Annual Report

Yucaipa Subbasin Groundwater Sustainability Plan 2019, 2020 & 2021 Water Years

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Prepared for:

YUCAIPA GROUNDWATER SUSTAINABILITY AGENCY
c/o San Bernardino Valley Municipal Water District
380 East Vanderbilt Way
San Bernardino, California 92408
Contact: Mark Iverson, President

Prepared by:

DUDEK
605 Third Street
Encinitas, California 92024
Contact: Steven Stuart, PE

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AF	acre-feet
AFY	acre-feet per year
bgs	below ground surface
DTW	depth-to-water
DWR	California Department of Water Resources
ET	evapotranspiration
ft/ft	feet per foot
GDE	groundwater dependent ecosystem
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
MOA	Memorandum of Agreement
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanographic and Atmospheric Administration
OGSWFF	Oak Glen Surface Water Filtration Facility
RMP	representative monitoring point
SBCFCD	San Bernardino County Flood Control District;
SBVMWD	San Bernardino Valley Municipal Water District
SGMA	Sustainable Groundwater Management Act
SGPWA	San Gorgonio Pass Water Agency
SWP	State Water Project
USGS	U.S. Geological Survey
WHWC	Western Heights Water Company
WY	water year
YIHM	Yucaipa Integrated Hydrologic Model
YVRWFF	Yucaipa Valley Regional Water Filtration Facility
YVWD	Yucaipa Valley Water District

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1 Executive Summary

1.1 Introduction

The Yucaipa Subbasin (Subbasin, Plan Area) lies within the Upper Santa Ana River Basin Hydrologic Region (DWR basin number 8-002.07). DWR designated the Yucaipa Subbasin a high priority basin based primarily on its reliance on groundwater for water supply (DWR 2019). Nine local agencies with jurisdiction in the Plan Area formed the Yucaipa Groundwater Sustainability Agency (GSA) per a Memorandum of Agreement (MOA) adopted in 2017. The Yucaipa GSA adopted the Yucaipa Subbasin GSP on January 26, 2022 (Dudek 2022). The GSP established sustainability criteria and management actions to sustainably manage the groundwater resource per the following sustainability indicators: chronic lowering of groundwater levels, the significant and unreasonable reduction in groundwater in storage, the significant and unreasonable loss of surface water/groundwater interaction, and the significant and unreasonable occurrence of land subsidence resulting from groundwater production in the principal aquifer.

The Yucaipa Subbasin was divided into four management areas: North Bench, Calimesa, Western Heights, and San Timoteo. The boundaries of the management areas were based on geologic structures (i.e., faults, hydraulic barriers) that influence groundwater flow, the distribution of water supply wells by the different water users, and the identification and location of GDEs in the Subbasin. Sustainability criteria were identified for each management area. A network of wells was identified to monitor and characterize groundwater conditions in the principal aquifer. A subset of wells from the monitoring network were designated as representative monitoring points. Specific groundwater levels were defined at each RMP and represent minimum thresholds and measurable objectives that, based on the number and occurrence when conditions at the RMPs fall below these thresholds, will trigger the implementation of management actions to protect and manage the groundwater resource sustainably.

This annual report meets the requirements put forth in Sub-article 7 of Article 5 of the California Code of Regulations Division 2 Chapter 1.5 (23 CCR, Section 356.2). The Yucaipa Subbasin GSP included climatic, groundwater elevation and pumping data from the 1966 WY to the 2018 WY. This annual report includes data collected from the 2019 WY to the 2021 WY. Groundwater conditions observed in the last three water years are compared to the measurable objectives and minimum thresholds established in the GSP to characterize recent conditions and to identify potential trends leading into the 2022 WY.

1.2 Climatic Conditions

Daily precipitation data was obtained by the network of climatic stations maintained by the San Bernardino County Flood Control District in the Plan Area. The precipitation data compiled by month and used to characterize the water year-type for the 2019, 2020 and 2021 water years (WY). The water year-types for the 2019, 2020 and 2021 WY were “above-normal”, “normal”, and “critically dry.”

1.3 Groundwater Conditions

Groundwater conditions in the Subbasin in the 2019 to 2021 WY were characterized using static groundwater elevation data collected from 72 of the 73 wells included in the groundwater monitoring network defined in the GSP. Groundwater elevations were typically measured on a monthly basis by the member agencies of the GSA. Monthly groundwater extractions were reported by the member agencies of the GSA, and extractions by native vegetation in the Subbasin were estimated using the USGS Yucaipa Integrated Hydrologic Model (YIHM), an integrated surface water and groundwater numerical model developed for the San Timoteo Wash watershed.

Static groundwater elevations indicated that groundwater flows from northeast to southwest year-round, and that groundwater elevations have generally remained consistent or increased in the past three water years, with the exception of conditions in the North Bench management area. Groundwater elevations declined approximately 80 to 100 feet since March 2020 as rainfall in the region was 35% of normal annual rainfall in the 2021 WY, no surplus supplemental water was discharged to the Wilson Creek and Oak Glen Creek spreading basins in the 2021 WY, and groundwater production (5,000 AF) exceeded the estimated sustainable yield of 3,940 AFY for the North Bench Management Area. Groundwater elevations, however, remained above the measurable objectives and minimum thresholds defined in the North Bench management area during the 2019, 2020 and 2021 WY.

1.4 Change in Storage

The change in groundwater storage in the Subbasin for water years 2019 through 2021 was estimated using the YIHM. The YIHM simulates the hydrologic system using a combination of local climate conditions, land surface and land use properties, estimated aquifer properties, and native and non-native groundwater supplies and demands. The YIHM was extended to simulate conditions in the watershed through the end of water year 2021. The annual changes in groundwater in storage for the Subbasin were estimated at an increase of 8,522 AF in the 2019 WY, an increase of 3,861 AF in the 2020 WY, and a decrease of 3,792 AF in the 2021 WY.

1.5 GSP Implementation Progress

The Yucaipa Subbasin GSP was adopted by the Yucaipa GSA on January 26, 2022. The 2022 WY marks the first year that groundwater conditions will be evaluated against the sustainability criteria established in the GSP and whether, based on conditions in the 2022 WY, management actions will be implemented to sustainably manage the Subbasin. Data characterizing groundwater conditions in the 2019, 2020 and 2021 WY will not be used to determine if management actions established in the GSP will be implemented, but will be used to define recent conditions and how conditions may be trending into the 2022 WY.

Groundwater conditions observed in the 2019, 2020 and 2021 WY indicated that Management Action #1, which would lead to a reduction in the net use of groundwater when groundwater levels decline below measurable objectives, would not have been implemented in those water years if applicable at that time. Groundwater levels in the Subbasin did not fall below the measurable objectives at 50% or more of the RMPs for two consecutive years in any of the management areas in the Plan Area.

Management Action #2, which established sustainable yield pumping allocations for the groundwater users in the Subbasin and established a 5-year pumping credit system, was intended to constrain pumping to the sustainable yields estimated for each management area and to incentivize groundwater production below the sustainable yield pumping allocations. YVWD, South Mesa and South Mountain exceeded their respective sustainable yield pumping allocations in the 2020 WY (YVWD in the North Bench management area) and the 2021 WY (YVWD in North Bench, South Mesa, South Mountain and private users (estimated) in Calimesa management area). This management action will be implemented in the 2023 WY if these groundwater users exceed their respective sustainable yield pumping allocations in the 2022 WY.

If a groundwater user exceeds their respective sustainable yield pumping allocation, then the groundwater user will be charged a replenishment fee equivalent to the volume of groundwater that exceeds the sustainable yield pumping allocation multiplied by the rate per AF to purchase supplemental water at San Bernardino Valley Municipal Water District (SBVMWD) rates or San Gorgonio Pass Water Agency (SGPWA) rates, depending on management area and the availability of supplemental water for purchase. If the groundwater user has accrued pumping credits or has surplus supplemental water available in the aquifer, then the pumping credits or surplus supplemental water may be applied up to the pumping exceedance. If there continues to be a deficit, then a replenishment fee will be charged to the groundwater user. The supplemental water required under this management action will be purchased in the subsequent water year, if available, and used to artificially recharge and replenish the Subbasin. If no supplemental water is available, then the groundwater user may reduce pumping, implement programs (e.g., water conservation programs) and/or projects that will reduce the net use of groundwater.

The Yucaipa GSA identified proposed projects that have been designed, permitted, and are undergoing development or will in the near future. These include the Wilson Creek III Basins, the Pendleton Avenue Low Water Crossing, and the Upper Wildwood Creek Basin (Dudek 2022). These basins are designed to capture stormwater flows and enhance recharge to the Subbasin. These basins will be located in the North Bench Management Area.

The Yucaipa GSA is evaluating potential sites to construct and operate spreading basins to enhance recharge in the Calimesa Management Area. The YIHM predicts that groundwater elevations will decline below the measurable objective under the Future Baseline with Climate Change II scenario within the 50-year planning and implementation horizon (Dudek 2022). Therefore, in addition to the management actions described in the GSP, the potential construction of one or two spreading basins will benefit users in this management area. The Yucaipa GSA will evaluate the proposed basin(s) after more details of their construction and operation are developed. The basins will be included in the YIHM and evaluated during the 5-year evaluation study.

2 Background and Plan Area

2.1 Background

The Yucaipa Subbasin (Subbasin) lies within the Upper Santa Ana River Basin Hydrologic Region (DWR basin number 8-002.07) and underlies an area of approximately 25,300 acres under portions of the cities of Calimesa, Redlands, and Yucaipa, as well as unincorporated portions of San Bernardino and Riverside. The Yucaipa GSA jurisdictional boundary consists of the entire Yucaipa Subbasin within San Bernardino County and Riverside County Counties (**Figure 1**).

DWR designated the Yucaipa Subbasin a high priority basin based primarily on its reliance on groundwater for water supply (DWR 2019). However, the Subbasin is not in a state of critical overdraft. Marked declines in groundwater levels were observed within the Yucaipa Subbasin prior to the mid-2000s. The declining trends in groundwater levels ceased following the importation of State Water Project (SWP) water into the Subbasin in 2004. The importation of SWP water supplemented some of the local groundwater production in the Yucaipa Subbasin to where the annual rate of groundwater production fell below the estimated sustainable yield of the Subbasin (Dudek 2022). Occasionally, a portion of the imported SWP water, when available, was discharged to spreading basins to promote artificial recharge to the principal aquifer in the Subbasin. Consequently, groundwater levels observed in the principal aquifer of the Subbasin either stopped declining or recovered to historical highs observed in the late 1980s.

Prior to the Sustainable Groundwater Management Act (SGMA), the water agencies in the Subbasin worked collaboratively in developing a groundwater management plan. The agencies implemented investigations to estimate the safe yield of the Subbasin, and evaluated potential sites to enhance artificial recharge. The agencies formed the Yucaipa Groundwater Sustainability Agency (GSA) in 2017 to develop a Groundwater Sustainability Plan (GSP) for the Subbasin. Groundwater production continues to be the primary contributor to the water supply in the Subbasin. The Yucaipa Subbasin GSP establishes management actions to protect and maintain the beneficial use of the groundwater resource for all beneficial users, including groundwater dependent ecosystems located along riparian corridors.

2.1.1 Yucaipa Groundwater Sustainability Agency

Nine local agencies in the Plan Area entered into an agreement to form the Yucaipa Groundwater Sustainability Agency (GSA) per a Memorandum of Agreement (MOA) adopted in 2017. These local agencies include South Mesa Water Company, South Mountain Water Company, Western Heights Water Company and Yucaipa Valley Water District, herein collectively referred to as the "Water Purveyors"; the City of Calimesa, the City of Redlands, and the City of Yucaipa, herein collectively referred to as the "Municipalities"; and San Bernardino Valley Municipal Water District and San Gorgonio Pass Water Agency, herein collectively referred to as the "Regionals" (**Table 1**). Each agency is individually referred to as a "Party" and are collectively referred to as the "Parties." The County of Riverside and the County of San Bernardino, collectively referred to as the "Counties," are considered "Stakeholders" and were not Parties to this MOA. The City of Calimesa submitted a written Notice of Withdrawal dated November 19, 2018, and the Yucaipa GSA subsequently acknowledged the withdrawal of the City of Calimesa from the Yucaipa GSA at the January 23, 2019, GSA Board meeting. The City of Calimesa is a stakeholder in the Plan Area.

Table 1. Yucaipa GSA Member Agencies

Water Purveyors
South Mesa Water Company
South Mountain Water Company
Western Heights Water Company
Yucaipa Valley Water District
Municipalities
City of Redlands
City of Yucaipa
Regionals
San Bernardino Valley Municipal Water District
San Gorgonio Pass Water Agency

Source: Yucaipa Subbasin Groundwater Sustainability Plan (Dudek 2022).

2.1.2 Yucaipa Subbasin Groundwater Sustainability Plan

The Yucaipa GSA adopted the Yucaipa Subbasin GSP on January 26, 2022 (Dudek 2022). The GSP provides the framework for the sustainable management of the Subbasin's groundwater resource. The GSP identifies the GSA member agencies and legal authority of the GSA, presents historical observations of groundwater levels and usage in the Subbasin, and how climate, land use, and water management programs influenced groundwater conditions since the 1965-1966 water year ("WY", a water year extends from October 1 to September 30 of the following calendar year). The GSP also evaluated future conditions over the next 50 years by incorporating two different climate change scenarios.

A hydrogeological conceptual model was developed that identified the geological and hydrogeological characteristics of the Subbasin, and identified the inflow and outflow components of a water balance for the Subbasin (Dudek 2022). The USGS developed an integrated hydrological numerical model to simulate groundwater conditions in the Subbasin (Cromwell and Alzraiee 2022). The numerical model was used to estimate the sustainable yield of the Subbasin (10,980 acre-feet per year) and to calculate the annual change in storage for the Subbasin from the 1965 WY to the 2069 WY. The numerical model was also used to establish groundwater level thresholds for the sustainability criteria defined in the GSP.

The GSP established sustainability criteria and management actions to sustainably manage the groundwater resource per the following sustainability indicators: chronic lowering of groundwater levels, the significant and unreasonable reduction in groundwater in storage, the significant and unreasonable loss of surface water/groundwater interaction, and the significant and unreasonable occurrence of land subsidence resulting from groundwater production in the principal aquifer.

The Yucaipa Subbasin was divided into four management areas: North Bench, Calimesa, Western Heights, and San Timoteo (Figure 2). The boundaries of the management areas were based on the geologic structures (i.e., faults, hydraulic barriers) that influence groundwater flow, the distribution of water supply wells by the different water users, and the identification and location of GDEs in the Subbasin. Sustainability criteria were identified for each management area. For the North Bench, Calimesa, and Western Heights Management Areas, minimum thresholds were defined at either the historical low in groundwater elevations in the North Bench Management Area, or below historical lows in the Calimesa and Western Heights Management Areas. The minimum threshold and measurable objective for the San Timoteo Management Area were defined to prevent significant and unreasonable effects on groundwater-dependent ecosystems (GDEs) identified along San Timoteo Creek. A drought buffer was defined for the North Bench, Calimesa, and Western Heights Management Areas to provide operational flexibility between their respective measurable objectives and minimum thresholds.

A network of wells was identified to monitor and characterize groundwater conditions in the principal aquifer (Figure 3). A subset of wells from the monitoring network were designated as representative monitoring points (RMP, Figure 4). Specific groundwater levels were defined at each RMP and represent minimum thresholds and measurable objectives that, based on the number and occurrence when conditions at the RMPs fall below these thresholds, will trigger the implementation of management actions to protect and manage the groundwater resource sustainably.

Three management actions were defined in the GSP: (1) reduce the net use of groundwater when groundwater levels fall below measurable objectives, (2) constrain annual pumping to sustainable yield pumping allocations assigned to each user per management area and issue pumping credits when annual production is below the pumping allocation, and (3) provide an accounting of surplus supplemental water used to artificially recharge the Subbasin that is available to the water purveyor that purchased the water and percolated it at a spreading basin. The GSA has also designed, permitted and is currently developing the installation of storm water capture basins to enhance recharge to the Subbasin and reduce the dependence on imported water.

The Yucaipa Subbasin GSP includes groundwater and pumping data from the 1965 WY to the 2018 WY. This annual report includes data collected in the 2019, 2020 and 2021 WY, and provides a review of groundwater levels measured against the minimum thresholds and measurable objectives defined for each RMP in each management area. Section 7 provides a review of the GSP implementation progress and identifies whether conditions have required the implementation of management actions.

2.2 Plan Area

2.2.1 Description of the Plan Area

The Plan Area encompasses the entire Yucaipa Subbasin (DWR Basin Number 8-002.07) of the Upper Santa Ana Valley Basin (DWR Basin Number 8-002) as defined following the basin boundary modification adopted by DWR in 2016 (DWR 2016). The Plan Area has a surface area of approximately 39.5 square miles or 25,300 acres (Figure 1). The Plan Area is bounded to the north by the San Andreas Fault Zone and San Bernardino Mountains, to the east by the Yucaipa Hills, to the west by the Crafton Hills, and to the south by the San Timoteo Badlands.

The San Timoteo Subbasin (DWR Basin Number 8-002.08) is adjacent to the Yucaipa Subbasin on its southern boundary (Figure 5). The adjudicated San Bernardino Subbasin (DWR Basin Number 8-002.06) is adjacent to the Yucaipa Subbasin on its western boundary. The adjudicated Beaumont Basin lies almost entirely in the San Timoteo Subbasin and its northwestern boundary is adjacent to southeastern boundary of the Live Oak subbasin in the Yucaipa Subbasin.

2.2.2 Climate

San Bernardino Valley has a semiarid, Mediterranean climate characterized by relatively hot, dry summers and cool winters with intermittent precipitation. Most precipitation occurs from December through March, and rainless periods of several months are common in the summer. Precipitation is mostly in the form of rain in the lower elevations and mostly snow above approximately 6,000 feet above NAVD88 in the San Bernardino Mountains.

Mean annual precipitation by water year in the San Bernardino Valley ranges from approximately 10 inches near Riverside to approximately 30 inches in the upper San Bernardino Mountains (WSC 2018). Mean annual precipitation in the Yucaipa Subbasin is approximately 16 inches. Historical precipitation data indicates that a period of above average or below-average precipitation can last more than 30 years, such as the dry period that extended from 1947 to 1977. The region has been experiencing an ongoing drought since 1999 (WSC, 2018).

2.2.1 Precipitation

2.2.1.1 San Bernardino County Flood Control District

The San Bernardino County Flood Control District (SBCFCD), a division of the Department of Public Works, installed a network of climate stations throughout San Bernardino County to collect precipitation, stream flow and temperature data. The data is used to manage flood control storm warnings, structure and channel design, runoff calculations, and environmental studies (SBCFCD 2021). Daily precipitation data was obtained from San Bernardino's online database for 17 stations within the Plan Area (**Figure 6**). The stations range in elevation from 1,285 feet above NAVD88 at the Redlands – Roth station (Site ID 3023), which is located approximately 850 feet downstream of the farthest downstream extent of the Yucaipa Subbasin, to 4,630 feet above NAVD88 at the Oak Glen station (Site ID 3015) located near the eastern end of the Triple Falls Creek subarea. **Table 2** summarizes the locations and periods of record for each of the 17 stations used to characterize precipitation in the Yucaipa Subbasin.

The historical precipitation data collected at the 17 SBCFCD climate stations was used to characterize the water year types from the 1954 WY to the 2021 WY. Daily precipitation data was collected at various periods between these stations, with the longest running data collection period recorded at the Oak Glen station (SBCFCD Station ID No. 3015) from October 1, 1945 to September 30, 2021. The daily precipitation data was compiled by water year for each station.

Mean annual precipitation per water year ranged from 11.42 inches at Station 2890 in the Crafton subarea to 24.39 inches at Station 3015 in the Triple Falls Creek subarea (**Table 3**). Precipitation amounts tended to follow the topographical landscape of the Yucaipa Subbasin. Mean annual precipitation declined when transitioning from the highest elevations in the Triple Falls Creek subarea (24.39 inches) and the foothills of the San Bernardino Mountains to the lower elevations in the Yucaipa Plain where mean annual precipitation ranged from 15.03 to 17.96 inches in the Oak Glen, Gateway, Wilson Creek and Calimesa subareas. The mean annual precipitation in the Crafton, Western Heights and Live Oak subareas, which are the western subareas and lowest in elevation, ranged from 11.42 to 13.61 inches.

The weighted mean annual precipitation across the Plan Area is 15.76 inches based on precipitation data collected at the 17 SBCDPW climate stations from the 1953 WY to the 2021 WY (**Table 3**). The mean annual precipitation estimate was weighted against the number of annual precipitation totals recorded for each station divided by the total number of annual precipitation totals across the Subbasin.

Table 2. San Bernardino County Flood Control District Climatic Stations in the Yucaipa Subbasin

SBCFCD Station ID No.	Site Name	Subarea	Latitude	Longitude	Elevation (ft NAVD88)	Begin Data Record	End Data Record
2890	Yucaipa Regional	Crafton	34.04876	−117.04857	2,606	9/5/1989	Ongoing
2915	Wilson Creek	Western Heights	34.03437	−117.07441	2,235	2/12/2004	Ongoing
3015	Oak Glen	Triple Falls Creek	34.05185	−116.95272	4,680	10/1/1945	Ongoing
3023	Redlands–Roth	Live Oak	34.03402	−117.21035	1,285	2/1/1932	Ongoing
3099	Yucaipa County Yard	Western Heights	34.03351	−117.10241	2,140	5/1/1957	10/1/1978
3126	Yucaipa	Wilson Creek	34.03340	−117.03511	2,815	1/31/1949	10/1/1990
3126A	Calimesa East	Calimesa	34.00444	−117.01733	2,813	5/1/1964	Ongoing
3128B	Yucaipa Adams 2e	Wilson Creek	34.02924	−117.04426	2,860	10/1/1949	10/1/1980
3129	Yucaipa C.D.F.	Gateway	34.04653	−117.03558	2,660	1/1/1951	1/22/1980
3129A	Yucaipa C.D.F.	Gateway	34.04654	−117.03559	2,660	1/22/1980	Ongoing
3132	Yucaipa Water Company	Calimesa	34.02157	−117.04470	2,710	2/20/1953	Ongoing
3239	Redlands Country Club	Live Oak	34.01898	−117.14947	2,080	5/24/1964	1/27/2005
3239A	Redlands Country Club WT	Live Oak	34.01385	−117.13868	2,281	1/27/2005	Ongoing
3356	Crafton Hills Fire Station #18	Western Heights	34.03435	−117.09252	2,125	9/28/1979	Ongoing
3386	Calimesa–Raisner	Calimesa	34.00435	−117.03375	2,620	11/23/1988	Ongoing
3121	Oak Glen–Sample	Oak Glen	34.05525	−116.98675	3,695	10/2/1980	Ongoing
2800	Wildwood Canyon	Oak Glen	34.01434	−117.00778	2,946	9/14/1999	Ongoing

Note: SBCFCD = San Bernardino County Flood Control District; ft NAVD88 = feet above North American Vertical Datum of 1988.

Table 3. Mean Annual Precipitation in the Yucaipa Subbasin

Subarea	Mean Annual Precipitation (inches)[a]	Minimum Elevation at SBCFCD Station (ft NAVD88)	Maximum Elevation at SBCFCD Station (ft NAVD88)
Crafton	11.42	2,606	2,606
Live Oak	11.63	1,285	2,281
Western Heights	13.61	2,125	2,235
Gateway	15.03	2,660	2,660
Wilson Creek	15.31	2,815	2,860
Calimesa + Singleton	16.56	2,620	2,813
Oak Glen	17.96	2,946	3,695
Triple Falls Creek	24.39	4,680	4,680
Yucaipa Subbasin	15.76	1,285	4,680

Note: SBCFCD = San Bernardino County Flood Control District; ft NAVD88 = feet above North American Vertical Datum of 1988.
[a] Per water year (October 1 to September 30).

2.2.1.2 National Oceanic and Atmospheric Administration

Daily precipitation data were also obtained from National Oceanic and Atmospheric Administration (NOAA) weather stations located in Redlands (Station #USC00047306), Yucaipa (Station #US1CASR0044), and Beaumont (Station #US1CARV0018), California. The Redlands station is located approximately 0.5 miles northeast of the farthest downgradient end of the Plan Area (Figure 6). The station is at an elevation of 1,417 feet above NAVD88. The Yucaipa station, “Yucaipa 1.5NNE,” is located approximately 0.5 miles northwest of the Wilson Creek spreading basins. The Yucaipa station is at an elevation of 2,776 feet above NAVD88. The Beaumont station is located approximately 2 miles northwest of the intersection of Interstate 10 and State Route 60 in the San Timoteo Wash Watershed, approximately 1.9 miles south of the Singleton Subbasin (Figure 6). The elevation of the Beaumont station is 2,532 feet above NAVD88 (Table 4).

The mean annual (by water year) precipitation at these three NOAA stations ranged from 12.48 inches to 15.22 inches. The Redlands station, with an annual mean of 12.48 inches, has the longer record of data and is also at the lowest elevation. The highest average was 15.22 inches at the Yucaipa 1.5 NNE station, which is at the highest elevation at 2,776 feet above NAVD88 (Table 4).

Table 4. Summary Information for NOAA Climatic Stations in the Vicinity of the Yucaipa Subbasin

NOAA Station ID	NOAA Network ID	Latitude (degrees)	Longitude (degrees)	Elevation (ft NAVD88)	Period of Data Collection	Mean Annual Precipitation (inches)[a]
Redlands	USC00047306	34.037	−117.195	1,417	Oct. 1963–Sep. 2021	12.48
Beaumont 2.5 NW	US1CARV0018	33.954	−117.012	2,532	Oct. 2009–Sep. 2021	12.80
Yucaipa 1.5 NNE	US1CASR0044	34.054	−117.038	2,776	Oct. 2014–Sep. 2021	15.22

Notes: NOAA = National Oceanic and Atmospheric Administration; ft NAVD88 = feet above North American Vertical Datum of 1988; NW = northwest; NNE = north by northeast.

[a] Per water year (October 1 to September 30).

2.2.1.3 Cumulative Departure from Mean Monthly Precipitation

Historical daily precipitation data from the SBCFCD climatic stations 3015 (Oak Glen) and 3126A (Calimesa East) and from the NOAA Redlands, Yucaipa 1.5 NNE, and Beaumont 2.5NW stations were compiled as total monthly precipitation. Mean monthly precipitation was calculated for each station. Mean monthly precipitation ranged from 0.03 inches in June at the NOAA Beaumont 2.5 NW station to 4.55 inches in February at the SBCFCD Oak Glen station (**Table 5**).

The cumulative departure from the mean monthly precipitation was calculated for the SBCFCD Oak Glen and Calimesa East stations and the NOAA Redlands station because these stations had precipitation data records extending as far back as 1963 (**Figure 7**). The declining cumulative departure of mean monthly precipitation (i.e., less-than-normal rainfall) from the 1945 WY to 1965 WY at the Oak Glen station indicates an extended 20-year drought with intermittent wet years in 1951 and 1958. The trend after 1965 reversed direction and generally increased with significant wet periods from 1965 to 1969, 1978 to 1983, and 1992 to 1998. The region is currently experiencing a drought that started in the 1999 WY (**Figure 7**). The cumulative departure from the mean monthly for the SBCFCD Calimesa East and NOAA Redlands stations show the same trends, but with less variation in the changes in rainfall because these stations are at lower elevations than the Oak Glen station.

Table 5. Mean Monthly Precipitation in the Yucaipa Subbasin

Climatic Station ID	Elevation (ft NAVD88)	Mean Monthly Precipitation (inches)											
		Oct	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*
SBCFCD 3015 (Oak Glen)	4,680	0.89	2.29	3.18	4.40	4.56	4.07	1.92	0.96	0.16	0.40	0.44	0.63
SBCFCD 3126A (Calimesa East)	2,813	0.66	1.73	2.50	3.24	3.53	2.82	1.31	0.63	0.15	0.21	0.19	0.41
NOAA Yucaipa 1.5 NNE	2,776	0.50	1.25	3.09	3.25	2.44	2.21	1.10	0.89	0.05	0.27	0.21	0.25
NOAA Beaumont 2.5 NW	2,532	0.35	1.09	2.89	2.49	1.95	1.93	0.89	0.55	0.03	0.24	0.17	0.11
NOAA Redlands	1,417	0.49	1.15	1.89	2.63	2.57	2.04	0.96	0.36	0.09	0.12	0.18	0.31
Maximum Mean Monthly Precipitation		0.91	0.89	2.29	3.18	4.40	4.56	4.07	1.92	0.96	0.16	0.40	0.44
Minimum Mean Monthly Precipitation		0.33	0.35	1.09	1.89	2.49	1.95	1.93	0.89	0.36	0.03	0.12	0.17

Notes: ft NAVD88 = feet above North American Vertical Datum of 1988; SBCFCD = San Bernardino County Flood Control District; NOAA = National Oceanic and Atmospheric Administration; NNE = north by northeast; NW = northwest.

2.2.1.4 Water Year Type

Periods of above or below average precipitation affect the volume of water that naturally recharges the groundwater aquifer underlying the Plan Area. To characterize the effects of total water year precipitation on local groundwater supplies and demands, and the volume of groundwater in storage, the Yucaipa GSA defined the following six categories to characterize the water year types: Wet, Above Normal, Normal, Below Normal, Dry, and Critically Dry. Water year type was characterized by normalizing measured water year precipitation by the long-term water-year precipitation averages measured at each of the 17 SBCFCD climate stations in the Subbasin. The normalized water year precipitation measurements were then categorized into the following water year types:

1. Critically Dry: <50% of the long-term precipitation mean
2. Dry: ≥50%, but <75% of the long-term precipitation mean
3. Below Normal: ≥75%, but <90% of the long-term precipitation mean
4. Normal: ≥90%, but <110% of the long-term precipitation mean
5. Above Normal: ≥110%, but <150% of the long-term precipitation mean
6. Wet: ≥150% of the long-term precipitation mean

Figure 8 shows the water year-types for the Yucaipa Subbasin. Characterization of the basin-wide water year-types was computed by taking the average water year-type characterizations across the 17 SBCFCD stations for each water year. The mean annual rainfall in the Plan Area for the 2019 WY was 20.24 inches, which was 138% of the mean annual rainfall of 15.76 inches. The water year-type for the 2019 WY was characterized as “Above Normal.” The water year-type for the 2020 WY was characterized as “Normal” with rainfall at 107% of the mean annual rainfall in the Plan Area. The water year-type for the 2021 WY was characterized as “Critically Dry” with rainfall at 36% of mean annual rainfall, or at 5.64 inches. The water year-types for the 2019, 2020, and 2021 WY are summarized in Table 6.

Table 6. Water Year-Types for the 2019, 2020, and 2021 WY

Water Year[a]	Mean Annual Rainfall in Plan Area (inches)	Percentage of Mean Historical Annual Rainfall	Water Year-Type
2018-2019 (Oct. 1, 2018 – Sep. 30, 2019)	20.24	138%	Above Normal
2019-2020 (Oct. 1, 2019 – Sep. 30, 2020)	16.05	107%	Normal
2020-2021 (Oct. 1, 2020 – Sep. 30, 2021)	5.64	36%	Critically Dry

Source: San Bernardino County Flood Control District.
Note: [a] Water Year corresponds to October 1 of the previous year through September 30 of the current year.

3 Groundwater Conditions

3.1 Groundwater Monitoring Network

The existing network of wells to assess groundwater conditions in the Yucaipa Subbasin includes the majority of water supply wells operated by South Mesa, South Mountain, WHWC, and YVWD. Monitoring wells installed by YVWD, the USGS and SBVMWD also provide data characterizing groundwater conditions in the Subbasin. The groundwater monitoring network includes 77 wells (**Figure 3**). Groundwater elevation data is collected at 73 of these wells; water quality data is collected at 40 of these wells; and groundwater production data is collected at 31 wells. Four of the municipal wells in the monitoring network are located outside the Plan Area and supply water to the Subbasin. This water supply is characterized as an imported groundwater supply to the Subbasin. The majority of the wells are municipal supply and monitoring wells; however, the network does include two irrigation wells operated by South Mountain. **Table 7** presents the number and type of wells located in each management area.

TABLE 7. TYPES OF WELLS IN THE EXISTING MONITORING NETWORK

MANAGEMENT Area	Municipal	Monitoring	Private/Domestic[a]	Agricultural/ Irrigation
All wells	41	33	Unknown	3
Calimesa	13	9	0	2
North Bench	17	13	Unknown	0
San Timoteo	0	6	Unknown	1
Western Heights	7	5	0	0
Outside Subbasin	4	0	0	0

Source: Yucaipa Subbasin Groundwater Sustainability Plan (Dudek 2022).
[a] – The number of private well owners in the North Bench and San Timoteo management areas is unknown at this time. The Yucaipa GSA will reach out to the individual owners to confirm their use of groundwater and obtain well information and usage.

3.2 Groundwater Elevations

The water purveyors YVWD, WHWC, South Mesa, and South Mountain measure depths-to-water (DTW) at their respective wells on a monthly basis. The DTW are either measured using an electric tape, airline or by sonic methods. The electric tape, or DTW sounder, is a double-wired and graduated tape fitted with a weighted probe at the end of the tape that houses a water sensor. The accuracy of the electric tape sounder is +/− 0.01 foot (Cunningham and Schalk 2011). The airline involves the pressurization of a dedicated tube, or airline, to displace water from it. The pressure required to displace all air is equivalent to the height of water above the bottom of the airline, which is then converted to a DTW. The accuracy of the airline ranges between +/− 0.1 to 1 foot (Cunningham and Schalk 2011). All DTW measurements are referenced to a surveyed measuring point that was referenced to the National Geodetic Vertical Datum of 1929 (NGVD29) or the NAVD88. Elevations referenced to the NGVD29 datum were converted to the NAVD88 datum using the U.S. Army Corps of Engineers software program, Corpscon 6.0 (ACOE 2004). This is a publicly owned, free software program that converts coordinates and vertical elevations between various datums used in the United States.

The USGS, in cooperation with SBVMWD, constructed a network of multiple-well monitoring sites to characterize groundwater conditions in the San Bernardino Basin Area and Yucaipa Subbasin (Mendez et al. 2018). The USGS installed four multiple-well monitoring sites in the Yucaipa Subbasin: Wilson Creek (YVWC), 6th and E (YV6E), Dunlap Acres (YVDA), and Equestrian Park (YVEP). These multiple-well monitoring sites were constructed as nested wells in one boring with each well completed with 20 feet to 50 feet of screen set at various depths below land surface.

Each well at the monitoring sites was equipped with a dedicated, non-vented pressure transducer programmed to measure and record absolute pressures every hour. The USGS installed a barometer at each monitoring site to adjust the absolute pressure readings by subtracting atmospheric pressure. The resulting pressure represented the height of water above the pressure, which was then converted to an elevation referenced to NAVD88. Water level data was downloaded from the USGS website (USGS 2022). USGS noted that the accuracy of the measurements recorded by the dedicated pressure transducers is to the nearest hundredth of a foot (USGS 2022).

Other sources of groundwater elevation data include the USGS integrated hydrologic numerical model and the CASGEM website, which includes a selection of YVWD wells and one South Mountain well.

3.2.1 Seasonal High Groundwater Conditions in the Plan Area

Groundwater elevations measured in the Spring of 2019, 2020 and 2021 indicated seasonal high groundwater level conditions. The following subsection summarizes the seasonal high groundwater conditions observed in the last three water years.

3.2.1.1 Spring 2019, 2020 and 2021

Static groundwater levels measured in March/April 2019, 2020 and 2021 represented the seasonal highs in groundwater elevations measured in the 2019, 2020 and 2021 WY. **Table 8** summarizes the range in groundwater elevations observed in the Plan Area for each water year. The general direction of groundwater flow in the Plan Area was from northeast to southwest. **Figures 9 to 11** show the piezometric surface, or contours of equal groundwater elevation, in the Plan Area for the seasonal high groundwater elevations observed in the 2019, 2020 and 2021 WY, respectively.

Table 9 summarizes the estimated hydraulic gradients in the principal aquifer in the Plan Area for the 2019, 2020 and 2021 WY. The hydraulic gradients were estimated using groundwater elevations measured at wells YVWD-43, South Mesa-11, and WHWC-10.

Table 8. Range of Seasonal High Groundwater Elevations in the Plan Area

Water Year[a]	Highest Groundwater Elevation (ft NAVD88)	Lowest Groundwater Elevation (ft NAVD88)	Water Year-Type
Spring-2019	3854.38	1342.85	Above Normal
Spring-2020	3826.08	1343.17	Normal

Table 8. Range of Seasonal High Groundwater Elevations in the Plan Area

Water Year[a]	Highest Groundwater Elevation (ft NAVD88)	Lowest Groundwater Elevation (ft NAVD88)	Water Year-Type
Spring-2021	3844.08	1341.78	Critically Dry

Source: YVWD, WHWC, South Mesa Water Company.
Note: [a] Water Year corresponds to October 1 of the previous year through September 30 of the current year.

Table 9. Seasonal High Hydraulic Gradients in the Plan Area

Season + Water Year[a]	Groundwater Elevation at YVWD-43 (ft NAVD88)	Groundwater Elevation at South Mesa 11 (ft NAVD88)	Groundwater Elevation at WHWC-10 (ft NAVD88)	Hydraulic Gradient (ft/ft)	Direction of Groundwater Flow (Degrees Azimuth)
Spring 2019	2,650.37	2,075.14	1,738.04	0.0324	250
Spring-2020	2,666.77	2,103.14	1,752.04	0.0327	252
Spring-2021	2,649.37	2,105.14	1,756.04	0.0320	252

Source: YVWD, WHWC, South Mesa Water Company.
Note: [a] Water Year corresponds to October 1 of the previous year through September 30 of the current year.

3.2.2 Seasonal Low Groundwater Conditions in the Plan Area

Groundwater elevations measured in the Fall of 2019, 2020 and 2021 indicated seasonal low groundwater level conditions. The following subsections summarize the seasonal low groundwater conditions observed in the last three water years.

3.2.2.1 Fall 2019, 2020 and 2021

Static groundwater levels measured in August/September 2019, 2020 and 2021 represented the seasonal lows in groundwater elevations measured in the 2019, 2020 and 2021 WY. **Table 10** summarizes the range in groundwater elevations observed in the Fall for each water year. The general direction of groundwater flow in the Plan Area was from northeast to southwest. **Figures 12 to 14** show the piezometric surface, or contours of equal groundwater elevation, in the Plan Area for the seasonal low groundwater elevations observed in the 2019, 2020 and 2021 WY, respectively.

Table 11 summarizes the estimated hydraulic gradients in the principal aquifer in the Fall for each water year. The hydraulic gradients were estimated using groundwater elevations measured at wells YVWD-43, South Mesa-11, and WHWC-10.

Table 10. Range of Seasonal Low Groundwater Elevations in the Plan Area

Water Year	Highest Groundwater Elevation (ft NAVD88)	Lowest Groundwater Elevation (ft NAVD88)	Water Year-Type
Fall-2019	3848.78	1341.90	Above Normal
Fall-2020	3827.58	1342.16	Normal
Fall-2021	3822.28	1340.55	Critically Dry

Source: YVWD, WHWC, South Mesa Water Company.
Note: [a] Water Year corresponds to October 1 of the previous year through September 30 of the current year.

Table 11. Seasonal Low Hydraulic Gradients in the Plan Area

Water Year[a]	Groundwater Elevation at YVWD-43 (ft NAVD88)	Groundwater Elevation at South Mesa 11 (ft NAVD88)	Groundwater Elevation at WHWC-10 (ft NAVD88)	Hydraulic Gradient (ft/ft)	Direction of Groundwater Flow (Degrees Azimuth)
Fall-2019	2,655.37	2,098.14	1,748.04	0.0325	252
Fall-2020	2,654.27	2,098.14	1,733.04	0.0331	253
Fall-2021	2,650.07	2,096.14	1,754.04	0.0320	251

Source: YVWD, WHWC, South Mesa Water Company.
Note: [a] Water Year corresponds to October 1 of the previous year through September 30 of the current year.

3.3 Groundwater Elevation Hydrographs

Historical groundwater elevations observed at the 73 groundwater wells designated in the monitoring network to monitor groundwater elevations are included in individual hydrographs in **Appendix A.** The following subsections summarize groundwater level conditions observed in the four management areas in the Plan Area for the last three water years.

3.3.1 North Bench Management Area

In general, groundwater elevations in the North Bench Management Area increased in the 2019 WY and the first half of the 2020 WY (March 2020) by approximately 10 to 40 feet. Groundwater elevations declined after March 2020 and through the 2021 WY when rainfall in the region was 35% of normal annual rainfall in the 2021 WY and groundwater production (5,000 AF) exceeded the estimated sustainable yield of 3,940 AFY for the North Bench Management Area (**Appendix A Figures A-1 to A-30**). Static groundwater elevations measured at the USGS Wilson Creek nested monitoring wells declined approximately 100 feet from March 2020 to September 2021 (**Figure A-1**

to A-4). Similar declines were observed at YVWD-18, YVWD-44, YVWD-46, YVWD-53 and YVWD-56 (**Figures A-18, A-25, A-26, A-27 and A-29**). These wells are located near the USGS Wilson Creek nested wells and produced the most water in the last three water years in the North Bench Management Area. Groundwater elevations at wells located approximately 1 to 2 miles from this production area declined approximately 10 feet or less in this period (**Figures A-21 and A-30**).

3.3.2 Calimesa Management Area

Groundwater elevations in the Calimesa Management Area have generally followed an increasing trend since October 2018 (**Figures A-31 to A-54**). Groundwater elevations in the western half of the management area increased approximately 10 to 30 feet at the YVWD, South Mesa and USGS 6th Street wells. Groundwater elevations in the eastern half of the management area at USGS Equestrian Park wells increased approximately 5 to 10 feet (**Figures A-46 to A-49**).

3.3.3 Western Heights Management Area

Static groundwater elevations in the Western Heights Management Area have generally increased since October 2018 (**Figures A-55 to A-66**). Groundwater elevations increased approximately 10 to 20 feet at the USGS Dunlap nested wells. The shallowest well, USGS Dunlap #5 screened from 230 to 250 feet, showed an increase of approximately 40 feet (**Figure A-66**). The deepest well, USGS Dunlap #1 screened from 1,010 to 1,050 feet bgs, appeared to be influenced by production at municipal well WHWC-14, which is located approximately 50 feet from the USGS nested well cluster (**Figures A-61 and A-62**). Groundwater elevations at USGS Dunlap #1 and WHWC-14 fluctuated 20 to 30 feet, but generally trended flat or increased slightly since October 2018. Groundwater elevations at WHWC-02A, WHWC-10, and WHWC-11 trended generally flat since October 2018 (**Figures A-55, A-58, and A-59**).

3.3.4 San Timoteo Management Area

Groundwater elevations in the San Timoteo management area trended similarly to groundwater elevations observed in the North Bench management area where levels increased in the 2019 WY and the first half of the 2020 WY (March 2020), and then declined after March 2020 and through the 2021 WY when rainfall in the region was 35% of normal annual rainfall in the 2021 WY. Water levels at the RMPs in the San Timoteo management area are expressed as depths-to-water because the measurable objective and minimum threshold relate to a depth below land surface (bls) as it relates to GDEs along the reach of San Timoteo Creek in the Plan Area (**Figures A-68 to A-73**). Depths-to-water at the RMPs were consistently above the measurable objective of 20 ft bls, with the exception of YVWD GWMW-5A, which declined to approximately 22.5 ft bls. Groundwater levels were at all wells were influenced by climate (e.g., major precipitation events) with general declining trends observed after March 2020, which were attributed to the drier conditions following the above-normal water year-type in the 2019 WY.

3.4 Groundwater Extractions

Groundwater extractions in the Yucaipa Subbasin for the 2019, 2020 and 2021 WY included groundwater pumping by municipal and private well users, and evapotranspiration by native vegetation. **Table 12** summarizes the total volume of groundwater extracted per water year and identifies the quantities per water use sector. Urban use was the largest use of groundwater in the Subbasin for all three water years. Total groundwater extractions steadily increased from 12,208 AF in 2019, an above-normal water year-type, to 14,924 AF in 2021, a critically dry water year-type.

YVWD maintains 34 municipal water supply wells within the Subbasin, with 11 currently active. YVWD also maintains 24 wells outside the Subbasin, 20 of which produce groundwater from the fractured San Gabriel-type rock in the Yucaipa Hills. These wells supply water to the local communities outside the Subbasin, but within YVWD's service area. The exceptions are YVWD-16 and YVWD-61 that do supply groundwater to the Subbasin. Groundwater produced from these wells is characterized as a groundwater supply imported from outside the Yucaipa Subbasin. YVWD also maintains three wells, YVWD-34, YVWD-35, and YVWD-48, in the adjudicated Beaumont basin. Wells YVWD-34 and YVWD-35 are inactive and used for monitoring purposes only, but YVWD-48 is active and supplies water to YVWD's service area within the Subbasin.

WHWC maintains 10 municipal water supply wells (5 are currently active), all within the Western Heights Management Area. South Mesa maintains 12 municipal water supply wells in the Calimesa Management Area (7 are currently active). South Mesa also has 2 municipal water supply wells outside the Subbasin in the adjudicated Beaumont basin. One of these wells, South Mesa-04, is active and conveys water to South Mesa's drinking water distribution system in the Plan Area. The other well, South Mesa-03, is inactive and used to monitor static groundwater elevations only.

Groundwater produced by YVWD, South Mesa and WHWC is for municipal use (i.e., Urban water use sector category in **Table 12**). South Mountain operates two irrigation supply wells in the Calimesa Management Area: Hog Canyon 2 and Chicken Hill. Water produced by these two wells falls within the "Agricultural" water use sector category in **Table 12**. No groundwater is used for industrial purposes. There are no managed wetlands in the Plan Area.

Private well extractions were estimated at 317 AFY for the 2019, 2020 and 2021 WY based on the Yucaipa Integrated Hydrologic Model (YIHM) developed by the United States Geological Survey (Cromwell and Alzraiee 2022). The Yucaipa GSA is in the process of contacting the private well owners in the Subbasin to obtain information about their wells, groundwater production, and projections of future use to enhance the overall understanding of groundwater usage in the Subbasin. The majority of private well users are located at the base of the San Bernardino Mountains in the upper reaches of the North Bench Management Area and along Yucaipa Creek and San Timoteo Creek in the San Timoteo Management Area. Groundwater production by the water purveyors in these areas is minimal to non-existent and, therefore, does not threaten the water supply for these private users.

The YIHM was used to estimate the quantity of groundwater consumed by native vegetation in areas where GDEs were confirmed within the Plan Area. These areas include the reach of San Timoteo Creek within the Plan Area. The estimated consumption of groundwater by native vegetation ranges from 3,649 AF in the 2019 WY to 4,241 AF in the 2020 WY (**Table 12**).

The distribution and relative magnitude of groundwater extractions in the Subbasin for the 2019, 2020 and 2021 WY are included in **Figures 15 to 17**, respectively. In the North Bench management area, the majority of groundwater extractions was at YVWD-44, YVWD-46, YVWD-53, YVWD-55 and YVWD-56 during these three water years. Groundwater extractions in the North Bench management area ranged from 2,891 AF in the 2019 WY (**Figure 15**) to 4,879 AF in the 2021 WY (**Figure 17**).

In the Calimesa management area, the majority of groundwater extractions was at YVWD-02, YVWD-12, YVWD-24, South Mesa 5, South Mesa 7, South Mesa 9, South Mesa 12, South Mesa 17 and South Mountain's Chicken Hill well. Groundwater extractions in the Calimesa management area ranged from 3,252 AF in the 2020 WY (**Figure 16**) to 4,238 AF in the 2021 WY (**Figure 17**).

In the Western Heights management area, the majority of groundwater extractions was at WHWC-11, WHWC-12 and WHWC-14. Groundwater extractions in the Western Heights management area ranged from 1,472 AF in the 2021 WY (**Figure 17**) to 1,685 AF in the 2019 WY (**Figure 15**).

Currently, there is no information on groundwater extractions from the San Timoteo management area. There are no municipal supply wells. There are two known irrigation supply wells, but these wells are not metered. The Yucaipa GSA is in the process of contacting the private well users (both domestic and agricultural users) to obtain information about their respective wells and to establish a means of quantifying the volumes of groundwater extracted. Groundwater usage does not appear to cause declining groundwater levels and reduction in groundwater in storage. Nor does it appear to influence surface water flows and the GDEs identified along San Timoteo Creek as flows are regulated by storm water runoff and the riparian habitat is thriving along the creek.

Table 12. Groundwater Extractions

Water Year[a]	Total Groundwater Extractions (AF)	Water Use Sector Urban (AF)[b]	Water Use Sector Industrial (AF)	Water Use Sector Agricultural (AF)[b]	Water Use Sector Managed Wetlands (AF)	Water Use Sector Native Vegetation (AF)[c]	Water Use Sector Other (AF)
2019	12,208	8,343	0	217	0	3,649	0
2020	13,200	8,766	0	193	0	4,241	0
2021	14,924	10,289	0	618	0	4,017	0

Source: YVWD, WHWC, South Mesa Water Company, South Mountain Water Company, USGS Yucaipa Integrated Hydrological Model (YIHM).

Note:
a Water Year corresponds to October 1 of the previous year through September 30 of the current year.
b The volumes of groundwater extracted are directly measured using inline propeller flow meters with an accuracy of 2%.
c The volume of groundwater extracted by native vegetation is estimated from the USGS Yucaipa Integrated Hydrologic Model (Cromwell and Alzraizee, 2022). The normalized root mean square error for the groundwater model is 0.97%.
AF Acre-feet.

4 Surface Water Supply

Surface water supplies derive from imported State Water Project (SWP) water that is treated at the Yucaipa Valley Regional Water Filtration Facility (YVRWFF) and from stream flow in Oak Glen Creek that is diverted to the Oak Glen Surface Water Filtration Facility (OGSWFF) for drinking water purposes. Surplus SWP water, if available, may be diverted to the Wilson Creek and/or Oak Glen Creek spreading basins to artificially recharge the aquifer in the Subbasin.

The Yucaipa Subbasin lies within the San Timoteo Wash watershed. The primary surface water drainage features are Wilson Creek, Oak Glen Creek, Yucaipa Creek, and San Timoteo Creek (**Figure 1**). The headwaters for Wilson Creek and Oak Glen Creek originate in the San Bernardino Mountains. Yucaipa Creek begins in the Yucaipa Hills and flows east to west out of Wildwood Canyon. San Timoteo Creek is the major drainage feature in the San Timoteo Wash watershed. It enters the Yucaipa Subbasin at the southern end of the Live Oak subarea and runs approximately 3.5 miles before exiting the Plan Area. San Timoteo Creek is tributary to the Santa Ana River.

Stream flow near the upper reaches of Wilson Creek and Oak Glen Creek may be diverted to the Wilson Creek spreading basins and the Oak Glen spreading basins, respectively (Dudek, 2022). The Wilson Creek spreading basins are used for the infiltration of imported SWP water and stormwater. The Oak Glen Creek spreading basins were designed to reduce flooding downstream of Bryant Street, collect debris and sediment in the basins to improve downstream water quality, enhance groundwater recharge by capturing stormwater runoff, and provide additional open space and habitat. Yucaipa Creek originates out of the Yucaipa Hills through Wildwood Canyon. An unlined, trapezoidal engineered channel runs from Wildwood Canyon approximately 0.33 miles to spreading basins where stream flow may be diverted for flood control and enhance groundwater recharge.

4.1 Surface Water Diversions

YVWD constructed diversion structures to divert surface water from Oak Glen Creek and Birch Creek, which is tributary to Oak Glen Creek, to the OGSWFF for treatment and distribution in YVWD's drinking water system. YVWD historically diverted an average 40 AFY from the 2001 WY to 2018 WY at the Oak Glen Creek diversion, and an average of 70 AFY from the 2001 WY to 2009 WY at the Birch Creek diversion point. No surface water has been diverted from Birch Creek since the 2009 WY. One acre-foot of surface water was diverted from Oak Glen Creek in the 2019 WY and is categorized as a local surface water supply (**Table 13**). No surface water was diverted from Oak Glen Creek in the 2020 and 2021 WY. Both surface water diversion structures have experienced clogging and other technical issues that prevent further diversions of surface water.

4.2 Imported Water

YVWD has purchased SWP water from the San Bernardino Municipal Valley Water District (SBVMWD) every year since the 2003 WY. **Table 13** summarizes the volumes of imported SWP water to the Subbasin. No water was imported from the Central Valley Project or from the Colorado River.

YVWD purchased SWP from SBVMWD in the 2019 WY (11,261 AF), 2020 WY (6,782 AF), and 2021 WY (5,566 AF). A portion of the SWP water purchased by YVWD was delivered to the YVRWFF for treatment and distribution to YVWD's drinking water system. Surplus SWP water purchased from SBVMWD was diverted to the Wilson Creek spreading basins and the Oak Glen Creek spreading basins to artificially recharge the Yucaipa Subbasin. In the 2019 WY, 4,704 AF of imported SWP water was diverted to the Wilson Creek spreading basins and 265 AF to the

Oak Glen Creek spreading basins. In the 2020 WY, 377 AF of imported SWP water was diverted to the Wilson Creek spreading basins and 296 AF to the Oak Glen Creek spreading basins. No SWP water was discharged to the spreading basins in the 2021 WY.

YVWD also purchased 226 AF of SWP water from San Gorgonio Pass Water Agency (SGPWA) in the 2019 WY and delivered it to the YVRWFF for treatment and distribution to YVWD's drinking water system. Therefore, in addition to the 11,261 AF of SWP water purchased from SBVMWD, the total volume of SWP water imported to the Subbasin in the 2019 WY was 11,487 AF (Table 13). No SWP water was purchased from SGPWA in the 2020 and 2021 water years.

Table 13. Surface Water Supplies

Water Year[a]	Water Source Type Central Valley Project (AF)	Water Source Type State Water Project (AF)	Water Source Type Colorado River Project (AF)	Water Source Type Local Supplies (AF)[b]	Water Source Type Local Imported Supplies (AF)
2019	0	11,487	0	1	0
2020	0	6,782	0	0	0
2021	0	5,566	0	0	0

Source: Yucaipa Valley Water District.
Note: [a] Water Year corresponds to October 1 of the previous year through September 30 of the current year.
[b] Local Supplies includes surface water diverted from Oak Glen Creek and Birch Creek.
AF Acre-feet.

5 Total Water Use

Total water use in the Yucaipa Subbasin for the 2019, 2020 and 2021 WY is summarized in Tables 14 and 15. The total water usage in the 2019 WY, which was characterized as an “above-normal” water year-type, was 26,158 AF. Of the three last water years, the 2019 WY had the largest volume of imported SWP water at 11,487 AF (11,261 AF from SBVMWD and 226 AF from SGPWA). Of that volume, 4,969 AF was discharged to the Wilson Creek and Oak Glen Creek spreading basins to artificially recharge the Subbasin. The remaining 6,518 AF was directed to the YVRWFF for treatment and distribution in YVWD’s drinking water system. In the 2019 WY, YVWD delivered 1,828 AF of recycled water to its customers for applied irrigation and public facilities use; YVWD and South Mesa imported 632 AF of groundwater produced from their respective wells outside the Subbasin; and YVWD diverted 2 AF of water from the YVRWFF to the Oak Glen spreading basins. Groundwater extractions in the Subbasin totaled 12,208 AF in the 2019 WY (Table 14).

The total water usages in the subsequent 2020 and 2021 WY were 23,928 AF and 24,249 AF, respectively. These two water years were characterized as “normal” and “critically dry” water year-types, respectively. The volumes of SWP water imported into the Subbasin were 6,782 AF in the 2020 WY and 5,566 AF in the 2021 WY. 672 AF of SWP water was discharged to the Wilson Creek and Oak Glen Creek spreading basins in the 2020 WY. No SWP water was discharged to the spreading basins in the 2021 WY. Groundwater production in the Subbasin was 13,200 AF in the 2020 WY and 14,924 AF in the 2021 WY (Table 14).

The majority of water used in the Subbasin was for urban supply, which ranged from 17,321 AF in the 2019 WY to 24,249 AF in the 2021 WY (Table 15). Water used for managed recharge decreased from 4,971 AF in the 2019 WY to 0 AF in the 2021 WY. Groundwater use by native vegetation was estimated from the YIHM and ranged from 3,649 AF in the 2019 WY to 4,241 AF in the 2020 WY. Groundwater production from the South Mountain wells was used for irrigation purposes and ranged from 193 AF to 618 AF.

Table 14. Total Water Use – Water Source Type

Water Year[a]	Total Water Use (AF)	Water Source Type - Groundwater[b] (AF)	Water Source Type - Surface Water[b] (AF)	Water Source Type - Recycled Water[b] (AF)	Water Source Type - Reused Water[b] (AF)	Water Source Type - Imported Groundwater[b] (AF)
2019	26,158	12,208	11,488	1,828	2	632
2020	23,928	13,200	6,782	2,137	0	1,809
2021	24,249	14,924	5,566	2,210	0	1,549

Source: YVWD, WHWC, South Mesa Water Company, South Mountain Water Company.

Note:
a Water Year corresponds to October 1 of the previous year through September 30 of the current year.
b Groundwater extractions for municipal use are directly measured using in-line flow propellers and digital totalizers; groundwater extractions via native vegetation are estimated using a numerical model; imported SWP water volumes are purchased and measured directly using flow meters on delivery; imported groundwater pumped from outside the Subbasin is directly measured using in-line flow propellers and digital totalizers; recycled water delivery by YVWD is measured directly using flow meters; and reused water is treated water from YVRWFF that is discharged to spreading basins and measured directly using flow meters. The delivery of the reused water to the spreading basins is measured directly using flow meters.
AF Acre-feet.

Table 15. Total Water Use – Water Use Sector

Water Year[a]	Total Water Use (AF)	Water Use Sector - Urban (AF)	Water Use Sector - Industrial (AF)	Water Use Sector - Agricultural (AF)	Water Use Sector – Managed Wetlands (AF)	Water Use Sector – Managed Recharge (AF)	Water Use Sector – Native Vegetation (AF)
2019	26,158	17,321	0	217	0	4,971	3,649
2020	23,928	18,822	0	193	0	672	4,241
2021	24,249	19,614	0	618	0	0	4,017

Source: YVWD, WHWC, South Mesa Water Company, South Mountain Water Company, USGS Yucaipa Integrated Hydrological Model (YIHM).
Note: a Water Year corresponds to October 1 of the previous year through September 30 of the current year.
AF Acre-feet.

6 Change in Groundwater in Storage

The change in groundwater storage in the Subbasin for water years 2019 through 2021 was estimated using the YIHM, which was developed to simulate the hydrologic system in the San Timoteo Wash watershed (Cromwell and Alzraiee, 2022). The YIHM simulates the hydrologic system using a combination of local climate conditions, land surface and land use properties, estimated aquifer properties, and native and non-native groundwater supplies and demands. The model was originally designed to quantify conditions in the watershed between January 1, 1947 and December 31, 2014 and was calibrated to groundwater elevation and stream flow measurements collected between January 1, 1970 and December 31, 2014. As part of the GSP development for the Subbasin, the YIHM was extended using measured climate and groundwater pumping rates to simulate conditions across the watershed through the end of water year 2018 (Dudek 2022).

The YIHM was extended to simulate conditions in the watershed through the end of water year 2021 as part of this annual report preparation. The model update included incorporation of the following:

(1) Daily precipitation measured at the NOAA climate measurement station located in Redlands (GHCND: USC00047306)

(2) Daily temperature data measured at the NOAA Mill Creek station (GHCND: USR0000CMCB)

(3) Measured monthly groundwater extractions for each active groundwater extraction well in the watershed

(4) Measured volumes of imported SWP water discharged to the Oak Glen Creek and Wilson Creek spreading basins.

(5) Land use and land surface properties across the watershed were not changed because no significant changes to land use and land surface properties occurred within the last three years.

The YIHM was used to simulate the water balance of the Subbasin for the 2019, 2020 and 2021 WY. Inflows to the principal aquifer included stream leakage, return flows (municipal distribution network leaks, septic system discharges, and infiltration of applied irrigation water), precipitation recharge, subsurface inflows from upgradient adjacent basins, and surface water spreading. Outflows from the principal aquifer included evapotranspiration (ET), subsurface outflows to downgradient adjacent basins, groundwater discharges to streams, groundwater extractions, and groundwater discharges to land surface. Total basin inflows ranged from 32,191 AF in the 2021 WY (a critically dry water year-type) to 43,954 AF in the 2019 WY (an above-normal water year-type). Total basin outflows ranged from 35,444 AF in the 2019 WY to 35,982 AF in the 2021 WY (**Table 16**).

The annual changes in groundwater in storage for the Subbasin were estimated at an increase of 8,510 AF in the 2019 WY, an increase of 3,861 AF in the 2020 WY, and a decrease of 3,792 AF in the 2021 WY (**Table 16**). The annual changes in storage for the last three water years were appended to the chart showing the cumulative change in storage from the 1965 WY to the 2018 WY that was presented in the GSP (**Figure 18**). Juxtaposed with the cumulative change in storage in **Figure 18** are annual volumes of municipal pumping from the Subbasin and spreading of imported SWP water. Increasing trends in the change in storage were observed in the late 1970s to late 1980s and after 2009 when municipal pumping was below the sustainable yield of 10,980 AFY, while declining trends were observed in the 1990s and early 2000s when municipal pumping exceeded the sustainable yield. The marked increase in storage in the late 1970s to late 1980s corresponded with a very wet period in the region (Figure 19). The marked decrease in storage from 1999 to 2009 corresponded with a drier climate (including two

Table 16. Water Balance for the 2019, 2020 and 2021 WY in the Yucaipa Subbasin

Water Year[a]	Water Year Type	Individual Components of the Basin Water Budget Reported in Units of Acre-Feet (AF)													
		Inflows to the Groundwater System						Outflows from the Groundwater System						Change in Storage	
		Stream Leakage	Return Flows[b]	Precipitation Recharge	Subsurface Flows	Surface Water Spreading	Total Basin Inflows	ET	Subsurface Outflows	GW Discharge to Streams	GW Extractions	GW Discharge to Land Surface	Total Basin Outflows	Annual	Cumulative
2019	Above Normal	13,734	4,009	8,753	12,486	4,971	43,954	3,649	17,004	5,957	8,559	274	35,444	8,510	8,510
2020	Normal	12,794	4,020	9,545	12,666	672	39,698	4,241	17,667	4,866	8,959	104	35,837	3,861	12,371
2021	Critically Dry	10,901	4,009	4,603	12,677	0	32,191	4,017	17,633	3,415	10,907	11	35,982	-3,792	8,579

Source: USGS Yucaipa Integrated Hydrological Model (YIHM).
Note: [a] Water Year corresponds to October 1 of the previous year through September 30 of the current year.
[b] Return flows consist of water that recharges the Subbasin via municipal distribution network leaks, septic system discharges, and infiltration of irrigation water.

critically dry water year-types) and municipal pumping that approached 5,000 AFY more than the sustainable yield (**Figure 18**).

Annual changes in groundwater in storage were also calculated for the four management areas (**Table 17**). The North Bench management area showed the greatest variation in the change in storage as this management area is influenced by climate and recharge from runoff from the surrounding San Bernardino Mountains, Yucaipa Hills and Crafton Hills. The lower management areas, Western Heights and San Timoteo, showed less variation as these management areas are at lower elevations and flatter gradients. **Figures 20 to 22** show the spatial distribution of the changes in storage for the 2019, 2020 and 2021 WY in the Subbasin.

Table 17. Annual Change in Storage per Management Area

Water Year[a]	Management Area				Yucaipa Subbasin
	North Bench	Calimesa	Western Heights	San Timoteo	
2019	7,266	911	202	131	8,510
2020	1,240	1,616	446	559	3,861
2021	-4,127	83	510	-258	-3,792

Source: USGS Yucaipa Integrated Hydrological Model (YIHM).
Note: [a] Water Year corresponds to October 1 of the previous year through September 30 of the current year.

7 GSP Implementation Progress

The Yucaipa Subbasin GSP was adopted by the Yucaipa GSA on January 26, 2022. The 2022 WY marks the first year that groundwater conditions will be evaluated against the sustainability criteria established in the GSP and whether, based on conditions in the 2022 WY, management actions will be implemented in the 2023 WY to sustainably manage the Subbasin. Data characterizing groundwater conditions in the 2019, 2020 and 2021 WY will not be used to determine if management actions established in the GSP will be implemented, but will be used to define recent conditions and how conditions may be trending into the 2022 WY.

7.1 Management Action #1

Groundwater elevations measured in the 2019 to 2021 WY were compared to the groundwater elevation thresholds established for the RMPs in each management area to evaluate how conditions are trending into the 2022 WY, the first year of GSP implementation. **Tables 18 to 21** summarize the ranges of groundwater elevations observed for each of the last three water years and how groundwater elevations compare to the measurable objectives and minimum thresholds defined for each management area. A comparison of groundwater elevations to the measurable objectives and minimum thresholds is the basis for determining if Management Action #1 in the GSP will be implemented. The criteria for when Management Action #1 is implemented is (1) groundwater elevations decline below the measurable objectives or minimum thresholds at 50% or more of the RMPs in a management area, and (2) the groundwater elevation declines are below the thresholds for two consecutive years. Management Action #1 is designed to reduce the net use of groundwater to prevent further significant and unreasonable decline in groundwater levels, groundwater in storage, reduction in the interaction of surface water and groundwater, and the potential for land subsidence.

7.1.1 North Bench Management Area

The mean annual groundwater elevations measured at the eight representative monitoring points (RMP) for the North Bench Management Area did not fall below the individual measurable objectives established at each well for two consecutive years. No groundwater levels fell below the minimum thresholds established for each RMP (**Figures A-1, A-3, A-13, A-14, A-23, A-26, A-27 and A-29**). **Table 18** summarizes the groundwater elevations observed in the 2019 to 2021 WY compared to the groundwater elevations representing the measurable objectives and minimum thresholds established at each well.

USGS Wilson Creek #4, with screen set at 350' to 370' bls, was originally defined as a RMP in the North Bench management area. Groundwater elevations observed at this well in the 2000s indicated that the well would be dry at an elevation below 2,384 ft NAVD88 (**Figure A-4**). The measurable objective and minimum threshold established at this well in the GSP, which were based on projected conditions using the YIHM, were set below 2,384 ft NAVD88 and, therefore, would be impossible to quantify conditions at those thresholds for this well. Therefore, USGS Wilson Creek #4 was replaced with USGS Wilson Creek #3 (with well screen set at 500' to 520' bls) as a RMP for this management area. The measurable objective and minimum threshold established for this well are 2,345.20 ft NAVD88 and 2,313.02 ft NAVD88, respectively (**Figure A-3**).

7.1.2 Calimesa Management Area

The mean annual groundwater elevations measured at the thirteen RMP for the Calimesa Management Area did not fall below the individual Tier 1 measurable objectives established at each well for two consecutive years. No groundwater levels fell below the minimum thresholds established for each RMP (**Figures A-32, A-35, A-36, A-38, A-40, A-42, A-44, A-47, A-49, A-51, A-52, A-53, and A-54**). **Table 19** summarizes the groundwater elevations observed in the 2019 to 2021 WY compared to the groundwater elevations representing the measurable objectives and minimum thresholds established at each well.

USGS 6th St #1, with screen set at 870' to 930' bls, and USGS Equestrian Park #1, with screen set at 830' to 850' bls, are both screened in fractured bedrock (Mendez et al., 2018). These two wells were designated as RMPs in the GSP. However, because they are screened in the underlying basement bedrock and may not represent conditions in the overlying principal aquifer, the nested monitoring wells set one interval above these two wells will be designated as RMPs. USGS 6th St #2, with screen set at 730' to 750' bls, will replace USGS 6th St #1. USGS Equestrian Park #2, with screen set at 625' to 655' bls, will replace USGS Equestrian Park #1. The measurable objectives and minimum thresholds designated for these new RMPs are summarized in **Table 19.**

7.1.3 Western Heights Management Area

The mean annual groundwater elevations measured at the seven RMP for the Western Heights Management Area did not fall below the individual Tier 1 measurable objectives established at each well for two consecutive years

(**Figures A-55, A-58, A-59, A-60, A-61, A-63 and A-65**), except at WHWC-11 in the 2020 and 2021 WY (**Figure A-59**). The highest groundwater elevations observed at WHWC-11 in those two water years were below the tier 1 measurable objective. No groundwater levels fell below the minimum thresholds established at each RMP. **Table 20** summarizes the groundwater elevations observed in the 2019 to 2021 WY compared to the groundwater elevations representing the measurable objectives and minimum thresholds established at each well.

7.1.4 San Timoteo Management Area

The measurable objective established for the six RMP in the San Timoteo management area was designed to protect the GDEs confirmed along the reach of San Timoteo Creek in the Subbasin. The measurable objective was set at 20 feet below land surface. Measured depths-to-water, either manually with an electric water level sounder, or with dedicated pressure transducers programmed to measured absolute pressure every hour, indicated that groundwater levels did not fall below the 20-ft measurable objective threshold except at well GWMW-5A (**Figures A-67 to A-72**). Declining trends of 2 to 3 feet were observed at these wells from mid-2020 to the end of the 2021 WY, but precipitation events in the early wet season of the 2022 WY indicate some recovery of water levels. Management Action #1, if applicable at this time, would not have been implemented because groundwater levels below the measurable objective were observed at only 1 of 6 RMPs.

Table 18. Groundwater Elevations at RMPs in the North Bench Management Area

Representative Monitoring Point	Measurable Objective (ft NAVD88)	Minimum Threshold (ft NAVD88)	Range of Groundwater Elevations in 2019 WY		Range of Groundwater Elevations in 2020 WY		Range of Groundwater Elevations in 2021 WY		Groundwater Elevation Below Measurable Objective?
			Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	
YVWD-06	2,276.91	2,255.47	2,358.20	2,367.40	2,343.90	2,374.10	2,360.40	2,363.90	No
YVWD-07	2,318.07	2,239.38	2,438.10	2,450.70	2,450.80	2,450.80	2,411.80	2,441.30	No
YVWD-37	2,527.68	2,503.91	2,583.89	2,643.49	2,630.19	2,659.69	2,630.89	2,644.09	No
YVWD-46	2,228.73	2,209.32	2,357.42	2,439.02	2,374.52	2,425.22	2,333.42	2,394.82	No
YVWD-53	2,337.17	2,315.55	2,450.30	2,506.80	2,444.70	2,509.30	2,394.80	2,450.60	No
YVWD-56	2,291.03	2,269.24	2,405.53	2,437.43	2,421.23	2,456.83	2,399.53	2,412.23	No
USGS Wilson Creek #1 (820'-840')	2,329.25	2,300.24	2,453.24	2,483.64	2,444.49	2,488.96	2,395.85	2,444.78	No
USGS Wilson Creek #3 (500'-520')	2,345.20	2,313.02	2,471.21	2,511.82	2,472.16	2,516.14	2,419.02	2,459.83	No

Source: YVWD, USGS, Dudek 2022.
Note: Ft NAVD88 Feet above the North American Vertical Datum of 1988.

Table 19. Groundwater Elevations at RMPs in the Calimesa Management Area

Representative Monitoring Point	Measurable Objective (Tier 1 in the Drought Buffer) (ft NAVD88)	Measurable Objective (Tier 2 in the Drought Buffer) (ft NAVD88)	Measurable Objective (Tier 3 in the Drought Buffer) (ft NAVD88)	Minimum Threshold (ft NAVD88)	Range of Groundwater Elevations in the 2019 WY		Range of Groundwater Elevations in the 2020 WY		Range of Groundwater Elevations in the 2021 WY		Groundwater Elevation Below Measurable Objective?
					Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	
Hog Canyon 2	2,083.77	2,063.66	2,040.10	2,021.82	2,079.98	2,085.98	2,082.98	2,088.98	2,088.98	2,090.98	No
South Mesa 07	2,044.08	2,022.66	2,000.74	1,982.14	2,053.70	2,064.70	2,060.70	2,069.70	2,064.70	2,073.70	No
South Mesa 09	2,024.19	1,993.77	1,972.09	1,958.58	2,063.70	2,073.70	2,068.70	2,085.70	2,070.70	2,089.70	No
South Mesa 12	2,080.33	2,059.58	2,036.88	2,018.27	2,095.74	2,106.74	2,102.74	2,113.74	2,108.74	2,118.74	No
South Mesa 17	2,068.72	2,048.20	2,024.96	2,006.30	2,082.77	2,096.77	2,082.77	2,098.77	2,086.77	2,099.77	No
USGS 6th St #2 (730-750)	2,121.51	2,101.06	2,077.69	2,058.22	2,132.39	2,137.01	2,137.98	2,151.64	2,153.12	2,161.19	No
USGS 6th St #4 (380'-400')	2,175.05	2,165.66	2,146.93	2,127.70	2,170.93	2,180.41	2,181.27	2,189.92	2,191.37	2,194.02	No
USGS Equestrian Park #2 (625-655)	2,203.60	2,197.67	2,186.58	2,172.80	2,202.26	2,203.19	2,202.23	2,204.38	2,205.70	2,209.95	No
USGS Equestrian Park #4 (380'-400')	2,207.39	2,201.74	2,190.86	2,176.87	2,205.46	2,206.59	2,205.42	2,207.92	2,208.82	2,213.75	No
YVWD-10	2,076.79	2,056.62	2,033.14	2,014.16	2,079.34	2,092.44	2,080.14	2,108.44	2,104.54	2,104.54	No
YVWD-12	2,081.92	2,062.26	2,037.96	2,020.26	2,055.55	2,131.35	2,090.95	2,173.35	2,085.45	2,166.35	No
YVWD-24	2,120.42	2,100.29	2,075.90	2,061.63	2,113.71	2,204.01	2,100.11	2,133.31	2,099.71	2,132.31	No
YVWD-49	2,076.94	2,056.68	2,033.31	2,041.03	2,083.74	2,105.34	2,097.34	2,110.84	2,111.24	2,115.14	No

Source: YVWD, South Mesa Water Company, South Mountain Water Company, USGS, Dudek 2022.
Note: Ft NAVD88 Feet above the North American Vertical Datum of 1988..

Table 20. Groundwater Elevations at RMPs in the Western Heights Management Area

Representative Monitoring Point	Measurable Objective (Tier 1 in the Drought Buffer) (ft NAVD88)	Measurable Objective (Tier 2 in the Drought Buffer) (ft NAVD88)	Minimum Threshold (ft NAVD88)	Range of Groundwater Elevations in the 2019 WY		Range of Groundwater Elevations in the 2020 WY		Range of Groundwater Elevations in the 2021 WY		Groundwater Elevation Below Measurable Objective?
				Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	Lowest Elevation (ft NAVD88)	Highest Elevation (ft NAVD88)	
WHWC-2A	1,735.68	1,716.00	1,695.24	1,735.68	1,744.68	1,740.68	1,740.68	1,738.68	1,738.68	No
WHWC-10	1,750.04	1,734.04	1,714.26	1,738.04	1,759.04	1,729.04	1,766.04	1,738.04	1,756.04	No
WHWC-11	1,748.93	1,735.76	1,712.24	1,723.93	1,760.93	1,725.93	1,746.93	1,718.93	1,748.93	Yes
WHWC-12	1,747.11	1,732.52	1,708.84	1,743.11	1,764.11	1,738.11	1,777.11	1,761.11	1,775.11	No
WHWC-14	1,726.90	1,717.20	1,696.12	1,748.90	1,772.90	1,749.34	1,772.90	1,737.90	1,772.90	No
USGS Dunlap #2 (830'-850')	1,748.40	1,729.36	1,708.97	1,741.43	1767.95	1,746.34	1770.58	1,752.92	1776.42	No
USGS Dunlap #4 (440'-460')	1,740.32	1,720.05	1,699.54	1,734.38	1761.12	1,742.70	1769.91	1,749.98	1770.93	No

Source: WHWC, USGS, Dudek 2022.
Note: Ft NAVD88 Feet above the North American Vertical Datum of 1988..

7.2 Management Action #2

Management Action #2 established sustainable yield pumping allocations for the municipal, agricultural and private well users in each management area in the Subbasin. The pumping allocations were proportioned based on historical use as a percentage, with the pumping allocations defined based on the historical use percentages applied to the sustainable yield. As an incentive to manage groundwater production at or below the sustainable yield pumping allocation, a groundwater user may earn pumping credits in the amount of the sustainable yield pumping allocation less the groundwater pumped. This management action is implemented if a user pumps more than their assigned pumping allocation. If the user has pumping credits, then the pumping credits may be applied to offset the pumping exceedance. If the pumping credits don't offset the total overage, then the user will need to reduce the net use of groundwater in the subsequent water year to match the exceedance. This may be done by reducing groundwater pumping, replenishing the basin with supplemental water, the implementation of water conservation programs, the use of recycled water to reduce groundwater pumping, or a combination of any of these actions (or others) that will reduce the net use of groundwater.

Management Action #2 was not in effect during the 2019, 2020 and 2021 WY. The Yucaipa Subbasin GSP stated that the assessment of the sustainable yield pumping allocations and pumping credits will begin with the 2022 WY. The following review of pumping data in the last three water years characterizes conditions relative to Management Action #2 and provides an indication of pumping conditions trending into the 2022 WY.

7.2.1 North Bench Management Area

YVWD and private well users pump groundwater from the North Bench Management Area for municipal and domestic use. Sustainable yield pumping allocations were assigned to each user based on historical usage from the 1966 WY to the 2018 WY (Dudek 2022). Groundwater extractions by private well users were obtained from information in the USGS YIHM, and were assumed constant at 125 AFY for the 2019, 2020 and 2021 WY.

YVWD pumped 2,891 AF, 3,726 AF, and 4,879 AF from the management area in the 2019, 2020 and 2021 WY, respectively. YVWD exceeded their sustainable yield pumping allocation of 3,045 AFY in the 2020 and 2021 WY (**Figure 23**). Private well users, estimated at a constant rate of 125 AFY in the last three water years, were below their collective sustainable yield pumping allocation of 895 AFY (**Figure 23**).

7.2.2 Calimesa Management Area

YVWD, South Mesa, South Mountain, and private well users pump groundwater from the Calimesa management area for municipal, agricultural and domestic uses. Sustainable yield pumping allocations were assigned to each user based on historical usage from the 1966 WY to the 2018 WY (Dudek 2022). Groundwater extractions by private well users were obtained from information in the USGS YIHM, and were assumed constant at 192 AFY for the 2019, 2020 and 2021 WY.

YVWD pumped 1,736 AF, 1,171 AF, and 1,608 AF in the 2019, 2020 and 2021 WY, which were below the sustainable yield pumping allocation of 2,341 AFY assigned to YVWD (**Figure 24**). South Mesa pumped 1,713 AF, 1,889 AF, and 2,012 AF in the last three water years. South Mesa exceeded their sustainable yield pumping allocation of 1,959 AFY by 53 AF in the 2021 WY (**Figure 24**). South Mountain pumped 217 AF, 193 AF, and 618

AF in the last thee water years. South Mountain exceeded their sustainable yield pumping allocation of 518 AFY by 100 AF in the 2021 WY (**Figure 24**). Private pumping was estimated at 192 AFY, which is 55 AF more than the assigned pumping allocation of 137 AFY (**Figure 24**). The Yucaipa GSA will identify and contact the private well users in the Calimesa management area to confirm their use of groundwater and reassess the sustainable yield pumping allocations in the first 5-year period after adopting the GSP. Total pumping ranged from 3,445 AF in the 2020 WY to 4,430 AF in the 2021 WY, which were all below the sustainable yield of 4,955 AFY estimated for the Calimesa management area (**Figure 25**).

7.2.3 Western Heights Management Area

WHWC is the only user of groundwater in the Western Heights Management Area. The sustainable yield pumping allocation assigned to WHWC is the sustainable yield for the Western Heights management area, which is estimated at 1,760 AFY. WHWC pumped 1,685 AF, 1,663 AF, and 1,472 AF in the 2019, 2020, and 2021 WY, respectively (**Figure 26**). WHWC did not exceed their sustainable yield pumping allocation assigned for the Western Heights Management Area.

7.2.4 San Timoteo Management Area

Management Action #2 does not apply to the San Timoteo management area because there is no municipal pumping. There are two known agricultural wells operating in the management area, but the wells are not metered. The Yucaipa GSA will work with the private well owners to have meters installed. Sustainable yield pumping allocations will be assigned when the volume of groundwater extracted from the management area is measured.

7.3 Management Action #3

This management action provides a separate accounting mechanism for surplus supplemental water discharged directly to a spreading basin to artificially recharge the Subbasin. The surplus supplemental water will be accessible to the water purveyor that purchased the water and percolated it at a spreading basin. This water will be available to help offset production exceedances above the sustainable yield pumping allocations instead of pumping credits earned via Management Action No. 2.

The Yucaipa GSA will conduct a study within the first year of adopting the GSP to estimate the amount of water lost from the point of discharge at a spreading basin to the water table. This study will estimate monthly losses due to evaporation of water from a spreading basin to water retained in the soil column between the bottom of a spreading basin and the underlying water table. The estimate of water loss will be applied to the volume of surplus supplemental water discharged on a monthly basis to a spreading basin. Monthly estimates of water loss are appropriate because evaporative losses in the summer are higher than in the winter. The remaining water will directly recharge the aquifer and be available to the water purveyor that purchased the water.

YVWD began discharging surplus supplemental water to the Wilson Creek and Oak Glen Creek spreading basins in 2009. YVWD has discharged a total 22,278 AF of imported SWP water to these spreading basins since 2009. This includes the 4,971 AF and 672 AF discharged in the 2019 and 2020 WY (**Table 15**). The YIHM was used to simulate the flow of water from the Wilson Creek and Oak Glen Creek spreading basins over the 50-year implementation and planning horizon. The YIHM indicated that water originating from these two spreading basins will remain in the

North Bench Management Area over the 50-year period. Therefore, YVWD has access to the 22,278 AF of surplus supplemental water that was directed to the spreading basins and may use this water to offset pumping exceedances above their respective sustainable yield pumping allocation established under Management Action #2.

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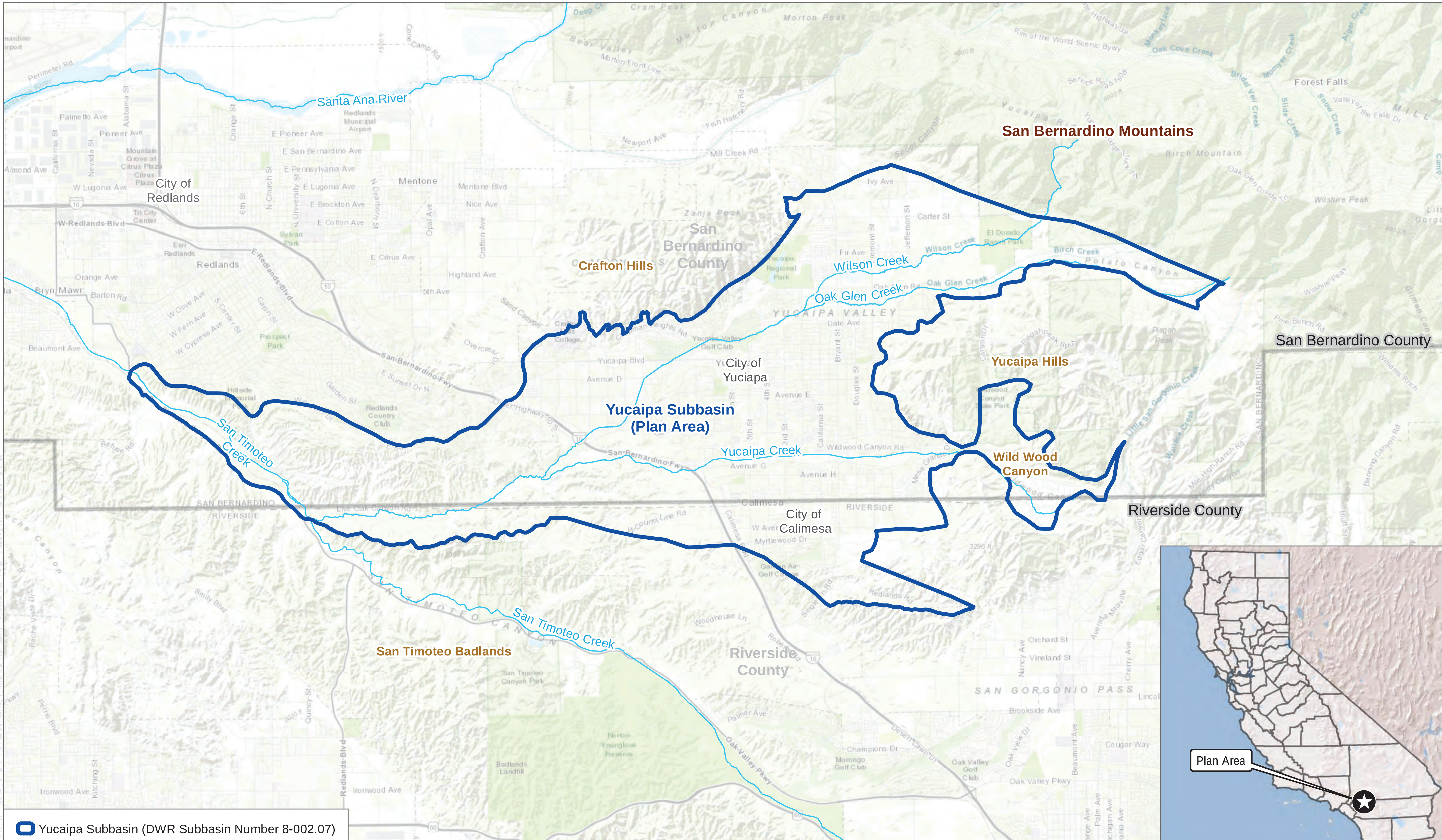


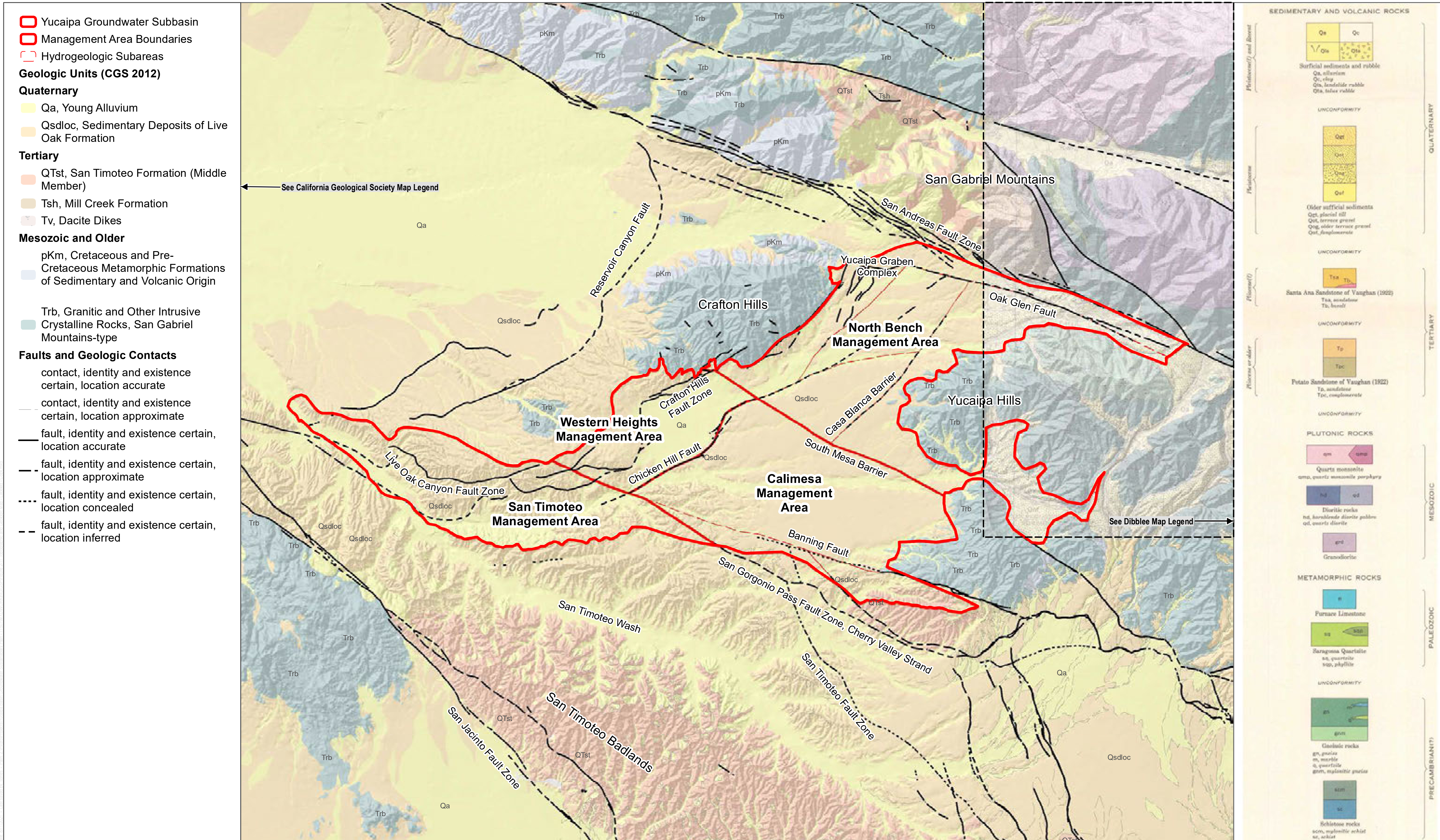
SOURCE: ESRI, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordanance Survey, ESRI Japan, METI, ESRI China (Hong Kong), swisstopo, OpenStreetMap contributors, and the GIS User Community; DWR 2015; USGS NHD 2017

DUDEK

0 0.5 1 Miles

FIGURE 1

Vicinity Map of the Yucaipa Subbasin Plan Area



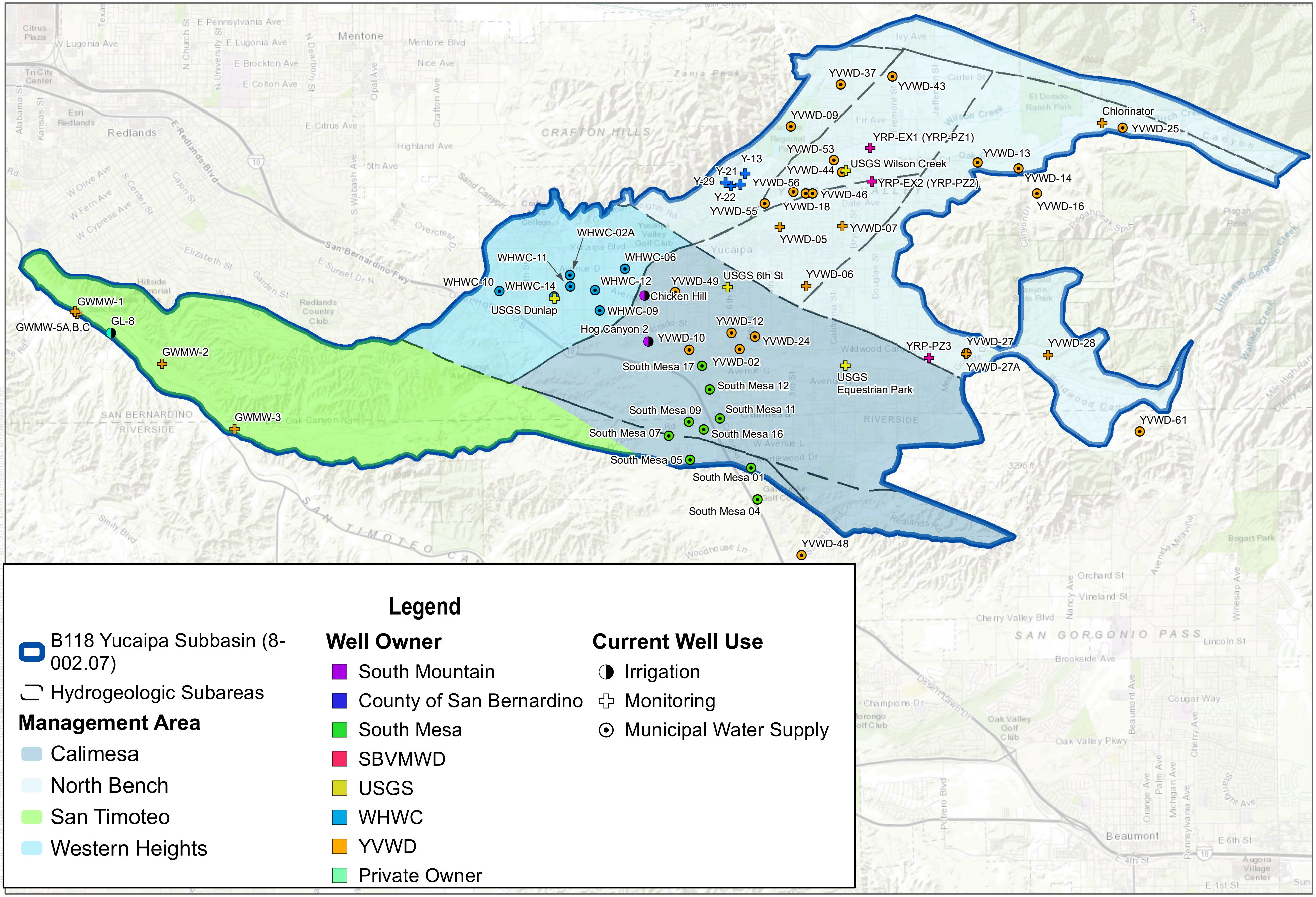
SOURCE: CGS 2012, USGS 1999

DUDEK

0 0.5 1 2 Miles

FIGURE 2

Geologic Map and Management Area Boundaries in the Yucaipa Subbasin



SOURCE: SBVMWD, YVWD, WHWC, SMWC, City of Redlands, USGS

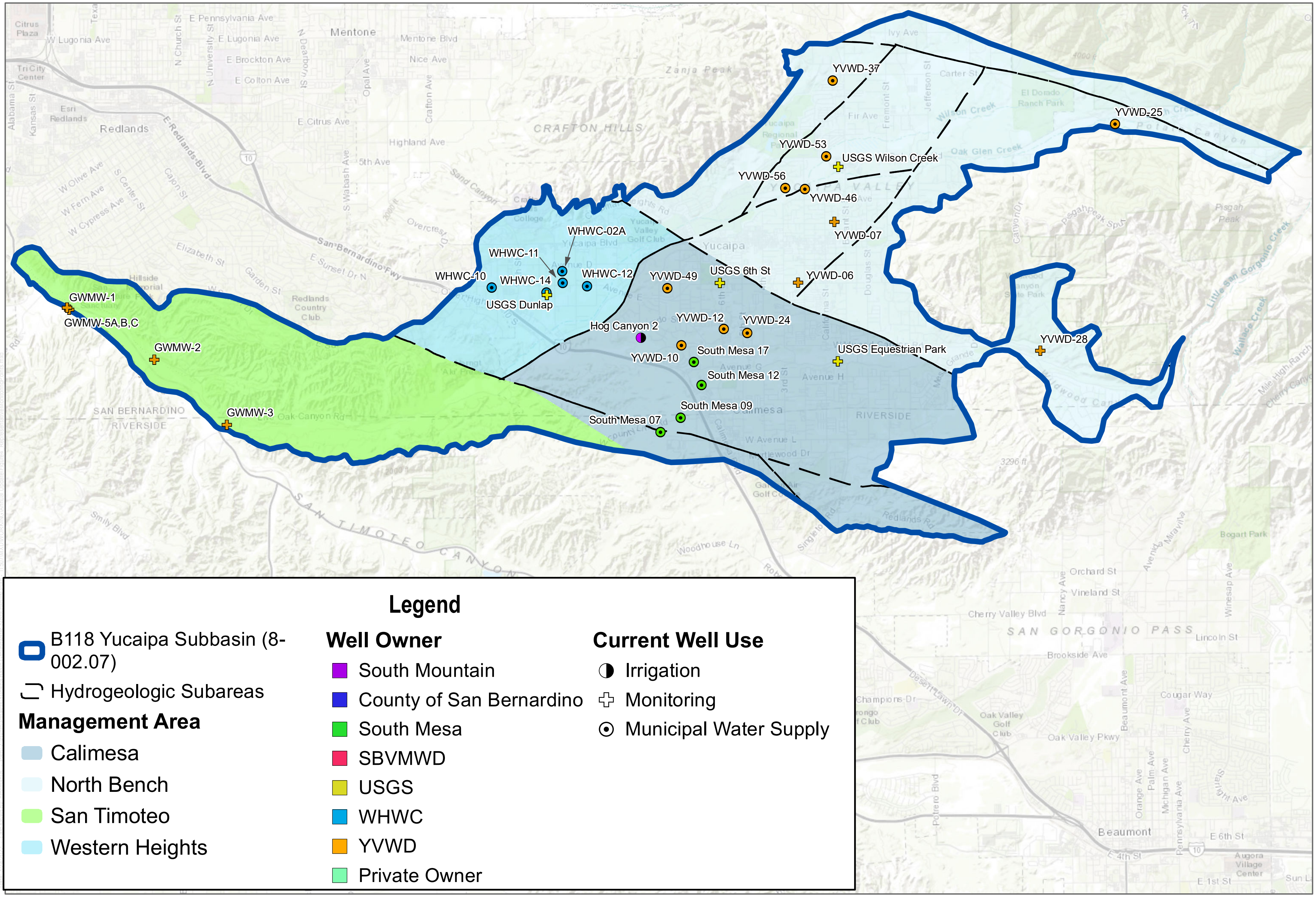
DUDEK

0 0.5 1 Miles

FIGURE 3

Yucaipa Subbasin Groundwater Monitoring Network

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan



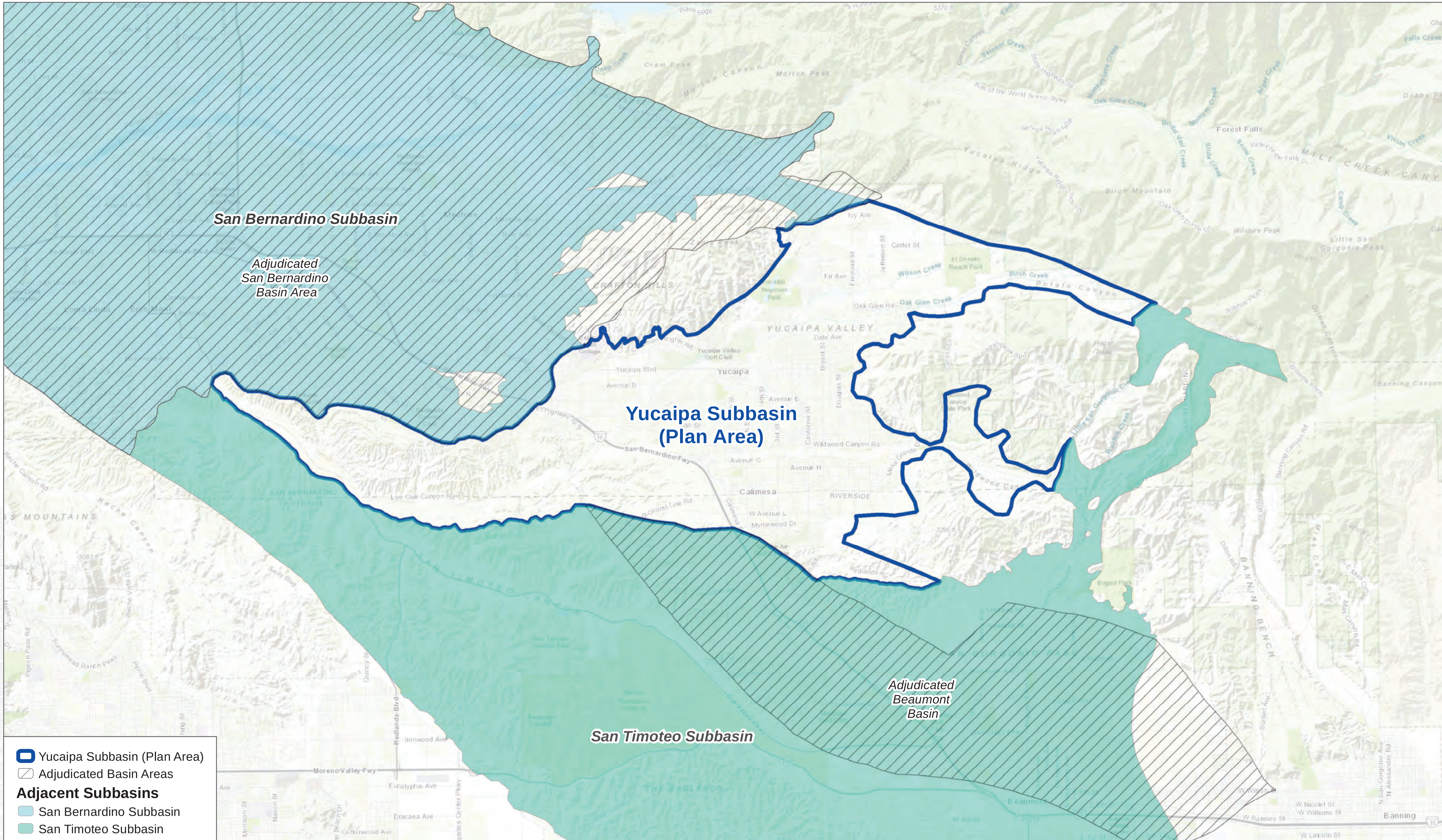
SOURCE: SBVMWD, YVWD, WHWC, SMWC, City of Redlands, USGS

DUDEK

FIGURE 4

Representative Monitoring Points

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan

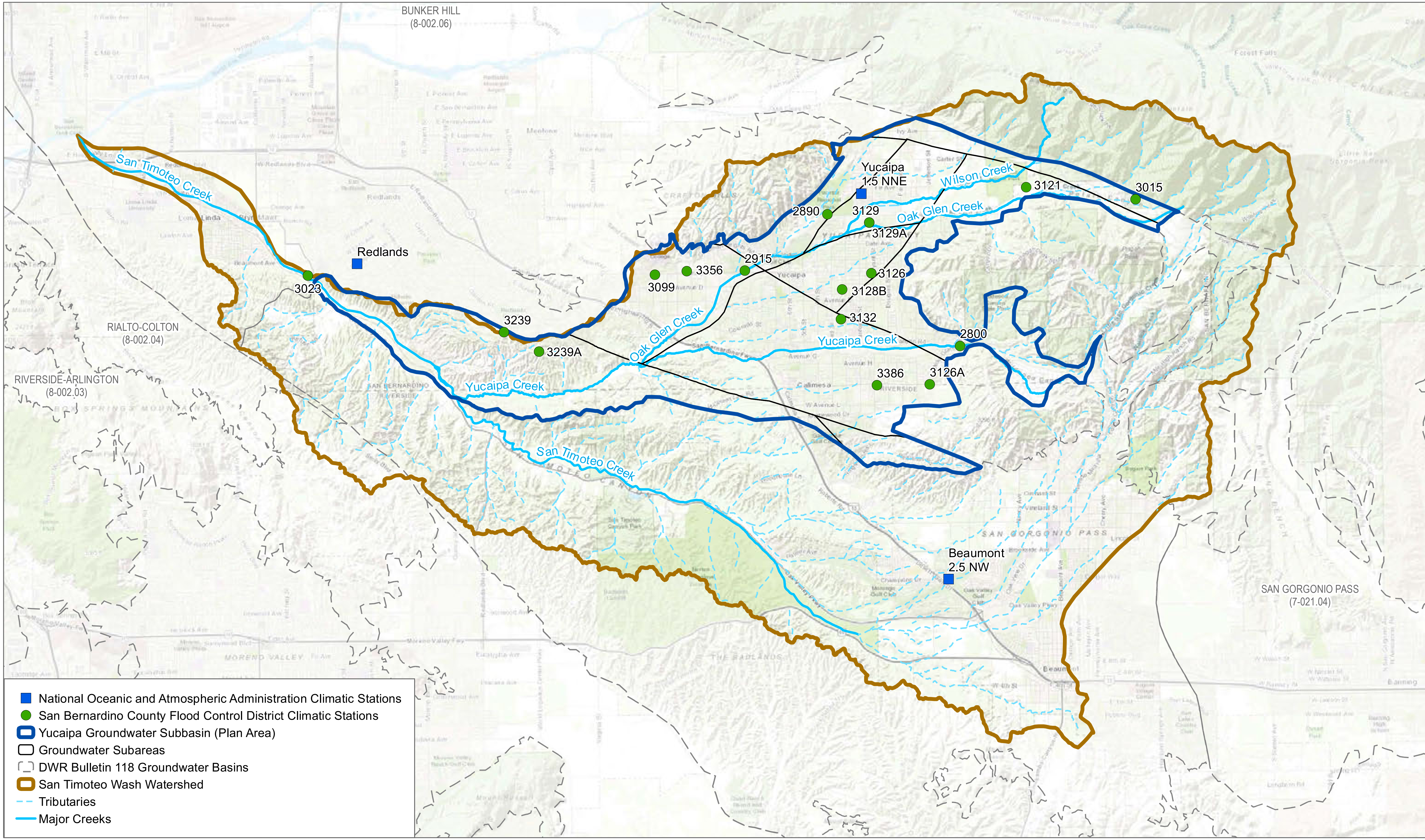


SOURCE: ESRI, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordanance Survey, ESRI Japan, METI, ESRI China (Hong Kong), swisstopo, OpenStreetMap contributors, and the GIS User Community; DWR 2015; USGS NHD 2017

DUDEK

0 0.5 1 Miles

FIGURE 5
Adjacent Subbasins



SOURCE: ESRI, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordanance Survey, ESRI Japan, METI, ESRI China (Hong Kong), swisstopo, OpenStreetMap contributors, and the GIS User Community; DWR 2015; USGS NHD 2017; Geoscience 2017

DUDEK 0 0.5 1 Miles

FIGURE 6

Climate Station Locations in the San Timoteo Wash Watershed

Figure 7. Cumulative Departure from Mean Monthly Precipitation at the SBCFCD Oak Glen and Calimesa East Climatic Stations and the NOAA Redlands Climatic Station

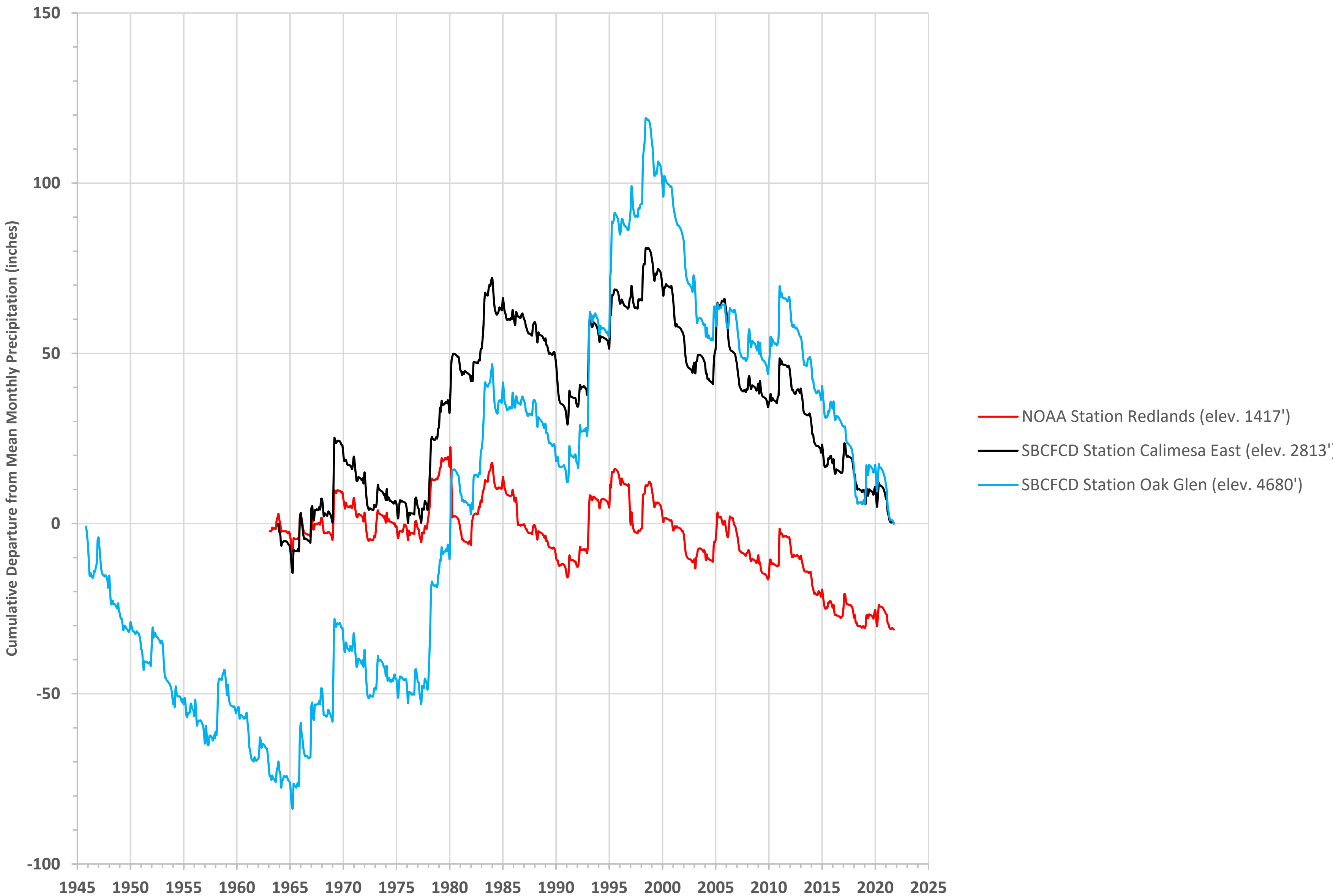
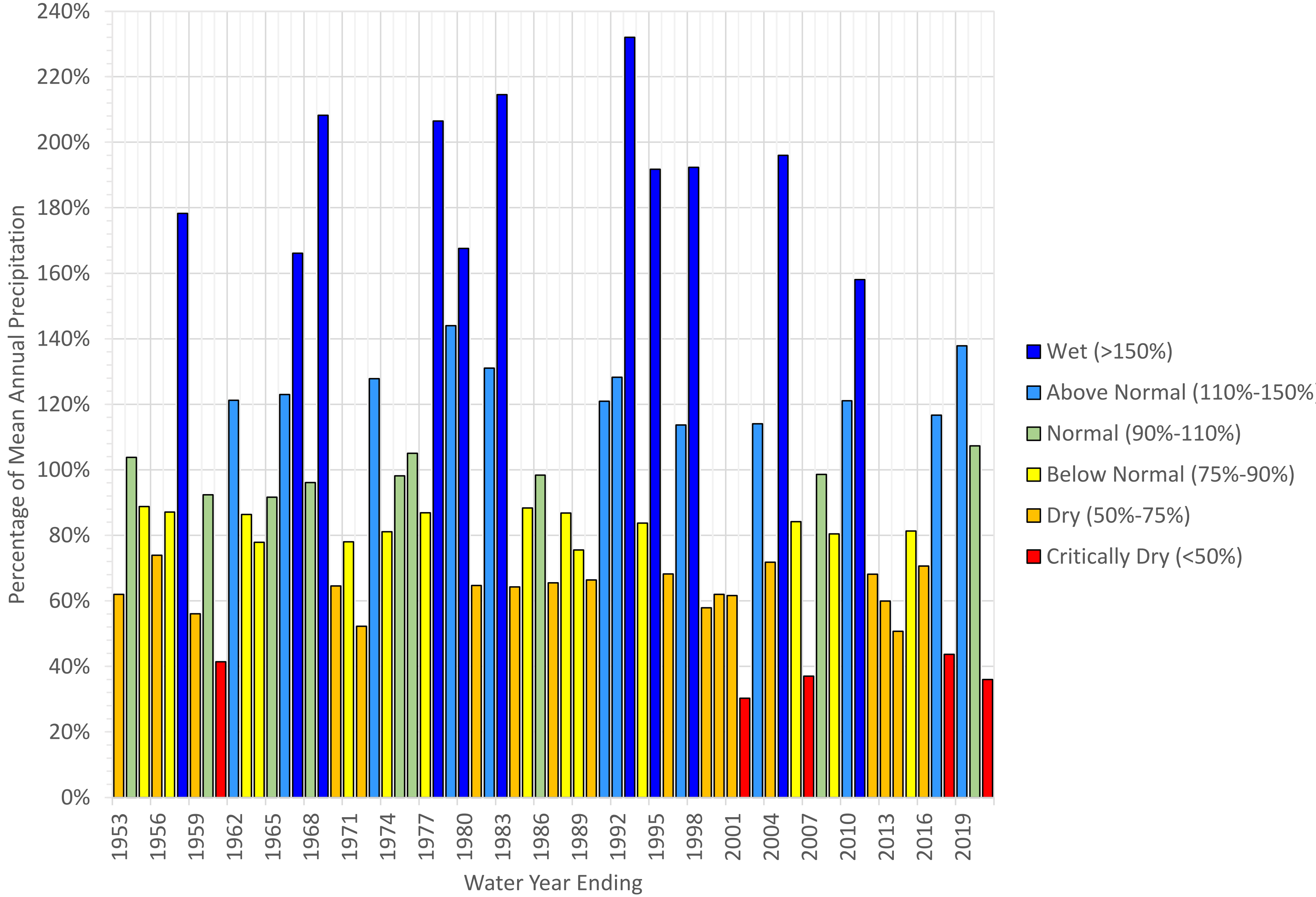
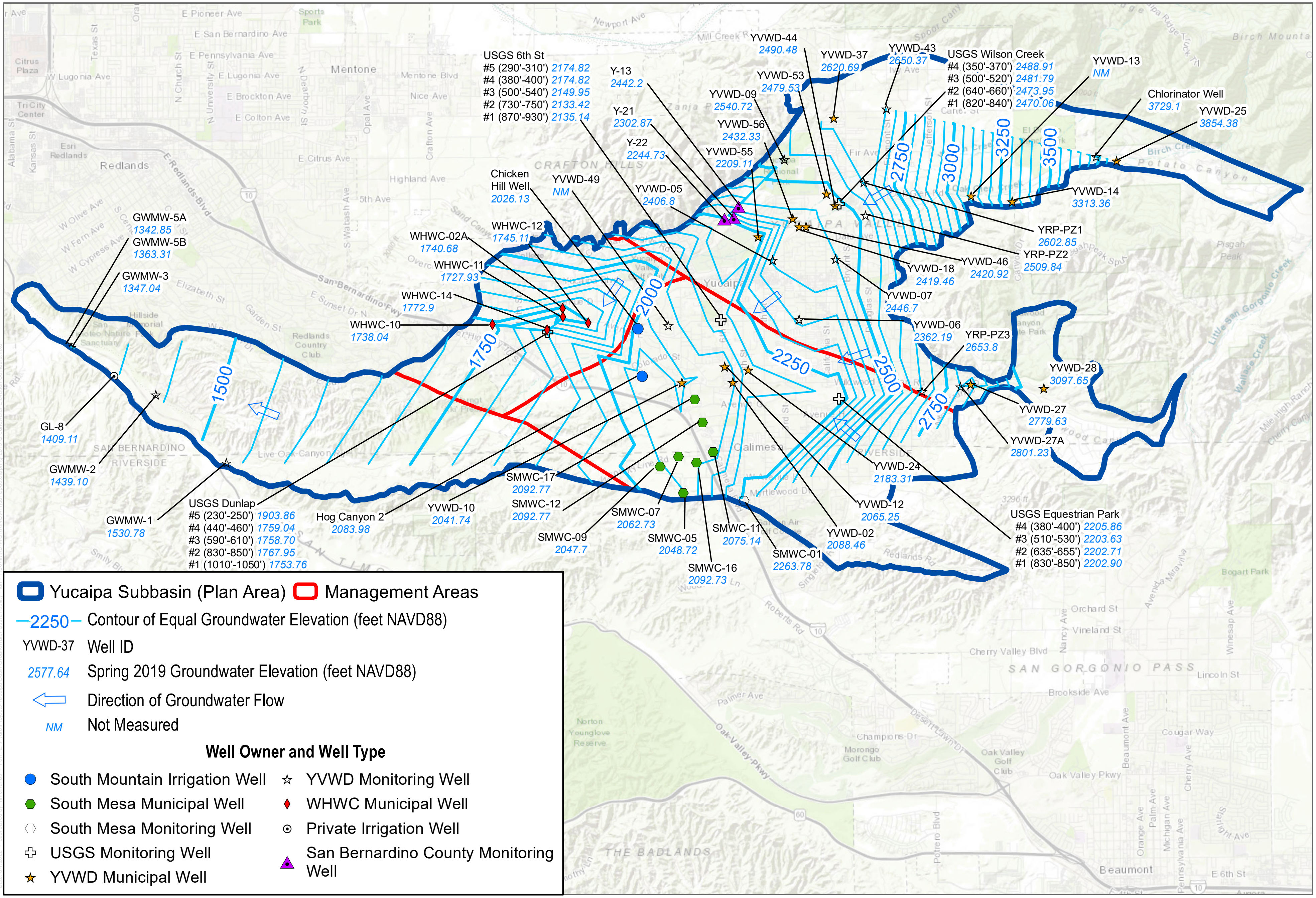


Figure 8. Historical Water Year-Types in the Yucaipa Subbasin





SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

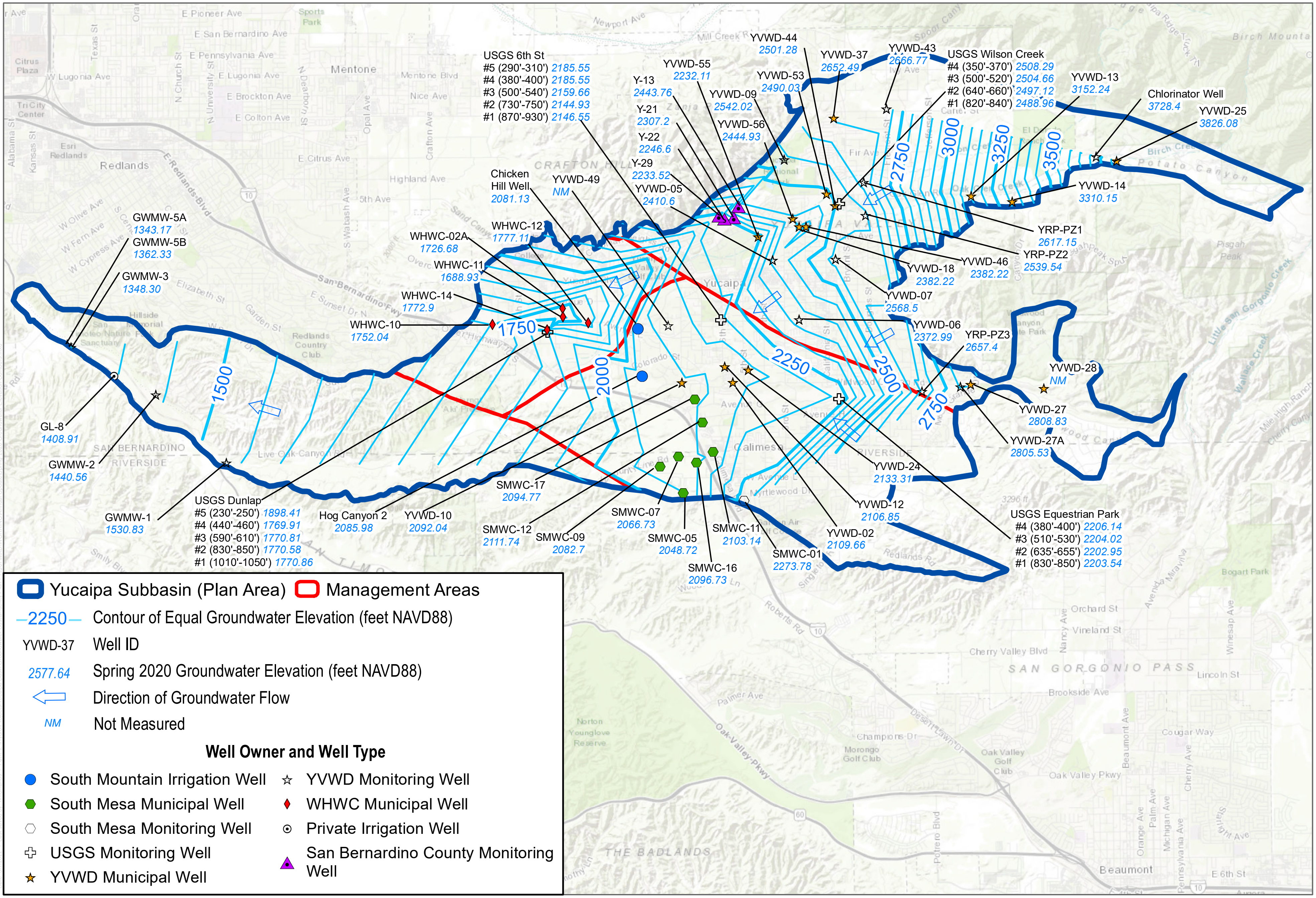
DUDEK

0 0.5 1 Miles

FIGURE 9

Spring 2019 Groundwater Elevations in the Yucaipa Subbasin

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan



SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

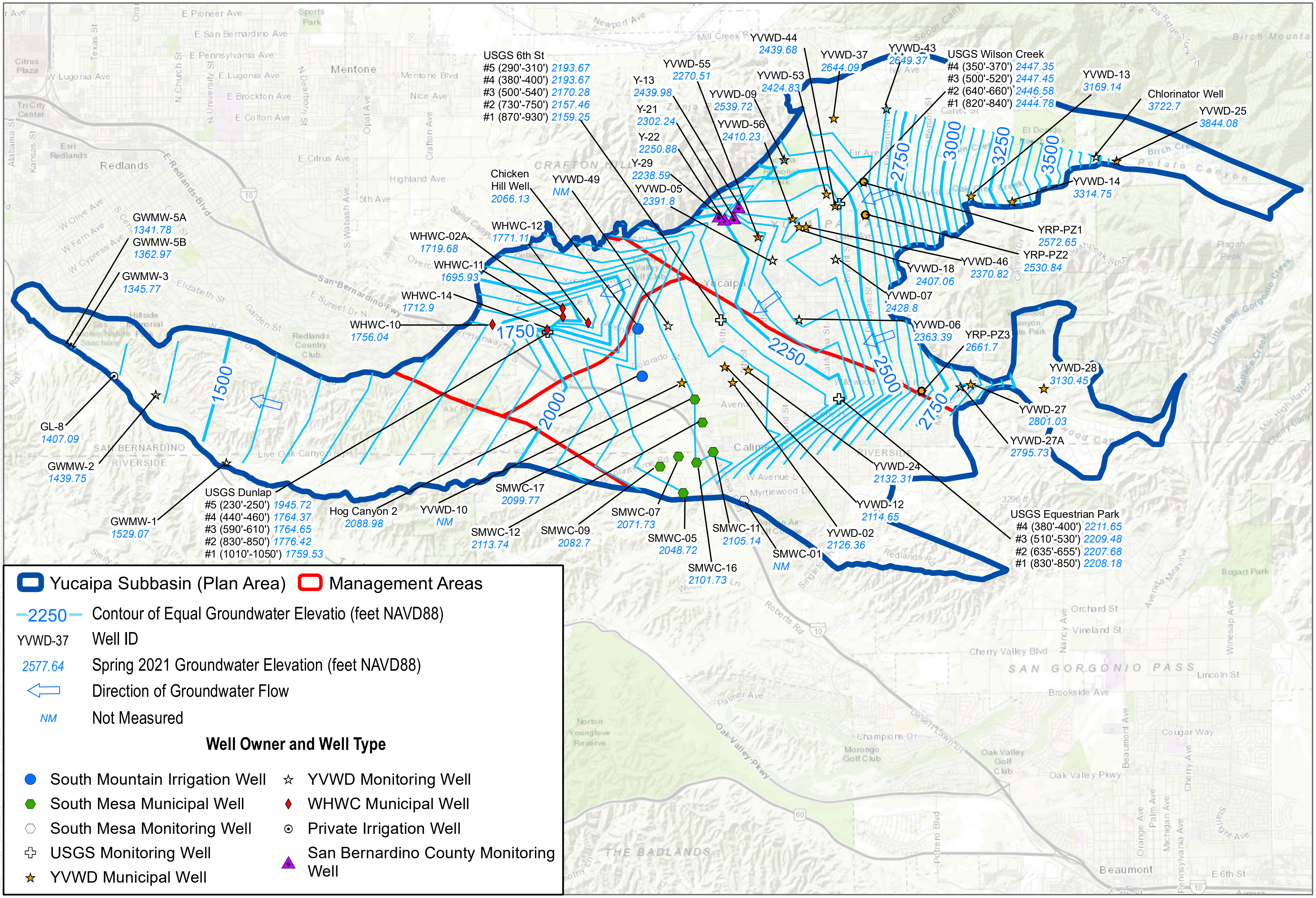
DUDEK

0 0.5 1 Miles

FIGURE 10

Spring 2020 Groundwater Elevations in the Yucaipa Subbasin

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan



SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

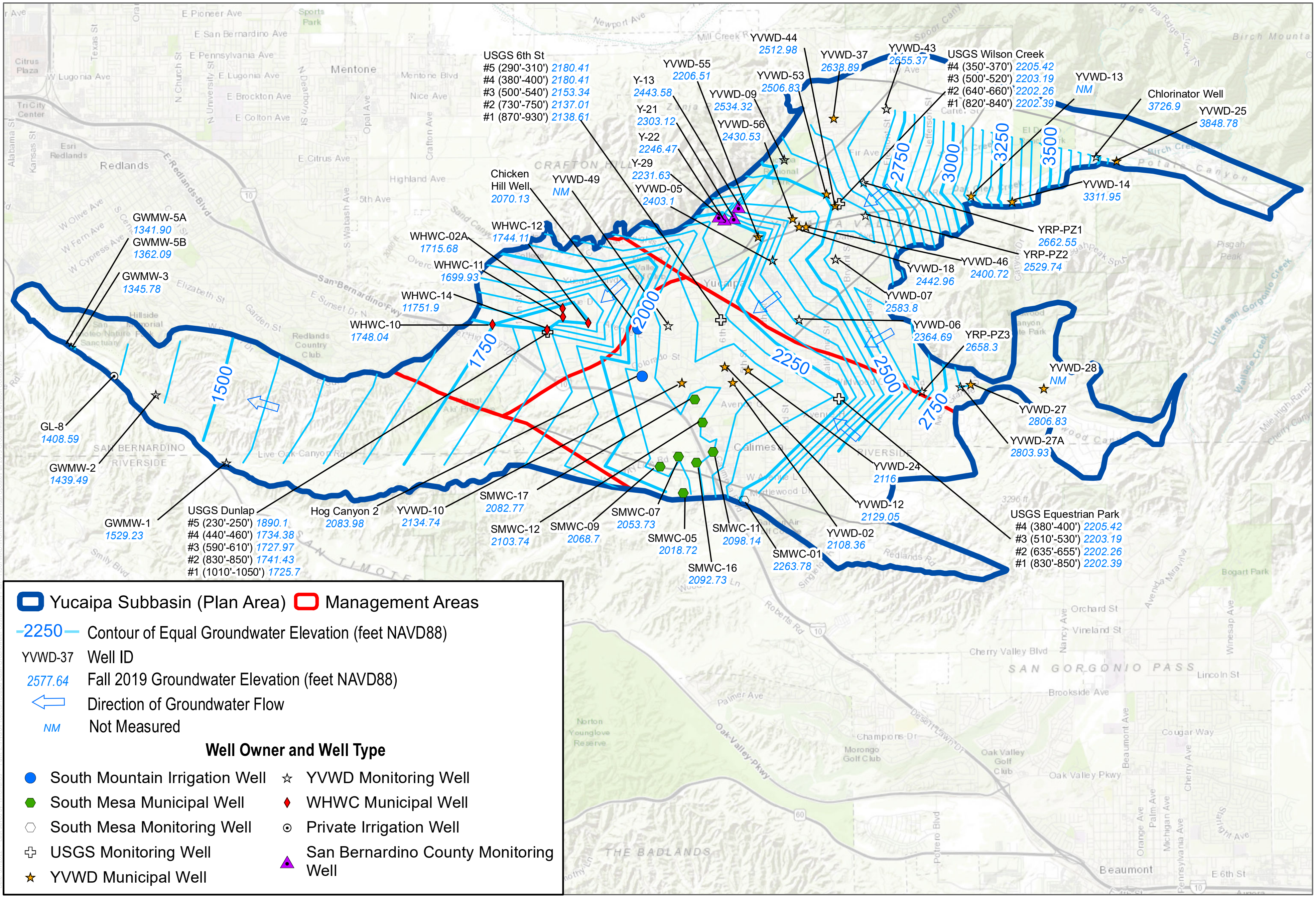
DUDEK

0 0.5 1 Miles

FIGURE 11

Spring 2021 Groundwater Elevations in the Yucaipa Subbasin

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan



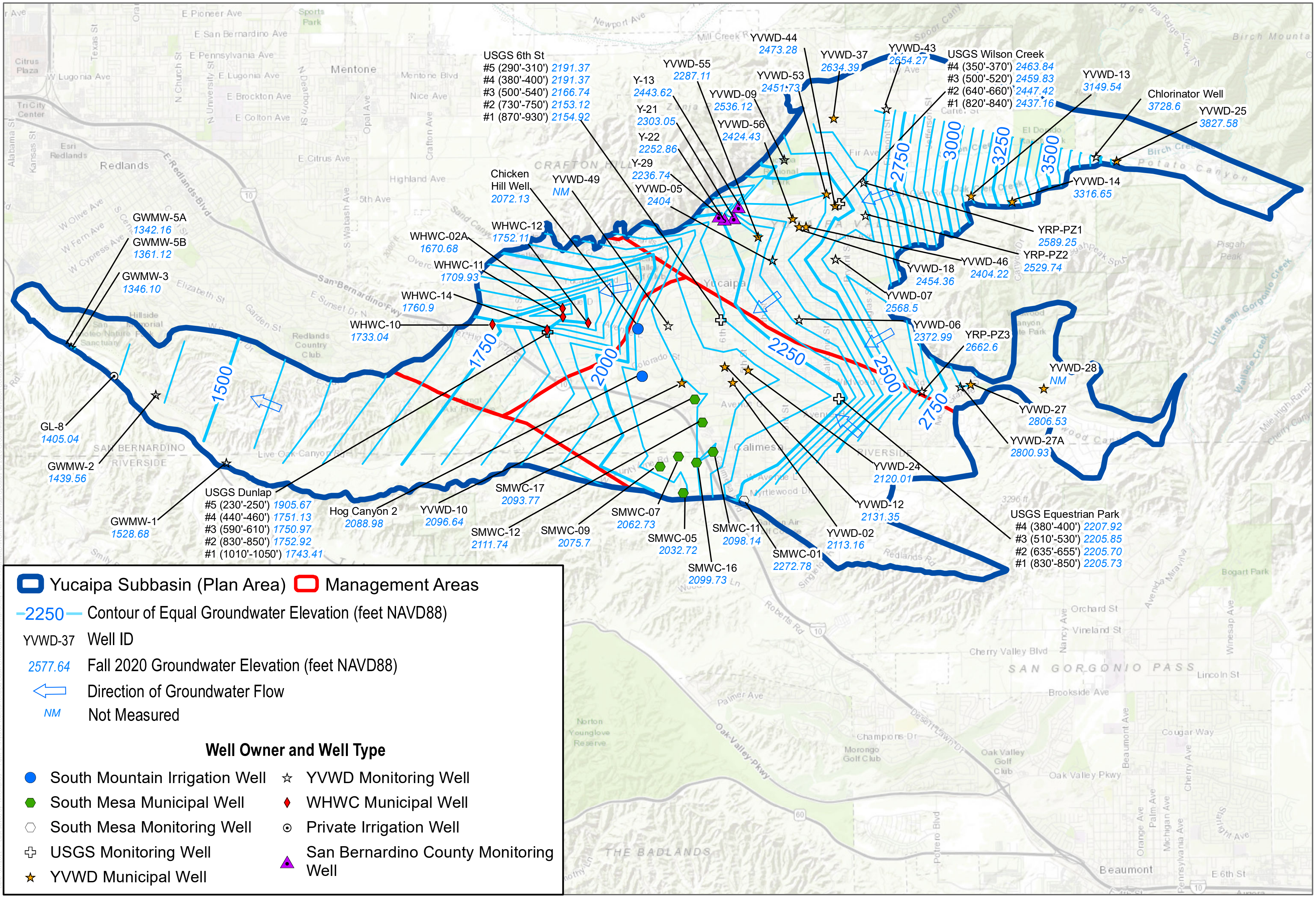
SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

DUDEK

FIGURE 12

Fall 2019 Groundwater Elevations in the Yucaipa Subbasin

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan



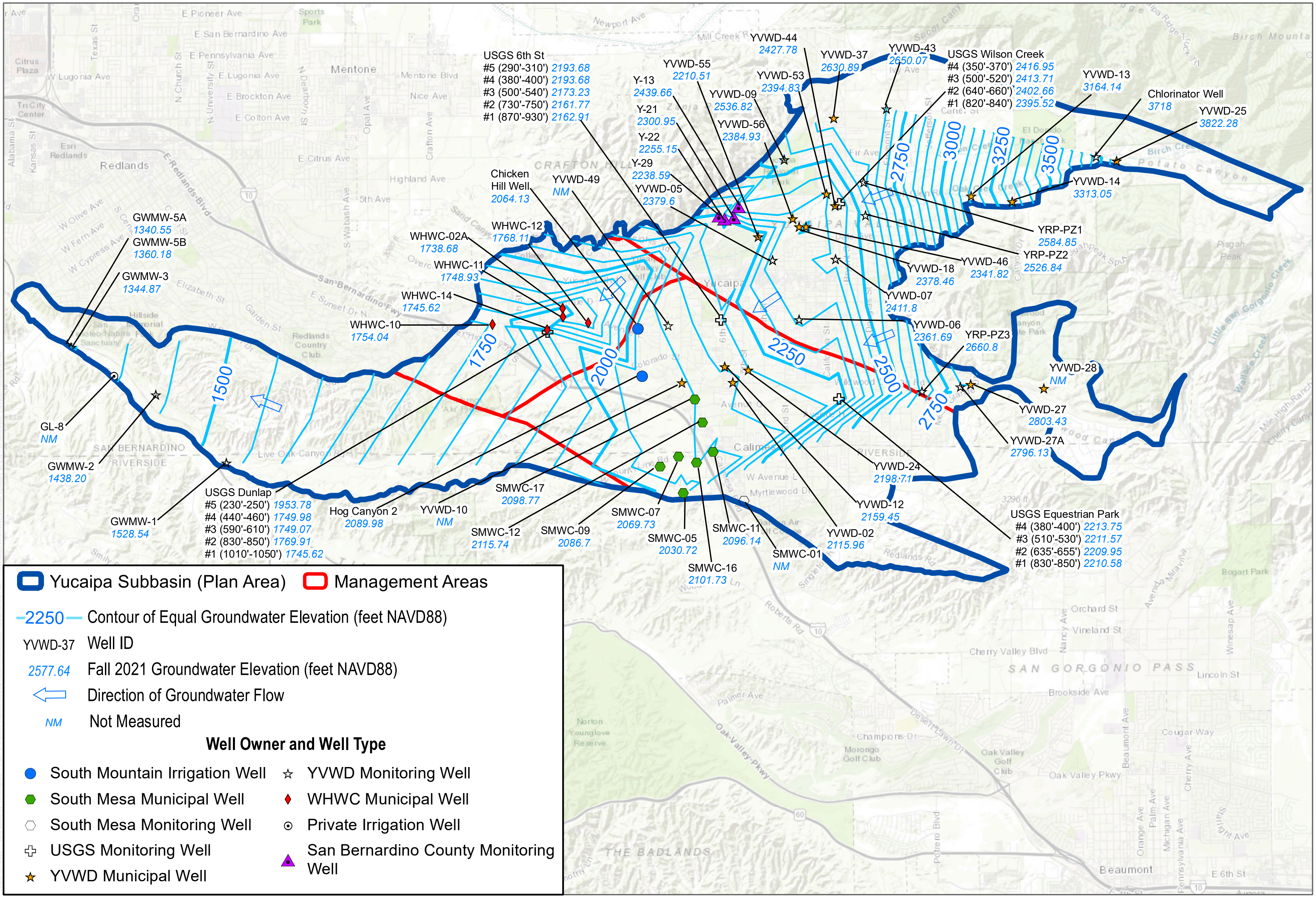
0 0.5 1 Miles

SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

DUDEK

FIGURE 13

Fall 2020 Groundwater Elevations in the Yucaipa Subbasin



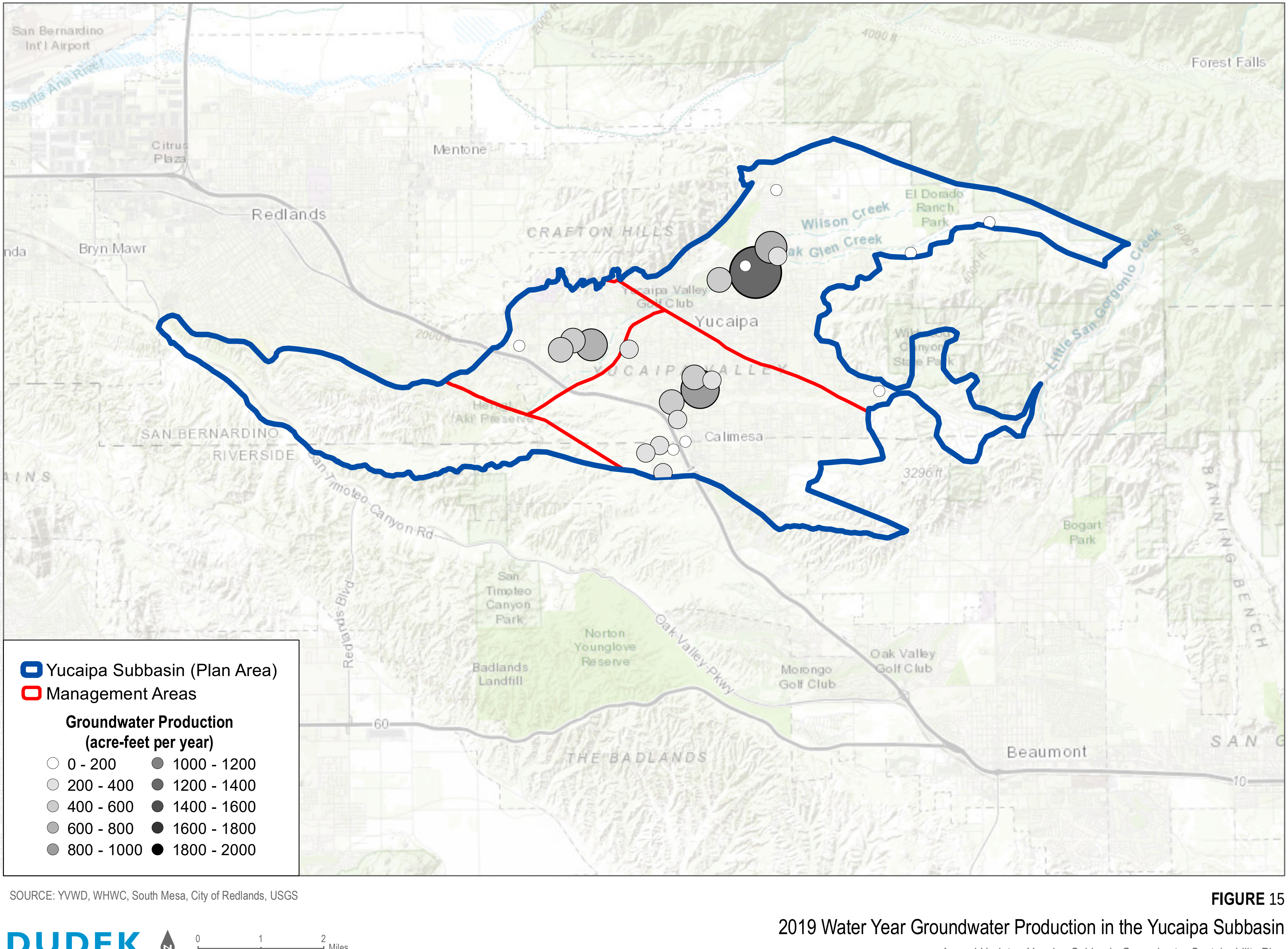
SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

DUDEK

0 0.5 1 Miles

FIGURE 14

Fall 2021 Groundwater Elevations in the Yucaipa Subbasin

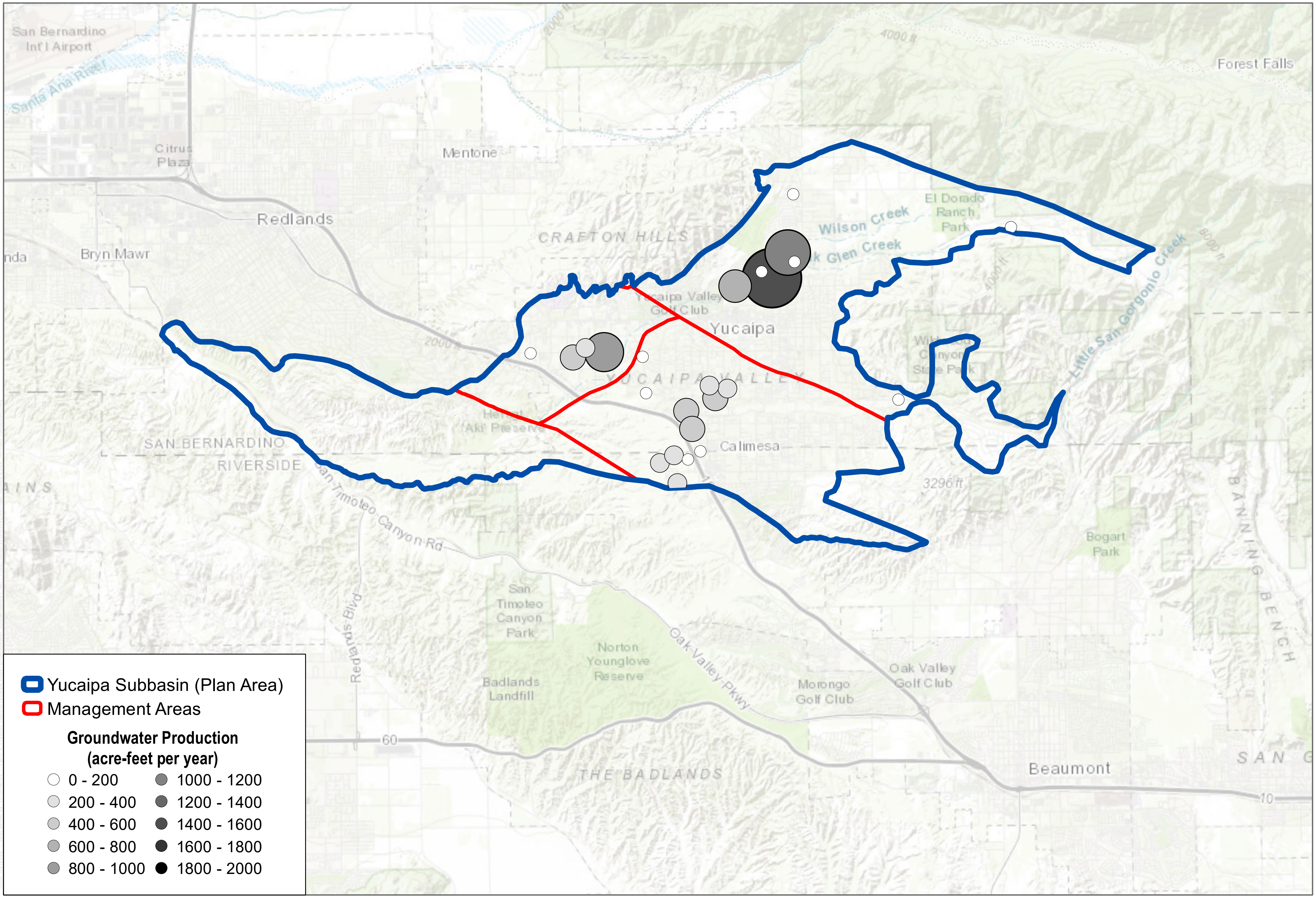


SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

DUDEK

FIGURE 15

2019 Water Year Groundwater Production in the Yucaipa Subbasin



SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

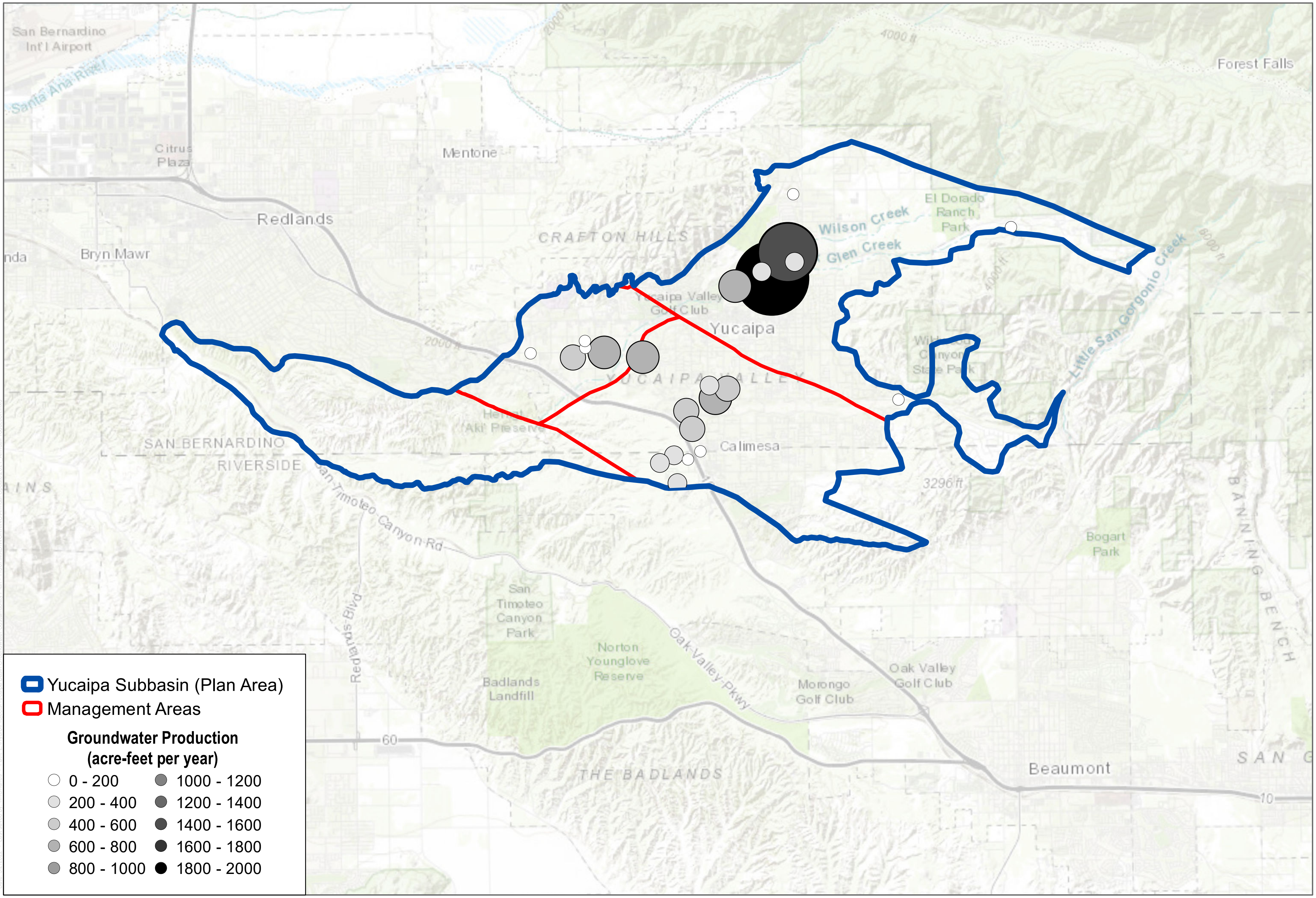
DUDEK

0 1 2 Miles

FIGURE 16

2020 Water Year Groundwater Production in the Yucaipa Subbasin

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan



SOURCE: YVWD, WHWC, South Mesa, City of Redlands, USGS

DUDEK

0 1 2 Miles

FIGURE 17

2021 Water Year Groundwater Production in the Yucaipa Subbasin

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan

Figure 18. Annual Change in Groundwater in Storage in the Yucaipa Subbasin

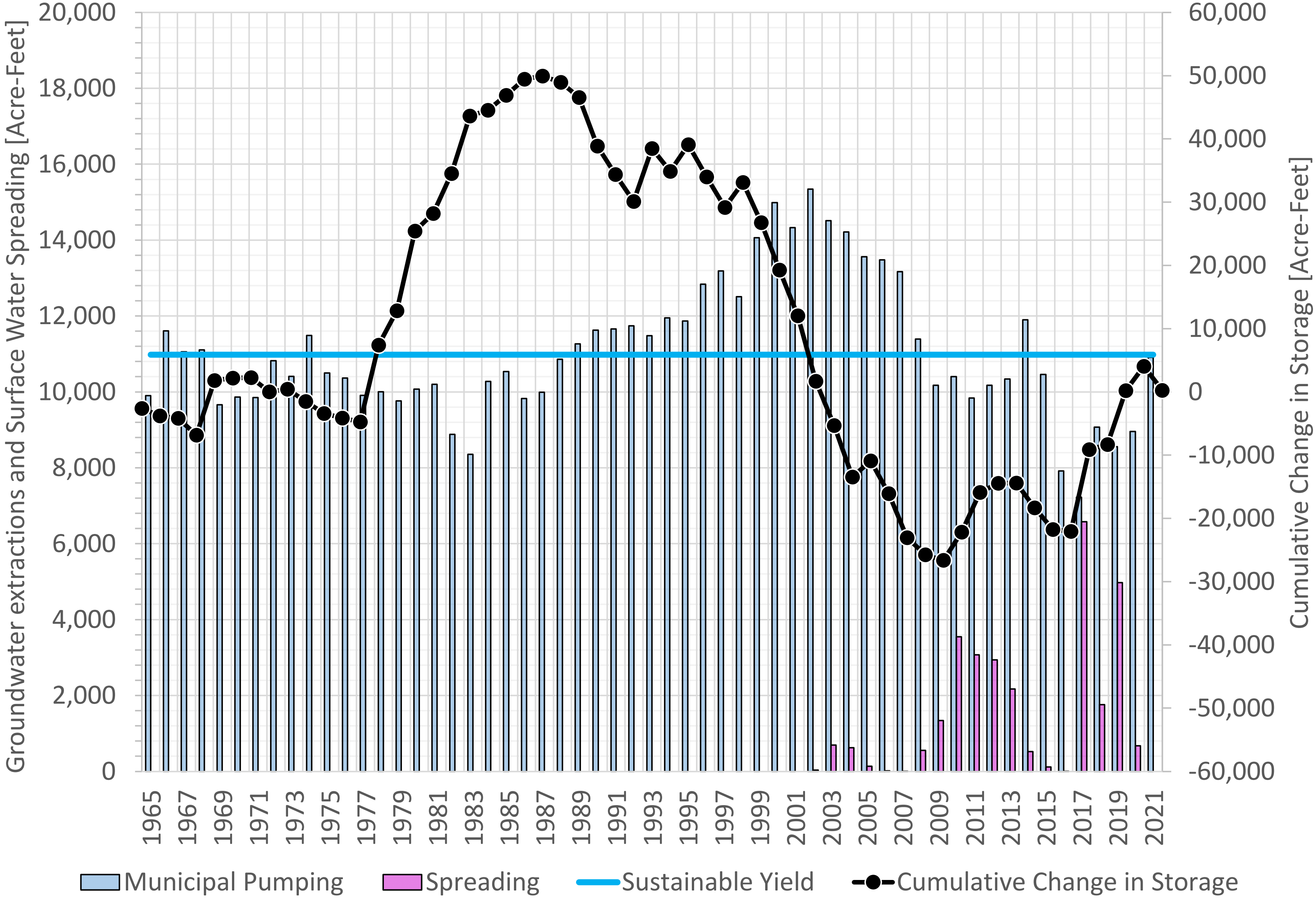
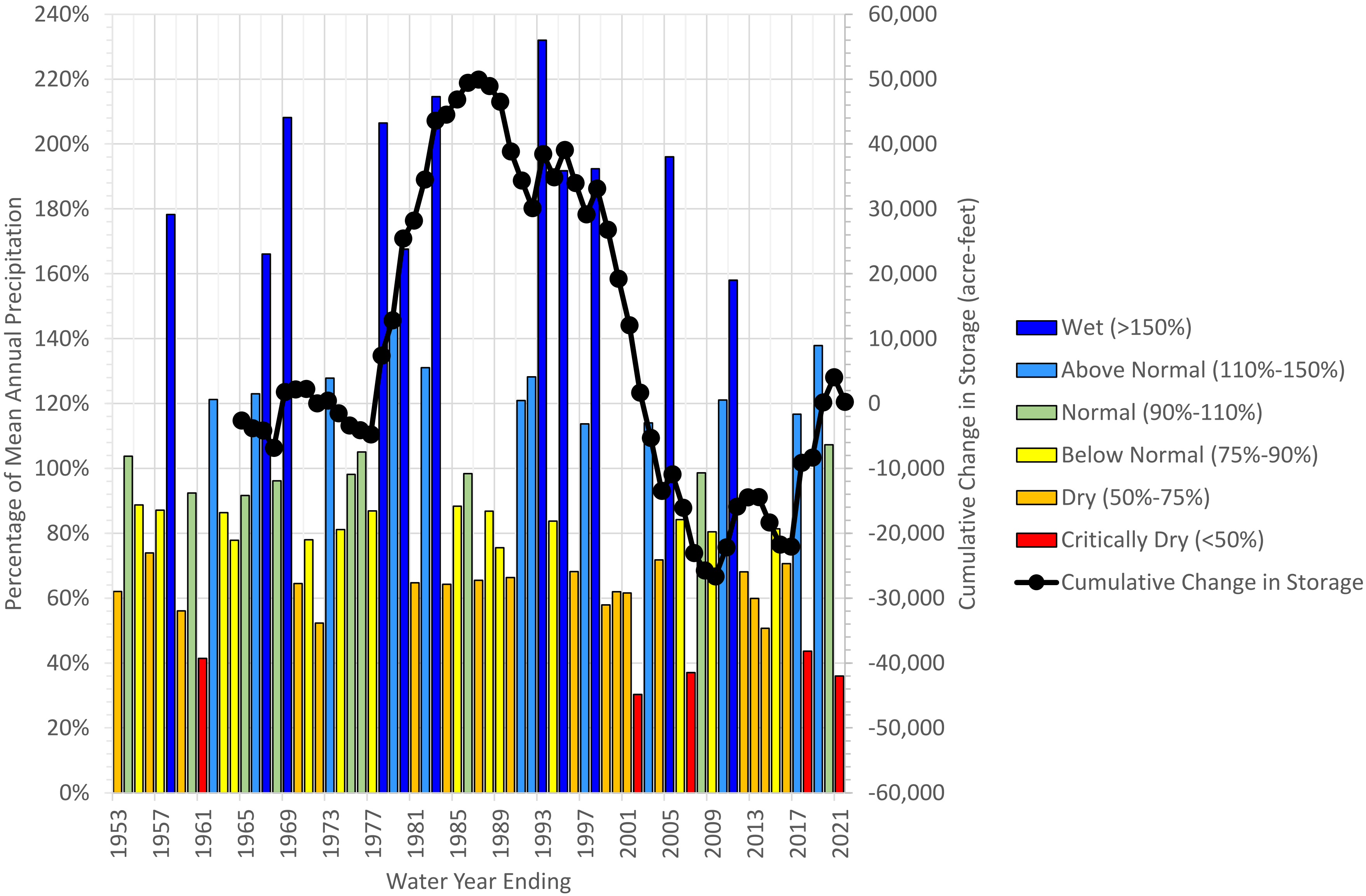
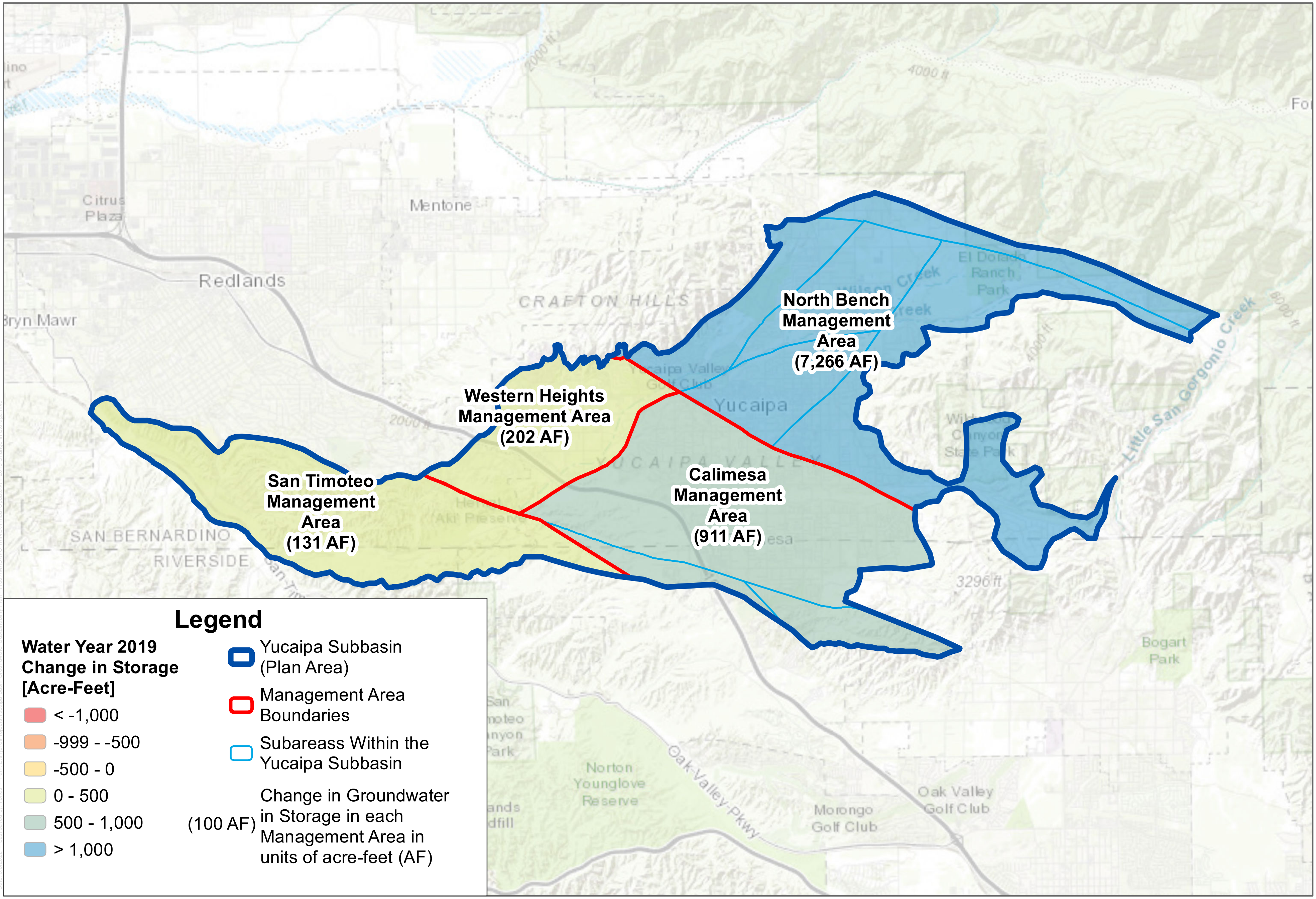


Figure 19. Historical Water Year-Types and Cumulative Change in Storage in the Yucaipa Subbasin





SOURCE: ESRI, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordanance Survey, ESRI Japan, METI, ESRI China (Hong Kong), swisstopo, OpenStreetMap contributors, and the GIS User Community; DWR 2015; USGS NHD 2017

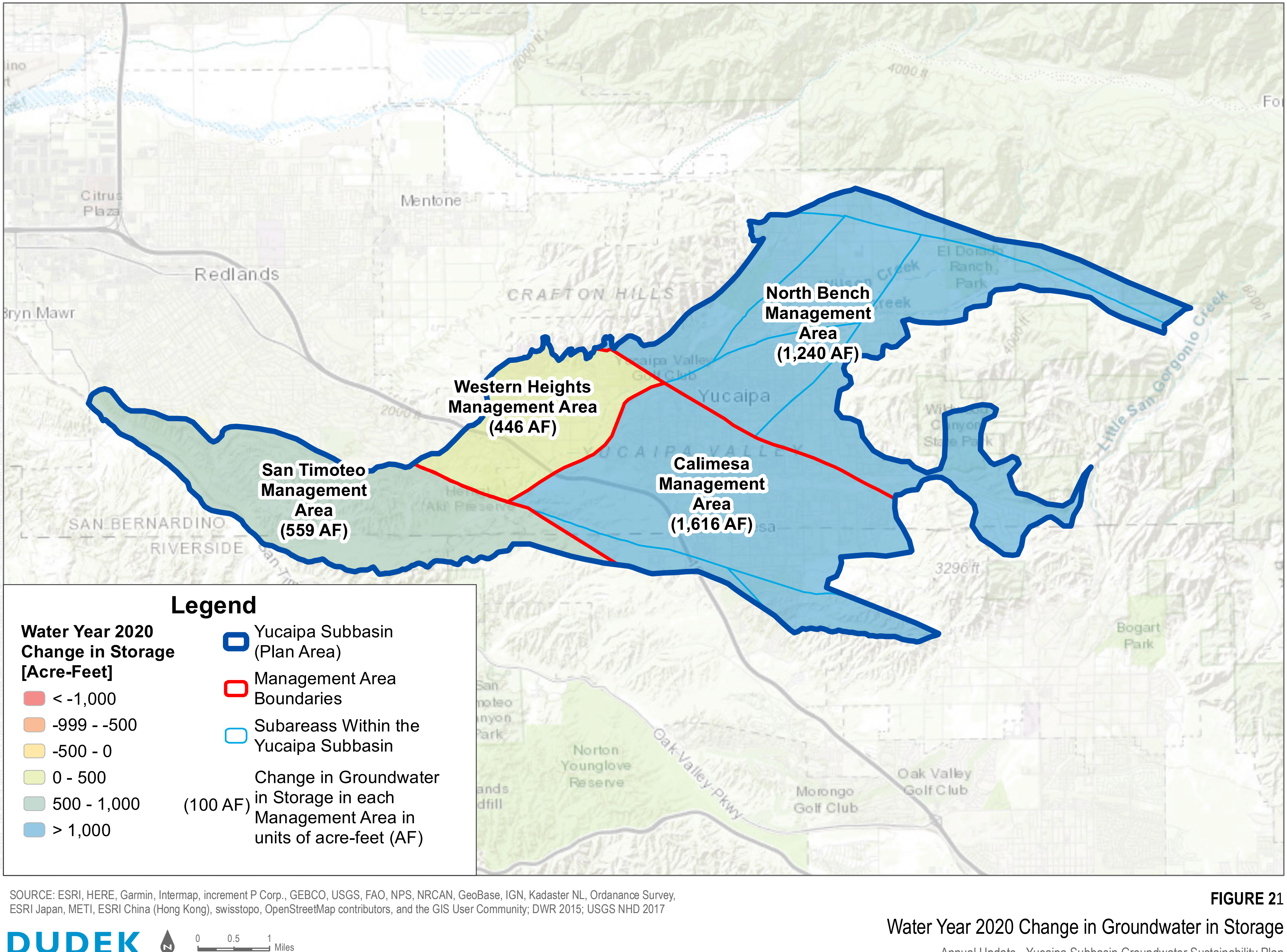
DUDEK

0 0.5 1 Miles

FIGURE 20

Water Year 2019 Change in Groundwater in Storage

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan

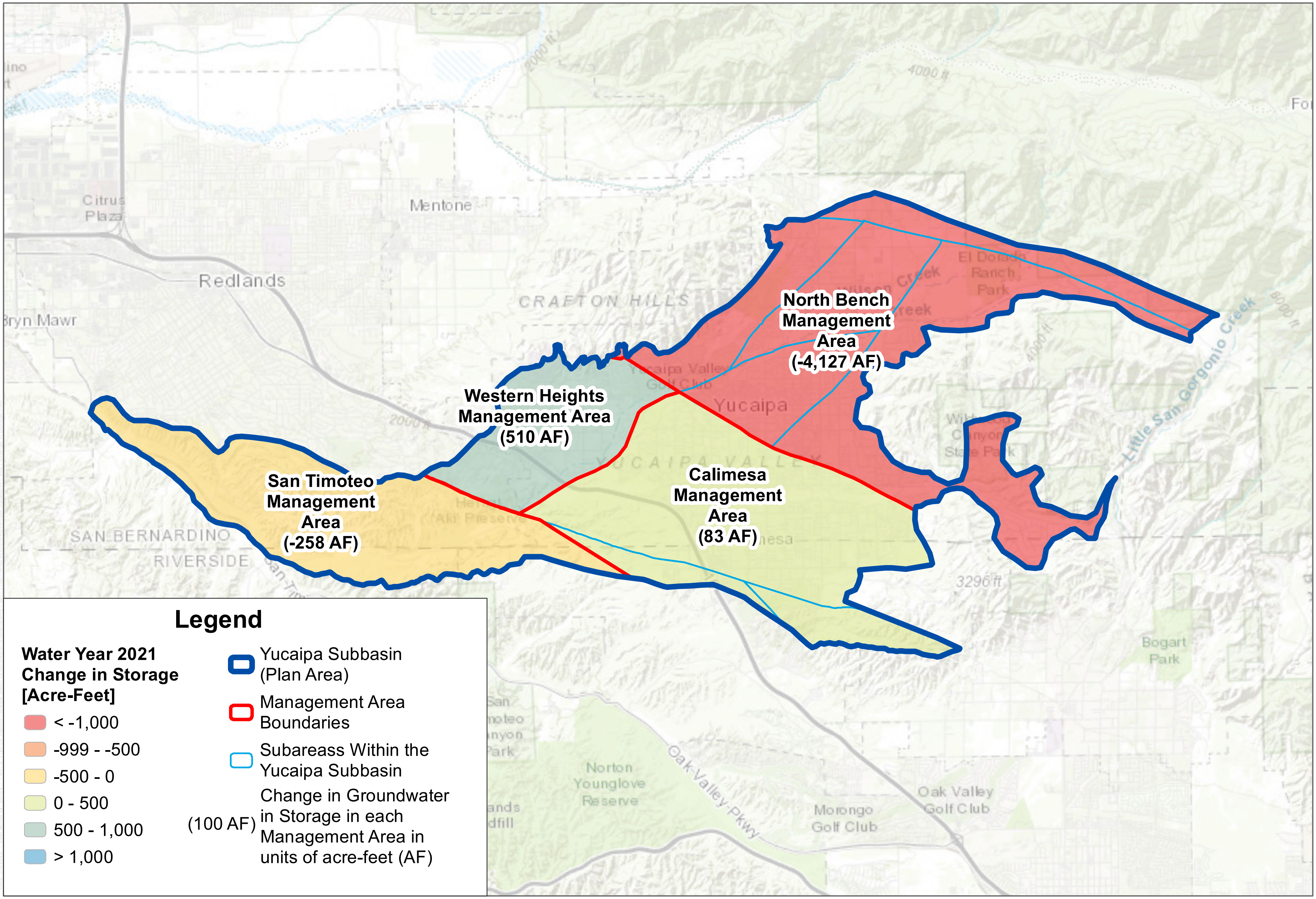


SOURCE: ESRI, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordanance Survey, ESRI Japan, METI, ESRI China (Hong Kong), swisstopo, OpenStreetMap contributors, and the GIS User Community; DWR 2015; USGS NHD 2017

FIGURE 21

Water Year 2020 Change in Groundwater in Storage

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan



SOURCE: ESRI, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordanance Survey, ESRI Japan, METI, ESRI China (Hong Kong), swisstopo, OpenStreetMap contributors, and the GIS User Community; DWR 2015; USGS NHD 2017

DUDEK

0 0.5 1 Miles

FIGURE 22

Water Year 2021 Change in Groundwater in Storage

Annual Update - Yucaipa Subbasin Groundwater Sustainability Plan

Figure 23. Annual Pumping and Spreading in the North Bench Management Area for the 2019, 2020 and 2021 Water Years

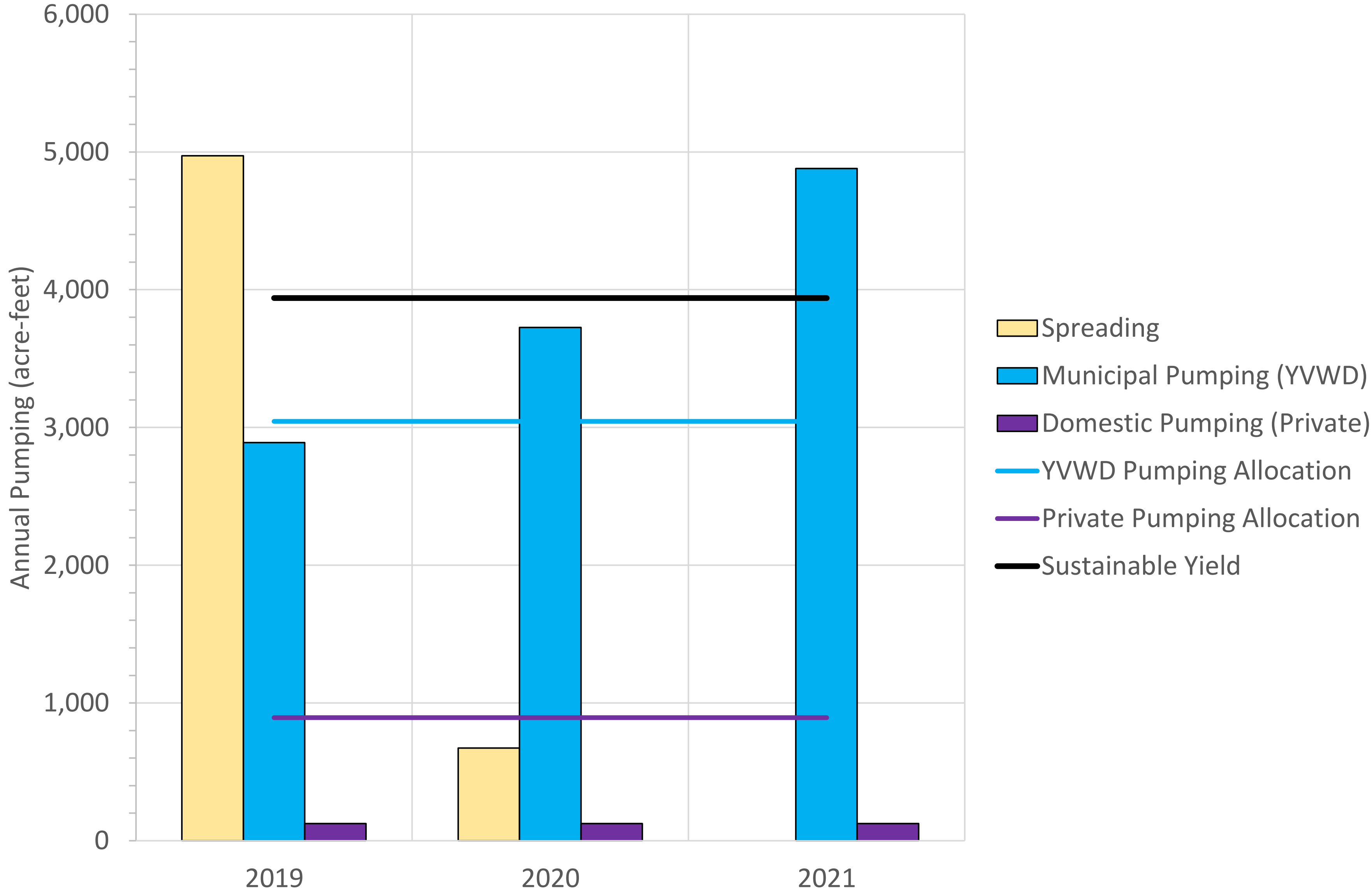


Figure 24. Annual Pumping by User in the Calimesa Management Area for the 2019, 2020, and 2021 Water Years

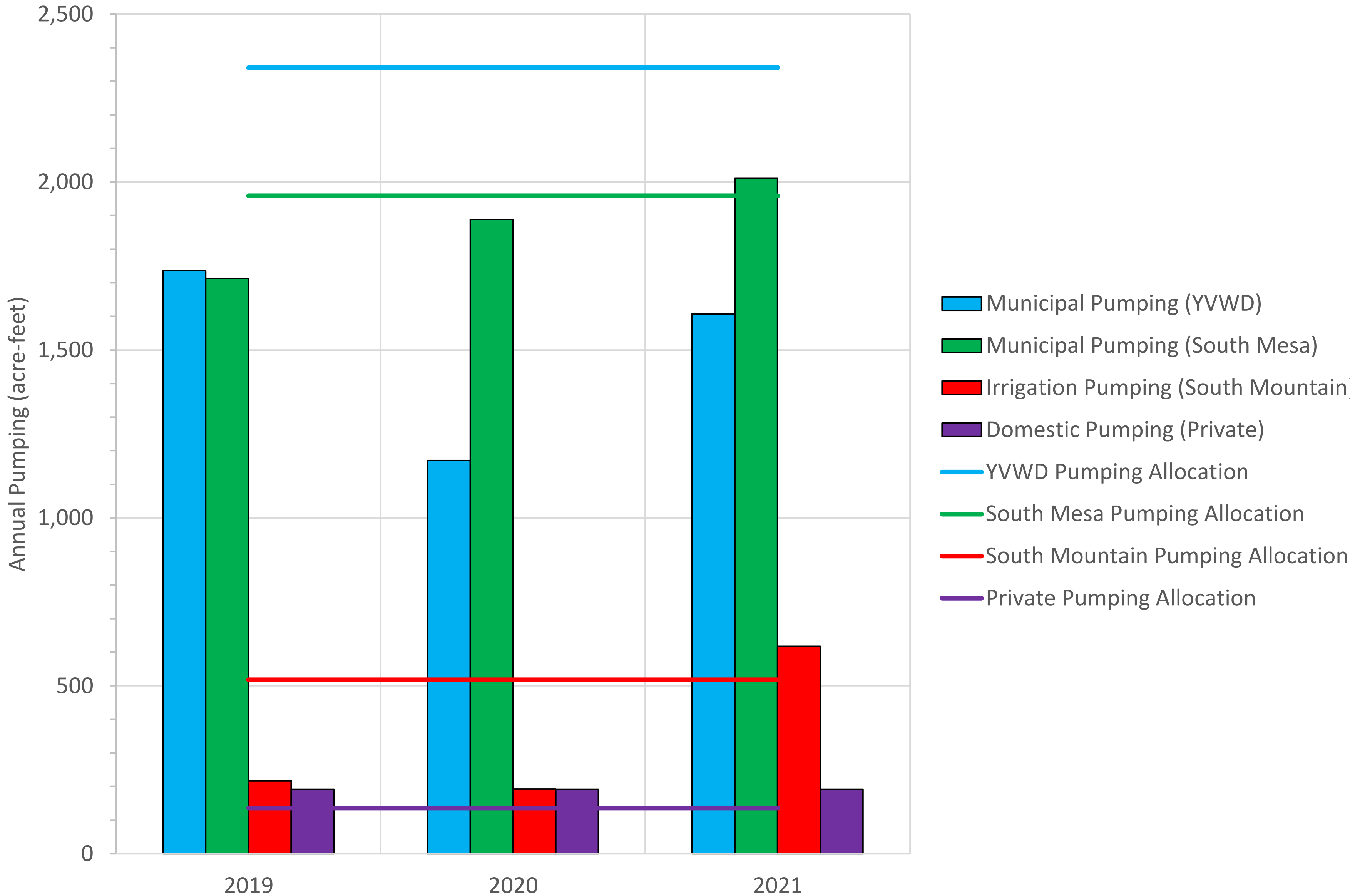


Figure 25. Annual Pumping in the Calimesa Management Area for the 2019, 2020 and 2021 Water Years

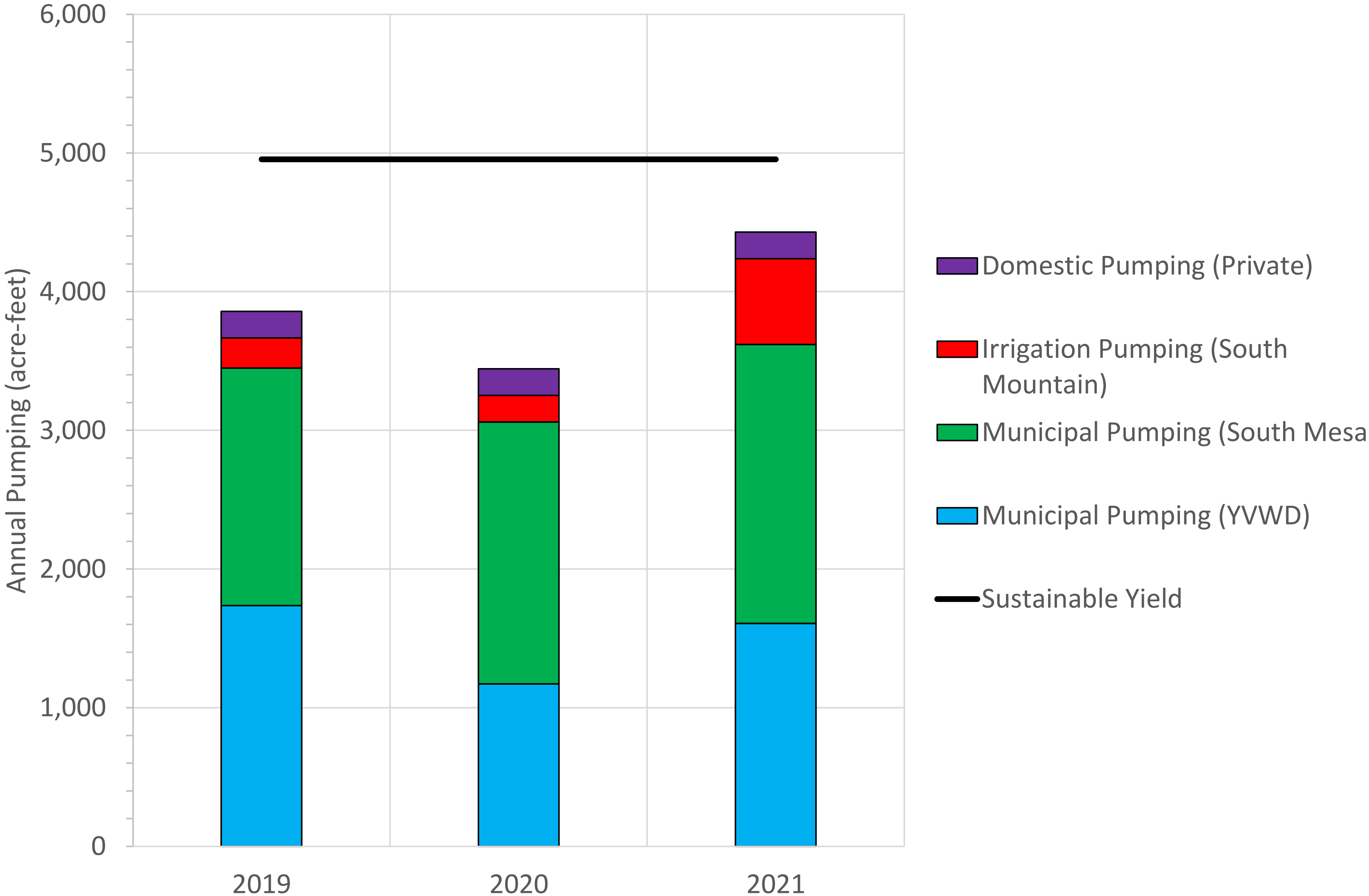
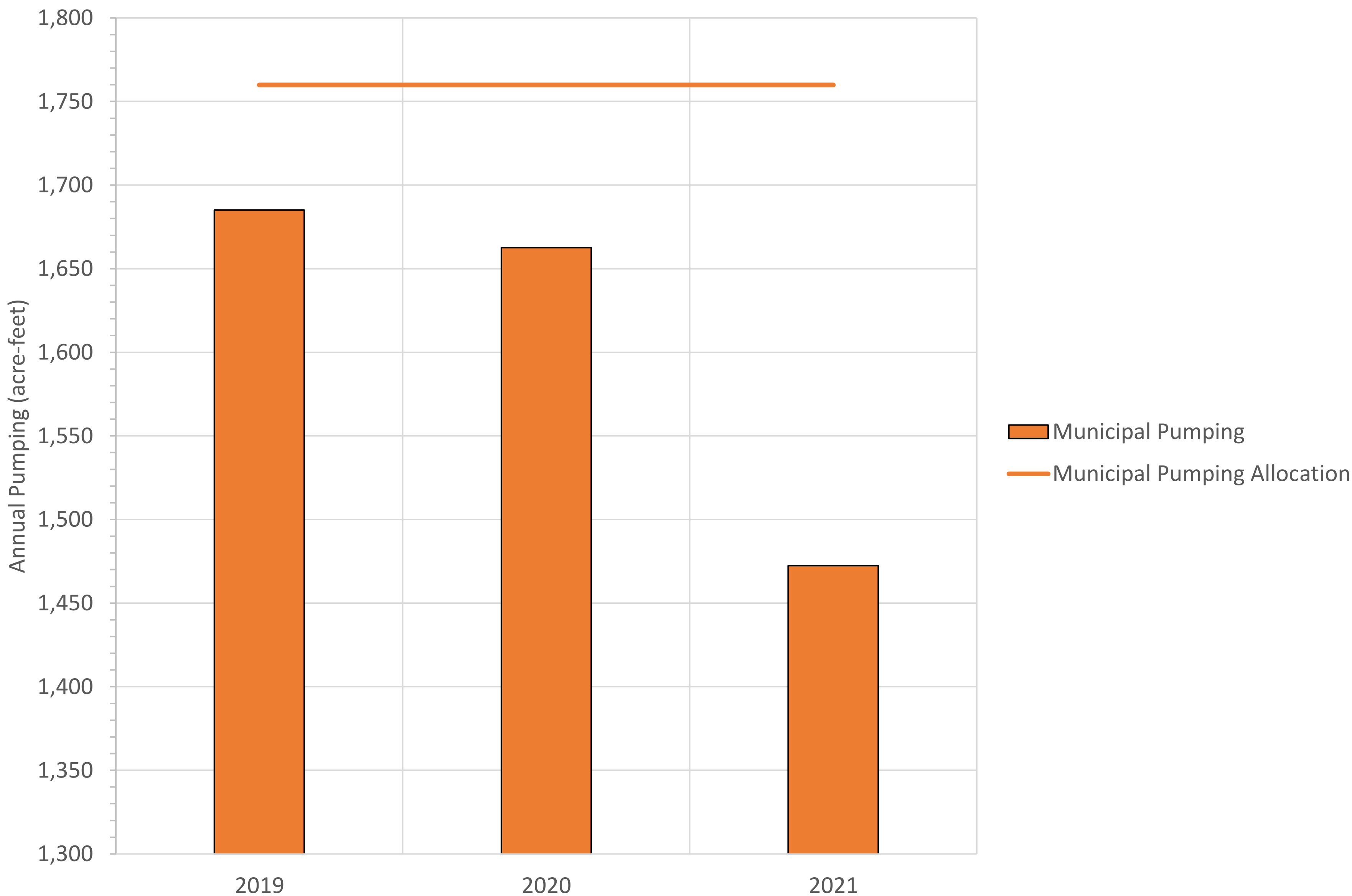


Figure 26. Annual Pumping in Western Heights Management Area for 2019, 2020 and 2021 Water Years



APPENDIX A

Groundwater Elevation Hydrographs for the Yucaipa Subbasin Groundwater Monitoring Network

APPENDIX A

Groundwater Elevation Hydrographs

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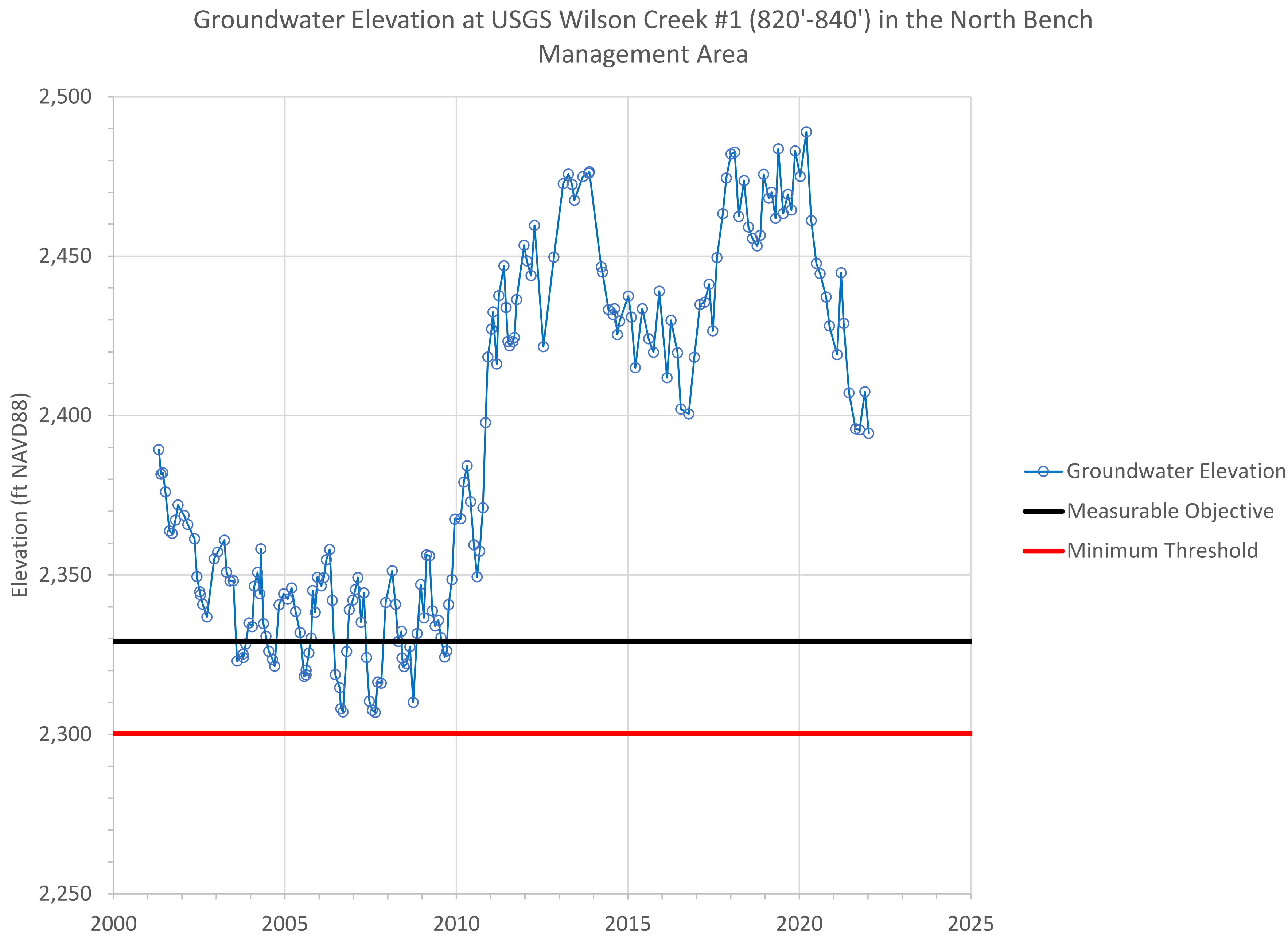

Groundwater Elevation at USGS Wilson Creek #1 (820'-840') in the North Bench Management Area
Elevation (ft NAVD88)
2,500
2,450
2,400
2,350
2,300
2,250
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective
Minimum Threshold

Figure A-1

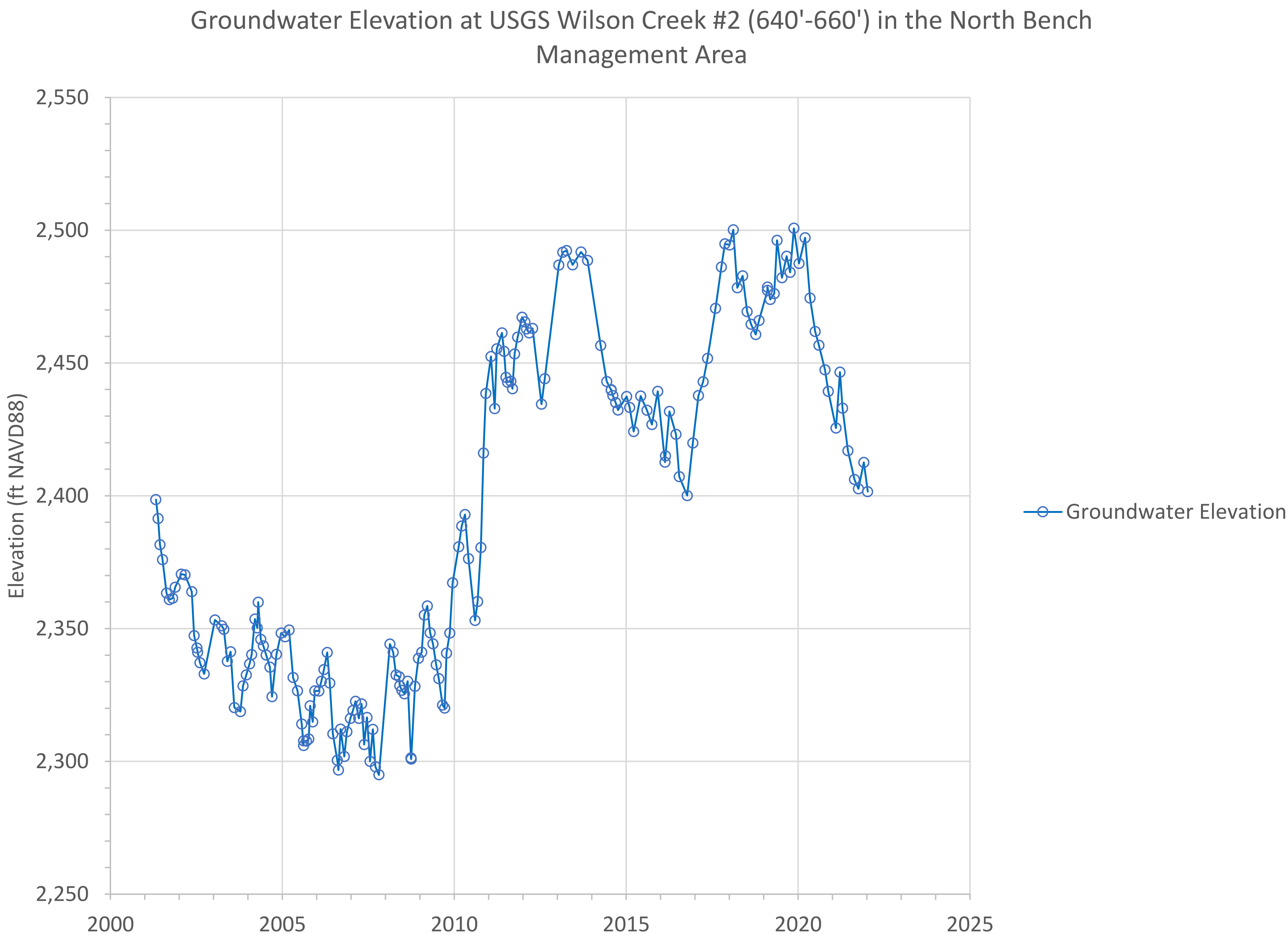

Groundwater Elevation at USGS Wilson Creek #2 (640'-660') in the North Bench Management Area
Elevation (ft NAVD88)
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-2

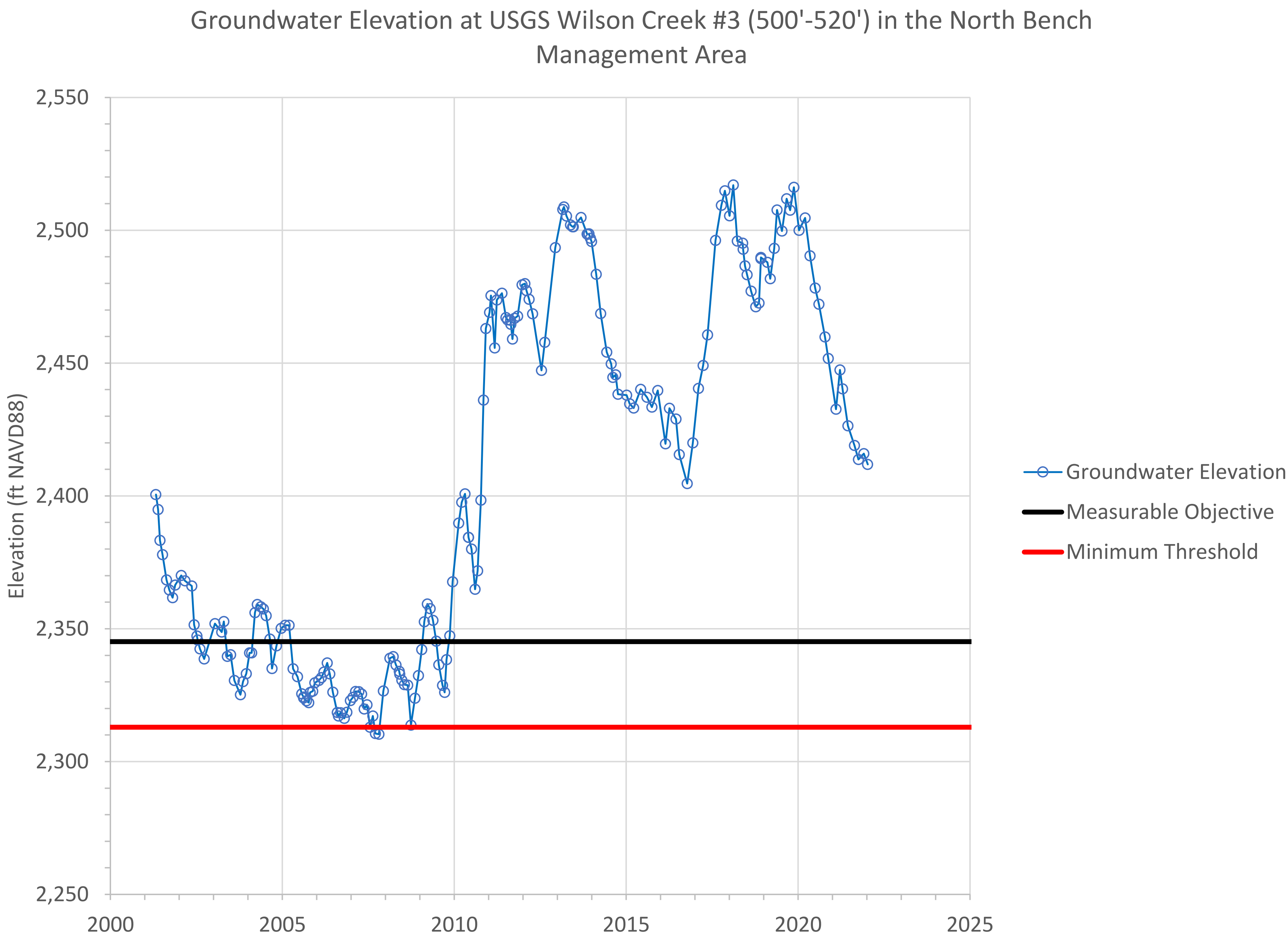

Groundwater Elevation at USGS Wilson Creek #3 (500'-520') in the North Bench Management Area
Elevation (ft NAVD88)
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective
Minimum Threshold

Figure A-3

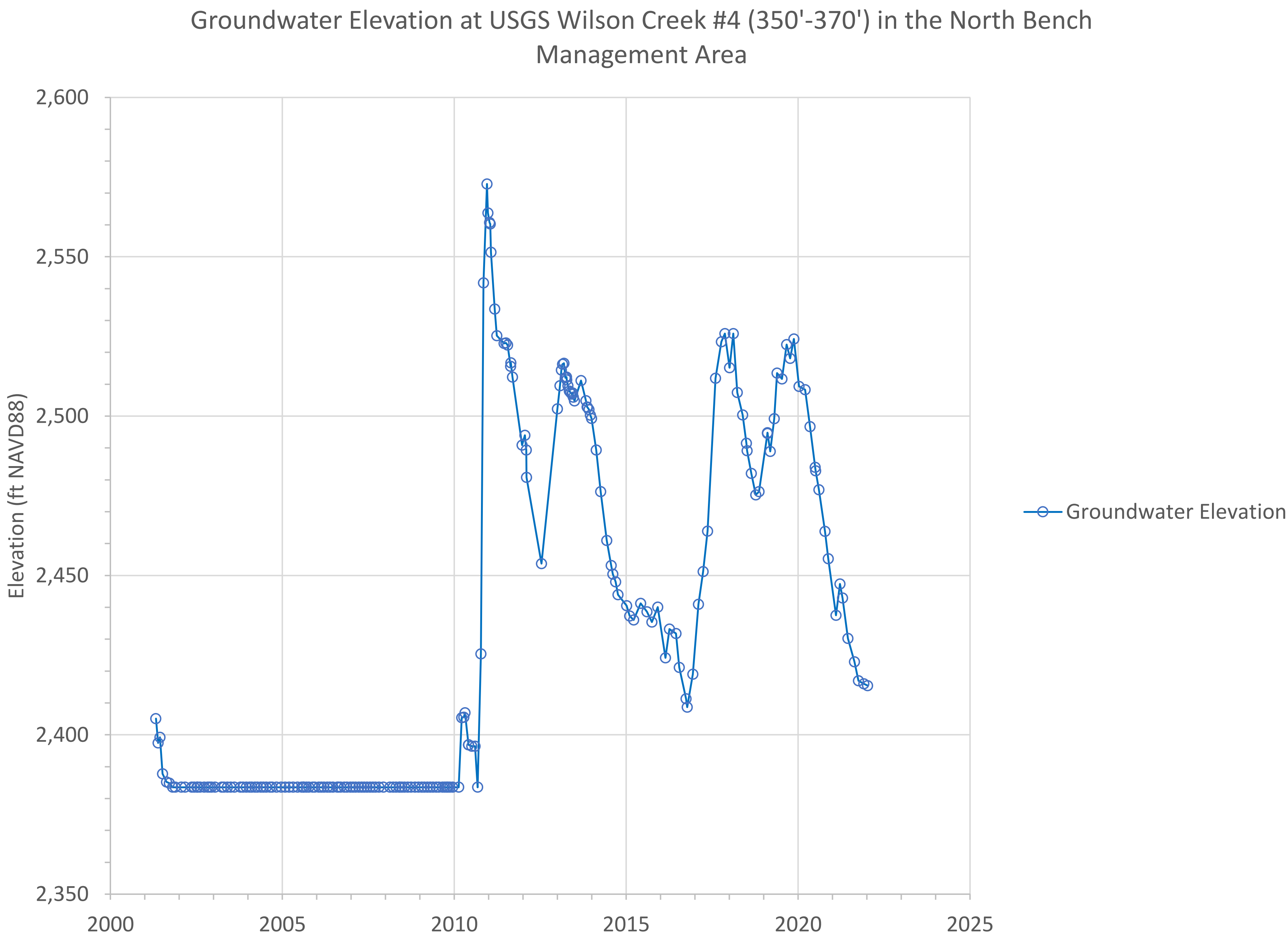
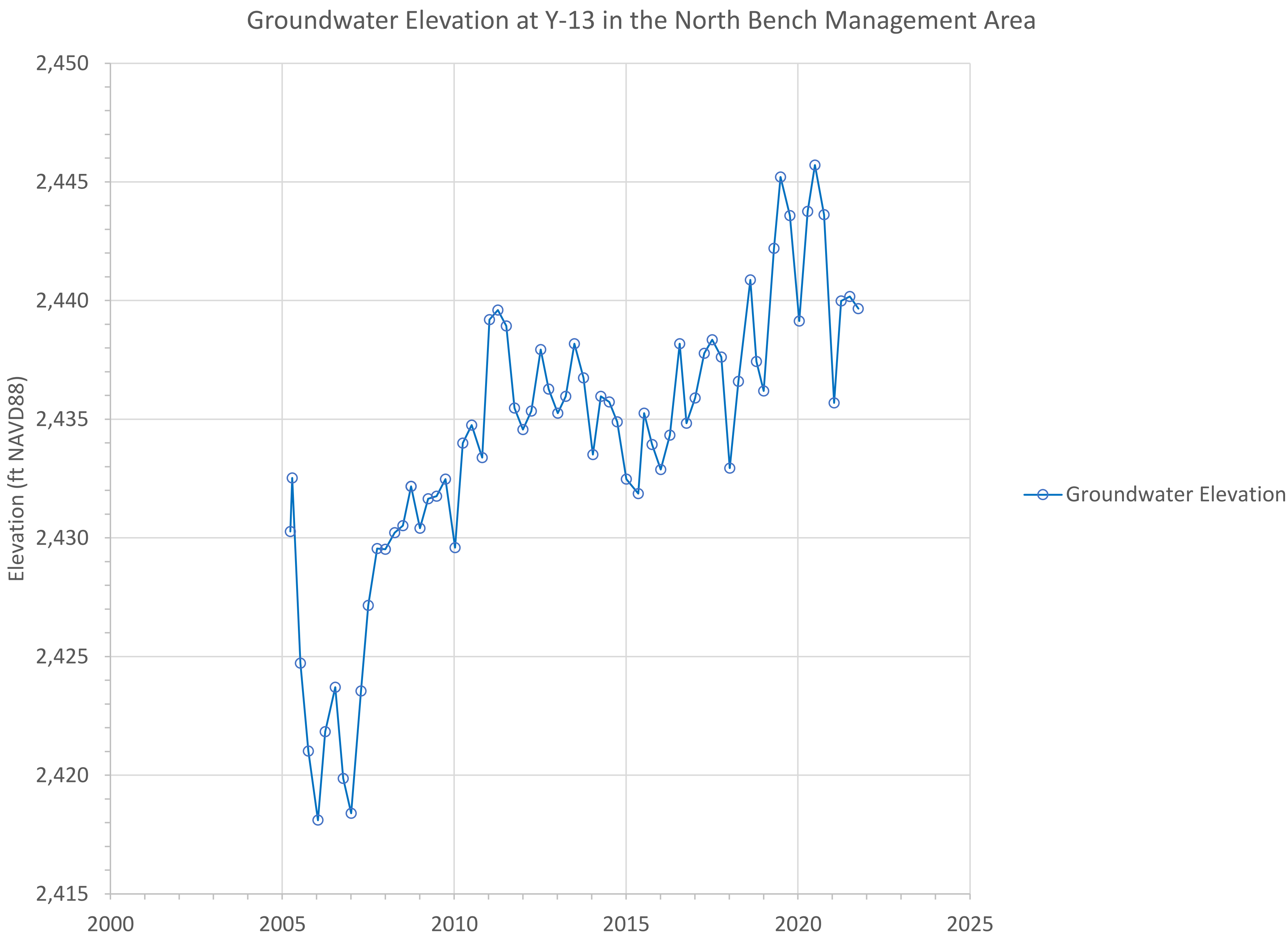

Groundwater Elevation at USGS Wilson Creek #4 (350'-370') in the North Bench Management Area
Elevation (ft NAVD88)
2,600
2,550
2,500
2,450
2,400
2,350
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-4



Groundwater Elevation at Y-13 in the North Bench Management Area
Elevation (ft NAVD88)
2,450
2,445
2,440
2,435
2,430
2,425
2,420
2,415
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-5

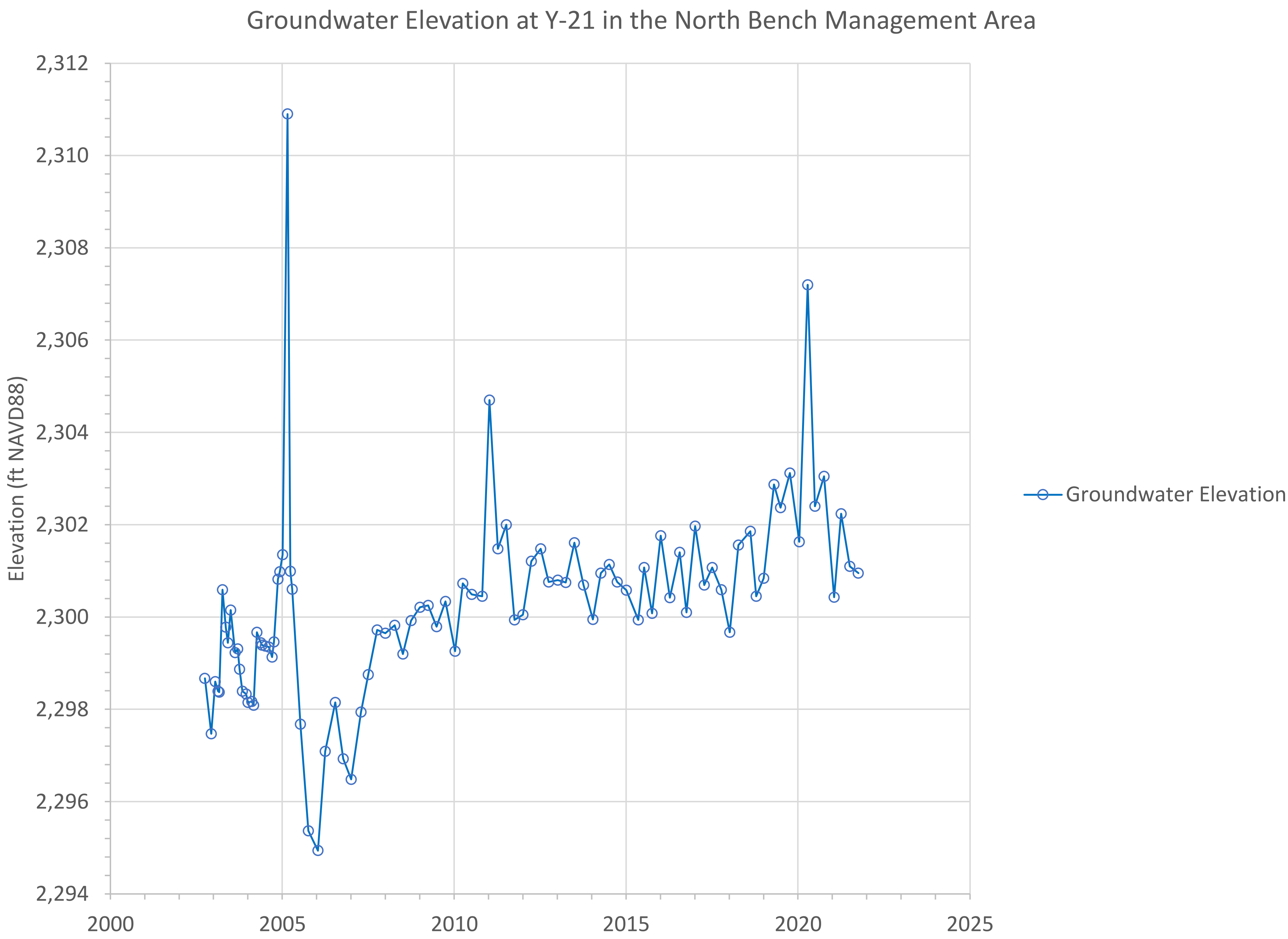

Groundwater Elevation at Y-21 in the North Bench Management Area
Elevation (ft NAVD88)
2,294
2,296
2,298
2,300
2,302
2,304
2,306
2,308
2,310
2,312
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-6

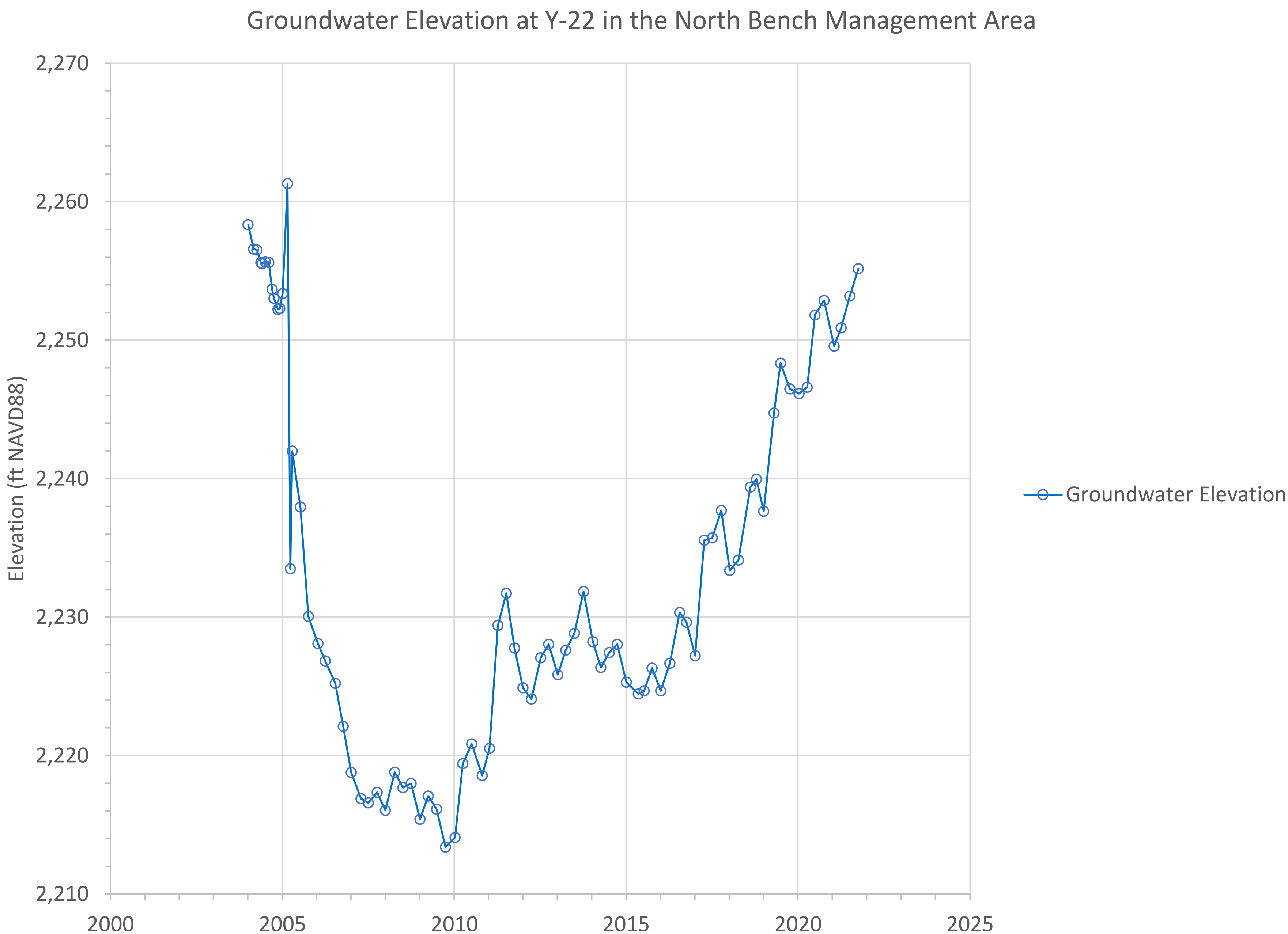

Groundwater Elevation at Y-22 in the North Bench Management Area
Elevation (ft NAVD88)
2,270
2,260
2,250
2,240
2,230
2,220
2,210
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-7

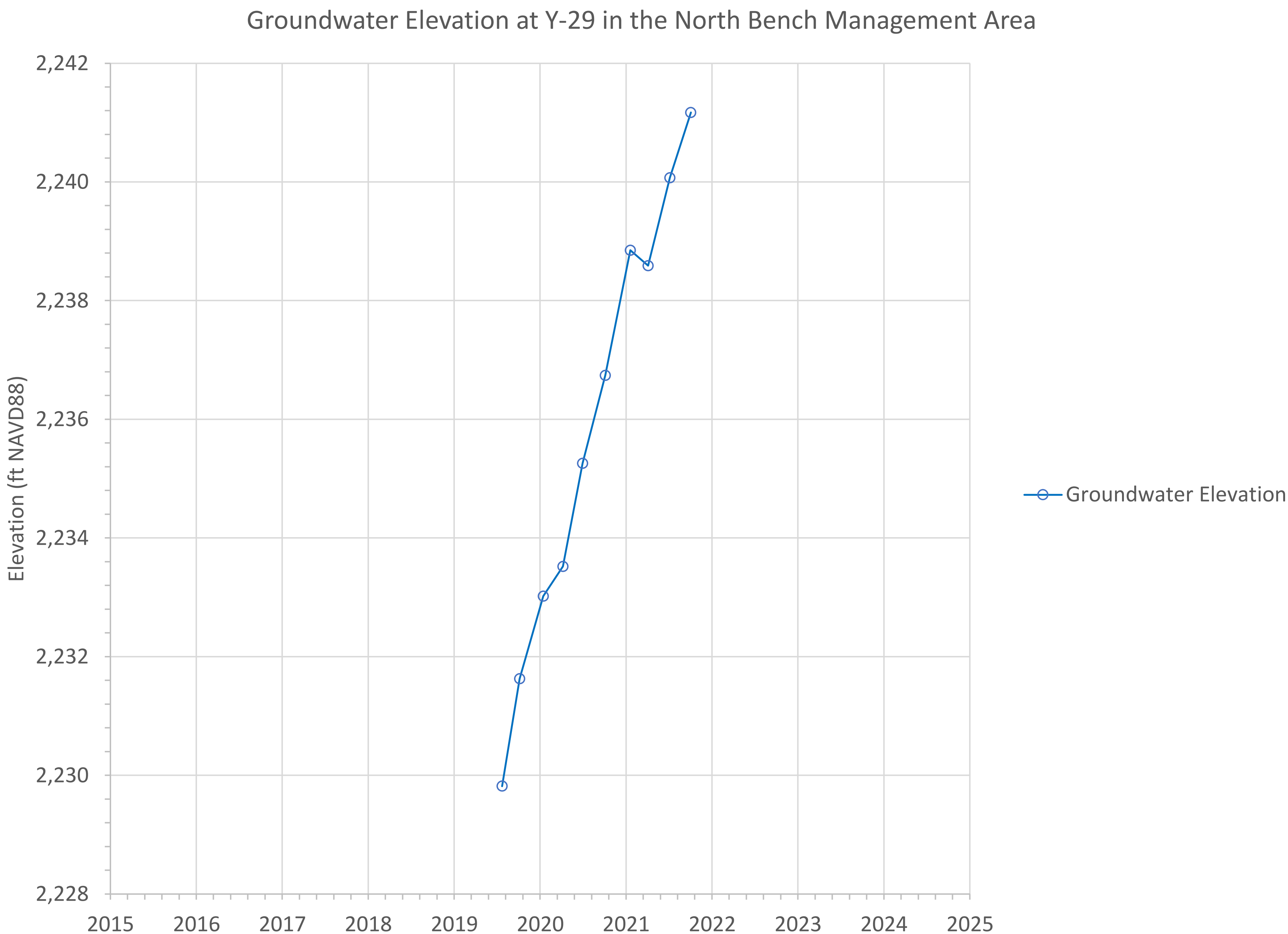

Groundwater Elevation at Y-29 in the North Bench Management Area
Elevation (ft NAVD88)
2,242
2,240
2,238
2,236
2,234
2,232
2,230
2,228
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Groundwater Elevation

Figure A-8

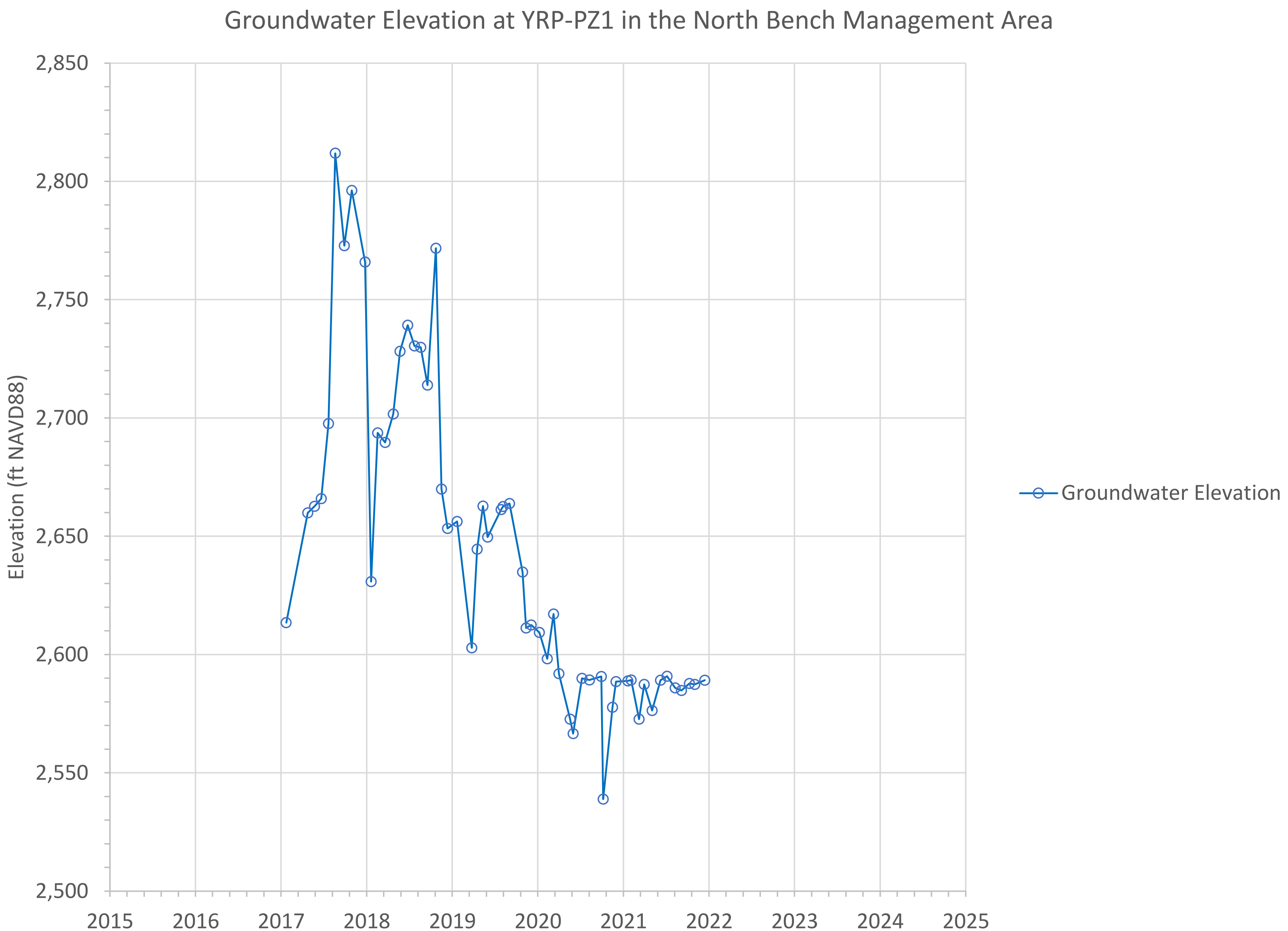
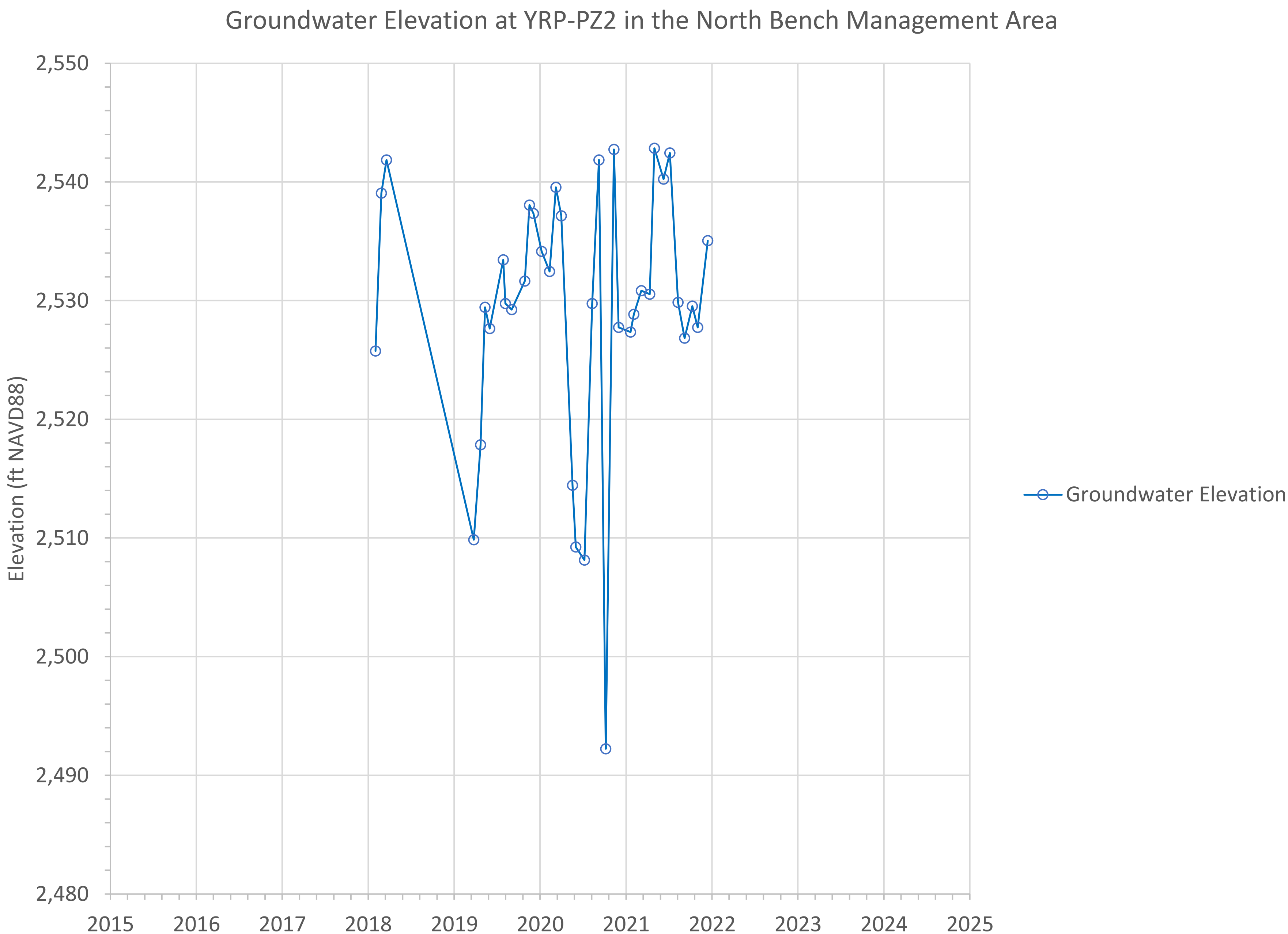

Groundwater Elevation at YRP-PZ1 in the North Bench Management Area
Elevation (ft NAVD88)
2,850
2,800
2,750
2,700
2,650
2,600
2,550
2,500
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Groundwater Elevation

Figure A-9



Groundwater Elevation at YRP-PZ2 in the North Bench Management Area
Elevation (ft NAVD88)
2,550
2,540
2,530
2,520
2,510
2,500
2,490
2,480
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Groundwater Elevation

Figure A-10

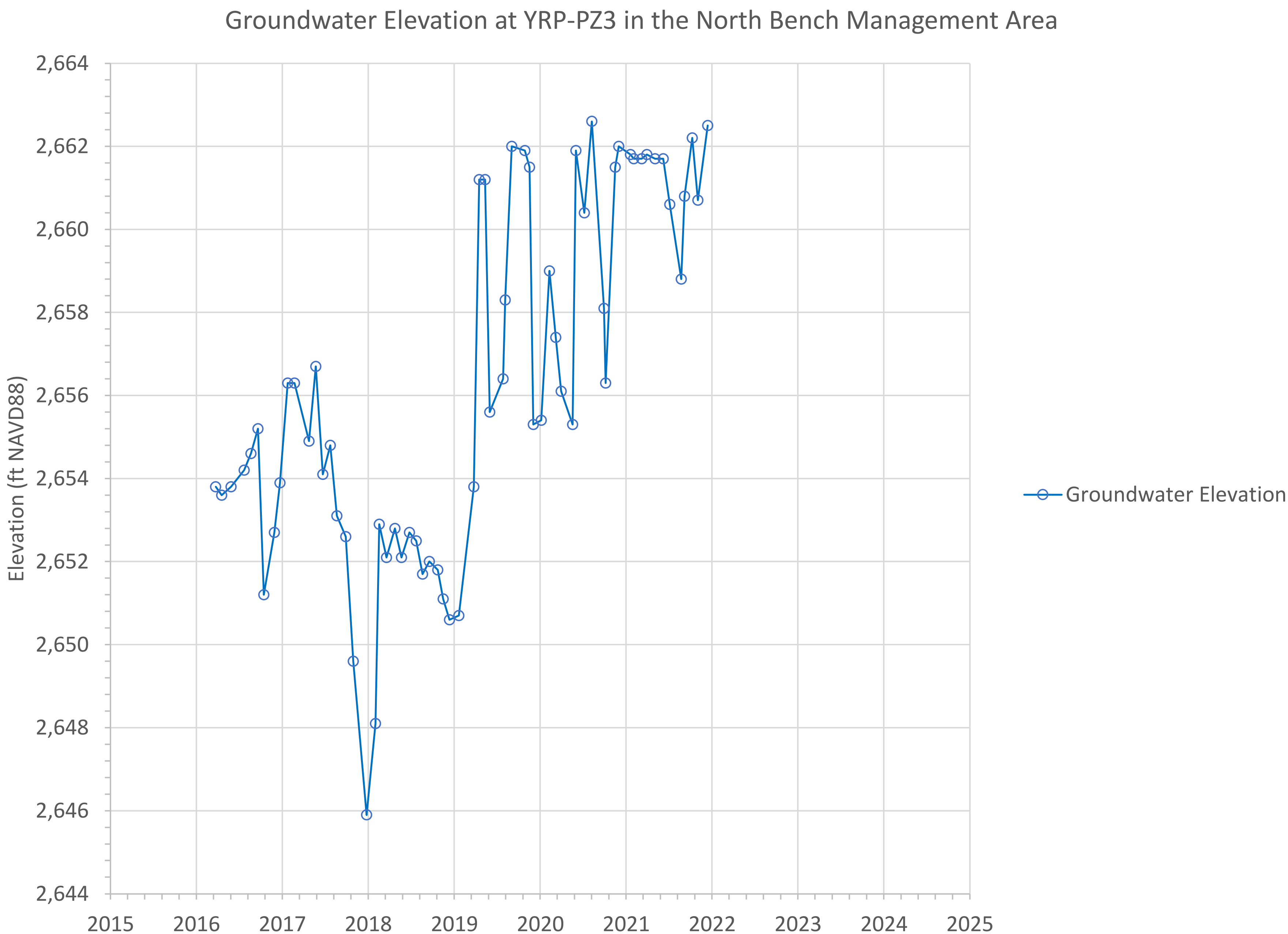
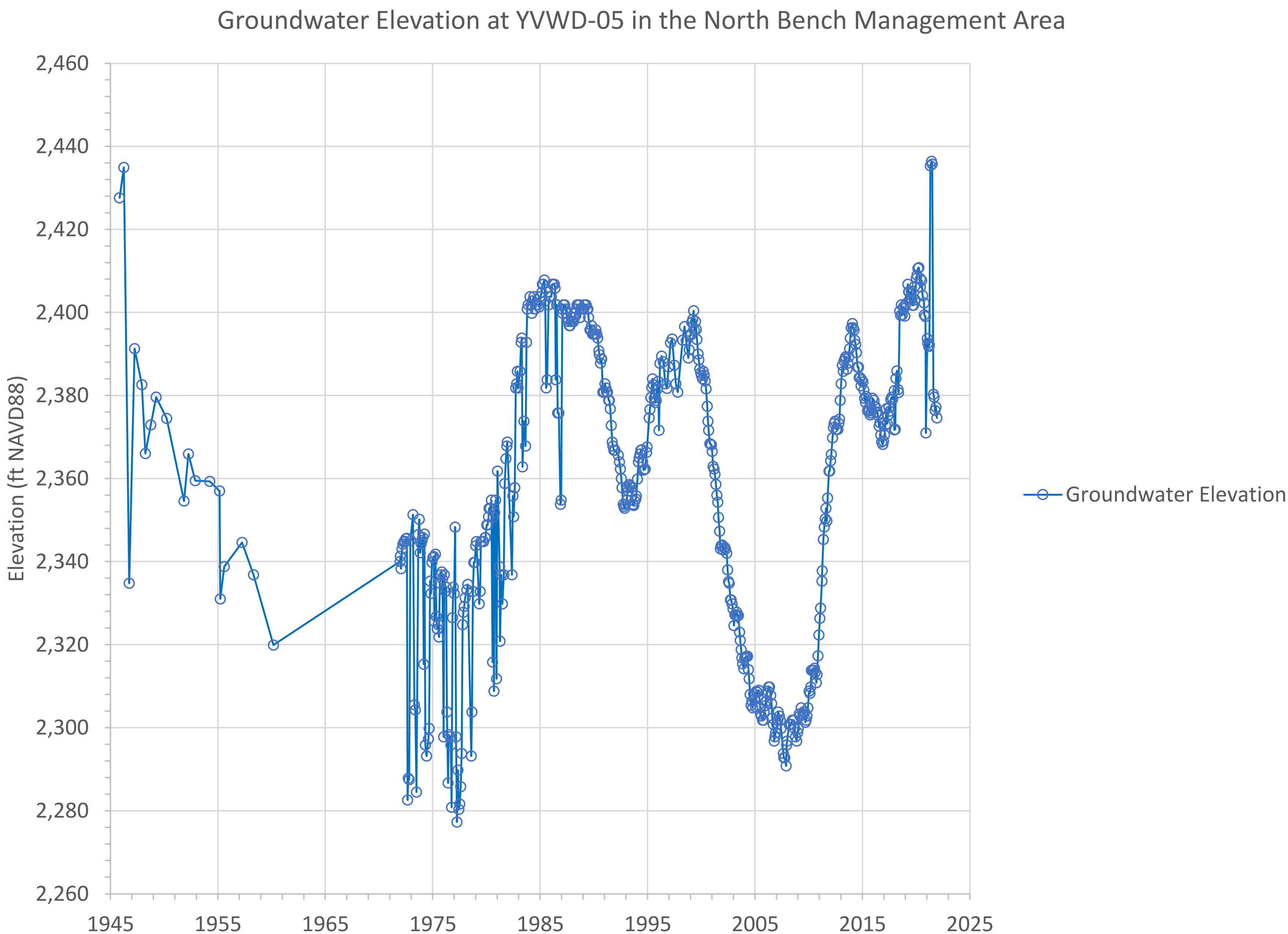
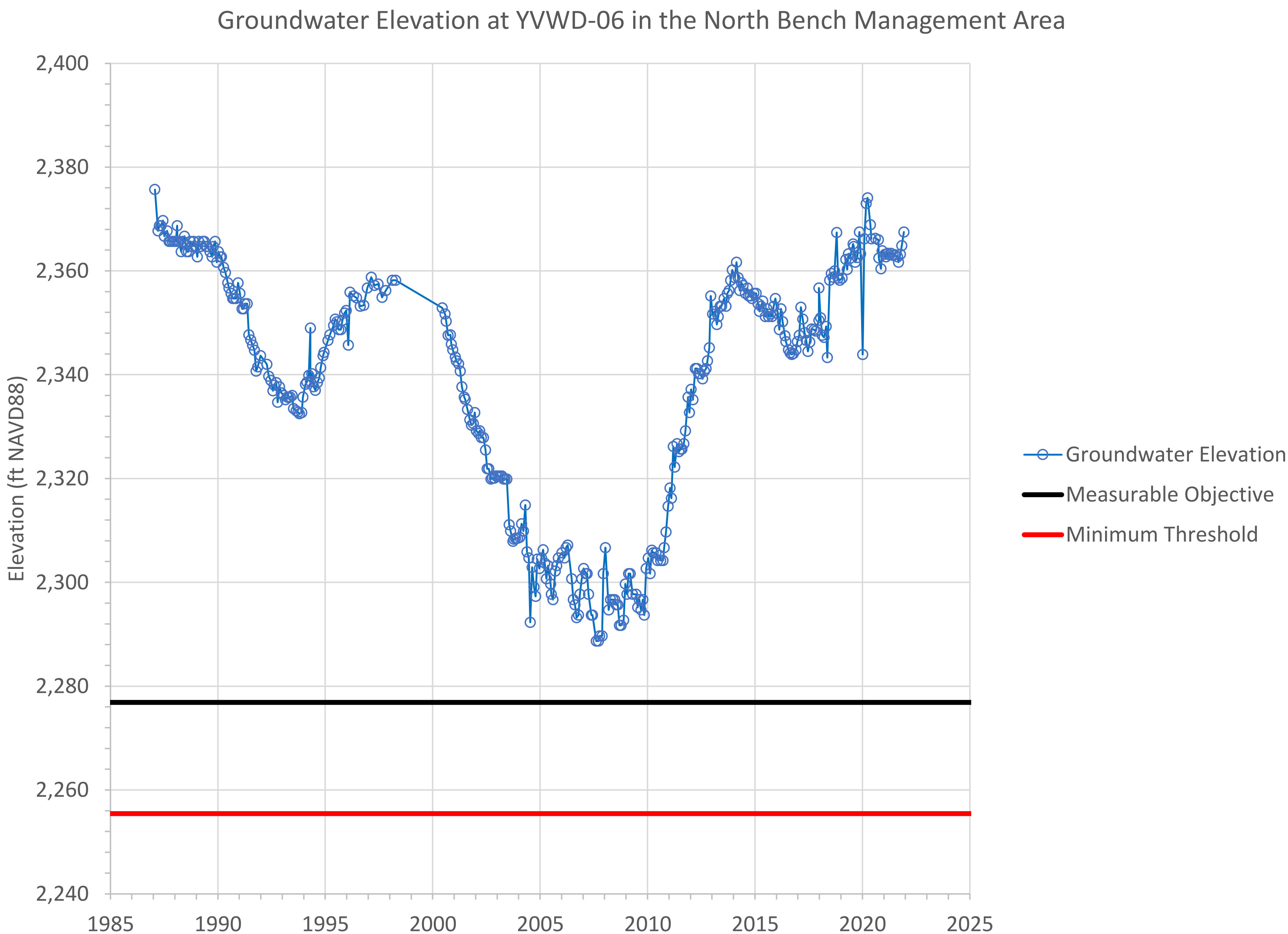

Groundwater Elevation at YRP-PZ3 in the North Bench Management Area
Elevation (ft NAVD88)
2,664
2,662
2,660
2,658
2,656
2,654
2,652
2,650
2,648
2,646
2,644
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Groundwater Elevation

Figure A-11



Groundwater Elevation at YVWD-05 in the North Bench Management Area
Elevation (ft NAVD88)
2,460
2,440
2,420
2,400
2,380
2,360
2,340
2,320
2,300
2,280
2,260
1945
1955
1965
1975
1985
1995
2005
2015
2025
Groundwater Elevation

Figure A-12



Groundwater Elevation at YVWD-06 in the North Bench Management Area
Elevation (ft NAVD88)
2,400
2,380
2,360
2,340
2,320
2,300
2,280
2,260
2,240
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective
Minimum Threshold

Figure A-13

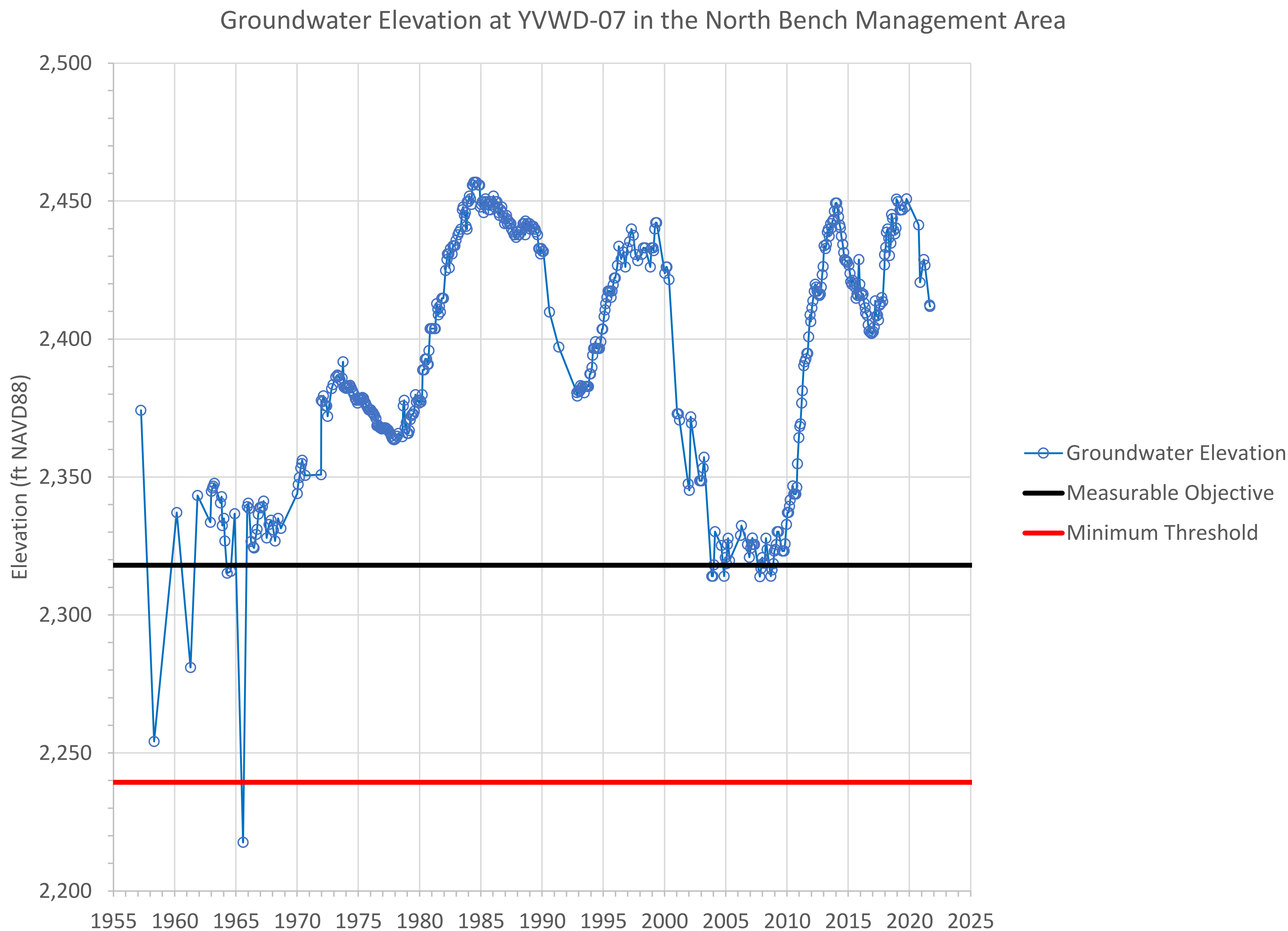

Groundwater Elevation at YVWD-07 in the North Bench Management Area
Elevation (ft NAVD88)
2,500
2,450
2,400
2,350
2,300
2,250
2,200
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective
Minimum Threshold

Figure A-14

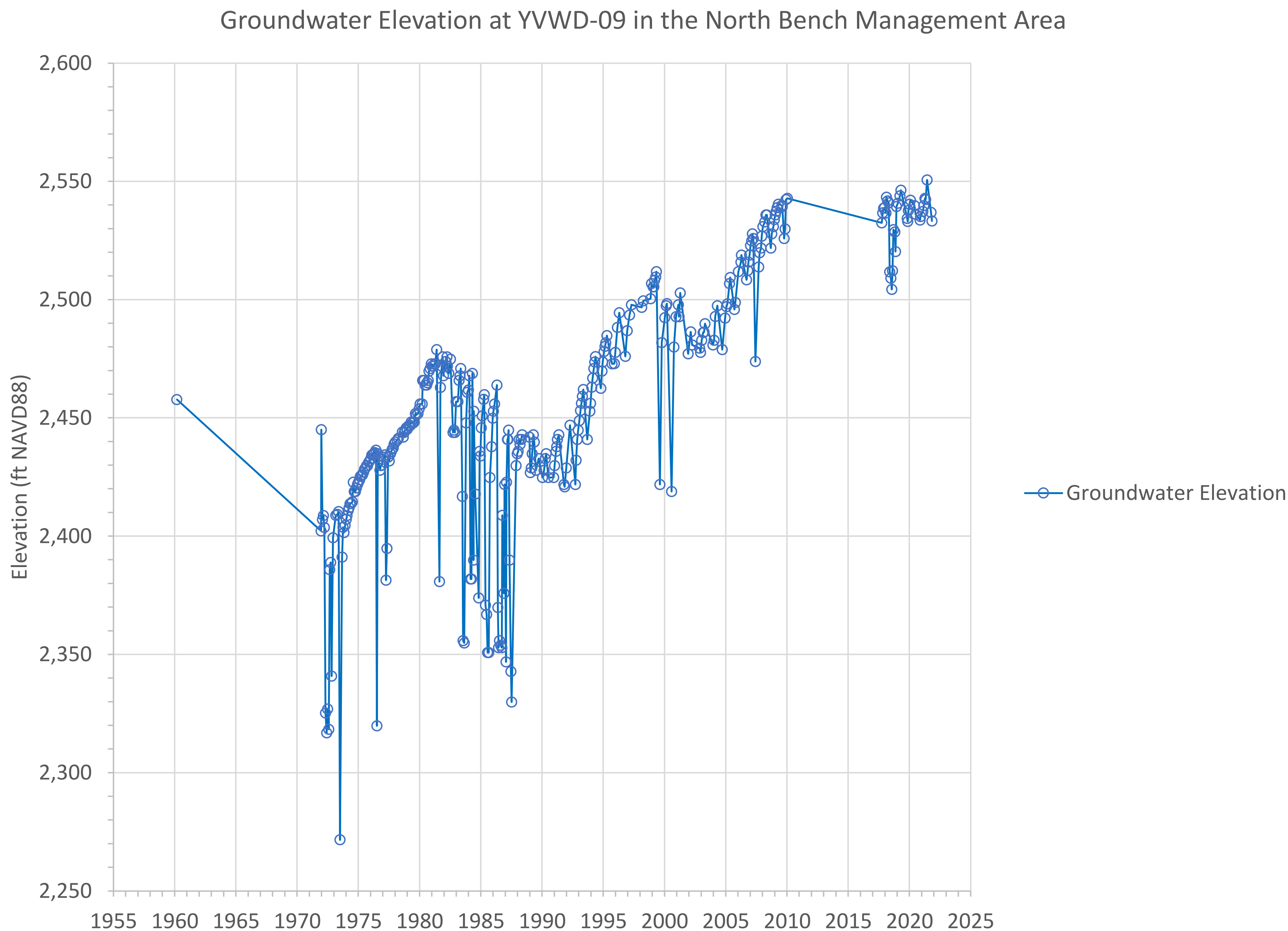

Groundwater Elevation at YVWD-09 in the North Bench Management Area
Elevation (ft NAVD88)
2,600
2,550
2,500
2,450
2,400
2,350
2,300
2,250
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-15

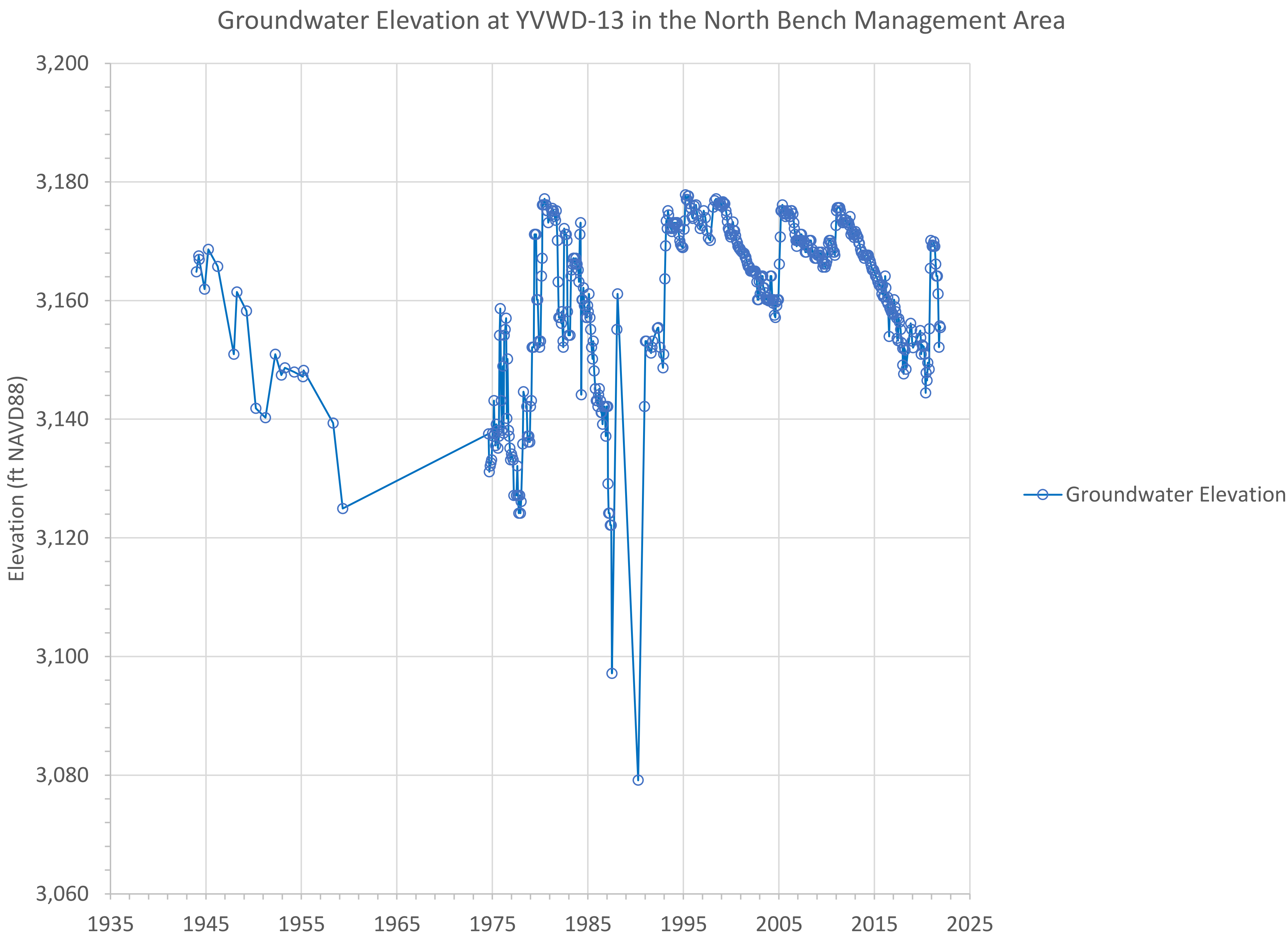

Groundwater Elevation at YVWD-13 in the North Bench Management Area
Elevation (ft NAVD88)
3,200
3,180
3,160
3,140
3,120
3,100
3,080
3,060
1935
1945
1955
1965
1975
1985
1995
2005
2015
2025
Groundwater Elevation

Figure A-16

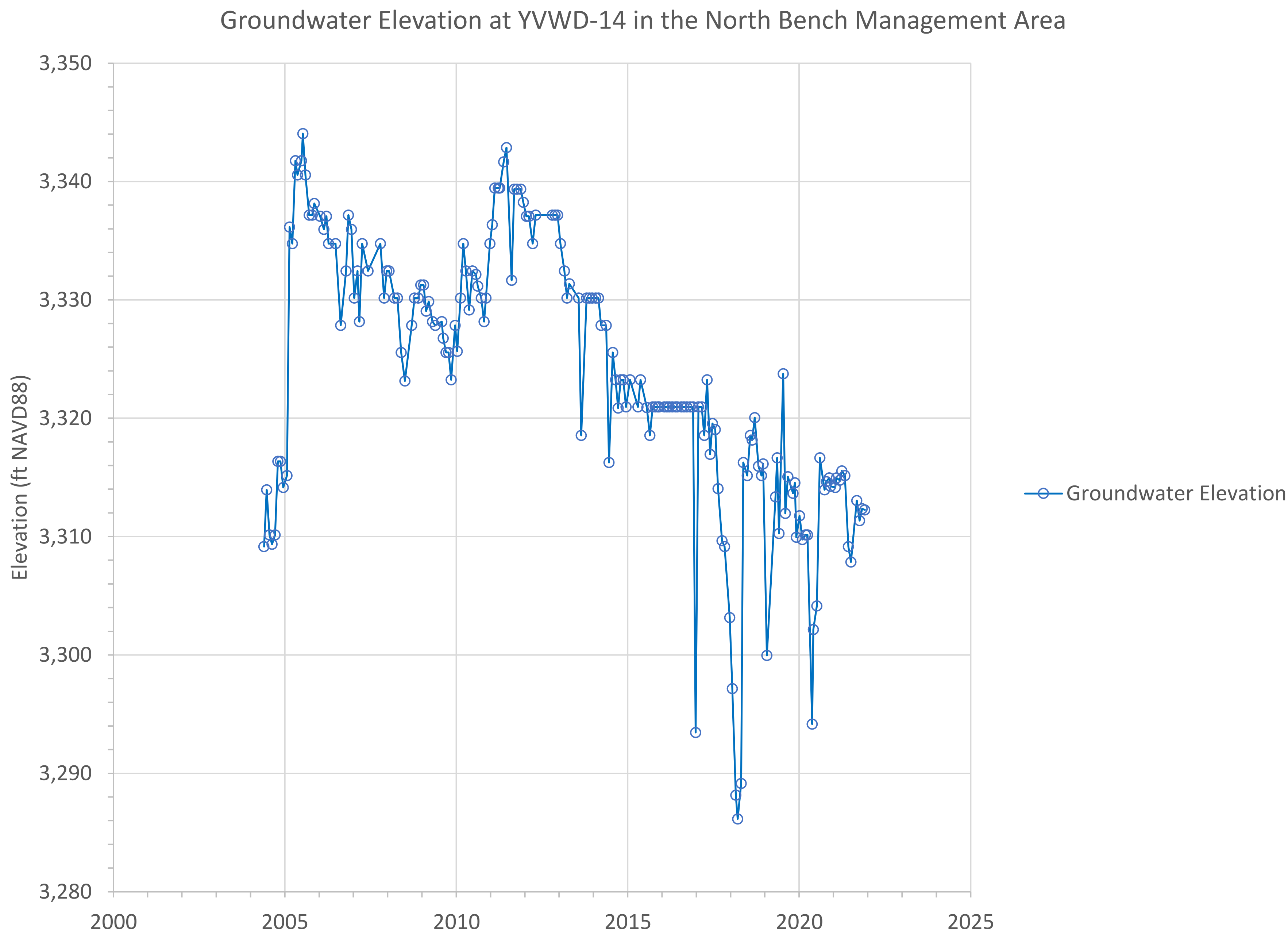
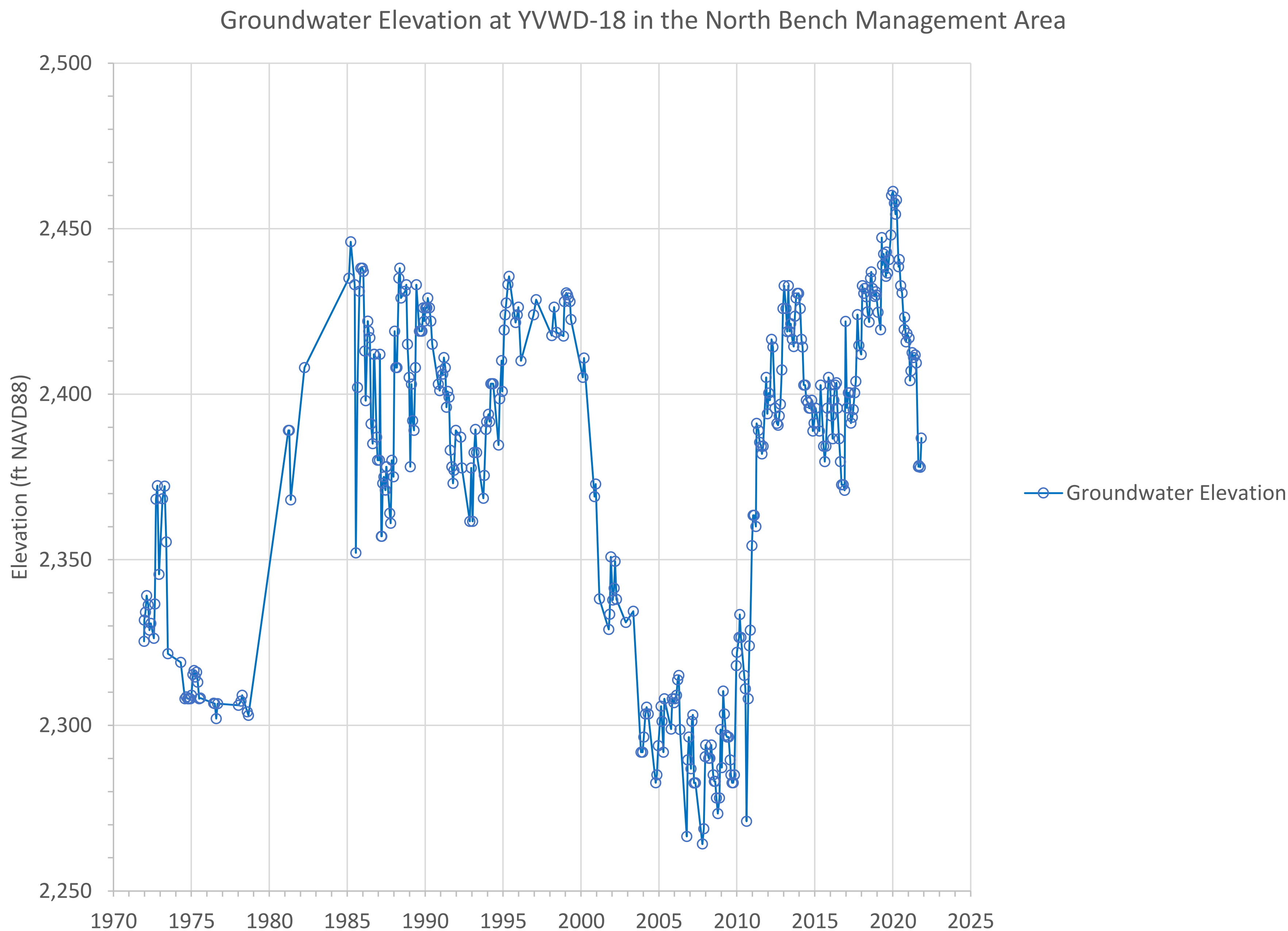

Groundwater Elevation at YVWD-14 in the North Bench Management Area
Elevation (ft NAVD88)
3,350
3,340
3,330
3,320
3,310
3,300
3,290
3,280
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-17



Groundwater Elevation at YVWD-18 in the North Bench Management Area
Elevation (ft NAVD88)
2,500
2,450
2,400
2,350
2,300
2,250
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-18

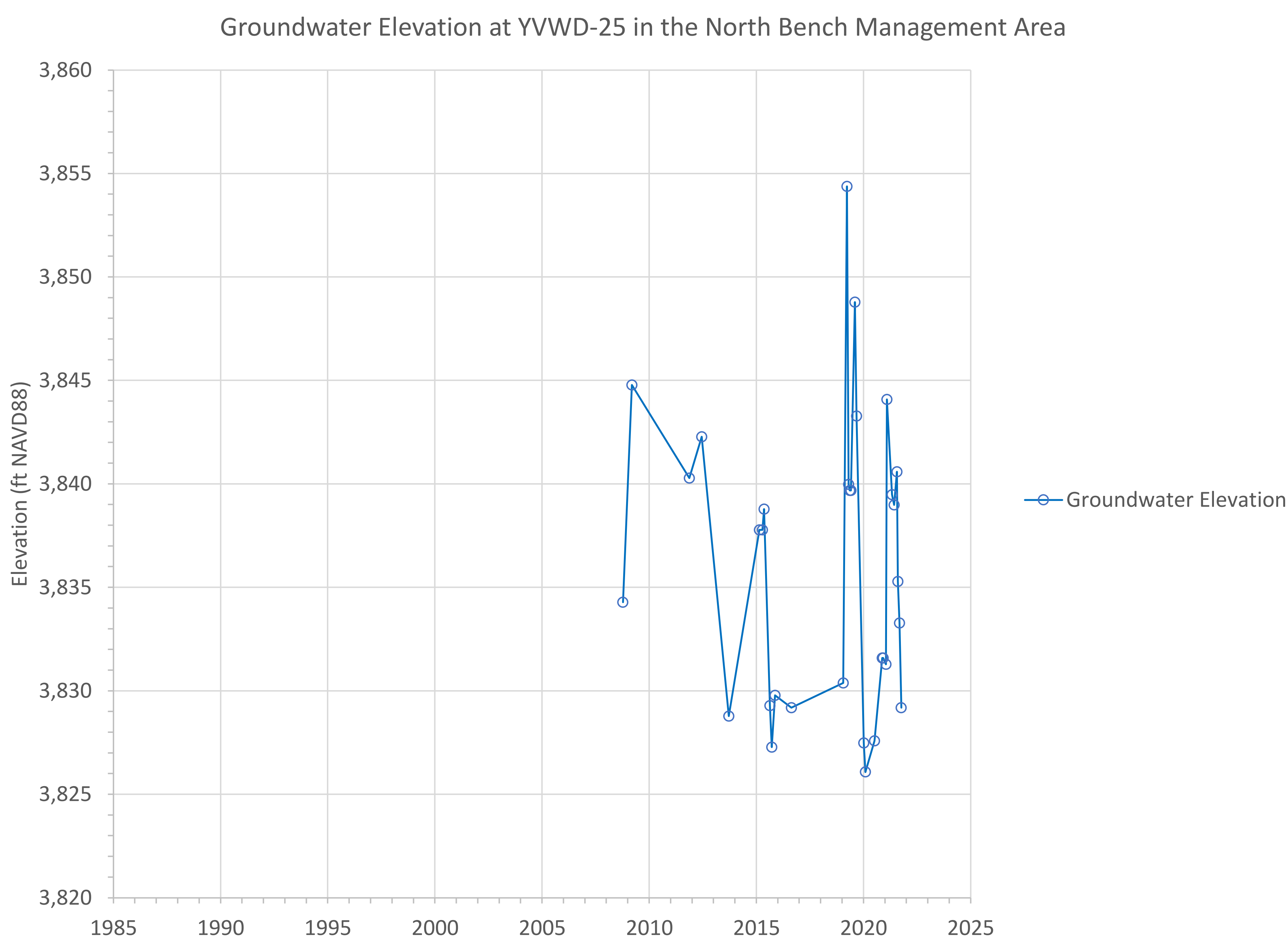

Groundwater Elevation at YVWD-25 in the North Bench Management Area
Elevation (ft NAVD88)
3,860
3,855
3,850
3,845
3,840
3,835
3,830
3,825
3,820
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-19

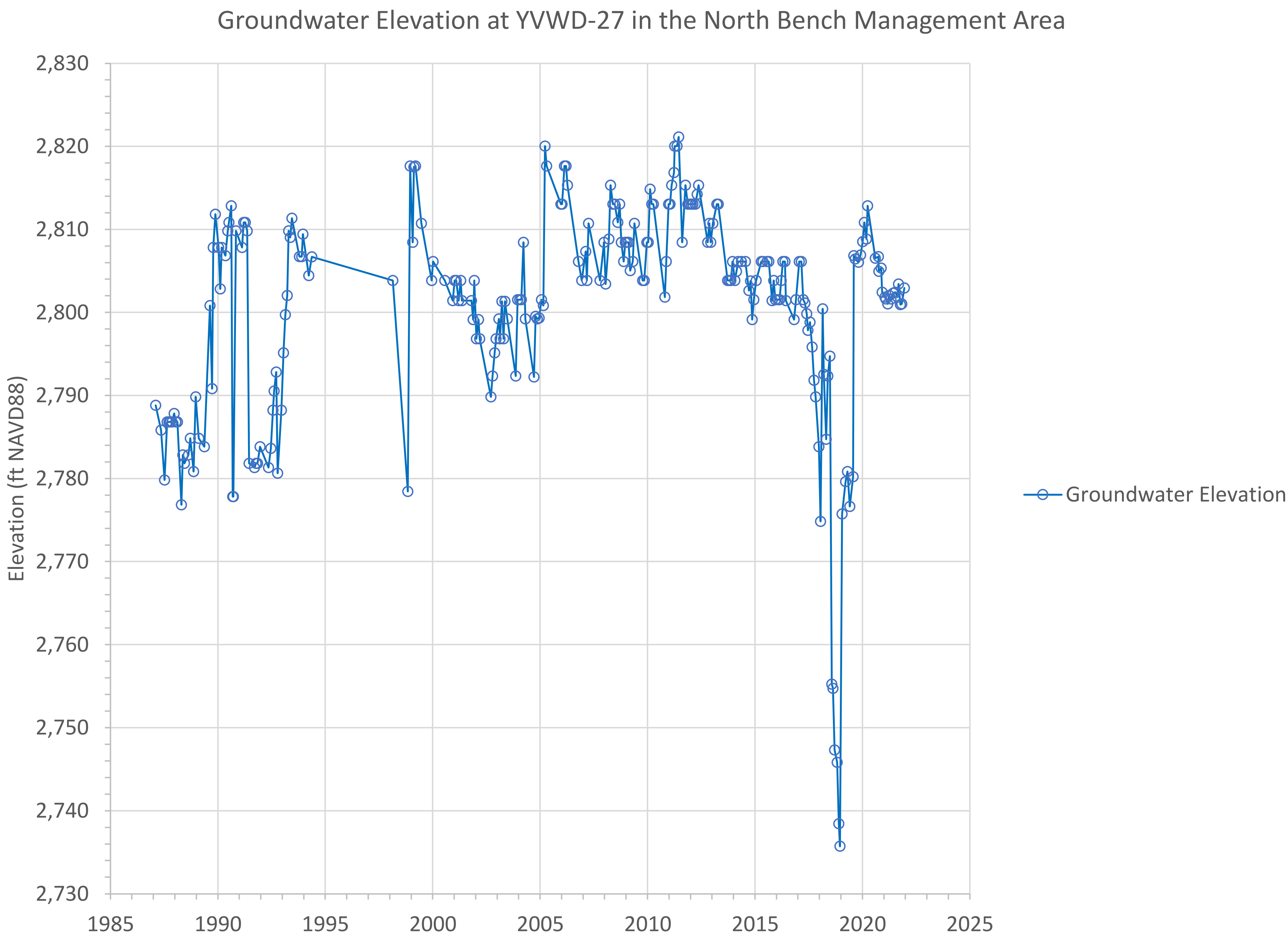
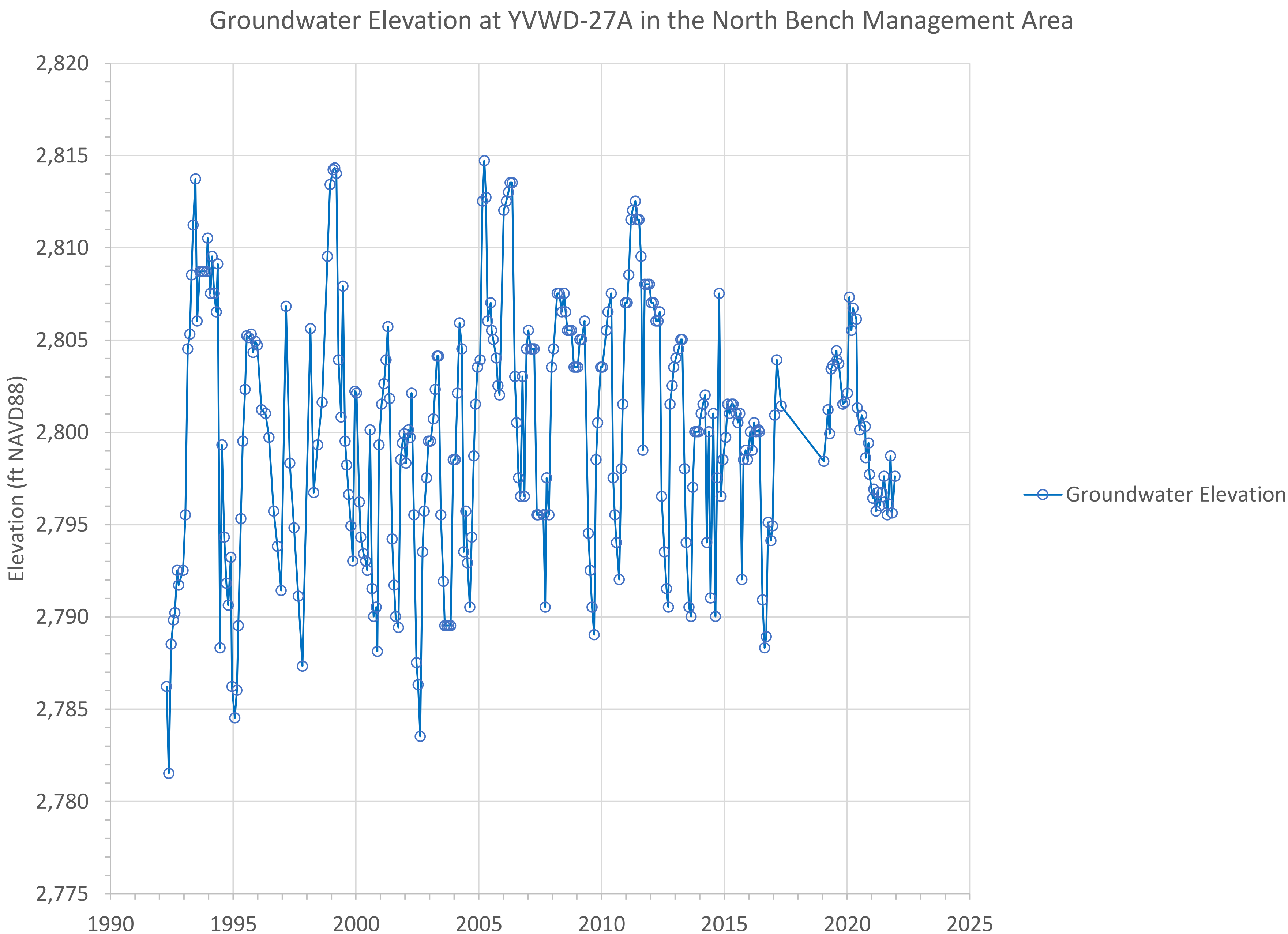

Groundwater Elevation at YVWD-27 in the North Bench Management Area
Elevation (ft NAVD88)
2,830
2,820
2,810
2,800
2,790
2,780
2,770
2,760
2,750
2,740
2,730
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-20



Groundwater Elevation at YVWD-27A in the North Bench Management Area
Elevation (ft NAVD88)
2,820
2,815
2,810
2,805
2,800
2,795
2,790
2,785
2,780
2,775
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-21

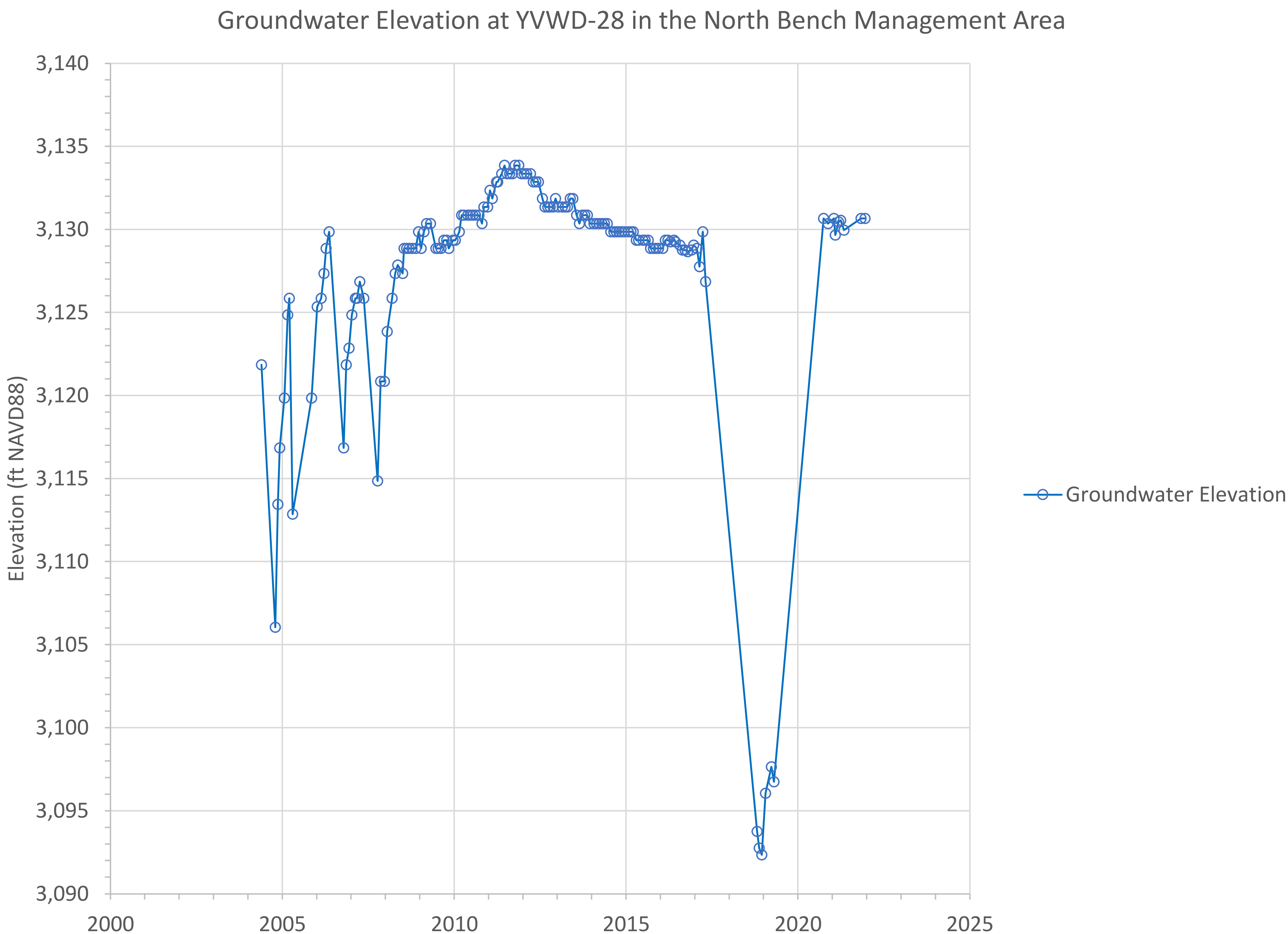

Groundwater Elevation at YVWD-28 in the North Bench Management Area
3,140
3,135
3,130
3,125
3,120
3,115
3,110
3,105
3,100
3,095
3,090
Elevation (ft NAVD88)
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-22

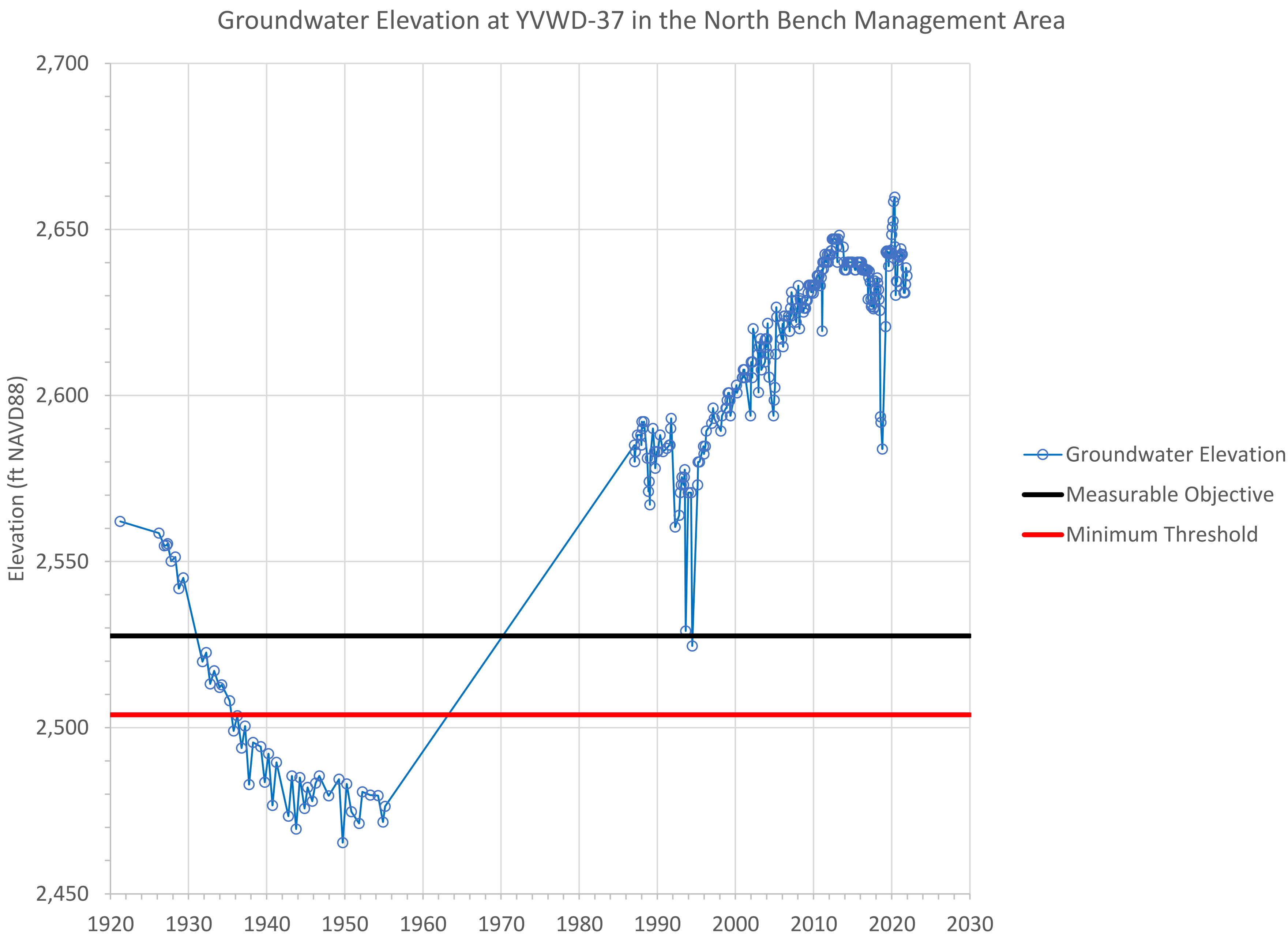
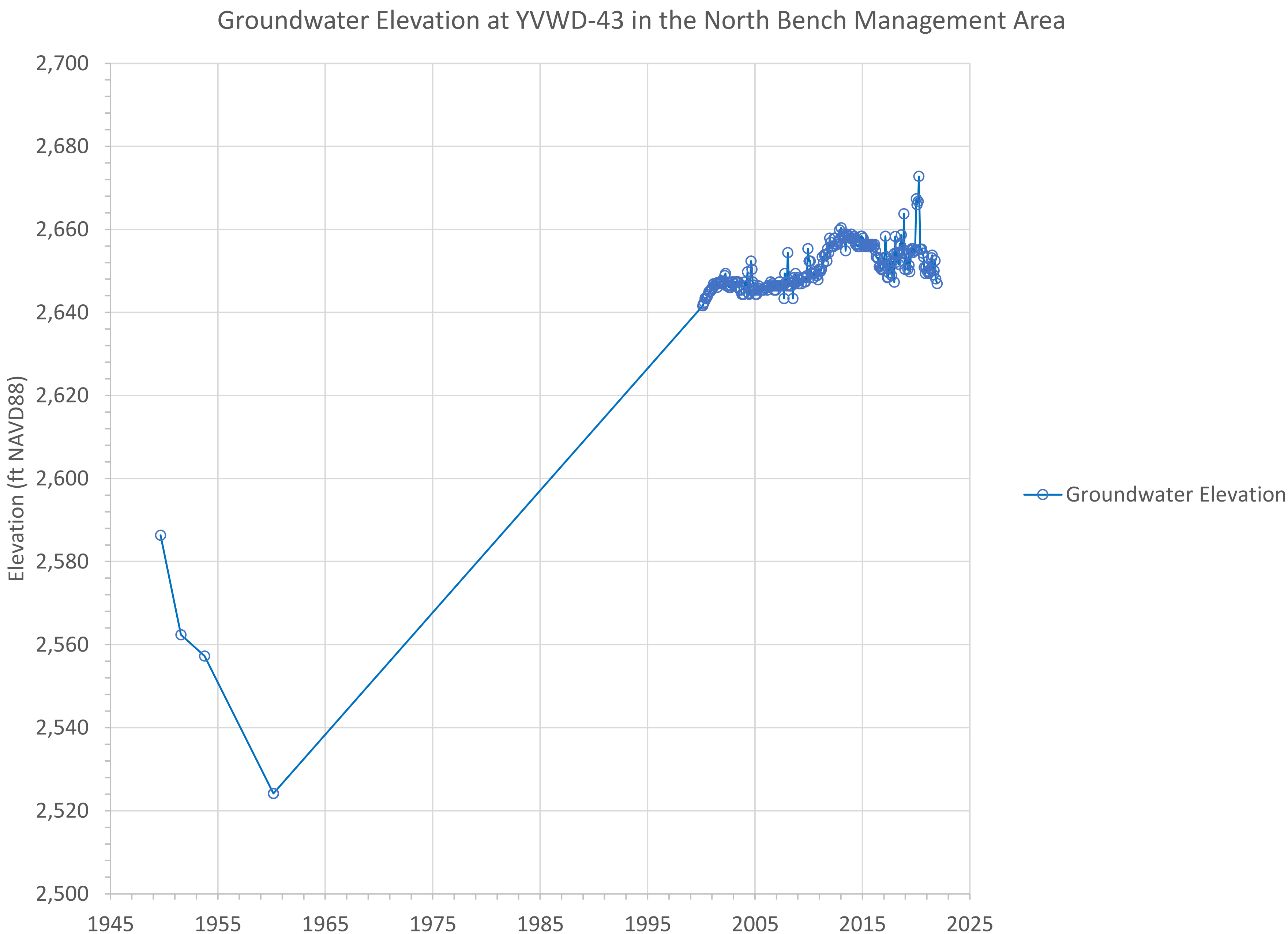

Groundwater Elevation at YVWD-37 in the North Bench Management Area
Elevation (ft NAVD88)
2,700
2,650
2,600
2,550
2,500
2,450
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
Groundwater Elevation
Measurable Objective
Minimum Threshold

Figure A-23



Groundwater Elevation at YVWD-43 in the North Bench Management Area
Elevation (ft NAVD88)
2,700
2,680
2,660
2,640
2,620
2,600
2,580
2,560
2,540
2,520
2,500
1945
1955
1965
1975
1985
1995
2005
2015
2025
Groundwater Elevation

Figure A-24

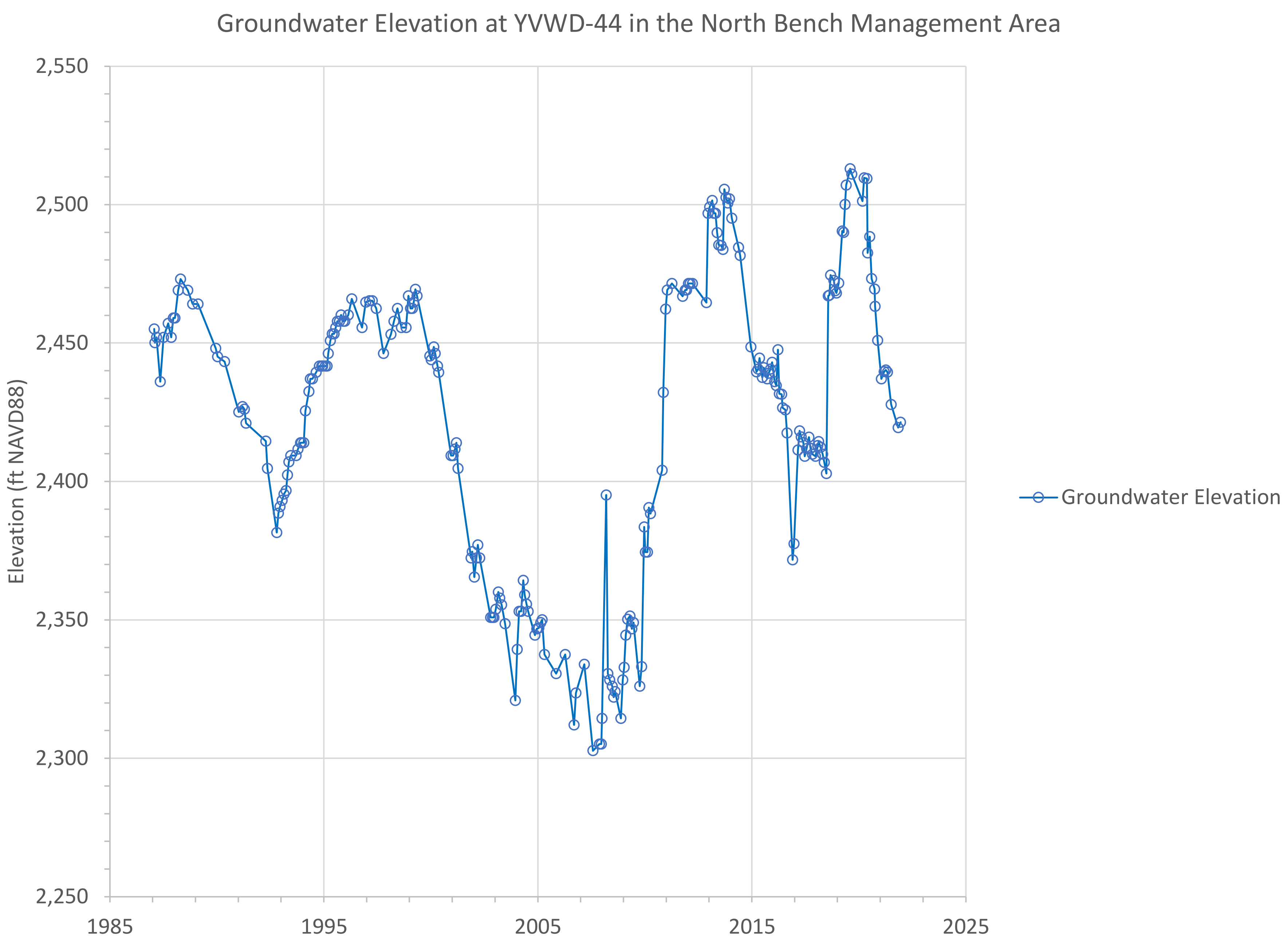

Groundwater Elevation at YVWD-44 in the North Bench Management Area
Elevation (ft NAVD88)
2,550
2,500
2,450
2,400
2,350
2,300
2,250
1985
1995
2005
2015
2025
Groundwater Elevation

Figure A-25

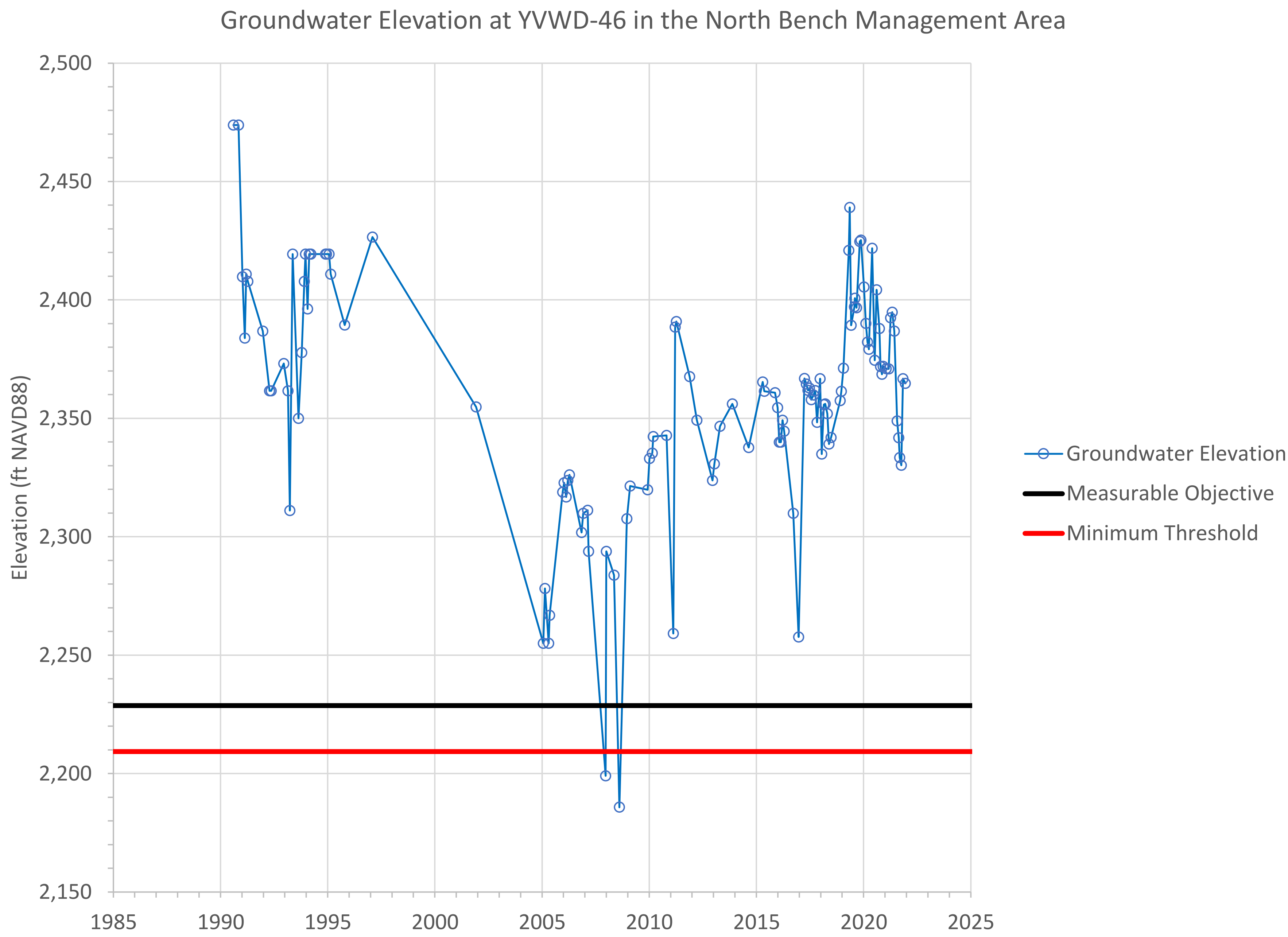

Groundwater Elevation at YVWD-46 in the North Bench Management Area
Elevation (ft NAVD88)
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective
Minimum Threshold

Figure A-26

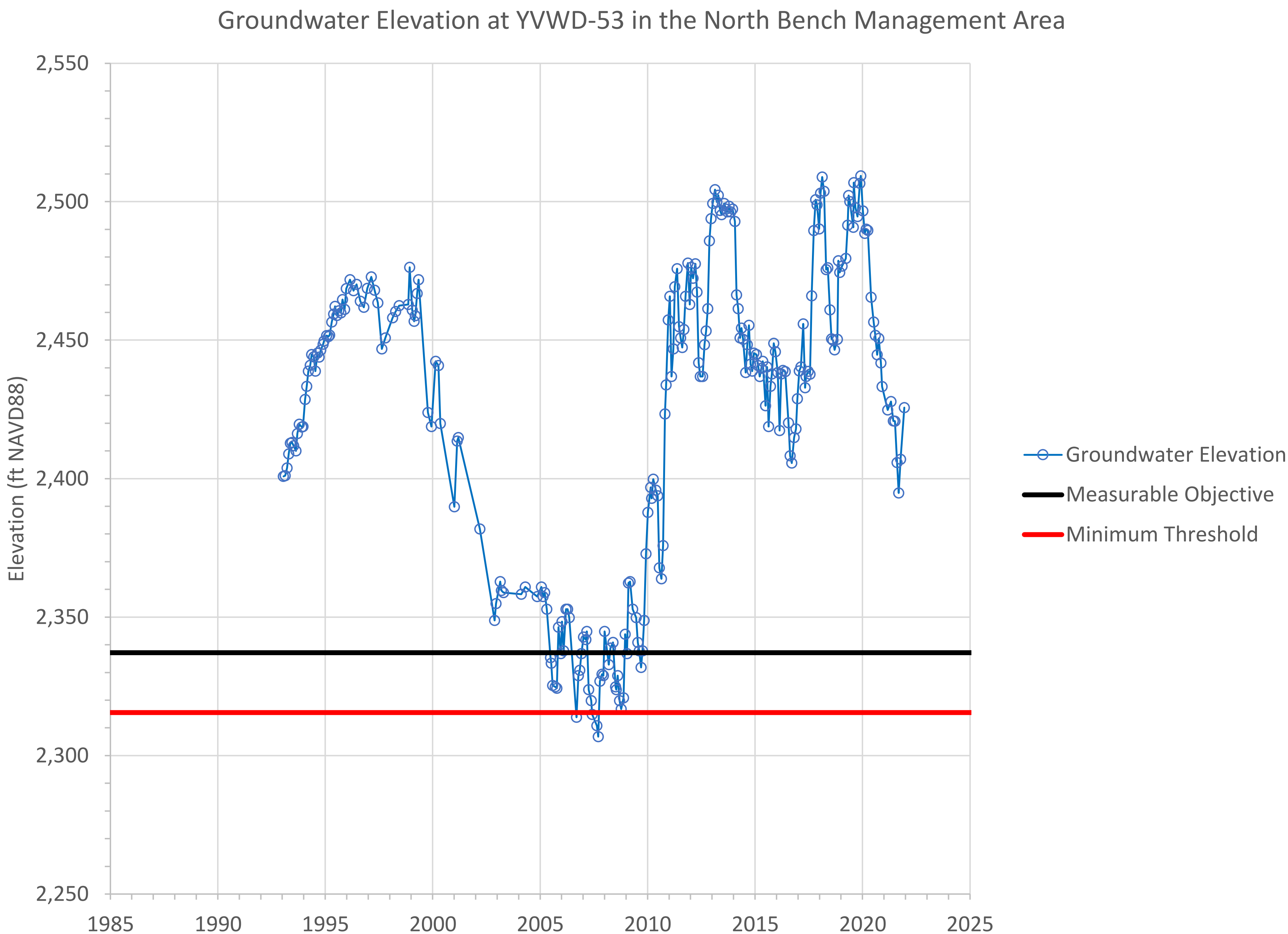
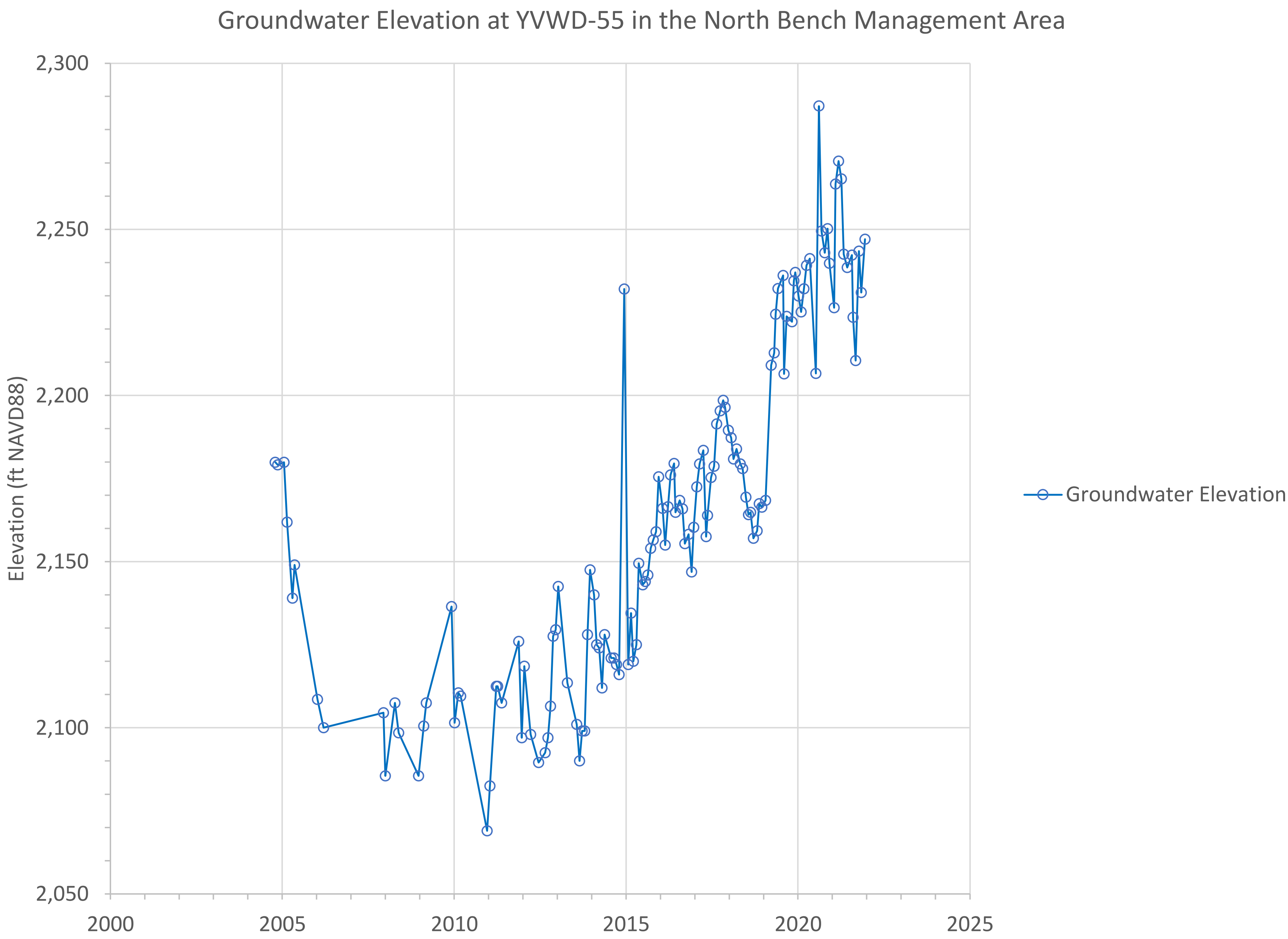

Groundwater Elevation at YVWD-53 in the North Bench Management Area
Elevation (ft NAVD88)
2,550
2,500
2,450
2,400
2,350
2,300
2,250
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective
Minimum Threshold

Figure A-27



Groundwater Elevation at YVWD-55 in the North Bench Management Area
Elevation (ft NAVD88)
2,300
2,250
2,200
2,150
2,100
2,050
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-28

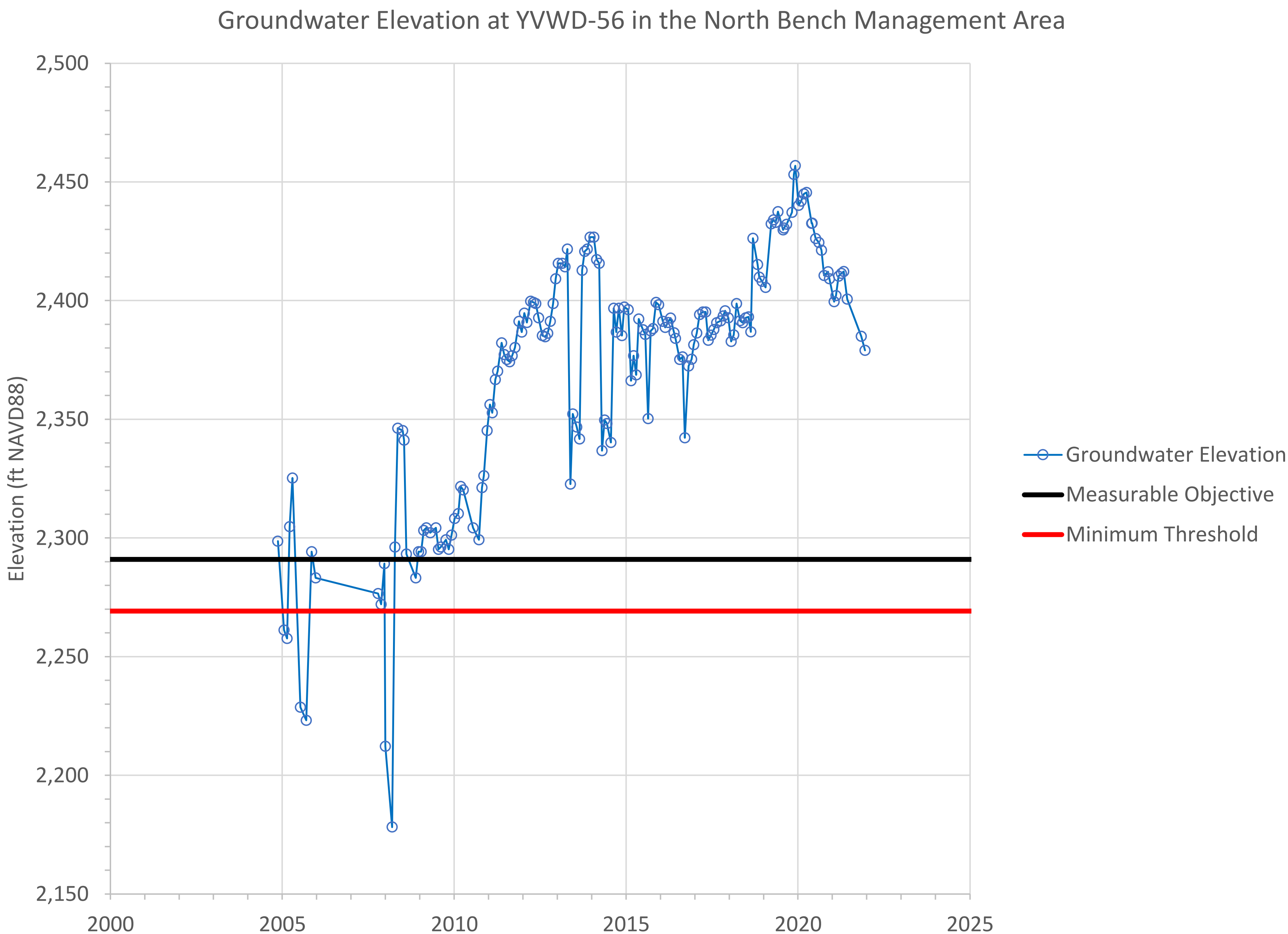

Groundwater Elevation at YVWD-56 in the North Bench Management Area
Elevation (ft NAVD88)
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective
Minimum Threshold

Figure A-29

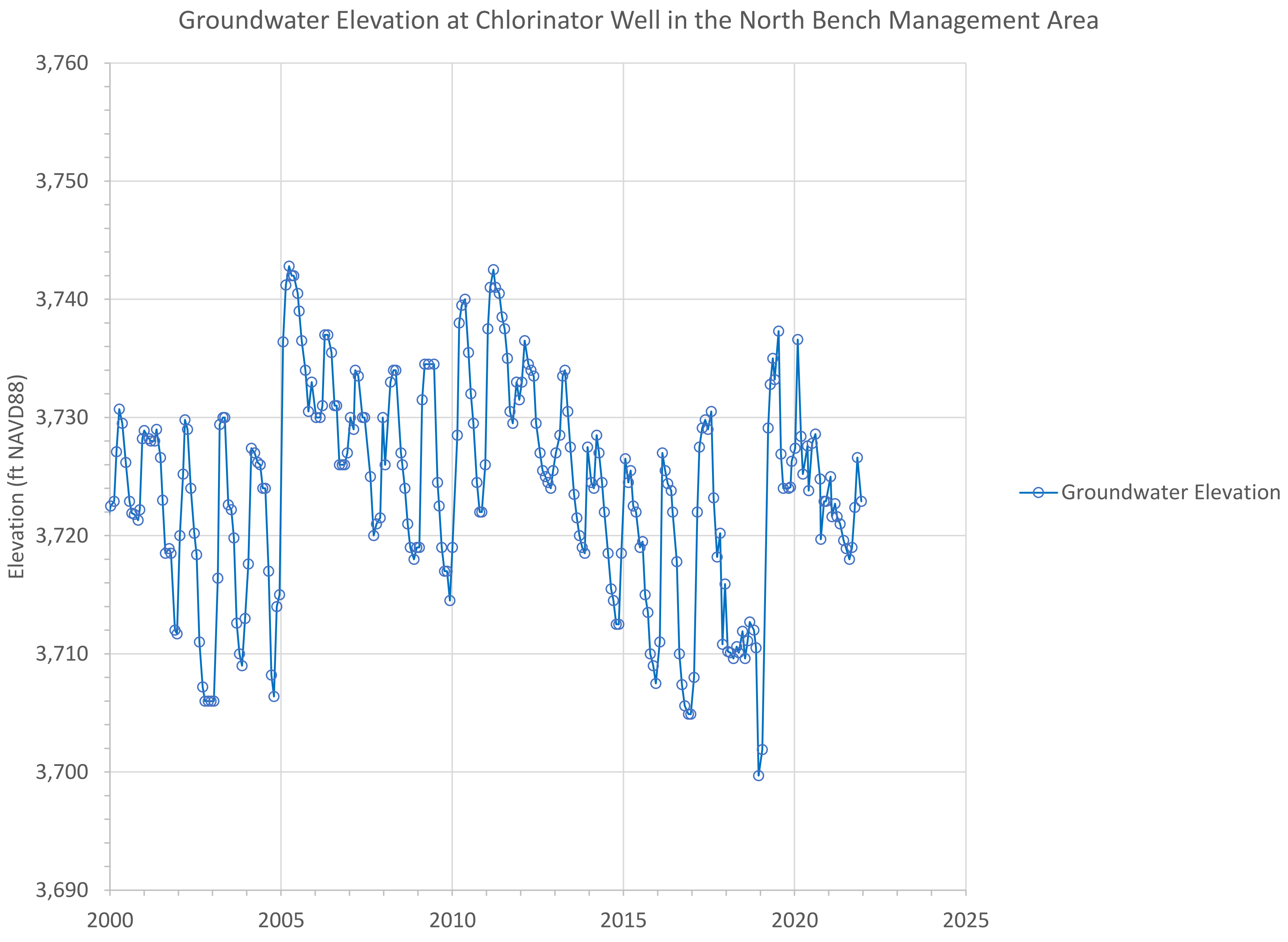
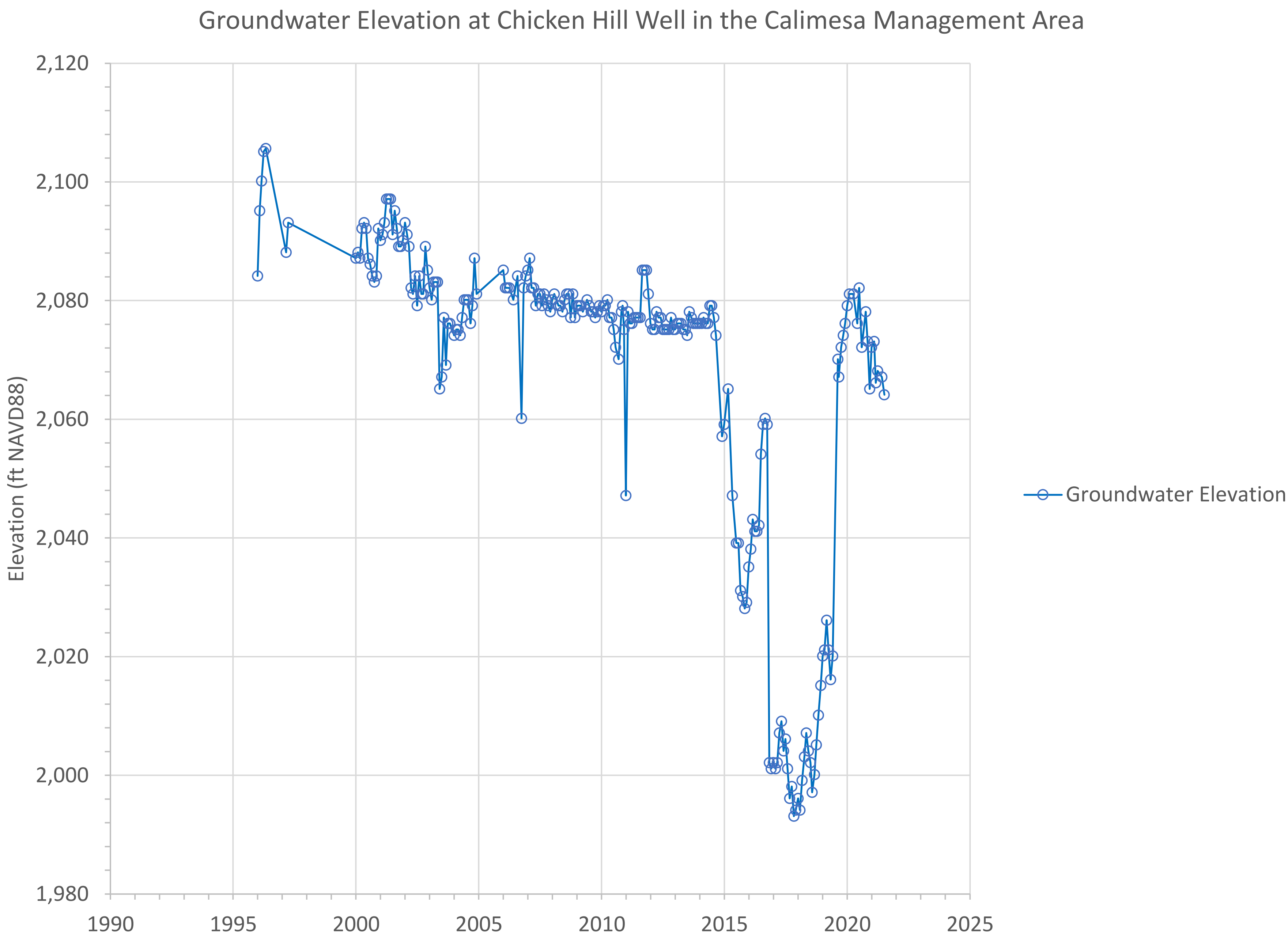
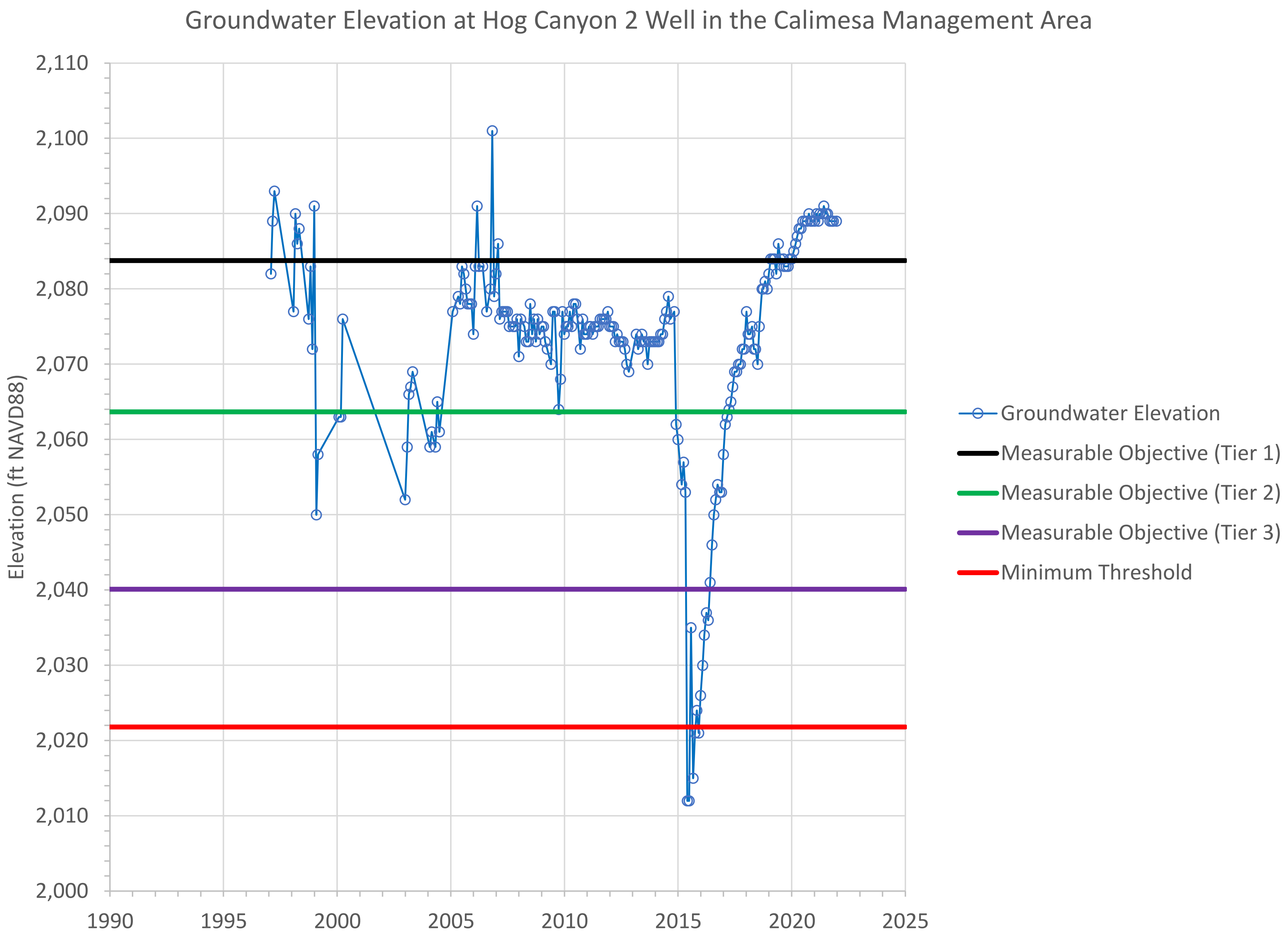

Groundwater Elevation at Chlorinator Well in the North Bench Management Area
Elevation (ft NAVD88)
3,760
3,750
3,740
3,730
3,720
3,710
3,700
3,690
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-30



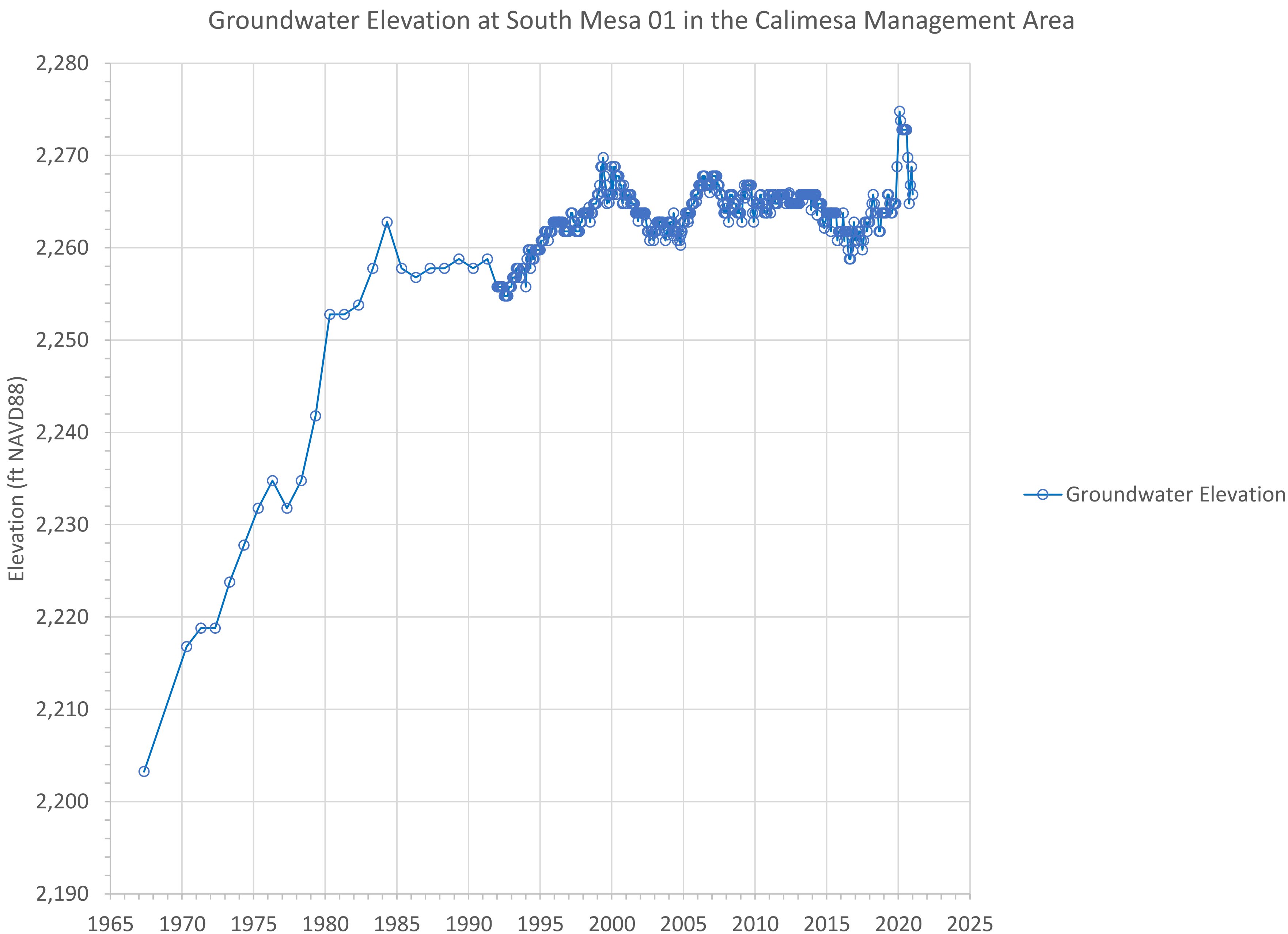
Groundwater Elevation at Chicken Hill Well in the Calimesa Management Area
Elevation (ft NAVD88)
2,120
2,100
2,080
2,060
2,040
2,020
2,000
1,980
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-31



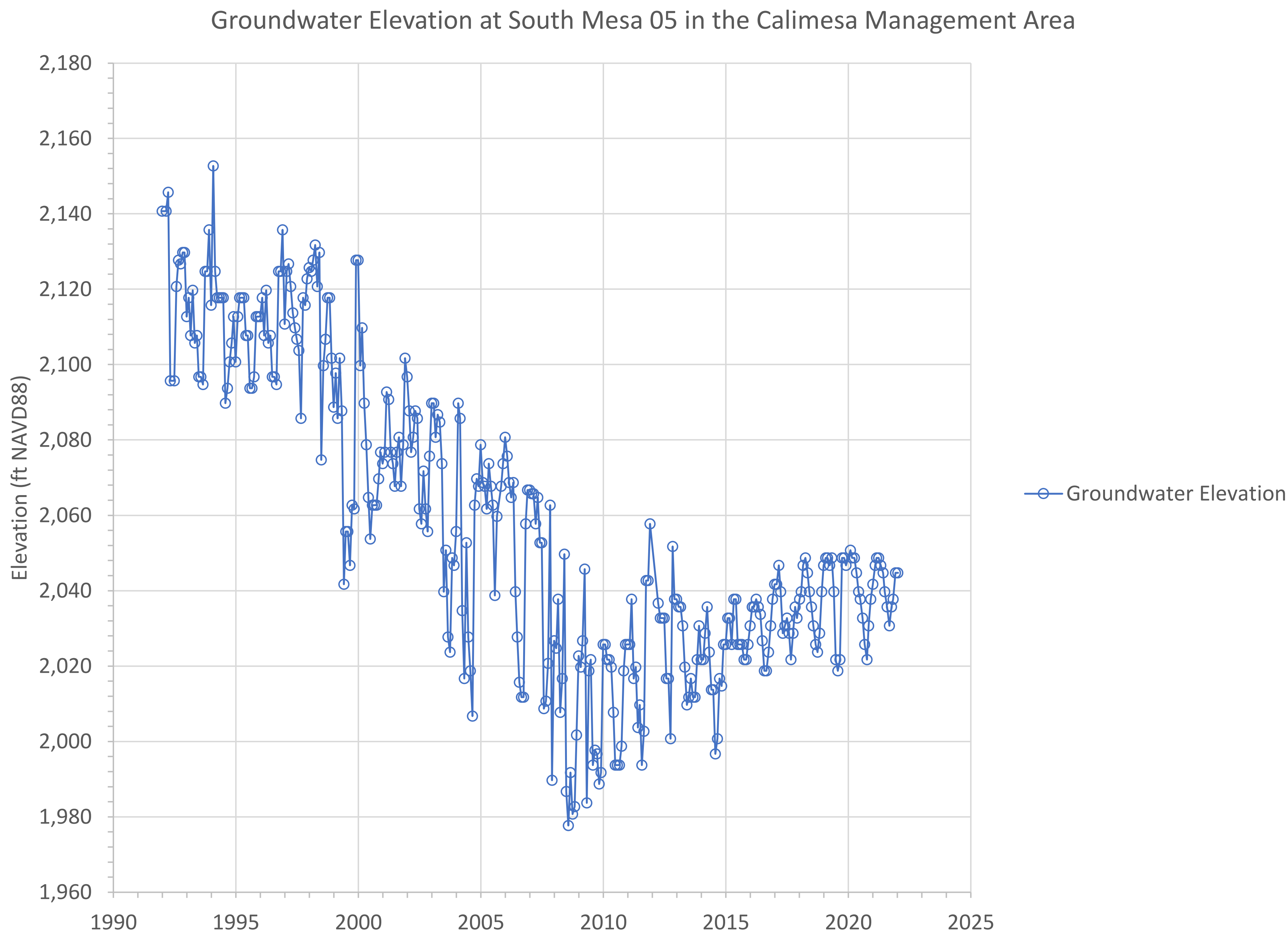
Groundwater Elevation at Hog Canyon 2 Well in the Calimesa Management Area
Elevation (ft NAVD88)
2,110
2,100
2,090
2,080
2,070
2,060
2,050
2,040
2,030
2,020
2,010
2,000
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-32



Groundwater Elevation at South Mesa 01 in the Calimesa Management Area
Elevation (ft NAVD88)
2,280
2,270
2,260
2,250
2,240
2,230
2,220
2,210
2,200
2,190
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-33



Groundwater Elevation at South Mesa 05 in the Calimesa Management Area
Elevation (ft NAVD88)
2,180
2,160
2,140
2,120
2,100
2,080
2,060
2,040
2,020
2,000
1,980
1,960
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-34

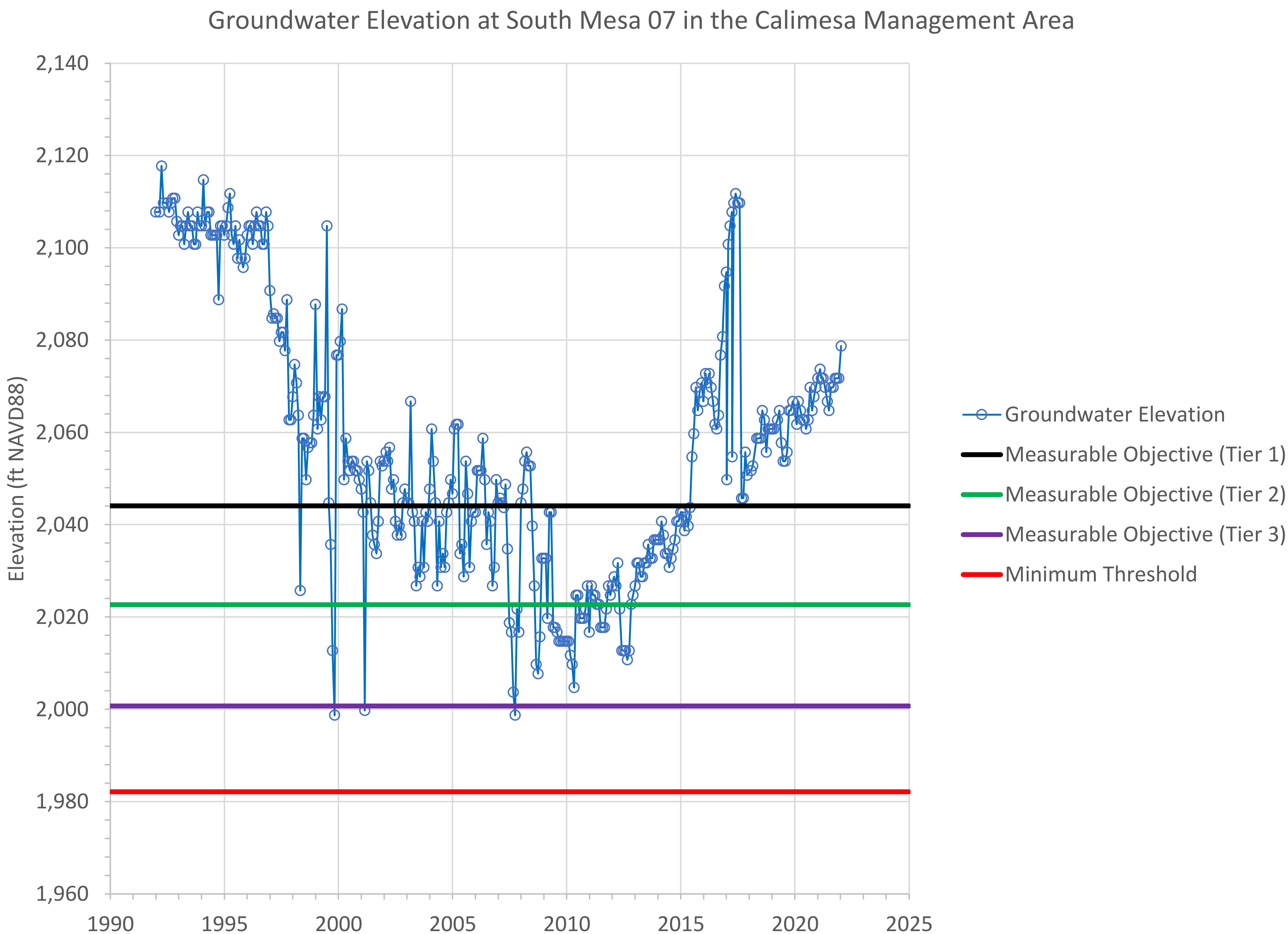

Groundwater Elevation at South Mesa 07 in the Calimesa Management Area
Elevation (ft NAVD88)
2,140
2,120
2,100
2,080
2,060
2,040
2,020
2,000
1,980
1,960
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-35

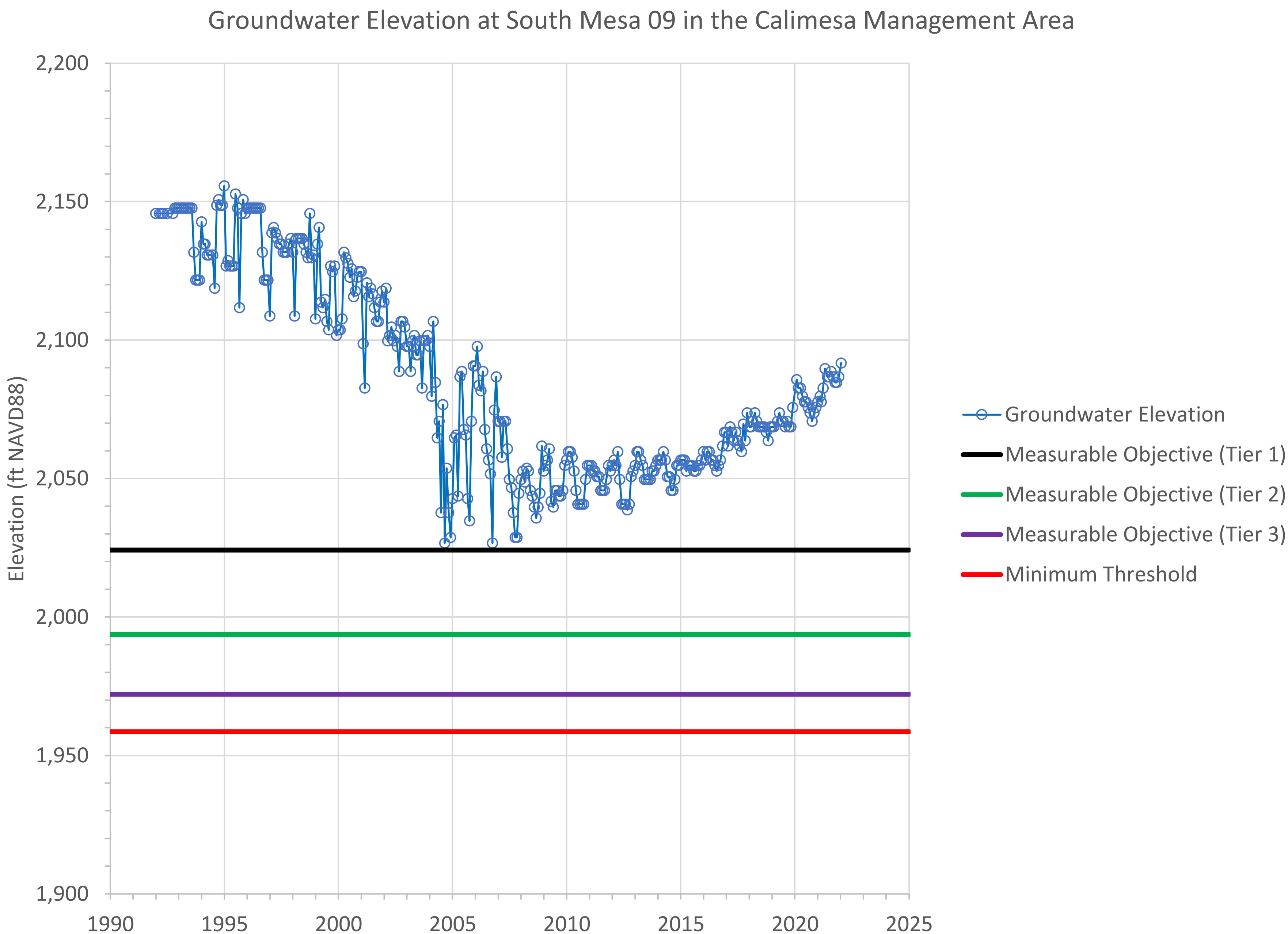
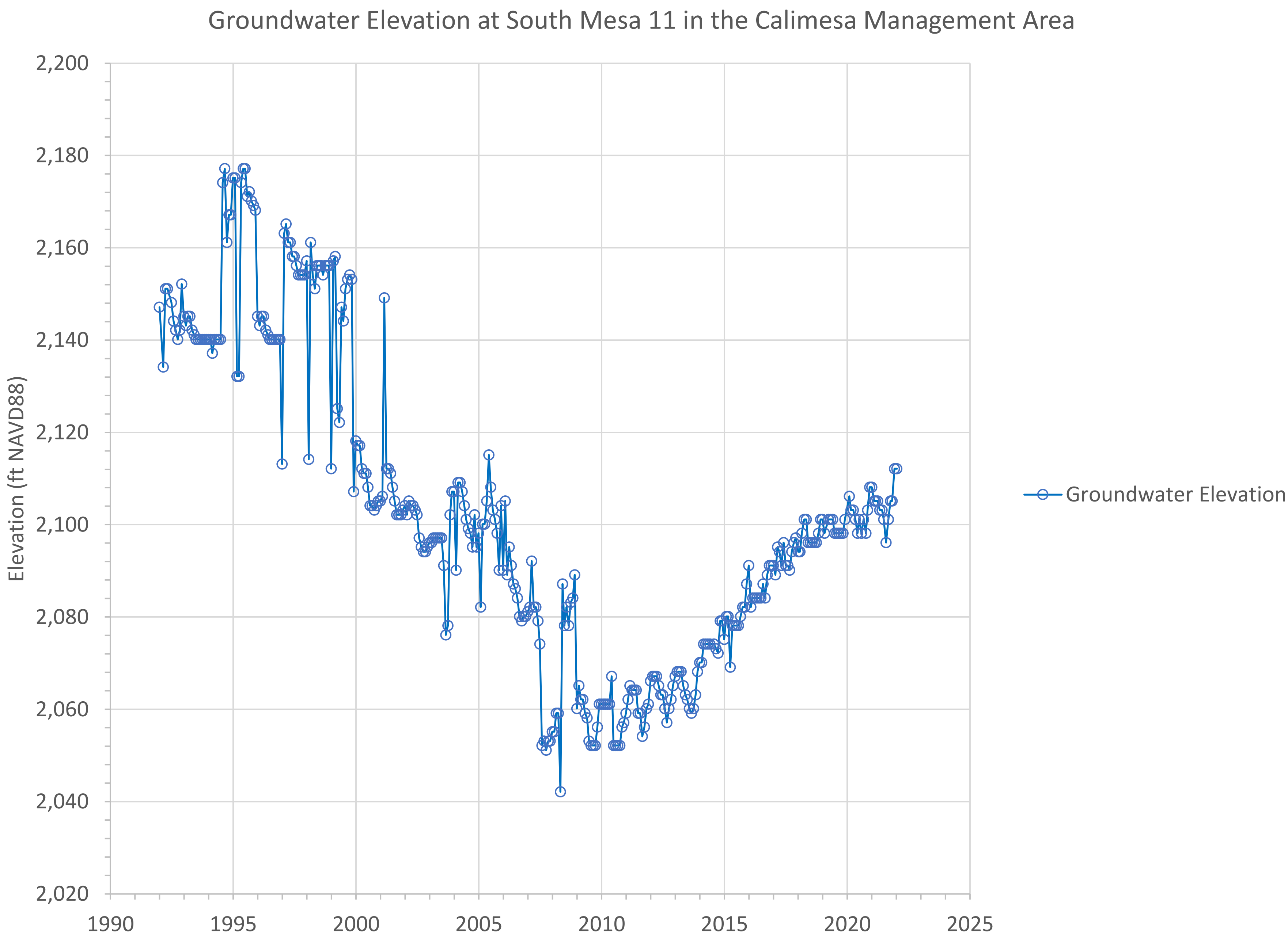
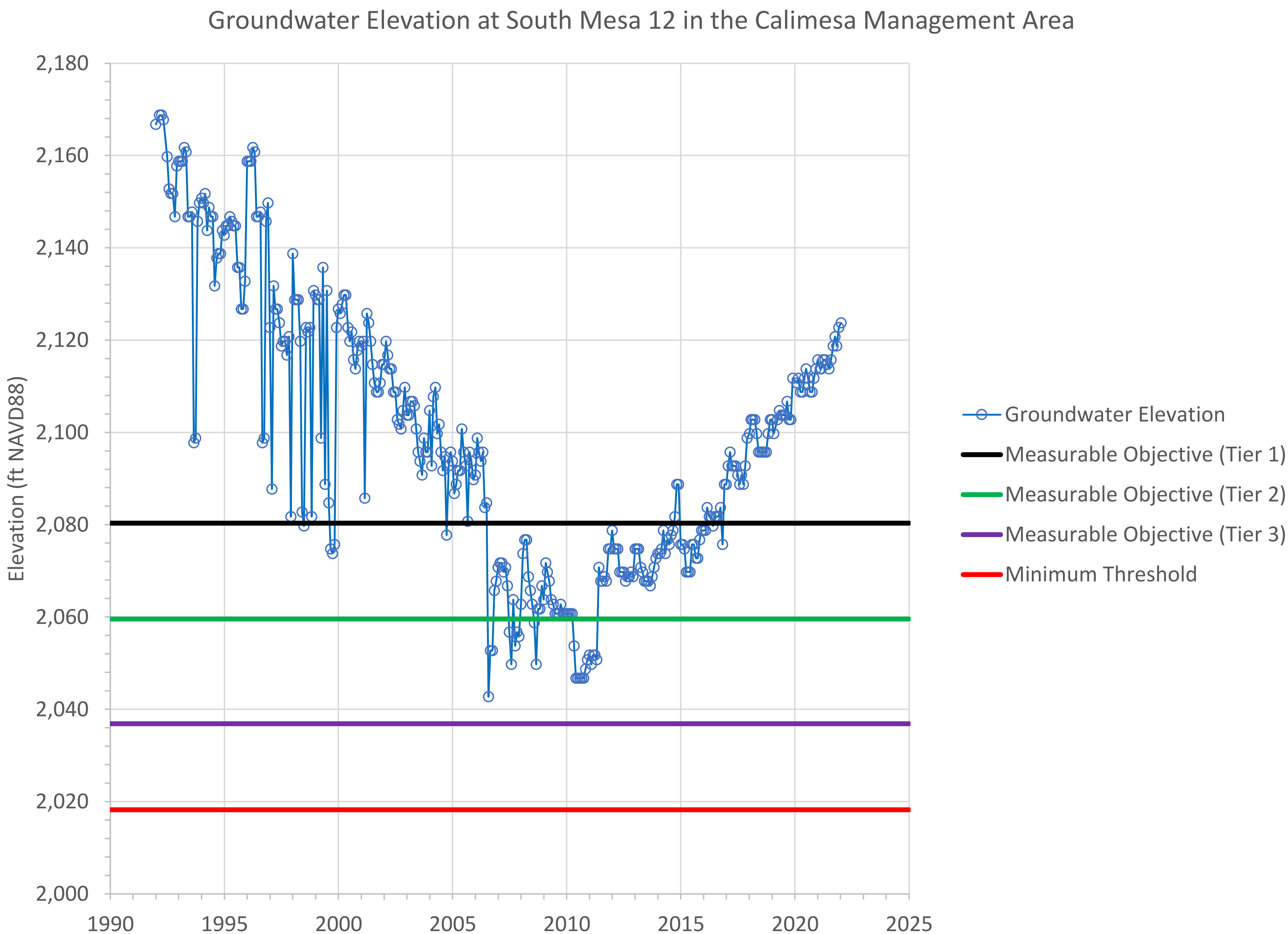

Groundwater Elevation at South Mesa 09 in the Calimesa Management Area
Elevation (ft NAVD88)
2,200
2,150
2,100
2,050
2,000
1,950
1,900
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-36



Groundwater Elevation at South Mesa 11 in the Calimesa Management Area
Elevation (ft NAVD88)
2,200
2,180
2,160
2,140
2,120
2,100
2,080
2,060
2,040
2,020
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-37



Groundwater Elevation at South Mesa 12 in the Calimesa Management Area
Elevation (ft NAVD88)
2,180
2,160
2,140
2,120
2,100
2,080
2,060
2,040
2,020
2,000
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-38

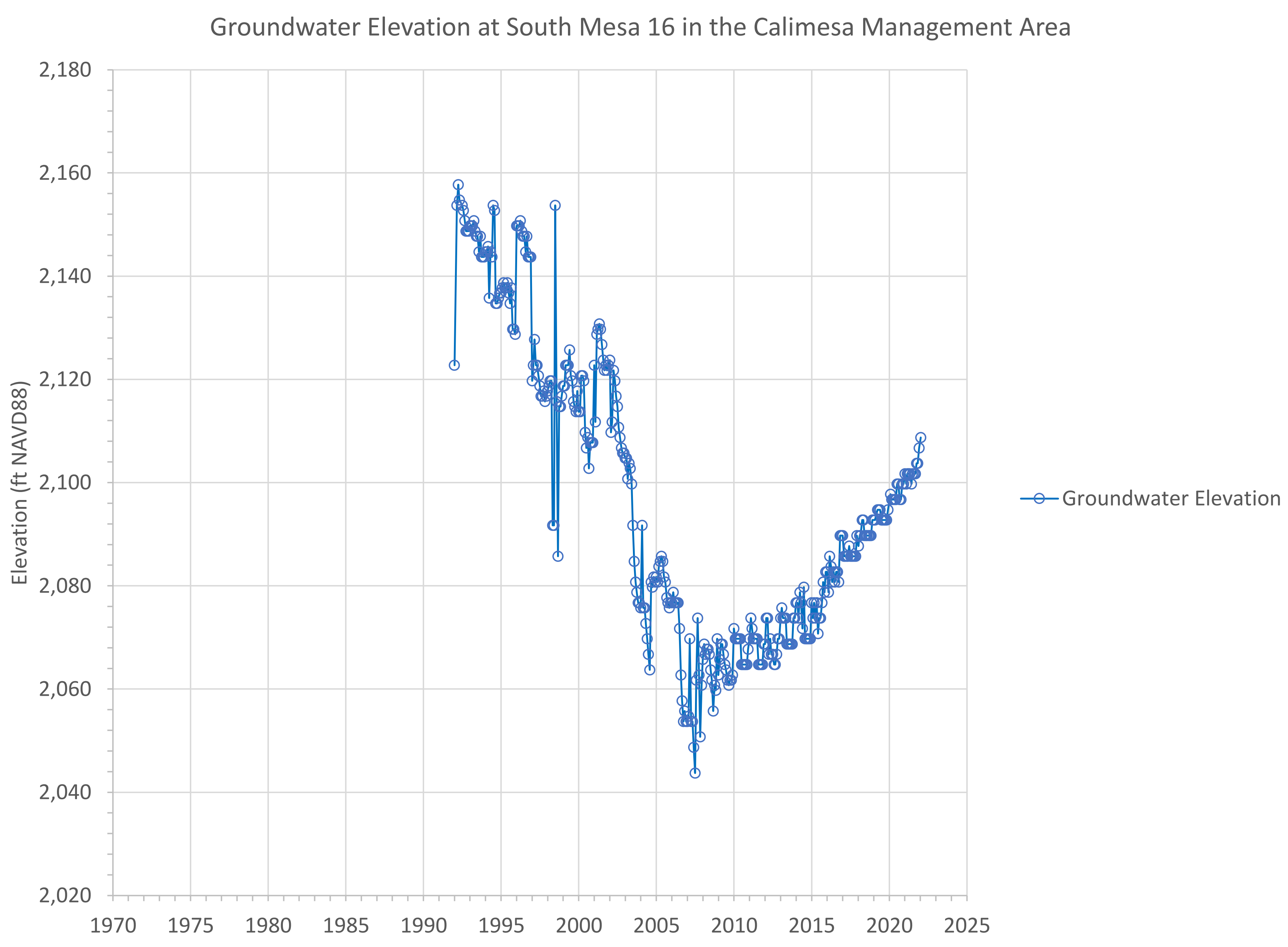

Groundwater Elevation at South Mesa 16 in the Calimesa Management Area
Elevation (ft NAVD88)
2,180
2,160
2,140
2,120
2,100
2,080
2,060
2,040
2,020
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-39

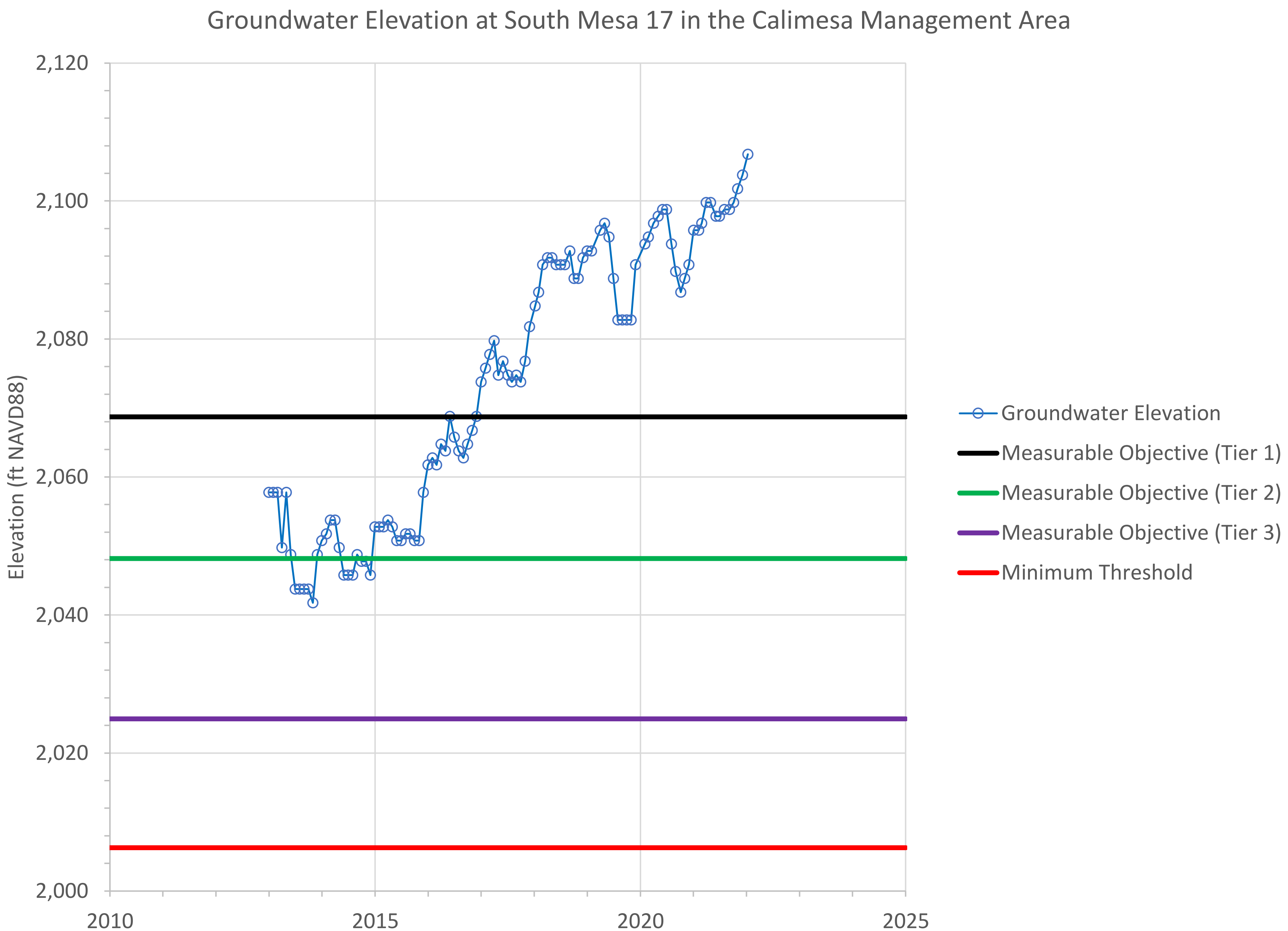

Groundwater Elevation at South Mesa 17 in the Calimesa Management Area
Elevation (ft NAVD88)
2,120
2,100
2,080
2,060
2,040
2,020
2,000
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-40

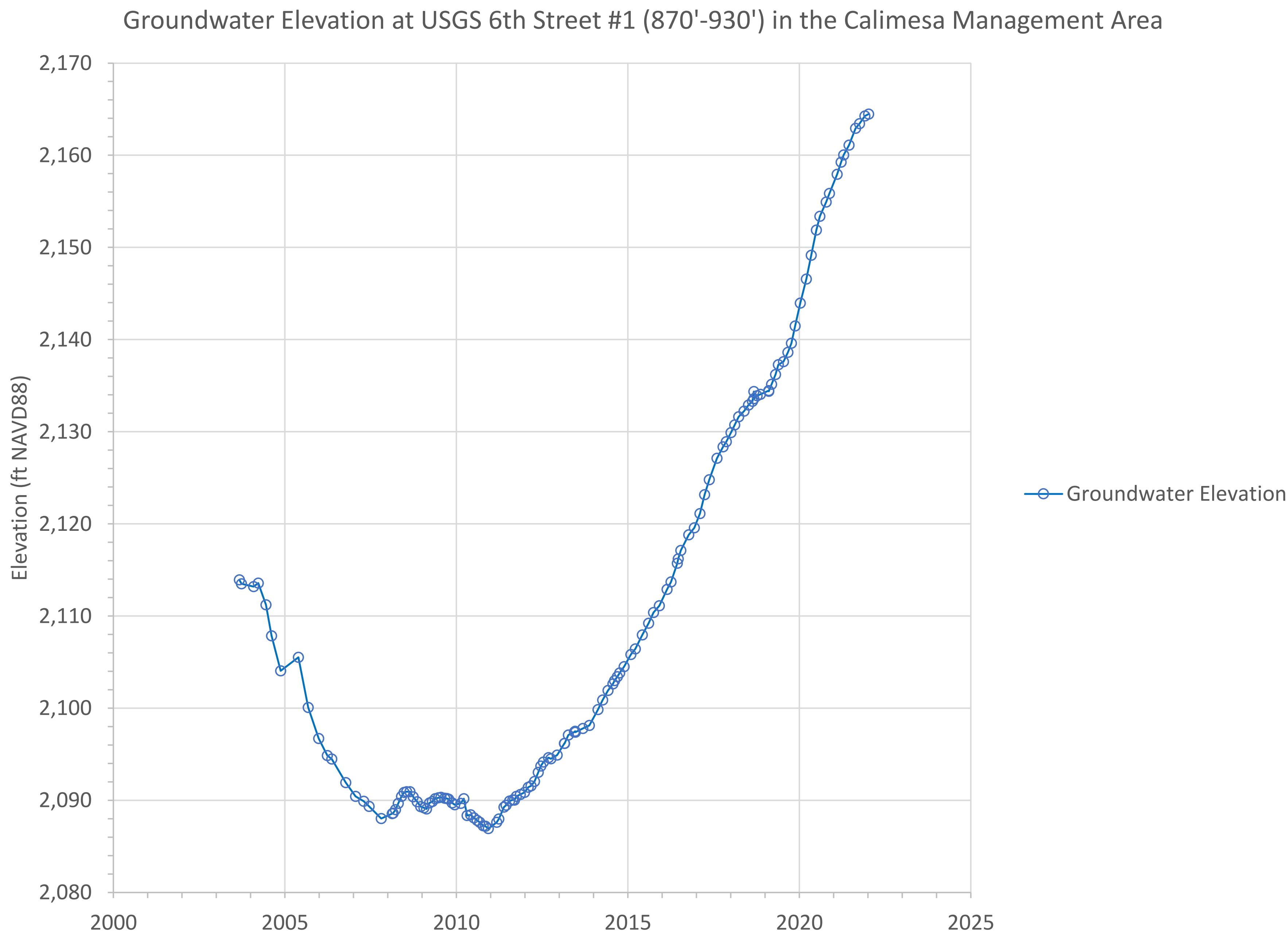
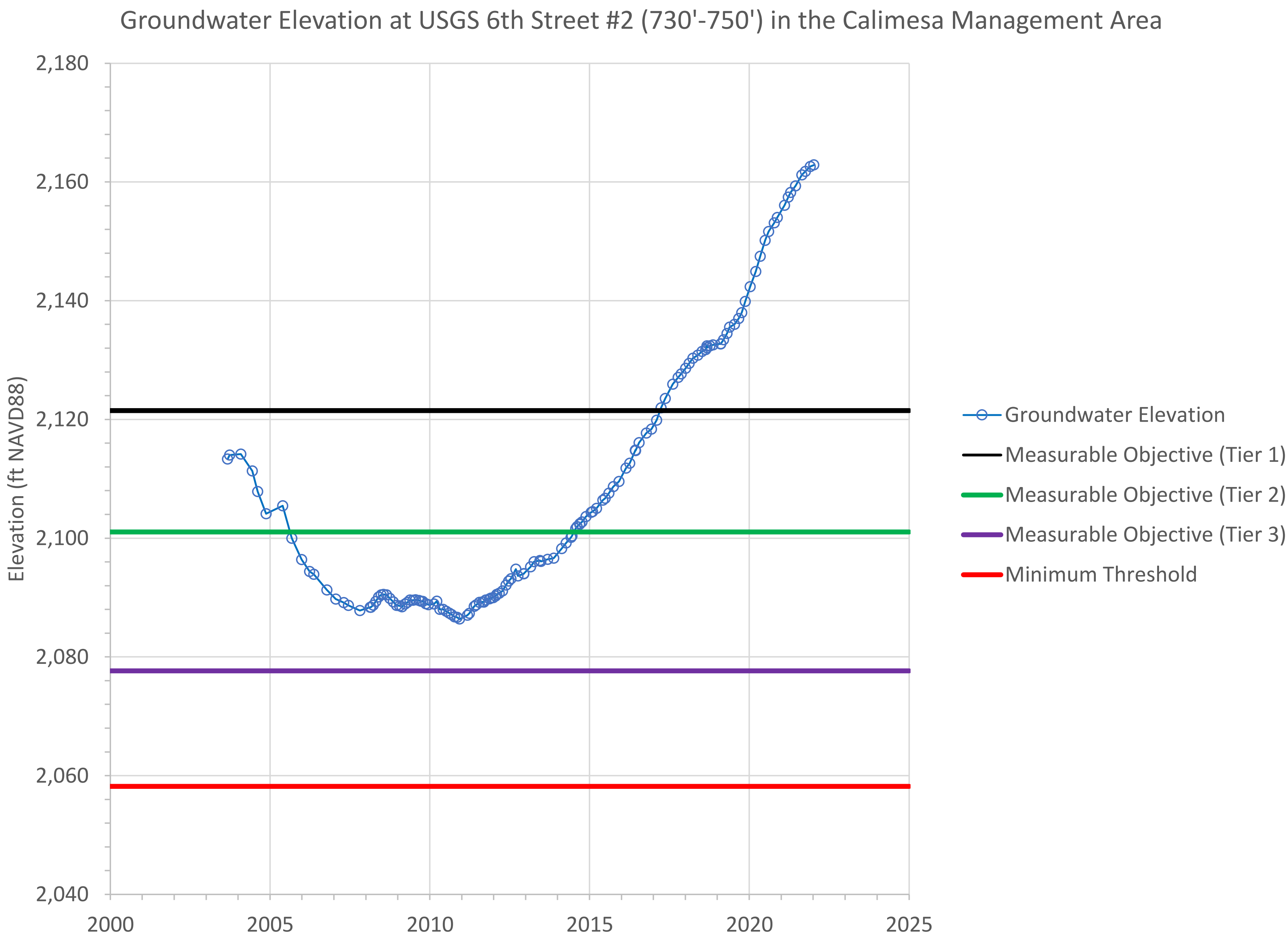

Groundwater Elevation at USGS 6th Street #1 (870'-930') in the Calimesa Management Area
Elevation (ft NAVD88)
2,170
2,160
2,150
2,140
2,130
2,120
2,110
2,100
2,090
2,080
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-41



Groundwater Elevation at USGS 6th Street #2 (730'-750') in the Calimesa Management Area
Elevation (ft NAVD88)
2,180
2,160
2,140
2,120
2,100
2,080
2,060
2,040
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-42

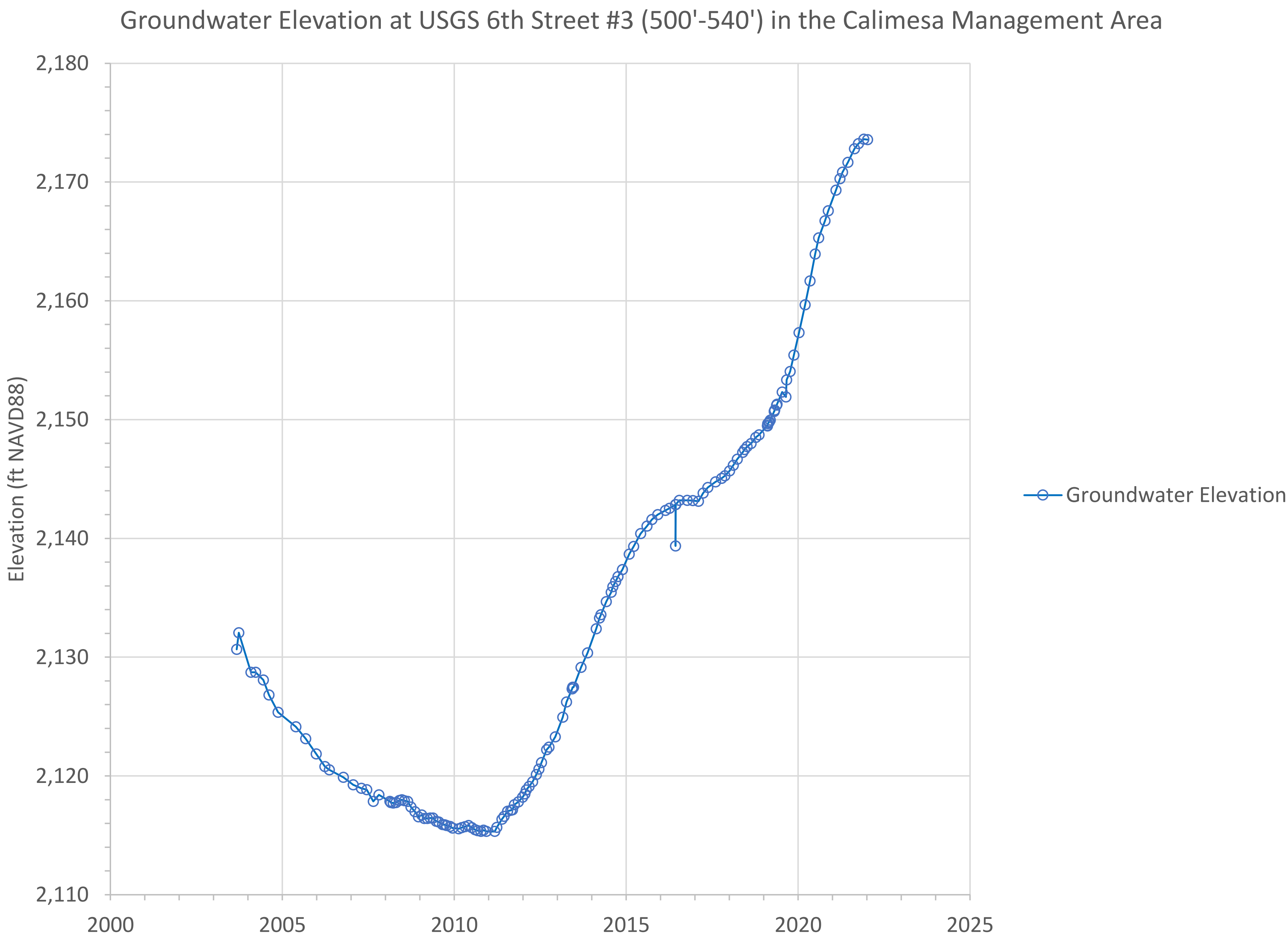
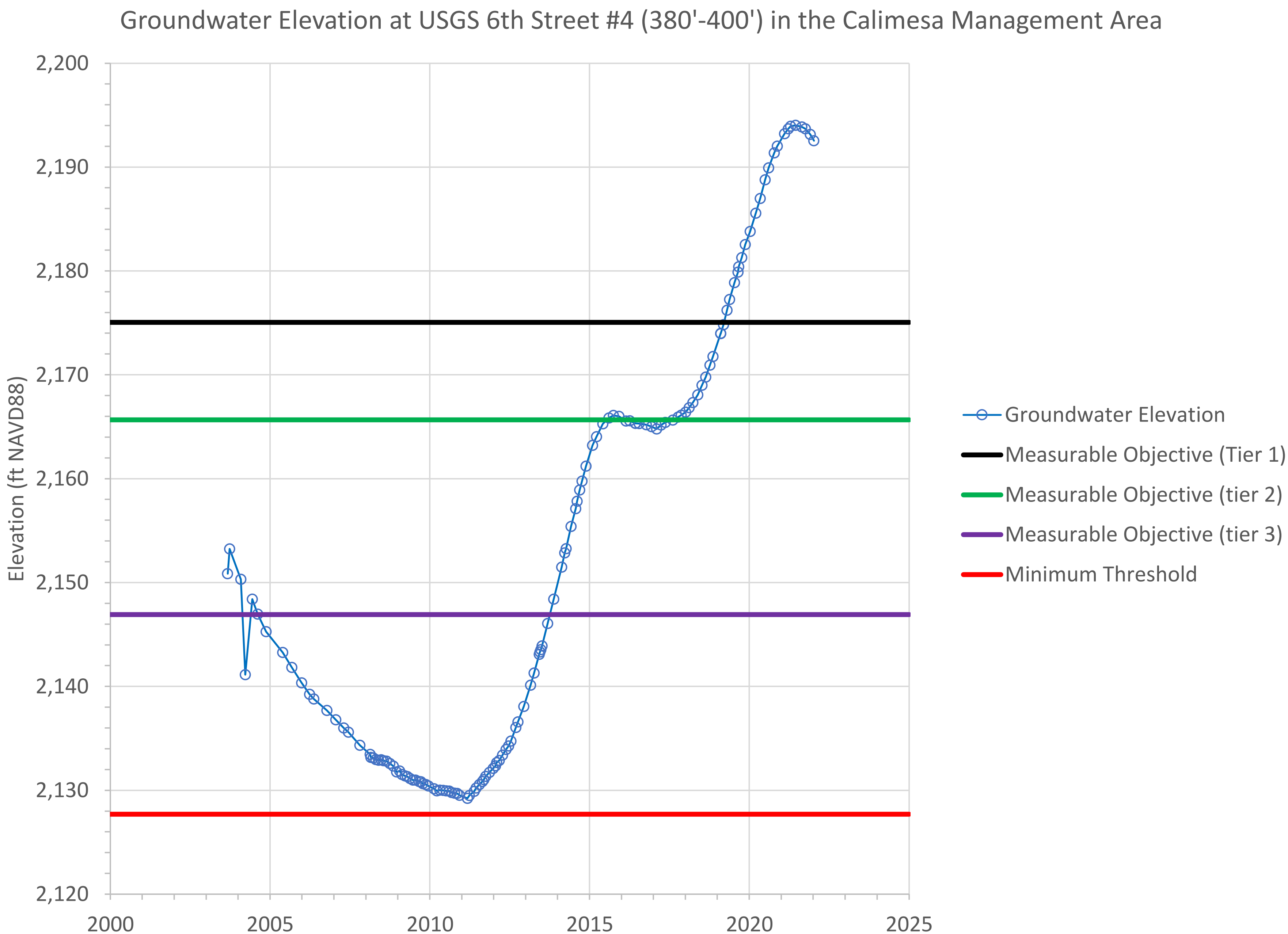

Groundwater Elevation at USGS 6th Street #3 (500'-540') in the Calimesa Management Area
Elevation (ft NAVD88)
2,180
2,170
2,160
2,150
2,140
2,130
2,120
2,110
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-43



Groundwater Elevation at USGS 6th Street #4 (380'-400') in the Calimesa Management Area
Elevation (ft NAVD88)
2,200
2,190
2,180
2,170
2,160
2,150
2,140
2,130
2,120
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (tier 2)
Measurable Objective (tier 3)
Minimum Threshold

Figure A-44

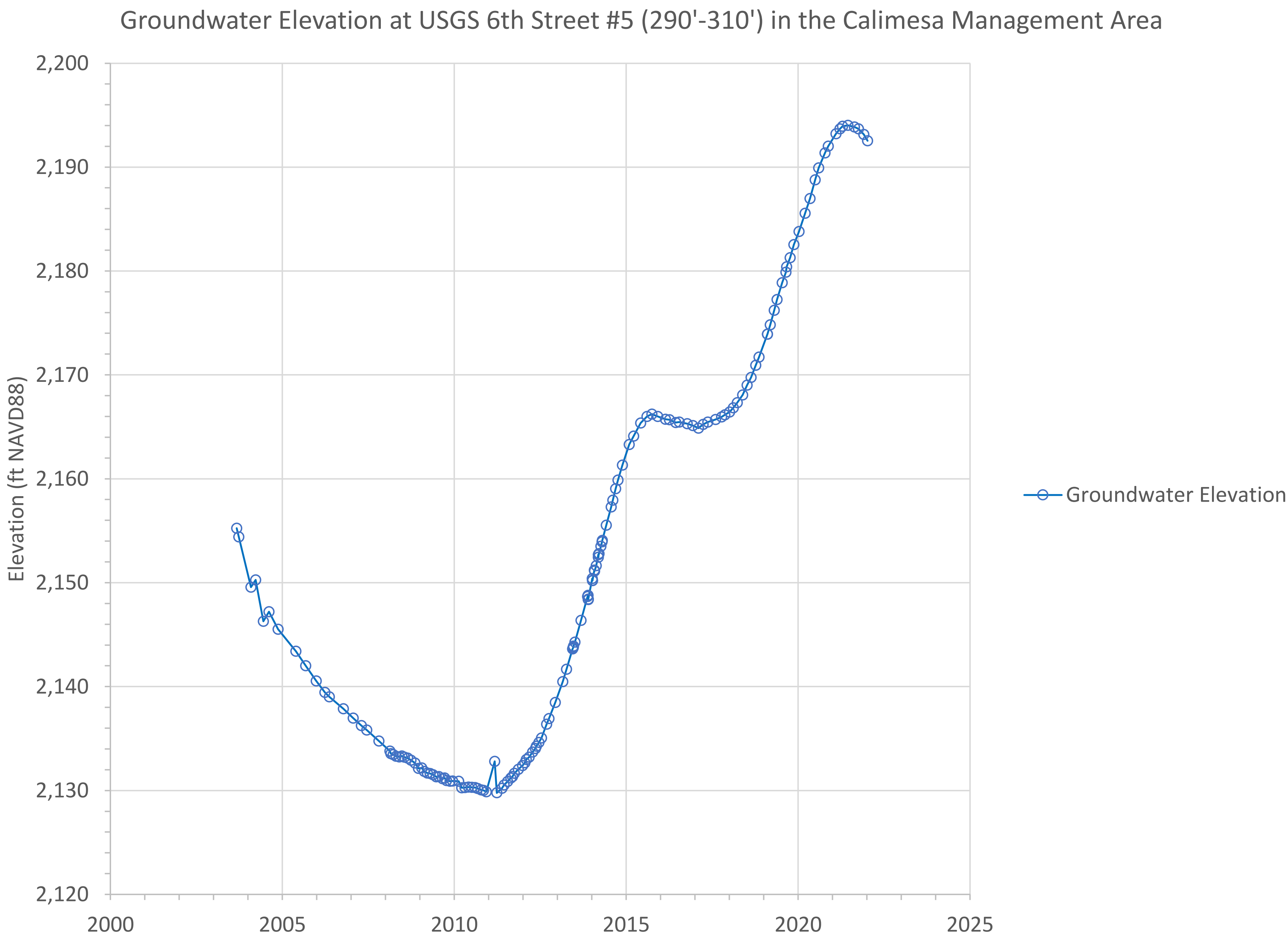
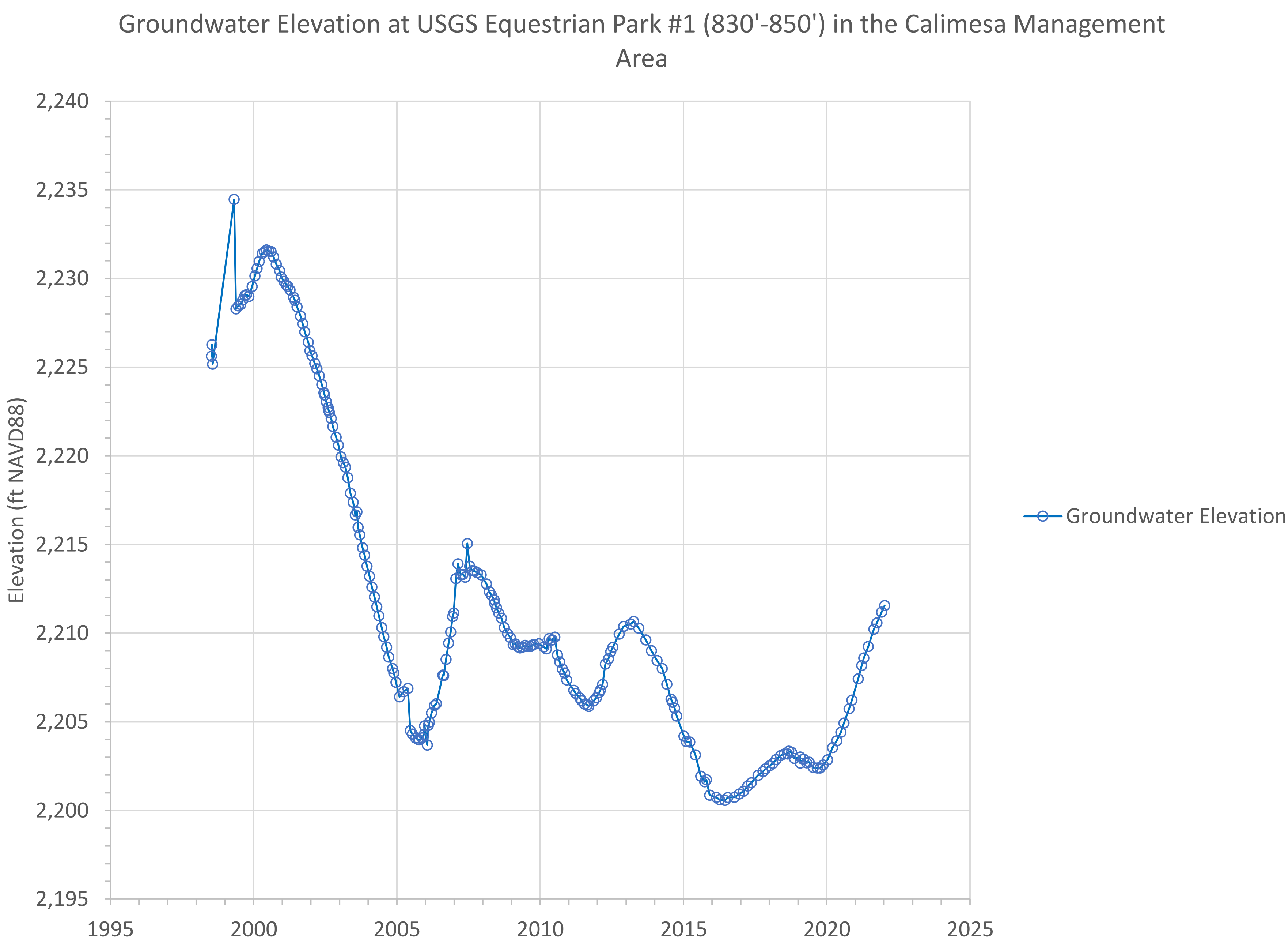
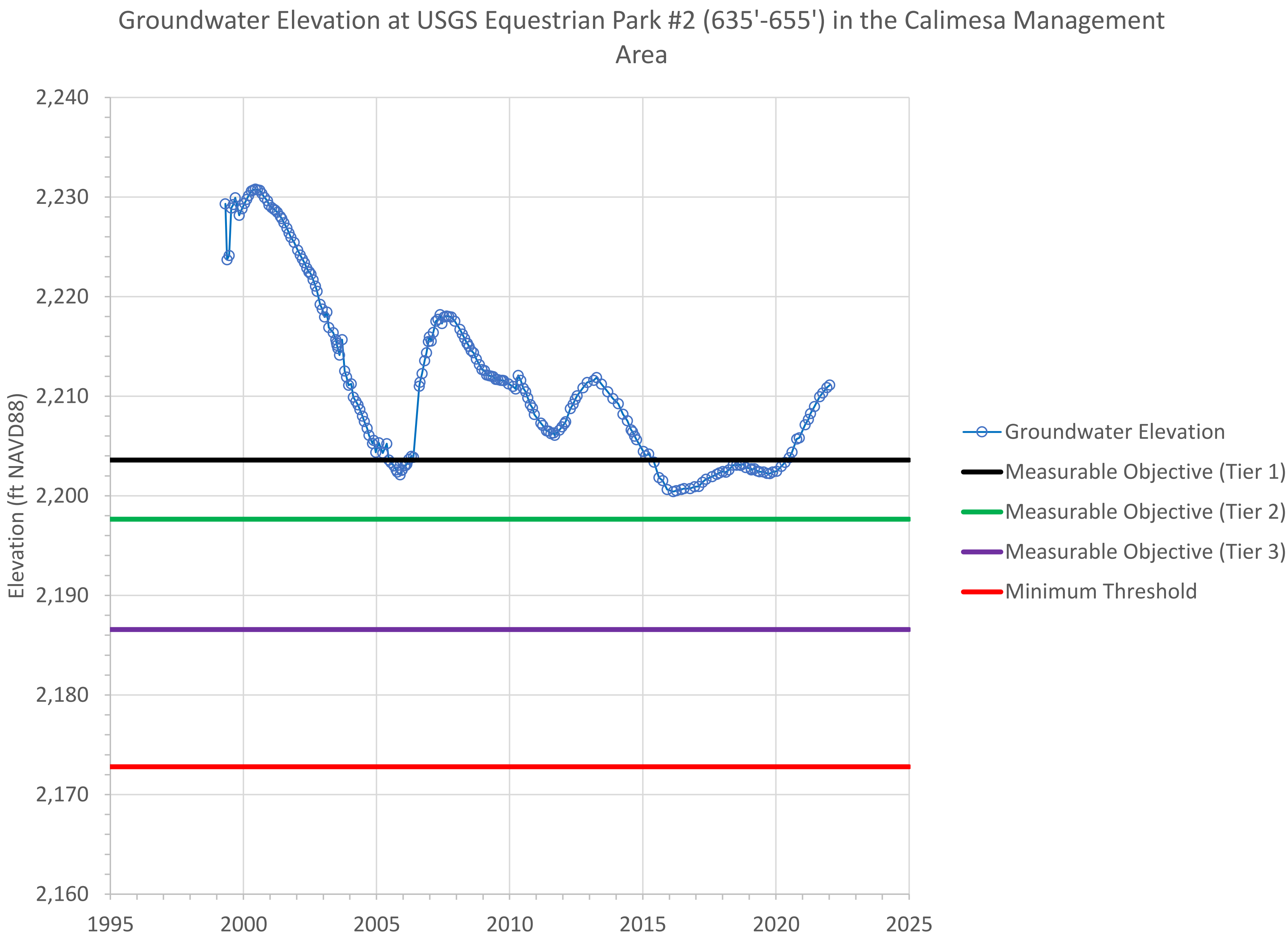

Groundwater Elevation at USGS 6th Street #5 (290'-310') in the Calimesa Management Area
Elevation (ft NAVD88)
2,200
2,190
2,180
2,170
2,160
2,150
2,140
2,130
2,120
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-45



Groundwater Elevation at USGS Equestrian Park #1 (830'-850') in the Calimesa Management Area
Elevation (ft NAVD88)
2,240
2,235
2,230
2,225
2,220
2,215
2,210
2,205
2,200
2,195
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-46



Groundwater Elevation at USGS Equestrian Park #2 (635'-655') in the Calimesa Management Area
Elevation (ft NAVD88)
2,240
2,230
2,220
2,210
2,200
2,190
2,180
2,170
2,160
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-47

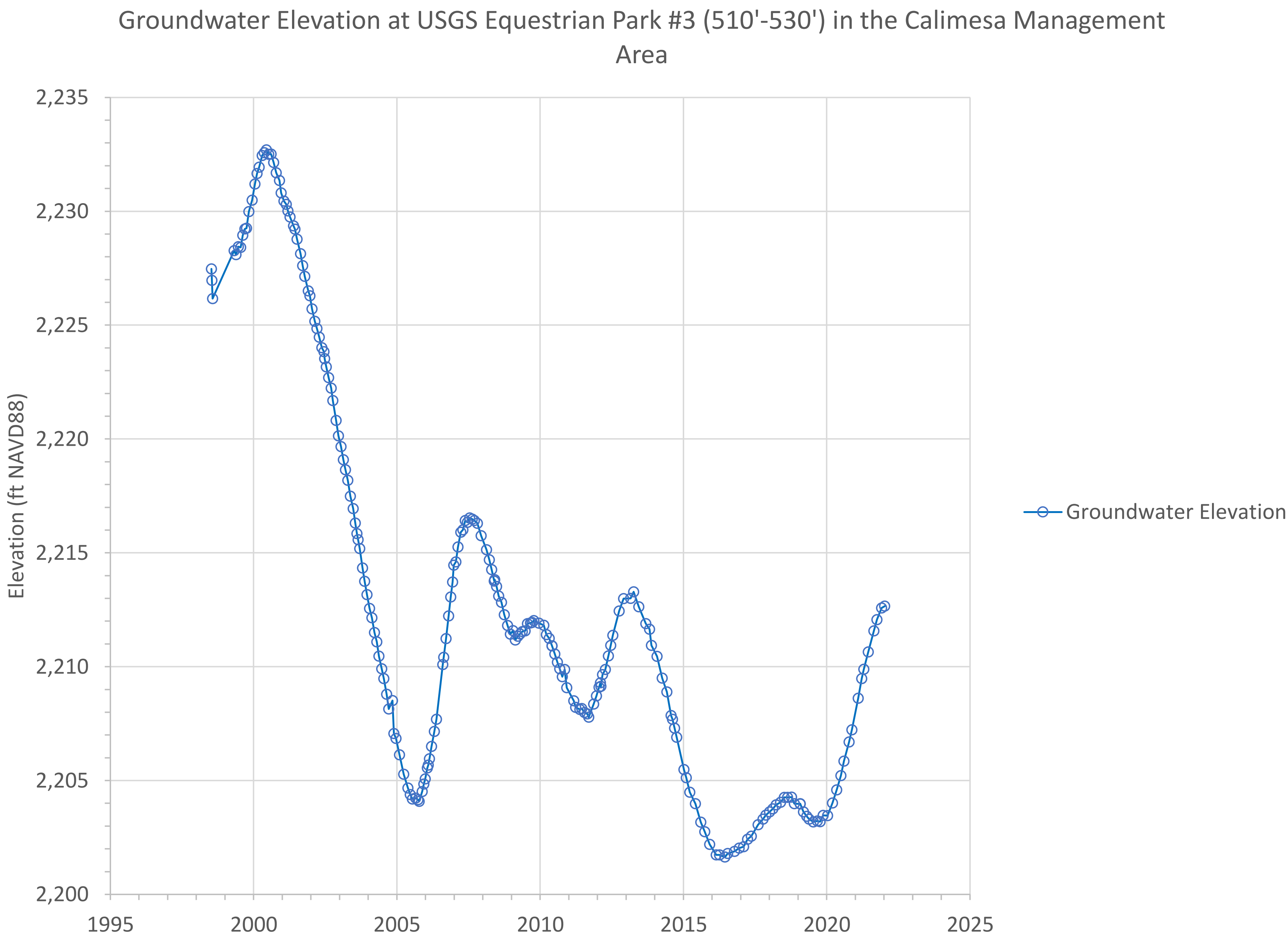
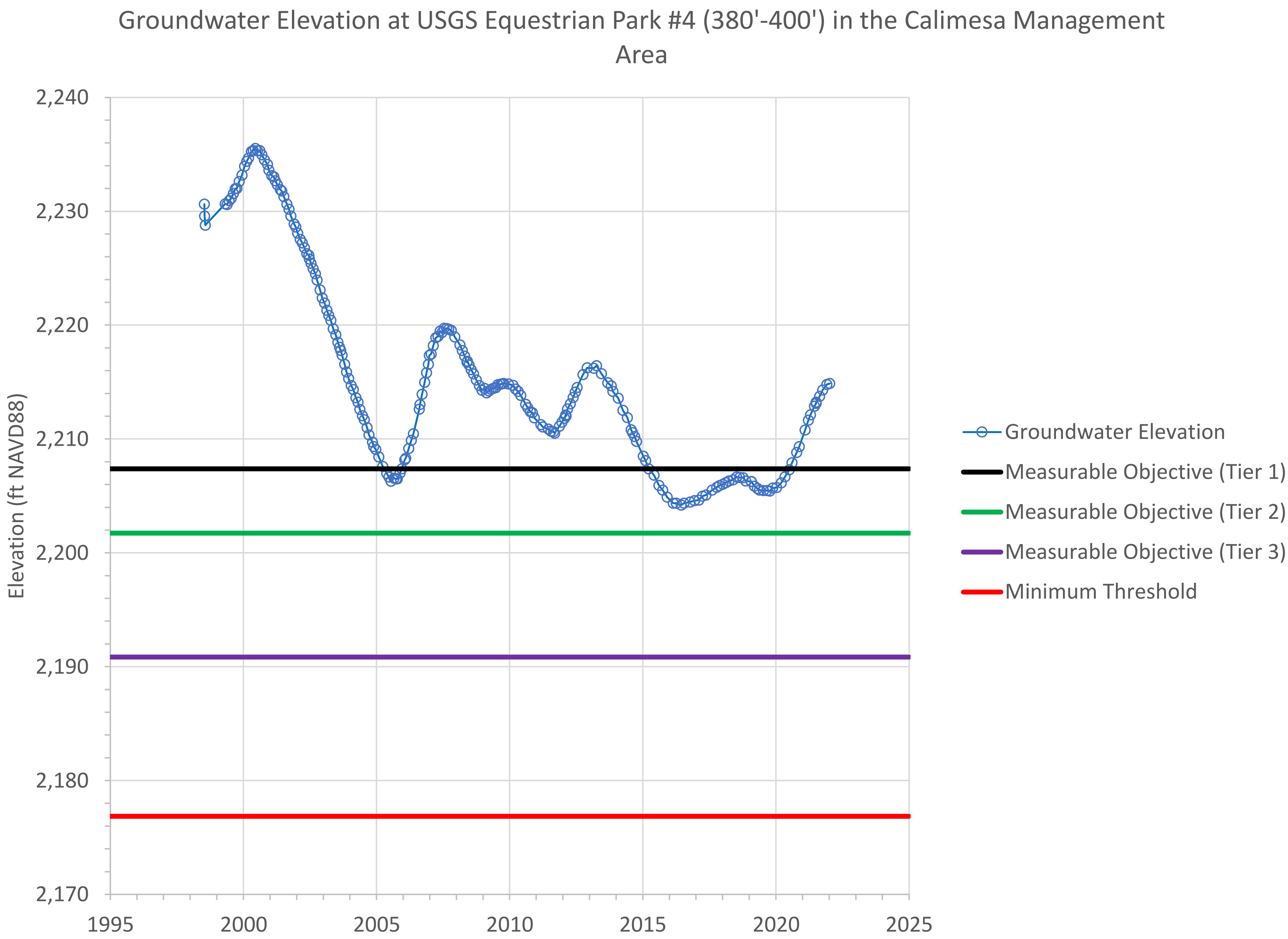

Groundwater Elevation at USGS Equestrian Park #3 (510'-530') in the Calimesa Management Area
Elevation (ft NAVD88)
2,235
2,230
2,225
2,220
2,215
2,210
2,205
2,200
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-48



Groundwater Elevation at USGS Equestrian Park #4 (380'-400') in the Calimesa Management Area
Elevation (ft NAVD88)
2,240
2,230
2,220
2,210
2,200
2,190
2,180
2,170
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-49

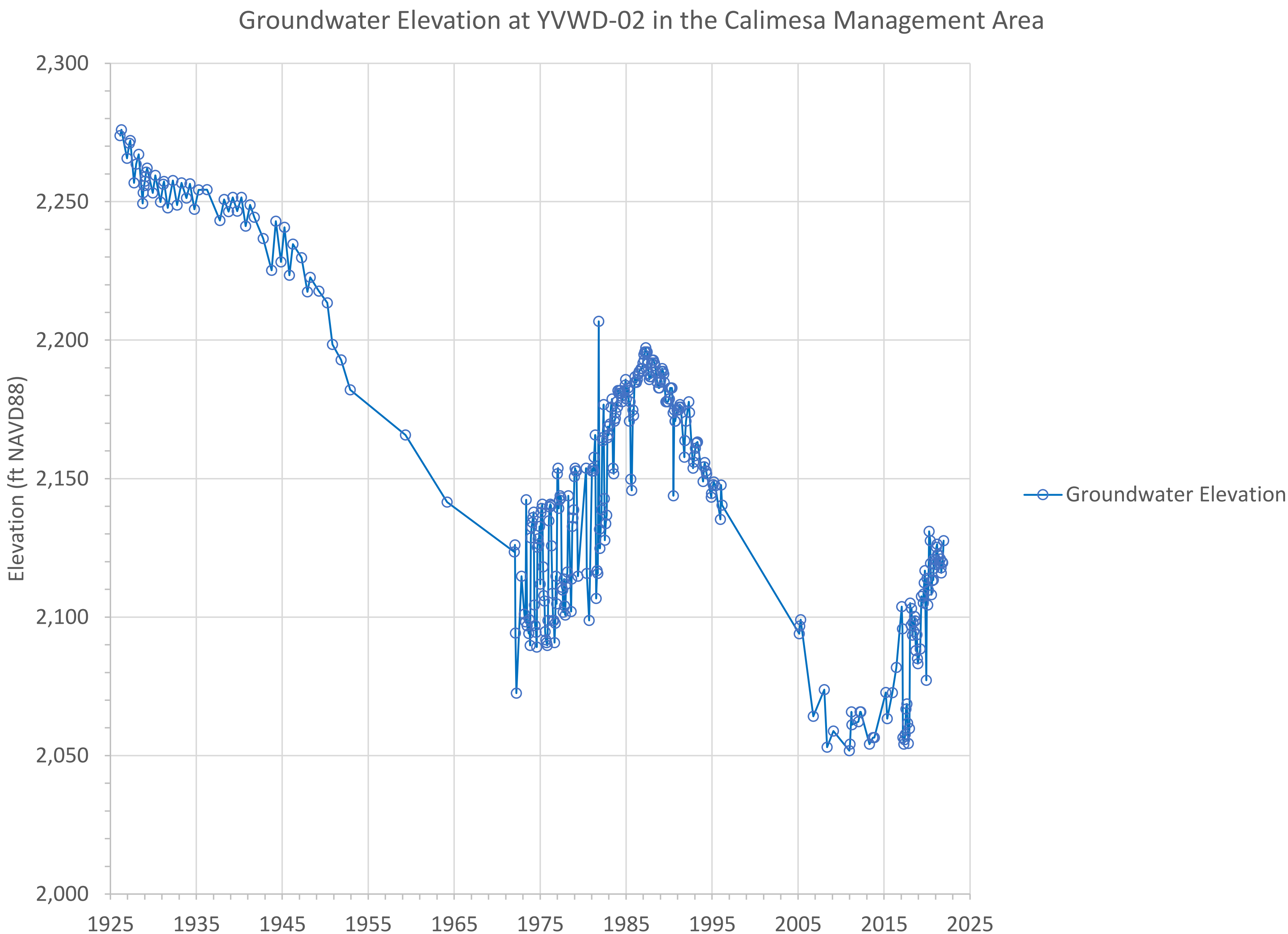
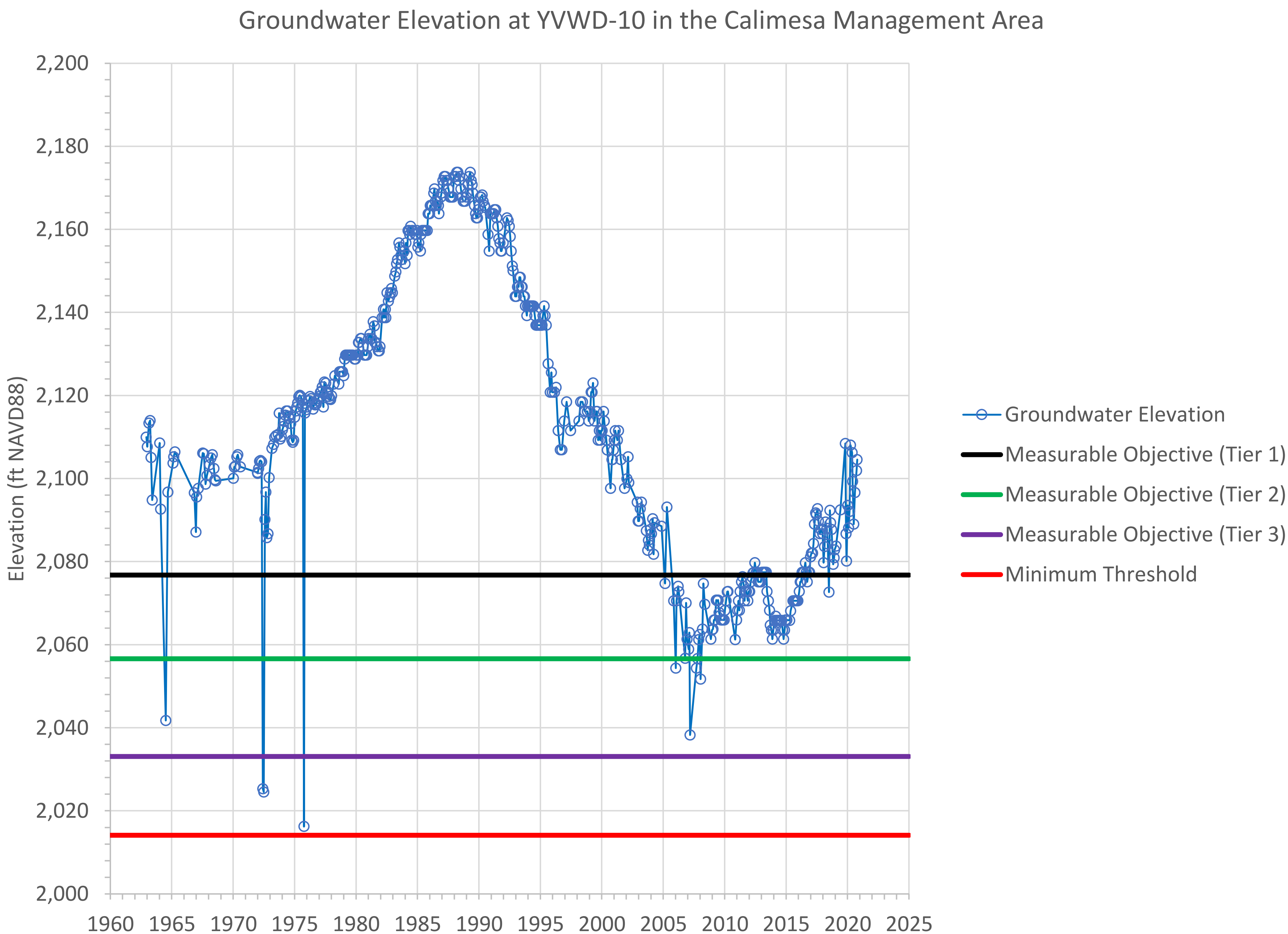

Groundwater Elevation at YVWD-02 in the Calimesa Management Area
Elevation (ft NAVD88)
2,300
2,250
2,200
2,150
2,100
2,050
2,000
1925
1935
1945
1955
1965
1975
1985
1995
2005
2015
2025
Groundwater Elevation

Figure A-50



Groundwater Elevation at YVWD-10 in the Calimesa Management Area
Elevation (ft NAVD88)
2,200
2,180
2,160
2,140
2,120
2,100
2,080
2,060
2,040
2,020
2,000
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-51

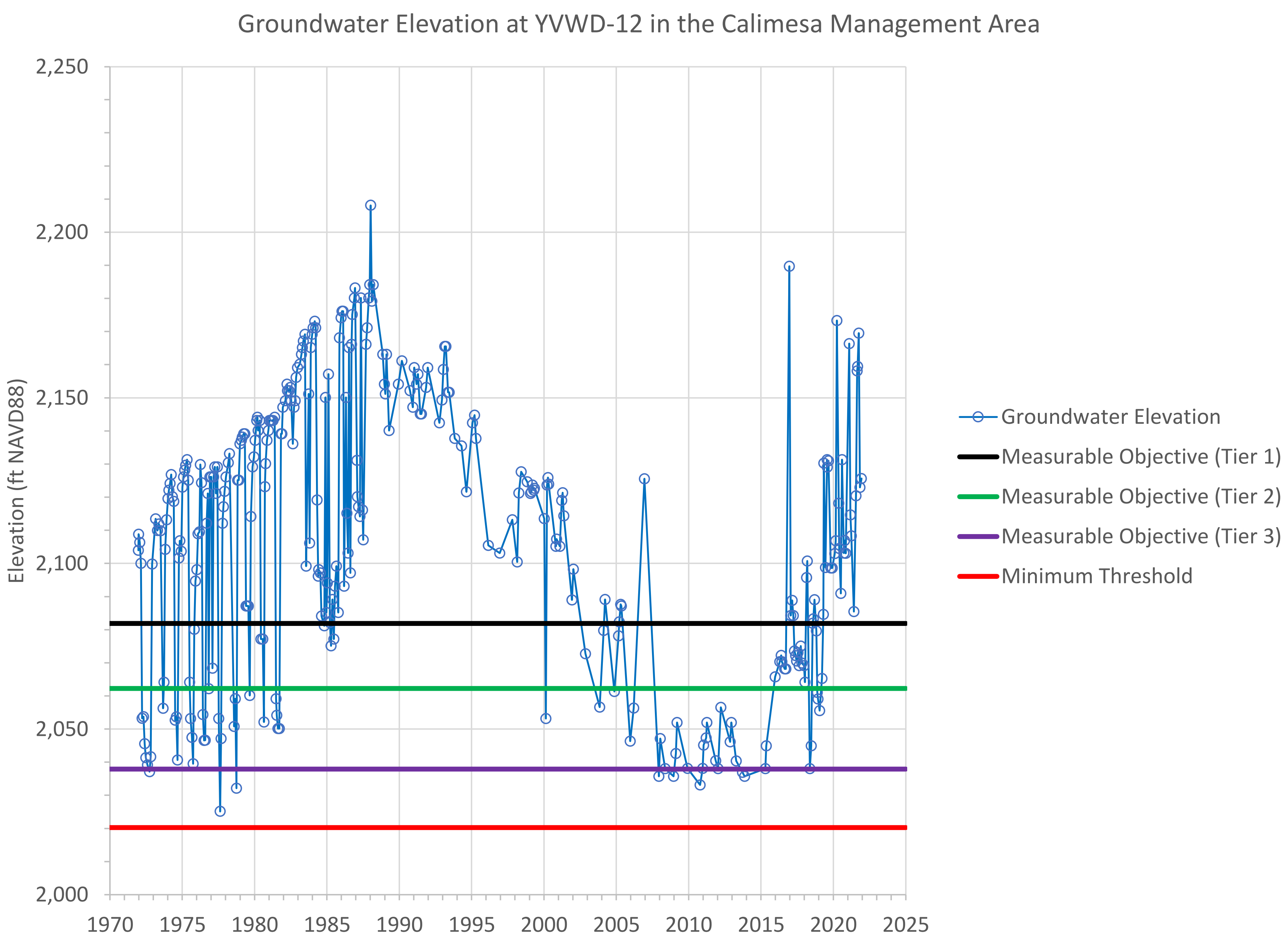

Groundwater Elevation at YVWD-12 in the Calimesa Management Area
Elevation (ft NAVD88)
2,250
2,200
2,150
2,100
2,050
2,000
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-52

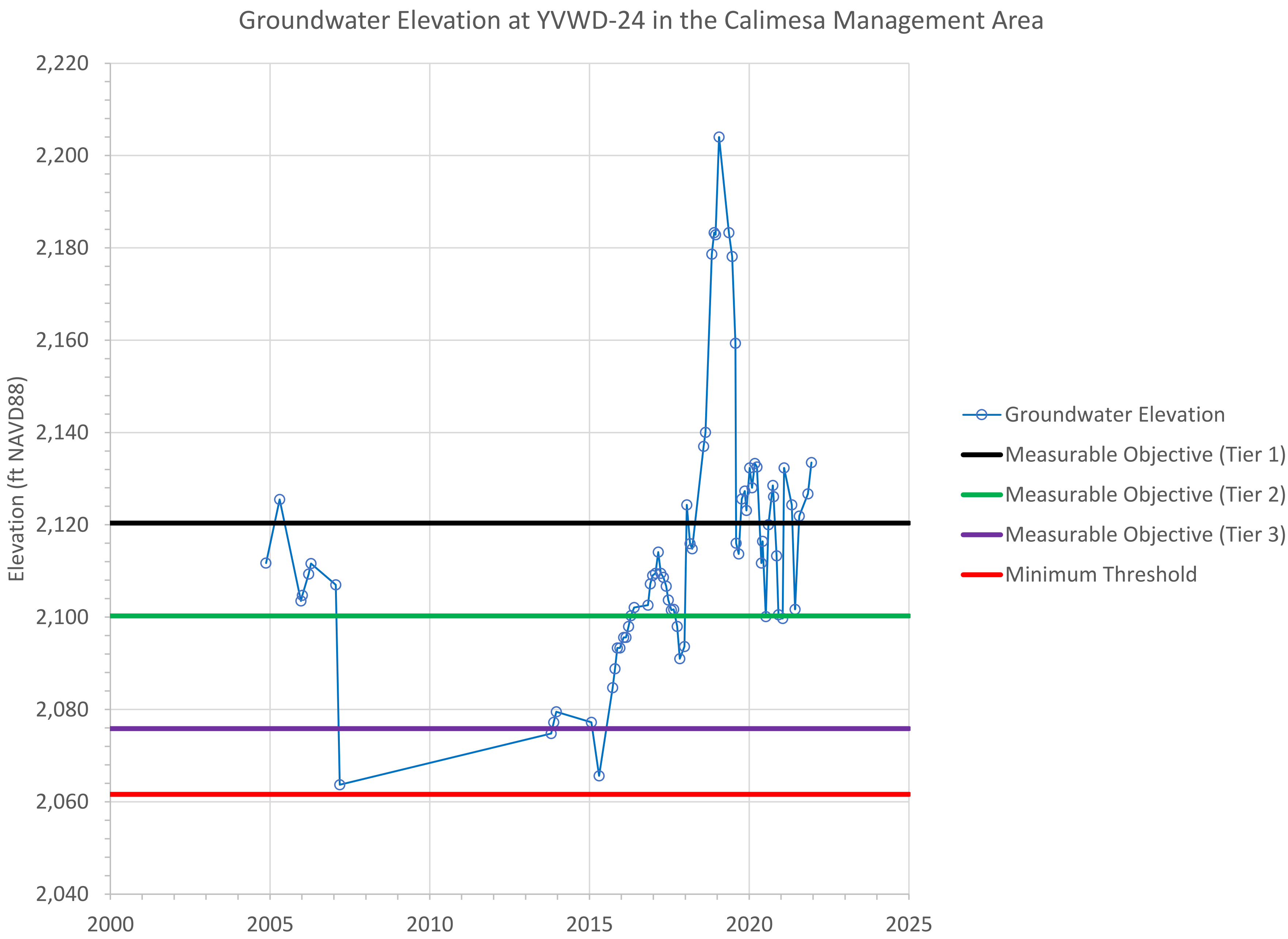

Groundwater Elevation at YVWD-24 in the Calimesa Management Area
Elevation (ft NAVD88)
2,220
2,200
2,180
2,160
2,140
2,120
2,100
2,080
2,060
2,040
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-53

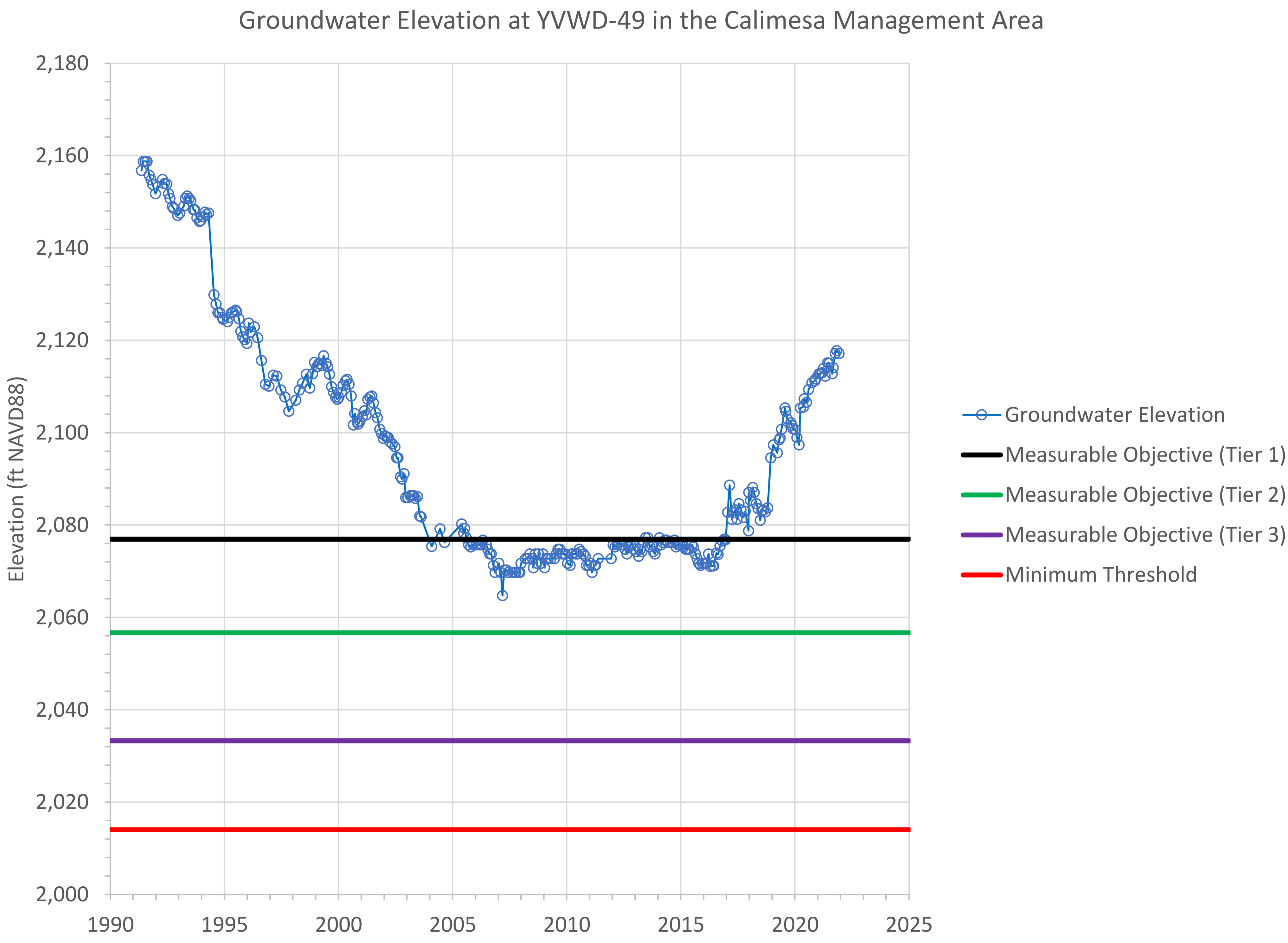

Groundwater Elevation at YVWD-49 in the Calimesa Management Area
Elevation (ft NAVD88)
2,180
2,160
2,140
2,120
2,100
2,080
2,060
2,040
2,020
2,000
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Measurable Objective (Tier 3)
Minimum Threshold

Figure A-54

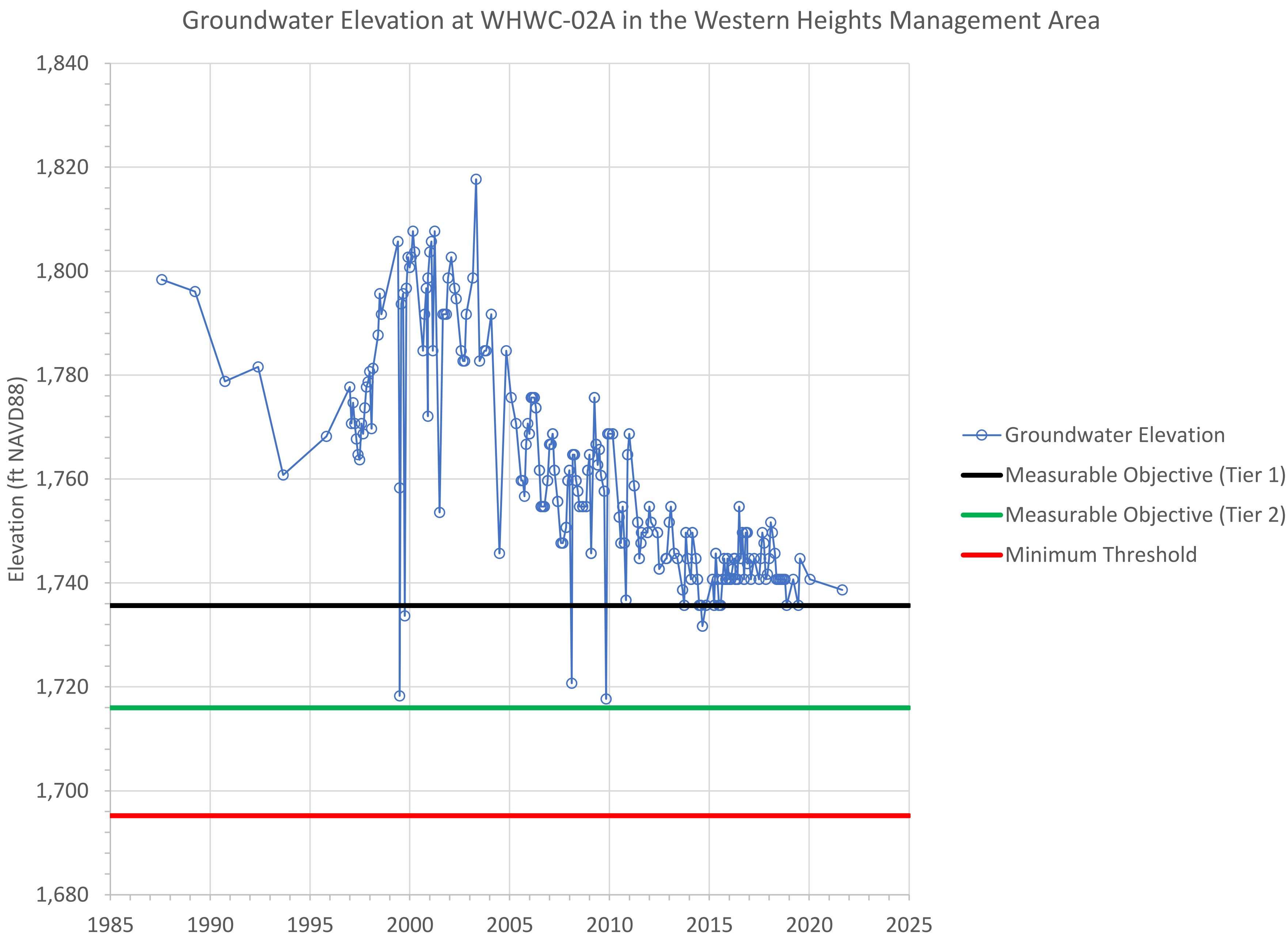
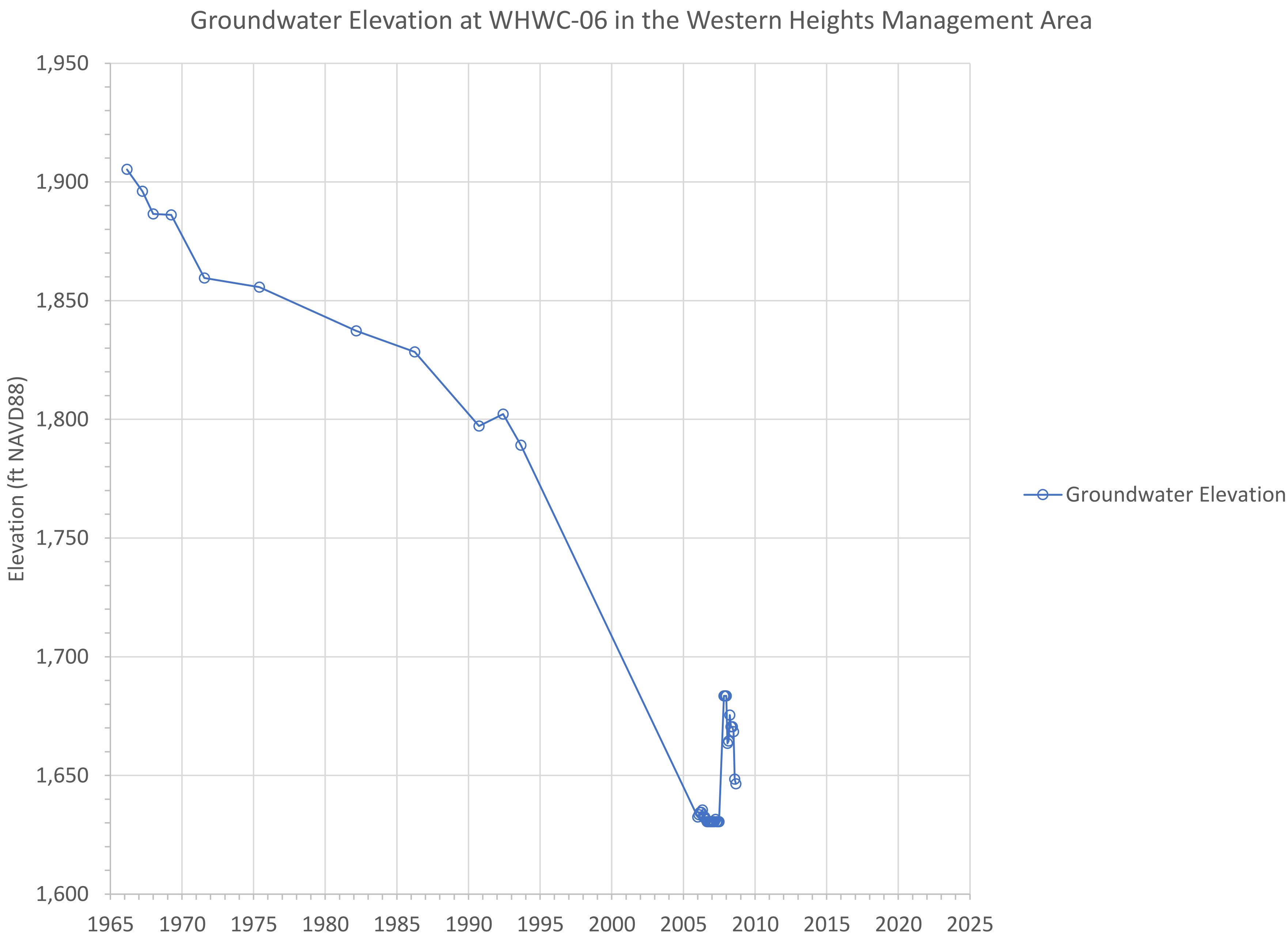
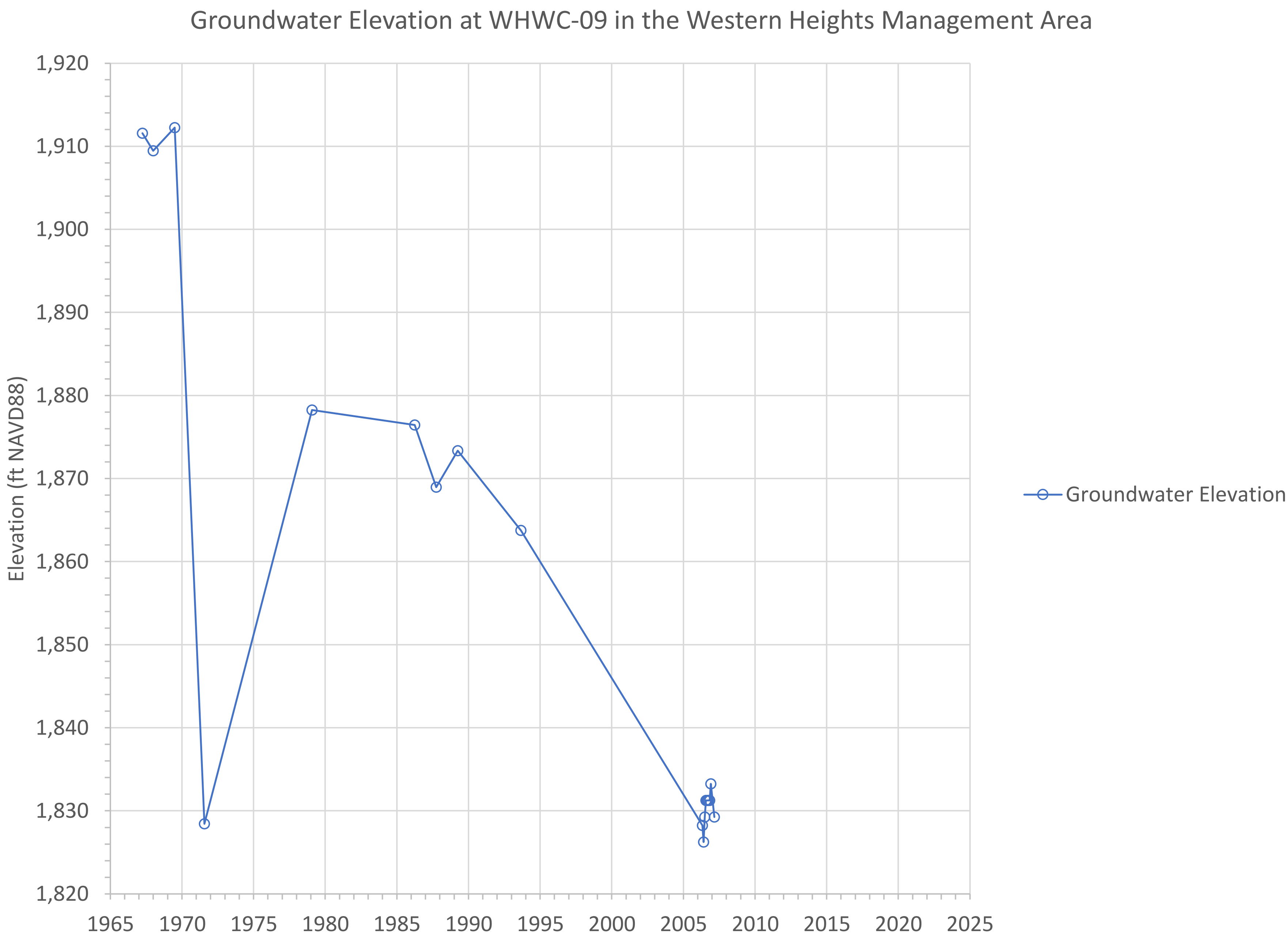

Groundwater Elevation at WHWC-02A in the Western Heights Management Area
Elevation (ft NAVD88)
1,840
1,820
1,800
1,780
1,760
1,740
1,720
1,700
1,680
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Minimum Threshold

Figure A-55



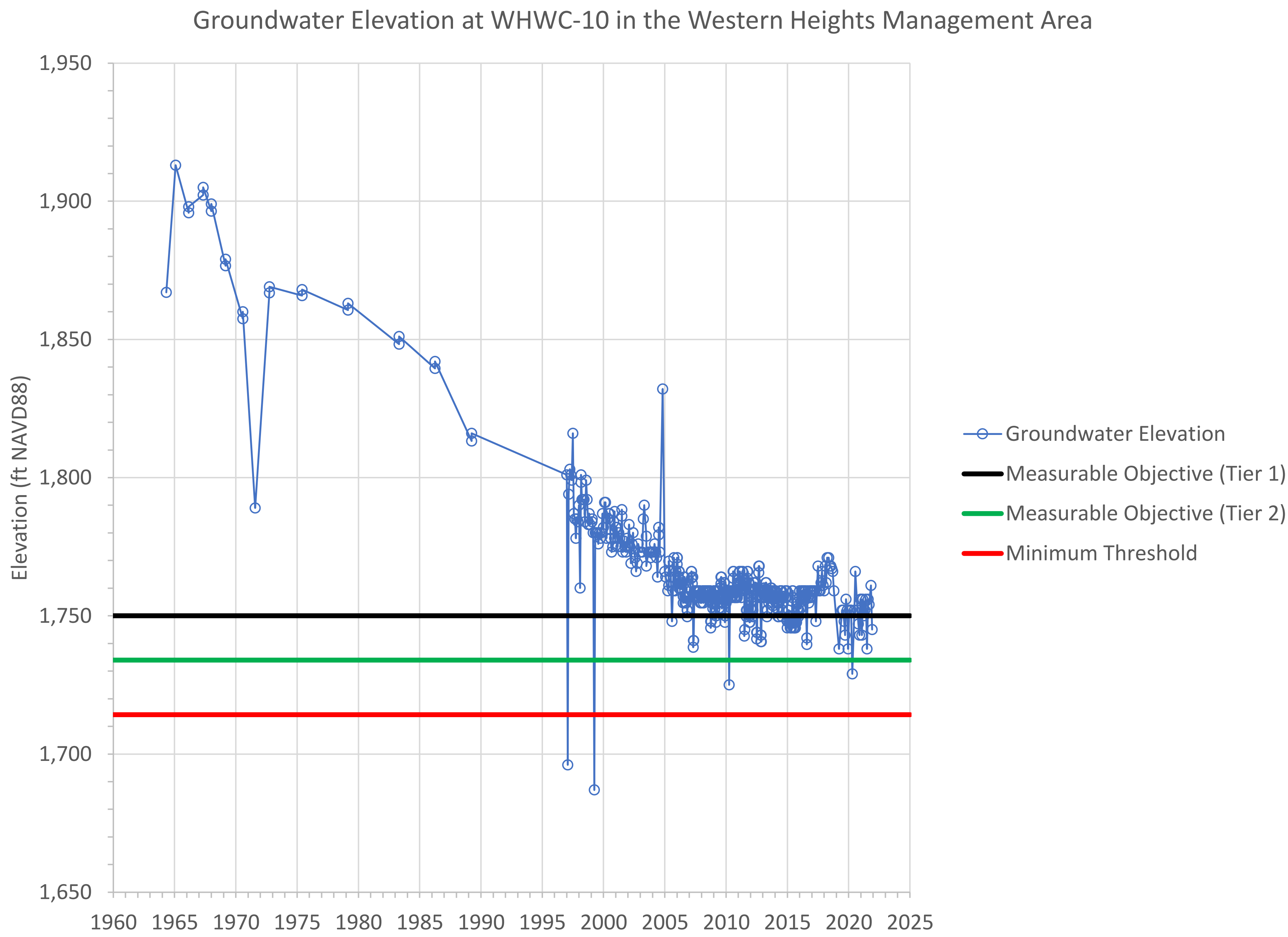
Groundwater Elevation at WHWC-06 in the Western Heights Management Area
Elevation (ft NAVD88)
1,950
1,900
1,850
1,800
1,750
1,700
1,650
1,600
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-56



Groundwater Elevation at WHWC-09 in the Western Heights Management Area
Elevation (ft NAVD88)
1,920
1,910
1,900
1,890
1,880
1,870
1,860
1,850
1,840
1,830
1,820
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-57



Groundwater Elevation at WHWC-10 in the Western Heights Management Area
Elevation (ft NAVD88)
1,950
1,900
1,850
1,800
1,750
1,700
1,650
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Minimum Threshold

Figure A-58

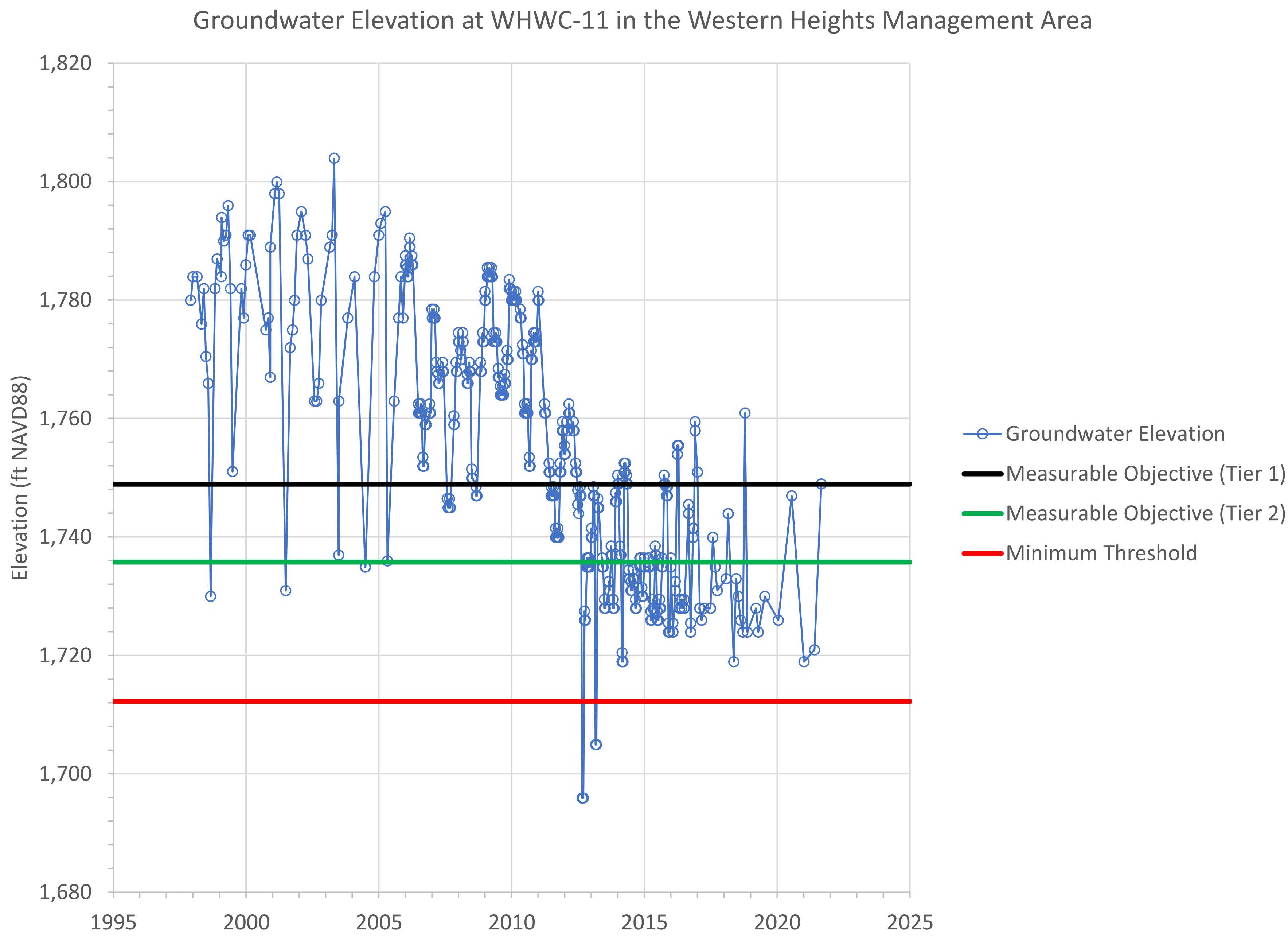
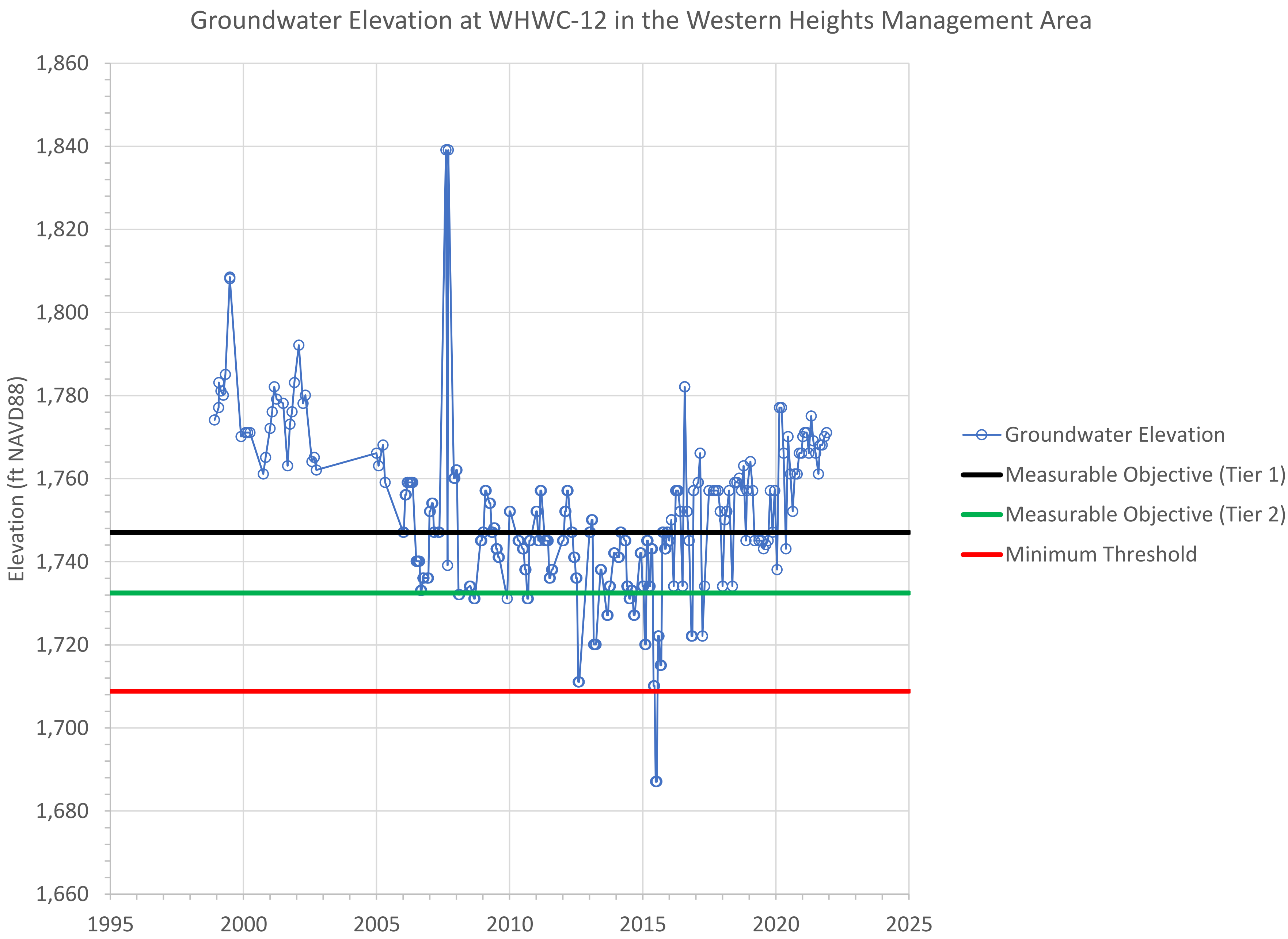

Groundwater Elevation at WHWC-11 in the Western Heights Management Area
Elevation (ft NAVD88)
1,820
1,800
1,780
1,760
1,740
1,720
1,700
1,680
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Minimum Threshold

Figure A-59



Groundwater Elevation at WHWC-12 in the Western Heights Management Area
Elevation (ft NAVD88)
1,860
1,840
1,820
1,800
1,780
1,760
1,740
1,720
1,700
1,680
1,660
1995
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Minimum Threshold

Figure A-60

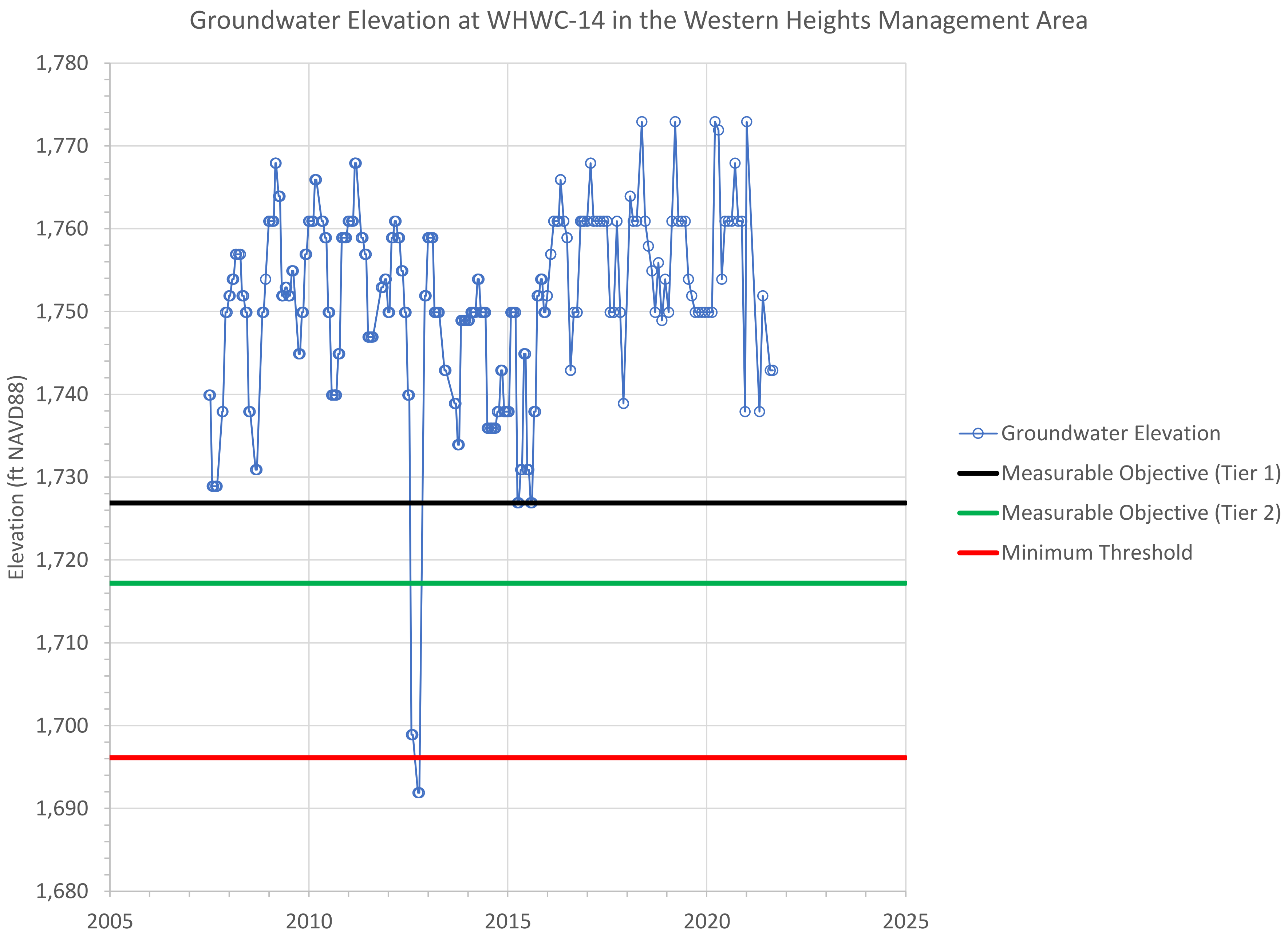
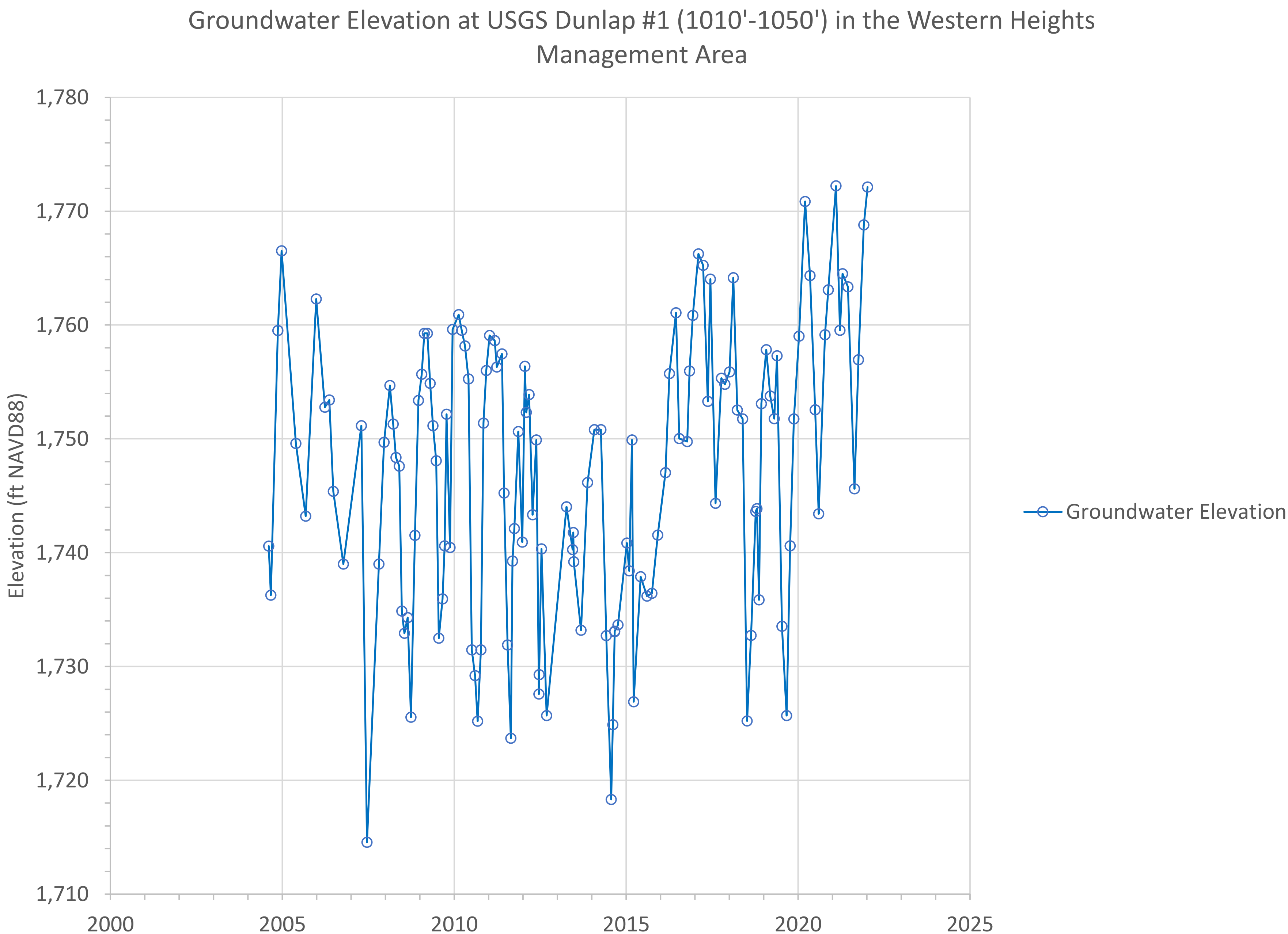
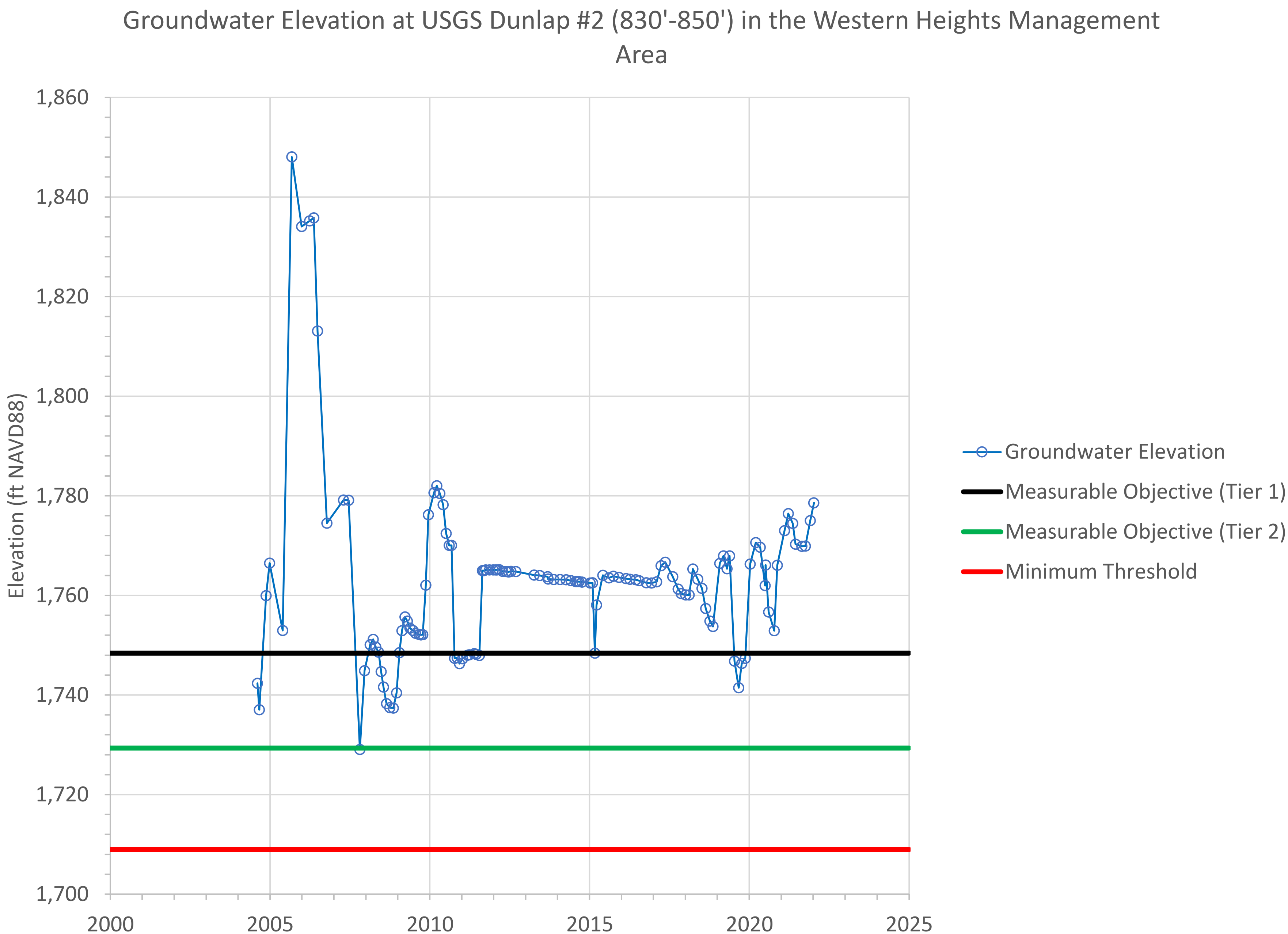

Groundwater Elevation at WHWC-14 in the Western Heights Management Area
Elevation (ft NAVD88)
1,780
1,770
1,760
1,750
1,740
1,730
1,720
1,710
1,700
1,690
1,680
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Minimum Threshold

Figure A-61



Groundwater Elevation at USGS Dunlap #1 (1010'-1050') in the Western Heights Management Area
Elevation (ft NAVD88)
1,780
1,770
1,760
1,750
1,740
1,730
1,720
1,710
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-62



Groundwater Elevation at USGS Dunlap #2 (830'-850') in the Western Heights Management Area
Elevation (ft NAVD88)
1,860
1,840
1,820
1,800
1,780
1,760
1,740
1,720
1,700
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Minimum Threshold

Figure A-63

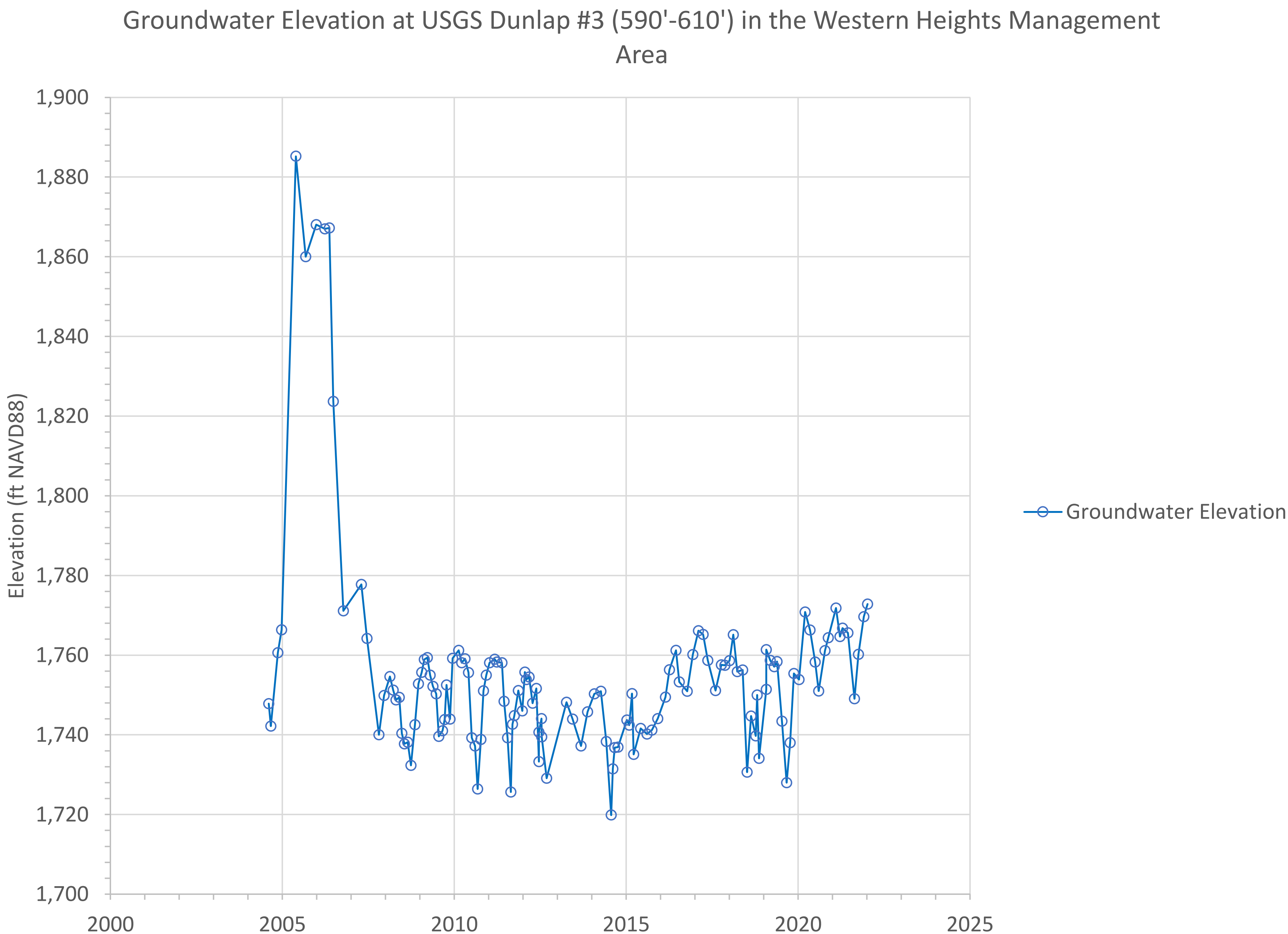
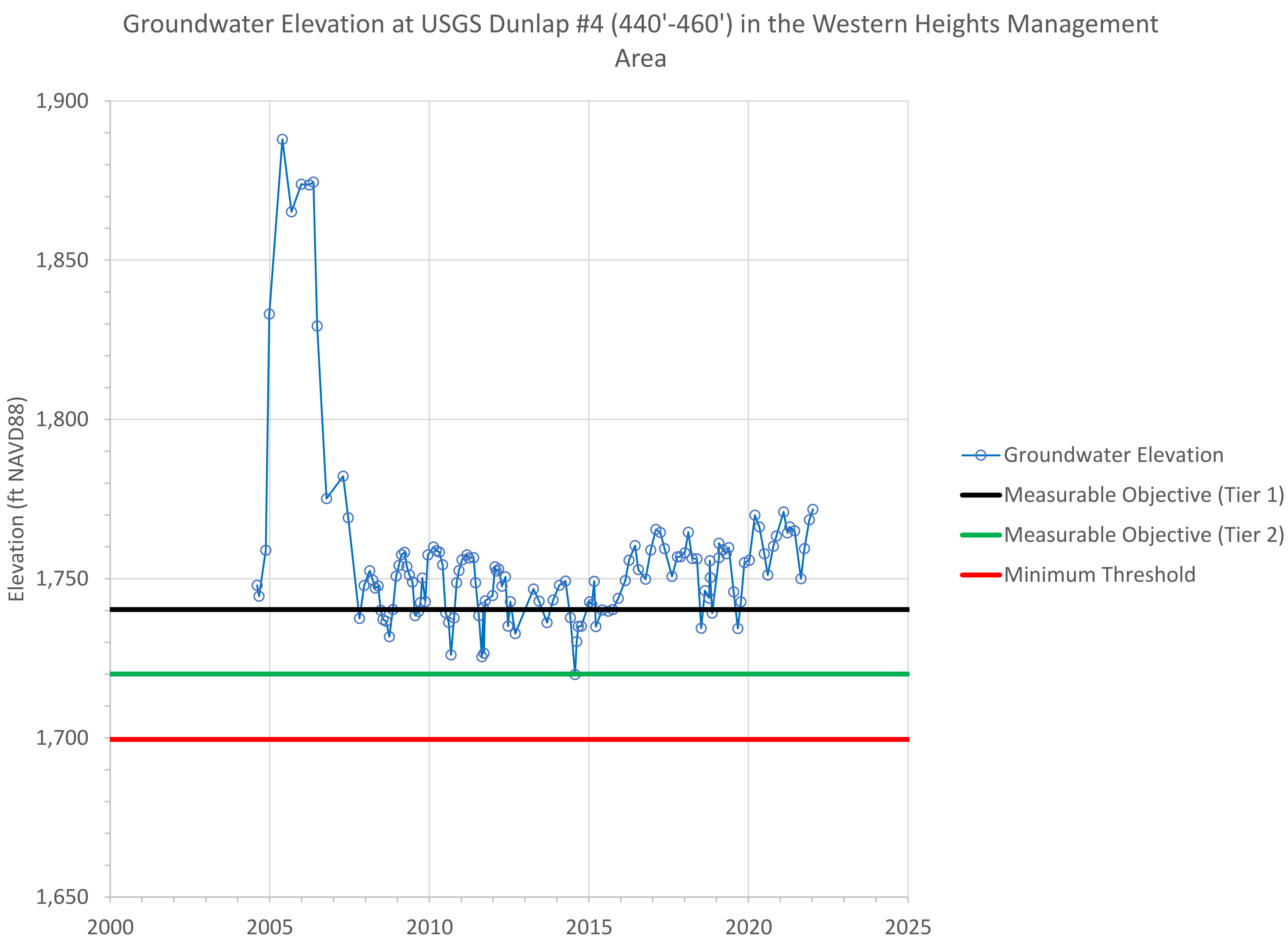

Groundwater Elevation at USGS Dunlap #3 (590'-610') in the Western Heights Management Area
Elevation (ft NAVD88)
1,900
1,880
1,860
1,840
1,820
1,800
1,780
1,760
1,740
1,720
1,700
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-64



Groundwater Elevation at USGS Dunlap #4 (440'-460') in the Western Heights Management Area
Elevation (ft NAVD88)
1,900
1,850
1,800
1,750
1,700
1,650
2000
2005
2010
2015
2020
2025
Groundwater Elevation
Measurable Objective (Tier 1)
Measurable Objective (Tier 2)
Minimum Threshold

Figure A-65

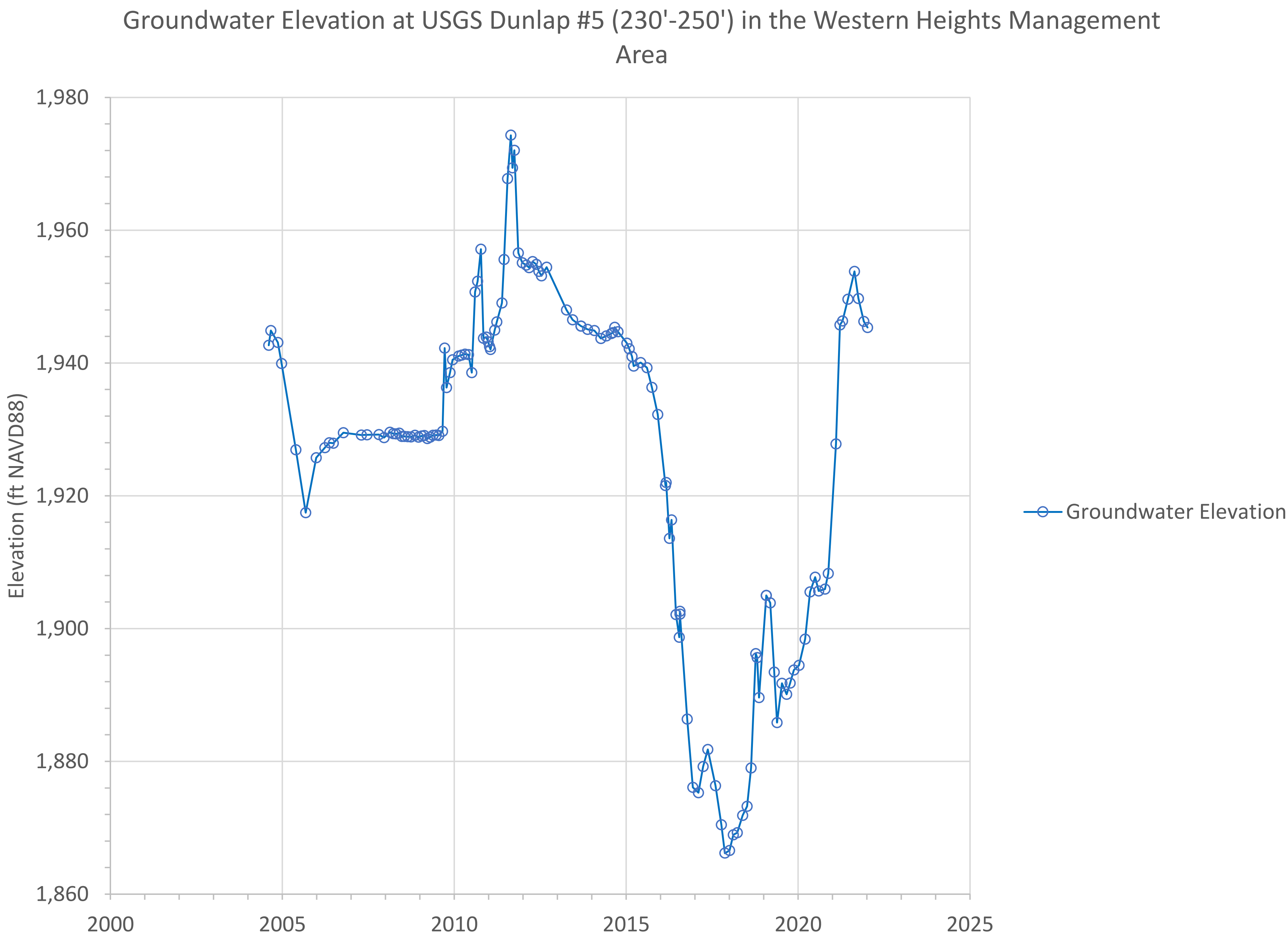
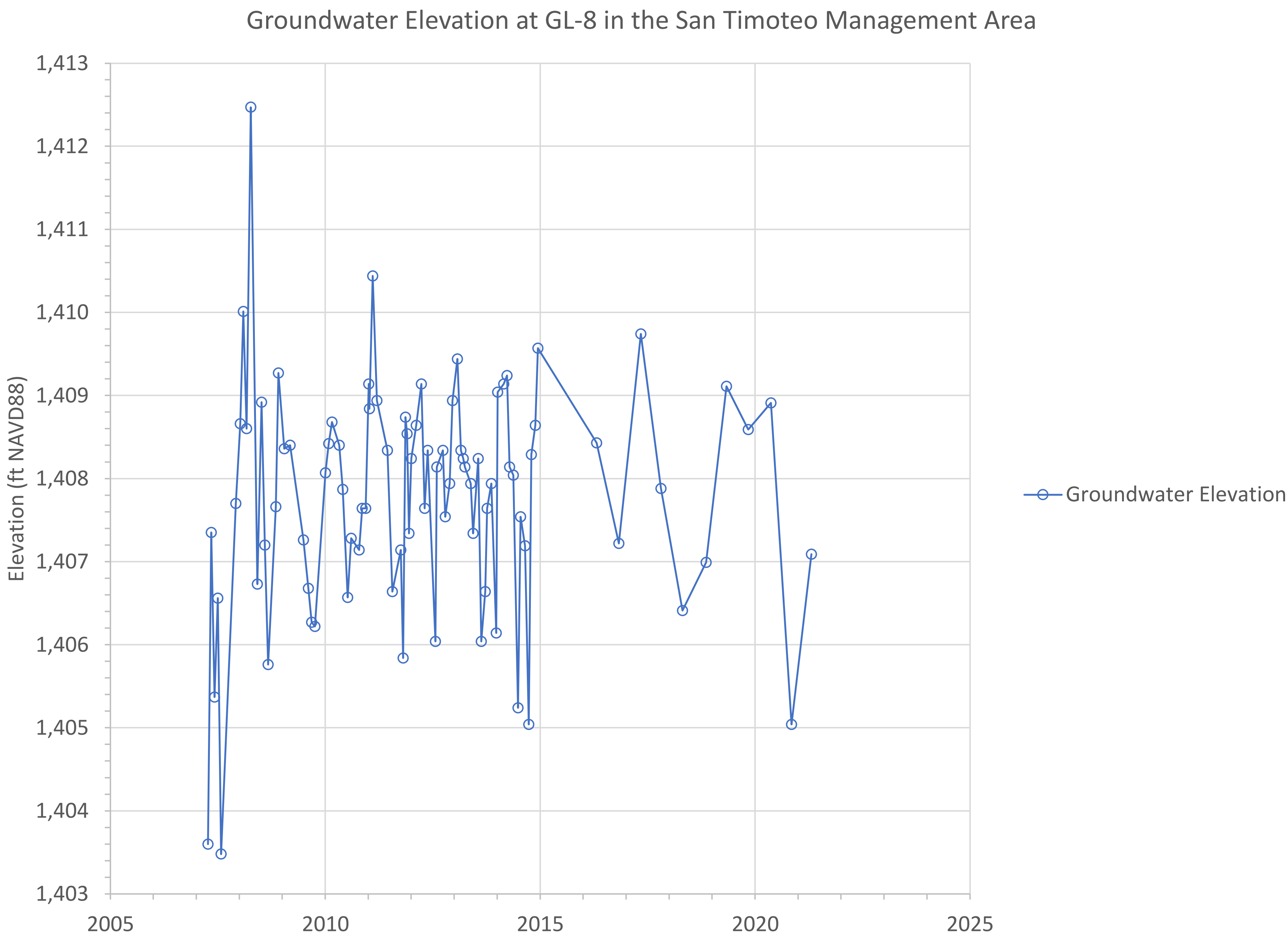

Groundwater Elevation at USGS Dunlap #5 (230'-250') in the Western Heights Management Area
Elevation (ft NAVD88)
1,980
1,960
1,940
1,920
1,900
1,880
1,860
2000
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-66



Groundwater Elevation at GL-8 in the San Timoteo Management Area
Elevation (ft NAVD88)
1,413
1,412
1,411
1,410
1,409
1,408
1,407
1,406
1,405
1,404
1,403
2005
2010
2015
2020
2025
Groundwater Elevation

Figure A-67

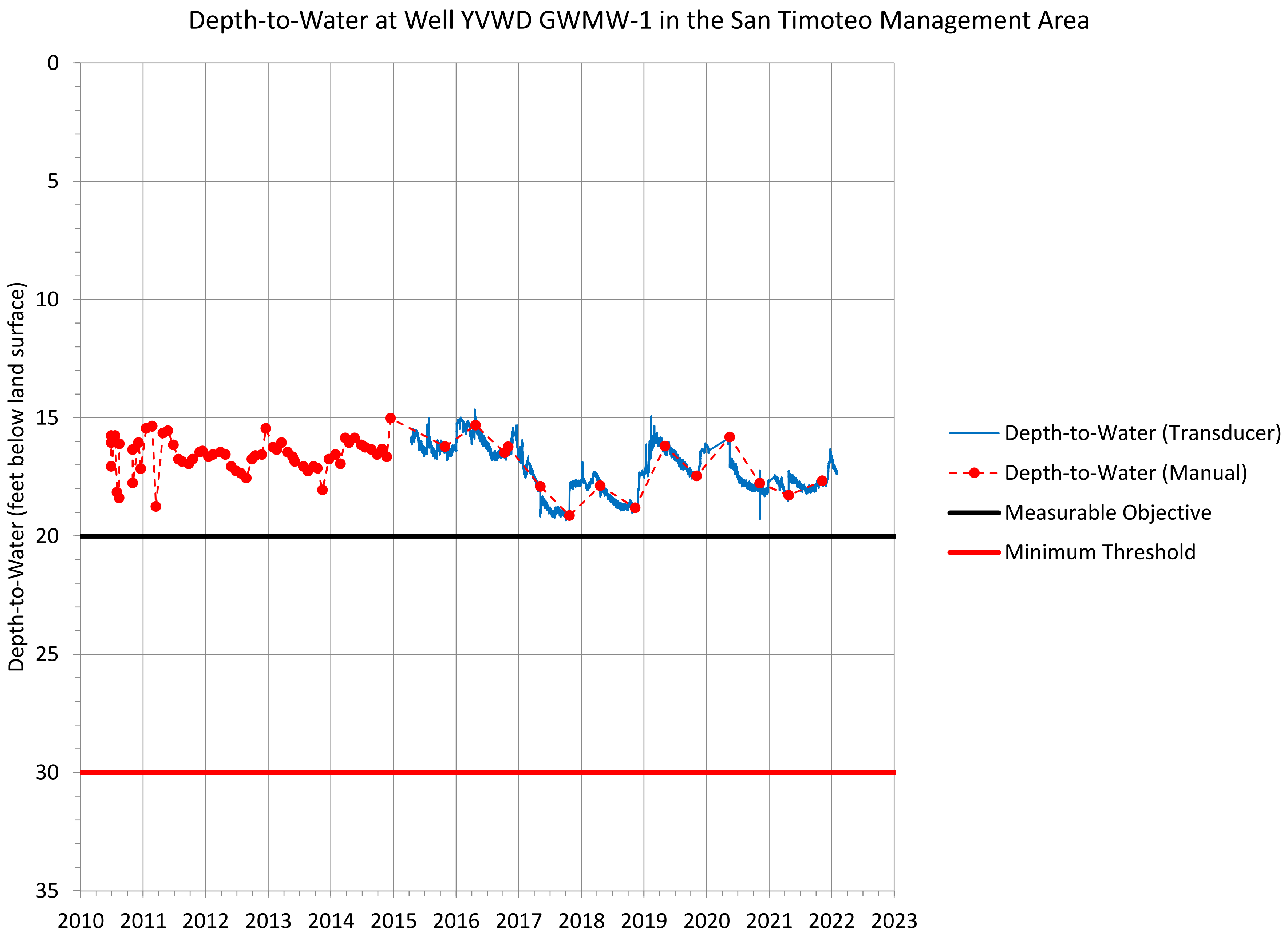

Depth-to-Water at Well YVWD GWMW-1 in the San Timoteo Management Area
Depth-to-Water (feet below land surface)
0
5
10
15
20
25
30
35
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Depth-to-Water (Transducer)
Depth-to-Water (Manual)
Measurable Objective
Minimum Threshold

Figure A-68

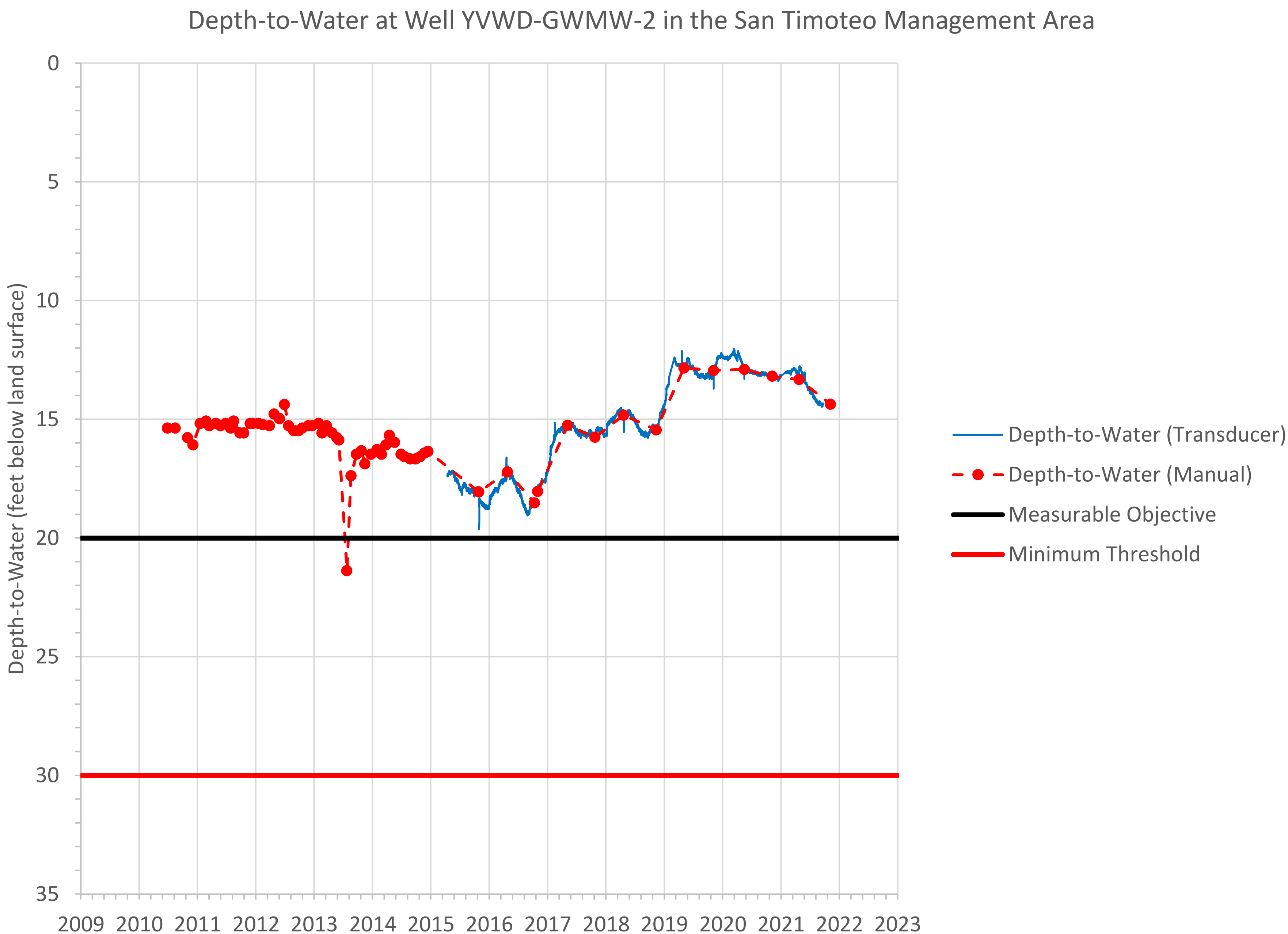

Depth-to-Water at Well YVWD-GWMW-2 in the San Timoteo Management Area
Depth-to-Water (feet below land surface)
0
5
10
15
20
25
30
35
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Depth-to-Water (Transducer)
Depth-to-Water (Manual)
Measurable Objective
Minimum Threshold

Figure A-69

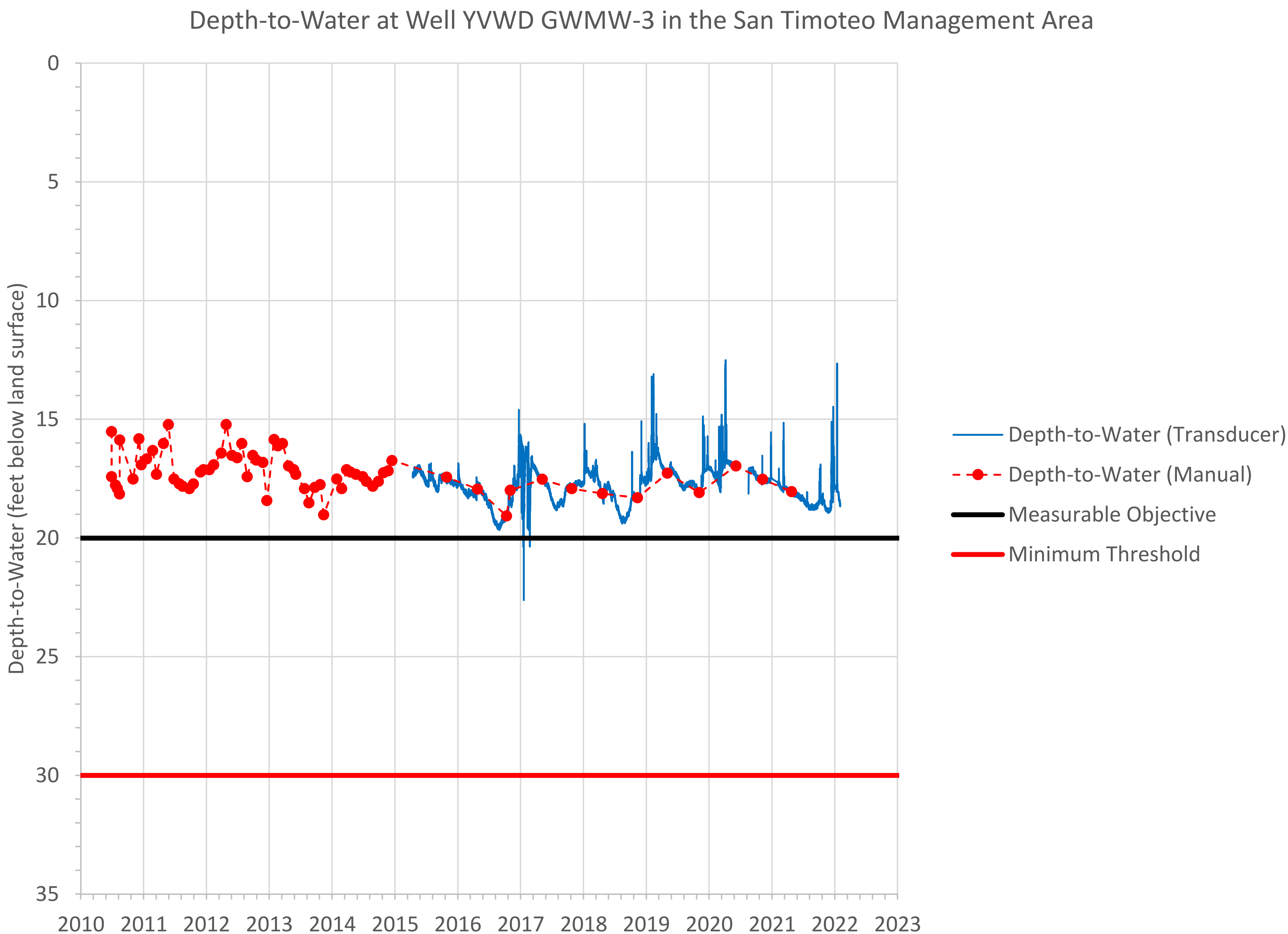

Depth-to-Water at Well YVWD GWMW-3 in the San Timoteo Management Area
Depth-to-Water (feet below land surface)
0
5
10
15
20
25
30
35
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Depth-to-Water (Transducer)
Depth-to-Water (Manual)
Measurable Objective
Minimum Threshold

Figure A-70

Depth-to-Water at Well YVWD GWMW-5A in the San Timoteo Management Area

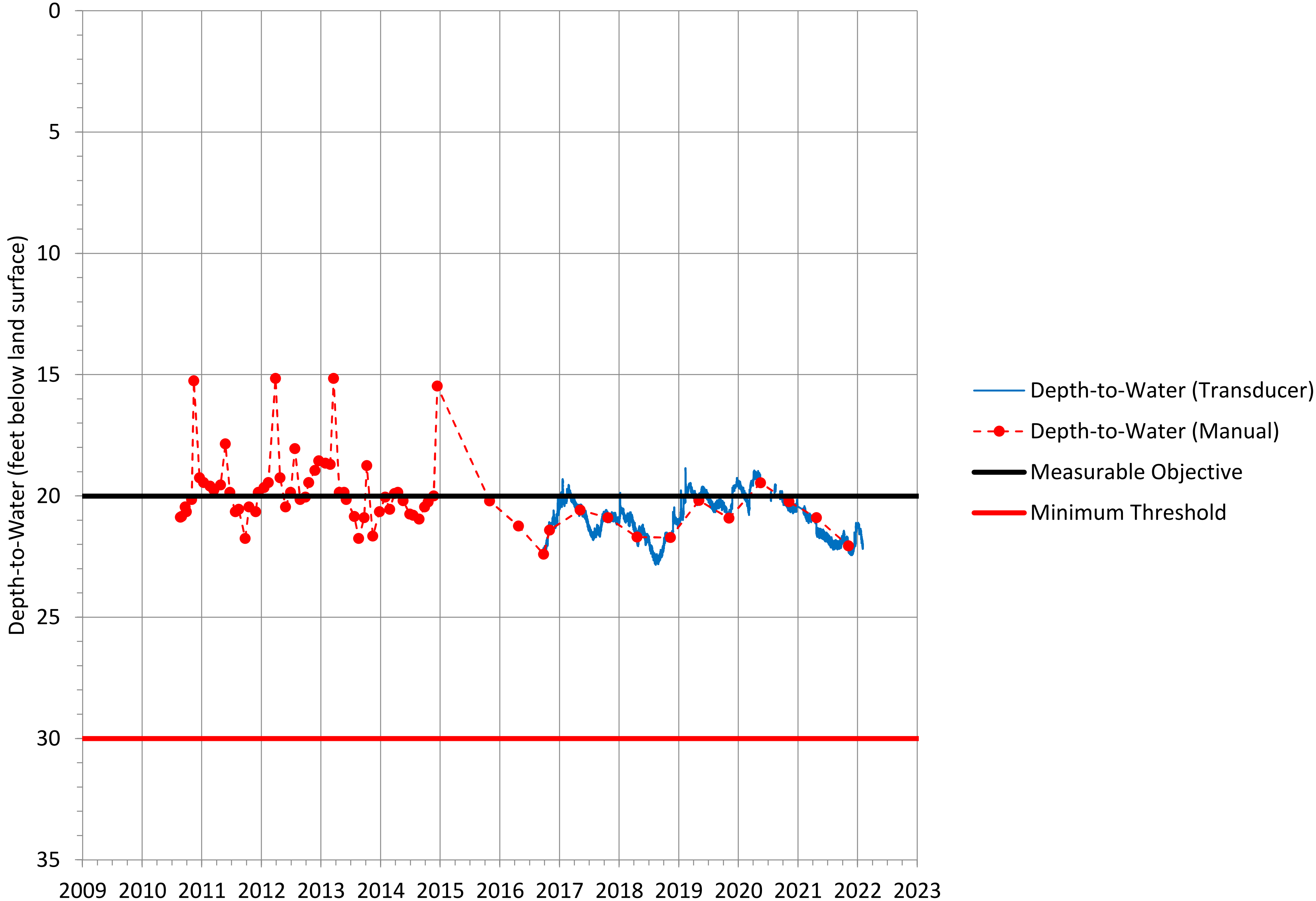
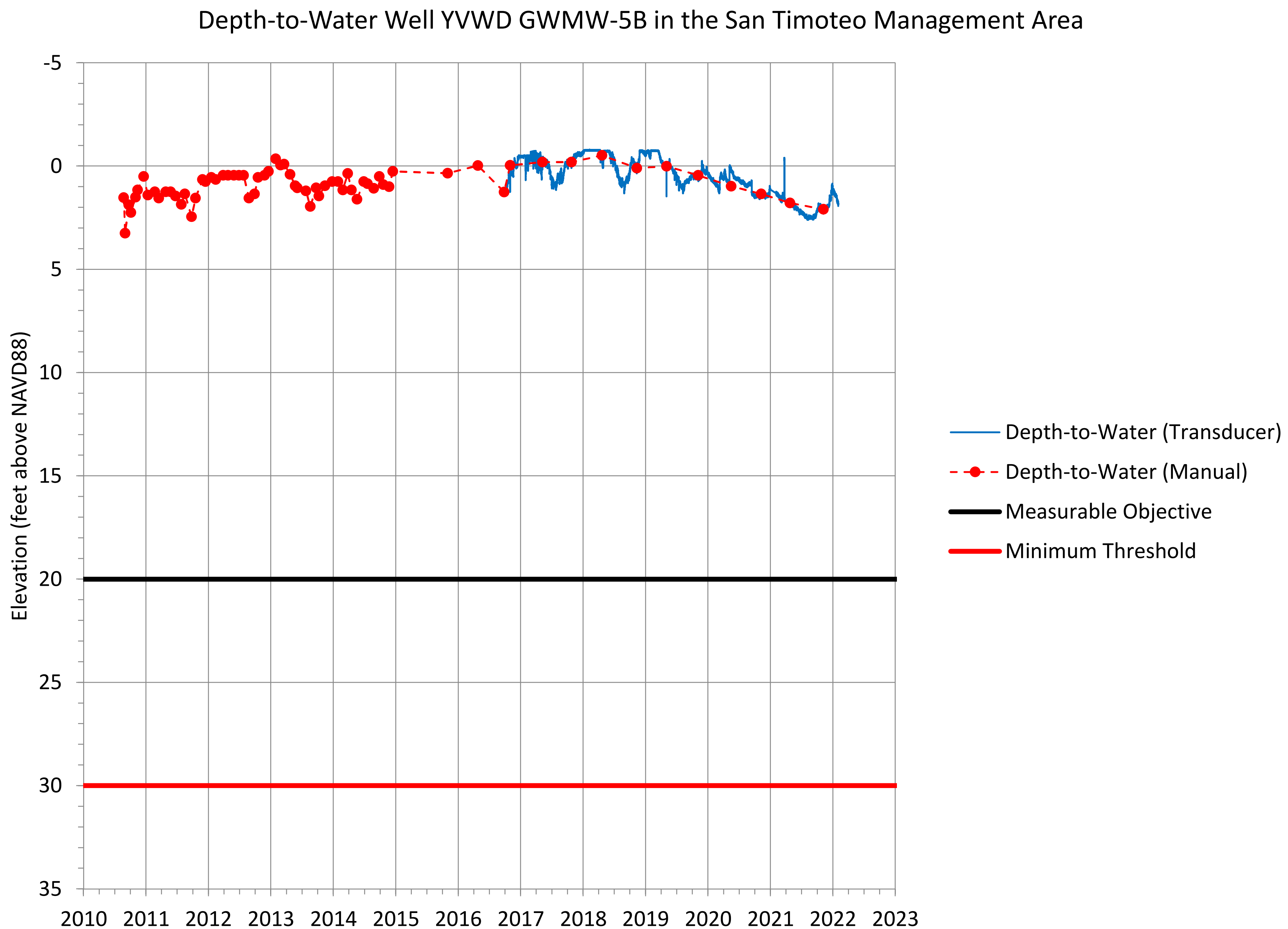


Figure A-71



Depth-to-Water Well YVWD GWMW-5B in the San Timoteo Management Area
Elevation (feet above NAVD88)
-5
0
5
10
15
20
25
30
35
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Depth-to-Water (Transducer)
Depth-to-Water (Manual)
Measurable Objective
Minimum Threshold

Figure A-72

No Hydrograph for YVWD GWMW-5C because well is artesian and no hydraulic heads have been measured to date. The Yucaipa GSA will look into measuring a pressure head at this well and convert it to hydraulic head to characterize conditions at the depth the well is screened (340’ to 360’ below land surface).

Figure A-73