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EAST BAY PLAIN SUBBASIN GROUNDWATER SUSTAINABILITY PLAN WATER YEAR 2022 ANNUAL REPORT

EAST BAY MUNICIPAL UTILITY DISTRICT GSA AND

CITY OF HAYWARD GSA

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
ACWD	Alameda County Water District
AF	acre-feet
AFY	acre-feet per year
AMSL	above mean sea level
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CWC	California Water Code
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EBP	East Bay Plain
EBPGWM	East Bay Plain Groundwater Model
ft	foot, feet
GAMA	Groundwater Ambient Monitoring and Assessment
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
Hayward	City of Hayward
HCM	Hydrogeologic Conceptual Model
IM	Interim Milestone
LSCE	Luhdorff & Scalmanini Consulting Engineers
MO	Measurable Objective
MT	Minimum Threshold
RMS	Representative Monitoring Site
SFPUC	San Francisco Public Utility Commission
SGMA	Sustainable Groundwater Management Act of 2014
SMC	Sustainable Management Criteria
USGS	United States Geological Survey
WY	Water Year

EXECUTIVE SUMMARY §356.2(A)

In January 2022, the two groundwater sustainability agencies (GSAs) in the East Bay Plain Subbasin, East Bay Municipal Utility District (EBMUD) and City of Hayward (Hayward), collectively adopted and submitted the East Bay Plain Subbasin Groundwater Sustainability Plan (GSP), fulfilling the requirements established under Sustainable Groundwater Management Act (SGMA). Coordinated implementation of the GSP is now underway. The full extent of the East Bay Plain (EBP) Subbasin is covered by the GSP (**Figure ES-1**).

Following adoption of the GSP, the California Code of Regulations Title 23 (23 CCR) §356.2 requires that GSAs submit Annual Reports to California Department of Water Resources (DWR) by April 1 of each year to document the progress made in GSP implementation over the previous water year (October through September). This document is the second Annual Report for the EBP Subbasin GSP. In accordance with GSP Regulations, this report summarizes groundwater conditions and water use in the GSP area, as well as the progress that has been made to implement projects and management actions, and achieve interim milestones established in the GSP. Key data sources and findings of each section are summarized below for water year (WY) 2022 and are described in the associated Annual Report section.

Groundwater Elevations – §356.2(b)(1)

Groundwater level monitoring data were assembled for January 1, 2015 through the end of 2022. Data were collected from various entities, including: EBMUD, Hayward, Alameda County Water District (ACWD), DWR, United States Geological Survey (USGS), and GeoTracker Groundwater Ambient Monitoring and Assessment (GAMA) program.

In Spring 2022, groundwater elevations at available representative monitoring site (RMS) wells in the EBP Subbasin ranged from -10.24 feet (ft) above mean sea level (AMSL) to 30.59 ft AMSL. In Fall 2022, groundwater elevations at available RMS wells ranged from -21.34 ft AMSL to 28.89 ft AMSL. RMS well groundwater elevations were generally higher in the shallower aquifers and lower in the deeper aquifers.

Groundwater Elevation Contour Maps – §356.2(b)(1)(A)

Spring and fall groundwater elevation contour maps were prepared for 2022 and shown in this Annual Report. Spring contours generally represent seasonal high groundwater levels, while fall contours generally represent seasonal low groundwater levels. Data were assembled from all known and available groundwater level information sources in the GSP area, including from public sources, local GSAs, and other local entities.

In summary, the general patterns seen in the Spring 2022 and Fall 2022 groundwater elevation contour maps are, in most cases, similar to the patterns observed in earlier spring and fall contour maps provided in the GSP and previous annual report. However, differences in availability of groundwater level data for each year can influence the contour patterns exhibited in different years. The Shallow Aquifer generally has higher groundwater elevations near the East Bay Hills and lower groundwater elevations near San Francisco Bay, which indicates an overall pattern of groundwater flow towards the Bay. The Intermediate and Deep Aquifers also tend to have higher groundwater elevations towards the East Bay Hills and lower elevations near San Francisco Bay; however, the overall hydraulic gradient towards the Bay is steeper within the Shallow Aquifer compared to the Intermediate and Deep Aquifers. As would be expected, fall groundwater elevations in all aquifers are generally lower than those observed for spring.

Groundwater Hydrographs – §356.2(b)(1)(B)

All available groundwater level monitoring data were used to prepare groundwater hydrographs for the period from January 1, 2015 through the end of 2022. Additional data were included prior to 2015 when available. The hydrographs generally reflect year to year variability in climatic conditions, with lower groundwater elevations at the end of the 2012 to 2015 drought followed by rising elevations during wet years (e.g., 2017) and declining elevations during dry years (e.g., 2021).

Groundwater Extractions – §356.2(b)(2)

Groundwater extraction in the EBP Subbasin is the same amount that has been estimated for the past several years and is based on estimates from references cited in the GSP. The GSAs are currently working on updating the groundwater extraction estimates. In total, groundwater pumping was estimated to be 3,600 acre-feet per year (AFY) during water year 2022. All of this groundwater is used to meet urban water demands for irrigation and industrial uses and is not being used as a source of drinking water. Groundwater used for irrigation ranges from large parcels such as parks, golf courses, and cemeteries to small residential parcels.

Surface Water Supplies – §356.2(b)(3)

Surface water supplies in the EBP Subbasin include local and imported surface water from the EBMUD water system and imported water from San Francisco Public Utilities Commission (SFPUC) Regional Water System for the Hayward water system. No surface water was used to recharge groundwater or for in-lieu use in the EBP Subbasin during water year 2022.

Total Water Use – §356.2(b)(4)

In this Annual Report, total water use is assumed to equal the total combined use of groundwater, surface water, and recycled water to meet the demands of the overlying population, as well as native vegetation. During water year 2022, total water use was estimated to be approximately 96,000 acre-feet (AF). Of this total, approximately 94 percent was surface water, 4 percent was groundwater (3.7 percent from pumping and 0.3 percent for native vegetation), and 2 percent was recycled water.

Change in Groundwater Storage – §356.2(b)(5)

Annual changes in groundwater storage were calculated for each aquifer between Spring 2021 and Spring 2022 based on East Bay Plain Groundwater Model (EBPGWM) results. Based on the current hydrogeologic conceptual model (HCM) in the EBP Subbasin, the Shallow Aquifer is divided into the Water Table Aquifer (or Upper Shallow Aquifer) for sediments within the upper 50 feet and the Lower Shallow Aquifer from depths of 50 to 200 feet below ground surface. The change in groundwater storage in the Upper Shallow Aquifer is based on an unconfined specific yield value of 0.06, while the underlying Lower Shallow, Intermediate, and Deep Aquifers have various specific storage values assigned that are representative of semi-confined to confined conditions in these aquifers. The specific yield and storage coefficient values used in the analysis are based on values in the EBPGWM developed and applied during preparation of the GSP.

In summary, the combined change in groundwater storage for the entire Subbasin was about -1,100 AF from Spring 2019 to Spring 2020 (dry year), -1,500 AF for Spring 2020 to Spring 2021 (dry year), +40 AF for Spring 2021 to Spring 2022 (dry year). Negative change in storage values indicate reduction of groundwater storage, whereas positive change in storage values represent accretion of groundwater in storage. Review of changes in groundwater storage in the EBP Subbasin going back to 1991 indicate a long-term recovery in groundwater levels and storage between 1991 and 2006 due to decreases in total groundwater pumping, followed by annual fluctuations in groundwater storage that correlate closely to annual climatic/hydrologic conditions during a time of steady groundwater pumping between 2006 and 2022.

Implementation of Projects or Management Actions – §356.2(c)

Appreciable progress has not been made on projects and management actions beyond that described in the GSP. The primary initial GSA projects have already been built and are ready for operation under the conditions described in the GSP. These conditions did not occur in water year 2022 and the GSA projects were not operated in that time frame. Management actions were implemented beginning in Spring 2022.

Interim Milestone Status – §356.2(c)

In the GSP, interim milestones (IMs) for the six sustainability indicators were established at five-year intervals over the implementation period from 2022 to 2042 at years 2027, 2032, 2037, and 2042, based on the observed and/or modeled data and other analyses described in the GSP.

The status of groundwater level RMS wells is presented in relation to the sustainable management criteria (SMC), including 2027 IMs, measurable objectives (MOs), and minimum thresholds (MTs) defined in the GSP. For chronic lowering of groundwater levels, review of the Spring 2022 groundwater level measurements that are available for 15 RMS wells indicate that groundwater levels remain well above MTs, and the majority of groundwater levels are above their 2027 IMs and MOs (which are equivalent to IMs). For reduction in groundwater storage, groundwater pumping in WY 2022 did not exceed the MT, IM, and MO. While available data for

Spring 2022 were limited relative to evaluation of the seawater intrusion SMC, the shallow groundwater levels indicate water levels have continued to remain nearly constant. Baseline groundwater quality sampling was initiated in 2022, but additional data is still needed to conduct an evaluation of water quality degradation. Based on stakeholder feedback, the GSAs have included consideration of sea level rise in this annual report when evaluating seawater intrusion and degradation of water quality. For subsidence, review of the Spring 2022 groundwater level measurements that are available for six subsidence RMS wells indicate that groundwater levels remain well above MTs, and the majority of groundwater levels are above the 2027 IMs and MOs. Evaluation of interconnected surface water SMC is also not provided in this Annual Report for WY 2022 because it requires the installation of shallow groundwater monitoring wells as described in the GSP.

1. INTRODUCTION

1.1. Purpose of Annual Report

The California Code of Regulations Title 23 (23 CCR) §356.2 requires that Annual Reports be submitted to the California Department of Water Resources (DWR) by April 1 of each year following the adoption of the GSP. This Annual Report for the East Bay Plain (EBP) Subbasin Groundwater Sustainability Plan (GSP) covers the area managed by two groundwater sustainability agencies (GSAs): East Bay Municipal Utility District GSA (EBMUD) and City of Hayward GSA (Hayward).

Per 23 CCR §356.2, this Annual Report presents the following technical information for the current reporting water year (2022):

- Groundwater elevation data from monitoring wells
- Contour maps and hydrographs of groundwater elevations
- Total groundwater extractions
- Surface water supply used, including for groundwater recharge or other in-lieu uses
- Total water use
- Change in groundwater storage
- Progress towards implementing the GSP

The DWR water year ends on September 30th of the named year and begins on October 1st of the previous year; therefore, the period covered by this report is October 1, 2021 through September 30, 2022 (water year 2022).

1.2. Agency Information

EBMUD and Hayward each formed a GSA pursuant to SGMA. Together, the two GSAs cover the entirety of the EBP Subbasin. The EBMUD GSA incorporates all, or portions of the cities of San Pablo, Richmond, El Cerrito, Albany, Berkeley, Emeryville, Alameda, Oakland, Piedmont, San Leandro, and other unincorporated areas including the community of San Lorenzo. The Hayward GSA covers the portion of the City of Hayward located within the EBP Subbasin. Other portions of Hayward are located in the East Bay Hills to the east of the EBP Subbasin, and within the Niles Cone Subbasin to the south of the EBP Subbasin.

1.3. Plan Area

The Plan area is defined as the EBP Subbasin (2-009.04), which is part of the Santa Clara Valley Groundwater Basin as described in DWR Bulletin 118 (DWR, 2016), with boundary updates approved in 2016. The lateral extent of the EBP Subbasin is defined by the subbasin boundaries provided in Bulletin 118 (DWR, 2016). The EBP Subbasin is bounded in the north and west by San Francisco Bay, in the east by the East Bay Hills, and in the south by the Niles Cone Subbasin (**Figure ES-1**). The vertical boundaries of the Subbasin are the land surface (upper boundary) and the definable bottom of the basin in terms of the depth to bedrock (lower boundary). The Subbasin does not contain state lands but does include some federal lands including Lytton Tribal lands and U.S. Department of Defense lands. While the area is primarily urban (94 percent), it does have some areas with vegetation and open water.

1.4. Basin Setting

1.4.1. Hydrogeologic Conceptual Model

The EBP Subbasin consists of three major aquifer zones: Shallow Aquifer Zone, Intermediate Aquifer Zone, and Deep Aquifer Zone (southern half of the Subbasin only). The geologic history of the EBP Subbasin over the past 800,000 years involves the rise and fall of sea level, which resulted in deposits of different types of sediments/soils from streams (e.g., clay, sand, gravel), wind (e.g., sand dunes), and the Bay (e.g., Bay Mud, silt). These sediments were laid down in different places at different times, thereby resulting in alternating sequences of clay, silt, sand, and gravel within each aquifer zone. Aquitard layers consist primarily of fine-grained materials (clay, silt) and exist between the Shallow/Intermediate Aquifer Zones and Intermediate/Deep Aquifer Zones. This depositional history resulted in more coarse-grained material (sand, gravel) in the Deep Aquifer Zone in the southern EBP Subbasin compared to shallower zones or more northerly locations. The transition zone is a hydrogeologic boundary between the EBP Subbasin and Niles Cone Subbasin related to vertical offsets of coarse-grained layers that restrict groundwater flow between the two subbasins.

Most high-yield production wells have been developed within the Deep Aquifer Zone and lower portion of the Intermediate Aquifer Zone in the southern EBP Subbasin. The Shallow Aquifer Zone and upper to middle portions of the Intermediate Aquifer Zone have geologic conditions that tend to result in lower yielding wells.

1.4.2. Current and Historical Groundwater Conditions

Groundwater levels are generally stable, and the basin is considered sustainable in relation to the six sustainability indicators defined in SGMA because groundwater pumping is much lower today (approximately 3,600 AF) than in the 1960s (greater than 20,000 AF). Furthermore, the EBP Subbasin GSAs are not aware of any residents who are solely or primarily dependent on groundwater for a drinking water supply.

Overall groundwater quality in the Intermediate and Deep Aquifers is good; commercial/industrial site contaminants (e.g., petroleum hydrocarbons, volatile organic compounds), where present, are generally limited to the upper 100 feet in the Shallow Aquifer.

No seawater intrusion problems have been observed or reported during water year 2022. Historically, no significant seawater intrusion was reported either, even during the 1950s and 1960s when extensive water supply development and groundwater pumping from the Intermediate and Deep Aquifers resulted in Intermediate/Deep Aquifer Zone groundwater levels that ranged from tens of feet (ft) to well over 100 ft below sea level.

No land subsidence (a permanent decline in ground surface elevation) has been reported to date, not even during the 1950s and 1960s when groundwater levels in the Intermediate/Deep Zones ranged from tens of ft to well over 100 ft below sea level. Since 2008, two deep extensometers have continually measured aquifer system compaction (elastic and inelastic subsidence) and expansion (uplift) in the southern portion of the EBP Subbasin. The extensometer monitoring (done in coordination with the USGS) is a key ongoing program that collects data pertinent to the land subsidence sustainability indicator.

2. GROUNDWATER ELEVATIONS §356.2(B)(1)

2.1. Groundwater Level Monitoring

The groundwater level monitoring information presented in this Annual Report includes historical monitoring conducted in the Subbasin by various entities, including some local GSA-coordinated monitoring conducted as part of efforts to establish the long-term GSP monitoring program. Monitoring data available for the period through WY 2022 (plus Fall 2022) are summarized and presented in this report (**Table 2-1** and **Appendices A and B**). Formal GSP groundwater level monitoring conducted by GSAs was initiated upon adoption and submittal of the GSP in January 2022. Data for some proposed RMS wells are not available because the wells have not yet been installed.

Historically, groundwater level monitoring in and around the EBP Subbasin has been conducted by a variety of entities, including EBMUD, Hayward, ACWD, DWR, and USGS. Groundwater level monitoring data available from these entities and GeoTracker GAMA (which includes data collected by various consultants at environmental sites) were assembled for the period through the end of WY 2022 (plus Fall 2022) and are presented in this report. **Figure 2-1** includes a map showing the well locations and most recent monitoring year for historical groundwater level monitoring conducted in and around the EBP Subbasin. Groundwater level measurements acquired from groundwater level RMS wells identified in the GSP are submitted through the Monitoring Network Module on the SGMA Portal. **Figure 2-2** shows the groundwater level RMS well network included in the GSP. A summary of RMS well information and recent groundwater level measurements is presented in **Table 2-1**.

Table 2-1. Summary of Groundwater Level RMS Well Information and Measurements During Report Year (2022)

RMS Well I.D.	Estimated Reference Point Elevation (feet, msl[1])	Well Depth (feet bgs[2])	Screen Top-Bottom (feet bgs)	Aquifer Designation	Spring 2022 GWEL (feet, msl)	Date of Spring 2022 GWEL	Fall 2022 GWEL (feet, msl)	Date of Fall 2022 GWEL	GSA
MW-5S	13.88	460	200-210	Intermediate	11.18	4/12/2022	8.88	10/5/2022	EBMUD
MW-5I	13.88	460	315-325	Intermediate	5.78	4/12/2022	4.58	10/5/2022	EBMUD
MW-5D	13.78	1025	500-630	Deep	-3.94	4/12/2022	-7.44	10/5/2022	EBMUD
MW-8D	14.76	910	420-480	Deep	-10.24	4/12/2022	-21.34	10/5/2022	EBMUD
MW-9S	54.39	460	110-120	Shallow	30.59	4/12/2022	28.89	10/5/2022	EBMUD
MW-9I	54.39	460	200-210	Intermediate	19.79	4/12/2022	18.19	10/5/2022	EBMUD
MW-9D	54.39	460	325-335	Intermediate	6.59	4/12/2022	4.69	10/5/2022	EBMUD
MW-10S	11.76	680	100-120	Shallow	8.06	4/12/2022	7.26	10/5/2022	EBMUD
MW-10I	11.76	680	340-360	Intermediate	3.06	4/12/2022	1.96	10/5/2022	EBMUD
MW-10D	11.76	680	590-610	Deep	-4.14	4/12/2022	-7.34	10/5/2022	EBMUD
S2-MWS1	6	85	50-80	Shallow	-5.10	4/14/2022	-6.10	10/5/2022	EBMUD
S2-MWS2	6	205	140-180	Shallow	-3.8	4/14/2022	-6.8	10/5/2022	EBMUD
S2-MWD1	6	555	480-500	Deep	-6.2	4/14/2022	-7.2	10/5/2022	EBMUD
MW-N1S[3]	73	TBD	TBD	Shallow	Not constructed yet.				EBMUD
MW-N1I[3]	73	TBD	TBD	Intermediate	Not constructed yet.				EBMUD

Table 2-1. Summary of Groundwater Level RMS Well Information and Measurements During Report Year (2022) (Continued)

RMS Well I.D.	Estimated Reference Point Elevation (feet, msl[1])	Well Depth (feet bgs[2])	Screen Top-Bottom (feet bgs)	Aquifer Designation	Spring 2022 GWEL (feet, msl)	Date of Spring 2022 GWEL	Fall 2022 GWEL (feet, msl)	Date of Fall 2022 GWEL	GSA
MW-N2S[3]	19	TBD	TBD	Shallow	Not constructed yet.				EBMUD
MW-N2I[3]	19	TBD	TBD	Intermediate	Not constructed yet.				EBMUD
MW-N3S[3]	14	TBD	TBD	Shallow	Not constructed yet.				EBMUD
MW-N3I[3]	14	TBD	TBD	Intermediate	Not constructed yet.				EBMUD
MW-S1S[3]	27	TBD	TBD	Shallow	Not constructed yet.				Hayward
MW-S1I[3]	27	TBD	TBD	Intermediate	Not constructed yet.				Hayward
MW-S1D[3]	27	TBD	TBD	Deep	Not constructed yet.				Hayward
MW-S2S[3]	18	TBD	TBD	Shallow	Not constructed yet.				Hayward
MW-S2I[3]	18	TBD	TBD	Intermediate	Not constructed yet.				Hayward
MW-S2D[3]	18	TBD	TBD	Deep	Not constructed yet.				Hayward
Well D	47.1	600	500-585	Deep	6.11	4/19/2022	4.66	10/25/2022	Hayward
Mt. Eden Park	24	550	431-550	Deep	-8.29	4/19/2022	NM[4]	10/25/2022	Hayward

[1] Estimated reference point elevation and groundwater elevations (GWEL) are expressed in feet above mean sea level (msl).
[2] Well depth and screen information are expressed in feet below ground surface (bgs).
[3] Proposed RMS well
[4] The Mt. Eden Park well was not measured (NM) in Fall 2022 as it is being destroyed and removed from the monitoring network.

2.2. Groundwater Elevation Contour Maps – §356.2(b)(1)(A)

Groundwater elevation contours were developed from all known and available groundwater level information in the GSP area, including data from public sources and from the local GSAs. Annual spring and fall contour maps were prepared for each of the principal aquifers in the EBP Subbasin: Shallow, Intermediate, and Deep Aquifers. Separate groundwater contour maps have been developed for the Shallow Aquifer to represent the upper 50 feet of sediments (referred to as the Water Table Aquifer or Upper Shallow Aquifer) and to represent the depth interval from 50 to 200 feet (referred to as the Lower Shallow Aquifer). Spring contours generally represent seasonal high groundwater levels and fall contours generally represent seasonal low groundwater levels.

Contour maps for Spring and Fall 2022 for the different aquifer units are presented in **Figure 2-3 through 2-10** and are discussed below. Contour maps for Spring and Fall 2019 and 2020 are included in **Appendix A**. Due to very limited available data, groundwater elevation contours depicted on these maps are not well constrained. Therefore, these maps are not (and should not be) used directly to evaluate groundwater storage change. For this Annual Report, the method for evaluating change in groundwater storage is based primarily on numerical groundwater model results with qualitative use of observed groundwater elevation data, as discussed in Section 4.

2.2.1. Upper Shallow Zone

Groundwater level data for mapping groundwater elevations in the Upper Shallow Aquifer Zone were obtained from the GeoTracker GAMA database. More data for this aquifer zone were available in 2019 and previous years compared to Spring and Fall 2022. The reasons for the more limited recent data are being investigated but are unknown at this time. The groundwater elevation contours were only developed for areas where sufficient data were available (**Figures 2-3 and 2-4**).

Overall, groundwater elevation contours are similar to those presented and described in the GSP, with higher groundwater elevations near the East Bay Hills and lower groundwater elevations towards San Francisco Bay. As would be expected, the fall groundwater elevations are slightly lower than for spring. Groundwater contour maps presented in this Annual Report for Spring and Fall 2022 differ from contour maps presented in the GSP due to fewer data being available and inability to contour in areas with known data gaps.

2.2.2. Lower Shallow Zone

Groundwater level data for mapping groundwater elevations in the Lower Shallow Aquifer Zone were obtained from GSA wells and the GeoTracker GAMA database. The data available for this zone are quite limited for Spring 2019 through Fall 2022, but more data are anticipated to be available in the future. The groundwater elevation contours were only developed for areas where sufficient data were available in the southern portion of the EBP Subbasin (**Figures 2-5 and 2-6**).

Overall, groundwater elevation contours are similar to those presented and described in the GSP, with groundwater elevations higher near the East Bay Hills and declining towards San Francisco Bay. As would be expected, the fall groundwater elevations are slightly lower than for spring. Slight differences in groundwater contour maps presented in this Annual Report for Spring and Fall 2022 compared to contour maps presented in the GSP are due primarily to different datasets that were available for a given year.

2.2.3. Intermediate Zone

Groundwater level data for mapping groundwater elevations in the Intermediate Aquifer Zone were obtained from GSA wells. The data available for this aquifer are quite limited for Spring 2019 through Fall 2022, but more data are anticipated to be available in the future. The groundwater elevation contours were only developed for areas where sufficient data were available in the southern EBP Subbasin (**Figures 2-7 and 2-8**).

Overall, groundwater elevation contours are similar to those presented and described in the GSP, with groundwater elevations slightly higher towards the East Bay Hills and declining towards San Francisco Bay. As would be expected, the fall groundwater elevations are slightly lower than for spring..

2.2.4. Deep Zone

Groundwater level data for mapping groundwater elevations in the Deep Aquifer Zone were obtained from GSA wells and other deep wells with data available (e.g., ACWD wells). The data available for this zone are quite limited for Spring and Fall 2022, but more data are anticipated to be available in the future after additional wells are installed. The groundwater elevation contours were only developed for areas in the southern EBP Subbasin where sufficient data were available.

Overall, groundwater elevation contours are similar to those presented and described in the GSP; however, the available data did not allow for drawing more than one contour line. Previous maps (e.g., Spring 2018) generally showed slightly higher groundwater elevations towards the East Bay Hills and lower groundwater elevations towards San Francisco Bay. As would be expected, the fall groundwater level elevations are slightly lower than for spring.

2.3. Groundwater Hydrographs – §356.2(b)(1)(B)

Hydrographs of time-series groundwater level data for groundwater level RMS wells were prepared with all available groundwater level monitoring data through WY 2022 (plus Fall 2022) and are contained in **Appendix B**. The hydrographs generally show slightly lower groundwater elevations during the drought that extended from 2012 to 2015, followed by annual increases during wetter years (WY 2017 and WY 2019) and decreases during drier years (WY 2018, WY 2020, WY 2021, WY 2022). Several designated RMS wells do not have historical groundwater level data between 2015 and 2021 because they either were not monitored during that period (i.e., not part of a previous monitoring program such as CASGEM) or have not yet been installed. Hydrographs for these RMS wells will be included in future Annual Reports as data become available.

3. WATER SUPPLY AND USE

Water supply and use information are presented in this section. Water use data by sector (required per §356.2) are summarized below and categorized by groundwater extraction, surface water supply, and total supply in the EBP Subbasin using the best data available. Water use sectors are broadly identified as agricultural, urban, and native vegetation land uses.

3.1. Groundwater Extraction - §356.2(b)(2)

Groundwater extraction by water use sector for WY 2022 is presented in **Table 3-1**. The amount of groundwater extraction in the EBP Subbasin for WY 2022 is estimated at 3,600 AF, which is the same amount that has been estimated for the past several years and is based on estimates from references cited in the GSP[1] (LSCE, et al., 2022). This groundwater is used to meet urban water demands for irrigation and industrial uses and is not being used as a source of drinking water. Groundwater pumping has remained relatively steady since at least the early 2000s. The GSAs are planning to update the groundwater extraction estimates over the next year.

Table 3-1. Groundwater Extractions in the East Bay Plain Subbasin for Water Year 2022

Water Use Sector	Location	Total (AF)[1]
Urban[2]	Pumped by others within EBMUD GSA	3,100
	Pumped by others within Hayward GSA	500
TOTAL		**3,600**

[1] Derived from EBPGWM documented in EBP Subbasin GSP.
[2] Includes domestic and large parcel irrigation

The GSAs are currently evaluating alternative approaches to estimating the annual groundwater pumping in the EBP Subbasin. Maps that illustrate the general location and volume of groundwater extractions during WY 2022 are based on the East Bay Plain Groundwater Model (EBPGWM) for each aquifer zone are shown in **Figures 3-1 through 3-3**. Most of the groundwater pumping occurs in the southern EBP Subbasin.

3.2. Surface Water Supply - §356.2(b)(3)

Surface water supplies used in EBP Subbasin for WY 2022 are presented in **Table 3-2** and include local and imported surface water and recycled water for the EBMUD water system and imported water from San Francisco Public Utilities Commission (SFPUC) Regional Water System for the Hayward water system. A total of about 92,000 AF was used in WY 2022 to meet customer demand within the GSA service areas.

[1] Groundwater use estimates in the GSP are based on studies that included Muir (1996), EBMUD and Hayward (2018), and WRIME (2005).

Table 3-2. Surface Water Supply for the East Bay Plain Subbasin for Water Year 2022				
EBMUD			Hayward	TOTAL (AF)
Local Supplies[1] (AF)	Imported[1,2] (AF)	Recycled Water[3] (AF)	Imported[4] (AF)	
7,876	70,888	2,195	11,207	92,166

[1] Sourced from EBMUD's metered data and corrected for non-revenue water. EBMUD estimates that 10% of the surface water comes from local supplies and 90% is imported.
[2]Imported water from the Mokelumne River watershed.
[3]Sourced from EBMUD's metered data.
[4]Imported water from SFPUC Regional Water System and sourced from Hayward's metered data.

Surface water supply used for groundwater recharge or in-lieu use in WY 2022 is presented in **Table 3-3**. In WY 2022, surface water was not available for use in the EBP Subbasin for direct or in-lieu groundwater recharge.

EBMUD may use its water rights in the EBP Subbasin to inject surface water into the Bayside Phase 1 Well during years when all three of the following conditions occur: surplus water is available; pre-1914 water is available from the San Leandro Creek watershed; and EBMUD's Upper San Leandro Water Treatment Plant is operational and in use at the time of injection. Surplus water was not available in WY 2022.

The City of Hayward does not use surface water for groundwater recharge or in-lieu use. The City maintains five groundwater supply wells (three in the EBP Subbasin) on standby for use during emergency events, but relies entirely on imported surface water for its regular supplies.

Table 3-3. Surface Water Supply for Groundwater Recharge or In-Lieu Use in the East Bay Plain Subbasin for Water Year 2022		
Purpose	GSA Area	Total (AF)
Groundwater Recharge	EBMUD	0
	Hayward	0
In-lieu Use	EBMUD	0
	Hayward	0
TOTAL		**0**

3.3. Total Water Use by Sector - §356.2(b)(4)

Total water use volumes in the EBP Subbasin are included in **Table 3-4**. The table summarizes total water use by water use sector (groundwater, surface water, recycled water, and native vegetation), water source type (industrial and urban), and identifies the method of measurement. Groundwater use is estimated to be approximately constant as discussed in Section 3.1. While no surface water was used for groundwater recharge or in-lieu use as described above in Section 3.2, the surface water amounts included in **Table 3-4** represent surface water provided directly to the GSAs' retail customers to meet water demands.

Total water use in the EBP Subbasin has ranged from approximately 93,500 to 100,500 AFY between 2015 and 2022. This total includes approximately 3.7 percent groundwater use, 2 percent recycled water use, and 0.3 percent used by native vegetation. The remaining 94 percent of total water use is from local and imported surface water supplied directly to EBMUD and Hayward customers.

Table 3-4. Total Water Use in East Bay Plain Subbasin for Water Years 2015-2022											
Water Year	Groundwater[1] (AF)	Surface Water (AF)				Recycled Water (AF)				Native Vegetation[4] (AF)	TOTAL (AF)
	EBP Subbasin	EBMUD[2]		Hayward[2]		EBMUD[3]		Hayward		EBP Subbasin	EBP Subbasin
	Urban[5]	Industrial	Urban[5]	Industrial	Urban[5]	Industrial	Urban[5]	Industrial	Urban[5]		
2015	3,600	11,359	66,237	1,565	8,205	4,803	213	0	0	300	96,282
2016	3,600	12,056	65,347	1,379	7,758	2,839	162	0	0	300	93,441
2017	3,600	11,378	67,692	1,354	7,800	2,154	145	0	0	300	93,423
2018	3,600	11,183	69,058	1,896	9,077	2,426	159	0	0	300	97,699
2019	3,600	12,103	68,454	2,013	9,287	2,352	150	0	0	300	98,259
2020	3,600	11,623	70,213	2,022	9,731	2,742	171	0	0	300	100,402
2021	3,600	12,932	67,943	1,955	9,650	2,794	207	0	0	300	99,381
2022	3,600	13,660	65,105	1,825	9,286	2,000	195	30	66	300	96,067

[1] Estimates from references cited in the GSP.
[2] Sourced from EBMUD's and Hayward's metered data and corrected for non-revenue water.
[3] Sourced from EBMUD's metered data.
[4] Based on 147 acres of Potential GDEs with an estimated total evapotranspiration (ET) of 3 ft/acre total of which 2 ft/acre is estimated to come from shallow groundwater.
Urban" includes institutional, commercial, residential, and irrigation water use.

4. CHANGE IN GROUNDWATER STORAGE §356.2(B)(5)

4.1. Change in Groundwater Storage Maps

Consistent with §354.18(b), annual estimates of groundwater storage change are provided in this section. As discussed above in Section 2 on groundwater levels, insufficient historical observed data are available for direct calculation of groundwater storage changes. Therefore, the EBPGWM developed for the GSP, which incorporates the available groundwater level data, was utilized to evaluate annual changes in groundwater storage for each aquifer during the historical model calibration time period from 1991 to 2015 and for the subsequent time period from 2016 to 2022 (**Table 4-1 and Appendices C and D**).

Change in groundwater storage over the historical model calibration period (1991 to 2015) shows an ongoing recovery in groundwater levels/storage from the period prior to 1990 when there were greater amounts of groundwater pumping. This recovery continues through 2006 with a total groundwater storage increase of about 53,000 AF between 1991 and 2006. Groundwater levels/storage fluctuated with wet and dry years between 2007 and 2015 with a net gain in groundwater storage of about 750 AF over that time. Groundwater storage between 2016 and 2022 has also fluctuated with wet and dry years with an overall net gain in groundwater storage of approximately 550 AF. The changes in groundwater storage in the most recent years from 2020 to 2022 were approximately -1,500 AF, -1,500 AF, and +40 AF, respectively. These annual changes in groundwater storage correlate closely with local climatic conditions.

The overall annual changes in groundwater storage are consistent with the HCM presented in the GSP, which describes the significantly greater amounts of groundwater pumping that occurred prior to 1990 in the EBP Subbasin followed by stabilization of groundwater pumping at relatively consistent levels since the mid-1990s. The historical groundwater pumping patterns are consistent with long-term recovery in groundwater levels and storage though the mid-2000s, followed by annual fluctuations with increases during wet years and decreases during dry years. Total groundwater storage has been relatively stable since 2006 following the long period of increases prior to 2006.

While use of the EBPGWM provides the best means of evaluating groundwater storage changes, observed data were used to conduct qualitative evaluation and confirmation of groundwater storage change estimates produced by the EBPGWM. Observed groundwater elevation data were compiled and analyzed to calculate average changes in Spring to Spring groundwater elevations for each aquifer from 2018 through 2022 (**Table 4-2**). Review of these results generally shows positive changes in groundwater levels for Spring 2021 to Spring 2022. These changes in observed water levels are consistent with model-produced groundwater storage changes being slightly positive for Spring 2021 to Spring 2022.

An additional level of analysis was conducted to obtain an approximation of groundwater storage changes from observed groundwater level data by applying average specific yield and storage coefficients to average observed groundwater elevation changes in the northern portion and southern portion of the EBP Subbasin (**Table 4-3**). Using representative aquifer parameter values derived from the EBPGWM, the observed changes in groundwater levels in the various aquifer units were evaluated for comparison to model-based change in storage results (**Table 4-1**). Between Spring 2021 and Spring 2022 groundwater storage based on very limited observed data increased by about 2,200 AF (**Table 4-3**) compared to a slight increase of about 40 AF based on results from the EBPGWM.

Maps of the spatial distribution of change in groundwater storage in the various aquifers for the most recent period from Spring 2021 to Spring 2022 are presented in **Figures 4-1 through 4-4**. The maps of change in groundwater storage are based on results derived from the EBPGWM. The maps for the Upper Shallow, Lower Shallow, and Intermediate Aquifers show that most of the decreases in groundwater storage from Spring 2021 to Spring 2022 occur in the eastern portion of EBP Subbasin, while there were minimal changes in groundwater storage across the EBP Subbasin in the Deep Aquifer.

Table 4-1. Summary of Annual Change in Groundwater Storage

Water Year	Upper Shallow Aquifer (AF)	Lower Shallow Aquifer (AF)	Intermediate Aquifer (AF)	Deep Aquifer (AF)	Annual Change in GW Storage[1] (AF)	Cumulative Change in GW Storage Since 1991 (AF)
1991	-1,543	-940	8,143	63	5,724	5,724
1992	-230	-515	5,762	31	5,048	10,772
1993	1,393	158	4,480	3	6,034	16,806
1994	-518	-293	3,643	68	2,900	19,705
1995	2,165	405	3,396	5	5,971	25,676
1996	877	208	2,849	20	3,954	29,631
1997	555	131	2,507	13	3,206	32,837
1998	2,731	772	2,478	34	6,016	38,853
1999	-40	-33	2,054	13	1,994	40,846
2000	257	3	1,715	-5	1,970	42,816
2001	-567	-153	1,440	38	759	43,575
2002	428	101	1,269	-2	1,796	45,371
2003	418	72	1,071	0	1,560	46,931
2004	-123	-47	885	5	720	47,651
2005	1,420	285	965	10	2,680	50,331
2006	1,296	329	991	2	2,618	52,949
2007	-1,092	-271	677	5	-682	52,268

Table 4-1. Summary of Annual Change in Groundwater Storage (Continued)

Water Year	Upper Shallow Aquifer (AF)	Lower Shallow Aquifer (AF)	Intermediate Aquifer (AF)	Deep Aquifer (AF)	Annual Change in GW Storage[1] (AF)	Cumulative Change in GW Storage Since 1991 (AF)
2008	-506	-106	541	5	-67	52,201
2009	-115	-54	421	2	255	52,456
2010	486	126	415	-2	1,024	53,480
2011	1,049	206	445	0	1,699	55,179
2012	-226	-100	326	2	1	55,181
2013	-718	-166	213	-1	-671	54,510
2014	-758	-220	55	-1	-924	53,586
2015	16	18	105	-1	138	53,724
2016	646	185	139	-5	965	54,689
2017	2,186	521	444	2	3,153	57,842
2018	-795	-169	201	-1	-765	57,077
2019	726	161	235	1	1,123	58,200
2020	-1,226	-294	42	0	-1,478	56,722
2021	-1,096	-305	-116	-1	-1,517	55,205
2022	70	-30	0	0	40	55,245

[1] Groundwater storage changes are based on Spring to Spring (April) changes in groundwater levels/contour maps, which are considered to provide more representative and stable groundwater levels and contour surfaces than Fall readings (e.g., Fall water levels may reflect residual pumping depressions in some areas). However, Fall to Fall changes in groundwater levels/contour maps from EBPGWM were reviewed and found to result in very similar groundwater storage changes as calculated from Spring data.

Table 4-2. Summary of Annual Change in Groundwater Levels Based on Observed Data

Water Year	Location	Upper Shallow Aquifer (FT)	Lower Shallow Aquifer (FT)	Intermediate Aquifer (FT)	Deep Aquifer (FT)
2019	North	1.12	0.50	0.40	NA
2020	North	-0.63	-2.03	-2.90	NA
2021	North	0.01	-3.37	-2.95	NA
2022	North	0.14	4.70	4.70	NA
2019	South	0.62	0.27	-0.94	2.07
2020	South	-1.20	-0.43	-0.05	-3.14
2021	South	-0.11	-1.43	-1.17	-2.91
2022	South	0.38	0.61	-0.60	0.28

Table 4-3. Summary of Annual Change in Groundwater Storage Based on Observed Data

Water Year	Location	Upper Shallow Aquifer (AF)	Lower Shallow Aquifer (AF)	Intermediate Aquifer (AF)	Deep Aquifer (AF)	Annual Change in GW Storage (AF)
2019	North	1,482	11	88	NA	1,581
2020	North	-833	-45	-639	NA	-1,518
2021	North	13	-74	-650	NA	-712
2022	North	185	104	1,036	NA	1,325
2019	South	1,833	13	-463	10	1,393
2020	South	-3,547	-21	-25	-15	0
2021	South	-325	-70	-576	-14	0
2022	South	1,123	30	-296	1	0
2019	Total	3,314	24	-375	10	2,974
2020	Total	-4,381	-66	-664	-15	-5,126
2021	Total	-312	-145	-1,227	-14	-1,698
2022	Total	1,308	134	741	1	2,184
Assigned Sy or S		0.06	0.001	0.01	0.0001	

4.2. Groundwater Use and Change in Groundwater Storage

Annual groundwater extractions and change in groundwater storage in the GSP area are shown in **Figure 4-5** for WYs 2015 to 2022. Groundwater extractions are estimated to have remained steady at 3,600 AFY. Change in groundwater storage over the 2015 to 2022 period varies with climatic conditions and shows positive changes in storage during above average rainfall years and negative changes in storage during below average rainfall years.

Historical annual changes in groundwater storage and cumulative changes in storage are also shown in **Table 4-1** and **Appendix D**. Historical changes in groundwater storage between 1991 and 2022 were calculated based on a water balance of the Subbasin groundwater system using the EBPGWM (described in the GSP). Overall, groundwater pumping is substantially below the sustainable yield of 12,500 AFY estimated in the EBP Subbasin GSP. Groundwater storage has been relatively stable since 2006 after many years of groundwater level recovery and increasing groundwater storage related to decreases in groundwater pumping. In the time period since 2006 when groundwater extraction has been constant at about 3,600 AFY, the annual change in groundwater storage has fluctuated between approximately +3,000 AF and -1,500 AF as a function of annual variability in climatic and hydrologic conditions.

5. GROUNDWATER SUSTAINABILITY PLAN IMPLEMENTATION PROGRESS §356.2(C)

5.1. Implementation of Monitoring and Addressing Data Gaps

After submitting the GSP to DWR in January 2022, the GSAs have focused on coordinating access arrangements and plans for monitoring of existing RMS wells, while planning for installation of new RMS wells. The new RMS wells are being partially funded under a Proposition 68 DWR grant award, and after property access is obtained and drilling contractors procured, will include up to 12 new monitoring wells at up to five different locations. Information collected from the drilling, geologic and geophysical logging, groundwater quality sampling, and automated groundwater level monitoring will help fill data gaps in the monitoring and conceptualization of the EBP Subbasin's hydrogeology and will improve understanding and management of groundwater in the Subbasin. Groundwater level data from these monitoring wells will be incorporated into groundwater elevation contour maps and hydrographs prepared for future Annual Reports. The GSP also describes additional monitoring wells planned for installation by 2027.

5.2. Implementation of Projects or Management Actions – §356.2(c)

All the GSA projects (existing and potential future) are summarized in **Table 5-1** and are scheduled for implementation throughout the 2022 through 2042 implementation period. **Table 5-2** provides the estimated benefits and costs of each existing project as presented in the GSP. **Table 5-3** provides a summary of EBMUD GSA management actions, and **Table 5-4** provides a summary of Hayward GSA management actions. The GSAs in the EBP Subbasin are committed to adaptive management of groundwater resources through this suite of identified projects and management actions. As projects and management actions are implemented and monitoring continues, the viability of the initial projects will be further evaluated to provide input for consideration of future projects. If adjustments are needed to meet the sustainability goal identified in the GSP, existing and potential future projects will be evaluated and potentially modified. In addition to continuous monitoring and review of project and management action implementation, the status of GSP implementation efforts will be reviewed by the GSAs in each future Annual Report.

Additionally, the GSAs have updated the existing Stakeholder Communication and Engagement Plan for GSP implementation to provide continued opportunities for public engagement and to evaluate opportunities to increase engagement with disadvantaged communities and tribes.

Table 5-1. GSA Project Implementation Summary				
GSA	Project	First Year of Planned Use	Status	Project Description
EBMUD	Bayside Phase 1 Injection	TBD[1]	Construction Completed and Ready to Operate	Surface water will be injected into the Deep Aquifer when certain conditions are met during wet years.
EBMUD	Bayside Phase 2 Injection	NA[2]	Additional Studies Needed	Potential Future Project
EBMUD	Bayside Phase 3 Injection	NA	Additional Studies Needed	Potential Future Project
EBMUD	Bayside Phase 1 Extraction	TBD	Construction Completed and Ready to Operate	Groundwater will be extracted from the Deep Aquifer during third and subsequent years of drought.
EBMUD	Bayside Phase 2 Extraction	NA	Additional Studies Needed	Potential Future Project
EBMUD	Bayside Phase 3 Extraction	NA	Additional Studies Needed	Potential Future Project
Hayward	Emergency Well Extraction	TBD	Construction Completed and Ready to Operate	Three production wells are maintained on standby for use in emergency situations such as disruption to surface water supplies.
Hayward	Extraction for Municipal	NA	Additional Studies Needed	Potential Future Project
EBMUD	Recycled Water	Ongoing	In operation	Treatment of recycled water to allow for use in irrigation.
EBMUD	Extraction for Irrigation	NA	Additional Studies Needed	Potential Future Project
EBMUD	Extraction for Supplemental Surface Water Flows	NA	Additional Studies Needed	Potential Future Project

[1] TBD – To Be Determined; Planned use dependent on occurrence of conditions described in GSP.

[2] NA – Not Applicable; No planned use at this time; project will be further evaluated and may be implemented in the future.

Table 5-2. GSA Project Benefit and Cost Summary

GSA	Project or MA	Estimated Average Annual Benefit (AFY)	Estimated Capital Cost	Estimated Average Annual O&M Costs
EBMUD	Bayside Phase 1 Injection	47	Previously Constructed	$30,000 to $40,000
EBMUD	Bayside Phase 1 Extraction	134	Previously Constructed	$30,000 to $200,000
Hayward	Emergency Well Extraction	TBD[1]	Previously Constructed	$60,000 to $500,000
EBMUD	Recycled Water for Irrigation	2,300 to 5,000 (for 2015 through 2021)	Previously Constructed	See EBMUD Recycled Water Master Plan (2019)

[1]To Be Determined; Annual Benefit is dependent on future occurrence of emergency conditions described in GSP.

Table 5-3. EBMUD EBP Subbasin Management Actions						
Project	Anticipated First Year of Implementation	Completion Date	Number of Monitoring Stations	Minimum Frequency	Estimated Capital Cost	Estimated Five-Year Costs
Monitoring Actions						
RMS[1] GW[2] Level Monitoring	2022	Ongoing	19	Semi-Annual	NA[3]	$72,500
Non-RMS GW Level Monitoring	2022	Ongoing	TBD[4]	Semi-Annual	NA	$100,000
RMS GW Quality Monitoring	2022	Ongoing	19	Annual	NA	$110,000
Baseline GW Quality Sampling	2022	2024	19	Semi-Annual	NA	$88,000
Subsidence Monitoring	2022	Ongoing	2	Daily	NA	$77,500
Synoptic Stream Monitoring	2024	2030	NA[5]	NA[5]	NA	$75,000
Construction of New Monitoring Facilities						
Install Shallow RMS Wells Near Creeks	2024	2025	10	NA	$250,000	$250,000
Monitoring Shallow Wells for GWL	2025	Ongoing	10	Semi-Annual	NA	$21,000
Monitoring Shallow Wells for GWQ	2025	Ongoing	10	Annual	NA	$30,000
Install Stream Gages	2024	2024	2	NA	$65,000	$65,000
Monitor Stream Gages	2024	Ongoing	2	Monthly	NA	$87,500
Install New Nested Monitoring Wells	2023	2024	3	NA	$800,000	$800,000
Monitoring New Nested Wells for GWL	2024	Ongoing	9	Semi-Annual	NA	$21,000
Monitoring New Nested Wells for GW Quality	2024	Ongoing	9	Annual	NA	$30,000
Special Studies						
Isotopic Sampling	2028	2028	NA	NA	NA	$100,000

(Continued) Table 5-3. EBMUD EBP Subbasin Management Actions						
Project	Anticipated First Year of Implementation	Completion Date	Number of Monitoring Stations	Minimum Frequency	Estimated Capital Cost	Estimated Five-Year Costs
GDE/Biological Monitoring						
Baseline GDE/Biological Surveys	2023	2023	NA	NA	NA	$150,000
Biological Surveys	2023	Ongoing	NA	Every 5 Years	NA	$50,000
Reporting						
Annual Reporting	2022	Ongoing	NA	Annual	NA	$178,750
GSP Five-Year Updates	2027	Ongoing	NA	Every 5 Years	NA	$162,500
Other						
DMS	2022	Ongoing	NA	Annual	NA	$25,000
Update Plume Info	2023	Ongoing	NA	Every 2 Years	NA	$13,000
Fate/Transport Modeling	TBD[6]	TBD	NA	TBD	NA	$65,000

[1] Representative Monitoring Site (RMS)

[2] Groundwater (GW)

[3] Not Applicable (NA); no associated capital costs

[4] To Be Determined (TBD); candidate non-RMS wells need further evaluation.

[5] Not Applicable (NA), Number of Monitoring Stations/Frequency does not apply to this Action.

[6] To Be Determined (TBD); Start Date, Completion Date, and Frequency are unknown at this time.

Table 5-4. Hayward EBP Subbasin Management Actions

Project	First Year of Implementation	Completion Date	Number of Monitoring Stations	Minimum Frequency	Estimated Capital Cost	Estimated Five-Year Costs
Monitoring Actions						
RMS[1] GW[2] Level Monitoring	2022	Ongoing	8[3]	Semi-Annual	NA[4]	$27,500
Non-RMS GW Level Monitoring	2022	Ongoing	TBD[5]	Semi-Annual	NA	$25,000
RMS GW Quality Monitoring	2022	Ongoing	8[3]	Annual	NA	$40,000
Baseline GW Quality Sampling	2023	2024	8[3]	Semi-Annual	NA	$32,000
Special Studies						
Isotopic Sampling	TBD	TBD	NA[6]	NA5	NA	TBD[7]
Reporting						
Annual Reporting	2022	Ongoing	NA	Annual	NA	$96,250
GSP Five-Year Updates	2027	Ongoing	NA	Every 5 Years	NA	$87,500
Other						
DMS	2022	Ongoing	NA	Annual	NA	$25,000
Update Plume Info	2023	Ongoing	NA	Every 2 Years	NA	$7,000
Fate/Transport Modeling	TBD[8]	TBD	NA	TBD	NA	$35,000

[1] Representative Monitoring Site (RMS)
[2] Groundwater (GW)
[3] Up to 8 RMS locations; 2 locations currently available
[4] Not Applicable (NA); no associated capital costs.
[5] To Be Determined (TBD); candidate non-RMS wells need further evaluation.
[6] Not Applicable (NA), Number of Monitoring Stations/Frequency does not apply to this Action.
[7] To Be Determined (TBD); it is uncertain if additional isotopic studies will be needed; no cost is provided at this time.
[8] To Be Determined (TBD); Start Date, Completion Date, and Frequency are unknown at this time.

5.3. Interim Milestone Status – §356.2(c)

The status of the six sustainability indicators is presented in this section in relation to the 2027 interim milestones (IMs), measurable objectives (MOs), and minimum thresholds (MTs) defined in the GSP. Because the EBP Subbasin is sustainable under current conditions in relation to the six SGMA sustainability indicators, IMs were set equal to the MOs in the GSP. IMs and MOs represent average target values and it is expected that measured values will fluctuate above and below the stated values. The primary objectives during the GSP implementation period are to achieve the MOs when possible and to not exceed the MTs, which essentially represent thresholds not to be exceeded.

5.3.1. Groundwater Levels

In the GSP, IMs for chronic lowering of groundwater levels were established at five-year intervals over the implementation period from 2022 to 2042, at years 2027, 2032, 2037, and 2042. IMs for groundwater levels were set equal to MOs, which were established through review and evaluation of measured groundwater level data and future projected fluctuations in groundwater levels utilizing the EBPGWM, which simulated implementation of projects and management actions. Each IM/MO was developed based on either recent historical measured data or the average modeled future groundwater levels for the spring (when recent groundwater level data were unavailable). MOs for groundwater levels were established in accordance with the sustainability goal and to provide estimates of the expected groundwater level fluctuations due to climatic and operational variability.

The regulations define undesirable results as occurring when significant and unreasonable effects are caused by groundwater conditions occurring throughout the Plan area for a given sustainability indicator. The GSP Regulations provide that the “minimum thresholds for chronic lowering of groundwater levels shall be the groundwater level indicating a depletion of supply at a given location that may lead to undesirable results.” (354.28.c.1)

Table 5-5 and **Figures 5-1a-c and 5-2a-c** present the status of Spring 2022 groundwater levels in the RMS wells in relation to the 2027 IMs, MOs, and MTs defined in the GSP. Review of the Spring 2022 groundwater level measurements that are available for 15 RMS wells indicates that groundwater levels remain well above MTs, and the majority of groundwater levels are above the 2027 IMs and MOs. A more detailed analysis of observed groundwater levels compared to IMs will be performed for the five-year update report that coincides with the first IMs established in the GSP.

5.3.2. Groundwater Storage

In the GSP, IMs for reduction in groundwater storage were established at five-year intervals over the implementation period from 2022 to 2042, at years 2027, 2032, 2037, and 2042. IMs for groundwater storage were set equal to MOs, which were established through review and evaluation of measured and modeled groundwater pumping data and estimated sustainable yield. The IMs/MOs were developed based on maintaining groundwater pumping at 50% or less of the estimated sustainable yield. The MO for groundwater storage was established in accordance with the sustainability goal and to include consideration of expected fluctuations due to groundwater pumping and climatic and operational variability.

The GSP Regulations provide that the "minimum threshold for reduction of groundwater storage shall be the total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results." (354.28.c.2)

Review of the Spring 2022 groundwater pumping data that are available for EBP Subbasin indicates that groundwater pumping remains below the MT and in compliance with the established MO and IM. A more detailed analysis of groundwater pumping compared to the IM will be performed for the five-year update report that coincides with the first IMs established in the GSP.

5.3.3. Seawater Intrusion

In the GSP, IMs for seawater intrusion were established at five-year intervals over the implementation period from 2022 to 2042, at years 2027, 2032, 2037, and 2042. IMs for seawater intrusion were set equal to MOs, which were established through review and evaluation of groundwater level and quality data. The IM/MO was developed based on maintaining the 5-Foot groundwater elevation contour in the Upper Shallow Aquifer at the same location relative to San Francisco Bay as it was in Spring 2015. The MO for seawater intrusion was established in accordance with the sustainability goal and to include consideration of the expected fluctuations due to climatic and operational variability.

The GSP Regulations provide that the "minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where intrusion may lead to undesirable results." (354.28.c.3) The 5-foot groundwater elevation contour line in the Upper Shallow Aquifer, which is directly connected to San Francisco Bay, was used as a proxy for chloride concentrations due to lack of sufficient chloride data to develop isocontour maps.

In a March 2023 stakeholder workshop (after the period covered by this Annual Report), a stakeholder expressed their view about the importance of considering seawater intrusion due to sea level rise, including its impact to infrastructure. The GSAs recognize the importance of the issue of sea level rise and associated potential impacts to infrastructure. However, as sea level rise is not a phenomenon under the physical or jurisdictional control of GSAs under SGMA, it is not intended to be addressed by the GSAs and is being evaluated by some of the cities, counties, and other entities located along the Bay within the East Bay Plain Subbasin. The Port of Oakland and the City of San Leandro are in the process or will soon be developing their sea level rise adaptation plan, which will include vulnerability assessments (including for infrastructure) and evaluation of groundwater intrusion. The GSAs plan to reach out to the cities and other entities within the EBP Subbasin to discuss ways that their adaptation efforts and the EBP GSP could mutually benefit.

In the GSP, the sustainability management criteria (SMC) for seawater intrusion were developed to evaluate impacts to water supply due to groundwater extraction by assessing changes in the 5-foot contour line and monitoring chloride concentrations in the RMS wells. The SMC for seawater intrusion did not explicitly consider impacts from sea level rise; however, the long-term shallow groundwater levels will be evaluated for increasing trends along with monitoring chloride concentrations to incorporate consideration of sea level rise.

Available Upper Shallow Aquifer data for Spring 2022 were insufficient to construct a comparable 5-foot elevation contour line as was done for Spring 2015. However, a review of the Spring 2022 groundwater elevation data in the Upper Shallow Aquifer compared to Spring 2015 data for the same wells indicates an average net modest increase in groundwater elevations of approximately 0.23 feet. Therefore, data that are available for EBP Subbasin indicate that the spring shallow groundwater levels have remained nearly constant and that potential concerns for seawater intrusion have not occurred.

A more detailed analysis of seawater intrusion compared to the IM will be performed for the five-year update report that coincides with the first IMs established in the GSP.

5.3.4. Degraded Water Quality

In the GSP, IMs for groundwater quality were established at five-year intervals over the implementation period from 2022 to 2042, at years 2027, 2032, 2037, and 2042. IMs for water quality were set equal to MOs, which were established through review and evaluation of groundwater quality data. The IMs/MOs were developed based on maintaining the existing groundwater quality for the four key constituents at RMS wells. The MOs for degraded water quality were established in accordance with the sustainability goal and are based on the average existing groundwater quality that incorporate variability from one sampling event to another in terms of sampling protocol, aquifer conditions, and analytical lab procedures and instrumentation.

The GSP Regulations provide that the "minimum threshold for degraded water quality shall be the degradation of water quality…. that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results." (354.28.c.4) In the GSP, the available groundwater quality data for RMS wells were insufficient to establish baseline conditions for confirming IM/MO/MT. However, baseline water quality sampling was initiated in 12 of the 14 existing RMS wells in Fall 2022; two of the wells were inaccessible at that time. After four consecutive biannual sampling events from the RMS wells, enough data is expected to exist to establish a concentration baseline.

A summary of RMS groundwater quality data collected in 2022 is provided in **Table 5-6**. In most cases, the data are below the MTs and IMs/MOs. However, arsenic concentrations in two shallow wells, MW-10S and S2-MWS1, are above the MT. Water quality data was previously unavailable for those two wells when the interim sustainability criterion was developed in the GSP. The data currently being collected will establish the baseline concentrations that will be used to update the sustainability criteria in the future.

A stakeholder raised concerns to the GSAs during the March 2023 stakeholder workshop about the possibility of contaminants being mobilized by rising groundwater levels associated with sea level rise. Although the issue of managing and mitigating for sea level rise is outside the scope of the SGMA, it is being addressed by the San Francisco Regional Water Quality Control Board (SFRWQCB) as discussed on pages 11 and 24 of their March 2023 Strategic Workplan (SFRWQCB, 2023) and by the Department of Toxics Substance Control (DTSC, 2023). As part of the adaptive management process for the GSP, the GSAs plan to evaluate the groundwater quality and level data for increasing concentrations that could be driven by rising groundwater levels. If a concern is identified, the GSAs will inform the SFRWQCB and DTSC and provide the data. The GSAs plan to reach out to the SFRWQCB and DTSC for opportunities to coordinate on this issue. Since water quality sampling was initiated in many of the RMS wells in Fall 2022, not enough data exists at this time to assess the potential for contaminant mobilization from rising groundwater levels.

5.3.5. Subsidence

In the GSP, IMs for subsidence were established at five-year intervals over the implementation period from 2022 to 2042, at years 2027, 2032, 2037, and 2042. IMs for subsidence were set equal to MOs, which were established through review and evaluation of historical groundwater pumping and groundwater level data relative to the occurrence of subsidence (or lack thereof) in the EBP Subbasin. Each IM/MO was developed based on recent historical measured data using groundwater levels as a proxy. Measurable objectives for groundwater levels were established in accordance with the sustainability goal and to include consideration of the expected fluctuations due to climatic and operational variability.

The GSP Regulations provide that the "minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results." (354.28.c.5)

Table 5-7 presents the status of subsidence RMS wells in relation to the 2027 IMs, MOs, and MTs defined in the GSP. There are some RMS wells that do not have Spring 2022 measurements to compare with IMs, MOs, and MTs. GSA efforts to bring online the remaining RMS wells listed in the GSP are ongoing, including some existing wells not previously included in a CASGEM monitoring program and the implementation of a DWR Proposition 68 grant that includes installation of new groundwater monitoring wells that will become RMS wells. Review of the Spring 2022 groundwater level measurements that are available for 6 RMS wells indicates that groundwater levels remain well above MTs, and the majority of groundwater levels are above the 2027 IMs and MOs. A more detailed analysis of observed groundwater levels being used as a proxy for subsidence compared to IMs will be performed for the five-year update report that coincides with the first IMs established in the GSP.

5.3.6. Interconnected Surface Water

In the GSP, IMs for interconnected surface water were established at five-year intervals over the implementation period from 2022 to 2042, at years 2027, 2032, 2037, and 2042. IMs for interconnected surface water were set equal to MOs, which were established through review and evaluation of groundwater modeling results. The IMs/MOs were developed based on maintaining Upper Shallow Aquifer groundwater levels within an acceptable range at shallow monitoring wells to be installed along creeks. The MOs for interconnected surface water were established in accordance with the sustainability goal and to provide estimates of the expected groundwater level variability due to climatic and operational variability.

The GSP Regulations provide that the "minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." (354.28.c.6) The shallow monitoring wells along creeks that will be used to implement these sustainable management criteria are not yet installed as discussed in the GSP. However, the GSP describes the work to be done to fill this data gap early in the GSP implementation period. As the necessary data for evaluation of this sustainability criterion become available it will be discussed in future Annual Reports.

In 2021, synoptic streamflow measurements of San Pablo and San Leandro Creeks were conducted and stream water samples were collected for geochemical and isotopic analyses to better understand stream discharge rates, gaining and losing stream reaches, and sources of water to streams. This work is being partially funded by a Proposition 68 DWR grant award. The isotopic analyses were completed in 2022 and the report documenting the results is in progress. Results indicate that San Pablo Creek is gaining, and that San Leandro Creek is either neutral or losing over much of their respective reaches within the EBP Subbasin.

Table 5-5. Summary of RMS Well Groundwater Levels Relative to Interim Milestones, Minimum Thresholds, and Measurable Objectives									
RMS Well I.D.	Estimated Reference Point Elevation (feet, msl[1])	Aquifer Designation	2027 Interim Milestone GWEL (feet, msl)	MT GWEL (feet, msl)	MO GWEL (feet, msl)	Spring 2022 GWEL (feet, msl)	Date of Spring Measurement	2027 IM Status (feet)	MT Status (feet)
MW-5S	13.88	Intermediate	8	-36	8	11.18	4/12/2022	+3.18	+47.18
MW-5I	13.88	Intermediate	7	-50	7	5.78	4/12/2022	-1.22	+55.78
MW-5D	13.78	Deep	-5	-50	-5	-3.94	4/12/2022	+1.06	+46.06
MW-8D	14.76	Deep	-8	-50	-8	-10.24	4/12/2022	-2.24	+39.76
MW-9S	54.39	Shallow	33	4	33	30.59	4/12/2022	-2.41	+26.59
MW-9I	54.39	Intermediate	20	-50	20	19.79	4/12/2022	-0.21	+69.79
MW-9D	54.39	Intermediate	6	-50	6	6.59	4/12/2022	+0.59	+56.59
MW-10S	11.76	Shallow	8	-38	8	8.06	4/12/2022	+0.06	+46.06
MW-10I	11.76	Intermediate	4	-50	4	3.06	4/12/2022	-0.94	+53.06
MW-10D	11.76	Deep	-5	-50	-5	-4.14	4/12/2022	+0.86	+45.86
S2-MWS1	6	Shallow	3	-44	3	-5.10	4/14/2022	-8.10	+38.90
S2-MWS2	6	Shallow	3	-44	3	-3.8	4/14/2022	-6.8	+40.2
S2-MWD1	6	Deep	-3	-50	-3	-6.2	4/14/2022	-3.2	+43.8
MW-N1S[2]	73	Shallow	53	23	53	Not constructed yet.			
MW-N1I[2]	73	Intermediate	50	-50	50	Not constructed yet.			

(Continued) Table 5-5. Summary of RMS Well Groundwater Levels Relative to Interim Milestones, Minimum Thresholds, and Measurable Objectives

RMS Well I.D.	Estimated Reference Point Elevation (feet, msl[1])	Aquifer Designation	2027 Interim Milestone GWEL (feet, msl)	MT GWEL (feet, msl)	MO GWEL (feet, msl)	Spring 2022 GWEL (feet, msl)	Date of Spring Measurement	2027 IM Status (feet)	MT Status (feet)
MW-N2S[2]	19	Shallow	5	-31	5	Not constructed yet.			
MW-N2I[2]	19	Intermediate	5	-50	5	Not constructed yet.			
MW-N3S[2]	14	Shallow	7	-36	7	Not constructed yet.			
MW-N3I[2]	14	Intermediate	7	-50	7	Not constructed yet.			
MW-S1S[2]	27	Shallow	16	-23	16	Not constructed yet.			
MW-S1I[2]	27	Intermediate	7	-50	7	Not constructed yet.			
MW-S1D[2]	27	Deep	-3	-50	-3	Not constructed yet.			
MW-S2S[2]	18	Shallow	9	-32	9	Not constructed yet.			
MW-S2I[2]	18	Intermediate	6	-50	6	Not constructed yet.			
MW-S2D[2]	18	Deep	-4	-50	-4	Not constructed yet.			
Well D	47.1	Deep	-2	-50	-2	6.11	4/19/2022	+8.11	+56.11
Mt. Eden Park	24	Deep	-17	-50	-17	-8.29	4/19/2022	+8.71	+41.71

[1] Estimated reference point elevation and groundwater elevations (GWEL) are expressed in feet above mean sea level (msl).
[2] Proposed RMS well

Table 5-6. Summary of RMS Well Groundwater Quality and Interim Milestones, Minimum Thresholds, and Measurable Objectives

RMS Well I.D.	Aquifer	Date	Arsenic Conc. (ug/L)			Nitrate (NO3) Conc. (mg/L)			Chloride Conc. (mg/L)			TDS Conc. (mg/L)			GSA
			Fall 2022 Meas.	2027 IM/MO Status[1]	MT Status[1]	Fall 2022 Meas.	2027 IM/MO Status[1]	MT Status[1]	Fall 2022 Meas.	2027 IM/MO Status[1]	MT Status[1]	Fall 2022 Meas.	2027 IM/MO Status[1]	MT Status[1]	
MW-5S	Int.	10/26/22	2.7	3	10	0.023 (U)	8	10	57	56	250	430	459	551	EBMUD
MW-5I	Int.	11/17/22	11.0	19	23	0.023 (U)	8	10	59	63	250	460	454	551	EBMUD
MW-5D	Deep	11/16/22	1.2	0.5	10	0.23 (U)	0.06	10	80	85	250	450	463	545	EBMUD
MW-8D	Deep	NA	NA	15	18	NA	0.006	10	NA	50	250	NA	420	556	EBMUD
MW-9S	Shallow	10/27/22	4.0	2	10	8.4	8	10	50	52	250	590	614	737	EBMUD
MW-9I	Int.	10/27/22	3.0	2	10	0.023 (U)	8	10	48	47	250	440	428	514	EBMUD
MW-9D	Int.	11/15/22	3.0	3	10	0.023 (U)	8	10	51	53	250	400	474	569	EBMUD
MW-10S	Shallow	10/27/22	24.0	6	10	0.77	8	10	33	43	250	320	390	500	EBMUD
MW-10I	Int.	11/15/22	5.8	6	10	0.078	8	10	54	53	250	440	465	558	EBMUD
MW-10D	Deep	11/15/22	2.4	2	10	0.12 (U)	8	10	100	123	250	480	528	634	EBMUD
S2-MWS1	Shallow	10/25/22	99	8	10	2.3 (U)	8	10	18,000	15,000	18,000	37,000	27,000	32,400	EBMUD
S2-MWS2	Shallow	10/25/22	3.4	8	10	6.9 (E1)	8	10	1,200	3,500	4,200	2,700	6,100	7,320	EBMUD
S2-MWD1	Deep	NA	NA	8	10	NA	8	10	NA	200	250	NA	420	500	EBMUD
MW-N1S[2]	Shallow	Not constructed yet.													
MW-N1I[2]	Int.	Not constructed yet.													
MW-N2S[2]	Shallow	Not constructed yet.													
MW-N2I[2]	Int.	Not constructed yet.													
MW-N3S[2]	Shallow	Not constructed yet.													
MW-N3I[2]	Int.	Not constructed yet.													

(Continued) Table 5-6. Summary of RMS Well Groundwater Quality and Interim Milestones, Minimum Thresholds, and Measurable Objectives

RMS Well I.D.	Aquifer	Date	Arsenic Conc. (ug/L)			Nitrate (NO3) Conc. (mg/L)			Chloride Conc. (mg/L)			TDS Conc. (mg/L)			GSA
			Fall 2022 Meas.	2027 IM/MO Status[1]	MT Status[1]	Fall 2022 Meas.	2027 IM/MO Status[1]	MT Status[1]	Fall 2022 Meas.	2027 IM/MO Status[1]	MT Status[1]	Fall 2022 Meas.	2027 IM/MO Status[1]	MT Status[1]	
MW-S1S[2]	Shallow	Not constructed yet.													
MW-S1I[2]	Int.	Not constructed yet.													
MW-S1D[2]	Deep	Not constructed yet.													
MW-S2S[2]	Shallow	Not constructed yet.													
MW-S2I[2]	Int.	Not constructed yet.													
MW-S2D[2]	Deep	Not constructed yet.													
Well D	Deep	10/28/22	2	1	10	0.1	8	10	45	56	250	350	414	500	Hayward

[1] Values represent concentration units (mg/L) below IM, MO, and MT in order of arsenic, nitrate, chloride, and TDS. A negative number means the current concentration is above the IM/MO or MT value.
[2] Proposed RMS well.
NA = Data Not Available.

Table 5-7. Summary of RMS Well Subsidence Groundwater Levels Relative to Interim Milestones, Minimum Thresholds, and Measurable Objectives

RMS Well I.D.	Estimated Reference Point Elevation (feet, msl[1])	Aquifer Designation	2027 Interim Milestone GWEL (feet, msl)	MT GWEL (feet, msl)	MO GWEL (feet, msl)	Spring 2022 GWEL (feet, msl)	Date of Spring Measurement	2027 IM Status (feet)	MT Status (feet)
MW-5D	13.78	Deep	-5	-50	-5	-3.94	4/12/2022	+1.06	+46.06
MW-8D	14.76	Deep	-8	-50	-8	-10.24	4/12/2022	-2.24	+39.76
MW-9I	54.39	Intermediate	20	-50	20	19.79	4/12/2022	-0.21	+69.79
MW-9D	54.39	Intermediate	6	-50	6	6.59	4/12/2022	+0.59	+56.59
MW-10I	11.76	Intermediate	4	-50	4	3.06	4/12/2022	-0.94	+53.06
MW-10D	11.76	Deep	-5	-50	-5	-4.14	4/12/2022	+0.86	+45.86
S2-MWD1	6	Deep	-3	-50	-3	-6.2	4/14/2022	-3.2	+53.8
MW-N1I[2]	73	Intermediate	50	-20	50	Not constructed yet.			
MW-N2I[2]	19	Intermediate	5	-20	5	Not constructed yet.			
MW-N3I[2]	14	Intermediate	7	-20	7	Not constructed yet.			
MW-S1I[2]	27	Intermediate	7	-50	7	Not constructed yet.			
MW-S1D[2]	27	Deep	-3	-50	-3	Not constructed yet.			
MW-S2I[2]	18	Intermediate	6	-50	6	Not constructed yet.			
MW-S2D[2]	18	Deep	-4	-50	-4	Not constructed yet.			
Well D	43	Deep	-2	-50	-2	6.11	4/19/2022	+8.11	+56.11
Mt. Eden Park	24	Deep	-17	-50	-17	-8.29	4/19/2022	+8.71	+41.71

[1] Estimated reference point elevation and groundwater elevations (GWEL) are expressed in feet above mean sea level (msl).
[2] Proposed RMS well

6. REFERENCES

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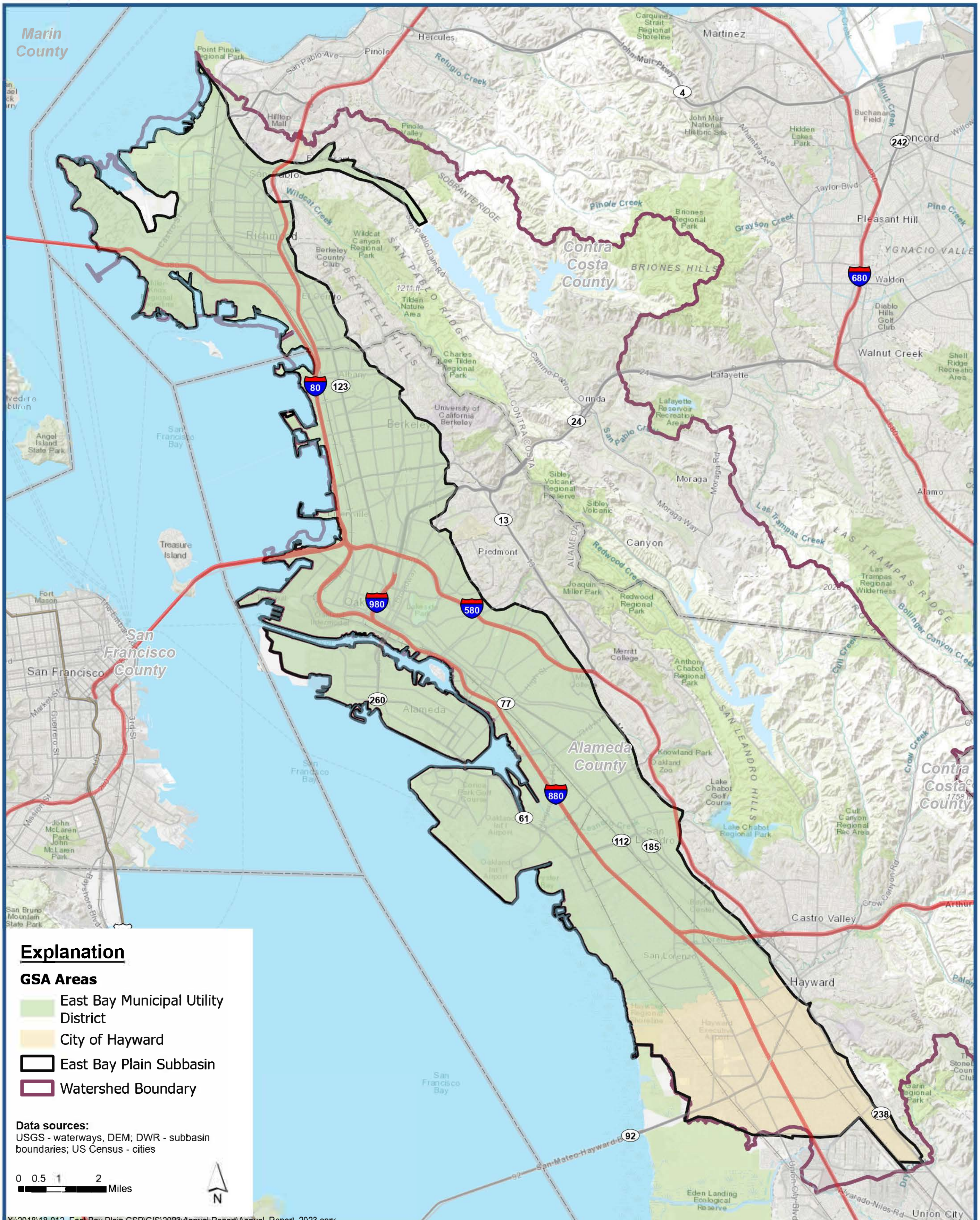
FIGURES



Map of East Bay Plain Subbasin GSP Groundwater Sustainability Agencies

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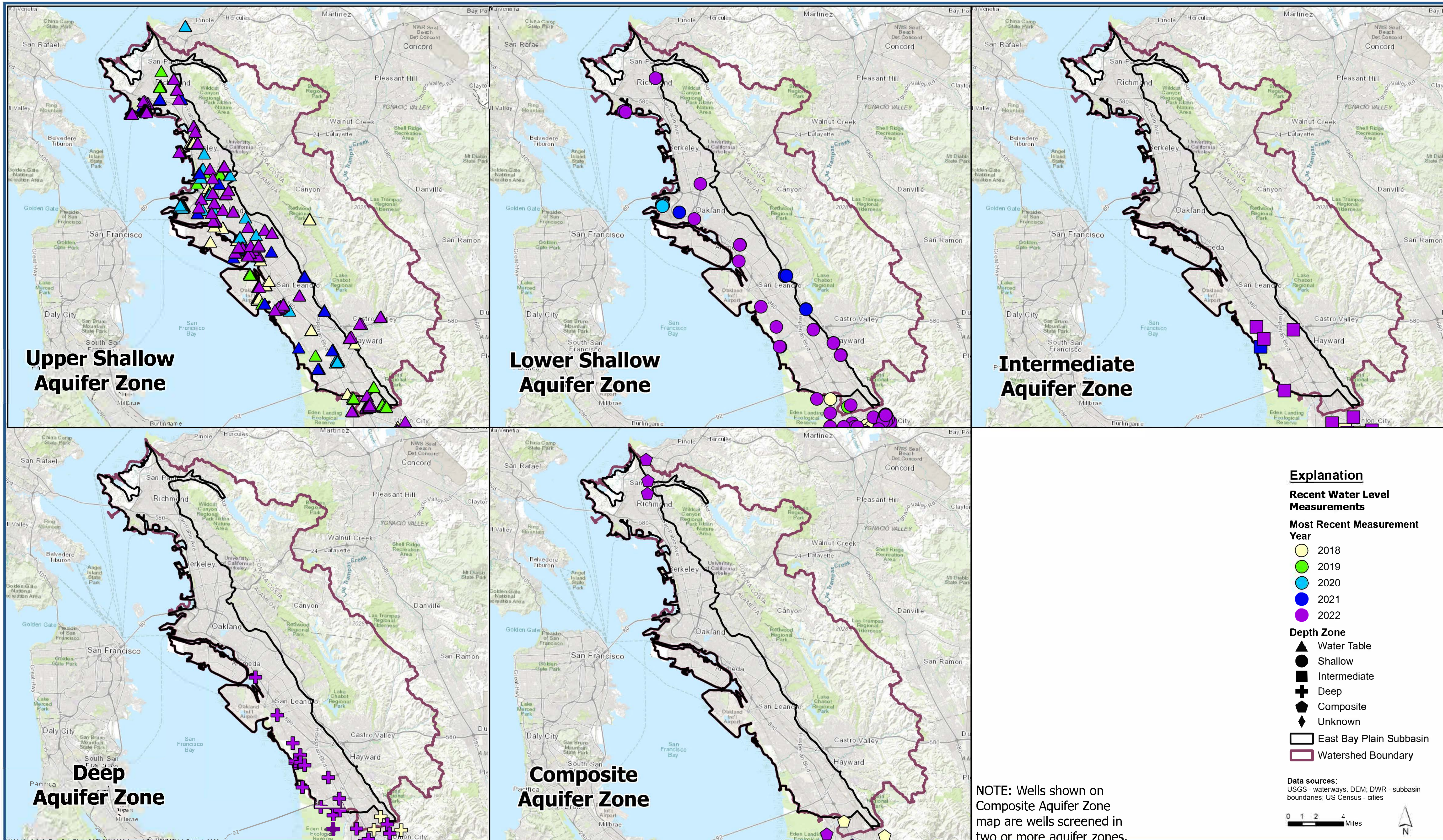
Figure ES-1



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Most Recent Groundwater Level Measurement by Well

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Figure 2-1

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Groundwater Levels Sustainable Indicator Wells

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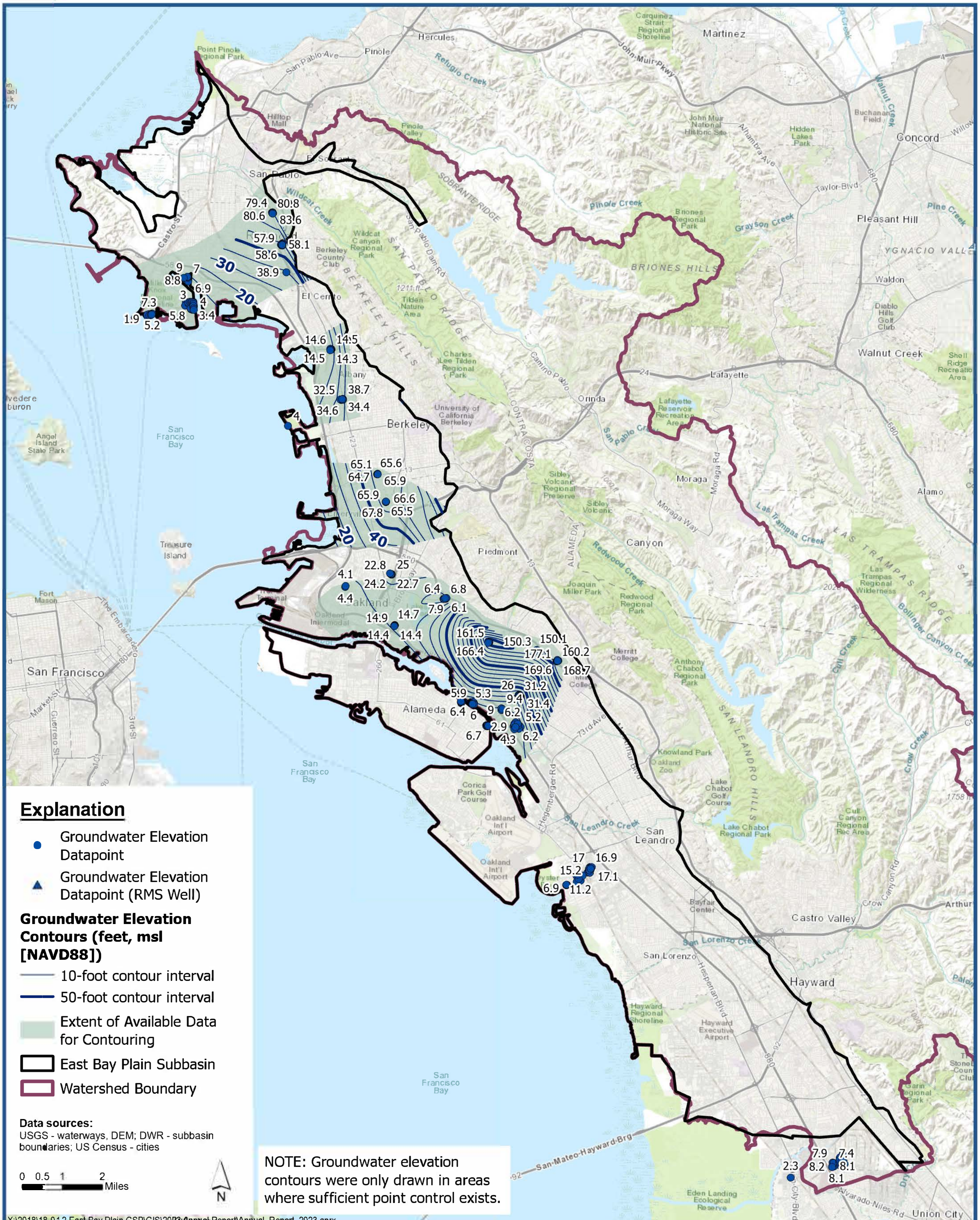
Figure 2-2



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Contours of Equal Groundwater Elevation: Upper Shallow Aquifer Zone - Spring 2022

Figure 2-3

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Contours of Equal Groundwater Elevation: Upper Shallow Aquifer Zone - Fall 2022

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Figure 2-4

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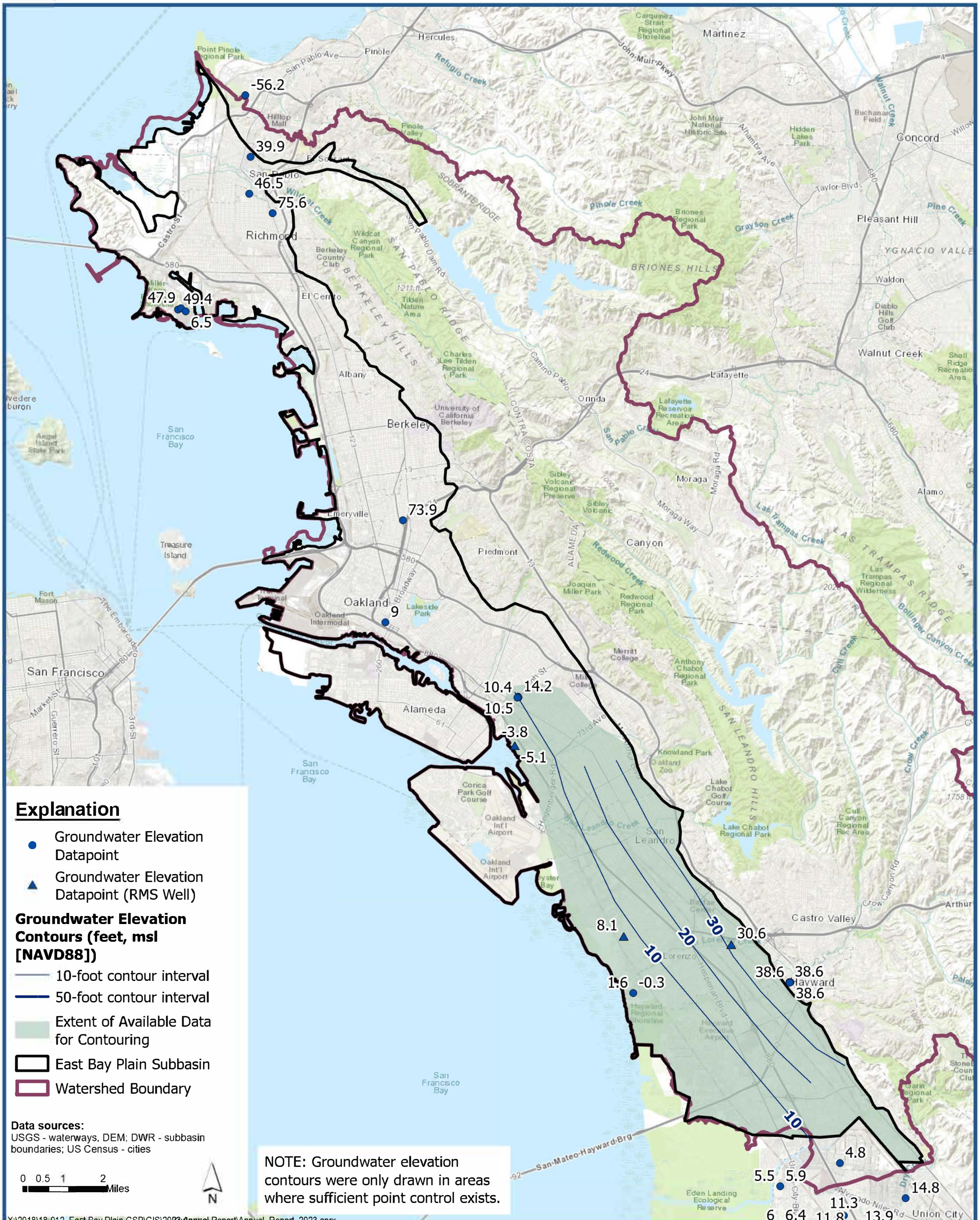

Contours of Equal Groundwater Elevation: Lower Shallow Aquifer Zone - Spring 2022

Figure 2-5

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Contours of Equal Groundwater Elevation: Lower Shallow Aquifer Zone - Fall 2022

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Figure 2-6

Contours of Equal Groundwater Elevation: Intermediate Aquifer Zone - Spring 2022

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Figure 2-7

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Contours of Equal Groundwater Elevation: Intermediate Aquifer Zone - Fall 2022

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Figure 2-8

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Contours of Equal Groundwater Elevation: Deep Aquifer Zone - Spring 2022

Figure 2-9

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Contours of Equal Groundwater Elevation: Deep Aquifer Zone - Fall 2022

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Figure 2-10

East Bay Plain Subbasin
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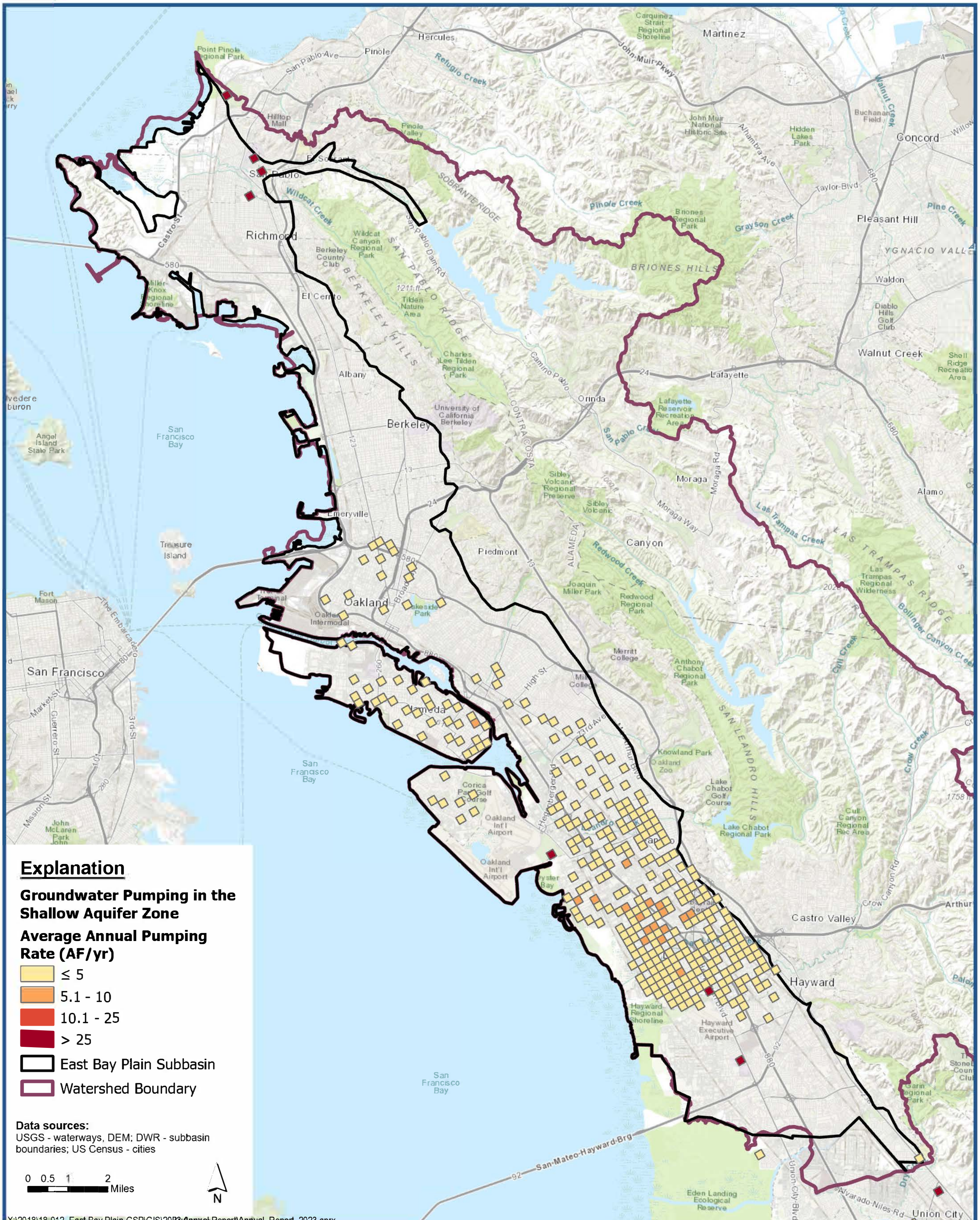

Groundwater Extractions from the Shallow Aquifer Zone for Water Year 2022

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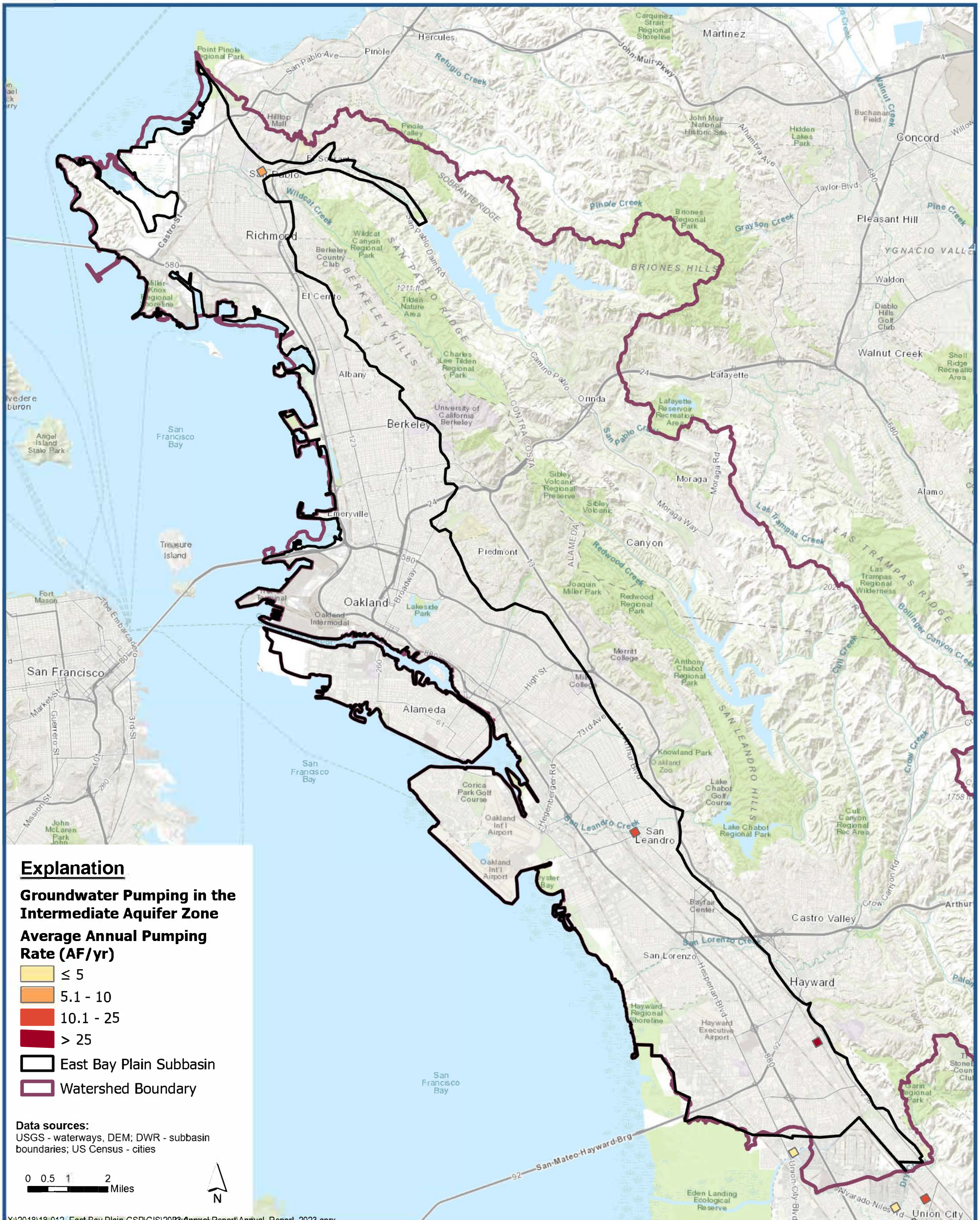
Figure 3-1



Groundwater Extractions from the Intermediate Aquifer Zone for Water Year 2022

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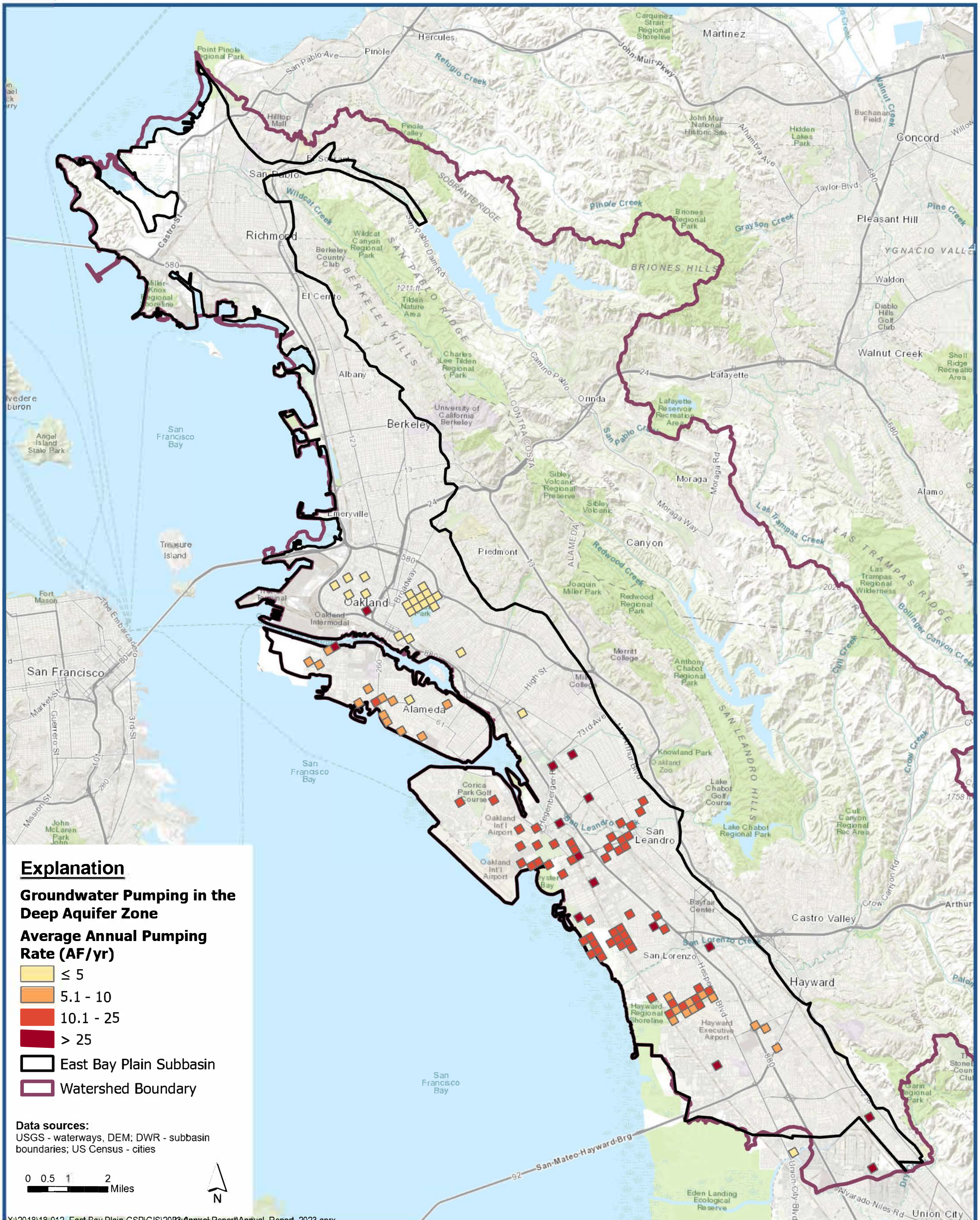
Figure 3-2



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Groundwater Extractions from the Deep Aquifer Zone for Water Year 2022

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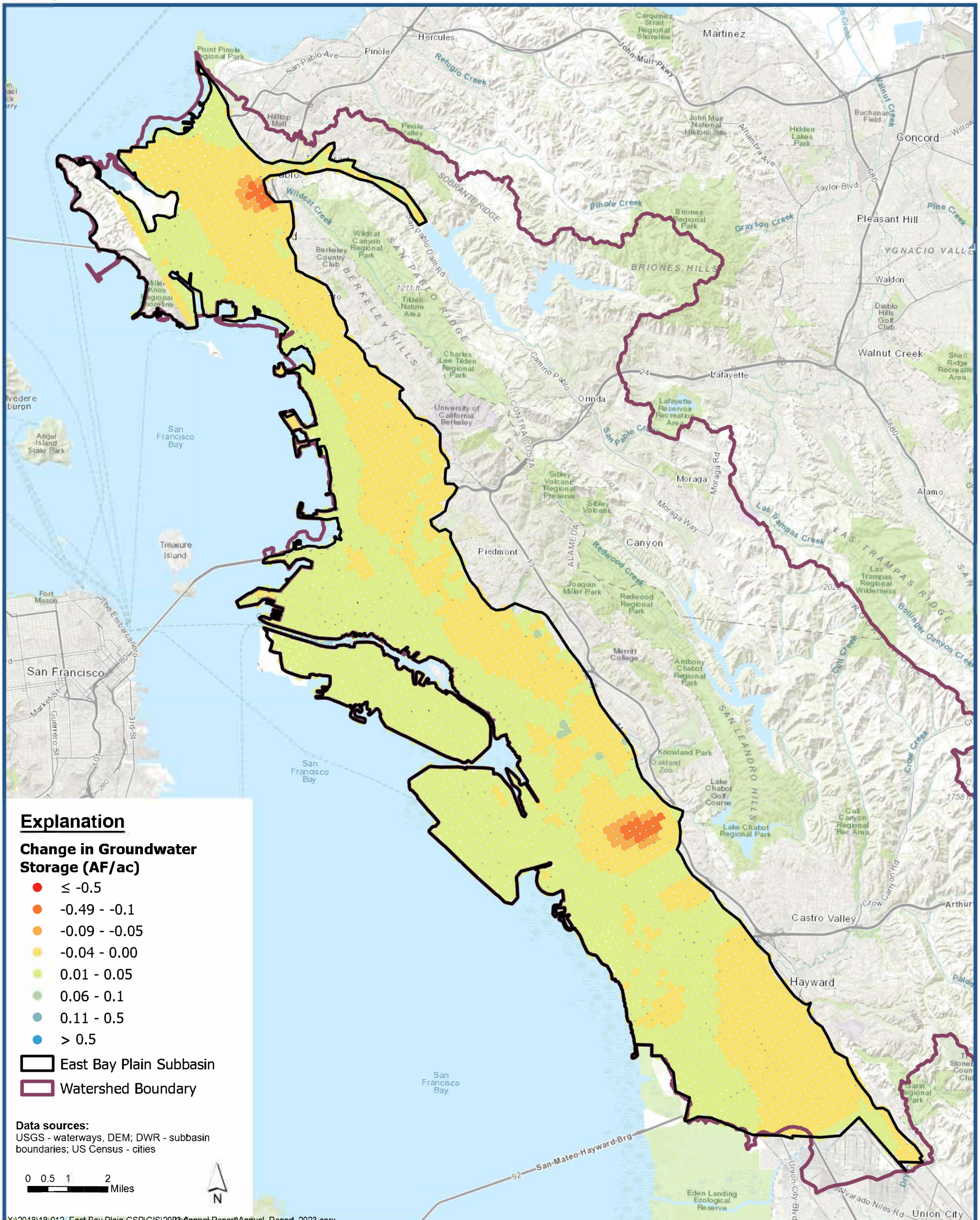
Figure 3-3



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Change in Groundwater Storage in the Upper Shallow Aquifer Zone – Spring 2021 to Spring 2022

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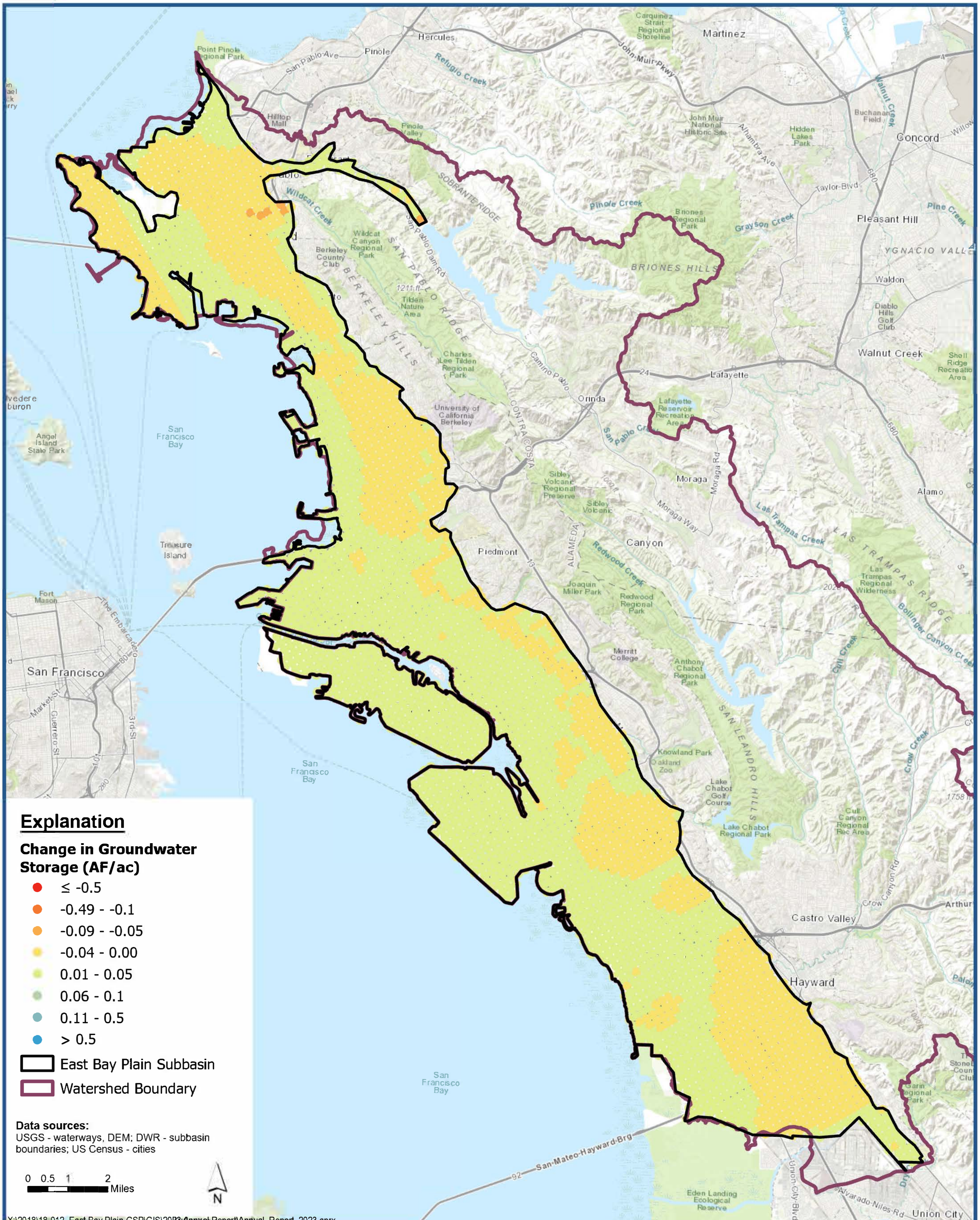
Figure 4-1



Change in Groundwater Storage in the Lower Shallow Aquifer Zone – Spring 2021 to Spring 2022

Figure 4-2

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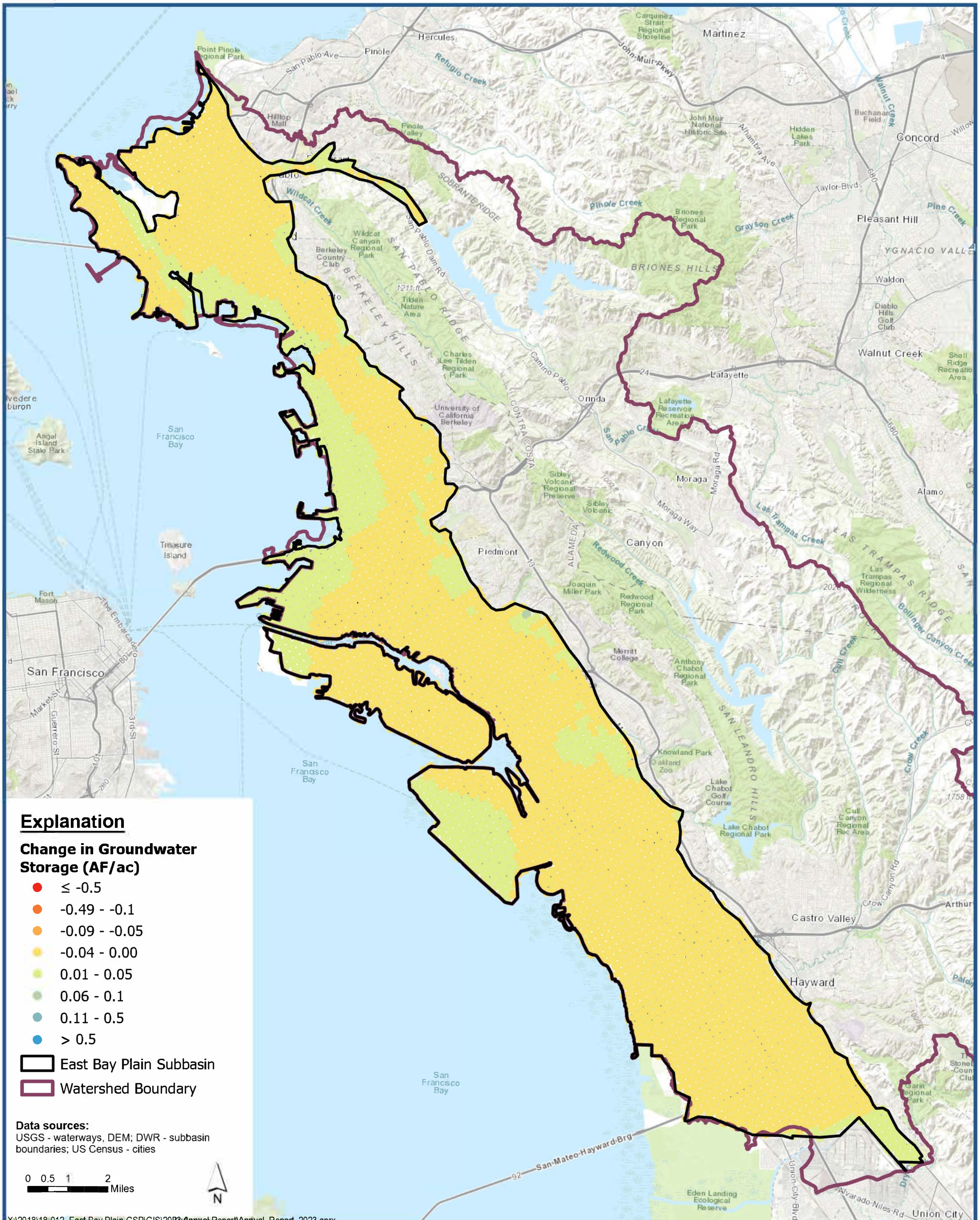

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Change in Groundwater Storage in the Intermediate Aquifer Zone – Spring 2021 to Spring 2022

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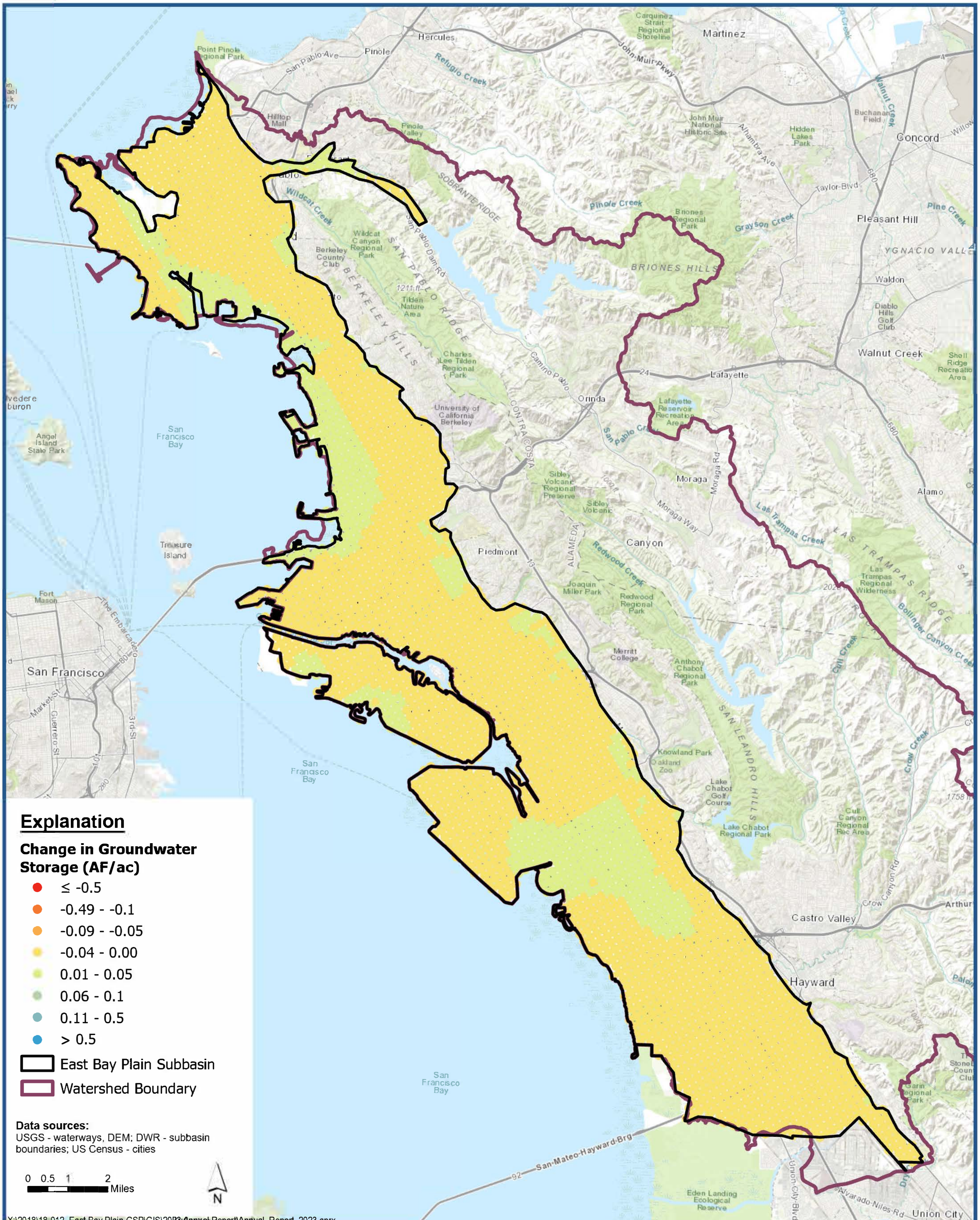
Figure 4-3



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Change in Groundwater Storage in the Deep Aquifer Zone – Spring 2021 to Spring 2022

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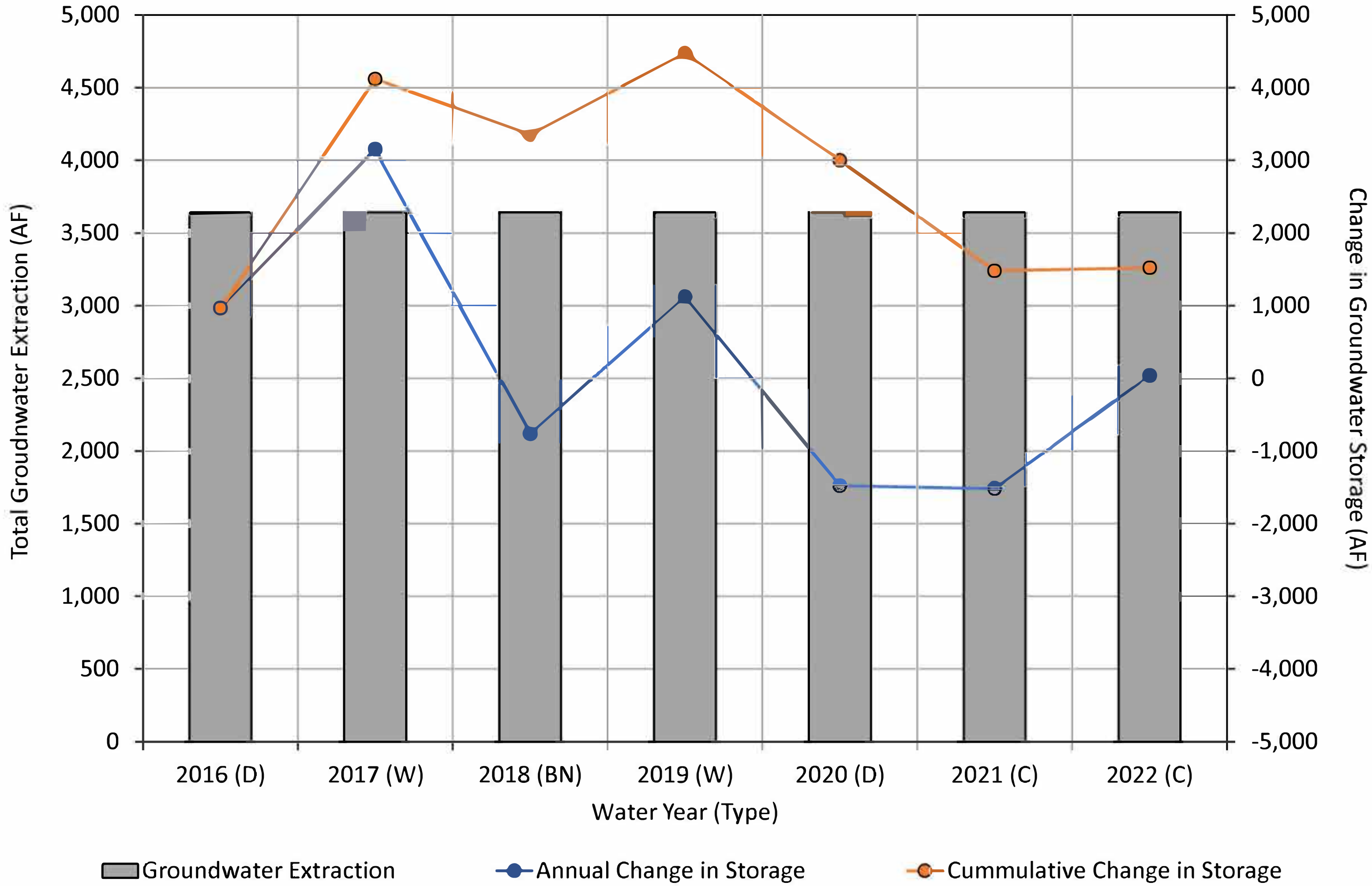
Figure 4-4



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. (W - Wet; AN - Above Normal; BN - Below Normal; D - Dry; C - Critical)

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Groundwater Storage Changes and Annual Extractions

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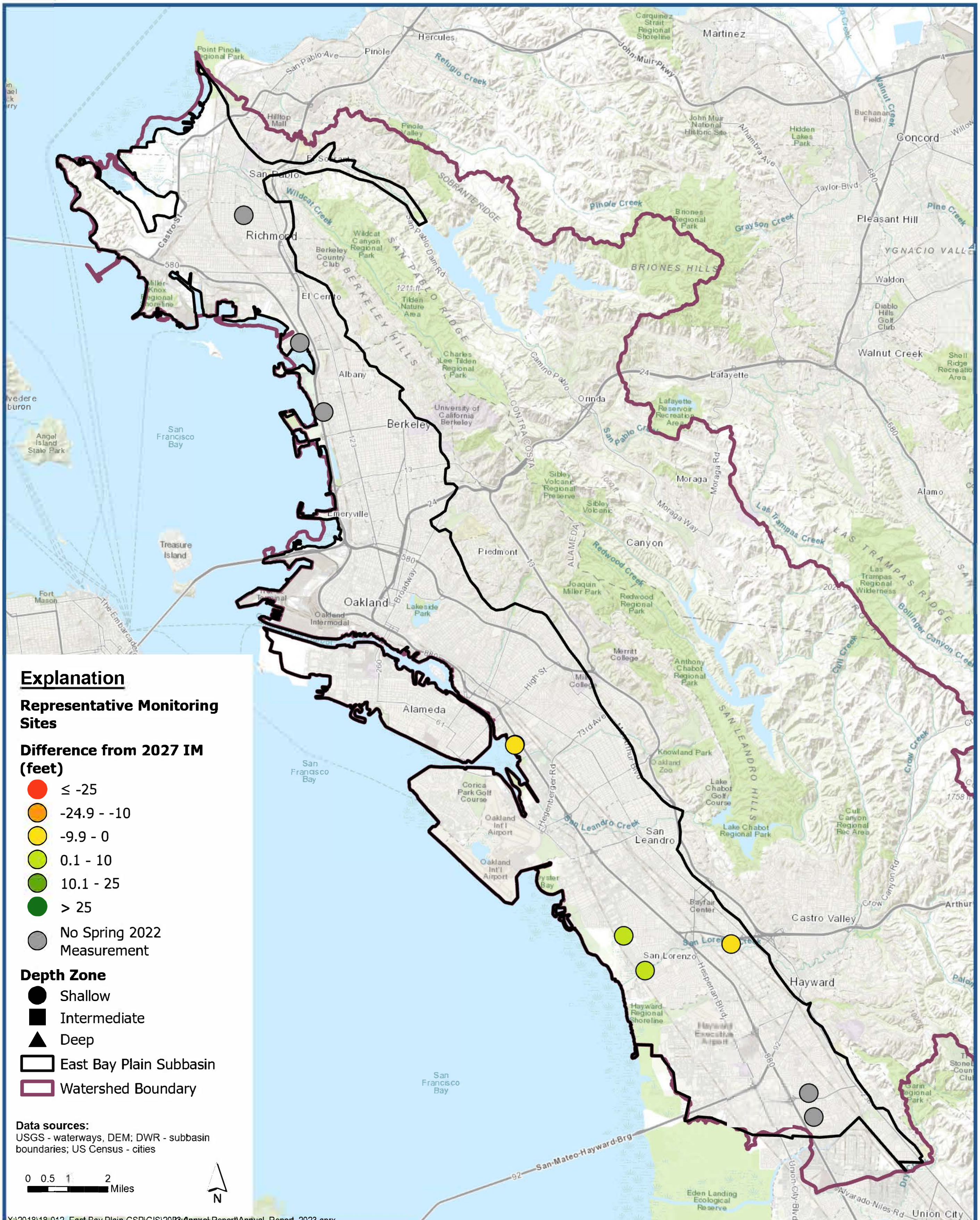
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure 4-5



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Spring 2022 Water Level Measurements at RMS Wells compared to 2027 Interim Milestone - Shallow Aquifer

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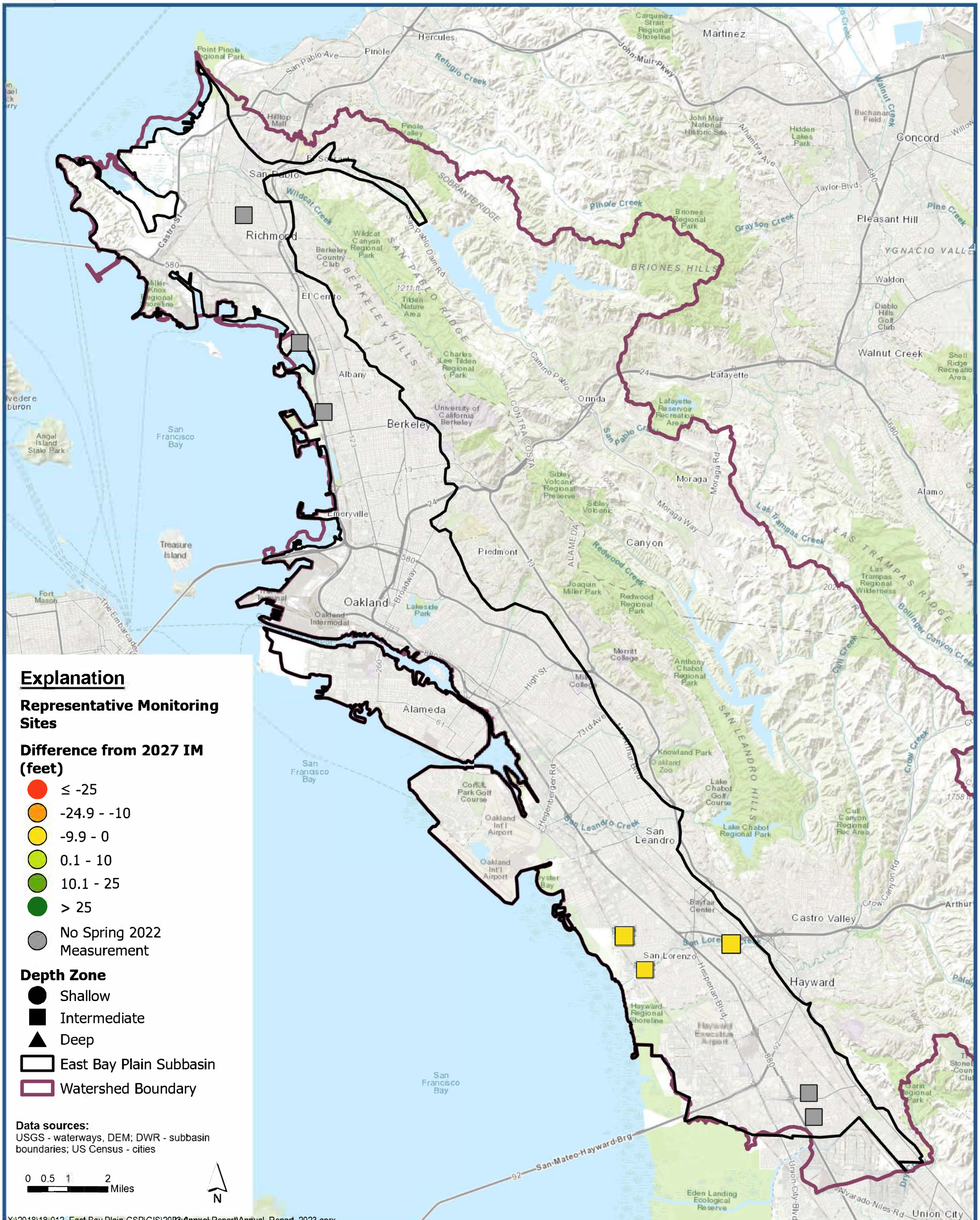
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure 5-1a



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Spring 2022 Water Level Measurements at RMS Wells compared to 2027 Interim Milestone - Intermediate Aquifer

Figure 5-1b

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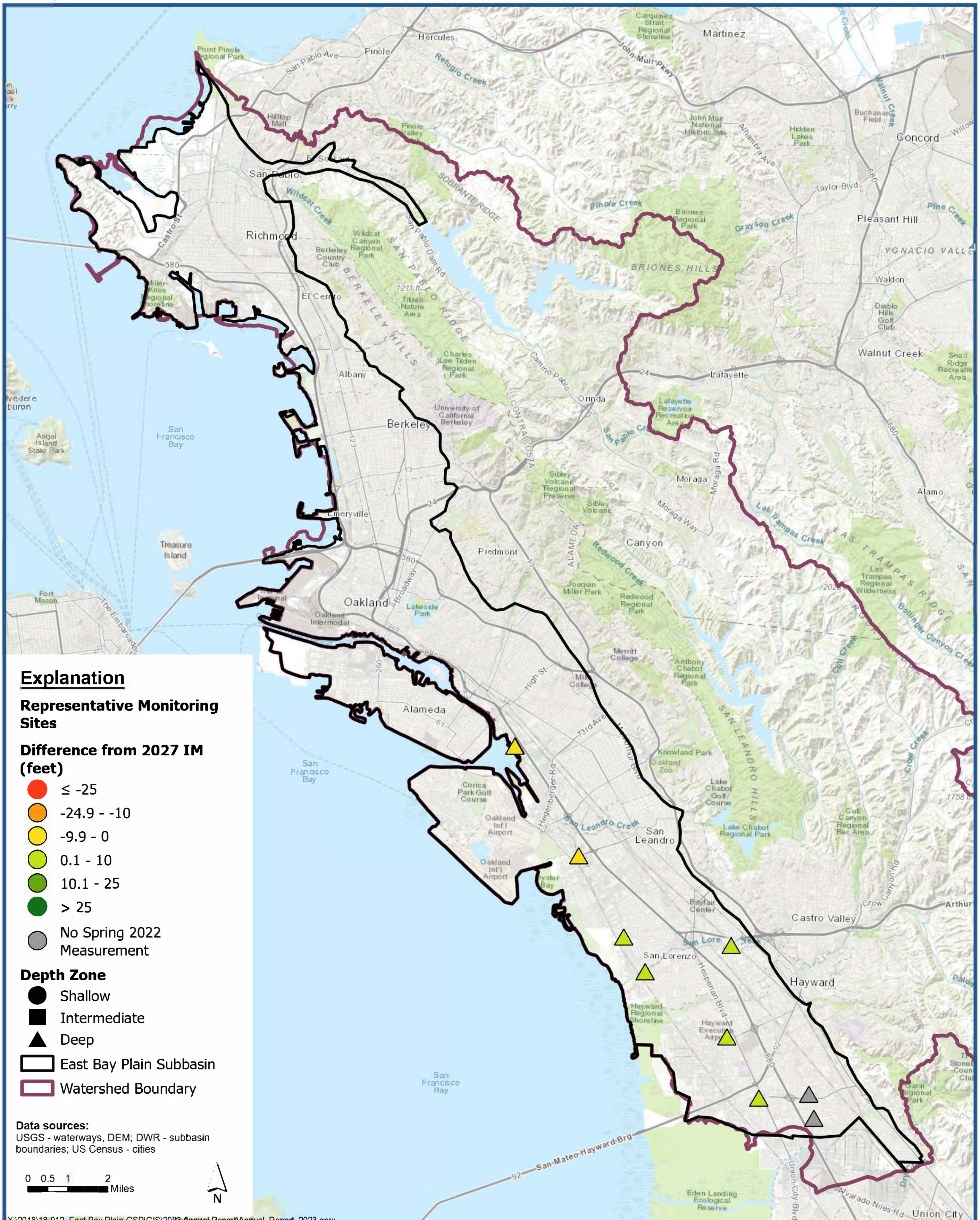

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Spring 2022 Water Level Measurements at RMS Wells compared to 2027 Interim Milestone - Deep Aquifer

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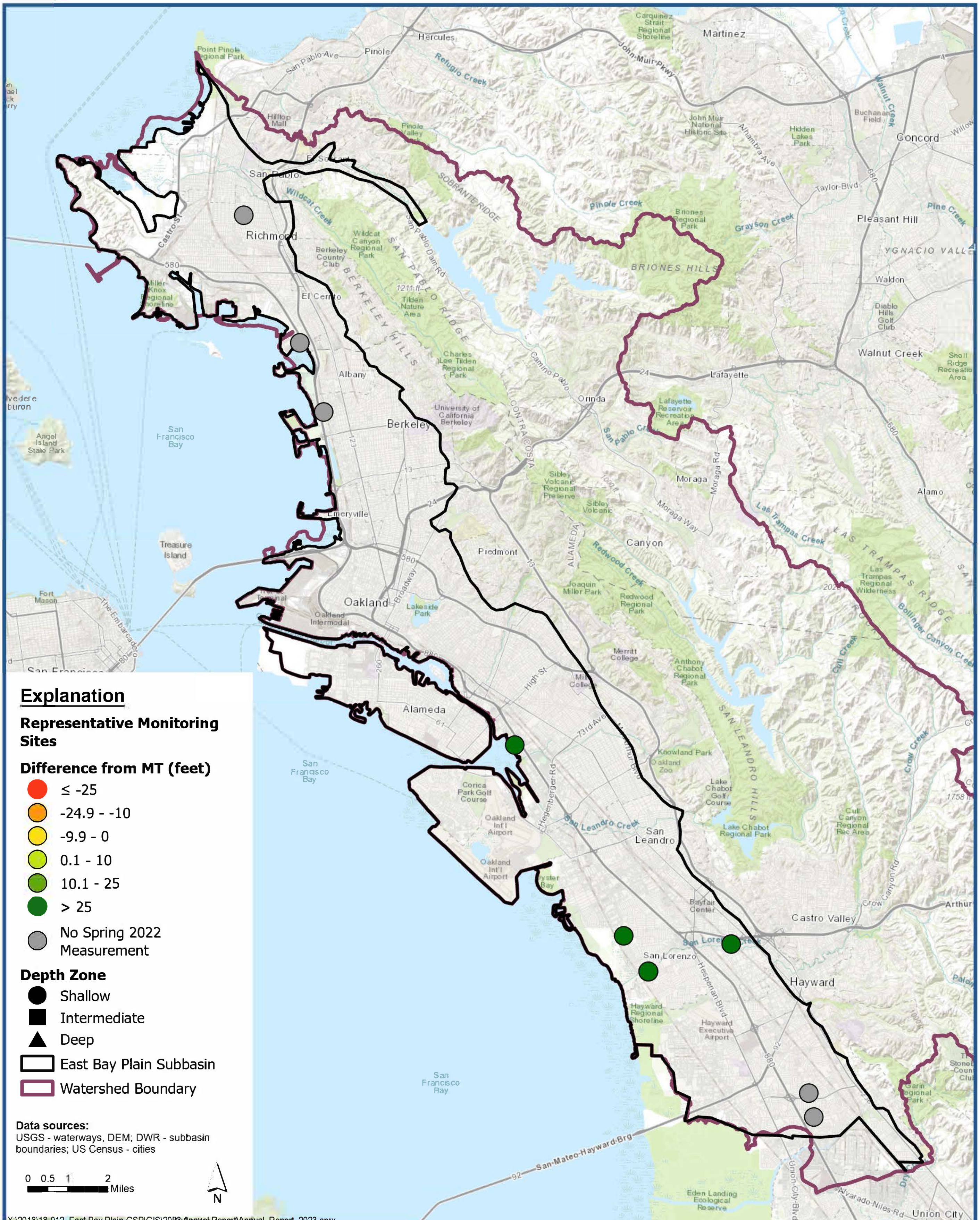
Figure 5-1c



Spring 2022 Water Level Measurements at RMS Wells compared to Minimum Threshold - Shallow Aquifer

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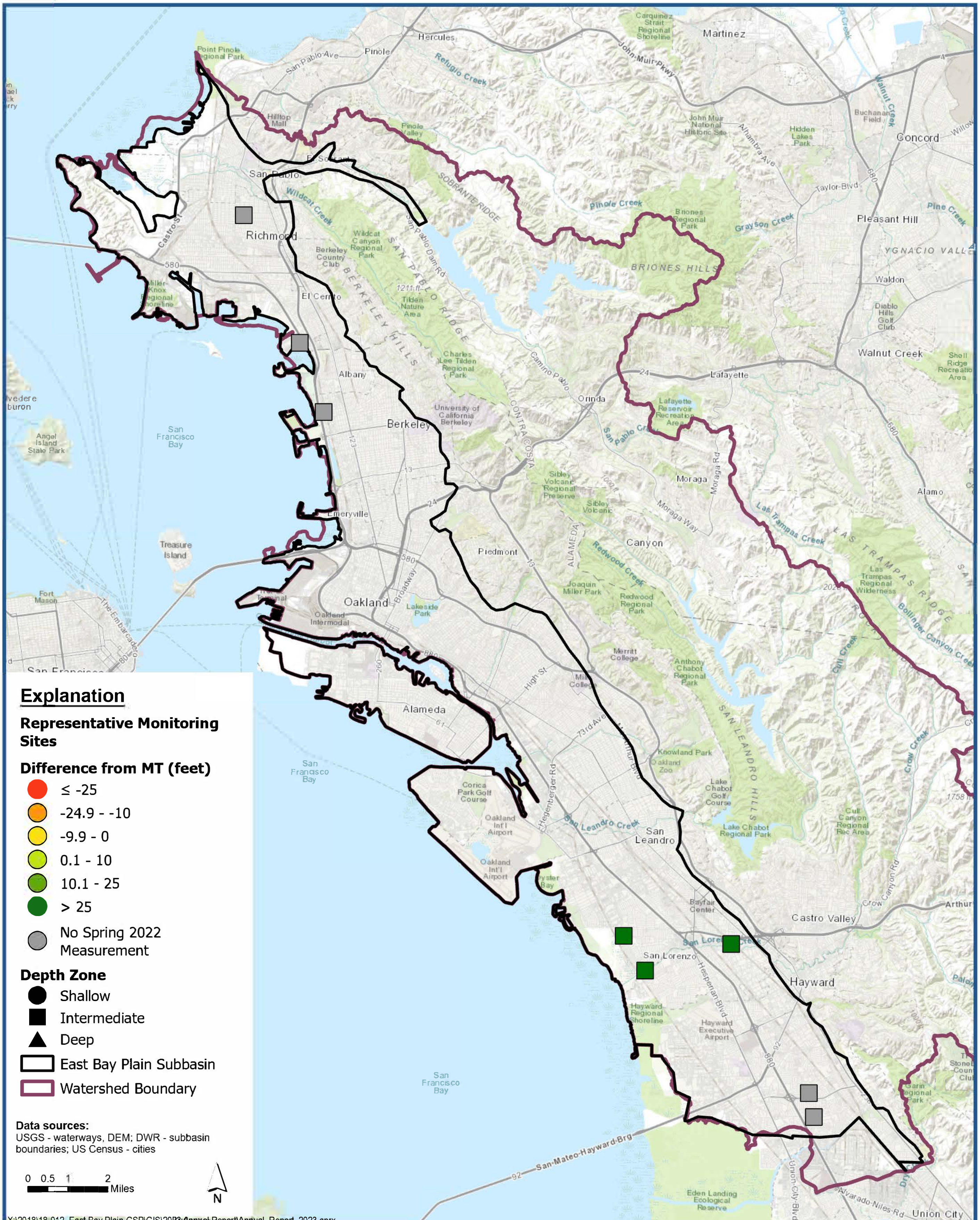
Figure 5-2a



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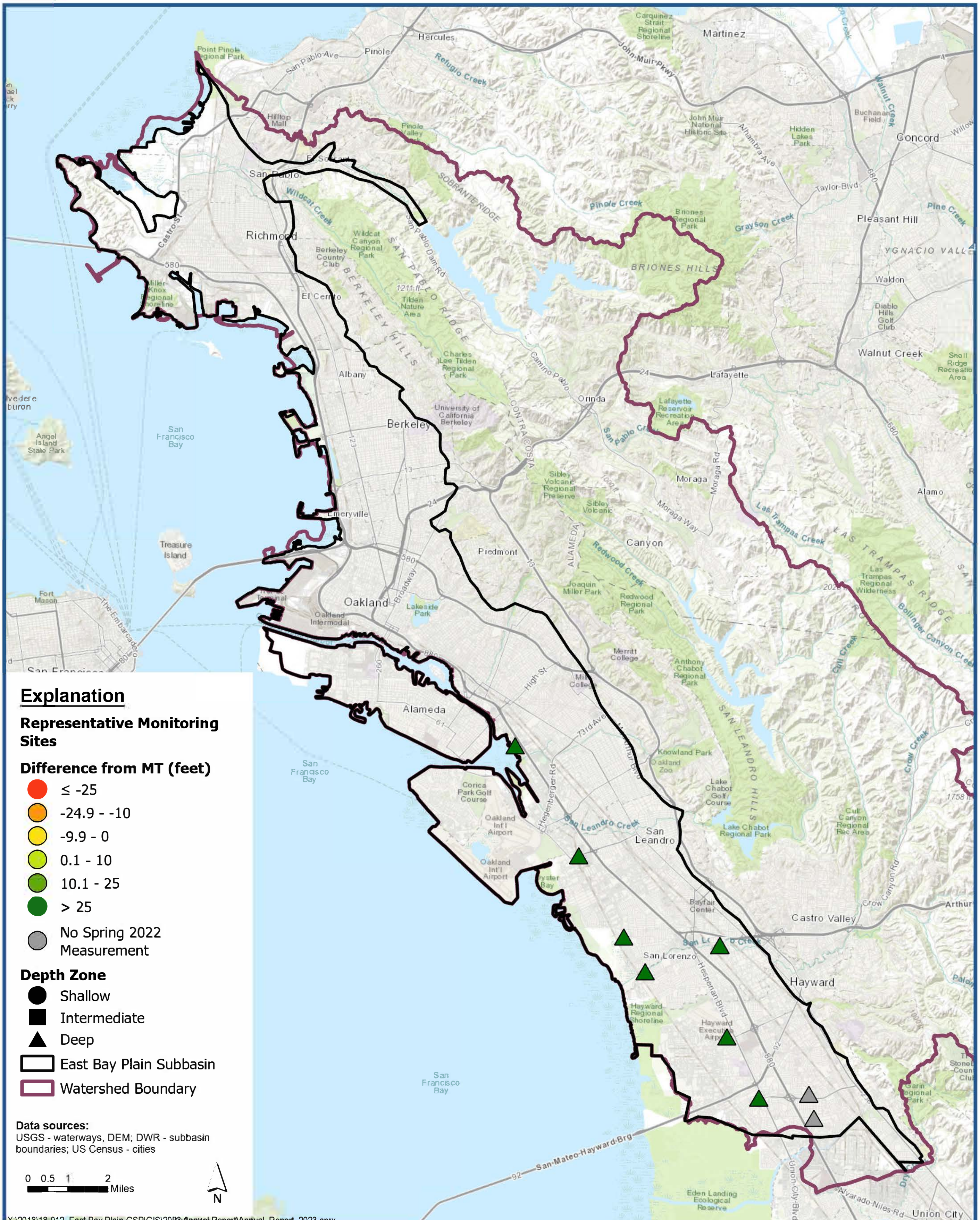
Spring 2022 Water Level Measurements at RMS Wells compared to Minimum Threshold - Intermediate Aquifer

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure 5-2b



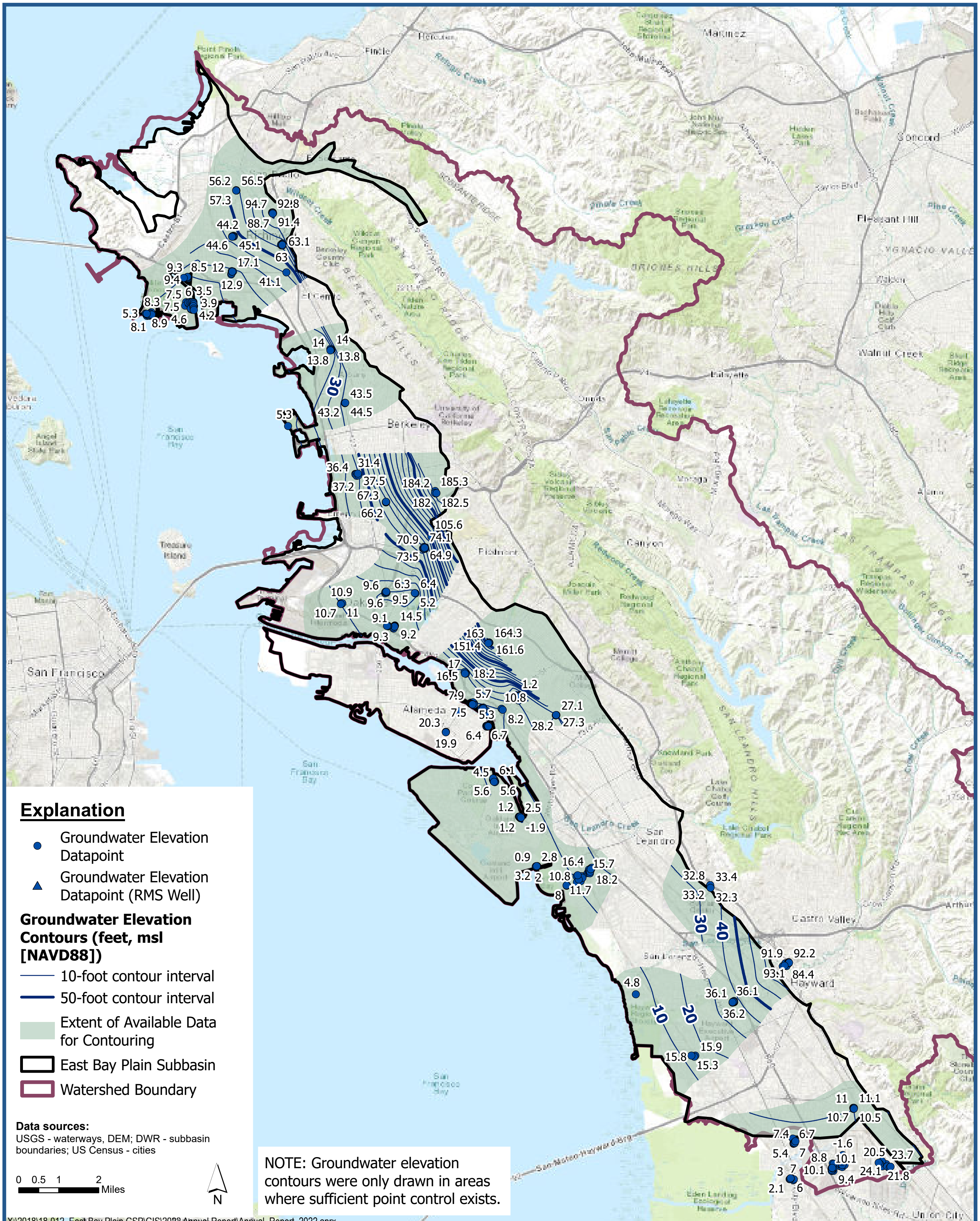
Spring 2022 Water Level Measurements at RMS Wells compared to Minimum Threshold - Deep Aquifer

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure 5-2c

APPENDIX A

Groundwater Elevation Contour Maps of Different Aquifer Zones for 2019, 2020 and 2021



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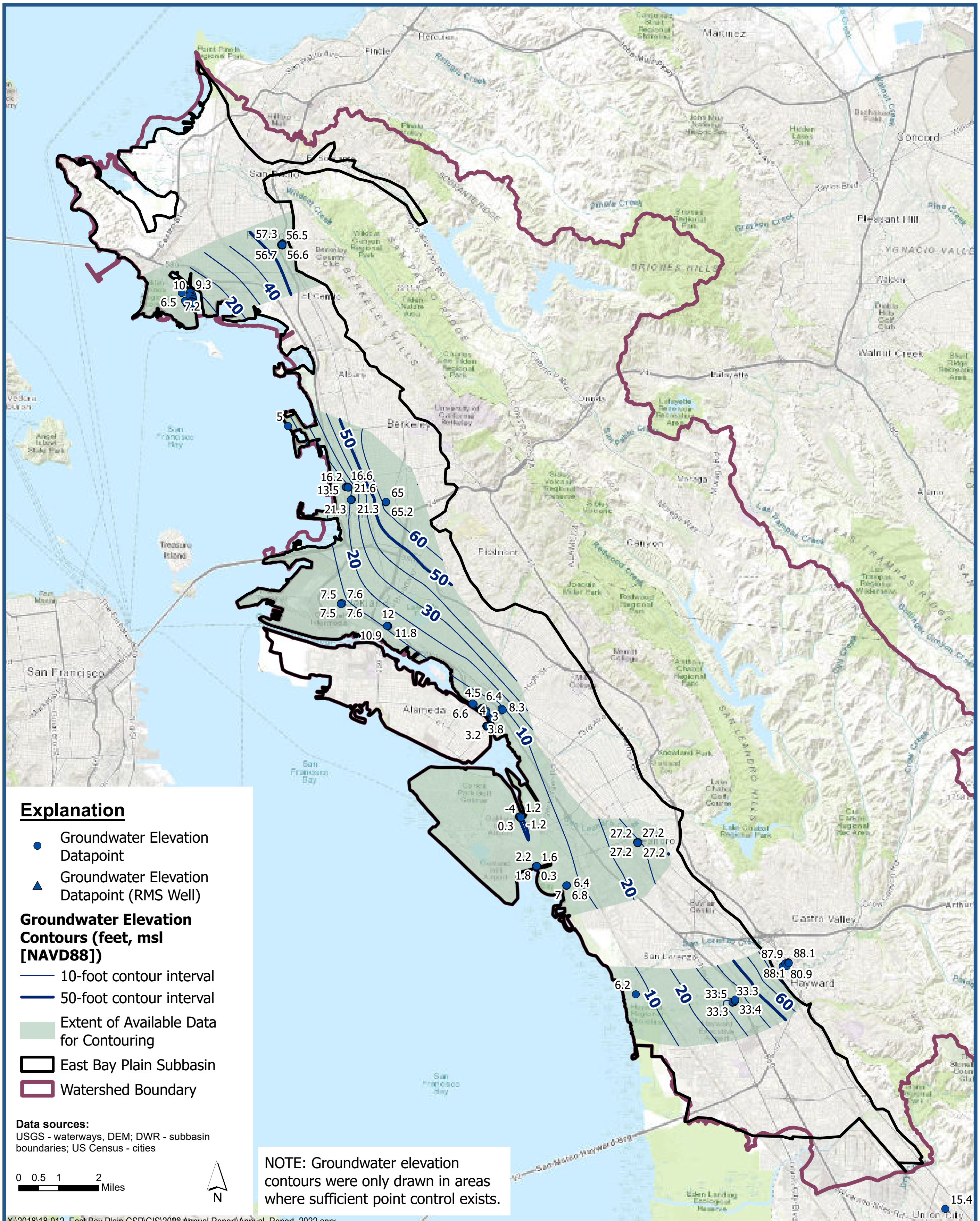
Contours of Equal Groundwater Elevation: Upper Shallow Aquifer Zone - Spring 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-1

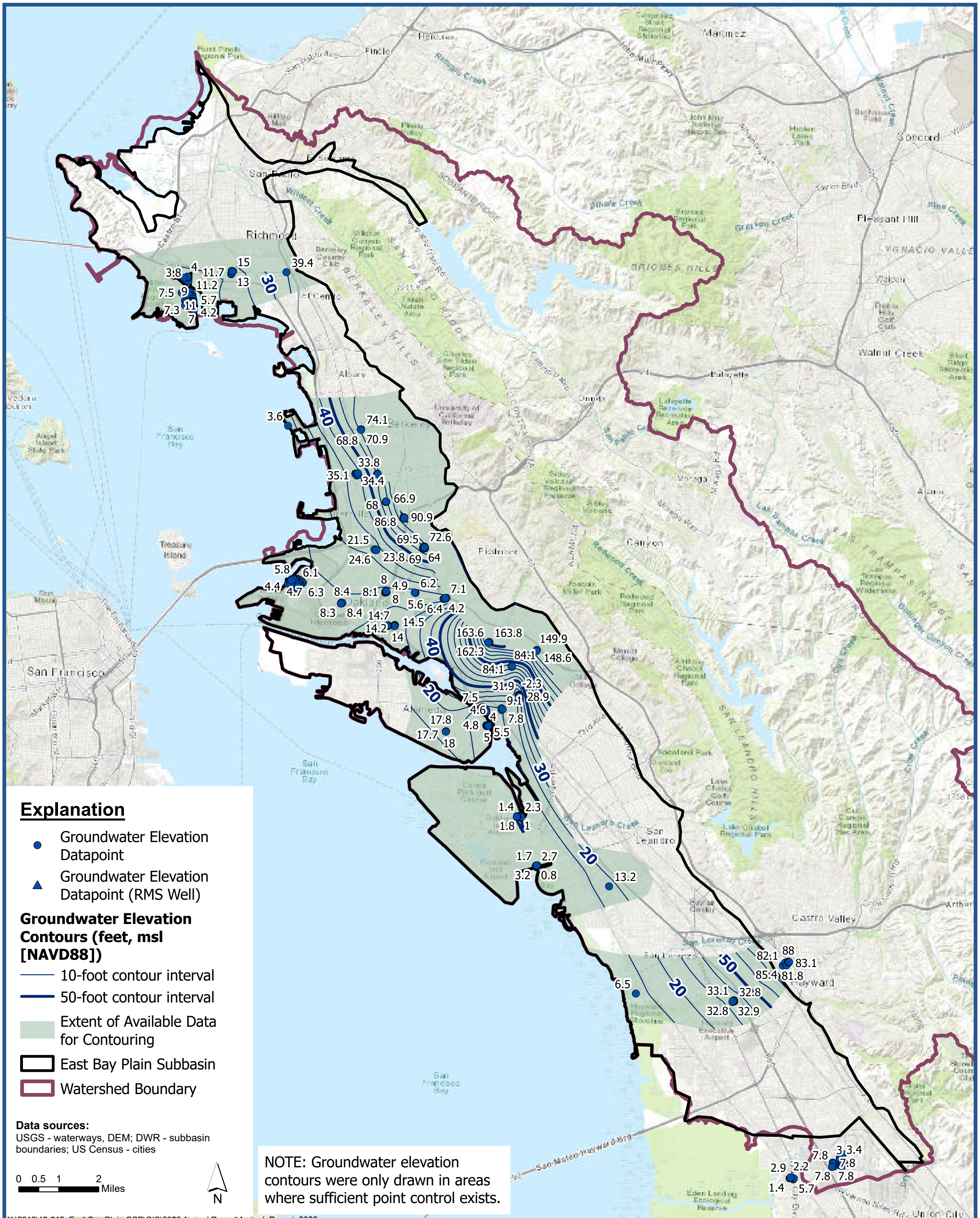


LSCE TEAM

Contours of Equal Groundwater Elevation: Upper Shallow Aquifer Zone - Fall 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-2

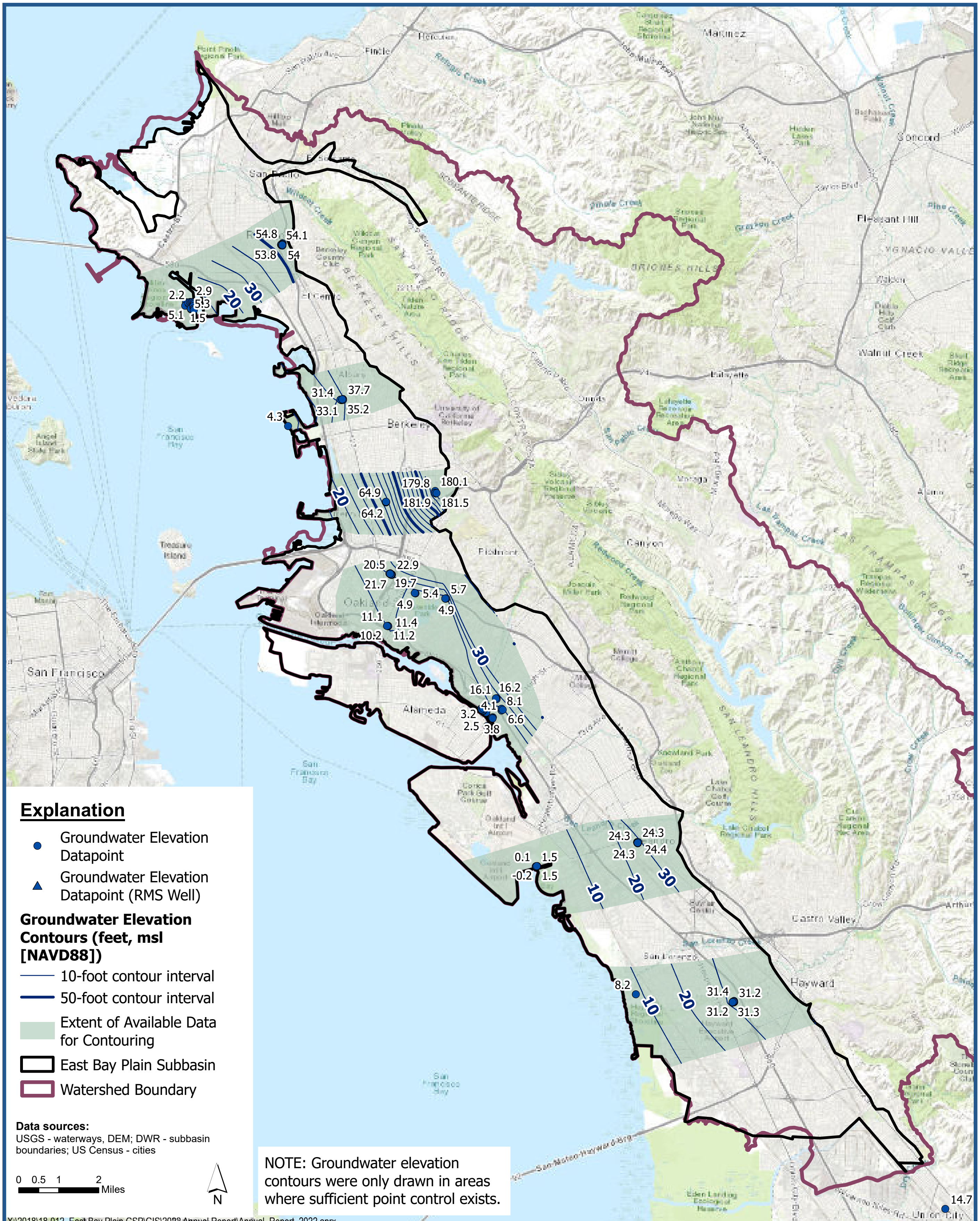


LSCE TEAM

Contours of Equal Groundwater Elevation: Upper Shallow Aquifer Zone - Spring 2020

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

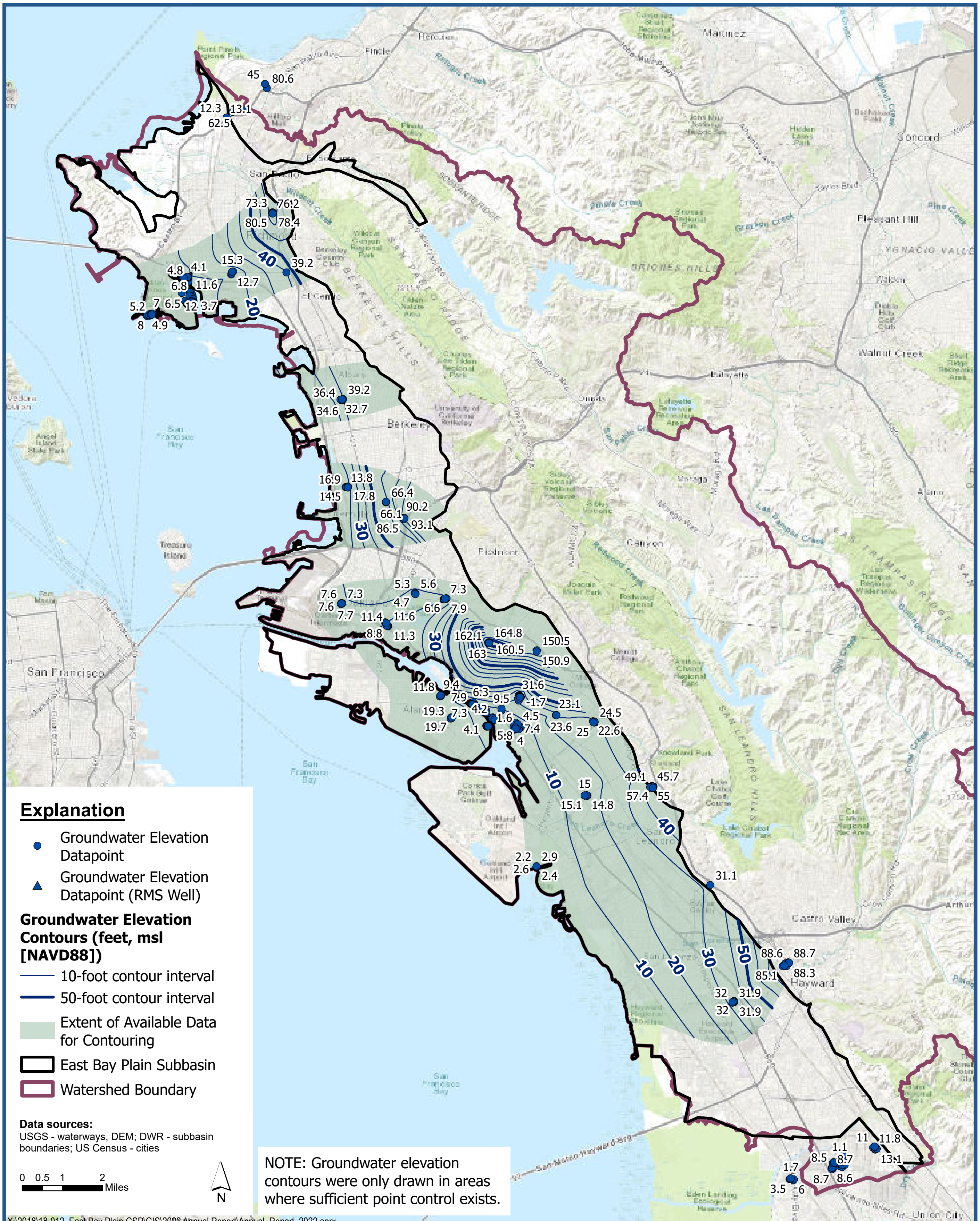
Figure A-3



Contours of Equal Groundwater Elevation: Upper Shallow Aquifer Zone - Fall 2020

Figure A-4

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report



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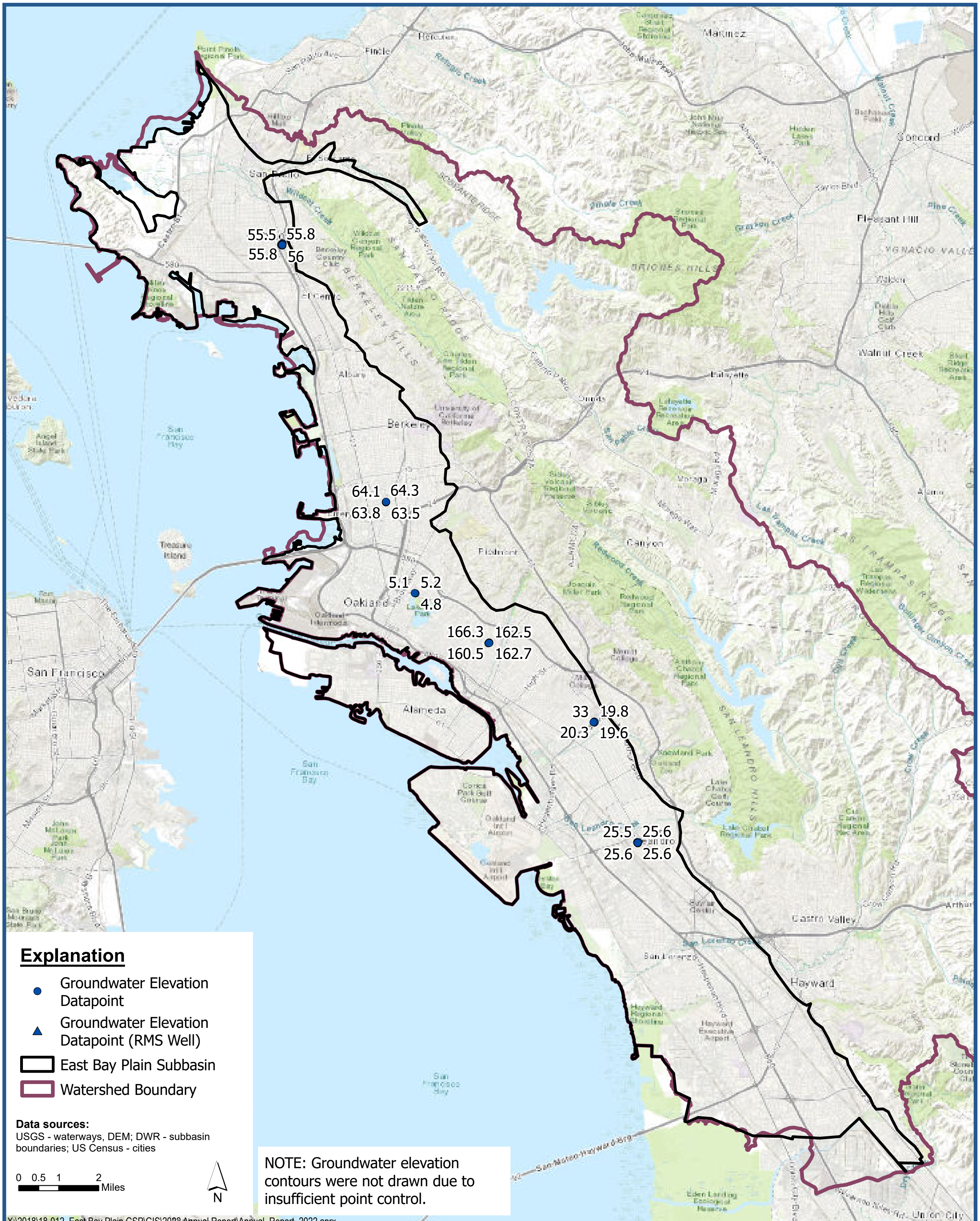
Contours of Equal Groundwater Elevation: Upper Shallow Aquifer Zone - Spring 2021

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-5



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Contours of Equal Groundwater Elevation: Upper Shallow Aquifer Zone - Fall 2021

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

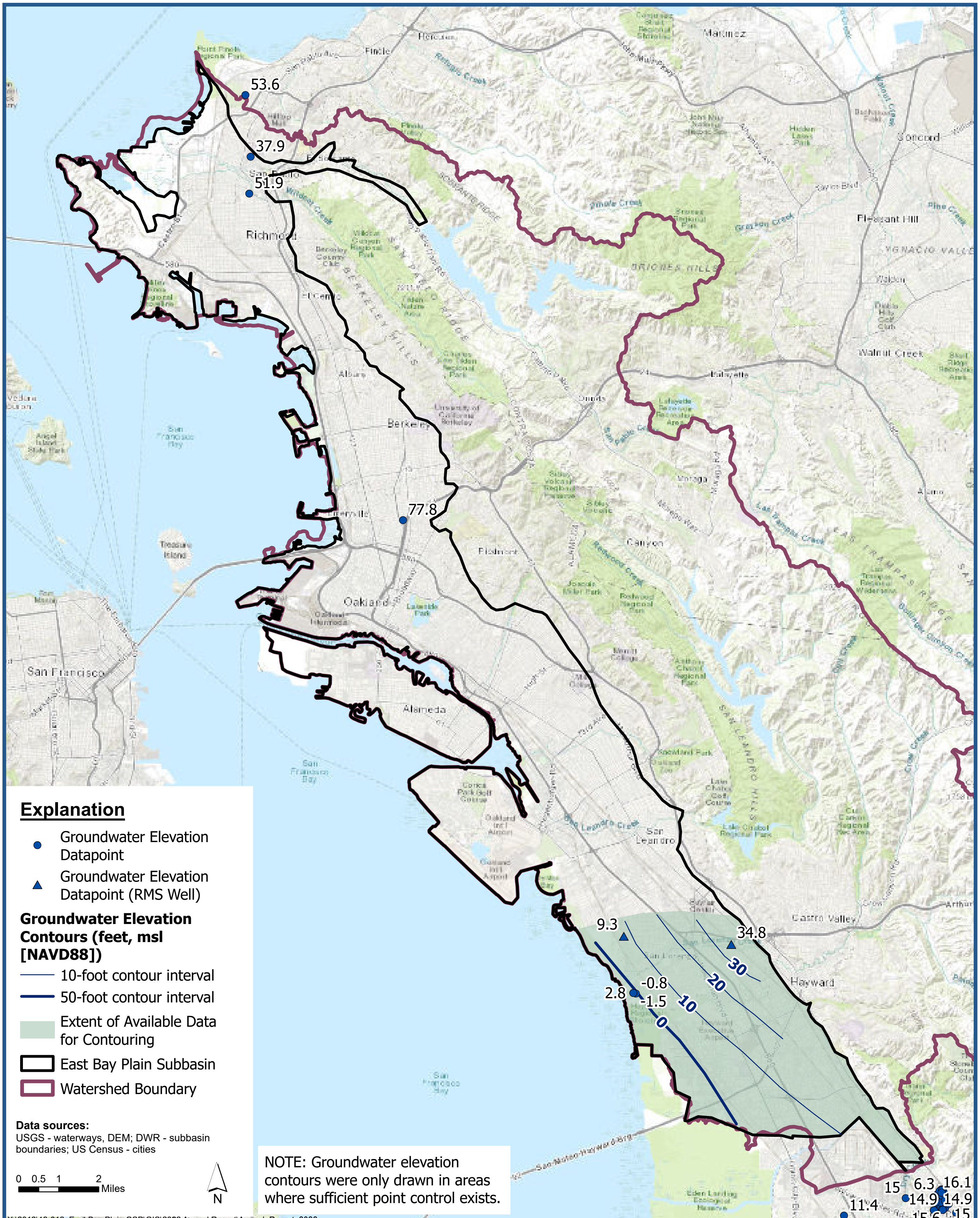
Figure A-6

LSCE TEAM

Contours of Equal Groundwater Elevation:
Lower Shallow Aquifer Zone - Spring 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-7



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Contours of Equal Groundwater Elevation: Lower Shallow Aquifer Zone - Fall 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-8

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Contours of Equal Groundwater Elevation: Lower Shallow Aquifer Zone - Spring 2020

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-9

Contours of Equal Groundwater Elevation: Lower Shallow Aquifer Zone - Fall 2020

Figure A-10

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

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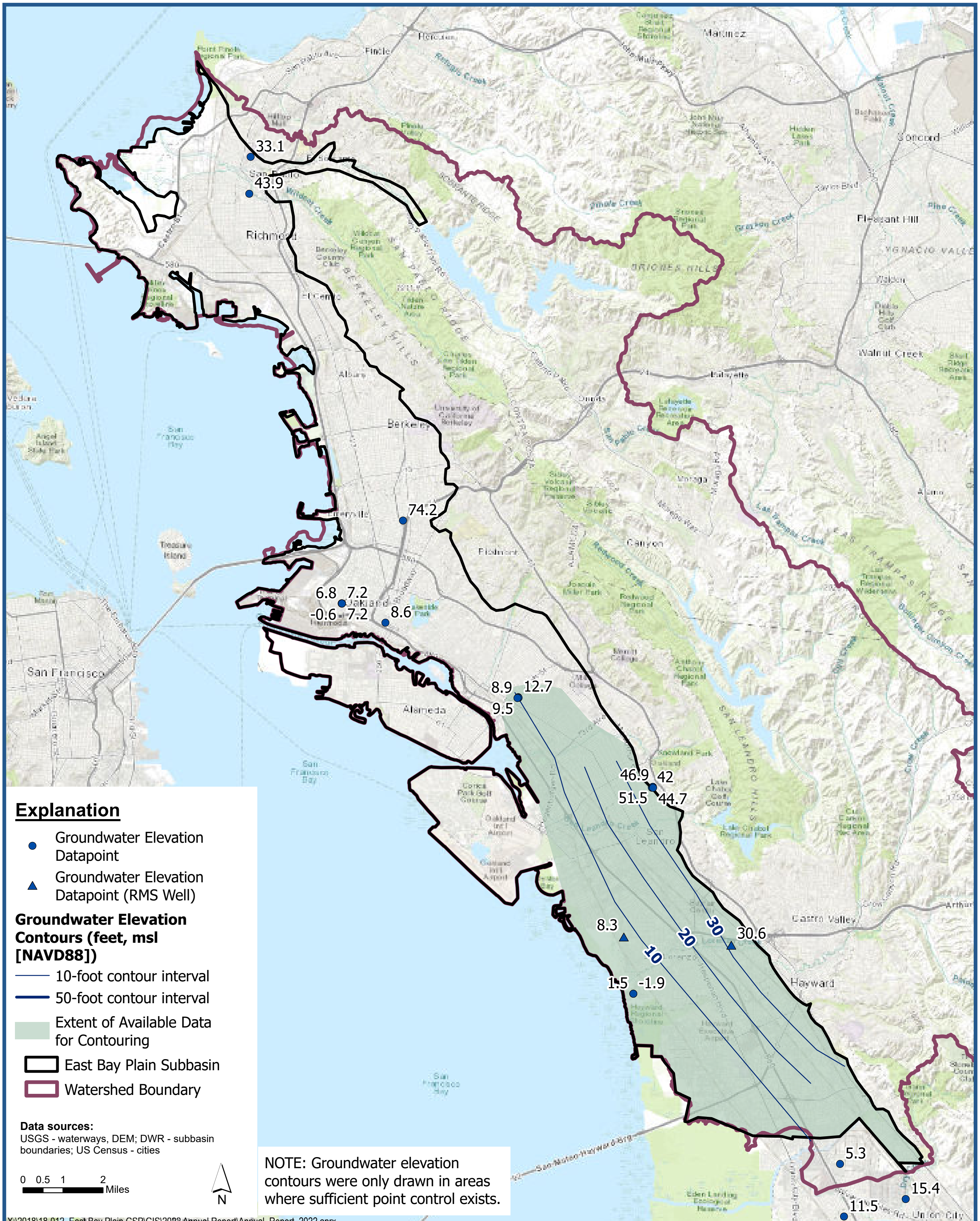

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Contours of Equal Groundwater Elevation: Lower Shallow Aquifer Zone - Spring 2021

Figure A-11

East Bay Plain Subbasin
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Contours of Equal Groundwater Elevation: Lower Shallow Aquifer Zone - Fall 2021

Figure A-12

East Bay Plain Subbasin
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Contours of Equal Groundwater Elevation: Intermediate Aquifer Zone - Spring 2019

Figure A-13

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

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Contours of Equal Groundwater Elevation: Intermediate Aquifer Zone - Fall 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-14

Contours of Equal Groundwater Elevation: Intermediate Aquifer Zone - Spring 2020

East Bay Plain Subbasin
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Figure A-15

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Contours of Equal Groundwater Elevation: Intermediate Aquifer Zone - Fall 2020

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-16

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Contours of Equal Groundwater Elevation: Intermediate Aquifer Zone - Spring 2021

Figure A-17

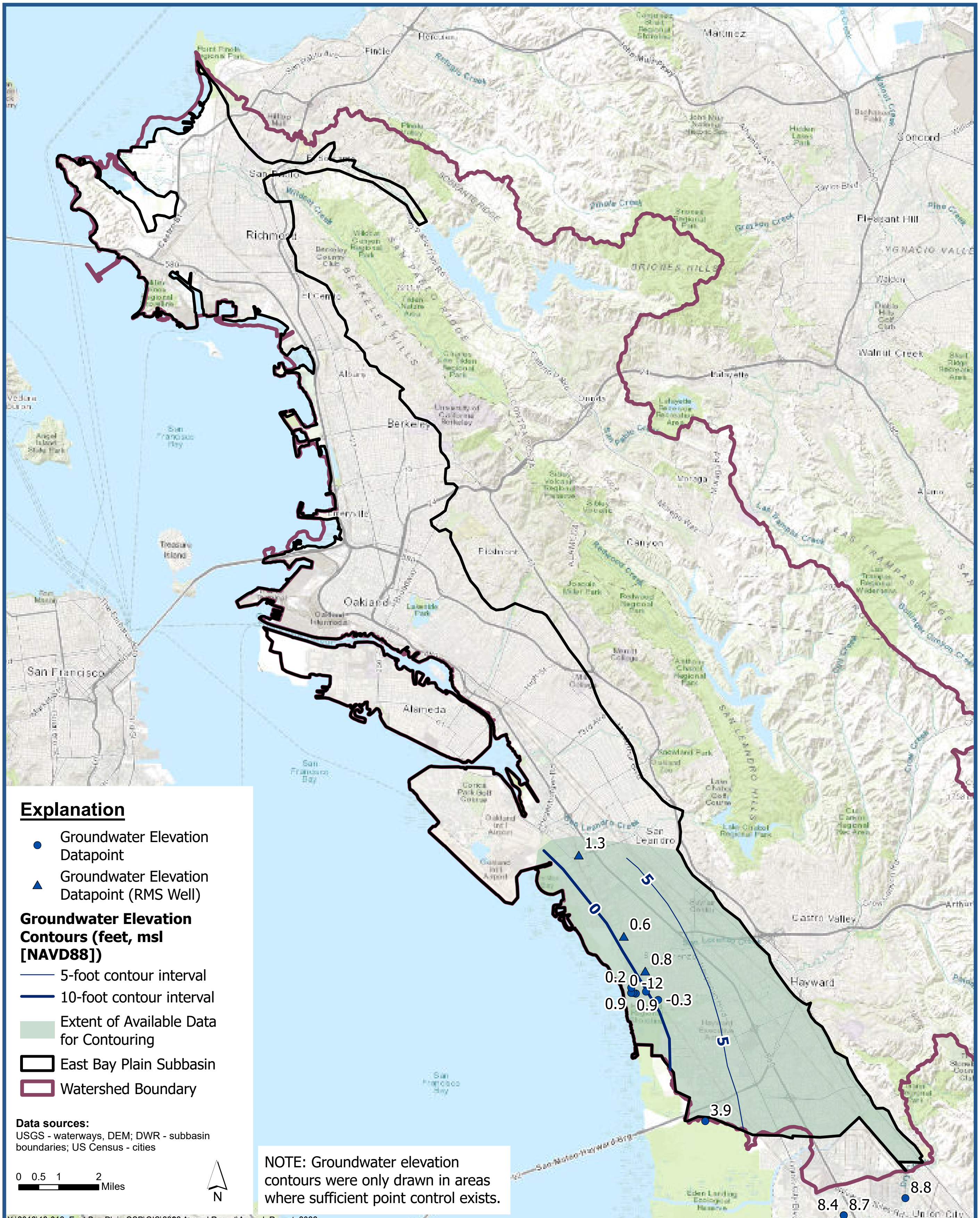
East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

LSCE TEAM

Contours of Equal Groundwater Elevation: Intermediate Aquifer Zone - Fall 2021

Figure A-18

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report



Contours of Equal Groundwater Elevation: Deep Aquifer Zone - Spring 2019

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Figure A-19

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Contours of Equal Groundwater Elevation: Deep Aquifer Zone - Fall 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

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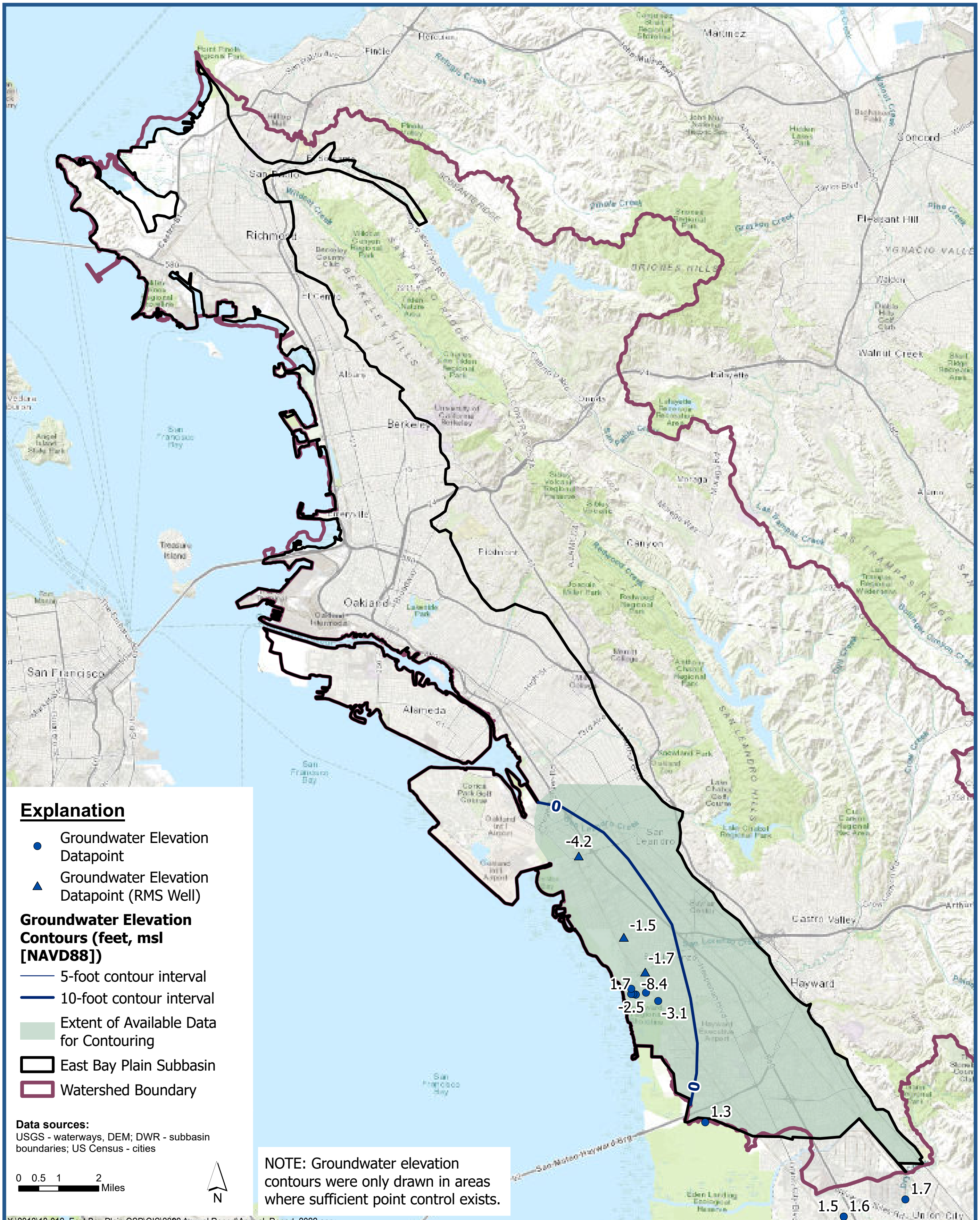
Figure A-20



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Contours of Equal Groundwater Elevation: Deep Aquifer Zone - Spring 2020

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-21

Contours of Equal Groundwater Elevation: Deep Aquifer Zone - Fall 2020

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure A-22

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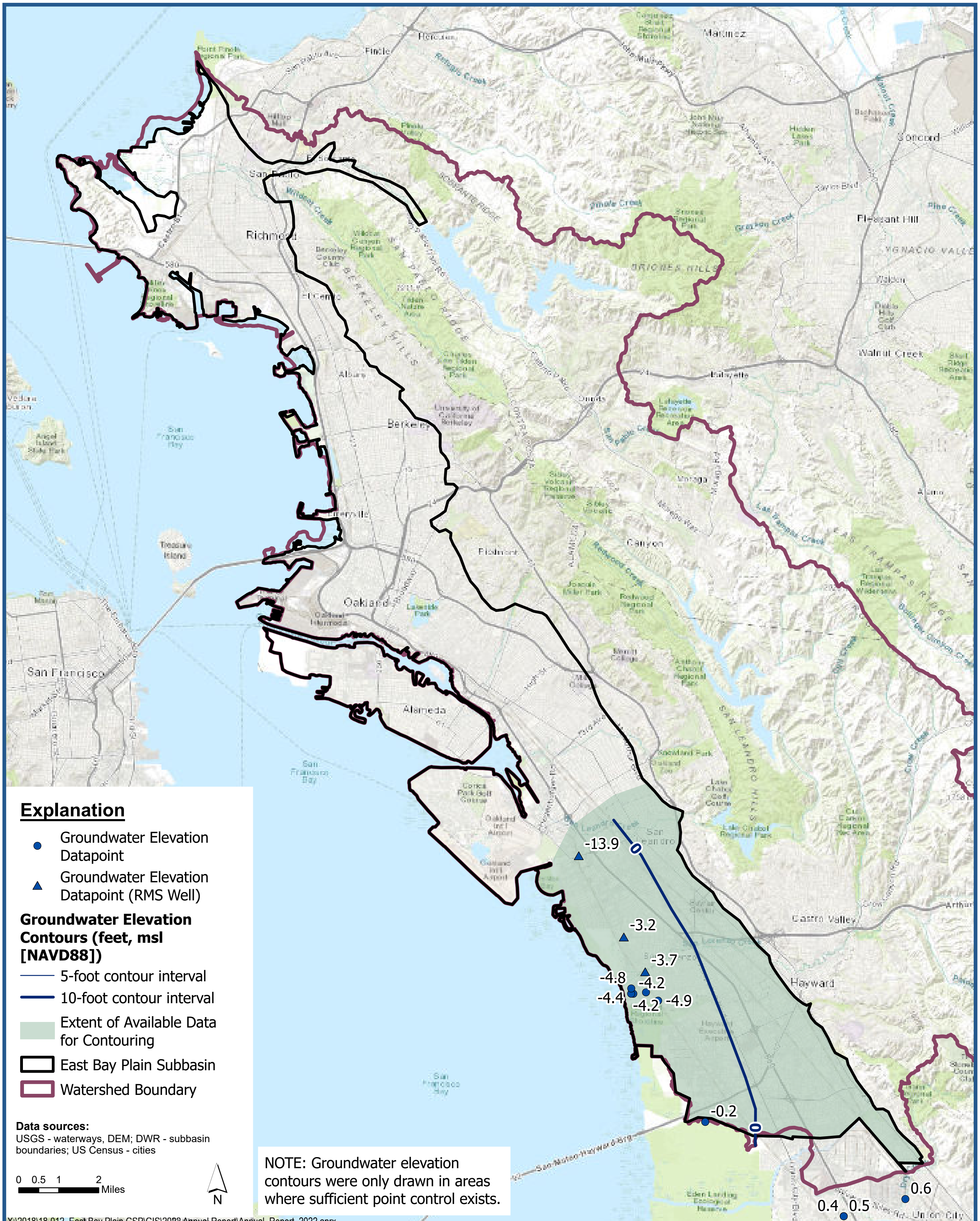

Contours of Equal Groundwater Elevation: Deep Aquifer Zone - Spring 2021

Figure A-23

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

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Contours of Equal Groundwater Elevation: Deep Aquifer Zone - Fall 2021

Figure A-24

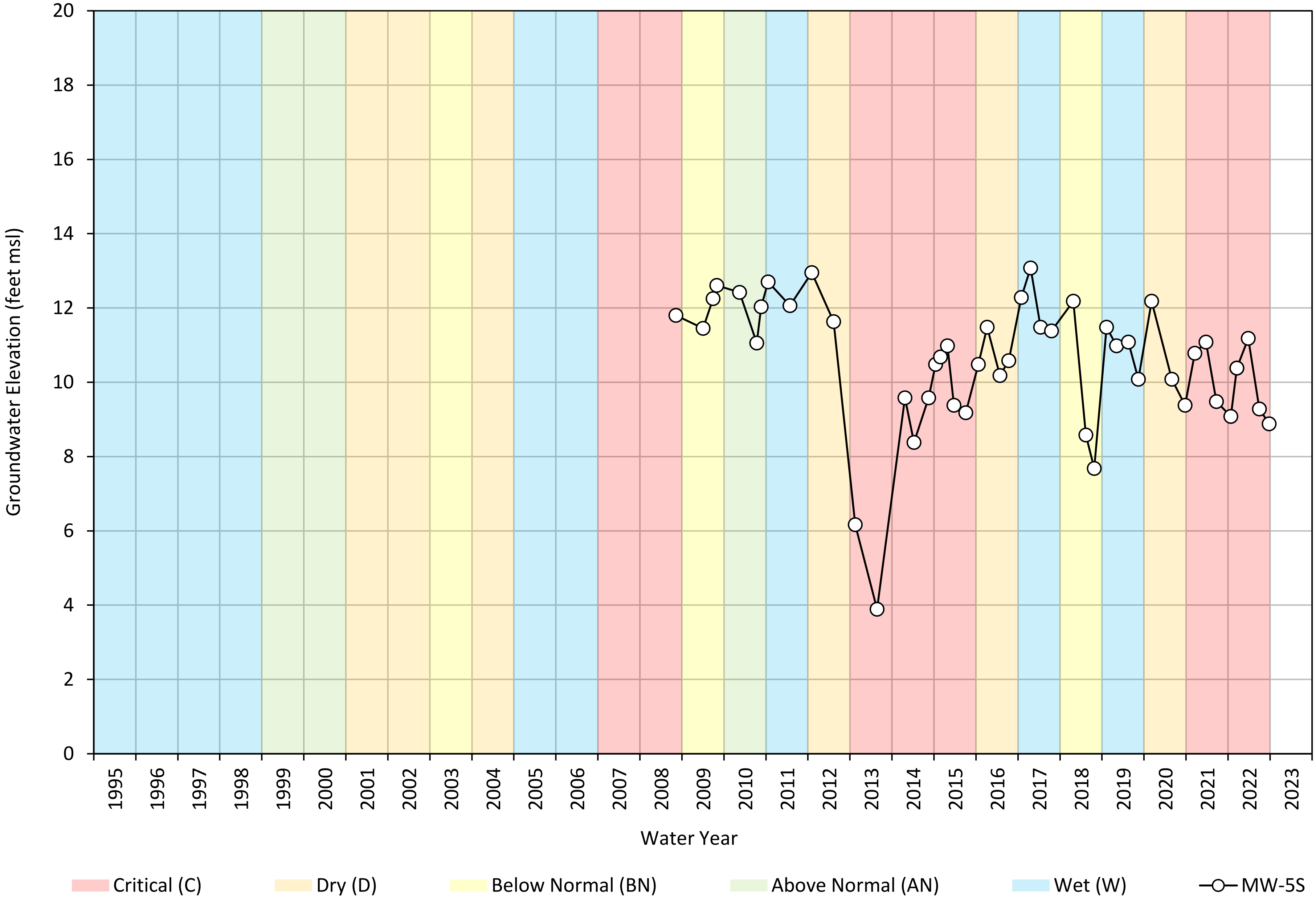
East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

APPENDIX B

Hydrographs of Time-Series Groundwater Level Data for Groundwater Level RMS Wells

Well Name: MW-5S
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 13.92

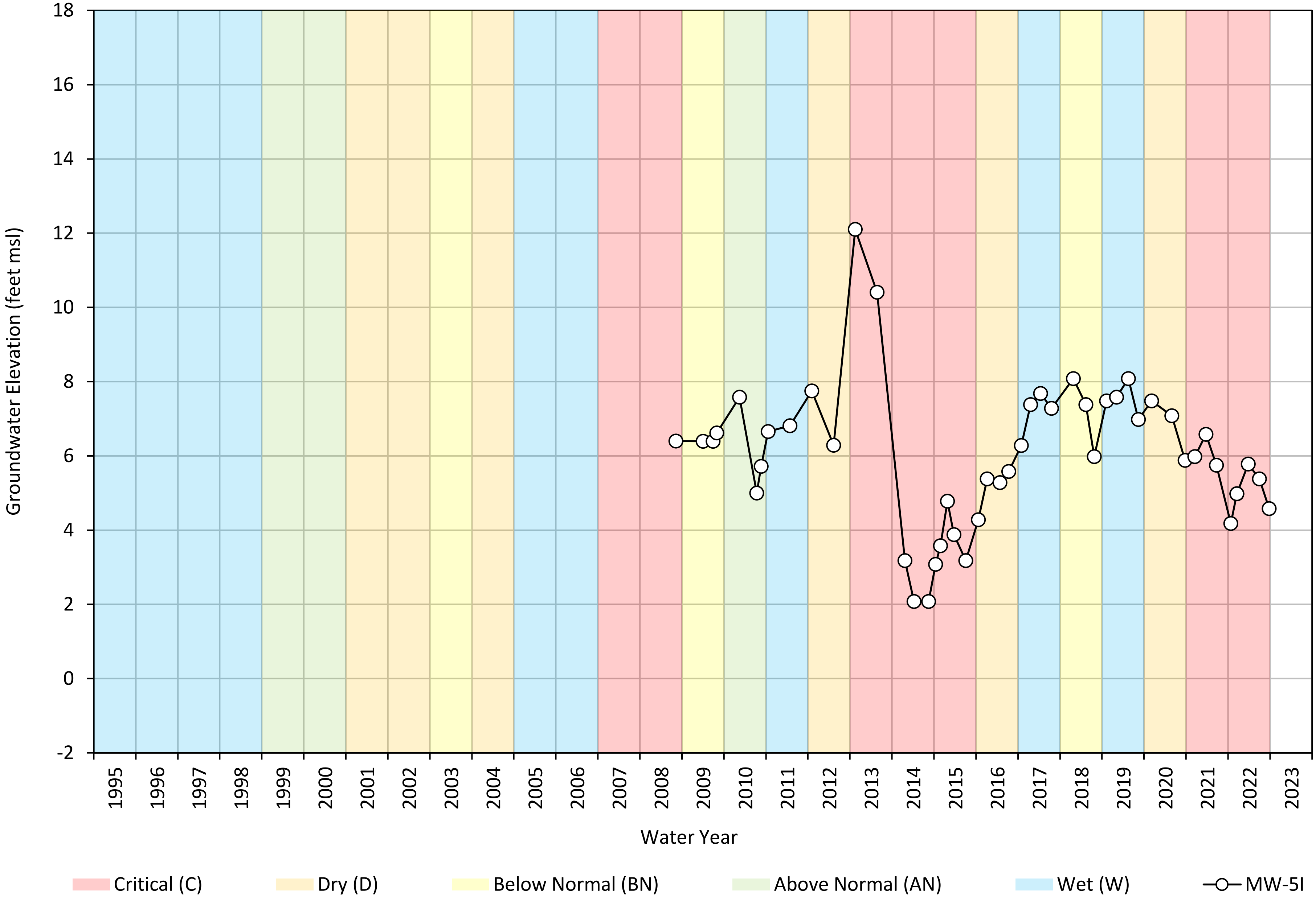
Total Depth (feet bgs): 460
Perforation Interval (feet bgs): 200-210
Depth Zone: Intermediate
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-5I
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 13.92

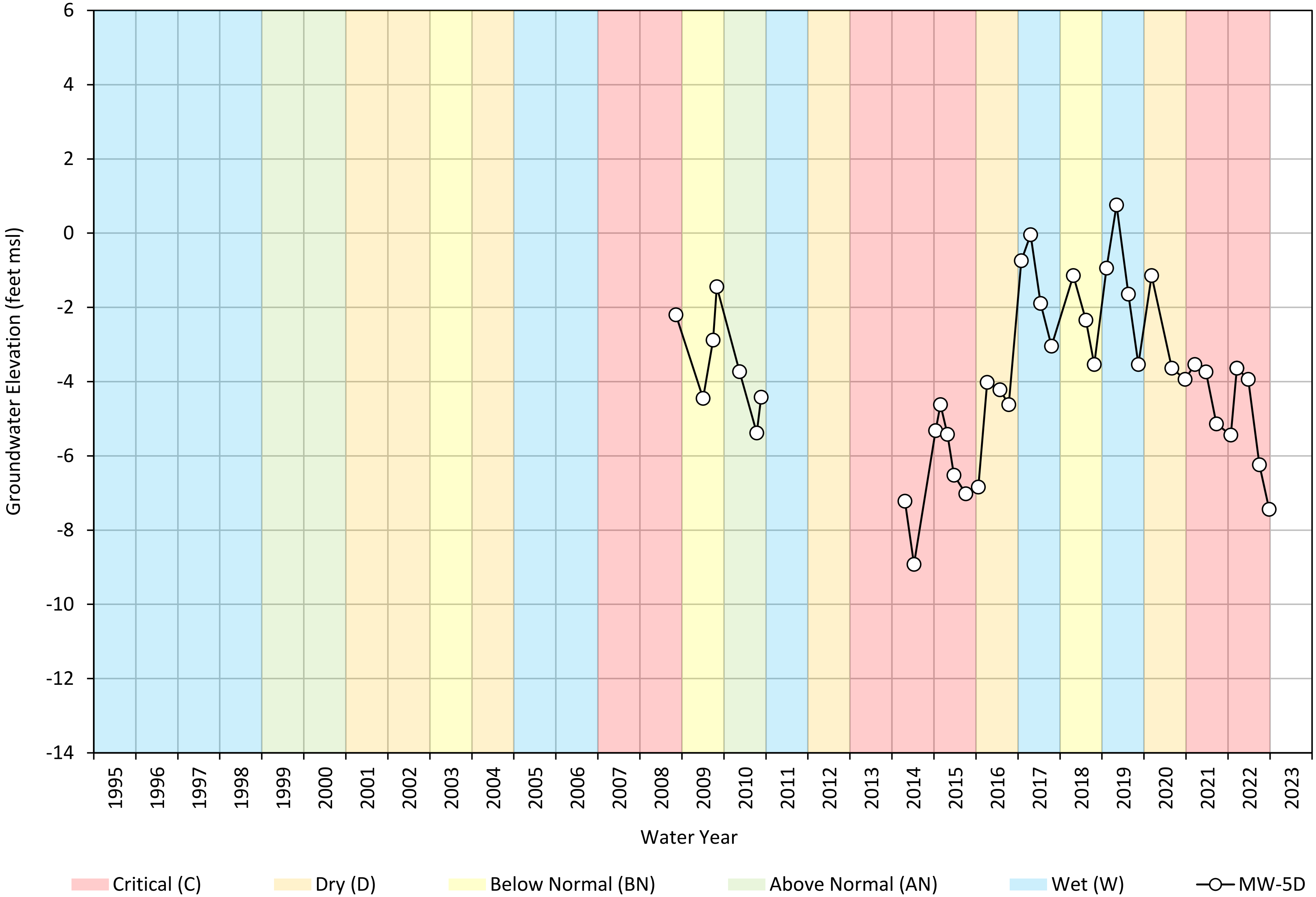
Total Depth (feet bgs): 460
Perforation Interval (feet bgs): 315-325
Depth Zone: Intermediate
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-5D
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 13.92

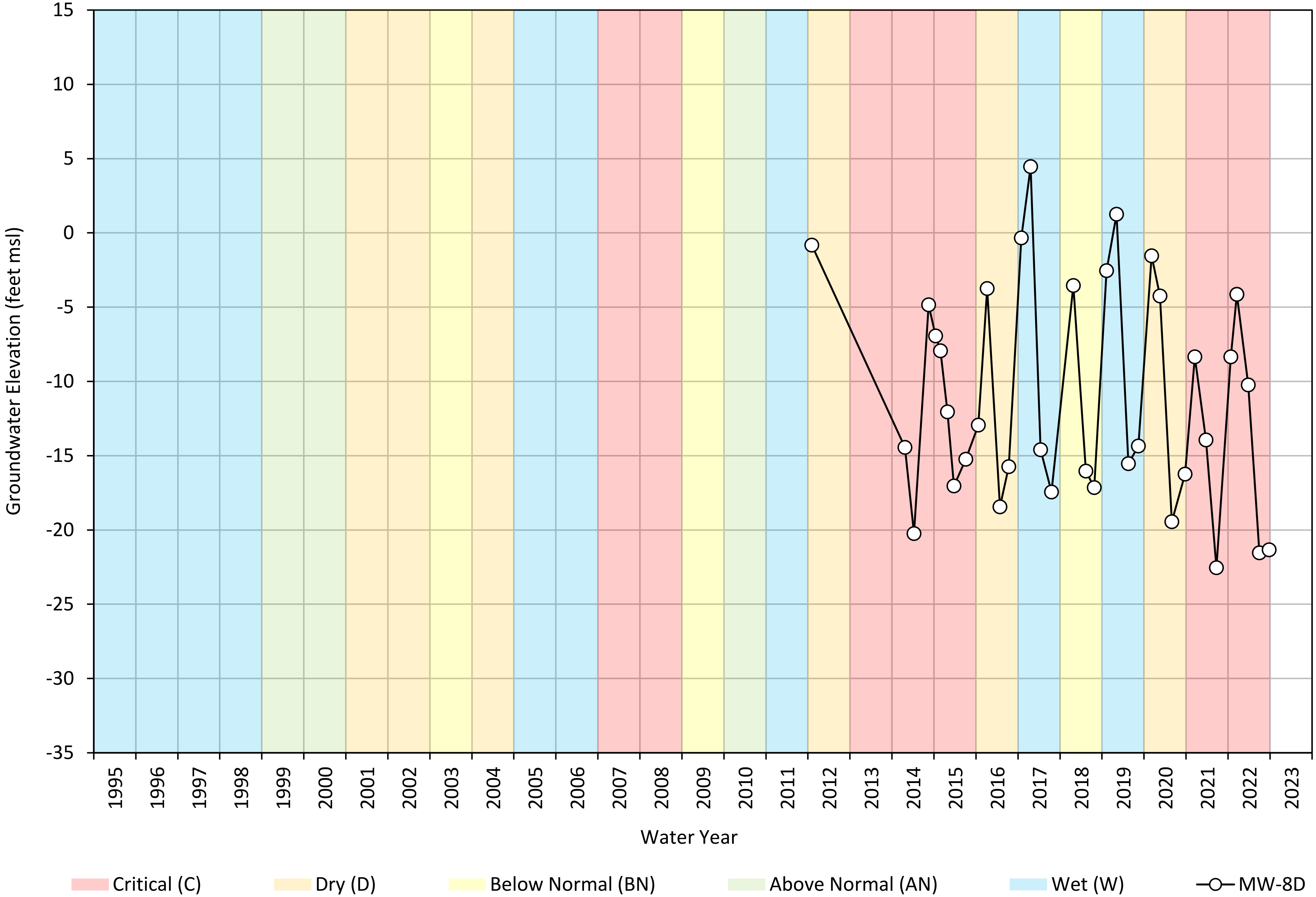
Total Depth (feet bgs): 1,025
Perforation Interval (feet bgs): 500-630
Depth Zone: Deep
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-8D
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 14.81

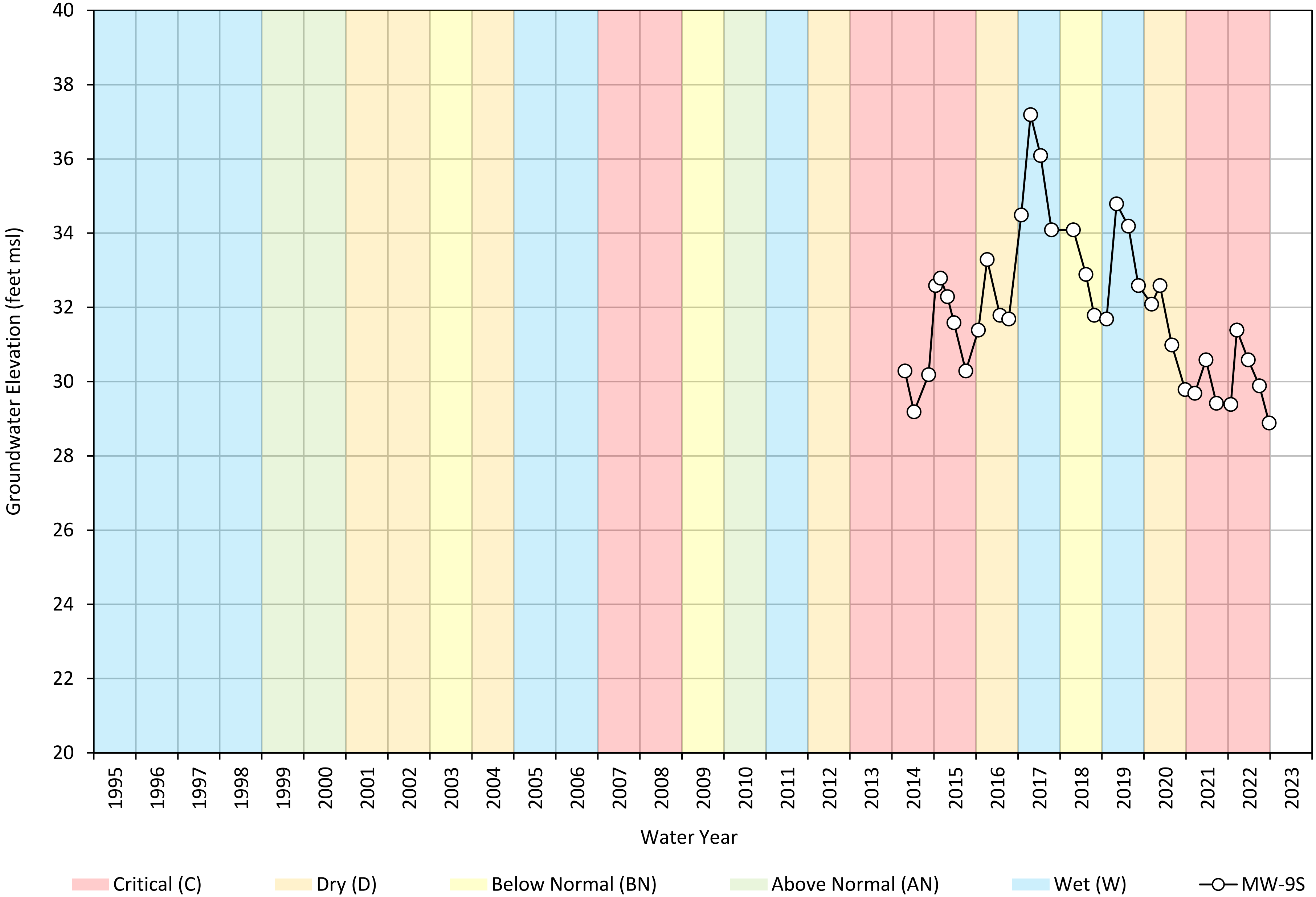
Total Depth (feet bgs): 910
Perforation Interval (feet bgs): 420-480
Depth Zone: Deep
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-9S
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 54.45

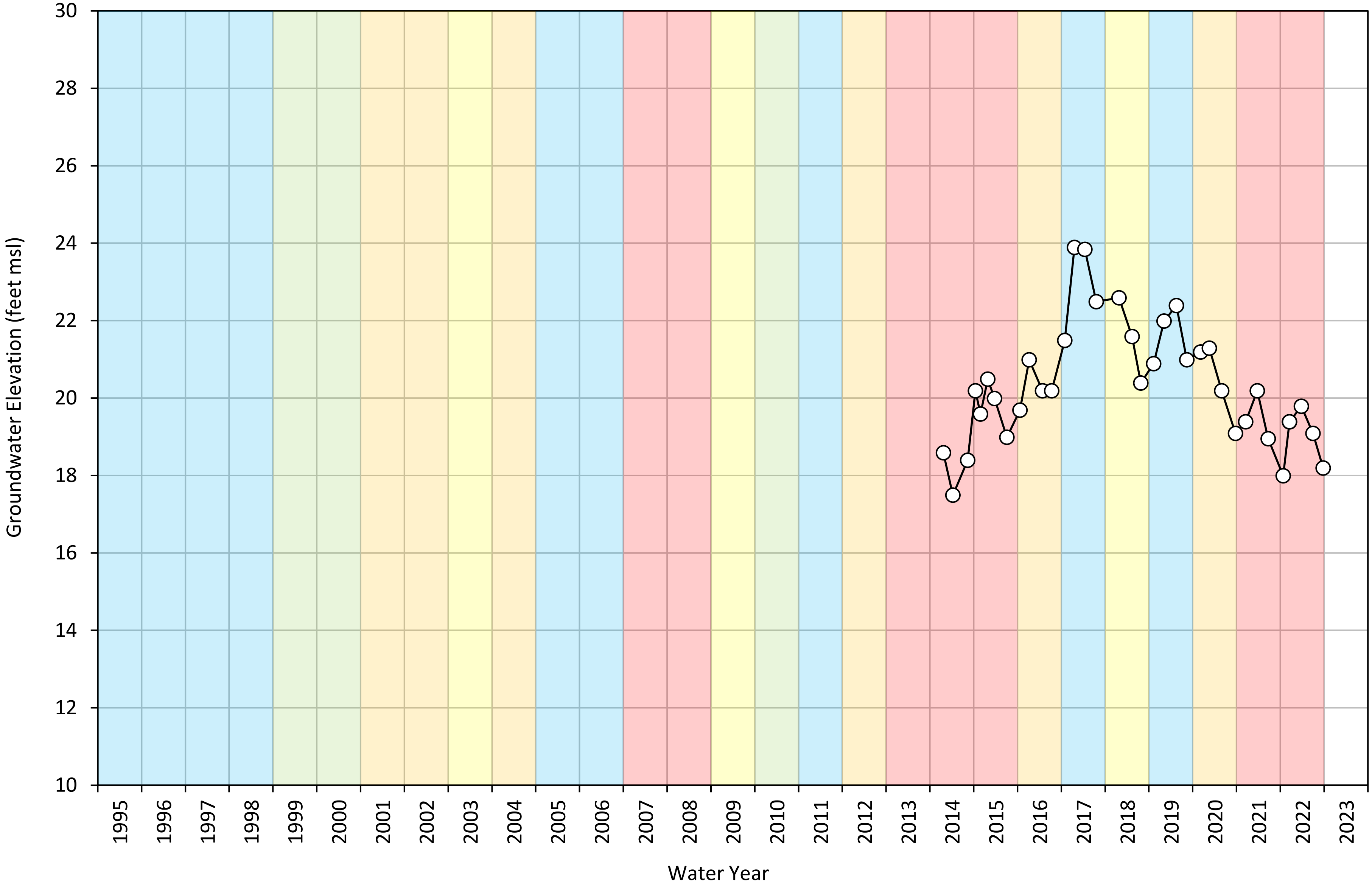
Total Depth (feet bgs): 460
Perforation Interval (feet bgs): 110-120
Depth Zone: Shallow
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-9I
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 54.45

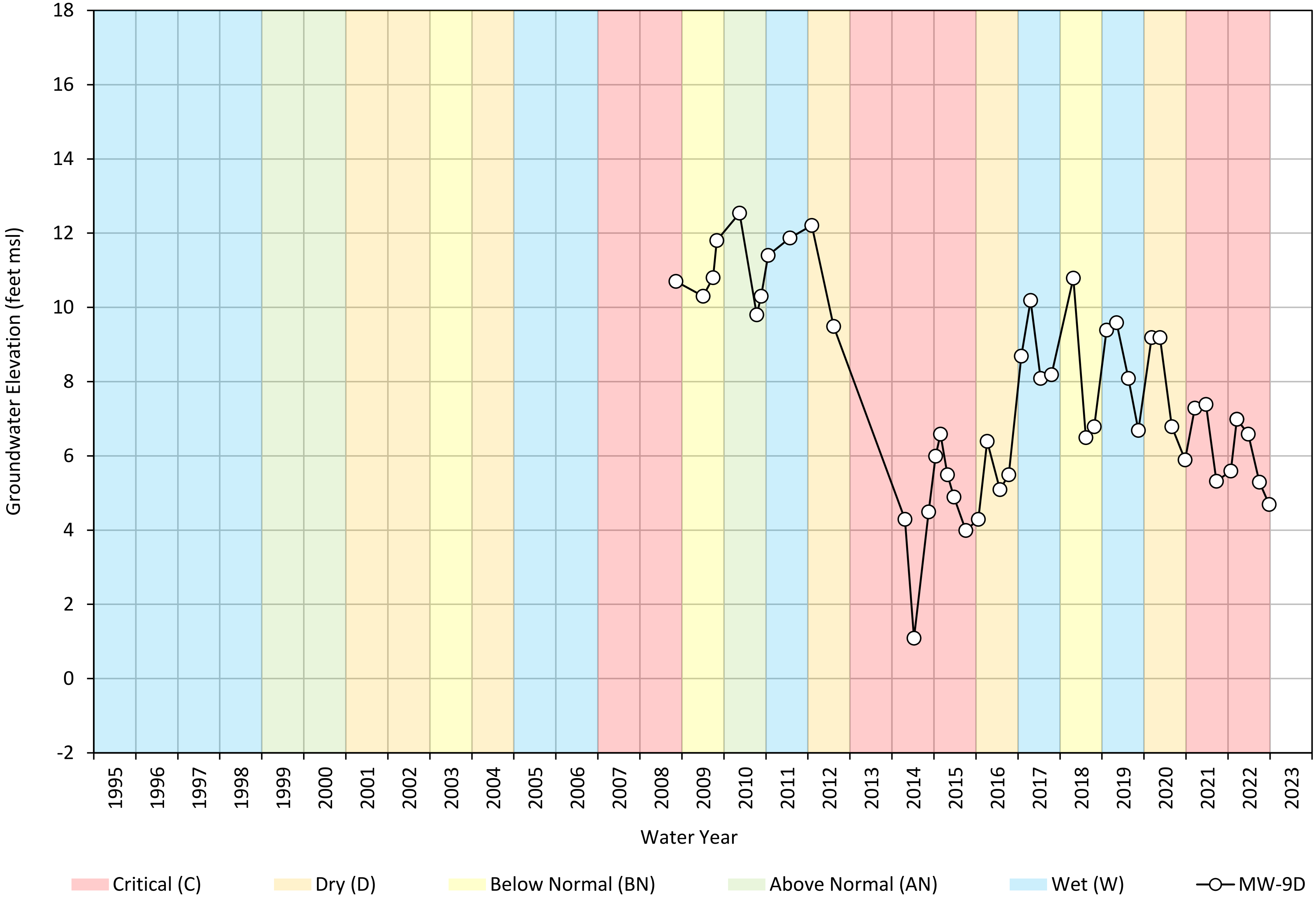
Total Depth (feet bgs): 460
Perforation Interval (feet bgs): 200-210
Depth Zone: Intermediate
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-9D
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 54.45

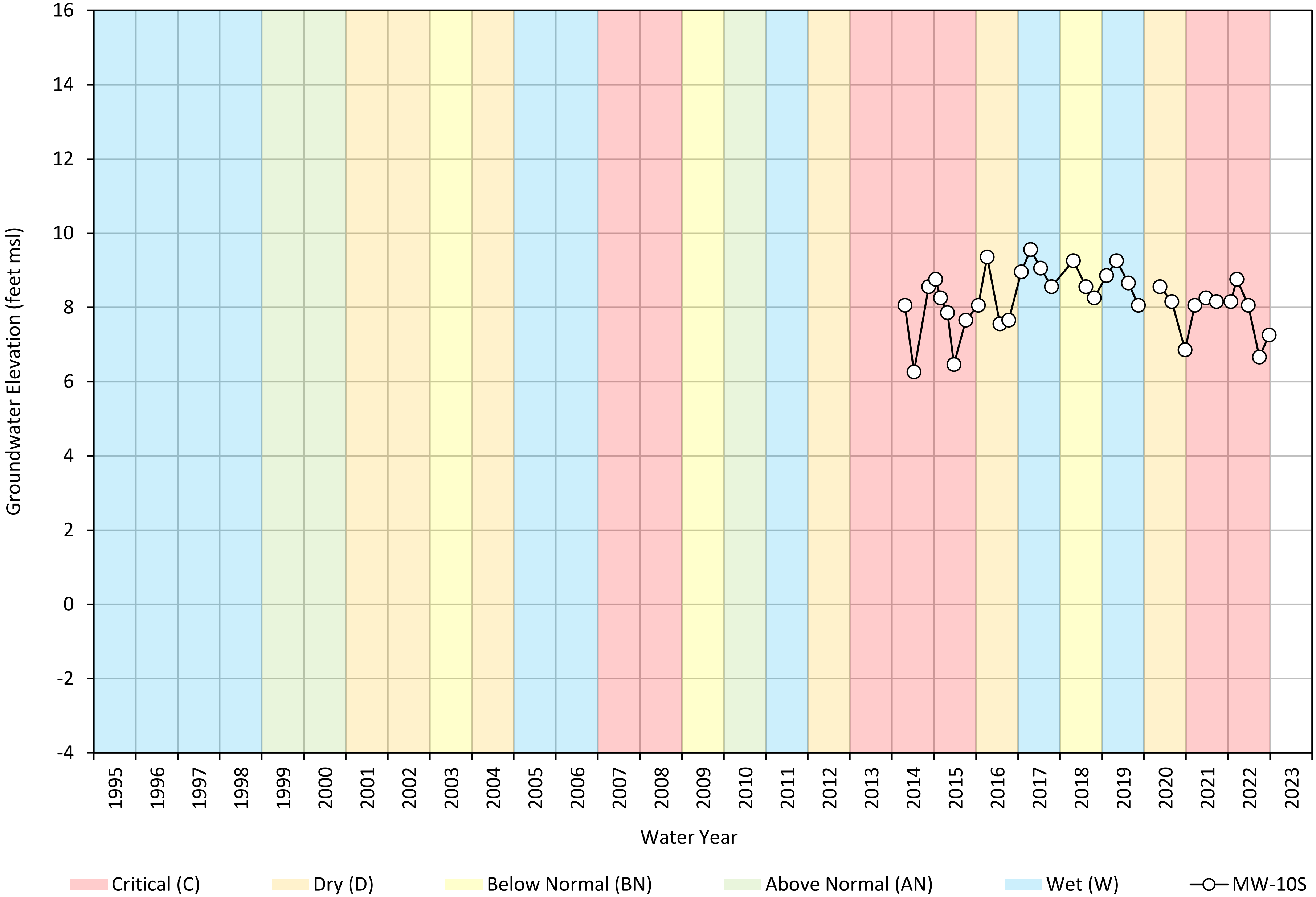
Total Depth (feet bgs): 460
Perforation Interval (feet bgs): 325-335
Depth Zone: Intermediate
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-10S
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 11.81

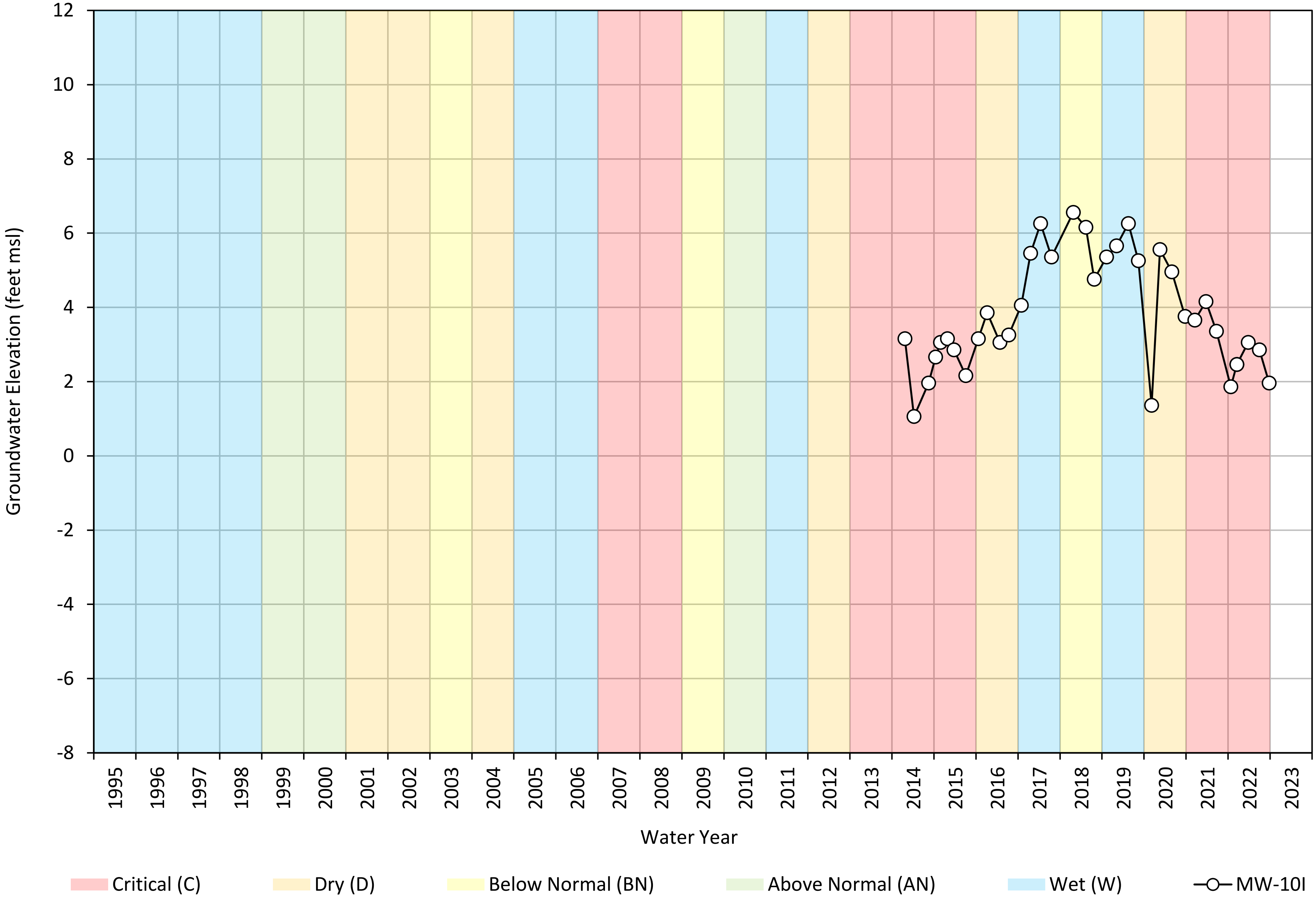
Total Depth (feet bgs): 680
Perforation Interval (feet bgs): 100-120
Depth Zone: Shallow
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-10I
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 11.81

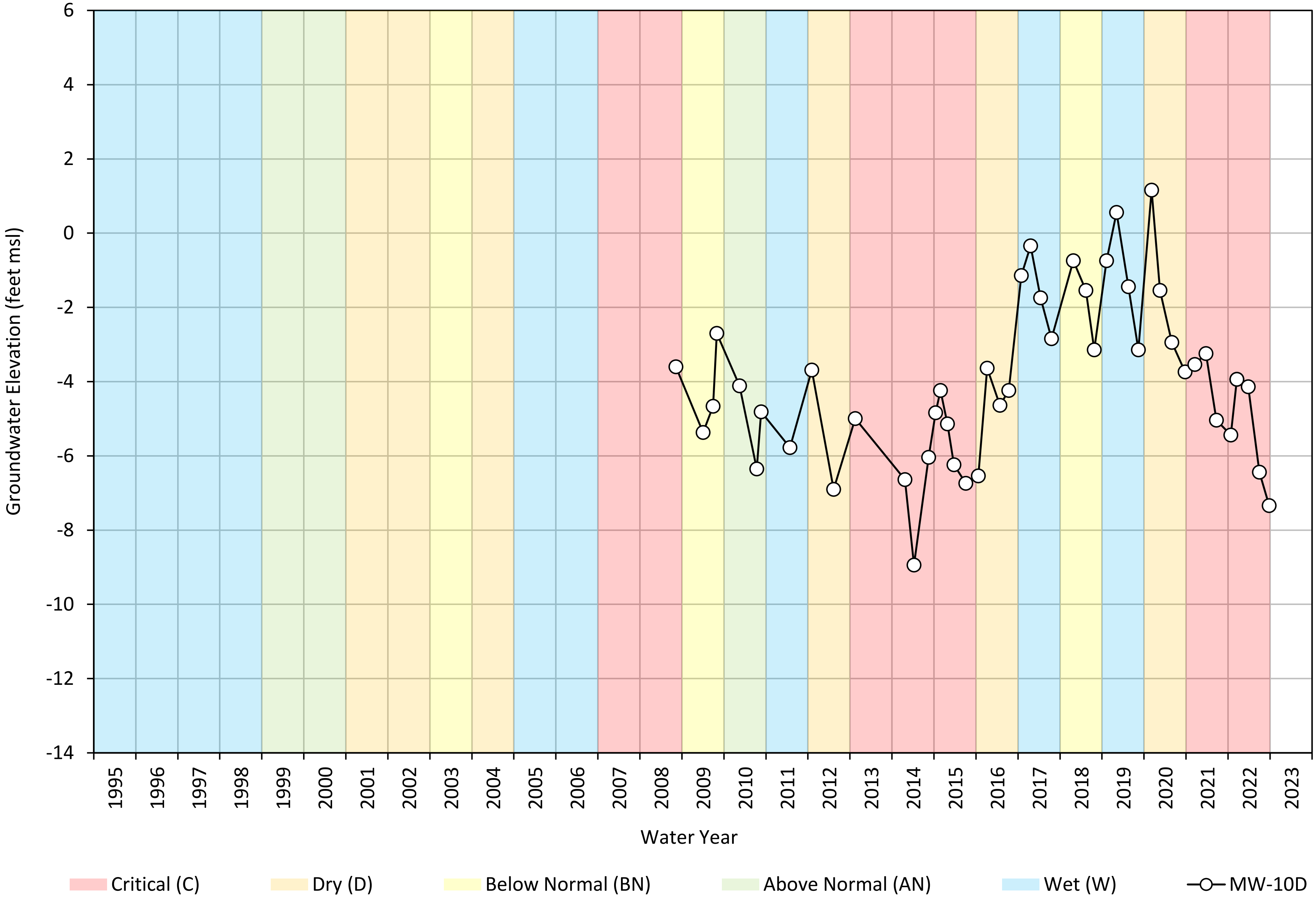
Total Depth (feet bgs): 680
Perforation Interval (feet bgs): 340-360
Depth Zone: Intermediate
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: MW-10D
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 11.81

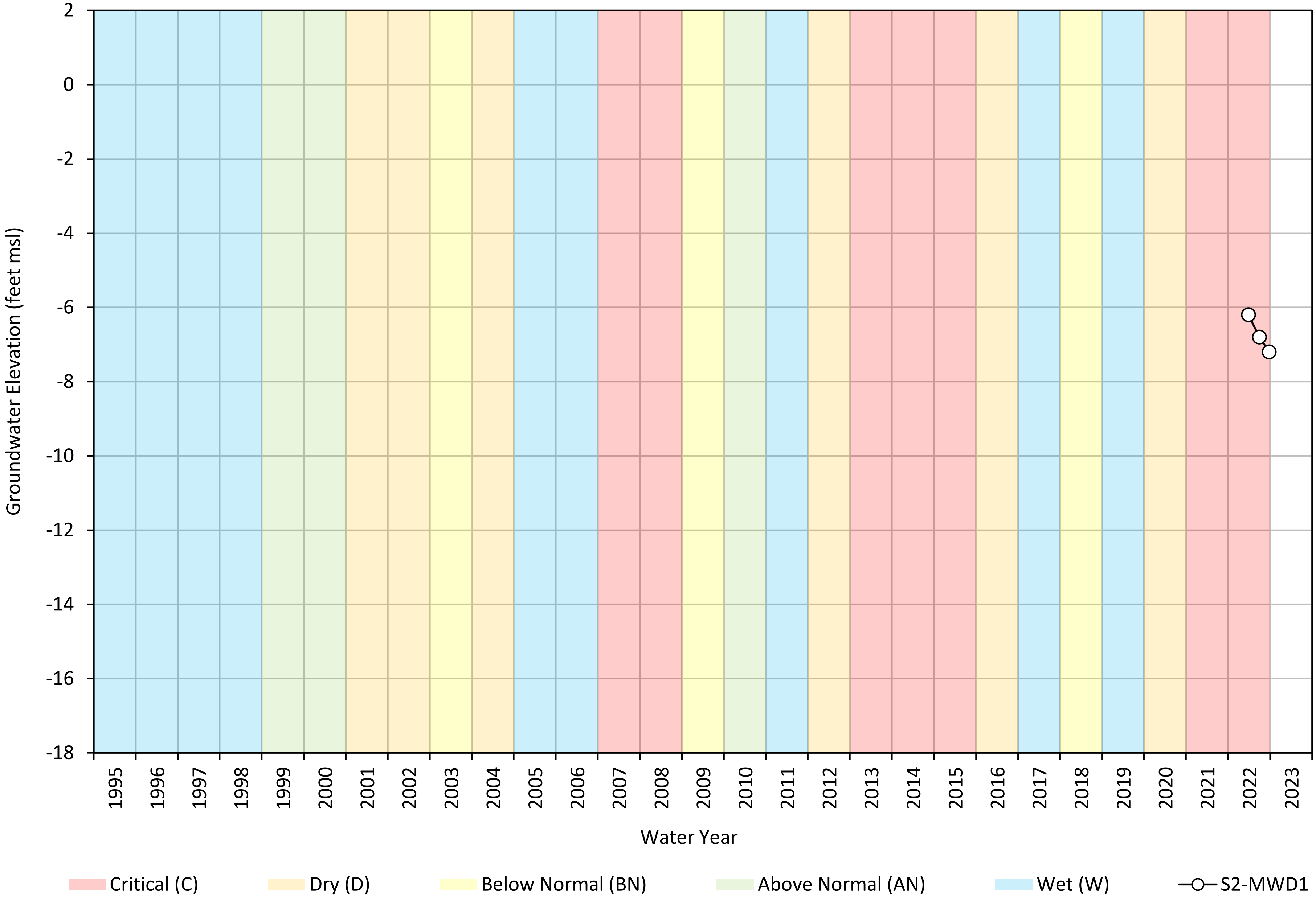
Total Depth (feet bgs): 680
Perforation Interval (feet bgs): 590-610
Depth Zone: Deep
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: S2-MWD1
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 6

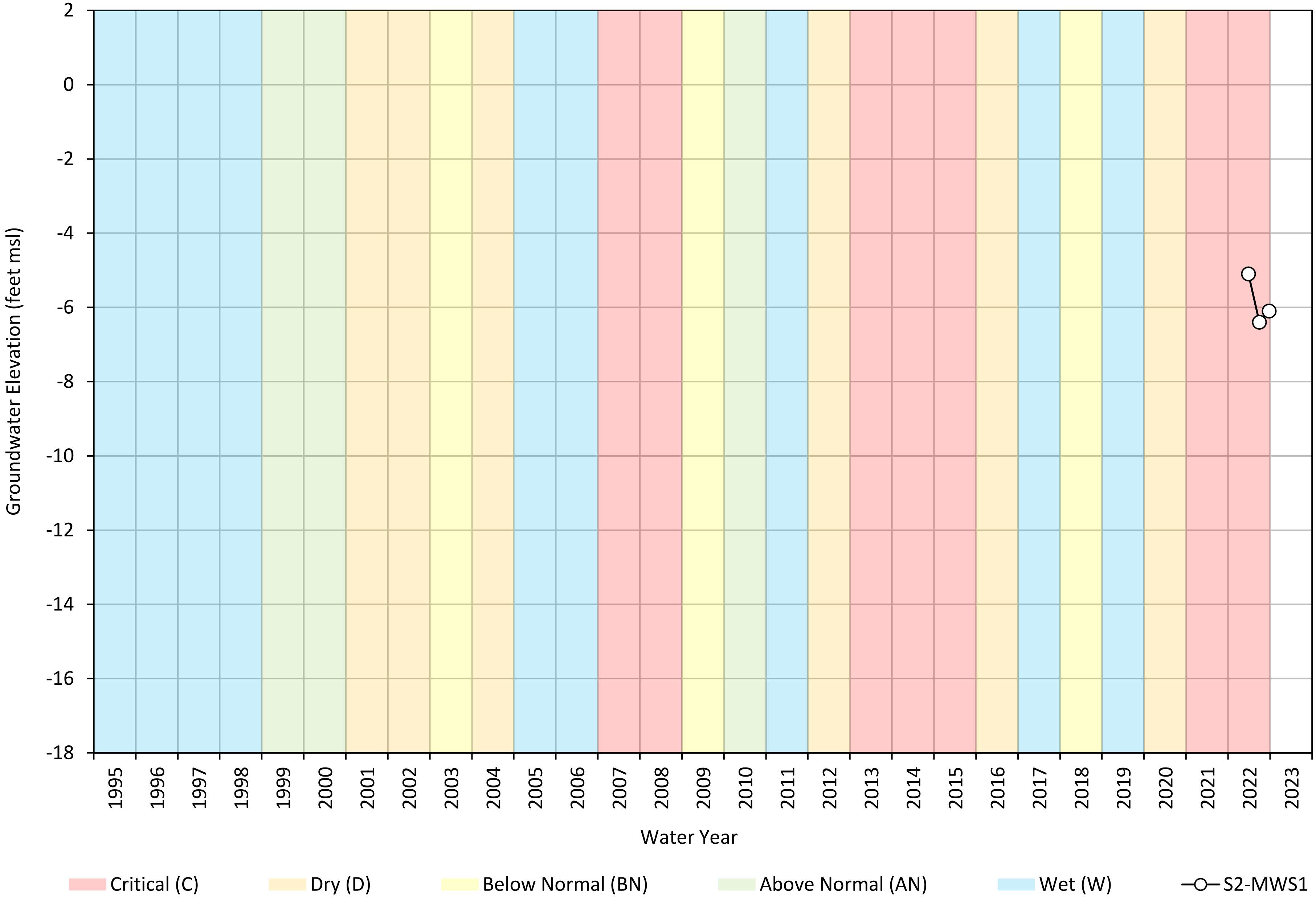
Total Depth (feet bgs): 555
Perforation Interval (feet bgs): 480-500
Depth Zone: Deep
Well Use: Monitoring



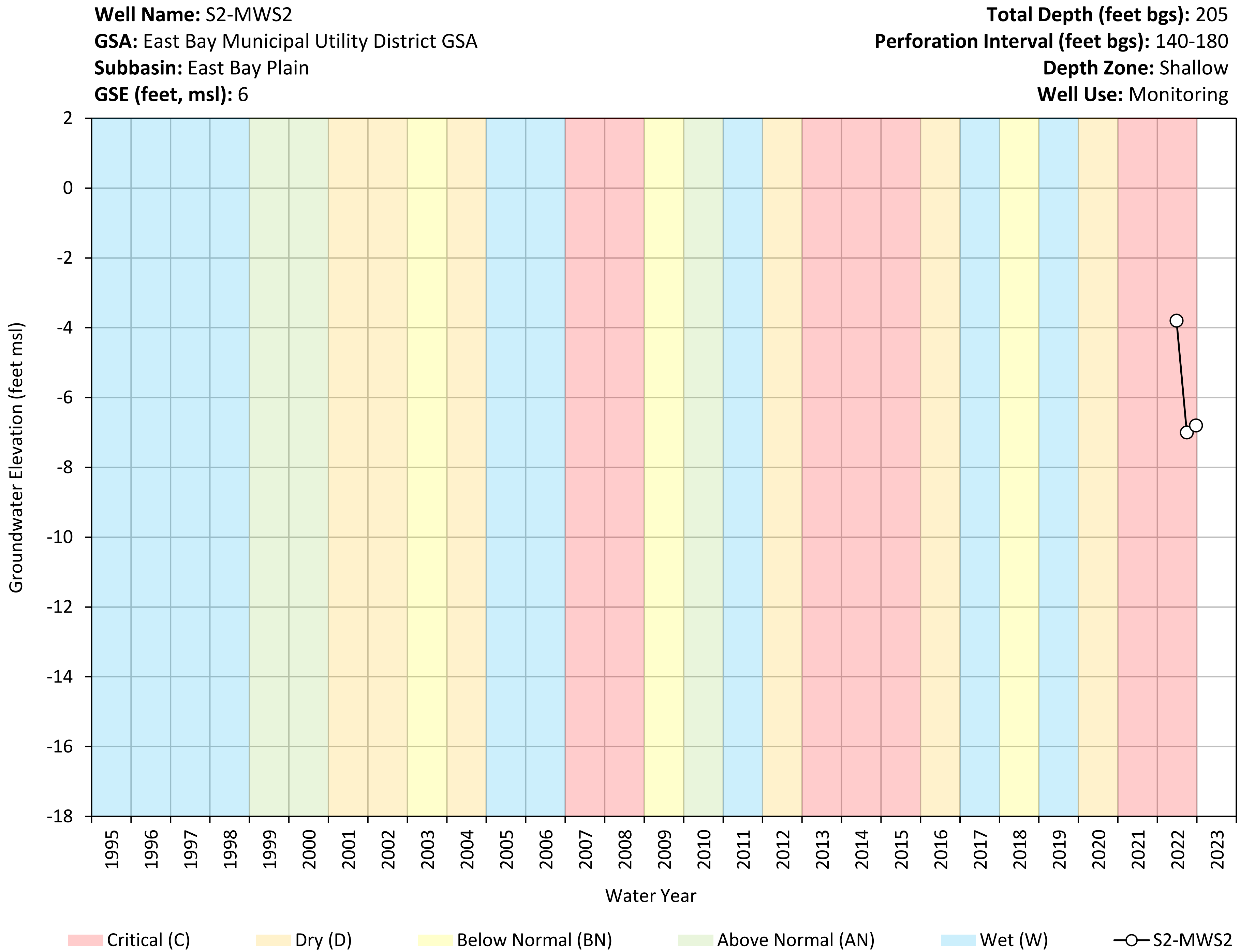
NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: S2-MWS1
GSA: East Bay Municipal Utility District GSA
Subbasin: East Bay Plain
GSE (feet, msl): 6

Total Depth (feet bgs): 85
Perforation Interval (feet bgs): 50-80
Depth Zone: Shallow
Well Use: Monitoring



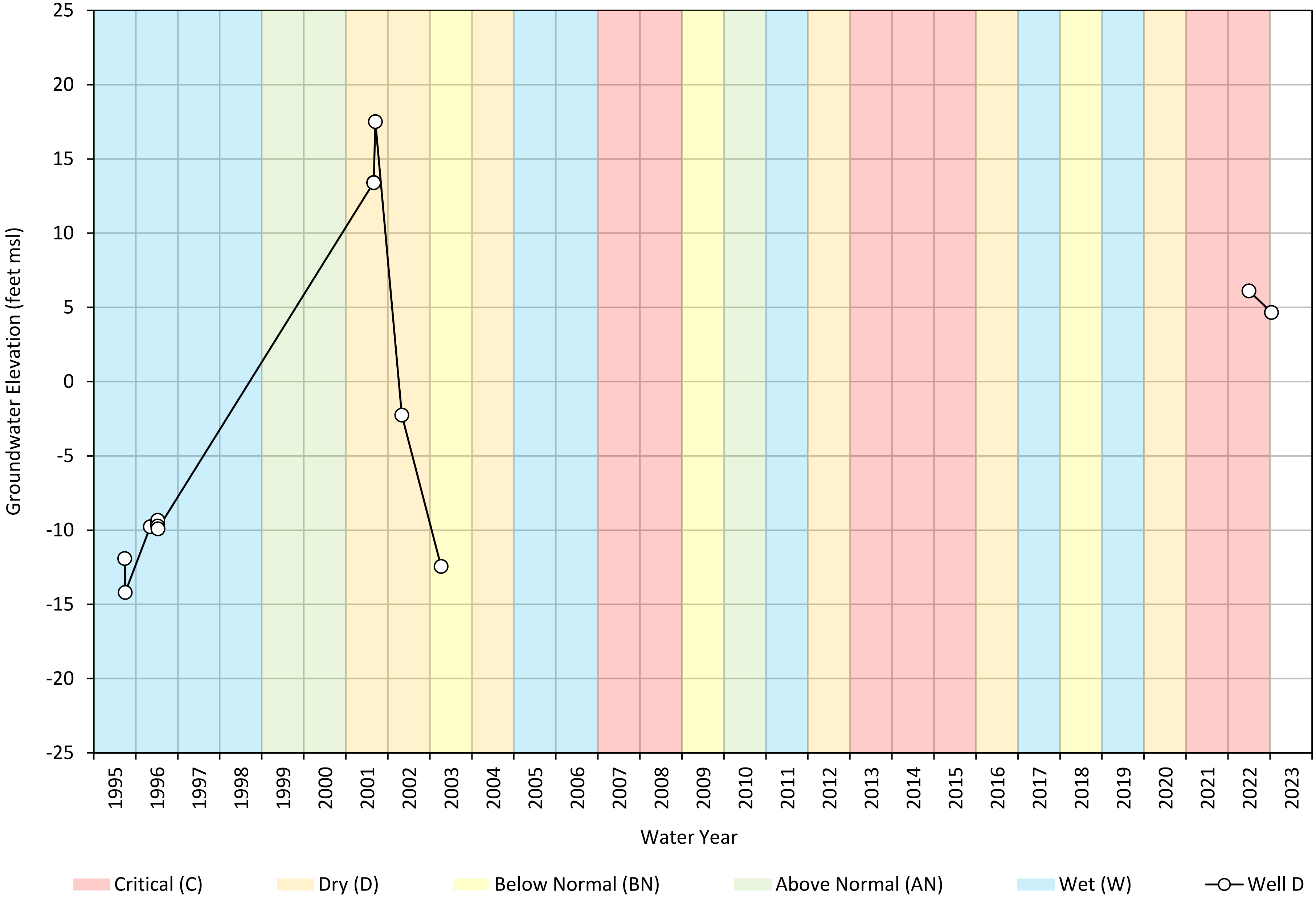
NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: Well D
GSA: City of Hayward GSA
Subbasin: East Bay Plain
GSE (feet, msl): 47.1

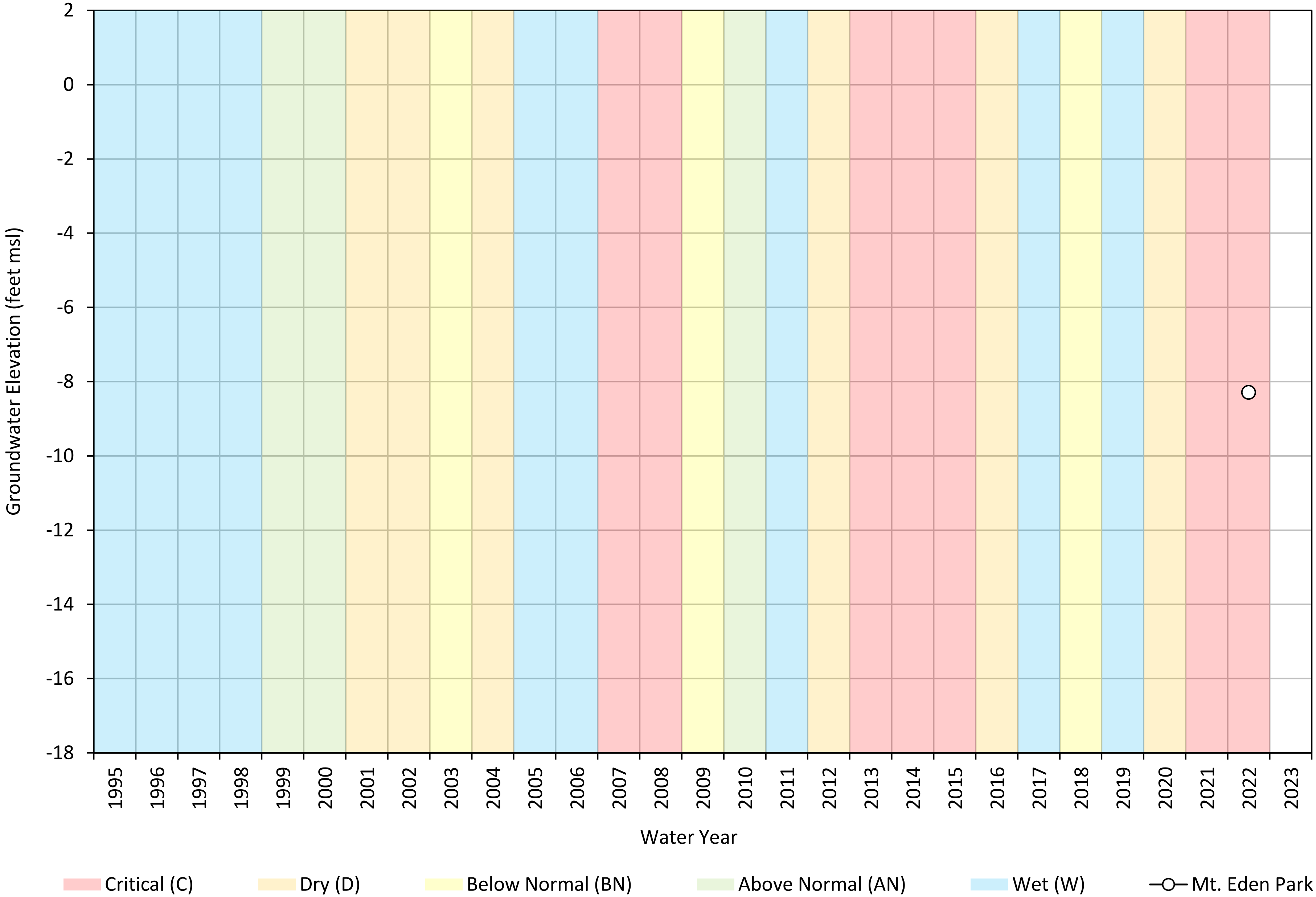
Total Depth (feet bgs): 600
Perforation Interval (feet bgs): 500-585
Depth Zone: Deep
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

Well Name: Mt. Eden Park
GSA: City of Hayward GSA
Subbasin: East Bay Plain
GSE (feet, msl): 24

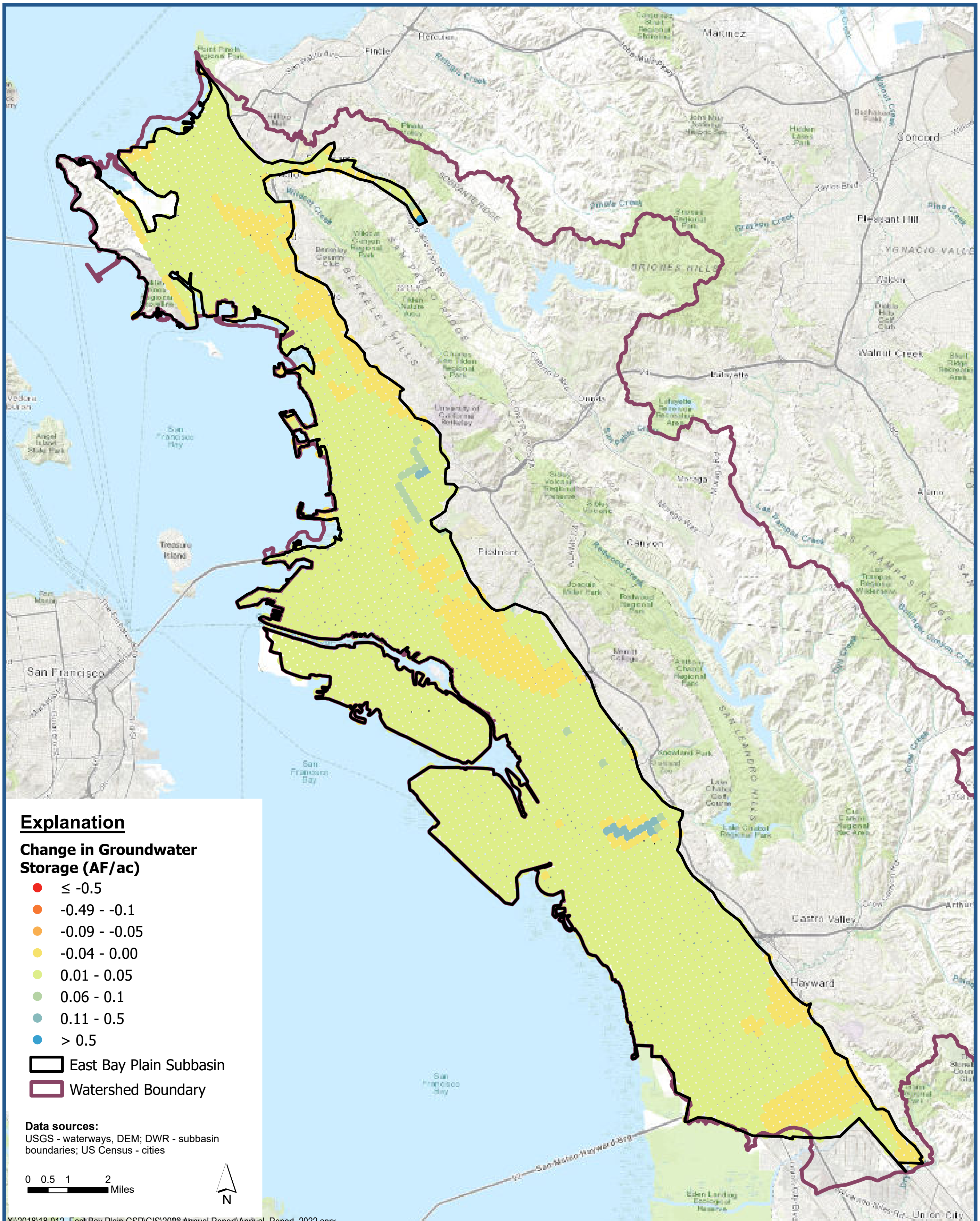
Total Depth (feet bgs): 550
Perforation Interval (feet bgs): 431-550
Depth Zone: Deep
Well Use: Monitoring



NOTE: Water Year Type is based on the San Joaquin Valley Water Year Index. The current year (WY 2023) is blank as the year type has not been defined.

APPENDIX C

Maps of Annual Change in Groundwater Storage for 2019, 2020 and 2021



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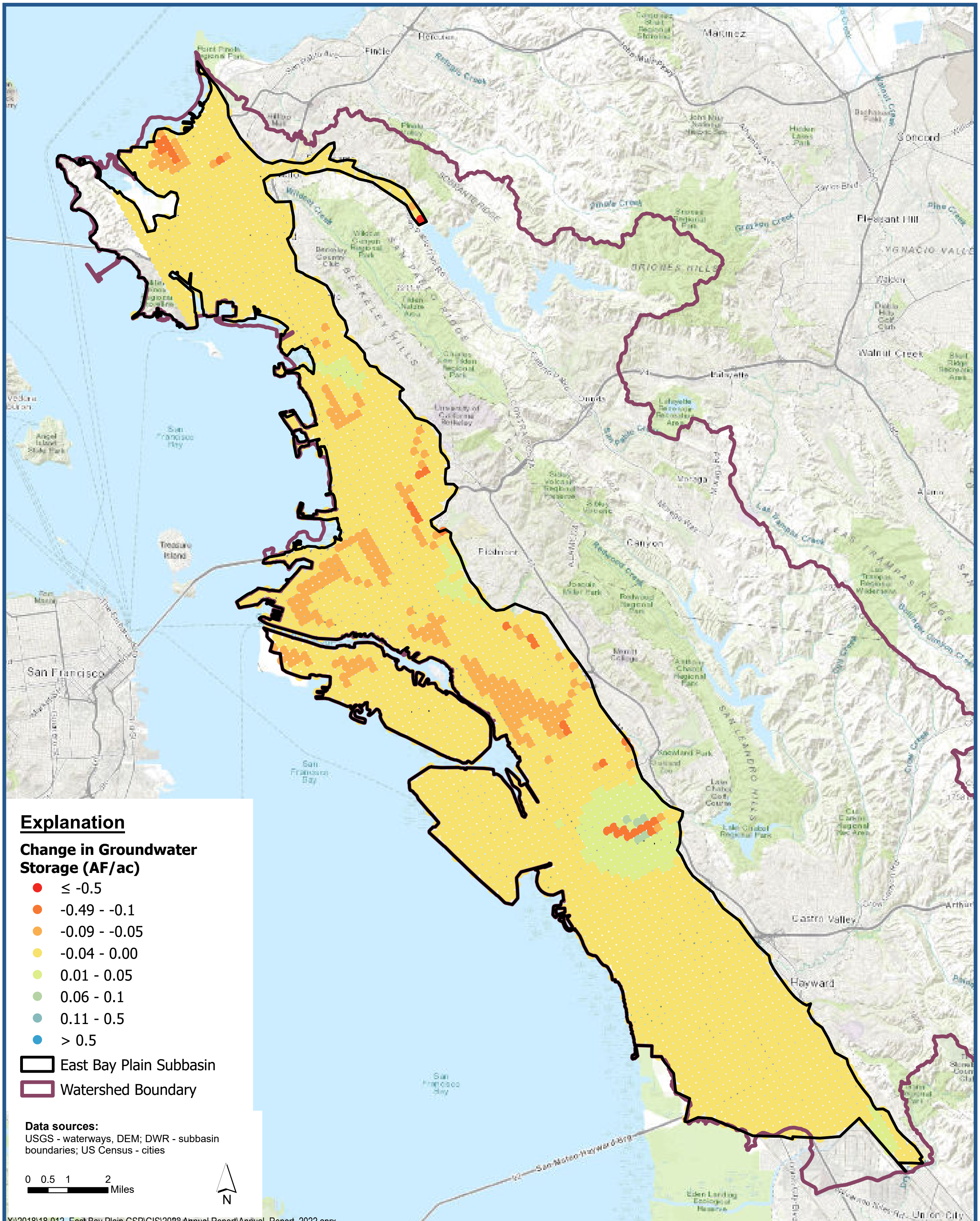
Change in Groundwater Storage in the Upper Shallow Aquifer Zone – Spring 2018 to Spring 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure C-1

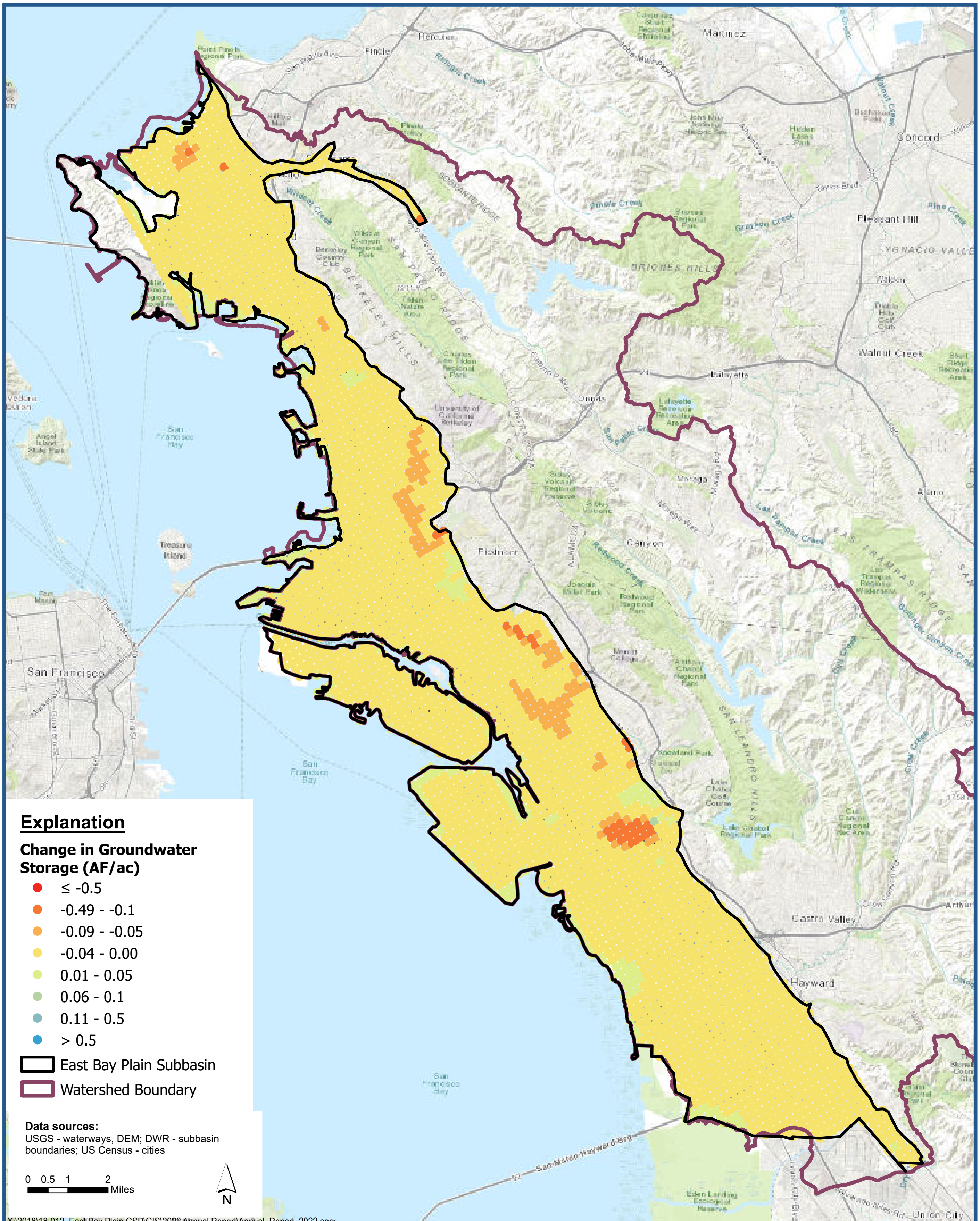


LSCE TEAM

Change in Groundwater Storage in the Upper Shallow Aquifer Zone – Spring 2019 to Spring 2020

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure C-2

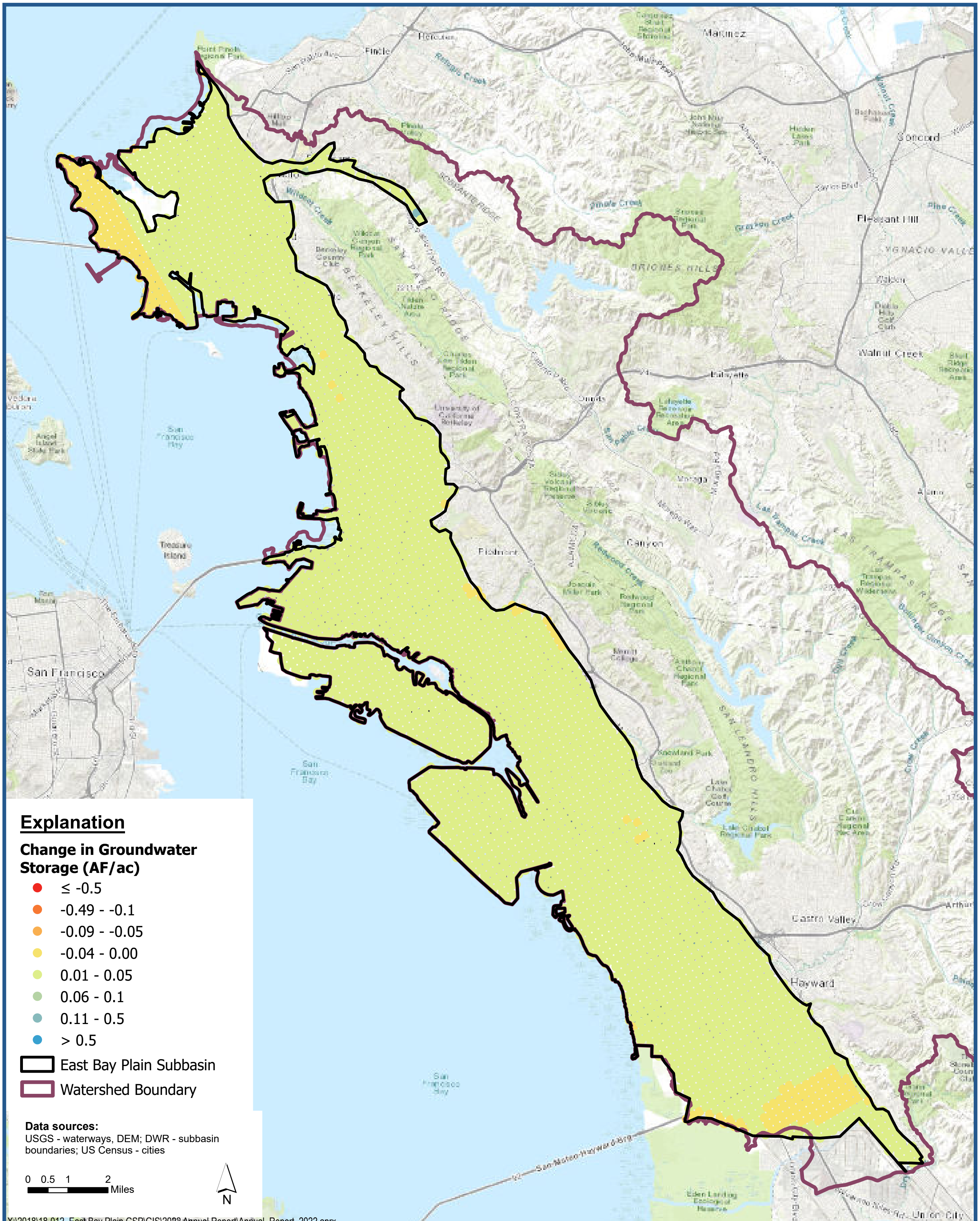


LSCE TEAM

Change in Groundwater Storage in the Upper Shallow Aquifer Zone – Spring 2020 to Spring 2021

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

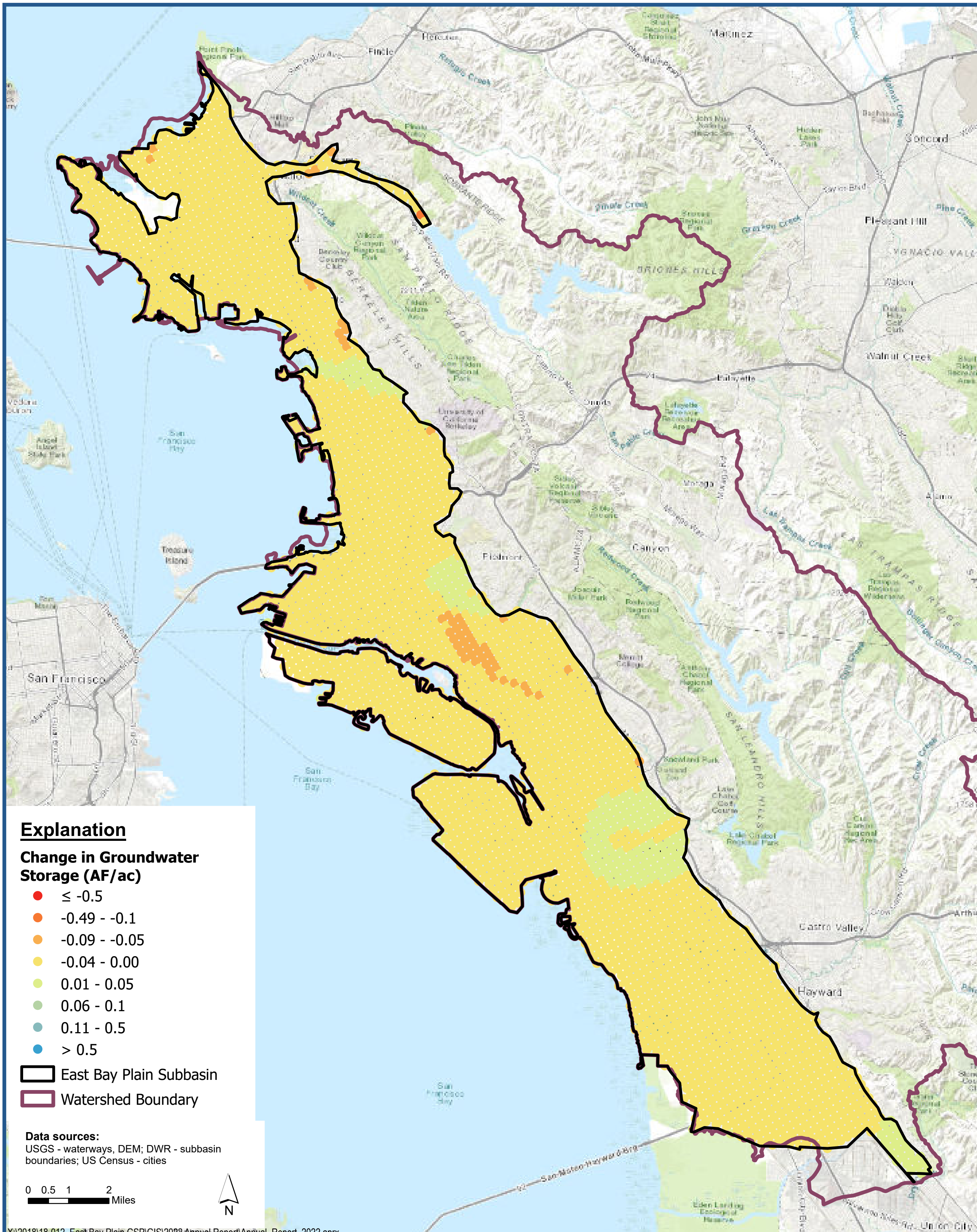
Figure C-3



Change in Groundwater Storage in the Lower Shallow Aquifer Zone – Spring 2018 to Spring 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure C-4



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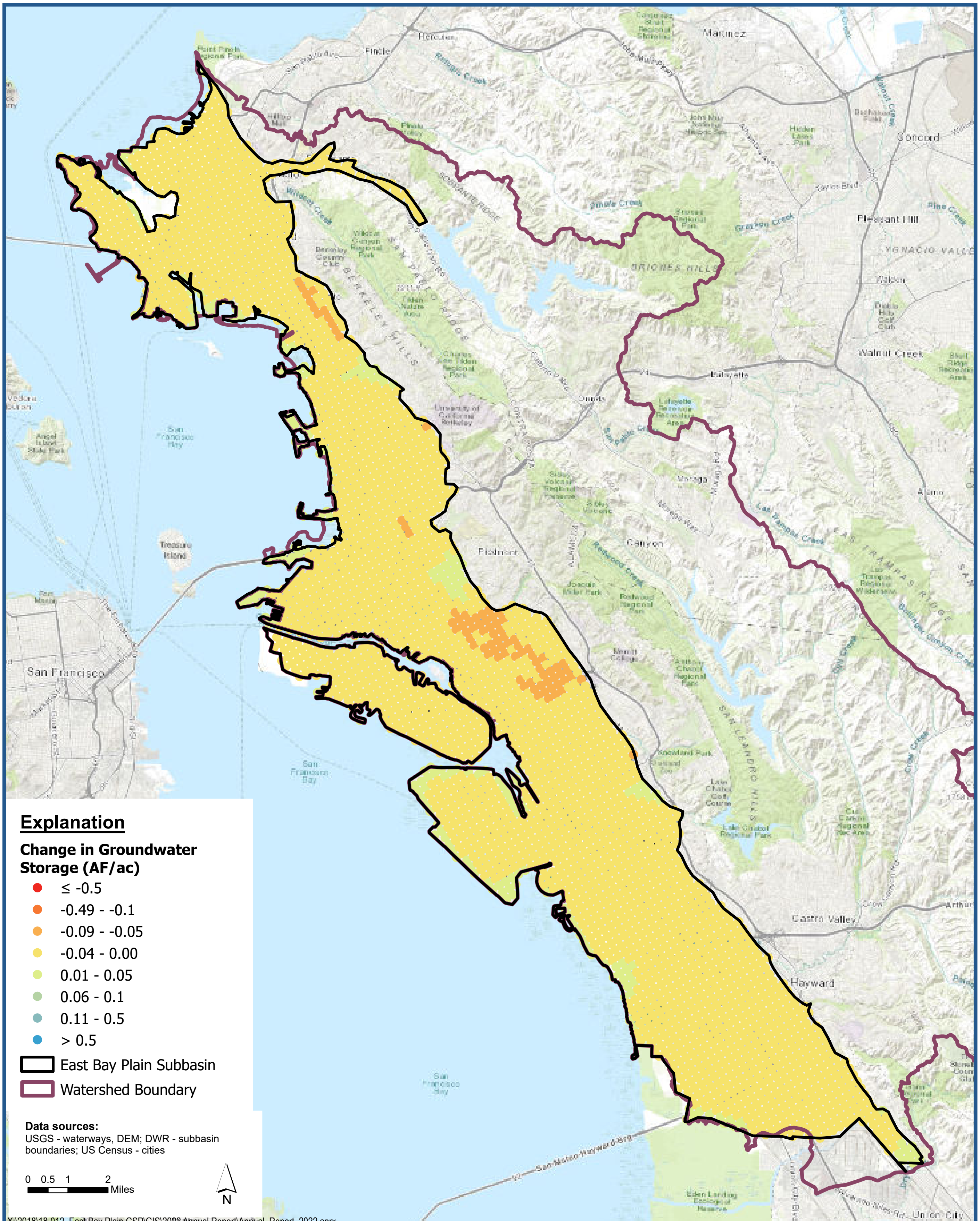
Change in Groundwater Storage in the Lower Shallow Aquifer Zone – Spring 2019 to Spring 2020

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure C-5



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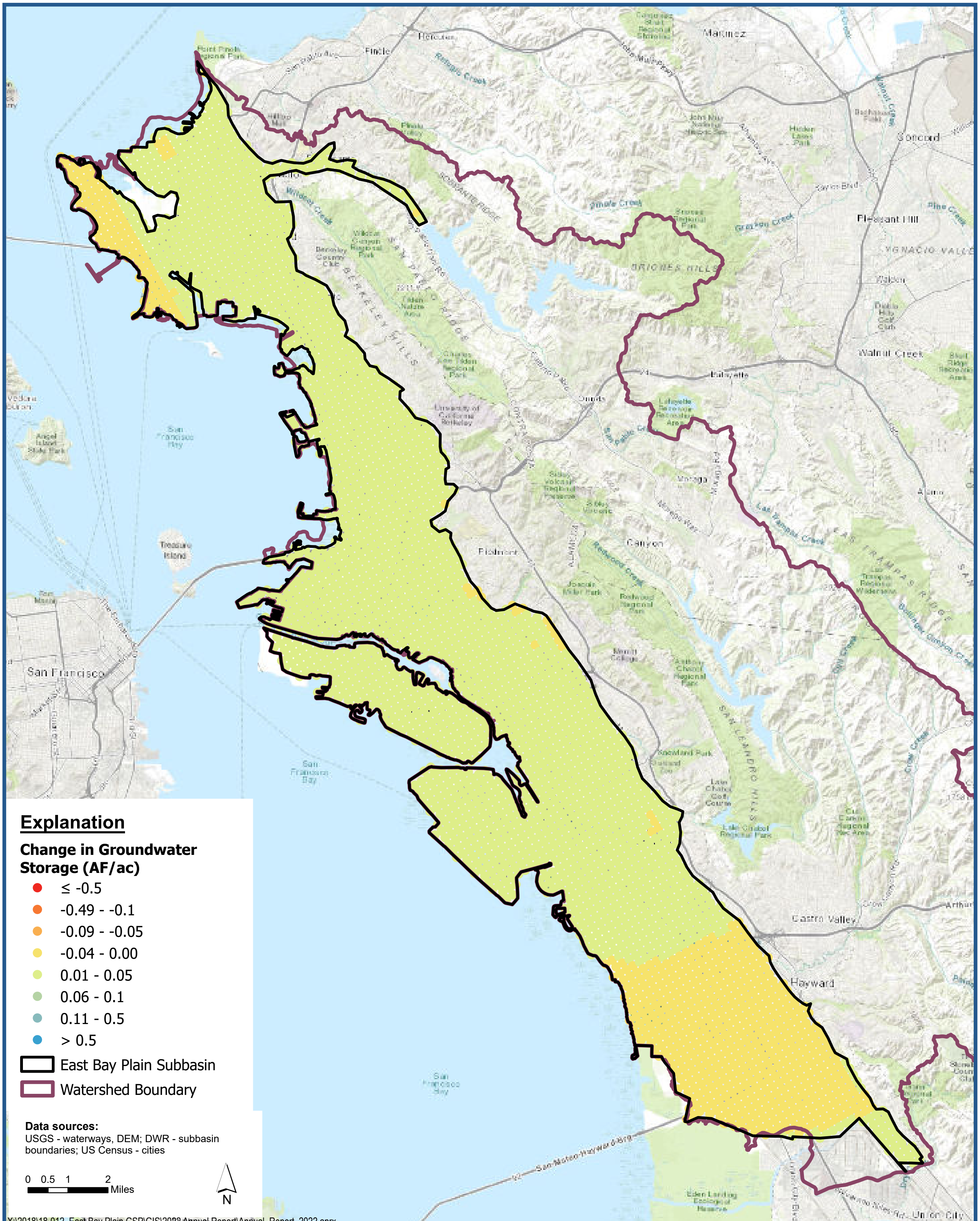
Change in Groundwater Storage in the Lower Shallow Aquifer Zone – Spring 2020 to Spring 2021

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure C-6



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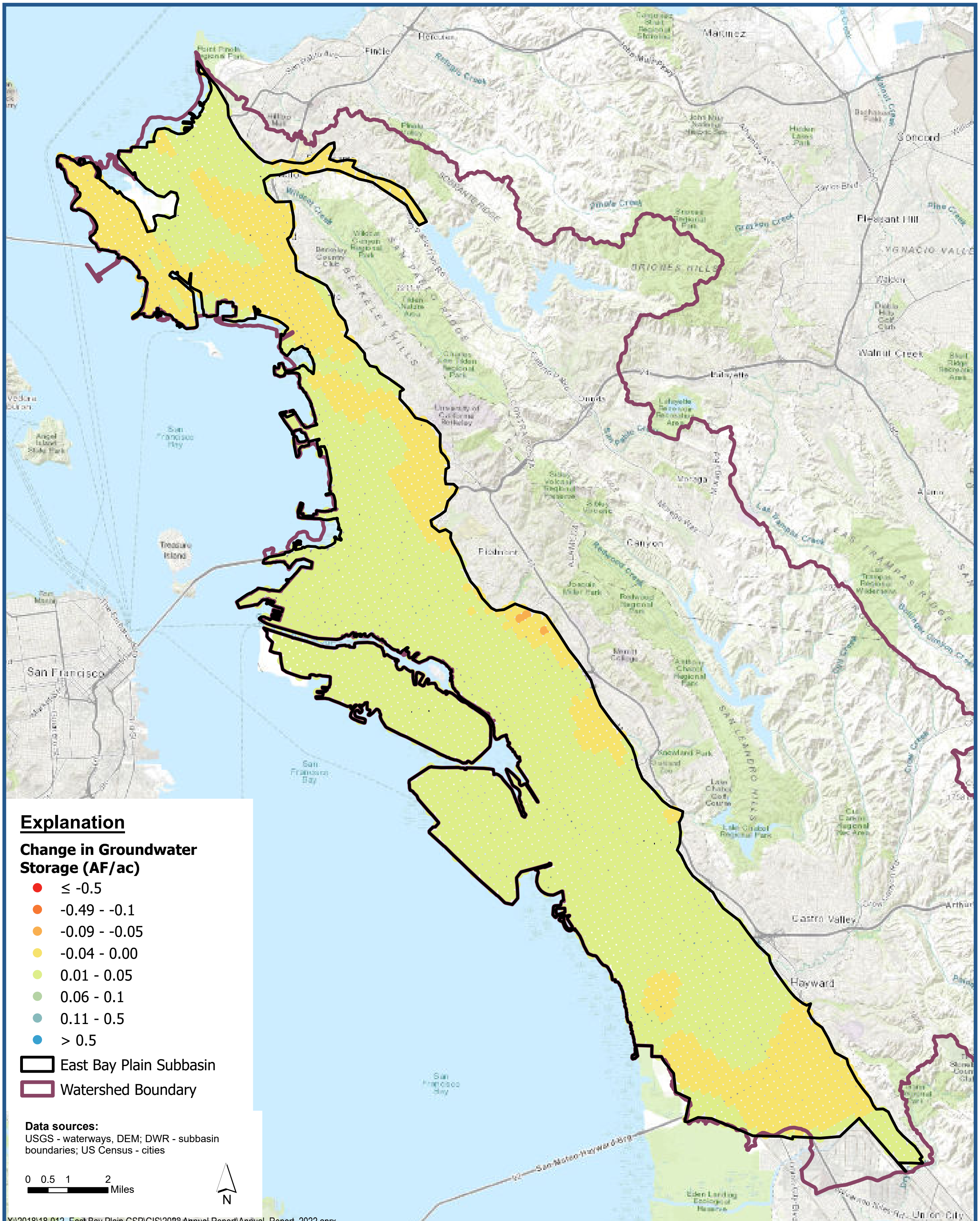
Change in Groundwater Storage in the Intermediate Aquifer Zone – Spring 2018 to Spring 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure C-7



Change in Groundwater Storage in the Intermediate Aquifer Zone – Spring 2019 to Spring 2020

Figure C-8

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

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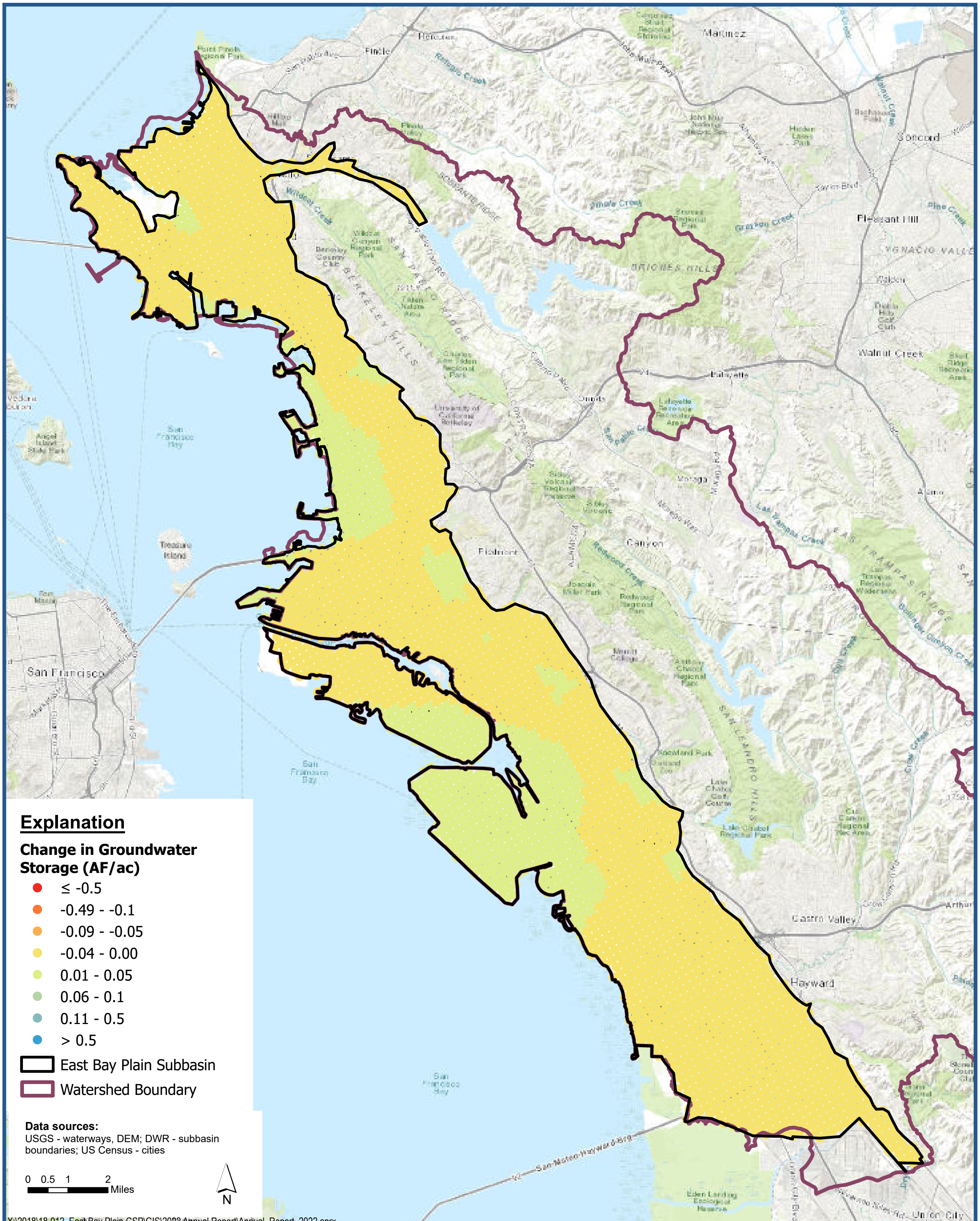

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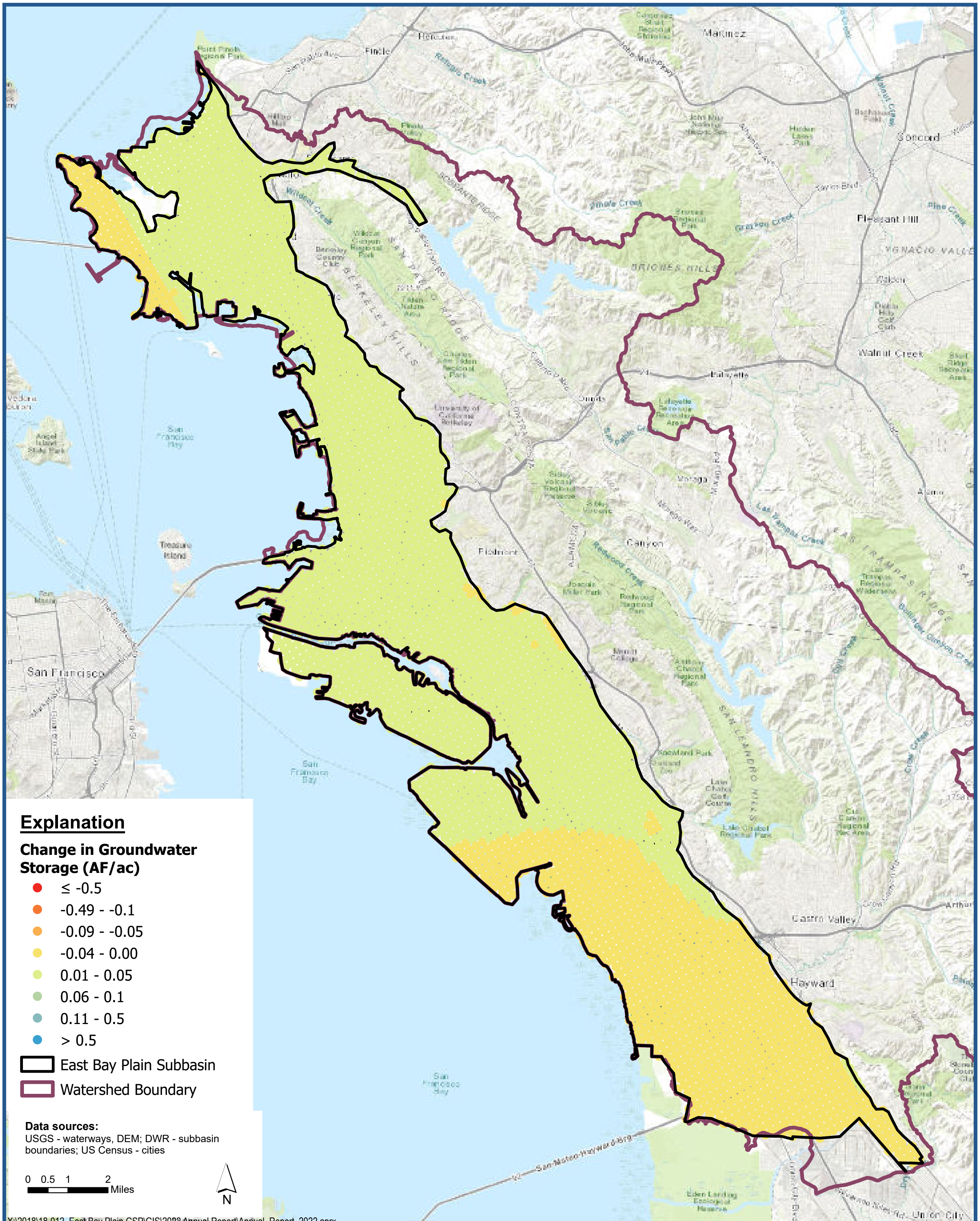
Change in Groundwater Storage in the Intermediate Aquifer Zone – Spring 2020 to Spring 2021

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure C-9



Change in Groundwater Storage in the Deep Aquifer Zone – Spring 2018 to Spring 2019

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure C-10

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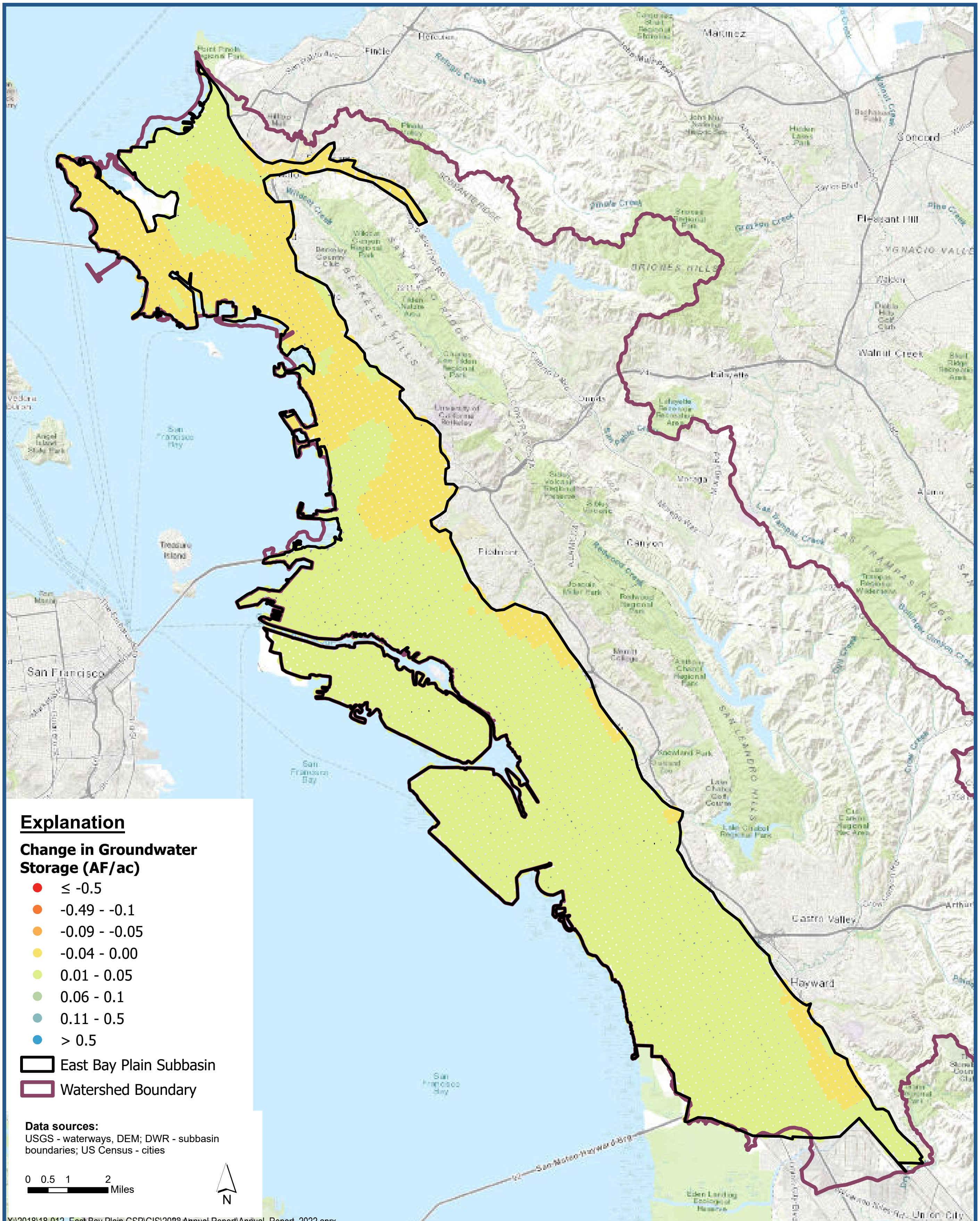

Change in Groundwater Storage in the Deep Aquifer Zone – Spring 2019 to Spring 2020

Figure C-11

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

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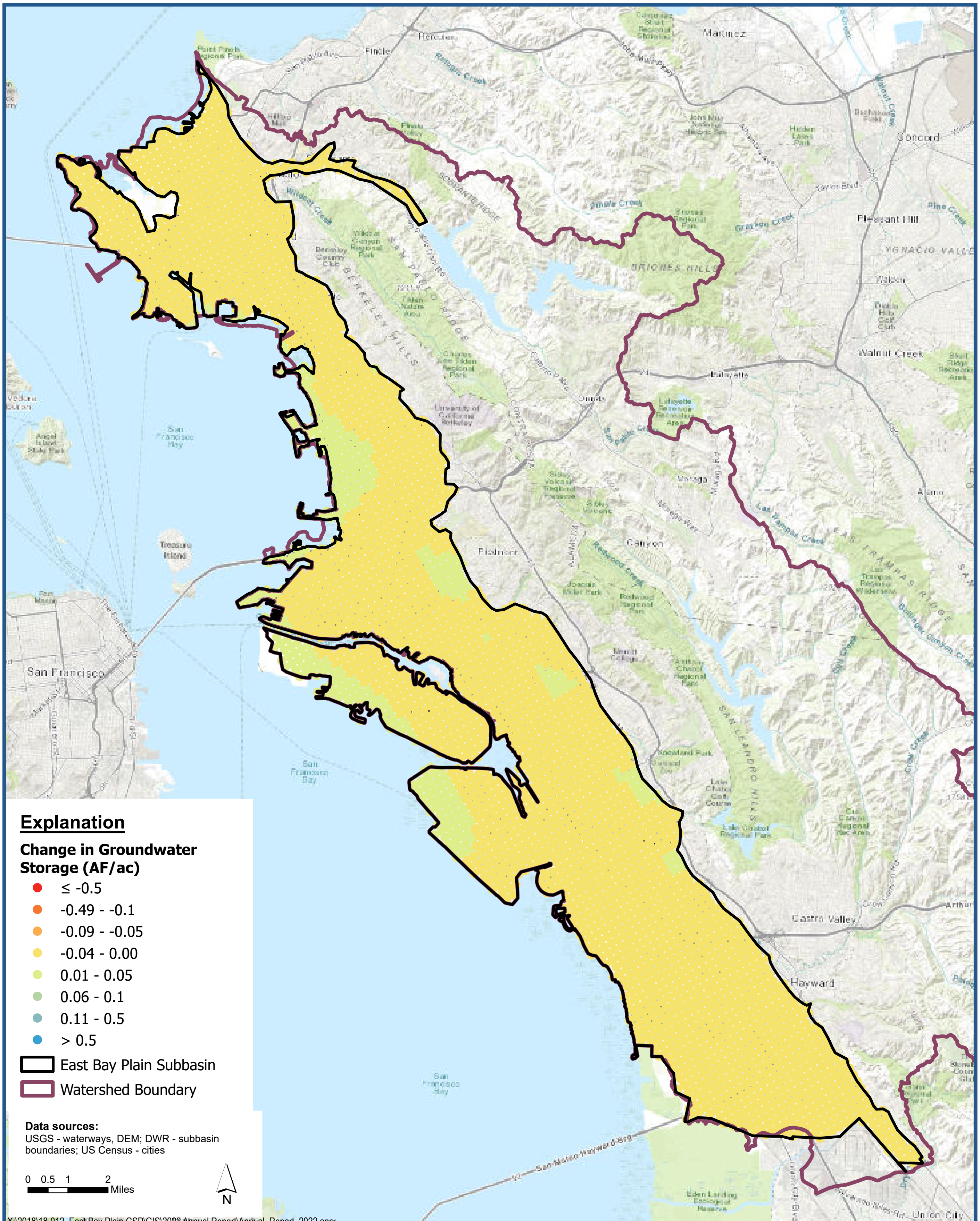

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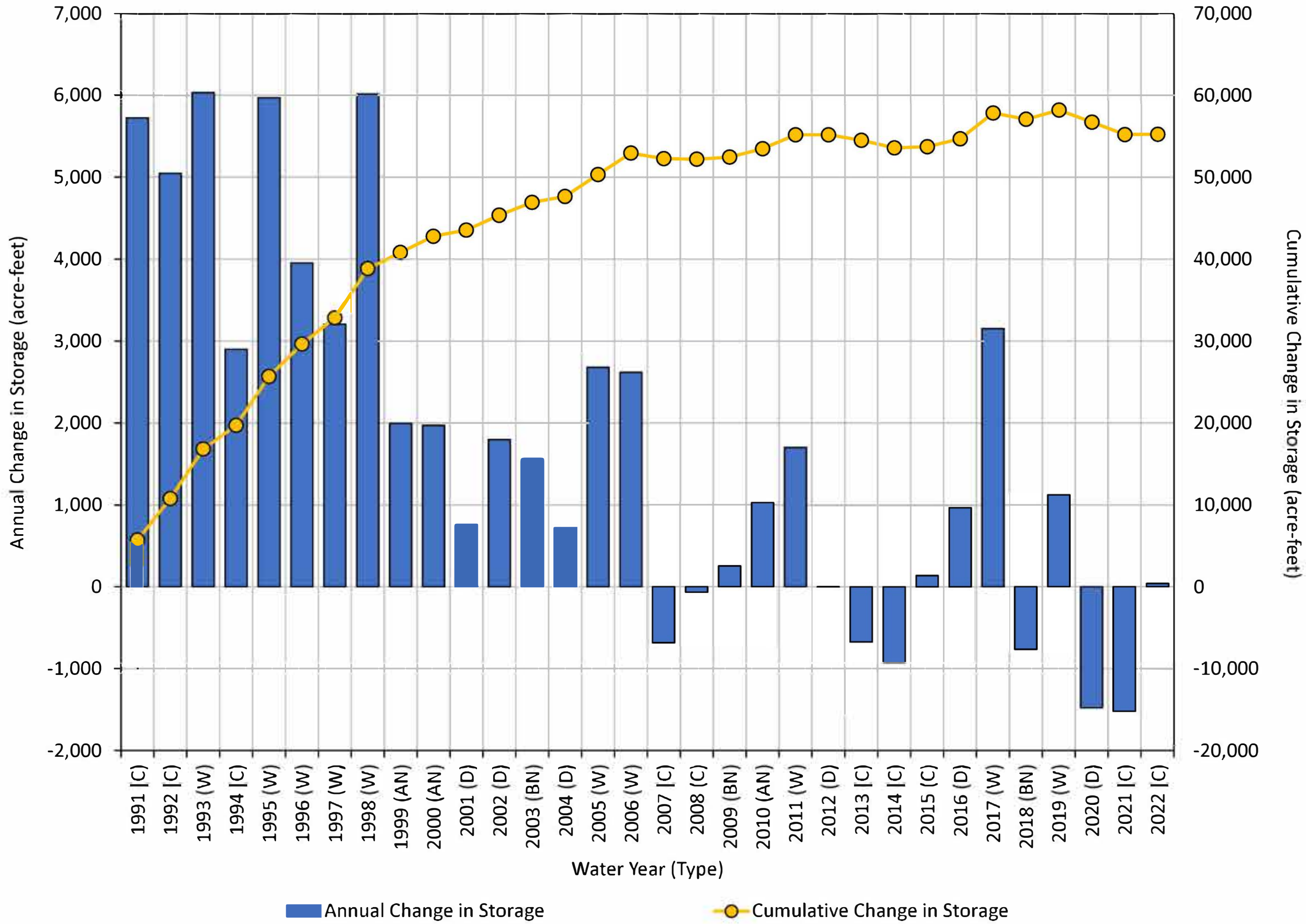
Change in Groundwater Storage in the Deep Aquifer Zone – Spring 2020 to Spring 2021

Figure C-12

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

APPENDIX D

Tables and Figures for Groundwater Storage Change from 1991 to 2022



NOTE: Positive value indicates increase in storage; Negative value indicates decrease in storage.
Water Year Type is based on the San Joaquin Valley Water Year Index. (W - Wet; AN - Above Normal; BN - Below Normal; D - Dry; C - Critical)

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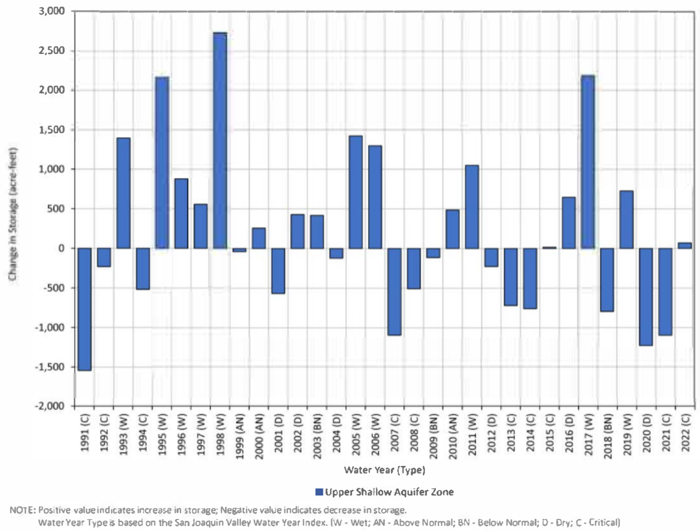
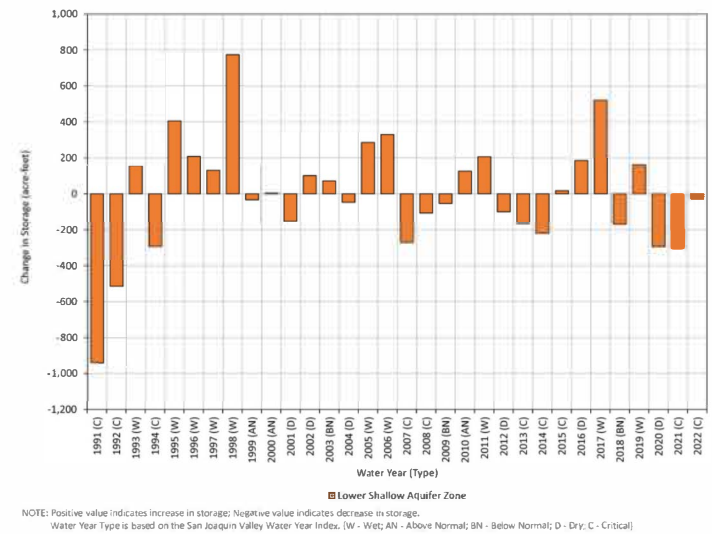
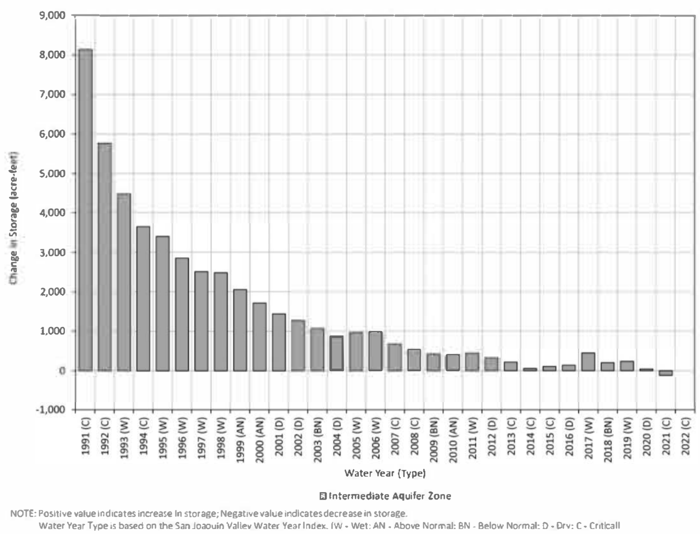
Change in Groundwater Storage in the East Bay Plain Subbasin

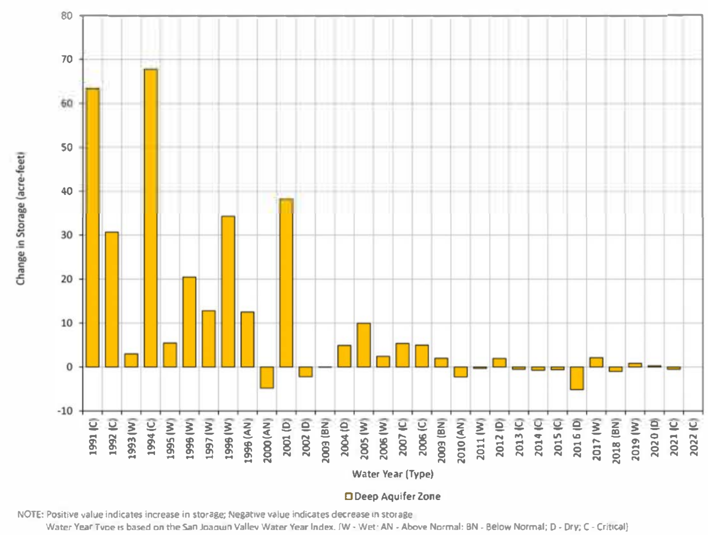
East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure D-1









NOTE: Positive value indicates increase in storage; Negative value indicates decrease in storage.
Water Year Type is based on the San Joaquin Valley Water Year Index. (W - Wet; AN - Above Normal; BN - Below Normal; D - Dry; C - Critical)

LSCE TEAM

Change in Groundwater Storage in the East Bay Plain Subbasin by Aquifer Zone

East Bay Plain Subbasin
Groundwater Sustainability Plan Water Year 2022 Annual Report

Figure D-2