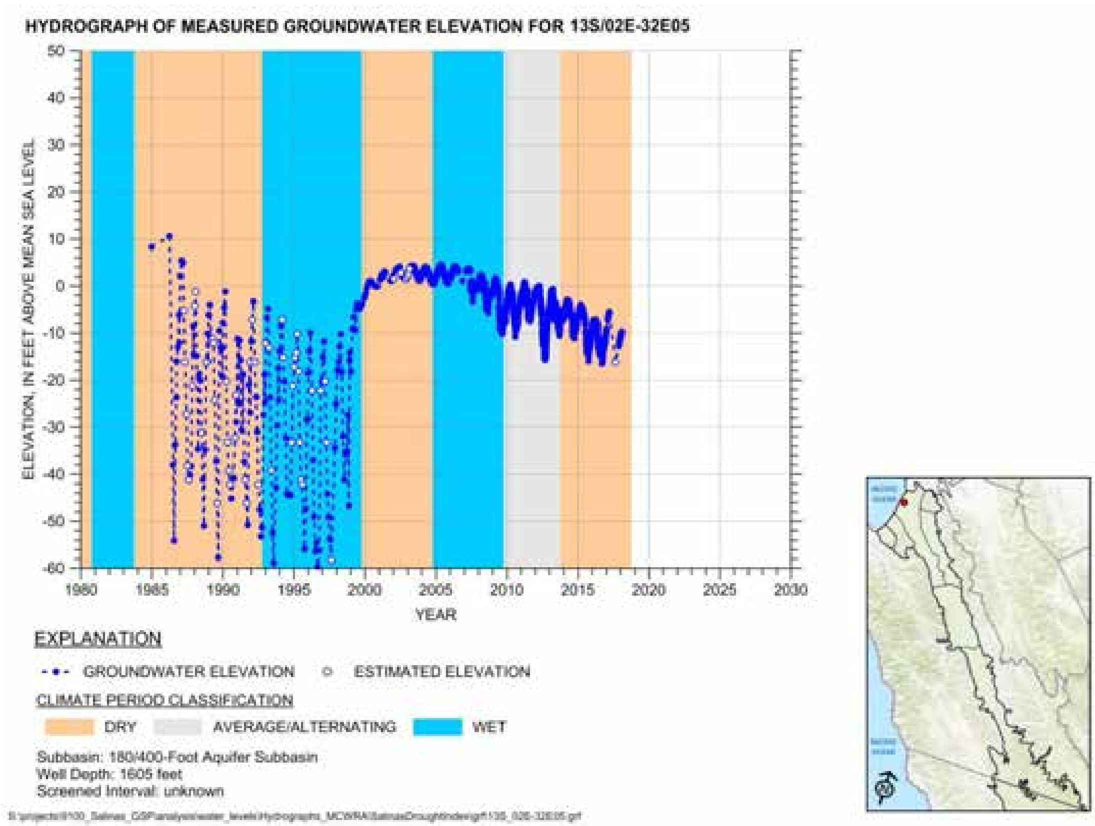
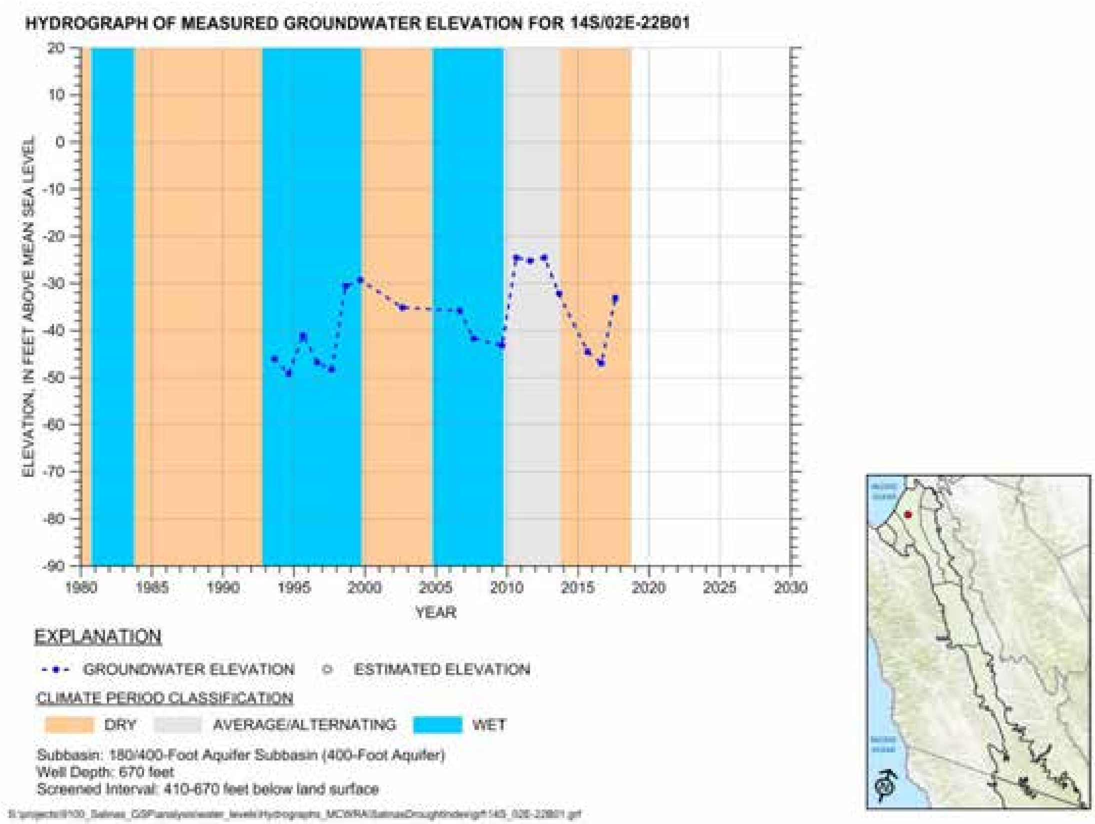


Figure 5-7: Representative Hydrographs Shown on the Salinas Valley Hydrographs Map (1)



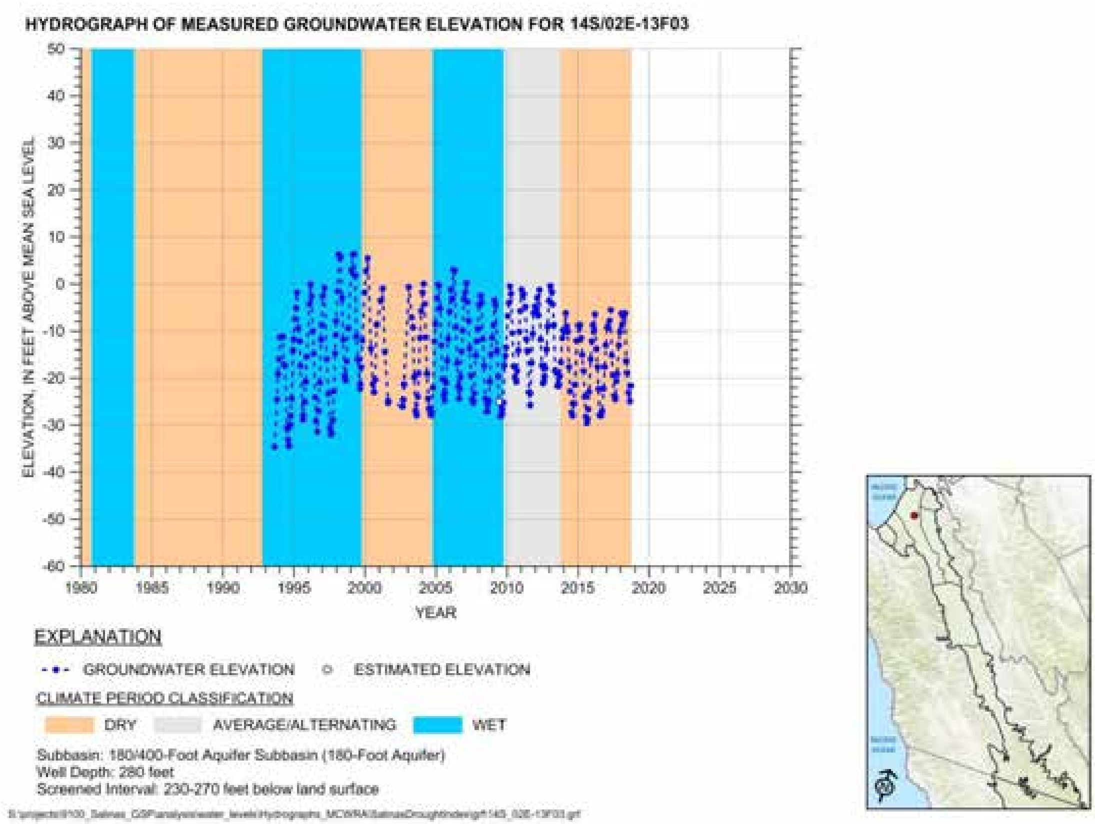
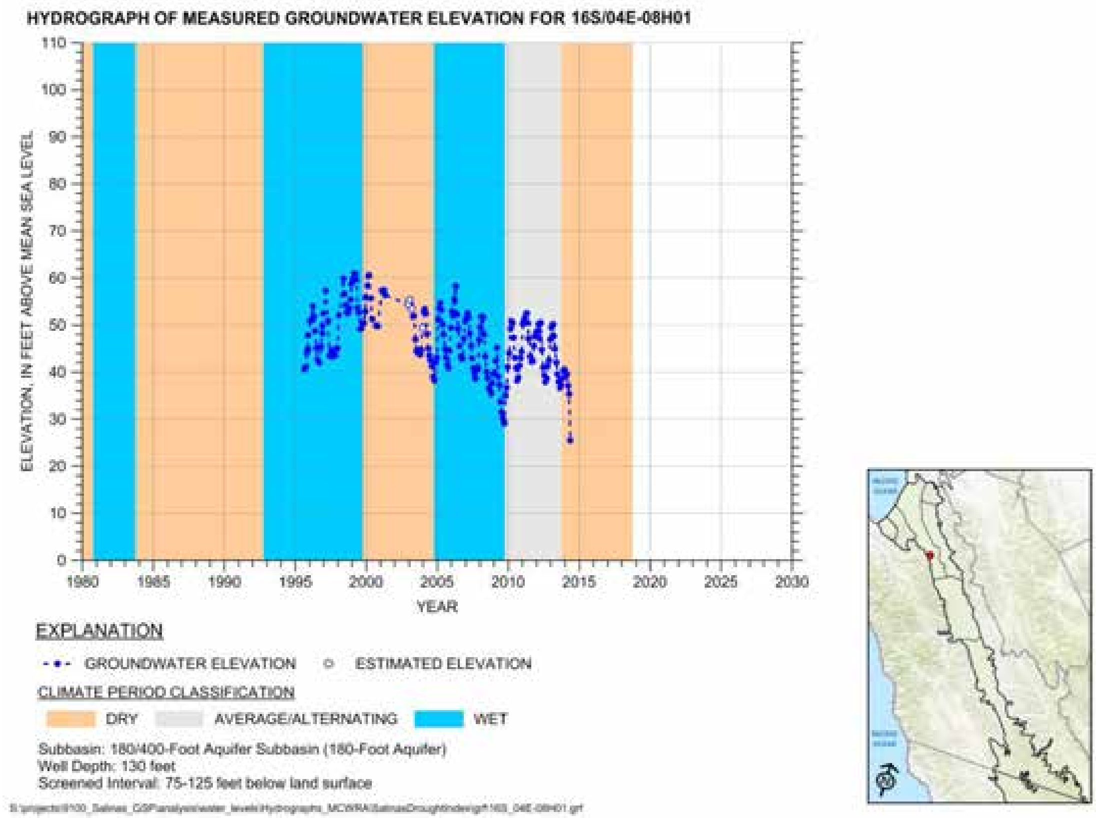


Figure 5-8: Representative Hydrographs Shown on the Salinas Valley Hydrographs Map (2)



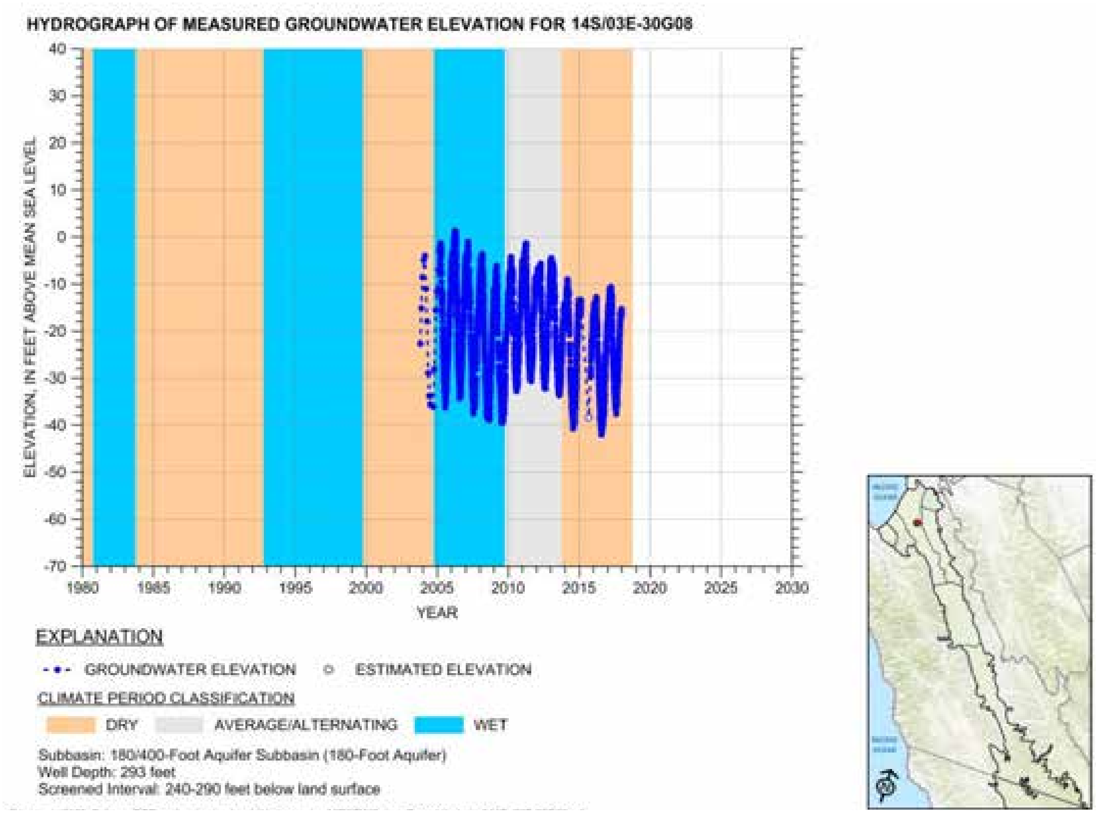


Figure 5-9: Representative Hydrographs Shown on the Salinas Valley Hydrographs Map (3)

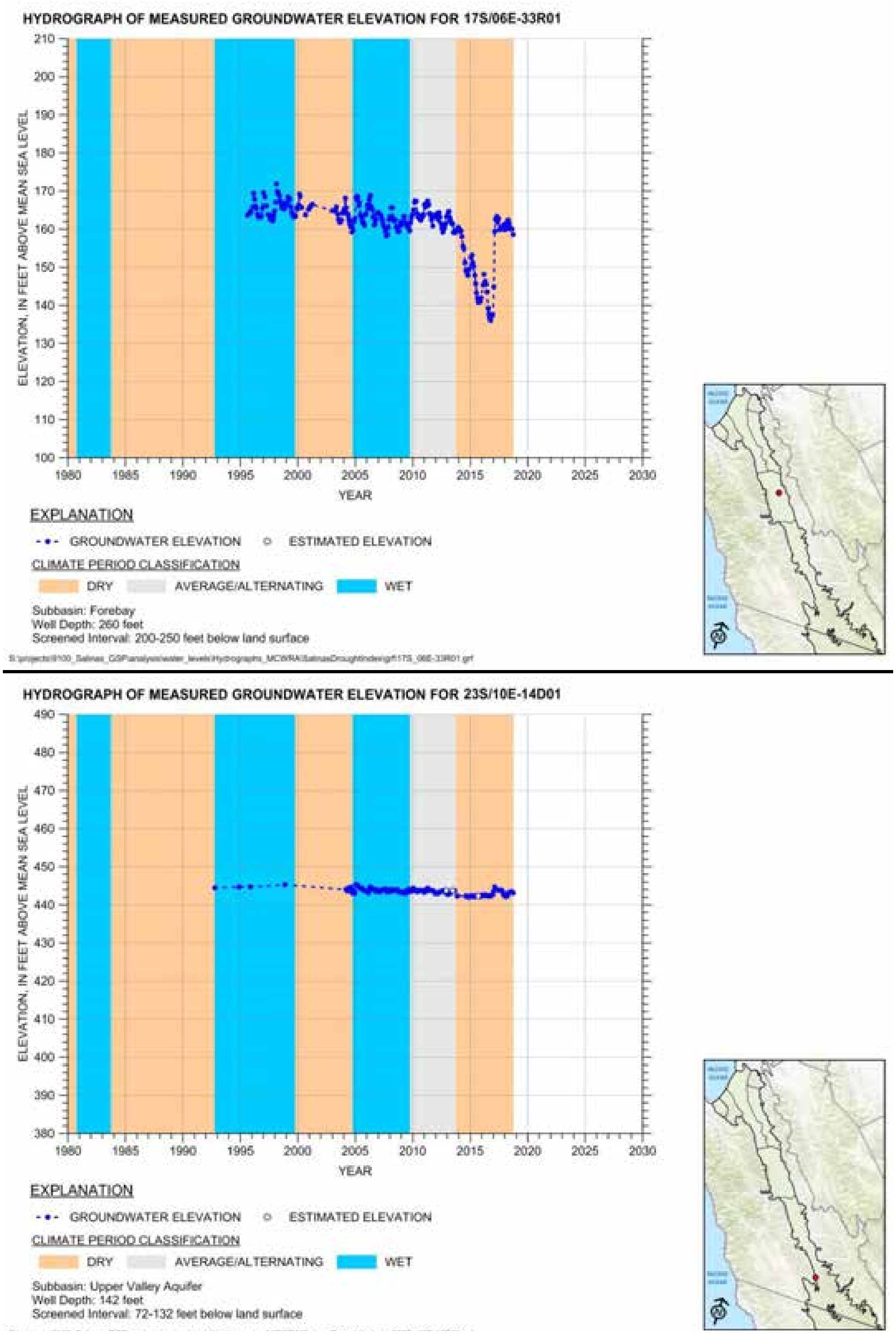


Figure 5-10: Representative Hydrographs Shown on the Salinas Valley Hydrographs Map (4)

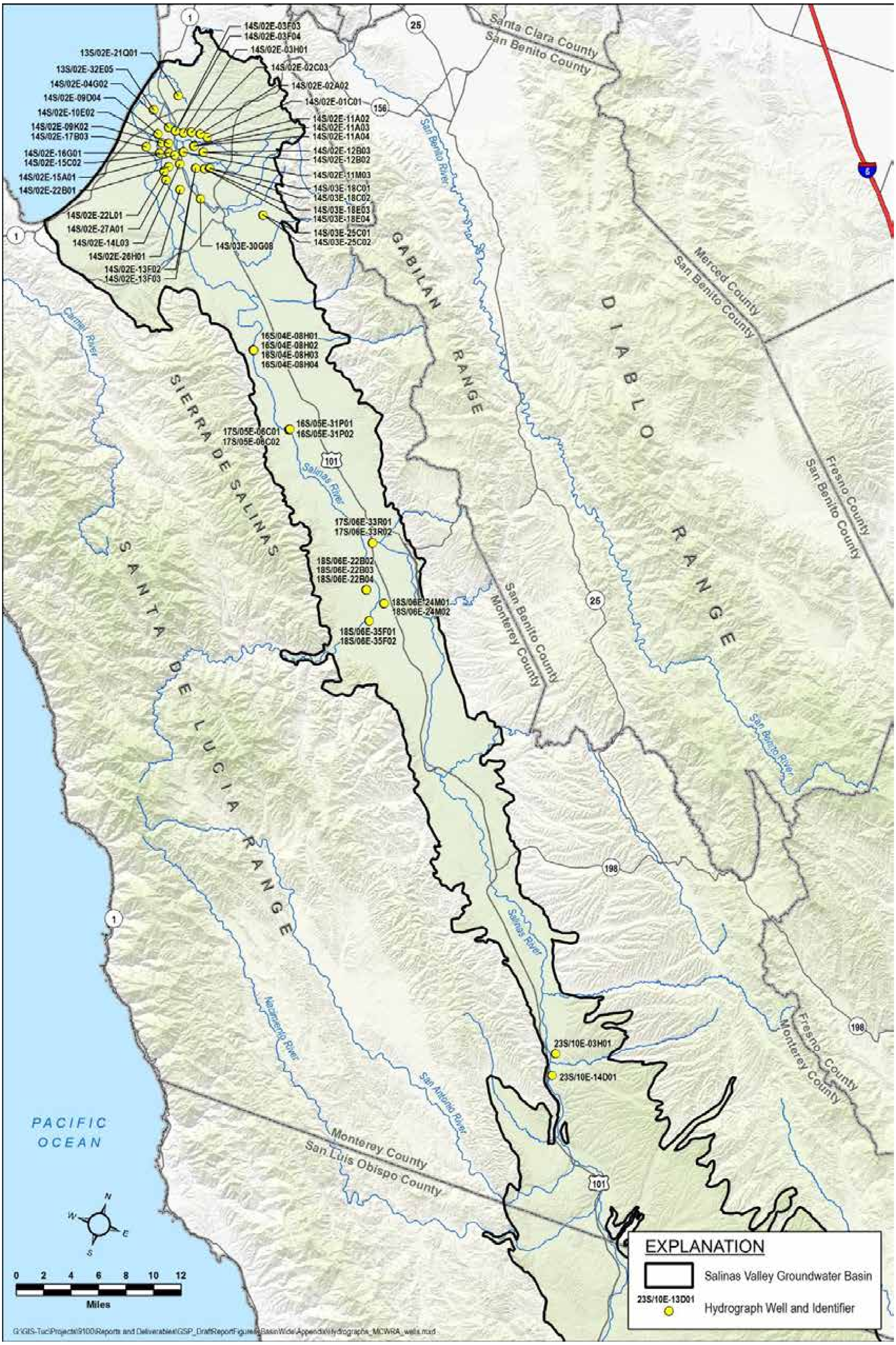


Figure 5-11: Locations of All Wells with Hydrographs

The cumulative groundwater level change graph shown on Figure 5-12 shows an apparent drop in average groundwater elevations following activation of the CSIP system in 1998; and another apparent drop in average groundwater elevations following activation of the SVWP in 2010. These apparent drops in average groundwater elevations are not the result of either of these projects, but are rather the result of natural climatic variation. The water year type information shown behind the hydrographs on Figure 5-7 through Figure 5-10 indicate that there was a dry period between 2000 and 2005, soon after the CSIP project was initiated. Similarly, the SVWP project came online during an alternating climatic period, and just before an extended dry period. This is substantiated by the fact that similar groundwater elevation drops are seen in three of the four MCWRA Subareas on Figure 5-12. The groundwater elevation drops are Valley-wide and are in response to climatic variation, not localized or in response to particular projects.

Based on the cumulative data presented in Figure 5-12, and the specific hydrographs presented in Figure 5-6, the following general observations can be made.

- After the Nacimiento and San Antonio reservoirs began operation in 1957 and 1967, respectively, the average groundwater levels in the Upper Valley returned to 1945 levels and have remained close to those levels for most years. The Upper Valley had two periods of significant groundwater level declines: the 1989 to 1991 drought and the 2012 to 2016 drought. Following these two drought events, water levels recovered from the extreme lows within one to two years.
- Groundwater levels in the Forebay were relatively constant through 1983. Since 1983, groundwater levels in the Forebay have slowly declined, punctuated by two significant declines during the 1989 to 1991 drought and the 2012 to 2016 drought. Groundwater levels recovered from these two droughts more slowly in the Forebay subarea than in the Upper Valley subarea.
- Groundwater levels in the 180/400-Aquifer Subbasin show a general decline over time. The high groundwater levels observed in 1952 and 1983 suggest that groundwater levels previously had the capacity to recover to earlier levels in response to significant recharge events. Groundwater levels have declined since 1983 with no indication that they will recover to pre-1983 levels.
- Groundwater levels in the Eastside Subbasin follow a similar pattern to the groundwater levels in the 180/400-Foot Aquifer Subbasin. However, the magnitude of the groundwater level declines has been greater in the Eastside Subbasin. This is likely because groundwater elevations in the Eastside Subbasin are not propped up by seawater intrusion, as they are in the 180/400-Foot Aquifer Subbasin.

- Groundwater levels in the 180/400-Foot Aquifer Subbasin and the Eastside Subbasin have experienced more pronounced and more prolonged declines associated with the multi-year droughts than the groundwater levels in the southern portion of the Basin. This suggests wet-year recharge has more limited impact in the 180/400-Foot Aquifer Subbasin and the Eastside Subbasin than in the southern subbasins.

It should be noted that MCWRA's subarea cumulative groundwater level change calculations include groundwater levels measured in privately-owned wells. As these data are considered confidential, they are not presented in this document. This partially accounts for differences in the groundwater levels depicted in Figure 5-6, which are from wells in the CASGEM program, and Figure 5-12.

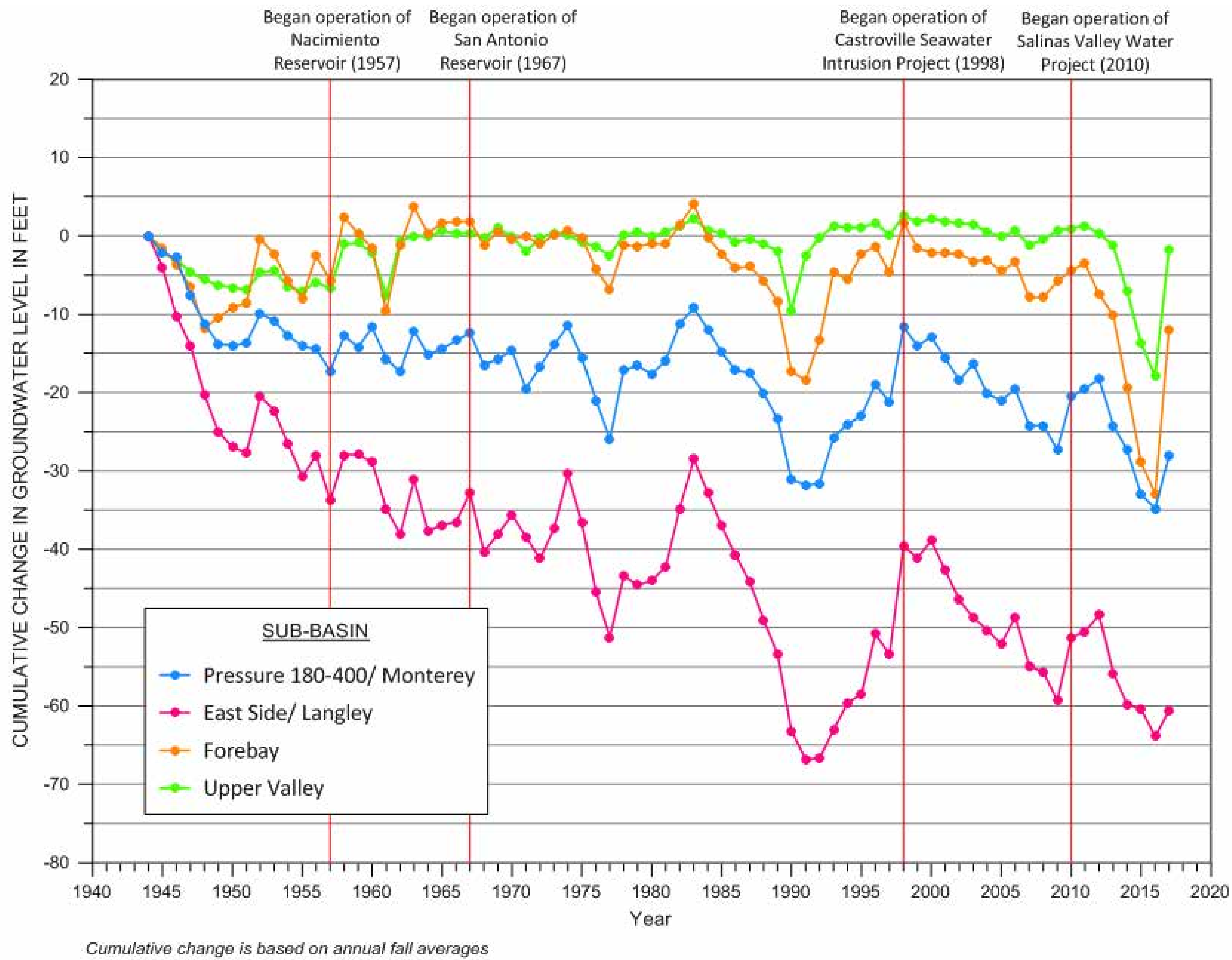


Figure 5-12: Cumulative Groundwater Change Graphs (from MCWRA, 2018b)

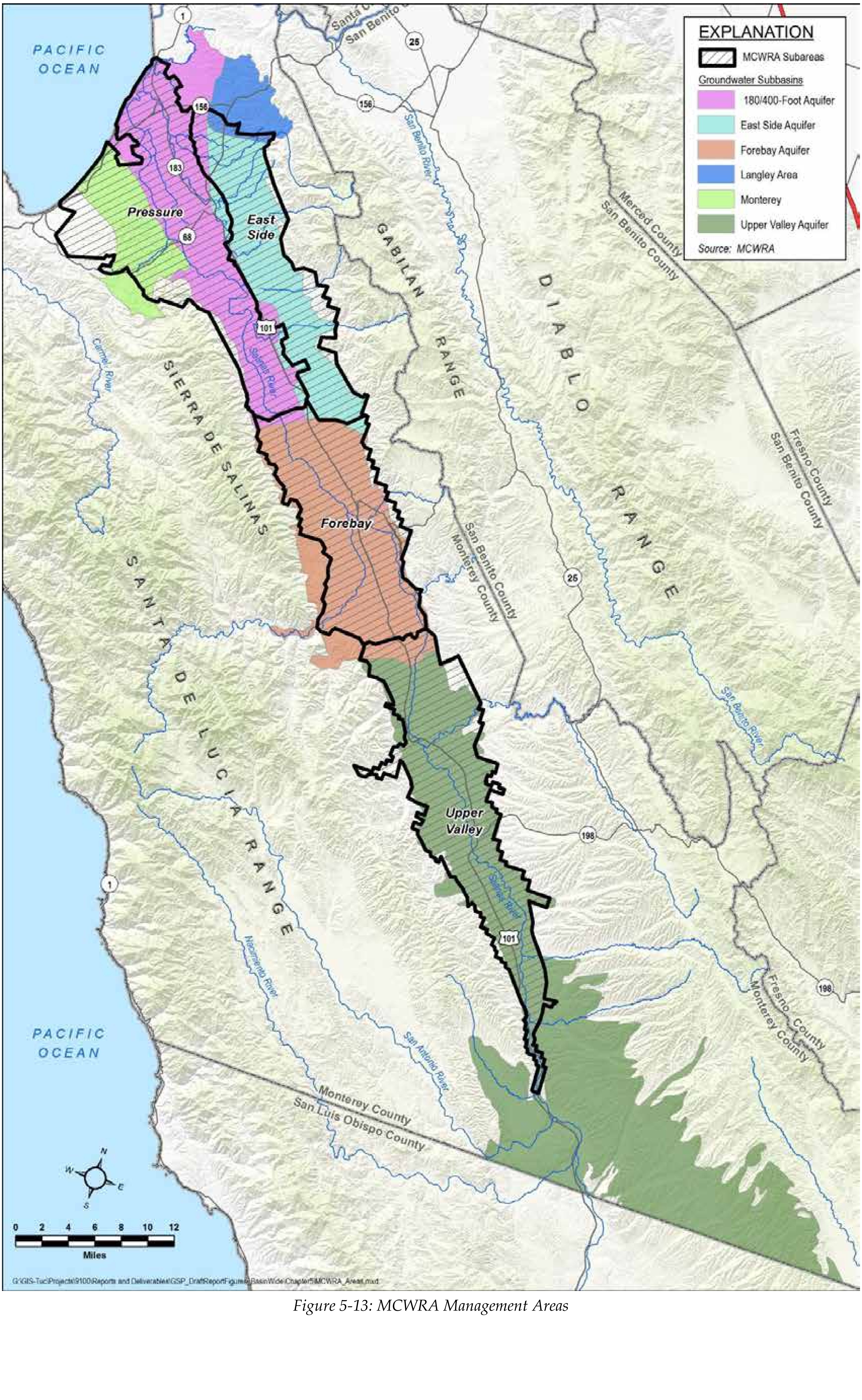


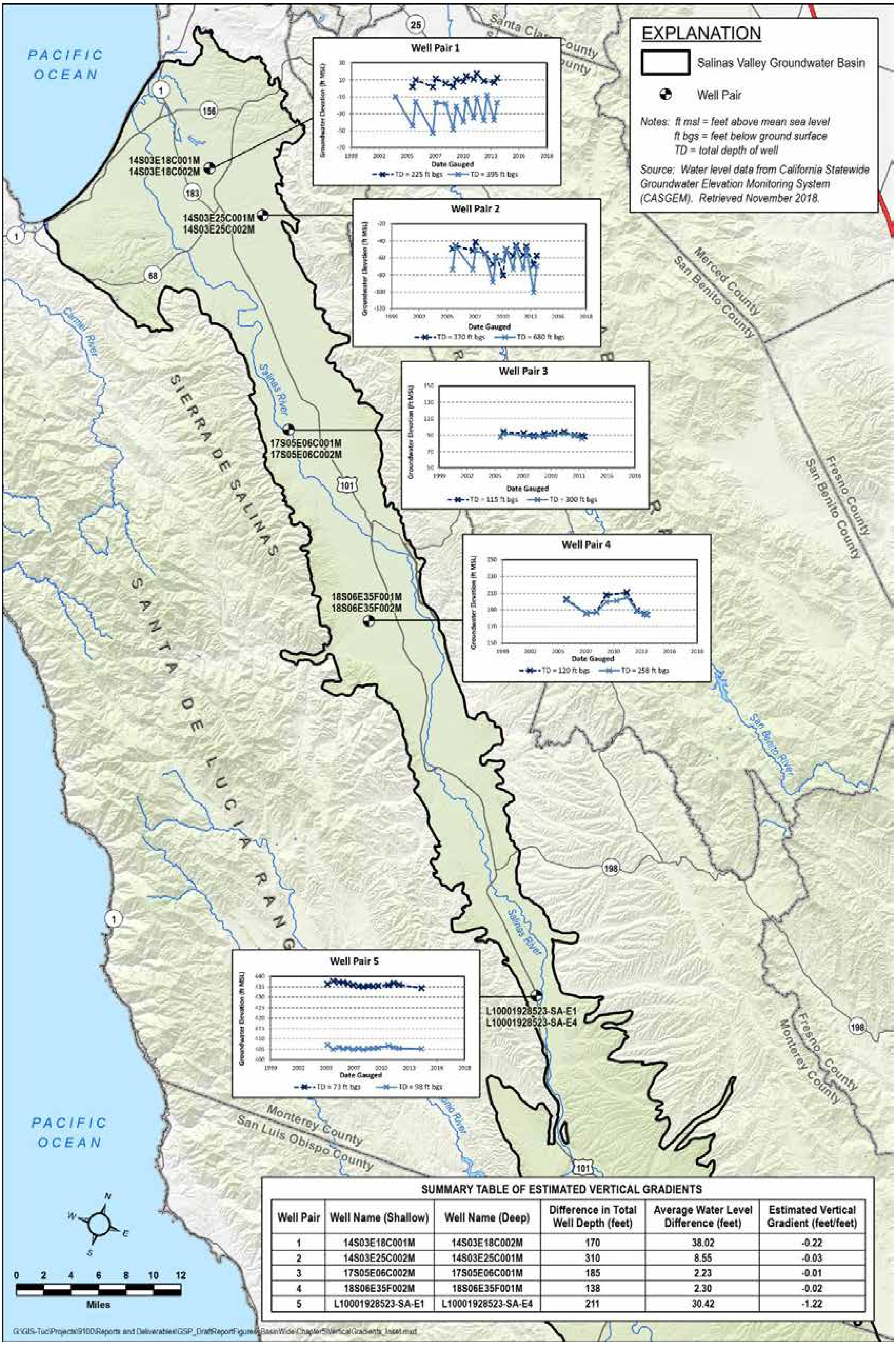
Figure 5-13: MCWRA Management Areas

5.1.4 VERTICAL GROUNDWATER GRADIENTS

In addition to the horizontal hydraulic gradients discussed, there are vertical hydraulic gradients associated with vertical groundwater flow. With groundwater recharge occurring at the ground surface and groundwater withdrawal from wells at depth, there is a basin-wide vertical downward flow that results in downward hydraulic gradients. The practical impact of the vertical gradients is that wells completed at deeper depths may have lower water levels than shallow wells. These vertical groundwater gradients can impact the location and amount of natural groundwater discharge to groundwater dependent ecosystems.

Although groundwater flow is vertically downward through the entire Basin, the magnitude of the vertical gradients is variable. Throughout most of the Basin, the lithology does not limit vertical groundwater movement; therefore, the vertical hydraulic gradients are often small and only discerned with precise measurements in monitoring wells. However, near the northern portion of the Basin, where the 180-Foot and 400-Foot Aquifers have been delineated, the intervening clay layers result in notable vertical hydraulic gradients, with water levels approximately 20 to 50 feet lower in deeper wells than in shallower wells. Because the downward vertical gradients are caused by pumping, the magnitudes of the vertical gradients in many areas are greater during the irrigation season.

Figure 5-14 illustrates how the vertical gradients at representative well pairs vary throughout the Basin. Each of the five representative well pairs consists of two adjacent wells with different well depths. The hydrographs for each well pair illustrate the difference in water level between wells of different depths at the same location.



SUMMARY TABLE OF ESTIMATED VERTICAL GRADIENTS

Well Pair	Well Name (Shallow)	Well Name (Deep)	Difference in Total Well Depth (feet)	Average Water Level Difference (feet)	Estimated Vertical Gradient (feet/feet)
1	14S03E18C001M	14S03E18C002M	170	38.02	-0.22
2	14S03E25C002M	14S03E25C001M	310	8.55	-0.03
3	17S05E06C002M	17S05E06C001M	185	2.23	-0.01
4	18S06E35F002M	18S06E35F001M	138	2.30	-0.02
5	L10001928523-SA-E1	L10001928523-SA-E4	211	30.42	-1.22

Figure 5-14: Representative Vertical Groundwater Gradients in the Salinas Valley

- Well Pair 1: The two wells, completed at depth of 225 and 395 ft below ground surface (bgs), respectively; have noticeably different groundwater levels for all years and for both August and Fall measurements. The average difference is 38 feet, but there is also a large seasonal increase in groundwater level difference, with differences of up to 50 ft during the August measurements (irrigation season) and only 20 ft during the Fall measurements.
- Well Pair 2: The two wells, completed at depths of 370 and 680 ft bgs, have no discernible groundwater level difference during the Fall measurements but have approximately 20 ft of groundwater level difference during the August measurements.
- Wells Pairs 3 and 4: Well pair 3 consists of two wells, completed at depths of 115 and 300 feet bgs. Well pair 4 consists of two wells, completed at 120 and 258 ft bgs. Both of these well pairs show only a small discernible difference in groundwater levels. These pairs are typical of most of the Forebay and Upper Valley.
- Well Pair 5: These two wells, completed at depths of 73 and 98 ft bgs, show an unusually large water level difference, with an average difference of 30 ft, compared to other wells in the Upper Valley. These data indicate that locally-significant vertical hydraulic gradients may be present in some areas of the Upper Valley, likely associated with pumping at a nearby well.

5.2 SEAWATER INTRUSION

The northern portion of the Basin has been subject to seawater intrusion into the 180-Foot and 400-Foot Aquifers for more than 70 years, based on increased salt content in wells near the Monterey Bay coastline. The negative impact of seawater intrusion on local water resources and the agricultural economy has been the primary motivation for many studies dating back to 1946 (DWR, 1946). MCWRA and others have implemented a series of engineering and management projects including well construction moratoriums, developing the CSIP system, and implementing the SVWP among other actions to halt seawater intrusion. Although those actions have managed to slow the advance of intrusion and reduce its impacts, seawater intrusion remains an ongoing threat.

The extent and advancement of seawater intrusion over time has been well-monitored and reported by MCWRA. Monitoring seawater intrusion has been on-going since the Agency formed in 1947 and currently includes a network of 96 agricultural wells and 25 dedicated monitoring wells that are sampled twice annually: in June and August. The water samples are analyzed for general minerals; and the analytical results are used by MCWRA to analyze and report the following:

- Maps and graphs of historical chloride and specific conductivity trends
- Stiff diagrams and Piper diagrams
- Plots of chloride concentration vs. Na/Cl molar ratio trends

MCWRA publishes estimates of the extent of seawater intrusion every two years. The MCWRA maps define the extent of seawater intrusion as the inferred location of the 500 mg/L chloride concentration. This chloride concentration is significantly lower than the 19,000 mg/L chloride concentration typical of seawater, but it represents a concentration that may begin to impact use of the water.

Figure 5-15 and Figure 5-16 present the most recent MCWRA maps of the current and historical extent of seawater intrusion for the 180-Foot Aquifer and the 400-Foot Aquifer, respectively. In each of the two figures, the extent of the shaded contours represents the extent of groundwater with chloride exceeding 500 mg/L during the 2017 monitoring period. The historical progression of the 500 mg/L extent is also illustrated on these figures through the colored overlays that represent the extent observed during selected years.

Figure 5-15 and Figure 5-16 also present the mapped August 2017 groundwater elevations for the 180-Foot Aquifer and the 400-Foot Aquifer. These maps show the seasonally low groundwater elevations that drive seawater intrusion. Figure 5-15 shows that the extent of seawater intrusion in the 180-Foot Aquifer has approximately reached a local cone of depression; represented by the small circular water level contour with a -20 foot msl label. This may partially explain why the rate of seawater intrusion has slowed in recent years: the seawater intrusion is reaching a local low point and is not being drawn further inland.

Figure 5-17 and Figure 5-18 present the time series graphs of the total acreage that overlies groundwater with chloride concentration greater than 500 mg/L. Figure 5-17 shows the time series of acreage overlying seawater intrusion in the 180-Foot Aquifer. Figure 5-18 shows the time series of acreage overlying seawater intrusion in the 400-Foot Aquifer.

As shown in Figure 5-17, seawater intrusion into the 180-Foot Aquifer covered approximately 20,000 acres in 1995 and had expanded to approximately 28,000 acres by 2010. Since then, the rate of expansion has decreased, with an overlying area of 28,300 acres in 2017.

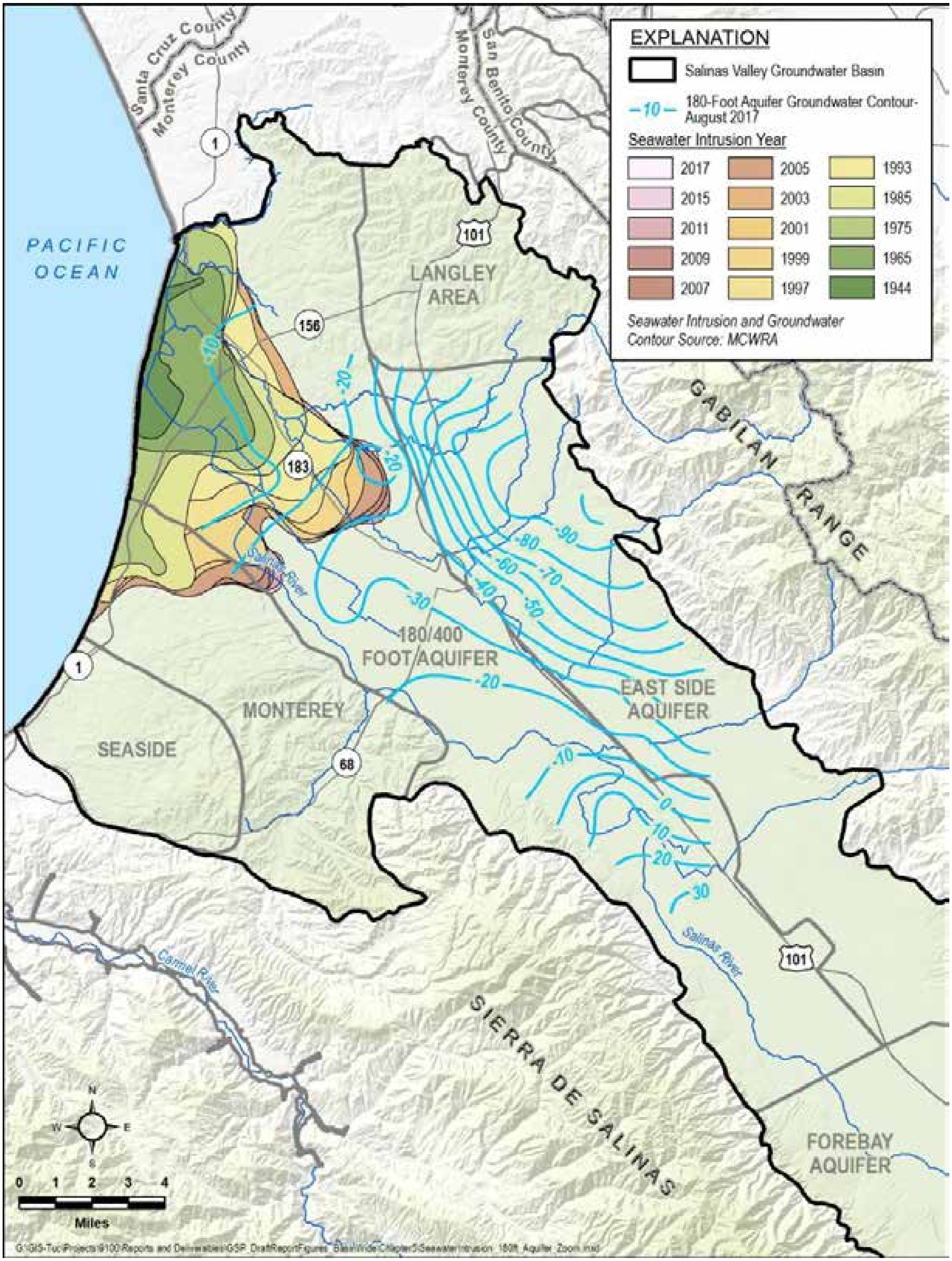


Figure 5-15: Seawater Intrusion in the 180-Foot Aquifer (from MCWRA)

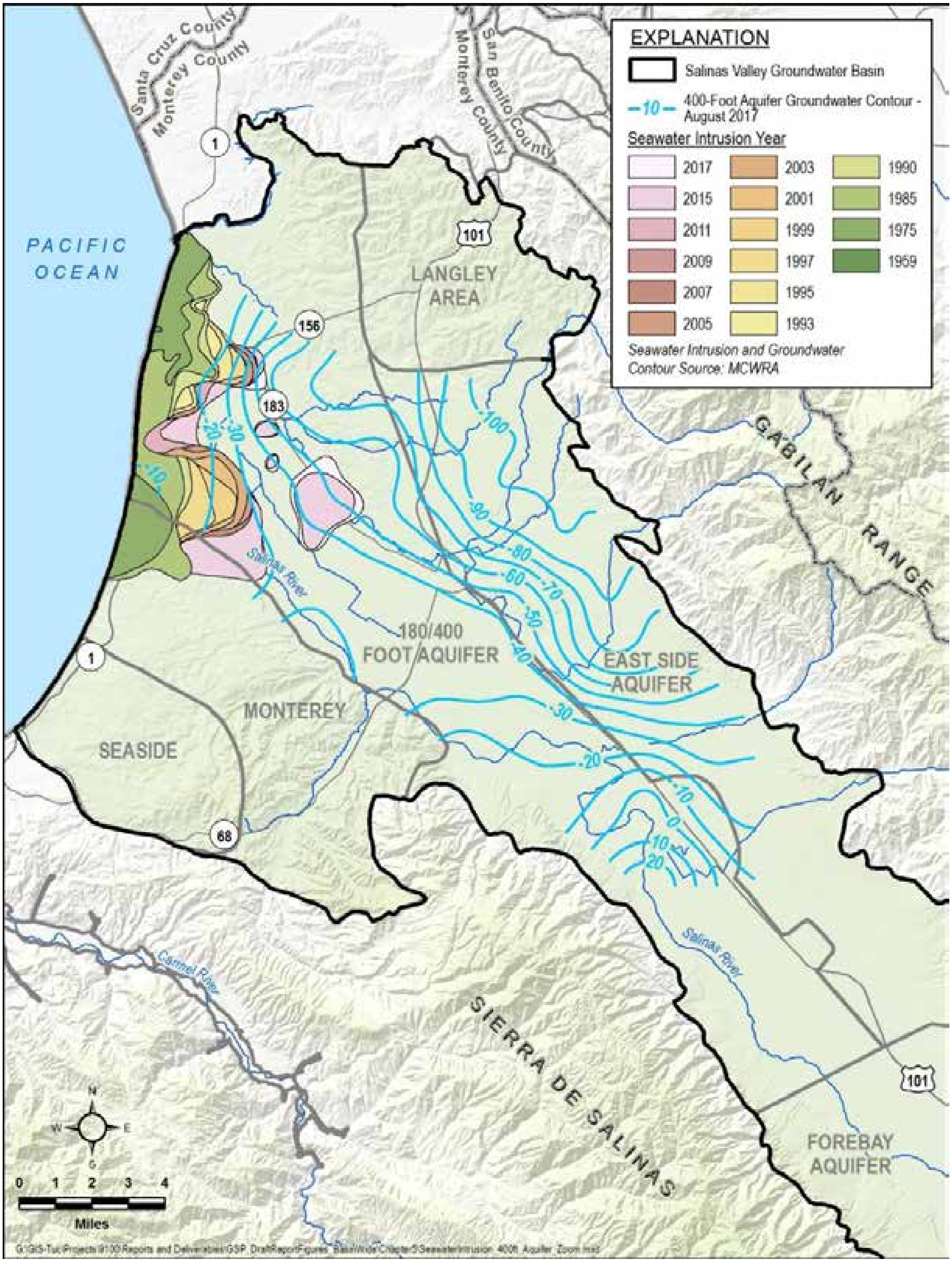
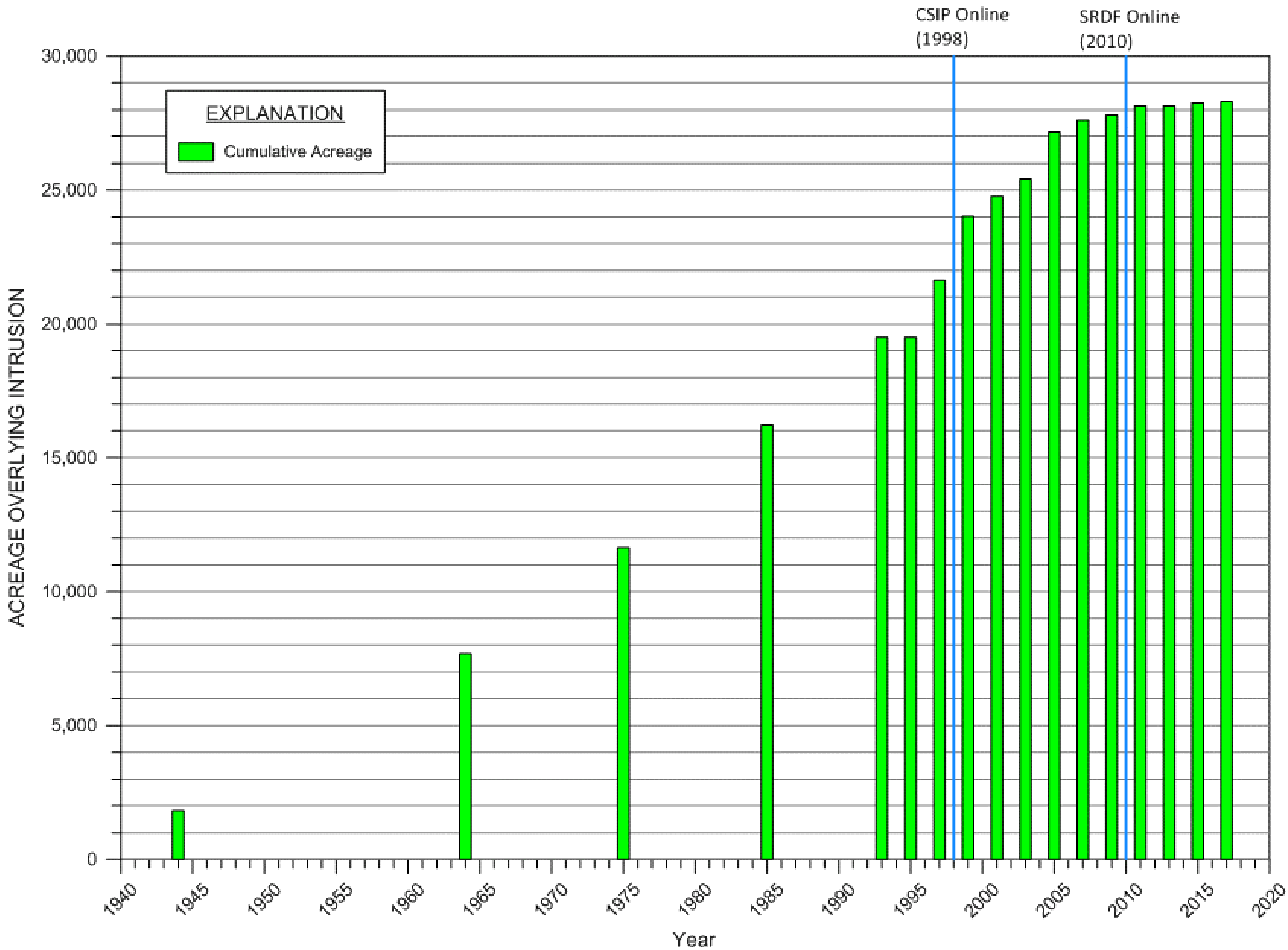


Figure 5-16: Seawater Intrusion in the 400-Foot Aquifer (from MCWRA)



Source: Special Joint Meeting of MCWRA BOD and Monterey County BOS

Figure 5-17: Acreage Overlying Seawater Intrusion in the 180-Foot Aquifer

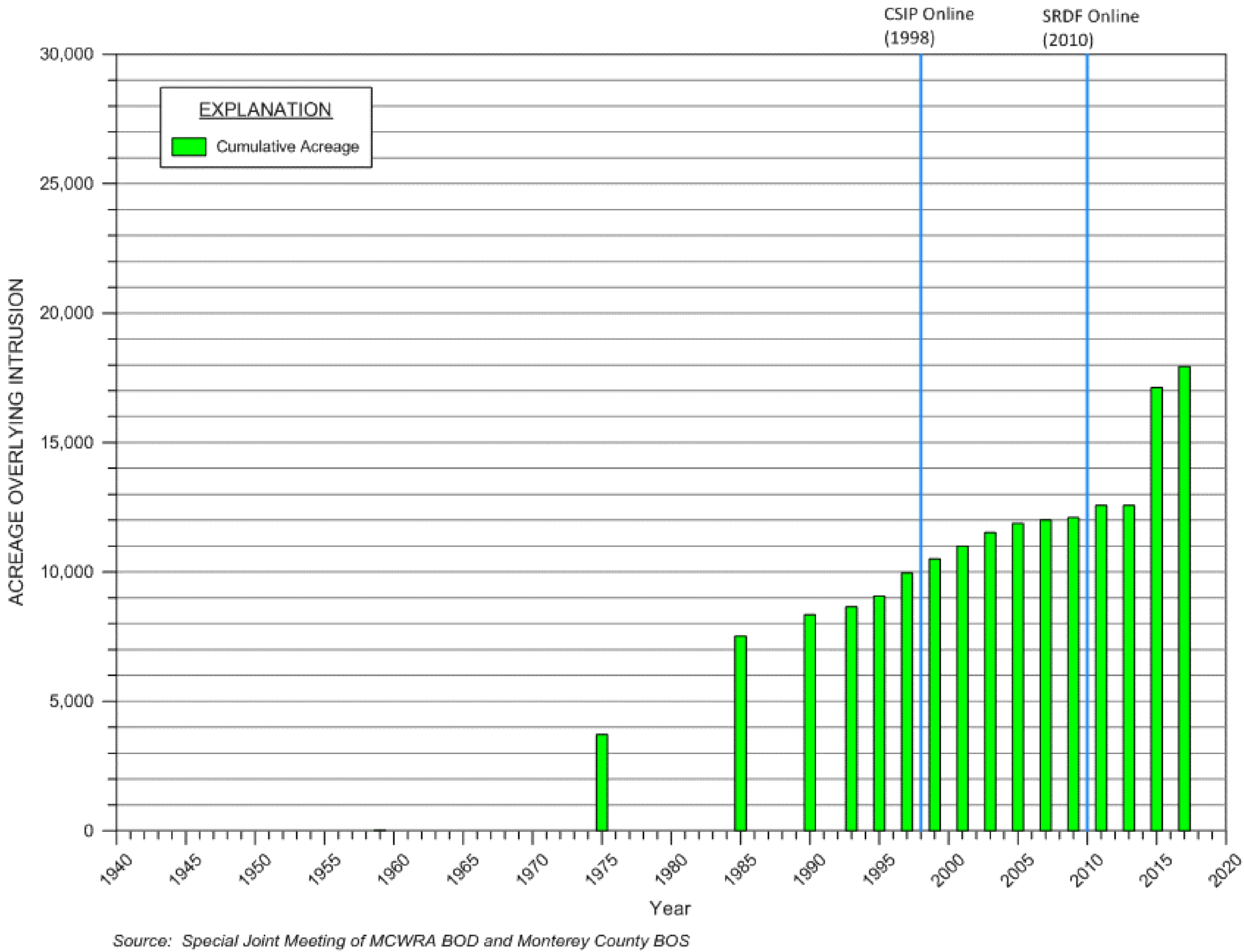


Figure 5-18: Acreage Overlying Seawater Intrusion in the 400-Foot Aquifer

The area overlying intrusion into the 400-Foot Aquifer (Figure 5-18) is not as extensive, with an overlying area of approximately 12,000 acres in 2010. However, between 2013 and 2015, the 400-Foot Aquifer experienced a significant increase in the area of seawater intrusion, from approximately 12,500 acres to approximately 18,000 acres. This apparent rapid increase in area is likely the result of localized downward migration of high-chloride groundwater from the 180-Foot Aquifer to the 400-Foot Aquifer. The process of downward migration between aquifers may be in part attributed to wells that are screened across both aquifers. Regardless of the specific pathways, the presence of vertical downward hydraulic gradients from the 180-Foot Aquifer to the 400-Foot Aquifer presents a risk that eventually the intruded area of the 400-Foot Aquifer will be as large as that of the 180-Foot Aquifer

To date, seawater intrusion has not been reported in the Deeper Aquifers. However, due to concern over this risk, the County has a current moratorium under Ordinance 5302 on the construction of new wells in the Deep Aquifers beneath the areas impacted by seawater intrusion.

The volume of seawater flowing into the Basin every year does not strictly correspond to the acreages overlying the seawater-intruded area that is shown in Figure 5-17 and Figure 5-18. As the seawater intrusion front approaches pumping depressions, the front will slow down and stop at the lowest point in the pumping depression. The seawater intrusion front will then appear to stop; and no more acreage will be added every year. However, seawater will continue to flow in from the ocean towards the pumping depression. The *State of the Salinas River Groundwater Basin* estimated that approximately 11,000 acre-feet of seawater flow into the Pressure subarea every year. Previous estimates have ranged between 14,000 and 18,000 acre-feet per year of seawater intrusion (Brown and Caldwell, 2016)

5.3 CHANGE IN GROUNDWATER STORAGE

The Salinas Valley Groundwater Basin serves as a water storage reservoir for multiple groundwater use sectors in the Salinas Valley. Every year, groundwater stored in the Basin is used to accommodate the difference in timing between water availability in the wet season and irrigation, municipal, and industrial water demand in the dry season. In addition, and of likely greater net value to the economy of the Salinas Valley, is the significant volume of year-to-year groundwater storage that allows municipalities and growers to continue obtaining water during the multi-year droughts that are common to the region.

This ISP adopts the concept of change in usable groundwater storage; defined as the annual average increase or decrease in groundwater that can be safely used for municipal, industrial, or agricultural purposes. Change in usable groundwater storage is the sum of change in storage due to groundwater level changes and the change in storage due to seawater intrusion.

5.3.1 Change in Groundwater Storage Due to Groundwater Level Changes

One component of the change in groundwater storage is calculated from groundwater levels in the Basin. The amount of groundwater stored in the Basin depends on variations in both seasonal and multi-year climatic cycles. The observed groundwater level changes provide a measure of the amount of groundwater that has moved into and out of storage during each year, not accounting for seawater intrusion. The change in storage can be calculated by multiplying a change in groundwater elevation by a storage coefficient. Storage coefficients depend on the hydraulic properties of the aquifer materials and are commonly measured through long-term pumping tests or laboratory tests.

The average groundwater level changes in each subarea that are shown on Figure 5-12 are used to estimate annual changes in water storage through the following relationship:

$$\Delta S = \Delta WL \times A \times SC$$

Where: ΔS = Annual change in storage volume in the subbasin (ac-ft/yr.)
ΔWL= Annual change in average water level in the subbasin (ft/yr.)
A = Land area of subbasin (acres)
SC = Storage Coefficient (ft^3/ft^3)

Estimated values for the area and storage coefficient for each subarea are derived from MCWRA's *State of the Basin Report* (Brown and Caldwell, 2015); and are summarized in Table 5-1.

Table 5-1: Subbasin Areas and Storage Coefficients

Subarea)	Subarea Area Land Area (acres)	Subbasin Land Area (acres)	Storage Coefficient (ft^3/ft^3)
180/400-Foot Aquifer (Pressure)	126,000	90,000	0.04
Monterey	-	31,000	0.04
Eastside	75,000	57,000	0.08
Langley	-	18,000	0.08
Forebay	87,000	94,000	0.12
Upper Valley	92,000	240,000	0.10

Figure 5-19 presents a time series graph from 1944 through 2017 showing the estimated cumulative change in groundwater storage in each of the six subareas and the total change in storage for all six subareas.

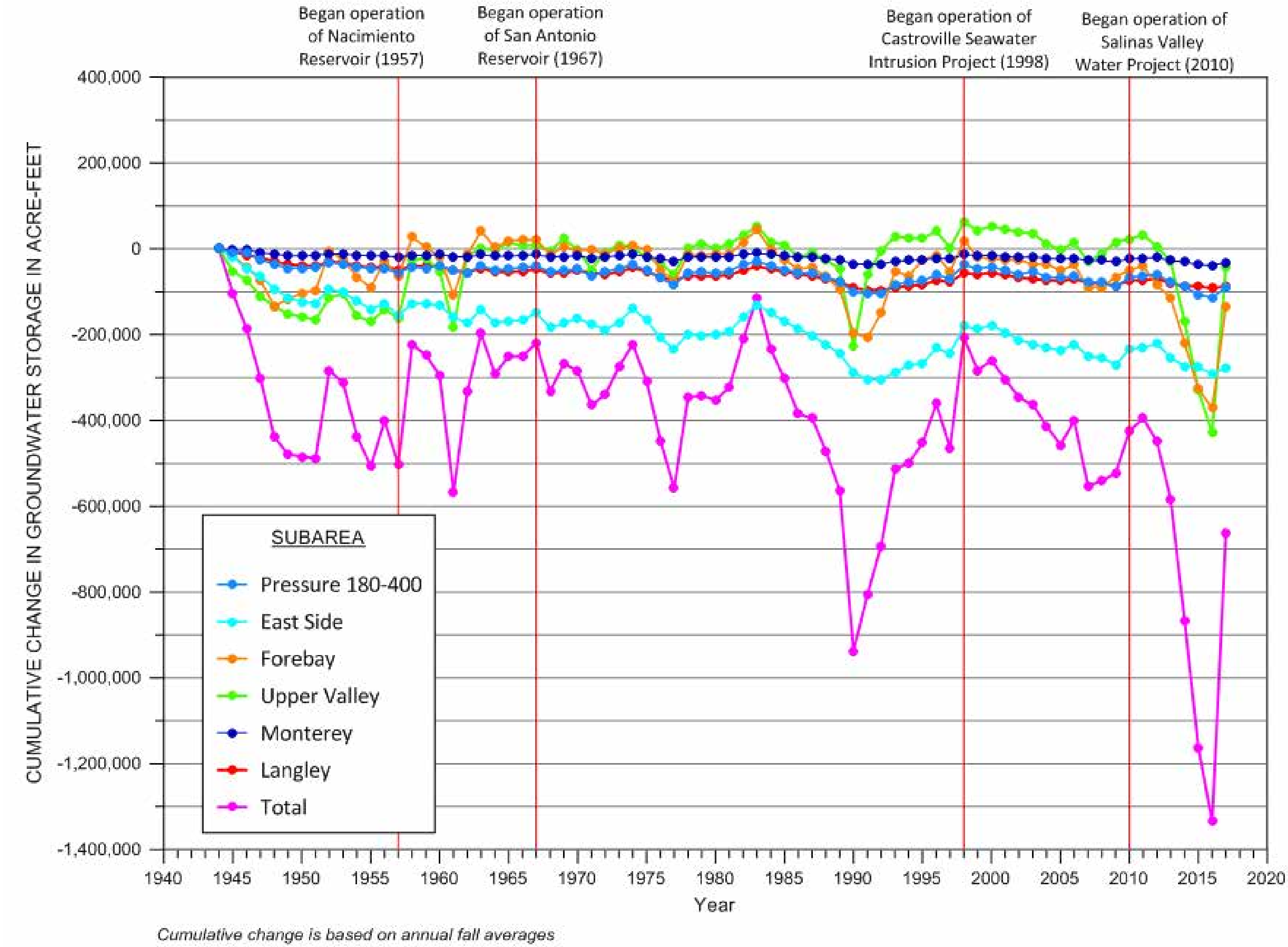


Figure 5-19: Cumulative Change in Groundwater Storage Based on Groundwater Elevations (From MCWRA, 2018b)

The timing of groundwater storage declines and recovery match the groundwater level patterns described in Section 5.1.3. However, the magnitudes of the groundwater storage changes are scaled by the appropriate storage coefficients and size of the subarea. Average water levels from the MCWRA Pressure subarea were used for both the 180/400-Foot Subbasin and the Monterey Subbasin. Likewise, average water levels from the MCWRA East Side subarea were used for both the Eastside Subbasin and the Langley Subbasin.

The following observations are evident from Figure 5-19:

- The Upper Valley Subbasin shows effectively no long-term loss of groundwater storage. The annual change in groundwater storage is small; typically, around 10,000 to 20,000 ac-ft per year. The 2012 to 2016 drought had the largest impact on change in storage, although the Subbasin appears to be recovering from the drought.
- The Forebay Subbasin shows the next lowest long-term loss of groundwater storage. Until 1984, the Forebay often had more water in storage than during the base year of 1944 and the cumulative loss of groundwater storage is above the zero line. These large amounts of groundwater in storage correlate to the operation of Nacimiento Dam. Since 1984, the Forebay subarea shows a slow decline in cumulative groundwater in storage. During dry cycles, this Subbasin is subject to larger decreases in storage than the Upper Valley Subbasin. The average annual storage loss due to lowering groundwater levels in the Forebay Subbasin between 1944 and 2017 is approximately 1,800 acre-feet per year.
- The Monterey Subbasin shows a steady decline in groundwater storage due to lowering groundwater elevations. The average annual storage loss due to lowering groundwater levels in the Monterey Subbasin between 1944 and 2017 is approximately 430 acre-feet per year. However, this measure of storage loss does not include the amount of storage that has been lost to seawater intrusion, as described below.
- The 180/400-Foot Aquifer Subbasin shows a steady decline in groundwater storage due to lowering groundwater elevations. The average annual storage loss due to lowering groundwater levels in the 180/400-Foot Aquifer Subbasin between 1944 and 2017 is approximately 1,200 acre-feet per year. However, this measure of storage loss does not include the amount of storage that has been lost to seawater intrusion, as described below.
- The Langley Subbasin shows a steady decline in groundwater storage due to lowering groundwater elevations. The average annual storage loss due to lowering groundwater levels in the Langley Subbasin between 1944 and 2017 is approximately 1,200 acre-feet per year.
- The Eastside Subbasin shows the most significant loss of groundwater storage due to the greatest magnitude of lowering groundwater levels of all the Subbasins. The

average annual storage loss due to lowering groundwater levels in the Eastside Subbasin between 1944 and 2017 is approximately 3,800 acre-feet per year.

- The average annual storage loss due to lowering groundwater levels in Salinas Valley between 1944 and 2017 is approximately 9,000 acre-feet per year. Changes in the total basin groundwater storage can be divided into the following three periods:
    - 1944 to 1947: decrease of 300,000 acre-feet in groundwater storage
    - 1947 to 1998: no clear upward or downward trend in the change in groundwater storage
    - 1998 to 2017: decrease of approximately 460,000 acre-feet in groundwater storage.
- Throughout the record, there were frequent periods when the Salinas Valley saw groundwater storage fluctuations of approximately 200,000 acre-feet, suggesting the storage capacity of the Valley can be exercised and refilled under normal conditions.

5.3.2 CHANGE IN GROUNDWATER STORAGE DUE TO SEAWATER INTRUSION

As noted in Section 5.2, estimates of groundwater storage losses due to seawater intrusion have ranged from 11,000 to 18,000 acre-feet per year. This ISP adopts a mid-range estimate of 14,000 acre-feet per year of storage loss due to seawater intrusion. This storage loss is in addition to the change in groundwater storage due to changes in groundwater levels. The length of coastline subject to seawater intrusion is approximately 75% in the 180/400-Foot Aquifer Subbasin and therefore we estimate the flow of seawater intrusion into the 180/400-Foot Aquifer Subbasin is approximately 10,500 AFY and the flow of seawater intrusion into the Monterey Subbasin is approximately 3,500.

5.3.3 TOTAL CHANGE IN GROUNDWATER STORAGE

The total change in groundwater storage is the sum of the changes in groundwater storage due to groundwater level changes and seawater intrusion. Seawater intrusion does not influence the change in storage in the Eastside, Forebay, or Upper Valley subareas. Seawater intrusion adds 14,000 acre-feet of lost groundwater storage to the combined 180/400-Foot Aquifer Subbasin and the Monterey Subbasin. Table 5-2 shows the annual loss in groundwater storage due to the additive effects of groundwater level changes and seawater intrusion. Storage loss due to seawater intrusion is combined for the 180/400-Foot Aquifer and Monterey Subbasins

Table 5-2: Estimated Annual Loss in Storage by Subarea

Subarea	Estimated Annual Loss in Storage (Acre-Feet/Year)		
	From GW Level Changes	From Seawater Intrusion	Total
Upper Valley	580	0	580
Forebay	1,800	0	1,800
Eastside	3,800	0	3,800
Langley	1,200	0	1,200
180/400-Foot Aquifer	1,200	10,500	11,700
Monterey	430	3,500	3,930
Total	9,000	14,000	23,000

5.4 SUBSIDENCE

Land subsidence has not been reported in Salinas Valley and is not closely monitored. There are only limited data available to monitor subsidence. The National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) processes Interferometric Synthetic Aperture Radar (InSAR) satellite data to estimate subsidence. Figure 5-20 presents a map of interpreted subsidence for the ISP area for the period April 2016 to April 2017.

This map suggests that much of the Valley experienced between 0 and -3 inches of subsidence during this period. This single measurement, however, is likely not representative of long-term subsidence. A continuous GPS station is located in the Valley at the Monterey/San Luis Obispo County line. Data from this station is processed by UNAVCO, a non-profit, university-governed research consortium that facilitates geoscience research using geodesy. Ground surface elevation measurements at this GPS location, identified as station CRBT, are plotted on Figure 5-21. Although, similar to the INSAR data, this site shows 0.4 inches of subsidence between April 2016 to April 2017; that subsidence is not indicative of long-term trends. As shown in Figure 5-21, the long-term vertical displacement is on the order of positive 0.4 inches between 2001 and 2018. This demonstrates the difficulty in extrapolating long term trends from snapshot data such as INSAR. Based on the data shown in Figure 5-21, it is likely that little to no land subsidence is occurring in the ISP area. Additional data will be necessary, however, to verify this.

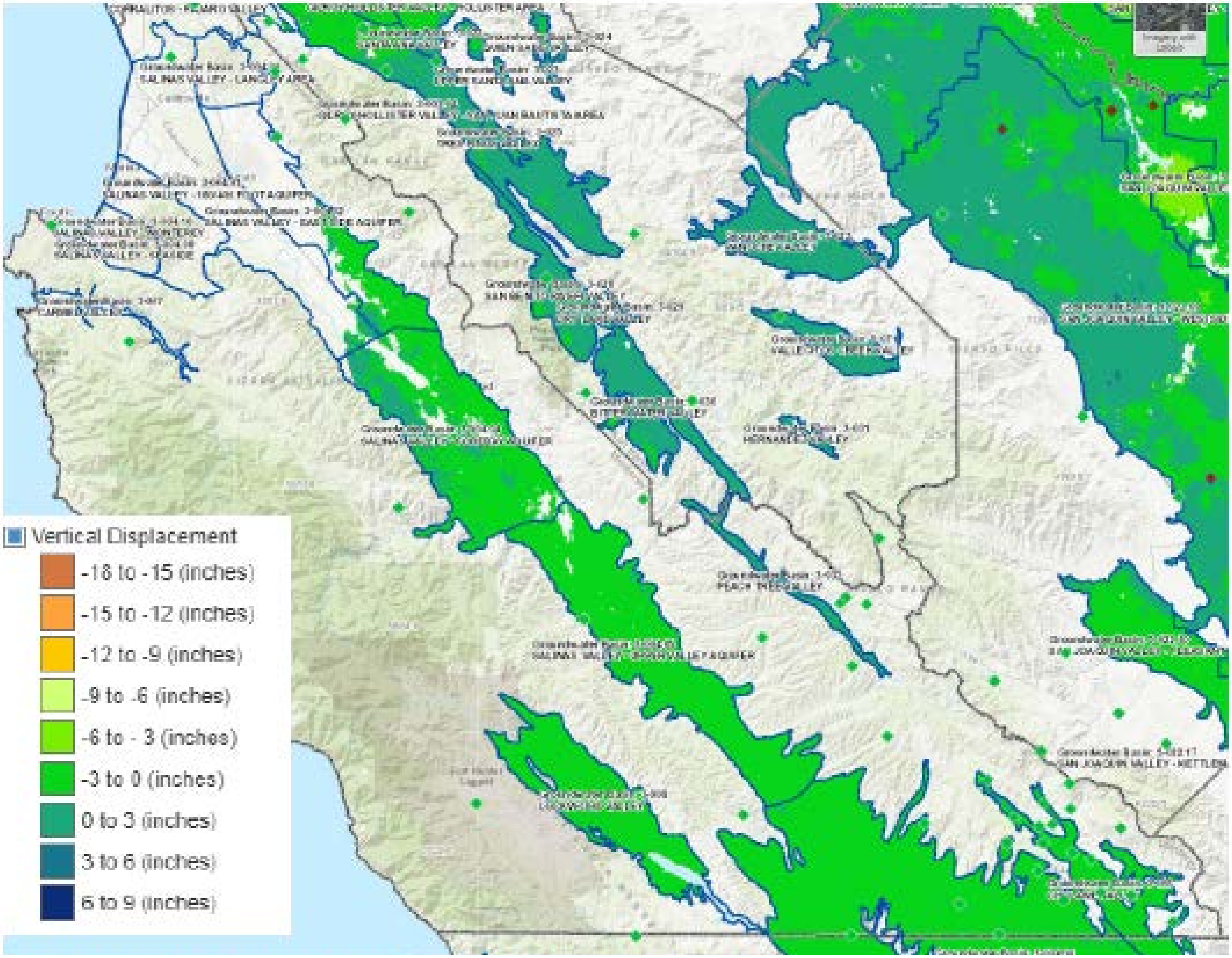


Figure 5-20: Estimated InSAR Subsidence in Salinas Valley

source: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

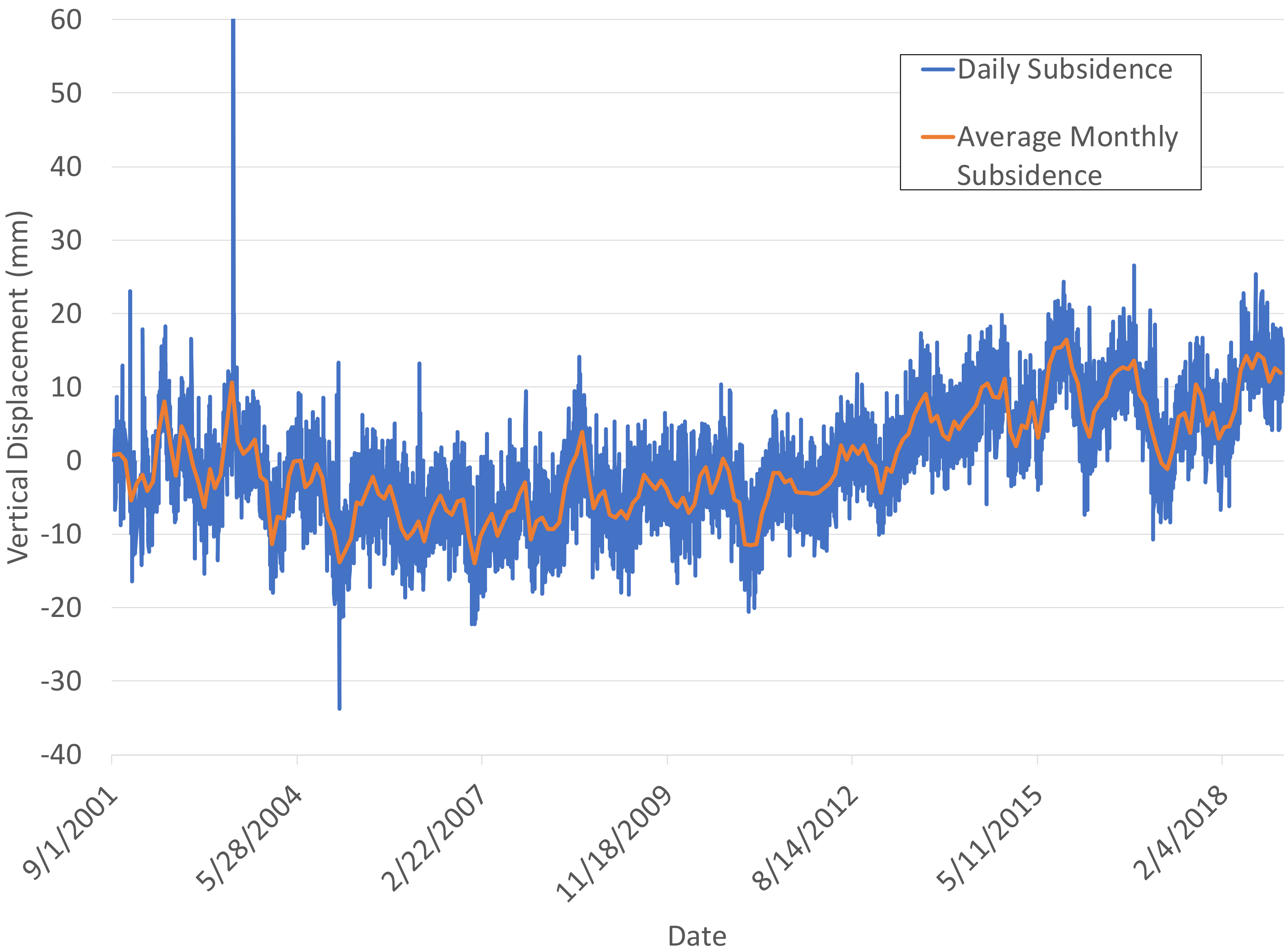


Figure 5-21: Subsidence Measured at Continuous GPS Site CRBT

5.5 INTERCONNECTED SURFACE WATER

Surface water that is connected to the groundwater flow system is referred to as interconnected surface water. If the groundwater elevation is higher that the water level in the stream, the stream is said to be a gaining stream, because it gains water from the surrounding groundwater. If the groundwater elevation is lower than the water level in the stream, it is termed a losing stream, because it loses water to the surrounding groundwater flow system. If the groundwater level is below the stream bottom, the stream and groundwater are disconnected. SGMA does not require that disconnected stream reaches be analyzed or managed. These concepts are illustrated in Figure 5-22, below.

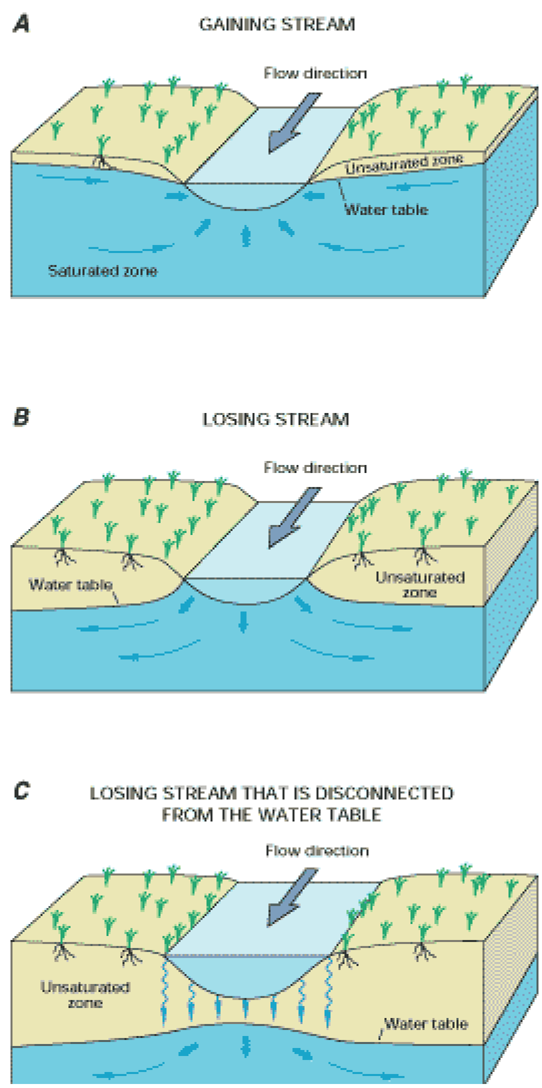


Figure 5-22: Conceptual Representation of Interconnected Surface water (Source: USGS)

The close connection between surface water in the Salinas River and groundwater in the Salinas Valley Basin has long been recognized. Historical accounts of flows in the Salinas

River mention areas where water appears and reappears (San Francisco Estuary Institute, 2009). DWR (1946) reported that much of the surface water in the Salinas River and its major tributary, the Arroyo Seco, infiltrates into the groundwater basin in the Upper Valley and Forebay. In the 180/400-Foot Aquifer Subbasin, the Salinas Valley Aquitard – a shallow, laterally extensive clay layer separates the Salinas River from the underlying principal aquifers. In this Subbasin, there is no connection between the Salinas River and the 180/400-Foot Aquifer.

5.5.1 INTERCONNECTED SURFACE WATER LOCATIONS

Groundwater levels are compared to ground surface elevation to estimate the depth to groundwater and identify likely areas of interconnected surface water. Figure 5-23 presents contours of depth to groundwater measured in Fall 2013. Fall 2013 was selected because it is a recent year with groundwater levels mapped by MCWRA that does not represent the end of a drought period. For this analysis, any area with a depth to groundwater of less than 20 feet is assumed to be an area of potentially interconnected surface water. Figure 5-23 shows that groundwater is greater than 20 feet below ground surface in most of the Basin.

For areas of the Basin with groundwater levels less than 20 feet below ground surface, a more detailed analysis is needed to evaluate the hydraulic connection between surface water and groundwater. There are two areas where there may be interconnected surface water. The first is along the Salinas River in the Upper Valley and Forebay Subbasins. The second is at the mouth of the Basin near the border with the Monterey Bay. In both of these areas, the depth-to-groundwater is less than 20 feet.

The conceptual hydrogeologic model of the Salinas Valley Groundwater Basin (Chapter 4) suggests that shallow groundwater along the Salinas River in the Upper Valley and Forebay Subbasins likely coincides with areas of interconnected surface water. In these Subbasins, the aquifer is unconfined. There is no physical geologic barrier separating the principal aquifer from surface water; therefore, water levels measured in wells are a true indication of water table elevation.

In the 180/400-Foot Aquifer Subbasin, the Salinas Valley Aquitard physically separates groundwater in the principal aquifers from surface water. Groundwater levels measured in the 180/400-Foot Aquifer Subbasin represent the piezometric head in confined aquifers and not the elevation of the water table. The area near Monterey Bay where measured water levels are within 20 feet of ground surface is not indicative of interconnection between surface water and the principal aquifers, but rather indicates that the piezometric head in the confined aquifers is near the ground surface. Surface water in this subbasin may be interconnected with unconsolidated near-surface sediments, however these sediments are not an important water-supply source and not a focus of this ISP.

This identification of interconnected surface water is supported by numerical groundwater modeling conducted by Durbin *et. al* (1978). Figure 5-24 is a profile of the Salinas Valley Basin showing simulated groundwater elevations in May 1971 and September 1970 relative to the thalweg, or lowest point, of the Salinas River. These profiles show that south of Gonzales, Salinas River was at various points and times either a gaining or losing stream; and that groundwater levels were less than 5 feet below the Salinas River. North of Gonzales, in the 180/400-Foot Aquifer Subbasin; groundwater levels have historically been much deeper than Salinas River, indicating that the surface water is disconnected from groundwater.

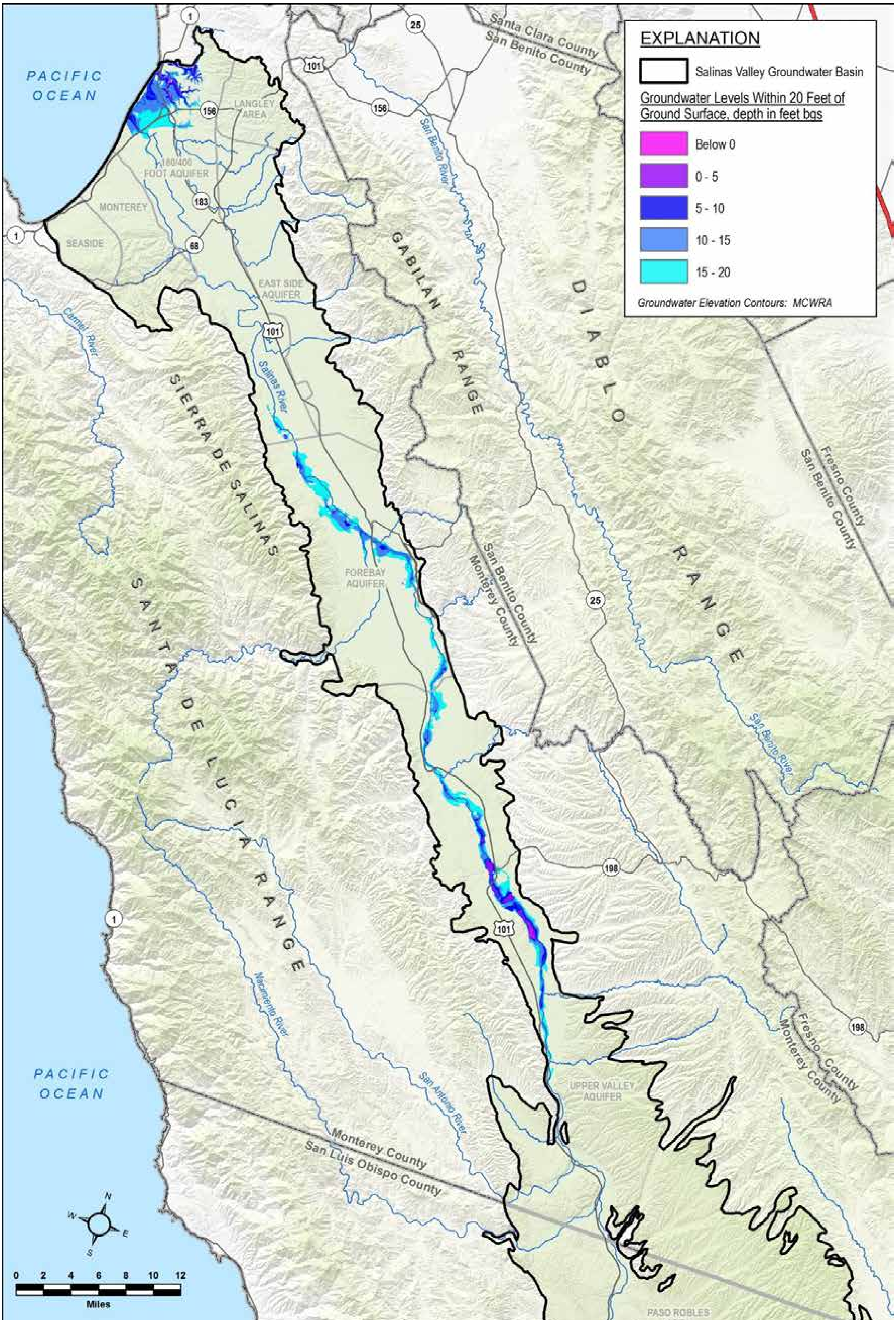


Figure 5-23: Groundwater levels within 20 feet of Ground Surface

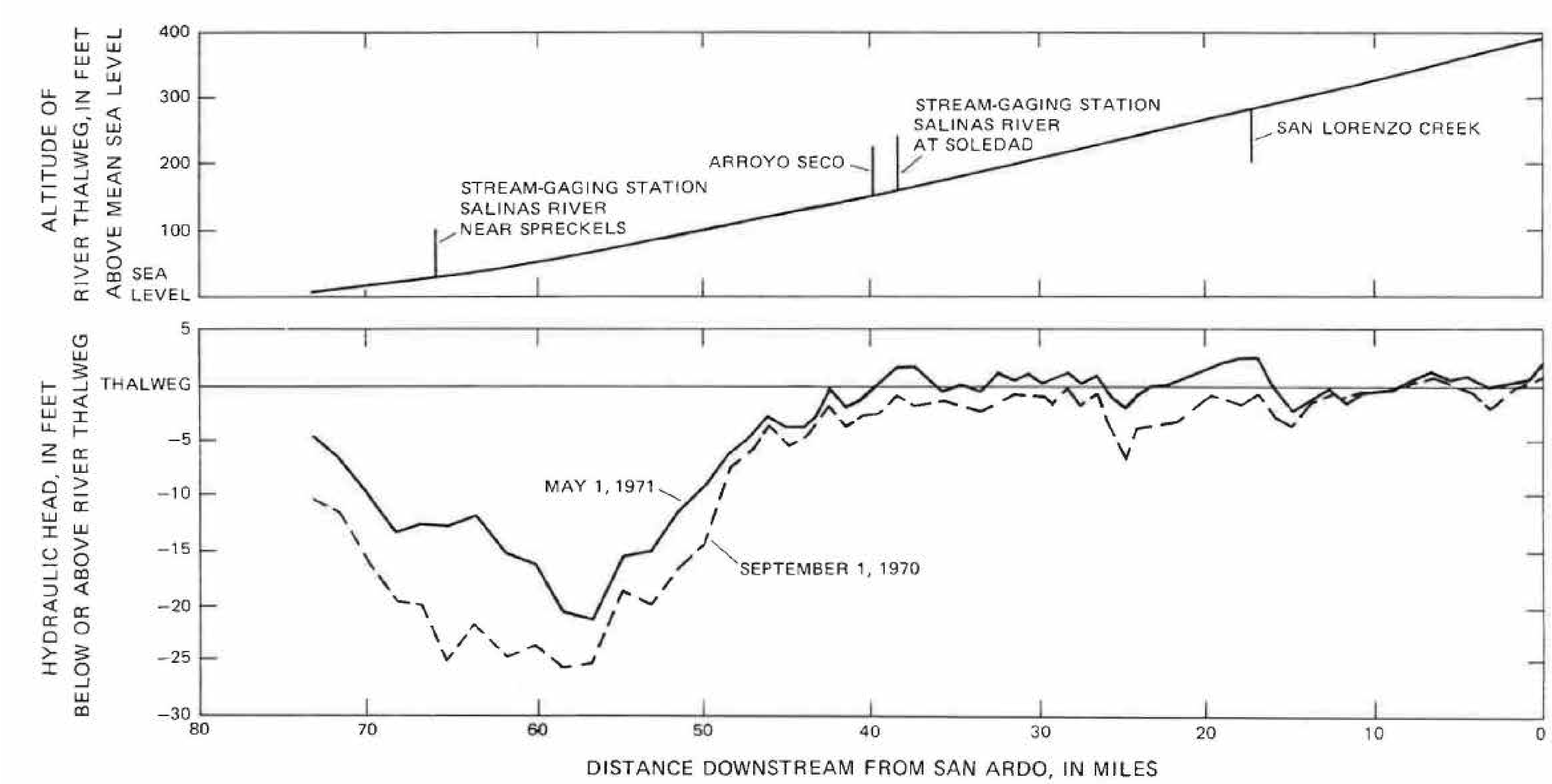


Figure 5-24: Groundwater Profiles Computed by Two-Dimensional Groundwater Model and Thalweg Profile Along the Salinas River (Durbin et al., 1978)

5.5.2 SURFACE WATER DEPLETION RATES

Rates of surface water depletion can be estimated from the observed changes in surface water flow between multiple gaging stations along the Salinas River. Data for this analysis are available from the following sources:

- Five permanent USGS gaging stations, including four locations on the Salinas River and one on the Arroyo Seco, where river flow rates are recorded daily. These data are publicly available through the USGS website. These data often cover many decades, including data from the late 1940's for some Salinas River gages.
- Temporary gaging locations that are measured periodically to provide supplementary gaging data from locations between the permanent gaging stations. Data from these periodic gaging data have been collected by MCWRA since the late 1950s and have been occasionally measured by the USGS.

Figure 5-25 shows the locations of the gaging stations used to evaluate surface water depletion on the Salinas River.

In September 2017, MCWRA and USGS measured discharge from the reservoirs and from nine locations along the Salinas River. MCWRA used these data to estimate surface water depletion from the river along the nine river reaches, measured in cubic feet per second (cfs). The gauge locations were noted in river mile distance measured upstream from the mouth of the Salinas River in Monterey Bay; these distances were used to calculate the rate of surface water depletion in units of cfs/mile. Table 5-3 summarizes the measured surface water depletion in September 2017.

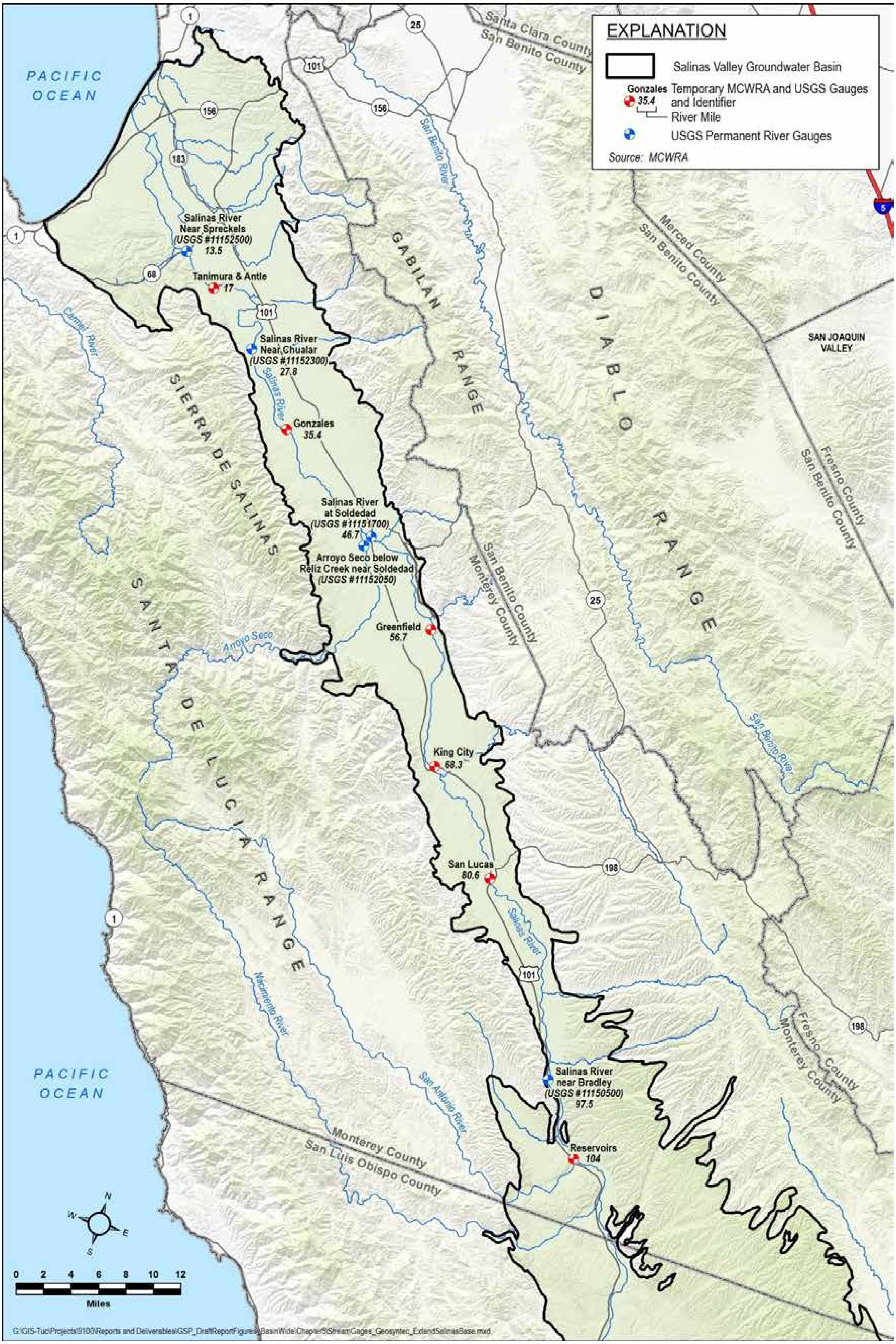


Figure 5-25: Surface-Water Gaging Stations

Table 5-3: Calculated 2017 River Depletion (MCWRA, 2018c)

Site Name	River Mile	Measurement Date	Measurement Time	Data Source	Q (cfs)	ΔQ (cfs)	ΔQ/RM (cfs/mi)	Q %	River Reach[*]
Reservoirs	104	9/25/2017	12:00	MCWRA	725			100	
Bradley	97.5	9/25/2017	15:12	USGS	694	31	4.8	96	Res-Brad
San Lucas	80.6	9/25/2017	12:41	USGS	613	81	4.8	85	Brad-SL
King City	68.3	9/25/2017	10:10	USGS	519	95	7.7	72	SL-KC
Greenfield	56.7	9/26/2017	10:00	MCWRA	385	134	11.5	53	KC-Gf
Soledad	46.7	9/26/2017	12:05	USGS	336	49	4.9	46	Gf-Sol
Gonzales	35.4	9/26/2017	12:30	MCWRA	202	134	11.9	28	Sol-Gon
Chualar	27.8	9/26/2017	13:45	USGS	123	79	10.4	17	Gon-Ch
T&A	17	9/26/2017	16:00	MCWRA	42	81	7.5	6	Ch-T&A
Spreckels*	13.5	9/27/2017	10:30	MCWRA	30	12	3.5	4	T&A-Spr
						93	6.5		Ch-Spr**

[*] Reach Name Abbreviations: Res= Nacimiento and San Antonio Reservoirs; Brad=Bradley; SL = San Lucas; KC = King City = Gf = Greenfield; Sol = Soledad; Gon = Gonzales; Ch = Chualar; Spr = Spreckels

*Gage site temporarily re-located downstream of bridge during bridge construction.

**Used for historical comparison

The data measured in September 2017, shown on Table 5-3, are also plotted with black diamonds on Figure 5-26. The brown bars on Figure 5-26 show the range of similar depletion measurements made by MCWRA in previous years from 1995 through 2011.

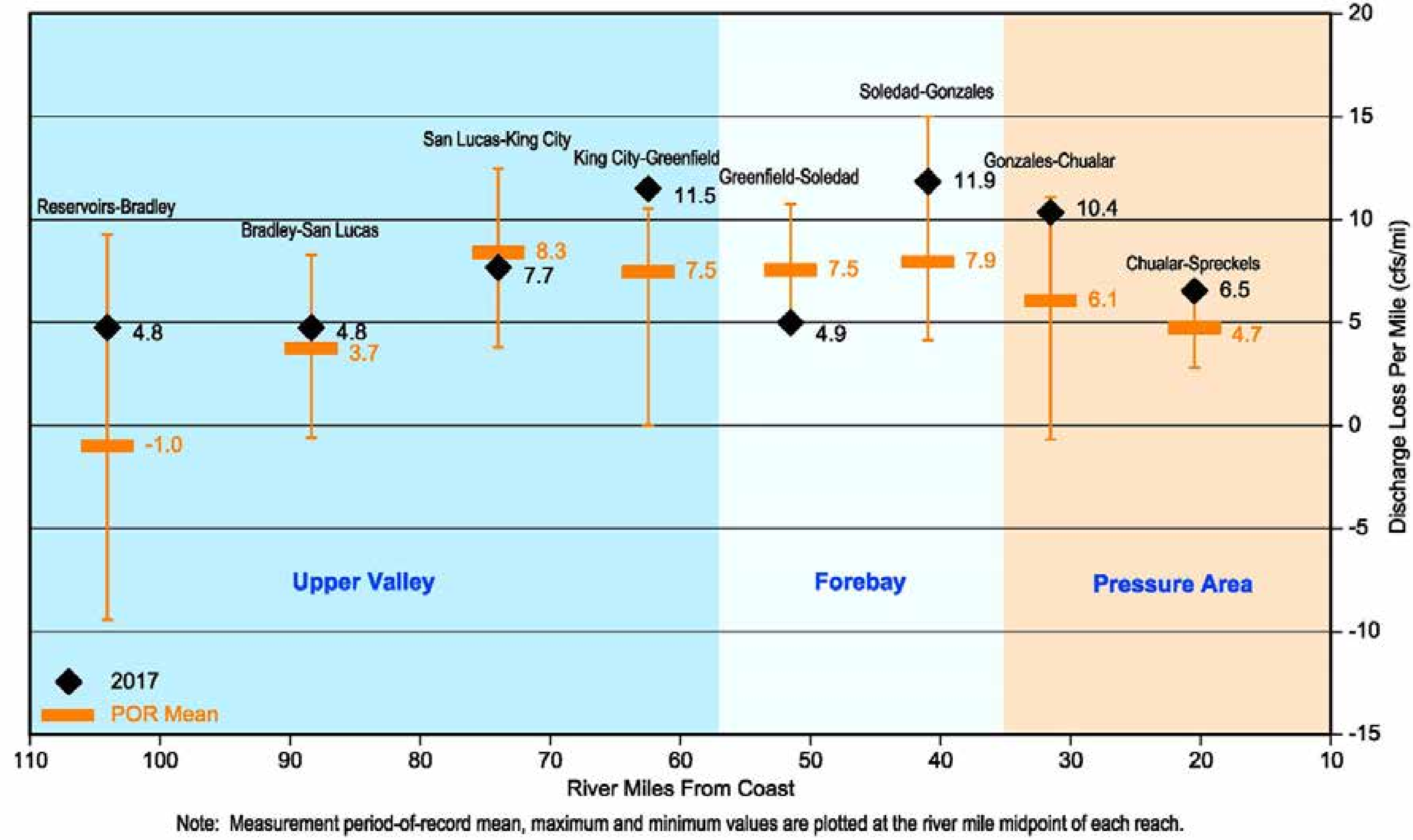


Figure 5-26: River Depletion per River Mile

The following conclusions can be drawn from the distribution of stream depletion measured between 1995-2011, and again 2017. These depletion rates are limited by the discharge rate from the reservoirs and therefore should not be extrapolated to flows during wet season discharge rates, which can be significantly higher.

- The 1995 through 2011 data range constitutes a reasonable measure of surface water depletion conditions that were present during September flows in the Basin prior to January 2015.
- During the dry season, the Salinas River is a losing stream, i.e. water discharges from the river to the groundwater basin, for nearly its entire length within the Salinas Valley Basin. Only the short length of river between the reservoirs and Bradley show significant periods when the river is a gaining stream, shown by negative values on the y-axis.
- During typical September flow conditions, the average surface water depletion exceeds 7 cfs/mile over approximately half of the 100-mile length of river. Depletion rates are lower, but still significant, in the upper reaches where the river is narrower and in the lower reaches where the alluvium has increased percentage of clay layers.
- In the 180/400-Foot Aquifer Subbasin, which is roughly equivalent to the Pressure Area on Figure 5-13, water from the Salinas River is connected with near-surface unconsolidated sediments in only the most northern part of the Subbasin. The presence of aquitards restricts the vertical migration of groundwater downward into the more productive 180/400-Foot Aquifers.

In addition to the above MCWRA data, daily data from the USGS gages were also evaluated to evaluate surface water depletion rates over a broader range of flow conditions. An estimate of total Salinas River water depletion within the groundwater basin was developed based on the daily stream gage measurements collected from October 1, 1994 to September 30, 2017 at three USGS gages: Salinas River at Bradley (USGS Gage 11150500); Arroyo Seco (USGS Gage 11152000); and Salinas River at Spreckels (USGS Gage 11152500)

The daily gage data from the Salinas River near Bradley and the Arroyo Seco were added together, assuming a 2-day lag between flow in the Salinas River at Bradley and Arroyo Seco, to provide an estimate of the total surface water flow entering this reach of the Salinas River from these two sources. The daily gage data from the Salinas River near Spreckels were used as an estimate of the total surface water discharging from the Basin, assuming a 1-day delay from Arroyo Seco to Spreckels. The difference between these estimates for total surface water inflow and outflow is the estimated loss of surface water to groundwater. All of the loss of surface water is attributed to infiltration into groundwater, although pumping or diversion for agriculture or other uses may account for some of the losses. This approach does not include the surface water contribution from other tributaries because there are not gage data available to quantify those contributions.

Based on the above analysis, Figure 5-27 depicts each daily measurement as a single point. For graphical clarity, the plot was limited to a flow range up to 1000 cfs. Figure 5-27 plots inflows versus outflows as follows:

- The X-axis is the total combined surface water flow (cfs) that enters the Salinas River
- The Y-axis is the river loss (positive values) or gain (negative values)

Points plotted below zero on the y-axis indicate that outflows exceed inflows. This is indicative of a gaining river, either due to groundwater discharge from higher groundwater elevations; or inflow from other tributaries or contributions not recorded at the Bradley or Arroyo Seco gauges. Points plotted above zero on the y-axis indicate a losing river, where the difference between inflows and outflows is attributed to losses to groundwater or surface water diversions.

The data plotted in Figure 5-27 illustrates that most of the surface water that enters the ISP area infiltrates into the groundwater basin or is diverted as a surface water right. The dense cluster of points that forms the upper bound of the plot represents individual days over the 23-year period when the surface-water losses and diversions were nearly equal to the total surface water inflow. When all the daily measurements from this period are considered, the weighted average surface infiltration and diversions exceeds 45% of the surface water inflow.

The daily gage data were also used to evaluate how losses were related to the magnitude of flow in the river. Table 5-4 shows that when the observed upstream flow is less than 1,000 cfs, greater than 75% of the water flowing through Salinas River infiltrates into the groundwater basin or is diverted through surface water diversions. Flow conditions with less than 1,000 occurred in 92% of the days in the 23-year record. When Salinas River carries larger flows of greater than 1,000 cfs, less than 20% of the water flowing through Salinas River infiltrates into the groundwater basin. These high flow conditions occur on 8% of the days over the course of 23 years.

Table 5-4: Infiltration from Salinas River by Flow Rate

River Discharge			Infiltration Percentage		
Observed Upstream Flow (cfs)	Percent of Days with Observed Upstream Flow	Percent of 23-Year Cumulative Upstream Flow	Average Upstream Flow (cfs)	Average Streamflow Lost to Infiltration or Diversion (cfs)	Percent Infiltrated or Diverted
0 - 100	30%	3%	55	52	95%
100 - 500	40%	22%	320	260	81%
500 – 1,000	22%	23%	620	460	74%
1,000 – 5,000	6%	20%	2,000	300	15%
5,000 – 10,000	1%	16%	7,000	1,400	20%
10,000 – 100,000	1%	16%	15,000	1,000	7%

The relationship between surface water and groundwater is affected in part by the operation of the two upstream reservoirs. These reservoirs were constructed for the dual purposes of reduced flooding and increased groundwater recharge. Since the reservoirs were completed in 1957 and 1967, respectively; they have been operated for these dual purposes such that high flows during the wet season are held in the reservoirs to decrease flooding on the valley floor. Water is later released during the dry season to extend the period of groundwater recharge.

These changes to the natural hydrology of the Salinas River have resulted in some alteration to the riparian corridor that likely affect the rates of groundwater recharge. In particular:

- With peak flood flows decreased, the river channel is likely less complex, and flows may be concentrated in a smaller wetted perimeter, thus decreasing recharge,
- Dry season flows are larger and more prolonged, allowing for significant growth of non-native riparian species, particularly *Arundo donax*, which has high evapotranspiration rates.

The impacts of these riparian hydrology changes to groundwater infiltration rates have not been quantified.

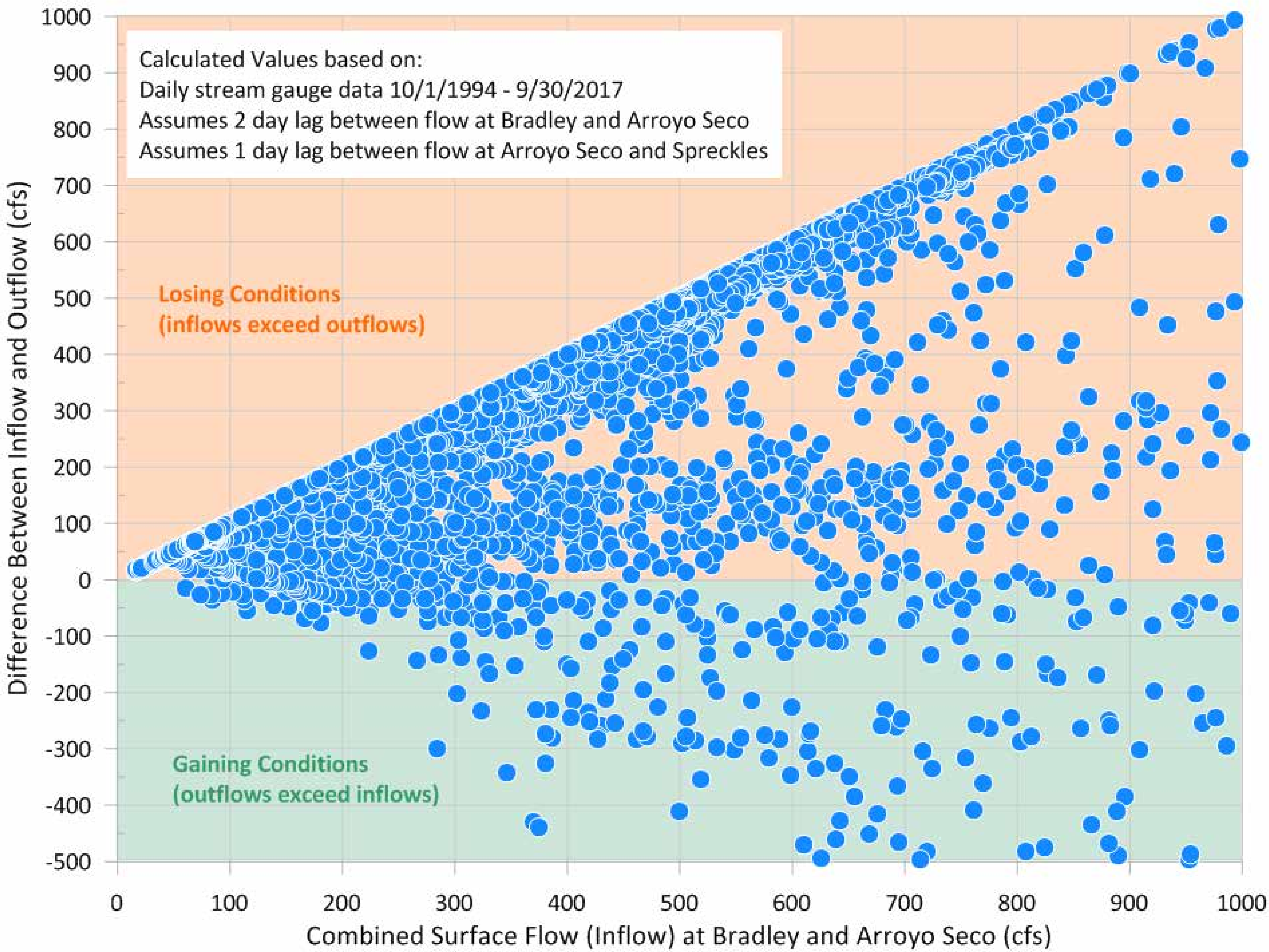


Figure 5-27: Loss or Gain in Salinas River Flow from Bradley and Arroyo Seco to Spreckels

5.6 GROUNDWATER QUALITY DISTRIBUTION AND TRENDS

This section presents a summary of current groundwater quality conditions. The SVBGSA does not have regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Salinas Basin. Projects and actions implemented by the SVBGSA are not required to improve groundwater quality; however, they must not further degrade groundwater quality.

Groundwater quality samples have been collected and analyzed throughout the Basin for various studies and programs. Groundwater quality samples have also been collected on a regular basis for compliance with regulatory programs. In particular, a broad survey of groundwater quality was conducted in 2015 by the Central Coast Groundwater Coalition (LSCE, 2015).

Groundwater quality in the Salinas Valley Basin and adjacent areas was evaluated by the USGS in two studies under the Groundwater Ambient Monitoring and Assessment Program (GAMA) - a statewide groundwater quality monitoring program established in 2000 by the California State Water Resources Control Board (SWRCB). The USGS investigated water quality in groundwater resources used for public supply and in the shallow aquifer used for domestic wells (USGS, 2005; USGS 2018). These GAMA projects sampled 136 wells in the Salinas Valley Basin; and the samples were analyzed for up to 270 constituents and water-quality indicators including volatile organic compounds (VOCs), pesticides, pesticide degradates, nutrients, major and minor ions, trace elements, radioactivity, microbial indicators, dissolved noble gases, and naturally occurring isotopes (USGS, 2005). All quality-assured data collected for the GAMA Program are publicly available through the USGS National Water Information System (NWIS) web interface (http://waterdata.usgs.gov/ca/nwis/) and the SWRCB GeoTracker groundwater information system (https://geotracker.waterboards.ca.gov/gama/) (USGS, 2018).

5.6.1 POINT SOURCES OF GROUNDWATER POLLUTANTS

Because of overlapping agency responsibilities, clean-up and monitoring of point source pollutants may be under the responsibility of either the Regional Board or the California State Department of Toxic Substances Control (DTSC). The Regional Board and DTSC make all related materials available to the public through two public portals: GeoTracker (https://geotracker.waterboards.ca.gov/) managed by the Regional Board and Envirostor (https://www.envirostor.dtsc.ca.gov/public/) managed by DTSC. Figure 5-28 presents a map with the location of active clean-up sites within the Basin and Table 5-5provides a summary of the active clean-up sites. Figure 5-28 and Table 5-5 do not include sites that have leaking underground storage tanks, which are not overseen by DTSC or the Regional Board.

The following constituents have been identified in the California Water Service Company's Salinas District wellfields: nitrate, Methyl tert-butyl ether (MTBE), and hexavalent chromium (Cr(VI)). Six of Cal Water's wells have been placed on inactive status due to water quality issues (Cal Water UWMP, 2016). Wellhead treatment is used to reduce nitrate and Cr(VI) concentrations to levels that meet applicable standards. Cal Water is currently in compliance with the USEPA standard for arsenic (10 ppb) but may be impacted if the standard is lowered to 5 ppb (Cal Water UWMP, 2016).

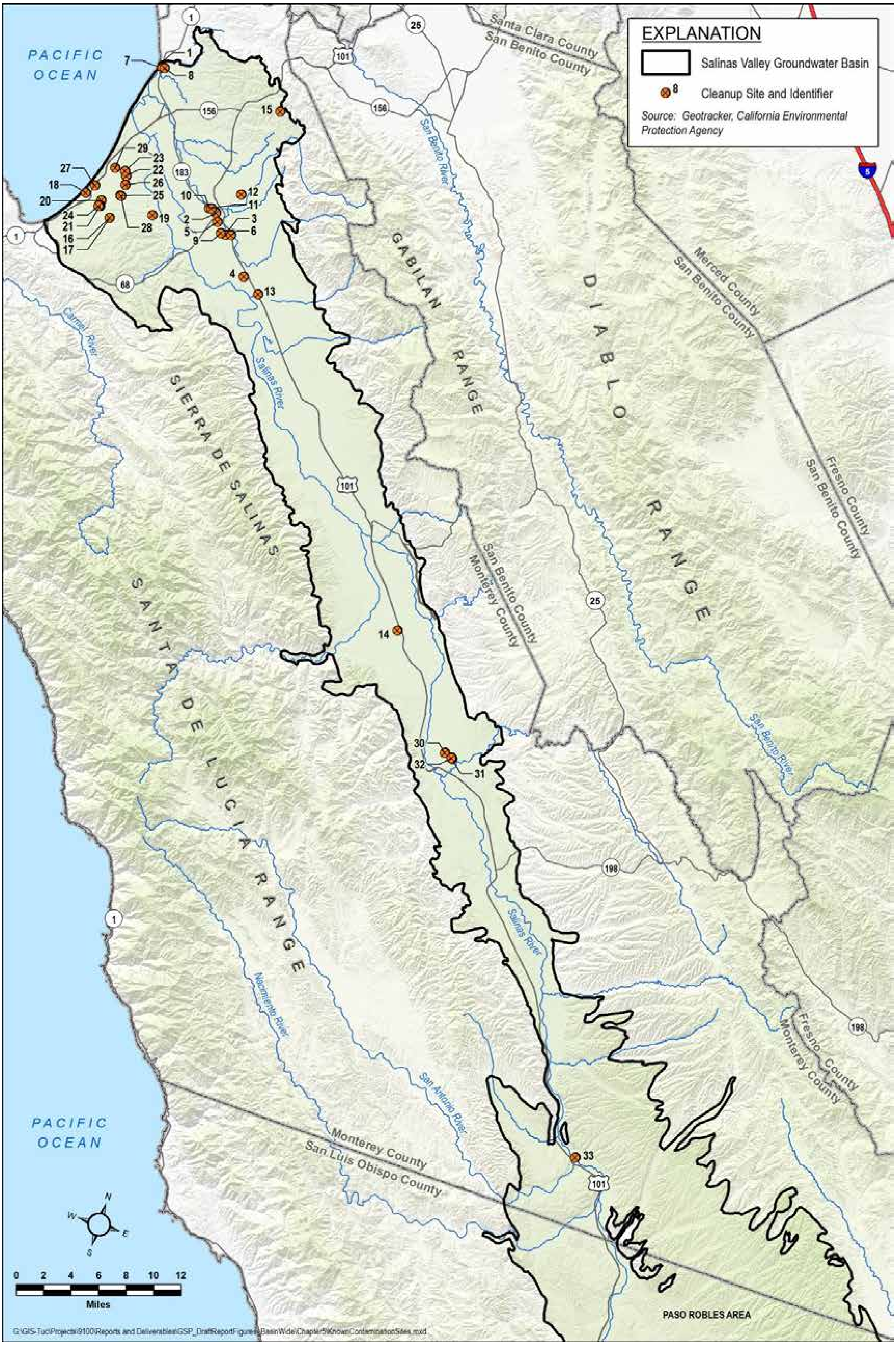


Figure 5-28: Active Cleanup Sites

Table 5-5: Active Cleanup Sites

Label	Site Name	Site Type	Status	Address	City
1	Dynegy Moss Landing	Corrective Action	Active	California Highway 1 And Dolan Rd	Moss Landing
2	PG&E, Salinas MGP	Voluntary Cleanup	Active	2 Bridge Street	Salinas
3	Pure-Etch Co	Corrective Action	Active	1031 Industrial St	Salinas
4	Firestone Tire (Salinas Plant)	State Response or National Priorities List	Certified	340 El Camino Real South	Salinas
5	Borina Foundation	Cleanup Program Site	Open - Remediation	110-124 Abbott Street	Salinas
6	Crop Production Services, Inc. - Salinas	Cleanup Program Site	Open - Remediation	1143 Terven Ave.	Salinas
7	National Refractories (Former)	Cleanup Program Site	Open - Remediation	7697 California Highway 1	Moss Landing
8	Moss Landing Power Plant	Cleanup Program Site	Open - Verification Monitoring	Highway One & Dolan Rd.	Moss Landing
9	NH3 Service Company	Cleanup Program Site	Open - Verification Monitoring	945 Johnson Avenue	Salinas
10	Toro Petroleum-Agt	Cleanup Program Site	Open - Verification Monitoring	308 West Market Street	Salinas
11	Union Pacific Railroad - Salinas Yard	Cleanup Program Site	Open - Verification Monitoring	Rico And West Lake Streets	Salinas
12	Salinas Community School	School	Active	615 Leslie Drive	Salinas
13	Berman Steel-Salinas	State Response or National Priorities List	Certified / Operation & Maintenance	Highway 101 At Spence Road	Salinas
14	Reconstruction of Mary Chapa And El Camino Real Schools Site	School	Active	490 El Camino Real	Greenfield
15	Crazy Horse Sanitary Landfill	State Response or National Priorities List	Refer: Regional Water Quality Control Board	Crazy Horse Canyon Road	Salinas
16	Fort Ord Reuse Authority (Early Transfer)	Closed Base	Active	3500 Acres of The Former Fort Ord; 5 Miles N of Monterey, Ca	Fort Ord

Label	Site Name	Site Type	Status	Address	City
17	Fort Ord Reuse Authority Moa	Closed Base	Active	5 Miles N of Monterey, Ca	Monterey
18	Fort Ord State Park-Memorandum of Understanding with Department of Pesticide Regulation	Closed Base	Active	Intersection of Hwy 1 And 8th Street	City of Marina
19	Fort Ord - East Garrison (VCA)	Closed Base	Certified	Northeast Side of Former Fort Ord Base	East Garrison
20	Fort Ord - Fort Ord - Building 4225	Military UST Site	Open - Eligible for Closure	Building 4225 Fort Ord	Fort Ord
21	Fort Ord - Fort Ord	Military Cleanup Site	Open - Remediation	Fort Ord	Marina
22	Fort Ord - Fort Ord OU1 (Fritzsche Army Airfield Fire Drill Area, On-Site Plume)	Military Cleanup Site	Open - Remediation	Fort Ord	Marina
23	Fort Ord - Fort Ord OU1 (Off-Site Plume)	Military Cleanup Site	Open - Remediation	Fort Ord	Monterey
24	Fort Ord - Fort Ord - Basewide Information	Military Cleanup Site	Open - Remediation	Fort Ord	Monterey
25	Fort Ord - Fort Ord - OU2	Military Cleanup Site	Open - Remediation	Fort Ord	Monterey
2	Fort Ord - Fort Ord - OUCTP	Military Cleanup Site	Open - Remediation	Fort Ord	Monterey
27	Fort Ord - Fort Ord - Sites 2 And 12	Military Cleanup Site	Open - Remediation	Fort Ord	Monterey
28	Fort Ord - Fort Ord Sanitary Landfill	Military Cleanup Site	Open - Remediation	Former Fort Ord	Fort Ord
29	Don's One Hour Dry Cleaners	Cleanup Program Site	Open - Verification Monitoring	215 C Reservation Road	Marina
30	Chalone Peaks Middle School	School	Certified / Operation & Maintenance	667 Meyer Avenue	King City
31	Sabec Inc. (Vt Petroleum)	Cleanup Program Site	Open - Remediation	412 Metz Rd.	King City
32	Toro Petroleum	Cleanup Program Site	Open - Remediation	448 Metz Rd.	King City

Label	Site Name	Site Type	Status	Address	City
33	Camp Roberts - Robert Yard	Military Cleanup Site	Open - Site Assessment	789 Dixie	Bradley

5.6.2 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents

In addition to the point sources described above, the Regional Board monitors and regulates activities and discharges that can contribute to non-point pollutants, which are constituents that are released to groundwater over large areas. In the Salinas Valley Basin, the most prevalent non-point source water quality concern is nitrate. The current distribution of nitrate was extensively monitored and evaluated by the CCGC and documented in a report submitted to the Regional Board (LSCE, 2015).

Figure 5-29 presents a map of nitrate distribution in the Basin prepared by LSCE (2015) and included in the report prepared for CCGC. The orange and red areas on this figure illustrate the portions of the Basin where groundwater has nitrate concentrations above 45 mg/L as nitrate (NO_3)– the maximum contaminant level (MCL) for drinking water and the Basin Plan Water Quality Objective set by the Regional Board. The analysis performed by LSCE was based on sampling 758 wells used for domestic supply. The study results indicated:

- The mean nitrate concentration in the Basin is 68 mg/L as NO_3
- The median nitrate concentration in the Basin is 26 mg/L as NO_3, meaning 50% of the samples had concentrations higher than 26 mg/L and 50% of the samples had concentrations lower than 26 mg/L
- 41% of the wells (309 wells) had a maximum concentration above the MCL of 45 mg/L.

Figure 5-30 presents maps of measured nitrate concentration from six decades of monitoring. These maps, prepared by MCWRA, indicate that elevated nitrate concentrations in groundwater were locally present through the 1960s, but significantly increased in 1970s and 1980s. It appears that the extensive distribution of nitrate concentrations above the MCL as shown in Figure 5-30 has been present for 20 to 30 years.

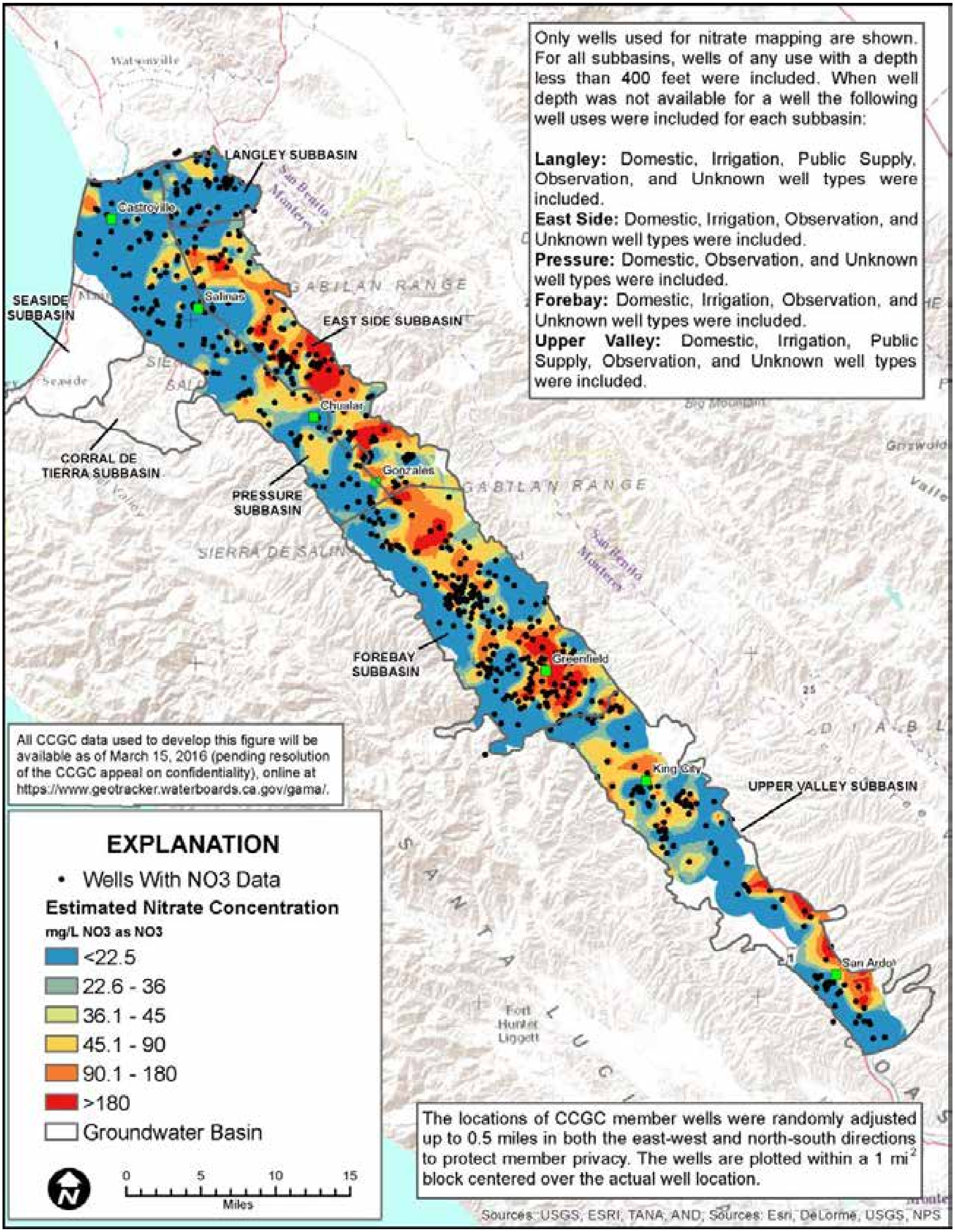


Figure 5-29: Estimated Nitrate Concentrations (from LSCE, 2015)

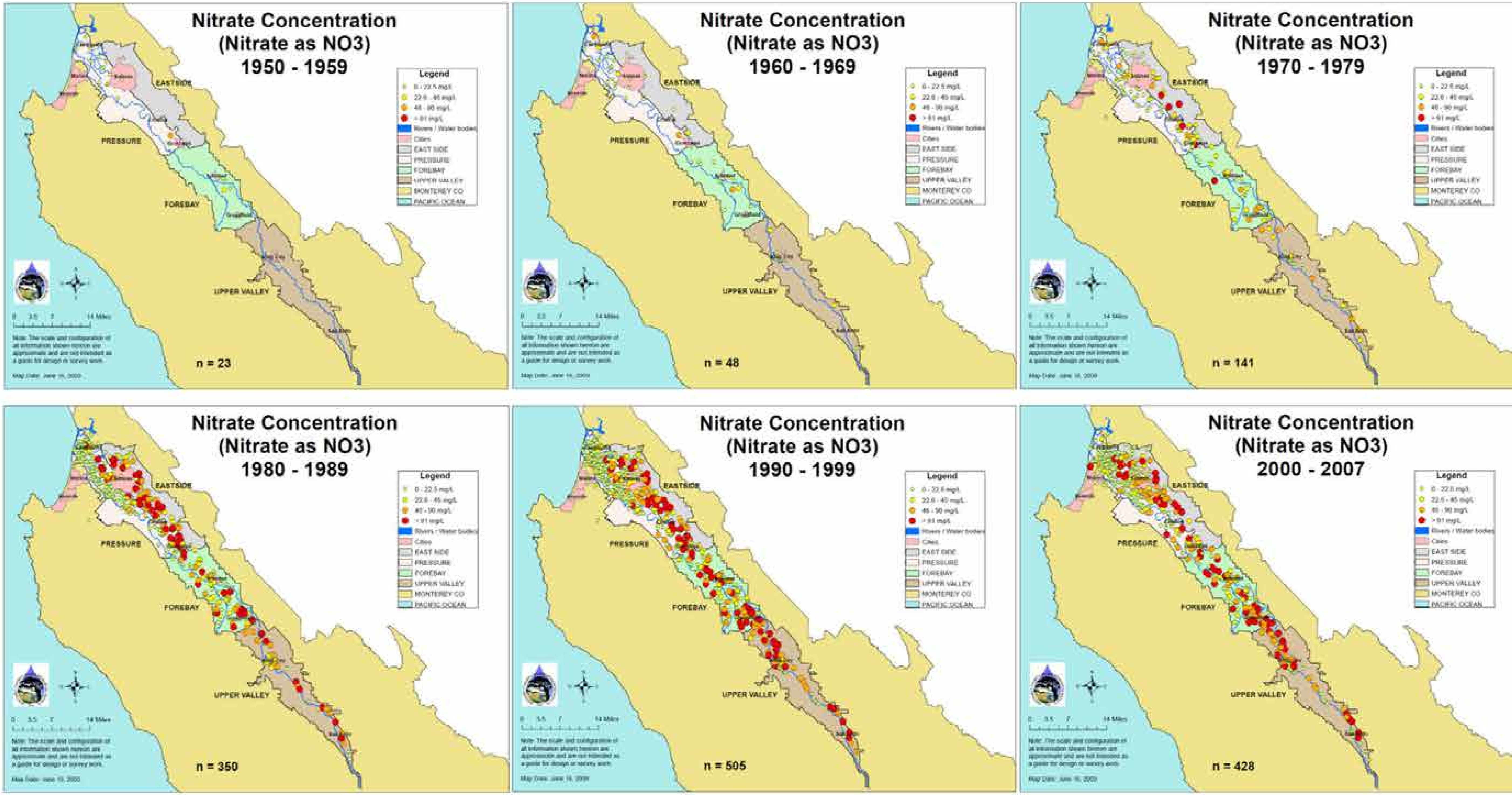


Figure 5-30: Nitrate Concentrations, 1950 to 2007 (from MCWRA)

Additional water quality conditions in the Basin are summarized below based on the two USGS water quality studies for the GAMA Priority Basin Project in the Salinas Valley Basin (USGS, 2005; USGS, 2018). Although the GAMA studies are useful to identify regional water quality issues, the GAMA study areas extended beyond the boundaries of the Salinas Valley Groundwater Basin, including the Pajaro Valley and Santa Cruz basins, and therefore the results of the studies should be viewed as potentially, but not definitively, indicative of Salinas Valley Basin conditions.

The 2005 GAMA study in Salinas Valley characterized groundwater resources used for public water supply (USGS, 2005). Out of the 270 constituents analyzed, only six constituents were detected at concentrations greater than the regulatory Maximum Contaminant Levels (MCLs):

- alpha radioactivity,
- N-nitrosodimethylamine,
- 1,2,3-trichloropropane,
- nitrate,
- radon-222, and
- coliform bacteria.

And six constituents were detected at concentrations above Secondary Maximum Contaminant Levels (SMCLs). These constituents do not pose any health risk, but could result in aesthetic concerns such as taste and odor:

- total dissolved solids,
- hexavalent chromium,
- iron,
- manganese,
- molybdenum, and
- sulfate.

Of these constituents, most were detected at concentrations above regulatory limits in a small percentage of the sampled wells (<10%). Since these do not represent groundwater quality issues at the basin-scale, these constituents will not be further discussed in this report. More information can be found in the original report (USGS, 2005).

The following constituents were detected at concentrations above regulatory limits in greater than 10% of the sampled wells:

- Radon-222 was detected in all 31 samples analyzed, and had activities ranging from 170 to 1,610 pCi/L. Twenty-three samples for radon-222 activities were above the proposed MCL of 300 pCi/L.
- TDS was detected above the recommended SMCL of 500 mg/L in sixteen samples of 31 samples, and 4 samples had concentrations greater than the upper SMCL of 1,000 mg/L.
- Hexavalent chromium was detected above the Detection Limits for Reporting (DLR) threshold of 1 μg/L in 86 out of 97 ground-water samples. DLR are set by California Department Services (CADHS) for the purposes of tracking unregulated chemicals for which monitoring is required.
- Manganese was detected in all 31 ground-water samples analyzed, with concentrations ranging from 0.1 to 2,410 μg/L. Eight of the samples had concentrations of manganese above the non-health-based SMCL threshold of 50 μg/L.
- Five out of 31 samples had sulfate concentrations above the recommended SMCL threshold of 250 mg/L, and one sample had sulfate concentrations greater than the upper SMCL of 500 mg/L.

The 2018 GAMA study in Salinas Valley characterized shallow groundwater resources used primarily as a water supply for domestic wells (USGS, 2018). Groundwater samples were collected from 100 sites and analyzed for 208 constituents, including volatile organic compounds, pesticides, trace elements, isotopic tracers, and radioactivity. An additional 70 samples were collected from household taps, typically supplied by a domestic well, and analyzed for 39 water quality indicators and inorganic constituents.

The following constituents were detected at concentrations greater than water-quality standards over more than 1% of the Salinas Valley Study Area (USGS, 2018 [Table 8A and 8B]):

- arsenic (5.0%),
- iron (3.8%),
- manganese (2.1%),
- molybdenum (3.3%),
- selenium (3.8%),
- strontium (2.1%),
- uranium (3.3%),
- nitrate (32.1%),
- chloride (7.5%),
- sulfate (16%),
- TDS (31%),
- perchlorate (2.5%), and
- N-nitroso dimethylamine (7.5%).

5.6.3 GROUNDWATER QUALITY SUMMARY

Based on the water quality information presented in the previous sections, the following constituents will be included in the GSP monitoring program:

- 1,2,3-trichloropropane,
- alpha radioactivity,
- arsenic,
- chloride,
- coliform bacteria
- hexavalent chromium,
- iron,
- iron,
- manganese,
- manganese,
- molybdenum,
- molybdenum,
- nitrate,
- nitrate,
- N-nitroso dimethylamine.
- N-nitrosodimethylamine,
- perchlorate (2.5%),
- radon-222
- selenium,
- strontium,
- sulfate,
- Sulfate,
- TDS,
- total dissolved solids, and
- uranium.

The monitoring system will be further defined in the individual GSPs. The constituents listed above are the constituents of concern for all aquifers in all Subbasins. Each GSP will identify only a subset of these constituents that are relevant to the particular Subbasin.

5.7 REFERENCES

Brown and Caldwell, 2015. State of the Salinas River Groundwater Basin. Prepared for the Monterey County Water Resource Management Agency.

California Department of Water Resources, 1946. Salinas Basin Investigation. Bulletin No. 52

California State Water Resources Control Board, Groundwater Ambient Monitoring and Assessment Program (GAMA) Website

California Water Service, 2016. 2015 Urban Water Management Plan. Salinas District.

Kennedy-Jenks, 2004. Hydrostratigraphic Analysis of the Northern Salinas Valley. Prepared for Monterey County Water Resources Agency. 14 May.

Luhdorff & Scalmanini Consulting Engineers, 2015, Distribution of Groundwater Nitrate Concentrations, Salinas Valley, California. Prepared for: Central Coast Groundwater Coalition. 1 June.

MCWRA, No Date. "August Groundwater Level Monitoring", http://www.co.monterey.ca.us/government/government-links/water-resources-agency/programs/groundwater-level-monitoring/august-groundwater-level-monitoring#wra

MCWRA, 2018a, Special Joint Meeting of MCWRA BOD and Monterey County BOS. April 24.

MCWRA, 2018b. Personal communication.

MCWRA, 2018c. 2017 Salinas River Discharge Measurement Series Results in Context. Memorandum from Peter Kwiek. 23 January.

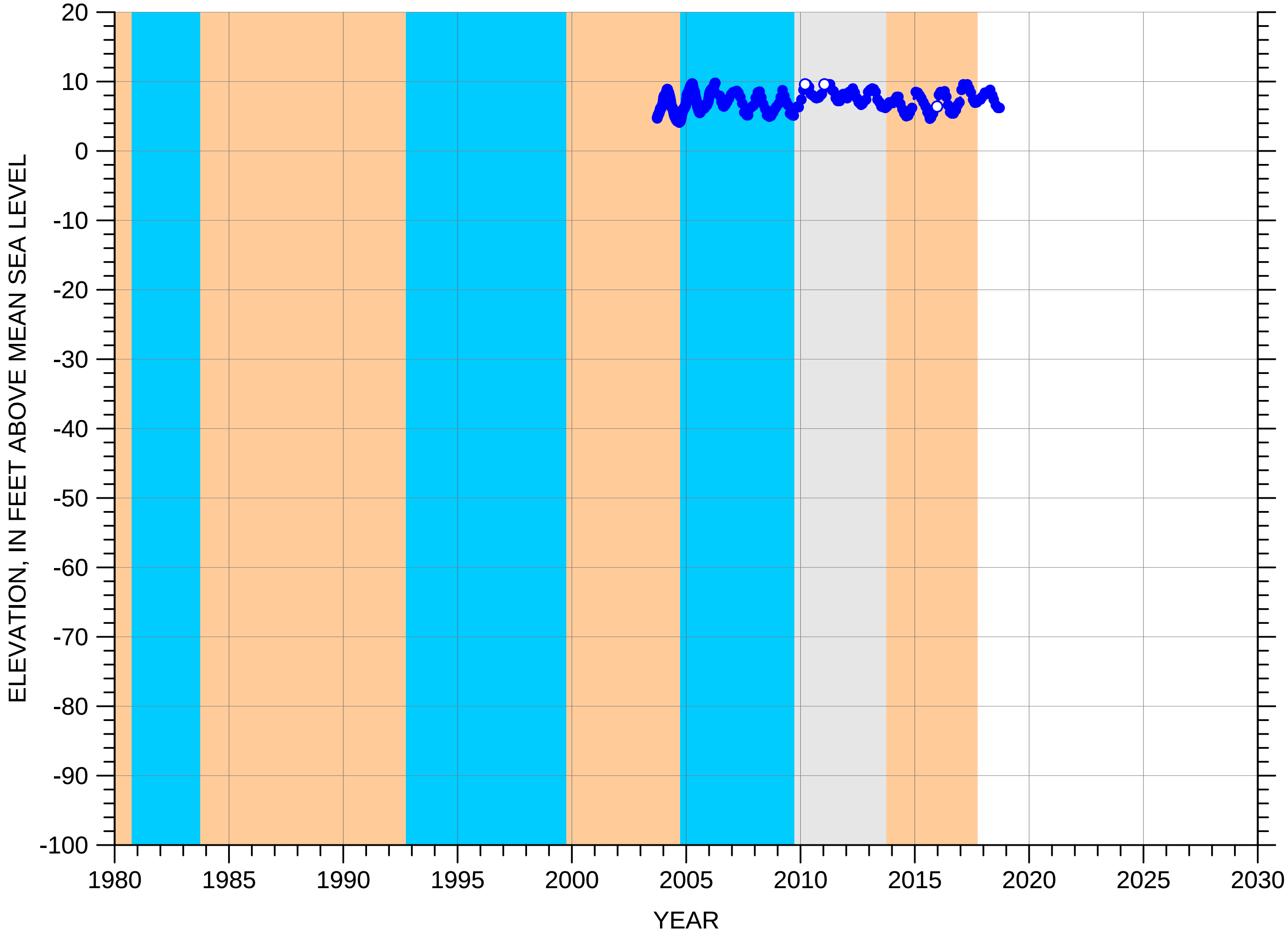
MCWRA, 2015. CASGEM Monitoring Plan for High and Medium Priority Basins in the Salinas Valley Groundwater Basin. 10 March.

USGS, 2005. Ground-Water Quality Data in the Monterey Bay and Salinas Valley Basins, California, 2005—Results from the California GAMA Program. Data Series 258 Version 1.1.

USGS, 2018. Status and Understanding of Groundwater Quality in the Monterey-Salinas Shallow Aquifer Study Unit, 2012–13: California GAMA Priority Basin Project. Scientific Investigations Report 2018–5057.

APPENDIX 5A
HYDROGRAPHS

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-21Q01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 157.4 feet
Screened Interval: 105-155 feet below land surface

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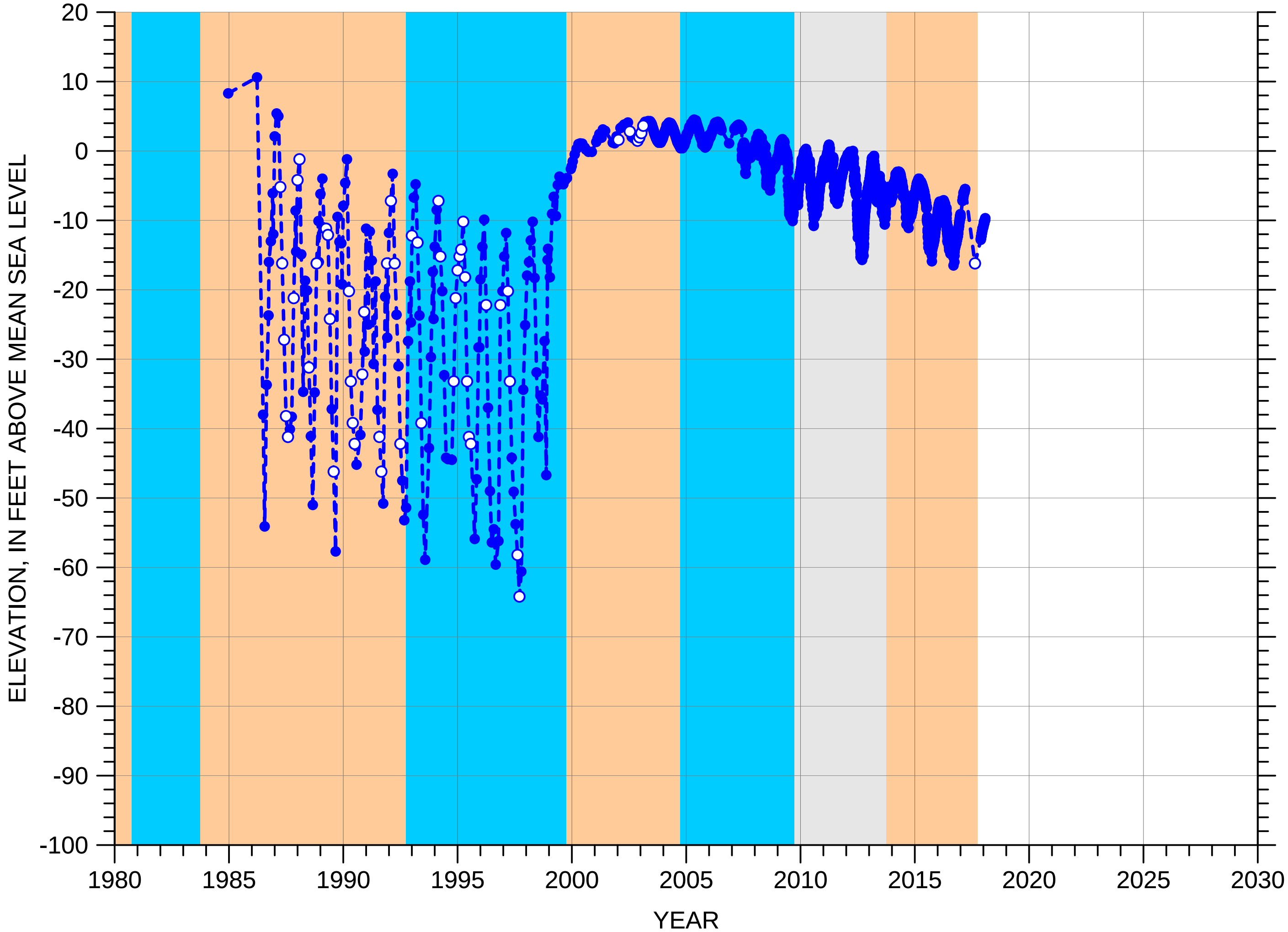
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-32E05



EXPLANATION

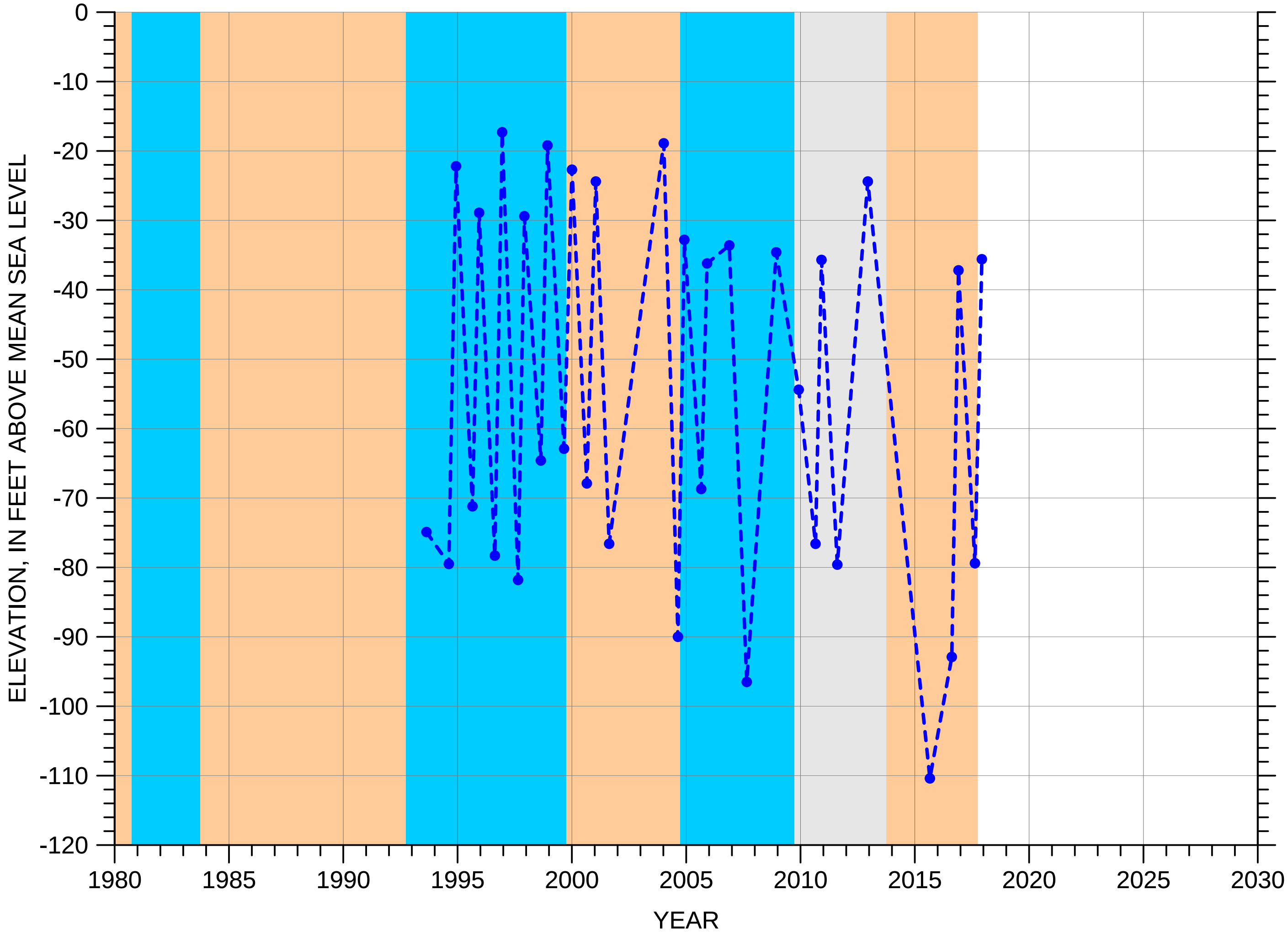
GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 1605 feet
Screened Interval: unknown

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\13S_02E-32E05.grf



EXPLANATION

GROUNDWATER ELEVATION
ESTIMATED ELEVATION

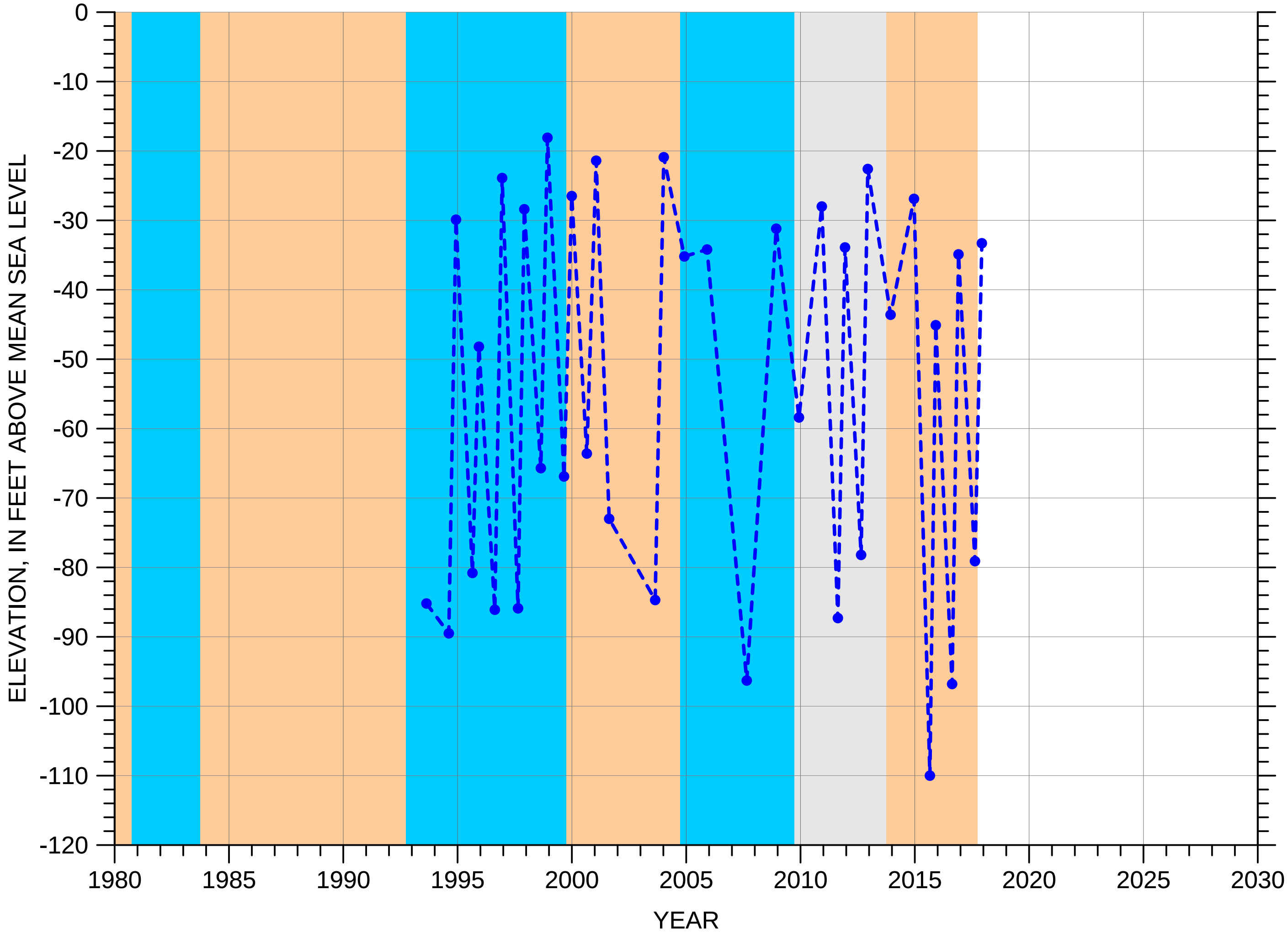
CLIMATE PERIOD CLASSIFICATION

DRY
AVERAGE/ALTERNATING
WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 591 feet
Screened Interval: 350-591 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-01C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-02A02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

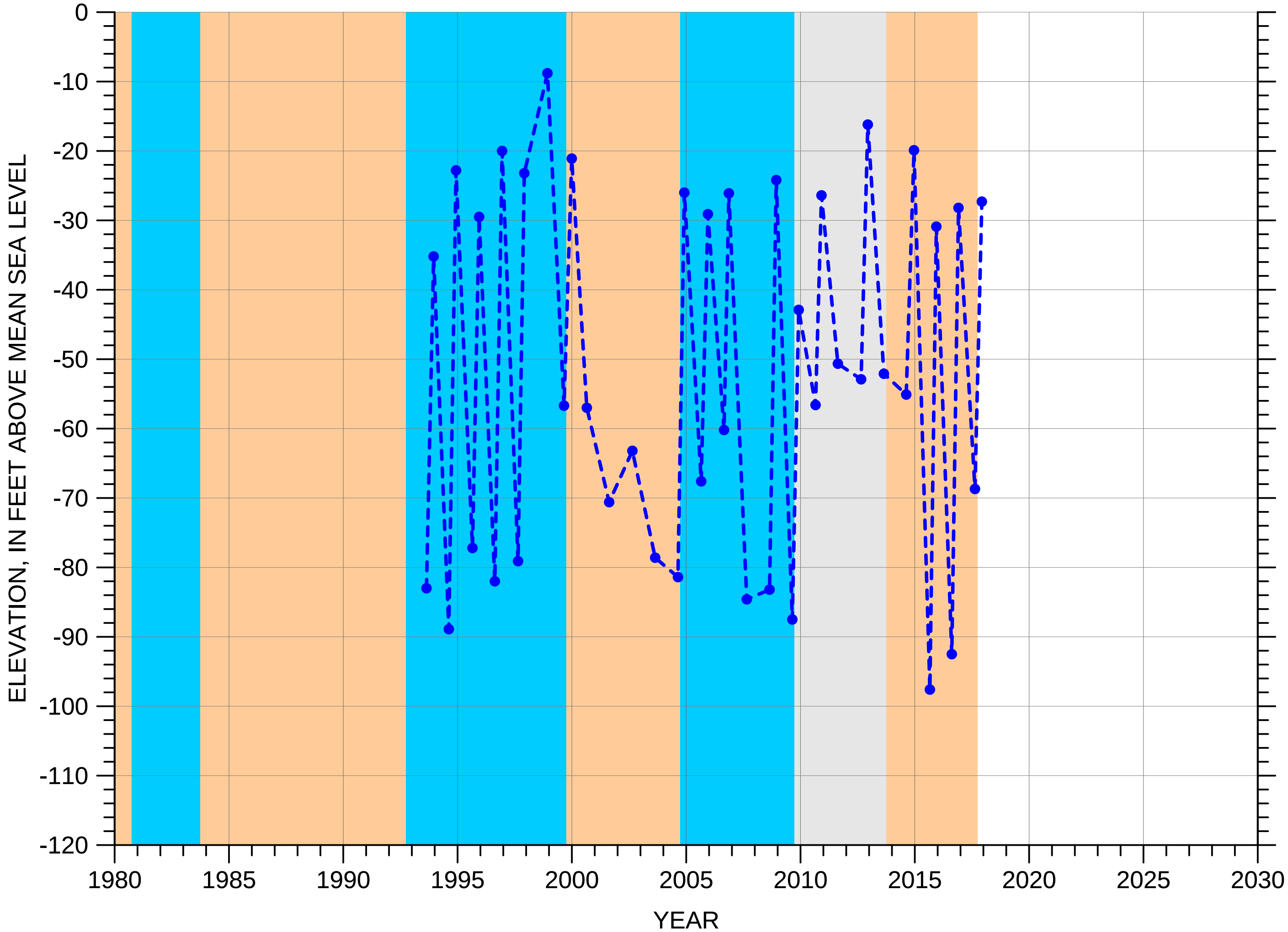
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 810 feet
Screened Interval: 360-810 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-02A02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-02C03



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 835 feet
Screened Interval: 393-832 feet below land surface

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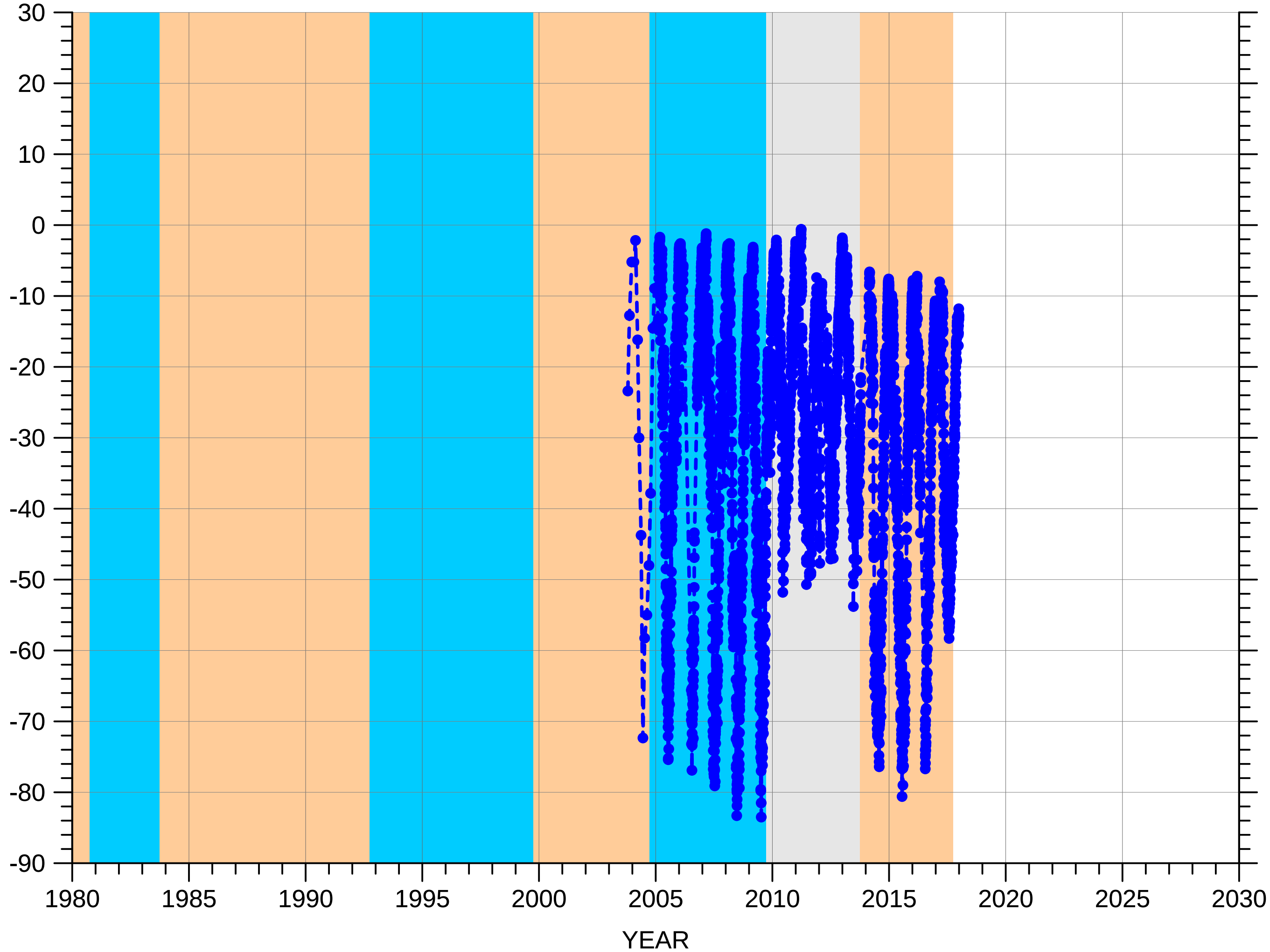
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-03F03



EXPLANATION

GROUNDWATER ELEVATION　　ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY　　AVERAGE/ALTERNATING　　WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 455 feet
Screened Interval: 420-450 feet below land surface

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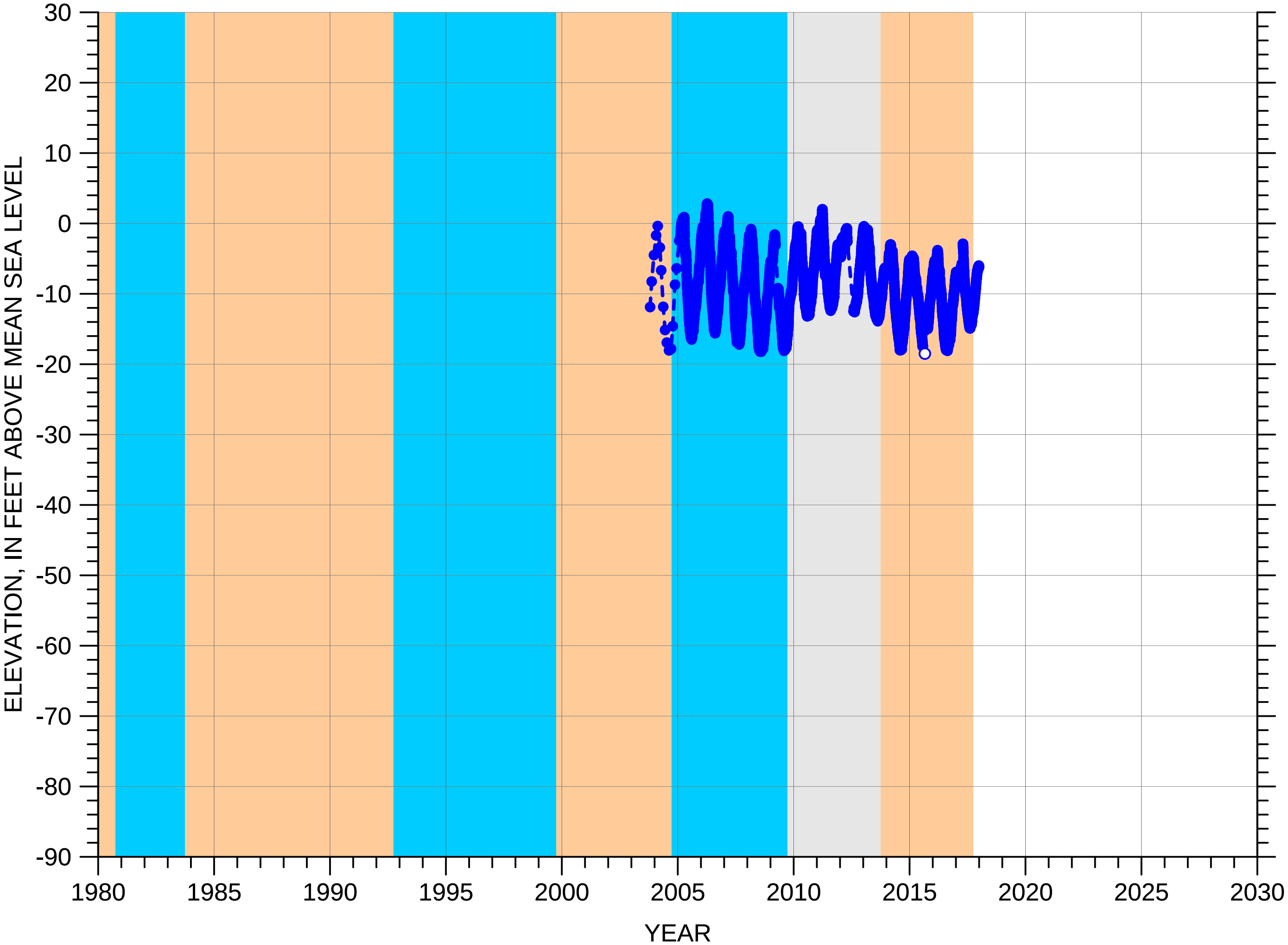
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-03F04



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

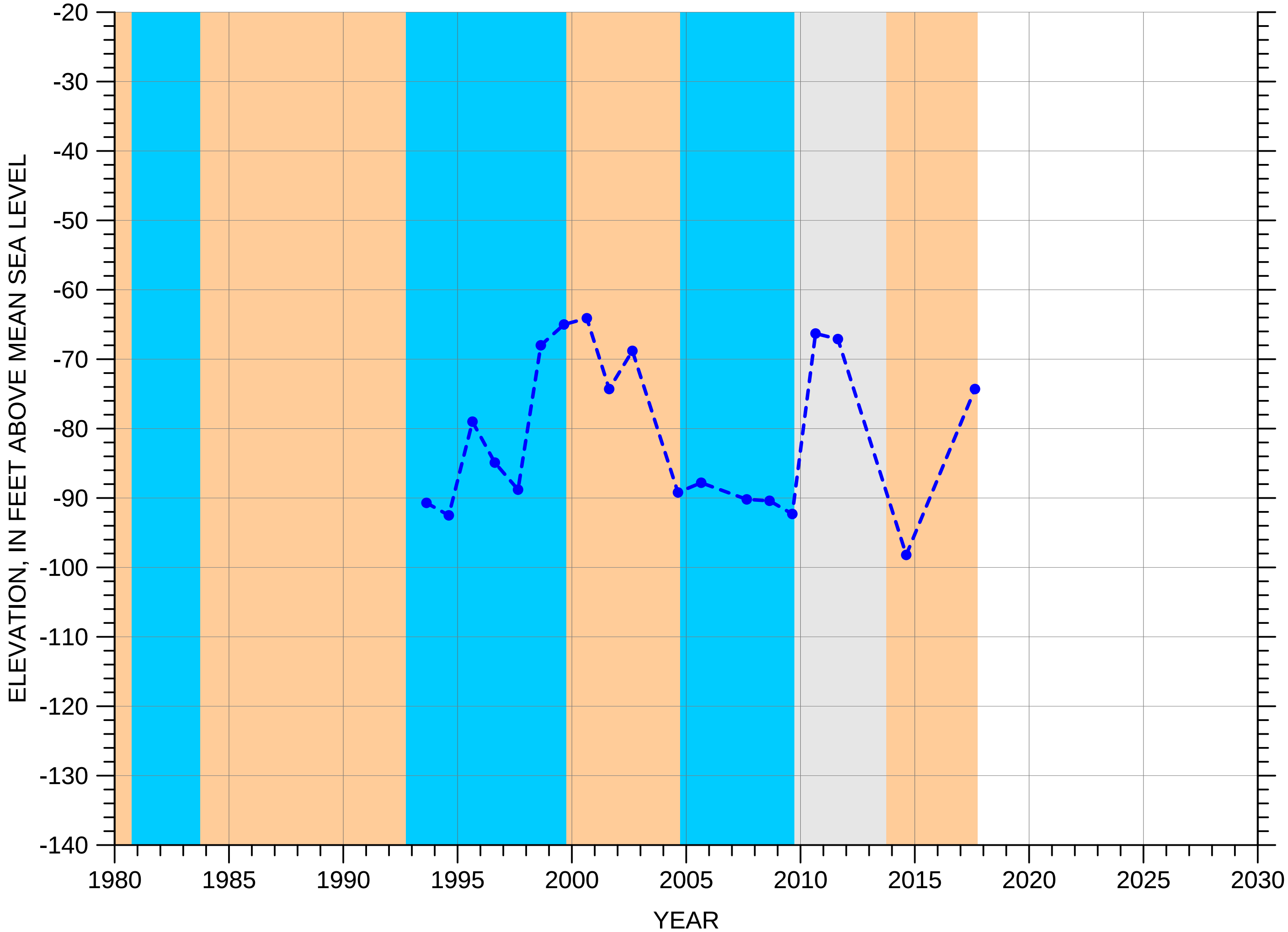
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 205 feet
Screened Interval: 154-204 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-03F04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-03H01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 800 feet
Screened Interval: 350-800 feet below land surface

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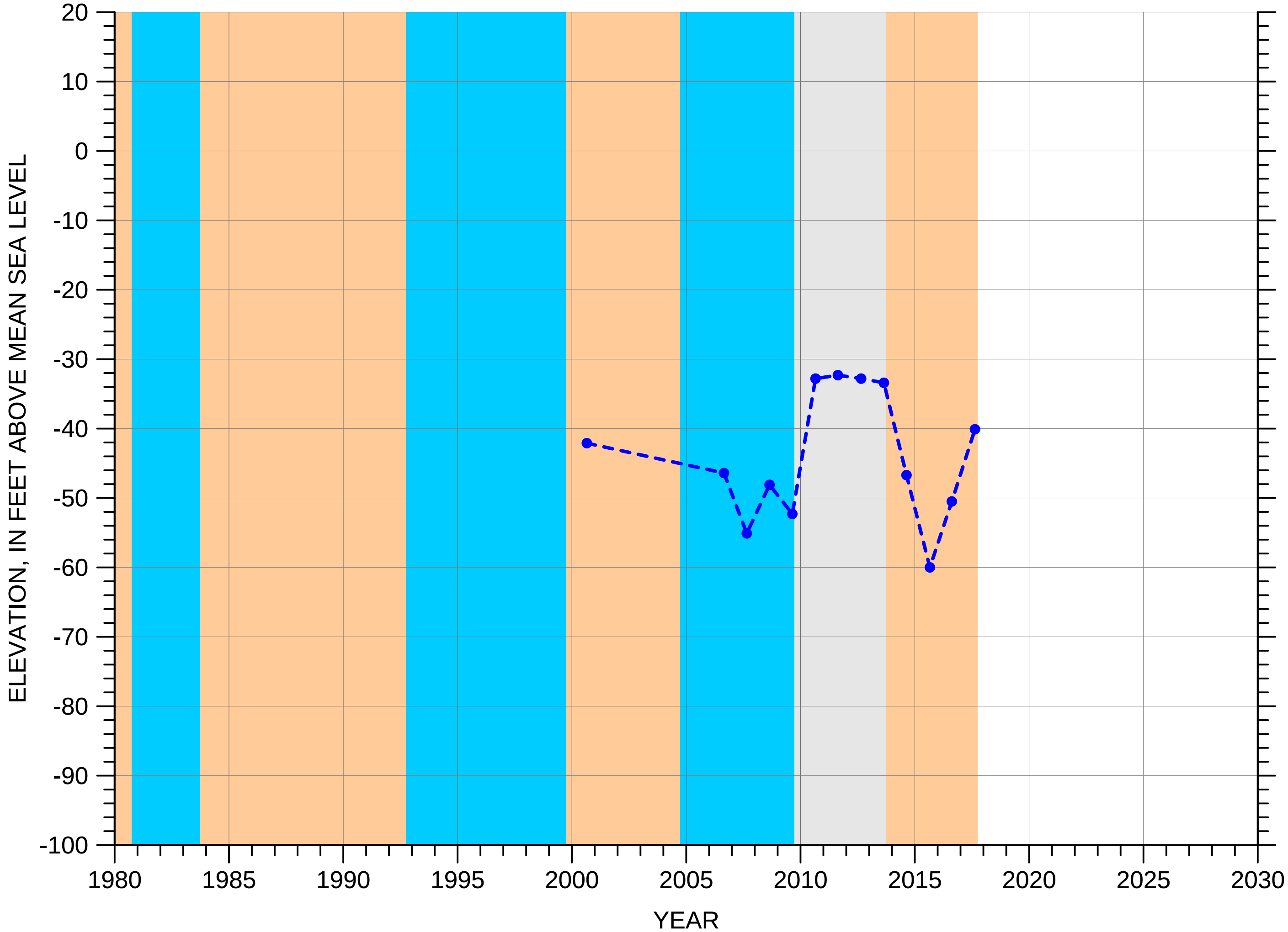
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-04G02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

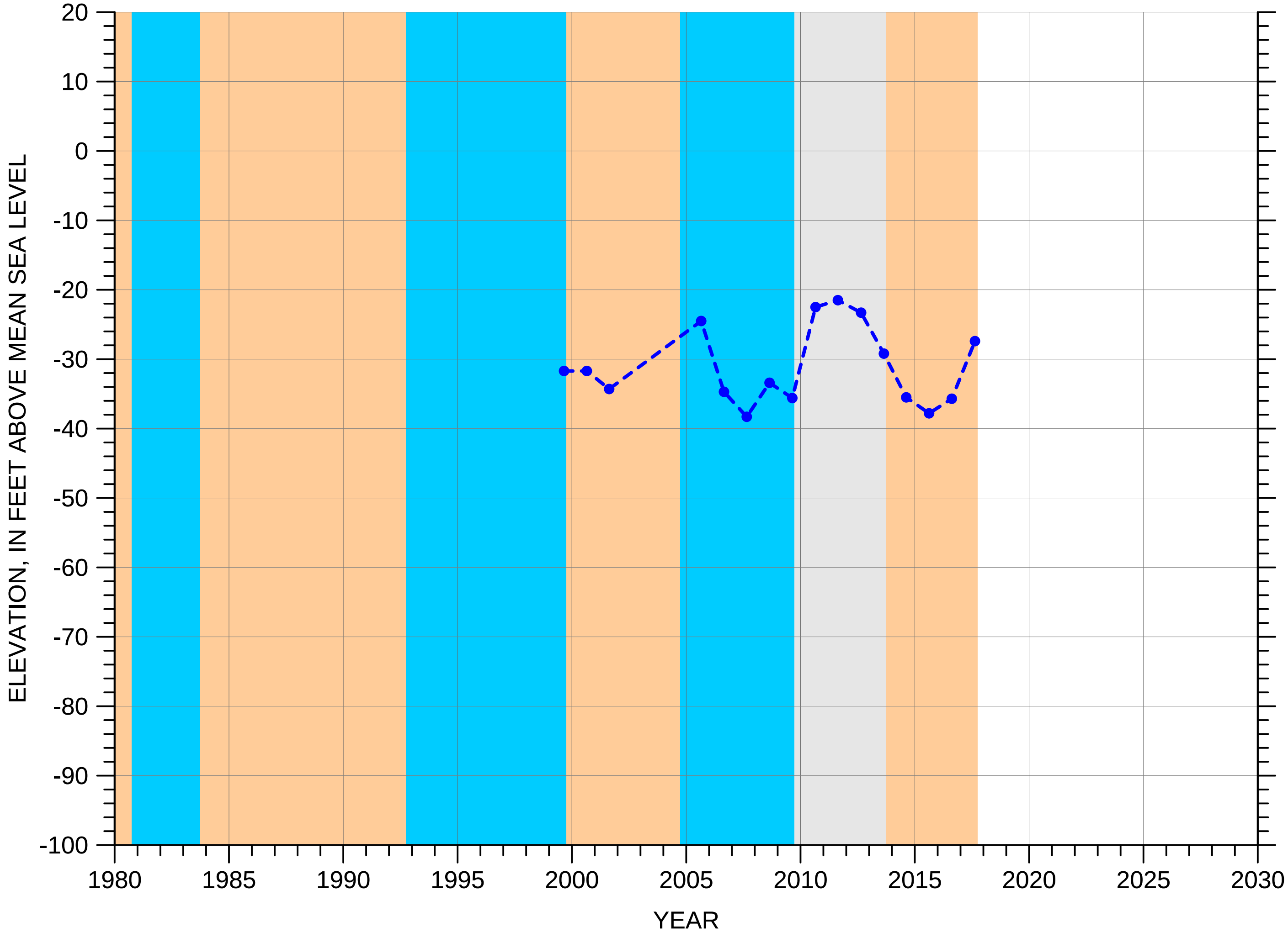
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 620 feet
Screened Interval: 370-610 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-04G02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-09D04



EXPLANATION

GROUNDWATER ELEVATION — ESTIMATED ELEVATION

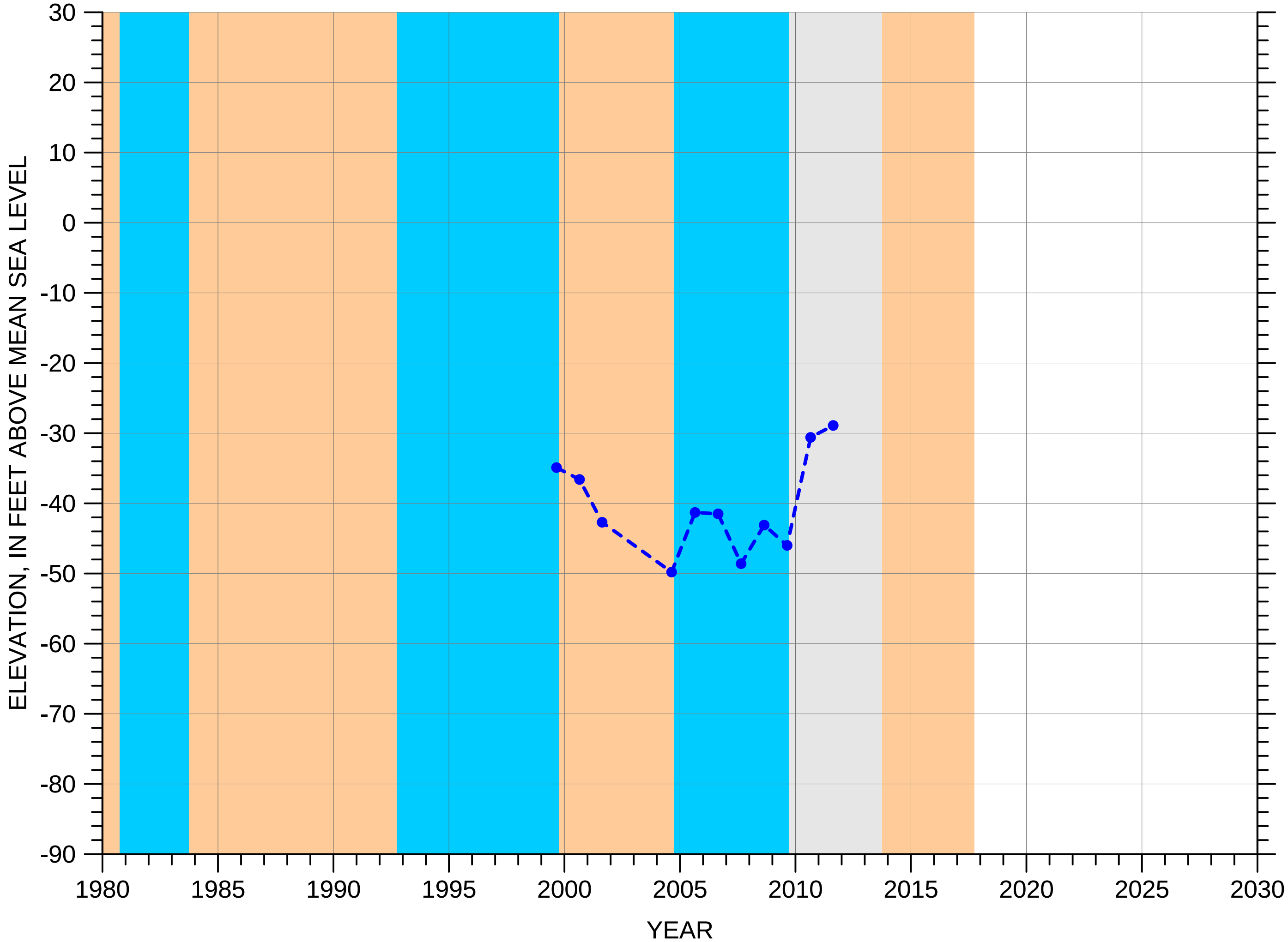
CLIMATE PERIOD CLASSIFICATION

DRY — AVERAGE/ALTERNATING — WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 610 feet
Screened Interval: 350-600 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-09D04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-09K02



EXPLANATION

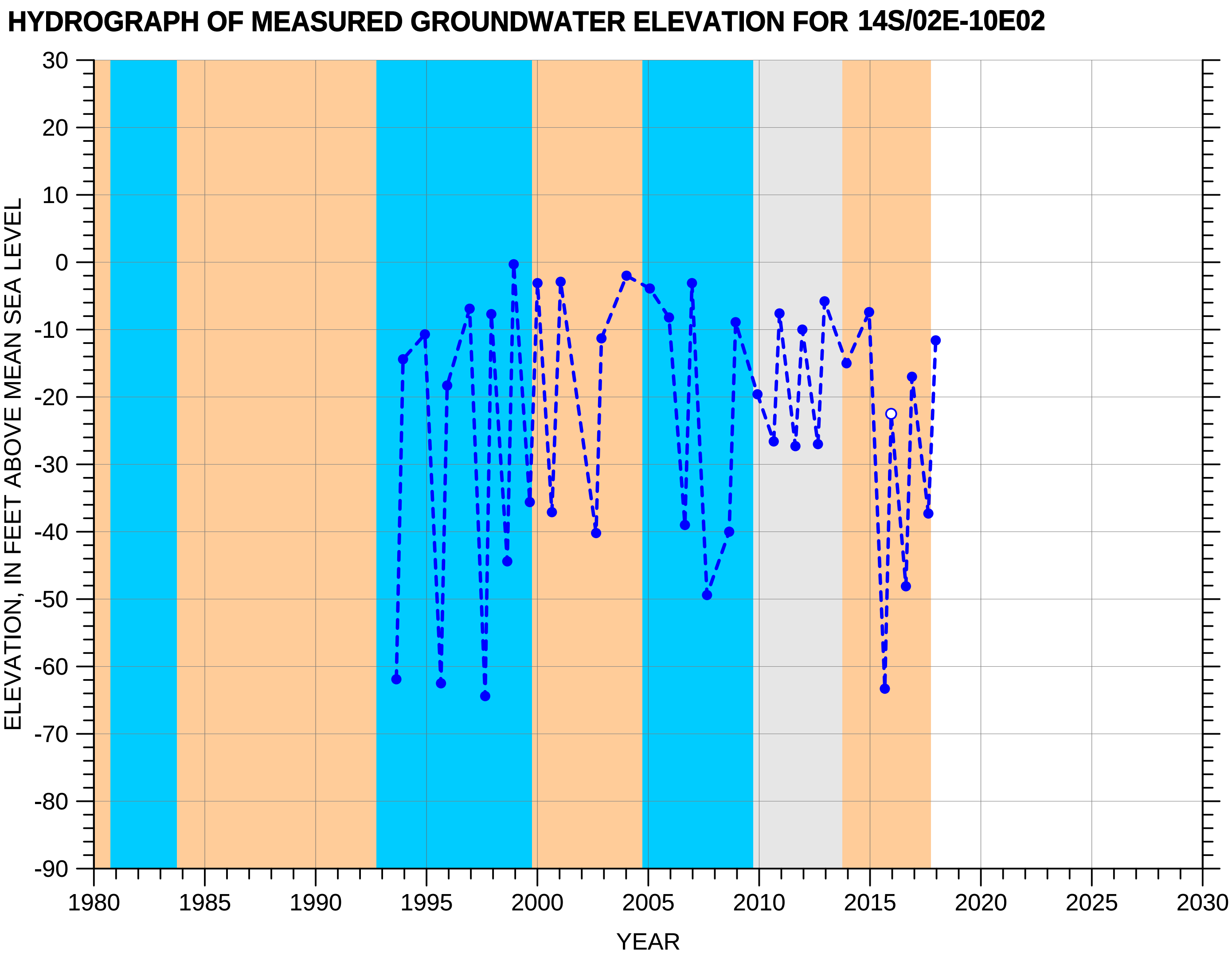
GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 610 feet
Screened Interval: 360-600 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-09K02.grf



EXPLANATION

GROUNDWATER ELEVATION
ESTIMATED ELEVATION

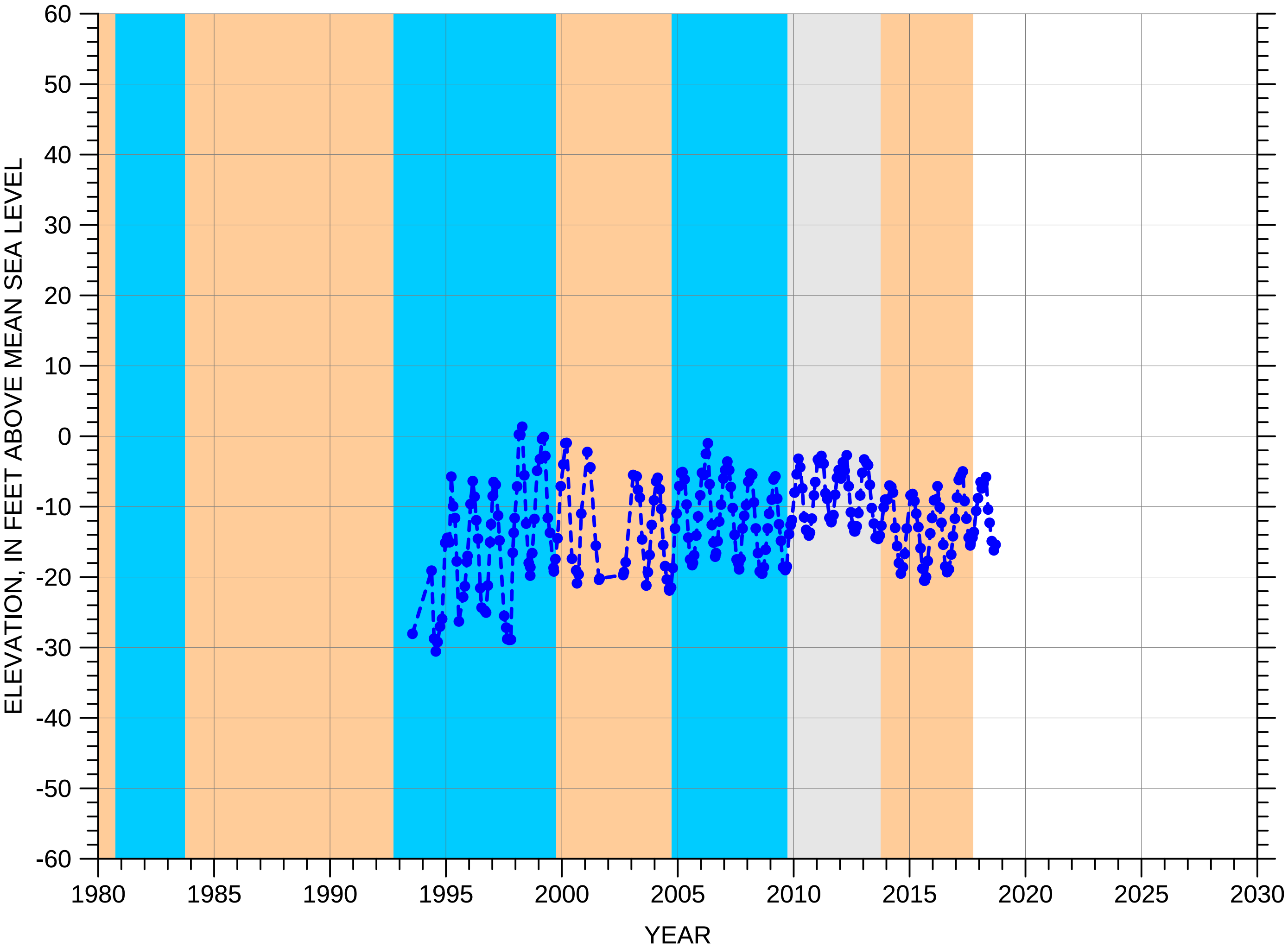
CLIMATE PERIOD CLASSIFICATION

DRY
AVERAGE/ALTERNATING
WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 717 feet
Screened Interval: 298-660 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-10E02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11A02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

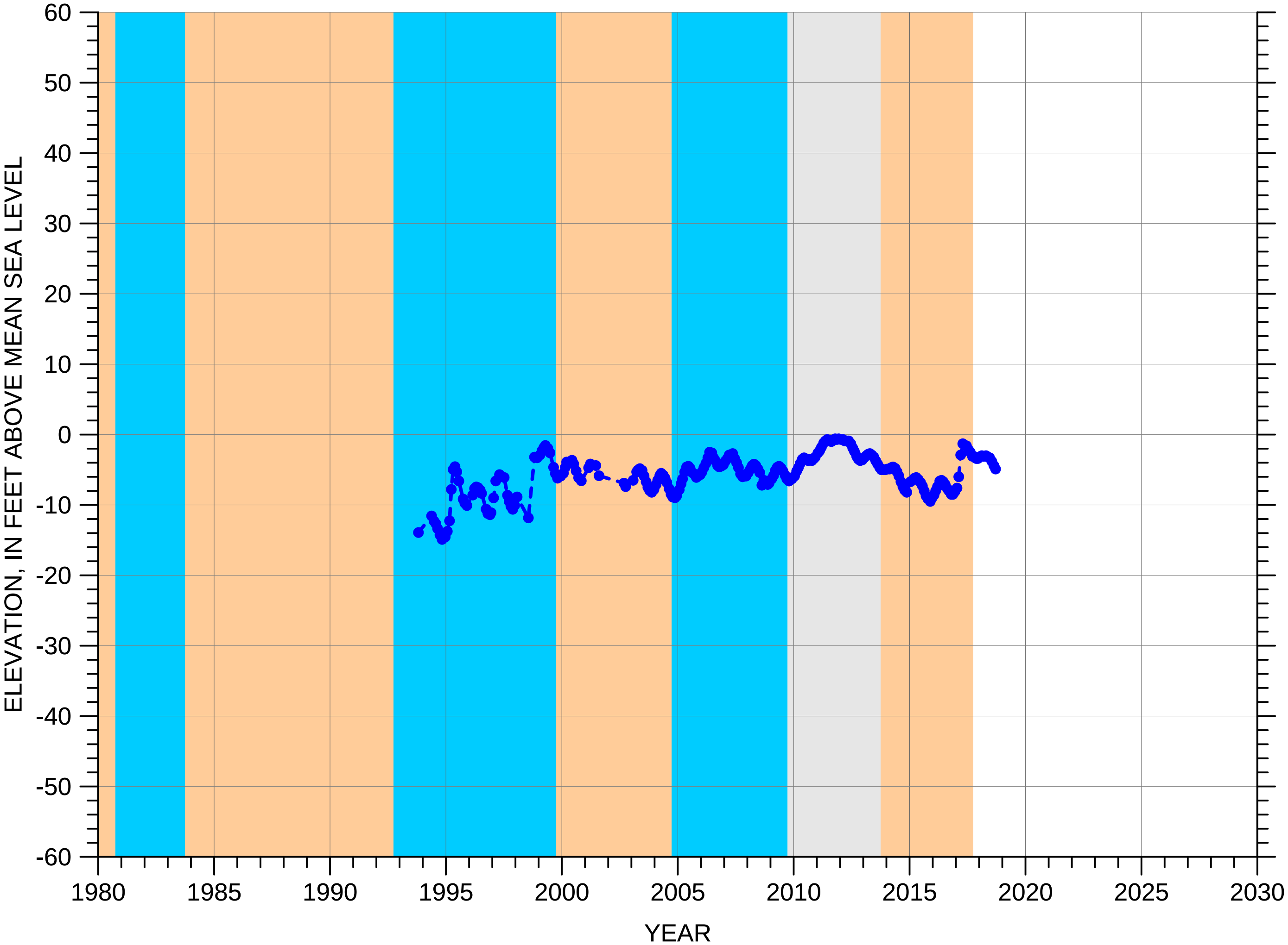
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 250 feet
Screened Interval: 190-240 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-11A02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11A03



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

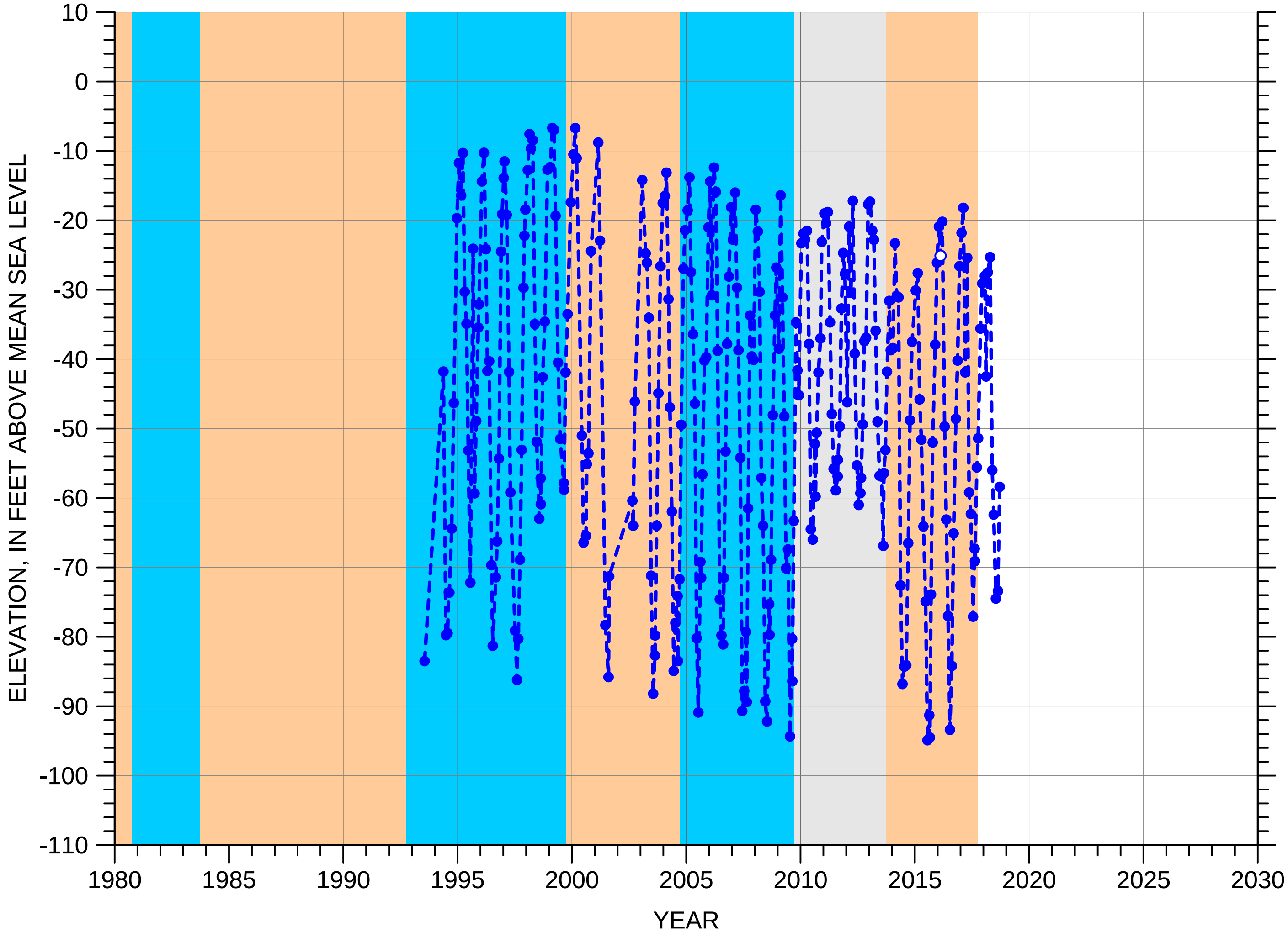
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 100 feet
Screened Interval: 60-90 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-11A03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11A04



EXPLANATION

GROUNDWATER ELEVATION

ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY

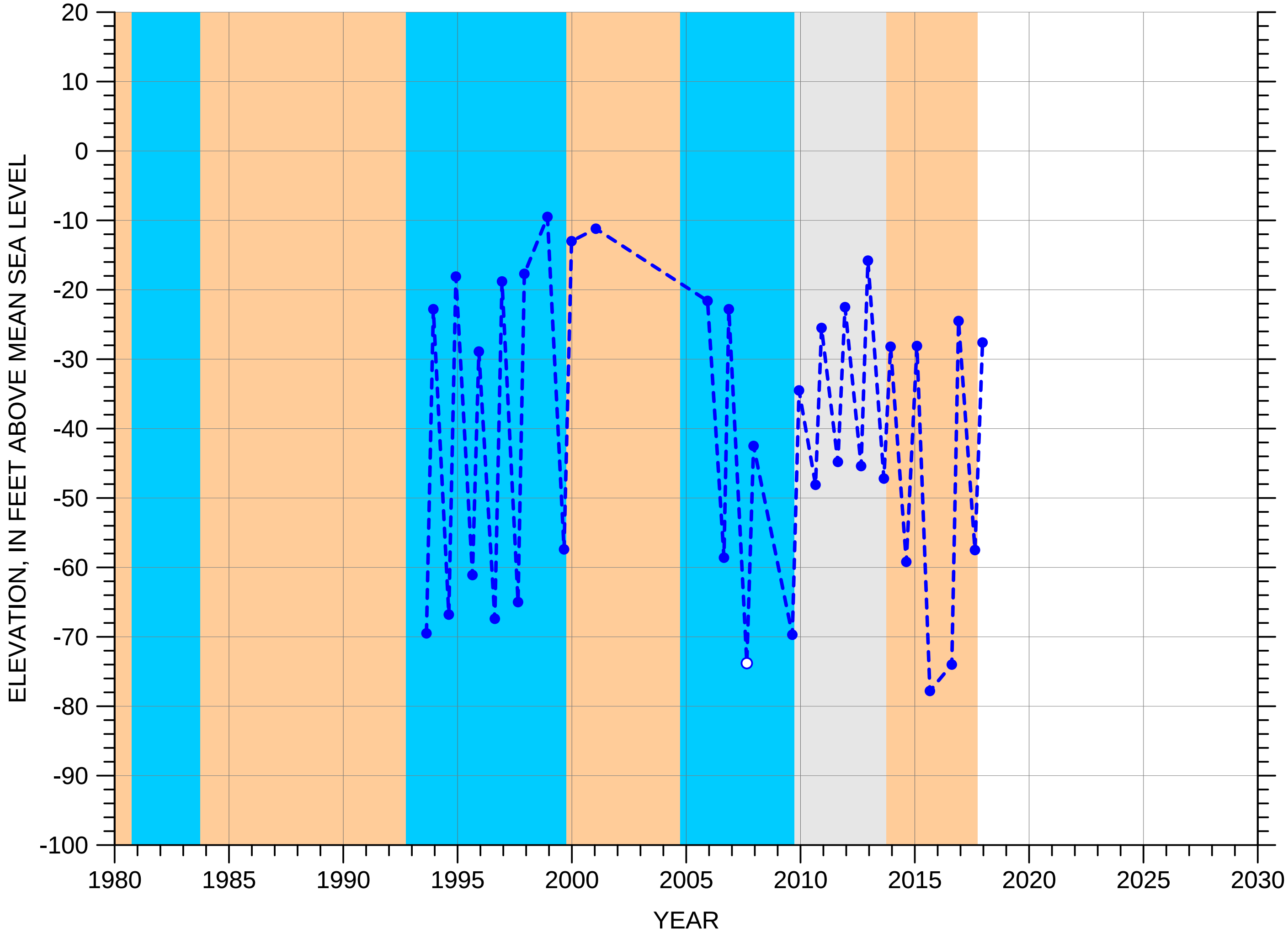
AVERAGE/ALTERNATING

WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 490 feet
Screened Interval: 450-480 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-11A04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11M03



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

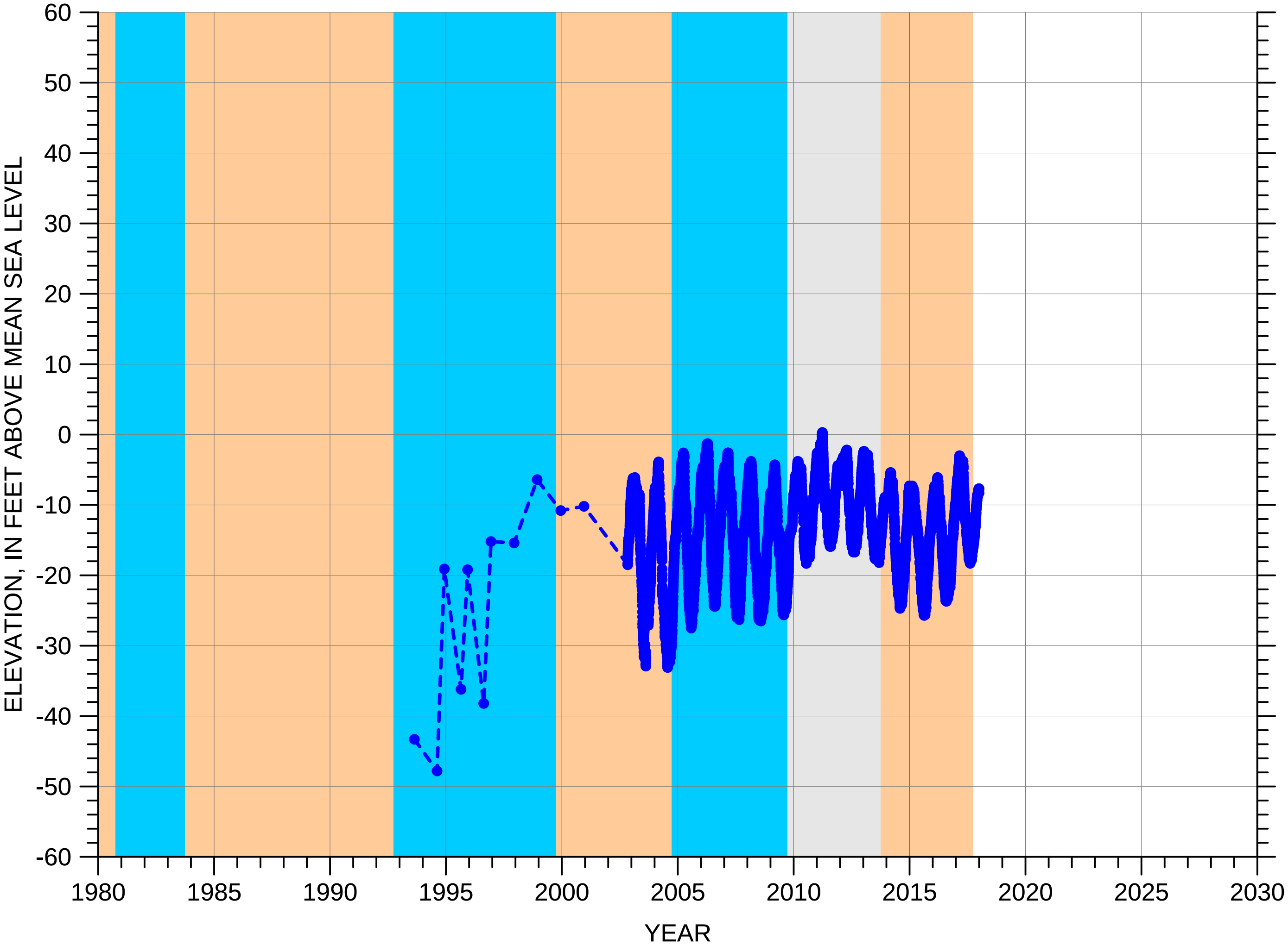
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 660 feet
Screened Interval: 400-660 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-11M03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-12B02



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

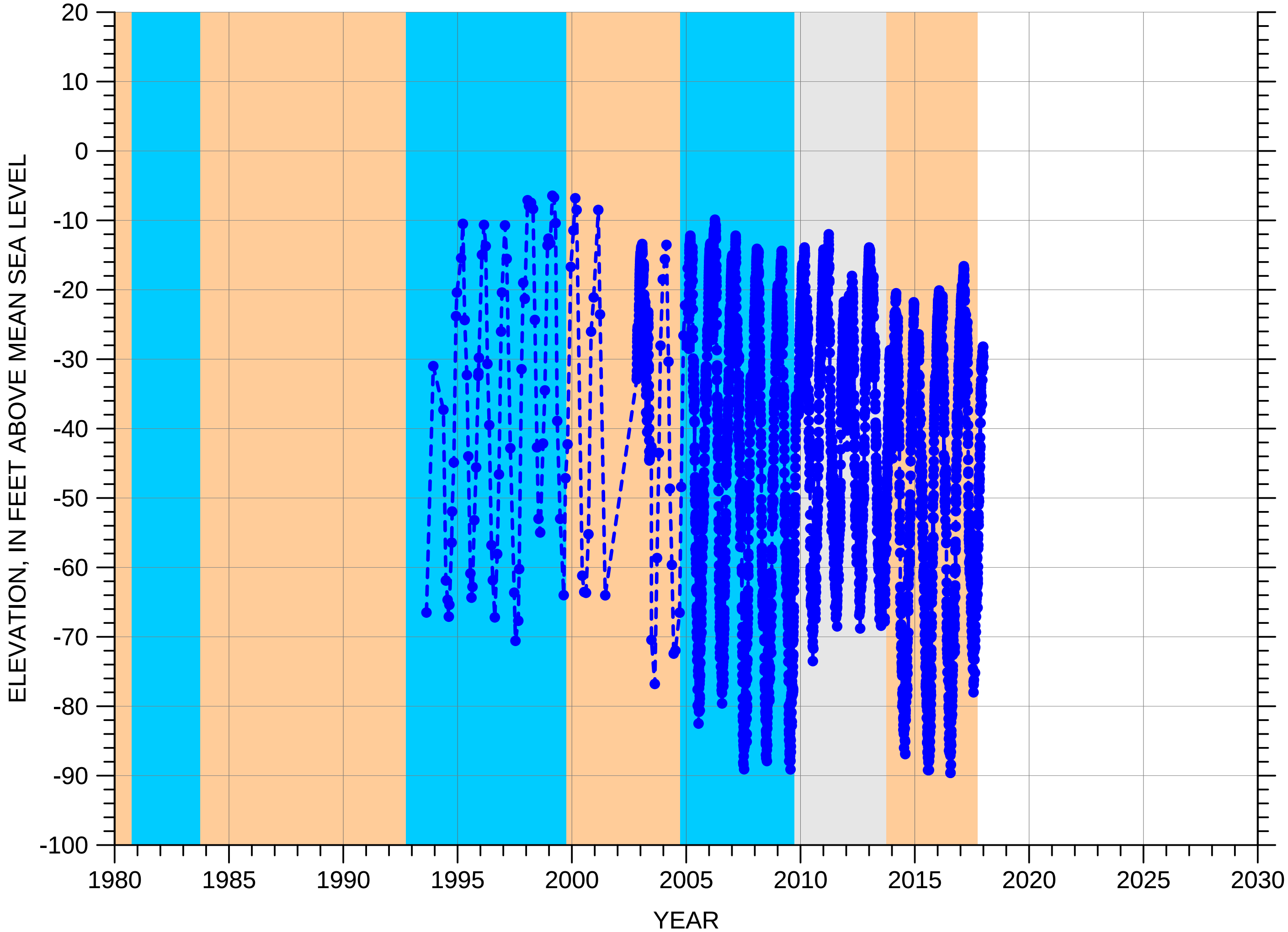
CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 265 feet
Screened Interval: 210-260 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-12B02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-12B03



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 390 feet
Screened Interval: 350-380 feet below land surface

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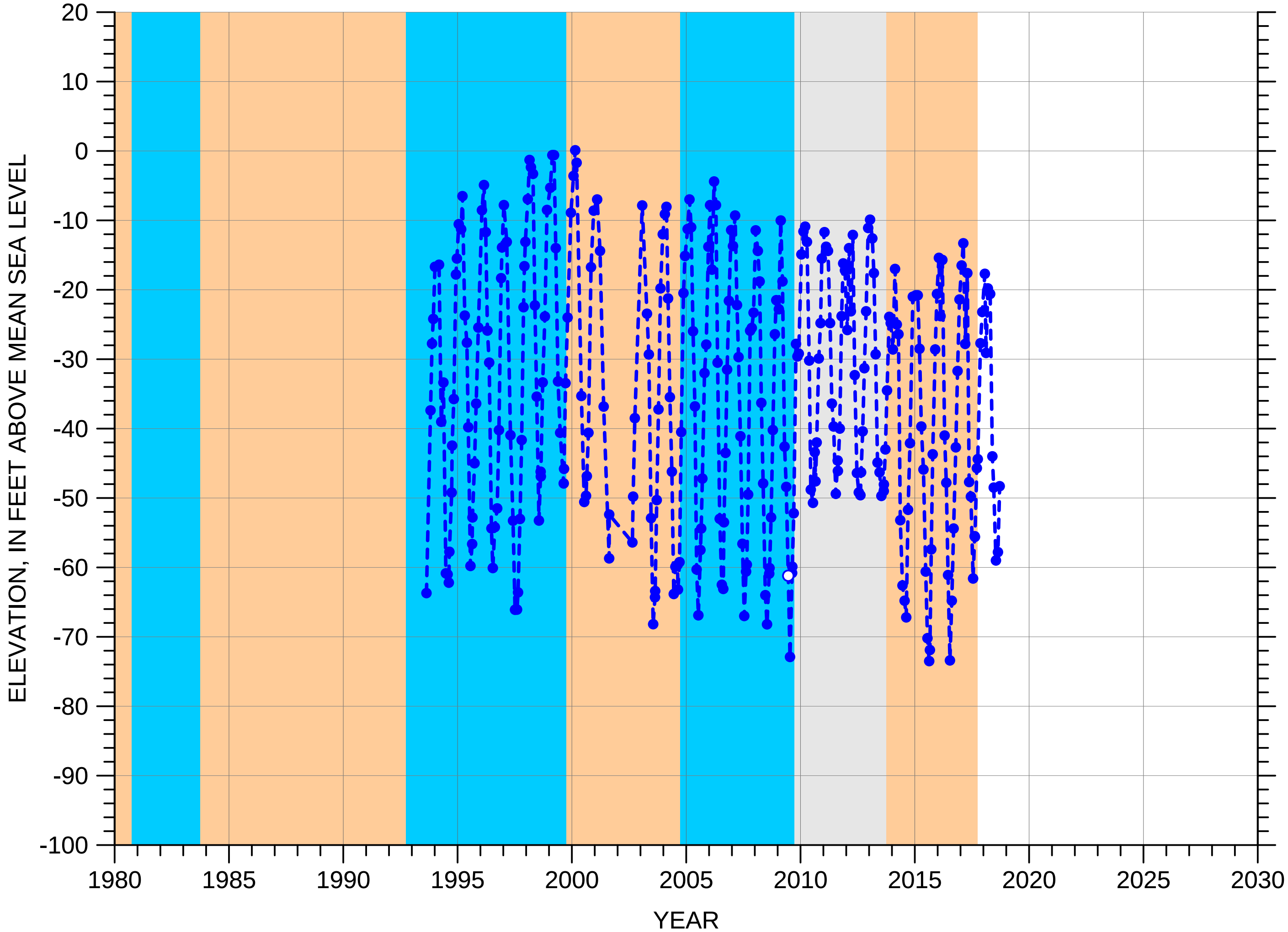
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-13F02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

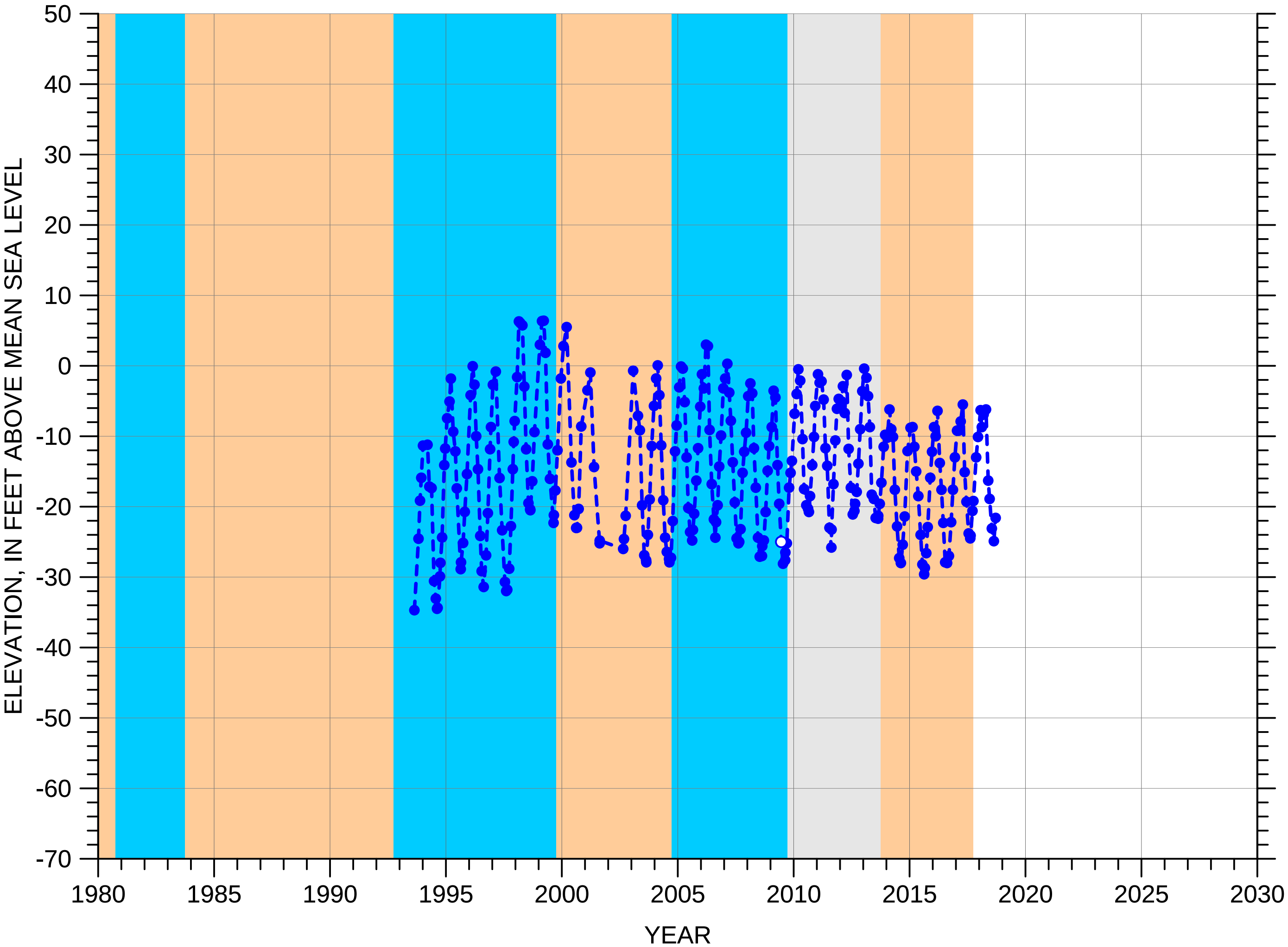
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 480 feet
Screened Interval: 420-470 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-13F02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-13F03



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

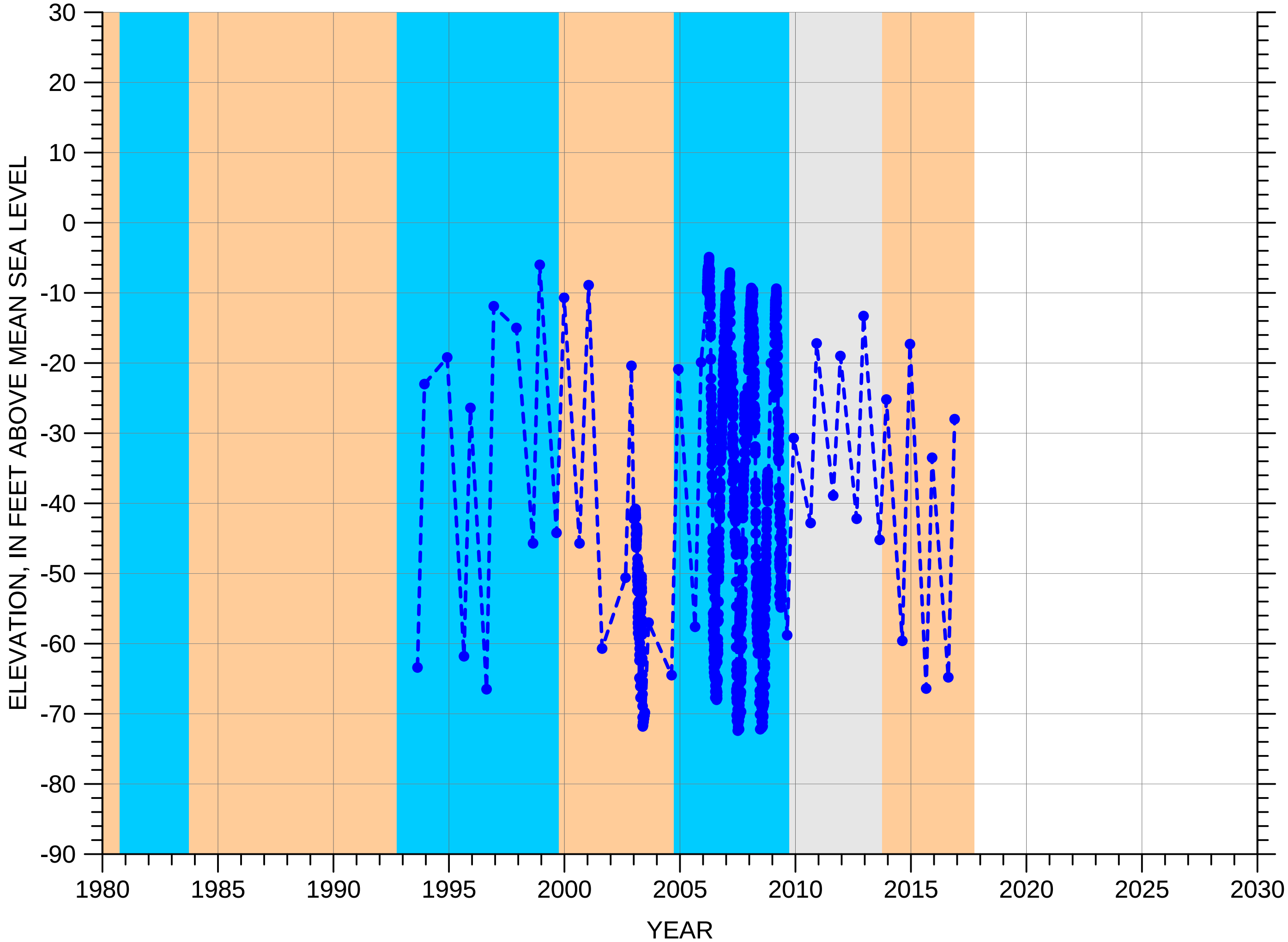
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 280 feet
Screened Interval: 230-270 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-13F03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-14L03



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

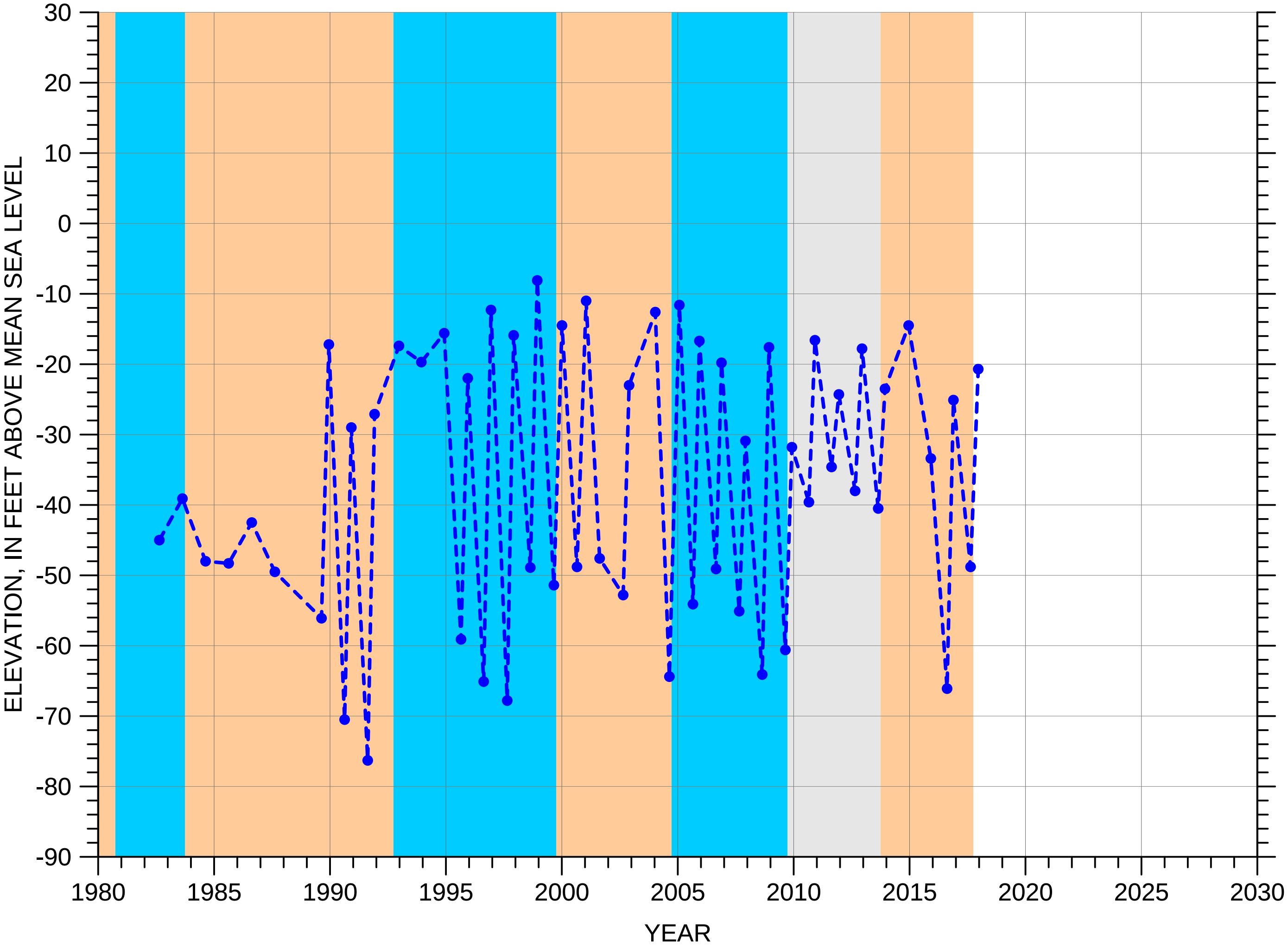
CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 612 feet
Screened Interval: 332-612 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-14L03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-15A01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

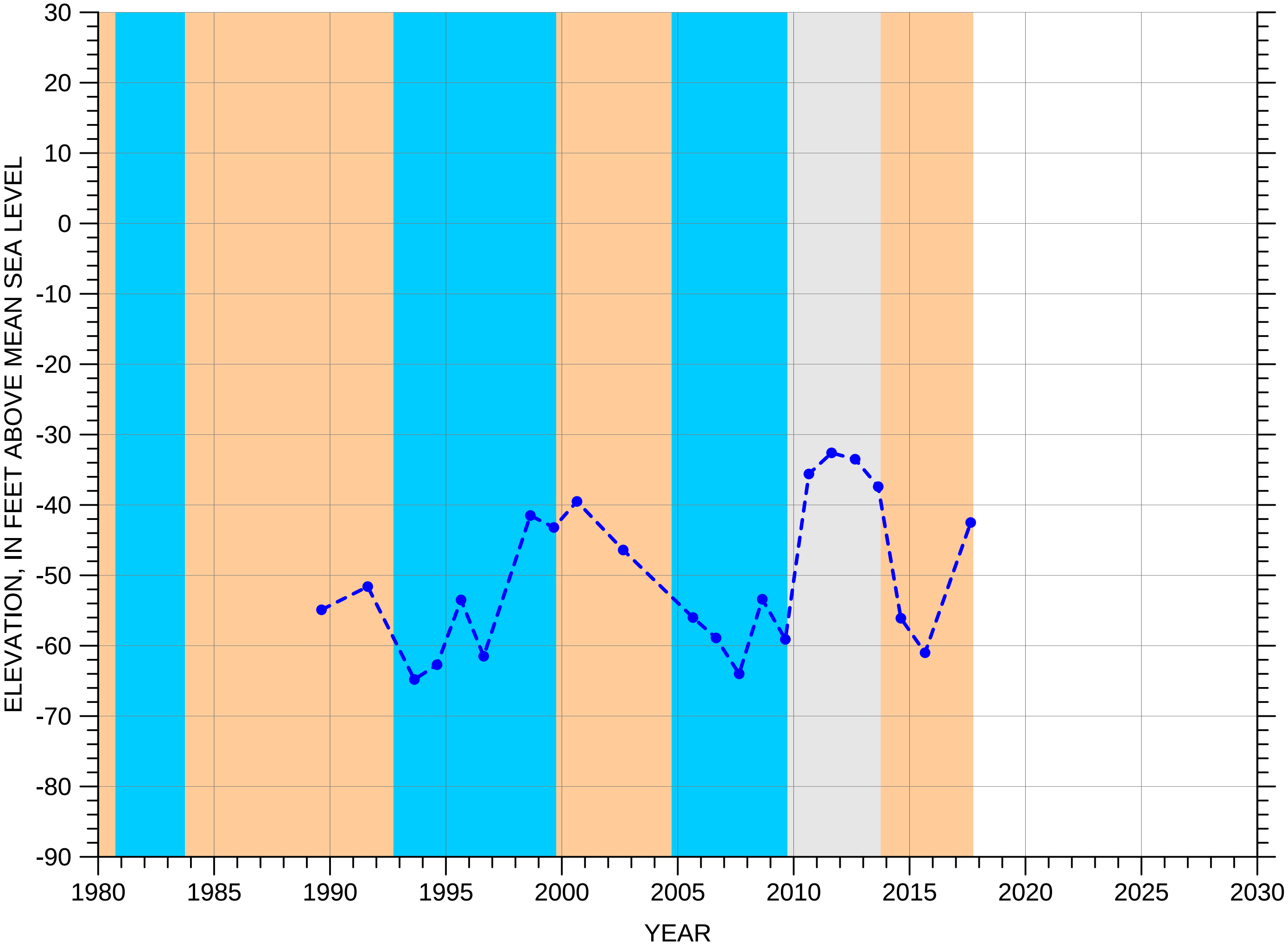
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 623 feet
Screened Interval: 386-608 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-15A01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-15C02



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

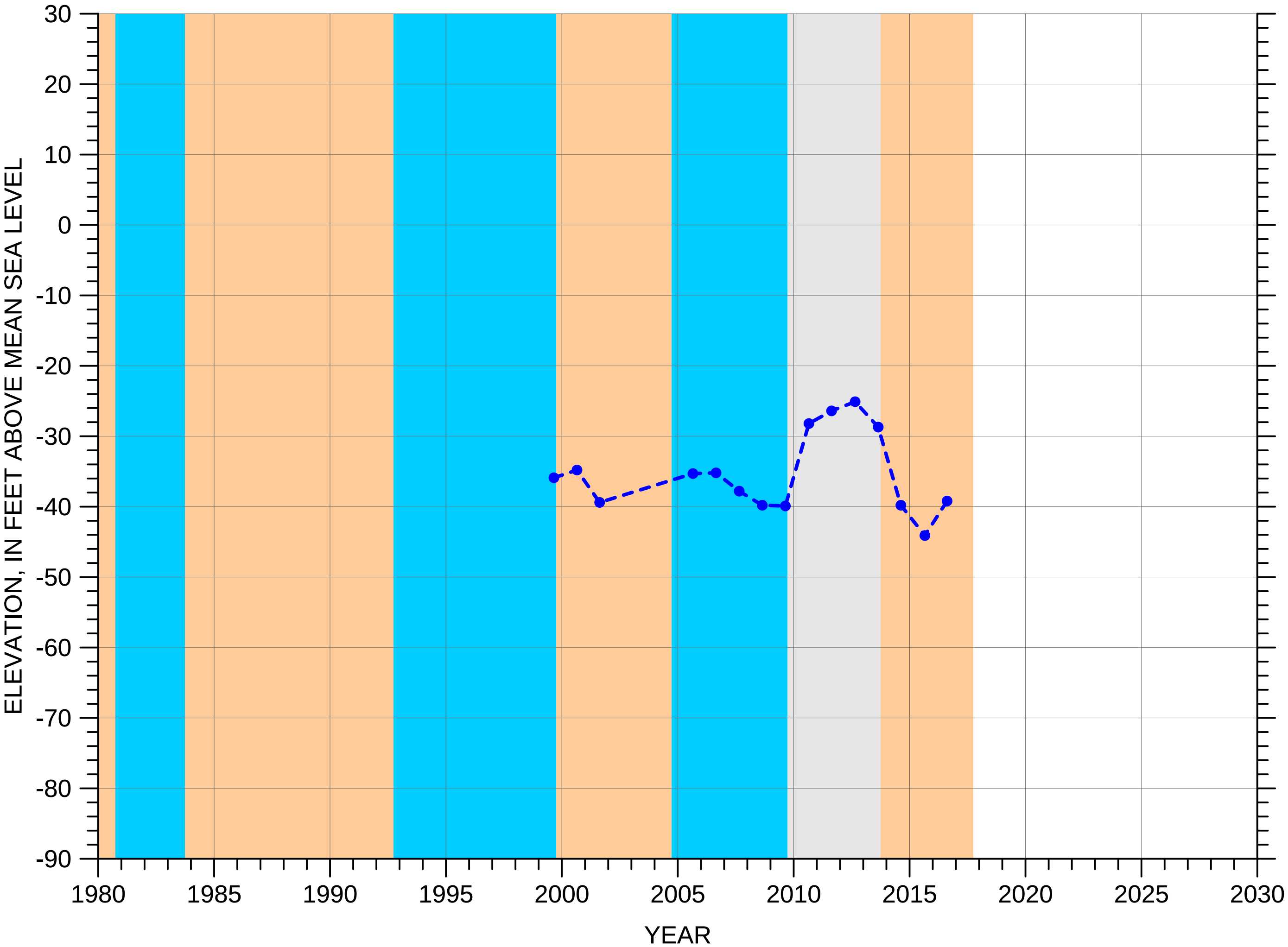
CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 550 feet
Screened Interval: 328-550 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-15C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-16G01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 610 feet
Screened Interval: 330-600 feet below land surface

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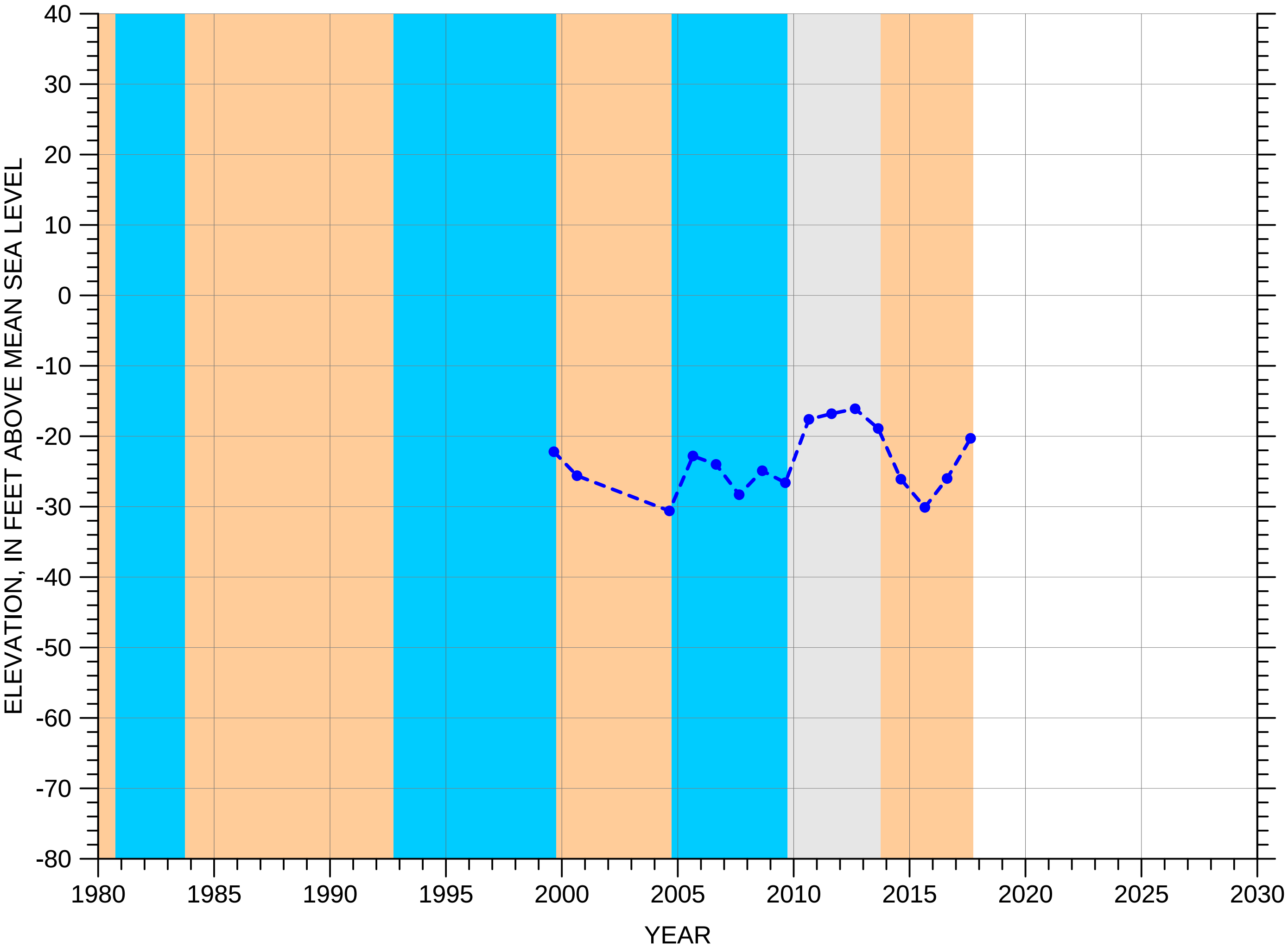
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-17B03



EXPLANATION

GROUNDWATER ELEVATION
ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY
AVERAGE/ALTERNATING
WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 615 feet
Screened Interval: 330-600 feet below land surface

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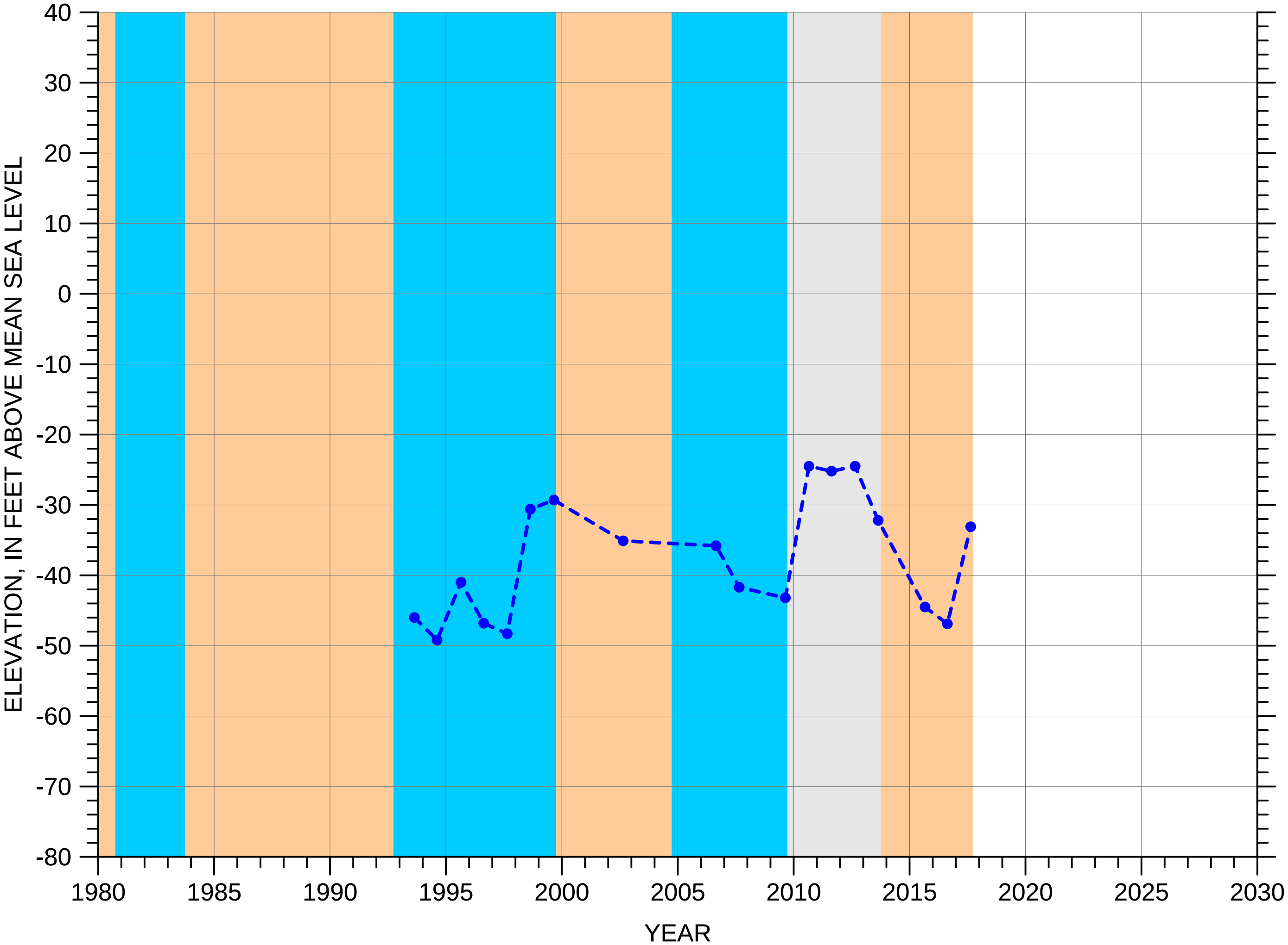
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-22B01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

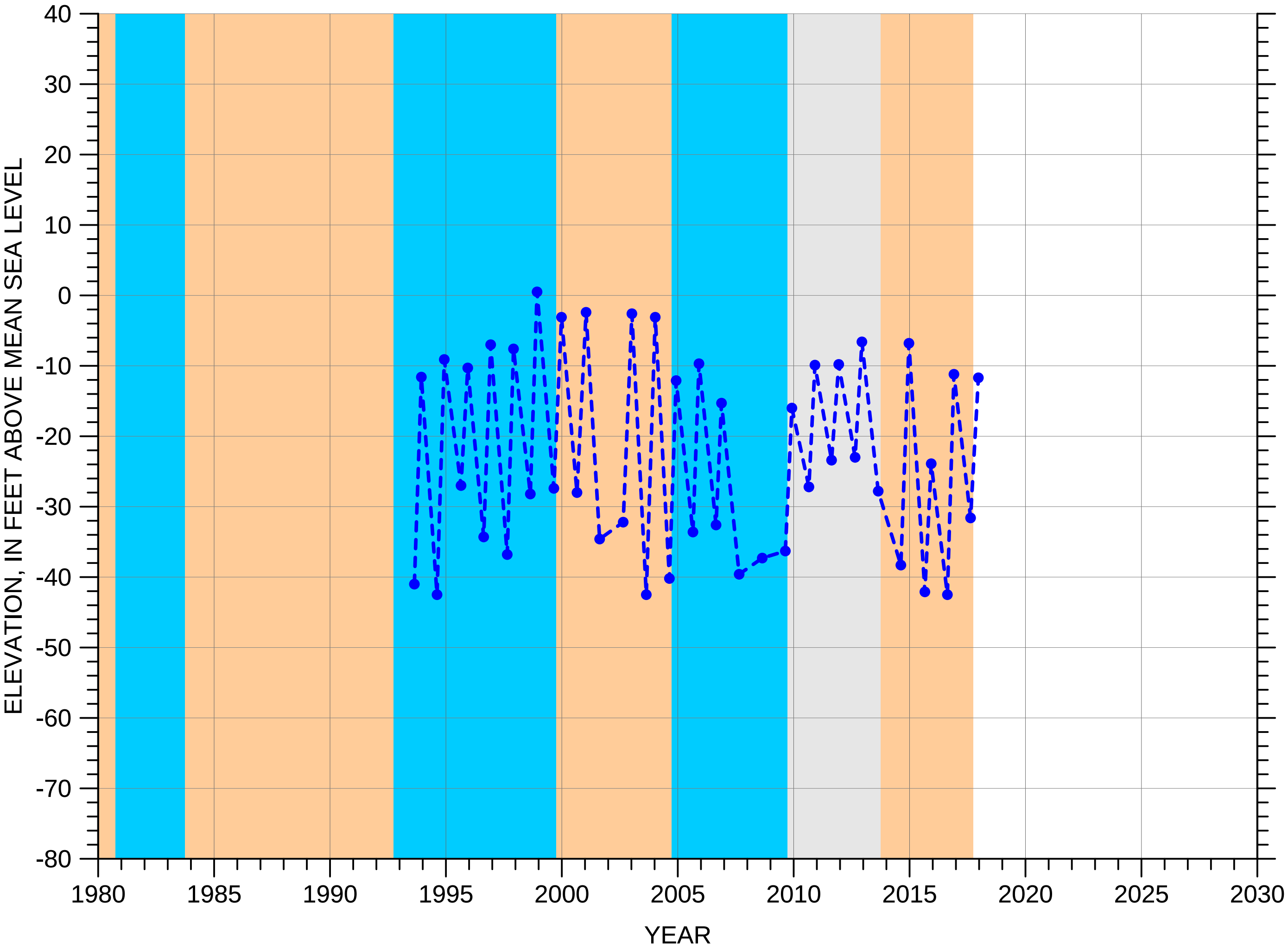
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 670 feet
Screened Interval: 410-670 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-22B01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-22L01



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

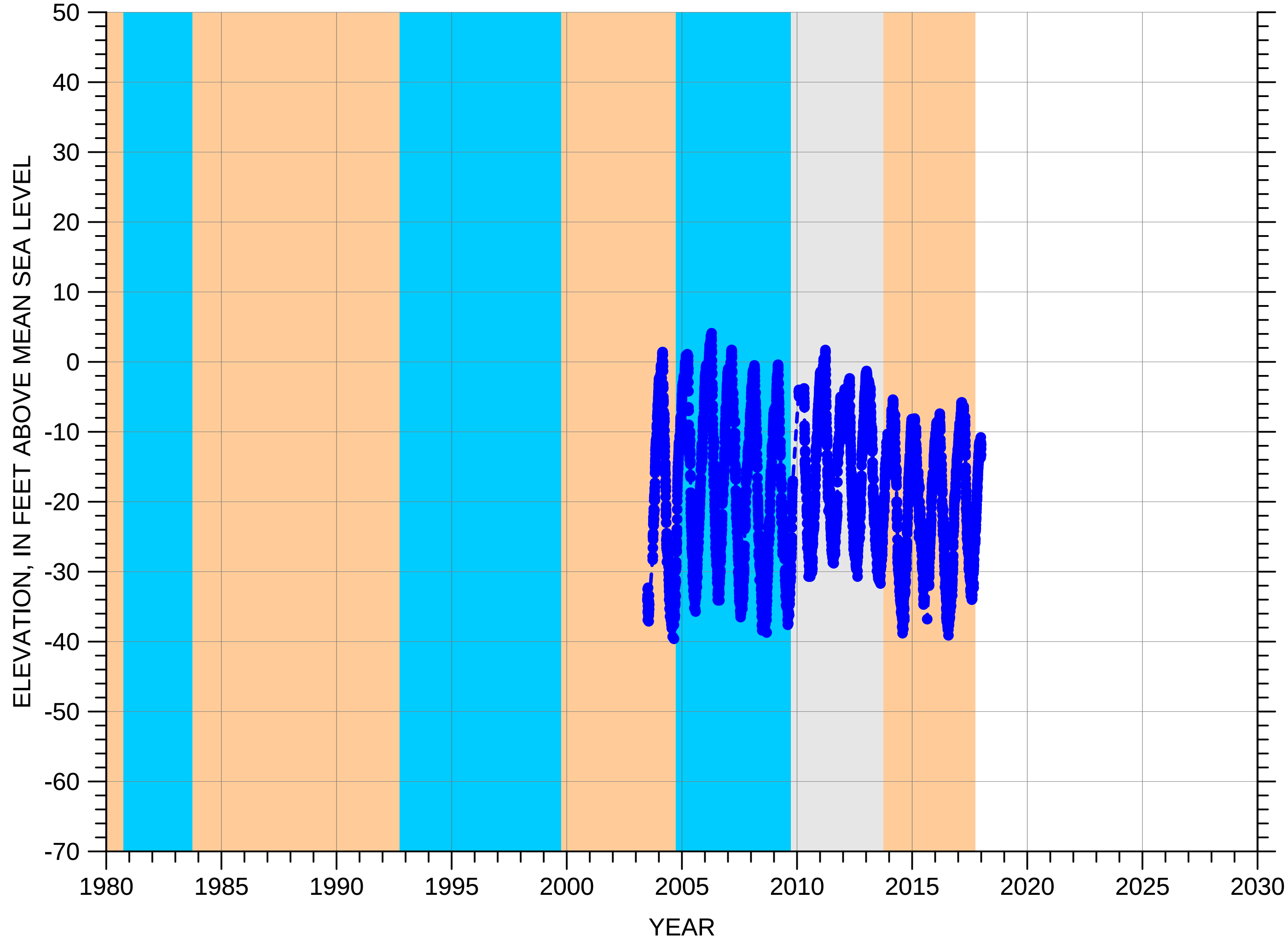
CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 680 feet
Screened Interval: 420-680 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-22L01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-26H01



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

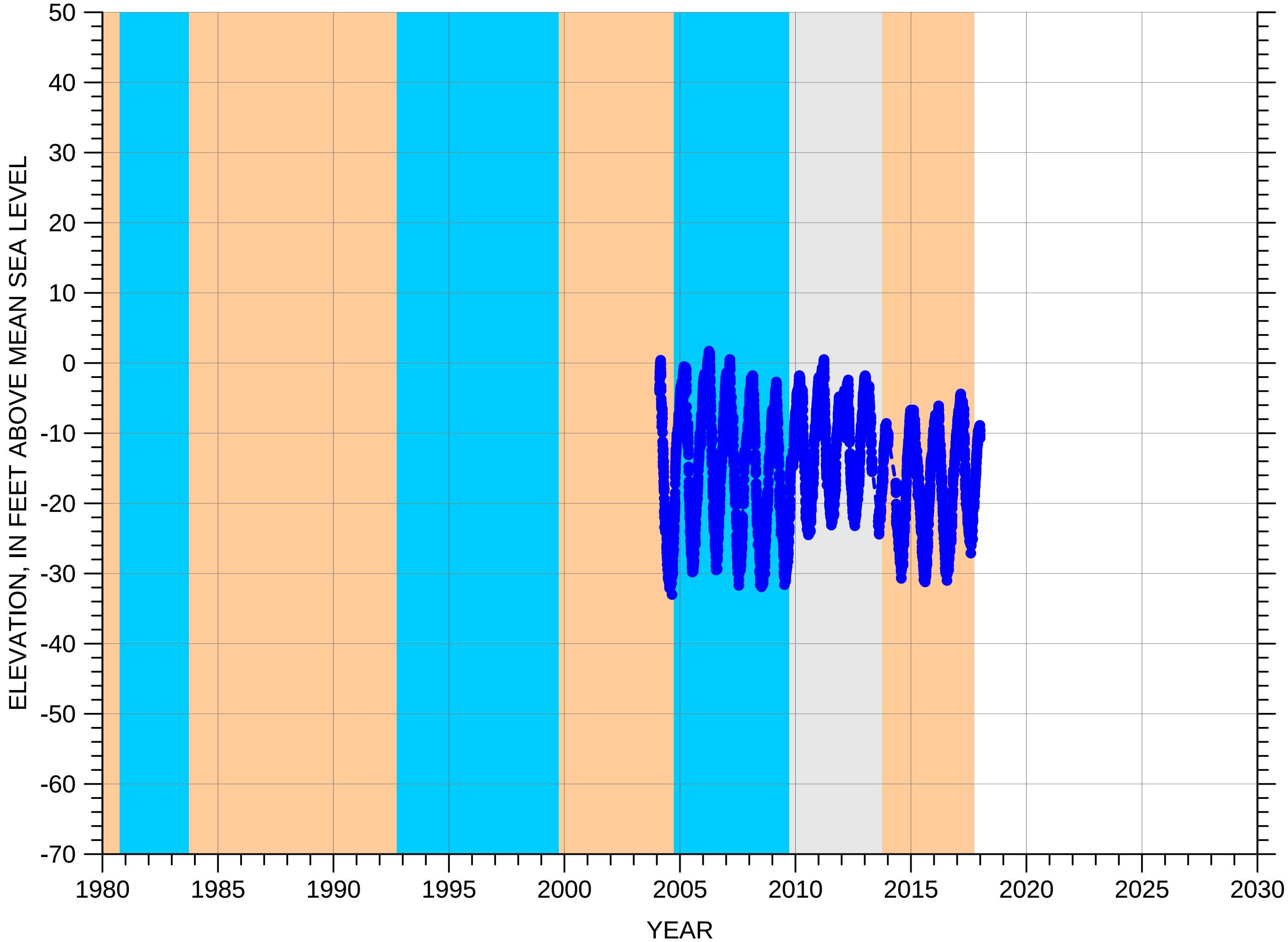
CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 339.3 feet
Screened Interval: 287-337 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_02E-26H01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-27A01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 292.7 feet
Screened Interval: 240-290 feet below land surface

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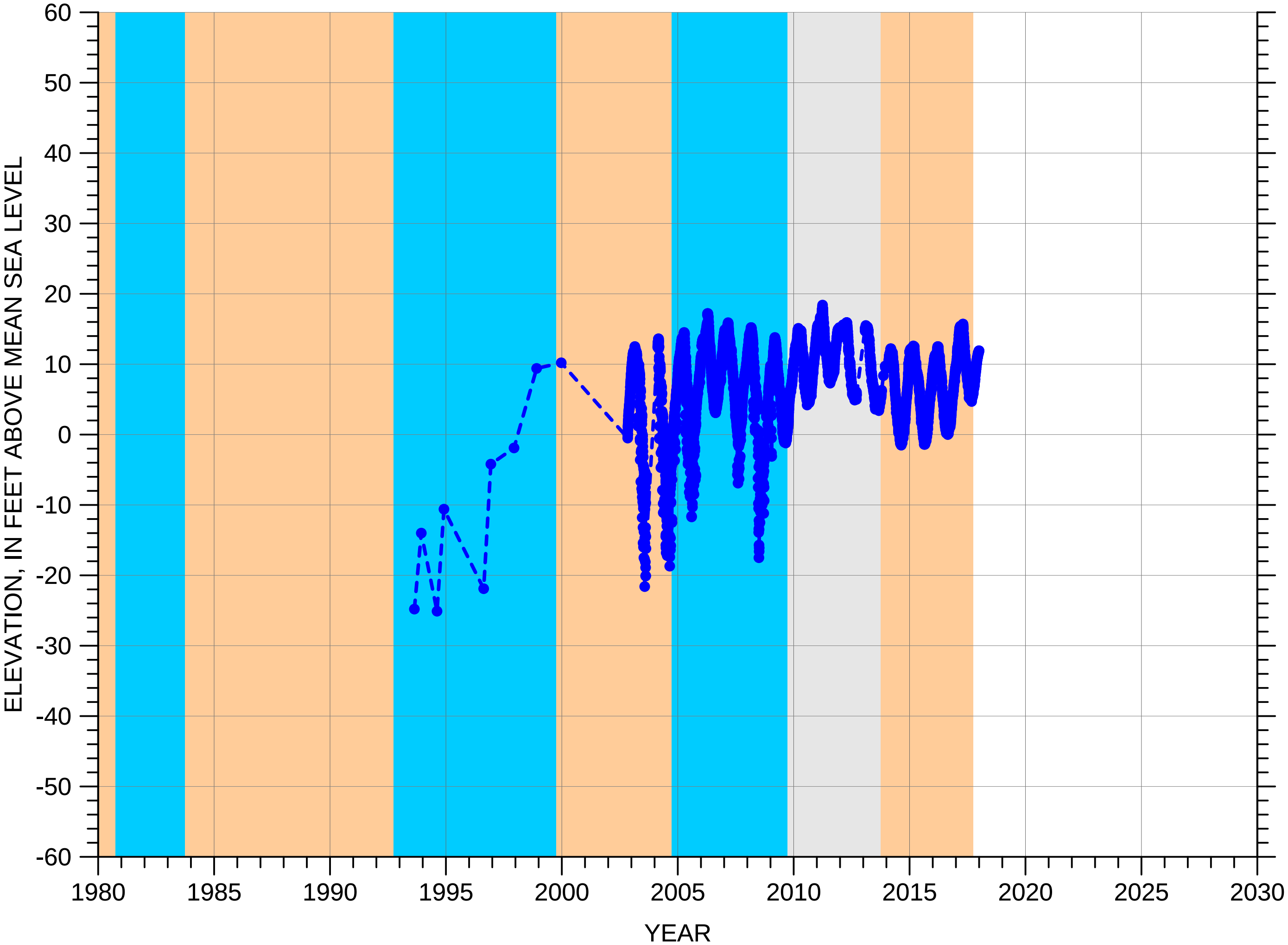
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-18C01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 225 feet
Screened Interval: 165-215 feet below land surface

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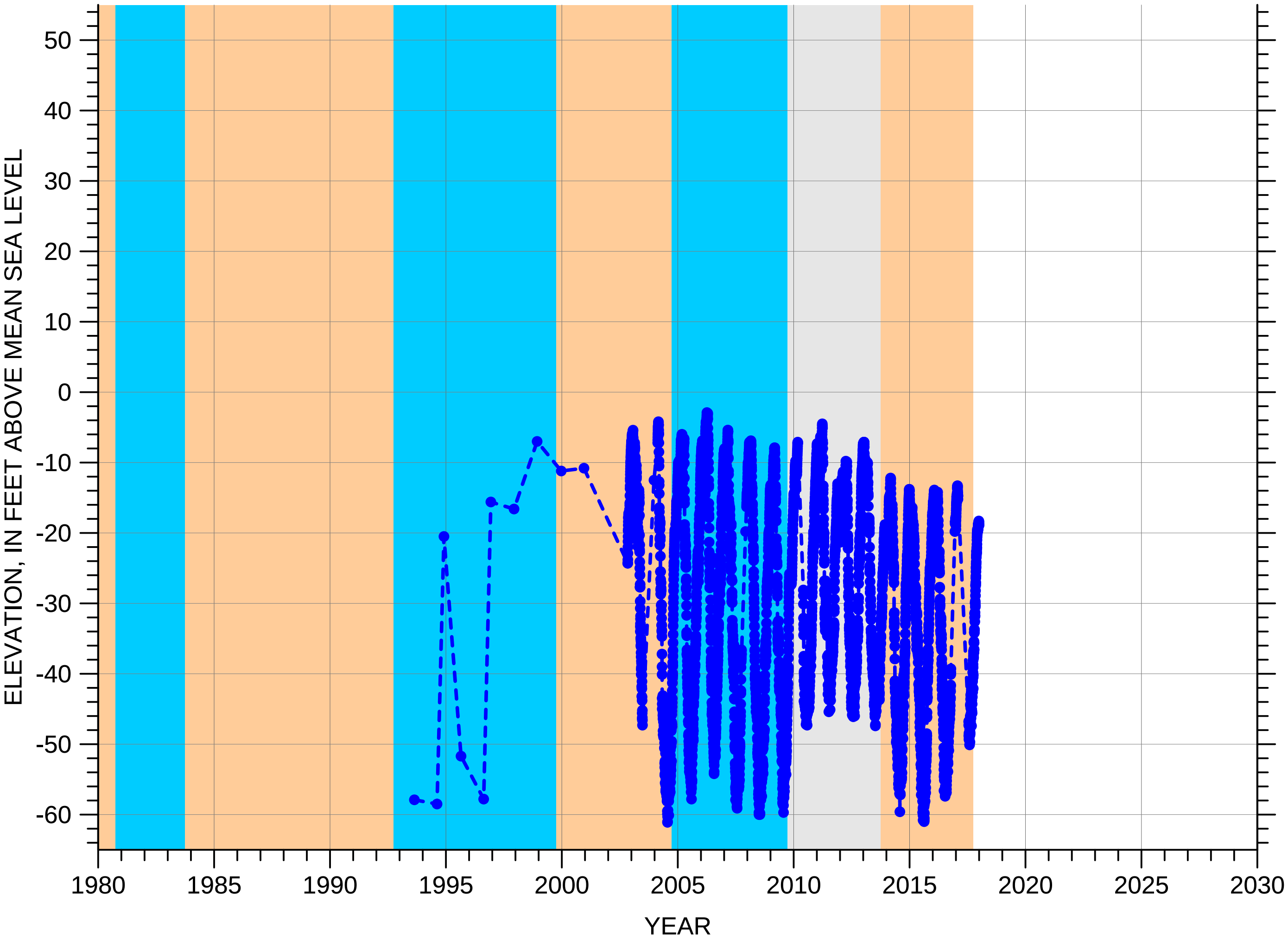
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-18C02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

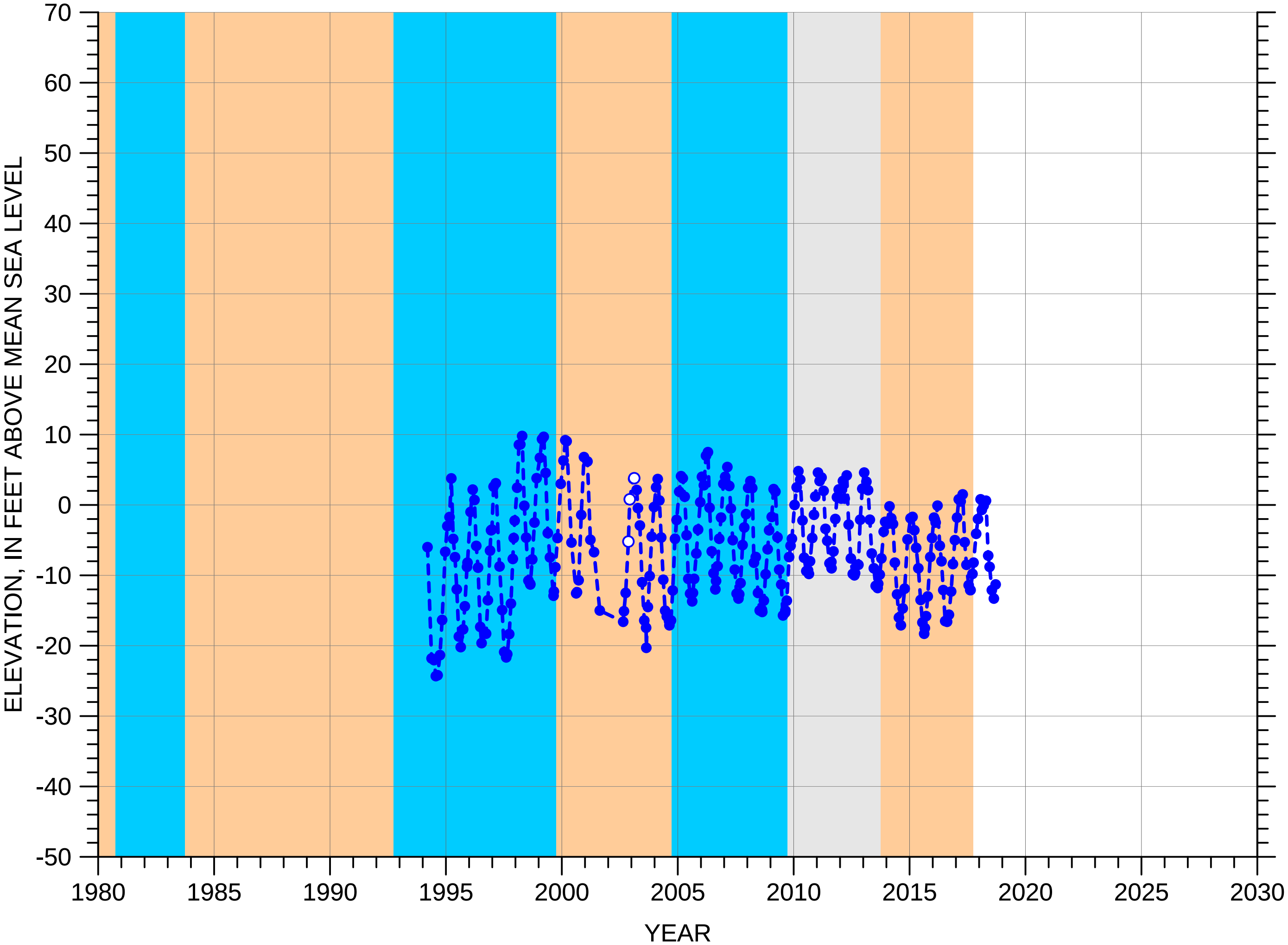
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 395 feet
Screened Interval: 270-385 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_03E-18C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-18E03



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 260 feet
Screened Interval: 230-250 feet below land surface

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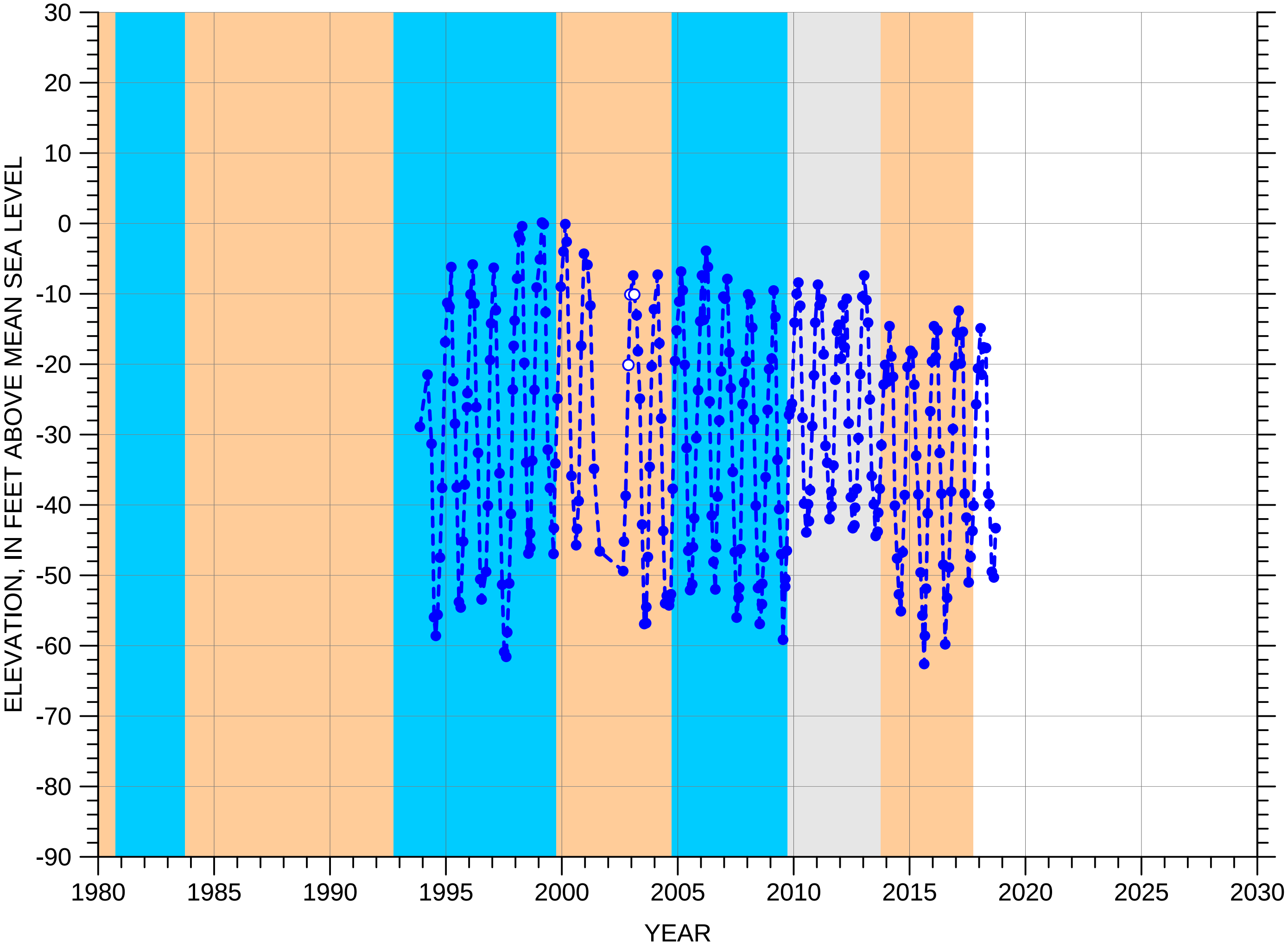
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-18E04



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 495 feet
Screened Interval: 335-485 feet below land surface

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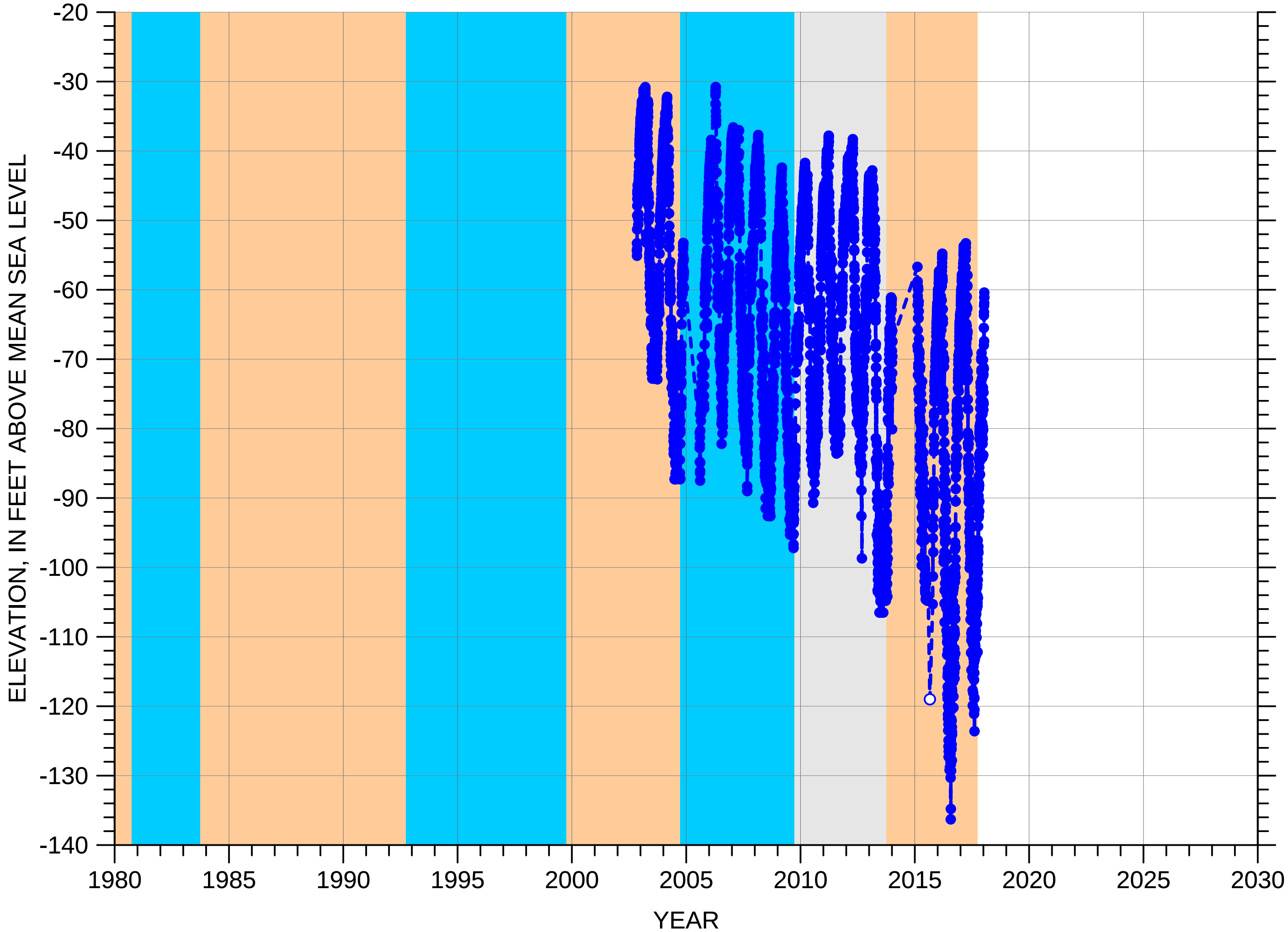
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-25C01



EXPLANATION

GROUNDWATER ELEVATION
ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY
AVERAGE/ALTERNATING
WET

Subbasin: East Side Subbasin
Well Depth: 680 feet
Screened Interval: 570-670 feet below land surface

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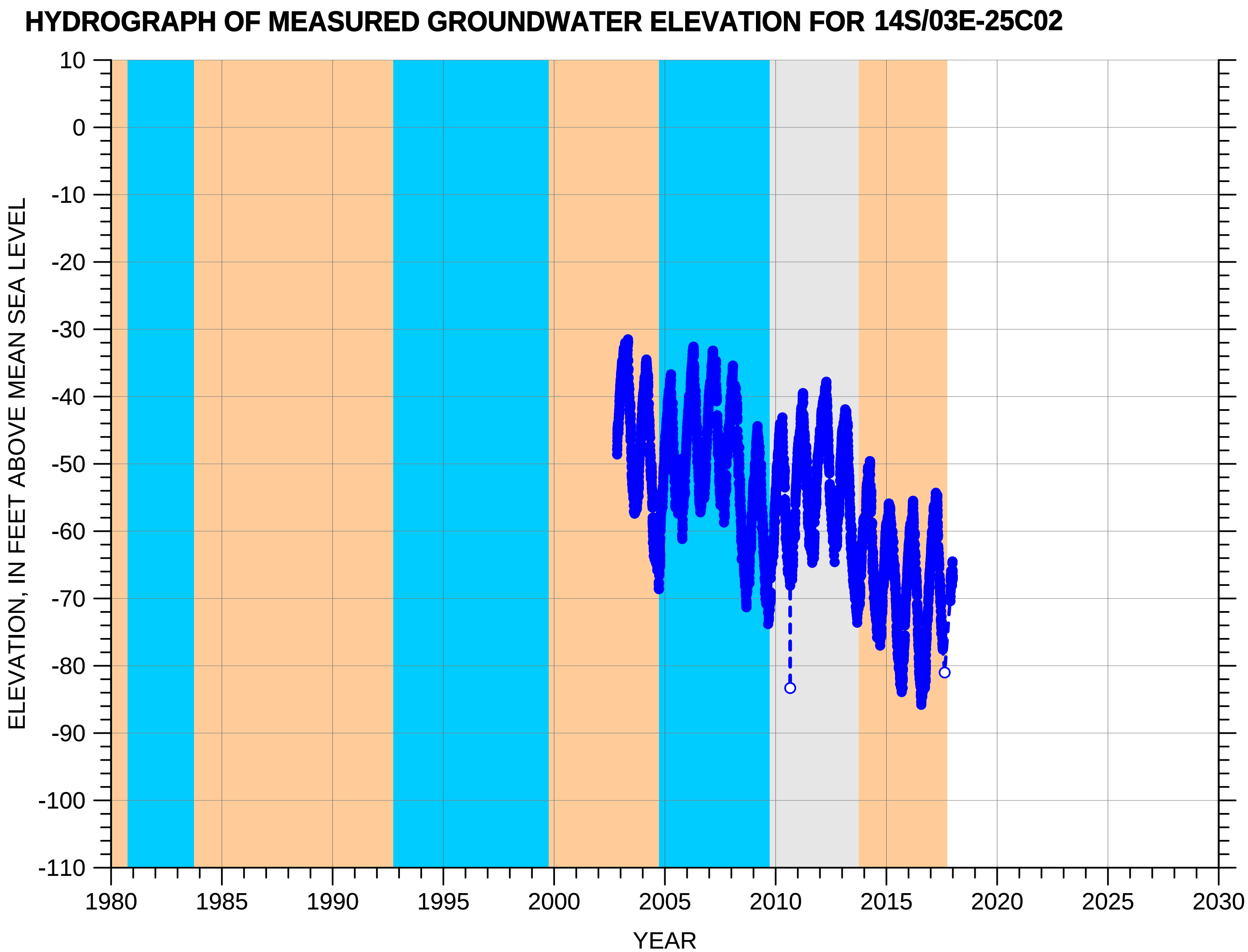

EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: East Side Subbasin
Well Depth: 370 feet
Screened Interval: 175-360 feet below land surface

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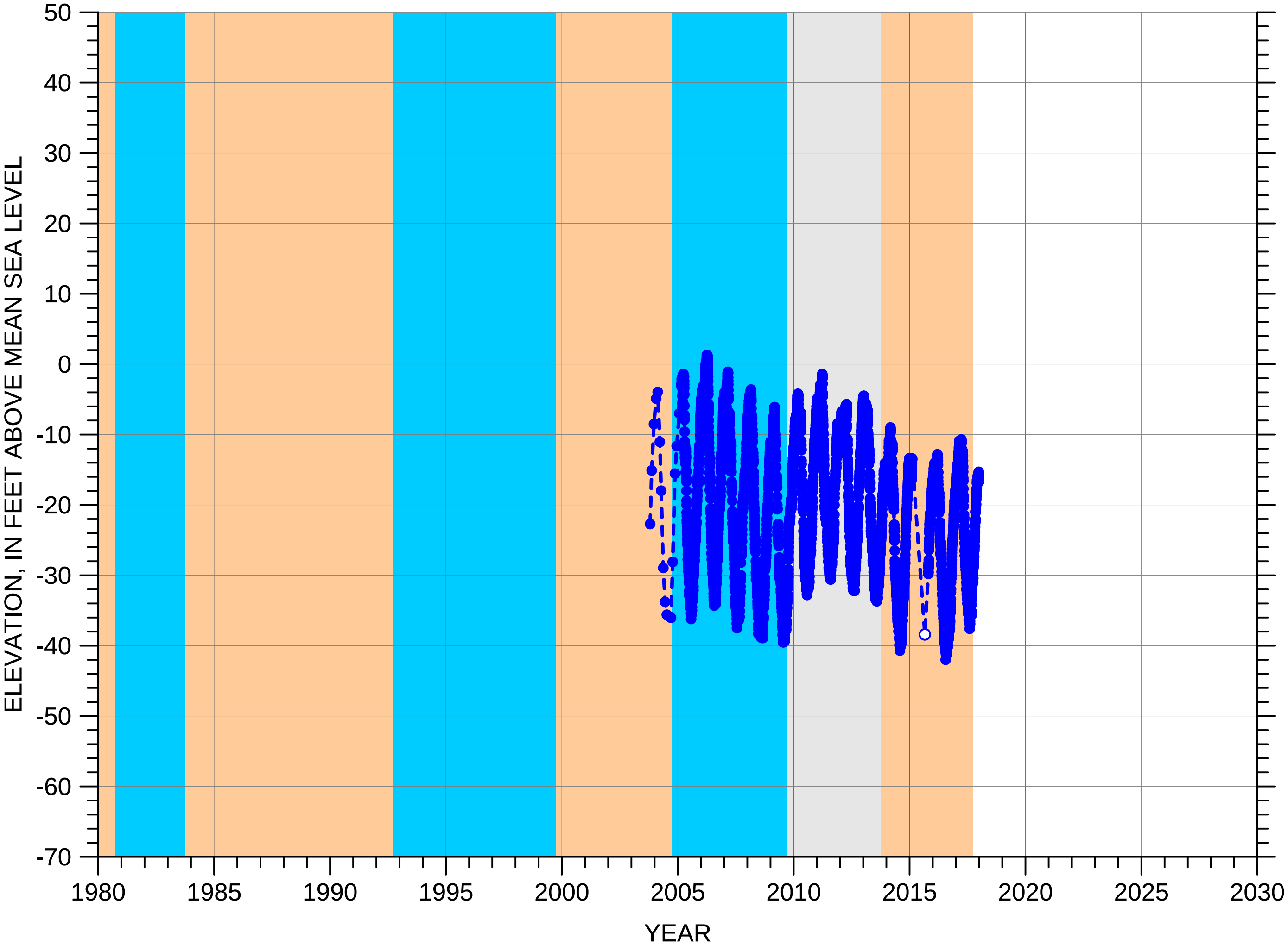
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-30G08



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

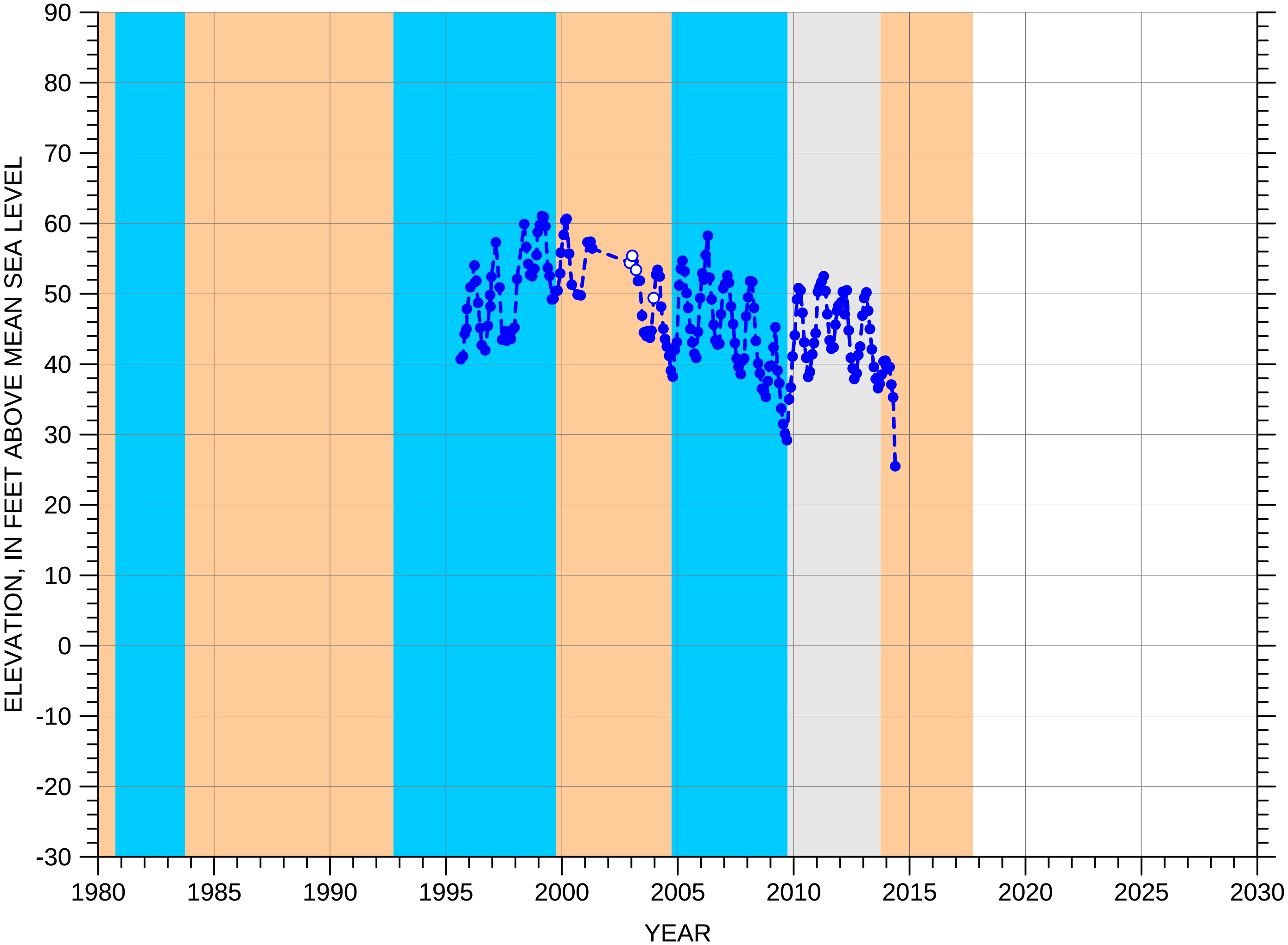
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 293 feet
Screened Interval: 240-290 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\14S_03E-30G08.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-08H01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

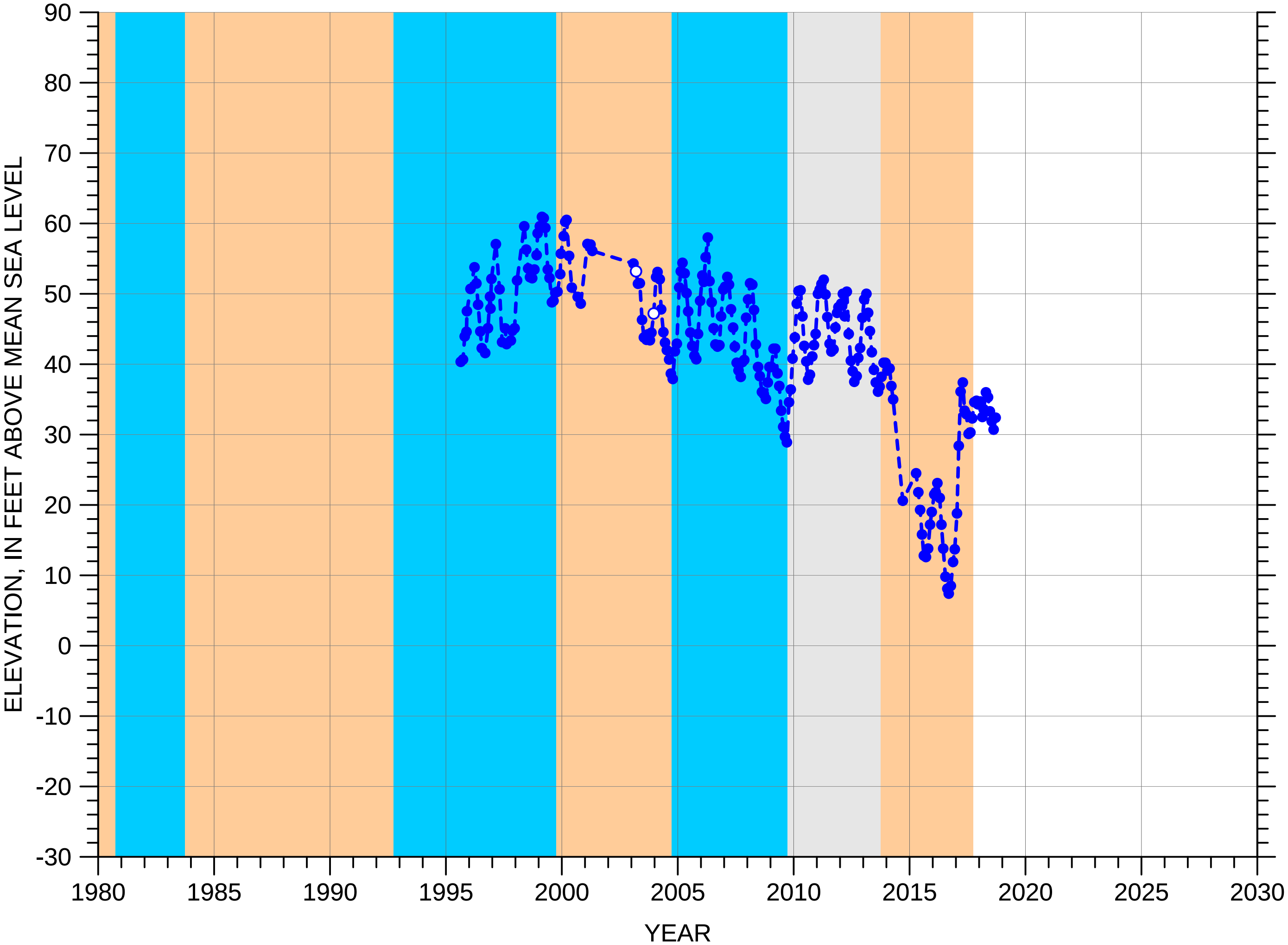
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 130 feet
Screened Interval: 75-125 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\16S_04E-08H01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-08H02



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

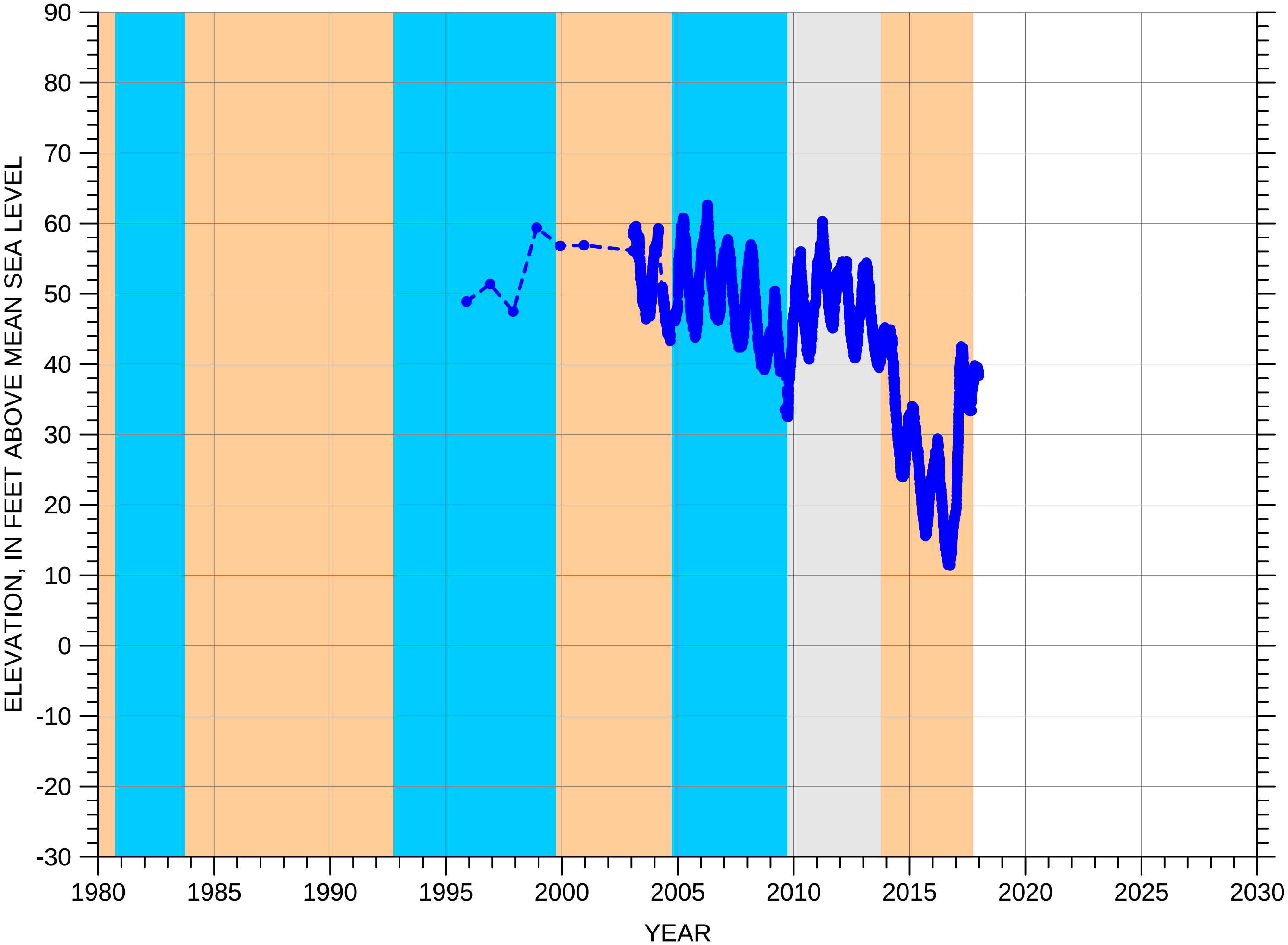
CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 295 feet
Screened Interval: 240-290 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\16S_04E-08H02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-08H03



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

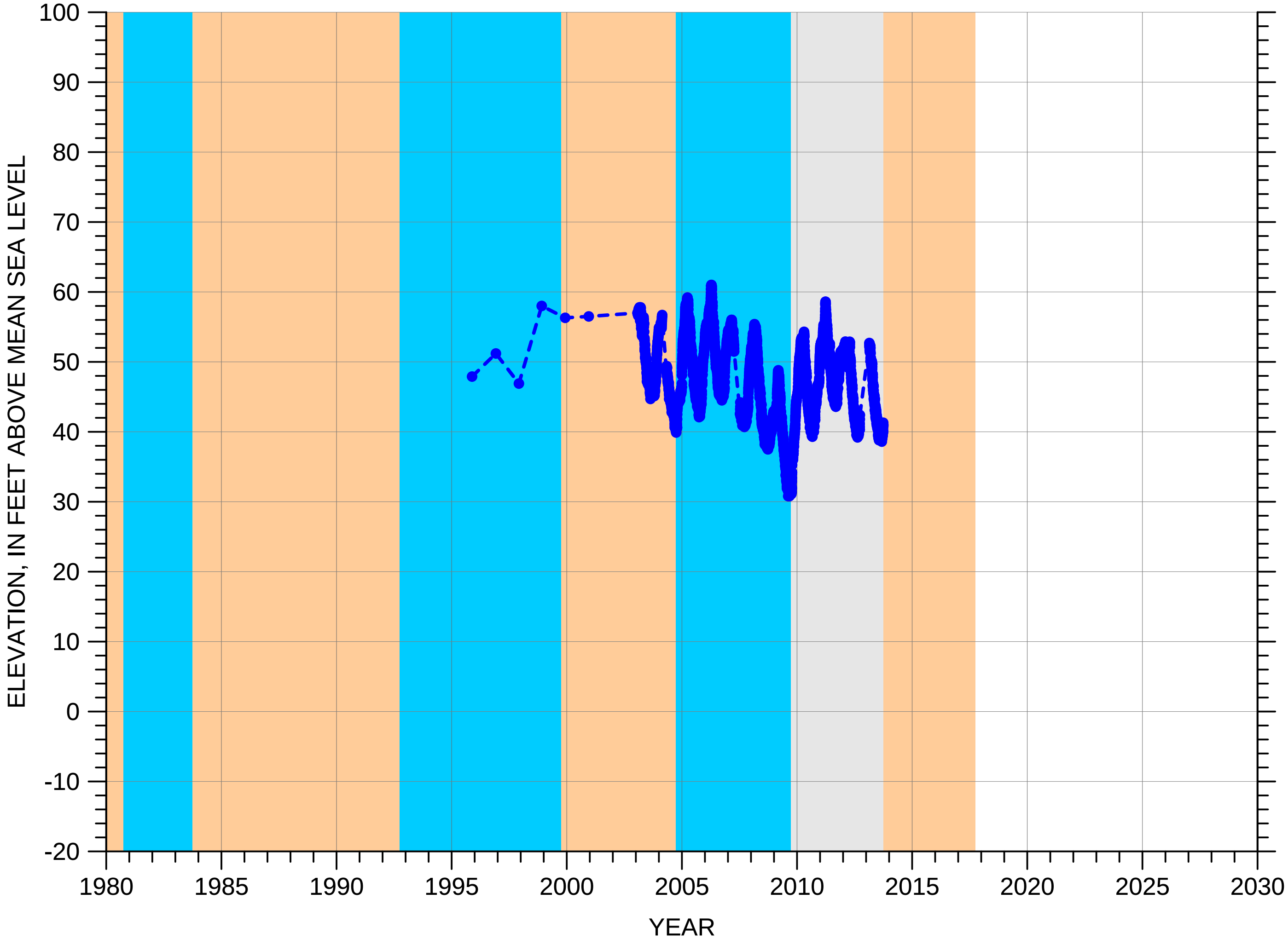
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin (400-Foot Aquifer)
Well Depth: 295 feet
Screened Interval: 240-290 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\16S_04E-08H03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-08H04



EXPLANATION

GROUNDWATER ELEVATION　　ESTIMATED ELEVATION

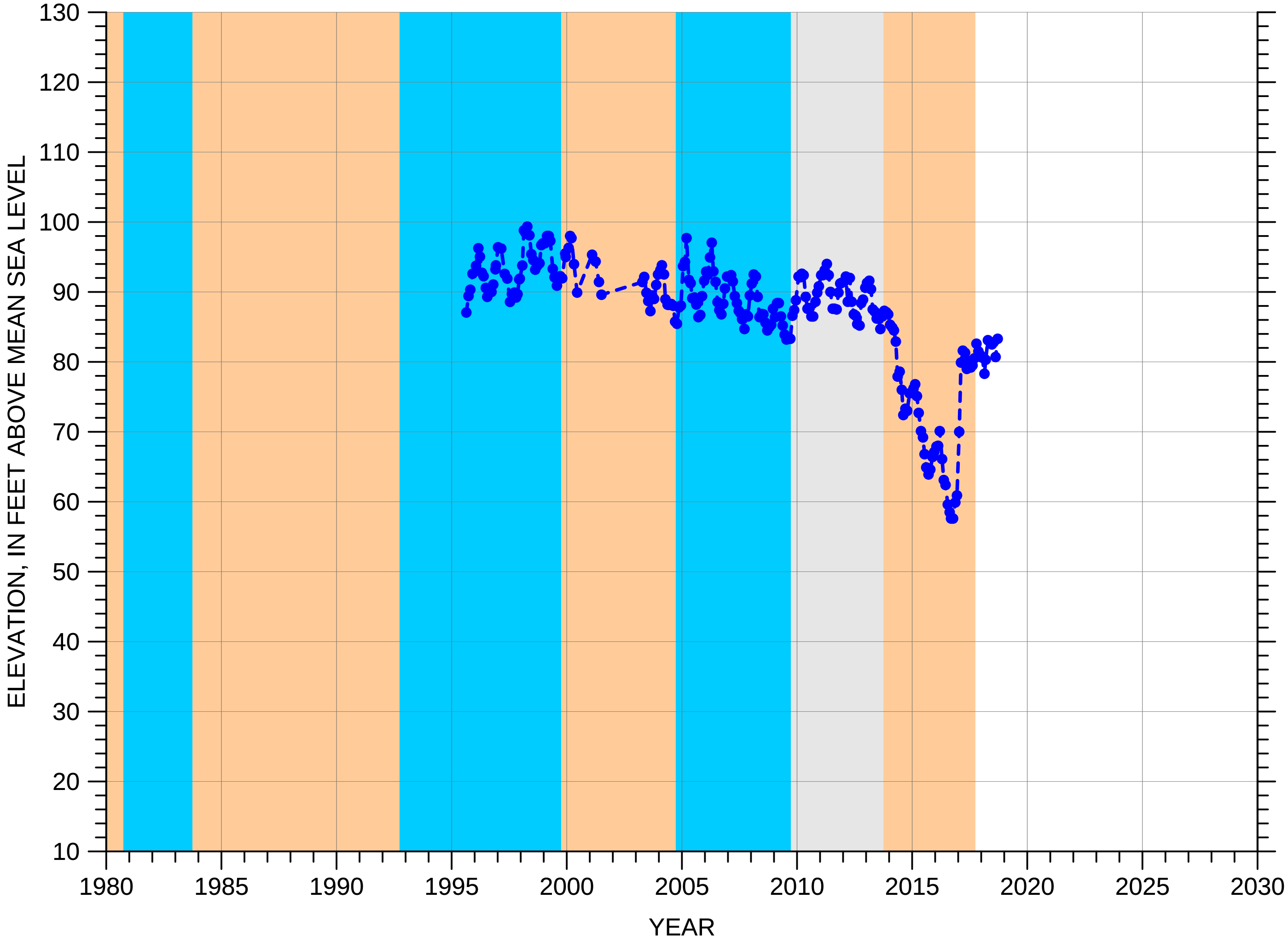
CLIMATE PERIOD CLASSIFICATION

DRY　　AVERAGE/ALTERNATING　　WET

Subbasin: 180/400-Foot Aquifer Subbasin (180-Foot Aquifer)
Well Depth: 140 feet
Screened Interval: 85-135 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\16S_04E-08H04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/05E-31P01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

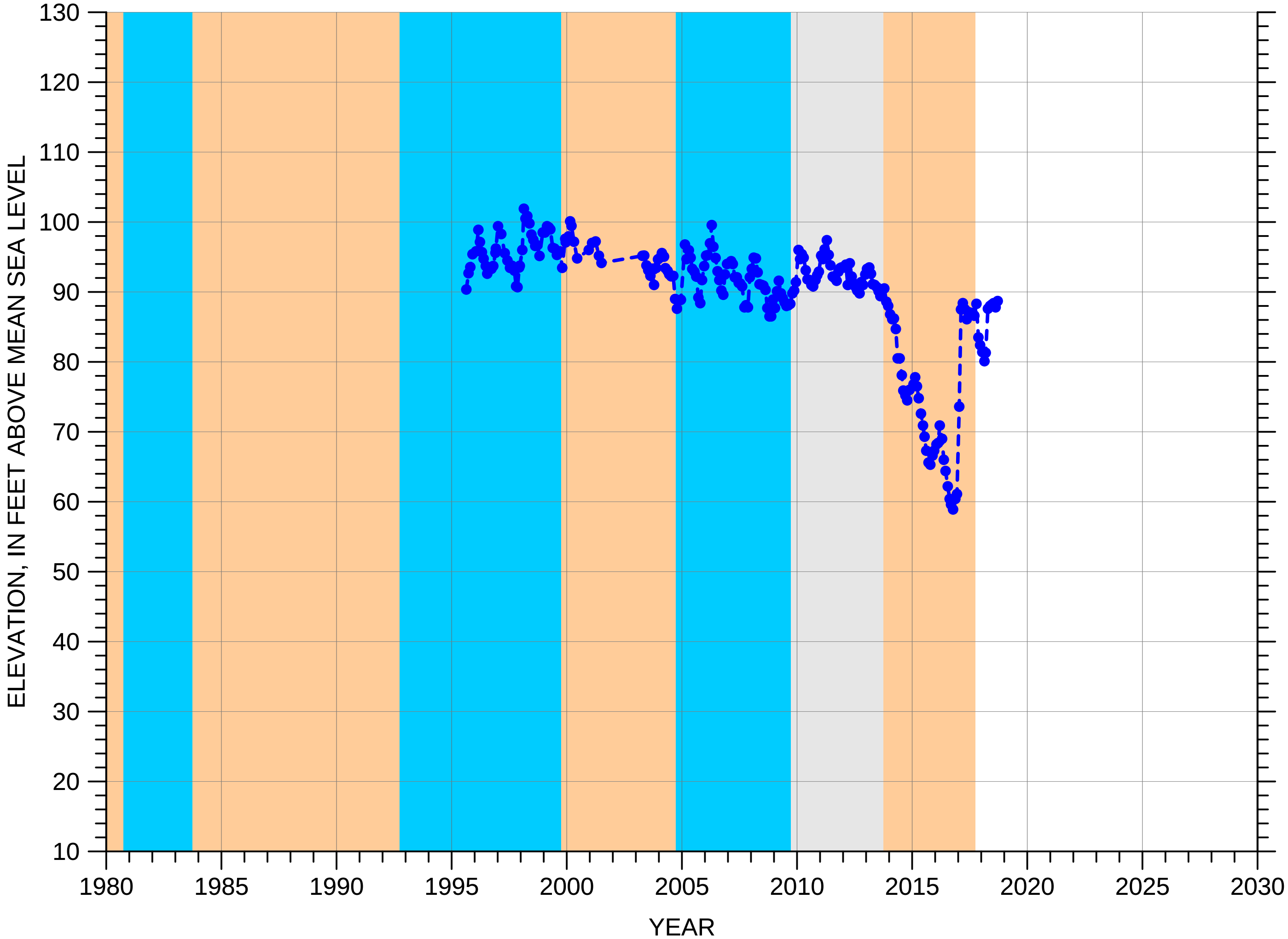
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 300 feet
Screened Interval: 255-295 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\16S_05E-31P01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/05E-31P02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

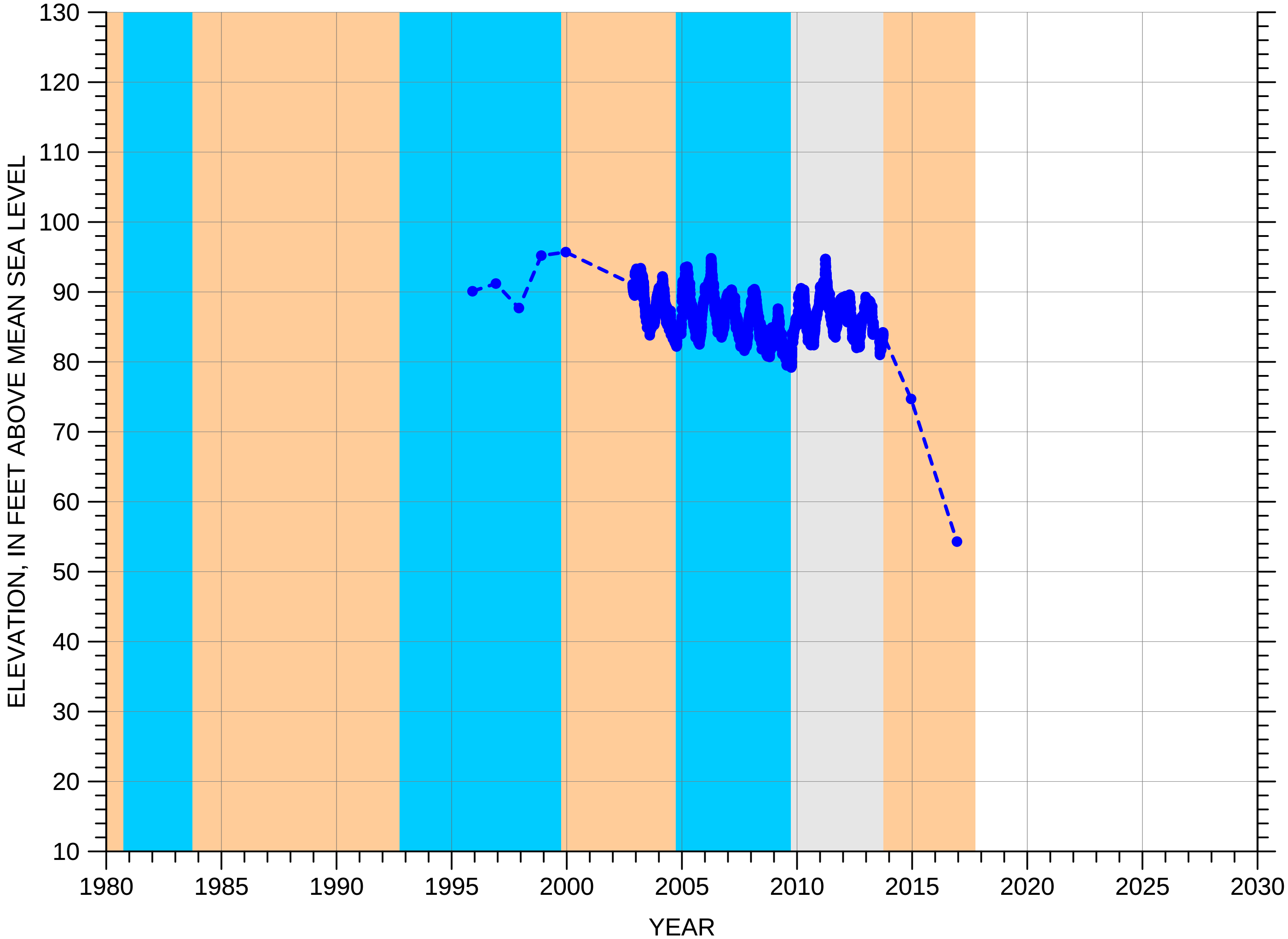
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 115 feet
Screened Interval: 60-110 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\16S_05E-31P02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 17S/05E-06C01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

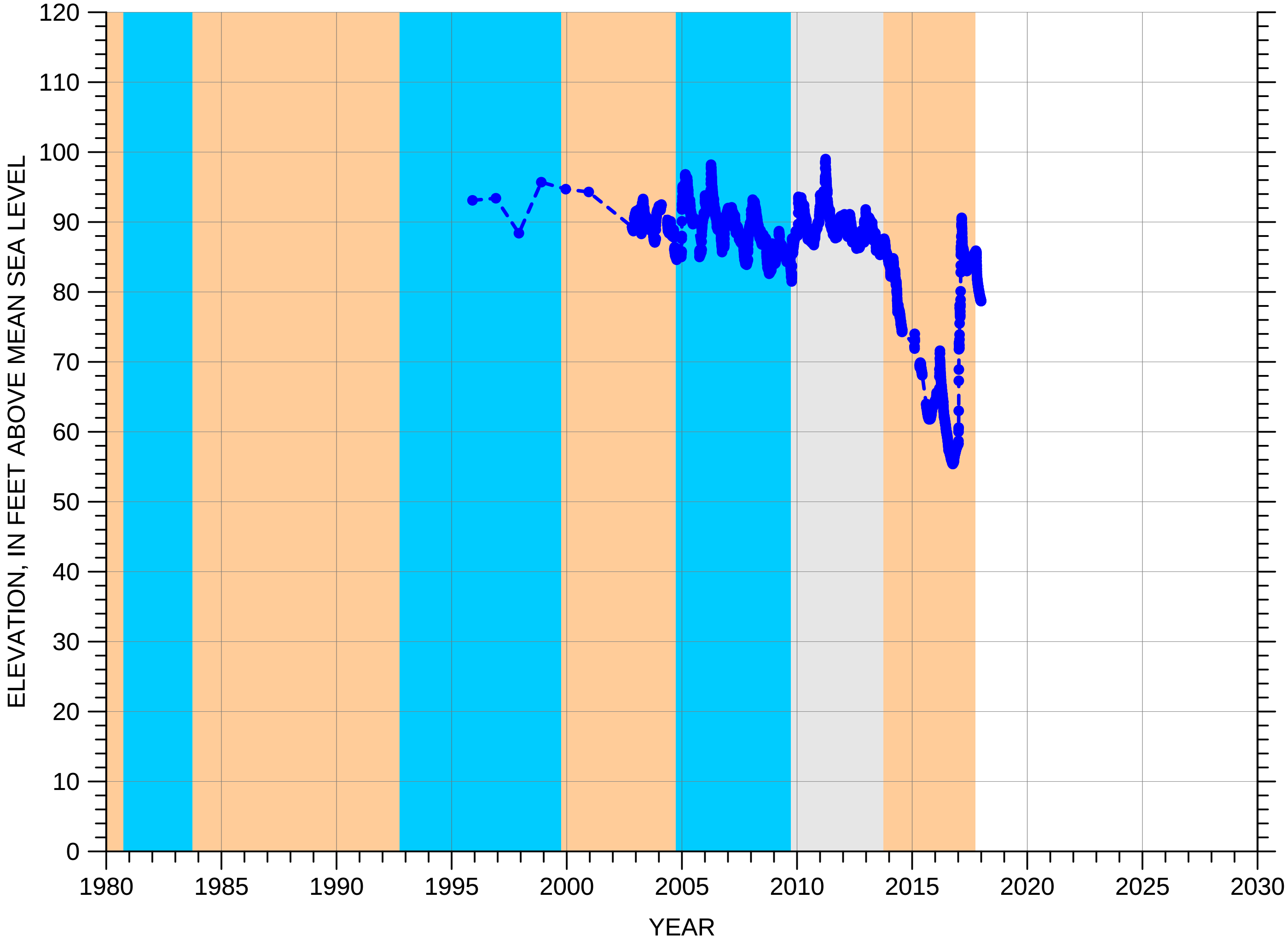
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 290 feet
Screened Interval: 250-290 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\17S_05E-06C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 17S/05E-06C02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

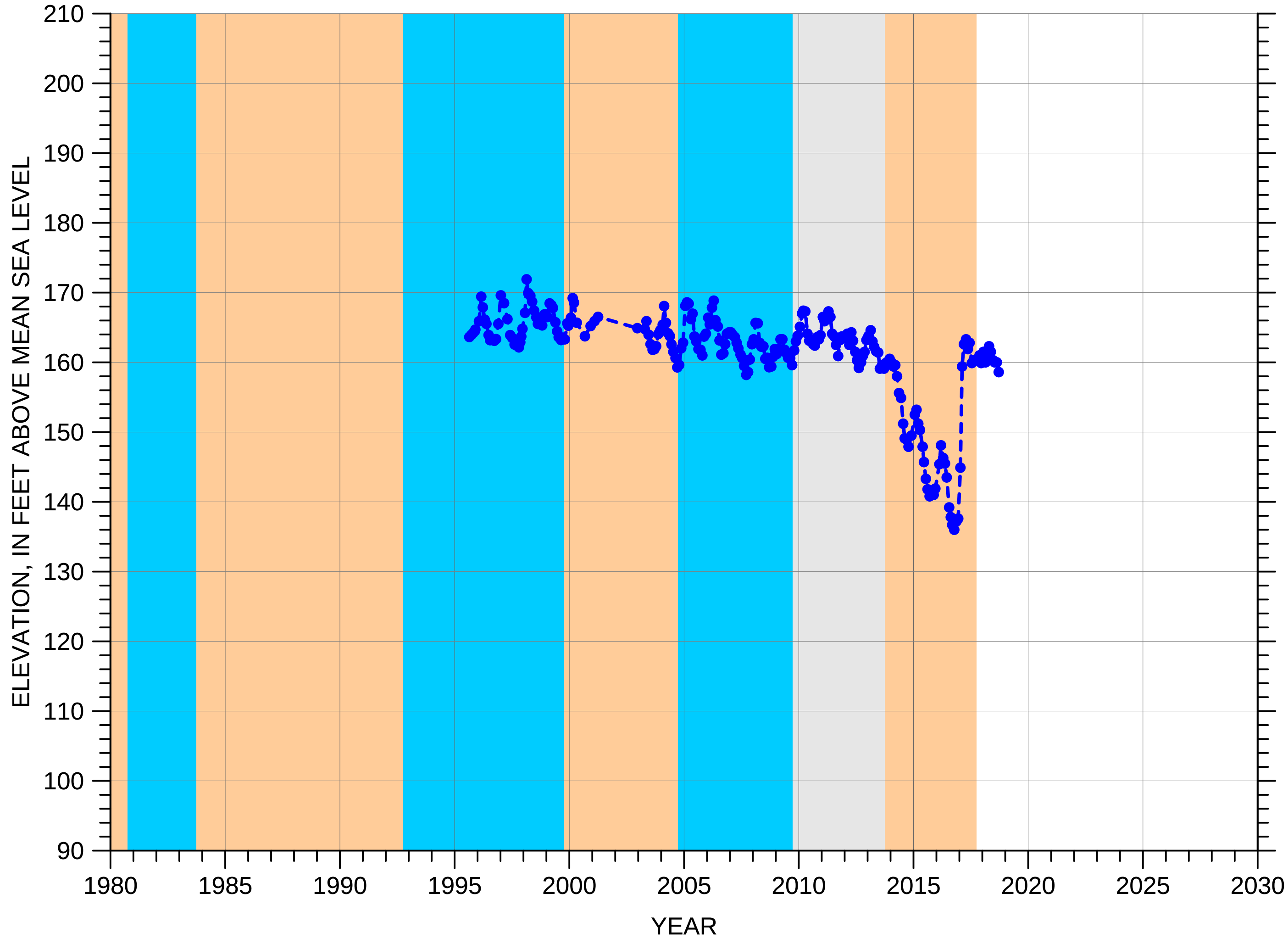
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: 180/400-Foot Aquifer Subbasin
Well Depth: 110 feet
Screened Interval: 60-110 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\17S_05E-06C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 17S/06E-33R01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

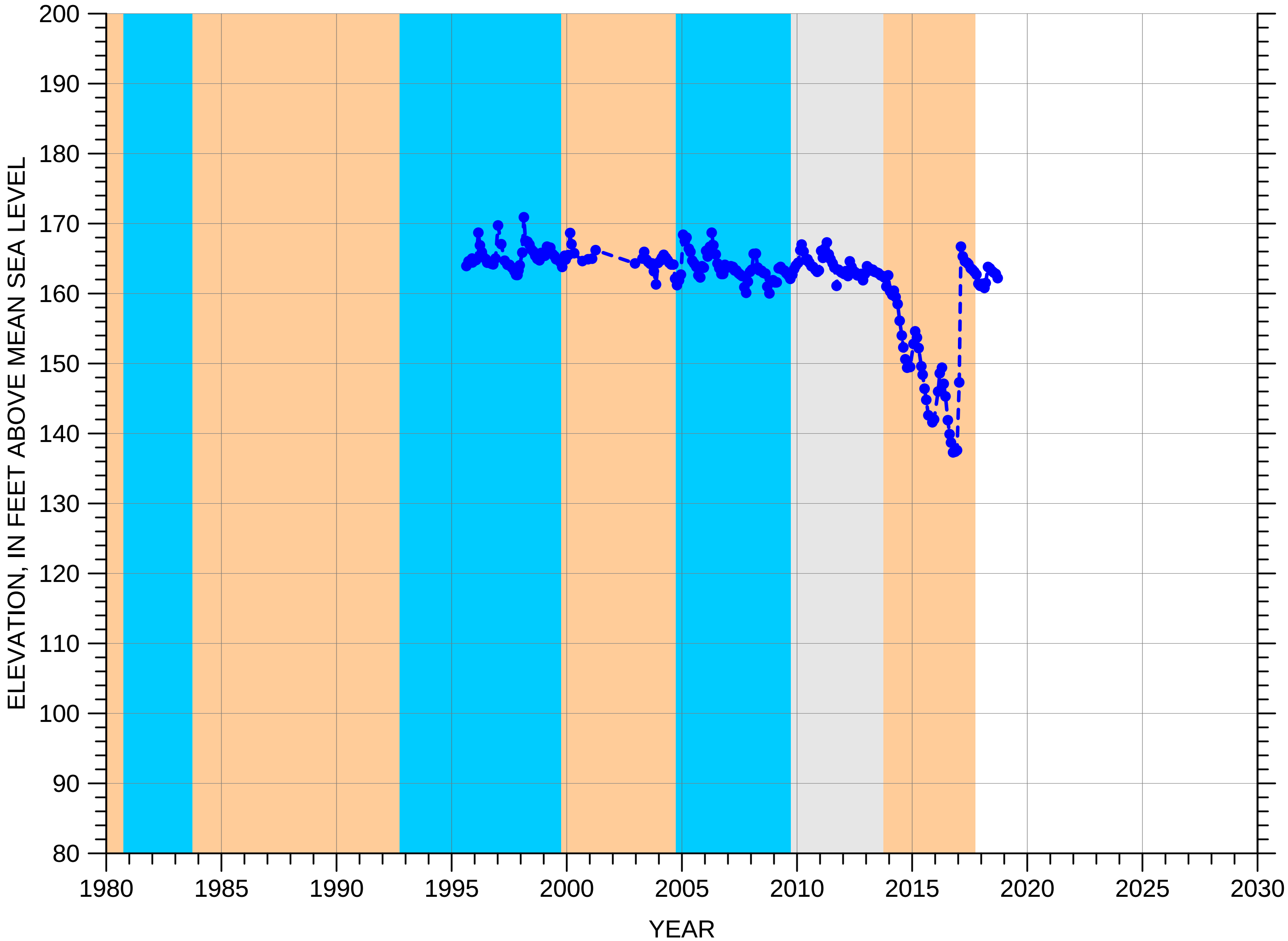
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: Forebay Subbasin
Well Depth: 260 feet
Screened Interval: 200-250 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\17S_06E-33R01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 17S/06E-33R02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

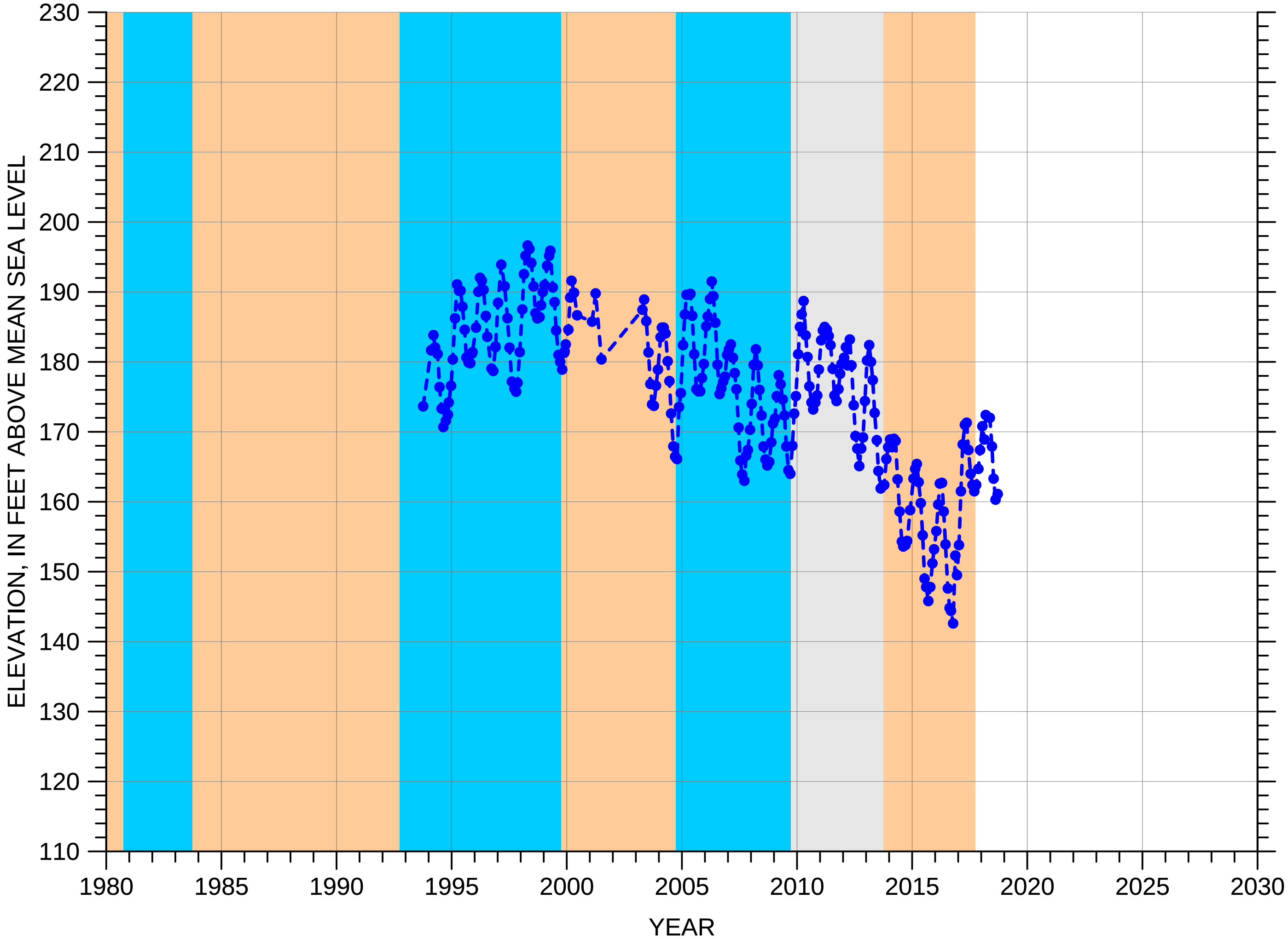
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: Forebay Subbasin
Well Depth: 120 feet
Screened Interval: 50-115 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\17S_06E-33R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 18S/06E-22B02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

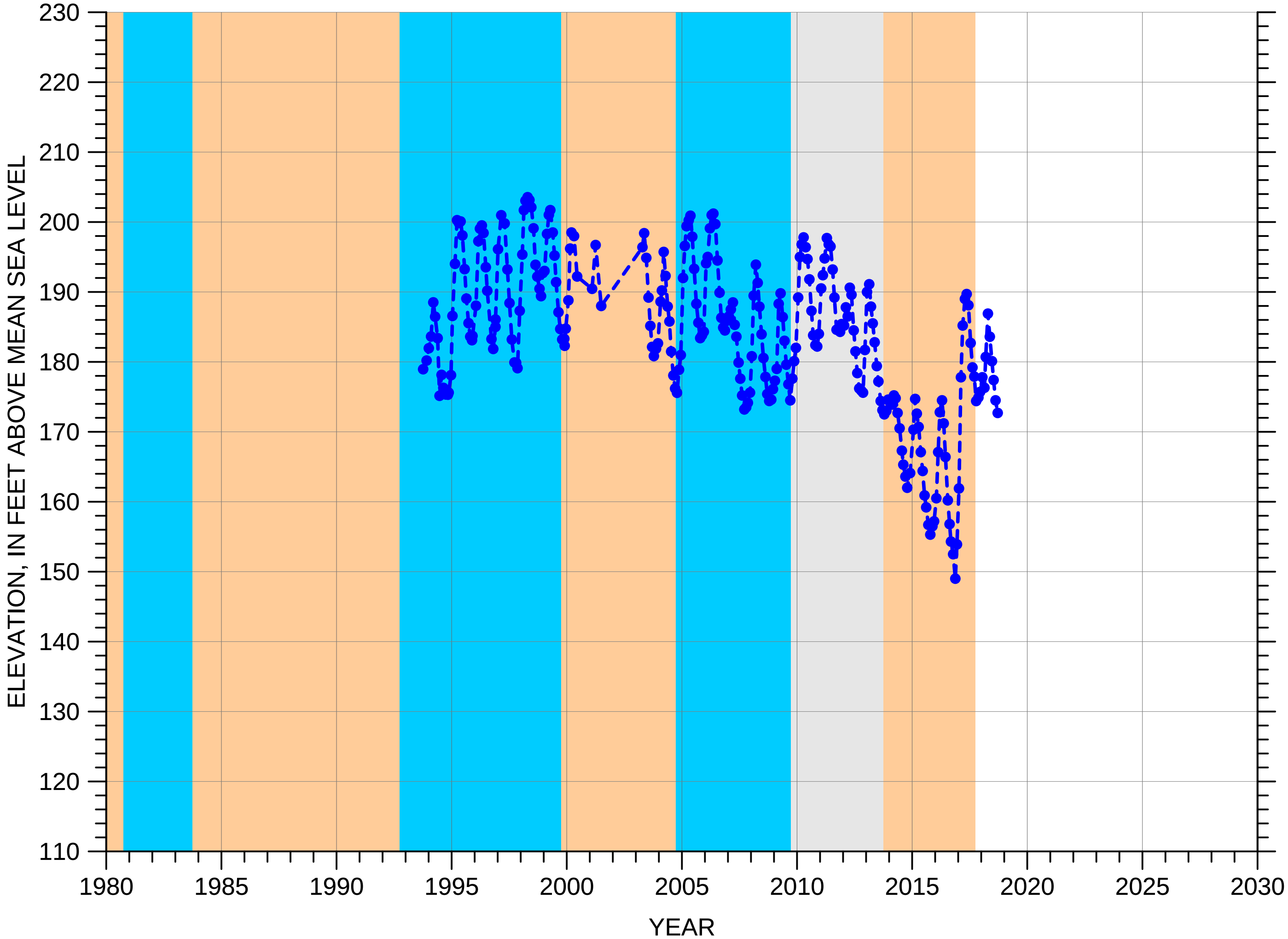
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: Forebay Subbasin
Well Depth: 590 feet
Screened Interval: 510-580 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\18S_06E-22B02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 18S/06E-22B03



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

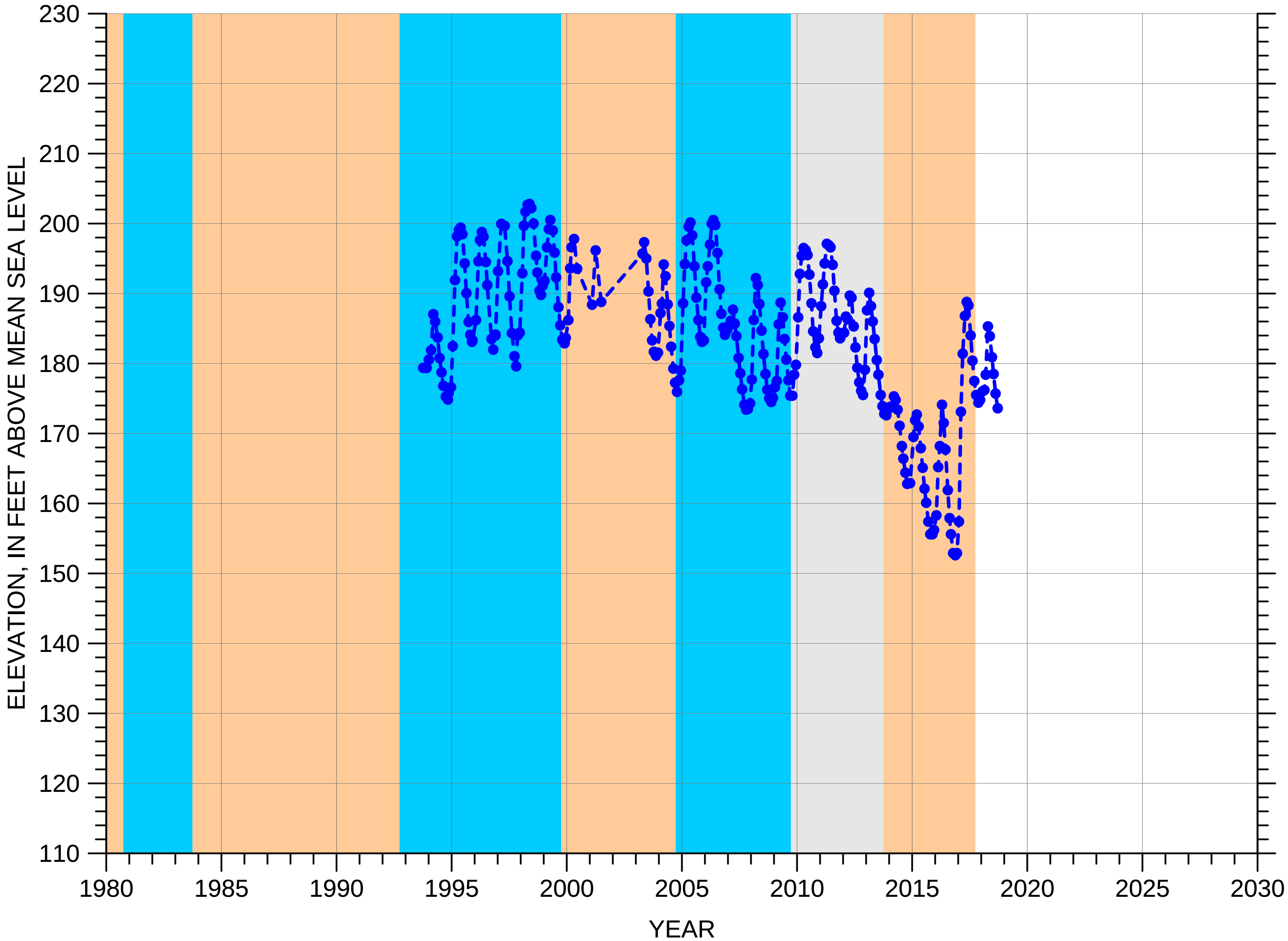
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: Forebay Subbasin
Well Depth: 280 feet
Screened Interval: 220-270 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\18S_06E-22B03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 18S/06E-22B04



EXPLANATION

GROUNDWATER ELEVATION ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY AVERAGE/ALTERNATING WET

Subbasin: Forebay Subbasin
Well Depth: 95 feet
Screened Interval: 40-90 feet below land surface

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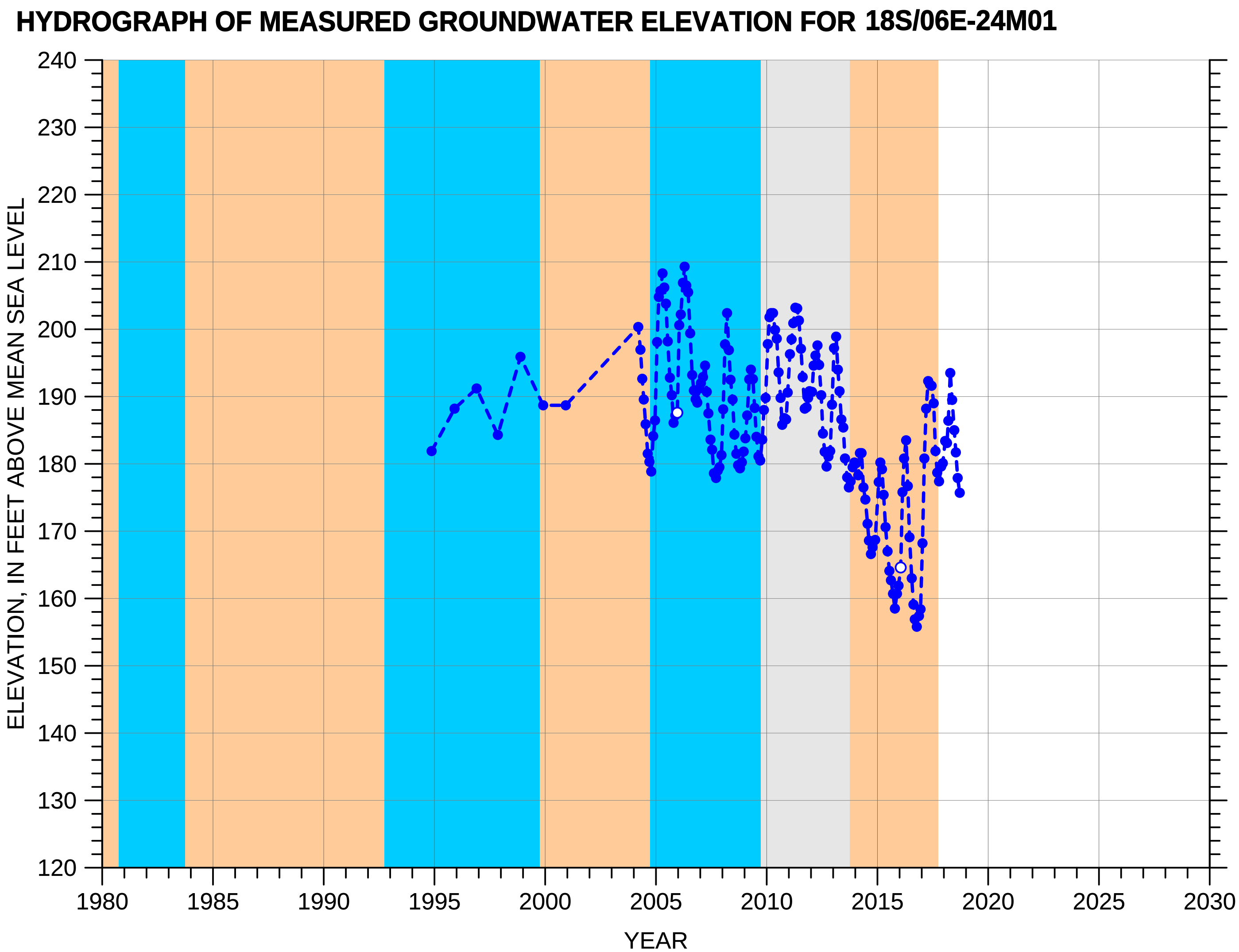


EXPLANATION

GROUNDWATER ELEVATION
ESTIMATED ELEVATION

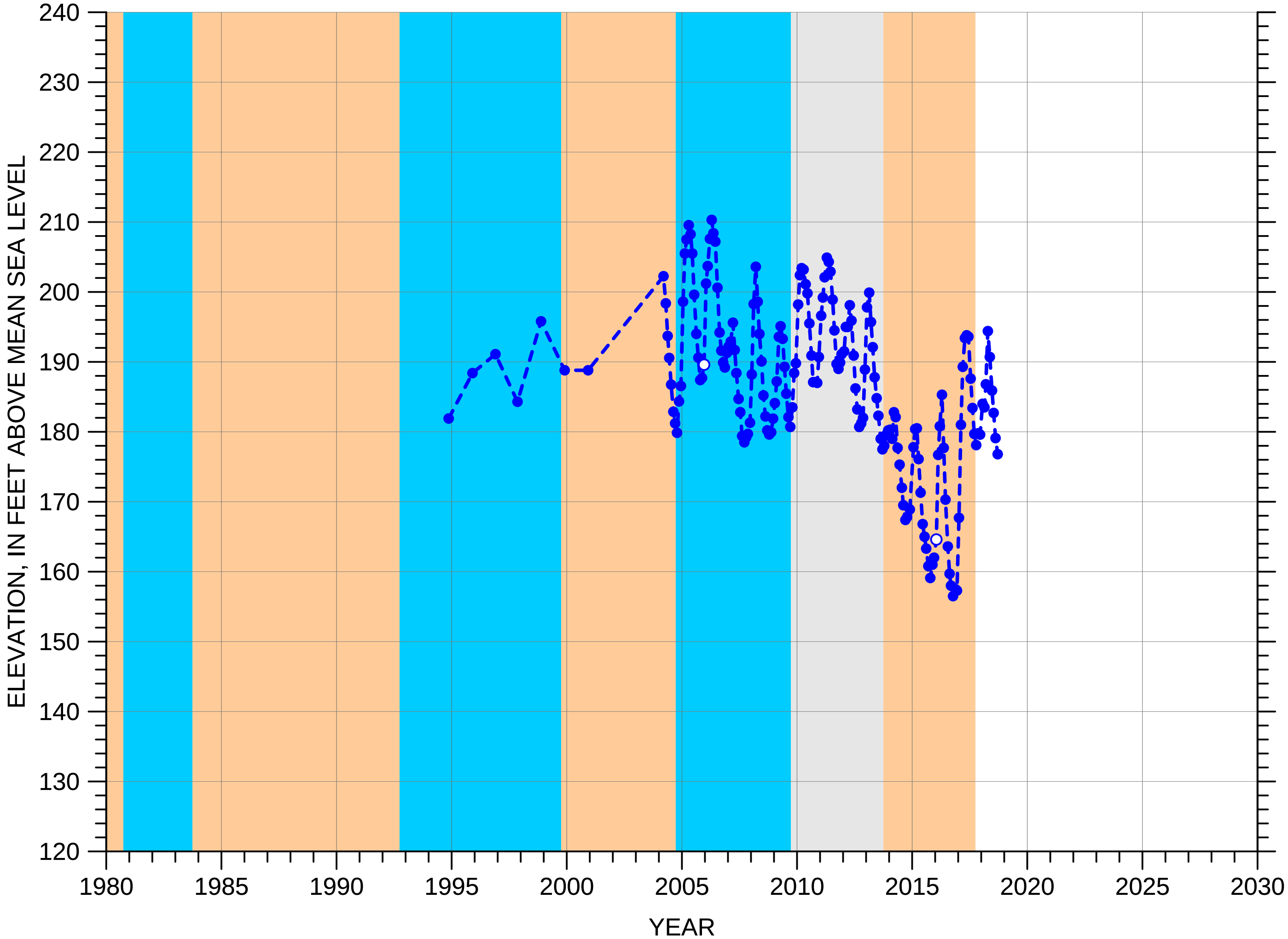
CLIMATE PERIOD CLASSIFICATION

DRY
AVERAGE/ALTERNATING
WET

Subbasin: Forebay Subbasin
Well Depth: 253 feet
Screened Interval: 193-243 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\18S_06E-24M01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 18S/06E-24M02



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

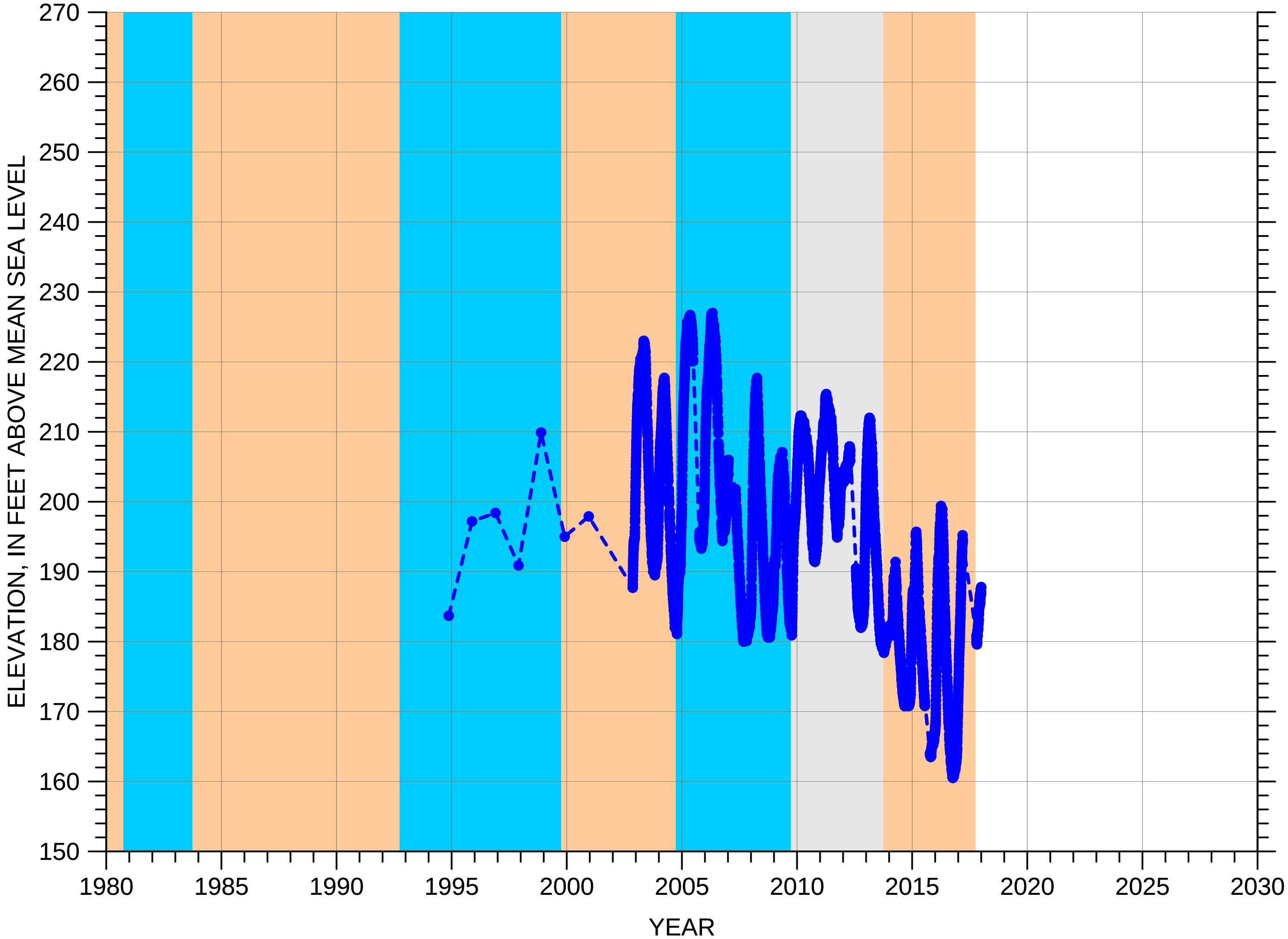
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: Forebay Subbasin
Well Depth: 130 feet
Screened Interval: 70-120 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\18S_06E-24M02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 18S/06E-35F01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

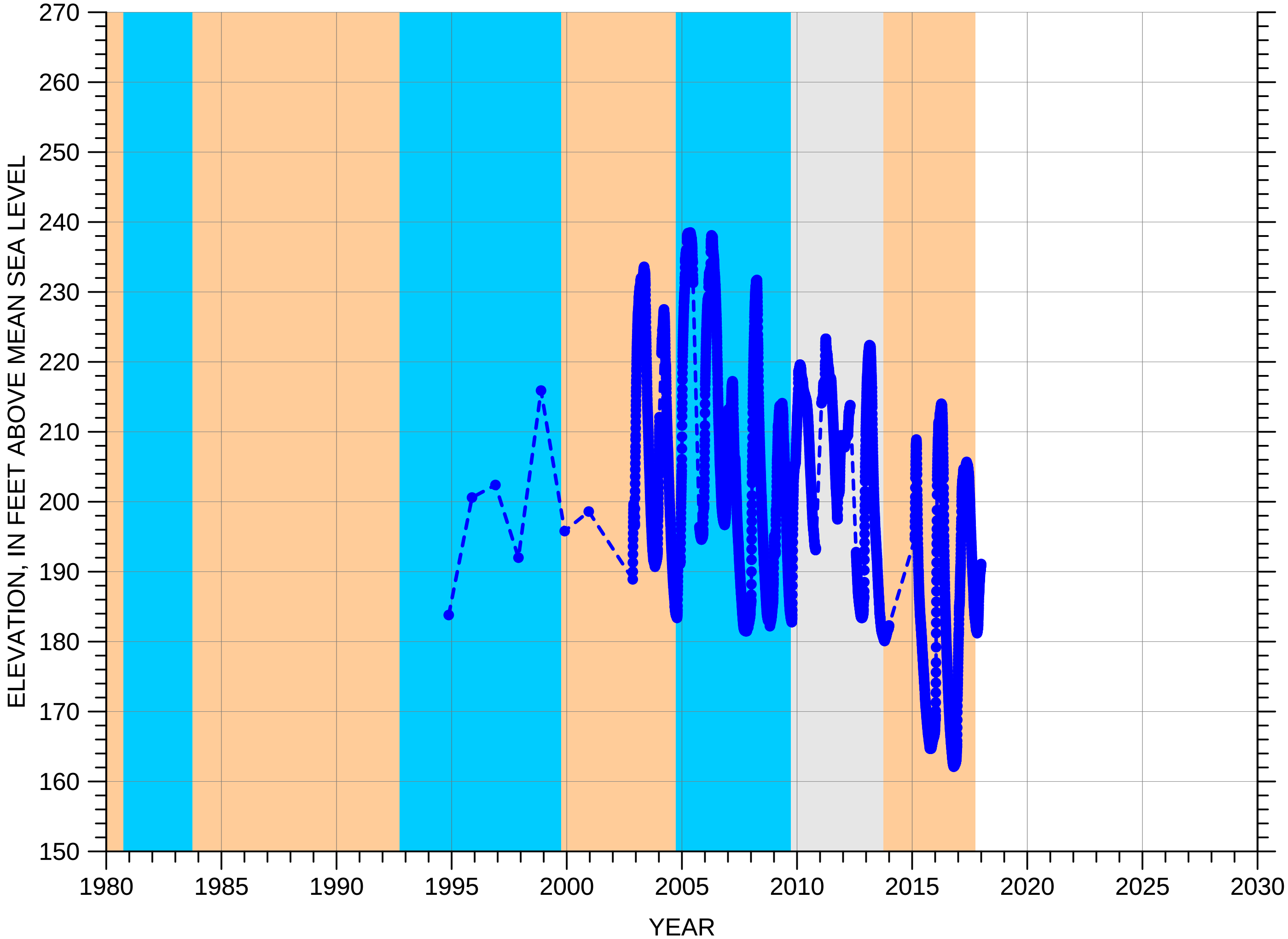
CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: Forebay Subbasin
Well Depth: 258 feet
Screened Interval: 198-248 feet below land surface

S:\projects\9100_Salinas_GSP\analysis\water_levels\Hydrographs_MCWRA\SalinasDroughtIndex\grf_noConstruction\18S_06E-35F01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 18S/06E-35F02



EXPLANATION

GROUNDWATER ELEVATION

ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY

AVERAGE/ALTERNATING

WET

Subbasin: Forebay Subbasin
Well Depth: 110 feet
Screened Interval: 60-110 feet below land surface

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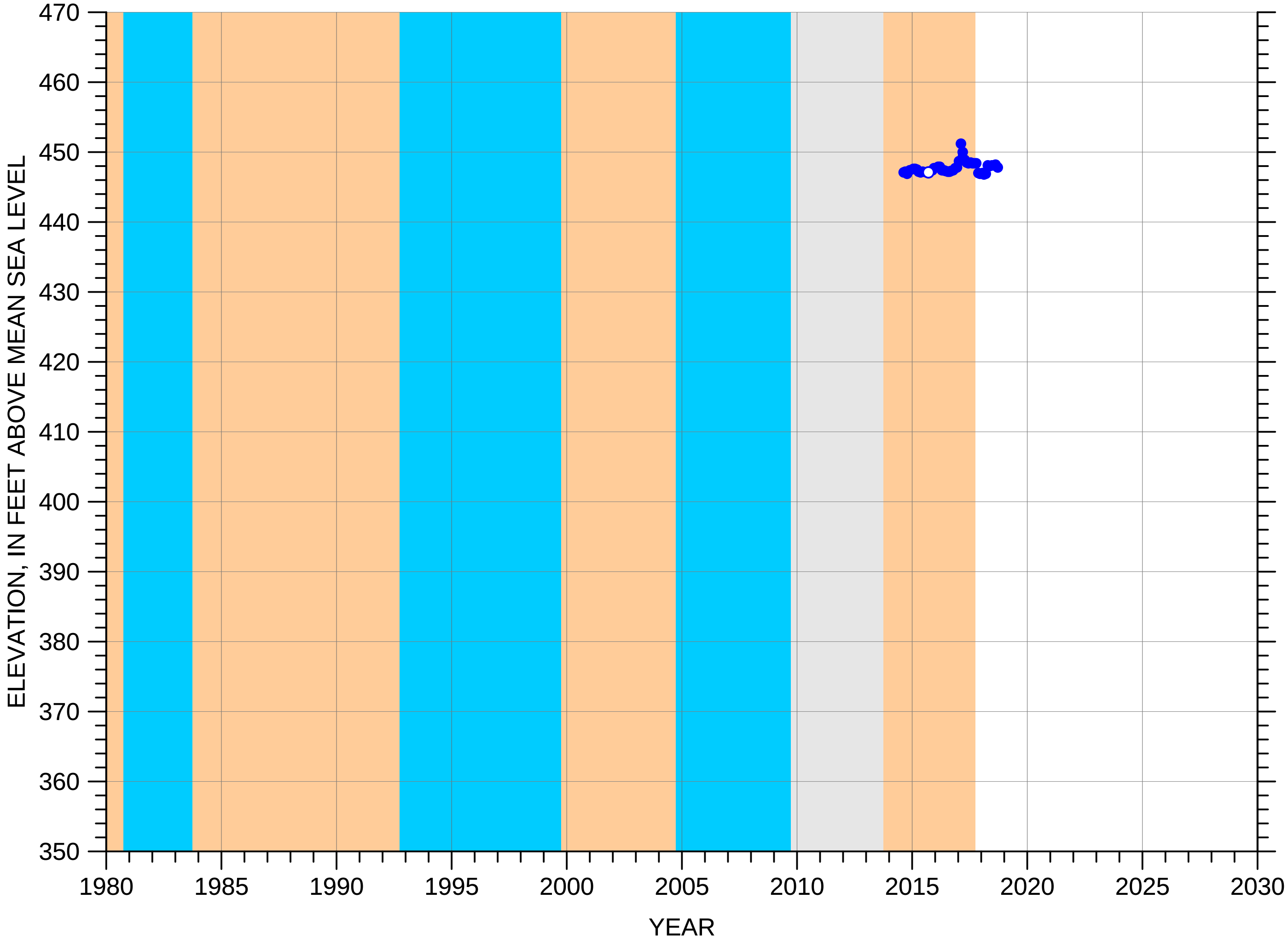
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 23S/10E-03H01



EXPLANATION

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

CLIMATE PERIOD CLASSIFICATION

DRY   AVERAGE/ALTERNATING   WET

Subbasin: Upper Valley Subbasin
Well Depth: 132 feet
Screened Interval: 72-132 feet below land surface

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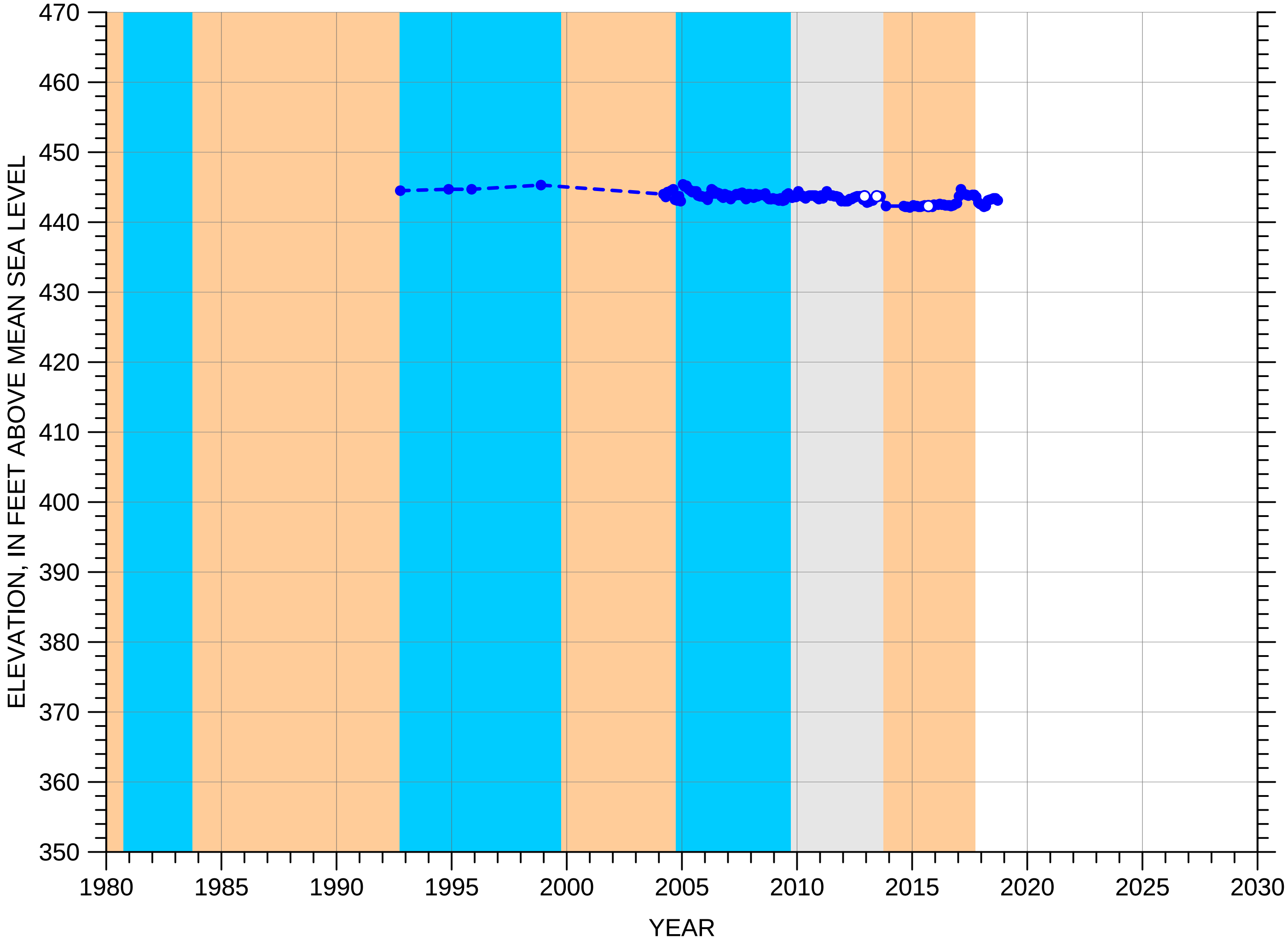
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 23S/10E-14D01



<u>EXPLANATION</u>

GROUNDWATER ELEVATION   ESTIMATED ELEVATION

<u>CLIMATE PERIOD CLASSIFICATION</u>

DRY   AVERAGE/ALTERNATING   WET

Subbasin: Upper Valley Subbasin
Well Depth: 142 feet
Screened Interval: 72-132 feet below land surface

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