March 2023

Modesto Subbasin

Annual Report WY 2022

Groundwater Sustainability Plan (GSP)

Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA) Groundwater Sustainability Agency

&

County of Tuolumne Groundwater Sustainability Agency

STANISLAUS & TUOLUMNE RIVERS GROUNDWATER BASIN ASSOCIATION AND COUNTY OF TUOLUMNE GROUNDWATER SUSTAINABILITY AGENCIES (GSAs)

Modesto Subbasin
Groundwater Sustainability Plan (GSP)

Second Annual Report

Water Year 2022

(October 2021 through September 2022)

March 22, 2023

TODD GROUNDWATER

Woodard & Curran

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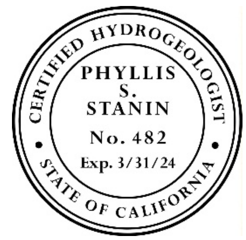

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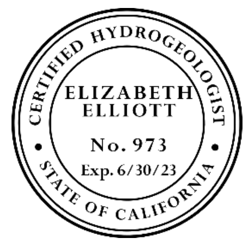

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Acronyms

AF	Acre-feet
AFY	Acre-feet per year
BMP	Best Management Practices
Brown Act	Ralph M. Brown Act
C2VSim	California Central Valley Groundwater-Surface Water Simulation Model
C2VSimTM	C2VSim-Turlock/Modesto; local model for Turlock and Modesto subbasins
CASGEM	California Statewide Groundwater Elevation Monitoring
CDEC	DWR California Data Exchange Center
cfs	Cubic Feet per Second
CGPS	Continuously Operating Global Positioning System
CIMIS	California Irrigation and Management Information System
COC	Constituent of Concern
DBCP	Dibromochloropropane
DMS	Data Management System
DNAPL	Dense Non-Aqueous Phase Liquid
DWR	Department of Water Resources, State of California
eWRIMS	SWRCB Electronic Water Rights Information Management System
GAMA	Groundwater Ambient Monitoring and Assessment Program, California
GSA	Groundwater Sustainability Agency
GSE	Ground surface elevation
GPS	Global Positioning System
GSP	Groundwater Sustainability Plan
IM	Interim Milestone
InSAR	Interferometric Synthetic Aperture Radar
IWFM	Integrated Water Flow Model
MA	Management Area
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MID	Modesto Irrigation District
mm	Millimeters
MO	Measurable Objective
msl	Mean Sea Level
MT	Minimum Threshold
NRCS	U.S. Natural Resources Conservation Service
OID	Oakdale Irrigation District
OSU	Oregon State University
PCE	Tetrachloroethylene

pCi/L	Picocuries per Liter
PRISM	Precipitation-Elevation Regressions on Independent Slopes Model
RMWs	Representative Monitoring Wells
SGMA	Sustainable Groundwater Management Act
STRGBA	Stanislaus and Tuolumne Rivers Groundwater Basin Association
STRGBA GSA	Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TCP	1,2,3-Trichloropropane
TDS	Total Dissolved Solids
Tuolumne GSA	The County of Tuolumne GSA
µg/L	Micrograms per liter
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WY	Water Year (October 1 through September 30)

EXECUTIVE SUMMARY

The Stanislaus and Tuolumne Rivers Groundwater Basin Association Groundwater Sustainability Agency (STRGBA GSA) and the County of Tuolumne Groundwater Sustainability Agency (Tuolumne GSA) jointly prepared this Second Annual Report (Annual Report) for the Modesto Subbasin (5-22.02), addressing groundwater and surface water conditions during Water Year (WY) 2022. This Annual Report is being submitted to the Department of Water Resources (DWR) by April 1, 2023, in accordance with regulatory requirements. Along with this annual report, the GSAs are submitting the DWR water use templates for groundwater extraction, groundwater extraction methods, surface water supply, and total water use for WY 2022.

This Annual Report includes an update of the local C2VSimTM model for WY 2022. This updated model provides the best available method for developing estimates of changes in groundwater in storage, groundwater extractions and surface water-groundwater interaction. Data from WY 2022 were collected from the same public and private sources that provided historical data through WY 2021 for the GSP and the First Annual Report. Updated components of the model include precipitation, evapotranspiration, land use, population, surface water operations, canal and reservoir recharge, groundwater pumping, stream inflow, and boundary conditions. Model results show that in WY 2022, the Modesto Subbasin experienced a decline in groundwater in storage of 172,200 AFY, primarily due to the critically dry hydrologic conditions. On average during WY 2022, deep percolation from rainfall and irrigation applied water (126,300 AFY) was the largest contributor of groundwater inflow to the Modesto Subbasin, while groundwater production (364,100 AFY) accounted for the largest outflow from the Modesto Subbasin.

Groundwater elevation data were compiled for this Annual Report for the GSP representative monitoring network wells (RMWs) in the three principal aquifers: Western Upper Principal Aquifer, Western Lower Principal Aquifer and Eastern Principal Aquifer. Groundwater level hydrographs were updated through WY 2022 (**Appendix A**) and groundwater elevation contour maps were developed to illustrate seasonal low (Fall 2021) and seasonal high (Spring 2022) groundwater elevations during the reporting period.

Since the 2012-2016 drought, groundwater elevations in the Western Upper Principal Aquifer have partially recovered and have been relatively stable in the last few years, with some declines during WY 2021 and WY 2022. Water levels in the western portion of the Eastern Principal Aquifer have declined since post-drought recovery, while water levels in the eastern portion of the Eastern Principal Aquifer are continuing to decline through WY 2022, with little to no post-drought recovery. Groundwater level trends in the Western Lower Principal Aquifer are less clear because of the lack of historical groundwater level data in the RMWs, but illustrate seasonal pumping fluctuations during WY 2022.

The hydrographs provided in **Appendix A** show available historical water levels from WY 1991 through the reporting period (WY 2022) for each RMW, along with the minimum thresholds (MTs) and measurable objectives (MOs), and in some cases the interim milestone (IM), established for each well. The Spring 2022 monitoring event was the first monitoring event following the adoption and submittal of the GSP and the adoption of monitoring protocols. As such, the Spring 2022 groundwater elevations were compared to the GSP sustainable management criteria (MTs and IMs) for analysis in this Annual Report.

Groundwater levels for the chronic lowering of groundwater levels indicator were below the MTs in 11 out of 58 wells measured in Spring 2022. Water levels were not below MTs in any wells in the Western Upper Principal Aquifer and water levels in 1 out of 5 wells in the Western Lower Principal Aquifer were below the MT. Water levels in 10 out of 36 wells measured in the Eastern Principal Aquifer were below the MTs in Spring 2022. Groundwater levels for the interconnected surface water monitoring network were below the MTs in 3 out of 19 RMWs measured. The MT exceedances occurred in 2 out of 8 wells measured along the Stanislaus River and 1 out of 9 wells measured along the Tuolumne River. Water levels were not below the MTs in either well along the San Joaquin River. During the Spring 2022 monitoring event, groundwater elevations were above the Interim Milestones (IMs) in all of the wells.

Groundwater elevation contour maps show similar groundwater flow patterns in Fall 2021 and Spring 2022 in the Western Upper Principal Aquifer and the Eastern Principal Aquifer. Groundwater highs are present in the eastern Subbasin and from these highs, groundwater flows towards the central part of the Subbasin and then to the west-southwest, with a southerly component towards the Tuolumne River in the central and eastern Subbasin. There are localized groundwater depressions and mounds in the central and western Subbasin in the vicinity of the City of Modesto. From Fall 2021 to Spring 2022, groundwater elevations increased an average of 0.8 feet. The largest increase occurred in the eastern Subbasin at MW-10 (+3.7 feet), with other notable increases in wells near Riverbank, Oakdale and Waterford. **Figure ES-1** illustrates groundwater elevation contours in the Western Upper and Eastern Principal Aquifer during Spring 2022.

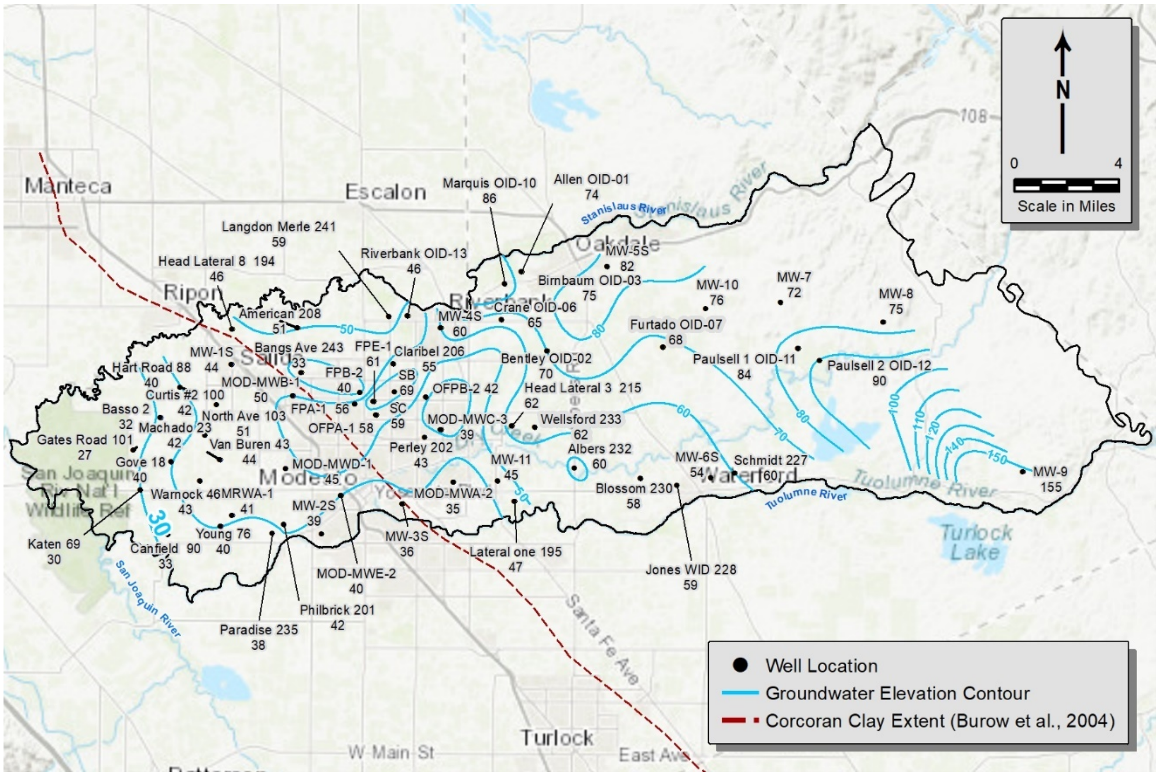

Figure ES-1 Groundwater Elevation Contours, Western Upper and Eastern Principal Aquifers, Spring 2022

Based on the limited groundwater elevation data in the Western Lower Principal Aquifer, groundwater flow direction in Fall 2021 was toward the south-southeast and the Tuolumne River, and to the northeast and the Stanislaus River. In Spring 2022, the groundwater elevation data are too similar for generating meaningful contours. From Fall 2021 to Spring 2022, groundwater elevations in the Western Lower Principal Aquifer decreased.

Total groundwater extractions in the Modesto Subbasin during WY 2022 were estimated to be 364,100 AFY. These estimates are based on directly measured groundwater extraction data collected by local water agencies and estimates for private pumping using the C2VSimTM model. During WY 2022, agricultural groundwater extraction accounts for 85% (310,800 AFY) of the total pumping in the Modesto Subbasin, while urban groundwater extraction accounts for the remaining 15% (53,300 AFY). Industrial water use is included in the urban water use for WY 2022. No known groundwater extraction is used for maintaining managed wetlands, used to supply managed recharge operations, or used for maintaining native vegetation in the Modesto Subbasin. **Figure ES-2** illustrates the distribution of groundwater extraction within the Modesto Subbasin during WY 2022. The pumping distribution generally corresponds to irrigated areas where demand is not met by surface water supplies.

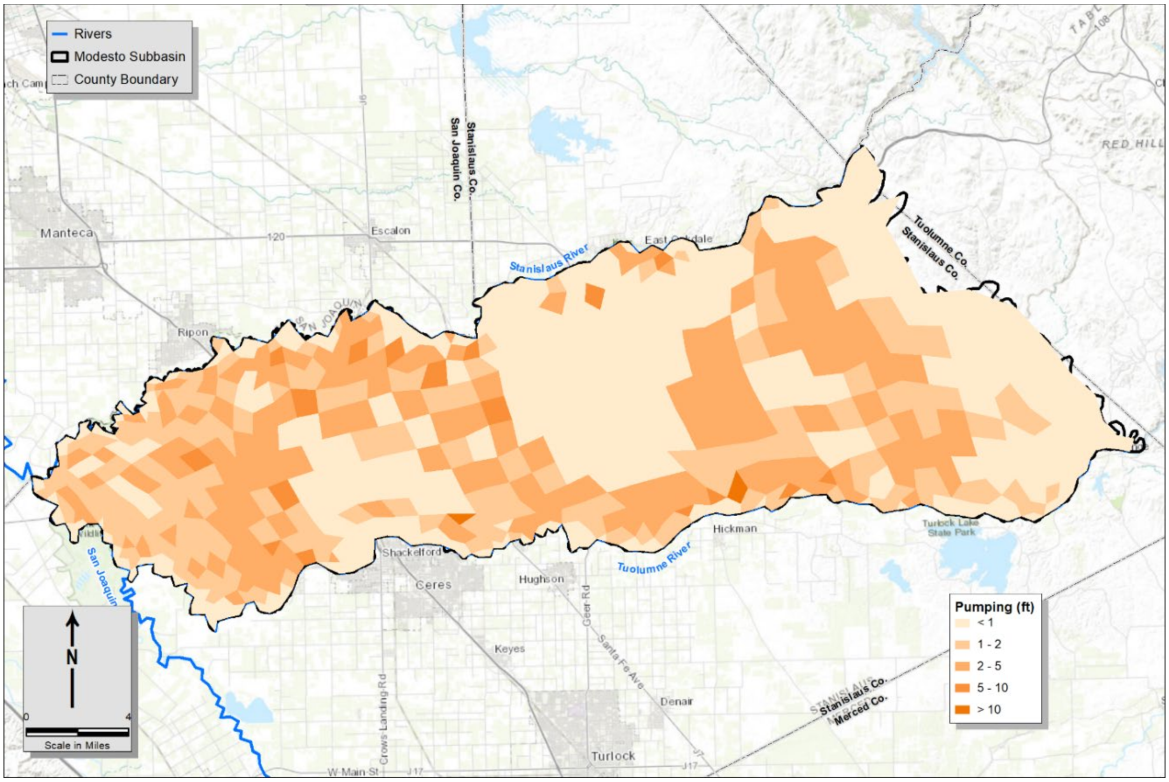

Figure ES-2 Groundwater Extractions, Modesto Subbasin WY 2022

Surface water supply in the Modesto Subbasin during WY 2022 was estimated to be 286,600 AFY. This surface water supply is comprised of Modesto Irrigation District (MID) and Oakdale Irrigation District (OID) deliveries and riparian deliveries. Direct measurements of surface water deliveries were provided by MID and OID, while riparian deliveries off the Stanislaus, Tuolumne and San Joaquin rivers are estimated by the State Water Resources Control Board (SWRCB) Electronic Water Rights Information Management System (eWRIMS) and the C2VSimTM model. **Figure ES-3** illustrates surface water deliveries in the Modesto Subbasin.

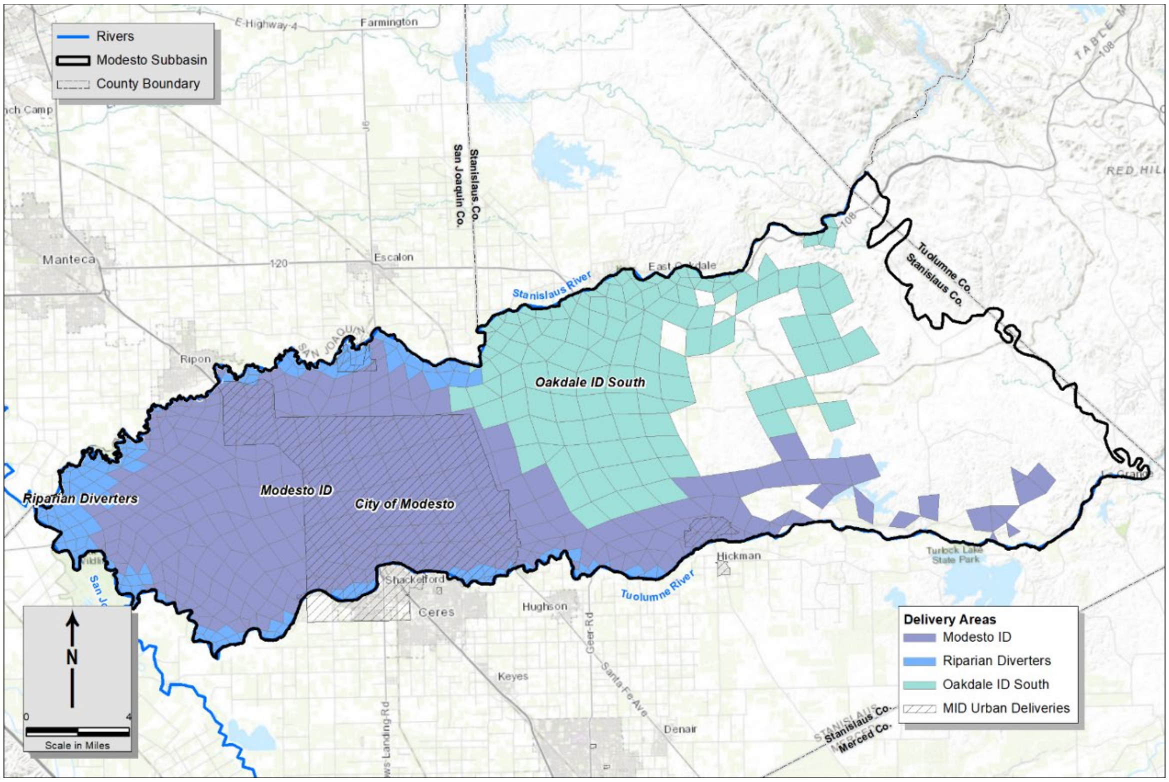

Figure ES-3 Surface Water Deliveries, Modesto Subbasin

During WY 2022, the total water use for the Modesto Subbasin was 650,700 AF. Groundwater extraction represents about 56% of the total supplies (364,100 AF), followed by surface water at 44% (286,600 AF). The total water supply for WY 2022 is summarized in **Table ES-1**.

Table ES-1: Total Water Use by Water Source for Water Year 2022 (in acre-feet)

	Groundwater[1]	Surface Water[2]	Other	Total Water Use
2022	364,100	286,600	0	650,700

1. *Includes "Agency" and "Private" pumping described in Section 4.*
2. *Includes "Measured" and "Estimated" surface water supplies described in Section 5.*

The total change in groundwater in storage during WY 2022 was estimated by the C2VSimTM model to be a decline of 172,200 AF. A change in groundwater in storage map for WY 2022 is provided as **Figure ES-4**. The figure shows that most of the Subbasin is losing storage during WY 2022, with higher rates of decline throughout MID and the Non-District

Areas, and with reduced impacts in parts of OID and along the eastern extent of the Stanislaus and Tuolumne rivers.

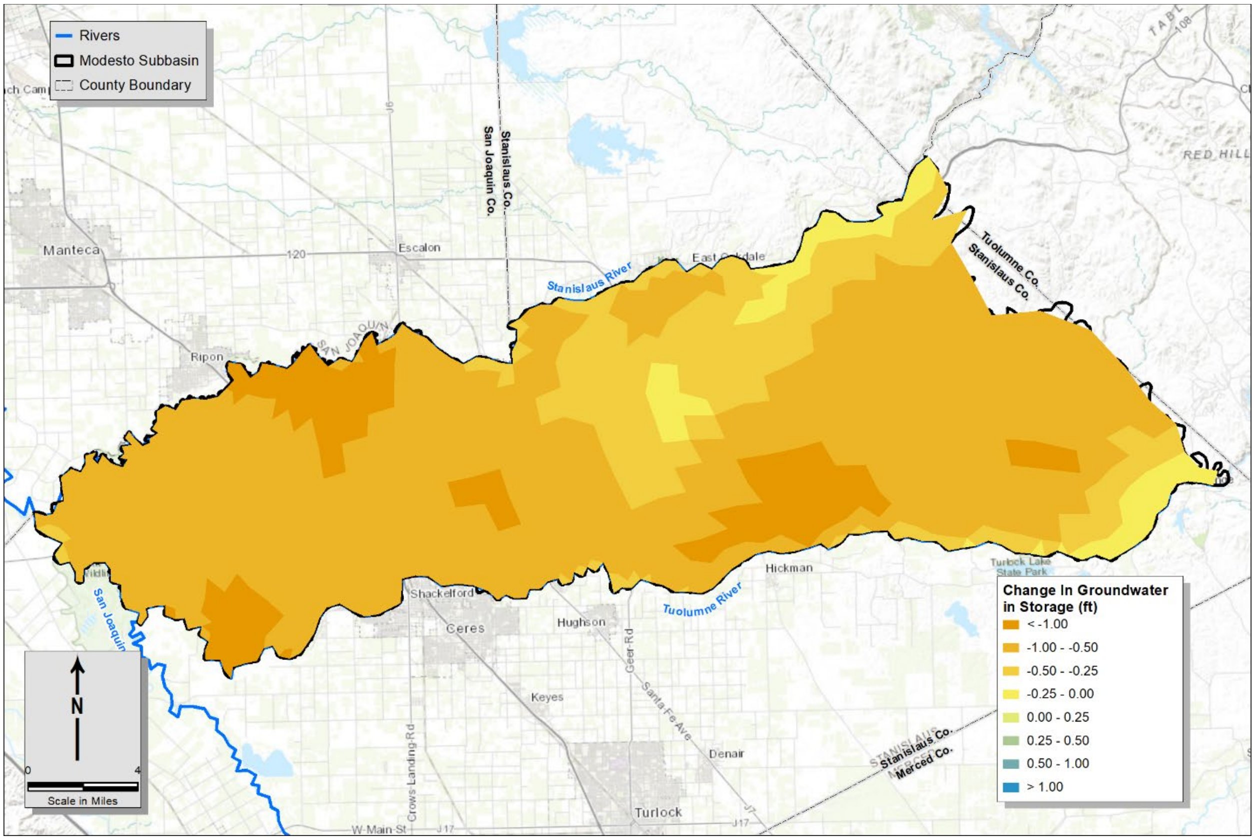

Figure ES-4 Change in Groundwater in Storage, Modesto Subbasin WY 2022

This Second Annual Report includes the first groundwater quality assessment following the baseline that was developed in the First Annual Report for WY 2021. The Modesto Subbasin GSP determined that an undesirable result for groundwater quality may be triggered when a Subbasin potable well in the monitoring network reports a new (first-time) exceedance of the MT (i.e., the primary or secondary California maximum contaminant level (MCL)), or a further exceedance of the MT, for any of the seven constituents of concern that results in increased operational costs and is caused by GSA management activities. The seven constituents of concern are arsenic, uranium, nitrate, 1,2,3-trichloropropane (TCP), dibromochloropropane (DBCP), tetrachloroethene (PCE), and total dissolved solids (TDS).

Data collected during WY 2022 for the seven COCs were downloaded from the State Groundwater Ambient Monitoring and Assessment Program (GAMA) Groundwater Information System through the State GeoTracker website. Water quality data collected during WY 2022 were compared to the baseline to determine if any new MCL exceedances, or further increases above the MCL, occurred. Five COCs met this criteria: arsenic, uranium, nitrate, TCP, and TDS. There were no MCL exceedances, or further increases above the MCL, for DBCP and PCE. Based on an analysis of historical water quality trends and nearby water levels, it is concluded that MT exceedances were not caused by GSA management activities, and therefore did not meet the definition of undesirable results. **Figure ES-5** illustrates nitrate during WY 2022 in the Western Upper and Eastern Principal Aquifers.

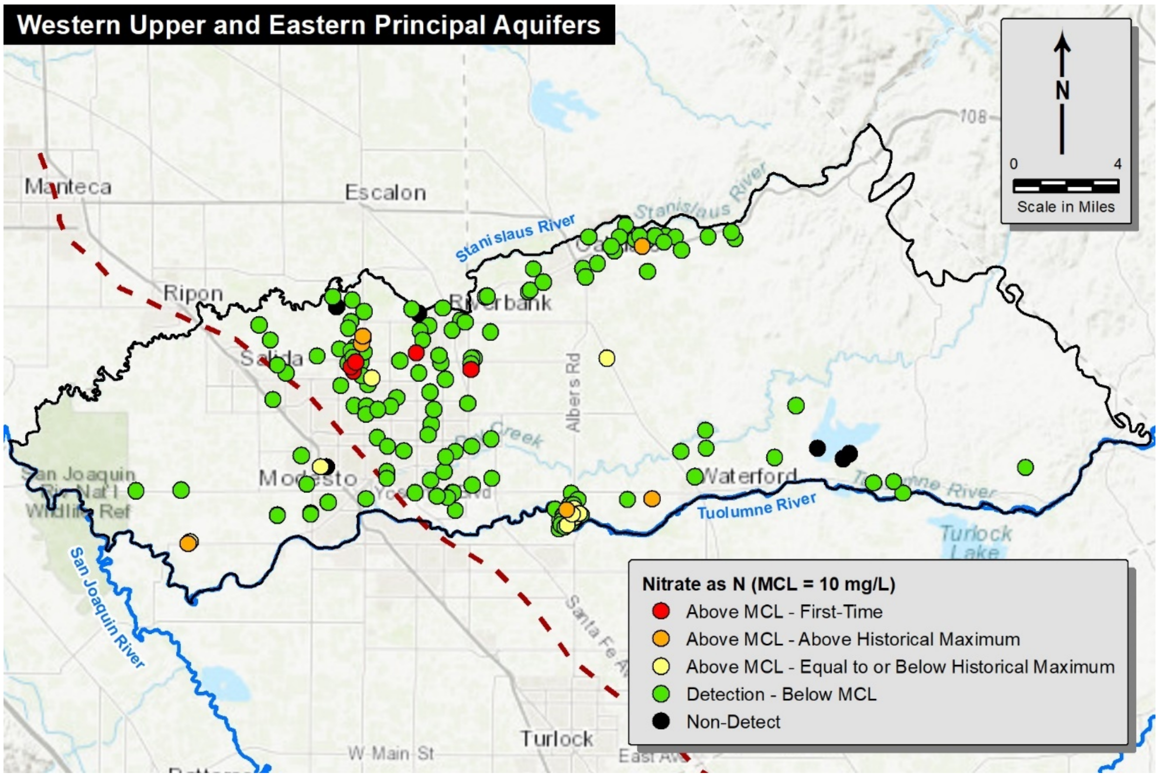

Figure ES-5 Nitrate in Groundwater, WY 2022

As described in the GSP, groundwater elevations are used as a proxy for a rate or extent of subsidence and remote sensing data is used as a screening tool to evaluate land subsidence. Groundwater levels in most of the monitoring network wells are above the MTs during WY 2022. Vertical displacement data collected using Interferometric Synthetic Aperture Radar (InSAR) by TRE Altamira Inc., under contract with DWR, indicates negative vertical displacement (indicating land subsidence) between 0 and -0.05 feet (0.6 inches) throughout most of the Subbasin. This is a relatively small amount and the mean amount is within the InSAR measurement error.

The C2VSimTM model was used to evaluate interconnected surface water during WY 2022. Model results show that during WY 2022, the Stanislaus River and the Tuolumne River are net losing streams and the San Joaquin River is a net gaining stream. Streamflow loss was 35,500 AFY along the Stanislaus River and 13,700 AFY along the Tuolumne River, while the

San Joaquin River gained approximately 12,500 AFY. During WY 2022, groundwater levels at 3 out of 19 RMWs in the monitoring network for interconnected surface water were below the MTS. Two of these RMWs are along the Stanislaus River and one is along the Tuolumne River. The GSAs recognize the need to improve the monitoring network for interconnected surface water and plan to construct additional monitoring wells along the rivers to support GSP implementation.

This annual report provides an update on GSP implementation progress. Because of the timing of this Second Annual Report, the first several months of the reporting period (October 2021 through January 2022) occurred prior to completion and adoption of the GSP at the end of January 2022. However, GSP implementation activities have been prioritized since the GSP was submitted. The GSAs conducted the first GSP monitoring event in Spring 2022 and uploaded the water level data to the SGMA portal. The GSAs have continued public outreach with regular monthly STRGBA GSA meetings and the first of a series of three public meetings for landowners in the Non-District East Management Area. Since GSP submittal, the landowners in the Non-District East Management Area have been meeting on a regular basis to plan and develop water supply projects. In November 2022, the Stanislaus East Mutual Water Company was formed and currently represents 16,000 acres in the Non-District East Management Area. GSP Project #6, the Oakdale Irrigation District (OID) In-lieu and Direct Recharge Project, is underway as well. This project consists of a 10-Year Out-of-District Water Sales Program in which over 6,000 irrigated acres in the Modesto Subbasin outside of OID's service area would purchase surplus surface water when available. OID, on behalf of the GSAs, also submitted a Round 2 Sustainable Groundwater Management Grant application to DWR in December 2022, with a request of approximately $18.6 million to fund design and construction of the expansion of OID's Paulsell Lateral. Should grant funds be awarded, OID's existing Paulsell Lateral would be expanded to increase the capacity of approximately 10 miles of open ditch, tunnel and culverts to increase flow from 30 cubic feet per second (cfs) up to 180 cfs thereby improving the level of service to OID's in-district lands and availability of surface water to surrounding out-of-district lands when available.

1 INTRODUCTION

Since the Modesto Subbasin Groundwater Sustainability Plan (GSP or Plan) was submitted on January 31, 2022, the two Groundwater Sustainability Agencies (GSAs) in the Subbasin have been implementing the GSP. An important part of GSP implementation is development of the GSP Annual Reports. The First GSP Annual Report was submitted to the Department of Water Resources (DWR) on March 31, 2022. This Second GSP Annual Report (Annual Report) is being submitted to the DWR by April 1, 2023, in accordance with regulatory requirements.

The Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA) GSA covers more than 99 percent of the Plan area and is taking the lead for Annual Report preparation. The County of Tuolumne GSA (Tuolumne GSA) is participating in GSP-related activities, including preparation of Annual Reports, through a Cooperation Agreement with the County of Stanislaus. The Annual Report covers the entire Modesto Subbasin as defined by DWR (5-22.02) and addresses groundwater and surface water conditions during Water Year (WY) 2022. The Modesto Subbasin and GSA boundaries are shown on **Figure 1-1**.

1.1 PURPOSE AND TIMING OF THE SECOND ANNUAL REPORT

Annual reporting is required by the GSP regulations and provides an opportunity to demonstrate to DWR and stakeholders that the GSP is being implemented in a manner that will achieve the Subbasin Sustainability Goal. This Annual Report is being prepared under the guidance of Water Code Section 10728 and GSP regulations (in particular, Article 7, §356) and generally follows the organization of the regulations to facilitate DWR review.

GSP regulations require an annual report to be submitted by April 1 of each year following GSP adoption (§356.2). Each report describes water conditions for the preceding water year. This Second Annual Report (2022 Annual Report) covers the preceding water year (WY) 2022, extending from October 1, 2021, to September 30, 2022 (reporting period). In addition, certain historical datasets are included to illustrate conditions prior to WY 2022. Specifically, regulations require groundwater elevation hydrographs and annual changes in groundwater in storage to be based on “historical data to the greatest extent available including from January 1, 2015, to the current reporting year” (§356.2 (b)(1)(B) and §356.2 (b)(5)(B)).

Modesto Subbasin GSP implementation activities have been underway since the GSP was submitted. The STRGBA GSA and member agencies have made significant progress on GSP projects as summarized in **Section 11** of this report.

1.2 MANAGEMENT AREAS

The Modesto Subbasin Management Areas are referenced throughout the Annual Report. As explained in the GSP, four Management Areas have been established to facilitate GSP implementation. Management Area (MA) boundaries are based on areas of similar water supplies and ongoing water management activities. These four MAs are summarized in **Table 1-1** below and illustrated on **Figure 1-2**.

Table 1-1: Modesto Subbasin Management Areas

Management Area	Size (acres)[1]	Description
Modesto ID Management Area	101,914	Western and southwestern portions of the Subbasin; consistent with Modesto ID service area boundaries.
Oakdale ID Management Area	49,893	Northern and northeastern portions of the Subbasin; consistent with Oakdale ID service area boundaries.
Non-District East Management Area	77,218	Eastern Subbasin lands outside of Modesto ID and Oakdale ID boundaries.
Non-District West Management Area	15,777	Narrow rim of lands along the three river boundaries in the western Subbasin outside of irrigation district boundaries.

[1] Management Area acres are based on GIS, and the total Subbasin acres are within one percent, but not identical, to the Subbasin total in previous DWR Bulletin 118 descriptions. Nonetheless, Management Areas cover the entire Subbasin, and approximate acres are shown here for relative comparisons.

Surface water supplies are available to supplement groundwater use in the Modesto ID, Oakdale ID, and Non-District West MA, including the Tuolumne River, Stanislaus River, and riparian diversions along the western river boundaries, respectively. Only the Non-District East Management Area relies almost solely on groundwater without dedicated and consistent surface water supplies. Accordingly, groundwater levels in the Non-District East MA have experienced the most significant and ongoing water level declines. GSP projects and management actions have targeted the Non-District East MA to arrest overdraft conditions and water level declines.

1.3 Approach

The GSAs updated the local C2VSimTM model for WY 2022 for this Second Annual Report. This integrated water resources model was derived from the DWR regional C2VSim model and modified with local data from the Turlock and Modesto subbasins for application to GSPs in each subbasin. The updated model provides a useful tool to meet regulatory requirements for certain historical data in this report and to support ongoing evaluations in the Subbasin. Additional information is provided in **Section 2**.

In addition to the model update, data from the various monitoring networks were compiled for the Annual Report. Groundwater elevation hydrographs were prepared for the representative monitoring wells (RMWs) and were compared to the sustainable management criteria.

Significant data compilation and analyses were conducted for this second Annual Report as summarized below:

- compilation of water level, water quality, water use, climate, land use, and subsidence data sets from member agencies, state agencies, and other sources for WY 2022,
- update of C2VSimTM integrated water resources model for WY 2022,
- preparation of groundwater elevation hydrographs for RMWs from WY 1991 through WY 2022 and comparison to sustainable management criteria,
- development of groundwater elevation contour maps for the seasonal low (Fall 2021) and high (Spring 2022) groundwater levels in each principal aquifer,
- tabulation of groundwater extractions, surface water supply, and total water use data for WY 2022 using DWR water use templates,
- mapping of groundwater extractions illustrating volumes and general locations (using C2VSimTM results to prepare the required map),
- updated analysis of water budgets, including graphical representations of annual and cumulative changes in groundwater in storage from WY 1991 through WY 2022,
- map presentation of groundwater in storage for WY 2022,
- extended analysis (in addition to groundwater elevations) for three sustainability indicators including:
    - degraded water quality analysis for WY 2022,
    - land subsidence screening analysis of InSAR data for WY 2022,
    - interconnected surface water and streamflow depletion analysis using the updated C2VSimTM model for WY 2022
- documentation of GSP implementation support activities and descriptions of early progress on projects and management actions.

1.3.1 Data Compilation

Data described in the previous section were compiled from numerous sources. Climate data, water quality, land use, and remote sensing data were compiled primarily from state agencies and other public resources. Much of the water level, surface water supply, groundwater extractions, and total water use information were provided by GSA member agencies, who cooperated to provide local data to support the Annual Report (see **Figure 1-3)**. Specific data compiled for each of the required elements and analyses are further described in each associated section in the Annual Report.

1.3.2 DWR Water Use Templates

DWR has provided Microsoft Excel© templates for agencies to report Subbasin-wide groundwater extraction data and measurement methods, surface water supplies, and total water use; GSAs are required to use these templates to support consistent statewide data reporting. A description of the data provided for these templates is included in the following sections.

- **Part A. Groundwater Extractions** – Description of groundwater extractions by water use sector data (23 CCR §356.2(b)(2)) is presented in **Section 4**.
- **Part B. Groundwater Extraction Methods** – Description of groundwater extraction measurement methods (23 CCR §356.2(b)(2)) is presented in **Section 4**.
- **Part C. Surface Water Supply** – Description of surface water supply by water source type (23 CCR §356.2(b)(3)) is presented in **Section 5.**
- **Part D. Total Water Use** – Description of total water supply and use (23 CCR §356.2(b)(4)) is presented in **Section 6**.

As part of the submission of this Annual Report, these data templates will be uploaded to the DWR SGMA Portal.

1.3.3 Progress on Plan Implementation

As required by the regulations, **Section 11** describes progress on GSP implementation. The section includes a summary of GSP implementation support activities as well as activities regarding projects and management actions. As demonstrated by the descriptions, GSP implementation is well underway.

1.4 Report Organization

This Annual Report is organized by the regulatory-required components presented in Article 7 of the GSP regulations. These components include groundwater elevations (**Section 3**), groundwater extractions (**Section 4**), surface water supply (**Section 5**), total water use (**Section 6**), and change in groundwater in storage (**Section 7**). Additional monitoring for sustainable management criteria and focused technical analyses are included for several of the sustainability indicators including degraded water quality (**Section 8**) , land subsidence (**Section 9**) and interconnected surface water (**Section 10**). As mentioned previously, **Section 11** provides a narrative description of progress on GSP implementation. The model update is documented in **Section 2**.

1.5 Limitations

This Second GSP Annual Report presents inherent limitations because part of the Reporting Period (Fall 2021) occurred prior to completion and adoption of the GSP. Although most RMWs have a historical record, there are new monitoring wells in the monitoring networks that were installed during GSP preparation to support ongoing GSP monitoring. Accordingly, some RMWs have limited water level data. In addition, the GSP recognizes that the monitoring networks contain data gaps and present plans for addressing these in subsequent years of the GSP implementation period.

The Modesto Subbasin GSAs are collectively committed to successful GSP implementation and attainment of the Subbasin Sustainability Goals. Substantial compliance with the requirements of this Annual Report and the GSP is demonstrated throughout the document.

1.6 ANNUAL REPORT PREPARATION AND SUBMITTAL

As required in §353.4, this Second GSP Annual Report for the Modesto Subbasin is being submitted electronically to DWR through its online reporting system (SGMA Portal) at https://sgma.water.ca.gov/portal/, using forms and submittal instructions provided by DWR (§353.2).

This Annual Report has been prepared by Todd Groundwater and Woodard & Curran on behalf of STRGBA GSA and Tuolumne GSA, with oversight and submittal by Plan Manager Eric Thorburn. The GSAs Technical Advisory Committee (TAC) Planning Group – composed of a subset of TAC members – coordinated data requests and provided additional guidance on Annual Report preparation.

This Annual Report was reviewed for GSA member agencies, stakeholders, and the public in a STRGBA GSA public meeting held on March 29, 2023, prior to submittal to DWR by the April 1, 2023, deadline.

2 C2VSimTM UPDATE (WATER YEAR 2022)

The C2VSimTM integrated surface water-groundwater model was developed as part of the Modesto Subbasin Groundwater Sustainability Plan to simulate historical and projected hydrologic conditions for the surface, stream, and groundwater systems. The original model in the GSP included water years 1991-2015 and was updated last year through WY 2021, for the First Annual Report, and through WY 2022 for this Annual Report. For the 2022 update, data were collected from federal, state, and local sources. As a result of the model update, an extended historical water budget was generated, including refined estimates for stream-aquifer interaction, pumping, and change in groundwater in storage.

The extension of the historical water budget is intended to verify and further evaluate the aquifer system under a variety of hydrologic and anthropogenic conditions. This update is important to the management of the aquifer system as it reflects conditions and operations of the Subbasin following GSP adoption and submittal. The annual groundwater budget for water years 1991-2022 is presented in **Section** Error! Reference source not found..

Data Sources

Data were requested and received from the following entities within the Modesto Subbasin to complete the C2VSimTM update:

Local Water Agencies:

- Modesto Irrigation District
- Oakdale Irrigation District
- City of Modesto
- City of Oakdale
- City of Riverbank
- City of Waterford

Additionally, publicly available data were downloaded from the following sources to complete the C2VSimTM update:

- DWR SGMA Data Viewer
- DWR California Data Exchange Center (CDEC)
- California Irrigation Management Information System (CIMIS)
- California State Water Resources Control Board (SWRCB)
- Oregon State University Climate Group (OSU)
- United States Natural Resources Conservation Service (NRCS)
- United States Geological Survey (USGS)
- United States Census Bureau

2.1 UPDATED COMPONENTS

The sources summarized above provided the necessary data to update the historical model to reflect the most recent conditions. The following components of the model were updated for the 2022 Annual Report.

Precipitation: Monthly precipitation in the Subbasin and its watersheds was derived on a four-kilometer grid using the Precipitation-Elevation Regressions on Independent Slopes Model (PRISM) dataset available online from Oregon State University, through a partnership with the U.S. Natural Resources Conservation Service (NRCS) National Water and Climate Center.

Land Use: Each element within the C2VSimTM is comprised of some fraction of 24 land use categories, including 20 agricultural crops, refuge, native vegetation, riparian vegetation, and urban. For the 2022 update, spatial land use data was downloaded from the DWR SGMA Data Viewer and incorporated into IWFM.

Population: The population for each municipality was provided by that municipality for WY 2022. For the model development in the GSP, rural populations were extracted from census block data. However, at the time of data collection, these had not yet been updated by the US Census for 2022. For this model update, populations were projected based on historical trends and will be revised, if needed, when data becomes available.

Surface Water Operations: Monthly surface water flows were provided from October 2021 through September 2022 by Modesto Irrigation District (MID) and Oakdale Irrigation District (OID). These operational flows included diversions, deliveries, spills, seepage, and evaporative losses. Non-district water, including riparian diversions and recycled water supplies were provided by the California State Water Resources Control Board (SWRCB) Electronic Water Rights Information Management System (eWRIMS) and the City of Modesto, respectively.

Groundwater Pumping: Groundwater extractions from October 2021 to September 2022 were provided by the agricultural and municipal entities listed above. Agency groundwater production was simulated on a monthly timestep using measured data at each production well. Pumping estimates were made for private agriculture and domestic wells based on a variety of operational parameters including land use, surface water availability, and population.

Streamflow: Monthly inflow to the Modesto Subbasin from the Tuolumne River was provided by MID and was downloaded for the Stanislaus River and the San Joaquin River from CDEC. Streamflow associated with non-gauged tributaries within and adjacent to the Subbasin were estimated using a combination of the Integrated Water Flow Model (IWFM) rainfall-runoff and small-watershed package.

Boundary Conditions: Biannual groundwater elevation contours were downloaded from DWR's SGMA Data Viewer for water year 2022 and used to update the groundwater elevation boundary conditions in the model. As groundwater level contours are only available in semiannual intervals, intermediary months were estimated though linear interpolation.

2.2 MODELED RESULTS: WY 2022 GROUNDWATER BUDGET

Evaluation of the 2022 water year shows that the Modesto Subbasin experienced net 191,900 AF of inflows and 364,100 AF of outflows. Deep percolation from rainfall and irrigation applied water (126,300 AFY) is the largest contributor of groundwater inflow, followed by net-recharge from the canal and reservoir system (48,200 AFY), net-inflow from the stream system (36,800 AFY) and inflow from the Sierra Nevada foothills (4,200 AFY). Groundwater production (364,100 AFY) accounts for the greatest outflow from the Modesto Subbasin, followed by net-subsurface flow (23,600 AFY). In WY 2022, the Modesto Subbasin experienced a decline in groundwater in storage of 172,200 AFY. Details of the model results are provided in **Section** Error! Reference source not found..

3 GROUNDWATER ELEVATIONS

Historical groundwater elevations for GSP monitoring wells in the Modesto Subbasin have been compiled for the 2022 Annual Report to provide the following:

- Water level hydrographs to illustrate long-term trends and fluctuations and to compare water levels to sustainable management criteria (**Appendix A**).
- Water level contour maps for Modesto Subbasin principal aquifers illustrating the seasonal high and seasonal low levels during the reporting period (i.e., Fall 2021 and Spring 2022).

3.1 Groundwater Elevation Monitoring Network

The Modesto Subbasin developed monitoring networks for the five sustainability indicators applicable to the Subbasin[1]. Four of the five sustainability indicators use groundwater elevations for the sustainable management criteria. In addition to the chronic lowering of water levels, groundwater elevations were demonstrated in the GSP to be an appropriate proxy for reduction of groundwater in storage, land subsidence, and interconnected surface water. Degraded water quality is the only applicable indicator that does not rely on groundwater elevations for minimum thresholds (MTs) and measurable objectives (MOs). This reliance on groundwater elevations emphasizes the importance of the GSP groundwater elevation monitoring network for GSP implementation.

Figures 3-1 through **3-4** illustrate the groundwater elevation monitoring networks and include the RMWs in each principal aquifer. The GSP defined three principal aquifers for the Modesto Subbasin as listed in **Table 3-1**.

Table 3-1: Local Principal Aquifers in the Modesto Subbasin

Principal Aquifer	Subbasin Area
Western Upper Principal Aquifer	Western Subbasin above the Corcoran Clay
Western Lower Principal Aquifer	Western Subbasin below the Corcoran Clay
Eastern Principal Aquifer	Central and eastern Subbasin outside of the Corcoran Clay extent

Management Areas are included on the maps for reference. **Figures 3-1** through **3-3** show the groundwater elevation monitoring networks for chronic lowering of water levels, which also serve as a proxy for the reduction of groundwater in storage, and land subsidence

[1] Seawater intrusion was determined to not be present and not likely to occur in the inland Modesto Subbasin (as explained in the Modesto Subbasin GSP, Section 6.5).

indicators. **Figure 3-4** provides the groundwater elevation monitoring network for interconnected surface water.

Each RMW on the monitoring network maps (**Figures 3-1** through **3-4**) includes the MTs and MOs that have been assigned to each. Hydrographs for these wells are provided in **Appendix A**.

Groundwater elevations are collected by various member agencies of the GSAs according to the adopted monitoring protocols documented in the Modesto Subbasin GSP. Monitoring protocols considered Best Management Practices (BMPs), as well as protocols from existing monitoring programs in the Subbasin such as CASGEM[2], the City of Modesto, and previous USGS monitoring efforts.

Monitoring protocols adopted as part of the GSP require that water levels be measured within the two time periods established to capture the annual seasonal high and low water levels as follows:

- February 1st to April 15th, representing the seasonal high water levels.
- September 1st to November 30th, representing the seasonal low water levels.

These relatively long time periods have been established to provide flexibility to the GSAs to capture the high and low water levels during years of varying hydrologic conditions. GSAs intend to coordinate sampling events within a relatively narrow window of time within the larger time frames above based on then-current conditions and anticipated irrigation schedules and surface water deliveries. The timing of these activities can vary significantly from wet years to dry years and can affect the timing of seasonal high and low water levels within the Subbasin.

The reporting period for this Second Annual Report (WY 2022) includes water levels from Fall 2021 before the GSP, monitoring network, and monitoring protocols were adopted. The reporting period also includes the first GSP monitoring event following GSP adoption and submittal, which was conducted in Spring 2022. Groundwater elevations measured during these monitoring events are discussed in **Section 3.3** below.

3.2 WATER YEAR TYPE

To provide context for the analysis of groundwater elevations throughout the historical Study Period (WY 1991 through WY 2015) and subsequent years (WY 2016 through WY 2022), the natural hydrologic conditions for the associated water years have been tabulated. DWR developed a hydrologic classification index based on a runoff analysis for the San Joaquin Valley by water year dating back to 1901. These indices provide a consistent

[2] California Statewide Groundwater Elevation Monitoring (CASGEM) program.

methodology for comparing water year types to the groundwater elevation hydrographs from WY 1991 through WY 2022 for this Annual Report.

Figure 3-5 illustrates the water year type as classified by the San Joaquin Valley Index compared to the annual precipitation as measured in the western Modesto Subbasin at MID's weather station. Precipitation amounts from WY 1990 through WY 2022 are color-coded to indicate the respective water year type. Because the DWR-designated index is based on a runoff analysis from the San Joaquin River, the water year type does not correlate directly to the number of inches of precipitation in the Modesto Subbasin. However, the annual precipitation totals provide a reasonable match to water year types for most years. Water year types illustrated on **Figure 3-5** are summarized in **Table 3-2**.

Table 3-2: San Joaquin Valley Water Year Index

Water Year	Water Year Type San Joaquin Valley Water Year Index	Water Year	Water Year Type San Joaquin Valley Water Year Index
1990	Critically Dry	**2007**	Critically Dry
1991	Critically Dry	**2008**	Critically Dry
1992	Critically Dry	**2009**	Below Normal
1993	Wet	**2010**	Above Normal
1994	Critically Dry	**2011**	Wet
1995	Wet	**2012**	Dry
1996	Wet	**2013**	Critically Dry
1997	Wet	**2014**	Critically Dry
1998	Wet	**2015**	Critically Dry
1999	Above Normal	**2016**	Dry
2000	Above Normal	**2017**	Wet
2001	Dry	**2018**	Below Normal
2002	Dry	**2019**	Wet
2003	Below Normal	**2020**	Dry
2004	Dry	**2021**	Critically Dry
2005	Wet	**2022**	Critically Dry
2006	Wet		

As described in the GSP, WY 1991 through WY 2015 represents average hydrologic conditions and is characterized by a series of wet and dry years over a relatively long period of time. As indicated in **Table 3-2** and on **Figure 3-5**, that period begins and ends with a series of critically dry years indicating severe drought conditions. Since WY 2015, water year types indicate a series of intervening wet/dry years. WY 2021 and WY 2022 were critically dry years.

Because WY 2016 through WY 2022 follows a severe drought, groundwater levels were already at or near historical lows. Without consecutive wet years since WY 2016, groundwater elevations have not fully recovered, and in some areas, continue to decline.

3.3 GROUNDWATER ELEVATIONS WY 1991 – WY 2022

Available water level data through WY 2022 from RMWs have been compiled in DWR water level templates and uploaded onto the SGMA portal. Water level data collected during the Fall 2022 monitoring event are included in the analysis for completeness but are not part of the current reporting period. All monitoring data have been stored in the Modesto Subbasin Data Management System (DMS).

3.3.1 Hydrograph Development

Groundwater elevation data described above were used to generate water level hydrographs for RMWs where MTs and MOs have been established. GSP regulations require that hydrographs use "historical data to the greatest extent available, including from January 1, 2015, to current reporting year" (§356.2(b)(1)(B)). For this GSP Annual Report for the Modesto Subbasin, the time period from WY 1991 through WY 2022 (reporting period) was chosen to meet GSP requirements and allow for consistent hydrograph development. As described previously, this 32-year period includes the historical GSP Study Period (WY 1991 – WY 2015) and subsequent years for C2VSimTM model updates.

Hydrographs for the RMWs are provided in **Appendix A** in two groups: 1) wells that are in the monitoring network for chronic lowering of groundwater levels, reduction of groundwater in storage, and land subsidence (total 61 RMWs), and 2) wells in the monitoring network for depletions of interconnected surface water (total 20 RMWs). Some Group 1 wells are repeated in Group 2 to illustrate all MTs associated with each monitoring network.

In compliance with GSP regulations Article 4, the hydrographs are submitted electronically and labeled with a unique site identification number (Site Code and Local Identifier/RMW#), monitoring agency, and the ground surface elevation (GSE). In addition, hydrographs have incorporated the same datum and scaling to the greatest extent practical (§352.4(e)). Some vertical scales are adjusted to allow the GSE, MT, and MO to be displayed (**Appendix A**).

The 2022 Annual Report includes 81 hydrographs for RMWs in the combined networks in **Appendix A**. For each hydrograph, a solid black horizontal line shows the GSE, and the MT is represented by an orange line, the MO is represented by a green line, and, where applicable, the Interim Milestone (IM) is represented by a blue line. Groundwater elevation data are shown in blue.

3.3.2 Water Level Trends and Fluctuations

Example hydrographs were selected from **Appendix A** to illustrate long-term trends and seasonal fluctuations for the various principal aquifers and management areas. Selected RMW hydrographs are illustrated on **Figure 3-6**.

Trends and fluctuations in the Subbasin throughout the historical study period were discussed in detail in the GSP; that discussion is not repeated here. However, in general, water levels in the Western Upper Principal Aquifer are relatively stable, especially along the western Subbasin boundary near the San Joaquin River. Water levels in the Eastern Principal Aquifer have exhibited more historical declines. Some recovery has occurred since the 2012-2015 drought in the western region of the Eastern Principal Aquifer, but water levels remain below pre-drought levels. Water level records in the eastern region of the Eastern Principal Aquifer indicate historical declining groundwater level trends since about the mid-2000s, with significant declines during the recent drought.

Since WY 2015, the end of the historical GSP Study Period, water levels in the Western Upper Principal Aquifer partially recovered and have been relatively stable or have declined again since that time (see hydrographs Canfield, Machado, and North Ave 103 on **Figure 3-6**). Similar patterns have persisted in WY 2022.

Water levels in the western region of the Eastern Principal Aquifer exhibit a similar pattern of post-drought recovery as the Western Upper Principal Aquifer. Water levels recovered somewhat after the drought but have since declined, and this declining trend has continued during WY 2022 (see Bangs and Cavil hydrographs, **Figure 3-6**). Water levels in the eastern portion of the Eastern Principal Aquifer continued to decline through WY 2022 (see Furtado and Paulsell-2 hydrographs, **Figure 3-6**).

There are five RMWs in the Western Lower Principal Aquifer. Water levels measured in four of the five RMWs during WY 2022 exhibit seasonal pumping fluctuations (MW-1D, MW-2D, MOD-MWB-2, and MOD-MWD-3, see wells on **Figure 3-2**). In general, water levels were relatively low in Summer 2021, rebounded in Fall 2021, and then declined in Summer 2022 (see hydrographs in **Appendix A**). During WY 2022, the GSAs were able to gain access to USGS well MRWA-3, which was measured during the Spring 2022 monitoring event for the first time since 2010 (**Figure 3-2**).

3.3.3 Compliance with Sustainable Management Criteria

As mentioned previously, hydrographs in **Appendix A** and on **Figure 3-6** show the MTs and MOs established for that RMW. As explained in the GSP, the historical low water level are the MTs for most RMWs in the monitoring networks. To provide context for these sustainable management criteria, **Table 3-3** summarizes how the MTs and MOs are defined for each applicable sustainability indicator in the GSP. The GSP provides the analysis and justification for the MTs and MOs, and how they are used to inform the definition of undesirable results for the Subbasin.

Table 3-3: Sustainable Management Criteria Summary

Sustainability Indicator	Minimum Thresholds (MTs)	Measurable Objectives (MOs)
Chronic Lowering of Groundwater Levels	Historic low groundwater elevation observed or estimated during WY 1991 – WY 2020 at each representative monitoring location, based on available data.	Midpoint between the historical high groundwater elevation and the MT at each representative monitoring location.
Reduction of Groundwater in Storage	Historic low groundwater elevation observed or estimated during WY 1991 – WY 2020 at each representative monitoring location, based on available data. (Chronic Lowering of Groundwater Levels as a proxy.)	Midpoint between the historical high groundwater elevation and the MT at each representative monitoring location. (Chronic Lowering of Groundwater Levels as a proxy.)
Degraded Water Quality	Minimum thresholds are set as the primary or secondary California maximum contaminant level (MCL) for each of seven (7) constituents of concern (COCs): • Nitrate (as N) - 10 mg/L • Arsenic - 10 ug/L • Uranium - 20 pCi/L • Total dissolved solids (TDS) - 500 mg/L • Dibromochloropropane (DBCP) - 0.2 ug/L • 1,2,3-Trichloropropane (TCP) - 0.005 ug/L • Tetrachloroethene (PCE) - 5 ug/L.	Historical maximum concentration of each constituent of concern (COC) at each representative monitoring location.
Inelastic Land Subsidence	Historic low groundwater elevation observed or estimated during WY 1991 – WY 2020 at each representative monitoring location, based on available data. (Chronic Lowering of Groundwater Levels as a proxy.)	Midpoint between the historical high groundwater elevation and the MT at each representative monitoring location. (Chronic Lowering of Groundwater Levels as a proxy.)
Interconnected Surface Water	Low groundwater elevation observed in Fall 2015 at each representative monitoring location.	Midpoint between the historical high groundwater elevation and the MT at each representative monitoring site.

A mentioned previously, the WY 2022 reporting period for this Second Annual Report includes data from Fall 2021 – a time period before the final monitoring networks, protocols, and GSP had been adopted. As such, the Fall 2021 measurements pre-date the initiation of GSA management in the Subbasin. The Spring 2022 monitoring event was the first GSP monitoring event following GSP adoption and submittal; accordingly, it is the focus for evaluation of the sustainable management criteria.

A comparison of groundwater elevations in Spring 2022 to the sustainable management criteria is provided in **Table 3-4** on the following pages. Maps showing MT comparison during the Spring 2022 monitoring event for the groundwater elevation monitoring network in each principal aquifer and for the interconnected surface water monitoring network are shown on **Figures 3-7 through 3-10**.

Table 3-4: Comparison of Groundwater Elevations to Sustainable Management Criteria Modesto Subbasin

			Spring 2022 Monitoring Event	
Local Well Name	**Minimum Threshold (MT) (feet msl)**	**Interim Milestone (IM) (feet msl)**	**Groundwater Elevation Below MT? (yes/no)**	**Groundwater Elevation Below IM? (yes/no)**
Western Upper Principal Aquifer				
Canfield 90	32	--	no	--
Curtis #2 100	34	--	no	--
Gates Road 101	24	--	no	--
Hart Road 88	35	--	no	--
Katen 69	27	--	no	--
Machado 23	31	--	no	--
North Ave 103	41	--	no	--
Paradise 235	34	--	no	--
Philbrick 201	34	--	no	--
Van Buren 43	38	--	no	--
Warnock 46	35	--	no	--
Young 76	36	--	no	--
MOD-MWB-1	40	--	no	--
MOD-MWD-1	30	--	no	--
MRWA-2	36	--	no	--
MW-1S	33	--	no	--
MW-2S	34	--	no	--
Summary - Western Upper Principal Aquifer				
		Above	17	--
		Below	0	--
		Not Measured	0	--
		% Below (includes measured wells)	0%	--

Western Lower Principal Aquifer				
MOD-MWB-2	26	--	no	--
MOD-MWD-3	30	--	no	--
MRWA-3	28	--	no	--
MW-1D	14	--	no	--
MW-2D	35	--	Yes	--
Summary - Western Lower Prinicpal Aquifer				
		Above	4	--
		Below	1	--
		Not Measured	0	--
		% Below (includes measured wells)	20%	--

Table 3-4: Comparison of Groundwater Elevations to Sustainable Management Criteria Modesto Subbasin

Local Well Name	Minimum Threshold (MT) (feet msl)	Interim Milestone (IM) (feet msl)	Spring 2022 Monitoring Event: Groundwater Elevation Below MT? (yes/no)	Spring 2022 Monitoring Event: Groundwater Elevation Below IM? (yes/no)
Eastern Principal Aquifer				
Albers 232	60	--	no	--
Allen OID-01	72	61	no	no
American 208	48	--	no	--
Bangs Ave 243	32	--	no	--
Bentley OID-02	71	56	Yes	no
Birnbaum OID-03	72	61	no	no
Blossom 230	61	--	Yes	--
Cavil 214	53	--	NM	--
Claribel 206	49	--	no	--
Crane OID-06	66	55	Yes	no
Furtado OID-07	69	51	Yes	no
Head Lateral 3 215	56	--	no	--
Head Lateral 8 194	40	--	no	--
Jones WID 228	55	--	no	--
Langdon Merle 241	50	--	no	--
Lateral one 195	42	--	no	--
Marquis OID-10	85	78	no	no
Paulsell 1 OID-11	88	53	Yes	no
Paulsell 2 OID-12	94	58	Yes	no
Perley 202	36	--	no	--
Quesenberry 223	89	72	NM	NM
Riverbank OID-13	42	--	no	--
Schmidt 227	59	--	no	--
Wellsford 233	62	--	Yes	--
Wood 210	52	--	NM	--
MOD-MWA-2	30	--	no	--
MOD-MWC-3	40	--	Yes	--
FPA-2	38	--	no	--
OFPB-2	35	--	no	--
MW-3S	25	--	no	--
MW-3D	25	--	no	--
MW-4S	56	--	no	--
MW-5S	69	68	no	no
MW-6S	65	--	Yes	--
MW-7	75	40	Yes	no
MW-8	75	49	no	no
MW-9	150	138	no	no
MW-10	72	63	no	no
MW-11	35	--	no	--
Summary - Eastern Prinicpal Aquifer				
		Above	26	13
		Below	10	0
		Not Measured	3	1
		% Below (includes measured wells)	28%	0%

Table 3-4: Comparison of Groundwater Elevations to Sustainable Management Criteria Modesto Subbasin

Local Well Name	Minimum Threshold (MT) (feet msl)	Interim Milestone (IM) (feet msl)	Spring 2022 Monitoring Event: Groundwater Elevation Below MT? (yes/no)	Spring 2022 Monitoring Event: Groundwater Elevation Below IM? (yes/no)
Interconnected Surface Water				
San Joaquin River				
Canfield 90	33	--	no	--
Katen 69	27	--	no	--
Stanislaus River				
Allen OID-01	75	61	Yes	no
American 208	48	--	no	--
Birnbaum OID-03	74	61	no	no
Head Lateral 8 194	40	--	no	--
Langdon Merle 241	50	--	no	--
Marquis OID-10	86	78	Yes	no
Riverbank OID-13	42	--	no	--
MW-4S	56	--	no	--
Tuolumne River				
Jones WID 228	55	--	no	--
Lateral one 195	42	--	no	--
Paradise 235	34	--	no	--
Philbrick 201	38	--	no	--
Quesenberry 223	89	72	NM	NM
Schmidt 227	59	--	no	--
MW-2S	38	--	no	--
MW-3S	26	--	no	--
MW-6S	65	--	Yes	--
MW-9	150	138	no	no
Summary - Interconnected Surface Water				
San Joaquin River				
Above			2	--
Below			0	--
Not Measured			0	--
% Below (includes measured wells)			0%	--
Stanislaus River				
Above			6	3
Below			2	0
Not Measured			0	0
% Below (includes measured wells)			25%	0%
Tuolumne River				
Above			8	1
Below			1	0
Not Measured			1	1
% Below (includes measured wells)			11%	0%

Notes:

highlight: groundwater elevation is below (exceeds) the MT

MT: Minimum Threshold

NM: water level not measured

Groundwater levels for the chronic lowering of groundwater levels indicator were below the MTs in 11 out of 58 wells measured in Spring 2022. Water levels were not below MTs in any wells in the Western Upper Principal Aquifer (**Figure 3-7** and **Table 3-4**) and water levels in 1 out of 5 wells in the Western Lower Principal Aquifer were below the MT (MW-2D) (**Figure 3-8** and **Table 3-4**). Water levels in 10 out of 36 wells measured in the Eastern Principal Aquifer were below the MTs in Spring 2022 (**Figure 3-9** and **Table 3-4**). Three wells in the Eastern Principal Aquifer were not measured in Spring 2022. In general, the wells with MT exceedances in the Eastern Principal Aquifer are in the central and eastern regions of the aquifer.

Groundwater levels for the interconnected surface water monitoring network were below the MTs in 3 out of 19 wells measured (**Figure 3-10** and **Table 3-4**). The MT exceedances occurred in 2 out of 8 wells measured along the Stanislaus River (Marquis OID-10 and Allen OID-1) and 1 out of 9 wells measured along the Tuolumne River (MW-6S). One well along the Tuolumne River was not measured in Spring 2022. The MT exceedances in the interconnected surface water monitoring network occurred in the Eastern Principal Aquifer. Water levels were not below the MTs in either well along the San Joaquin River.

Water levels were not measured in three RMWs because of obstructions: Cavil 214, Quesenberry 223, and Wood 210. The STRGBA GSA cleared the obstructions in Cavil 214 and Wood 210 since the Spring 2022 monitoring event. However, the GSA has not been able to clear the obstruction in Quesenberry 223 and is working to replace it with a different well.

As described in the GSP and indicated on **Figure 3-6**, groundwater elevations have been declining over time in the Eastern Principal Aquifer (especially in the eastern Subbasin). MTs were selected in WY 2021 in recognition that these declines would continue until projects and management actions could be brought online. As such, MT exceedances were expected, which is why Interim Milestones (IMs) were developed. During the Spring 2022 monitoring event, groundwater elevations were not below the Interim Milestones (IMs) in any of the wells (**Table 3-4**).

3.4 GROUNDWATER ELEVATION CONTOUR MAPS

Groundwater elevation data were used to develop water level contour maps for the principal aquifers in the Subbasin (see **Table 3-1** for a description of the Principal Aquifers in the Modesto Subbasin). The contour maps are based on groundwater elevation data from RMWs and supplemented by additional SGMA monitoring wells in the three principal aquifers. Data were compiled and contoured for both Fall 2021 and Spring 2022, as shown on **Figures 3-11** through **3-14,** to comply with GSP regulations; maps are described in subsequent sections below.

3.4.1 Groundwater Elevations and Flow for Fall 2021

Groundwater elevations measured in Fall 2021 represent seasonal lows during WY 2022. Water levels were measured in late October and November, at the end of the irrigation season. As mentioned previously, these measurements were taken prior to the completion of the GSP and the final monitoring network.

3.4.1.1 Western Upper Principal Aquifer and Eastern Principal Aquifer

Groundwater elevation contours in Fall 2021 in the Western Upper Principal Aquifer and the Eastern Principal Aquifer are illustrated on **Figure 3-11**. The two principal aquifers are separated by the eastern extent of the Corcoran Clay, indicated on **Figure 3-11** by the dashed red line.

Groundwater elevation measurements range from 90 feet above mean sea level (msl) in the eastern Subbasin near Modesto Reservoir to 25 feet msl in the northwest Subbasin. The contours indicate that groundwater highs are present in the eastern Subbasin north of Modesto Reservoir and east of the City of Oakdale. From these highs, groundwater flows towards the central part of the basin and then to the west-southwest into the western Subbasin. Groundwater flows south towards the Tuolumne River in portions of the central and western Subbasin due to lower groundwater elevations south of the river. There are also localized groundwater depressions and mounds in the central and western Subbasin, in the vicinity of the City of Modesto. Hydraulic gradients are generally flatter in the central and western Subbasin.

3.4.1.2 Western Lower Principal Aquifer

Groundwater elevations in the Western Lower Principal Aquifer in Fall 2021 are illustrated on **Figure 3-12**. During this time, groundwater elevation data were available in four monitoring wells located in the eastern region of the aquifer. Groundwater elevations in these wells range from 34 feet msl to 46 feet msl. Limited data indicates local groundwater flow directions toward the south-southeast and the Tuolumne River, and to the northeast and the Stanislaus River.

3.4.2 Groundwater Elevations and Flow for Spring 2022

Groundwater elevations measured in Spring 2022 represent seasonal highs during WY 2022. Water levels in most of the wells were measured in February and early March, prior to increases in groundwater production for summer irrigation.

3.4.2.1 Western Upper Principal Aquifer and Eastern Principal Aquifer

Groundwater elevation contours in Spring 2022 in the Western Upper Principal Aquifer and Eastern Principal Aquifer are presented on **Figure 3-13**. During this time, groundwater elevation measurements ranged from 155 feet msl in the eastern Subbasin near the Tuolumne River to 27 feet msl in the northwestern Subbasin.

In general, groundwater elevations increased throughout the Subbasin from Fall 2021 to Spring 2022. For the 47 wells with measurements during both time periods, the average increase in groundwater elevation was 0.8 feet. The largest increase was observed in the eastern Subbasin (MW-10: +3.7 feet). Other notable increases occurred in wells located along the Stanislaus River from western Riverbank to south of Oakdale, and in Waterford.

Groundwater flow directions are similar to Fall 2021. Contours indicate that groundwater flow is predominantly towards the central portion of the eastern Subbasin and then to the west and southwest into the western Subbasin. The localized groundwater depressions and mounds in the City of Modesto area are more pronounced than in Fall 2021. Contours indicate steep gradients to the east of Modesto Reservoir based on the groundwater elevation at MW-9, which is a newly installed monitoring well that was not measured in Fall 2021. In the central region of the eastern Subbasin, groundwater elevations at MW-7, MW-8, and MW-10 are slightly lower than in other nearby wells, likely due to local irrigation pumping. The two wells north of Modesto Reservoir (Paulsell-1 and Paulsell-2) show little change in groundwater elevation from Fall 2021.

3.4.2.2 Western Lower Principal Aquifer

Groundwater elevations in the Western Lower Principal Aquifer for Spring 2022 are illustrated on **Figure 3-14**. During this time, groundwater elevation data are available in all five of the RMWs in this principal aquifer, but data are too similar for generating meaningful contours. Groundwater elevations in these wells are within six feet of each other, ranging from 31 to 37 feet msl.

Groundwater elevations decreased from Fall 2021 to Spring 2022 in the Western Lower Principal Aquifer. The maximum decrease of 15 feet was measured in MOD-MWB-2 and was likely due to local pumping. Due to the confined nature of this principal aquifer, water level fluctuations are expected to be greater than in the unconfined Western Upper Principal Aquifer for equivalent amounts of pumping. The remaining three wells with data measured during both Fall 2021 and Spring 2022 show a water level decrease ranging from 3 to 5 feet. MRWA-3 was measured in Spring 2022, but not in Fall 2021.

4 GROUNDWATER EXTRACTIONS

The volume of groundwater extraction in the Modesto Subbasin is provided for the preceding water year (WY 2022) per SGMA Annual Report requirements in 23 CCR §356.2(b)(2). Data presented in this section follow DWR reporting requirements for groundwater extractions by water use sector and include the method of measurement and accuracy of measurements. A map of groundwater extractions (**Figure 4-1**) is provided to illustrate the general location and volume of groundwater extractions in the Modesto Subbasin.

4.1 GROUNDWATER EXTRACTION DATA METHODS

Total groundwater extractions for the Subbasin for the preceding water year (WY 2022) were compiled and are summarized in this section. The data were collected using the "best available measurement methods." For the Modesto Subbasin, the groundwater extraction data were compiled using two methods:

- Directly measured groundwater extraction data collected by local water agencies and irrigation districts.
- Estimated groundwater extractions using the C2VSimTM model, an application of the Integrated Water Flow Model (IWFM) developed by DWR (Dogrul, Kadir and Brush, 2017).

Directly measured groundwater extractions were collected using meters and other appropriate comparable measuring devices by local water agencies in accordance with the monitoring protocols of the respective local agency. These data were compiled and provided to support this Annual Report by the local agency. These directly measured data were obtained using "high accuracy" measuring devices and methodologies (see **Section 4.4**).

Groundwater extractions from private irrigators and domestic wells are estimated by the California Central Valley Groundwater-Surface Water Simulation Model – Turlock/Modesto (C2VSimTM) for each model element based on factors including land use, evapotranspiration, surface water supply, population, and per-capita water use. Details about the C2VSimTM model can be found in the GSP, while recent updates to the model are described in **Section 2** of this Annual Report. A map illustrating the general location and volume of groundwater extractions as estimated by the C2VSimTM for water year 2021 can be found in **Figure 4-1**. These estimated data are expected to have a qualitative medium level of accuracy.

4.2 SUMMARY OF GROUNDWATER EXTRACTIONS WATER YEAR 2021

Using the methods described above, the total groundwater extractions in the Modesto Subbasin for WY 2022 were tabulated. **Table 4-1** summarizes the Modesto Subbasin groundwater extractions by water use type and measurement method for WY 2022.

Table 4-1: Groundwater Extractions for Water Year 2022 (AF)

WY	Agricultural Production (Agency)[1]	Agricultural Production (Private)[2]	Urban Production (Agency)[1]	Urban Production (Private)[3]	Total
2022	48,200	262,600	37,300	16,000	364,100

1. *"Agency Pumping" indicates direct measurements of volumes of pumped groundwater reported by agricultural purveyors and urban water suppliers. Directly measured data are expected to have a qualitative high level of accuracy.*
2. *"Private Pumping" for the agricultural sector is estimated by C2VSimTM based on land use, evapotranspiration, and surface water data. See Section 2 – C2VSimTM Update (Water Year 2022). These estimated data are expected to have a qualitative medium level of accuracy.*
3. *"Private Pumping" for the urban sector (primarily from domestic wells in rural regions) is estimated by C2VSimTM based on census data for population multiplied by a volumetric water use factor averaged from the urban regions. See Section 2 – C2VSimTM Update (Water Year 2022). These estimated data are expected to have a qualitative medium level of accuracy.*

The data show that 364,100 AF of groundwater extractions occurred in WY 2022. Following the DWR templates, the groundwater extractions are presented by water use sector. For the Modesto Subbasin, the water use sectors are described as follows:

- **Agricultural** – groundwater extractions used to meet irrigation demands and supplement surface water operations. Agency-reported data are provided by local agricultural water purveyors with metered data. Non-reported data are derived from a combination of land use, evapotranspiration, and surface water supply data through use of the C2VSimTM groundwater model. The total agricultural groundwater extraction in the Modesto Subbasin for WY 2022 is 310,800 AF which accounts for about 85% of the total pumping in the Modesto Subbasin.
- **Urban** – groundwater extractions for all urban uses including residential, commercial, municipal, industrial, landscaping, and other uses. Reported data are provided by urban water purveyors with metered data. Non-reported data are derived from a combination of land use, population, and per-capita water use within the C2VSimTM groundwater model. The total urban groundwater extraction in the Modesto Subbasin for WY 2022 is 53,300 AF which accounts for about 15% of the total pumping in the Modesto Subbasin.
- **Industrial** – current data does not allow for tabulation of groundwater extraction of industrial water use on a consistent basin-wide basis; therefore, industrial water use is included in the urban water use sector for WY 2022.
- **Managed Wetlands** – currently, no known groundwater extraction is used for maintaining managed wetlands in the Modesto Subbasin.
- **Managed Recharge** – currently, no known groundwater extractions are used to supply managed recharge operations in the Modesto Subbasin.

- **Native Vegetation** – currently, no groundwater extractions are used for maintaining native vegetation in the Modesto Subbasin.

In accordance with 23 CCR §356.2 (b)(2), the user must define the method of measurement (direct or indirect) and the accuracy of measurements. As shown on **Table 4-1**, the groundwater extractions are categorized into two of the methods listed by DWR. These include:

- **Measured (Metered)** – direct measurement of groundwater extraction collected by local water agencies using meters and other appropriate measurement devices. The total groundwater extraction from metered data in the Modesto Subbasin for WY 2022 is 85,500 AF which accounts for about 23% of the total pumping.
- **Estimated (Modeled)** – indirect estimate of groundwater extractions based on the simulation of urban and agricultural operations in the Modesto Subbasin using the C2VSimTM model, an application of the IWFM software package (Dogrul, Kadir and Brush, 2017). The C2VSimTM model estimates private groundwater production in addition to metered pumping based on a combination of land use, evapotranspiration, surface water supply, and urban water use factors. The total private groundwater extraction estimated by the C2VSimTM model for the Modesto Subbasin for WY 2022 is 278,600 AF which accounts for about 77% of the total pumping in the subbasin.

Groundwater extractions presented here represent the current best estimate of groundwater pumping in the Modesto Subbasin. The use of C2VSimTM provides a consistent, basin-wide method for estimating the unmeasured pumping in accordance with the Modesto Subbasin Coordination Agreement.

4.3 GROUNDWATER EXTRACTIONS MAPPING

In accordance with 23 CCR §356.2 (b)(2), a map (**Figure 4-1**) illustrating the general location and volume of groundwater extractions has been developed for the Annual Report. For WY 2022, a total groundwater extractions map was derived from the C2VSimTM simulation results. The specified metered pumping is directly input into C2VSimTM, and the IWFM framework estimates the unmeasured portion of agricultural and urban pumping based on land use calculations (Maley and Brush, 2020).

Figure 4-1 shows the distribution of total groundwater extractions over the Modesto Subbasin. Since agricultural pumping accounts for 85% of the total groundwater extractions, the pumping distribution generally corresponds to irrigated areas where demand is not met by surface water supplies.

4.4 PART A AND B DWR TEMPLATES

As part of the Annual Report submittal, DWR requires that a series of Excel spreadsheets be completed to summarize key water supply and use volumes for WY 2022 for the entire

Subbasin. For groundwater extraction, DWR requires two spreadsheets be submitted along with the Annual Report in accordance with 23 CCR §356.2 (b)(2):

- **Part A. Groundwater Extractions** - groundwater extractions for WY 2022 by water use sector (23 CCR §356.2(b)(2))
- **Part B. Groundwater Extraction Methods** - the volume of groundwater extractions for WY 2022 by different measurement methods (23 CCR §356.2(b)(2)).

Data summarized in **Table 4-1** follow the Part A and B DWR Template reporting requirements for groundwater extractions and were collected using the best available measurement methods. Accordingly, the data for WY 2022 on **Table 4-1** is submitted separately in the DWR templates.

The accuracy of measurement is required on the DWR templates. For the Modesto Subbasin, the groundwater extractions are based on either reported metered pumping data or from the C2VSimTM simulation results. These data were collected by experienced staff from agricultural and urban agencies in accordance with their monitoring protocols. The measuring devices used by these agencies are well maintained and consistently monitored; therefore, reported data meet high accuracy levels in compliance with AWWA (2006, 2012) and other relevant standards. In accordance with these standards, meter accuracy is considered high.

Estimated groundwater extractions are based on simulation results of the C2VSimTM model. The water balance accuracy of the groundwater model is considered medium.

5 SURFACE WATER SUPPLY

The volume of surface water supplies delivered to the Modesto Subbasin has been tabulated for WY 2022 per GSP Regulations (23 CCR §356.2(b)(3)). Data are summarized in a DWR template that provides surface water supplies by source and identifies the method used to determine the reported volume. That DWR template is being uploaded to the SGMA portal separately with this Annual Report.

5.1 SURFACE WATER DATA METHODS

Surface water supplies for the Subbasin for WY 2022 were compiled from data collected using the "best available measurement methods." Data report total surface water farm gate deliveries as reported by the purveying agency. Direct measurements of local supplies were provided by MID and OID and are expected to have a qualitative high level of accuracy. Riparian deliveries in the Modesto Subbasin are not metered. Deliveries are estimated based on data from the SWRCB eWRIMS and demands simulated by the C2VSimTM model. It is anticipated that some of these data will be incorporated into future reports, as data becomes available due to increased compliance with Senate Bill 88 (2015).

5.2 SURFACE WATER BY SOURCE TYPE

Using the methods described above, the surface water supplies by source in the Modesto Subbasin for WY 2022 are summarized in **Table 5-1**. The water source types are defined in 23 CCR §351 (a-k). The user can identify a different water source type than those predefined by selecting 'other source type' in the template and providing a description of the source type with the data. A map showing the primary surface water delivery areas in the Modesto Subbasin is provided on **Figure 5-1**.

Table 5-1: Surface Water Supplies for Water Year 2022 (AF)

	Local Supply (Measured)[1]	Local Supply (Estimated)[2]	Other Supply (Estimated)	Total
2022	228,700	57,900	0	286,600

1. *Includes Modesto ID and Oakdale ID deliveries to their respective agricultural and urban water users.*
2. *Includes riparian deliveries off the Stanislaus, Tuolumne, and San Joaquin rivers as estimated by the SWRCB eWRIMS database and adjusted to meet agricultural demand simulated by the C2VSimTM model.*

- **Local Supplies**: surface water diversions from local surface water sources. The primary local supply is from the Stanislaus, Tuolumne, and San Joaquin rivers. In WY 2022, 286,600 AF of local surface water were delivered to the Modesto Subbasin, representing 100% of total surface water supplies.

- **Recycled Water:** wastewater and recovered stormwater that is treated and used for either agriculture or groundwater recharge. Currently, no recycled water supplies are available in the Modesto Subbasin.
- **Local Imported Supplies:** surface water from local sources imported from areas outside of the Modesto Subbasin. Currently, no locally imported supplies are available in the Modesto Subbasin.
- **Desalination Water:** poor-quality surface water or groundwater that is treated to levels where it can be used for irrigated agriculture, urban water supply or groundwater recharge. Currently, no desalination water is available in the Modesto Subbasin.
- **Other Water Source**: surface water obtained from sources other than those listed above or from unspecified sources. Currently, there are no other surface water supplies in the Modesto Subbasin.

The surface water supplies in the Modesto Subbasin can vary from year-to-year due to water year type, statewide water demand and operational considerations. WY 2022 is a critically dry year according to the San Joaquin Valley Index.

5.3 PART C DWR TEMPLATE

As part of the Annual Report submittal, DWR requires that a series of Excel spreadsheets be completed to summarize key water supply and use volumes for WY 2022 for the Subbasin. The volume of surface water reported in the template is by water source type. For the surface water supply, DWR requires one spreadsheet be submitted along with the Annual Report in accordance with 23 CCR §356.2 (b)(3):

- **Part C. Surface Water Supply** – the surface water supply for WY 2022 based on quantitative data and listed by water source type (23 CCR §356.2(b)(3)).

Data summarized in **Table 5-1** follow the Part C DWR Template reporting requirements for surface water supply and were collected using the best available measurement methods.

Measurement of surface water supplies for the Modesto Subbasin consists of a variety of measurement methods, but all are considered reliable and accurate. Water agencies typically measure surface water deliveries with a combination of weirs and meters that are read and reported by agency staff. Senate Bill x7-7 (SBx7-7) requires flow measurement devices to be maintained within an acceptable range of accuracy that is defined as a volumetric flow measurement within +/- 12% (§597.3(a)(1))). Weirs and meters used in the Modesto Subbasin have been documented to conform to the SBx7-7 volumetric accounting standards (ITRC, 2012, USBR, 2001, AWWA 2006, 2012) in local water district agricultural water management plans. Procedures employed by water agencies have been standardized to further reduce potential sources of error to range between 1% to 10% depending on the measurement device. In the Part C template, an error range of 5% to 10% is listed as a conservative assumption for this Annual Report.

6 TOTAL WATER USE

The total water supply and use for the Modesto Subbasin is provided for WY 2022 per GSP Regulations 23 CCR §356.2(b)(4).

6.1 TOTAL WATER USE BY SOURCE

The total water supply uses the same data compiled for WY 2022 groundwater extractions and surface water supplies as presented in **Sections 4** and **5**. The data show total water use for the Modesto Subbasin was 650,700 AF in WY 2022. The total water supply for water year 2022 is summarized in **Table 6-1.** The water supply types shown on **Table 6-1** are described as follows:

- **Groundwater** includes groundwater extractions for all uses. In WY 2022, the groundwater supply totaled 364,100 AF representing about 56% of total supplies in WY 2022.
- **Surface water** includes surface water deliveries for all uses. In WY 2022, the surface water supply totaled 286,600 AF representing about 44% of total water supplies in WY 2022.
- **Other Water Source Type** – Currently no other water source type is noted for the Modesto Subbasin.

Table 6-1: Total Water Use by Water Source for Water Year 2022 (AF)

	Groundwater[1]	Surface Water[2]	Other	Total Water Use
2022	364,100	286,600	0	650,700

3. *Includes "Agency" and "Private" pumping described in Section 4.*
4. *Includes "Measured" and "Estimated" surface water supplies described in Section 5.*

The total surface water supply from **Section 5** that is shown distributed by water source in **Table 5-1** is presented in **Table 6-1** distributed by water supply type.

6.2 TOTAL WATER USE BY WATER USE SECTOR

The data shows total water use for the Modesto Subbasin was 650,700 AF in WY 2022. The total water supply is summarized in **Table 6-2** and the water use sectors shown on **Table 6-2** are described as follows:

- **Agricultural** includes total water use for all agricultural water uses. In WY 2022, agricultural water use totaled 573,300 AF, representing about 88% of the total water use in the Modesto Subbasin.

- **Urban** includes total water use for all urban water uses including residential, commercial, municipal, industrial, landscaping, and other uses. In WY 2022, urban water use totaled 77,400 AF, representing about 12% of the total water use in the Modesto Subbasin.
- **Industrial** includes total water use for industrial use. Current data does not allow for tabulation of industrial water use on a consistent basin-wide basis; therefore, industrial water use is included in the urban water use sector for WY 2022.
- **Managed Wetlands** would include groundwater extractions or surface water deliveries to manage local wetlands. In WY 2022, no known groundwater extractions or surface water deliveries were used to maintain managed wetlands in the Modesto Subbasin.
- **Managed Recharge** includes total water use for all managed recharge projects. In WY 2022, no known groundwater extractions or surface water deliveries were used for managed recharge operations in the Modesto Subbasin.
- **Native Vegetation** includes total water use for maintaining native vegetation. In WY 2022, no known groundwater extractions or surface water deliveries were used to maintain native vegetation in the Modesto Subbasin.
- **Other Water Use** includes total water use for uses other than those listed above or from unspecified uses. In WY 2022, no known groundwater extractions or surface water deliveries were used for other uses in the Modesto Subbasin.

Table 6-2: Total Water Use by Sector for Water Year 2022 (AF)

	Agricultural	Urban	Other	Total Water Use
2022	573,300	77,400	0	650,700

6.3 PART D DWR TEMPLATE

As part of the Annual Report submittal, DWR requires that a series of Excel spreadsheets be completed to summarize key water supply and use volumes for WY 2022 for the Subbasin. For the total water use, DWR requires one spreadsheet be submitted along with the Annual Report in accordance with 23 CCR §356.2 (b)(3):

- **Part D. Total Water Use** – the total water supply by water use type and total water uses by water use sector for the preceding water year (WY 2022) for the entire Modesto Subbasin (23 CCR §356.2(b)(4)).

Data summarized in **Table 6-1** and **Table 6-2** follow the Part D DWR Template reporting requirements for total water supply and use and were collected using the best available measurement methods.

7 CHANGE IN GROUNDWATER IN STORAGE

GSP regulation §356.2(b)(5) requires inclusion of the following maps and graphs in the Annual Report for the entire Modesto Subbasin:

(A) Change in groundwater in storage maps for each principal aquifer in the basin.

(B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.

This section provides a description of the methodology used to develop the required annual change in groundwater in storage maps and graphs.

7.1 METHODOLOGY

For the Modesto Subbasin, the change in groundwater in storage maps and graphs are based on the updated C2VSimTM model results. Between the Modesto GSP and the First Annual Report, the C2VSimTM model was used to estimate changes in groundwater storage for water years 1991-2021. The most recent update extends the simulation period though WY 2022 to support quantification of storage change for this Annual Report.

The methodology and data used to update the C2VSimTM for 2022 is consistent with the historical water budget analysis presented in the GSP. A summary of C2VSimTM development is provided in **Section 2** and discussed in more detail in Appendix C of the Modesto Subbasin GSP.

7.2 GRAPHICAL REPRESENTATION OF CHANGE IN GROUNDWATER IN STORAGE

GSP Regulations require that the Annual Report include graphs of the changes in groundwater in storage for historical data, to the greatest extent available, including from January 1, 2015, to the current reporting year (§356.2(b)(5)(B)). For the 2022 Annual Report, the change in groundwater in storage is presented for the GSP historical Study Period (WY 1991 – WY 2015) and appended with updated changes in groundwater in storage from WY 2016 through WY 2022. Regulations also require the graphs to provide the following information:

- Water Year Type (Wet, Above Normal, Below Normal, Dry, Critically Dry)
- Groundwater Use
- Annual Change in groundwater in storage
- Cumulative change in groundwater in storage

7.2.1 Change in Groundwater in Storage Graph

Figure 7-1 shows the simulated annual and cumulative changes in groundwater in storage over the 32-year period from WY 1991 through WY 2022. The updated C2VSimTM results for change in groundwater in storage for the Modesto Subbasin are compared to the water year type based on the San Joaquin Valley Index (CDEC, 2022, see **Table 3-2**) as follows:

- WY 2022, a critically dry year, had a **decline** of 172,200 AF.

7.2.2 Groundwater Use Graph

Figure 7-2 shows the simulated groundwater use based on C2VSimTM model results. The updated C2VSimTM simulation results for groundwater use in the Modesto Subbasin and the water year type based on the San Joaquin Valley Index (see **Table 3-2**, CDEC, 2022) are summarized as follows:

- WY 2022, a critically dry year, had a total groundwater use of 364,100 AF, of which 85% was for agricultural use and 15% for urban use.

7.3 SUBBASIN MAP FOR CHANGE IN GROUNDWATER IN STORAGE

GSP regulation §356.2(b)(5)(A) requires an annual change in groundwater in storage map for the Modesto Subbasin be included in the Annual Report.

7.3.1 Change in Groundwater in Storage Map

Figures 7-3 through **7-6** show the total change of groundwater in storage for WY 2022 for the entire Subbasin and by principal aquifer in a spatial format as estimated by the C2VSimTM model. The change in groundwater in storage is shown in units of feet, obtained from the change in volume per area of each model element. The figures show that the Subbasin is generally losing storage, with higher rates of decline throughout MID and the Non-District Areas, and with reduced impacts in parts of OID and along the eastern (upstream) extent of the Stanislaus and Tuolumne rivers (**Figure 7-3**). This trend is reflected in the Western Upper Principal Aquifer (**Figure 7-4**), where groundwater levels and aquifer storage show decline throughout the aquifer, with mitigated impacts near the San Joaquin River. The Western Lower Principal Aquifer (**Figure 7-5**), experienced greater declines in groundwater in storage than the Western Upper Principal Aquifer, with increased reductions along the southwestern boundary. There was also a reduction of groundwater in storage throughout the Eastern Principal Aquifer **(Figure 7-6)**, with the highest losses within MID near Waterford, in the Non-District East, and to the east and north of the City of Modesto.

7.3.2 Accuracy of Change in Groundwater in Storage Maps

Using WY 1991 to WY 2015 as the base period, C2VSimTM results show declining groundwater levels and long-term reduction of groundwater storage. During this period, C2VSimTM results show an average-annual decline in groundwater storage of 43,900 AFY. The GSP estimated these data to have a qualitative medium level of accuracy. Based on similar methodology and data, it is anticipated that simulated results for WY 2022 maintain comparable levels of uncertainty. For additional information regarding calibration and uncertainty in the C2VSimTM model, please refer to Appendix C of the Modesto Subbasin GSP.

8 GROUNDWATER QUALITY MONITORING

The Modesto Subbasin GSP defined undesirable results for degraded groundwater quality as significant and unreasonable adverse impacts to groundwater quality caused by GSA projects, management actions, or other management of groundwater levels or extractions such that beneficial uses are affected and well owners experience an increase in operational costs. Impacts that could lead to undesirable results might include groundwater level declines in areas where poor groundwater quality occurs at depth, pumping-induced migration of groundwater with poor quality into un-impacted areas, or groundwater quality degradation linked to recharge projects.

To ensure that GSA management is not causing the degradation of groundwater quality, the GSP established a tracking and analysis process for inclusion in annual reports. The WY 2021 Annual Report provided a baseline for existing conditions in the Subbasin of which potential degradation would be evaluated in subsequent annual reports. This WY 2022 Annual Reports marks the first groundwater quality monitoring assessment.

Groundwater quality monitoring in the Modesto Subbasin focuses on seven constituents of concern (COCs) that have been identified as having the highest potential to cause undesirable results. Four of the constituents of concern are anthropogenic: nitrate, tetrachloroethene (PCE), 1,2,3-trichloropropane (TCP), and dibromochloropropane (DBCP). Two are naturally occurring metals: arsenic and uranium. The remaining constituent, total dissolved solids (TDS), is naturally occurring but human activities – such as wastewater disposal – can also contribute to groundwater concentrations. For protection of drinking water supplies, the MTs are set as the maximum contaminant levels (MCLs) for each constituent. Collectively, these constituents are used as indicator chemicals to analyze the various potential GSA impacts on groundwater quality.

As described in the Modesto GSP, potential indicators of groundwater quality degradation are wells with new exceedances of, or further degradation of, an established MT for each of the seven constituents of concern. Indicators of groundwater quality degradation are assessed in each Annual Report through a comparison with baseline values established in the WY 2021 Annual Report. In each annual report, any potable water supply well that is a potential indicator of groundwater degradation is individually examined to determine if its concentrations may be due to GSA management.

The monitoring network makes best use of data from existing groundwater quality monitoring programs that are regulated by the State Water Resources Control Board (SWRCB). As stated in the GSP, the SWRCB and other agencies have the primary regulatory responsibility for water quality and the GSAs do not intend to duplicate this authority. Rather, the analysis focuses on potential groundwater quality degradation in potable water supply wells caused by GSAs management of groundwater in the Subbasin. Tracking and analyses of the SWRCB-regulated data obtained from the GAMA (Groundwater Ambient Monitoring and Assessment) portal, and the data used in these analyses are updated annually.

As described in the Modesto Subbasin GSP, an undesirable result may occur if water quality degradation occurs in a potable well. The baseline monitoring network includes all available water quality data, including data collected from monitoring wells at regulated facilities. It is important to track all groundwater quality data in the Subbasin so that the GSAs are aware of groundwater quality conditions throughout the Subbasin.

8.1 Approach and Data Compilation

The Modesto Subbasin GSP defined undesirable results as a new (first-time) exceedance of, or a further exceedance from, the MT for each constituent of concern. The MTs are the primary or secondary California maximum contaminant level (MCL) for each of the seven COCs:

- Arsenic - 10 ug/L
- Uranium- 20 pCi/L
- Nitrate (as N)- 10 mg/L
- 1,2,3-Trichloropropane (TCP) - 0.005 ug/L
- Dibromochloropropane (DBCP) - 0.2 ug/L
- Tetrachloroethene (PCE) - 5 ug/L
- Total dissolved solids (TDS)- 500 mg/L

In each annual report, new exceedances of, or further degradation at wells with prior exceedances of the MTs, are evaluated in relation to GSA management of water levels and extractions, GSA projects, and GSA management actions to determine if the groundwater degradation is caused by GSA activities. Starting with this Second Annual Report, each annual report compares measurements of each COC to the baseline conditions in all three principal aquifers established in the First Annual Report.

To establish baseline conditions in the First Annual Report, a database was created by downloading data from the Statewide Groundwater Ambient Monitoring and Assessment Program (GAMA) Groundwater Information System accessed through the State GeoTracker website for the seven constituents of concern, from WY 1991 to WY 2021. This 31-year period began with the historical GSP study period (WY 1991 through WY 2015) and extended through WY 2021. The monitoring network for each constituent of concern is composed of the wells that were sampled for that constituent during WY 2021; those wells are the designated RMWs for water quality.

There are 361 RMWs for water quality. The RMWs include 177 public supply wells[3] monitored by water suppliers and regulated by the Division of Drinking Water, 11 domestic wells monitored by the USGS under the GAMA program, 110 monitoring wells at regulated facilities overseen by the State Water Board, and 63 wells, mostly irrigation and domestic

[3] Water quality data from public supply wells are based on samples of untreated and unblended groundwater. See Consumer Confidence Reports for information about the quality of drinking water.

wells, associated with regulatory water quality coalitions (such as under the Irrigated Lands Regulatory Program) and monitored by Aglands. Of these wells, the 188 public supply wells and domestic wells are considered potable water supply wells that could potentially be indicators of groundwater quality degradation under the GSP.

All wells were classified by principal aquifer based on screen depth or well depth, depending upon data availability. Out of the 361 wells in the water quality monitoring network, 250 are in the Eastern Principal Aquifer, 66 are in the Western Upper Principal Aquifer, 22 are in the Western Lower Principal Aquifer, and 23 are in the western principal aquifers, a generic designation for western wells that either lack screen information or are screened in both aquifers. The baseline value established for each well is the maximum concentration of a given constituent of concern from WY 1991 to WY 2021. A table summarizing these RMWs and their maximum concentration for each COC is provided in **Appendix B**.

In this Annual Report, water quality conditions during WY 2022 are compared to the baseline water quality conditions established in the First Annual Report. Data for WY 2022 was downloaded from GAMA for each COC. For each RMW, the maximum concentration for each COC during WY 2022 was compared to the MT. The maximum value during WY 2022 is listed in **Appendix B.**

A measurement in a potable water supply well is considered an indicator of groundwater degradation if it exceeds the MT for the first time at that well, or is larger than the maximum baseline concentration above the MT. If the baseline is greater than the MT, any new maximums are considered groundwater quality degradation indicators. For those wells, historical water quality data are analyzed, along with changes in water quality or water levels in nearby wells, to determine whether degradation is attributable to GSA management and is resulting in increased operational costs to well owners.

The Measurable Objective (MO) for water quality is defined by the historical maximum concentration of each constituent of concern at each representative monitoring location. The same monitoring data that was used to determine potential indicators of groundwater degradation will be used to calculate the MO. The percentage of RMWs below their MO, or their historical maximum concentrations, are reported for each constituent of concern.

8.2 GROUNDWATER QUALITY ANALYSIS

The groundwater quality monitoring network consists of publicly available data downloaded from GAMA through the State GeoTracker website. In WY 2022, 274 RMWs, out of the 361 RMWs in the baseline water quality network, had at least one measurement of a COC (**Figure 8-1**). The RMWs with WY 2022 data include 160 municipal wells, 18 domestic wells monitored through Aglands, and 96 monitoring wells at regulated facilities. Most of the WY 2022 RMWs are located in the Eastern Principal Aquifer. In total, 181 RMWs are in the Eastern Subbasin Principal Aquifer, 17 are in the Western Lower Principal Aquifer, 63 are in the Western Upper Principal Aquifer, and 13 are designated in the western principal aquifers because their screen depths are unknown or they are screened across both aquifers.

The maximum values for each COC during WY 2022 were compared to the MT (the MCL for each COC) and the maximum historical values listed in **Appendix B. Figures 8-2** through **8-8** show the status of WY 2022 water quality, compared with baseline conditions. Each figure is divided by principal aquifer and shows the RMWs that were monitored for that constituent in WY 2022. **Figures 8-2 through 8-8** show both potable water supply wells and monitoring wells at regulated facilities. The monitoring wells at regulated facilities often occur in clusters. Some wells on the map may be obscured by the clusters due to the scale of the map.

In **Figures 8-2** through **8-8**, wells that reported a first-time exceedance of the MT (the MCL for each COC) in WY 2022 are shown as a red dot. Wells shown with an orange dot recorded a further exceedance of its MT in WY 2022. Potable water supply wells in these two categories (red and orange dots) are considered potential indicators of groundwater quality degradation in drinking water wells. Monitoring wells at regulated facilities with first-time MT exceedances or value above their historical maximum are not considered potential indicators of groundwater quality degradation that are the responsibility of the GSAs, given the non-potable nature of the wells, the ongoing remedial activities at the site, and regulation by state and local agencies with primary water quality authority.

Time-concentration plots for public supply wells with new (first-time) MCL exceedances or further exceedances of its MCL were developed and examined to see if concentrations began increasing prior to GSP implementation or if WY 2022 COC concentrations were a departure from previous trends. These time-concentration plots are provided in **Appendix C,** shown in the order in which they are discussed in the text. Hydrographs from local monitoring wells were also examined to see how groundwater levels are changing near these wells.

Wells shown on **Figures 8-2 through 8-8** as yellow, green, or black dots do not indicate groundwater quality degradation. The wells marked as yellow dots had a maximum concentration in WY 2022 greater than the MT but less than the historical maximum concentrations (not a further exceedance of its MCL). Wells shown as green dots had concentrations that were less than the MT. Wells shown with a black dot had concentrations below the detection limit (non-detect).

8.2.1 Arsenic

Arsenic is a naturally occurring trace element in Central Valley groundwater. Its occurrence depends on local and regional geology, groundwater pH, and groundwater redox conditions (anoxic vs. oxic). Even though arsenic is naturally occurring, arsenic concentrations can be related to local industrial contamination at regulated facilities or to groundwater management. Lateral and vertical gradients caused by pumping could cause arsenic migration (Jurgens et al, 2008). Increased arsenic concentrations in the Central Valley have been linked to the compaction and dewatering of the Corcoran Clay (Smith et al., 2018).

In WY 2022, 63 RMWs reported arsenic measurements. As shown on **Figure 8-2**, most of these were in the Eastern Principal Aquifer. Most of the RMWs monitored for arsenic are monitoring wells clustered at regulated facilities. Only four of the RMWs monitored for arsenic in WY 2022 were potable water supply wells, one well in each Principal Aquifer and one with unknown construction in the western principal aquifers. One potable water supply well and two monitoring wells at a regulated facility had a further exceedance of the MCL above the historical maximum in WY 2022 (orange dots), and two monitoring wells had a first-time MT exceedance in WY 2022 (red dots). In WY 2022, 87 percent of all RMWs sampled for arsenic reported maximum concentrations beneath their MO, or their maximum historical concentration.

Well 5000499-004, in the Western Lower Principal Aquifer, is the only potential indicator of water quality degradation for arsenic in WY 2022. The maximum WY 2022 concentration of arsenic at this well was 13 micrograms per liter (ug/L), above the well's historical maximum of 12 ug/L. Arsenic concentrations at this well have ranged from 10 to 12 ug/L since monitoring began in 2018 (see the time-concentration plot in **Appendix C**). Therefore, the maximum concentration is similar to historical concentrations. While this increase, from 12 to 13 ug/L, is small, more arsenic monitoring in the Western Lower Principal Aquifer is recommended, particularly given recent water level declines in this aquifer.

In WY 2022, 59 out of the 63 wells with arsenic measurements were from monitoring wells at regulated facilities. These wells are typically shallow and used to monitor a known contamination site, and thus representative of very localized groundwater conditions. Most of these wells occur in two clusters. One is a contamination site in the City of Modesto within the Western Upper Principal Aquifer and the other is a landfill along the Tuolumne River in the Eastern Principal Aquifer. Arsenic has been detected in these and other monitoring wells at both facilities at higher concentrations than seen in local potable wells and with variable trends.

8.2.2 Uranium

In the Modesto Subbasin, uranium is a naturally occurring groundwater contaminant that is derived from granitic rocks in the Sierra Nevada. In the eastern San Joaquin Valley, it typically occurs in shallow, oxic groundwater that is rich in calcium and bicarbonate (Jurgens et al., 2008; Lopez et al, 2021). Uranium concentrations can be related to management activities through several processes. Vertical gradients from pumping or from wells screened at multiple intervals could cause shallow water with high uranium concentrations to migrate into deeper aquifer zones. Uranium can be mobilized by water infiltrating through saline soils, and it could be mobilized through irrigation return flow or field flooding for managed aquifer recharge (Lopez et al., 2020).

Wells are monitored for uranium less frequently than other COCs, so the uranium monitoring network is small. The baseline RMWs for uranium includes 26 wells, all municipal or domestic wells. In WY 2022, seven of these wells were sampled for uranium (**Figure 8-3**). In WY 2022, all but one RMW sampled for uranium reported maximum concentrations beneath their MO, or their maximum historical concentration.

One well, 5010010-146 in the Western Upper Principal Aquifer, had a further exceedance of its MCL, above its historical maximum (see the time-concentration plot in **Appendix C**). Its historical maximum 27.8 picocuries per liter (pCi/L) is very similar to its WY 2022 maximum (28 pCi/L). This exceedance may be due to rounding differences when the samples were reported and not statistically significant. The last two measurements in this well are below the historical average. Since 1992, uranium measurements at this well have fluctuated between values greater than the MCL of 20 pCi/L and concentrations less than 10 pCi/L. The WY 2022 concentration is consistent with historical fluctuations over the past thirty years.

8.2.3 Nitrate

Most nitrate in Modesto Subbasin groundwater is from anthropogenic sources, such as nitrogen fertilizer, feedlot and dairy drainage, septic systems, or wastewater drainage. Nitrate can reach deeper portions of the aquifers by hydraulic gradients created by municipal or agricultural pumping. Of all the COCs, nitrate by far has the most extensive water quality monitoring network in WY 2022.

Out of 282 RMWs in the monitoring network for nitrate, 204 were monitored in WY 2022 (**Figure 8-4**). Of these, 153 were municipal wells, 18 were domestic wells monitored through Aglands, and 33 were monitoring wells at regulated facilities. Most of the wells sampled for nitrate in WY 2022 were in the Eastern Principal Aquifer. In WY 2022, 87 percent of RMWs sampled for nitrate reported maximum concentrations below their MO, or their maximum historical concentration.

Five potable water supply wells reported first-time exceedances of the 10 mg/L MT in WY 2022 (red dots) and six potable water supply wells reported MT exceedances above the historical maximum (orange dots) (see the 11 time-concentration plots in **Appendix C**). One well at a regulated facility reported an MT exceedance above the historical maximum in WY 2022 (orange dot). The historical trends in nitrate concentrations and water levels at nearby wells are discussed below to assess if nitrate conditions could be linked to groundwater management.

Five of the wells that could be indicators of groundwater quality degradation occur as a cluster, in the Eastern Principal Aquifer north of the City of Modesto: 5000411-001 (further MT exceedance above historical maximum), 500457-002 (further MT exceedance above historical maximum), 5000189-003 (new MT exceedance), 5000189-004 (new MT exceedance), 5000189-006 (new MT exceedance) (see the first five time-concentrations plots for nitrate in **Appendix C**). Nitrate concentrations at these five municipal wells have historical increasing trends. Concentrations at 5000411-001 increased from 2002 to 2012 and leveled off near 10 mg/L until WY 2022, when it reported three consecutive 12 mg/L nitrate measurements in 2022. While the WY 2022 nitrate measurements are greater than the historical maximum concentration, this is not a significant change from previous concentrations. Additionally, the nearby wells have shown long-term, steady increases. Wells 5000189-003, 5000189-004, and 5000189-006 have seen steady increases in nitrate concentrations, with seasonality, since monitoring began in 2002. Nitrate concentrations in well 5000457-002 have been increasing since monitoring began in 2017. Hydrographs of the nearby wells Riverbank OID-13, Claribel 206, and Bangs Ave 243 show that water levels near these wells have declined over the past ten years, but are above the MT during WY 2022 (**Appendix A**). It is unclear if the increasing nitrate concentrations are linked to the groundwater level declines.

Located about two miles east of the cluster of wells, Well 5010018-010 had a first-time exceedance of the MT in WY 2022 (see the time-concentration plot in **Appendix C**). Nitrate concentrations at this well in WY 2022 are much higher than previous readings. Concentrations in this well increased from about 4 to 7 mg/L from 2007 to 2018 and then remained stable until 2021. In WY 2022, 4 of the 5 nitrate concentrations measured in this well were greater than 15 mg/L. Well 5010018-010 is less than a mile from monitoring well Claribel 206, which shows a water level declining from 2008 to 2016 and then leveling off (see the time-concentration plot in **Appendix C**). The high nitrate concentrations in this well may be linked to groundwater level declines, the vertical migration of nitrate, or legacy loading. Nitrate concentrations in surrounding wells do not show a similar trend, and the surrounding monitoring wells did not report groundwater levels lower than the water level MTs. This increase in nitrate observed in Well 5010018-010 does not appear to be linked to any GSA management activities. Continued nitrate concentration monitoring in this area is recommended.

Two miles to the east of Well 5010018-010, Well 5000055-002 had a first-time exceedance of the MT in WY 2022 (see the time-concentration plot in **Appendix C**). This well has shown increasing nitrate concentrations since monitoring began in 2002, though in 2019 and 2021 concentrations were below 5 mg/L. Well 5000055-002 is about 0.5 miles west of monitoring well Cavil 214. The hydrograph from Cavil 214 shows that water levels dropped about 30 feet from 2012 to 2016, increased about 15 feet from 2016 to 2020, and then dropped 10 feet from 2020 through 2021. Cavil 214 was not monitored in Spring 2022, but its water level in Fall 2021 was above its MT.

In the Eastern Principal Aquifer east of Oakdale, Well 5000435-002 reported an MCL exceedance above its historical maximum (see the time-concentration plot in **Appendix C**). However, the new measurement was 24 mg/L, and the historical maximum was 23.9 mg/L, about the same. The nearby hydrograph for Birnbaum OID-03 shows that water levels in this area have declined about 25 to 30 feet since 2005, but remain above its MT in WY 2022. Nitrate concentrations at this well began increasing in 2017, prior to GSP implementation.

Well 5000530-004 is located in the southern portion of the Eastern Principal Aquifer, west of Waterford, and it reported a nitrate concentration above its historical maximum in WY 2022 (see the time-concentration plot in **Appendix C**). Nitrate levels in this well increased from less than 2 mg/L to slightly above 10 mg/L in 2018 and stayed near 10 mg/L for about 3 years. Starting in 2021, concentrations began increasing up to 17 mg/L. The nearby hydrographs for monitoring wells Blossom 230 and Jones WID 228 show declining water levels since about 1999. Water levels at Blossom 230 were below its MT in Spring 2022, and water levels at Jones WID 228 were above the MT in Spring 2022. The recent increases in nitrate concentrations may be due to legacy loading or from increased vertical migration of shallow groundwater. Because of the recent increases, continued monitoring at this well is recommended.

In the western region of the Western Upper Principal Aquifer, well 5000409-001 had a maximum nitrate concentration of 17 mg/L during WY 2022 (see the time-concentration plot in **Appendix C**). The historical maximum at this well was 12 mg/L, and nitrate concentrations increased near the end of WY 2021 and during WY 2022. While the hydrographs from nearby monitoring wells Young 76 and Canfield 90 do not show significant recent declines, water levels in this area have declined since their peak during post-drought recovery. Water levels in Young 76 and Canfield 90 were above their MTs during WY 2022. It is unclear if the high nitrate concentration observed at this well is an anomalously high fluctuation or if it is related to recent groundwater level declines. The most recent concentration in the well has fallen below historical high levels. Continued monitoring is encouraged in this area.

In the Western Principal Aquifers, Well 500372-003 had a nitrate concentration of 16 mg/L, above its historical maximum of 15 mg/L (see the time-concentration plot in **Appendix C**). Nitrate concentration measurements at this well were less than 3 mg/L during 2007 through 2017. In 2018, nitrate concentrations increased to 10 mg/L and have continued to increase. Nitrate concentrations in this well have continued their historical increasing trend and are not likely related to any GSA management activities.

In summary, nitrate concentrations in 11 of the potable water supply wells either exceeded the MT for the first time in WY 2022 or had a further exceedance of the MCL above its historical maximum. Of these, nine wells had increasing nitrate trends prior to GSP implementation, suggesting that the increasing nitrate levels are due to pre-existing conditions, such as the ongoing migration of nitrate from shallower portions of the aquifer. Three of the wells showed a distinct increase in nitrate during WY 2022: 5010018-010 in the Eastern Principal Aquifer southeast of Riverbank, 5000435-002 in the Eastern Principal Aquifer near Waterford, and 5000409-001 in the Western Upper Principal Aquifer. While it can take years or even decades for nitrate used in agricultural processes to reach deeper portions of the aquifer, increased pumping or wells screened across multiple aquifers can transport nitrate more quickly. Continued monitoring of both water quality and water levels in regions near these three wells is recommended.

8.2.4 1,2,3-Trichloropropane (TCP)

1,2,3-Trichloropropane (TCP) is a chlorinated hydrocarbon with a high chemical stability and often occurs as an intermediate in chemical manufacturing. This anthropogenic contaminant is often associated with pesticide products (SWRCB, 2019), and has been documented at industrial or hazardous waste sites. This chemical was banned from pesticides in the 1990s but has been widely detected in groundwater in agricultural areas of the Central Valley (Shelton et al., 2008). Like many agricultural constituents applied at the surface, upper portions of the aquifer are more vulnerable to TCP contamination. TCP can reach lower portions of the aquifer by vertical hydraulic gradients exacerbated by pumping.

The monitoring network for TCP contains 147 wells that were tested for TCP in WY 2021. Of these, 79 RMWs (37 potable water supply wells and 42 monitoring wells) were sampled in WY 2022 (**Figure 8-5**). In WY 2022, 89 percent of RMWs sampled for TCP reported maximum concentrations beneath their MO, or their maximum historical concentration.

A first-time exceedance of the MT was observed at one municipal well (red dot), and a further MT exceedance above its historical maximum was observed at four municipal wells (orange dots) (see five time-concentration plots in **Appendix C**). Two monitoring wells reported a first-time exceedance (red dots), and two monitoring wells reported a further MT exceedance above its historical maximum (orange dots). Every well with a first-time MT exceedance or a further MCL exceedance above its historical maximum was in the Eastern Principal Aquifer. Time-concentration plots in **Appendix C** for TCP are shown with logarithmic Y axes because the TCP range can vary by orders of magnitude. Non-detections are shown on the X axis as white dots.

The municipal well 5010010-192 in the southern portion of the City of Modesto, reported a TCP concentration of 0.017 ug/L in October 2021, above its historical maximum of 0.01 ug/L. This well is sampled monthly, and all subsequent readings in WY 2022 were less than the previous maximum TCP concentration.

Between the City of Modesto and Riverbank, four municipal wells reported TCP concentrations that were new MT exceedances or a further MT exceedance above its historical maximum. Well 5010029-002, along the Stanislaus River, reported a first-time TCP detection in June 2022 (0.0079 ug/L) and two subsequent detections in July (0.072 ug/L) and August (0.027 ug/L). To the south, Well 5010029-010 reported 0.011 ug/L, above the historical maximum of 0.010 ug/L. Since TCP monitoring in this well began in 2020, most TCP measurements have been relatively consistent, at or slightly below 0.01 ug/L. Further to the south, a TCP measurement of 0.068 ug/L was measured in August 2022 at Well 5000411-003, above the historical maximum of 0.053 ug/L. Similarly, an increasing trend has not been observed in this well since TCP was first detected in 2018, and TCP was not detected in May and June 2022. At well 5000249-004, the most western of these four wells, TCP concentrations show an increasing trend since 2018. The monitoring well closest to well 5000249-004, Bangs Ave 243, indicates declining groundwater levels from 2013 to 2016 and again from 2019 to 2022, but water levels were above its MT in WY 2022.

The TCP trends observed at these four municipal wells between Modesto and Riverbank do not suggest that management actions since GSP implementation have led to increased TCP concentrations, but they do suggest a need for further TCP monitoring in this region. Prior to WY 2022, well 5010029-002 did not have any TCP detections, and in WY 2022 there were three measurements above the MT. For two of the wells, TCP concentrations have been consistently detected or have consistently high concentrations for several years, and the concentrations fluctuate. For 5000249-004, the TCP concentrations were increasing prior to GSP implementation. These TCP concentration fluctuations and increases since 2018 may signify that shallow, poor-quality groundwater is being transported to deeper parts of the aquifer, although the closest monitoring well, Langdon Merle 241, has shown somewhat stable groundwater levels since 2017. The increasing nitrate concentrations observed at municipal wells in this region may also suggest increased transport of shallow, poor-quality groundwater.

As evidenced by numerous monitoring wells, the GSAs are aware that TCP has been detected at two regulated facilities in the Subbasin including a landfill near the Tuolumne River (L10005824413), and a site east of Modesto (SL205833043). These and other regulated facilities are being monitored under the requirements of state and local agencies with the primary responsibility to regulate groundwater quality.

8.2.5 Dibromochloropropane (DBCP)

DBCP was a widely used agricultural nematocide and soil fumigant that was banned in the 1970s. It was detected in groundwater in parts of the Central Valley in 1979 and has been monitored since. DBCP is relatively mobile when dissolved in water and may occur as a dense-non-aqueous phase liquid (DNAPL). Its occurrence can be affected by management activities if increased pumping exacerbates its transport to deeper portions of the aquifers.

There were 117 baseline wells that were monitored for DBCP in WY 2021. As shown on **Figure 8-6**, 53 of these wells were sampled during WY 2022 (15 municipal wells and 38 monitoring wells). There were no wells with first-time MT exceedances or further exceedances of the MT above the historical maximum. In WY 2022, 98 percent of all RMWs sampled for DBCP reported maximum concentrations beneath their MO, or their maximum historical concentration.

8.2.6 Tetrachloroethene (PCE)

PCE is a volatile organic compound (VOC), which is a point-source contaminant often sourced from dry cleaning operations, textile operations, and metal degreasing processes. PCE is a regulated chemical typically released at the surface but can reach deeper portions of aquifers by hydraulic gradients created by pumping.

In WY 2022, 71 out of the 142 baseline wells for PCE were sampled (**Figure 8-7**). Most of the wells sampled (65) were monitoring wells at regulated facilities, and 6 were municipal supply wells. There were no wells with first-time MT exceedances or further exceedances of the MT above the historical maximum. Every RMW sampled for PCE in WY 2022 reported maximum concentrations lower than the MO.

8.2.7 Total Dissolved Solids (TDS)

TDS is used as an indicator of overall salinity in groundwater. While high TDS concentrations can naturally occur (geogenic contaminant), it is also considered an anthropogenic contaminant because human processes have resulted in elevated concentrations of TDS in the Central Valley. Shallow groundwater is more vulnerable to salinization, and in the Modesto Subbasin, shallow groundwater generally has a higher TDS concentration than in lower portions of the principal aquifers. Elevated concentrations of TDS in shallow groundwater can occur from irrigation return flow percolating through sandy soil but can also be related to wastewater discharge or managed aquifer recharge using more saline water. It is recognized that TDS increases significantly at deeper depths and is used to define the bottom of the groundwater basin (i.e., base of fresh water). TDS concentrations at the groundwater basin bottom are naturally occurring and associated with older geologic formations that are not typically penetrated by Subbasin wells.

The baseline monitoring network for TDS contains 107 wells, consisting of 67 monitoring wells and 40 municipal wells. In WY 2022, 61 of these wells were sampled (**Figure 8-8)**. Only 2 of the wells sampled were municipal wells, and 59 were monitoring wells at regulated facilities, shown in clusters in **Figure 8-8.** In WY 2022, 98 percent of the wells sampled for TDS were below its MO, or their maximum historical concentration.

Every well with an MCL exceedance in WY 2022 was a monitoring well at a regulated facility. No potable water supply wells had first-time MCL exceedances or further exceedances of the MCL above its historical maximum.

8.3 LIMITATIONS

The water quality monitoring network contains several limitations, including the distribution of wells and the disproportionate number of monitoring wells for particular constituents; nonetheless, it makes best use of a wide variety of existing water quality data collected under a regulated program and approved protocols. The limitations are discussed below.

For every COC but nitrate in WY 2022, most of the RMWs monitored were monitoring wells at regulated facilities. Many municipal wells in the Subbasin may not monitor and report every COC each year, particularly for less common contaminants like DBCP or TCP. In contrast, many of the monitoring wells measure and report these constituents monthly. While regulated facilities can affect basin-wide water quality, measurements from their monitoring wells are often more representative of local conditions than basin-wide water quality. They are also often more shallow than municipal, agricultural, and even domestic wells. However, the information from these monitoring wells at regulated facilities provides valuable information to the GSAs with regards to the potential for spreading contaminants with groundwater extractions.

The wells in the monitoring network may be skewed towards areas with higher concentrations of the constituents of concern. Wells may be measured more frequently for a chemical if they have reported, or are at risk of, high concentrations of that contaminant. For example, wells at a regulated facility with PCE contamination will be regularly monitored for PCE, but these conditions are not reflective of the entire Modesto Subbasin. Wells with higher arsenic concentrations may be monitored and reported for arsenic more frequently, and thus be included in the GAMA database, than wells that have never previously reported a high arsenic concentration.

Finally, WY 2022 represents the first year where groundwater quality degradation has been evaluated. It is difficult to identify the relationship between water quality and GSA management since GSP submittal in January 2022. It takes time for water levels to respond to management activities including projects and management actions once they come online. In addition, contaminant transport from shallow to deep groundwater can take years or even decades. Similarly, it could take years for any water quality changes to affect deep municipal wells.

Notwithstanding these limitations, the large number of monitoring sites allows for tracking trends in concentrations in the same wells (or nearby wells) over time and will provide valuable information on the potential for degradation of groundwater quality in the Subbasin.

9 SUBSIDENCE MONITORING

As explained in the Modesto Subbasin GSP, groundwater elevations are used as a proxy for a rate or extent of subsidence. By managing water levels at or near the historical low levels, the Subbasin can be protected from potential future land subsidence from declining groundwater levels that could impact land use. Given the lack of undesirable results related to land subsidence in the Modesto Subbasin to date, groundwater elevation monitoring represents the best available information to avoid undesirable results from the potential for future land subsidence. Since the greatest risk for land subsidence in the Modesto Subbasin is likely associated with the dewatering/depressurization of the Corcoran Clay, MTs are set at historical low groundwater levels in order to minimize groundwater level declines.

To supplement groundwater elevation monitoring, remote sensing data is used as a screening tool to provide information on vertical displacement across the entire Subbasin. Vertical displacement data collected using Interferometric Synthetic Aperture Radar (InSAR) by TRE Altamira Inc., under contract with DWR, is published and available each year on the SGMA Data Viewer. Finally, local high-quality Global Positioning System (GPS) stations in the Subbasin are monitored by others and provide additional data on ground surface displacement. Data from local GPS stations in the Modesto Subbasin are also tracked on an annual basis, as available, for supplemental information on ground surface conditions within the Subbasin. These land subsidence datasets for WY 2022 are described below.

9.1 GROUNDWATER ELEVATION MONITORING

As summarized in **Section 3.3.3.**, water levels in most of the monitoring network wells are above the MTs during Spring 2022, the first GSP monitoring event. As mentioned above, the western areas within the Corcoran Clay extent are likely the most vulnerable to future land subsidence. Water levels were above MTs in the Western Upper Principal Aquifer (above the Corcoran Clay), which protects against potential land subsidence. However, the water levels at one out of five wells in the Western Lower Principal Aquifer (below the Corcoran Clay) were below its MT in Spring 2022. The well with the MT exceedance, MW-2D, is a Proposition 68 monitoring well constructed in Spring 2021, and as a result, water level data are limited. Without historical data, it is difficult to determine an accurate MT at this location.

As described below, additional datasets did not indicate the presence of inelastic land subsidence in this area , or in any other areas of the Subbasin, during WY 2022. However, additional monitoring is necessary to better understand conditions in the Western Lower Principal Aquifer.

9.2 INSAR DATA SCREENING

InSAR vertical displacement data during WY 2022 are presented on **Figure 9-1**. The figure illustrates that negative vertical displacement (indicating land subsidence) was indicated during WY 2022 throughout most of the Subbasin, between 0 and -0.05 feet (0.6 inches) (light orange shading). The actual maximum measured vertical displacement was -0.038 feet (-0.46 inches). As shown on **Figure 9-1**, positive vertical displacement (land surface rise) between 0 and 0.05 feet (0.6 inches) was indicated during WY 2022 in localized spots in the eastern Subbasin, along the eastern Subbasin boundary, and in one localized spot in the western Subbasin (grey shading).

A recent study conducted by Towill, Inc. and TRE Altamira, Inc., under contract with DWR, showed that InSAR vertical displacement data is highly accurate in most areas. The study compared vertical displacement ground surface elevation data from InSAR to continuously operating global positioning system (CGPS) base stations (Towill, 2021). The study found that the two data sets had a high degree of correlation and concludes that InSAR data accurately measured vertical displacement in California's ground surface to within 18 mm (0.7 inches) between January 1, 2015, and October 1, 2020 (equivalent to about 0.12 inches per year).

During WY 2022, the mean measured subsidence was 0.009 feet (0.11 inches). Therefore, the land subsidence indicated during WY 2022 is relatively small with the mean within the InSAR measurement error.

9.3 GPS Station Screening

In addition to the InSAR data, there are four GPS stations in the Subbasin. As shown on **Figure 9-1**, three of these stations are along the Highway 99 corridor in Salida and Modesto, and one is in the northeastern corner of the Subbasin. During WY 2022, the average measurements at Stations CMOD and P306 were 1.79 millimeters (mm) and 20.04 mm, respectively, indicating a positive vertical displacement (rise in ground surface and no indication of land subsidence). Local Stations P260 and P781 were inactive during WY 2022 and no vertical displacement data were measured. A rise in the ground surface can be related to tectonic processes or land use activities.

Both the InSAR data and the GPS measurements indicate an absence of significant land subsidence in the Subbasin during WY 2022.

10 INTERCONNECTED SURFACE WATER MONITORING

The C2VSimTM model, a surface water and groundwater flow model that was developed for the Modesto Subbasin GSP, has been updated for this Annual Report. The model provides a tool to analyze the linkages between groundwater extractions, reduction of groundwater in storage and interconnected surface water. Model results provided in the GSP showed that increased streamflow depletion along the Modesto Subbasin river boundaries is associated with groundwater level declines This association allows water levels along the rivers to be used as a proxy to monitor for streamflow depletions. Direct groundwater level monitoring is supplemented by ongoing analysis of streamflow depletions in the C2VSimTM model.

There are 20 RMWs in the monitoring network for interconnected surface water along the three river boundaries (**Figure 3-4**). These wells are relatively close to the rivers and screened in the unconfined aquifers that are connected to the rivers.

10.1 GROUNDWATER ELEVATION MONITORING

In **Section 3.3.3**, Spring 2022 groundwater elevations in the RMWs are compared to the sustainable management criteria for interconnected surface water (**Table 3-4, Figure 3-10**). As described previously, water levels at 3 out of 19 RMWs were below the MTs. Two of these wells are along the Stanislaus River within the OID Management Area (Allen OID-1 and Marquis OID-10). One well is along the Tuolumne River within the MID Management Area (MW-6S). No wells along the San Joaquin River had water levels below the MTs during WY 2022. One well along the Tuolumne River (Quesenberry 223) was not measured due to an obstruction in its casing.

The GSAs have recognized the need for improvements to this monitoring network and have planned for additional monitoring wells to support GSP implementation.

10.2 MODEL ESTIMATES FOR STREAMFLOW DEPLETION

For the GSP, the C2VSimTM model was applied to Subbasin water budgets covering the historical Study Period (WY 1991 – WY 2015) including an analysis of streamflow depletions. The First Annual Report included water budgets and streamflow depletion estimates for WY 2016 through WY 2021. As explained in **Section 2**, the C2VSimTM water budget has been updated for WY 2022 for this Annual Report.

As reported in the First Annual Report, from WY 2016 to WY 2021 streamflow depletions averaged approximately 26,000 AFY for the Stanislaus River and approximately 17,000 AFY for the Tuolumne River. During this time, the San Joaquin River gained approximately 11,500 AFY from the Modesto Subbasin.

Streamflow depletion estimates for WY 2022 are provided below in **Table 10-1**.

Table 10-1: Streamflow Depletion Estimates WY 2022

Water Year	Net Gain to Groundwater from Streamflow (AFY)		
	Stanislaus River	Tuolumne River	San Joaquin River
2022	35,500	13,700	-12,500

Notes:

1. Positive numbers represent water flowing from the stream to the groundwater system (i.e., net losing stream or recharge).
2. Negative numbers represent water flowing from the groundwater system to the stream (i.e., net gaining stream or baseflow).

As shown on **Table 10-1**, streamflow depletion has continued during WY 2022 along the Stanislaus River (35,500 AFY) and the Tuolumne River (13,700 AFY). Similarly, the San Joaquin River continues to gain from the Modesto Subbasin (12,500 AFY).

During WY 2022, streamflow depletion along the Stanislaus River is approximately 37 percent more than the average from WY 2016 to WY 2021 (26,000 AFY). Streamflow depletion along the Stanislaus River has increased since WY 2020 (18,084 AFY) in response to persistent dry conditions. As indicated on **Figure 3-5**, WY 2020 through WY 2022 have been dry or critically dry water year types.

Streamflow depletion along the Tuolumne River during WY 2022 is approximately 20 percent less than the average from WY 2016 to WY 2021 (17,000 AFY). Similar to the Stanislaus River, streamflow depletion has increased since WY 2020. In WY 2020, the Stanislaus River was a net gaining stream (-10,015 AFY) and became a net losing stream in WY 2021 (4,033 AFY).

The increase in streamflow depletion in WY 2022 along both the Stanislaus River and Tuolumne River is likely due to the persistent dry conditions and water level declines. These data support the use of water levels as a proxy for monitoring interconnected surface water; the local model allows these values to be consistently quantified.

During WY 2022, the San Joaquin River gained close to the average amount from WY 2016 to WY 2021 (11,500 AFY). Since WY 2016, the San Joaquin River has been a consistently gaining stream, except during WY 2017, the wettest year since the end of the historical study period, when it lost approximately 2,000 AFY.

The combination of groundwater elevation monitoring and updates to the C2VSimTM model provide complementary tools for monitoring and quantifying interconnected surface water for future Annual Reports. Future model upgrades will consider recalibration to groundwater elevation monitoring data as the monitoring network is improved over time.

11 PROGRESS ON GSP IMPLEMENTATION

GSP regulations (§356.2(b)(5)(C)) require GSAs to describe progress towards GSP implementation in the Annual Report, "including achieving interim milestones, and implementation of projects or management actions." These items are discussed below.

11.1 COMPLIANCE WITH SUSTAINABLE MANAGEMENT CRITERIA

Regulations require a description on sustainable management criteria to demonstrate how GSP implementation is progressing. This discussion is organized by the topics specifically listed in the regulations (*§*356.2(c)). Some of the information has already been addressed in **Section 3**, including a comparison of groundwater elevations to sustainable management criteria in **Table 3-4**, maps showing where MT exceedances occurred (**Figures 3-7** through **3-10**), and the hydrographs, which also show MTs and MOs, in **Appendix A**.

11.1.1 Implementation of GSP Monitoring Network

The first GSP monitoring event was conducted during this reporting period, in Spring 2022. The GSP monitoring network includes 61 RMWs. Each of these RMWs is included in the monitoring networks for chronic lowering of groundwater levels, reduction of groundwater in storage, and land subsidence; 20 of these are in the monitoring network for interconnected surface water. These RMWs include CASGEM wells, City of Modesto monitoring wells, USGS monitoring wells and monitoring wells constructed in 2021 with Proposition 68 grant funding from DWR. The monitoring networks are illustrated on **Figures 3-1** through **3-4** and discussed in **Section 3**.

During the Spring 2022 monitoring event, groundwater levels were measured in 58 of the 61 RMWs. Water levels were not measured in three RMWs because of obstructions: Cavil 214, Quesenberry 223, and Wood 210. The STRGBA GSA has cleared the obstructions in Cavil 214 and Wood 210 since the Spring 2022 monitoring event. However, the GSA has not been able to clear the obstruction in Quesenberry 223. Consequently, the GSA is working to replace Quesenberry 223 with a different well in the monitoring network.

As a result of an access agreement between the USGS and the STRGBA GSA, water levels were measured by the GSA in the USGS monitoring wells during the Spring 2022 monitoring event. This access agreement will also provide the GSA with future access to the USGS wells.

11.1.2 Progress in Achieving Interim Milestones

Interim Milestones (IMs) were developed for monitoring network wells in the OID and Non-District East Management Areas. The first IM occurs in 2027 with target values set below the MTs to provide a buffer to allow water levels to drop below the MT while projects and management actions are implemented. The GSP recognizes that water levels in these wells would likely continue to decline after the GSP is adopted and acknowledges that the aquifer response to projects and management actions will take time. 2027 IM values assume that water level declines will continue at similar rates between 2022 and 2027. Additional IMs are at five-year increments: the 2032 IM is the MT, the 2037 IM is half-way between the MT and the MO, and the 2042 IM is the MO. IMs provide a glide path for the Modesto Subbasin to reach its sustainability goal.

As summarized in **Table 3-4** and shown on the hydrographs in **Appendix A**, groundwater levels were above the IMs in all of the RMWs during the Spring 2022 monitoring event.

11.1.3 Compliance with Additional Sustainable Management Criteria

Groundwater level monitoring networks were developed to observe and document the chronic lowering of groundwater levels, reduction of groundwater in storage, land subsidence, and depletions in interconnected surface water. As described in **Section 3.3.3**, water levels for most of the wells in the monitoring network are above their MTs.

Water levels during WY 2022 are below the MTs in 11 out of 58 wells measured in the monitoring network for chronic lowering of groundwater levels. One of these is in the Western Lower Principal Aquifer and the remaining ten are in the Eastern Principal Aquifer. Three of the wells that exceeded the MTs are new Proposition 68 wells constructed in Spring 2021 (MW-2D, MW-6S and MW-7), and water levels in these wells will become better understood as future monitoring events provide additional data. As stated previously, water level measurements in three RMWs were not obtained because of obstructions.

As explained in the GSP, the sustainable management criteria for chronic lowering of groundwater levels are used as a proxy for monitoring the reduction of groundwater in storage and the land subsidence sustainability indicators.

Remote sensing data is used as a screening tool to evaluate land subsidence on a Subbasin-wide basis to complement the groundwater elevation monitoring network. During WY 2022, the InSAR vertical displacement data indicated minor land subsidence in the Modesto Subbasin. Data available at two GPS stations indicate a slight rise in ground surface at those locations.

Groundwater levels in 3 out of 19 wells measured in the monitoring network for interconnected surface water were below the MTs in Spring 2022. Two of these wells are along the Stanislaus River and one is along the Tuolumne River. As described above, one well in this monitoring network (Quesenberry 223) was not measured in Spring 2022 because of an obstruction. As mentioned previously, the GSAs are looking for a well to replace Quesenberry 223 in the monitoring network because the obstruction has not been cleared.

This annual report provides an update on the degraded water quality sustainability indicator for WY 2022. As discussed in **Section 8**, a baseline monitoring network was established in the First Annual Report based on water quality data collected from WY 1991 through WY 2021. Water quality data collected from baseline monitoring network wells during WY 2022 for the seven constituents of concern were downloaded from the GAMA database through the State GeoTracker website. There were 274 wells in the baseline monitoring network that were sampled for one or more of the constituents of concern during WY 2022. Both new (first time) MCL exceedances and further exceedances of the MCL occurred and are discussed in **Section 8**. These new MCL exceedances and further exceedances of the MCL do not appear to be related to GSP activities including projects or management of groundwater levels since the GSP was submitted in January 2022.

11.2 Implementation Progress

The regulations require a description of progress made on GSP implementation occurring during the reporting period (WY 2022). Because of the timing of this Second Annual Report, the first several months of the reporting period (October 2021 through January 2022) occurred prior to completion and adoption of the GSP at the end of January 2022. However, GSP implementation activities have been prioritized since the GSP was submitted.

In addition to the details on local GSP implementation described in this section, the GSAs and associated member agencies in the Subbasin conducted the first GSP monitoring event in Spring 2022 and uploaded the water level data from this monitoring event to the SGMA Portal before the July 1, 2022, deadline. The GSAs also collaborated and contributed to this Second GSP Annual Report.

During WY 2022, and since submittal of the GSP in January 2022, the GSAs have continued public outreach. Regular monthly STRGBA GSA meetings, which are open to the public and subject to the Brown Act, are planned on an ongoing basis.

In January 2023, Stanislaus County hosted the first of a series of three public meetings for landowners in the Non-District East MA. The purpose of the first meeting was to present and discuss the governance structure in the Modesto Subbasin, groundwater conditions, the GSP projects and management actions, and provide an update on recent and ongoing efforts that the GSAs are taking to achieve groundwater sustainability.

11.3 Projects

The Modesto Subbasin GSP includes 13 Phase One GSP projects. Since submittal of the GSP in January 2022, the landowners in the Non-District East MA have been meeting on a regular basis and planning and developing future water supply projects. In November 2022, the Stanislaus East Mutual Water Company was formed and currently represents approximately 16,000 acres in the Non-District East MA.

GSP Project #6, the Oakdale Irrigation District In-lieu and Direct Recharge Project, is underway. This project consists of a 10-Year Out-of-District Water Sales Program in which over 6,000 irrigated acres in the Modesto Subbasin outside of OID’s service area would purchase surplus surface water when available. OID plans to provide up to 20,000 AF of water to landowners in the Modesto Subbasin. OID is securing contracts with participants to commit to an annual purchase of a minimum of 1.5 AF per irrigated acre. There are existing out-of-district service connections to approximately 1,800 irrigated acres in the Modesto Subbasin. Over the next two years, it is anticipated that OID turnouts and private landowner conveyance systems will be completed such that all program lands can receive surplus surface water for irrigation. In addition, OID proposes to expand OID's existing Paulsell Lateral to increase the capacity of approximately 10 miles of open ditch, tunnel and culverts to increase flow from 30 cubic feet per second (cfs) to 180 cfs. OID, on behalf of the GSAs, submitted a Round 2 Sustainable Groundwater Management Grant application to DWR in December 2022, with a request for approximately $18.6 million to fund project design and construction.

Both of these projects are In-lieu recharge projects that will increase delivery of surface water to the Non-District East MA, thereby reducing the demand for groundwater pumping. These projects focus on the Non-District East MA to address the most significant area of groundwater level declines in the Subbasin.

11.4 Management Actions

The Modesto Subbasin GSP includes six management actions including improvements to the monitoring network. As reported in the First Annual Report, between February and June 2021, 17 monitoring wells were constructed at 11 locations throughout the Subbasin using Proposition 68 grant funding from DWR. In October 2022, the project, which was funded by Grant Agreement 4600012653 between DWR and the City of Modesto, was completed.

Management actions will be implemented on an as-needed basis; no management actions are being proposed for implementation at this time.

12 REFERENCES

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FIGURES

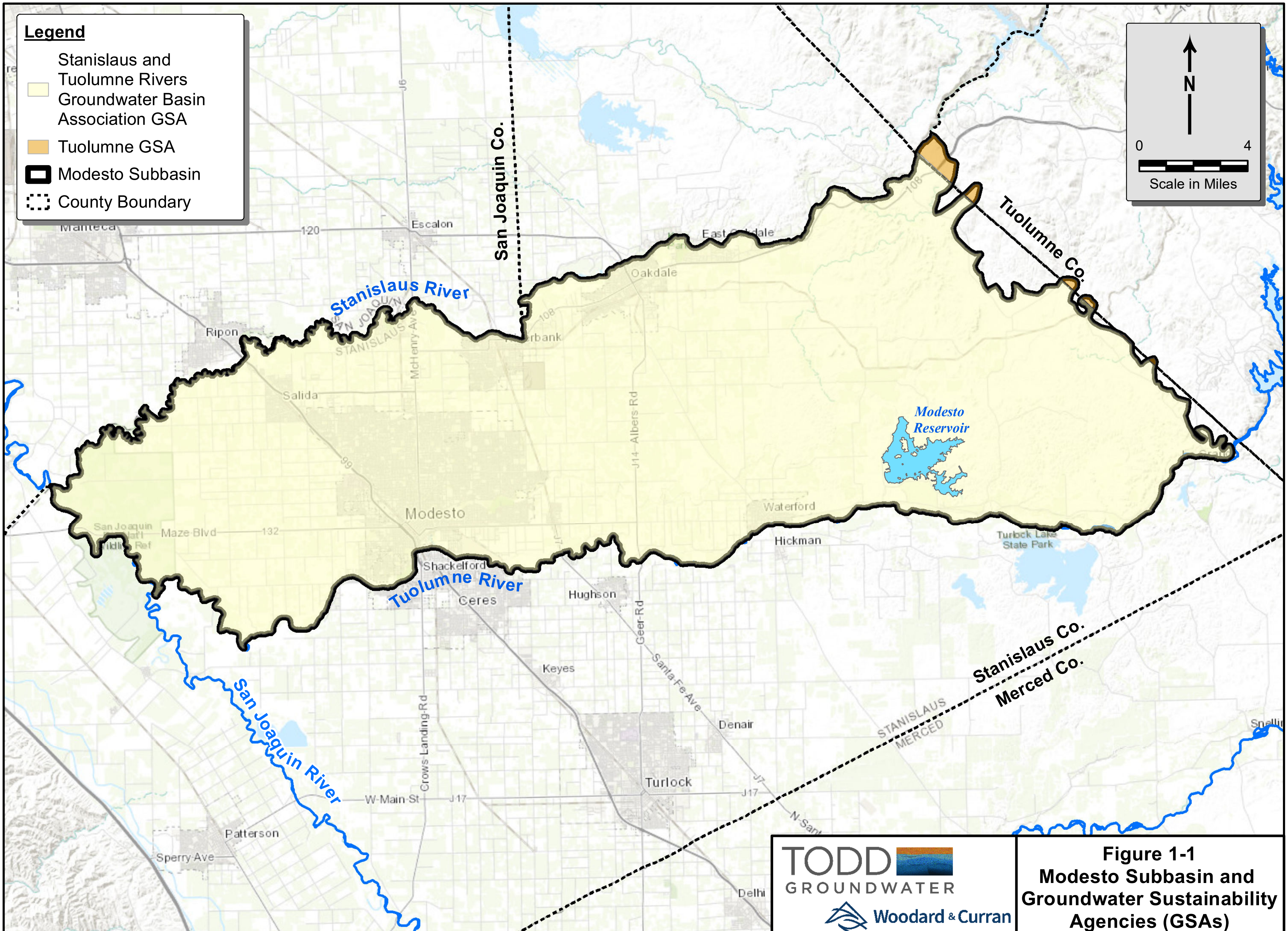


Figure 1-1
Modesto Subbasin and Groundwater Sustainability Agencies (GSAs)

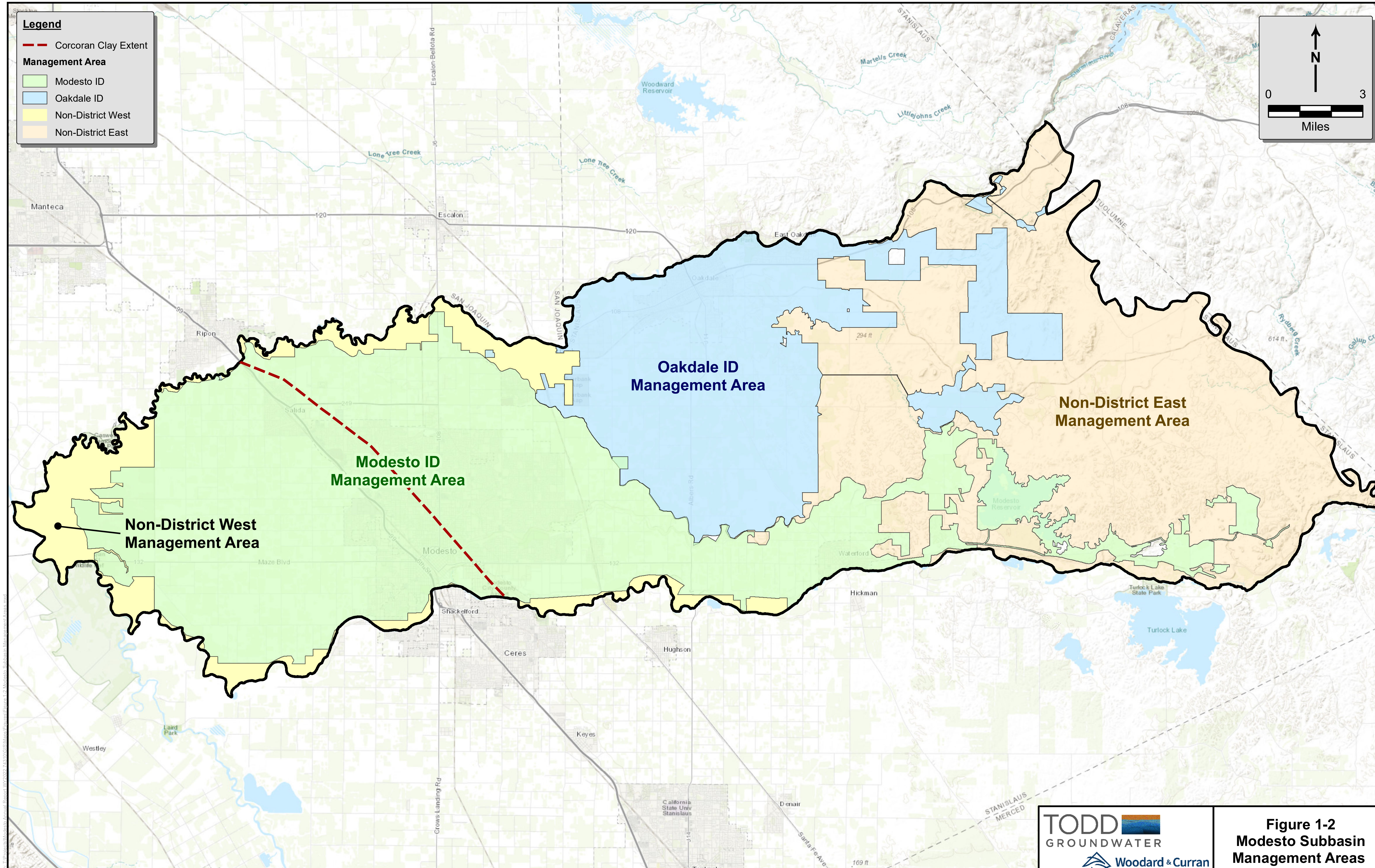


Figure 1-2
Modesto Subbasin Management Areas

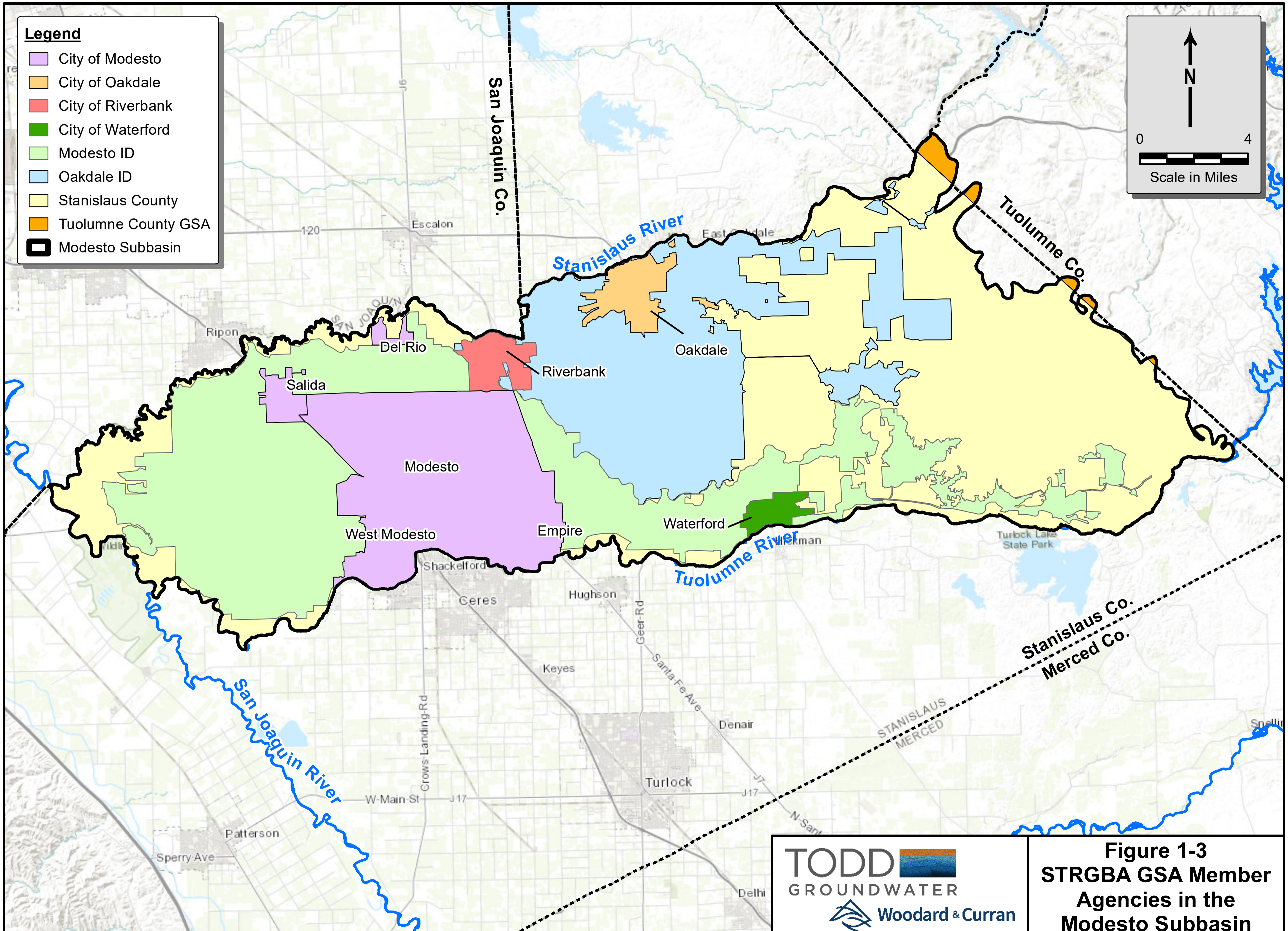


Figure 1-3
STRGBA GSA Member Agencies in the Modesto Subbasin

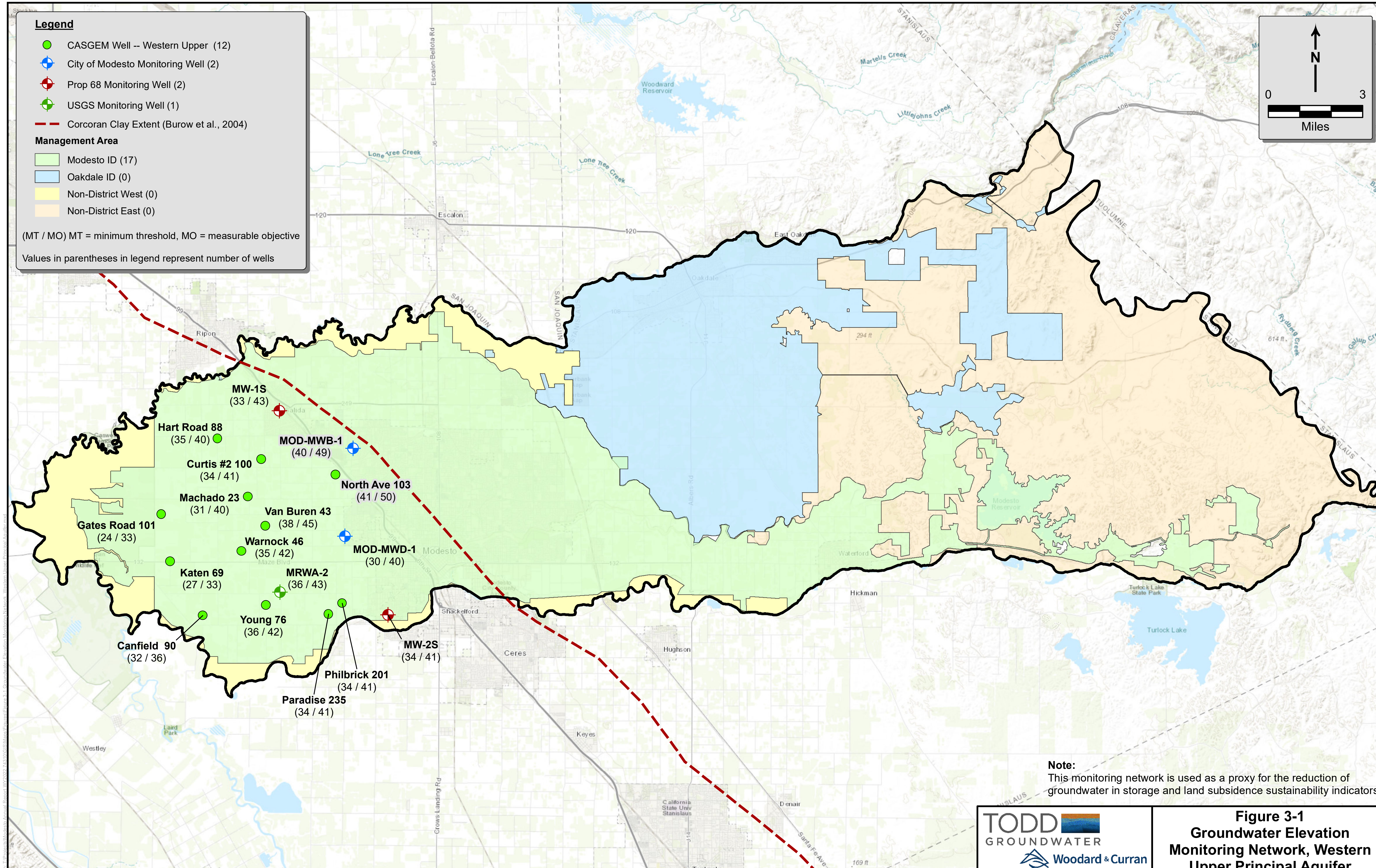


Figure 3-1
Groundwater Elevation Monitoring Network, Western Upper Principal Aquifer

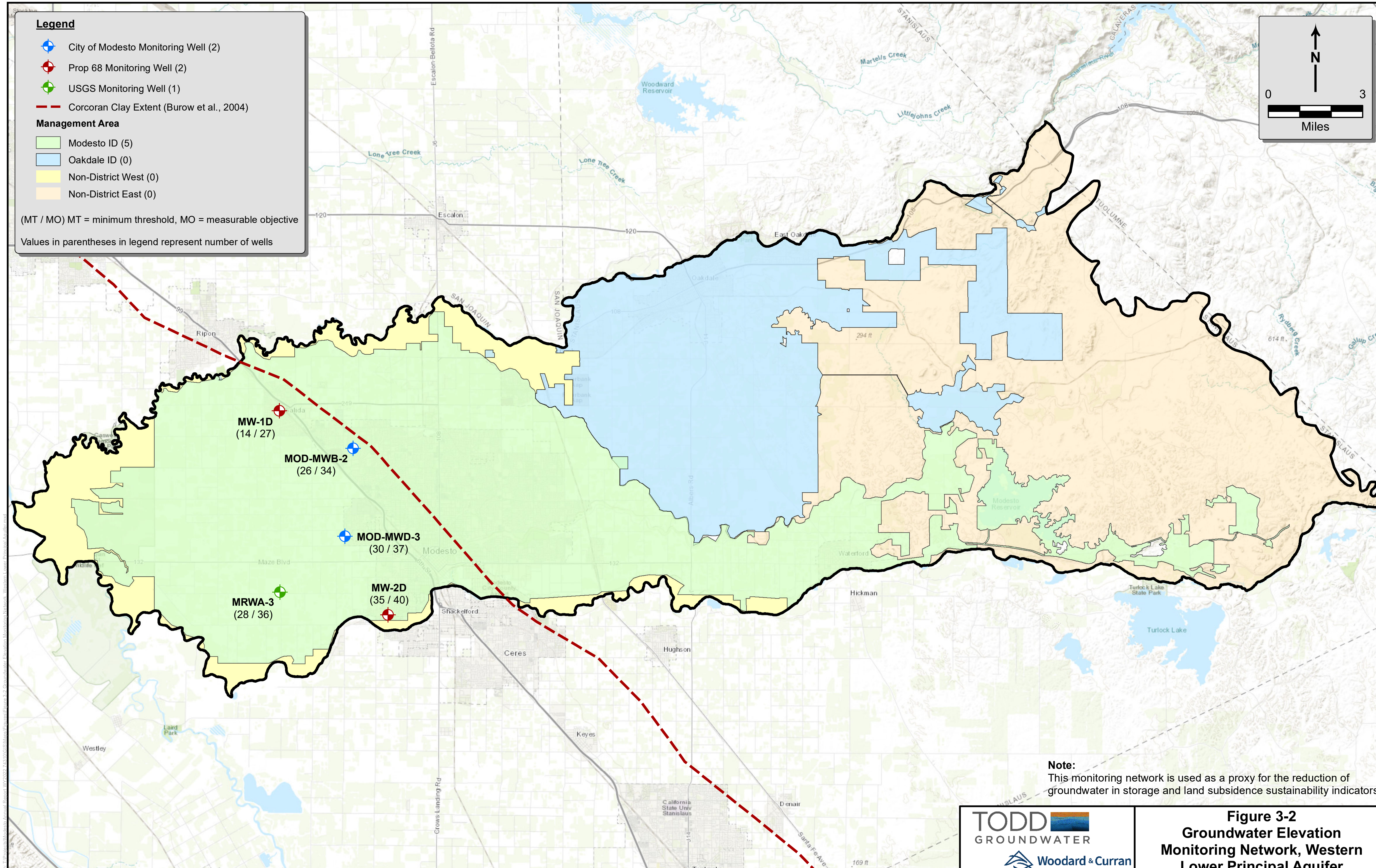
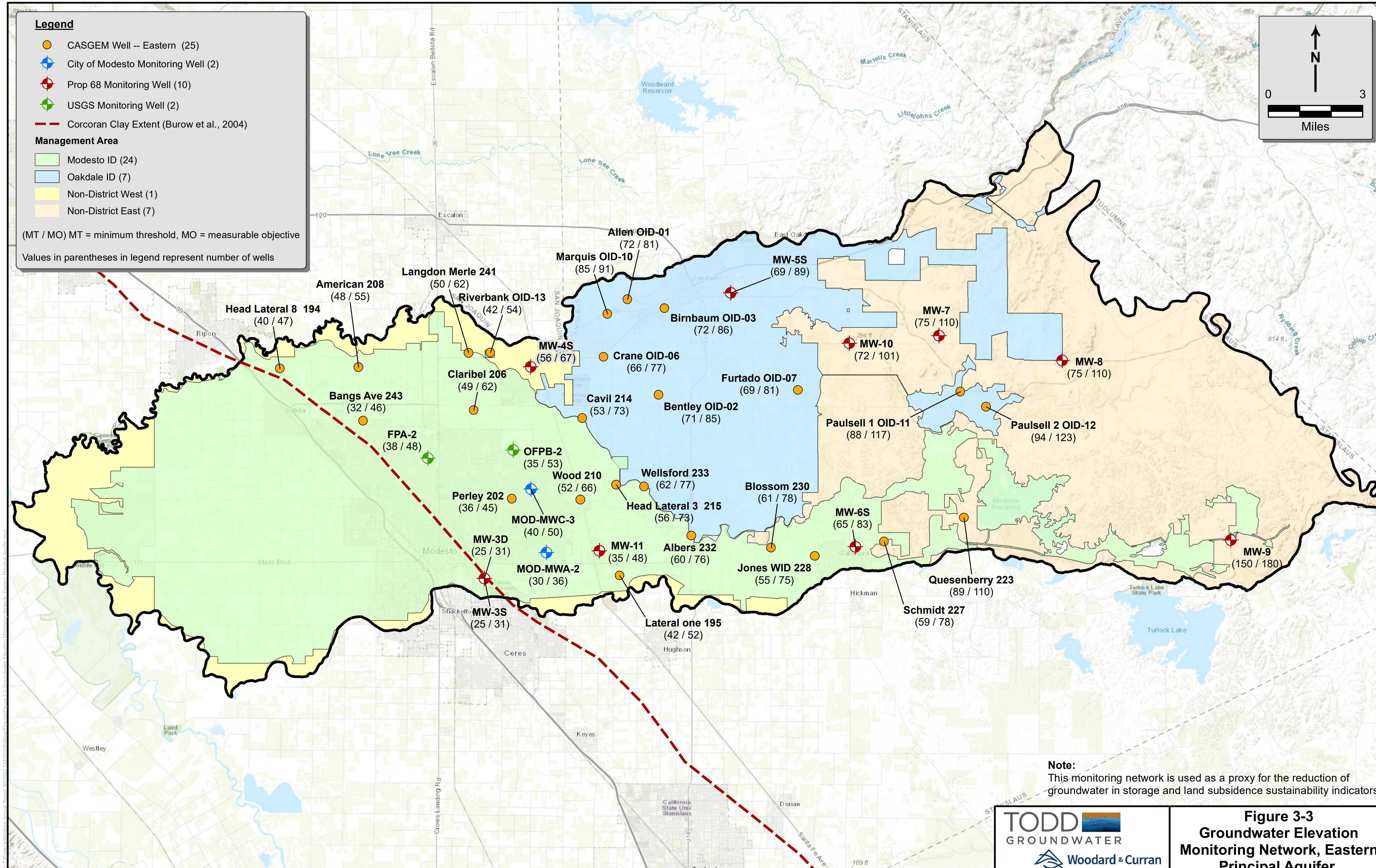


Figure 3-2
Groundwater Elevation Monitoring Network, Western Lower Principal Aquifer



Note:
This monitoring network is used as a proxy for the reduction of groundwater in storage and land subsidence sustainability indicators.

TODD GROUNDWATER
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Figure 3-3
Groundwater Elevation Monitoring Network, Eastern Principal Aquifer

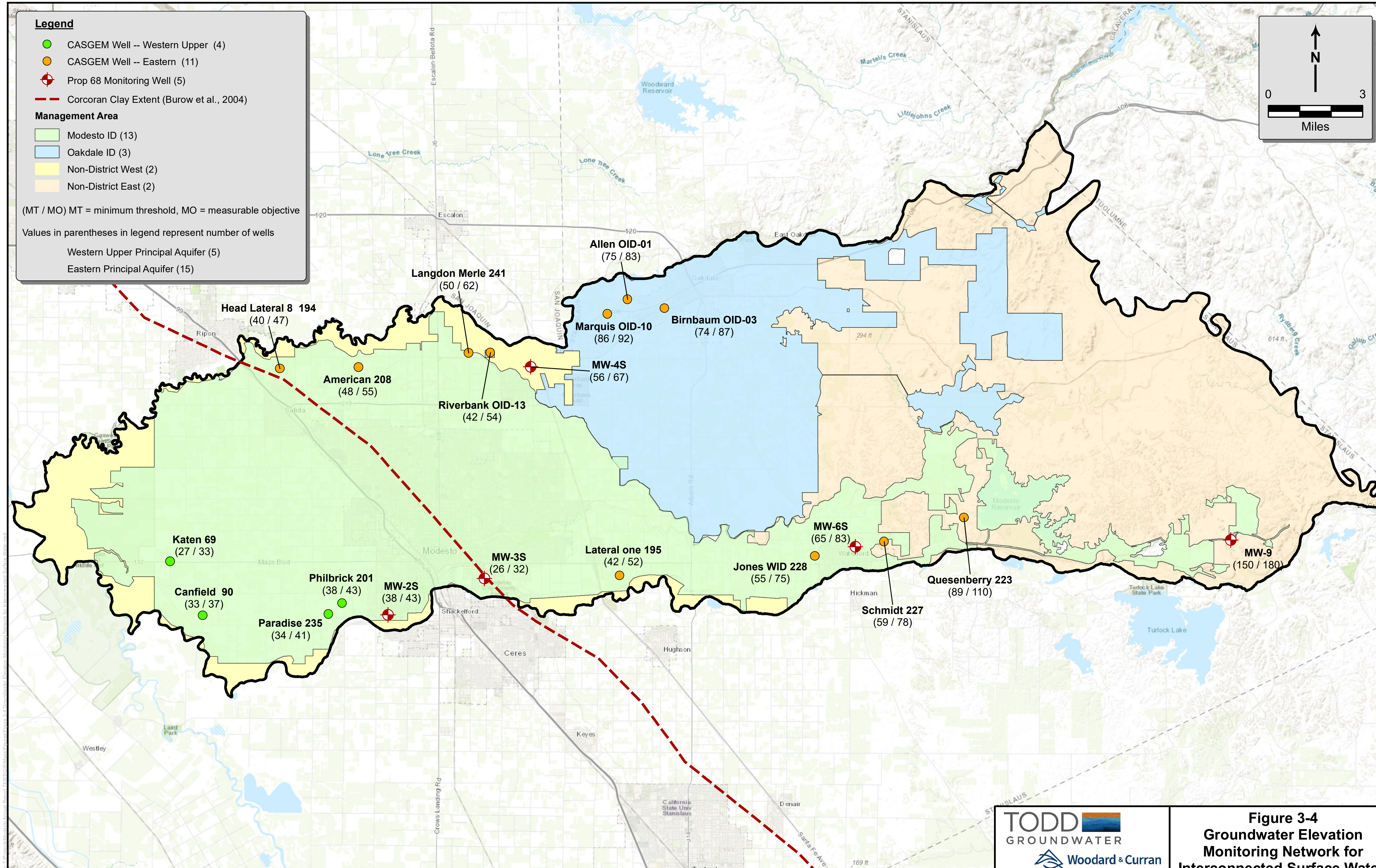
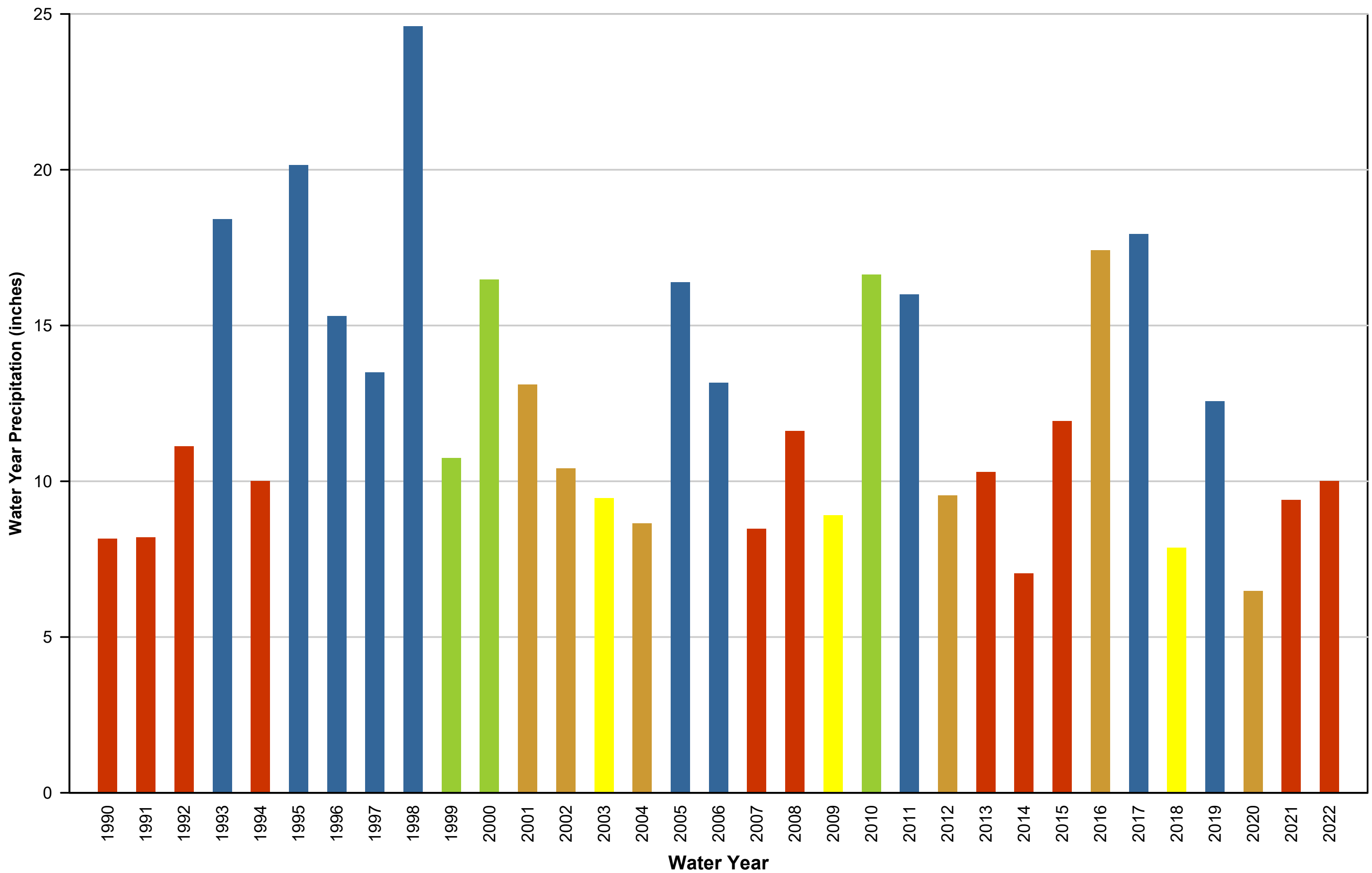


Figure 3-4
Groundwater Elevation Monitoring Network for Interconnected Surface Water



Notes:
Source - MID weather station (Modesto CA).
Water Year - October 1 through September 30.
Water year type is from the DWR San Joaquin Valley Index.

TODD GROUNDWATER
Woodard & Curran

Figure 3-5
Annual Precipitation and Water Year Type
WY 1990-2022

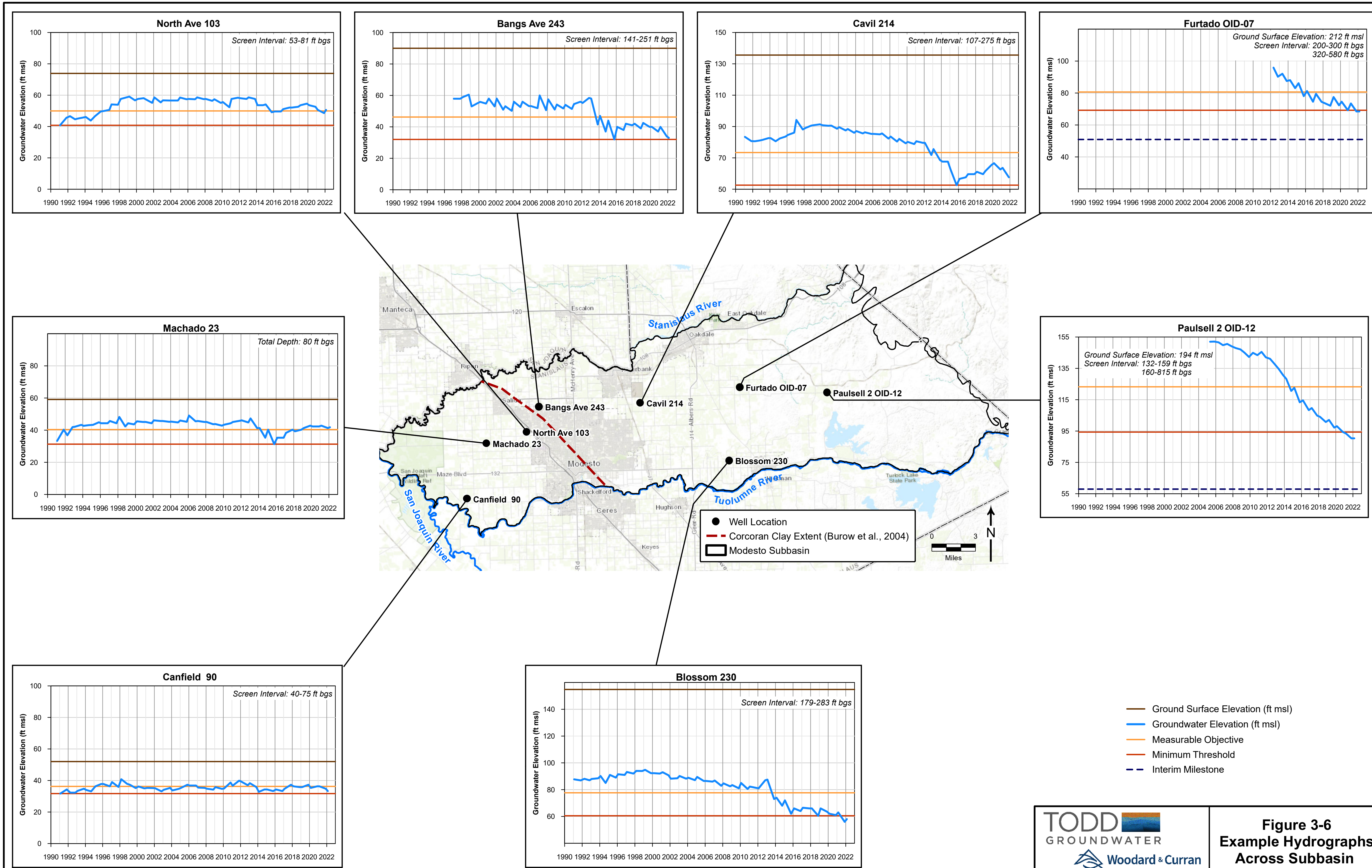


Figure 3-6
Example Hydrographs Across Subbasin

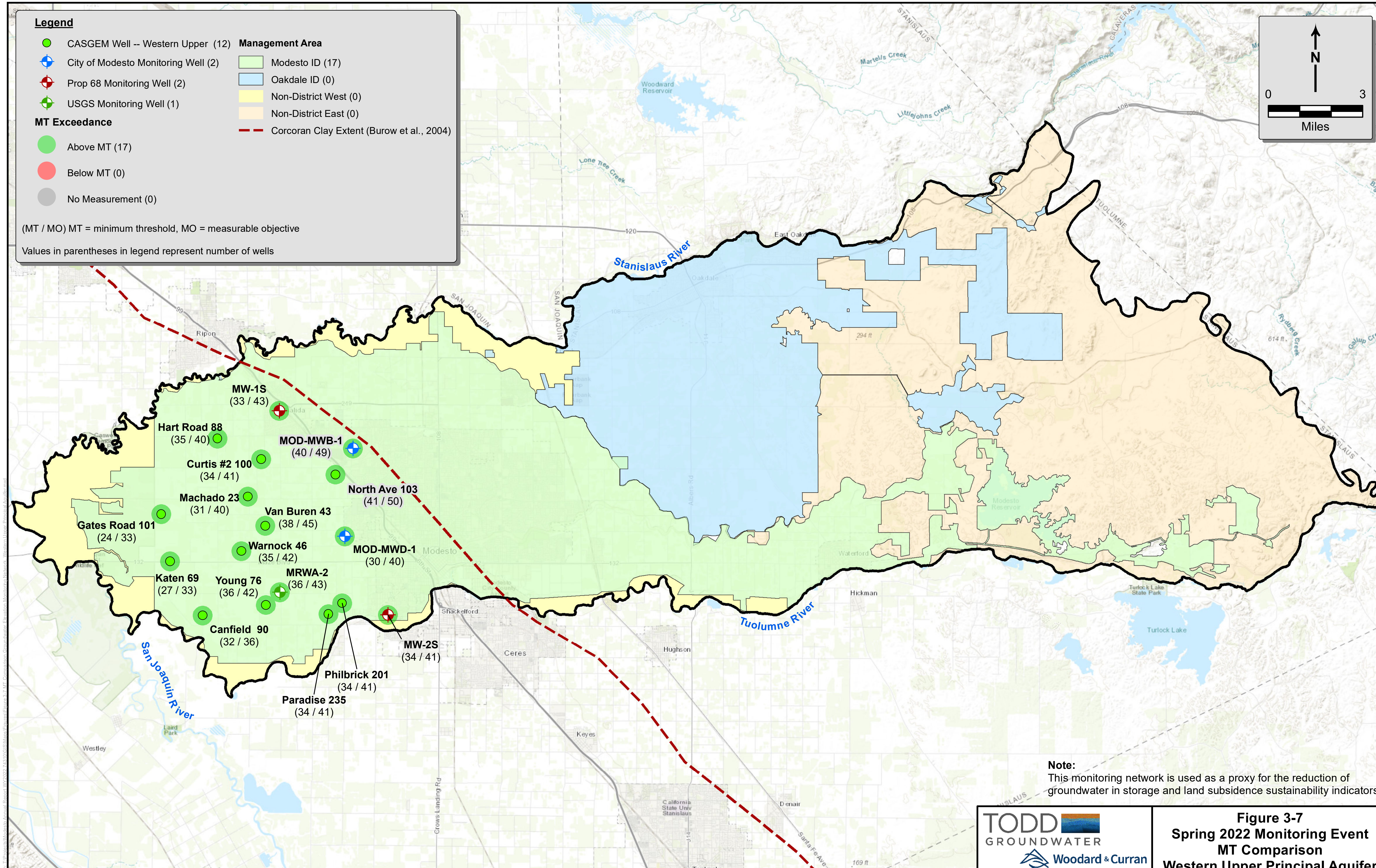


Figure 3-7
Spring 2022 Monitoring Event
MT Comparison
Western Upper Principal Aquifer

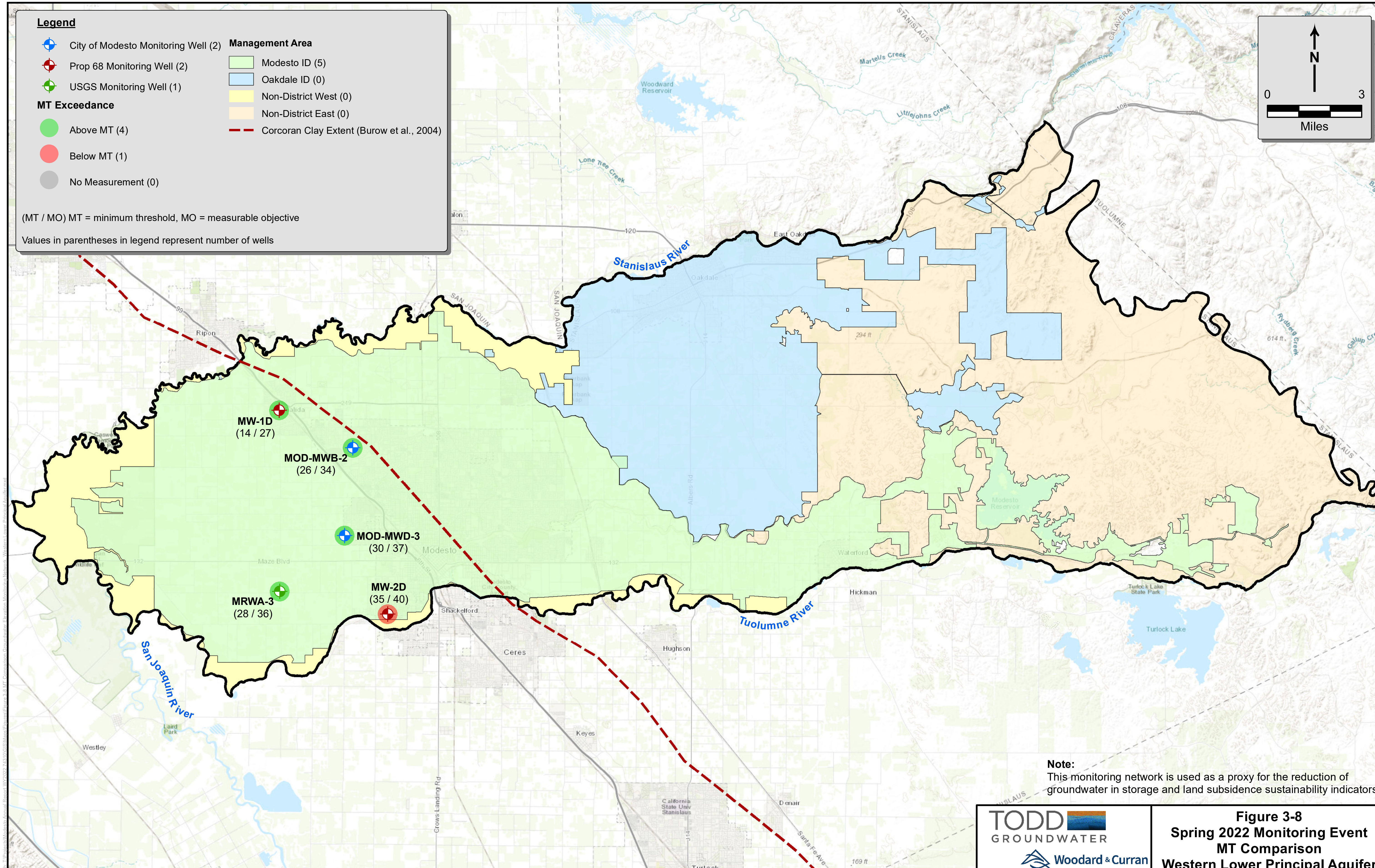


Figure 3-8
Spring 2022 Monitoring Event
MT Comparison
Western Lower Principal Aquifer

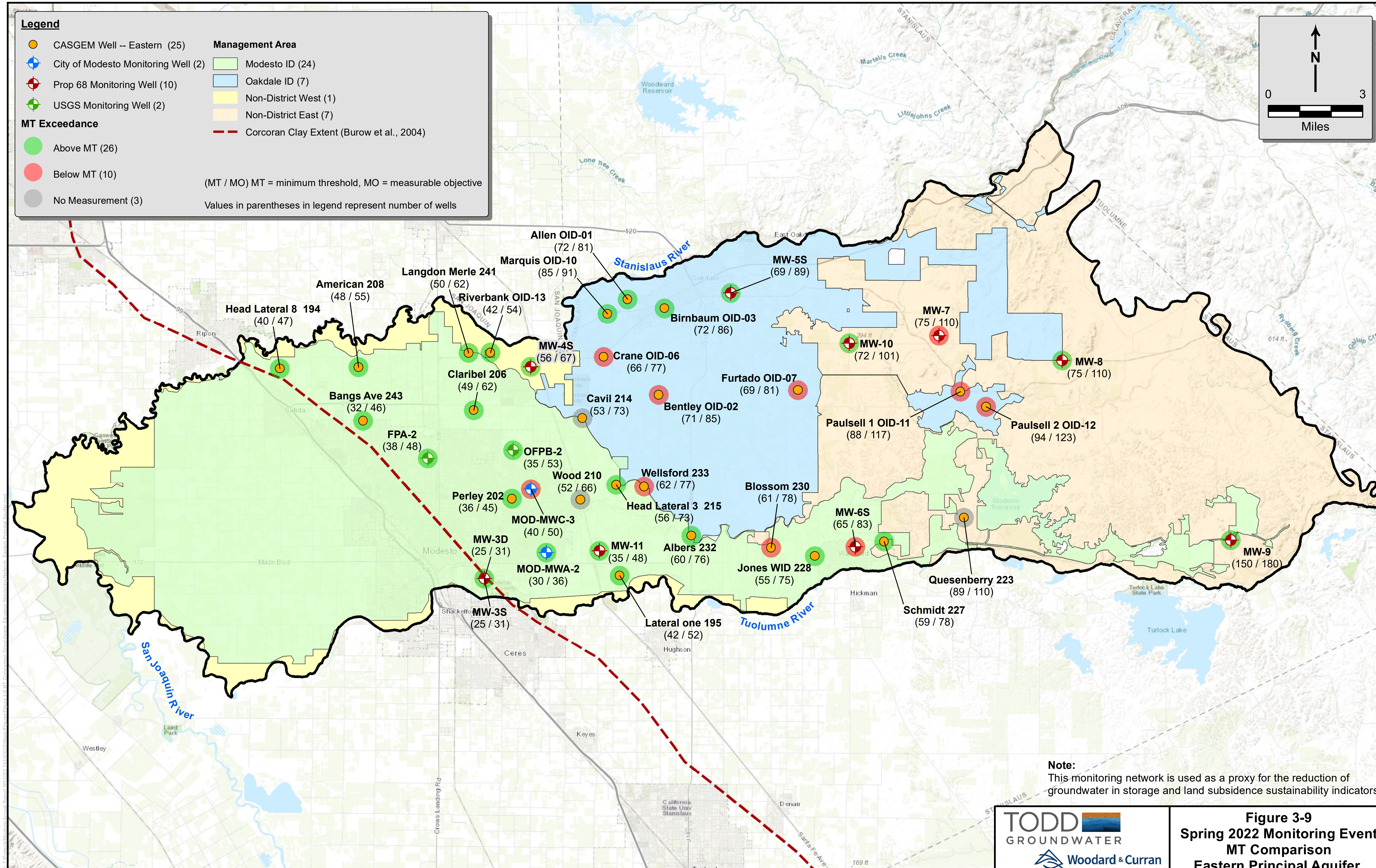
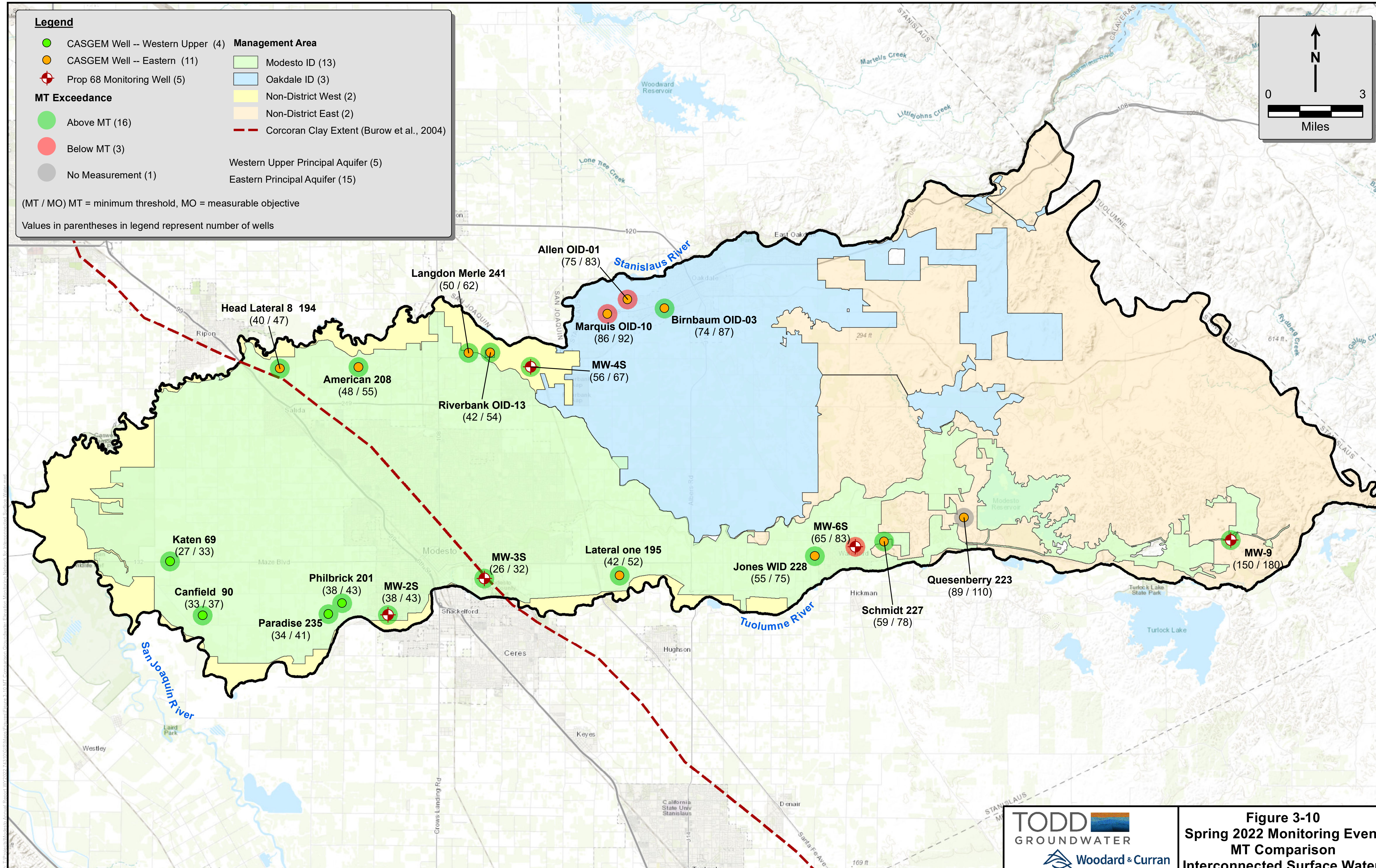


Figure 3-9
Spring 2022 Monitoring Event
MT Comparison
Eastern Principal Aquifer



TODD GROUNDWATER
Woodard & Curran

Figure 3-10
Spring 2022 Monitoring Event
MT Comparison
Interconnected Surface Water

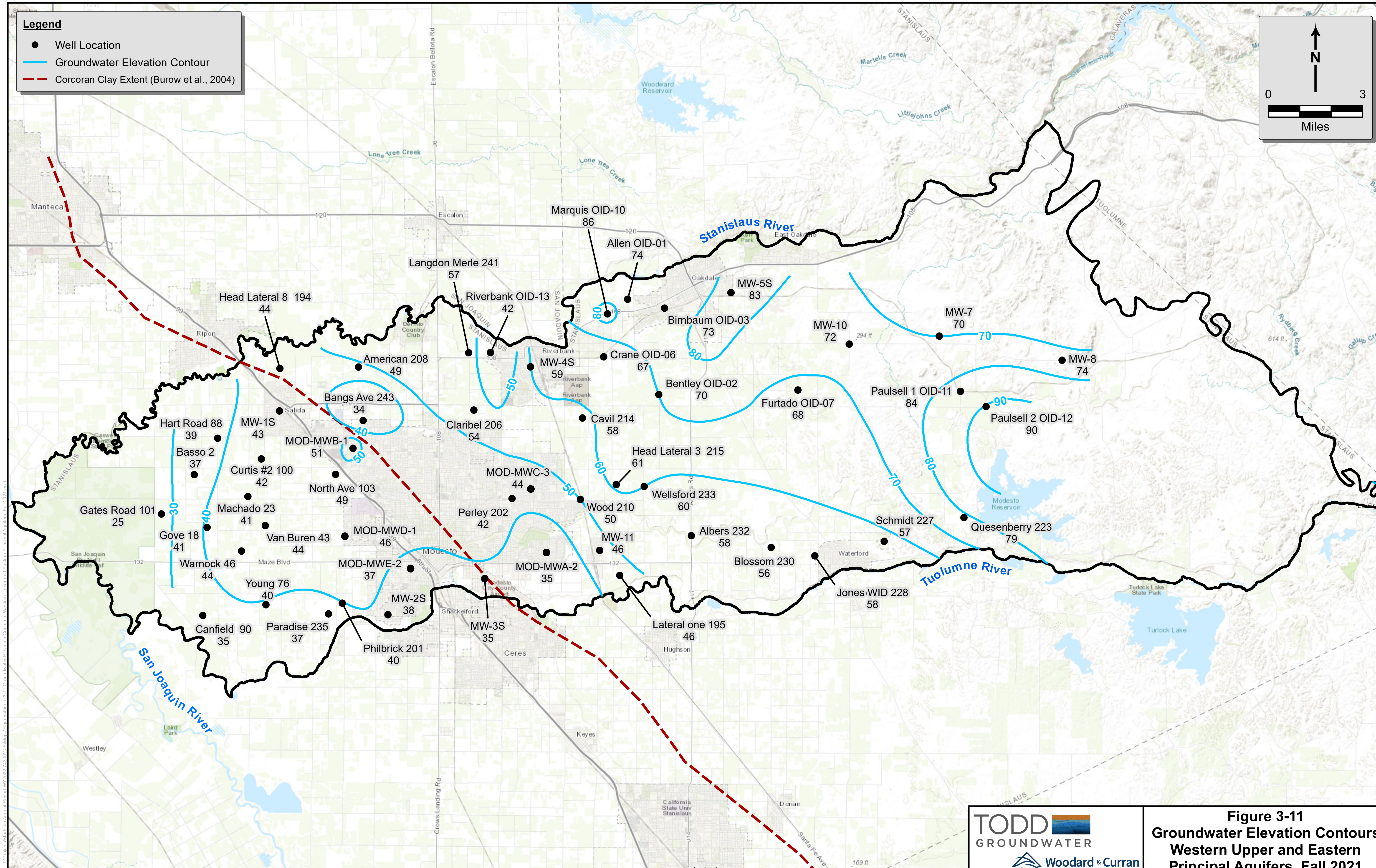


Figure 3-11
Groundwater Elevation Contours
Western Upper and Eastern
Principal Aquifers, Fall 2021

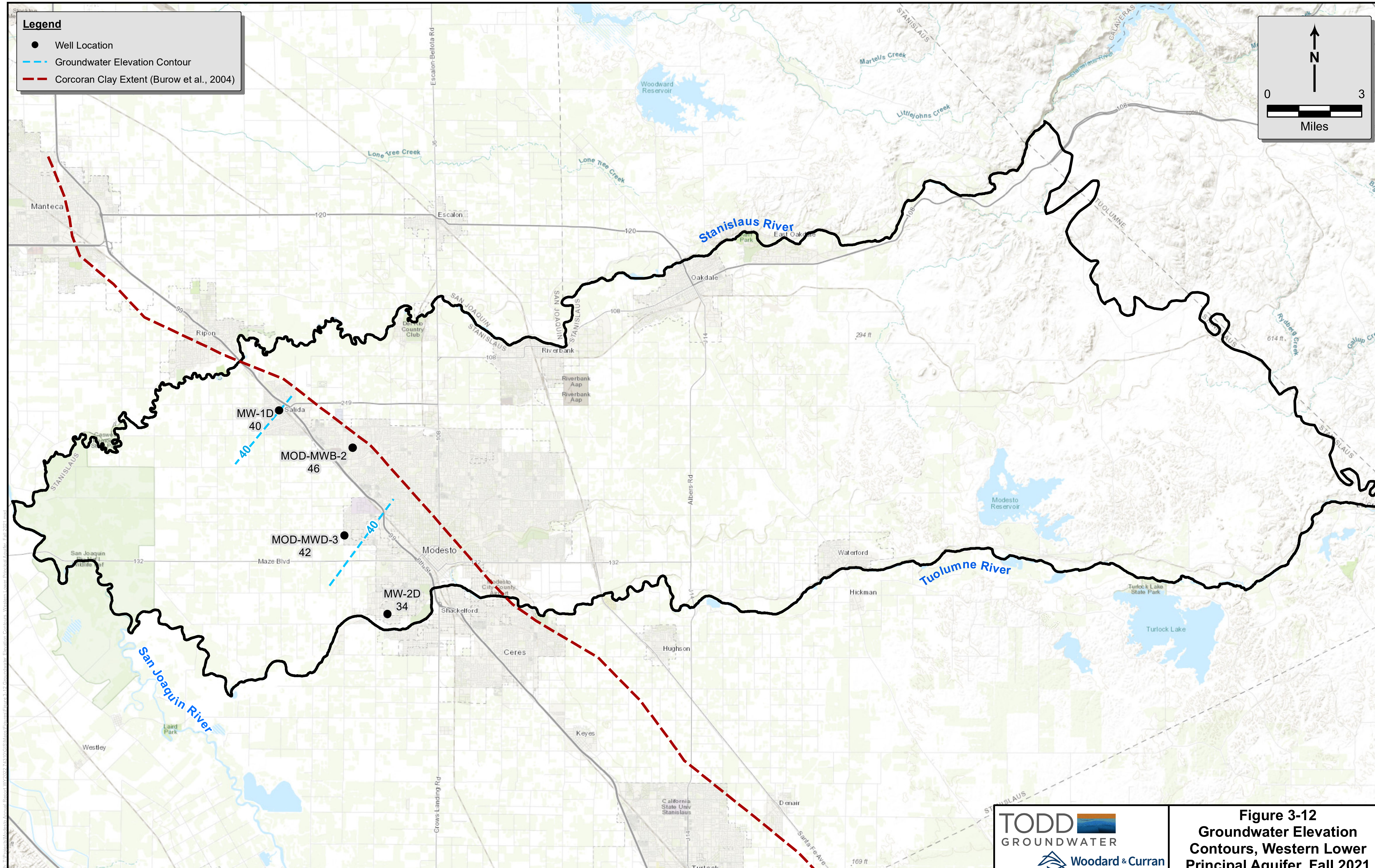


Figure 3-12
Groundwater Elevation Contours, Western Lower Principal Aquifer, Fall 2021

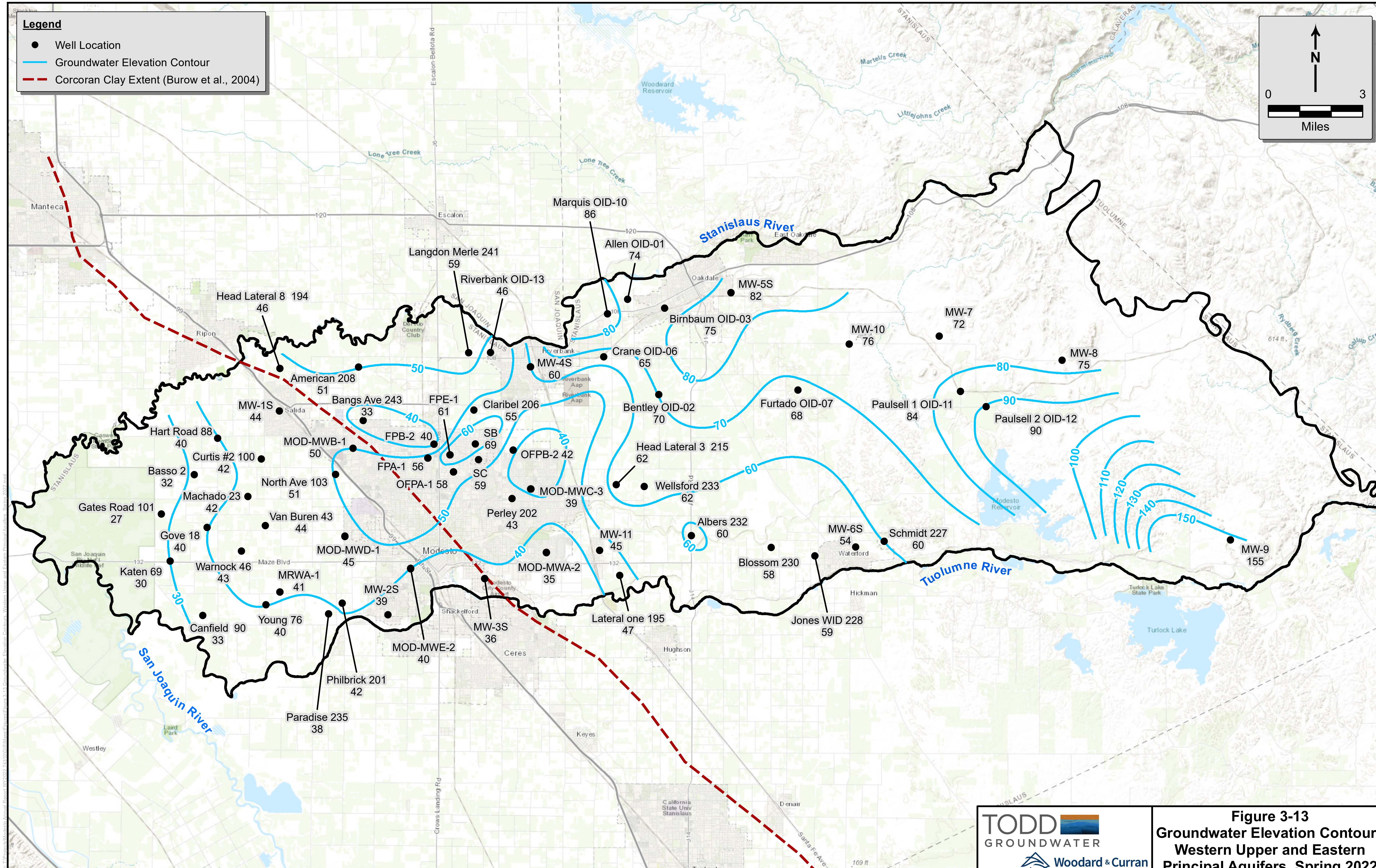
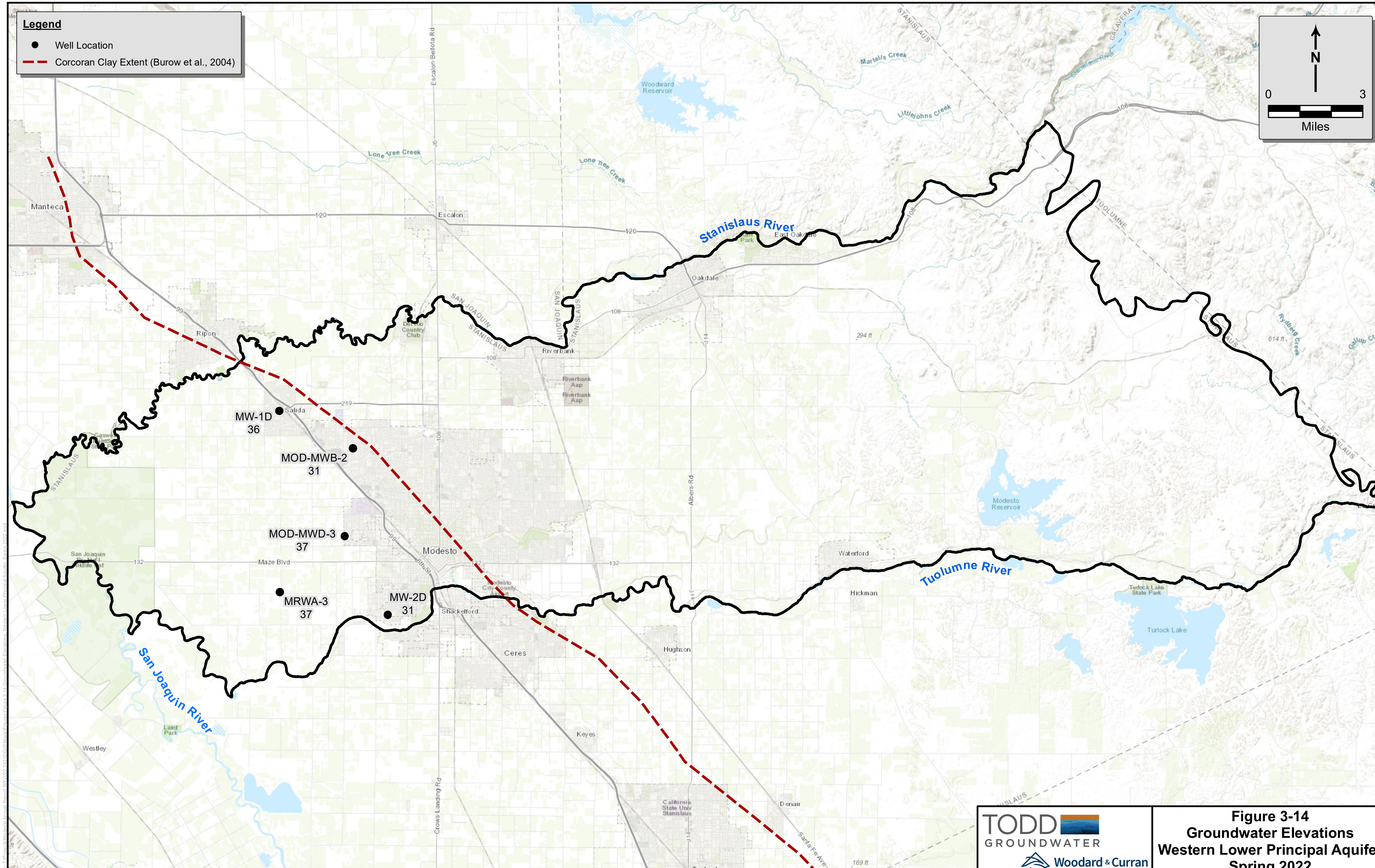


Figure 3-13
Groundwater Elevation Contours Western Upper and Eastern Principal Aquifers, Spring 2022



TODD GROUNDWATER

Woodard & Curran

Figure 3-14
Groundwater Elevations
Western Lower Principal Aquifer
Spring 2022

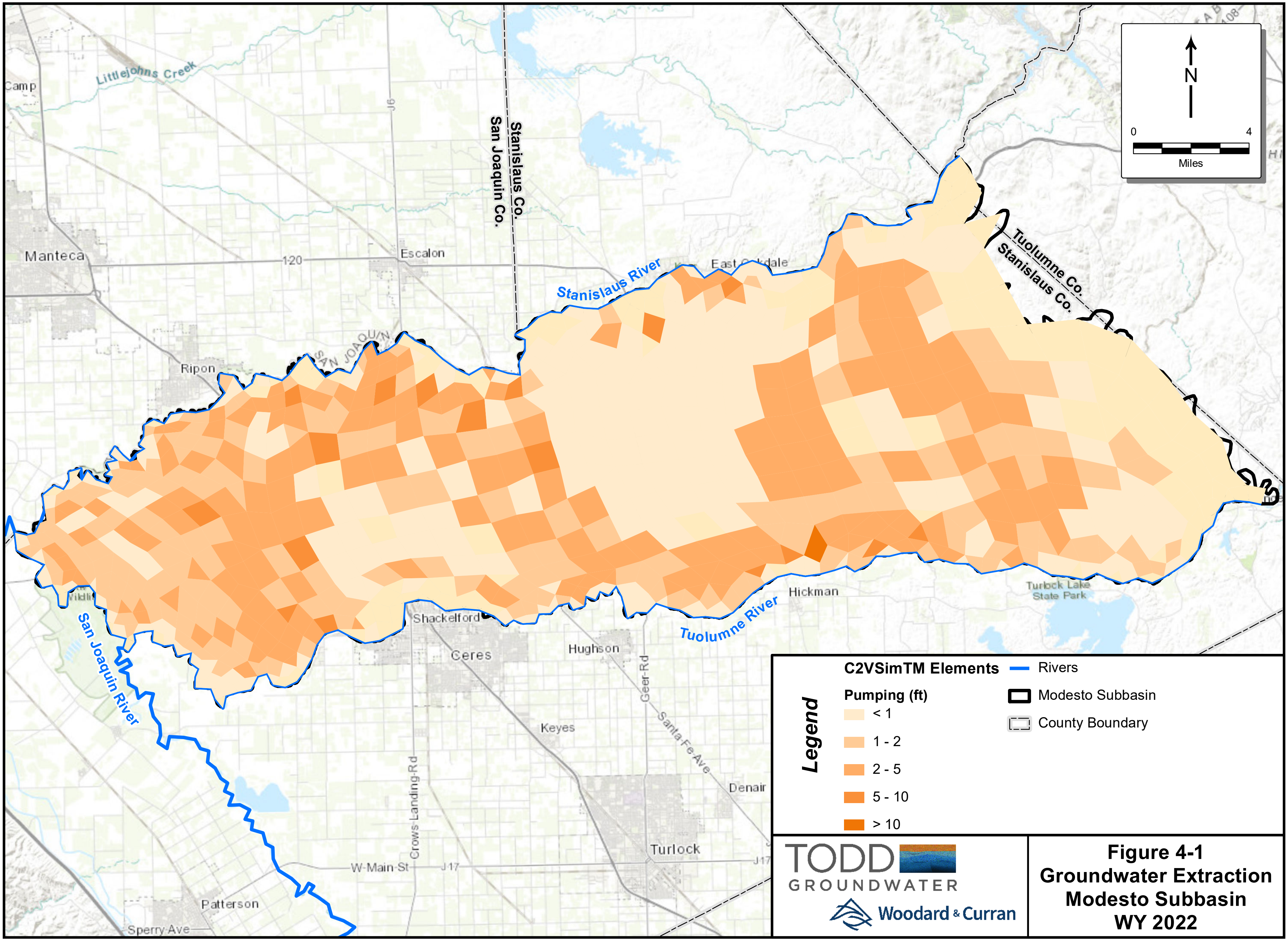


Figure 4-1
Groundwater Extraction
Modesto Subbasin
WY 2022

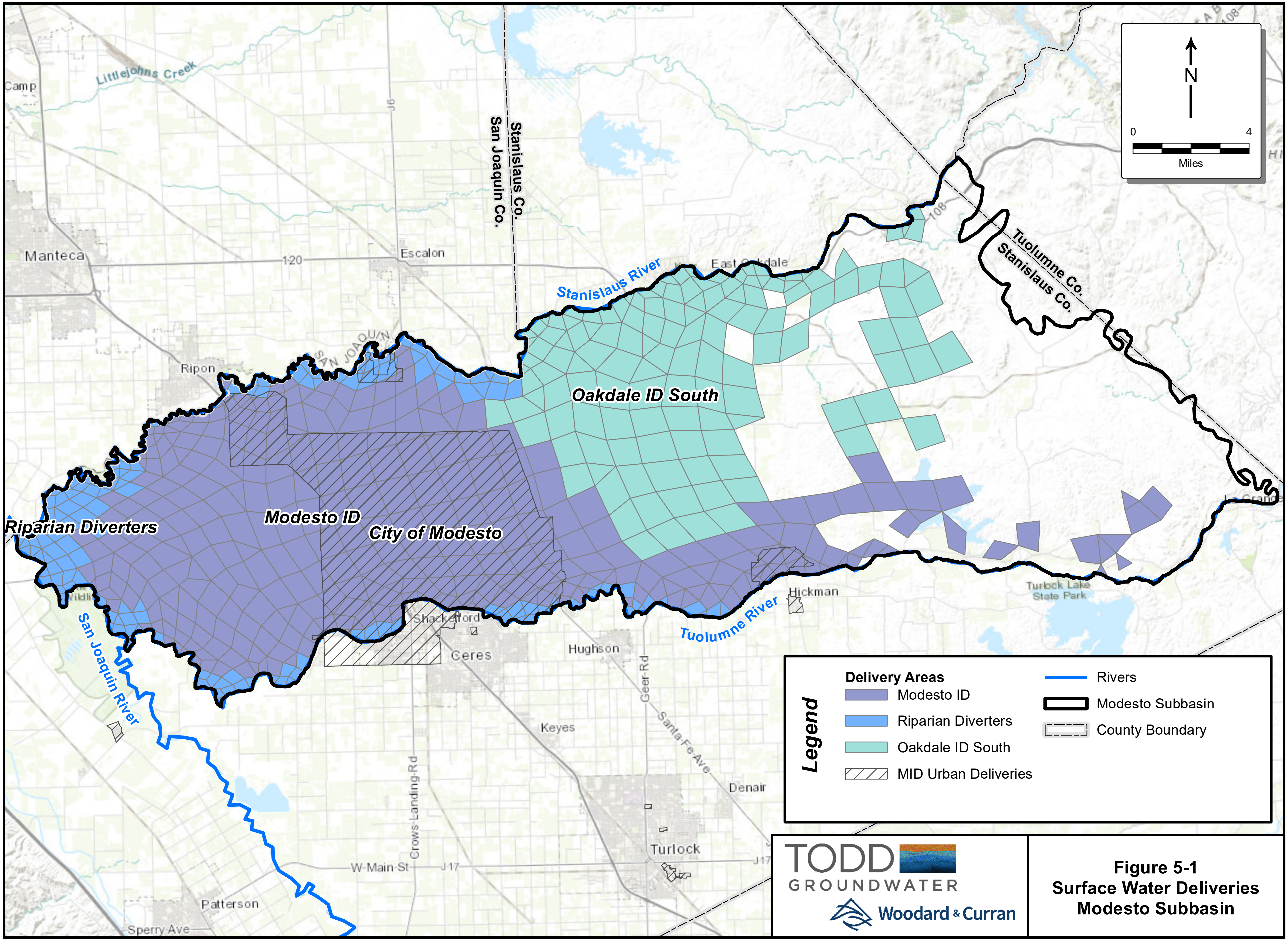
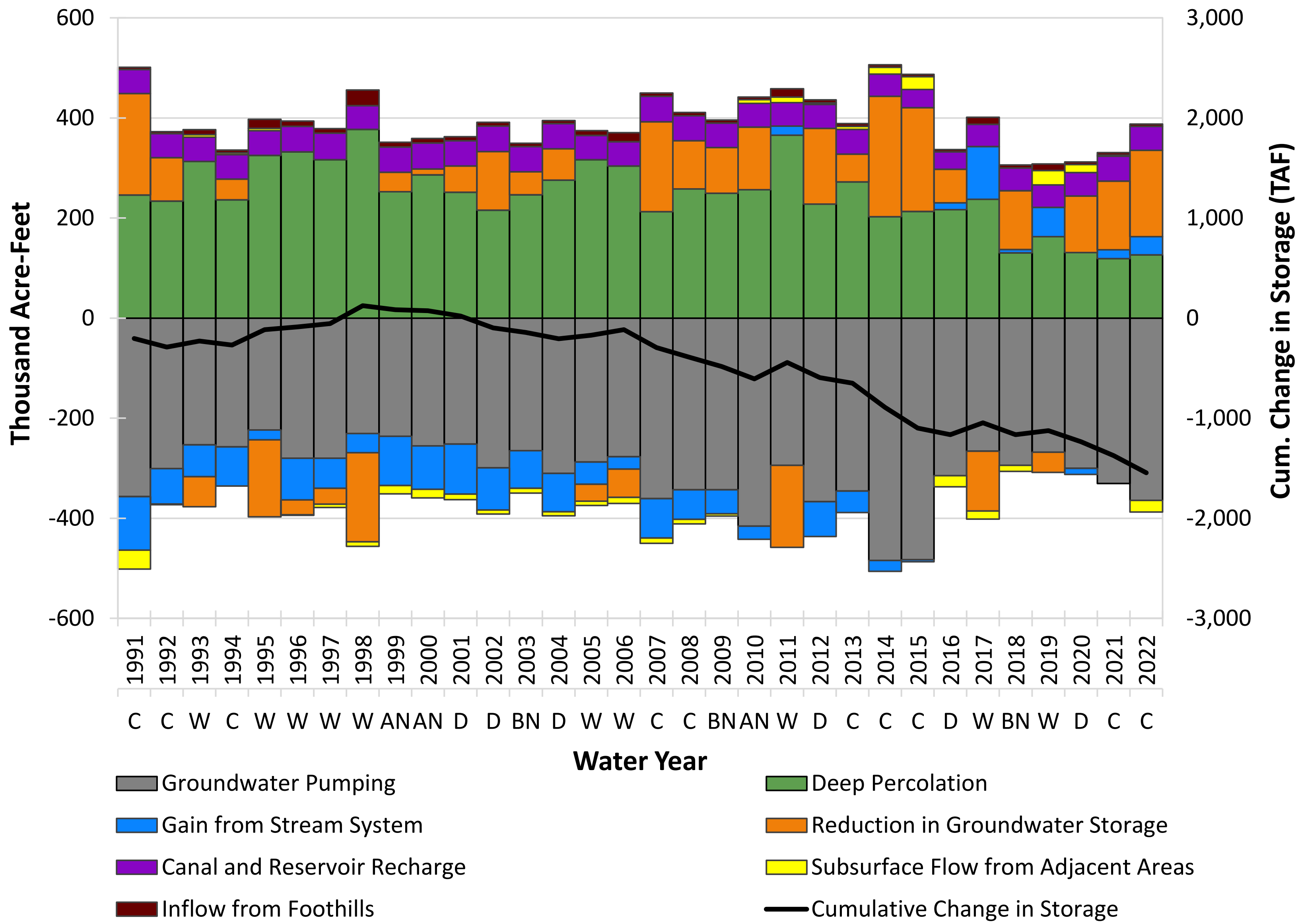


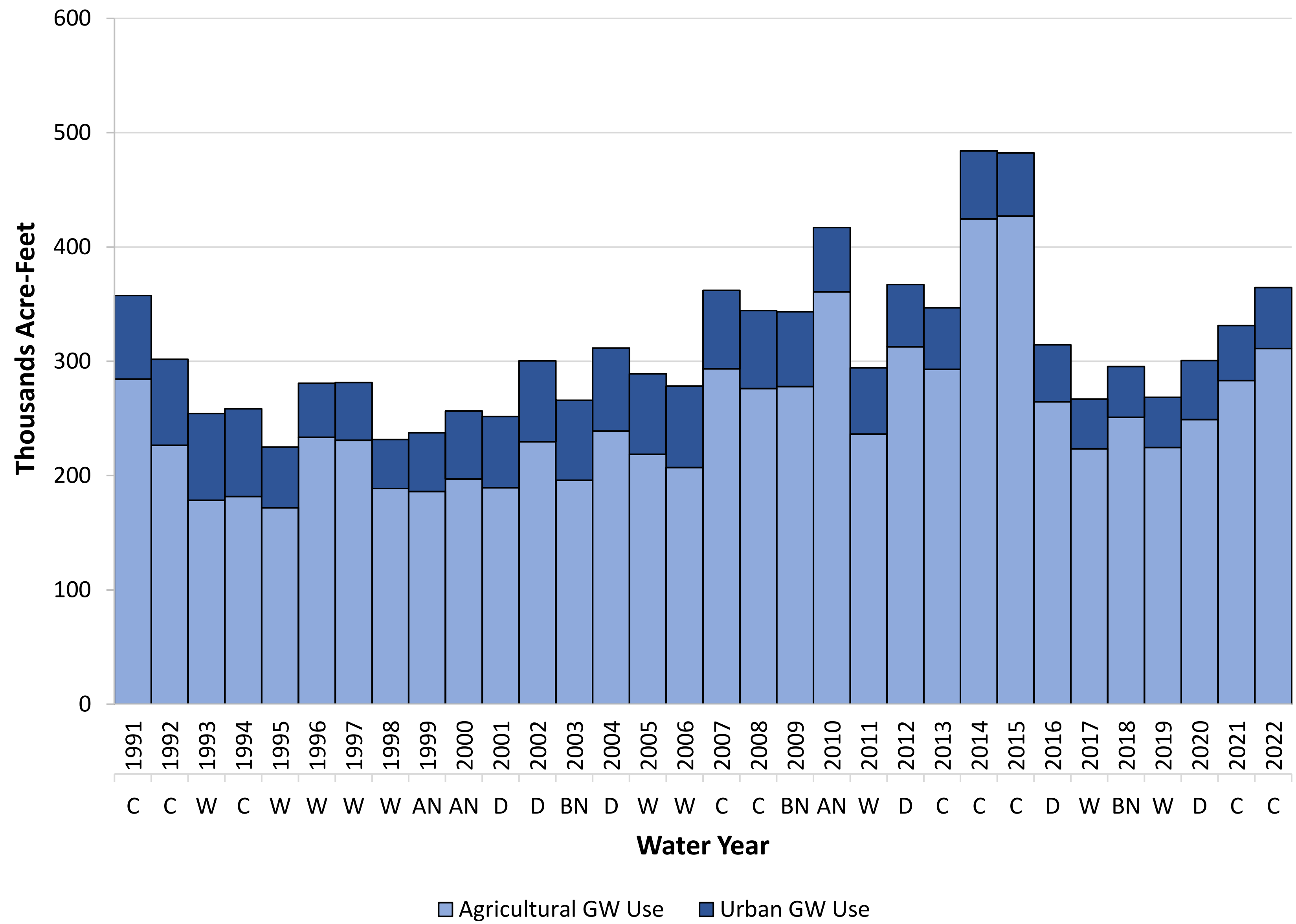
Figure 5-1
Surface Water Deliveries
Modesto Subbasin



TODD GROUNDWATER

Woodard & Curran

Figure 7-1
Groundwater Budget
Modesto Subbasin
WY 1991 - 2022



TODD GROUNDWATER

Woodard & Curran

Figure 7-2
Groundwater Use
Modesto Subbasin
WY 1991 - 2022

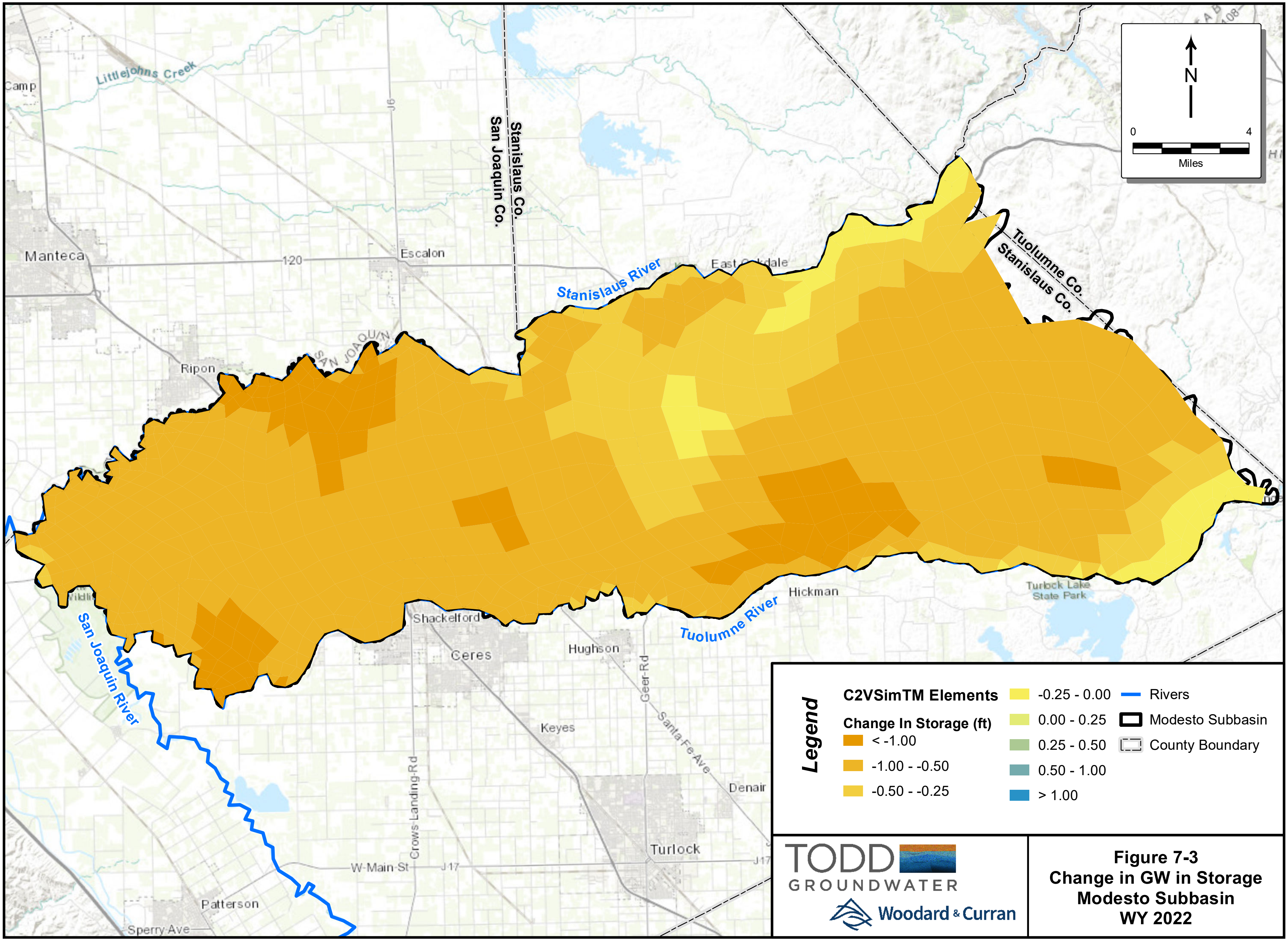


Figure 7-3
Change in GW in Storage
Modesto Subbasin
WY 2022

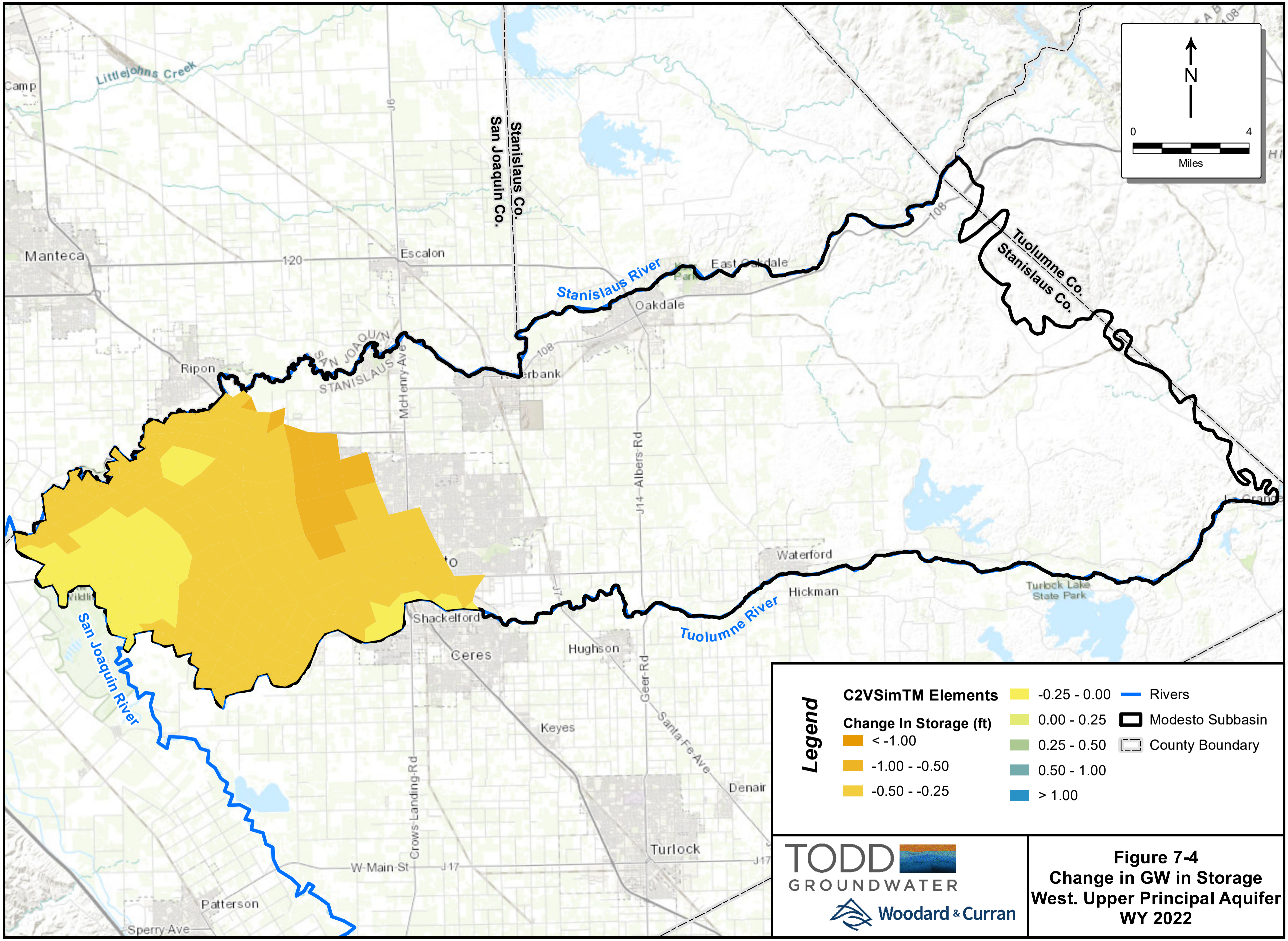


Figure 7-4
Change in GW in Storage
West. Upper Principal Aquifer
WY 2022

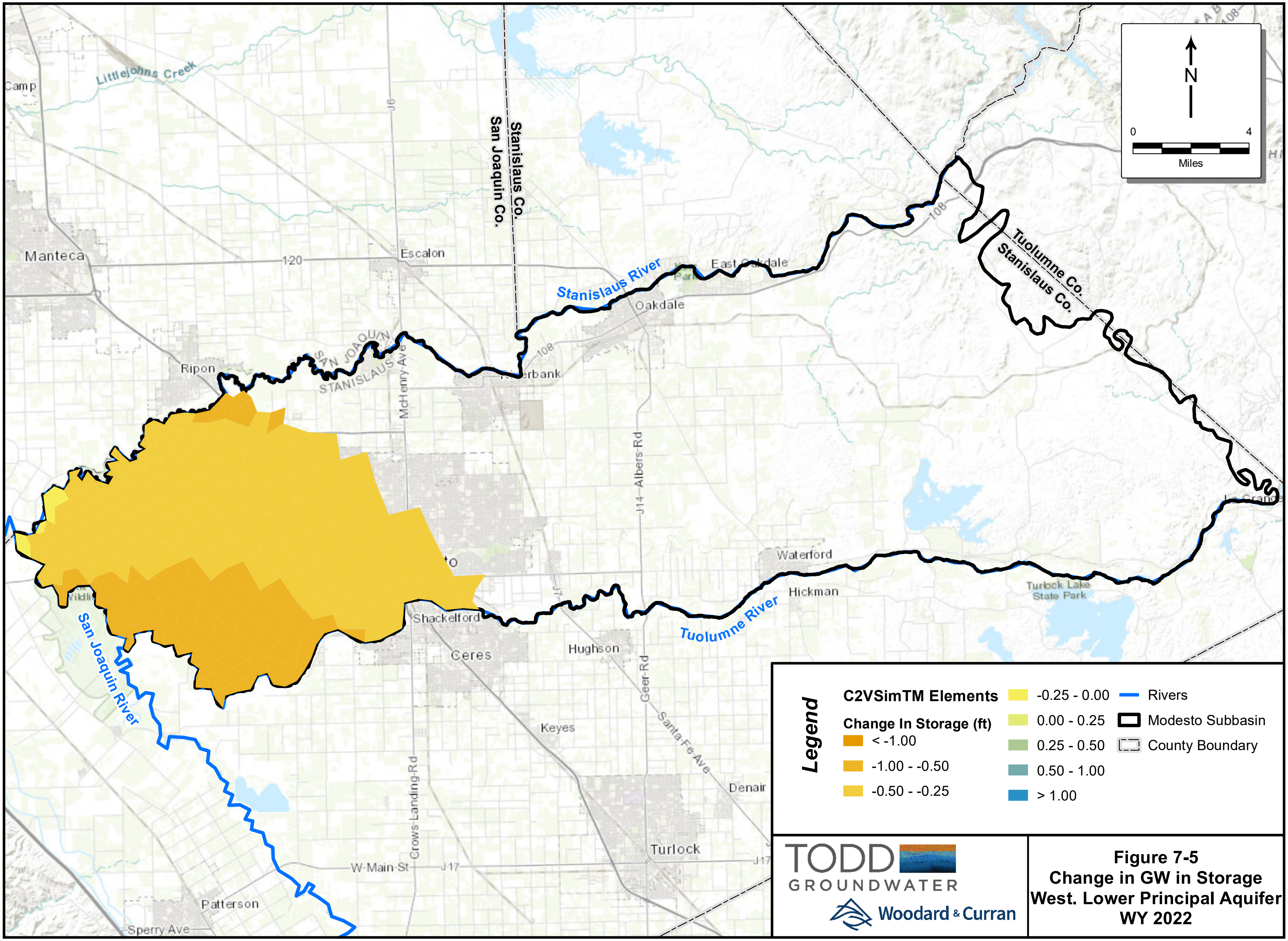


Figure 7-5
Change in GW in Storage
West. Lower Principal Aquifer
WY 2022

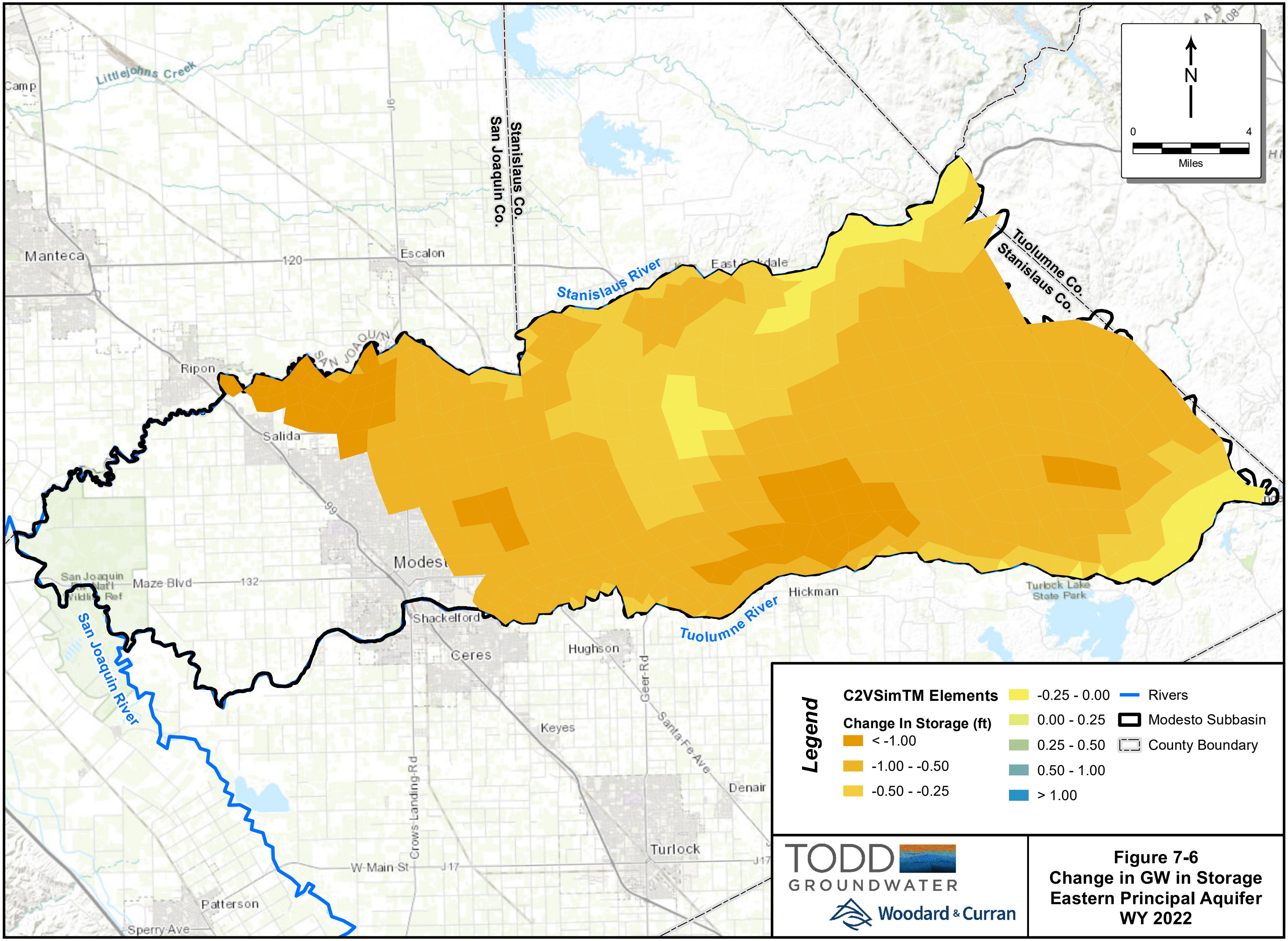


Figure 7-6
Change in GW in Storage
Eastern Principal Aquifer
WY 2022

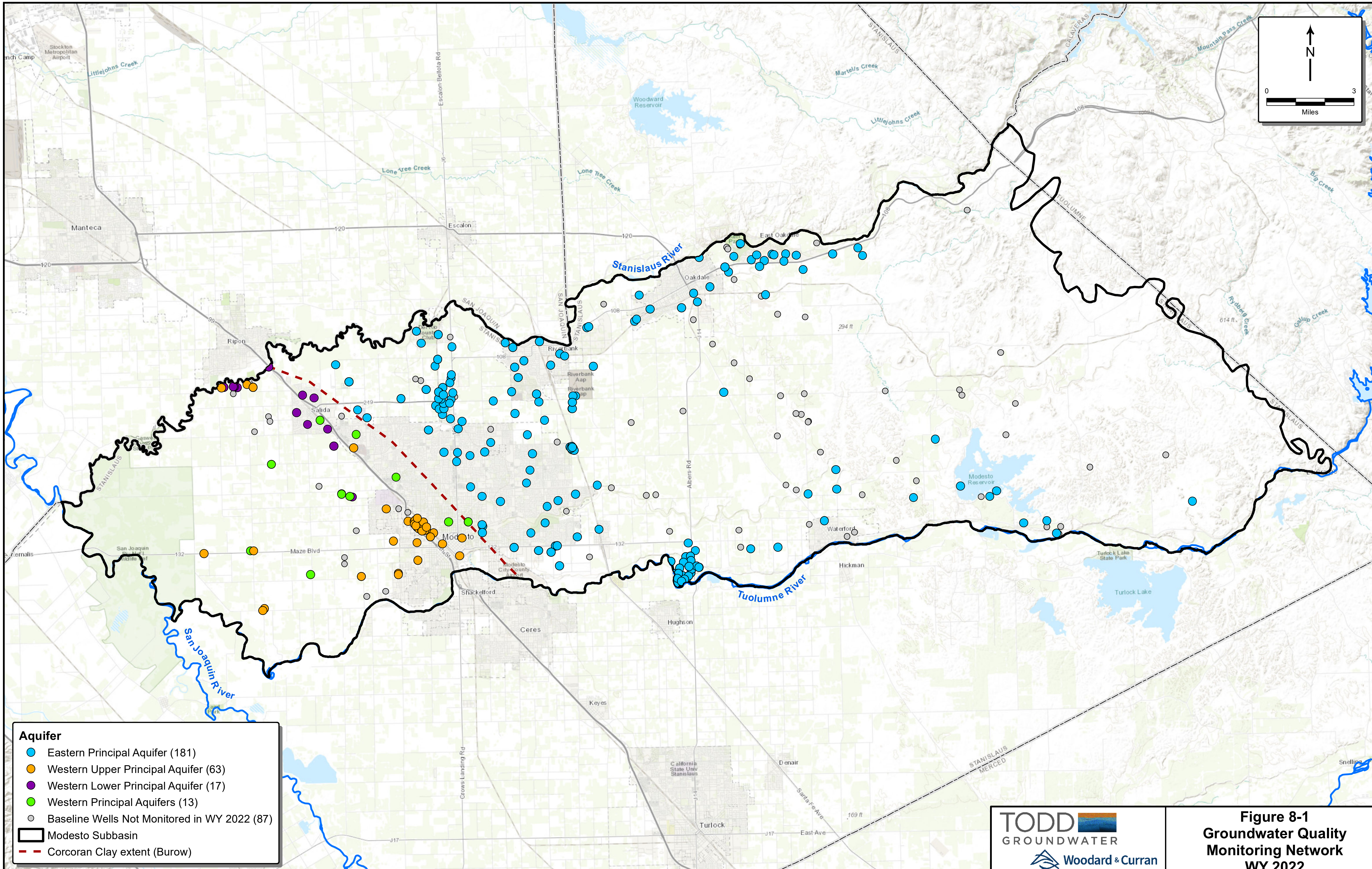


Figure 8-1
Groundwater Quality Monitoring Network
WY 2022

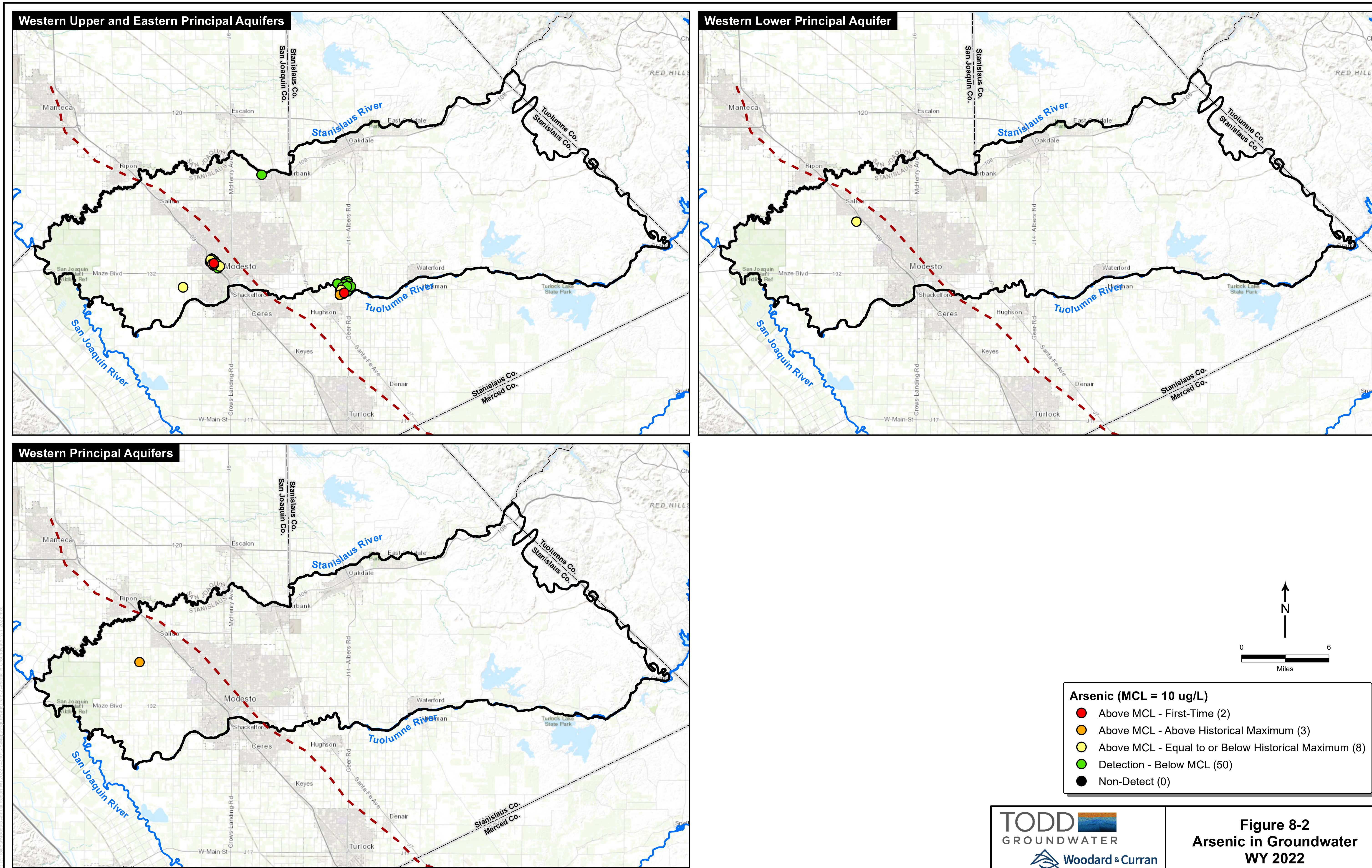
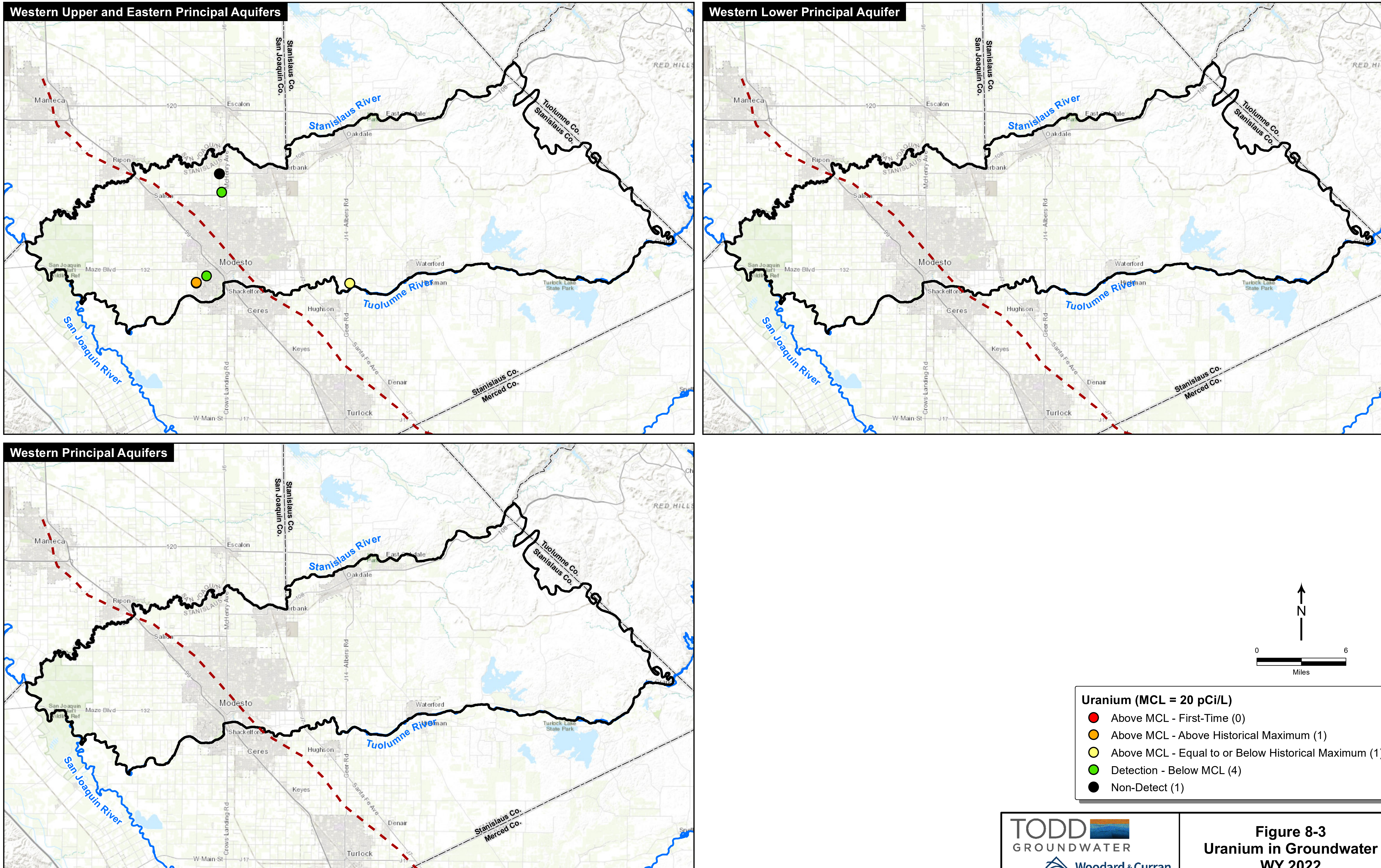


Figure 8-2
Arsenic in Groundwater
WY 2022



Uranium (MCL = 20 pCi/L)

- Above MCL - First-Time (0)
- Above MCL - Above Historical Maximum (1)
- Above MCL - Equal to or Below Historical Maximum (1)
- Detection - Below MCL (4)
- Non-Detect (1)

TODD GROUNDWATER

Woodard & Curran

Figure 8-3
Uranium in Groundwater
WY 2022

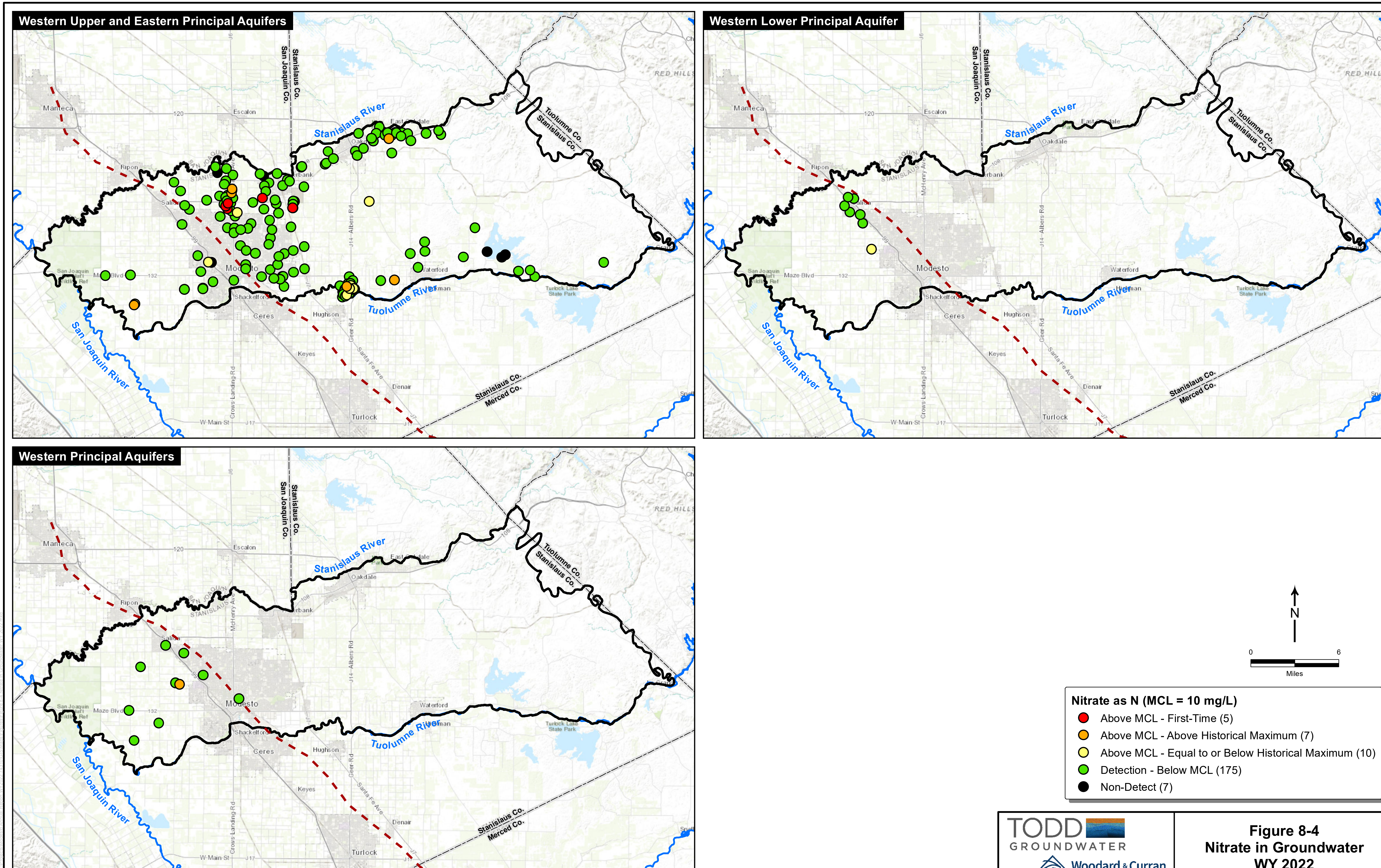


Figure 8-4
Nitrate in Groundwater
WY 2022

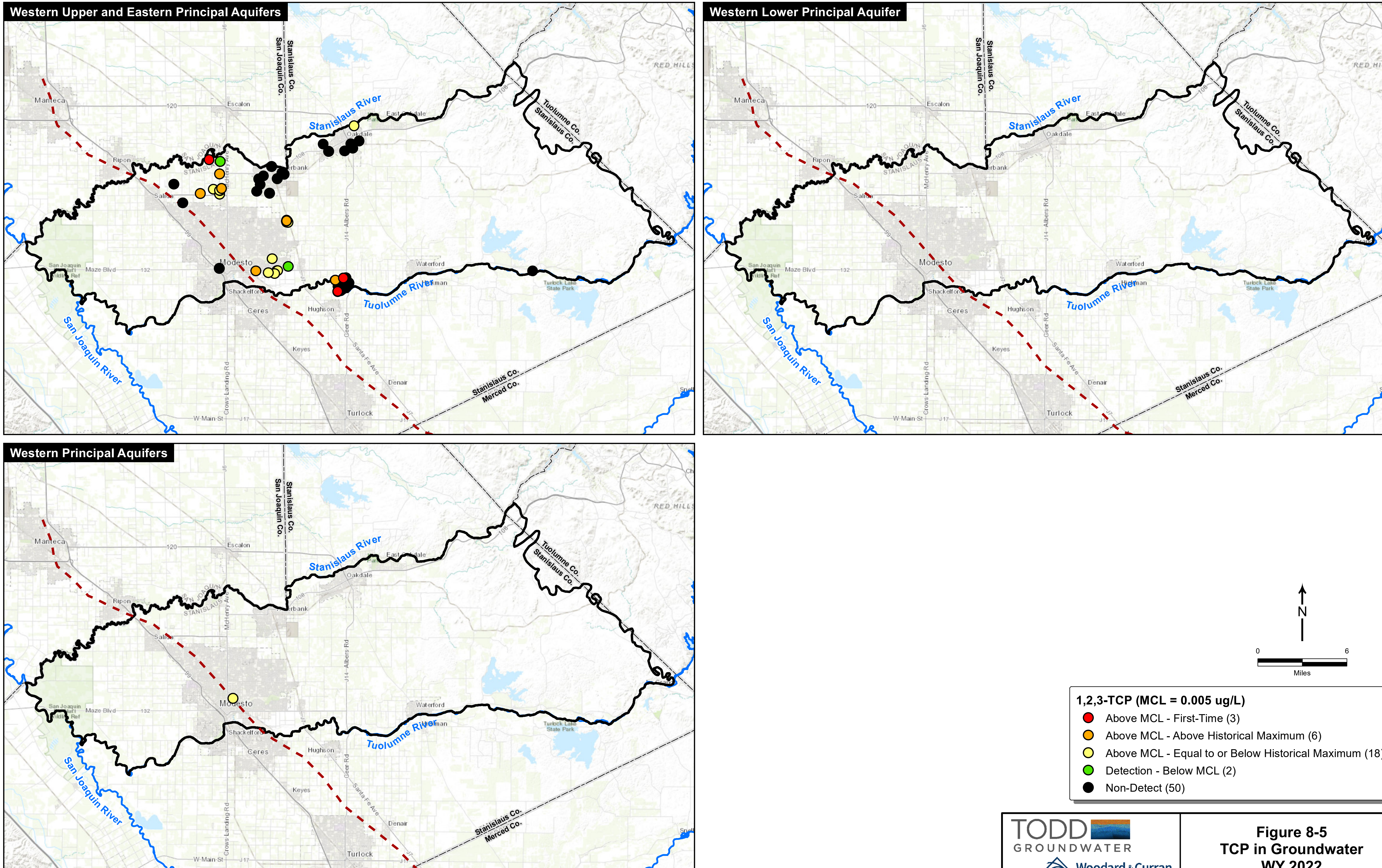
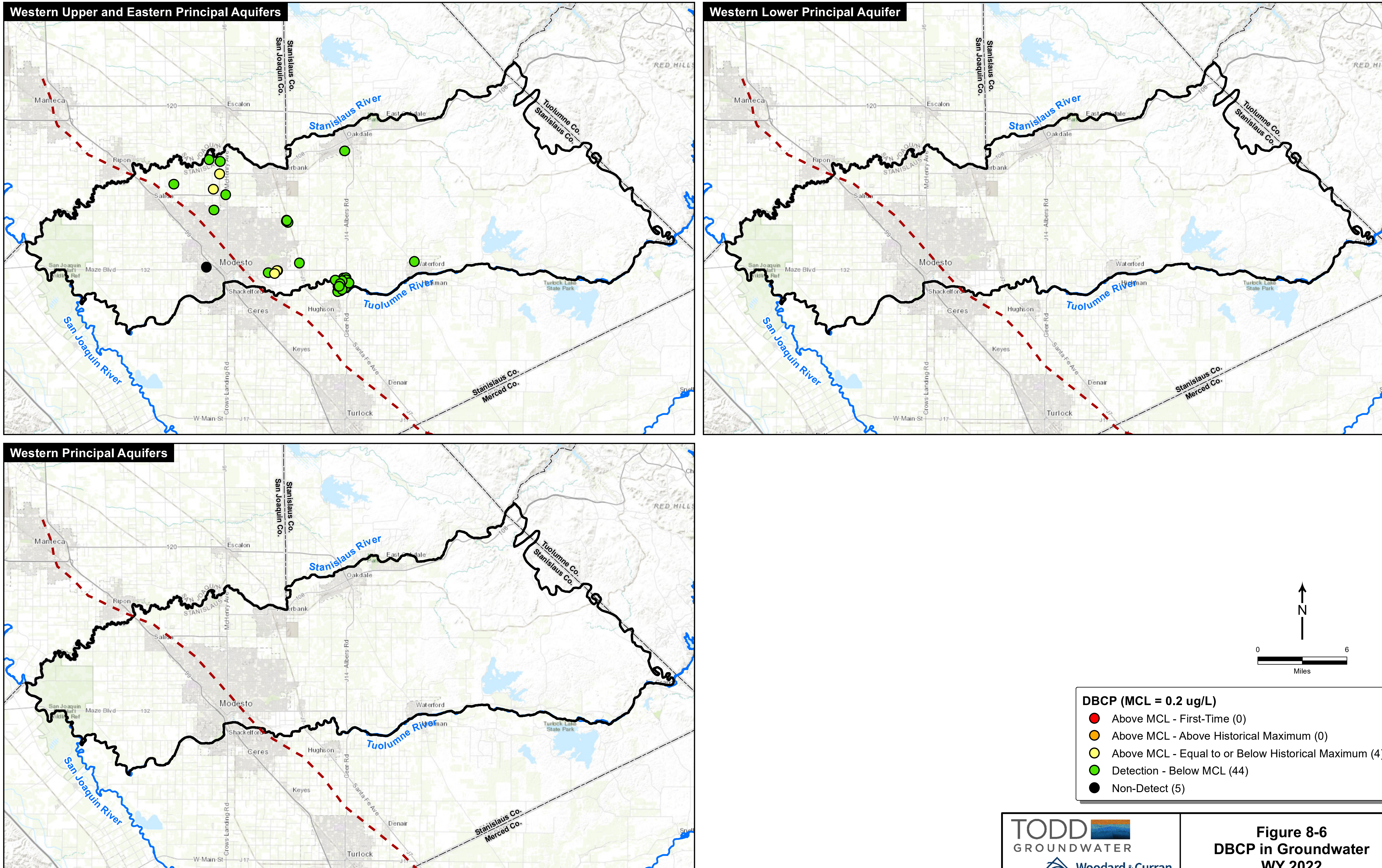


Figure 8-5
TCP in Groundwater
WY 2022



TODD GROUNDWATER

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Figure 8-6
DBCP in Groundwater
WY 2022

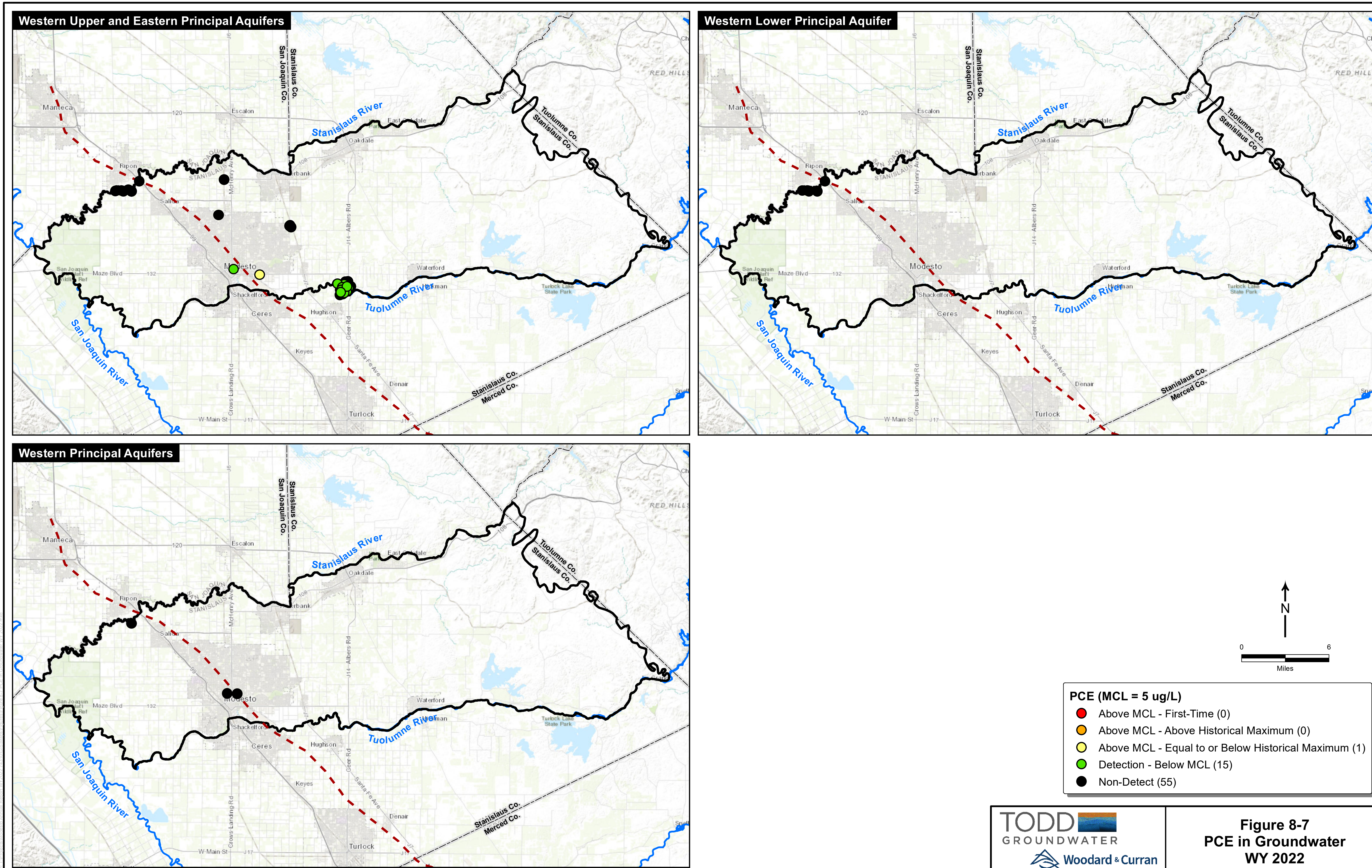


Figure 8-7
PCE in Groundwater
WY 2022

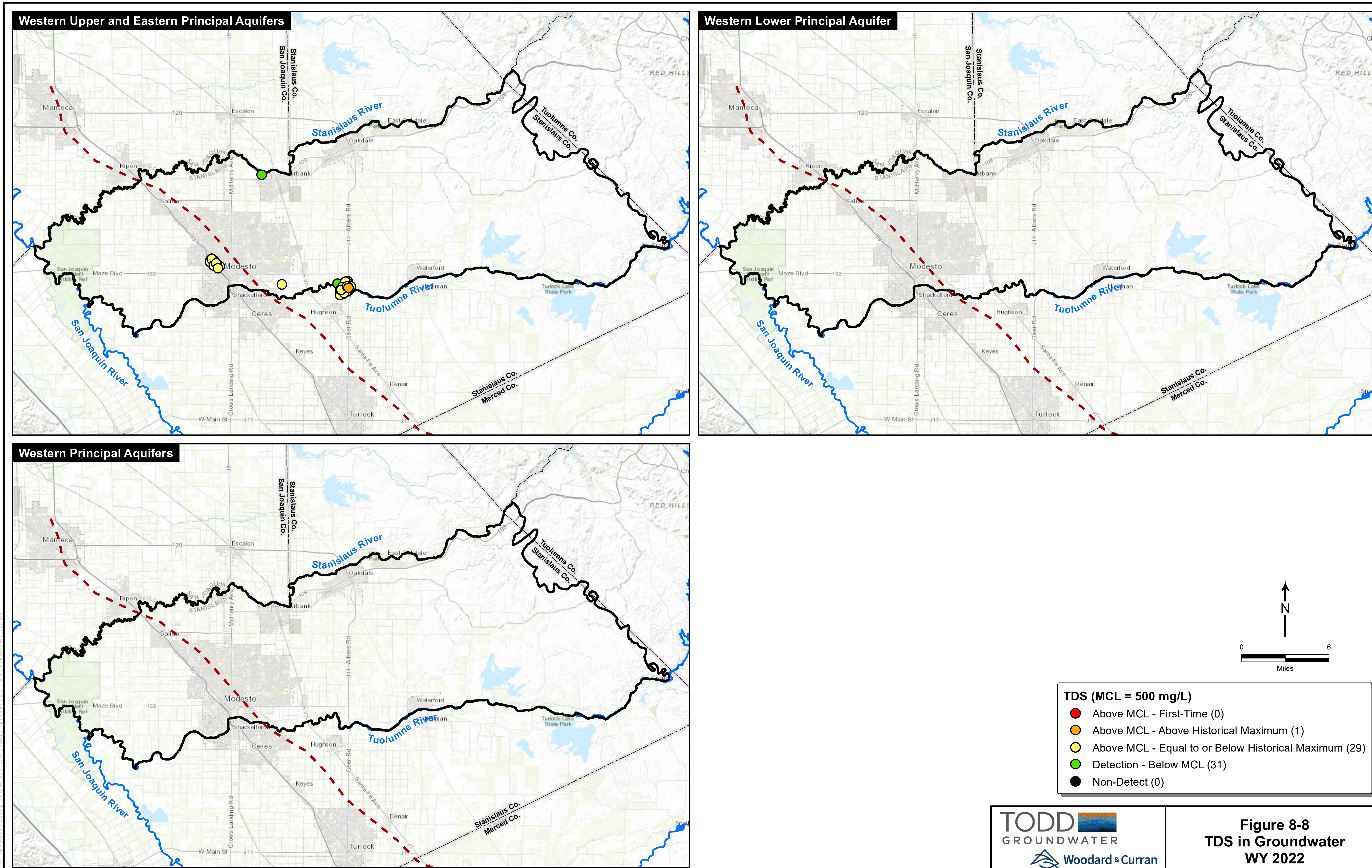


Figure 8-8
TDS in Groundwater
WY 2022

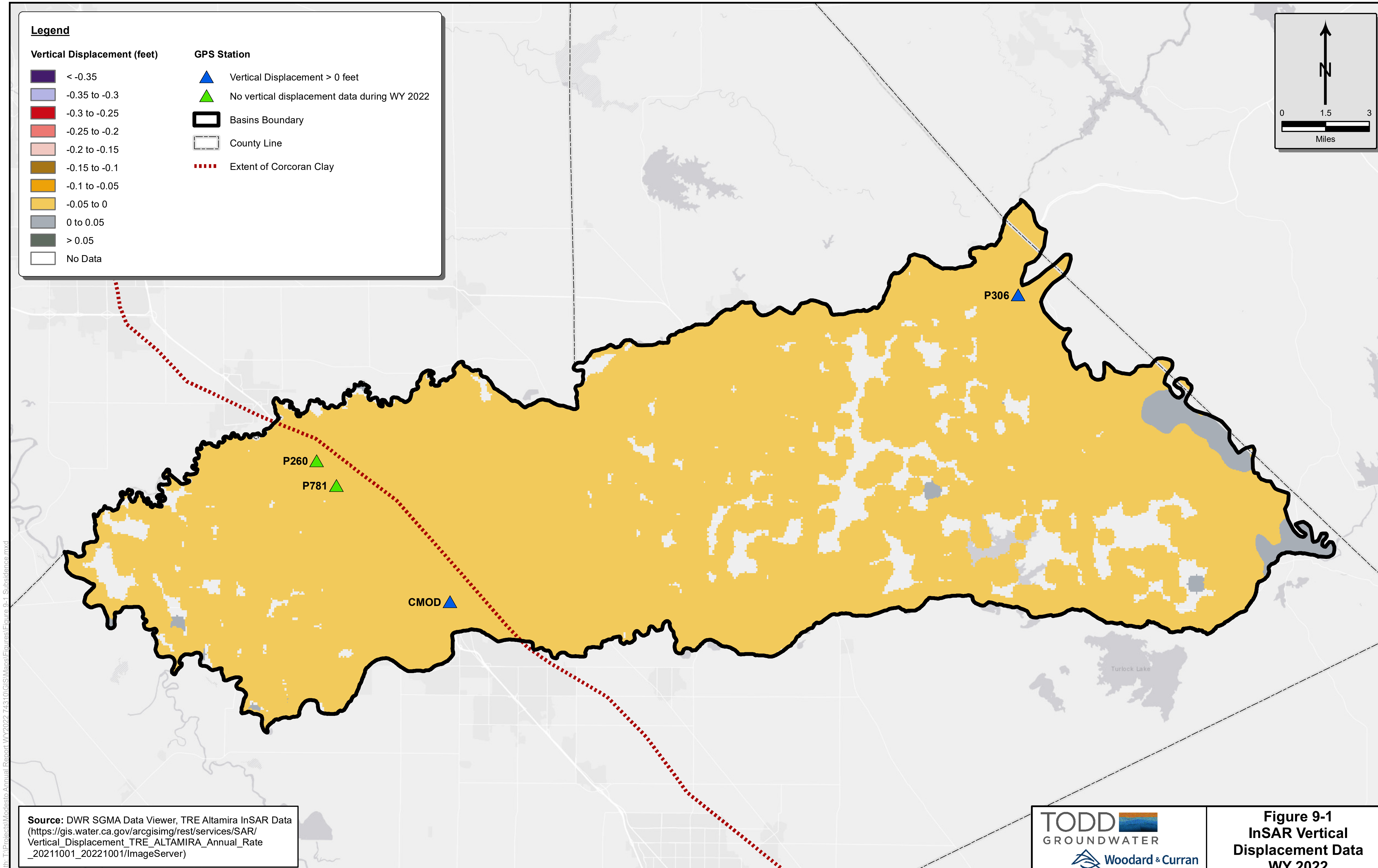


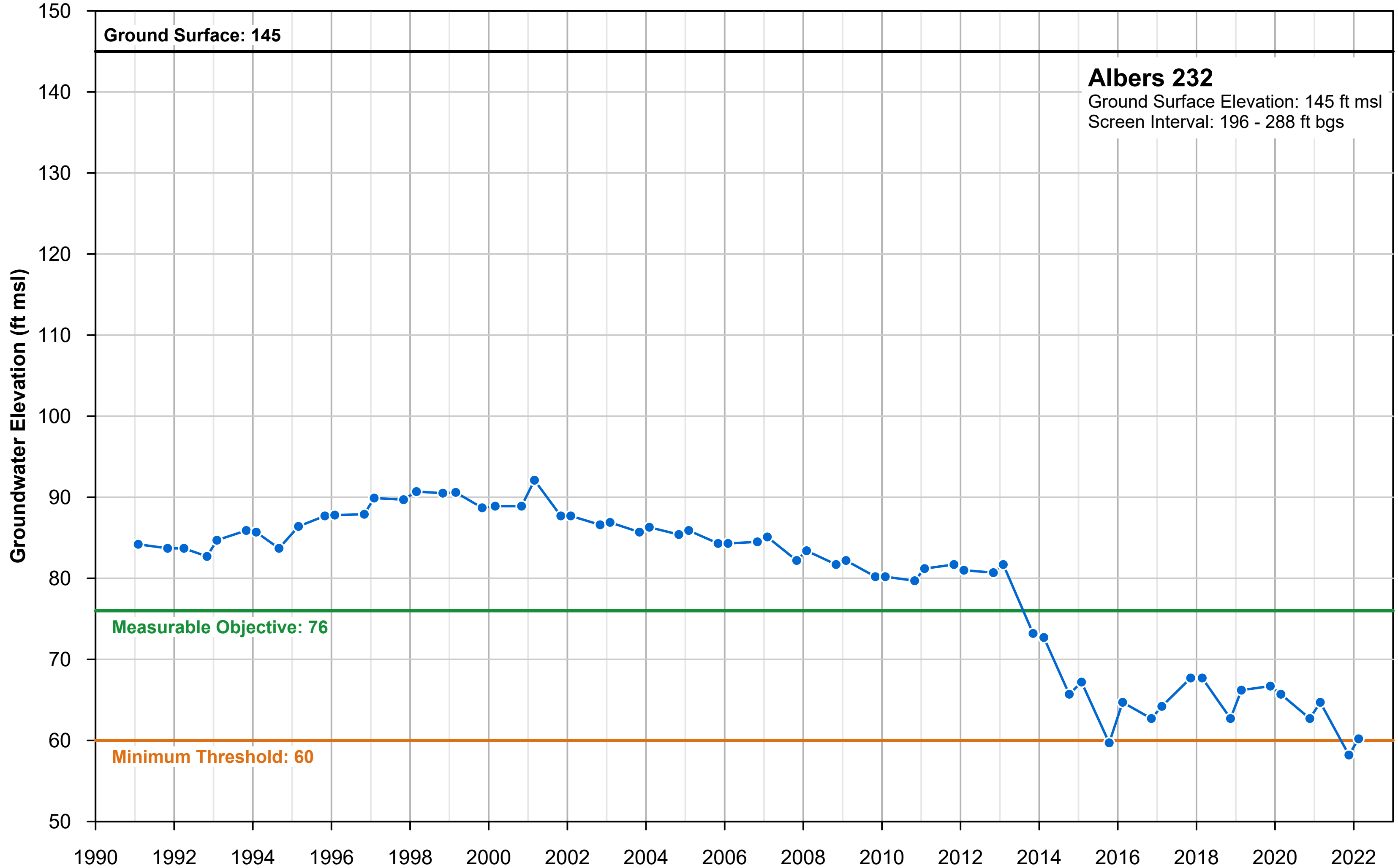
Figure 9-1
InSAR Vertical Displacement Data WY 2022

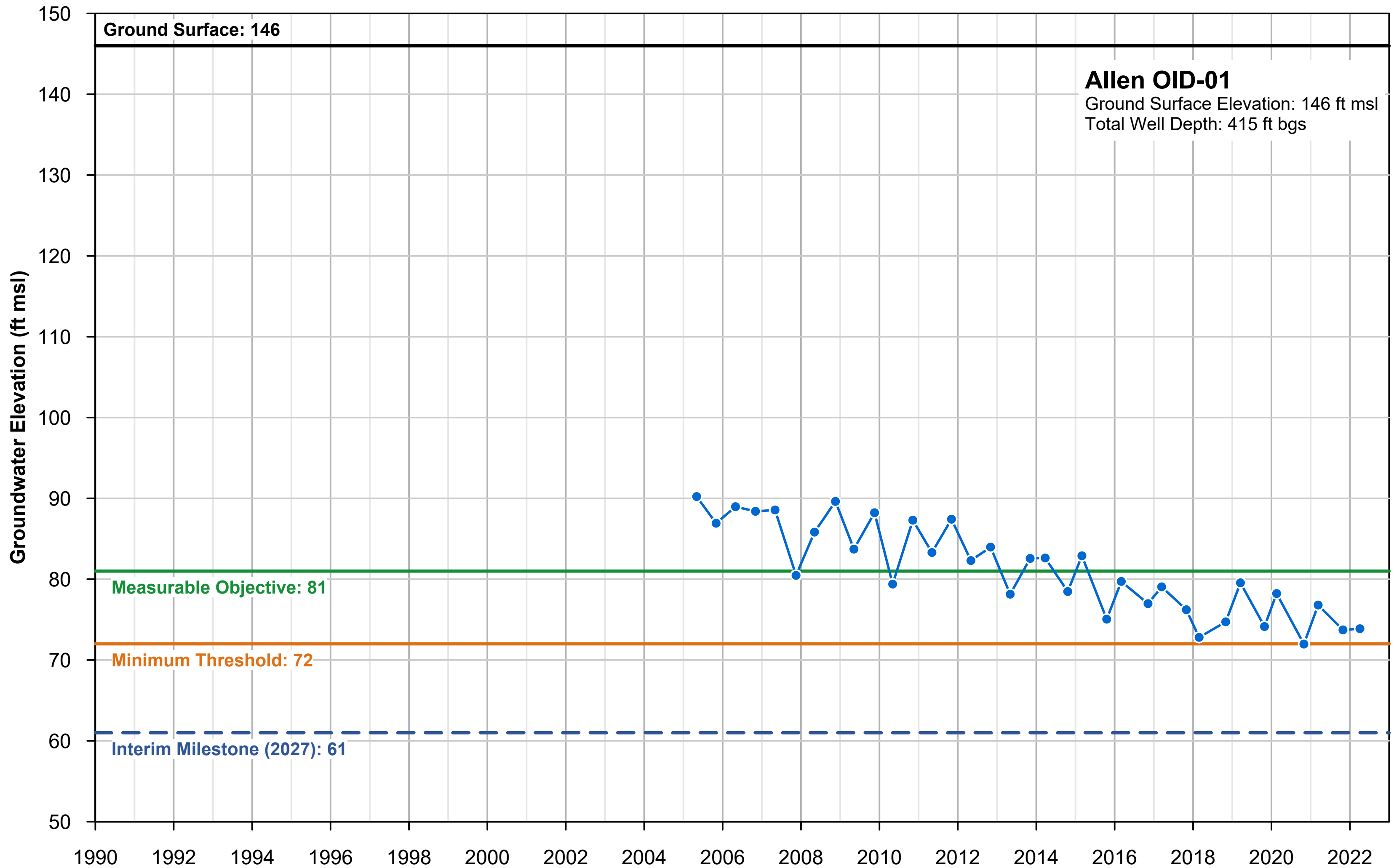
APPENDIX A

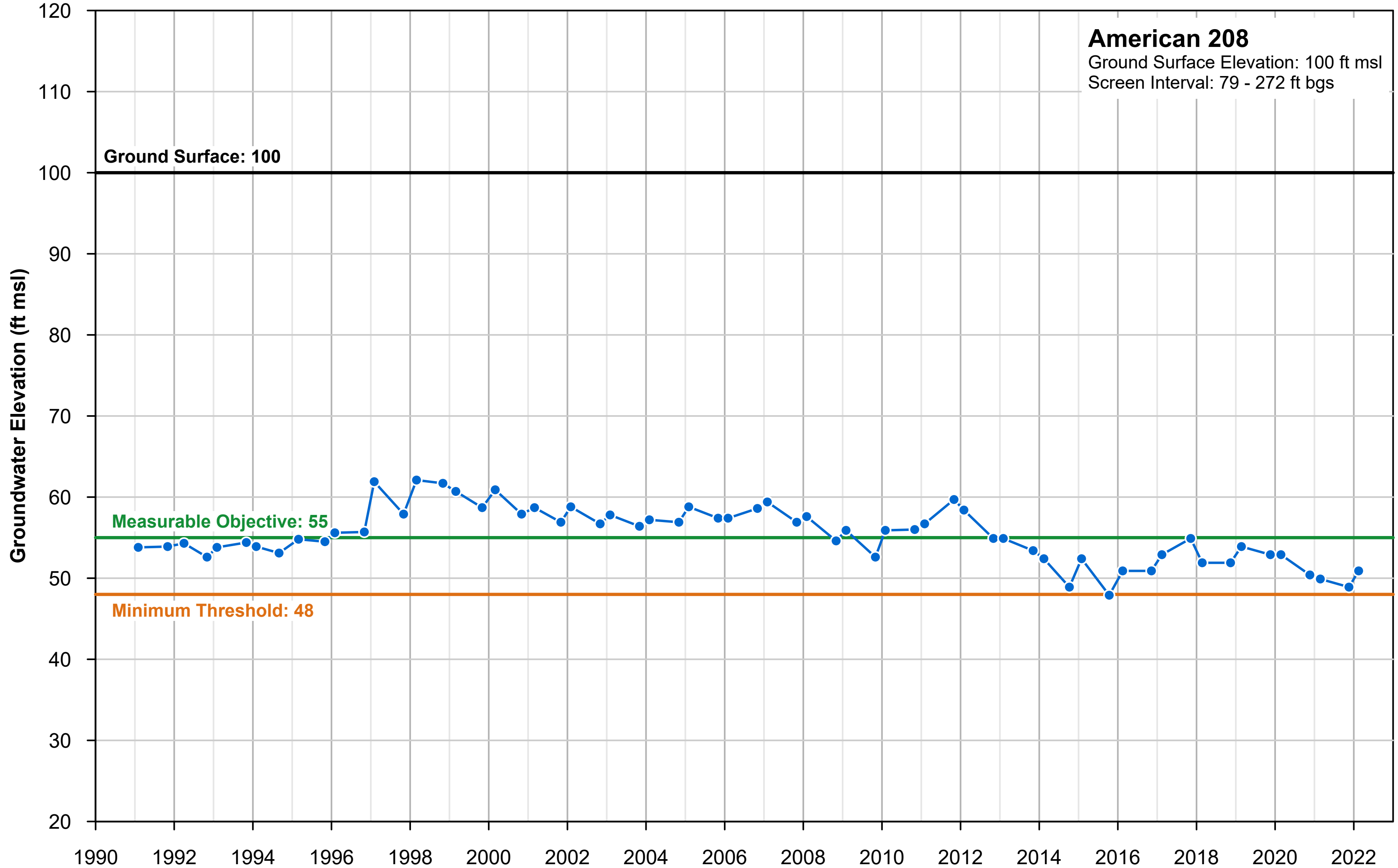
Hydrographs

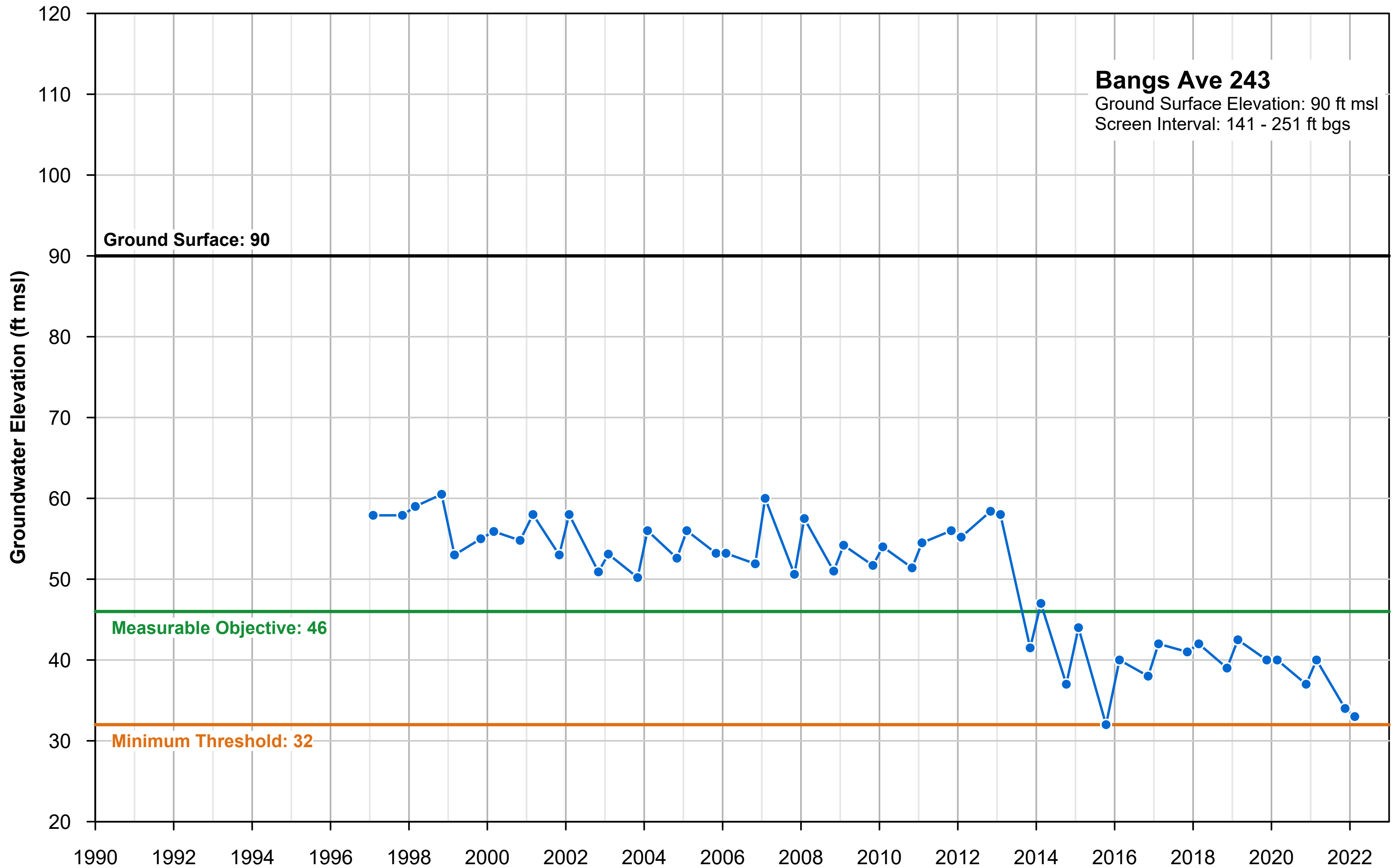
Representative Monitoring Wells
GSP Groundwater Elevation Monitoring Network

Hydrographs for Wells in the Monitoring Network for:
Chronic Lowering of Groundwater Levels
Reduction of Groundwater in Storage
Land Subsidence


Ground Surface: 145
Albers 232
Ground Surface Elevation: 145 ft msl
Screen Interval: 196 - 288 ft bgs
Measurable Objective: 76
Minimum Threshold: 60
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Ground Surface: 146
Allen OID-01
Ground Surface Elevation: 146 ft msl
Total Well Depth: 415 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 81
Minimum Threshold: 72
Interim Milestone (2027): 61
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


American 208
Ground Surface Elevation: 100 ft msl
Screen Interval: 79 - 272 ft bgs
Ground Surface: 100
Measurable Objective: 55
Minimum Threshold: 48
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Bangs Ave 243
Ground Surface Elevation: 90 ft msl
Screen Interval: 141 - 251 ft bgs
Ground Surface: 90
Measurable Objective: 46
Minimum Threshold: 32
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
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2020
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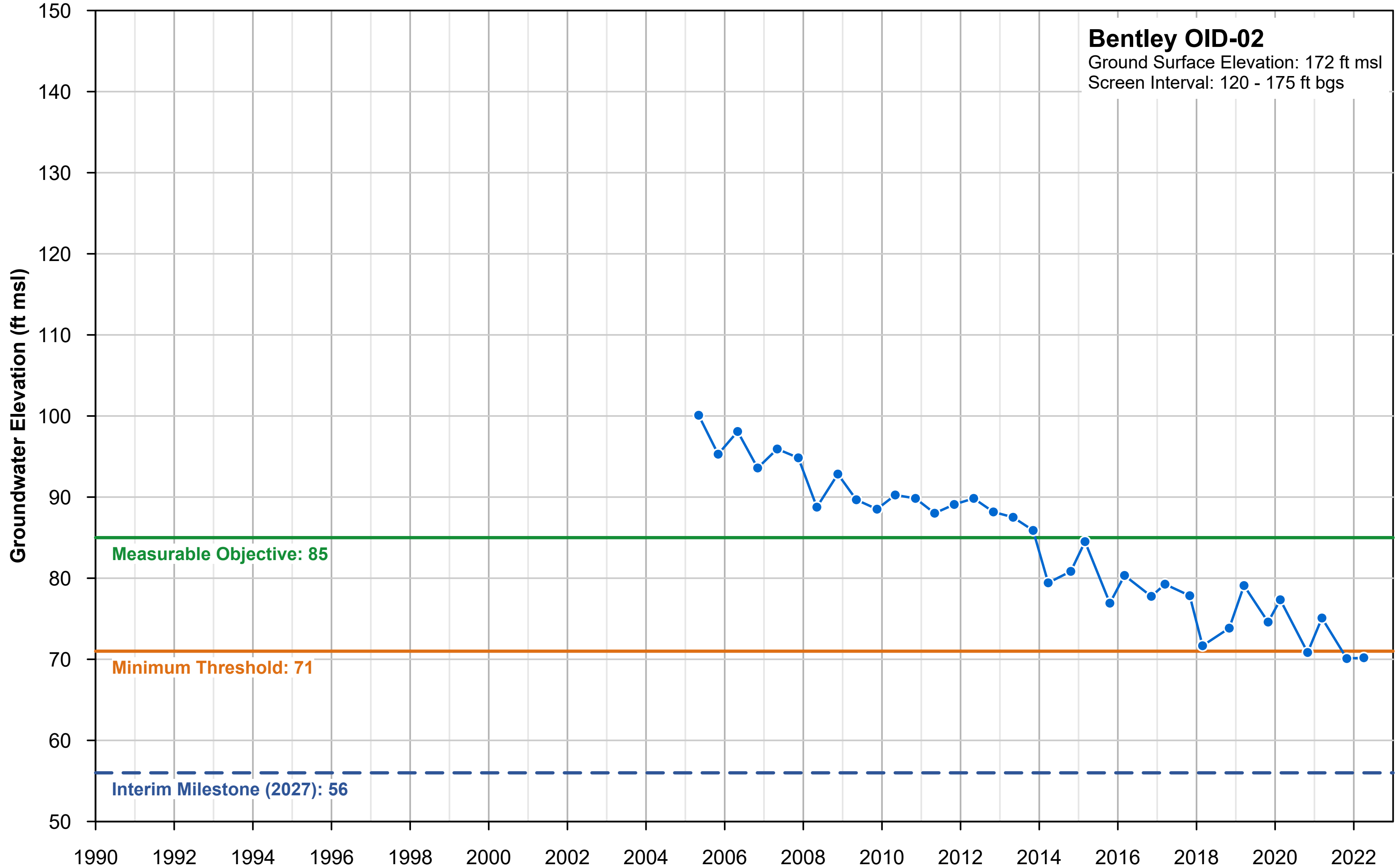

Bentley OID-02
Ground Surface Elevation: 172 ft msl
Screen Interval: 120 - 175 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 85
Minimum Threshold: 71
Interim Milestone (2027): 56
150
140
130
120
110
100
90
80
70
60
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1990
1992
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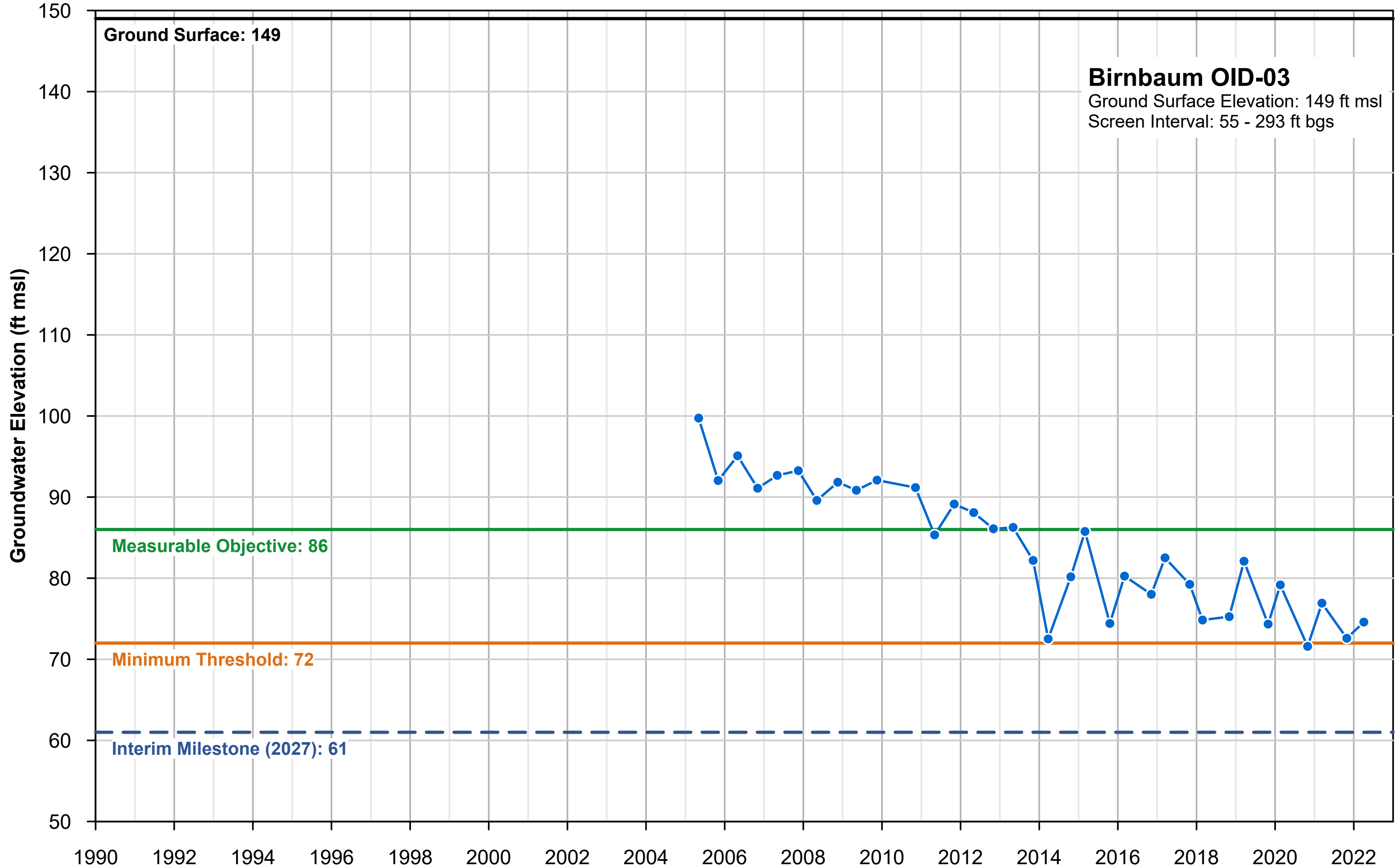
2018
2020
2022


Birnbaum OID-03
Ground Surface Elevation: 149 ft msl
Screen Interval: 55 - 293 ft bgs
Ground Surface: 149
Measurable Objective: 86
Minimum Threshold: 72
Interim Milestone (2027): 61
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
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2010
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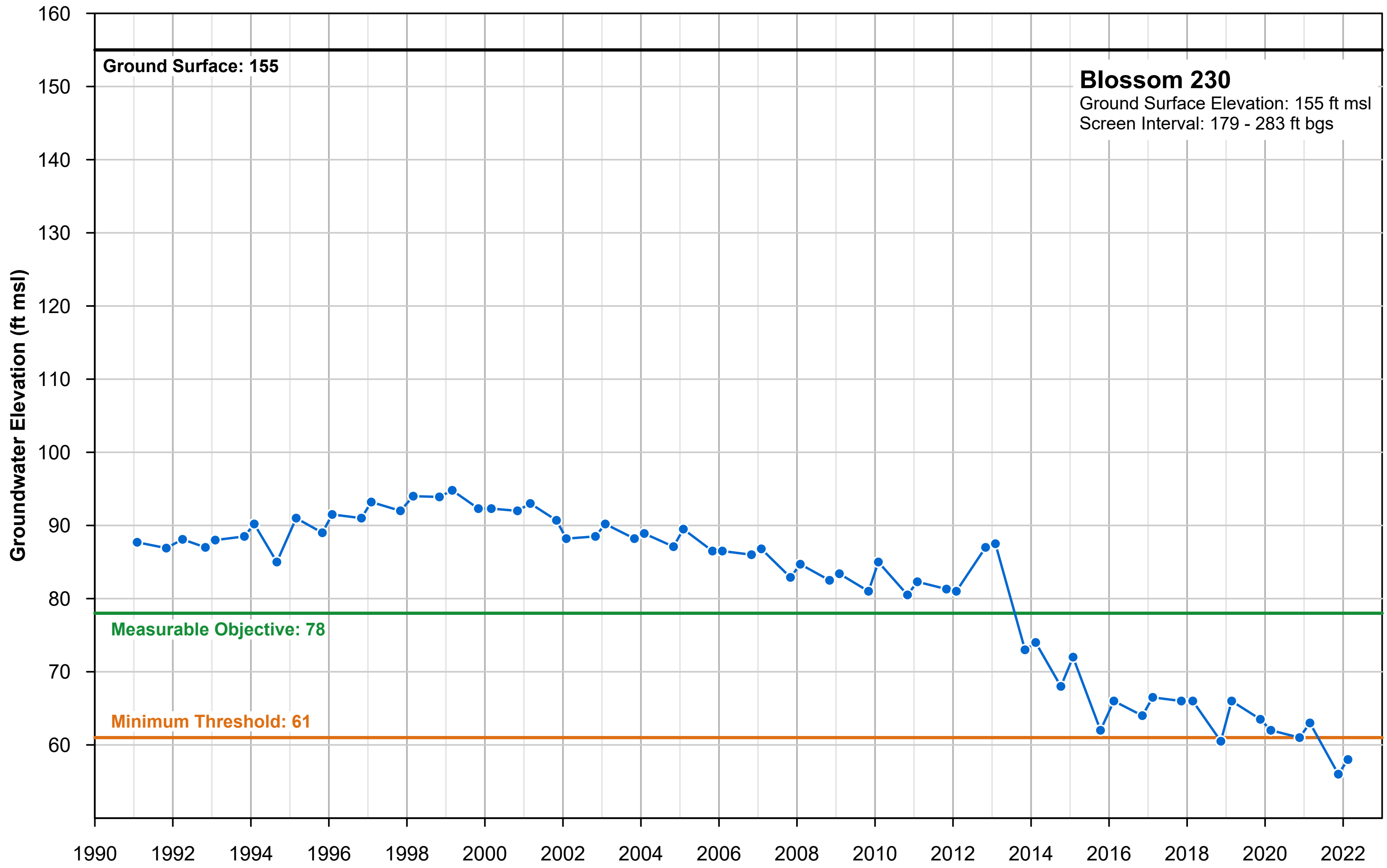
2016
2018
2020
2022


Blossom 230
Ground Surface Elevation: 155 ft msl
Screen Interval: 179 - 283 ft bgs
Ground Surface: 155
Measurable Objective: 78
Minimum Threshold: 61
Groundwater Elevation (ft msl)
160
150
140
130
120
110
100
90
80
70
60
1990
1992
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2010
2012
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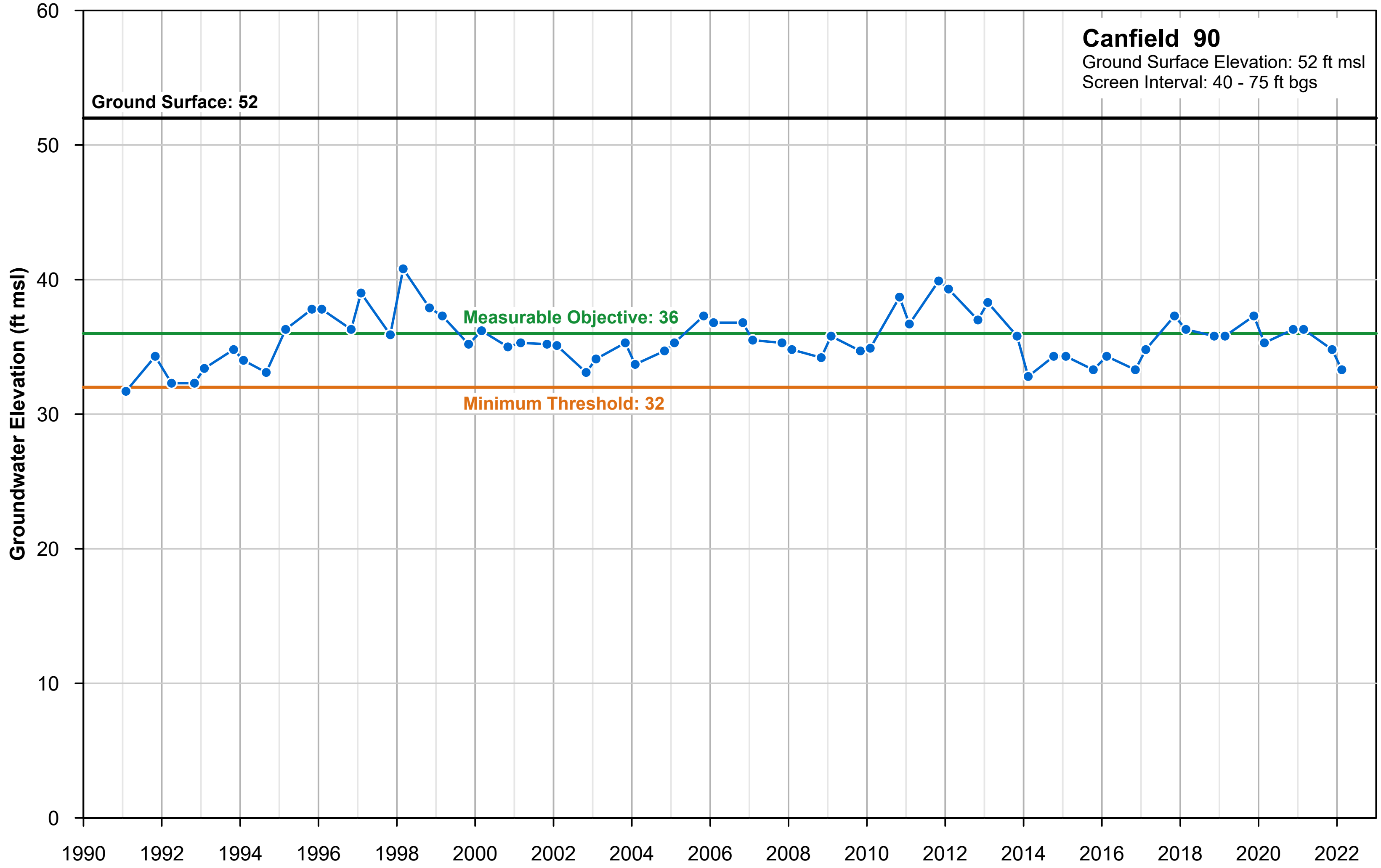
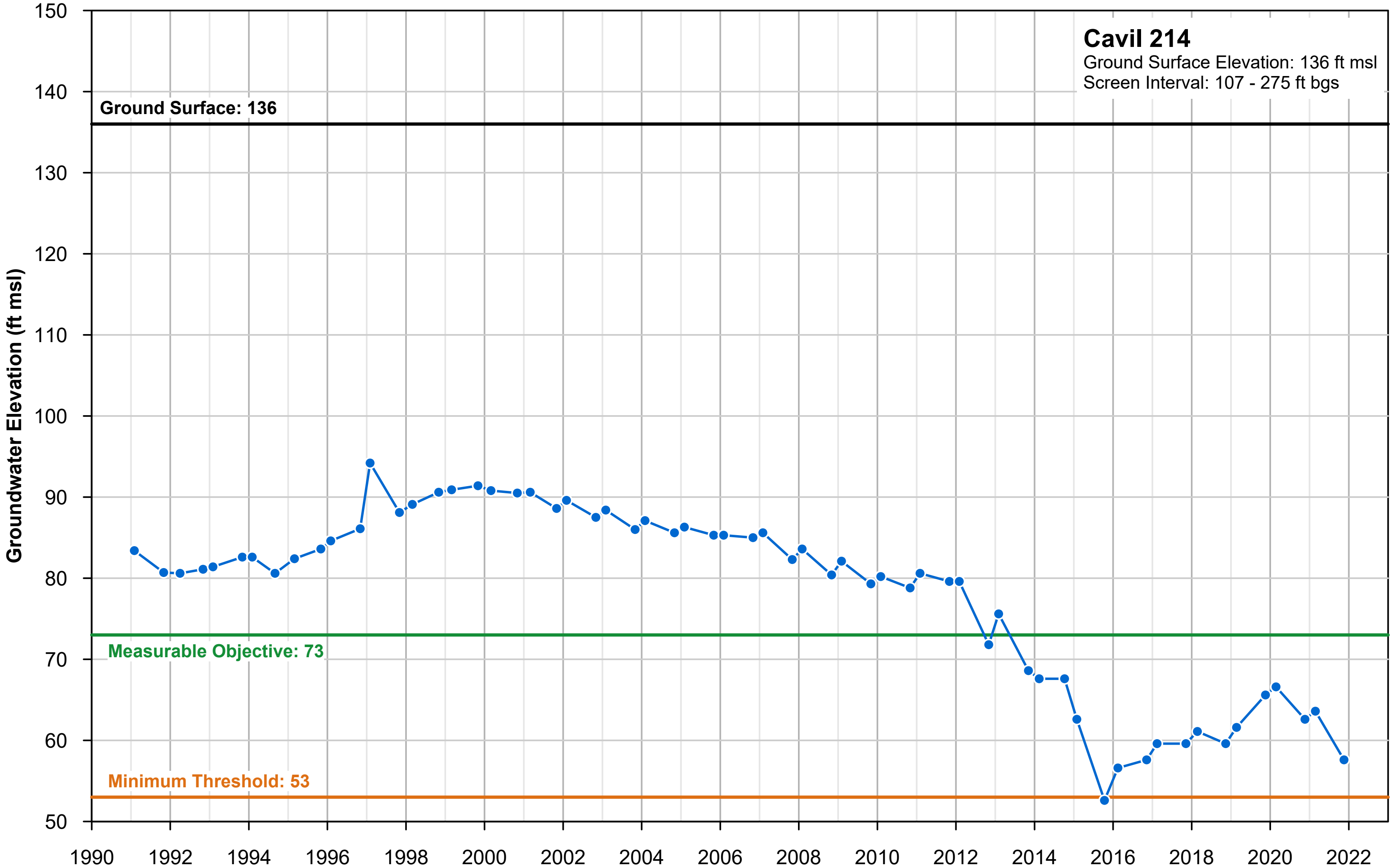
2016
2018
2020
2022



Canfield 90
Ground Surface Elevation: 52 ft msl
Screen Interval: 40 - 75 ft bgs
Ground Surface: 52
Measurable Objective: 36
Minimum Threshold: 32
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Cavil 214
Ground Surface Elevation: 136 ft msl
Screen Interval: 107 - 275 ft bgs
Ground Surface: 136
Measurable Objective: 73
Minimum Threshold: 53
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
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1998
2000
2002
2004
2006
2008
2010
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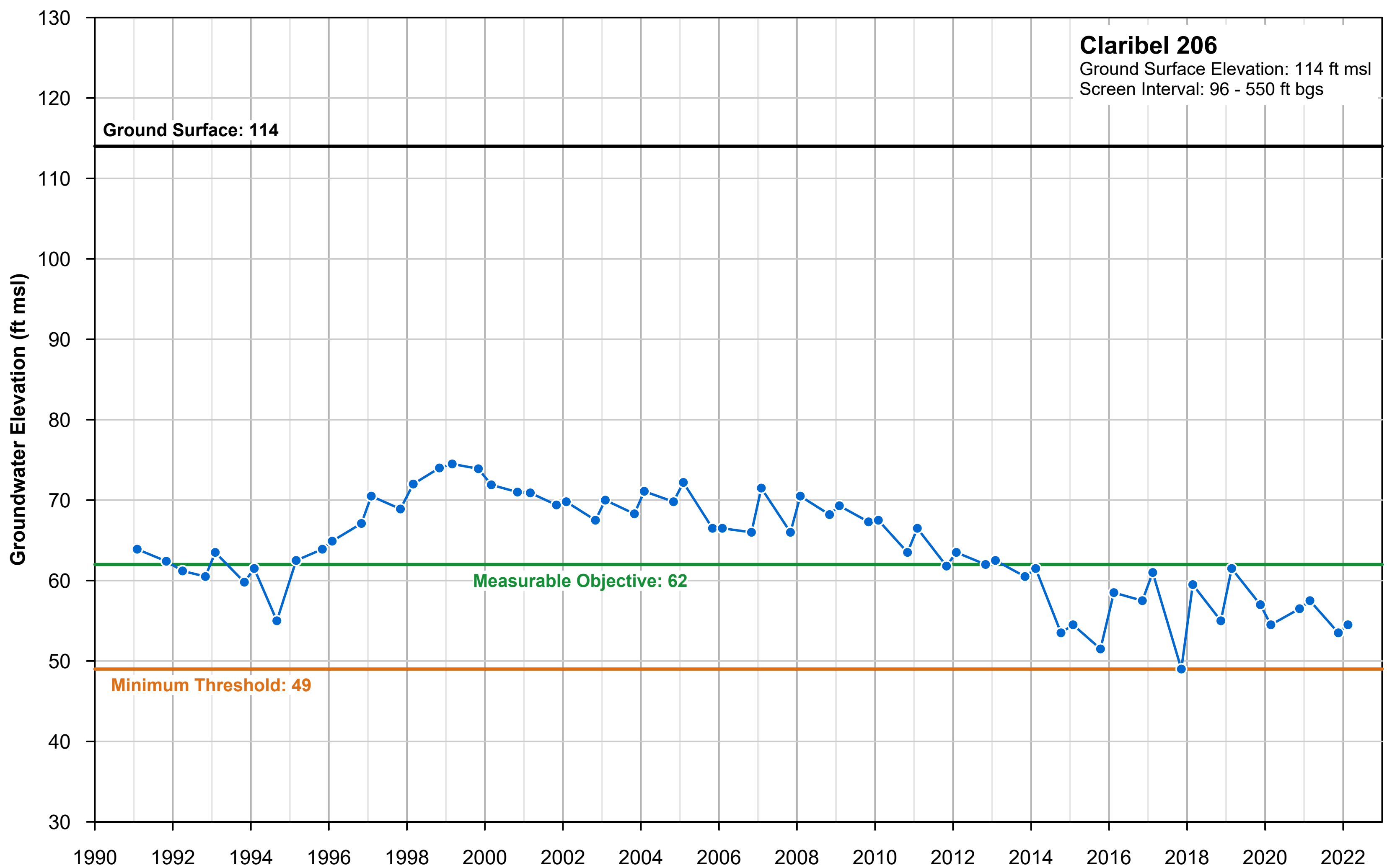
2020
2022


Claribel 206
Ground Surface Elevation: 114 ft msl
Screen Interval: 96 - 550 ft bgs
Ground Surface: 114
Measurable Objective: 62
Minimum Threshold: 49
Groundwater Elevation (ft msl)
130
120
110
100
90
80
70
60
50
40
30
1990
1992
1994
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1998
2000
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2004
2006
2008
2010
2012
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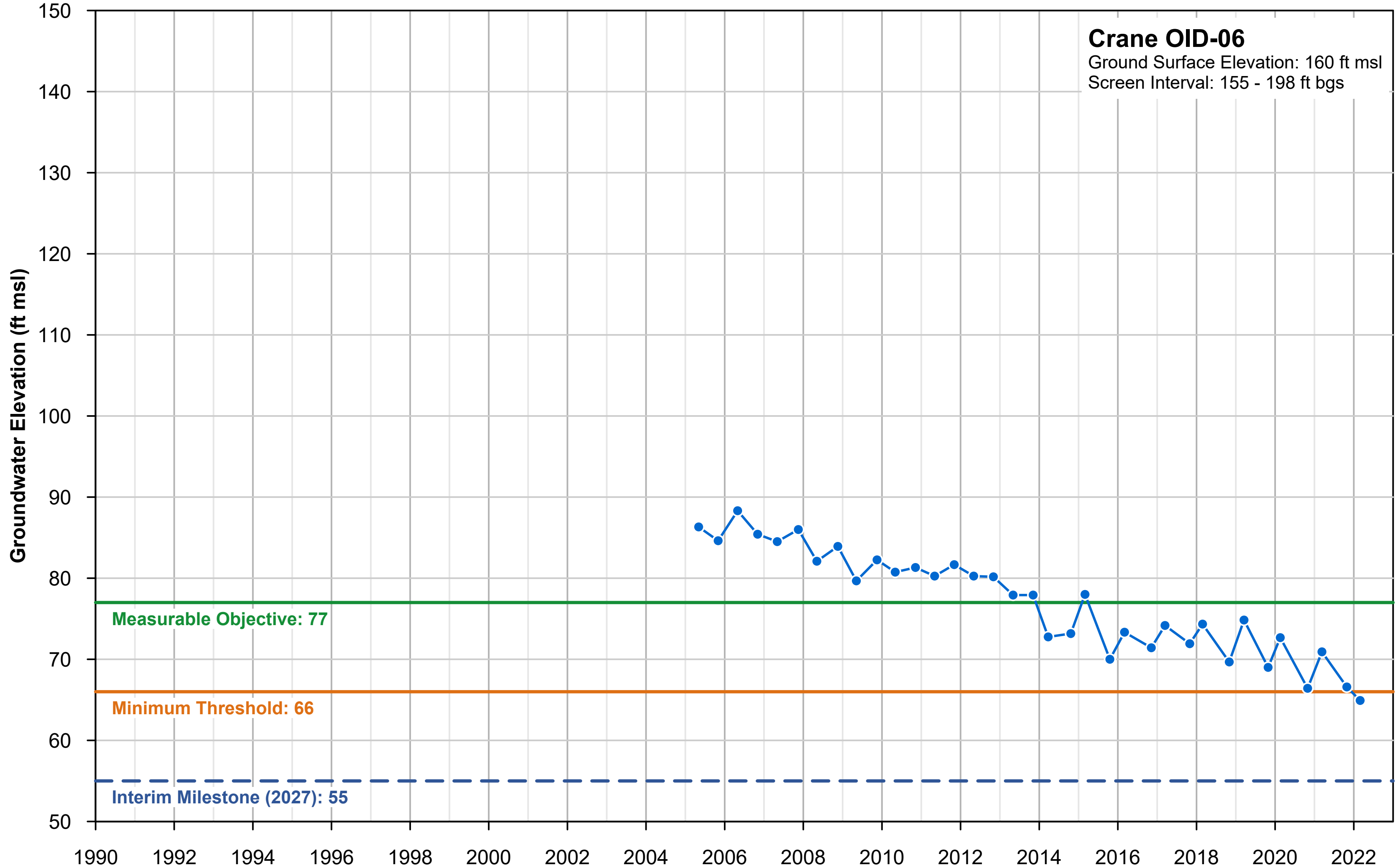
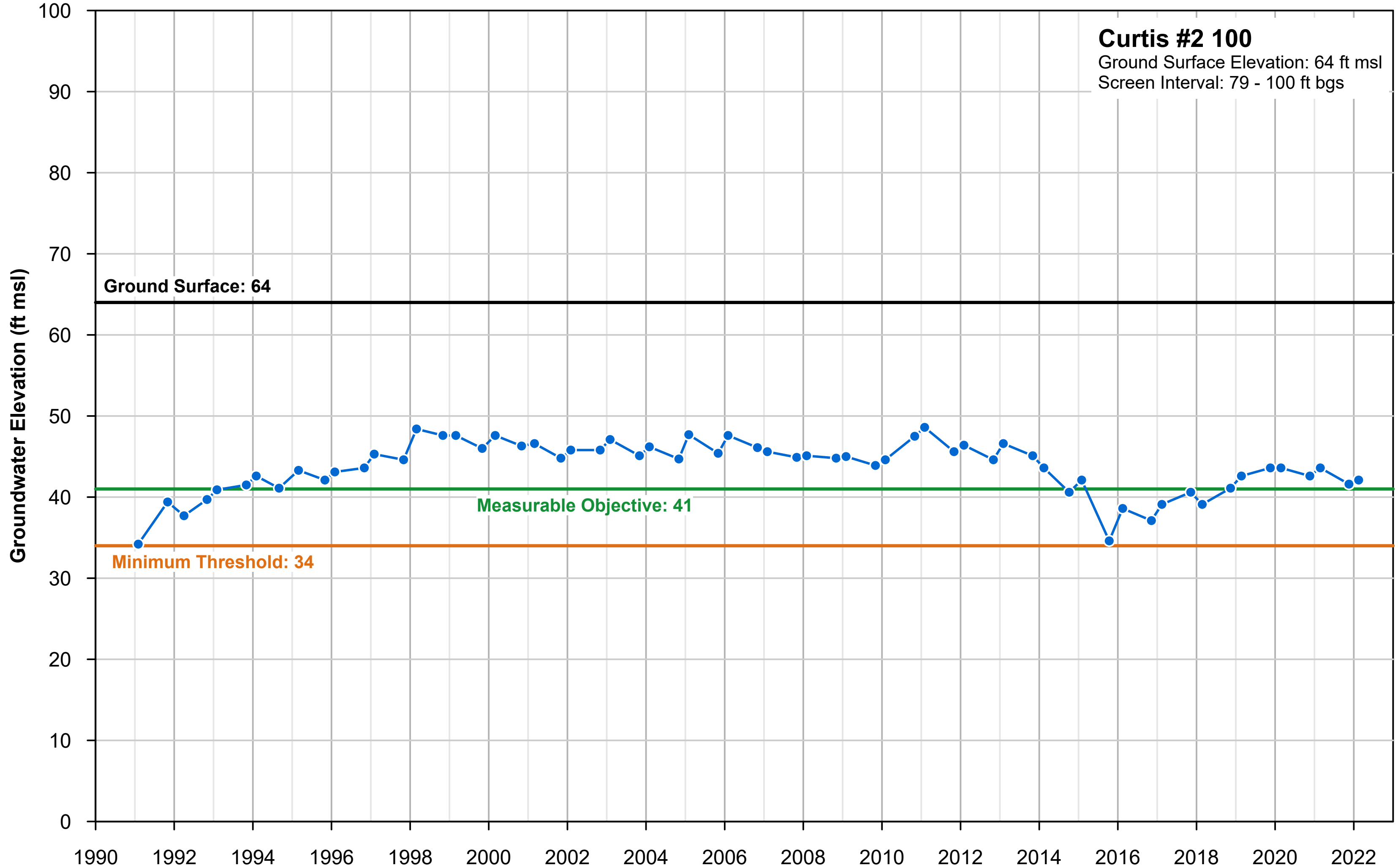
2020
2022



Crane OID-06
Ground Surface Elevation: 160 ft msl
Screen Interval: 155 - 198 ft bgs
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
Measurable Objective: 77
Minimum Threshold: 66
Interim Milestone (2027): 55



Curtis #2 100
Ground Surface Elevation: 64 ft msl
Screen Interval: 79 - 100 ft bgs
Ground Surface: 64
Measurable Objective: 41
Minimum Threshold: 34
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
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2008
2010
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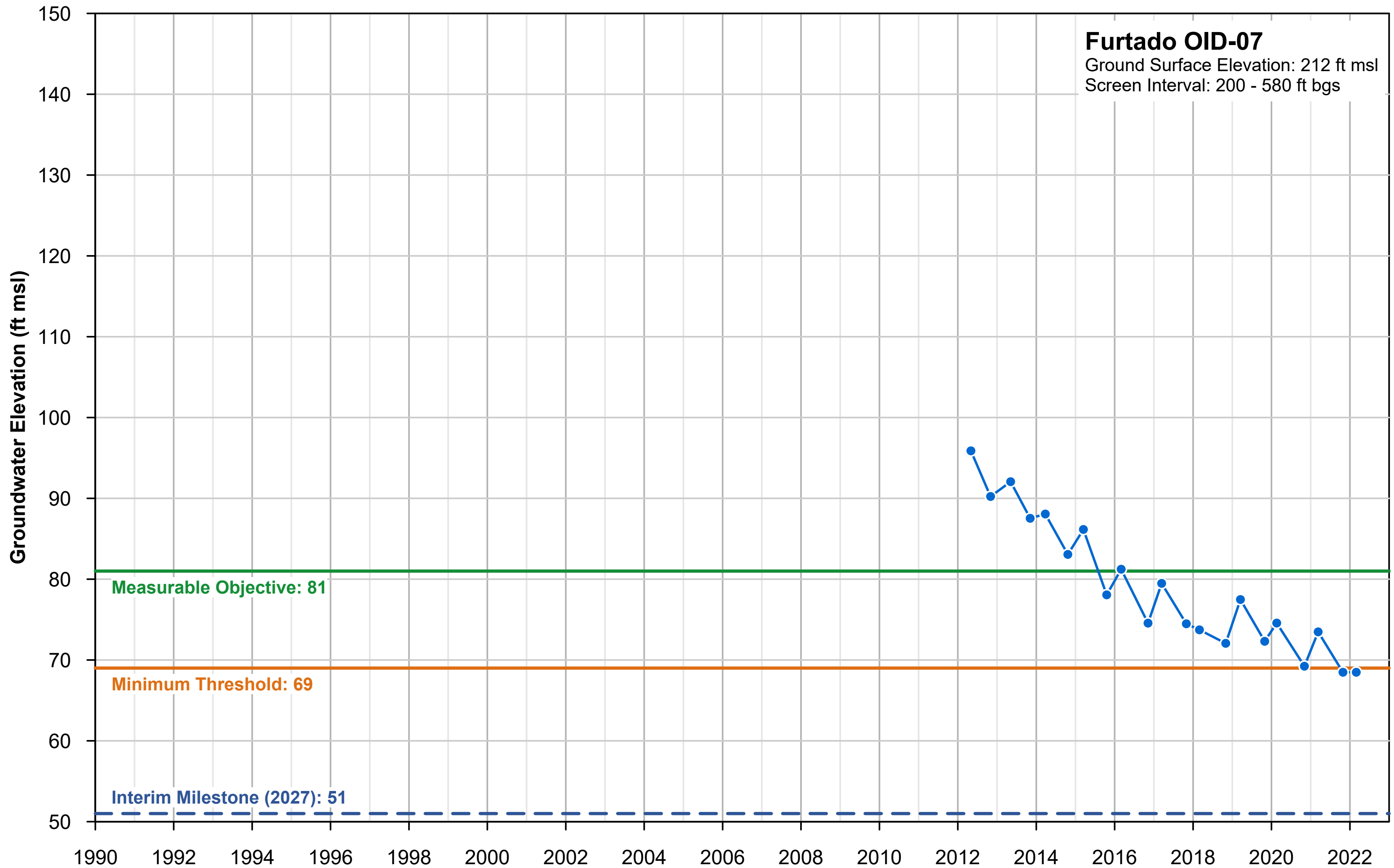
2018
2020
2022



Furtado OID-07
Ground Surface Elevation: 212 ft msl
Screen Interval: 200 - 580 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 81
Minimum Threshold: 69
Interim Milestone (2027): 51
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
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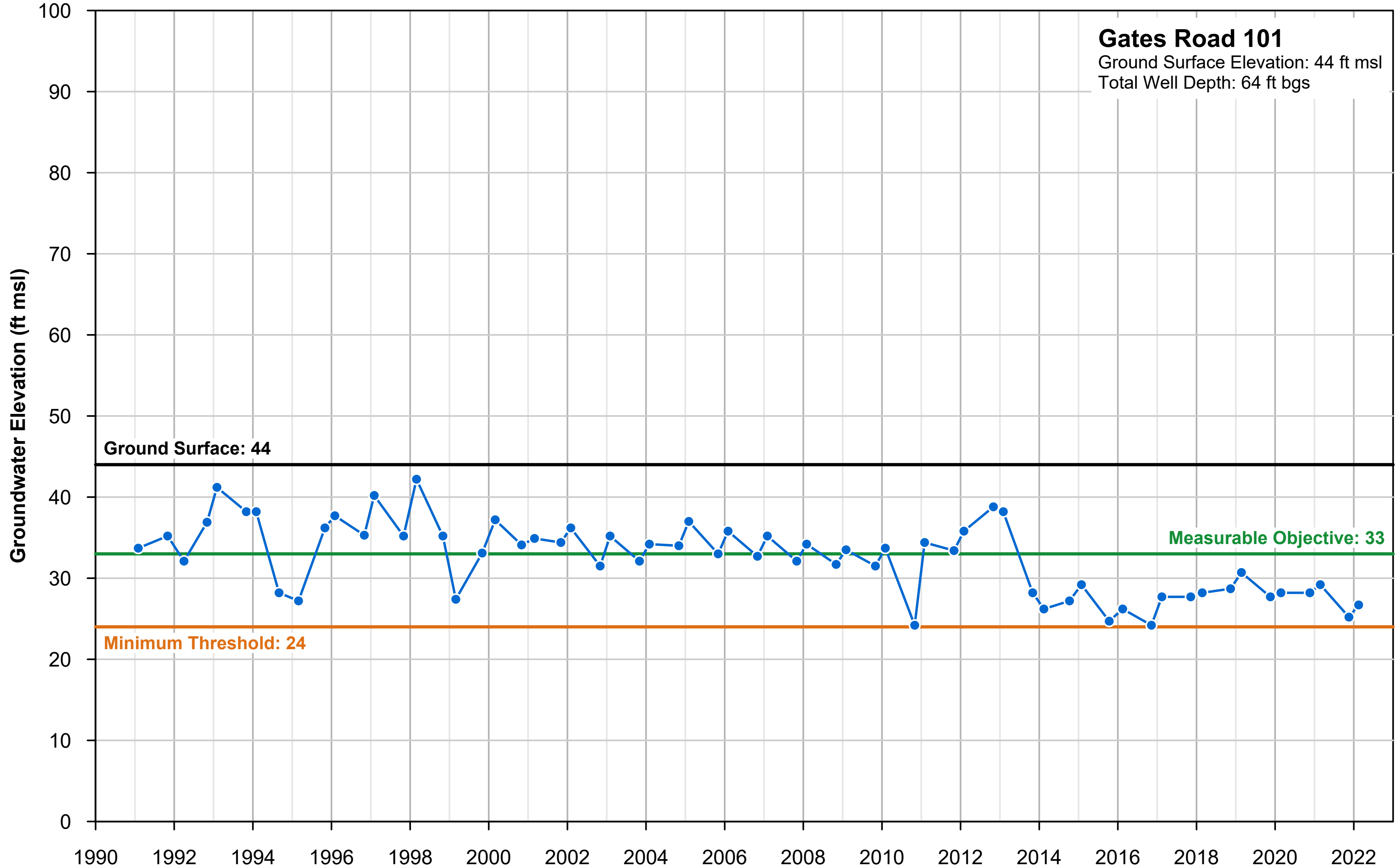
2018
2020
2022



Gates Road 101
Ground Surface Elevation: 44 ft msl
Total Well Depth: 64 ft bgs
Ground Surface: 44
Measurable Objective: 33
Minimum Threshold: 24
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
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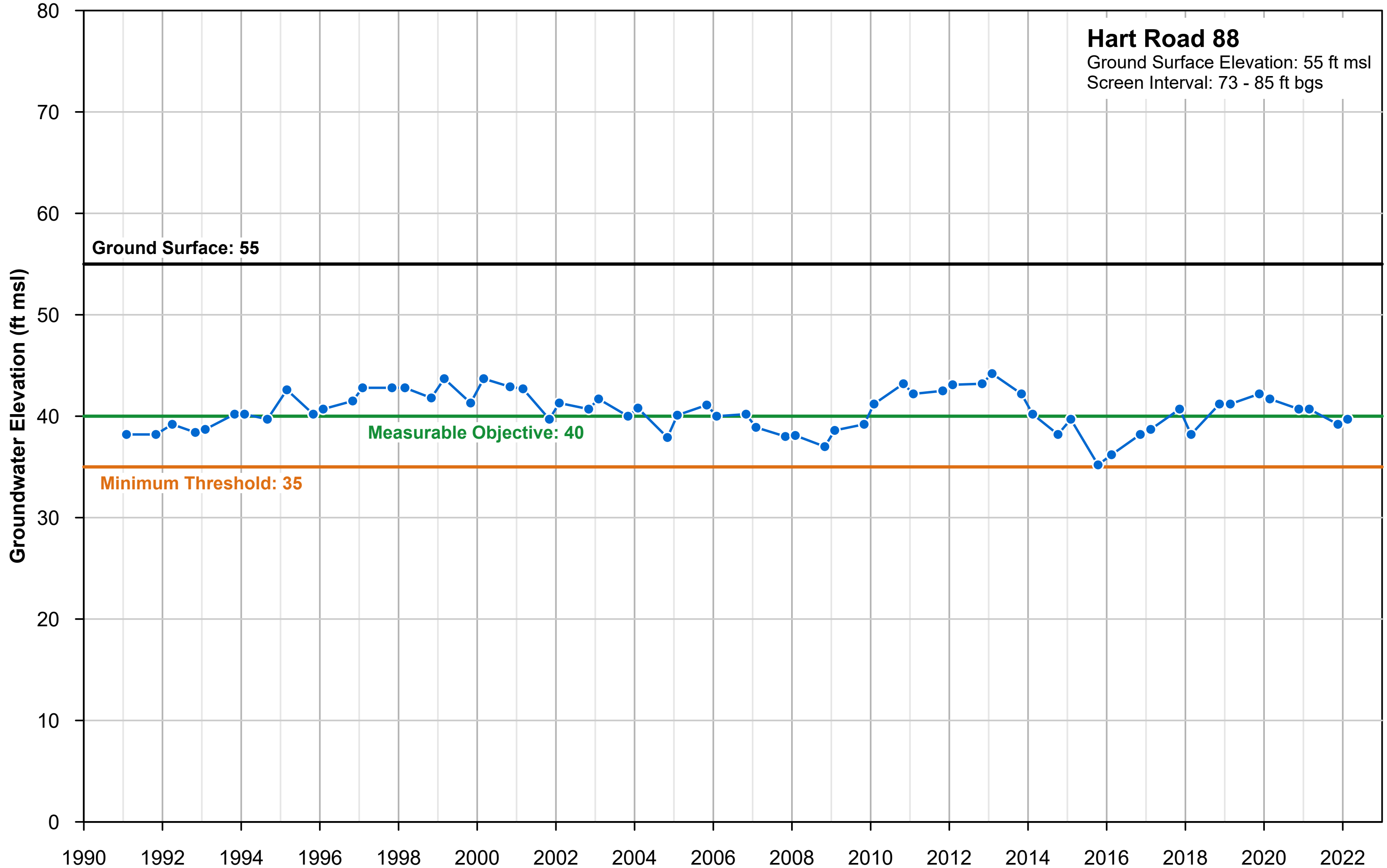
2018
2020
2022



Hart Road 88
Ground Surface Elevation: 55 ft msl
Screen Interval: 73 - 85 ft bgs
Ground Surface: 55
Measurable Objective: 40
Minimum Threshold: 35
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
1990
1992
1994
1996
1998
2000
2002
2004
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2010
2012
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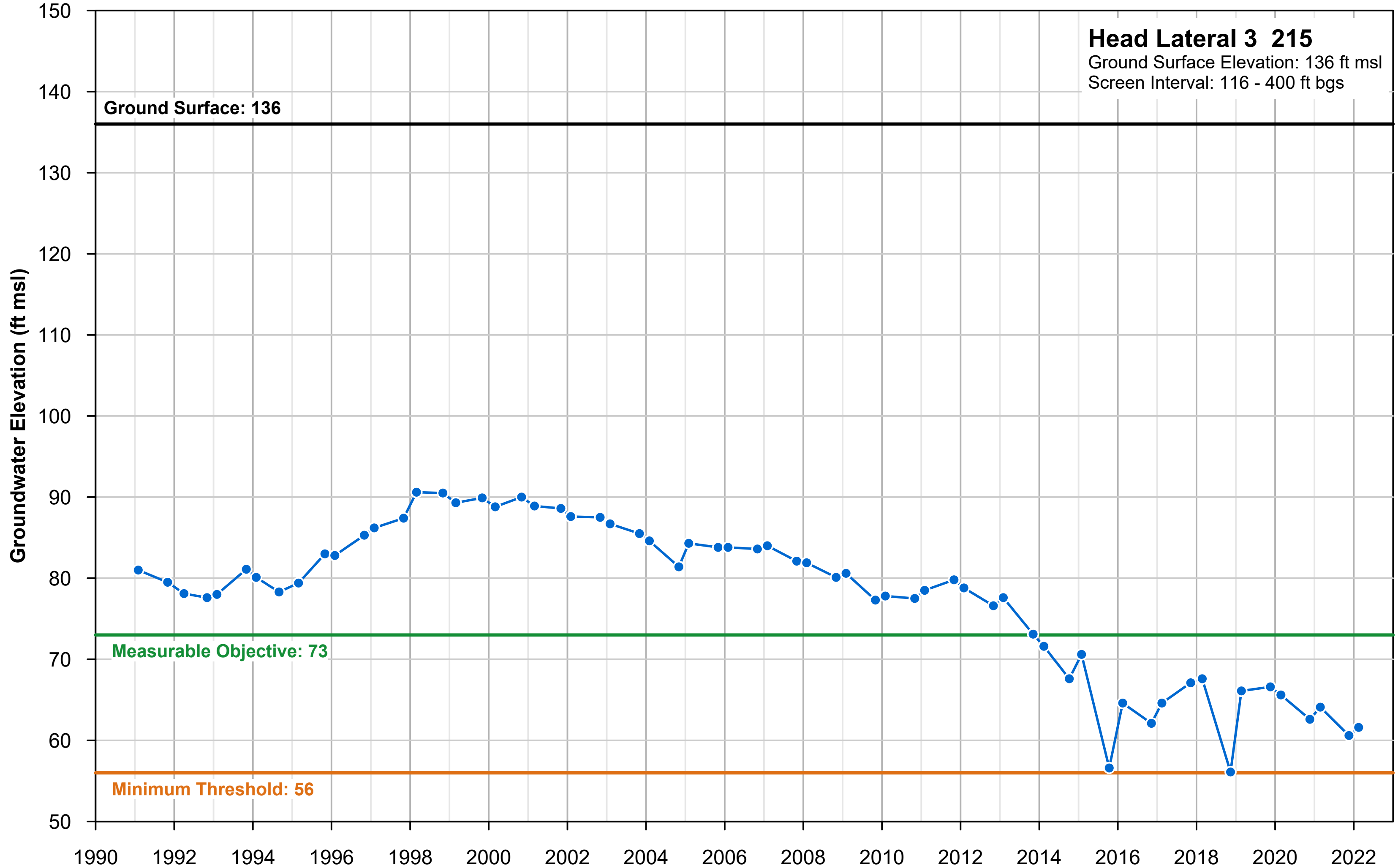
2020
2022



Head Lateral 3 215
Ground Surface Elevation: 136 ft msl
Screen Interval: 116 - 400 ft bgs
Ground Surface: 136
Measurable Objective: 73
Minimum Threshold: 56
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
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2008
2010
2012
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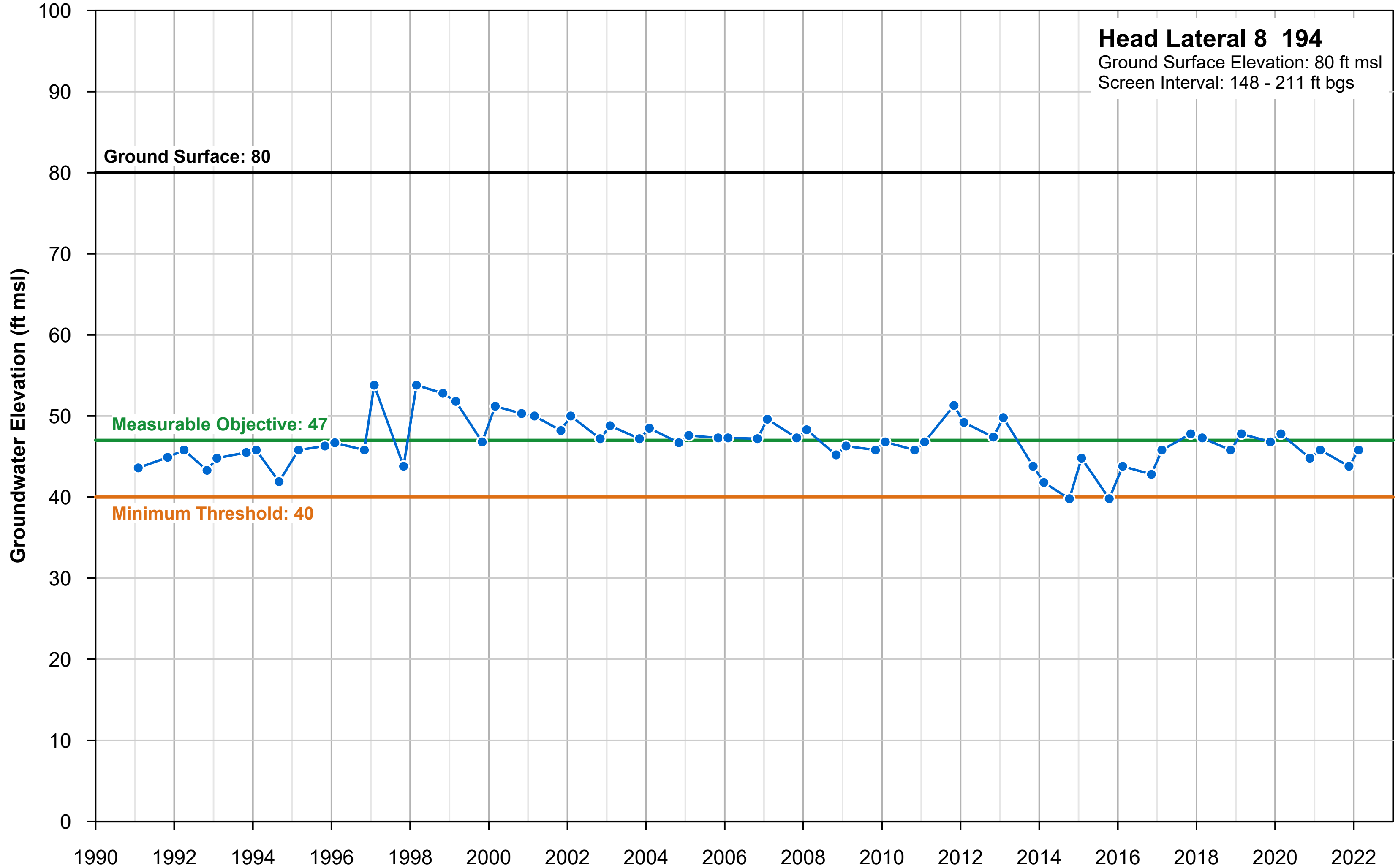
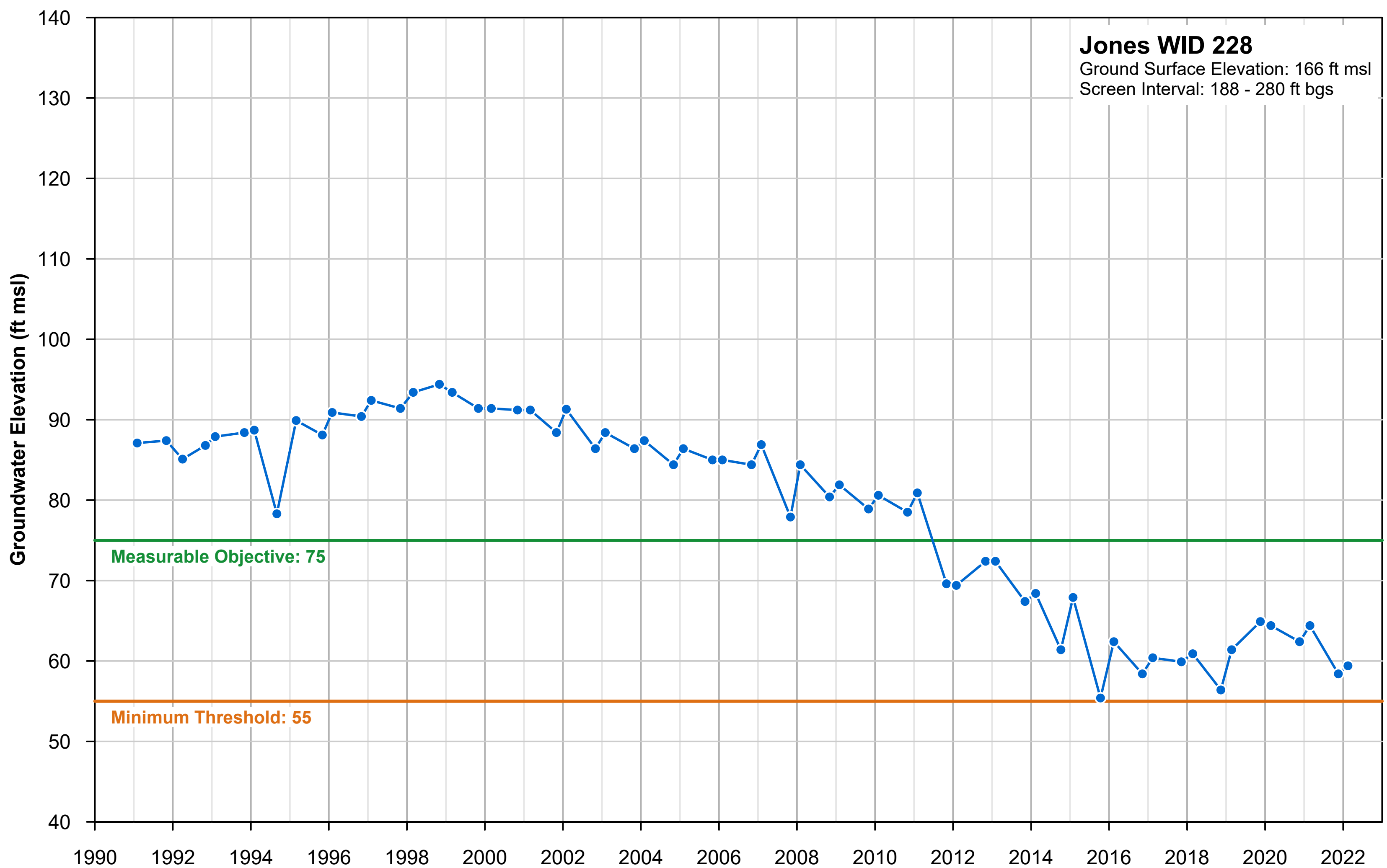
2016
2018
2020
2022



Head Lateral 8 194
Ground Surface Elevation: 80 ft msl
Screen Interval: 148 - 211 ft bgs
Ground Surface: 80
Measurable Objective: 47
Minimum Threshold: 40
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Jones WID 228
Ground Surface Elevation: 166 ft msl
Screen Interval: 188 - 280 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 75
Minimum Threshold: 55
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
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2010
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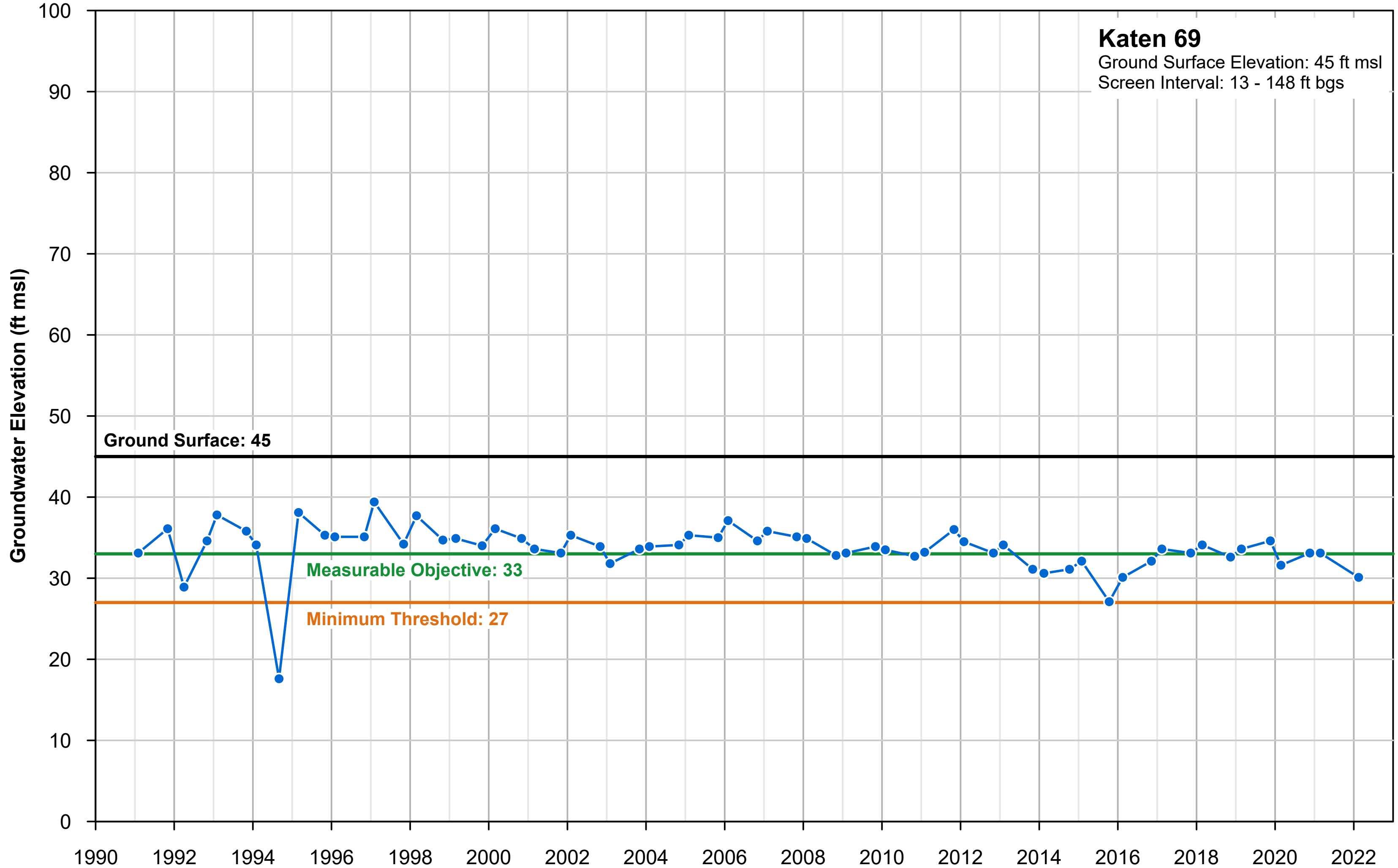
2018
2020
2022


Katen 69
Ground Surface Elevation: 45 ft msl
Screen Interval: 13 - 148 ft bgs
Ground Surface: 45
Measurable Objective: 33
Minimum Threshold: 27
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
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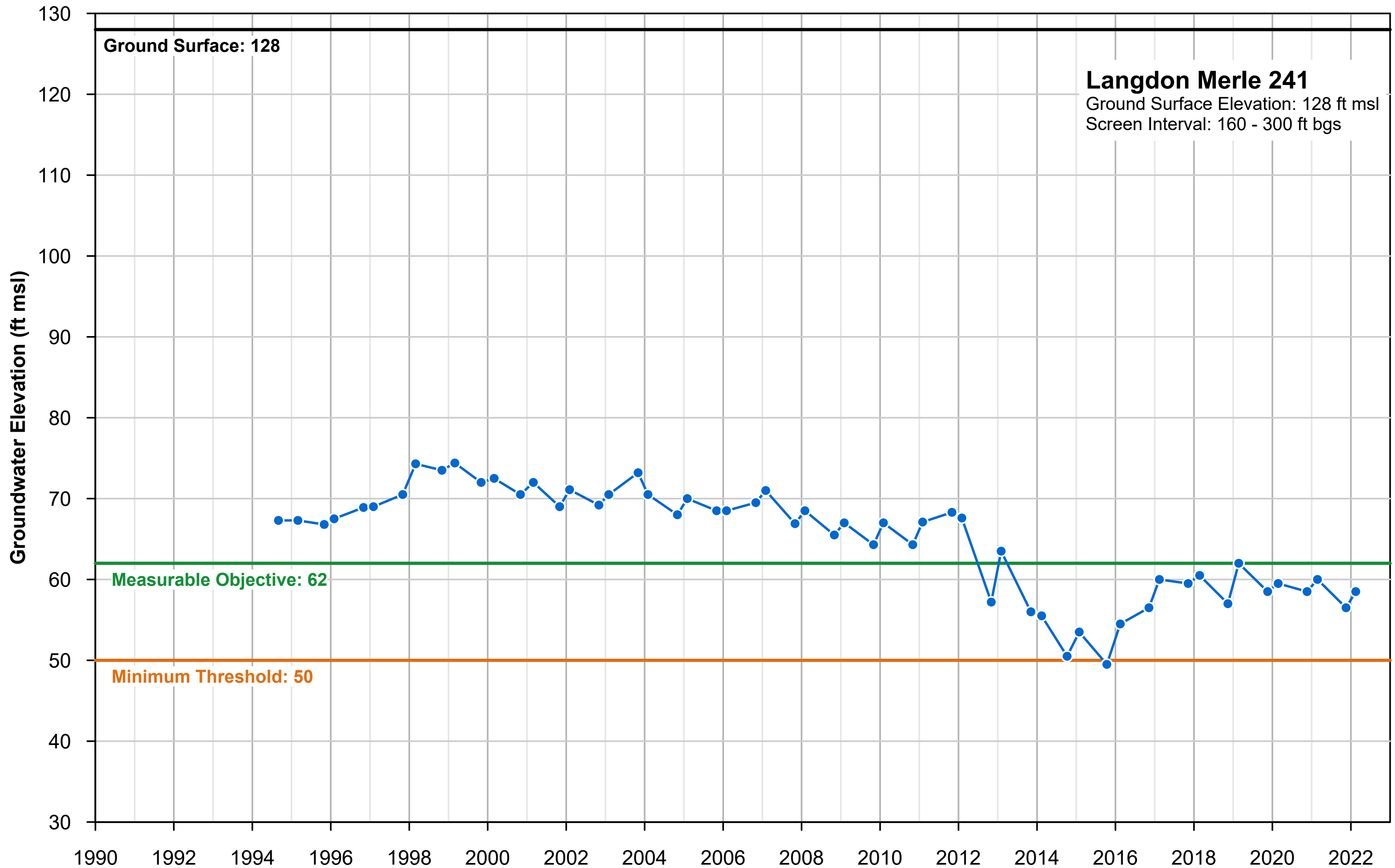
2018
2020
2022



Langdon Merle 241
Ground Surface Elevation: 128 ft msl
Screen Interval: 160 - 300 ft bgs
Ground Surface: 128
Measurable Objective: 62
Minimum Threshold: 50
Groundwater Elevation (ft msl)
130
120
110
100
90
80
70
60
50
40
30
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
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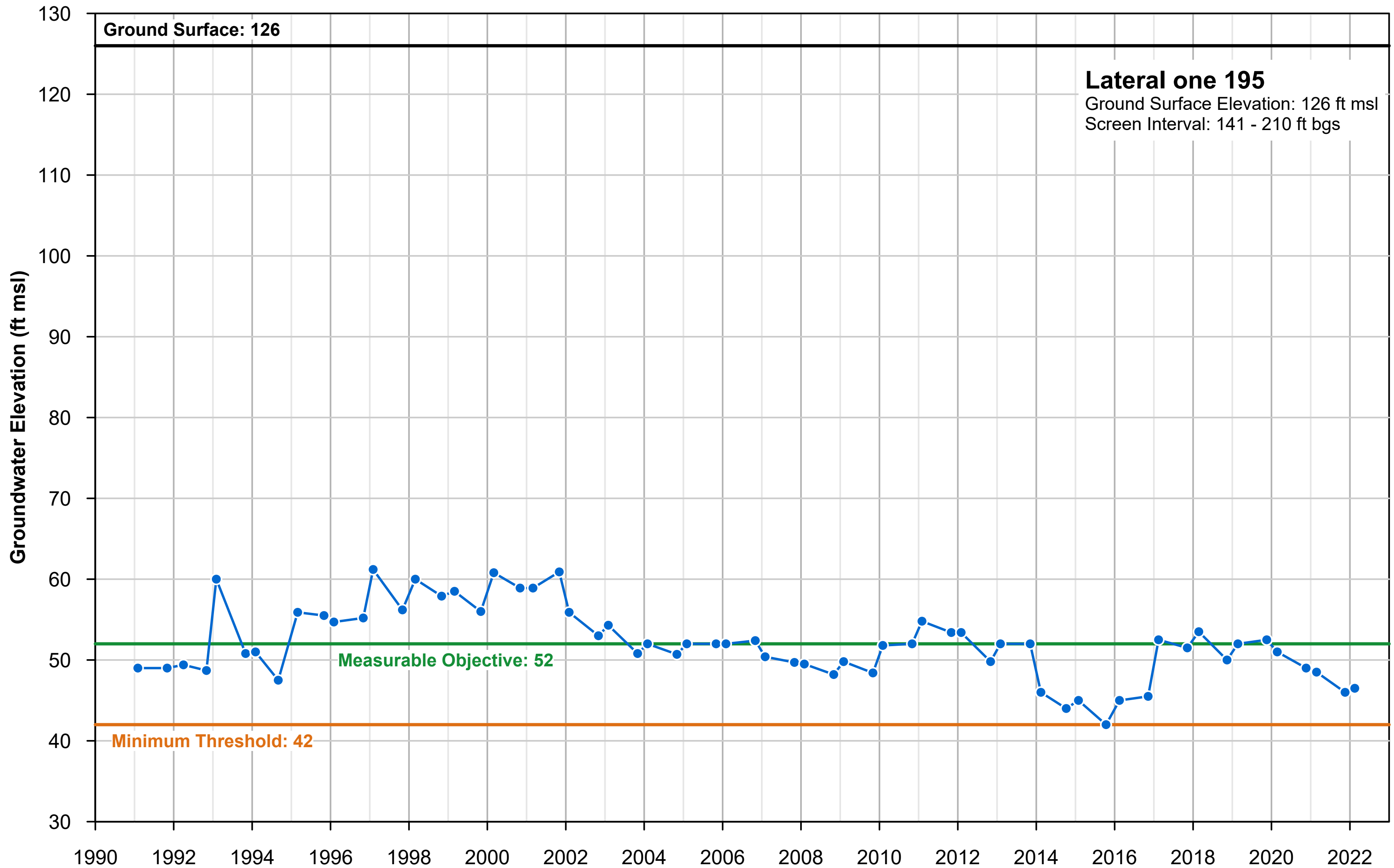
2018
2020
2022



Lateral one 195
Ground Surface Elevation: 126 ft msl
Screen Interval: 141 - 210 ft bgs
Ground Surface: 126
Measurable Objective: 52
Minimum Threshold: 42
Groundwater Elevation (ft msl)
130
120
110
100
90
80
70
60
50
40
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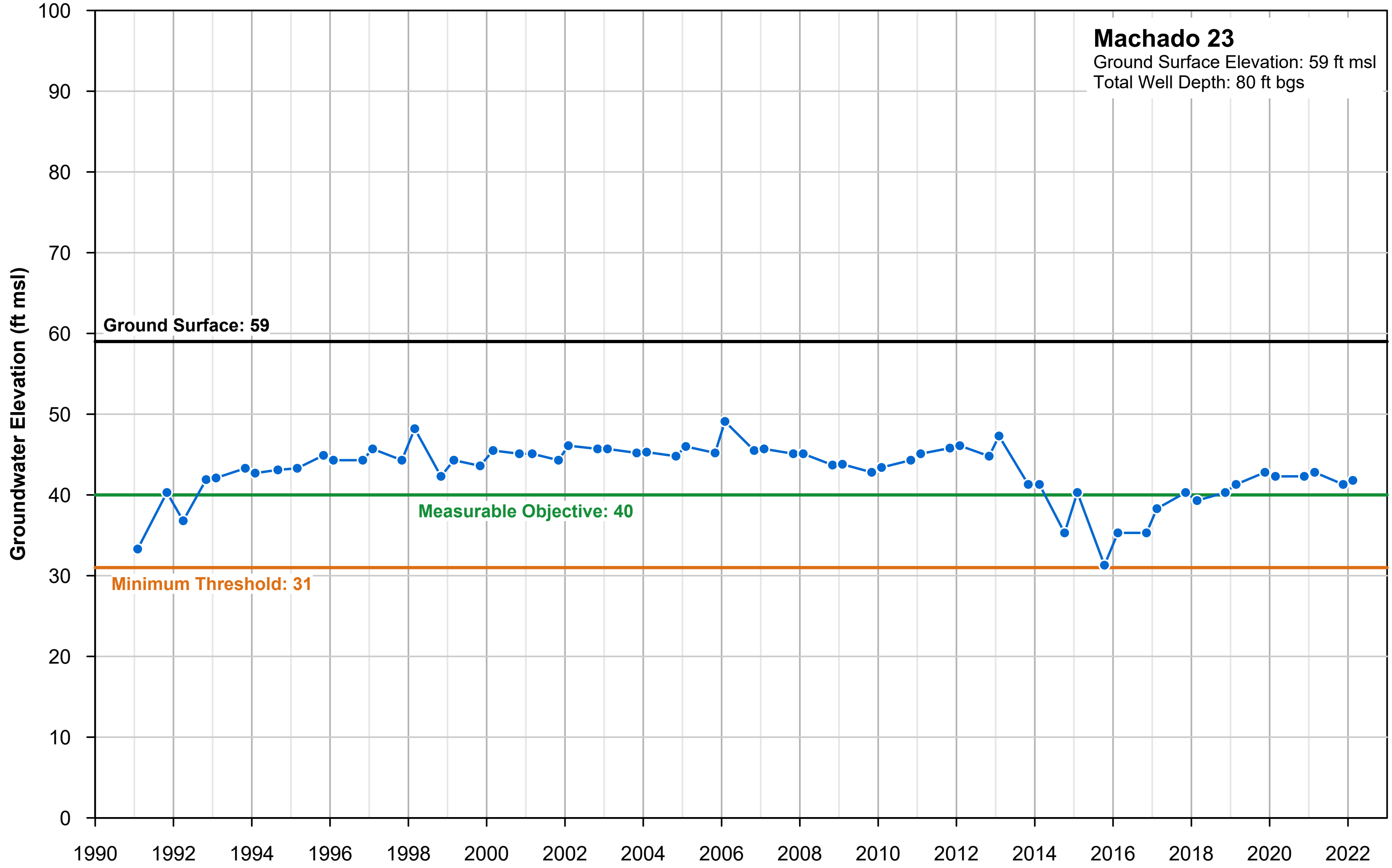
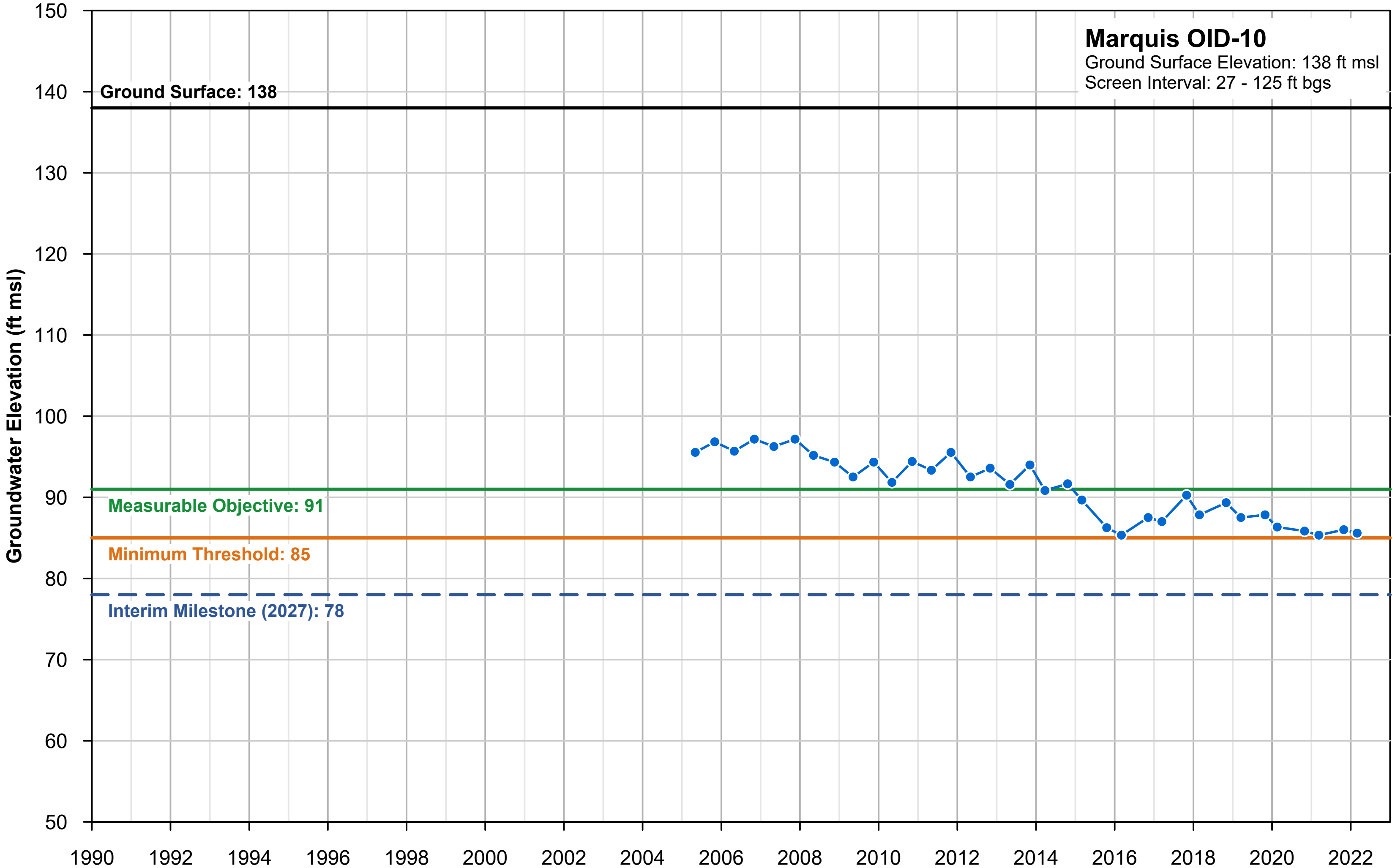
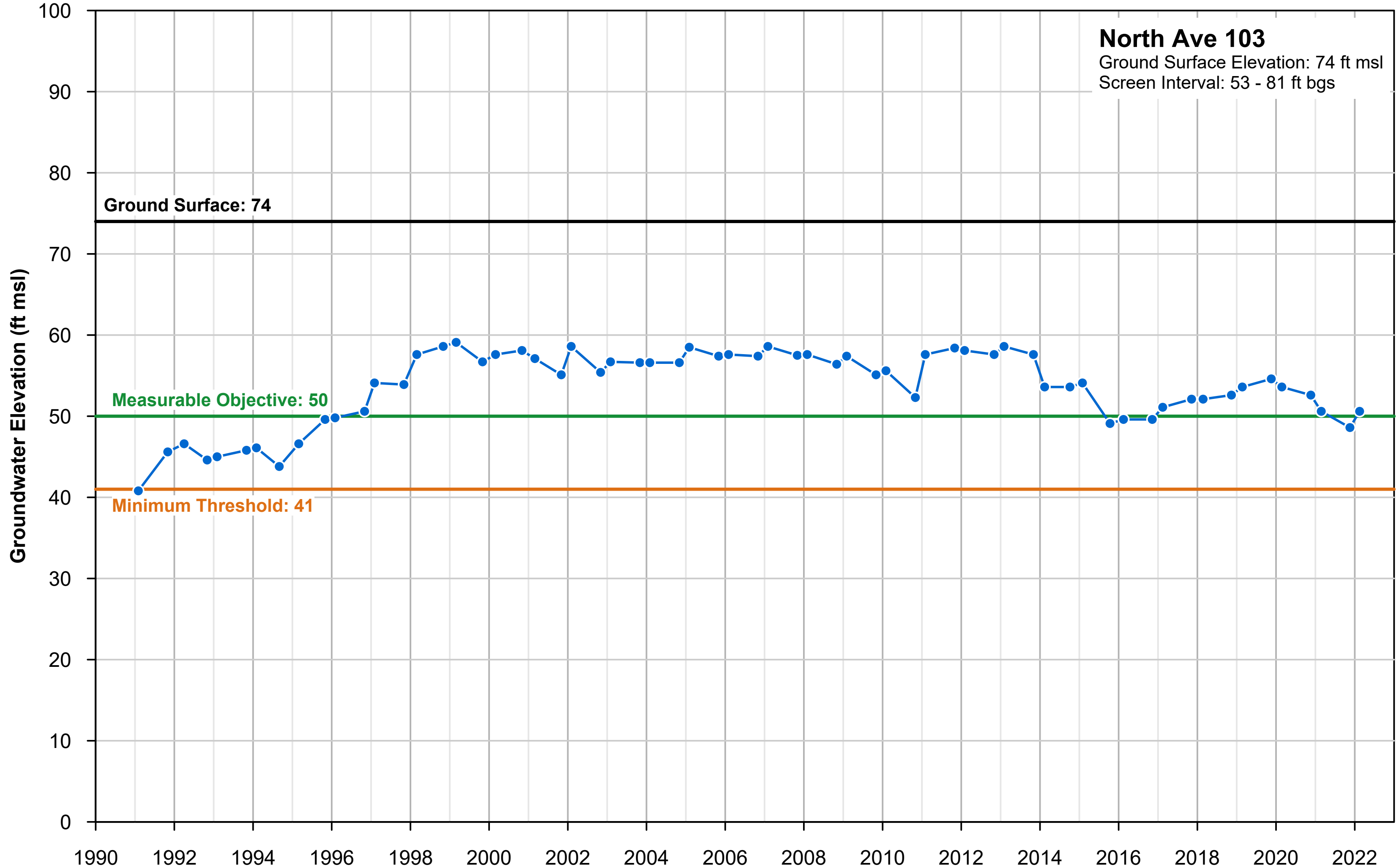
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



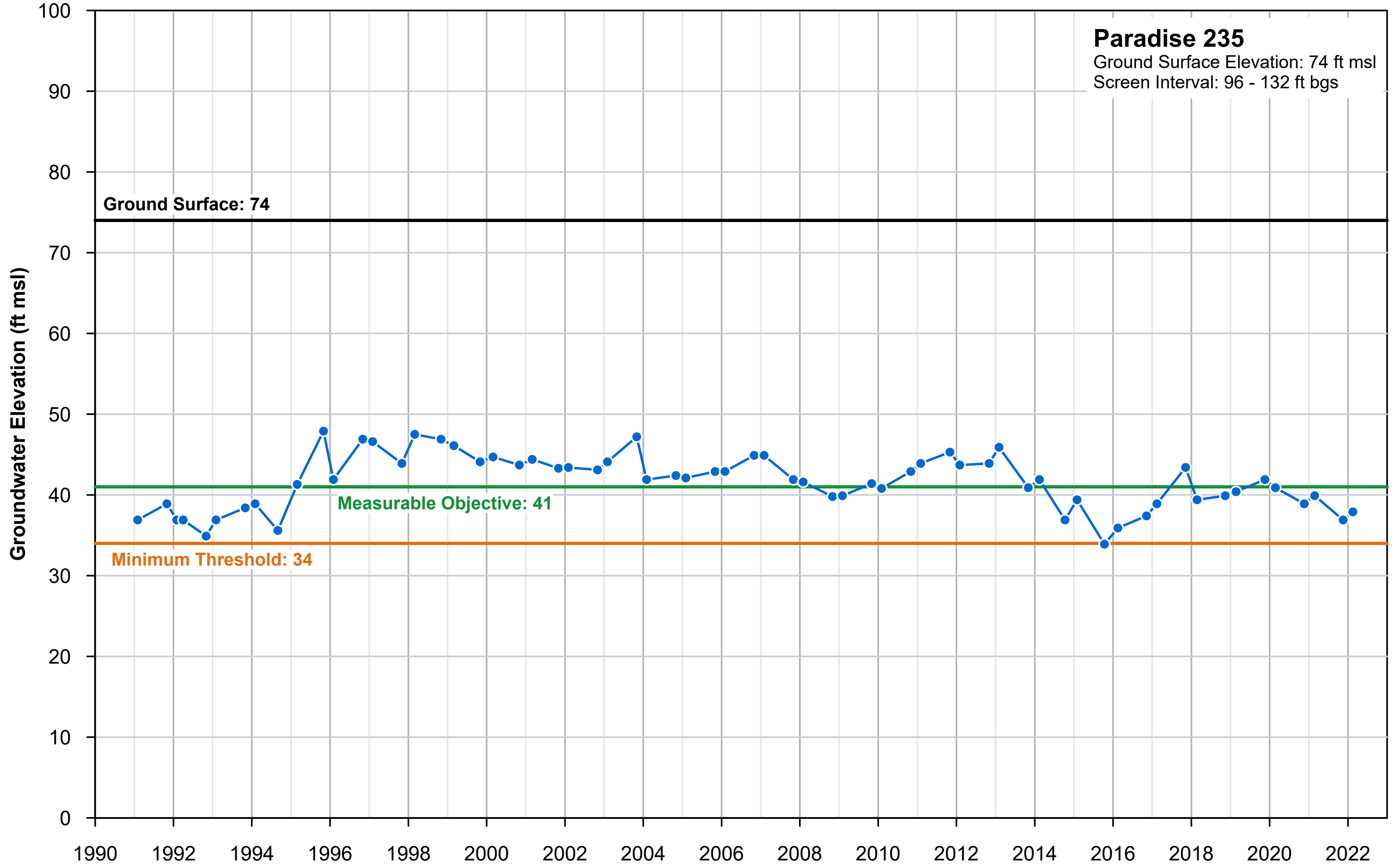
Machado 23
Ground Surface Elevation: 59 ft msl
Total Well Depth: 80 ft bgs
Ground Surface: 59
Measurable Objective: 40
Minimum Threshold: 31
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



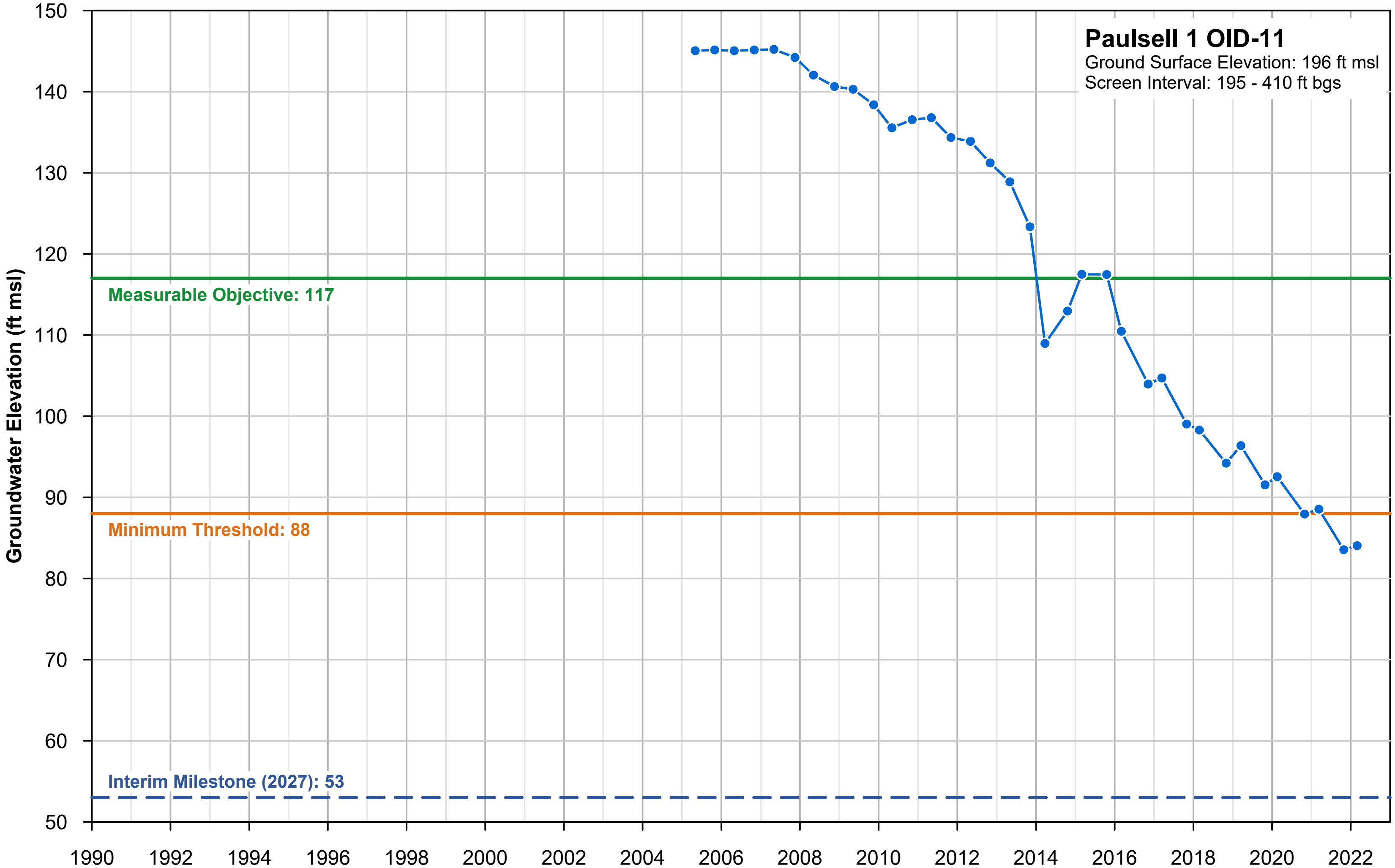
Marquis OID-10
Ground Surface Elevation: 138 ft msl
Screen Interval: 27 - 125 ft bgs
Ground Surface: 138
Measurable Objective: 91
Minimum Threshold: 85
Interim Milestone (2027): 78
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



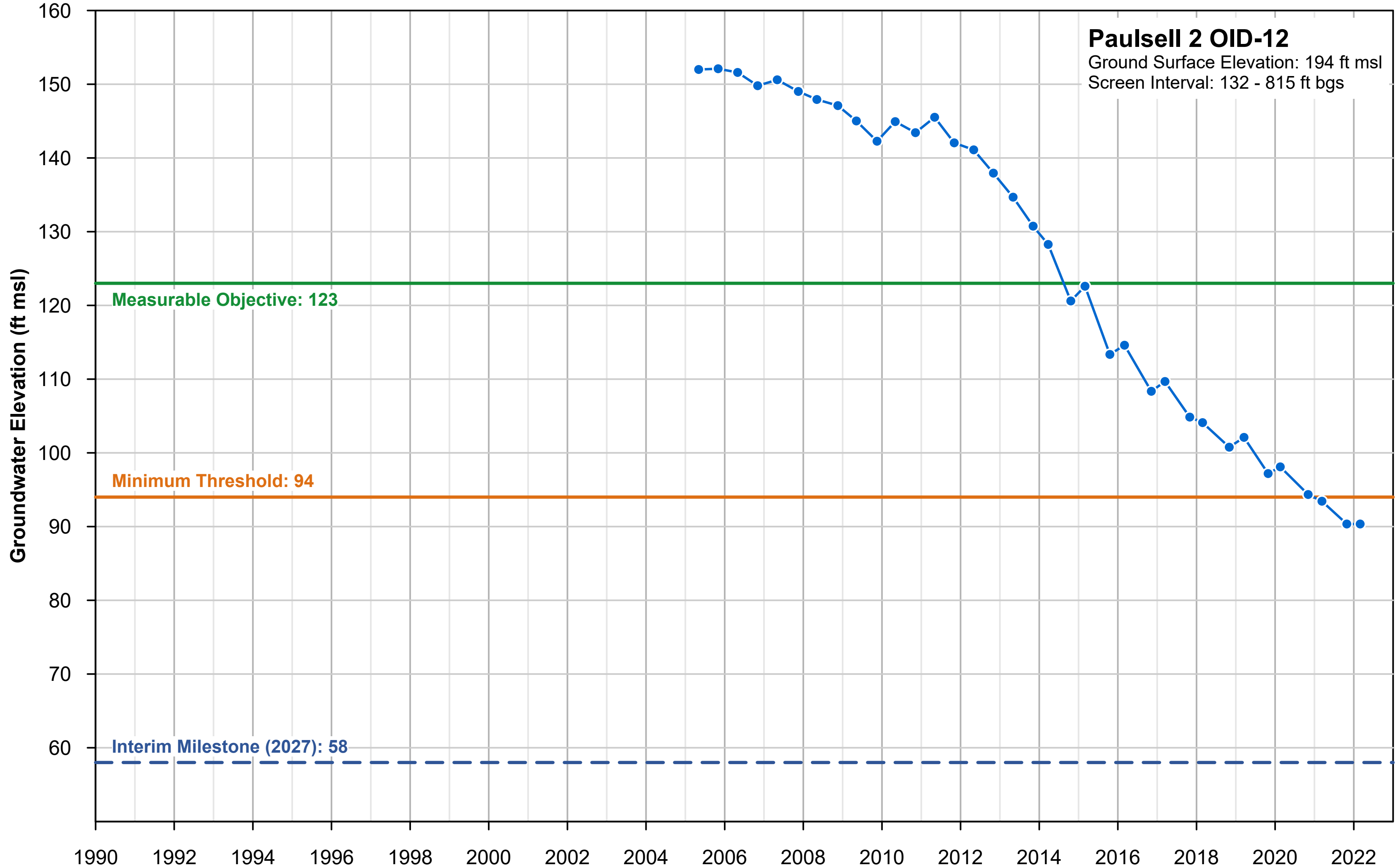
North Ave 103
Ground Surface Elevation: 74 ft msl
Screen Interval: 53 - 81 ft bgs
Ground Surface: 74
Measurable Objective: 50
Minimum Threshold: 41
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Paradise 235
Ground Surface Elevation: 74 ft msl
Screen Interval: 96 - 132 ft bgs
Ground Surface: 74
Measurable Objective: 41
Minimum Threshold: 34
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Paulsell 1 OID-11
Ground Surface Elevation: 196 ft msl
Screen Interval: 195 - 410 ft bgs
Measurable Objective: 117
Minimum Threshold: 88
Interim Milestone (2027): 53
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Paulsell 2 OID-12
Ground Surface Elevation: 194 ft msl
Screen Interval: 132 - 815 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 123
Minimum Threshold: 94
Interim Milestone (2027): 58
160
150
140
130
120
110
100
90
80
70
60
1990
1992
1994
1996
1998
2000
2002
2004
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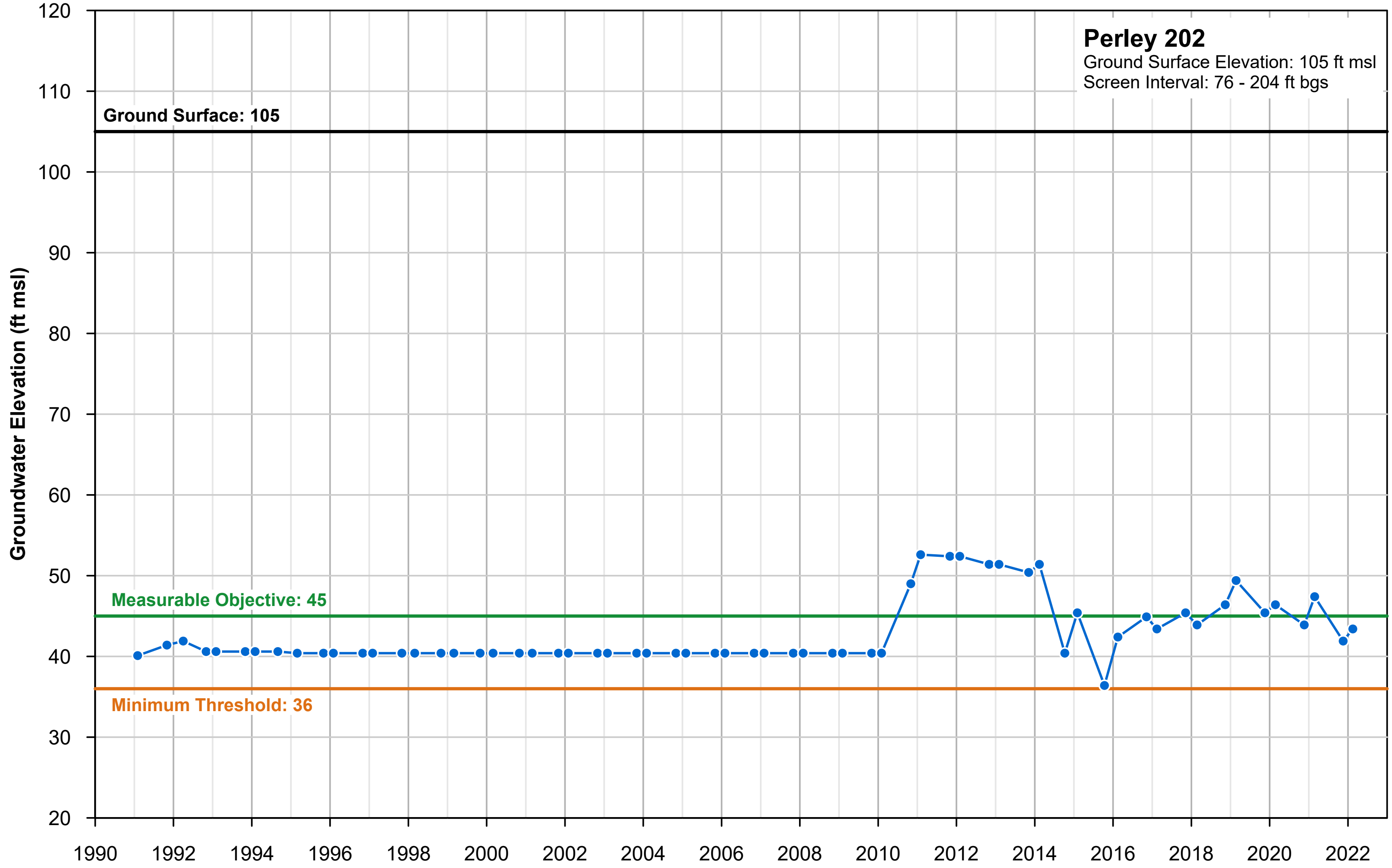
2018
2020
2022



Perley 202
Ground Surface Elevation: 105 ft msl
Screen Interval: 76 - 204 ft bgs
Ground Surface: 105
Measurable Objective: 45
Minimum Threshold: 36
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
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2010
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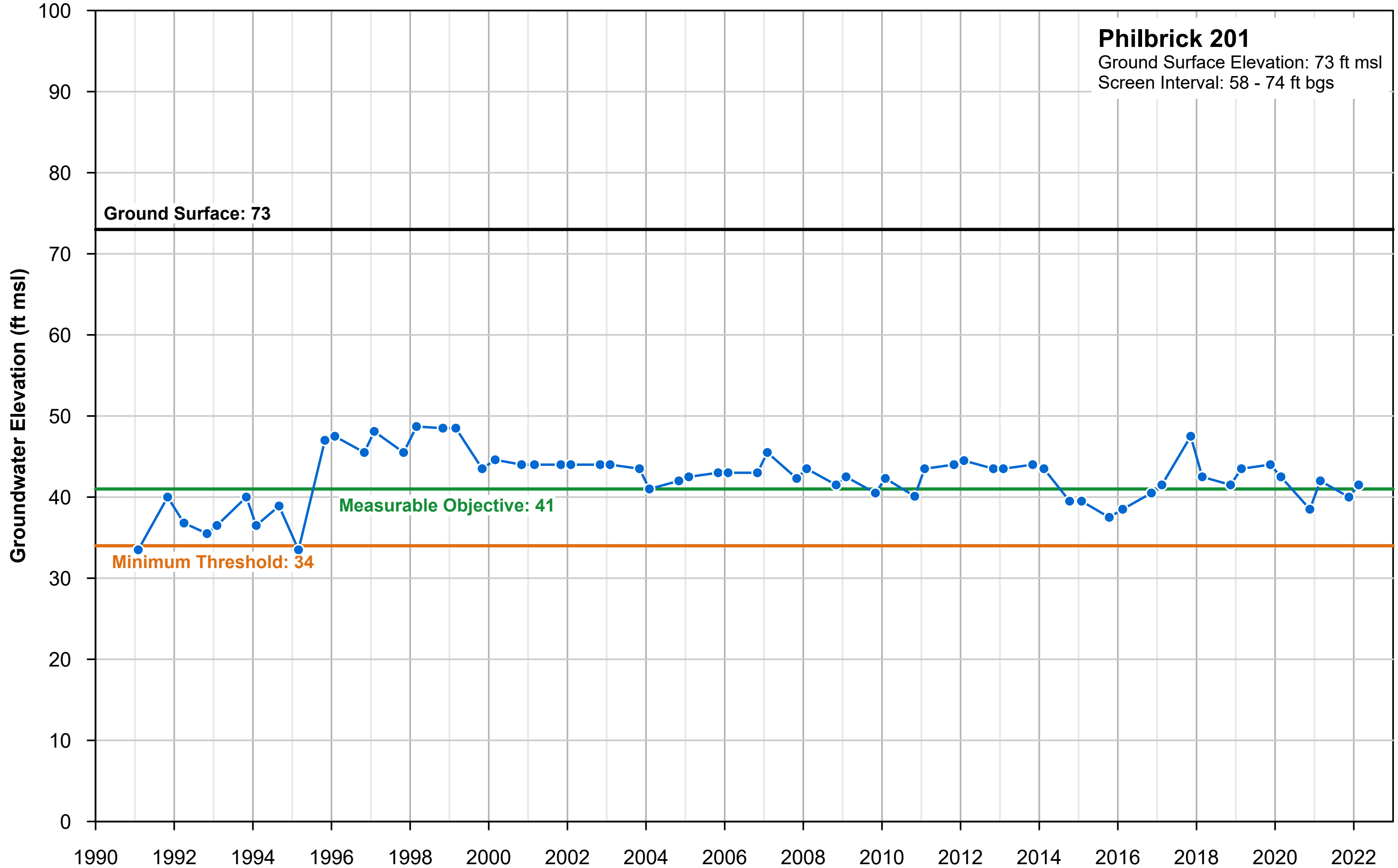
2022



Philbrick 201
Ground Surface Elevation: 73 ft msl
Screen Interval: 58 - 74 ft bgs
Ground Surface: 73
Measurable Objective: 41
Minimum Threshold: 34
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
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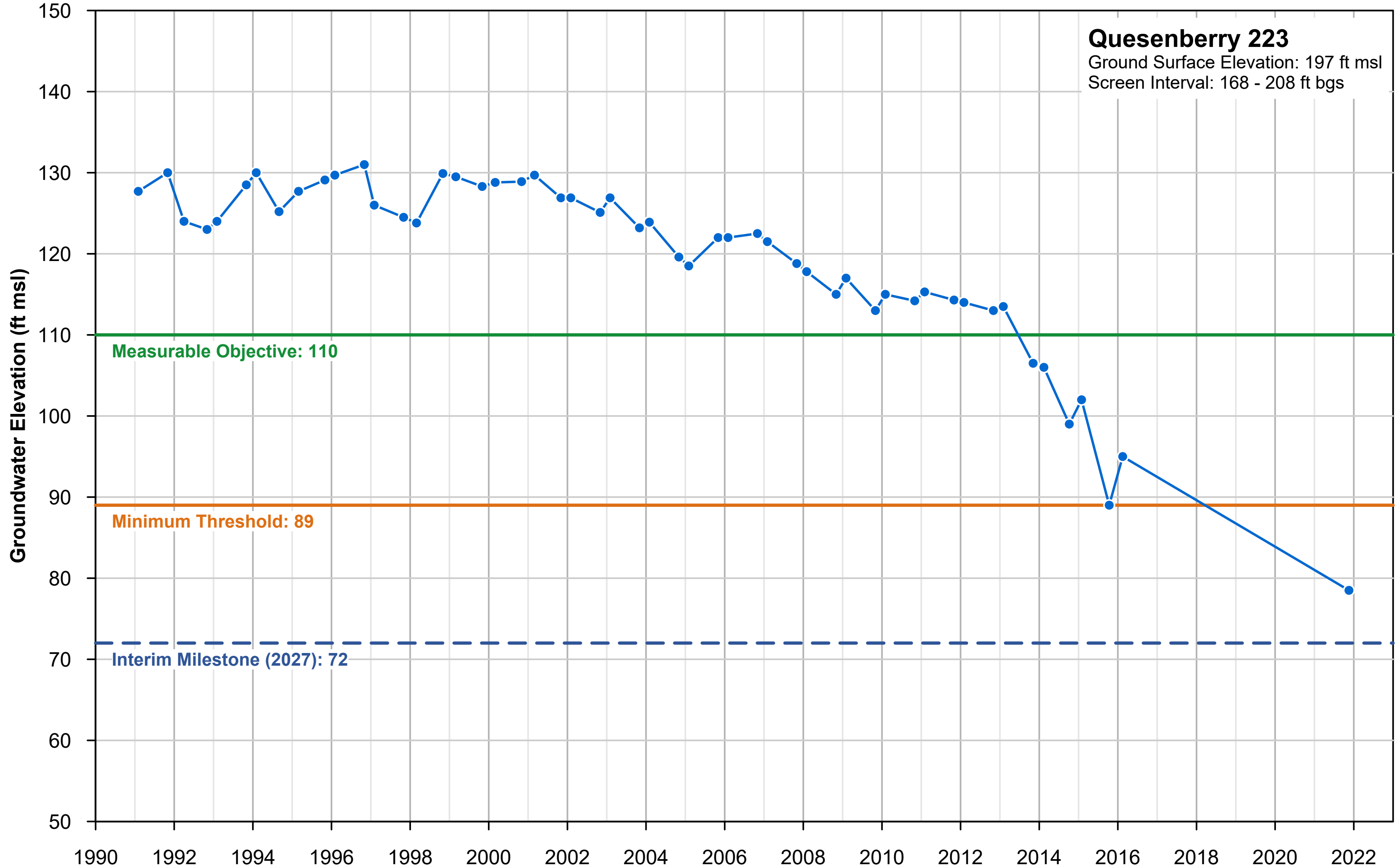
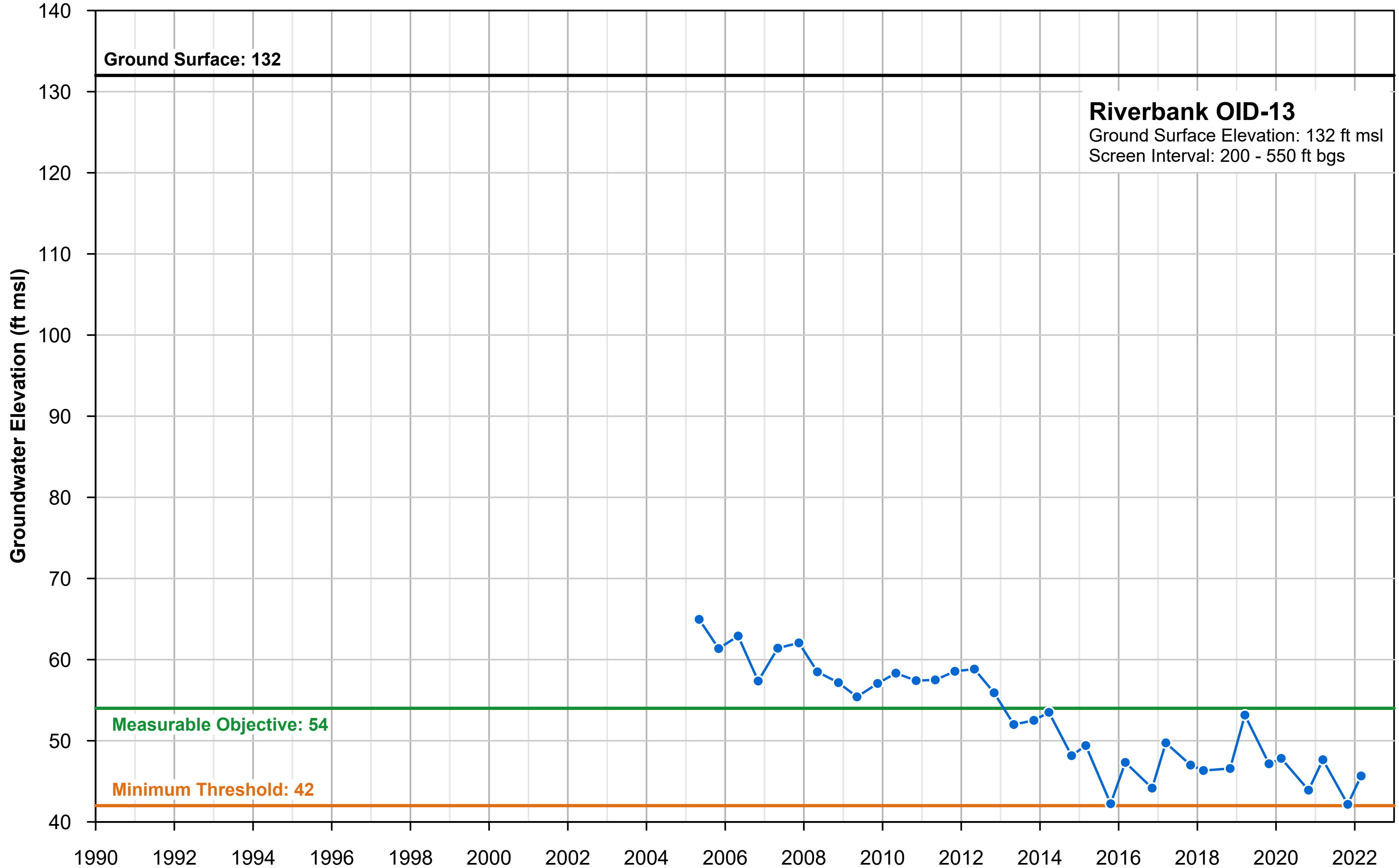
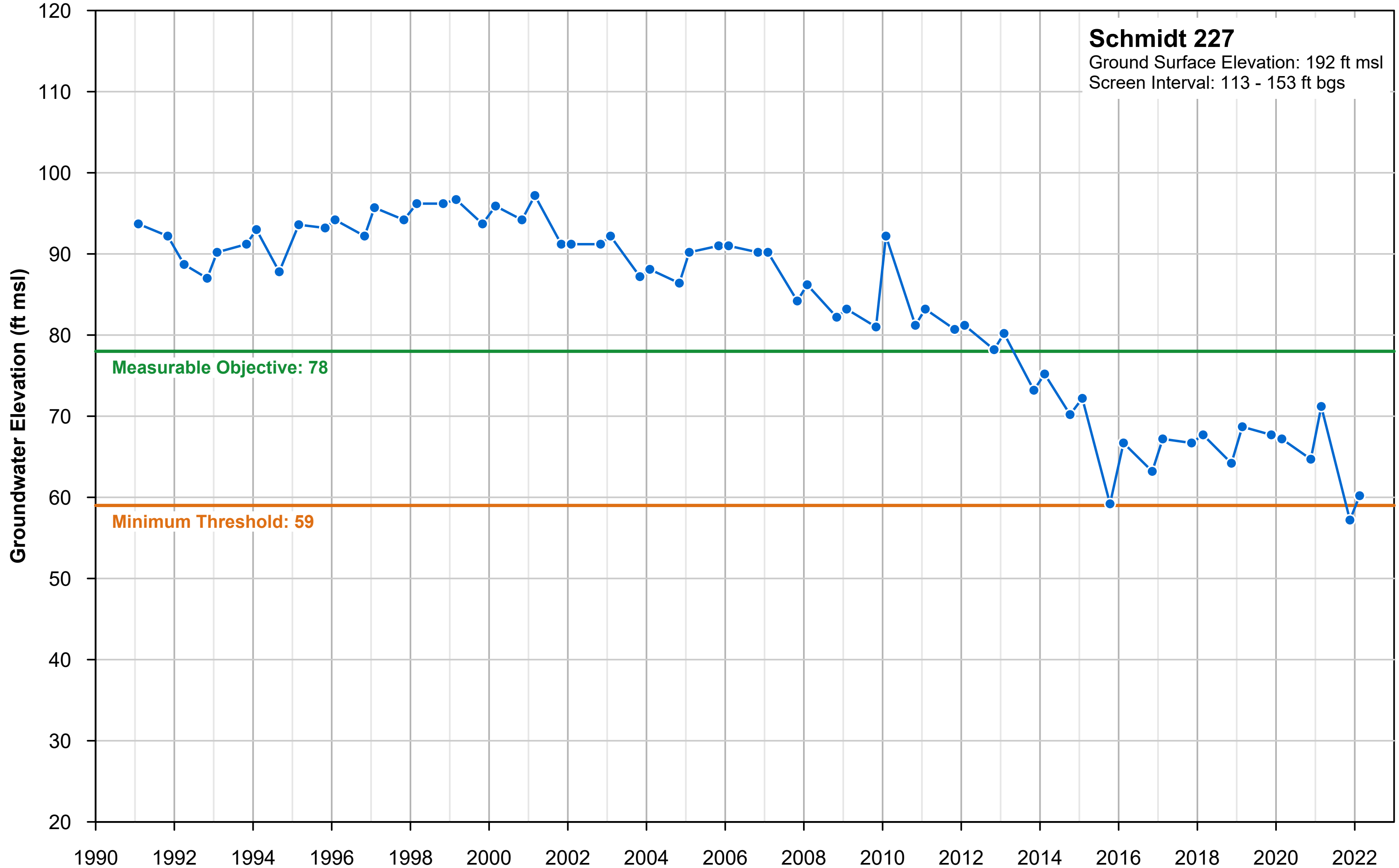
2022



Quesenberry 223
Ground Surface Elevation: 197 ft msl
Screen Interval: 168 - 208 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 110
Minimum Threshold: 89
Interim Milestone (2027): 72
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Riverbank OID-13
Ground Surface Elevation: 132 ft msl
Screen Interval: 200 - 550 ft bgs
Ground Surface: 132
Measurable Objective: 54
Minimum Threshold: 42
Groundwater Elevation (ft msl)
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Schmidt 227
Ground Surface Elevation: 192 ft msl
Screen Interval: 113 - 153 ft bgs
Measurable Objective: 78
Minimum Threshold: 59
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
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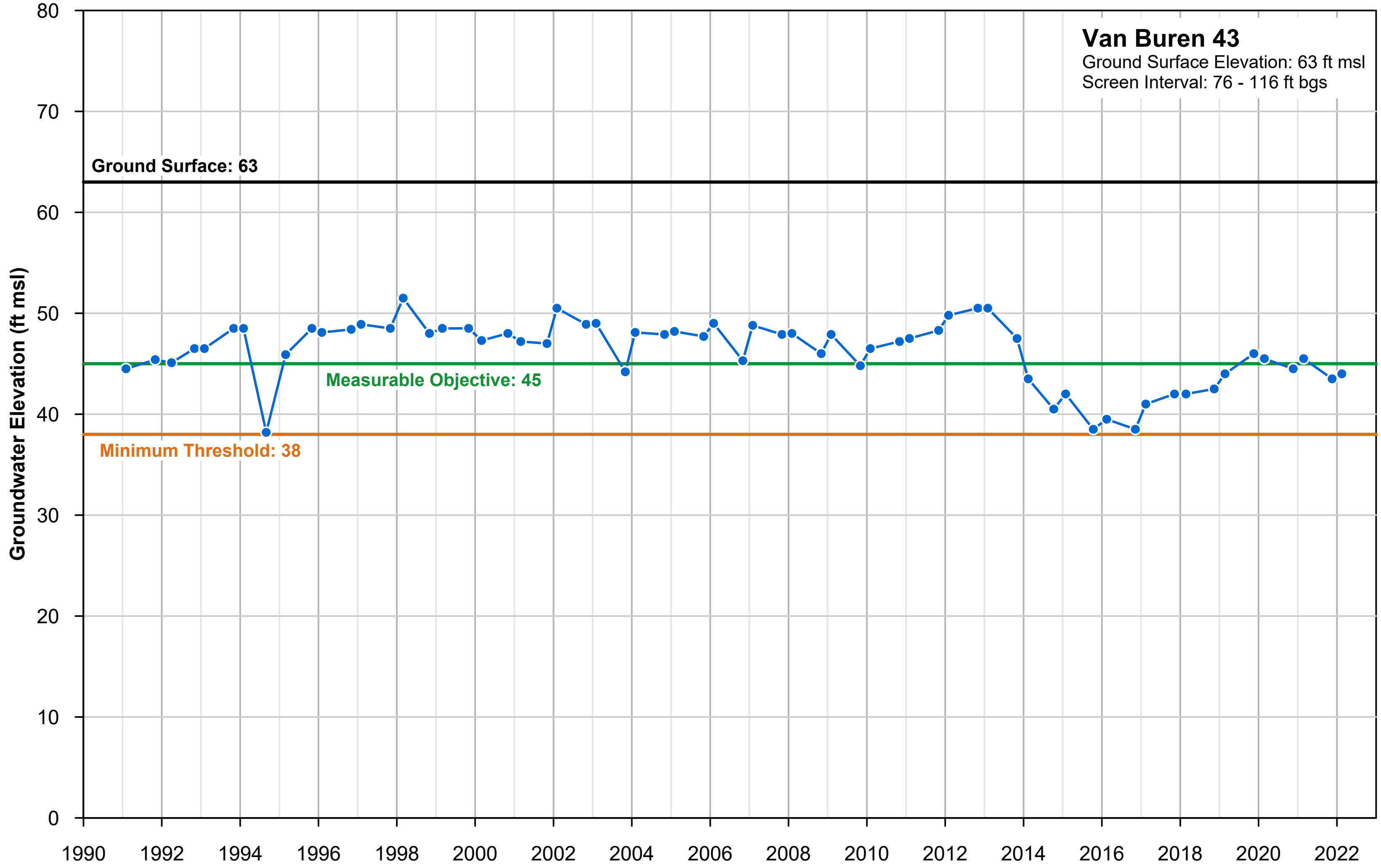
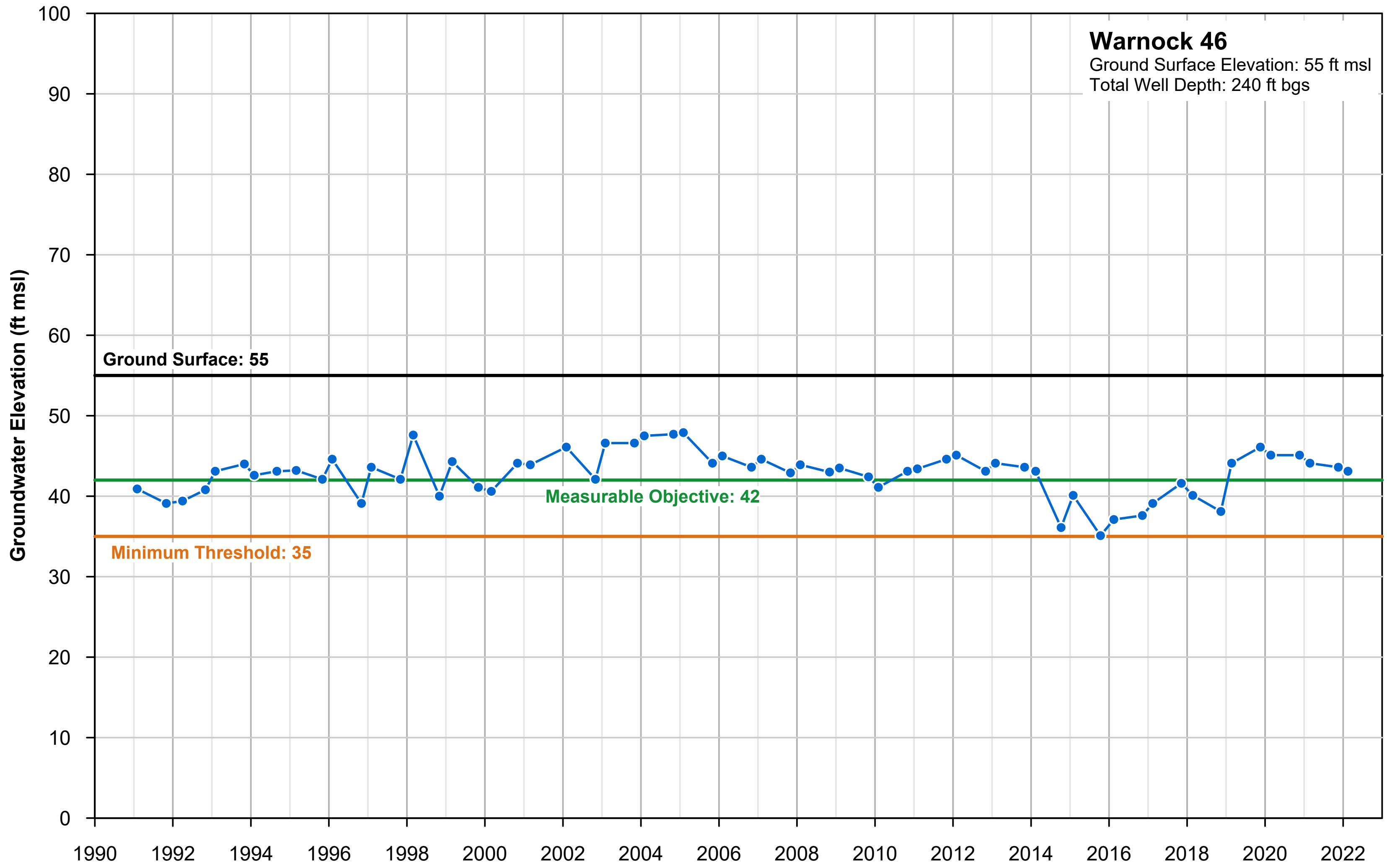
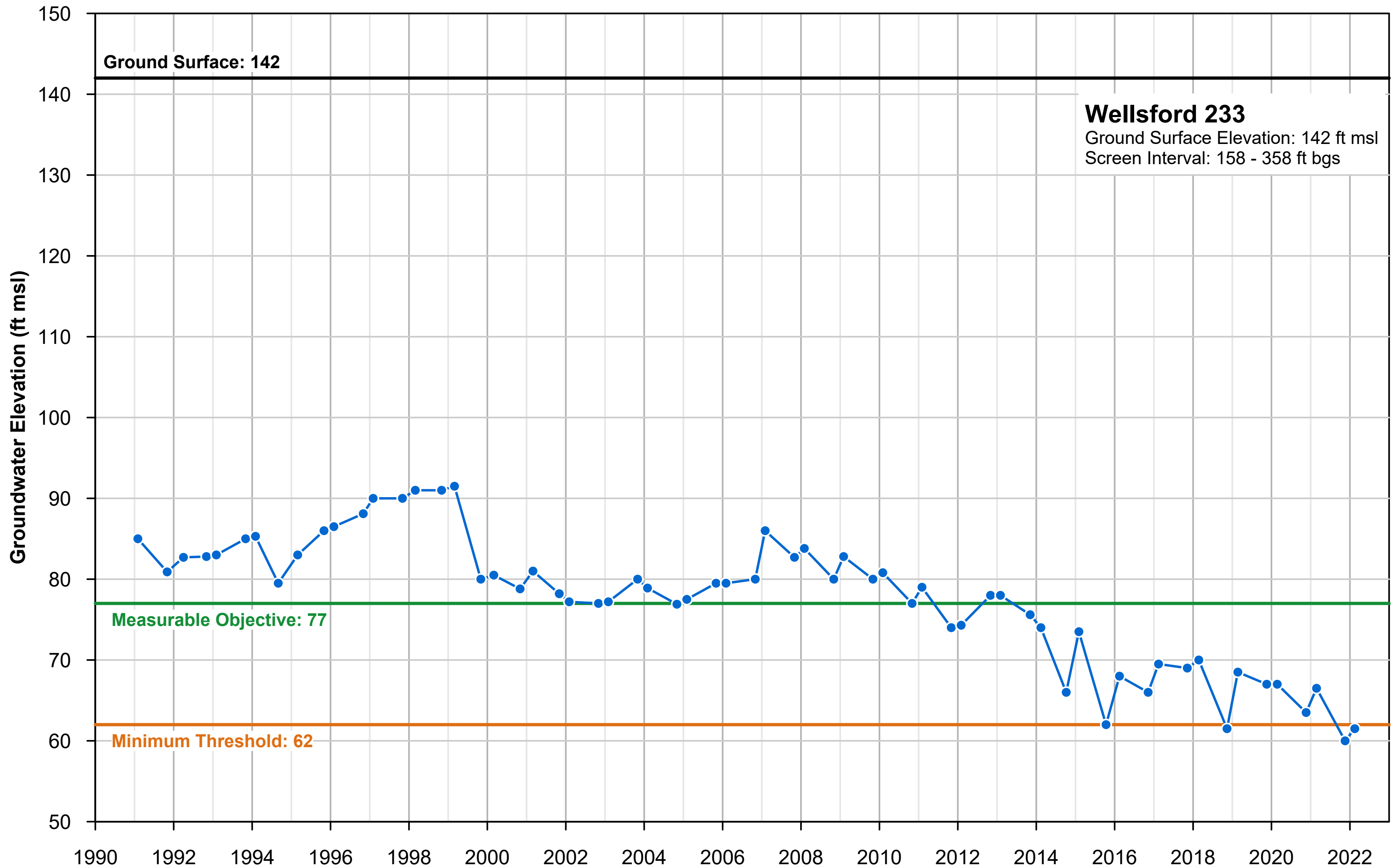
2020
2022



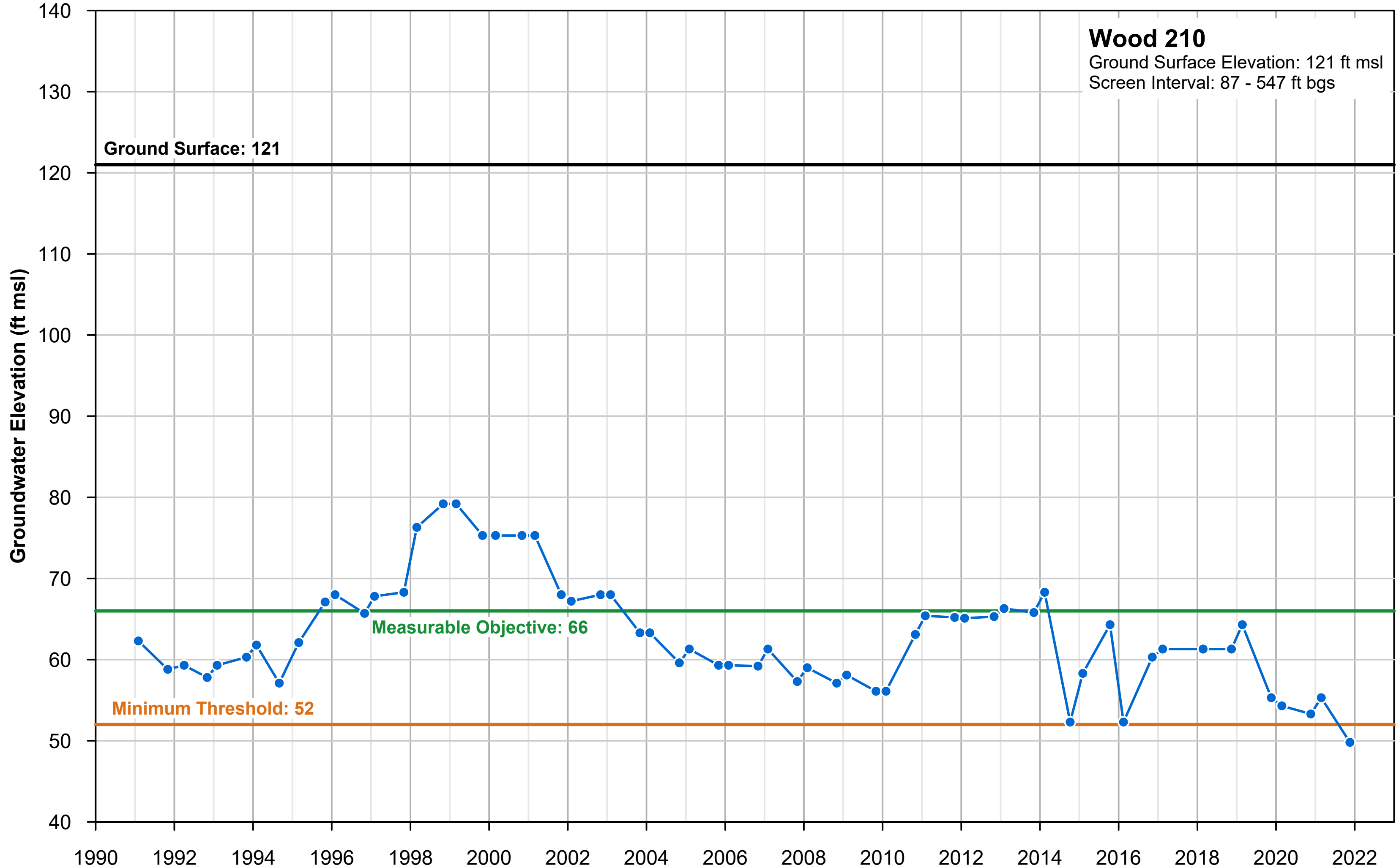
Van Buren 43
Ground Surface Elevation: 63 ft msl
Screen Interval: 76 - 116 ft bgs
Ground Surface: 63
Measurable Objective: 45
Minimum Threshold: 38
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Warnock 46
Ground Surface Elevation: 55 ft msl
Total Well Depth: 240 ft bgs
Groundwater Elevation (ft msl)
Ground Surface: 55
Measurable Objective: 42
Minimum Threshold: 35
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Ground Surface: 142
Wellsford 233
Ground Surface Elevation: 142 ft msl
Screen Interval: 158 - 358 ft bgs
Measurable Objective: 77
Minimum Threshold: 62
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Wood 210
Ground Surface Elevation: 121 ft msl
Screen Interval: 87 - 547 ft bgs
Ground Surface: 121
Measurable Objective: 66
Minimum Threshold: 52
Groundwater Elevation (ft msl)
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
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2008
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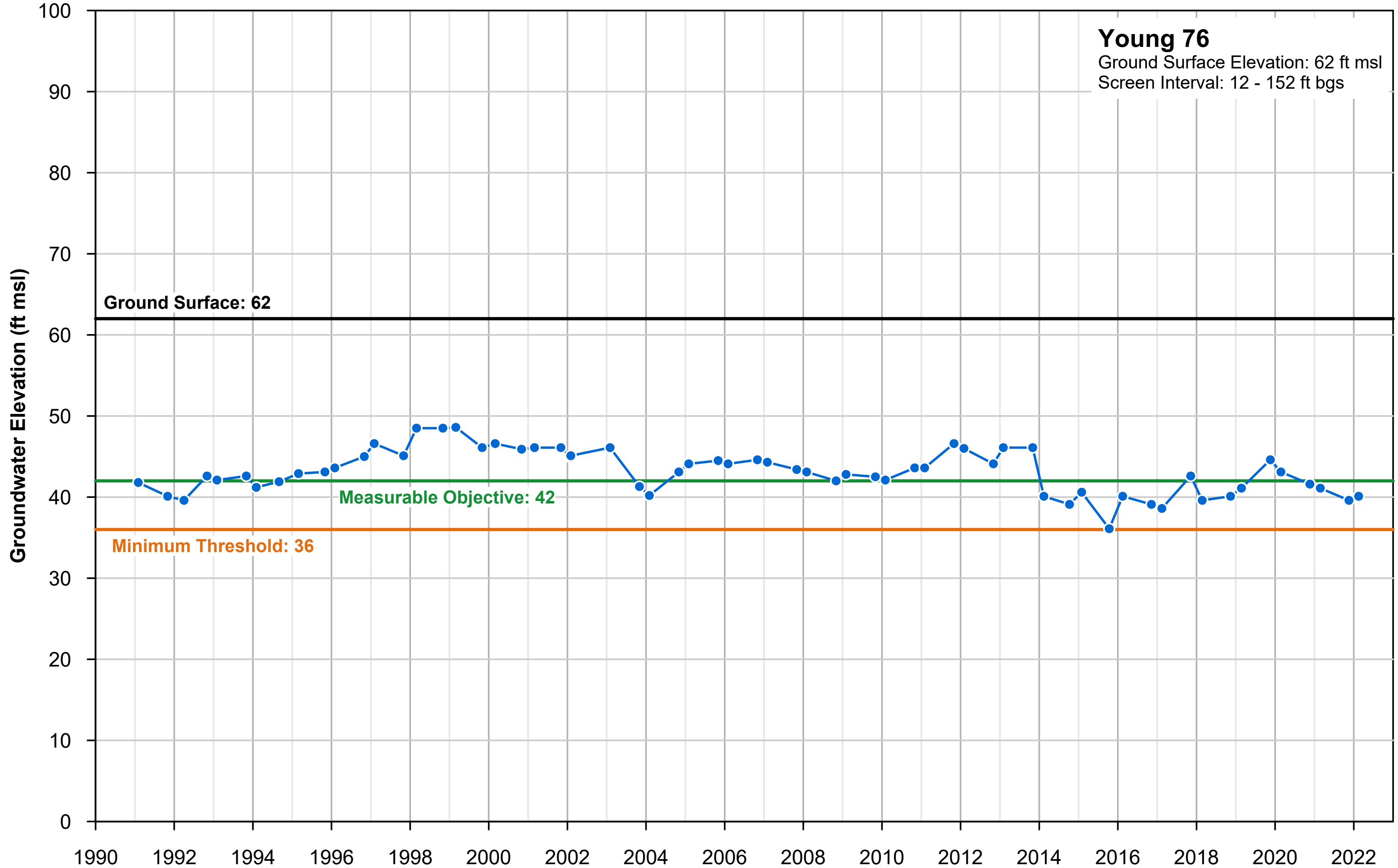
2022



Young 76
Ground Surface Elevation: 62 ft msl
Screen Interval: 12 - 152 ft bgs
Ground Surface: 62
Measurable Objective: 42
Minimum Threshold: 36
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
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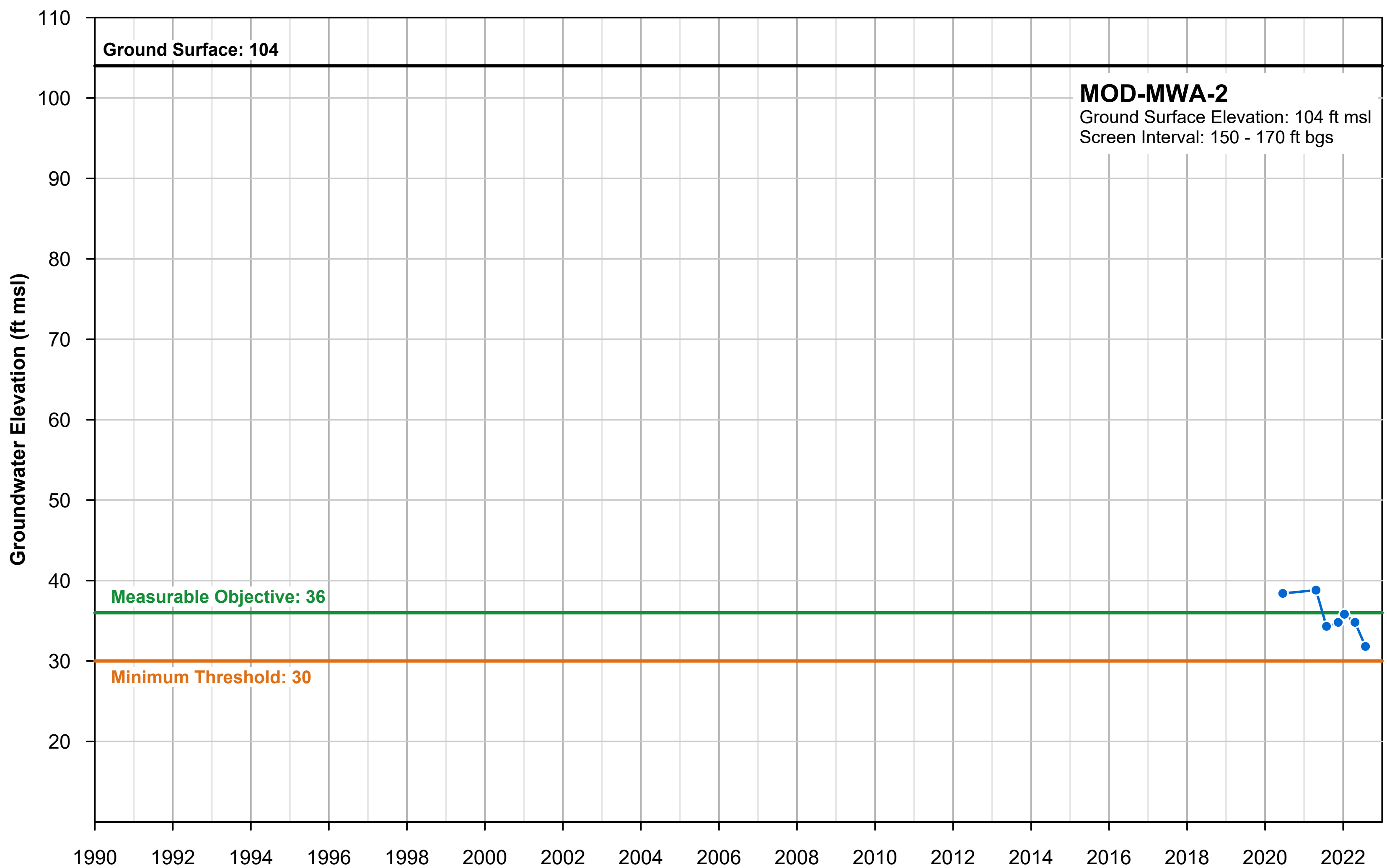
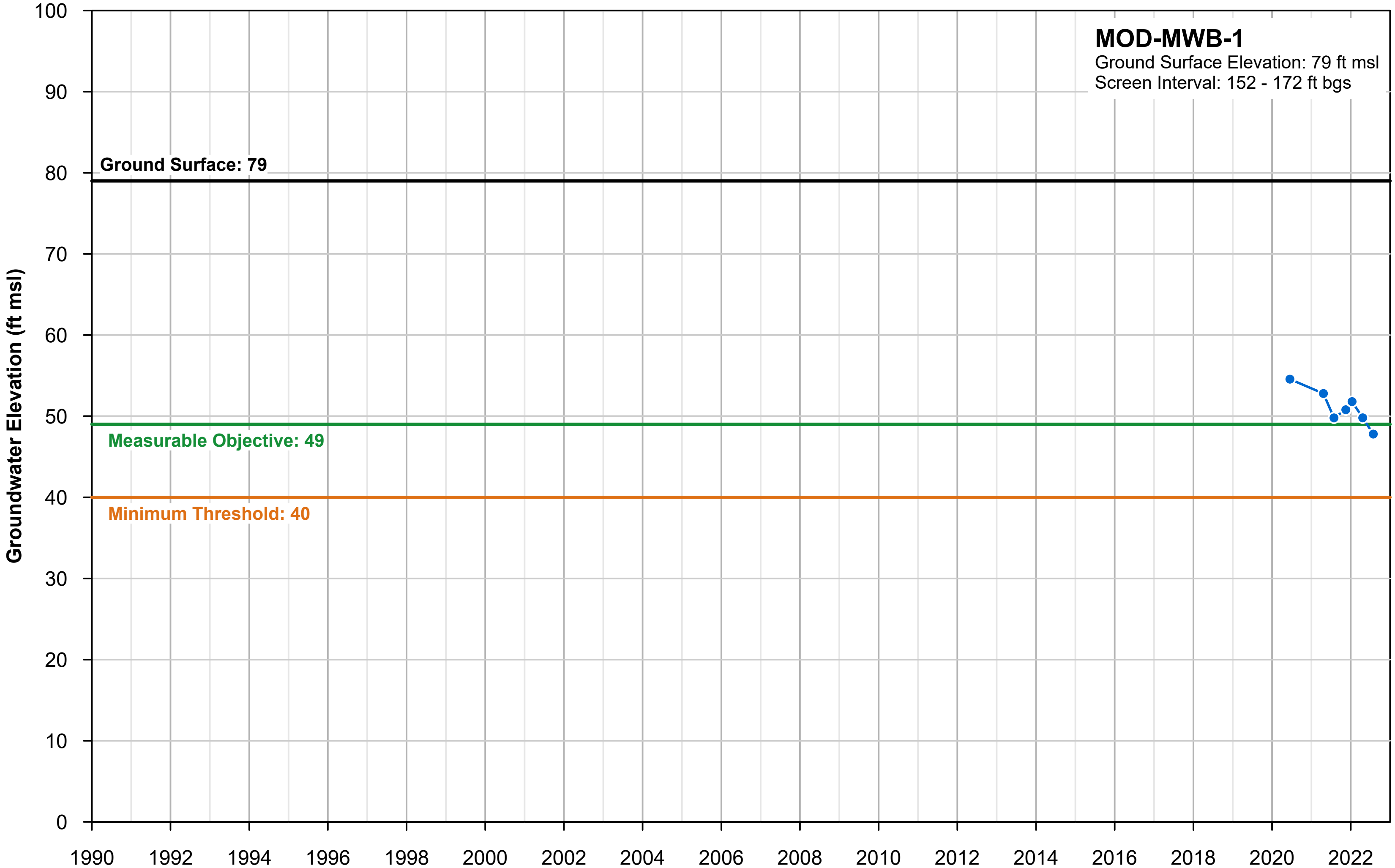


MOD-MWA-2
Ground Surface Elevation: 104 ft msl
Screen Interval: 150 - 170 ft bgs
Ground Surface: 104
Measurable Objective: 36
Minimum Threshold: 30
Groundwater Elevation (ft msl)
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


MOD-MWB-1
Ground Surface Elevation: 79 ft msl
Screen Interval: 152 - 172 ft bgs
Ground Surface: 79
Measurable Objective: 49
Minimum Threshold: 40
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
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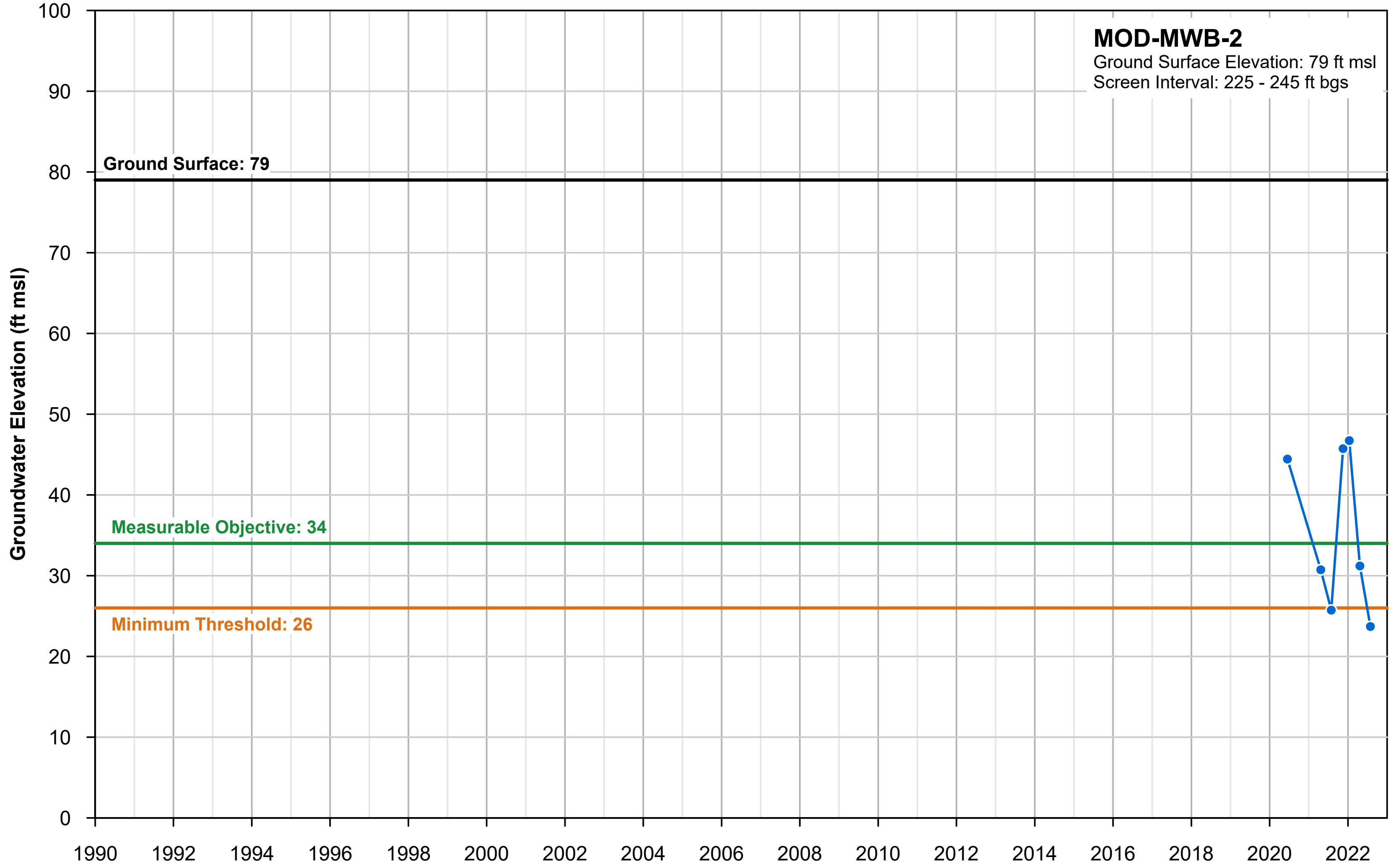
2018
2020
2022


MOD-MWB-2
Ground Surface Elevation: 79 ft msl
Screen Interval: 225 - 245 ft bgs
Ground Surface: 79
Measurable Objective: 34
Minimum Threshold: 26
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
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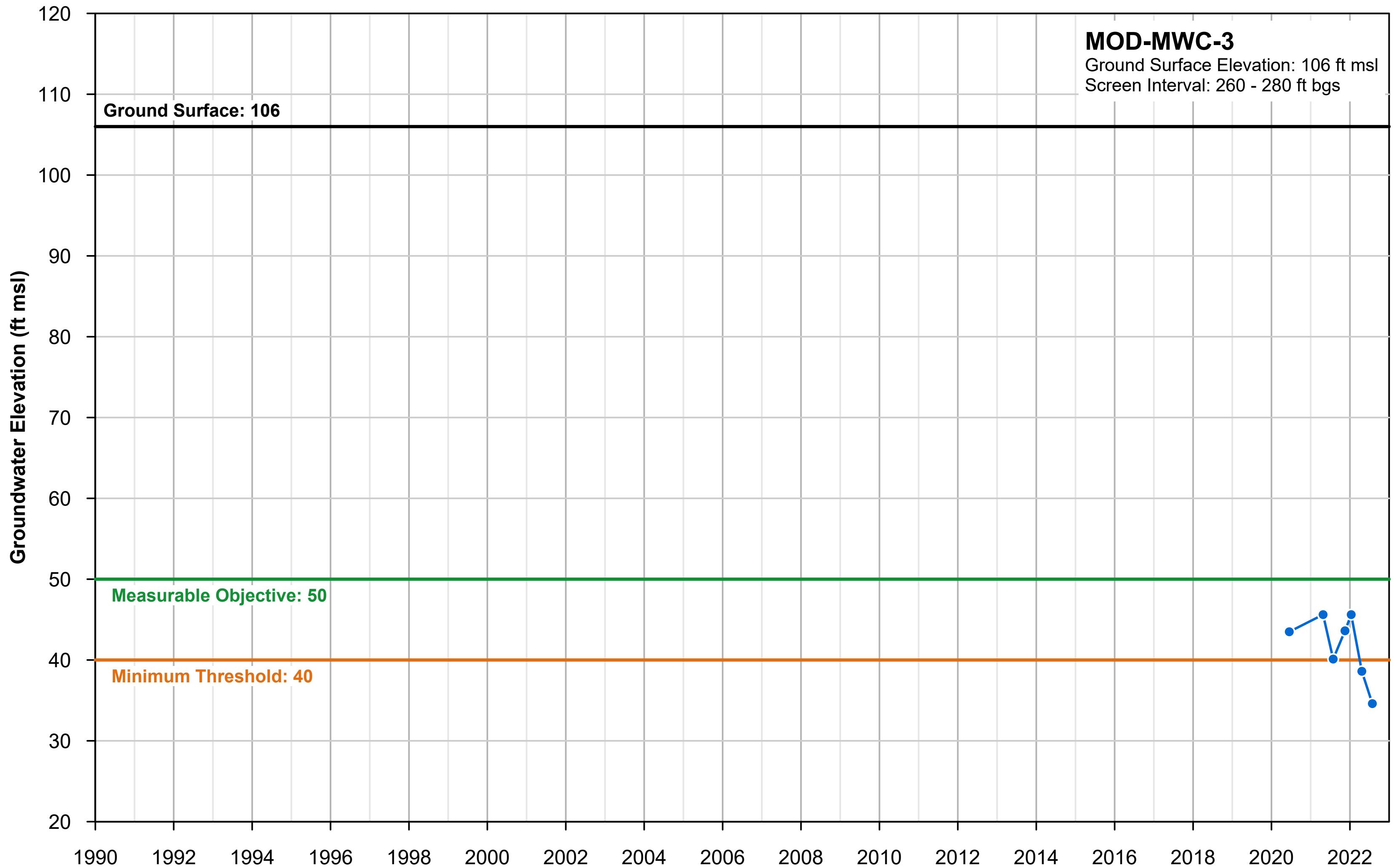
2018
2020
2022



MOD-MWC-3
Ground Surface Elevation: 106 ft msl
Screen Interval: 260 - 280 ft bgs
Ground Surface: 106
Measurable Objective: 50
Minimum Threshold: 40
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
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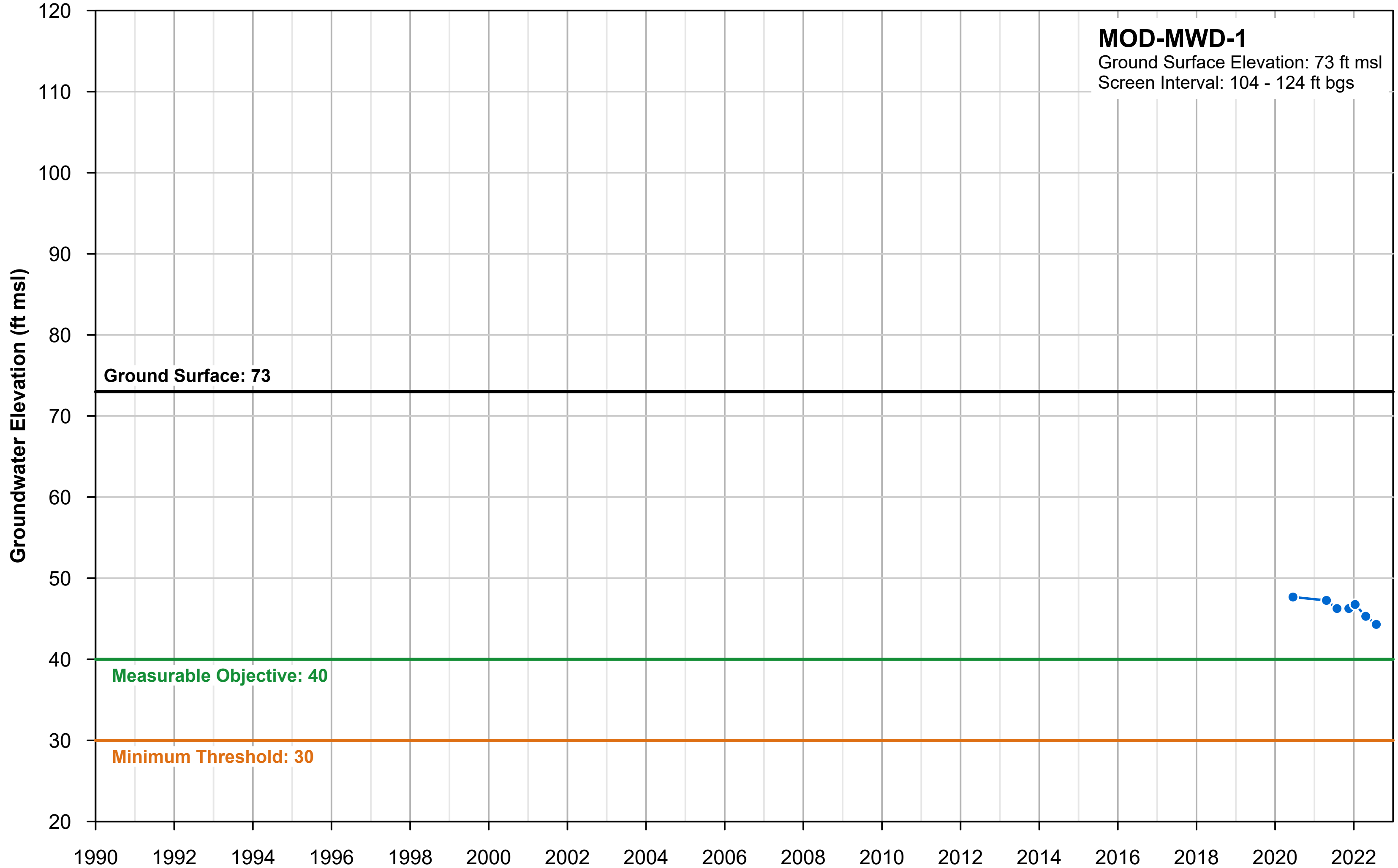
2018
2020
2022



MOD-MWD-1
Ground Surface Elevation: 73 ft msl
Screen Interval: 104 - 124 ft bgs
Ground Surface: 73
Measurable Objective: 40
Minimum Threshold: 30
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
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2018
2020
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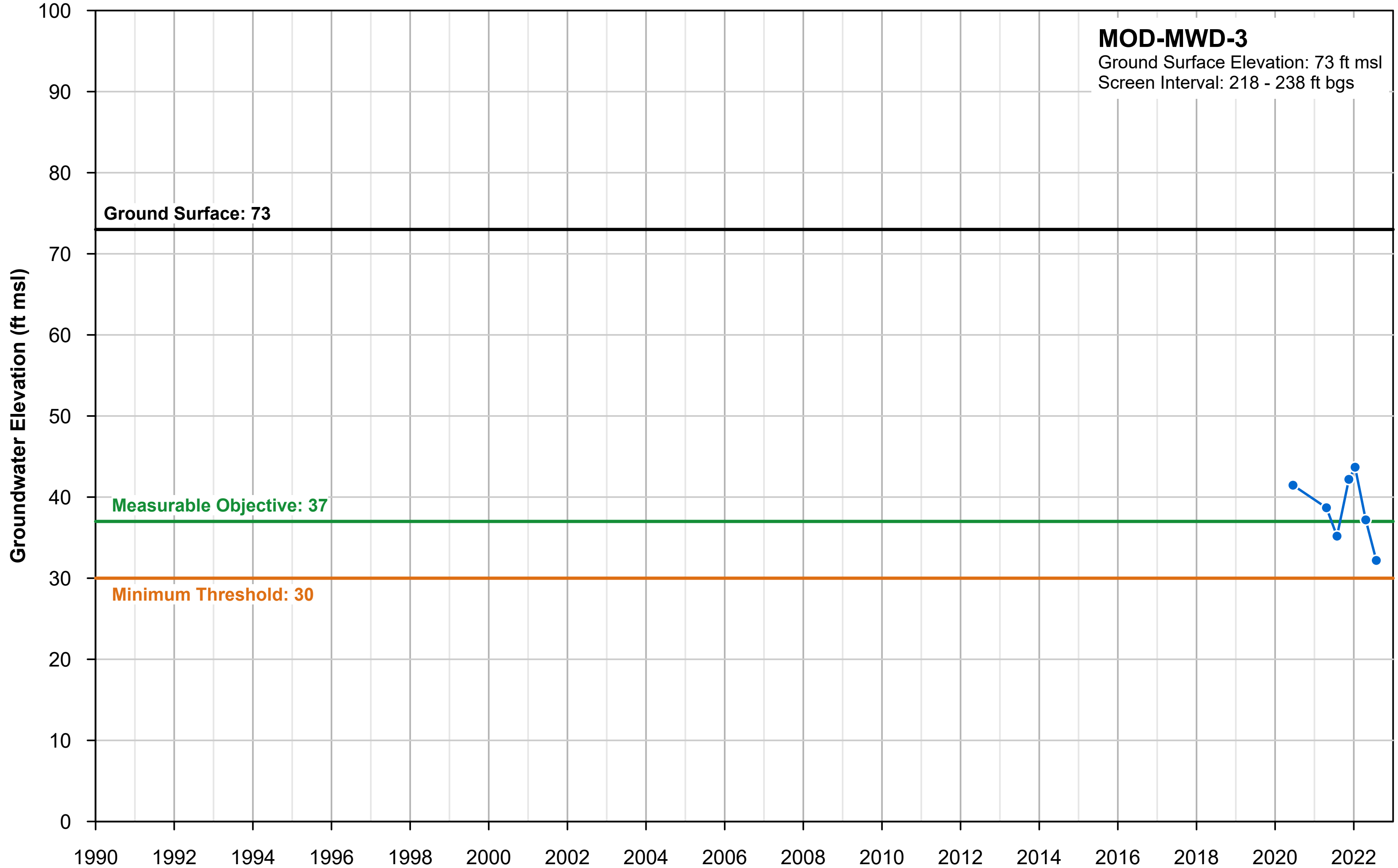
MOD-MWD-3
Ground Surface Elevation: 73 ft msl
Screen Interval: 218 - 238 ft bgs
Ground Surface: 73
Measurable Objective: 37
Minimum Threshold: 30
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
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2004
2006
2008
2010
2012
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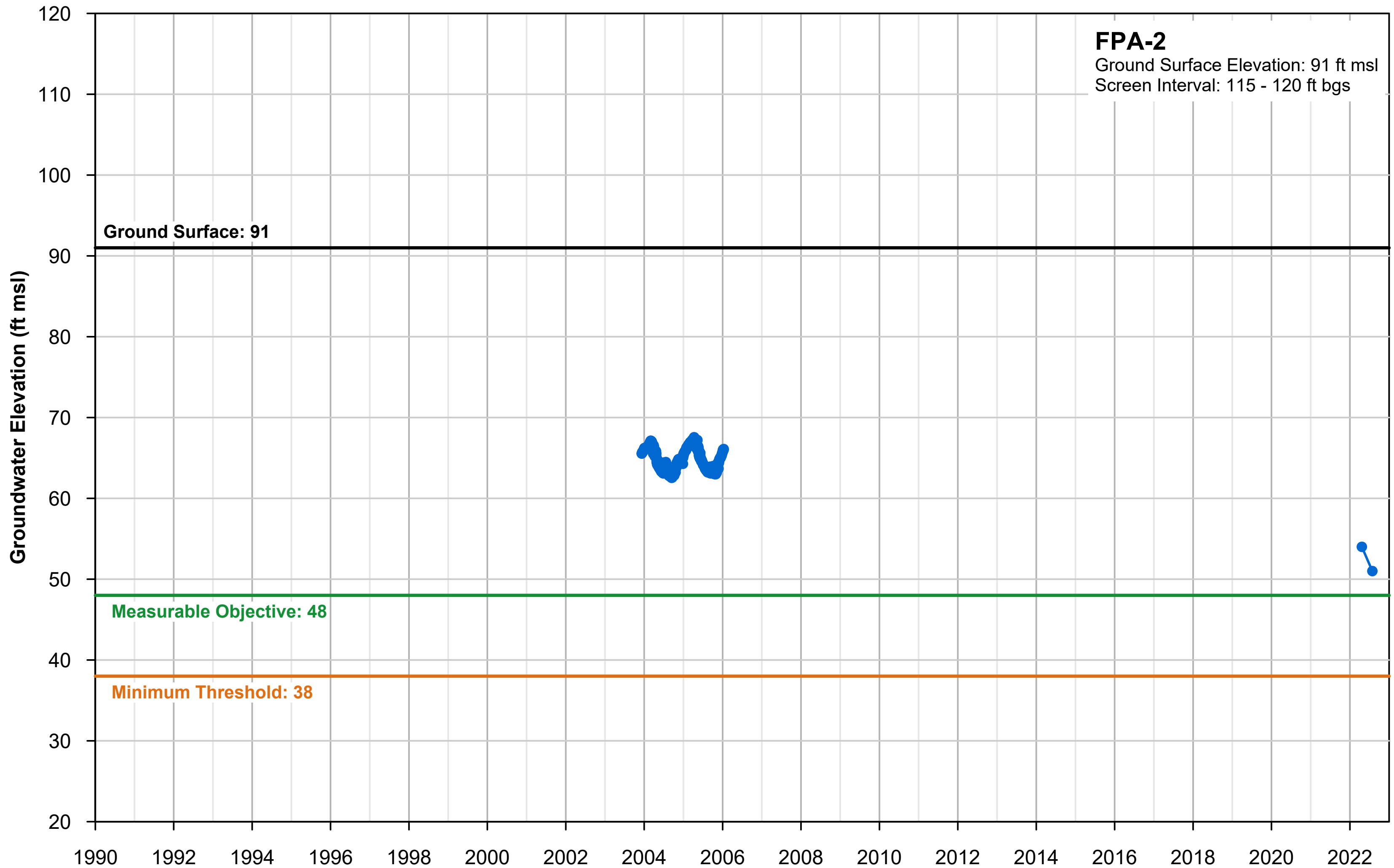
2018
2020
2022



FPA-2
Ground Surface Elevation: 91 ft msl
Screen Interval: 115 - 120 ft bgs
Ground Surface: 91
Measurable Objective: 48
Minimum Threshold: 38
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
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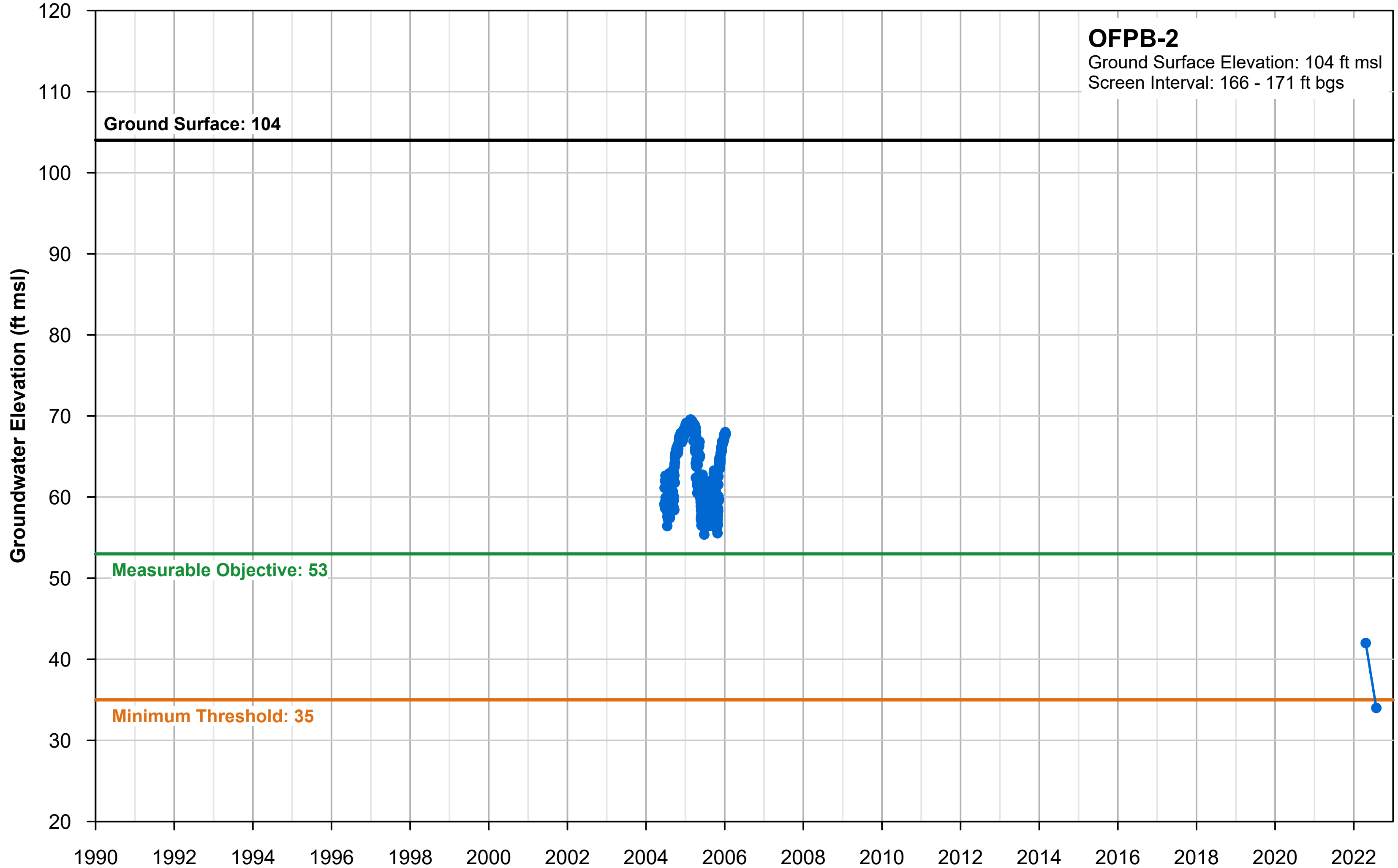
2020
2022



OFPB-2
Ground Surface Elevation: 104 ft msl
Screen Interval: 166 - 171 ft bgs
Ground Surface: 104
Measurable Objective: 53
Minimum Threshold: 35
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
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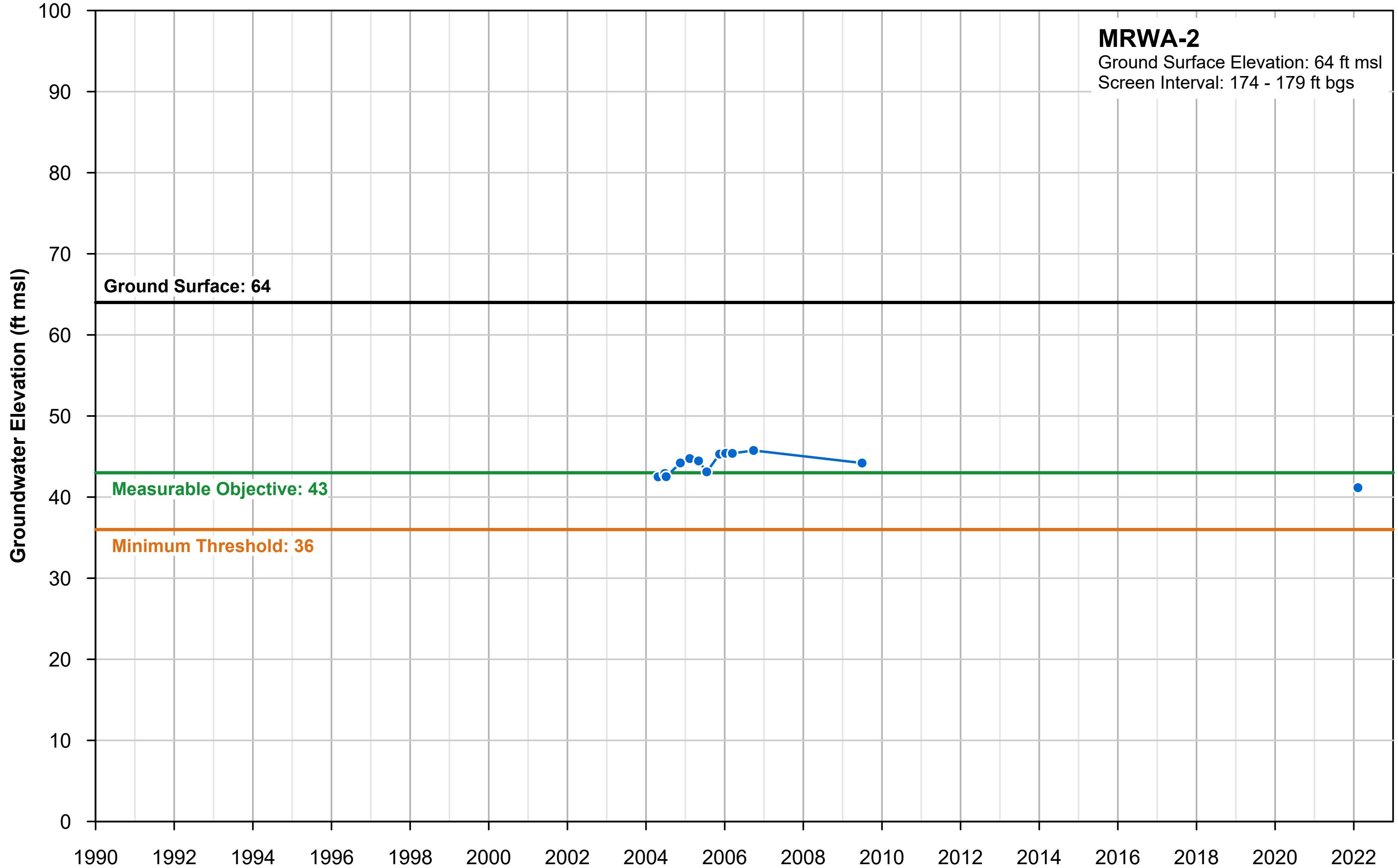
2022



MRWA-2
Ground Surface Elevation: 64 ft msl
Screen Interval: 174 - 179 ft bgs
Ground Surface: 64
Measurable Objective: 43
Minimum Threshold: 36
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
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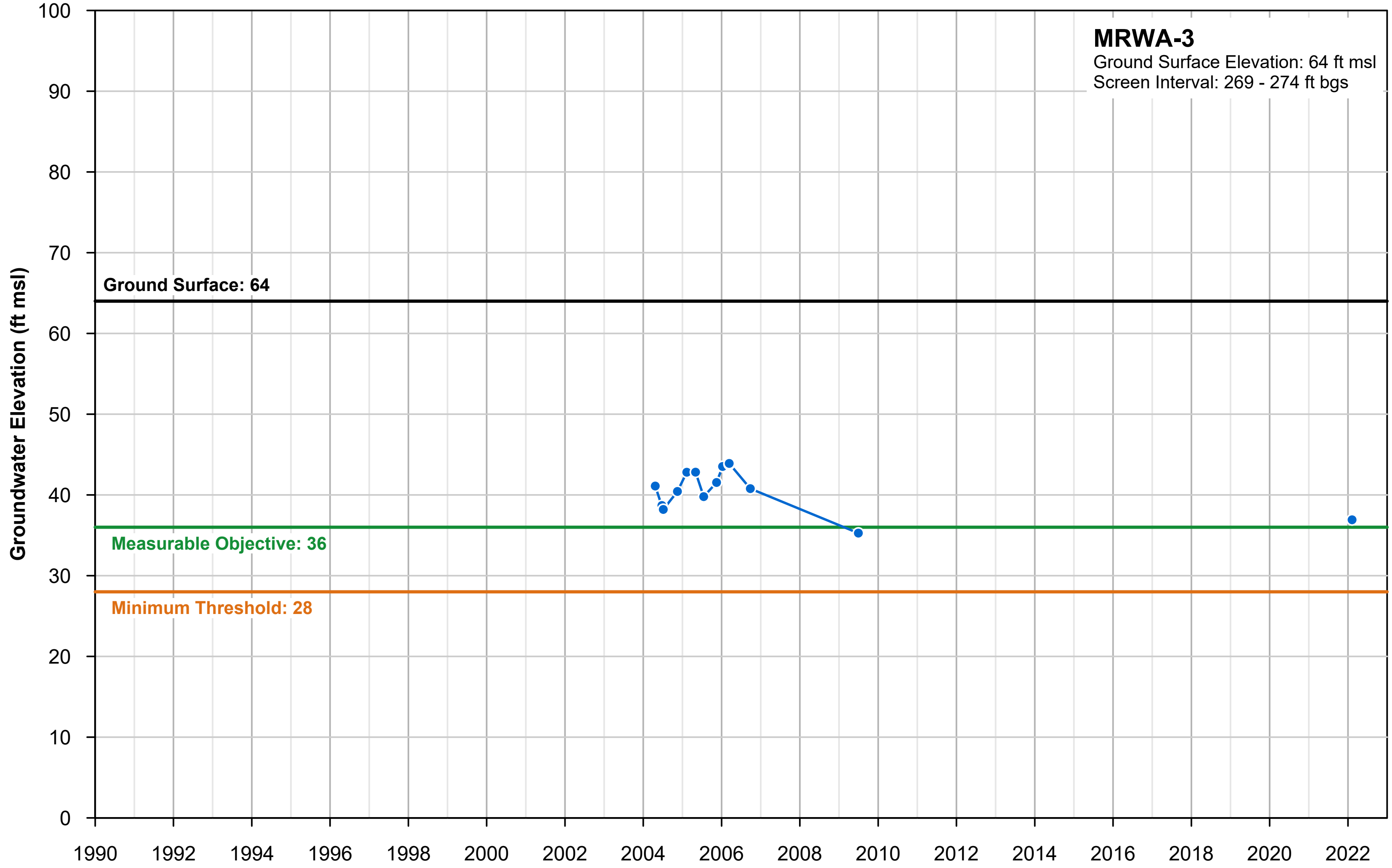
2018
2020
2022


MRWA-3
Ground Surface Elevation: 64 ft msl
Screen Interval: 269 - 274 ft bgs
Ground Surface: 64
Measurable Objective: 36
Minimum Threshold: 28
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
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2008
2010
2012
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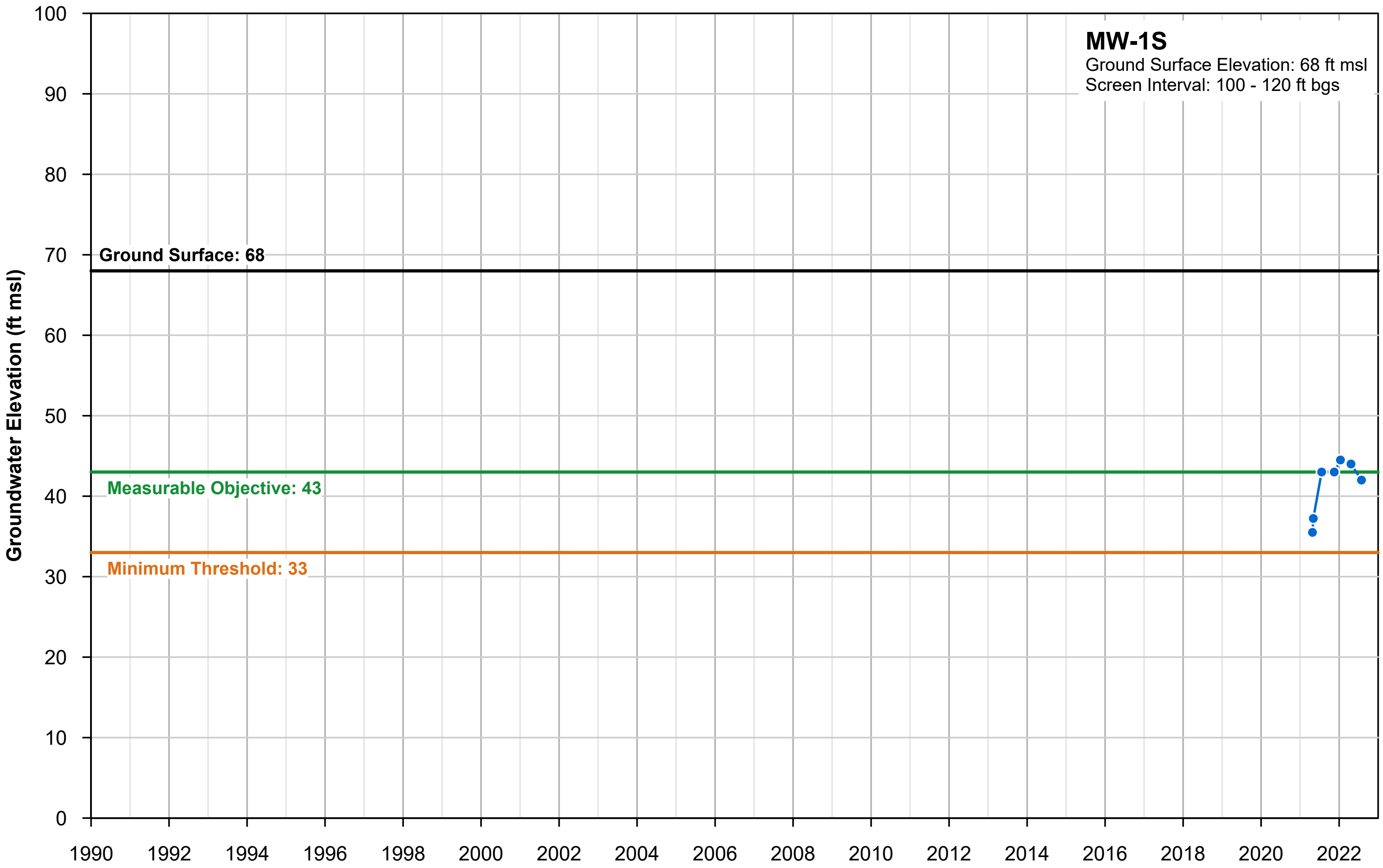
2018
2020
2022



MW-1S
Ground Surface Elevation: 68 ft msl
Screen Interval: 100 - 120 ft bgs
Ground Surface: 68
Measurable Objective: 43
Minimum Threshold: 33
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
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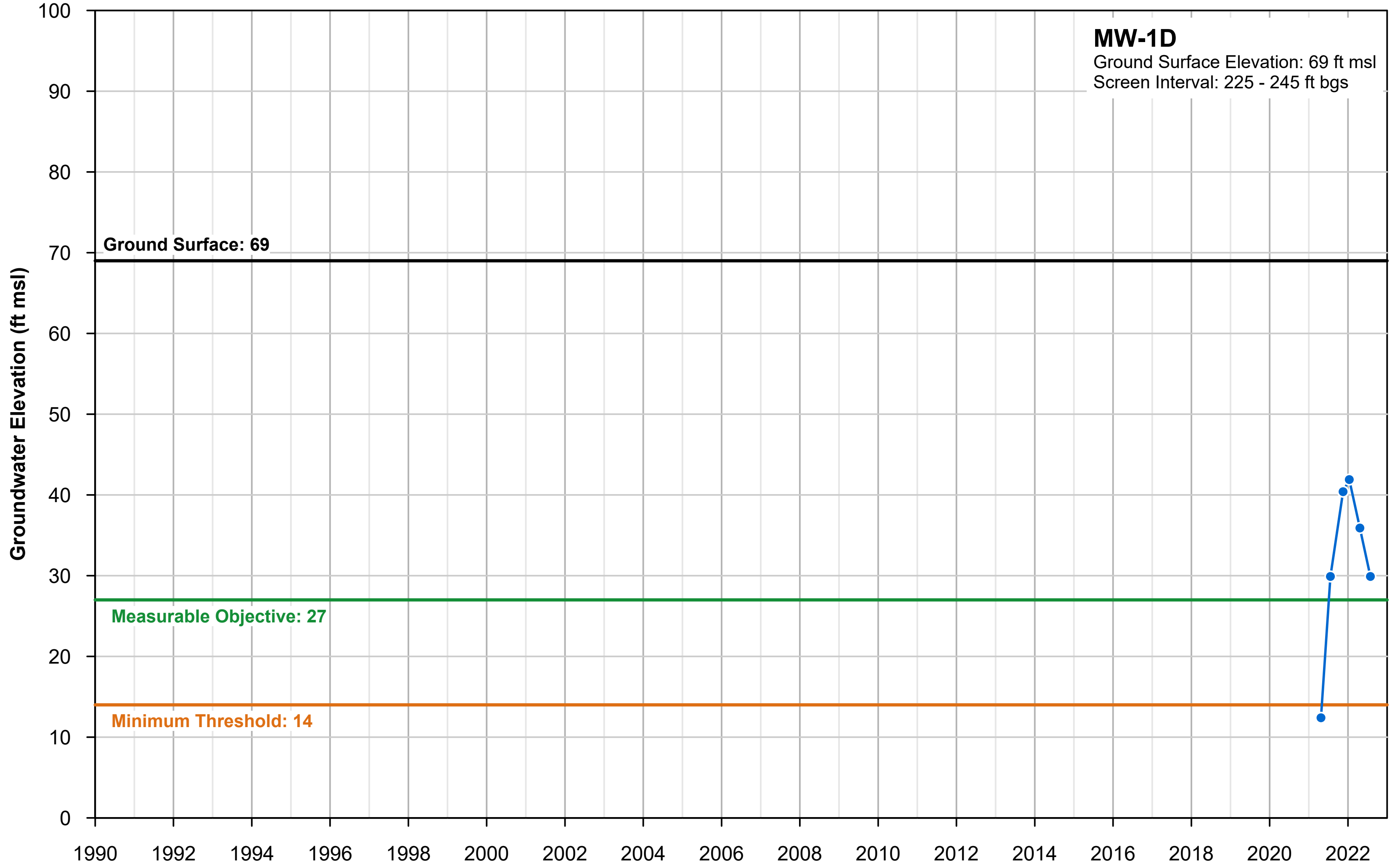
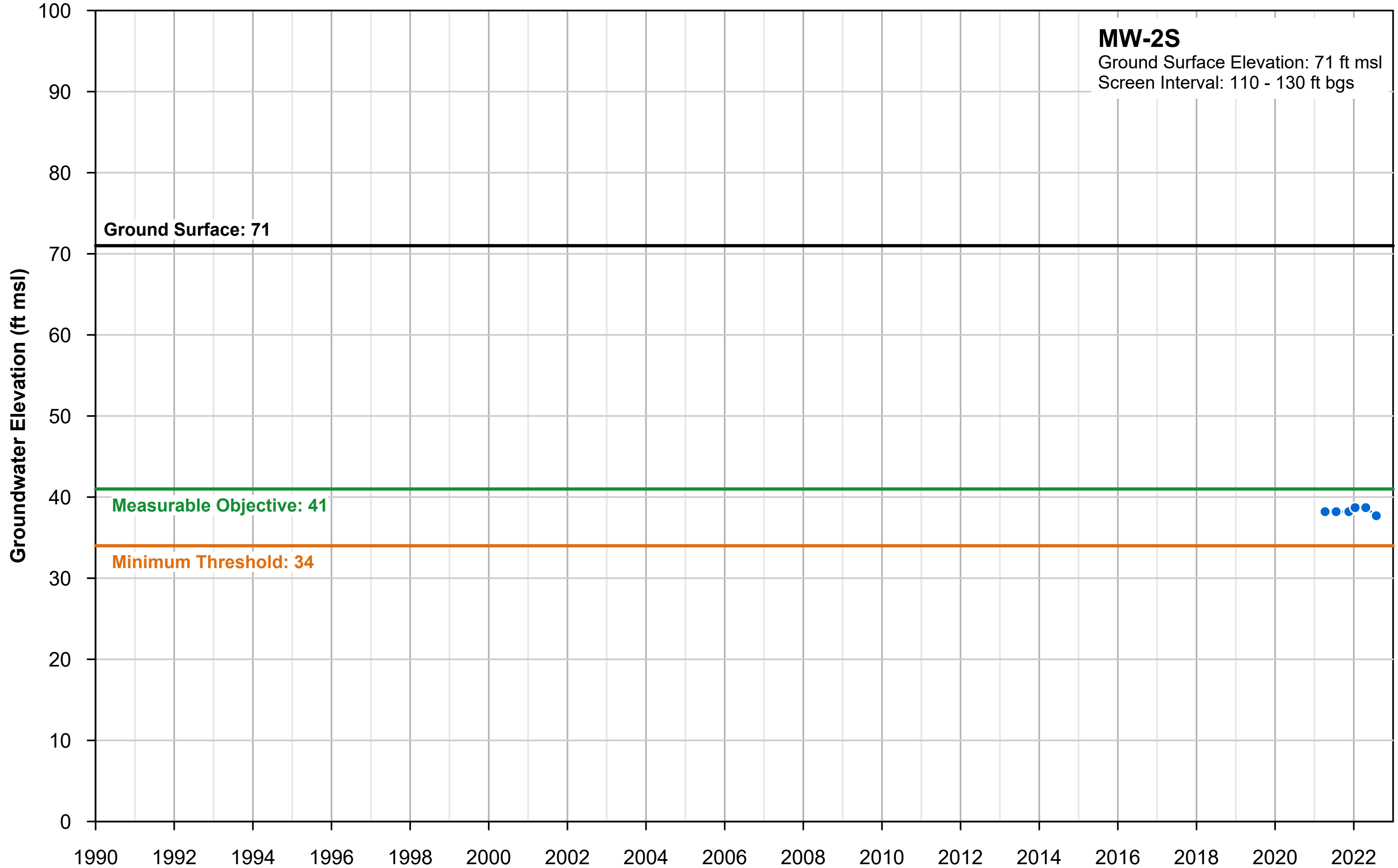
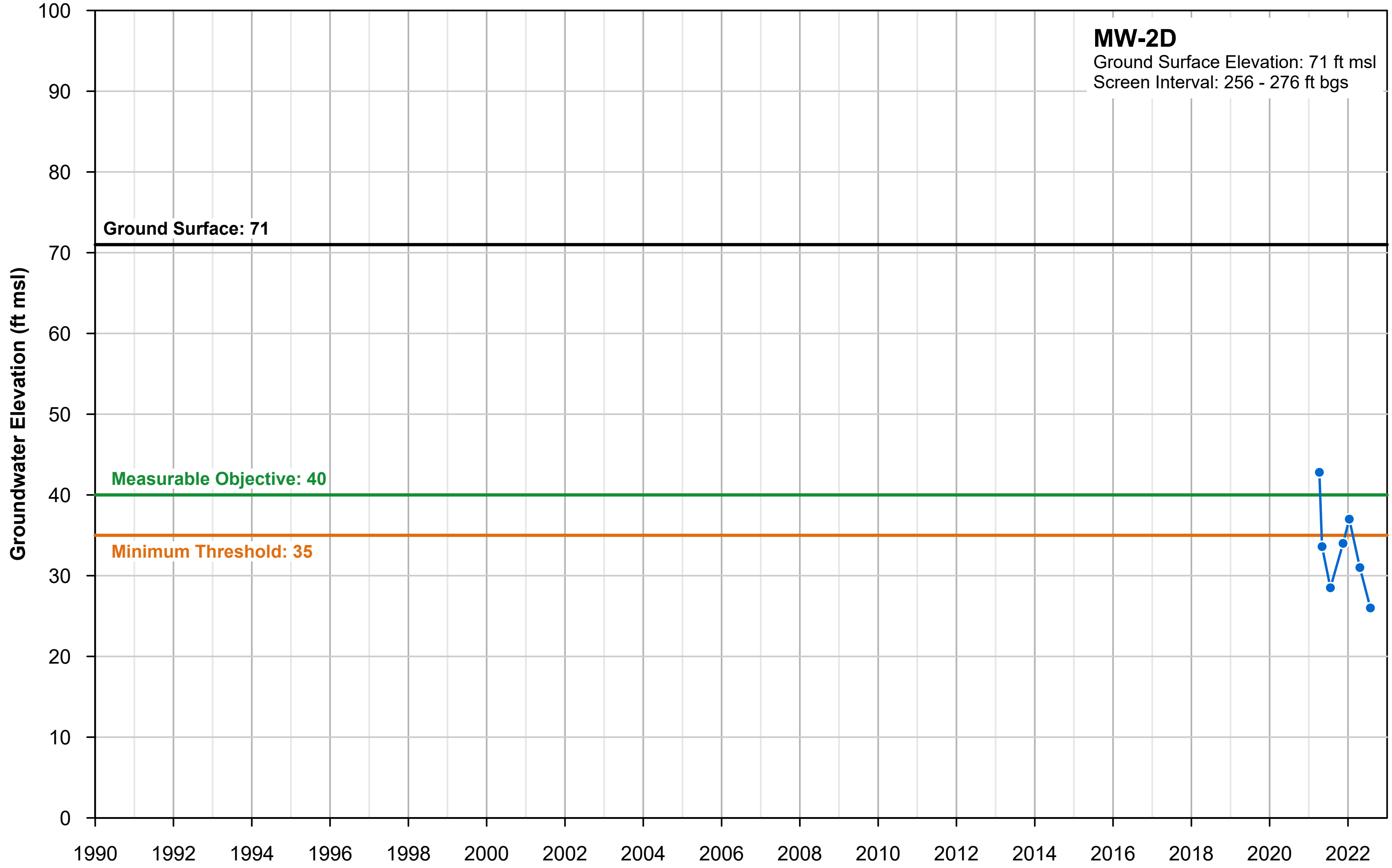
2018
2020
2022

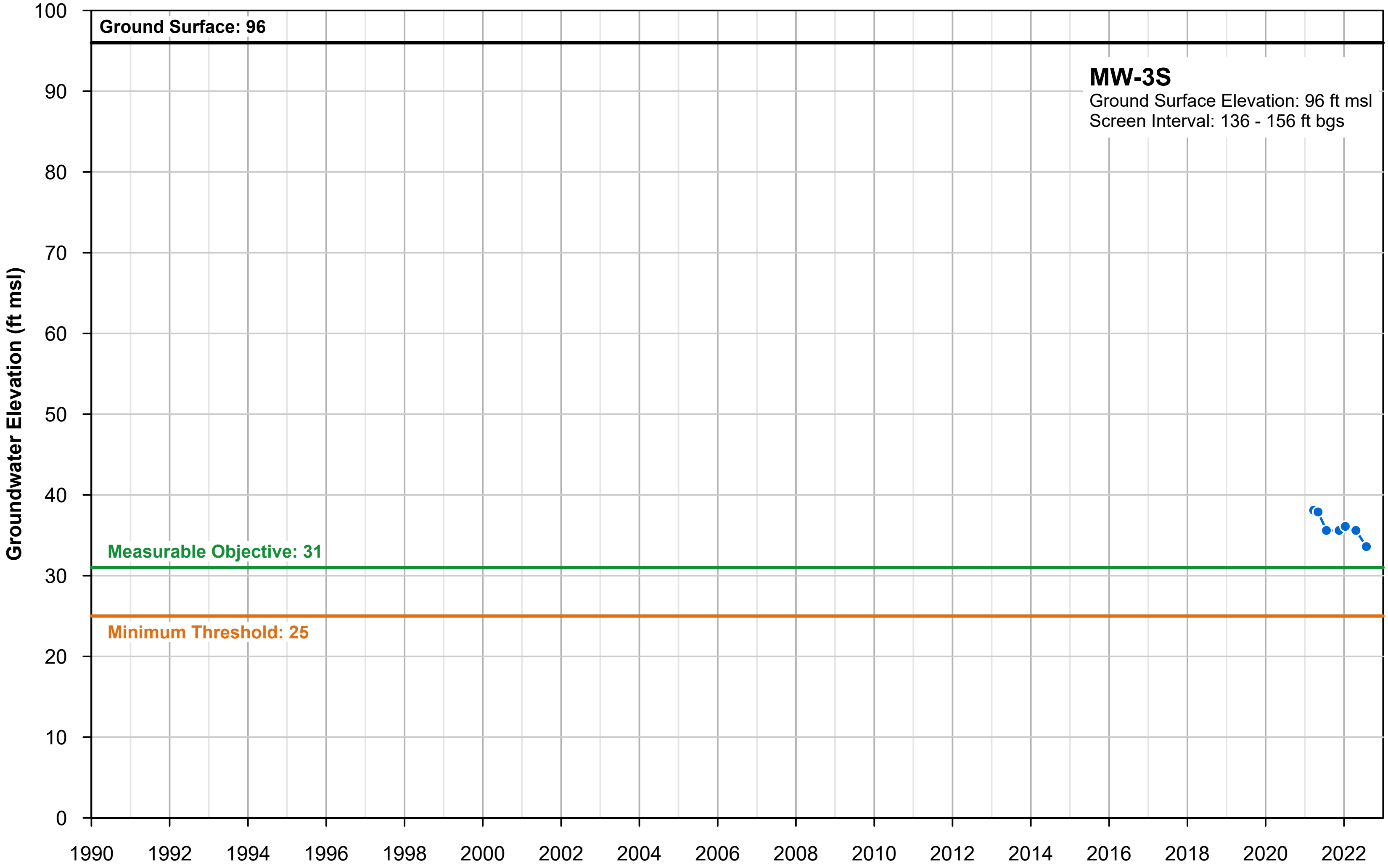


MW-1D
Ground Surface Elevation: 69 ft msl
Screen Interval: 225 - 245 ft bgs
Ground Surface: 69
Measurable Objective: 27
Minimum Threshold: 14
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

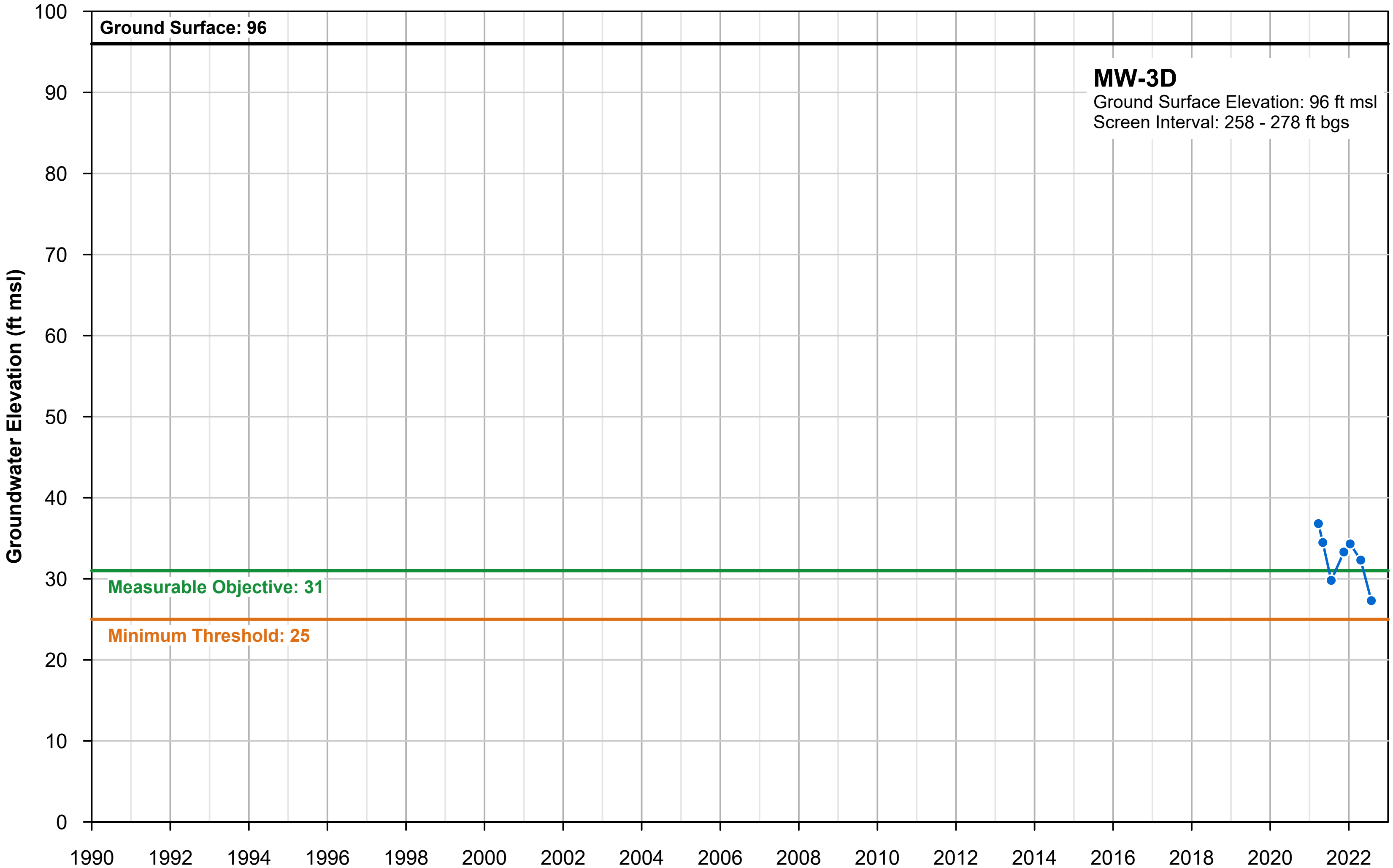

MW-2S
Ground Surface Elevation: 71 ft msl
Screen Interval: 110 - 130 ft bgs
Ground Surface: 71
Measurable Objective: 41
Minimum Threshold: 34
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



MW-2D
Ground Surface Elevation: 71 ft msl
Screen Interval: 256 - 276 ft bgs
Ground Surface: 71
Measurable Objective: 40
Minimum Threshold: 35
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



MW-3S
Ground Surface Elevation: 96 ft msl
Screen Interval: 136 - 156 ft bgs
Ground Surface: 96
Measurable Objective: 31
Minimum Threshold: 25
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



MW-3D
Ground Surface Elevation: 96 ft msl
Screen Interval: 258 - 278 ft bgs
Ground Surface: 96
Measurable Objective: 31
Minimum Threshold: 25
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
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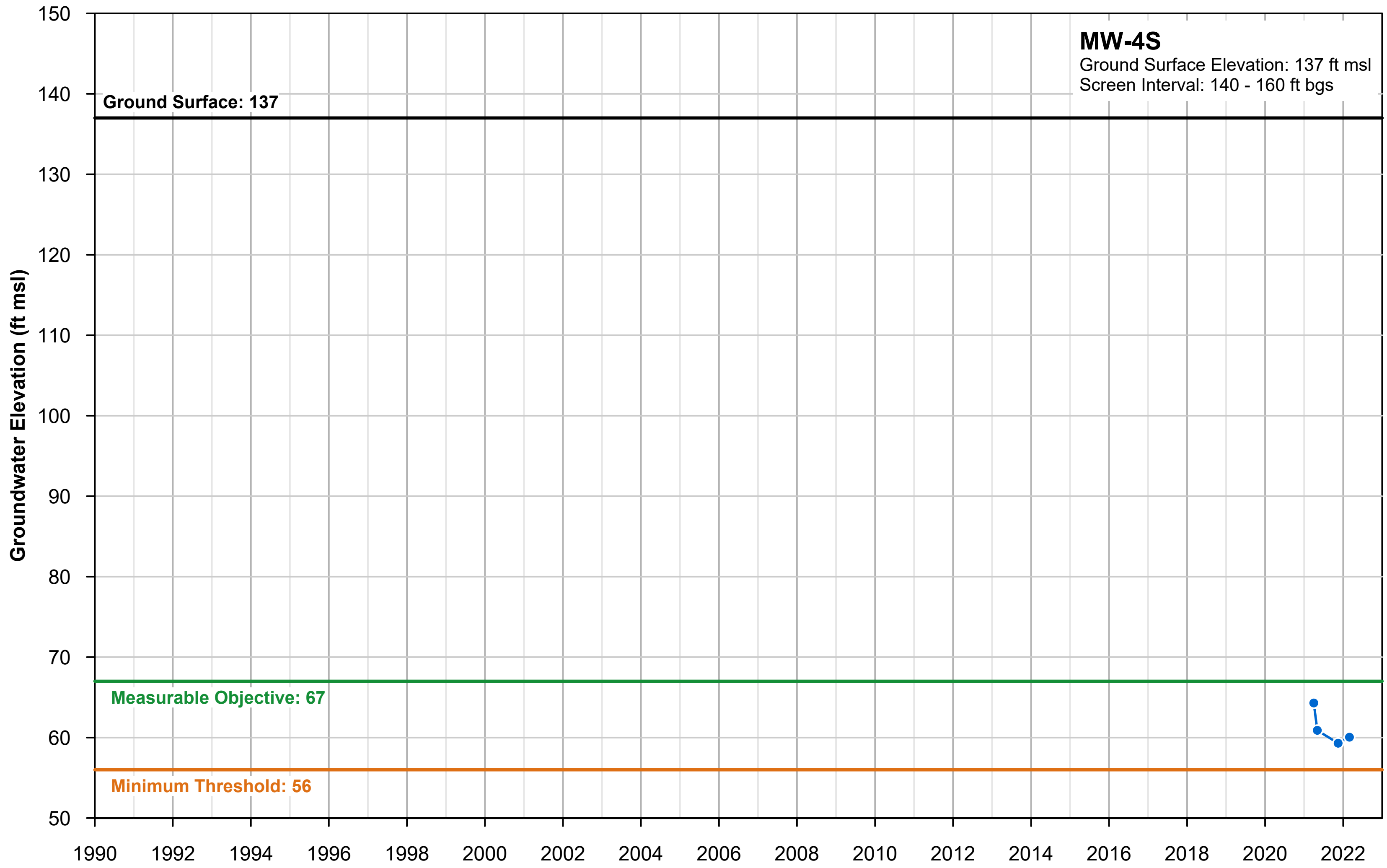
2018
2020
2022


MW-4S
Ground Surface Elevation: 137 ft msl
Screen Interval: 140 - 160 ft bgs
Ground Surface: 137
Measurable Objective: 67
Minimum Threshold: 56
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
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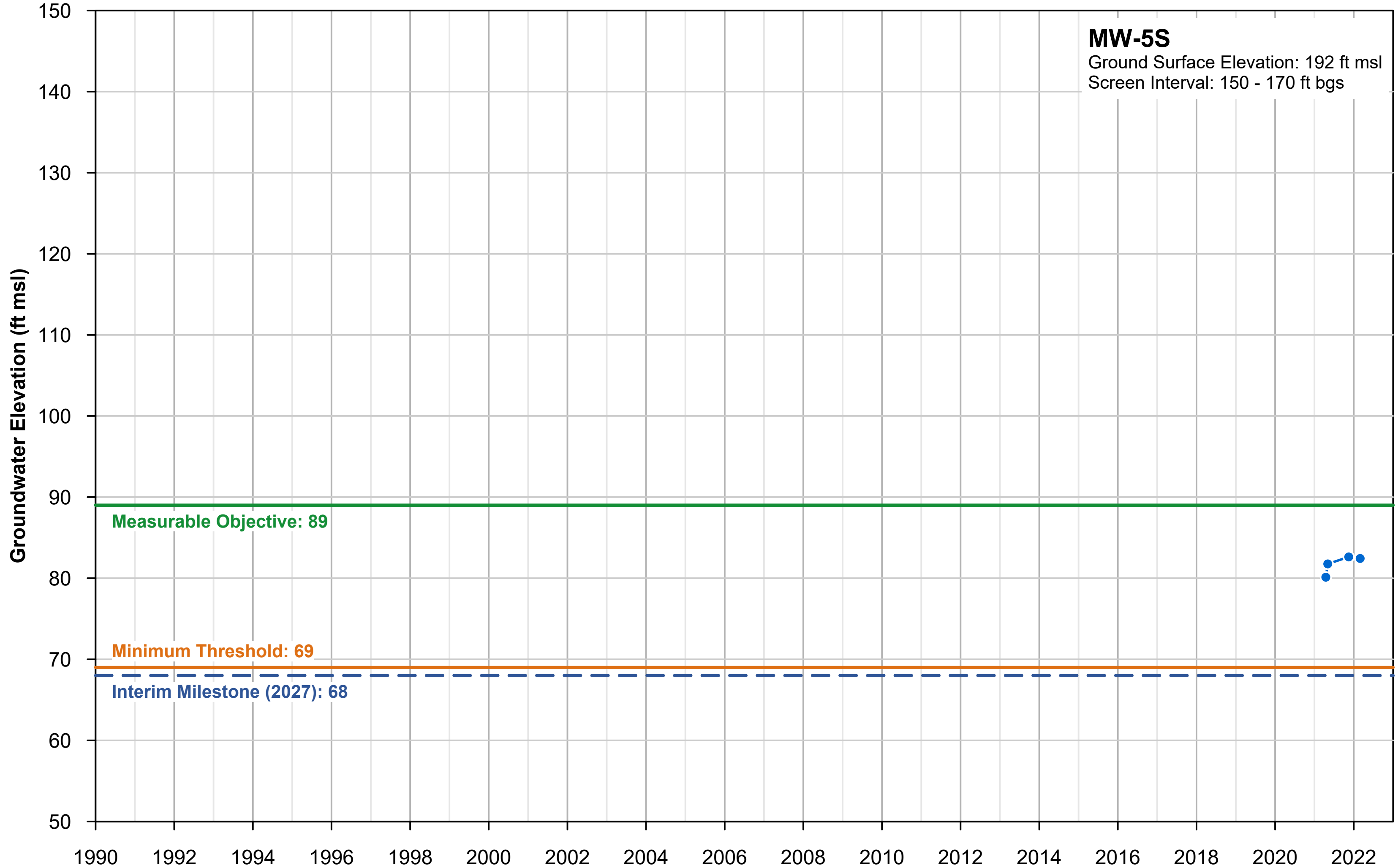
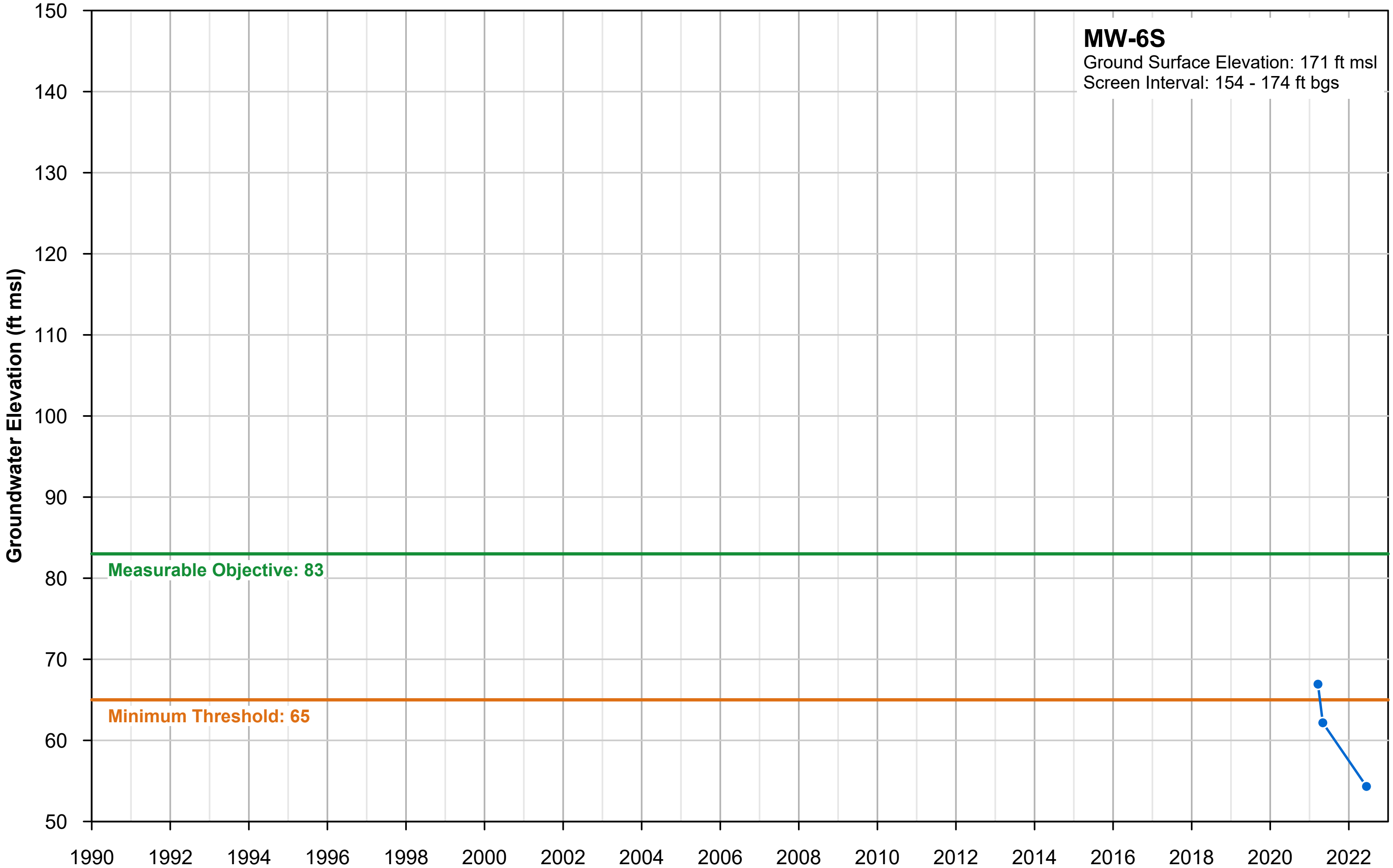
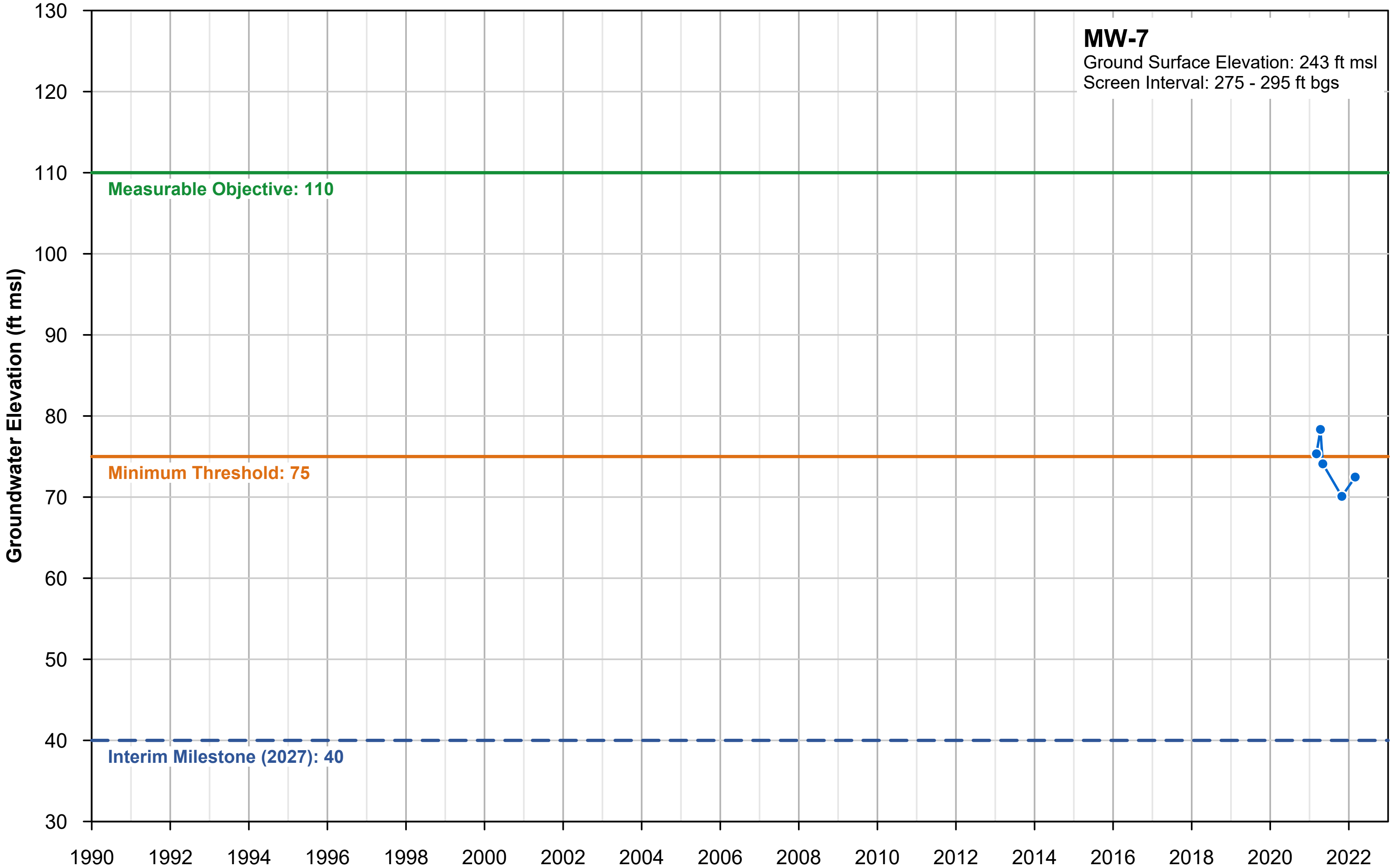
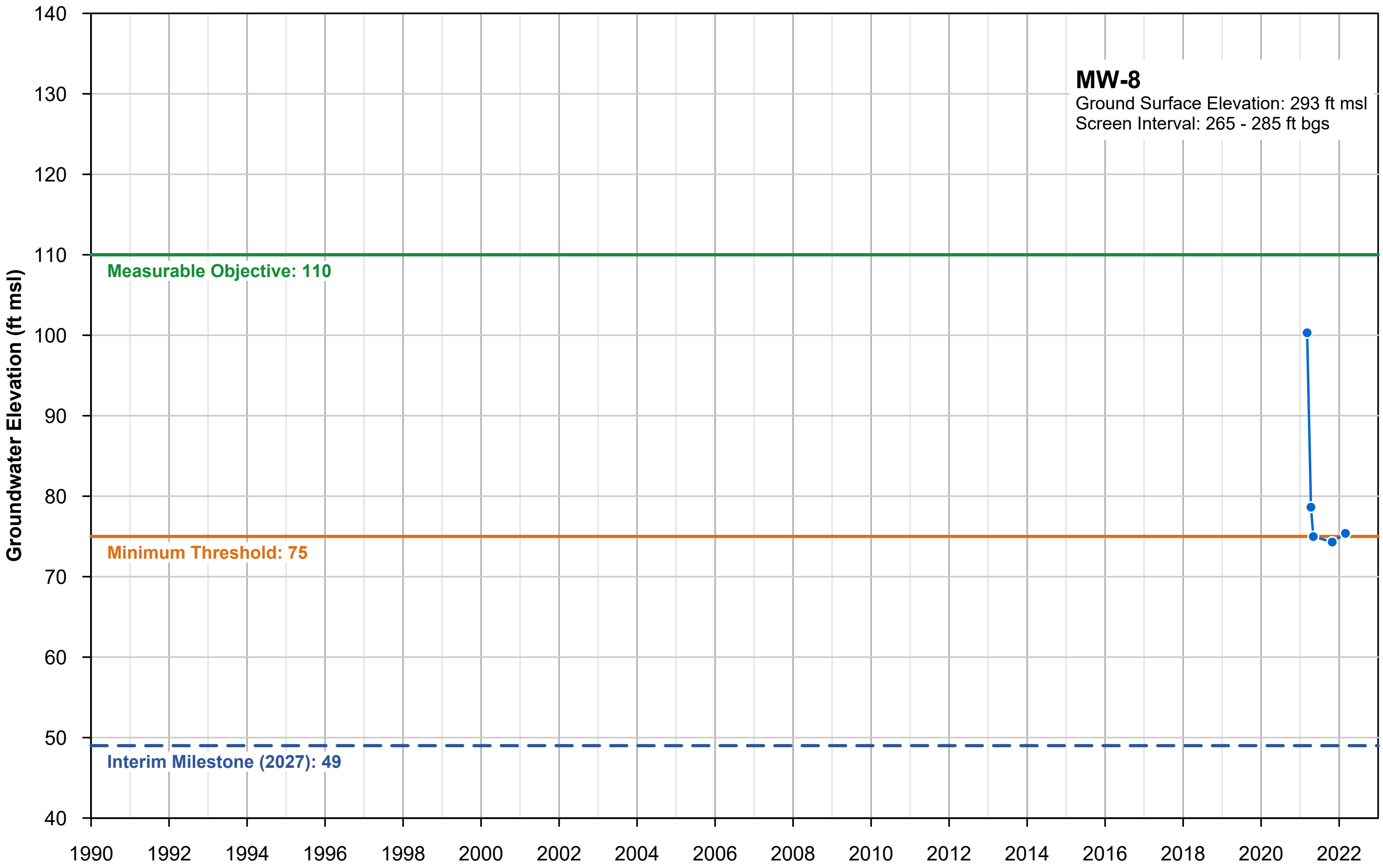
2018
2020
2022


MW-5S
Ground Surface Elevation: 192 ft msl
Screen Interval: 150 - 170 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 89
Minimum Threshold: 69
Interim Milestone (2027): 68
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

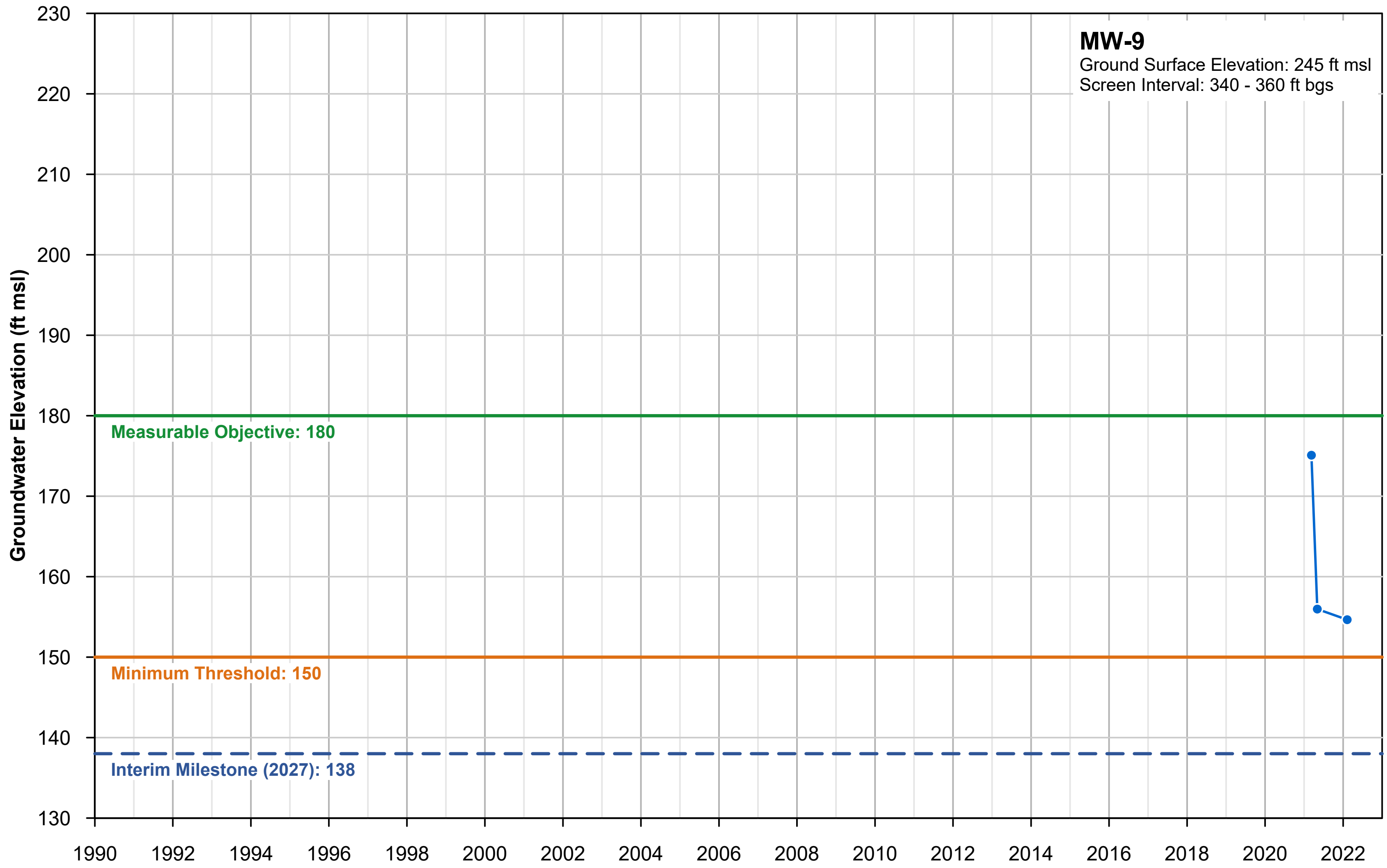


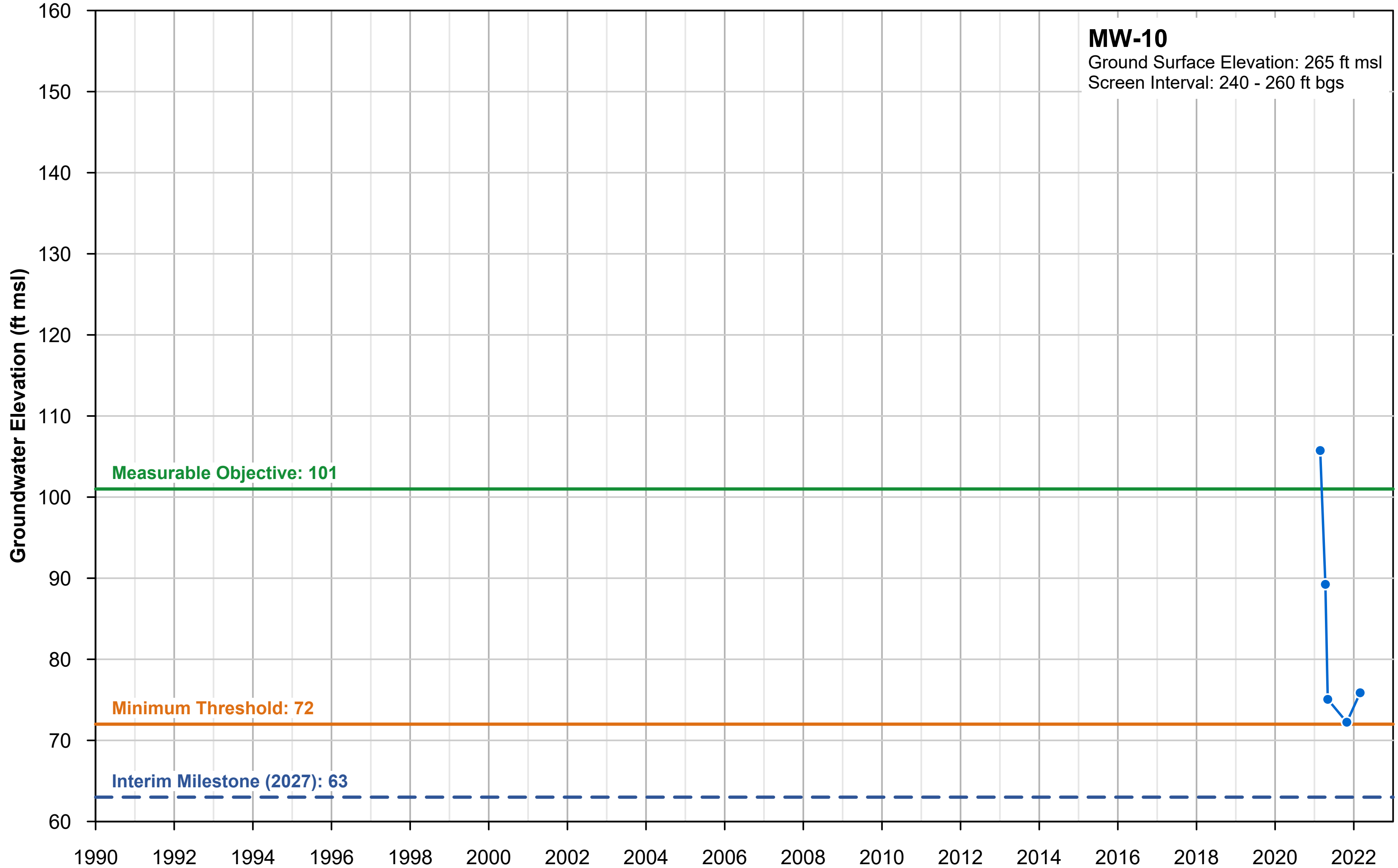
MW-6S
Ground Surface Elevation: 171 ft msl
Screen Interval: 154 - 174 ft bgs
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
Measurable Objective: 83
Minimum Threshold: 65
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


MW-7
Ground Surface Elevation: 243 ft msl
Screen Interval: 275 - 295 ft bgs
Measurable Objective: 110
Minimum Threshold: 75
Interim Milestone (2027): 40
Groundwater Elevation (ft msl)
130
120
110
100
90
80
70
60
50
40
30
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



MW-8
Ground Surface Elevation: 293 ft msl
Screen Interval: 265 - 285 ft bgs
Measurable Objective: 110
Minimum Threshold: 75
Interim Milestone (2027): 49
Groundwater Elevation (ft msl)
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


MW-9
Ground Surface Elevation: 245 ft msl
Screen Interval: 340 - 360 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 180
Minimum Threshold: 150
Interim Milestone (2027): 138
230
220
210
200
190
180
170
160
150
140
130
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



MW-10
Ground Surface Elevation: 265 ft msl
Screen Interval: 240 - 260 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 101
Minimum Threshold: 72
Interim Milestone (2027): 63
160
150
140
130
120
110
100
90
80
70
60
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
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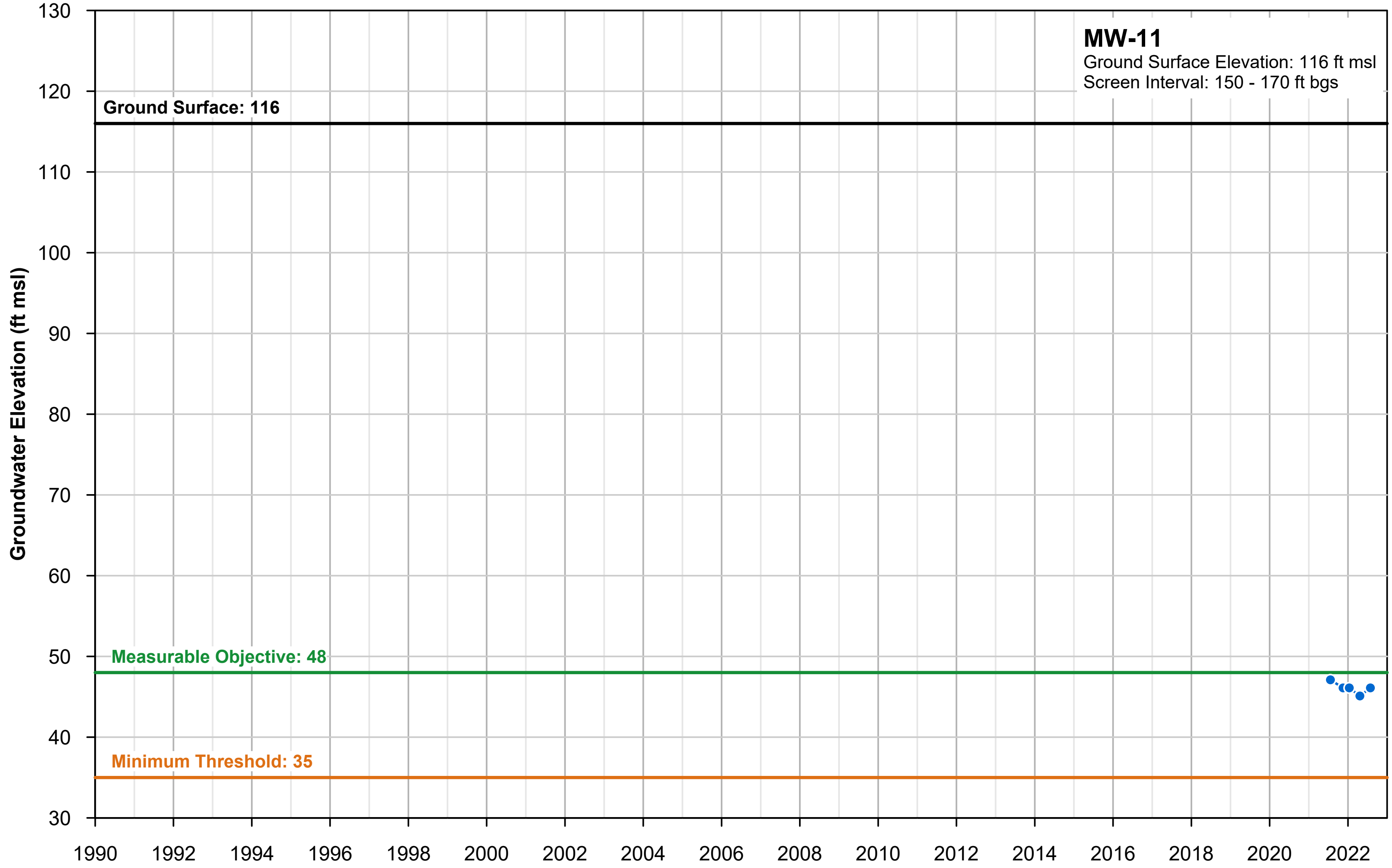
2016
2018
2020
2022



MW-11
Ground Surface Elevation: 116 ft msl
Screen Interval: 150 - 170 ft bgs
Ground Surface: 116
Measurable Objective: 48
Minimum Threshold: 35
Groundwater Elevation (ft msl)
130
120
110
100
90
80
70
60
50
40
30
1990
1992
1994
1996
1998
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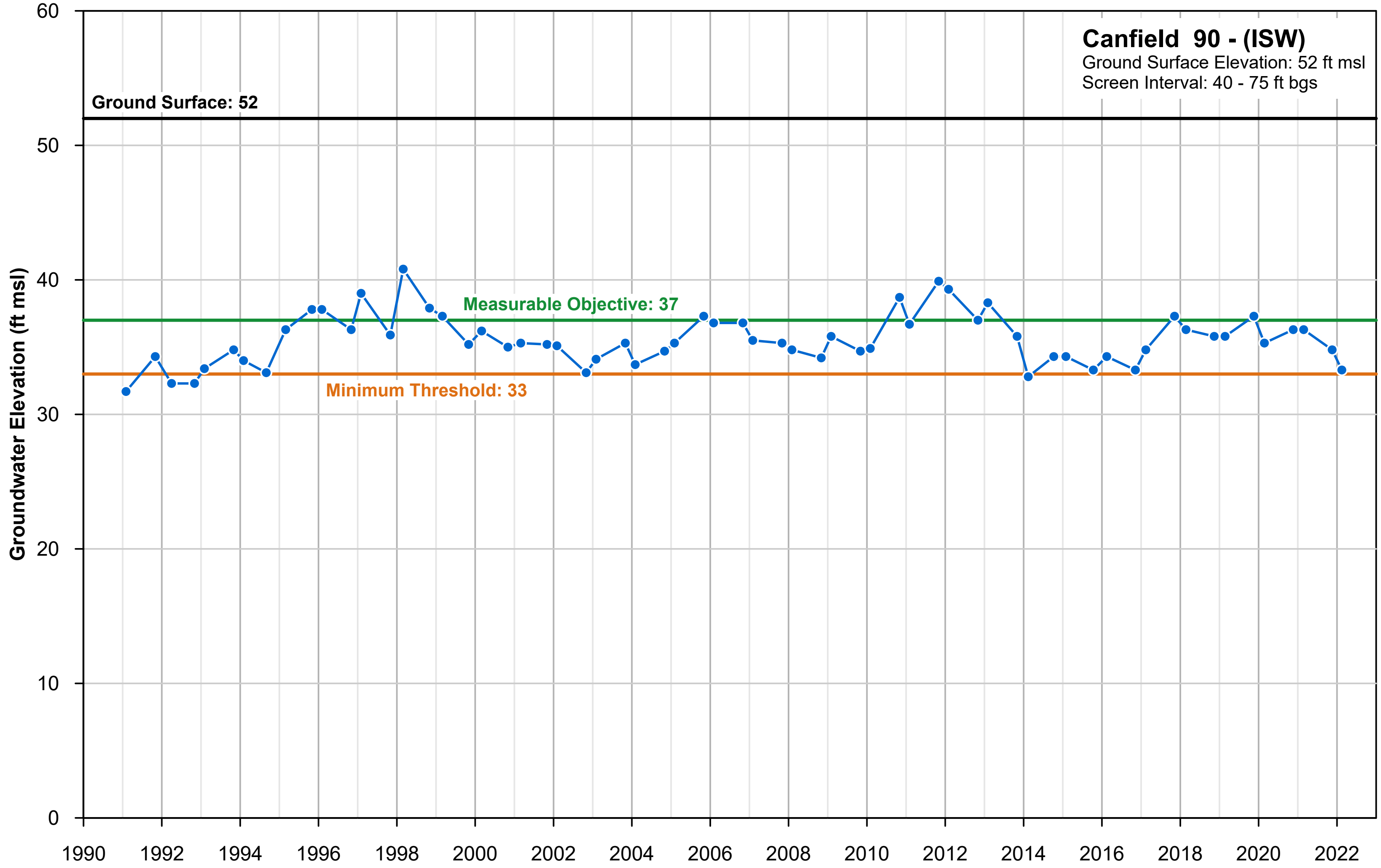
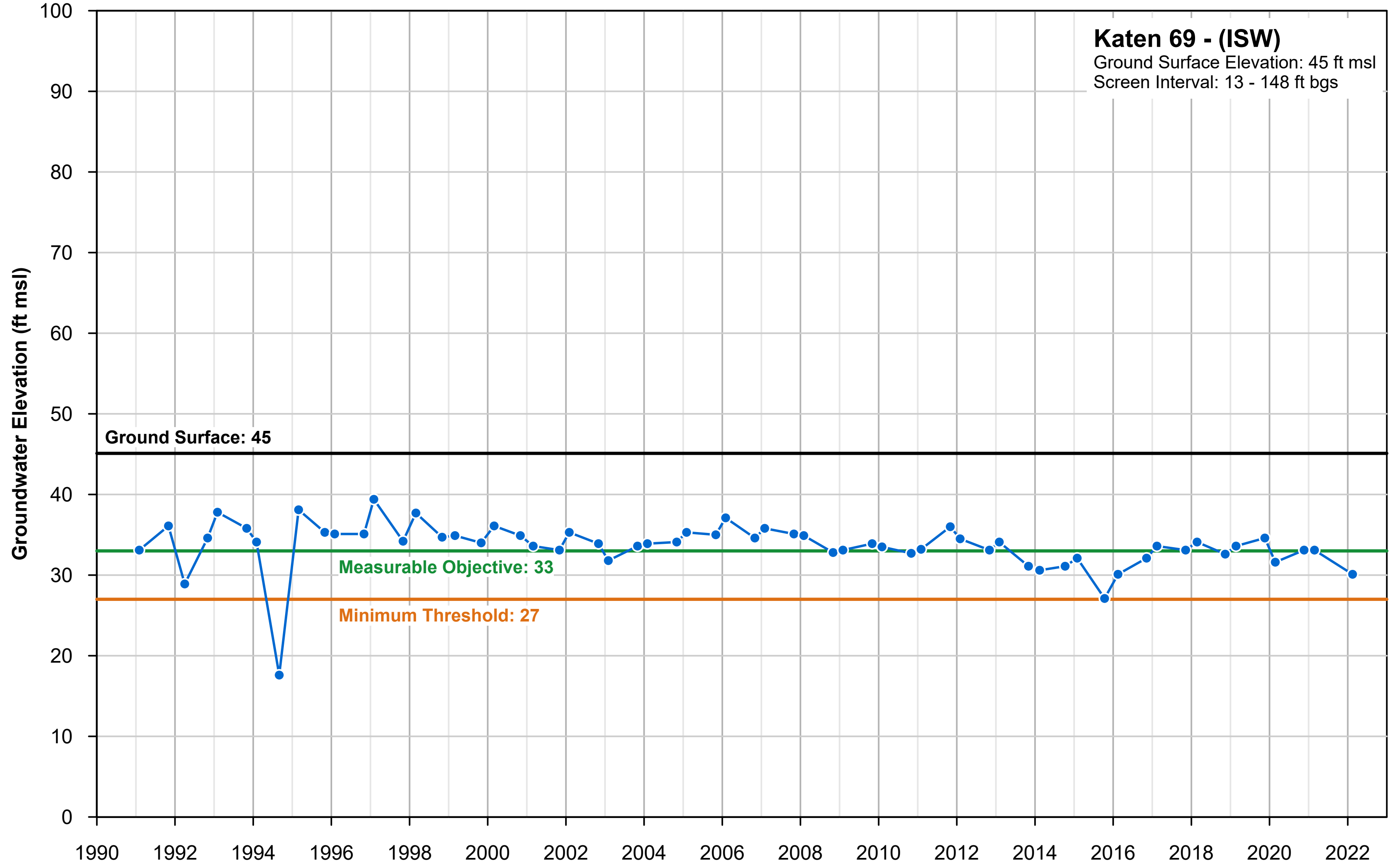
2020
2022

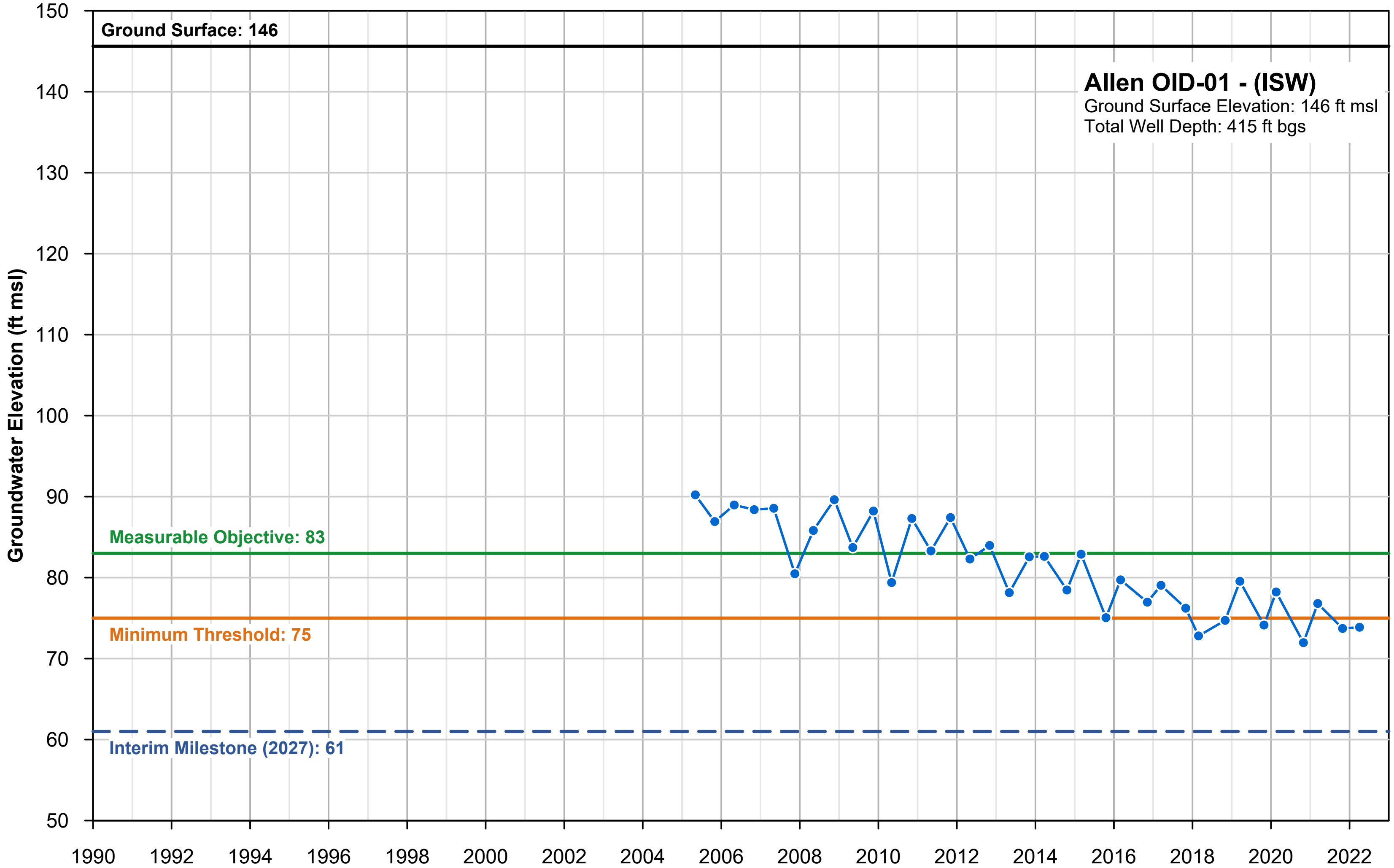
Hydrographs for Wells in the Monitoring Network for Depletions of Interconnected Surface Water



Canfield 90 - (ISW)
Ground Surface Elevation: 52 ft msl
Screen Interval: 40 - 75 ft bgs
Ground Surface: 52
Measurable Objective: 37
Minimum Threshold: 33
Groundwater Elevation (ft msl)
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Katen 69 - (ISW)
Ground Surface Elevation: 45 ft msl
Screen Interval: 13 - 148 ft bgs
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
Ground Surface: 45
Measurable Objective: 33
Minimum Threshold: 27
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Allen OID-01 - (ISW)
Ground Surface Elevation: 146 ft msl
Total Well Depth: 415 ft bgs
Ground Surface: 146
Measurable Objective: 83
Minimum Threshold: 75
Interim Milestone (2027): 61
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
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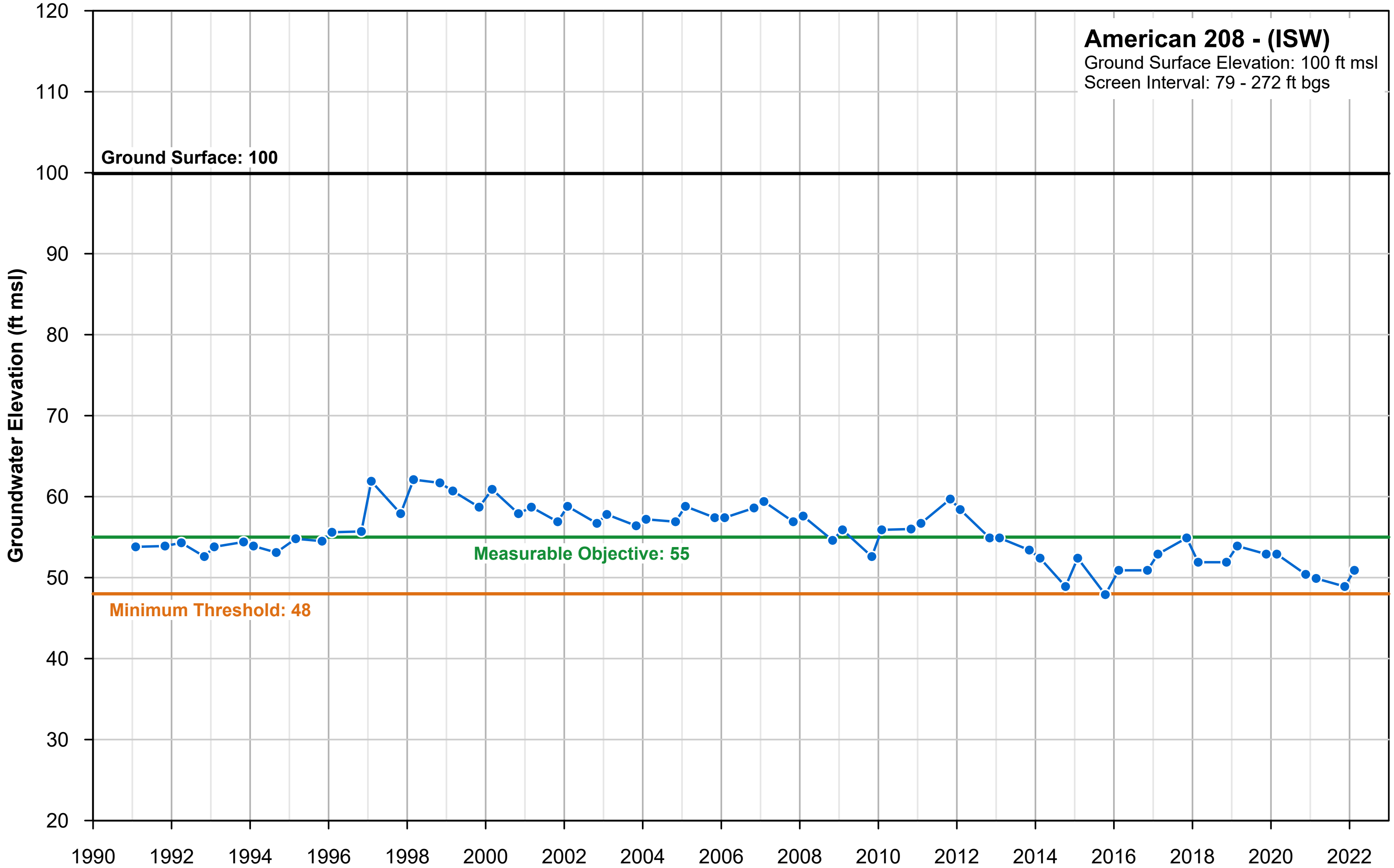
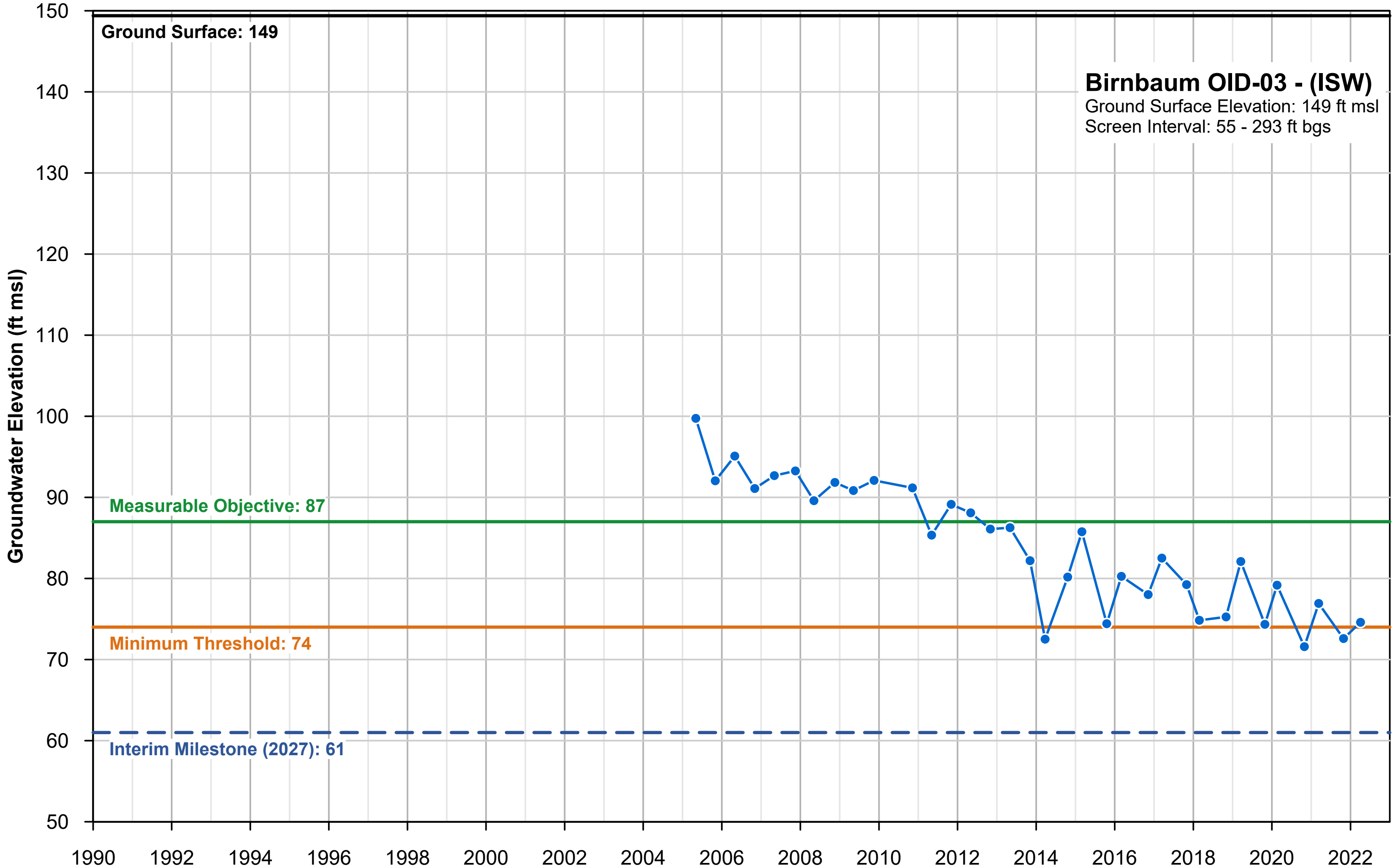
2018
2020
2022


American 208 - (ISW)
Ground Surface Elevation: 100 ft msl
Screen Interval: 79 - 272 ft bgs
Ground Surface: 100
Measurable Objective: 55
Minimum Threshold: 48
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Birnbaum OID-03 - (ISW)
Ground Surface Elevation: 149 ft msl
Screen Interval: 55 - 293 ft bgs
Ground Surface: 149
Measurable Objective: 87
Minimum Threshold: 74
Interim Milestone (2027): 61
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
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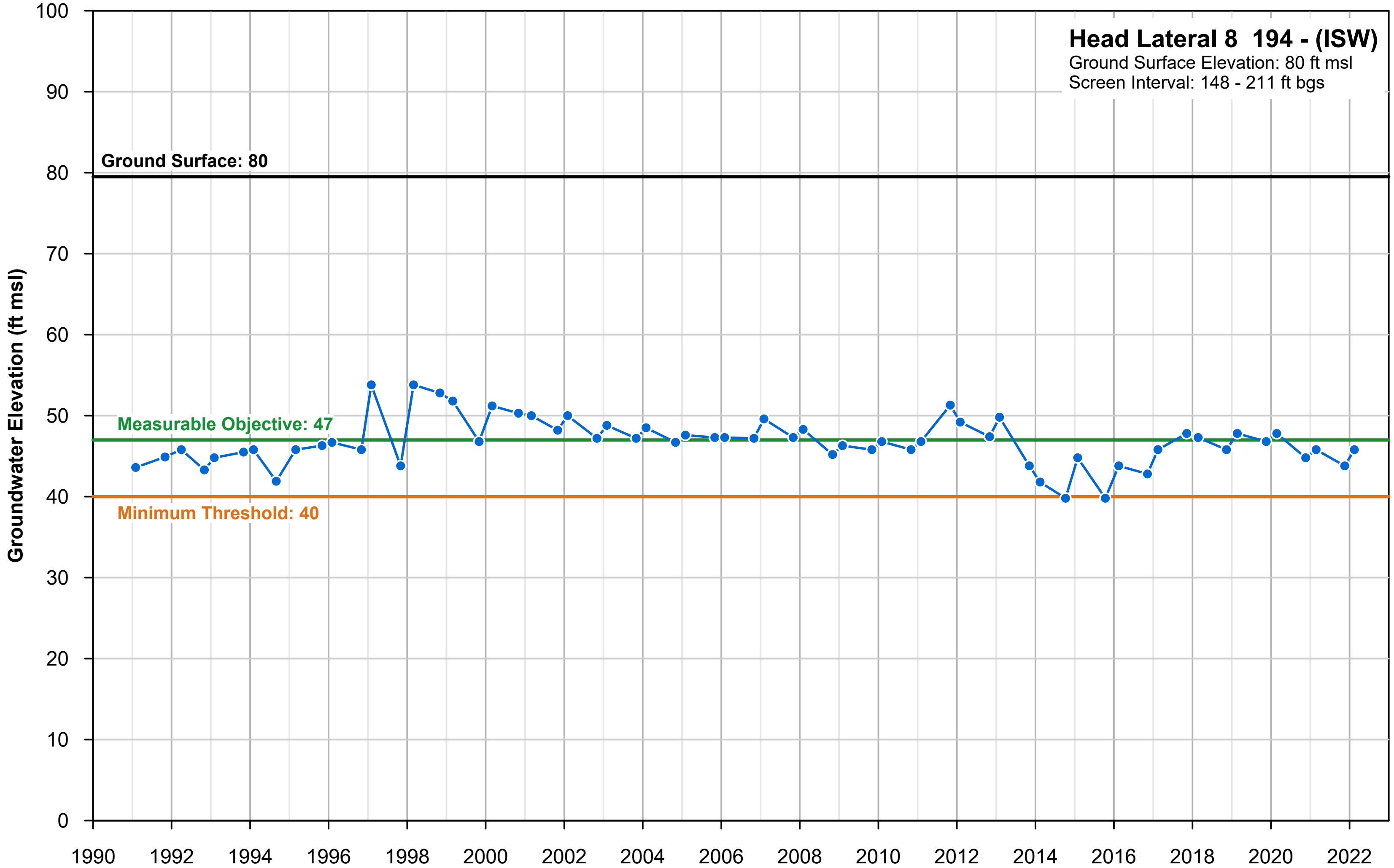

Head Lateral 8 194 - (ISW)
Ground Surface Elevation: 80 ft msl
Screen Interval: 148 - 211 ft bgs
Ground Surface: 80
Measurable Objective: 47
Minimum Threshold: 40
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
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2014
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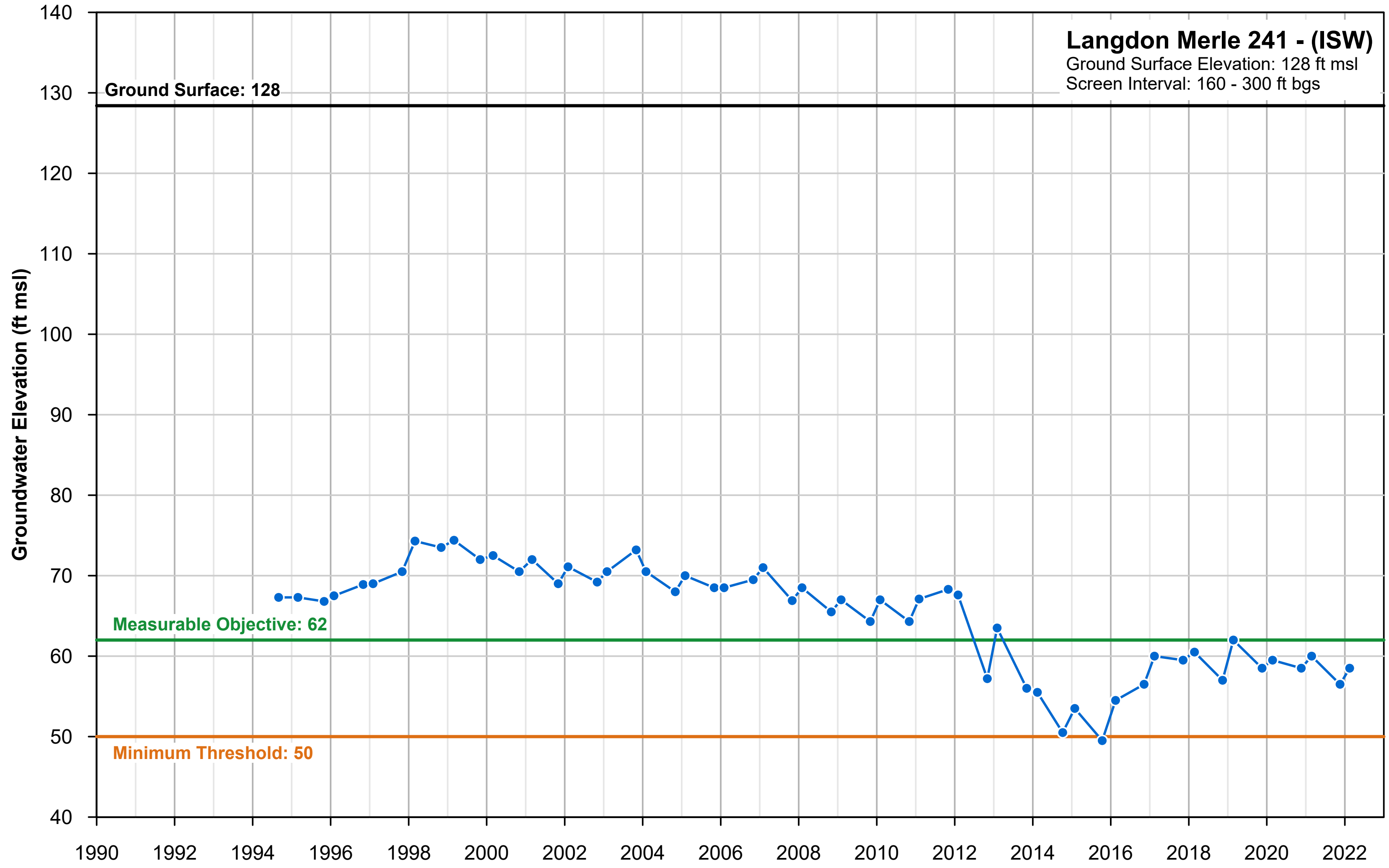
2018
2020
2022


Langdon Merle 241 - (ISW)
Ground Surface Elevation: 128 ft msl
Screen Interval: 160 - 300 ft bgs
Ground Surface: 128
Measurable Objective: 62
Minimum Threshold: 50
Groundwater Elevation (ft msl)
140
130
120
110
100
90
80
70
60
50
40
1990
1992
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1996
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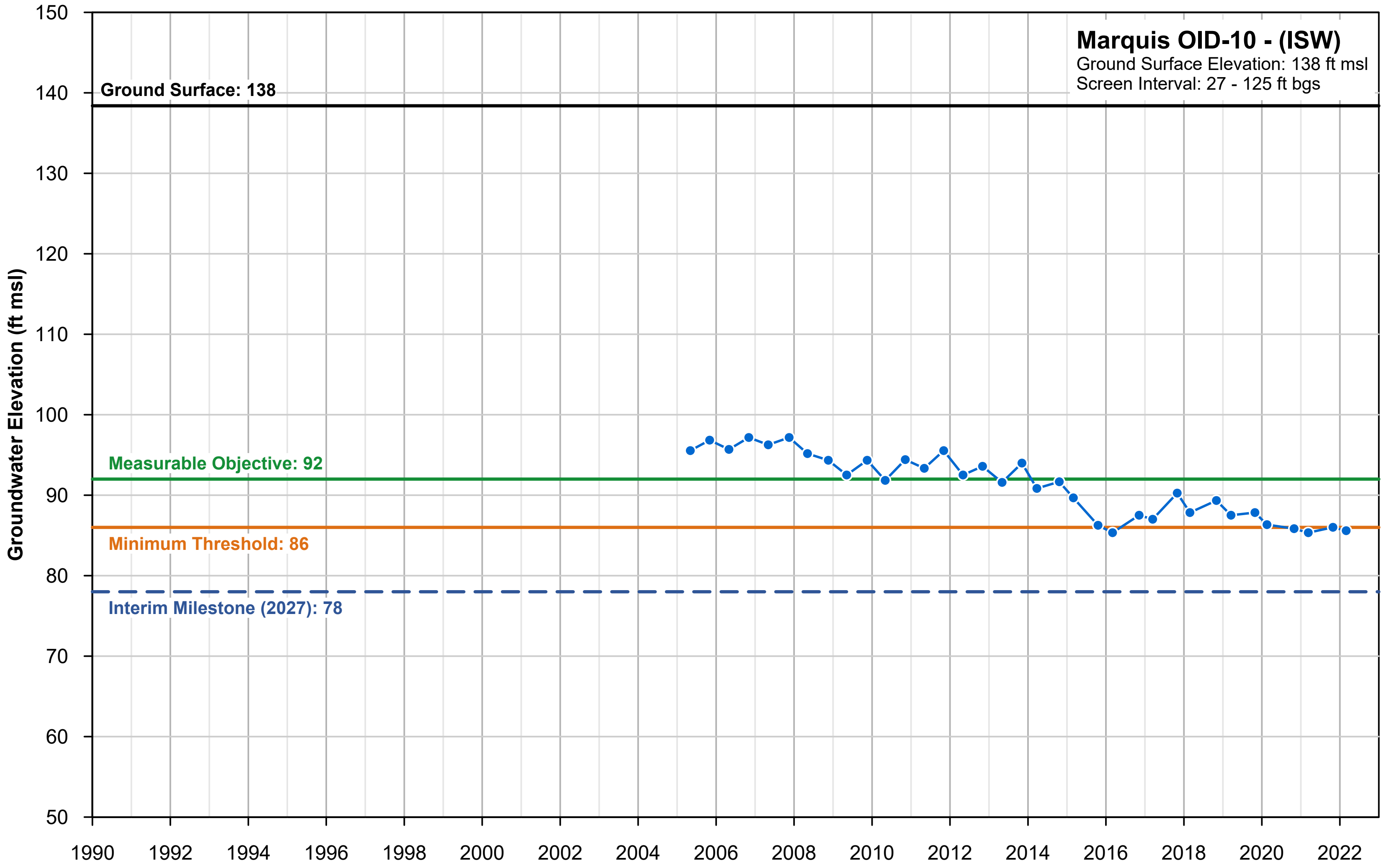
2010
2012
2014
2016
2018
2020
2022



Marquis OID-10 - (ISW)
Ground Surface Elevation: 138 ft msl
Screen Interval: 27 - 125 ft bgs
Ground Surface: 138
Measurable Objective: 92
Minimum Threshold: 86
Interim Milestone (2027): 78
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
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2002
2004
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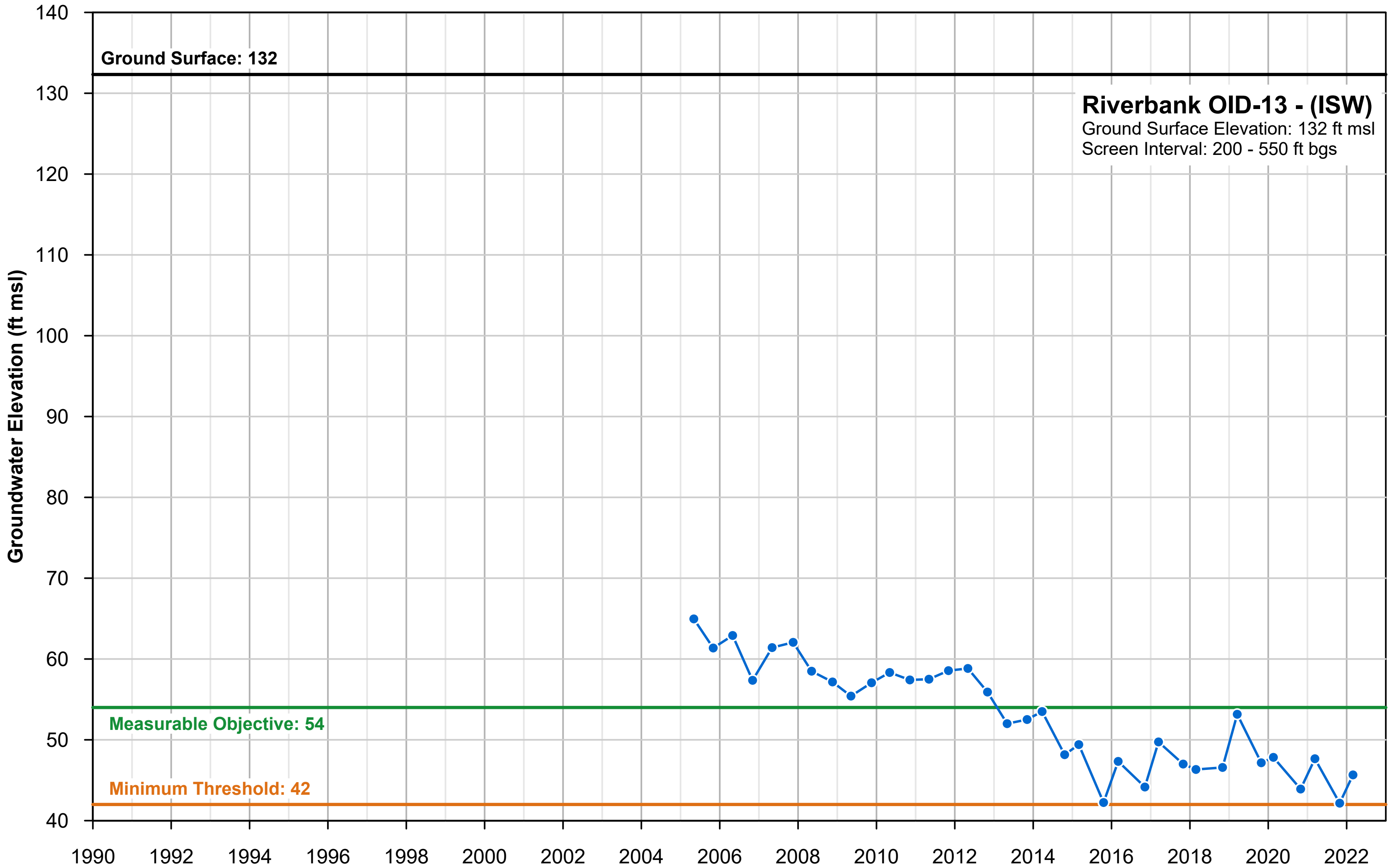
2008
2010
2012
2014
2016
2018
2020
2022



Riverbank OID-13 - (ISW)
Ground Surface Elevation: 132 ft msl
Screen Interval: 200 - 550 ft bgs
Ground Surface: 132
Measurable Objective: 54
Minimum Threshold: 42
Groundwater Elevation (ft msl)
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
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2000
2002
2004
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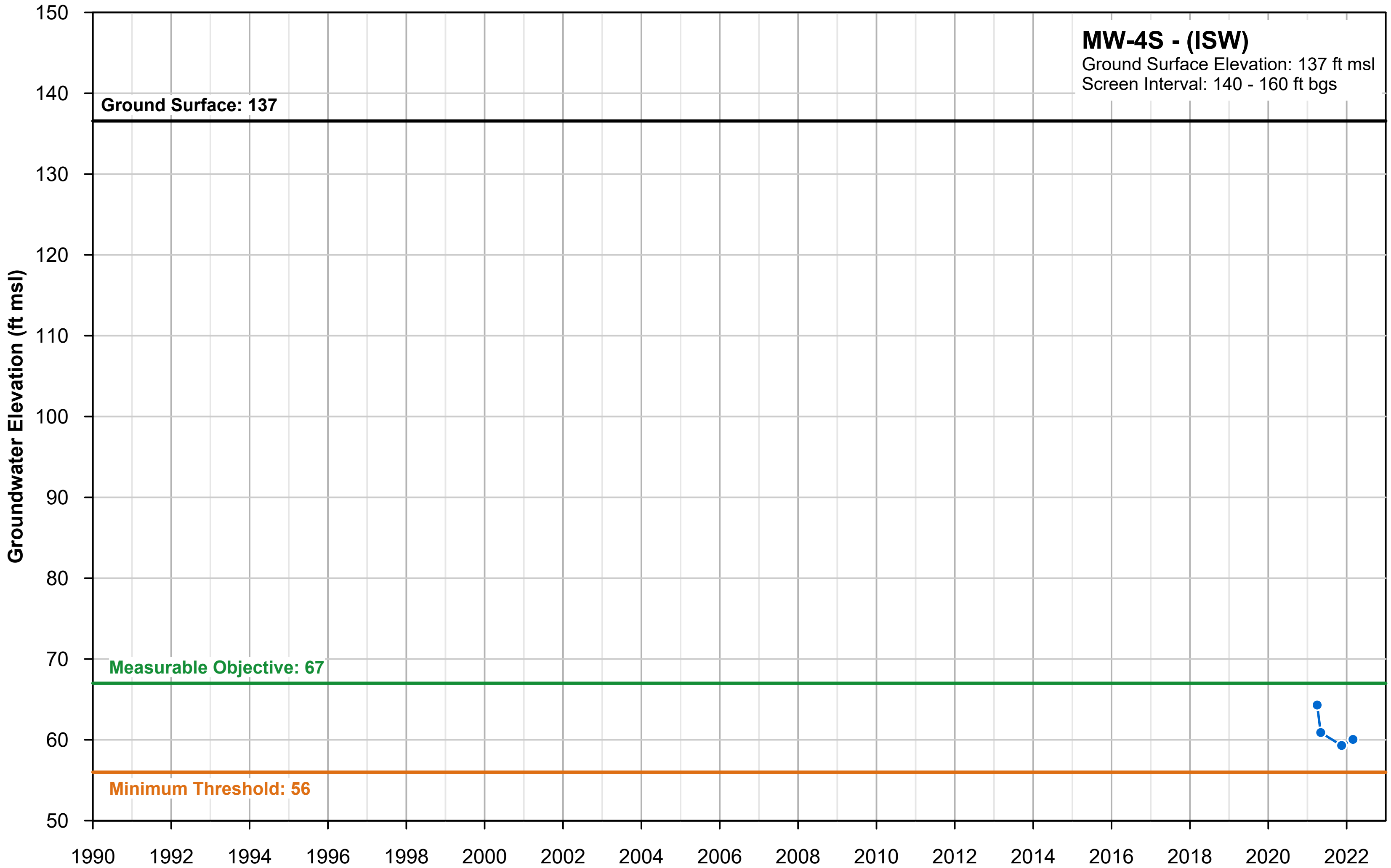
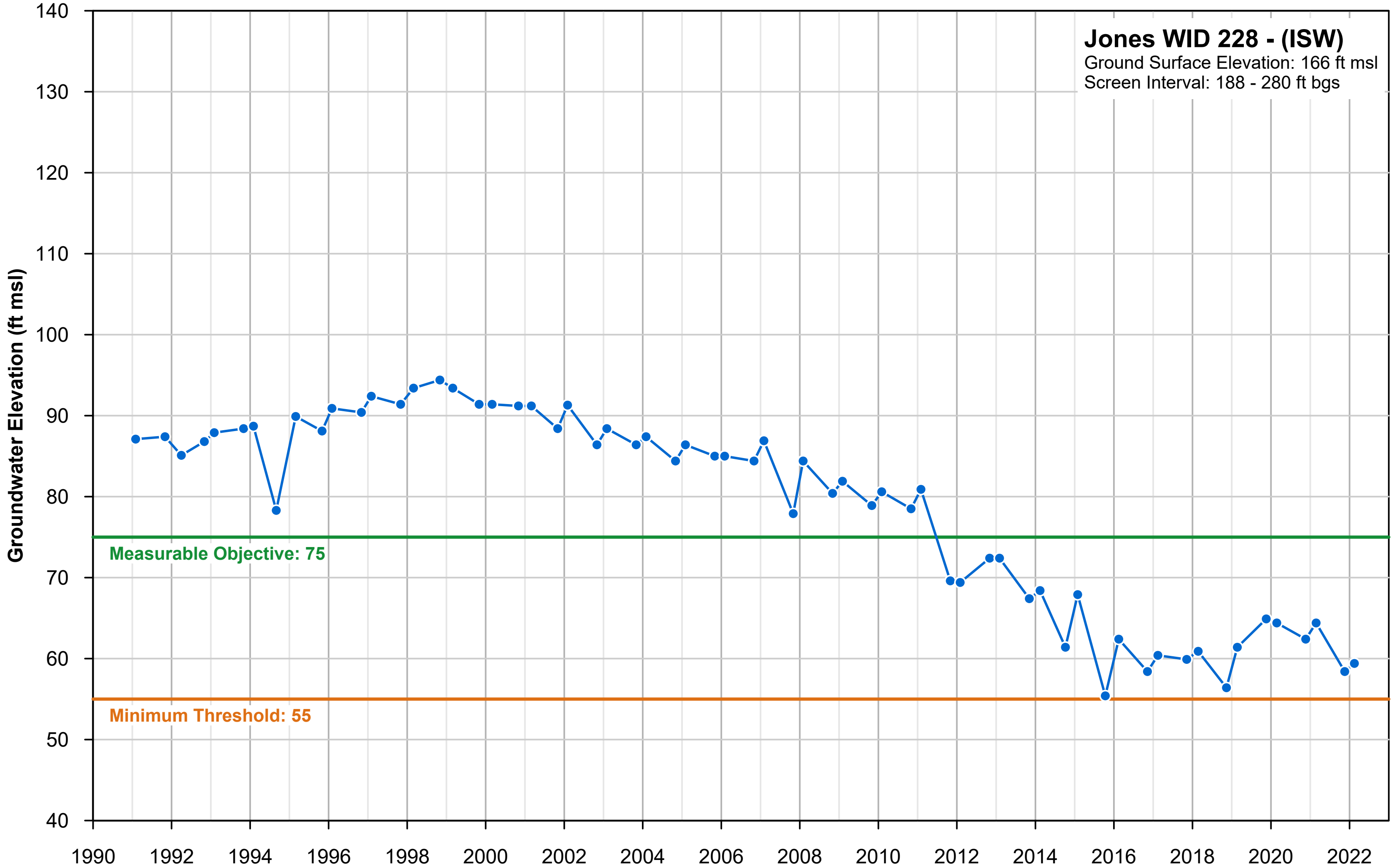
2008
2010
2012
2014
2016
2018
2020
2022



MW-4S - (ISW)
Ground Surface Elevation: 137 ft msl
Screen Interval: 140 - 160 ft bgs
Ground Surface: 137
Measurable Objective: 67
Minimum Threshold: 56
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Jones WID 228 - (ISW)
Ground Surface Elevation: 166 ft msl
Screen Interval: 188 - 280 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 75
Minimum Threshold: 55
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
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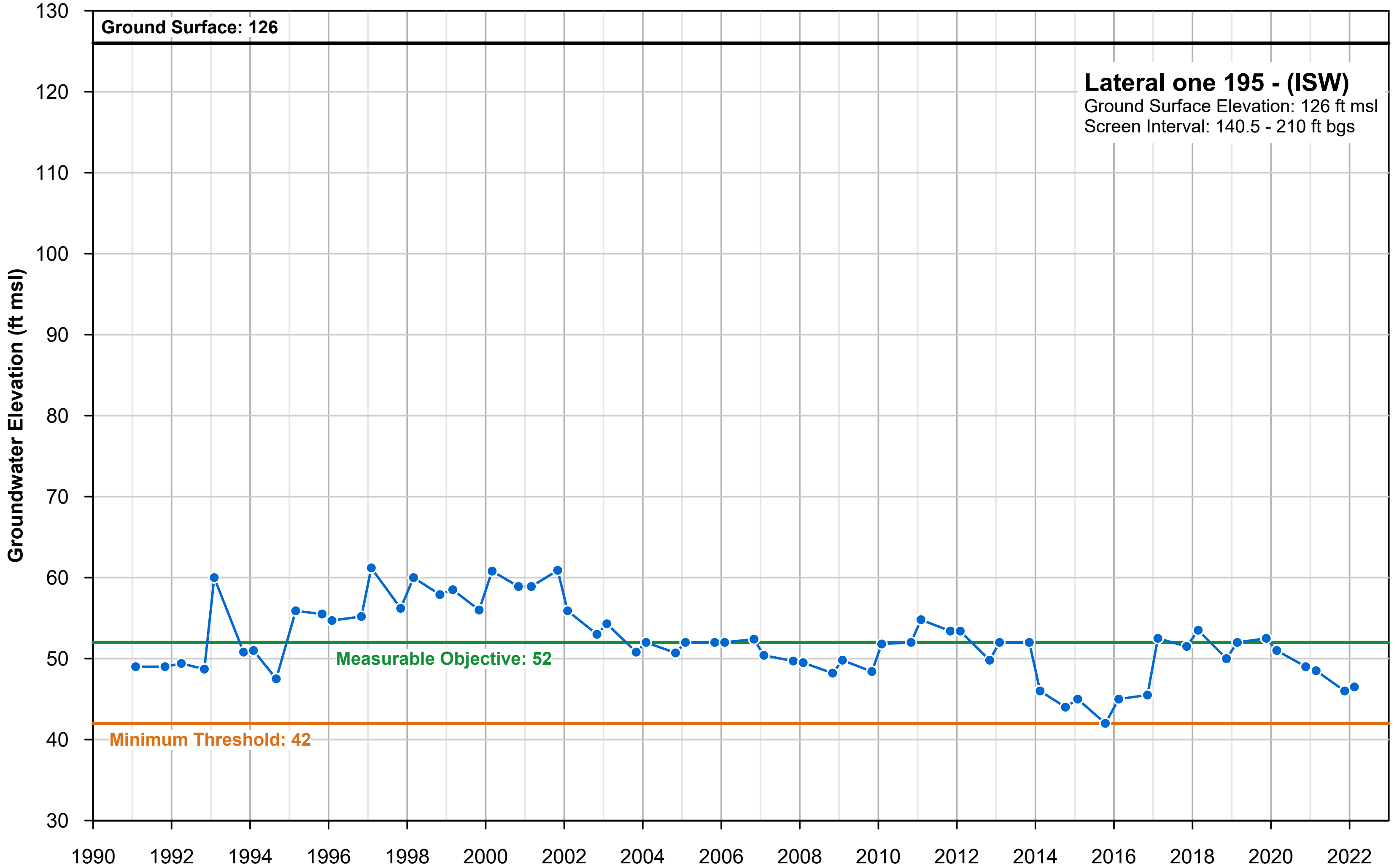
2008
2010
2012
2014
2016
2018
2020
2022



Lateral one 195 - (ISW)
Ground Surface Elevation: 126 ft msl
Screen Interval: 140.5 - 210 ft bgs
Ground Surface: 126
Measurable Objective: 52
Minimum Threshold: 42
Groundwater Elevation (ft msl)
130
120
110
100
90
80
70
60
50
40
30
1990
1992
1994
1996
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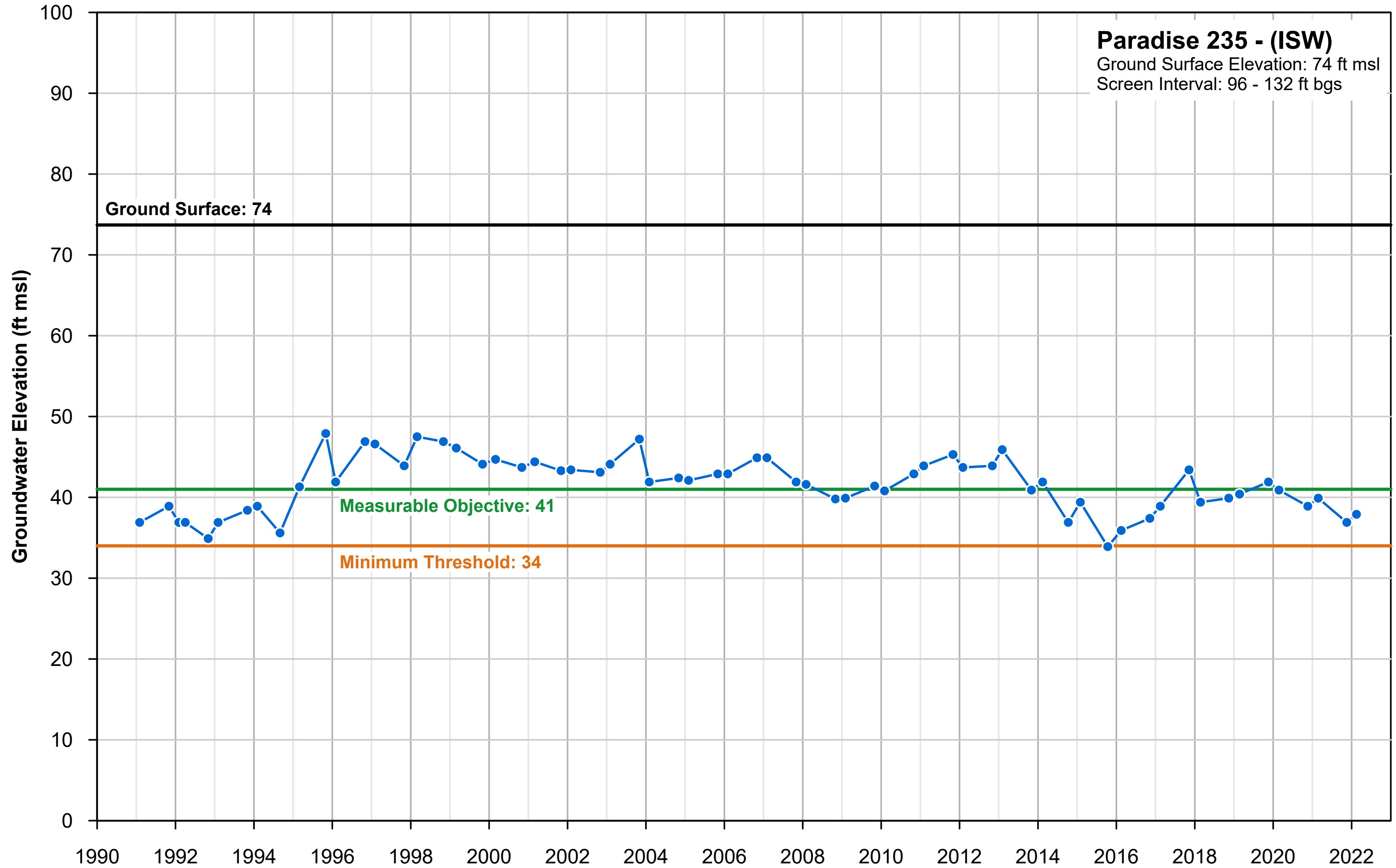
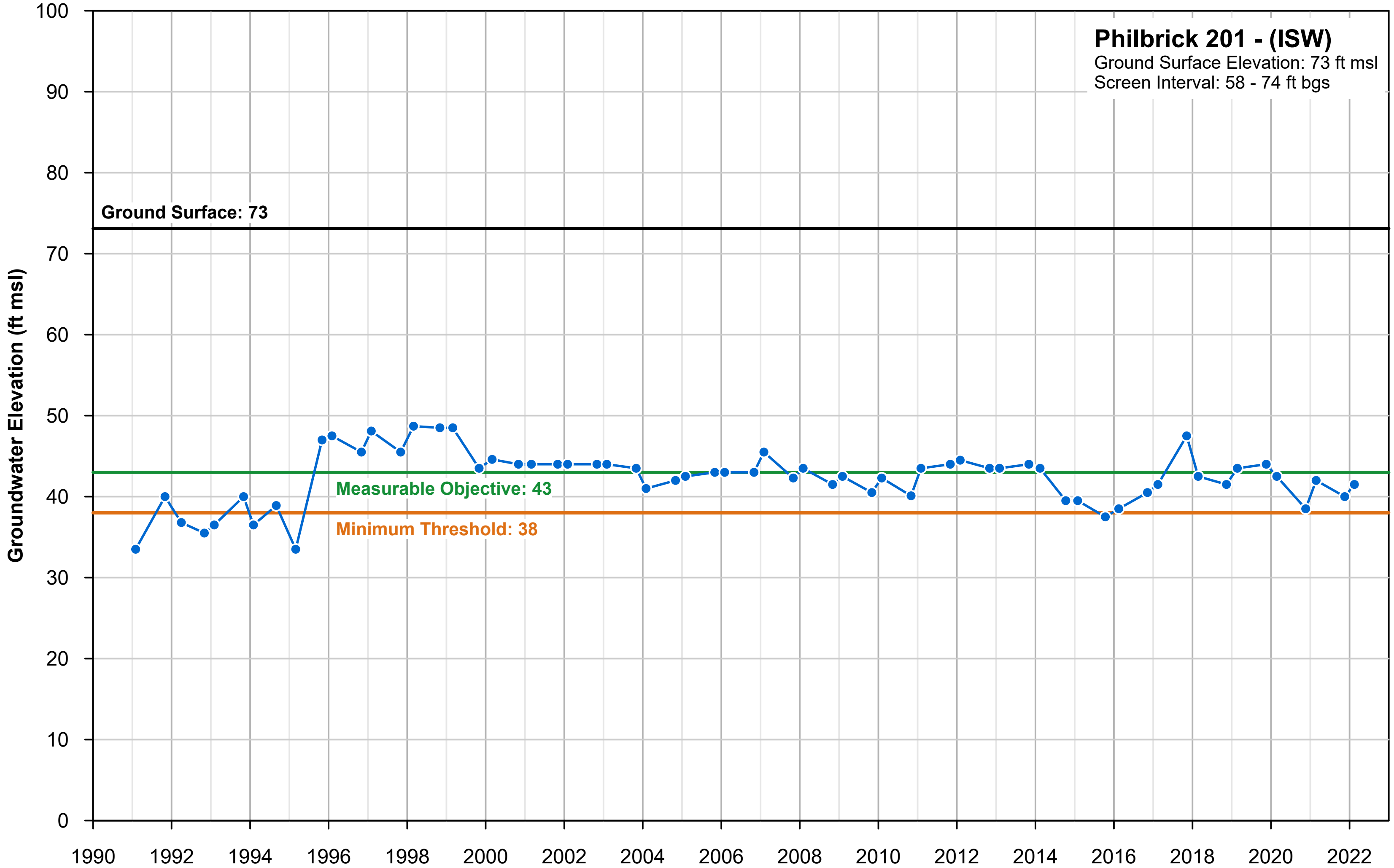
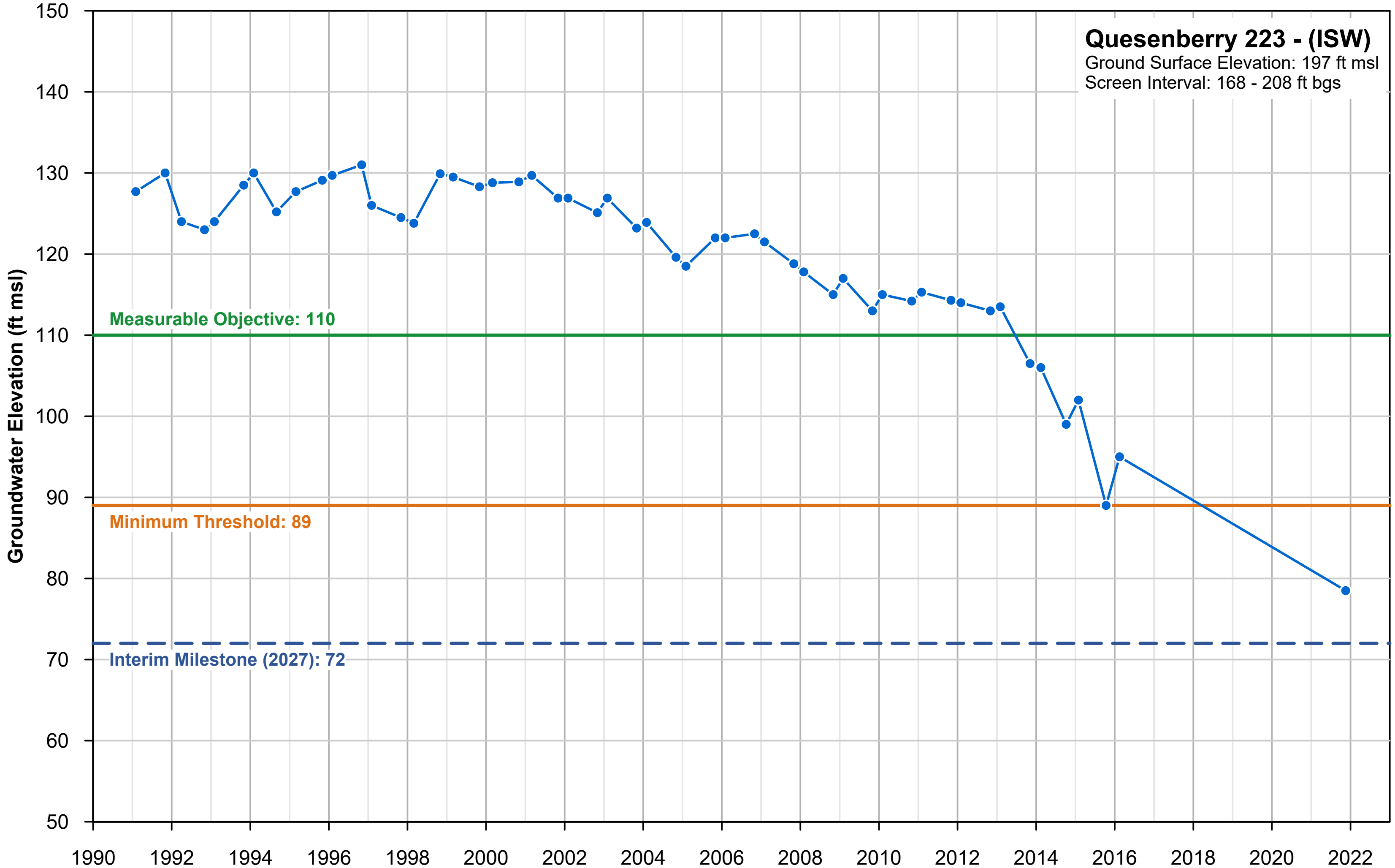
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Paradise 235 - (ISW)
Ground Surface Elevation: 74 ft msl
Screen Interval: 96 - 132 ft bgs
Ground Surface: 74
Measurable Objective: 41
Minimum Threshold: 34
Groundwater Elevation (ft msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Philbrick 201 - (ISW)
Ground Surface Elevation: 73 ft msl
Screen Interval: 58 - 74 ft bgs
Ground Surface: 73
Measurable Objective: 43
Minimum Threshold: 38
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



Quesenberry 223 - (ISW)
Ground Surface Elevation: 197 ft msl
Screen Interval: 168 - 208 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 110
Minimum Threshold: 89
Interim Milestone (2027): 72
150
140
130
120
110
100
90
80
70
60
50
1990
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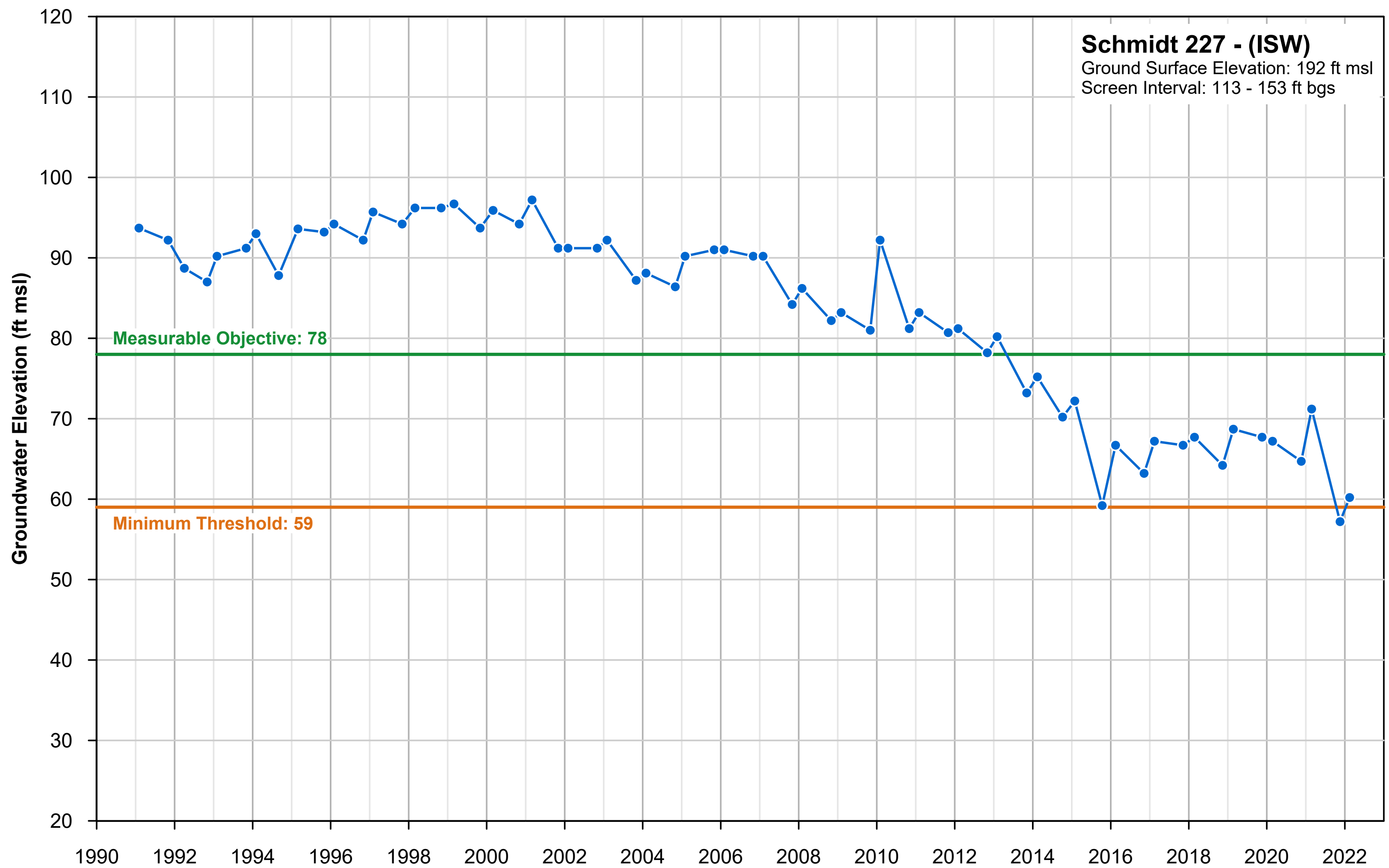
2016
2018
2020
2022


Schmidt 227 - (ISW)
Ground Surface Elevation: 192 ft msl
Screen Interval: 113 - 153 ft bgs
Measurable Objective: 78
Minimum Threshold: 59
Groundwater Elevation (ft msl)
120
110
100
90
80
70
60
50
40
30
20
1990
1992
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1996
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2000
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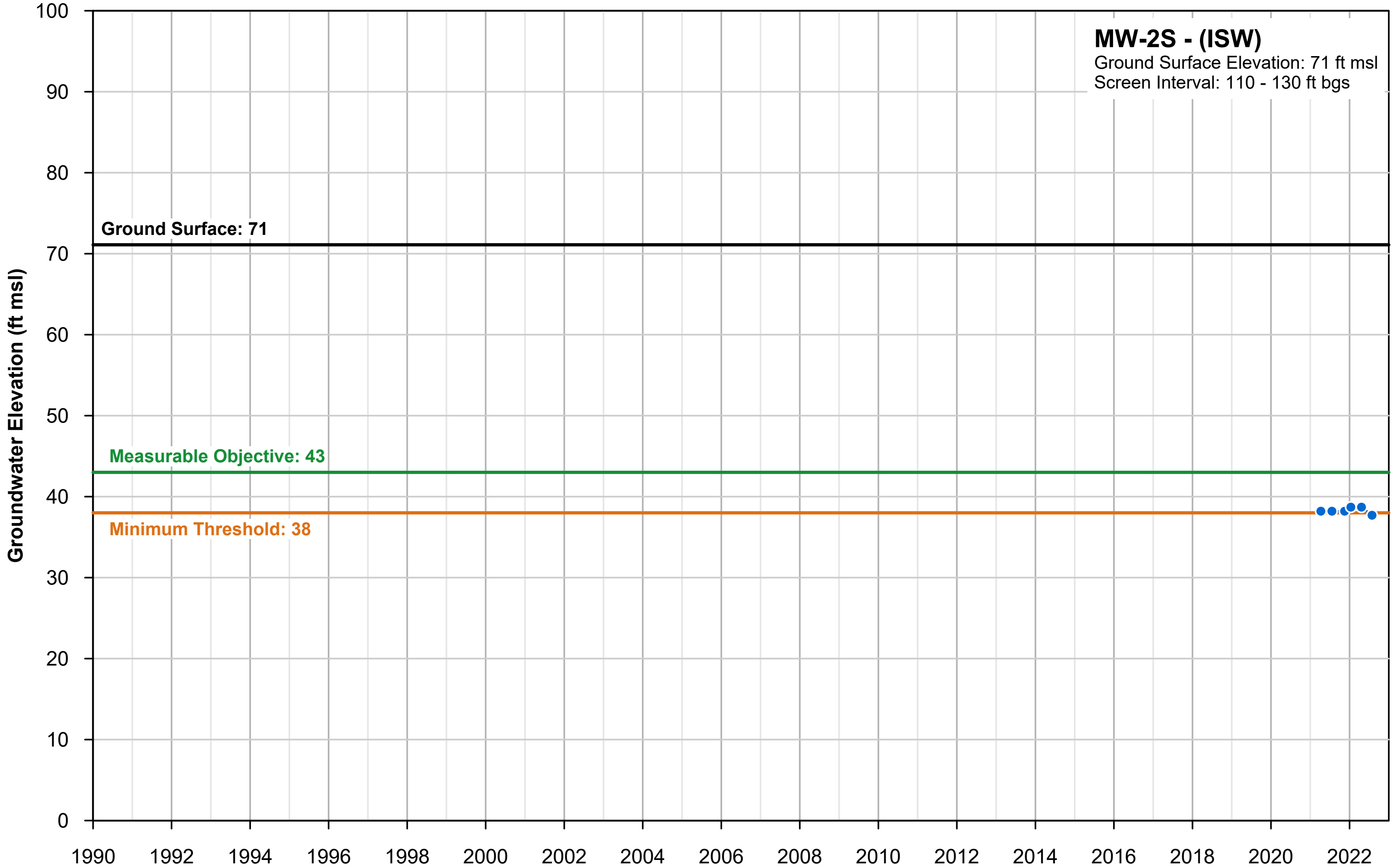
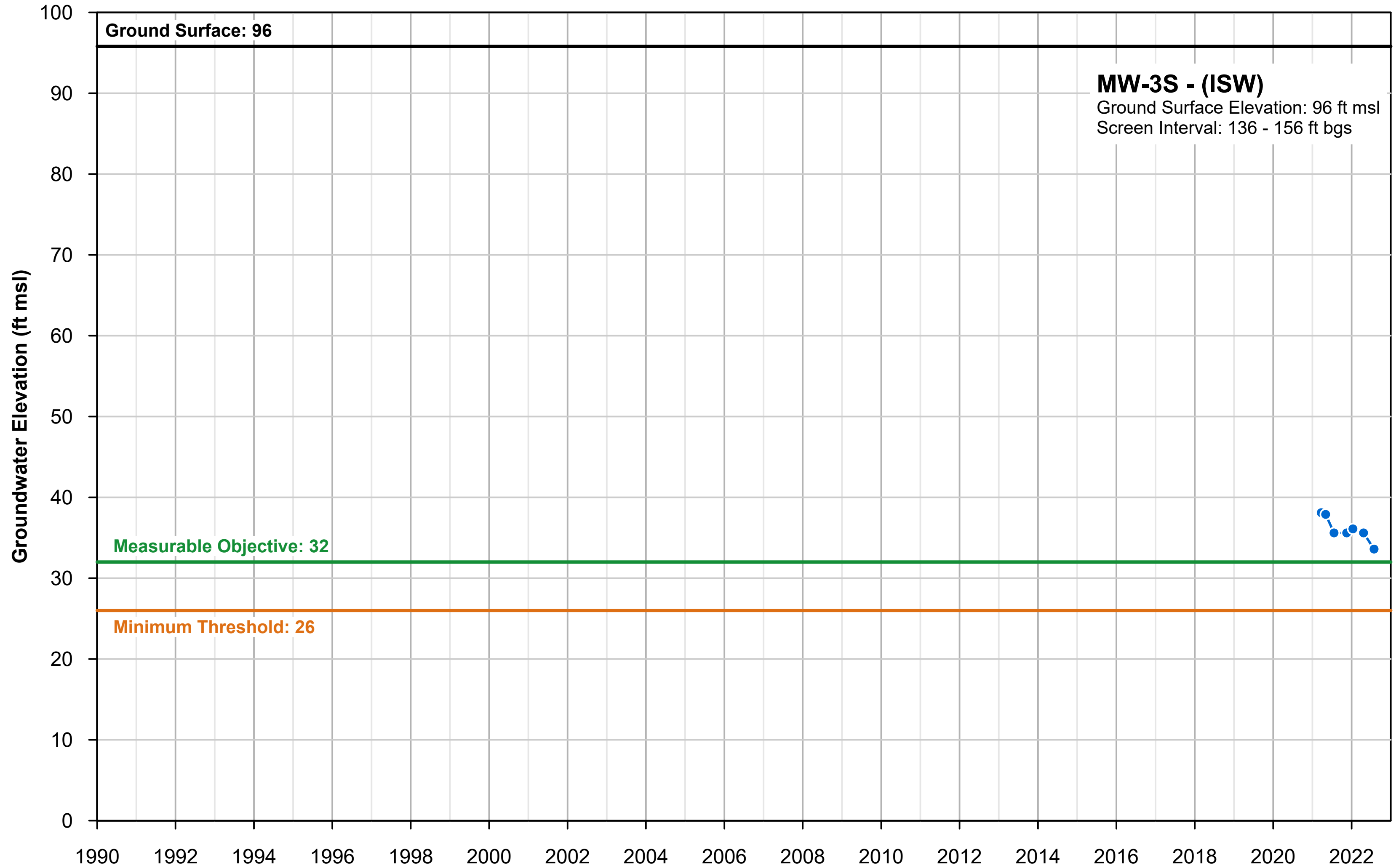
2018
2020
2022



MW-2S - (ISW)
Ground Surface Elevation: 71 ft msl
Screen Interval: 110 - 130 ft bgs
Ground Surface: 71
Measurable Objective: 43
Minimum Threshold: 38
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Ground Surface: 96
MW-3S - (ISW)
Ground Surface Elevation: 96 ft msl
Screen Interval: 136 - 156 ft bgs
Measurable Objective: 32
Minimum Threshold: 26
Groundwater Elevation (ft msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
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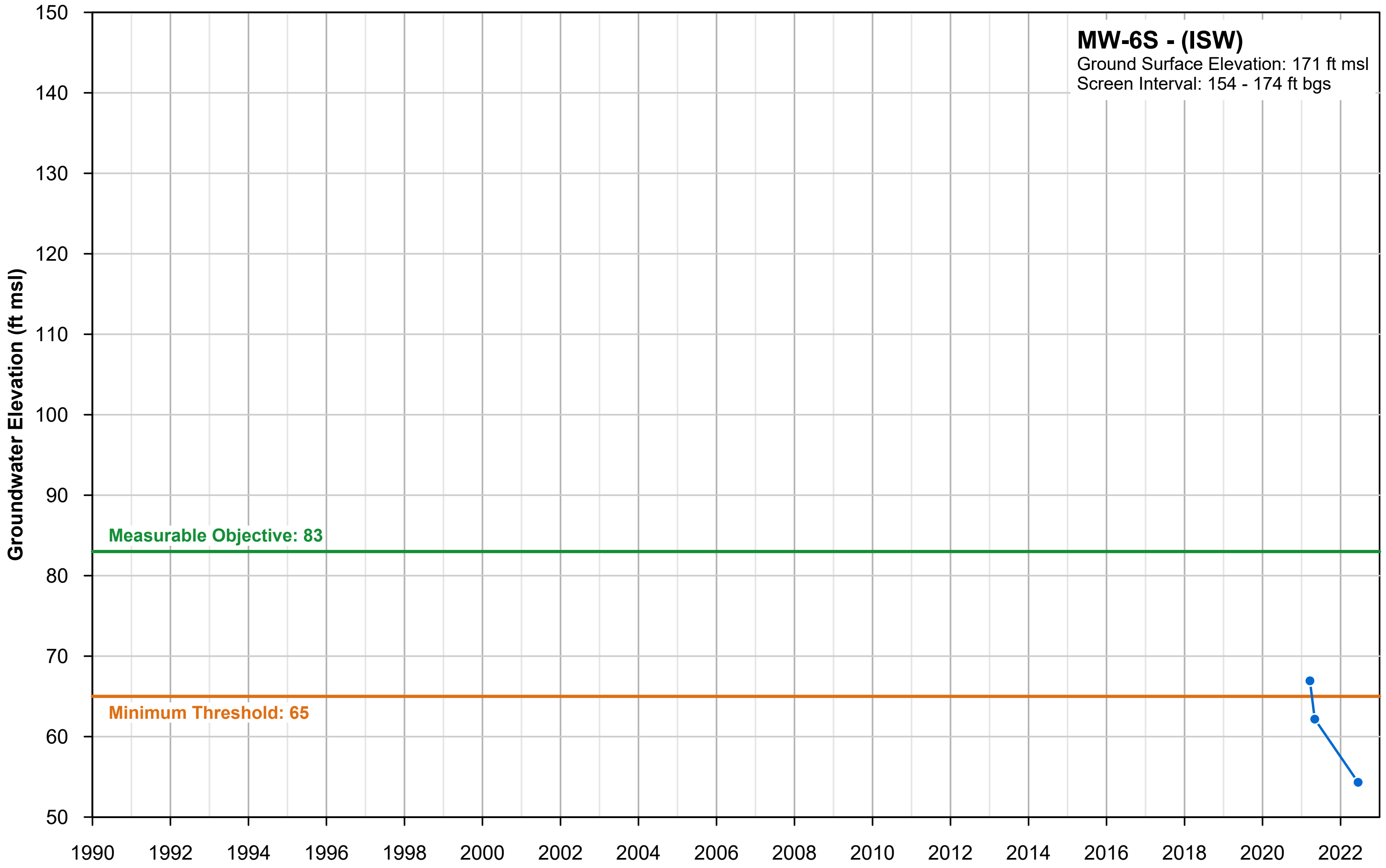
2022


MW-6S - (ISW)
Ground Surface Elevation: 171 ft msl
Screen Interval: 154 - 174 ft bgs
Measurable Objective: 83
Minimum Threshold: 65
Groundwater Elevation (ft msl)
150
140
130
120
110
100
90
80
70
60
50
1990
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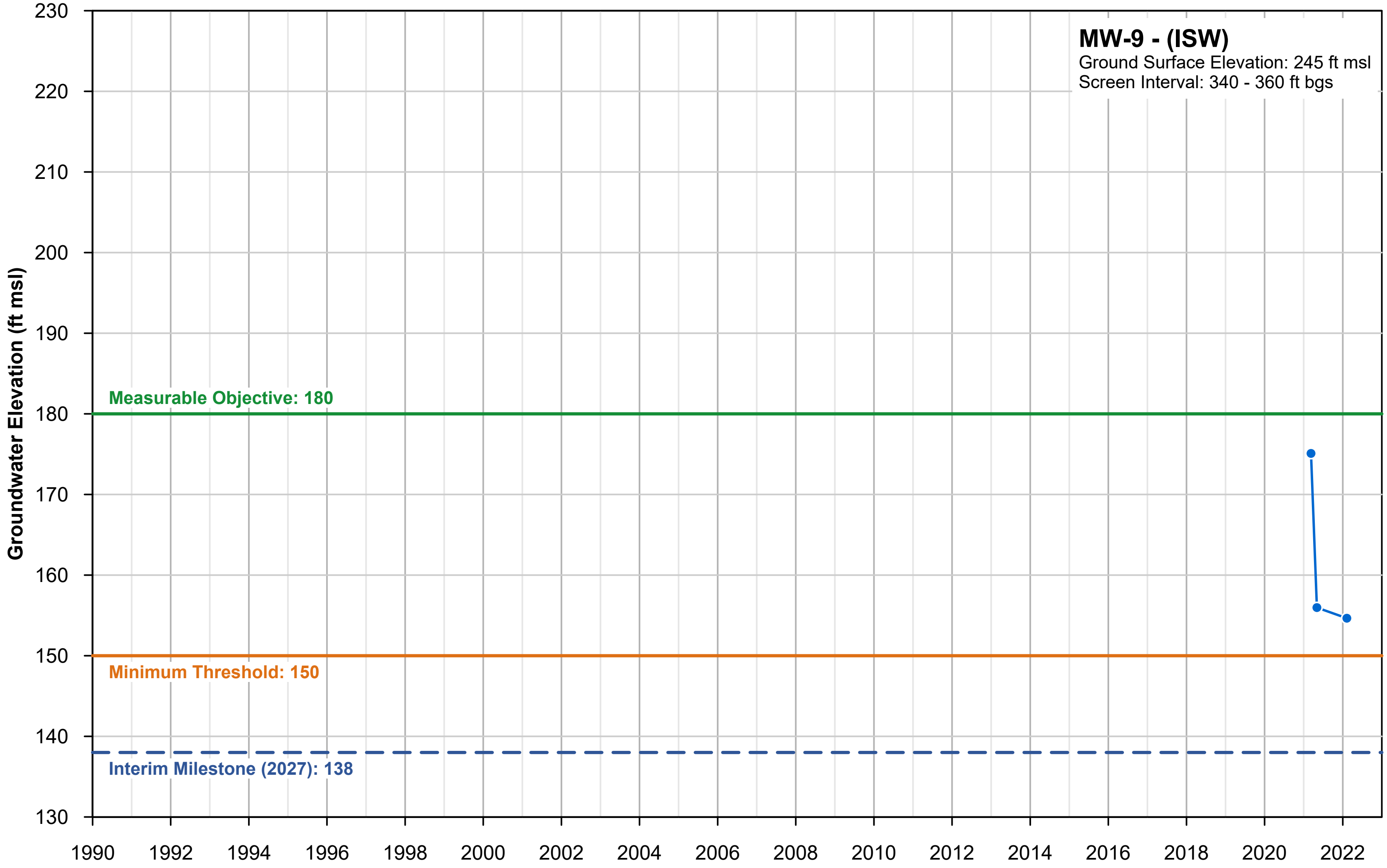
2022


MW-9 - (ISW)
Ground Surface Elevation: 245 ft msl
Screen Interval: 340 - 360 ft bgs
Groundwater Elevation (ft msl)
Measurable Objective: 180
Minimum Threshold: 150
Interim Milestone (2027): 138
230
220
210
200
190
180
170
160
150
140
130
1990
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2022

APPENDIX B

Water Quality Monitoring Network

Water Year 2022

Appendix B Groundwater Quality Monitoring Network

Well ID	Latitude	Longitude	Principal Aquifer	Well Type	Dataset Name[1]	Alternative Well ID	Alternative Well ID 2	Arsenic			DBCP			Nitrate as N			PCE			TCP			TDS			Uranium		
								WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01								3.80	3/8/2019												
5000013-002	37.78609	-120.81264	Eastern	Municipal	DHS	5000013-002	WELL 02- 2709 OAKHURST							1.2	1.60	3/25/2020												
5000014-001	37.78058	-120.79294	Eastern	Municipal	DHS	5000014-001	WELL#1							5.5	8.00	2/14/2017												
5000014-002	37.74884	-120.88009	Eastern	Municipal	DHS	5000014-002	WELL#2							1	3.00	3/8/2019												
5000015-002	37.77225	-120.82033	Eastern	Municipal	DHS	5000015-002	WELL #1 - SOUTH							2	5.67	5/3/2010												
5000016-001	37.74986	-120.87875	Eastern	Municipal	DHS	5000016-001	WELL#2							4.4	5.76	11/1/2010												
5000017-001	37.73708	-120.95675	Eastern	Municipal	DHS	5000017-001	ARROWOOD (EAST) WELL	3.3	3.00	5/6/2005		0.00	3/10/2021	0	7.03	5/16/2002		0.00	3/10/2021				390	609.00	12/16/2014			
5000017-002	37.73936	-120.96136	Eastern	Municipal	DHS	5000017-002	PARK RIDGE WEST					0.00	3/10/2021	0.74	9.35	10/29/2010												
SL185742938-M-109	37.64763	-121.01610	Western Upper	Monitoring	EDF	M-109	M-109	26	170.00	1/27/2014													2500	3300.00	1/20/2020			
5000048-002	37.74658	-120.90888	Eastern	Municipal	DHS	5000048-002	NORTH EAST WELL #1							8.7	8.90	7/6/2017												
5000048-003	37.74622	-120.91000	Eastern	Municipal	DHS	5000048-003	WEST #02							6.9	10.90	11/5/2009												
5000049-001	37.77481	-120.82256	Eastern	Municipal	DHS	5000049-001	NORTH WELL							6.1	6.60	6/13/2017												
5000049-002	37.77475	-120.82256	Eastern	Municipal	DHS	5000049-002	SOUTH WELL							8	9.70	4/8/2019												
5000054-002	37.71066	-120.96966	Eastern	Municipal	DHS	5000054-002	SOUTH WELL							0.4	8.40	7/11/2017												
5000055-002	37.70583	-120.92042	Eastern	Municipal	DHS	5000055-002	WEST FIELD		3.20	1/28/2002				11.1	8.80	11/3/2016								340.00	8/6/2014			
5000055-003	37.70586	-120.92032	Eastern	Municipal	DHS	5000055-003	EAST FIELD							8.3	9.50	11/14/2019												
5000058-002	37.74658	-120.90888	Eastern	Municipal	DHS	5000058-002	WEST- MHP WELL							8.9	9.70	1/15/2021												
5000066-001	37.69706	-120.99203	Eastern	Municipal	DHS	5000066-001	WELL)		5.30	5/29/2012				1.7	6.82	10/14/2014		0.00	12/2/2020					186.00	5/7/2009			
5000067-001	37.71702	-121.01164	Eastern	Municipal	DHS	5000067-001	WELL 03				0.24	0.60	6/17/2004	5.5	6.80	6/18/2015				0.13	0.31	6/18/2015						
5000090-002	37.62556	-120.84303	Eastern	Municipal	DHS	5000090-002	SOUTH WELL					0.05	5/13/2002	9.8	10.10	2/12/2014		0.00	4/5/2021							22	26.00	11/19/2019
5000090-013	37.62557	-120.84319	Eastern	Municipal	DHS	5000090-013	SOUTH WEST NEW WELL					0.02	4/19/2010	8.2	9.00	7/10/2017		0.00	4/5/2021							16	31.20	11/19/2019
5000091-001	37.77980	-120.81679	Eastern	Municipal	DHS	5000091-001	SOUTH WELL							2.4	2.80	11/12/2019												
5000110-001	37.64850	-120.97817	Eastern	Municipal	DHS	5000110-001	SOUTH/ MAIN WELL							8.9	9.17	10/15/2008												
5000110-002	37.64922	-120.97849	Eastern	Municipal	DHS	5000110-002	NORTH/BACK UP WELL							9.7	9.06	10/22/2010												
5000117-001	37.77475	-120.82256	Eastern	Municipal	DHS	5000117-001	DOMESTIC WELL							7.5	9.10	6/8/2015												
5000133-003	37.66597	-121.06601	Western Unknown	Municipal	DHS	5000133-003	2011 WELL					0.00	7/8/2021	0.77	1.90	4/28/2016		0.00	7/8/2021									
5000141-004	37.70900	-121.00577	Eastern	Municipal	DHS	5000141-004	WELL #3 (COLD STORAGE)		4.50	3/30/2012		0.02	3/13/2018	8.2	8.10	10/16/2018		0.00	3/10/2021					374.00	3/17/2015			
5000154-002	37.63783	-120.84967	Eastern	Municipal	DHS	5000154-002	WELL 02 OLD EASTERN							5.2	9.30	6/1/2010					0.00	1/6/2021					3.70	7/6/2020
5000155-001	37.63823	-120.61884	Eastern	Municipal	DHS	5000155-001	WELL 01		3.70	3/27/2018		0.00	3/15/2021	1.7	2.00	12/1/2017		0.00	3/15/2021	0	0.00	3/15/2021		170.00	3/15/2021			
5000164-001	37.65733	-120.66006	Eastern	Municipal	DHS	5000164-001	WELL #1							0	0.00	4/26/2021												
5000164-002	37.66297	-120.67831	Eastern	Municipal	DHS	5000164-002	WELL #2							0	0.00	4/26/2021												
5000164-003	37.65726	-120.66549	Eastern	Municipal	DHS	5000164-003	WELL #3								0.00	4/26/2021												
5000164-004	37.66001	-120.65574	Eastern	Municipal	DHS	5000164-004	WELL #4							0	0.00	4/26/2021												
5000179-003	37.74886	-120.84306	Eastern	Municipal	DHS	5000179-003	#3 WELL SOUTH		3.00	9/24/2008					3.20	10/4/2020												
5000179-004	37.66001	-120.65574	Eastern	Municipal	DHS	5000179-004	#4 WELL NORTH WEST		3.30	11/4/2014		0.00	10/1/2020		2.50	5/10/2011												
5000189-003	37.70452	-121.00170	Eastern	Municipal	DHS	5000189-003	S. WELL #1 (BY 4500 N. STAR)							11	8.80	4/6/2020												
5000189-004	37.70716	-121.00371	Eastern	Municipal	DHS	5000189-004	WAY)							11	7.60	1/12/2017												
5000189-005	37.70721	-121.00081	Eastern	Municipal	DHS	5000189-005	E.WELL, #4 622 GALAXY WAY							5.4	5.80	1/7/2019												
5000189-006	37.70981	-121.00082	Eastern	Municipal	DHS	5000189-006	N.WELL, #5, 4825 STRATOS							10	9.50	4/7/2020												
5000211-003	37.71228	-120.91821	Eastern	Municipal	DHS	5000211-003	WELL NO. 06		3.00	2/19/2009		0.00	5/12/2021	5.5	7.20	5/13/2020		0.00	5/12/2021		0.00	5/12/2021						
5000211-004	37.71232	-120.91980	Eastern	Municipal	DHS	5000211-004	WELL NO. 05		3.30	11/13/2008		0.00	5/12/2021	5.3	7.00	5/13/2020		0.00	5/12/2021		0.00	5/12/2021						
5000213-001	37.66593	-121.06596	Western Unknown	Municipal	DHS	5000213-001	LPA REPORTED PRIMARY SOURCE							5.1	10.00	9/11/2015												
5000249-004	37.71283	-121.02746	Eastern	Municipal	DHS	5000249-004	WELL 02 RAW							2.3	1.70	6/24/2021				0.063	0.05	2/13/2020						
5000261-003	37.72249	-120.99584	Eastern	Municipal	DHS	5000261-003	2007 WELL							3.7	4.20	4/7/2020												
5000263-002	37.71179	-120.99603	Eastern	Municipal	DHS	5000263-002	NEW 2006				0.092	0.11	10/14/2020															
SL185742938-M-106	37.64871	-121.01911	Western Upper	Monitoring	EDF	M-106	M-106	59	78.00	1/18/2012													2800	3800.00	1/20/2009			
SL185742938-M-6R	37.64782	-121.01803	Western Upper	Monitoring	EDF	M-6R	M-6R	73	72.10	7/10/2014													2600	3200.00	7/13/2016			
SL185742938-M-104	37.64899	-121.01712	Western Upper	Monitoring	EDF	M-104	M-104	7.3	52.00	1/10/2007													2300	3600.00	1/20/2009			
SL185742938-M-9R	37.65204	-121.02030	Western Upper	Monitoring	EDF	M-9R	M-9R	13	42.00	7/17/2007													470	950.00	1/18/2007			
SL185742938-M-121	37.64566	-121.00876	Western Upper	Monitoring	EDF	M-121	M-121	26	40.00	1/19/2010													840	3000.00	1/18/2007			
5000317-001	37.68982	-121.07024	Western Lower	Municipal	DHS	5000317-001	WELL#1							3.3	4.02	2/7/2011												
5000317-002	37.78055	-120.78424	Eastern	Municipal	DHS	5000317-002	WELL#2							2.2	4.80	3/25/2020												
5000335-001	37.68982	-121.07024	Western Lower	Municipal	DHS	5000335-001	WELL, PUBLIC/SOUTH	10	14.00	8/16/2007				8.5	9.90	7/5/2021												
5000372-001	37.66433	-121.05939	Western Lower	Municipal	DHS	5000372-001	WELL 01		12.00	8/17/2010		0.00	2/1/2021	16	20.00	5/4/2020		0.00	2/1/2021									
5000372-003	37.66461	-121.06086	Western Unknown	Municipal	DHS	5000372-003	SW NEW WELL		11.00	8/17/2010		0.00	2/1/2021	16	15.00	2/1/2021		0.00	2/1/2021									
5000384-003	37.65604	-121.02473	Western Lower	Municipal	DHS	5000384-003	NEW LONE PALM								4.50	3/28/2003												
SL185742938-M-111	37.64751	-121.01610	Western Upper	Monitoring	EDF	M-111	M-111	12	38.00	1/29/2006													3200	3500.00	1/20/2020			
5000401-001	37.60867	-121.11690	Western Unknown	Municipal	DHS	5000401-001	LPA REPORTED PRIMARY SOURCE							2.7	3.89	7/28/2009												
5000404-002	37.67000	-121.08000	Western Lower	Municipal	DHS	5000404-002	02 NEW SCHOOL		8.40	8/4/2020					9.00	3/22/2016												
SL185742938-M-103	37.65059	-121.01623	Western Upper	Monitoring	EDF	M-103	M-103	0	30.00	7/7/2006													1200	1800.00	7/12/2010			
5000411-001	37.72012	-120.99655	Eastern	Municipal	DHS	5000411-001	WELL 4 EAST MAIN WELL		4.20	11/5/2008		0.84	11/14/2003	12	11.50	2/12/2019		0.00	7/19/2021									
5000411-003	37.71786	-121.00124	Eastern	Municipal	DHS	5000411-003	WELL #3 WEST PARK		3.30	11/25/2020				9.8	9.80	11/28/2016				0.068	0.05	5/25/2021						
5000426-001	37.70085	-120.98959	Eastern	Municipal	DHS	5000426-001	WELL 01							14	14.80	2/6/2018												
5000433-002	37.77809	-120.80597	Eastern	Municipal	DHS	5000433-002	NO. 02							3.4	6.14	3/24/2003												
5000433-003	37.77747	-120.79795	Eastern	Municipal	DHS	5000433-003	NO. 01							5.4	6.20	3/25/2020												
5000433-004	37.78037	-120.80252	Eastern	Municipal	DHS	5000433-004	NO. 01							0.82	3.30	3/25/2020												
5000433-005	37.78032	-120.79170	Eastern	Municipal	DHS	5000433-005	01							4.2	5.70	3/25/2020												
5000433-006	37.77968	-120.77772	Eastern	Municipal	DHS	5000433-006	01							4.9	8.18	8/4/2015												
5000433-007	37.77693	-120.78556	Eastern	Municipal	DHS	5000433-007	01							6.8	8.00	2/14/2017												
5000435-002	37.77464	-120.80089	Eastern	Municipal	DHS	5000435-002	NEW WELL 01							24	23.90	4/15/2020												
5000457-002	37.72415	-120.99566	Eastern	Municipal	DHS	5000457-002	WELL 01							13	12.00	10/21/2020												
5000462-001	37.68692	-120.92228	Eastern	Municipal	DHS	5000462-001	MOTEL WELL								33.00	5/1/2020												
5000467-001	37.68692	-120.92228	Eastern	Municipal	DHS	5000467-001	LPA REPORTED PRIMARY SOURCE							8	9.70	2/27/2018												
5000481-002	37.66285	-120.78124	Eastern	Municipal	DHS	5000481-002	OLD WELL (WESTERN BY PLANT)														0.00	6/7/2021						

Appendix B Groundwater Quality Monitoring Network

Well ID	Latitude	Longitude	Principal Aquifer	Well Type	Dataset Name[1]	Alternative Well ID	Alternative Well ID 2	Arsenic			DBCP			Nitrate as N			PCE			TCP			TDS			Uranium		
								WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01								3.80	3/8/2019												
5000486-001	37.70914	-120.92019	Eastern	Municipal	DHS	5000486-001	LPA REPORTED PRIMARY SOURCE							1.9	2.80	5/15/2018												
5000493-002	37.70913	-120.92022	Eastern	Municipal	DHS	5000493-002	2016 WELL							4.6	4.60	12/4/2019												
5000499-004	37.68138	-121.10948	Western Unknown	Municipal	DHS	5000499-004	2018 WELL	13	12.00	9/22/2020				6.3	6.30	4/1/2021												
5000506-001	37.69836	-120.88367	Eastern	Municipal	DHS	5000506-001	WELL 01								4.83	1/13/2005												
5000509-001	37.77256	-120.77358	Eastern	Municipal	DHS	5000509-001	MAIN 2/96 WELL OLD OFFICE							1.3	2.62	8/12/2003												
5000516-001	37.70967	-120.94115	Eastern	Municipal	DHS	5000516-001	WELL							1.1	2.37	5/29/2015												
5000517-001	37.71001	-120.99702	Eastern	Municipal	DHS	5000517-001	WELL		7.00	3/11/2015				3.2	3.50	3/15/2017		0.00	6/22/2021									
5000529-001	37.70417	-120.95640	Eastern	Municipal	DHS	5000529-001	WELL							4.1	3.73	10/19/2015												
5000530-004	37.63466	-120.79356	Eastern	Municipal	DHS	5000530-004	2011 WELL		5.60	3/23/2012		0.00	6/1/2021	17	14.00	3/1/2021		0.00	6/1/2021									
5000535-001	37.71417	-121.00101	Eastern	Municipal	DHS	5000535-001	2003 WELL 01							6.2	6.70	2/4/2020										11	15.00	5/5/2021
5000538-001	37.66759	-120.90568	Eastern	Municipal	DHS	5000538-001	2003 WELL							7.3	7.70	8/11/2020												
5000551-001	37.70059	-120.93784	Eastern	Municipal	DHS	5000551-001	WELL							7	10.00	3/11/2020												
5000552-001	37.71237	-121.00386	Eastern	Municipal	DHS	5000552-001	WELL													0.027	0.08	5/16/2019						
5000561-001	37.71313	-120.99368	Eastern	Municipal	DHS	5000561-001	2005 DOMESTIC WATER WELL								9.90	12/4/2018												
5000562-002	37.71516	-120.99481	Eastern	Municipal	DHS	5000562-002	NEW 2006 WELL							4.7	5.80	2/7/2019												
5000563-001	37.71561	-121.00339	Eastern	Municipal	DHS	5000563-001	WELL		4.70	4/6/2021		0.00	5/5/2021	5.5	6.80	5/5/2020		0.00	5/5/2021	0.042	0.05	1/31/2018						
5000565-001	37.71575	-121.00392	Eastern	Municipal	DHS	5000565-001	NEW WELL							5.7	5.70	4/13/2021				0.073	0.09	8/14/2018						
5000568-001	37.72180	-121.05999	Eastern	Municipal	DHS	5000568-001	WELL #1 2007				0	0.00	4/19/2021	0.77	0.90	4/17/2018				0	0.00	4/19/2021						
5000573-002	37.71230	-121.00251	Eastern	Municipal	DHS	5000573-002	SCS 2007 WELL							3.8	4.31	1/28/2011												
5000580-001	37.73025	-121.06814	Eastern	Municipal	DHS	5000580-001	WELL		7.00	11/14/2017				2.6	3.10	11/3/2020												
5000584-001	37.73803	-120.99481	Eastern	Municipal	DHS	5000584-001	NEW WELL 2009							2.5	2.80	11/7/2016												
5000585-001	37.63855	-121.12369	Western Unknown	Municipal	DHS	5000585-001	1999 DOMESTIC WELL							4.6	4.60	2/3/2020												
5000588-001	37.65809	-121.03037	Western Unknown	Municipal	DHS	5000588-001	WELL 01					0.00	6/9/2021															
5000592-001	37.71245	-120.82519	Eastern	Municipal	DHS	5000592-001	2014 WELL		0.00	4/20/2021		0.00	4/20/2021	11	12.00	1/3/2018		0.00	4/20/2021									
5010005-001	37.70083	-121.08642	Western Lower	Municipal	DHS	5010005-001	WELL 250 - SALIDA GAS		12.00	6/12/2000				7.1	3.50	6/3/2008		0.00	5/5/2021		0.00	2/3/2021		210.00	3/10/1997		2.50	2/3/2021
5010005-005	37.70691	-121.09319	Western Lower	Municipal	DHS	5010005-005	WELL 288 - SUNNYBROOK		13.00	9/23/1997		0.00	5/5/2021	1.5	4.10	11/3/1999		0.00	5/5/2021		0.00	5/5/2021		290.00	11/3/1999			
5010005-006	37.71402	-121.08200	Western Lower	Municipal	DHS	5010005-006	WELL 290 - CLARENDON							6.8	7.84	9/4/2018		0.00	5/5/2021		0.00	2/3/2021						
5010005-007	37.69834	-121.07377	Western Lower	Municipal	DHS	5010005-007	WELL 297					0.00	5/5/2021	4.7	11.10	7/5/2013		0.00	5/5/2021		0.00	2/3/2021						
5010005-008	37.71553	-121.08905	Western Lower	Municipal	DHS	5010005-008	WELL 298							5.4	5.72	3/17/2009		0.00	5/5/2021		0.00	5/5/2021						
5010005-017	37.70294	-121.07842	Western Unknown	Municipal	DHS	5010005-017	WELL 313 - RAW							7.7	8.62	9/6/2017		0.00	5/5/2021		0.00	2/3/2021						
5010006-003	37.64117	-120.74547	Eastern	Municipal	DHS	5010006-003	WELL NO. 245		7.00	3/3/1997																		
5010006-004	37.64558	-120.77354	Eastern	Municipal	DHS	5010006-004	WELL NO. 286		4.00	1/13/2005																		
5010006-006	37.64727	-120.76391	Eastern	Municipal	DHS	5010006-006	WELL NO. 303 - RAW TO GAC				0.12	0.50	7/17/2003	4.5	7.48	5/2/2006												
SL185742938-M-119	37.65112	-121.01527	Western Upper	Monitoring	EDF	M-119	M-119	0	22.00	1/16/2020													94	20000.00	1/31/2008			
SL185742938-M-151	37.64856	-121.01341	Western Upper	Monitoring	EDF	M-151	M-151	8.4	19.00	7/12/2011													690	1300.00	1/26/2006			
5010010-008	37.65071	-120.98702	Western Unknown	Municipal	DHS	5010010-008	WELL 006					0.00	7/14/2021	6.3	7.05	7/11/2007	0	0.00	7/14/2021	0.0051	0.01	8/22/2018						
5010010-009	37.65093	-120.99944	Western Unknown	Municipal	DHS	5010010-009	WELL 007					0.00	7/14/2021				0	0.00	7/14/2021		0.00	7/14/2021						
5010010-027	37.68571	-121.00140	Eastern	Municipal	DHS	5010010-027	WELL 025					0.00	5/5/2021	7.9	9.63	4/21/1999		0.00	5/5/2021		0.00	5/5/2021						
5010010-035	37.67377	-121.03156	Western Unknown	Municipal	DHS	5010010-035	WELL 033		9.90	1/4/1994		0.00	2/3/2021	6	6.96	7/5/2017					0.00	5/5/2021		340.00	6/1/2021			
5010010-041	37.69001	-120.97187	Eastern	Municipal	DHS	5010010-041	WELL 039					0.00	5/12/2021	6	6.80	11/15/2012		0.00	5/12/2021		0.00	5/12/2021						
5010010-042	37.64458	-120.94783	Eastern	Municipal	DHS	5010010-042	WELL 040					0.33	1/11/1995	8.1	9.96	7/20/2016					0.01	8/22/2018						
5010010-043	37.66040	-120.93046	Eastern	Municipal	DHS	5010010-043	WELL 041							6.1	7.08	3/8/1995					0.00	5/19/2021						
5000316-001	37.62464	-121.05458	Western Upper	Municipal	DHS	5000316-001	WELL 01	12	16.10	8/5/2002				5.6	7.00	3/10/2003												
5010010-047	37.66340	-120.91952	Eastern	Municipal	DHS	5010010-047	WELL 045					0.00	5/19/2021	5.8	6.40	7/17/2019					0.00	5/19/2021						
5010010-048	37.67571	-120.94764	Eastern	Municipal	DHS	5010010-048	WELL 046					0.01	4/14/2009	4.2	4.17	2/22/2018					0.00	5/19/2021						
5010010-049	37.64931	-120.93879	Eastern	Municipal	DHS	5010010-049	WELL 047							1.1	6.14	7/21/2009		0.00	7/21/2021	0.0054	0.01	8/22/2018						
5010010-050	37.70231	-120.99673	Eastern	Municipal	DHS	5010010-050	WELL 048		8.00	1/4/1996		0.00	5/5/2021	2.3	2.69	2/19/2008		0.00	5/5/2021		0.00	5/5/2021		190.00	5/2/2018			
5010010-052	37.69679	-121.01066	Eastern	Municipal	DHS	5010010-052	WELL 050				0.018	0.09	7/3/1995	6.9	9.50	5/16/2005	0	0.00	7/6/2021		0.00	5/5/2021					13.12	5/16/2002
5010010-053	37.70363	-121.04910	Eastern	Municipal	DHS	5010010-053	WELL 051							4.7	9.93	1/4/1994		0.00	7/6/2021	0	0.00	7/6/2021						
5010010-124	37.65796	-121.03818	Western Upper	Municipal	DHS	5010010-124	WELL 241 - HAMMET		12.00	6/13/2000		0.00	7/6/2021	0.95	5.12	6/7/2017					0.00	7/6/2021		220.00	7/9/1993			
5010010-062	37.68394	-120.94584	Eastern	Municipal	DHS	5010010-062	WELL 052							3.8	3.90	2/16/2021					0.00	5/19/2021						
5010010-068	37.69341	-120.94873	Eastern	Municipal	DHS	5010010-068	WELL 054					0.00	5/19/2021	2.7	2.60	2/19/2020					0.00	5/19/2021						
SL185742938-M-2R	37.65010	-121.02073	Western Upper	Monitoring	EDF	M-2R	M-2R	1.9	12.00	7/22/2010													1300	2300.00	1/20/2009			
5010010-097	37.66944	-120.95000	Eastern	Municipal	DHS	5010010-097	WELL 65 - RAW					0.00	5/19/2021	2.8	5.20	10/6/2004					0.00	2/16/2021						
SL185742938-M-161	37.64677	-121.01631	Western Upper	Monitoring	EDF	M-161	M-161	7.5	9.70	1/24/2017													380	530.00	1/11/2007			
5010010-127	37.65759	-120.93726	Eastern	Municipal	DHS	5010010-127	WELL 265 - LINCOLN ESTATES		3.00	1/20/2005				5.1	6.77	10/10/2001					0.00	5/19/2021		370.00	5/16/2018		8.00	9/15/1992
5010010-129	37.68533	-120.97581	Eastern	Municipal	DHS	5010010-129	WELL 259 - COFFEE VILLAGE 01		5.10	5/9/2018				5.1	5.60	2/12/2014		0.00	5/12/2021		0.00	5/12/2021		390.00	5/9/2018			
5010010-130	37.68534	-120.99272	Eastern	Municipal	DHS	5010010-130	WELL 264 - SHERWOOD FOREST							0.91	2.18	10/9/2013					0.00	5/12/2021						
5010010-131	37.68089	-120.99341	Eastern	Municipal	DHS	5010010-131	WELL 262 - HART WELL 02		7.30	2/11/2015		0.00	5/12/2021	2.1	5.82	2/14/2018		0.00	5/12/2021		0.00	5/12/2021		210.00	7/6/2005			
SL185742938-M-118	37.65303	-121.01877	Western Upper	Monitoring	EDF	M-118	M-118	8.6	9.50	7/7/2011													260	340.00	1/25/2010			
SL185742938-M-102	37.64854	-121.01611	Western Upper	Monitoring	EDF	M-102	M-102	12	9.40	7/13/2021													840	4800.00	7/12/2006			
SL185742938-M-108	37.65060	-121.01623	Western Upper	Monitoring	EDF	M-108	M-108	6.4	9.20	7/13/2010													490	970.00	1/10/2007			
SL185742938-M-150	37.64871	-121.01612	Western Upper	Monitoring	EDF	M-150	M-150	7.2	9.10	1/20/2020													600	1320.00	7/23/2012			
SL185742938-M-152	37.64703	-121.01359	Western Upper	Monitoring	EDF	M-152	M-152	4.9	9.10	1/21/2013													870	1100.00	7/14/2010			
5010010-170	37.62793	-120.93048	Eastern	Municipal	DHS	5010010-170	WELL 308					0.06	10/10/2006	2	6.35	11/9/1998					0.00	5/19/2021	1100	1200.00	11/20/2018			
5010010-172	37.66808	-120.98508	Eastern	Municipal	DHS	5010010-172	WELL 300							1.5	3.66	3/28/2001					0.00	5/12/2021						
5010010-178	37.63784	-120.93285	Eastern	Municipal	DHS	5010010-178	WELL 292 - MARIPOSA WEST				0.31	2.00	1/20/2005	7	9.42	6/2/2009				0.011	0.02	12/13/2016						
5010010-180	37.63785	-120.93172	Eastern	Municipal	DHS	5010010-180	WELL 291 - MARIPOSA EAST				0.14	1.02	10/11/1990	5	10.10	5/14/2007				0.0061	0.01	7/3/2019						
5010010-184	37.63483	-120.93568	Eastern	Municipal	DHS	5010010-184	WELL 279 - FARRAR (OLD 06)				0.23	1.00	9/5/2000	6.2	9.85	9/26/2007				0.017	0.04	7/18/2018						
5010010-186	37.63194	-120.91164	Eastern	Municipal	DHS	5010010-186	WELL 277 - NORTH CODONI								9.74	10/19/2016												
5010010-187	37.66055	-120.96670	Eastern	Municipal	DHS	5010010-187	WELL 269 - ROSE AVENUE		4.00	7/14/2021				6	10.70	6/25/1993					0.00	5/12/2021		490.00	8/10/1993		32.00	9/23/1992
5010010-189	37.66316	-120.97808	Eastern	Municipal	DHS	5010010-189	WELL 267 - ORANGEBURG		9.00	6/7/2000				6.4	10.60	10/15/2016					0.00	5/12/2021		490.00	3/11/2015			
5010010-191	37.64560	-120.90525	Eastern	Municipal	DHS	5010010-191	WELL 247 - NORTH EMPIRE				0.046	0.49	8/7/1995	7.4	10.60	10/19/2016					0.01	8/22/2018						

Appendix B Groundwater Quality Monitoring Network

								Arsenic			DBCP			Nitrate as N			PCE			TCP			TDS			Uranium		
Well ID	Latitude	Longitude	Principal Aquifer	Well Type	Dataset Name[1]	Alternative Well ID	Alternative Well ID 2	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01								3.80	3/8/2019												
5010010-192	37.63757	-120.95876	Eastern	Municipal	DHS	5010010-192	WELL 225 - BUDGET PACK		4.00	9/1/2005				8.6	9.06	10/12/2016	6.4	32.00	6/1/2011	0.018	0.01	4/13/2018		1300.00	12/7/1995			
5010010-194	37.63565	-120.94334	Eastern	Municipal	DHS	5010010-194	WELL 212 - BEARD AVENUE				0.05	0.44	7/5/2006	7.5	10.10	7/9/2007				0.0077	0.01	8/24/2016						
5010010-196	37.64526	-120.97845	Eastern	Municipal	DHS	5010010-196	WELL 211 - THOUSAND OAKS							7.7	8.30	1/15/2020					0.50	3/10/1994						
5010010-221	37.68369	-120.98493	Eastern	Municipal	DHS	5010010-221	WELL 058							1.1	2.30	3/2/2011		0.00	5/12/2021		0.00	5/12/2021						
5010010-226	37.64198	-120.91903	Eastern	Municipal	DHS	5010010-226	WELL 059							6.2	8.90	2/2/2011		0.00	3/17/2021	0.0026	0.01	6/13/2018						
5010010-241	37.70767	-121.05488	Eastern	Municipal	DHS	5010010-241	WELL 61					0.00	3/3/2021	1.9	2.70	12/7/2006		0.00	3/3/2021		0.01	8/24/2016						
5010010-243	37.69540	-121.05603	Western Unknown	Municipal	DHS	5010010-243	WELL 63					0.00	5/5/2021	1	2.30	12/2/2015		0.00	5/5/2021		0.00	5/5/2021					1.70	2/1/2012
5010010-245	37.68948	-120.93022	Eastern	Municipal	DHS	5010010-245	WELL NO. 67														0.00	2/16/2021						
5010014-005	37.77968	-120.83856	Eastern	Municipal	DHS	5010014-005	WELL 03 - ON THE HILL		2.30	7/14/2021		0.02	1/13/1992	2.1	4.10	7/17/2013		0.00	7/14/2021	0.0074	0.01	7/6/2020		244.00	7/14/2004			
5010014-008	37.76212	-120.84250	Eastern	Municipal	DHS	5010014-008	WELL 05-A - SIERRA & J		3.30	7/14/2021		0.00	7/14/2021	2.8	4.70	8/6/2003		0.00	7/14/2021	0	0.00	7/14/2021		170.00	7/22/2015			
5010014-009	37.75773	-120.84036	Eastern	Municipal	DHS	5010014-009	WELL 06		3.30	7/14/2004		0.00	7/14/2021	2.2	4.61	7/19/1995		0.00	7/14/2021	0	0.00	7/14/2021		240.00	11/18/1998			
5010014-010	37.76164	-120.87669	Eastern	Municipal	DHS	5010014-010	WELL 07		3.00	1/18/2010		0.00	7/14/2021	0.68	3.60	1/18/2010		0.00	7/14/2021	0	0.00	7/14/2021		240.00	7/12/2018			
5010014-011	37.76502	-120.83228	Eastern	Municipal	DHS	5010014-011	WELL 08		2.40	7/14/2021		0.00	7/14/2021	4.3	6.80	8/22/2012		2.20	4/15/2011	0	0.00	7/14/2021		227.00	1/27/1993			
5010014-012	37.75455	-120.87014	Eastern	Municipal	DHS	5010014-012	WELL 09		2.50	7/14/2021		0.00	7/14/2021	1.6	8.25	4/26/2012		0.00	7/14/2021	0	0.00	7/14/2021		270.00	12/18/2019			
5010014-013	37.75502	-120.85043	Eastern	Municipal	DHS	5010014-013	WELL 10		2.50	7/15/2019	0	0.00	7/14/2021		4.00	7/12/2018		0.00	7/14/2021	0	0.00	7/14/2021		240.00	7/14/2021			
5010018-002	37.73336	-120.92734	Eastern	Municipal	DHS	5010018-002	WELL 02							2	3.80	11/12/2015				0	0.00	7/7/2021						
5010018-003	37.73033	-120.94992	Eastern	Municipal	DHS	5010018-003	WELL 03							5.6	6.57	8/21/2008				0	0.00	7/7/2021						
5010018-004	37.73973	-120.93995	Eastern	Municipal	DHS	5010018-004	WELL 04							2.5	5.40	6/9/2009				0	0.01	10/31/2002						
5010018-006	37.72784	-120.93318	Eastern	Municipal	DHS	5010018-006	WELL 06							1.5	4.90	12/14/2017				0	0.00	7/7/2021						
5010018-007	37.72726	-120.95580	Eastern	Municipal	DHS	5010018-007	WELL 07							8.5	9.60	10/14/2020				0	0.00	7/7/2021						
5010018-008	37.72194	-120.95380	Eastern	Municipal	DHS	5010018-008	WELL 08							7.3	7.40	10/11/2018				0	0.00	7/7/2021						
5010018-009	37.71361	-120.94250	Eastern	Municipal	DHS	5010018-009	WELL 09							6.2	8.00	10/10/2016				0	0.00	7/7/2021						
5010018-010	37.71508	-120.95810	Eastern	Municipal	DHS	5010018-010	WELL 10							21	8.50	10/11/2018				0	0.00	7/7/2021						
5010018-012	37.73216	-120.92441	Eastern	Municipal	DHS	5010018-012	WELL NO. 12							1.2	2.50	12/14/2017				0	0.00	7/7/2021						
5010029-001	37.74016	-121.01405	Eastern	Municipal	DHS	5010029-001	WELL 271 - HILLCREST ESTATES					1.00	3/19/1992	0	4.30	3/19/1992					0.00	5/5/2021						
5010029-002	37.74611	-121.01690	Eastern	Municipal	DHS	5010029-002	WELL 282 - DEL RIO		7.00	7/1/2020	0	0.06	9/13/2005	5.5	9.41	10/16/2017		0.00	5/5/2021	0.0079	0.00	5/5/2021		300.00	5/5/2021			
5010029-004	37.74423	-121.00330	Eastern	Municipal	DHS	5010029-004	WELL 289 - KRISTINA		5.70	5/5/2021	0.082	0.25	10/2/1990	3.6	3.90	1/6/2021		0.00	3/3/2021	0.0013	0.00	5/5/2021		180.00	6/27/2006			
5010029-008	37.74290	-120.99578	Eastern	Municipal	DHS	5010029-008	WELL NO. 70		4.80	12/27/2018		0.47	4/21/2021		5.10	4/21/2021		0.00	4/21/2021		0.00	4/21/2021		180.00	4/21/2021		0.00	4/21/2021
5010029-010	37.73200	-121.00397	Eastern	Municipal	DHS	5010029-010	WELL NO. 68		6.90	5/4/2021	0.57	0.87	5/13/2020	4.4	3.90	5/4/2021	0	0.00	7/6/2021	0.011	0.01	12/2/2020		170.00	5/13/2020	0	0.12	5/14/2018
5010042-002	37.63917	-120.75000	Eastern	Municipal	DHS	5010042-002	FE&MN								2.98	7/12/2017												
AGW080010534-HOME	37.66204	-120.87511	Eastern	Domestic	AGLAND	HOME	HOME								5.18	3/1/2019												
AGW080010535-HOME	37.67591	-120.54922	Eastern	Domestic	AGLAND	HOME	HOME								1.49	6/30/2021												
AGW080010562-8400	37.76046	-120.79739	Eastern	Domestic	AGLAND	8400	8400							0.629	0.63	11/9/2021												
AVE	37.64751	-121.05726	Western Unknown	Domestic	AGLAND	KANSAS AVE	KANSAS AVE								8.87	4/19/2021												
WELL	37.64162	-120.62486	Eastern	Domestic	AGLAND	FARM WELL	FARM WELL								0.94	6/25/2019												
HOUSE	37.64162	-120.62486	Eastern	Domestic	AGLAND	WEST HOUSE	WEST HOUSE								2.44	6/25/2019												
HOUSE	37.64158	-120.61632	Eastern	Domestic	AGLAND	EAST HOUSE	EAST HOUSE								2.13	6/25/2019												
AGW080010964-HOME	37.64454	-120.62481	Eastern	Domestic	AGLAND	HOME	HOME							0.463	0.46	11/29/2021												
AGW080010965-HOUSE	37.70330	-120.64263	Eastern	Domestic	AGLAND	HOUSE	HOUSE								4.18	5/7/2019												
AGW080010967-HOUSE	37.69013	-120.79227	Eastern	Domestic	AGLAND	HOUSE	HOUSE								3.46	5/7/2019												
AGW080010971-HQ	37.69691	-120.77239	Eastern	Domestic	AGLAND	HQ	HQ								3.19	5/7/2019												
AGW080010972-HOUSE F	37.69667	-120.77267	Eastern	Domestic	AGLAND	HOUSE F	HOUSE F								3.10	5/7/2019												
AGW080010973-HUDSON	37.71083	-120.77460	Eastern	Domestic	AGLAND	HUDSON	HUDSON								2.89	5/7/2019												
AGW080010974-HULLER	37.68141	-120.76551	Eastern	Domestic	AGLAND	HULLER	HULLER								2.01	6/24/2020												
SOUTH	37.70816	-120.67605	Eastern	Domestic	AGLAND	JKSN SOUTH	JKSN SOUTH								1.05	6/30/2021												
CLABL	37.71079	-120.67741	Eastern	Domestic	AGLAND	JKSN CLABL	JKSN CLABL								0.97	6/24/2020												
AGW080010979-ALMONDS	37.68781	-120.64916	Eastern	Domestic	AGLAND	ALMONDS	ALMONDS								1.75	5/7/2019												
AGW080010989-FRONT 40	37.66288	-120.75587	Eastern	Domestic	AGLAND	FRONT 40	FRONT 40							1.05	2.33	8/19/2019												
AGW080010990-BACK 40	37.67261	-120.75605	Eastern	Domestic	AGLAND	BACK 40	BACK 40							1.2	3.05	8/19/2019												
AGW080011023-DW2	37.70045	-120.77700	Eastern	Domestic	AGLAND	DW2	DW2								2.89	5/15/2019												
AGW080011024-DW1	37.70099	-120.78019	Eastern	Domestic	AGLAND	DW1	DW1								3.68	5/15/2019												
AGW080011029-GIL1	37.74882	-120.77300	Eastern	Domestic	AGLAND	GIL1	GIL1								3.18	5/14/2021												
AGW080011032-SHR	37.67078	-120.59682	Eastern	Domestic	AGLAND	SHR	SHR								3.57	4/29/2019												
AGW080011033-GIL2	37.75067	-120.79034	Eastern	Domestic	AGLAND	GIL2	GIL2								6.23	8/25/2020												
AGW080011065-6437	37.70516	-121.11071	Western Unknown	Domestic	AGLAND	6437	6437								0.55	5/30/2019												
AGW080011066-HOME	37.65984	-120.73983	Eastern	Domestic	AGLAND	HOME	HOME								2.72	5/21/2021												
AGW080011224-1131	37.62612	-121.08638	Western Unknown	Domestic	AGLAND	1131	1131							7.84	7.84	12/2/2021												
AGW080011346-WALI	37.71875	-120.80881	Eastern	Domestic	AGLAND	WALI	WALI								4.71	6/8/2021												
AGW080011487-6813	37.66217	-120.86911	Eastern	Domestic	AGLAND	6813	6813								2.02	7/10/2020												
AGW080011757-WVD1	37.72876	-120.65104	Eastern	Domestic	AGLAND	WVD1	WVD1								4.79	11/27/2019												
AGW080011758-ARD1	37.72693	-120.81828	Eastern	Domestic	AGLAND	ARD1	ARD1								8.13	11/24/2020												
AGW080011759-LRD1	37.75982	-120.80018	Eastern	Domestic	AGLAND	LRD1	LRD1								4.38	11/27/2019												
AGW080011760-OWD1	37.73642	-120.83138	Eastern	Domestic	AGLAND	OWD1	OWD1								4.76	11/27/2019												
AGW080011786-HOME	37.70469	-121.06488	Western Unknown	Domestic	AGLAND	HOME	HOME								7.65	12/2/2019												
AGW080011823-1081	37.65770	-120.70782	Eastern	Domestic	AGLAND	1081	1081							4.98	4.98	11/18/2021												
AGW080011852-6106	37.72682	-120.90655	Eastern	Domestic	AGLAND	6106	6106							7.75	7.75	11/1/2021												
AGW080011855-1772	37.61476	-121.05149	Western Unknown	Domestic	AGLAND	1772	1772								9.90	7/19/2021												
AGW080011876-530	37.63100	-121.06498	Western Unknown	Domestic	AGLAND	530	530								5.76	12/8/2020												
AGW080011877-431	37.63428	-121.06490	Western Unknown	Domestic	AGLAND	431	431								3.12	10/28/2019												
AGW080012103-HOUSE	37.78000	-120.75480	Eastern	Domestic	AGLAND	HOUSE	HOUSE							2.34	7.01	12/18/2019												
AGW080012136-SDW	37.77879	-120.73608	Eastern	Domestic	AGLAND	SDW	SDW							1.35	1.35	11/18/2021												
AGW080012137-NDW	37.78267	-120.73881	Eastern	Domestic	AGLAND	NDW	NDW							1.05	1.05	11/18/2021												
AGW080012192-848	37.72874	-121.00560	Eastern	Domestic	AGLAND	848	848							2.34	3.27	12/12/2019												

Appendix B Groundwater Quality Monitoring Network

								Arsenic			DBCP			Nitrate as N			PCE			TCP			TDS			Uranium		
Well ID	Latitude	Longitude	Principal Aquifer	Well Type	Dataset Name[1]	Alternative Well ID	Alternative Well ID 2	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01								3.80	3/8/2019												
AGW080012240-W#1	37.65495	-120.92531	Eastern	Domestic	AGLAND	W#1	W#1								9.37	11/24/2020												
AGW080012327-HOME	37.71006	-120.78962	Eastern	Domestic	AGLAND	HOME	HOME								7.77	1/26/2021												
AGW080012405-5261	37.75763	-120.89916	Eastern	Domestic	AGLAND	5261	5261								6.04	6/15/2020												
AGW080012447-CRABTREE	37.63413	-120.81047	Eastern	Domestic	AGLAND	CRABTREE	CRABTREE							1.2	8.98	12/9/2019												
AGW080012448-MCEWEN	37.63413	-120.81047	Eastern	Domestic	AGLAND	MCEWEN	MCEWEN							7.4	8.20	10/30/2020												
AGW080012666-1649	37.61698	-121.03971	Western Unknown	Domestic	AGLAND	1649	1649								4.83	12/9/2019												
AGW080012671-HAZL	37.64383	-120.86108	Eastern	Domestic	AGLAND	HAZL	HAZL								8.06	12/23/2019												
AGW080012678-WELL	37.63396	-120.84524	Eastern	Domestic	AGLAND	WELL	WELL							6.2	5.80	12/16/2020												
AGW080012806-BARN	37.66602	-120.70584	Eastern	Domestic	AGLAND	BARN	BARN								1.50	11/5/2020												
AGW080012860-HOME	37.67647	-120.71800	Eastern	Domestic	AGLAND	HOME	HOME								3.25	12/31/2019												
AGW080012938-1934	37.64380	-120.63930	Eastern	Domestic	AGLAND	1934	1934							2.6	2.60	10/28/2021												
AGW080012942-DW1	37.65250	-120.53320	Eastern	Domestic	AGLAND	DW1	DW1							3.6	3.60	10/28/2021												
AGW080013770-6725	37.69784	-121.11962	Western Unknown	Domestic	AGLAND	6725	6725								1.93	4/9/2020												
AGW080013782-454	37.64352	-120.81778	Eastern	Domestic	AGLAND	454	454								6.88	4/28/2020												
AGW080013900-237	37.63519	-120.81686	Eastern	Domestic	AGLAND	237	237								4.72	4/12/2021												
AGW080014842-HOME	37.66093	-120.77381	Eastern	Domestic	AGLAND	HOME	HOME							0.37	0.37	10/19/2021												
AGW080016092-106	37.63797	-120.61747	Eastern	Domestic	AGLAND	106	106								2.82	12/15/2020												
AGW080016185-HOME	37.70345	-120.85107	Eastern	Domestic	AGLAND	HOME	HOME								2.42	12/10/2020												
AGW080016580-3536	37.68651	-120.69332	Eastern	Domestic	AGLAND	3536	3536							1.91	1.91	10/4/2021												
AGW080018565-DW1	37.72151	-121.01482	Eastern	Domestic	AGLAND	DW1	DW1								1.69	4/16/2021												
L10005824413-MW-10S	37.62024	-120.85017	Eastern	Monitoring	EDF	MW-10S	MW-10S		4.40	6/7/2008		0.00	5/13/2021		19.00	11/18/2020		0.57	5/14/2014		0.00	5/13/2021		740.00	5/28/2020			
L10005824413-MW-11S	37.62294	-120.84817	Eastern	Monitoring	EDF	MW-11S	MW-11S	6.7	3.10	11/5/2014	0	0.00	5/12/2021	8.2	9.30	11/29/2006	0.28	1.60	6/4/2009	0	0.00	5/12/2021	570	620.00	11/5/2014			
L10005824413-MW-12S	37.62429	-120.84759	Eastern	Monitoring	EDF	MW-12S	MW-12S		1.80	6/7/2008		0.00	5/12/2021		25.00	6/7/2008		40.00	11/30/2006		0.00	5/12/2021		720.00	5/12/2015			
L10005824413-MW-13S	37.62747	-120.84811	Eastern	Monitoring	EDF	MW-13S	MW-13S		4.20	11/9/2011		0.00	5/12/2021		25.00	6/7/2008		1.40	5/4/2012		0.00	5/12/2021		610.00	11/13/2007			
L10005824413-MW-14SR	37.62154	-120.85382	Eastern	Monitoring	EDF	MW-14SR	MW-14SR	4.6	6.10	8/20/2015	0	0.00	5/14/2021	2.2	6.90	2/10/2017	3.5	16.00	7/20/2012	0	0.00	5/14/2021	600	720.00	5/24/2013			
L10005824413-MW-15D	37.61766	-120.85800	Eastern	Monitoring	EDF	MW-15D	MW-15D	12	11.00	5/13/2021	0	0.00	5/13/2021	0.66	0.98	11/18/2020	0	0.75	5/14/2014	0.02	0.00	5/13/2021	320	530.00	11/17/2010			
L10005824413-MW-15S	37.61763	-120.85804	Eastern	Monitoring	EDF	MW-15S	MW-15S	3	7.00	11/4/2014	0	0.00	5/13/2021	0.48	18.00	11/18/2020	0	0.49	11/10/2011	0	0.00	5/13/2021	890	1600.00	5/15/2018			
L10005824413-MW-16S	37.62618	-120.84678	Eastern	Monitoring	EDF	MW-16S	MW-16S		2.00	5/2/2012		0.00	5/11/2021		30.00	11/8/2011		0.66	5/12/2014		0.00	5/11/2021		860.00	11/13/2007			
L10005824413-MW-17D	37.63090	-120.85130	Eastern	Monitoring	EDF	MW-17D	MW-17D	3.4	4.60	11/18/2010	0	0.00	5/12/2021	6.4	11.00	6/2/2009	0	1.30	6/2/2009	0.025	0.00	5/12/2021	380	500.00	6/2/2009			
L10005824413-MW-17S	37.63090	-120.85130	Eastern	Monitoring	EDF	MW-17S	MW-17S	2.4	3.60	6/5/2008	0	0.00	5/12/2021	9.3	12.00	11/10/2011	0	2.80	5/14/2014	0	0.00	5/12/2021	630	660.00	5/12/2021			
L10005824413-MW-18D	37.63122	-120.84827	Eastern	Monitoring	EDF	MW-18D	MW-18D	2.2	5.00	12/1/2006	0	0.00	5/12/2021	1.9	9.50	12/1/2006	0	0.70	6/5/2008	0	0.00	5/12/2021	250	460.00	12/1/2006			
L10005824413-MW-18S	37.63122	-120.84827	Eastern	Monitoring	EDF	MW-18S	MW-18S	1.5	4.40	12/1/2006	0	0.00	5/12/2021	0.72	11.00	12/1/2006	0	1.00	5/9/2007	0	0.00	5/12/2021	150	440.00	12/1/2006			
L10005824413-MW-19D	37.62471	-120.84766	Eastern	Monitoring	EDF	MW-19D	MW-19D	0	4.30	6/7/2008	0	0.00	5/12/2021	0.16	8.50	11/19/2007	0	5.20	11/19/2007	0	0.00	5/12/2021	330	530.00	11/19/2007			
L10005824413-MW-19S	37.62471	-120.84767	Eastern	Monitoring	EDF	MW-19S	MW-19S	0	4.50	6/7/2008	0	0.00	5/12/2021	19	28.00	11/17/2020	0.5	6.30	5/12/2015	0	0.00	5/12/2021	790	780.00	11/20/2019			
L10005824413-MW-1D	37.62137	-120.84984	Eastern	Monitoring	EDF	MW-1D	MW-1D	1.6	2.90	8/20/2014	0	0.00	5/13/2021	3.3	9.30	6/7/2008	0.31	5.70	7/19/2012	0	0.00	5/13/2021	600	1700.00	11/19/2008			
L10005824413-MW-1S	37.62139	-120.84983	Eastern	Monitoring	EDF	MW-1S	MW-1S		3.10	11/18/2020		0.00	5/13/2021		27.00	5/18/2017		2.80	11/16/2007		0.00	5/13/2021		1800.00	5/28/2020			
L10005824413-MW-21D	37.63065	-120.84806	Eastern	Monitoring	EDF	MW-21D	MW-21D		5.10	5/16/2018		0.00	5/12/2021		7.30	11/30/2006		0.29	11/20/2008		0.00	5/12/2021		530.00	11/16/2010			
L10005824413-MW-21S	37.63065	-120.84806	Eastern	Monitoring	EDF	MW-21S	MW-21S		4.90	6/5/2008		0.00	5/12/2021		7.00	11/16/2007		0.63	5/13/2014		0.00	5/12/2021		490.00	11/16/2007			
L10005824413-MW-22D	37.62909	-120.84804	Eastern	Monitoring	EDF	MW-22D	MW-22D	3	4.70	6/5/2008	0	0.00	5/12/2021	1	9.60	11/19/2007	0	6.80	11/19/2007	0	0.00	5/12/2021	120	580.00	11/19/2007			
L10005824413-MW-22S	37.62909	-120.84804	Eastern	Monitoring	EDF	MW-22S	MW-22S	2.6	4.20	5/13/2014	0	0.00	5/12/2021	11	17.00	5/16/2018	0	23.00	11/19/2007	0	0.00	5/12/2021	350	730.00	11/19/2007			
L10005824413-MW-23D	37.62281	-120.85772	Eastern	Monitoring	EDF	MW-23D	MW-23D	3	22.00	5/15/2018	0	0.00	5/13/2021	3.1	2.90	11/17/2020	1.3	1.40	8/9/2017	0	0.00	5/13/2021	490	760.00	8/3/2011			
L10005824413-MW-23S	37.62277	-120.85776	Eastern	Monitoring	EDF	MW-23S	MW-23S	4.5	34.00	5/15/2018	0	0.00	5/13/2021	1	10.00	11/20/2019	0	0.51	10/9/2012	0	0.00	5/13/2021	1000	1400.00	5/27/2020			
L10005824413-MW-24D	37.62620	-120.84469	Eastern	Monitoring	EDF	MW-24D	MW-24D	4	4.60	11/18/2019	0	0.00	5/11/2021	2.7	22.00	11/9/2011	0	1.30	5/12/2014	0	0.00	5/11/2021	180	590.00	5/10/2016			
L10005824413-MW-24S	37.62620	-120.84461	Eastern	Monitoring	EDF	MW-24S	MW-24S	0.64	4.10	5/10/2016	0	0.00	5/11/2021	21	25.00	8/18/2014	0	0.14	2/17/2015	0	0.00	5/11/2021	620	690.00	5/14/2018			
L10005824413-MW-25D2	37.62269	-120.85618	Eastern	Monitoring	EDF	MW-25D2	MW-25D2	3.2	33.00	5/15/2018	0	0.00	5/13/2021	2.7	2.50	11/19/2019	0.15	1.20	5/15/2014	0	0.00	5/13/2021	460	630.00	2/19/2014			
L10005824413-MW-25D3	37.62267	-120.85618	Eastern	Monitoring	EDF	MW-25D3	MW-25D3	7.3	18.00	5/15/2018	0	0.00	5/13/2021	0.16	0.44	11/12/2018	0	0.39	8/20/2015	0	0.00	5/13/2021	460	530.00	5/22/2019			
L10005824413-MW-26D	37.62830	-120.85280	Eastern	Monitoring	EDF	MW-26D	MW-26D	2.5	4.30	11/14/2018	0	0.00	5/13/2021	1.9	6.80	11/20/2019	0	1.10	11/14/2017	0	0.00	5/13/2021	250	440.00	8/29/2019			
L10005824413-MW-26S	37.62829	-120.85277	Eastern	Monitoring	EDF	MW-26S	MW-26S	2.4	4.30	8/17/2012	0	0.00	5/13/2021	13	11.00	11/18/2020	0.59	1.70	11/19/2015	0	0.00	5/13/2021	390	400.00	5/13/2021			
L10005824413-MW-27D	37.62883	-120.86088	Eastern	Monitoring	EDF	MW-27D	MW-27D	3.5	3.50	8/13/2013	0	0.00	5/13/2021	6.5	6.40	11/20/2019	0	0.00	5/13/2021	0.021	0.00	5/13/2021	360	390.00	8/13/2013			
L10005824413-MW-27S	37.62885	-120.86090	Eastern	Monitoring	EDF	MW-27S	MW-27S	1.2	4.40	2/17/2015	0	0.00	5/13/2021	2.8	5.40	2/20/2018	0.56	1.20	11/13/2018	0	0.00	5/13/2021	280	340.00	10/4/2012			
L10005824413-MW-2D	37.61980	-120.85249	Eastern	Monitoring	EDF	MW-2D	MW-2D	50	4.30	6/7/2008	0	0.00	5/13/2021	3.4	24.00	8/14/2013	1.1	4.60	11/15/2007	0	0.00	5/13/2021	430	610.00	8/4/2011			
L10005824413-MW-2S	37.61982	-120.85246	Eastern	Monitoring	EDF	MW-2S	MW-2S	1.9	4.00	12/10/2009	0	0.00	5/13/2021	36	50.00	11/15/2018	0.31	5.20	11/29/2006	0	0.00	5/13/2021	1100	1800.00	5/28/2020			
L10005824413-MW-3D	37.62532	-120.85532	Eastern	Monitoring	EDF	MW-3D	MW-3D	2.9	4.80	6/7/2008	0	0.00	5/14/2021	0.15	3.70	7/19/2012	0	1.40	2/10/2016	0	0.00	5/14/2021	430	960.00	7/19/2012			
L10005824413-MW-3S	37.62534	-120.85531	Eastern	Monitoring	EDF	MW-3S	MW-3S	2.2	11.00	5/18/2017	0	0.00	5/14/2021	0.35	64.00	11/15/2017	0.24	2.10	11/19/2015	0	0.00	5/14/2021	790	3000.00	8/10/2017			
L10005824413-MW-4D	37.62277	-120.85618	Eastern	Monitoring	EDF	MW-4D	MW-4D	3.1	48.00	11/28/2006	0	0.00	5/13/2021	3.5	3.30	11/21/2019	0.97	2.30	11/21/2019	0	0.00	5/13/2021	410	680.00	8/4/2011			
L10005824413-MW-4S	37.62283	-120.85614	Eastern	Monitoring	EDF	MW-4S	MW-4S	89	110.00	2/28/2019	0	0.00	5/13/2021	0	11.00	11/15/2017	0	1.90	6/7/2008	0	0.00	5/13/2021	680	980.00	2/21/2018			
L10005824413-MW-5S	37.61952	-120.85203	Eastern	Monitoring	EDF	MW-5S	MW-5S		2.70	2/9/2017		0.00	5/13/2021		24.00	11/18/2020		1.70	8/29/2019		0.00	5/13/2021		1200.00	5/28/2020			
L10005824413-MW-7D	37.62611	-120.84943	Eastern	Monitoring	EDF	MW-7D	MW-7D	5.1	8.00	5/17/2018	0	0.00	5/11/2021	0.56	13.00	11/16/2007	0	5.80	11/14/2017	0	0.00	5/11/2021	310	2800.00	4/30/2012			
L10005824413-MW-7S	37.62610	-120.84943	Eastern	Monitoring	EDF	MW-7S	MW-7S	2	5.60	6/4/2009	0	0.00	5/12/2021	20	21.00	11/19/2020	2.2	7.10	5/28/2010	0	0.00	5/12/2021	540	680.00	6/4/2009			
L10005824413-MW-8S	37.62040	-120.85687	Eastern	Monitoring	EDF	MW-8S	MW-8S	1.1	4.70	11/19/2015	0	0.00	5/13/2021	3.7	8.30	5/23/2019	1.1	5.30	11/29/2006	0	0.00	5/13/2021	320	640.00	2/28/2019			
L10005824413-MW-9S	37.61878	-120.85437	Eastern	Monitoring	EDF	MW-9S	MW-9S	0.95	2.40	6/7/2008	0	0.00	5/13/2021	0.24	14.00	11/14/2017	0	0.92	7/18/2012	0	0.00	5/13/2021	290	2600.00	8/2/2011			
S12-MO05	37.69658	-120.97175	Eastern	Municipal	USGS	S12-MO05	S12-MO05		8.90	10/19/2020		0.00	10/19/2020		4.98	10/19/2020		0.00	10/19/2020		0.00	10/19/2020		411.00	10/19/2020		10.50	10/19/2020
S12-MO06	37.70285	-121.10984	Western Unknown	Municipal	USGS	S12-MO06	S12-MO06		8.00	10/19/2020		0.00	10/19/2020		15.80	10/19/2020		0.01	10/19/2020		0.00	10/19/2020		507.00	10/19/2020		52.50	10/19/2020
S12-MO07	37.66553	-120.78761	Eastern	Municipal	USGS	S12-MO07	S12-MO07		2.70	10/21/2020		0.00	10/21/2020		3.69	10/21/2020		0.00	10/21/2020		0.00	10/21/2020		356.00	10/21/2020		2.66	10/21/2020
S12-MO08	37.72242	-121.01800	Eastern	Municipal	USGS	S12-MO08	S12-MO08		8.50	11/3/2020		0.21	11/3/2020		2.92	11/3/2020		0.00	11/3/2020		0.03	11/3/2020		145.00	11/3/2020		0.21	11/3/2020
S12-MO09-U	37.71117	-120.72383	Eastern	Municipal	USGS	S12-MO09-U	S12-MO09-U		4.30	12/3/2020		0.00	12/3/2020		2.93	12/3/2020		0.00	12/3/2020		0.00	12/3/2020		188.00	12/3/2020		0.09	12/3/2020
S12-MO10	37.78458	-120.82131	Eastern	Municipal	USGS	S12-MO10	S12-MO10		0.80	12/15/2020		0.00	12/15/2020		2.39	12/15/2020		0.00	12/15/2020		0.00	12/15/2020		183.00	12/15/2020		0.55	12/15/2020
S12-MO11	37.66614	-120.89696	Eastern	Municipal	USGS	S12-MO11	S12-MO11		3.00	1/28/2021		0.00	1/28/2021		5.99	1/28/2021		0.00	1/28/2021		0.00	1/28/2021		287.00	1/28/2021		6.89	1/28/2021
S12-MO12-U	37.78371	-120.82063	Eastern	Municipal	USGS	S12-MO12-U	S12-MO12-U		1.00	2/25/2021		0.00	2/25/2021		2.13	2/25/2021		0.00	2/25/2021		0.00	2/25/2021		162.00	2/25/2021		0.48	2/25/2021
S12-MO13-U	37.76847	-120.81689	Eastern	Municipal	USGS	S12-MO13-U	S12-MO13-U		2.20	2/25/2021		0.00	2/25/2021		4.00	2/25/2021		0.00	2/25/2021		0.00	2/25/2021		145.00	2/25/2021		0.36	2/25/2021
S12-UP03	37.78561	-120.76481	Eastern	Municipal	USGS	S12-UP03	S12-UP03		0.87	10/20/2020		0.00	10/20/2020		5.50	10/20/2020		0.00	10/20/2020		0.00	10/20/2020		169.00	10/20/2020		0.33	10/20/2020
S12-UP04	37.80007	-120.66974	Eastern	Municipal	USGS	S12-UP04	S12-UP04		9.90	11/4/2020		0.00	11/4/2020		2.36	11/4/2020		0.00	11/4/2020		0.00	11/4/2020		200.00	11/4/2020		0.29	11/4/2020
SL185742938-M-107	37.65057	-121.01623	Western Upper	Monitoring	EDF	M-107	M-107	3.8	8.20	1/6/2011													370	960.00	1/8/2019			

Appendix B Groundwater Quality Monitoring Network

								Arsenic			DBCP			Nitrate as N			PCE			TCP			TDS			Uranium		
Well ID	Latitude	Longitude	Principal Aquifer	Well Type	Dataset Name[1]	Alternative Well ID	Alternative Well ID 2	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date	WY 2022 Max	Historical Max Conc (ug/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01								3.80	3/8/2019												
SL185742938-M-160	37.64939	-121.01989	Western Upper	Monitoring	EDF	M-160	M-160	7.1	8.10	7/11/2008													480	840.00	1/11/2007			
SL185742938-M-120	37.65110	-121.01524	Western Upper	Monitoring	EDF	M-120	M-120	6.8	8.00	1/19/2010													370	380.00	1/16/2020			
SL185742938-M-105	37.65301	-121.01874	Western Upper	Monitoring	EDF	M-105	M-105	7	7.80	1/17/2013													500	620.00	1/16/2020			
SL185742938-M-162	37.64693	-121.01441	Western Upper	Monitoring	EDF	M-162	M-162	6	7.80	7/19/2006													650	1100.00	7/19/2016			
SL185742938-M-101	37.64664	-121.01610	Western Upper	Monitoring	EDF	M-101	M-101	6.8	7.30	1/29/2006													730	1500.00	1/29/2006			
SL185742938-M-112	37.64369	-121.01082	Western Upper	Monitoring	EDF	M-112	M-112	4.9	7.20	1/7/2010													420	4800.00	7/14/2009			
SL185742938-M-163	37.64860	-121.01338	Western Upper	Monitoring	EDF	M-163	M-163	7.3	7.10	1/20/2011													540	1400.00	1/25/2006			
SL185742938-M-113	37.64365	-121.01084	Western Upper	Monitoring	EDF	M-113	M-113	2.8	6.20	7/26/2007													560	800.00	7/19/2006			
5010010-003	37.64277	-120.99117	Western Upper	Municipal	DHS	5010010-003	WELL 001		5.00	1/10/2001		0.00	5/12/2021		5.85	9/6/2005	4.9	8.70	6/9/2021		0.01	2/3/2021		560.00	6/28/2006			
5000041-001	37.63766	-121.15292	Western Upper	Municipal	DHS	5000041-001	EAST WELL NEW #02							3.1	7.60	12/1/2020												
5000274-001	37.62464	-121.05458	Western Upper	Municipal	DHS	5000274-001	NEW WELL							0.97	8.00	2/15/2002												
5000284-001	37.60964	-121.11564	Western Upper	Municipal	DHS	5000284-001	WELL 01							6.1	9.83	5/1/2008												
5000290-001	37.63844	-121.12181	Western Upper	Municipal	DHS	5000290-001	LPA REPORTED PRIMARY SOURCE							9.2	10.10	12/11/2014												
5000295-001	37.60964	-121.11564	Western Upper	Municipal	DHS	5000295-001	WELL 01							17	17.40	1/6/2020												
5000388-001	37.65169	-121.02475	Western Upper	Municipal	DHS	5000388-001	WELL 01							12	15.40	11/7/2018												
5000409-001	37.60867	-121.11690	Western Upper	Municipal	DHS	5000409-001	LPA REPORTED PRIMARY SOURCE							17	12.00	7/5/2021												
5010010-005	37.64003	-121.00358	Western Upper	Municipal	DHS	5010010-005	WELL 003													0	0.00	5/12/2021						
5010010-044	37.68880	-121.05788	Western Upper	Municipal	DHS	5010010-044	WELL 042					0.09	5/5/2003	8.7	9.20	4/7/2021					0.00	5/5/2021						
5010010-061	37.65147	-121.02083	Western Upper	Municipal	DHS	5010010-061	WELL 056							0	2.90	1/4/1993		0.54	10/11/2001		0.00	2/10/2021						
5010010-070	37.63391	-120.99295	Western Upper	Municipal	DHS	5010010-070	WELL 057							6.5	5.70	11/13/2018					0.00	2/10/2021						
5010010-146	37.62581	-121.03147	Western Upper	Municipal	DHS	5010010-146	WELL 304							6.8	7.84	1/6/2016					0.00	2/3/2021				28	27.80	7/22/2004
5010010-147	37.62531	-121.03148	Western Upper	Municipal	DHS	5010010-147	WELL 301							8.9	21.00	10/2/2019					0.00	5/5/2021				16	22.00	10/4/2017
5010010-148	37.63222	-121.01908	Western Upper	Municipal	DHS	5010010-148	WELL 283 - ANWAR MANOR							0.5	9.30	5/12/1993		0.00	6/1/2021		0.00	2/3/2021				3.6	27.00	9/16/1992
5010010-149	37.64199	-121.03415	Western Upper	Municipal	DHS	5010010-149	WELL 237 - ELM							8.8	8.99	1/6/2016		0.00	5/5/2021		0.00	5/5/2021						
5010010-151	37.64091	-121.01933	Western Upper	Municipal	DHS	5010010-151	WELL 236 - EMERALD				0	1.50	1/6/2016								0.00	2/3/2021					21.00	9/3/1992
SL205012989-M-19C1	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-19C1	M-19C1											0.00	4/15/2021									
SL205012989-M-20C1	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-20C1	M-20C1										0	0.00	4/14/2021									
SL205012989-M-20D	37.72000	-121.12000	Western Lower	Monitoring	EDF	M-20D	M-20D										0	0.00	10/7/2021									
SL205012989-M-21C1	37.72000	-121.13000	Western Upper	Monitoring	EDF	M-21C1	M-21C1										0	0.00	10/7/2021									
SL205012989-M-21D	37.72000	-121.13000	Western Lower	Monitoring	EDF	M-21D	M-21D										0	0.00	10/7/2021									
SL205012989-M-23A	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-23A	M-23A										0	0.00	4/14/2021									
SL205012989-M-23C1	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-23C1	M-23C1											0.00	4/14/2021									
SL205012989-M-23D	37.72000	-121.12000	Western Lower	Monitoring	EDF	M-23D	M-23D										0	0.00	4/14/2021									
SL205012989-M-26C2	37.73000	-121.11000	Western Lower	Monitoring	EDF	M-26C2	M-26C2										0	0.00	10/8/2021									
SL205012989-M-30C1	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-30C1	M-30C1										0	0.00	10/8/2021									
SL205012989-M-30C2	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-30C2	M-30C2										0	0.00	10/8/2021									
SL205012989-M-31C1	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-31C1	M-31C1										0	0.00	10/7/2021									
SL205012989-M-31C2D	37.72000	-121.12000	Western Unknown	Monitoring	EDF	M-31C2D	M-31C2D										0	0.00	4/15/2021									
SL205012989-M-32D	37.72050	-121.13170	Western Lower	Monitoring	EDF	M-32D	M-32D										0	0.00	10/8/2021									
SL205012989-M-34A	37.72050	-121.13240	Western Upper	Monitoring	EDF	M-34A	M-34A										0	0.00	4/9/2021									
SL205012989-M-34C	37.72050	-121.13240	Western Upper	Monitoring	EDF	M-34C	M-34C										0	0.00	10/8/2021									
SL205012989-M-34D	37.72050	-121.13240	Western Lower	Monitoring	EDF	M-34D	M-34D										0	0.00	10/8/2021									
SL205012989-M-34D1	37.72050	-121.13240	Western Lower	Monitoring	EDF	M-34D1	M-34D1											0.00	4/9/2021									
SL205012989-M-35A	37.72030	-121.13850	Western Upper	Monitoring	EDF	M-35A	M-35A										0	0.00	10/8/2021									
SL205012989-M-35B	37.72030	-121.13850	Western Upper	Monitoring	EDF	M-35B	M-35B										0	0.00	4/9/2021									
SL205012989-M-35D	37.72030	-121.13850	Western Lower	Monitoring	EDF	M-35D	M-35D										0	0.00	4/9/2021									
SL205012989-M-36C	37.72130	-121.12380	Western Upper	Monitoring	EDF	M-36C	M-36C										0	0.00	10/8/2021									
SL205012989-M-36D	37.72130	-121.12380	Western Lower	Monitoring	EDF	M-36D	M-36D											0.00	4/9/2021									
SL205012989-M-37D	37.71700	-121.13250	Western Lower	Monitoring	EDF	M-37D	M-37D											0.00	4/9/2021									
SL205012989-M-5A	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-5A	M-5A										0	0.00	10/8/2021									
SL205012989-M-5B	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-5B	M-5B											0.00	4/14/2021									
SL205012989-M-5C1	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-5C1	M-5C1										0	0.00	10/8/2021									
SL205012989-M-5C2	37.73000	-121.11000	Western Lower	Monitoring	EDF	M-5C2	M-5C2										0	0.00	10/8/2021									
SL205012989-M-7A	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-7A	M-7A										0	0.00	4/15/2021									
SL205012989-MW-11	37.72000	-121.14000	Western Upper	Monitoring	EDF	MW-11	MW-11										0	0.00	10/7/2021									
SL205012989-MW-7	37.73000	-121.11000	Western Upper	Monitoring	EDF	MW-7	MW-7										0	0.00	10/7/2021									
SL205012989-TH-1	37.73000	-121.11000	Western Lower	Monitoring	EDF	TH-1	TH-1										0	0.00	4/15/2021									
SL205012989-TH-10	37.72000	-121.12000	Western Upper	Monitoring	EDF	TH-10	TH-10										0	0.00	10/7/2021									
SL205012989-TH-9	37.72000	-121.12000	Western Upper	Monitoring	EDF	TH-9	TH-9										0	0.00	10/7/2021									
SL205833043-MMW-01A	37.68713	-120.92128	Eastern	Monitoring	EDF	MMW-01A	MMW-01A				0.071	0.20	8/17/2018							0.019	0.04	8/17/2018						
SL205833043-MMW-02A	37.68549	-120.92007	Eastern	Monitoring	EDF	MMW-02A	MMW-02A													0.0076	0.01	2/19/2016						
SL205833043-MMW-14A	37.68550	-120.92110	Eastern	Monitoring	EDF	MMW-14A	MMW-14A													0.0054	0.01	8/18/2016						
SL205833043-MMW-18A	37.68647	-120.92049	Eastern	Monitoring	EDF	MMW-18A	MMW-18A													0.017	0.02	8/19/2016						
SL205833043-MMW-21A	37.68613	-120.92034	Eastern	Monitoring	EDF	MMW-21A	MMW-21A													0	0.00	3/22/2021						
SL205833043-MMW-24A	37.68665	-120.92103	Eastern	Monitoring	EDF	MMW-24A	MMW-24A				0.021	0.06	2/19/2016				0	0.00	3/23/2021	1.9	1.80	2/19/2016						
SL205833043-MMW-27A	37.68517	-120.91972	Eastern	Monitoring	EDF	MMW-27A	MMW-27A				0.12	0.21	12/19/2015				0	0.00	3/23/2021	0.051	0.06	1/25/2019						
SL205833043-MMW-28A	37.68629	-120.92163	Eastern	Monitoring	EDF	MMW-28A	MMW-28A				0.03	0.07	8/16/2018				0	0.00	3/22/2021	0.45	0.90	3/22/2021						
SL205833043-MMW-29A	37.68677	-120.92084	Eastern	Monitoring	EDF	MMW-29A	MMW-29A				0.013	0.00	3/23/2021				0	0.00	3/23/2021	2.1	2.10	3/23/2021						

1. Dataset Descriptions:

AGLAND- Domestic wells monitored by the SWRCB Irrigated Lands Regulatory Program

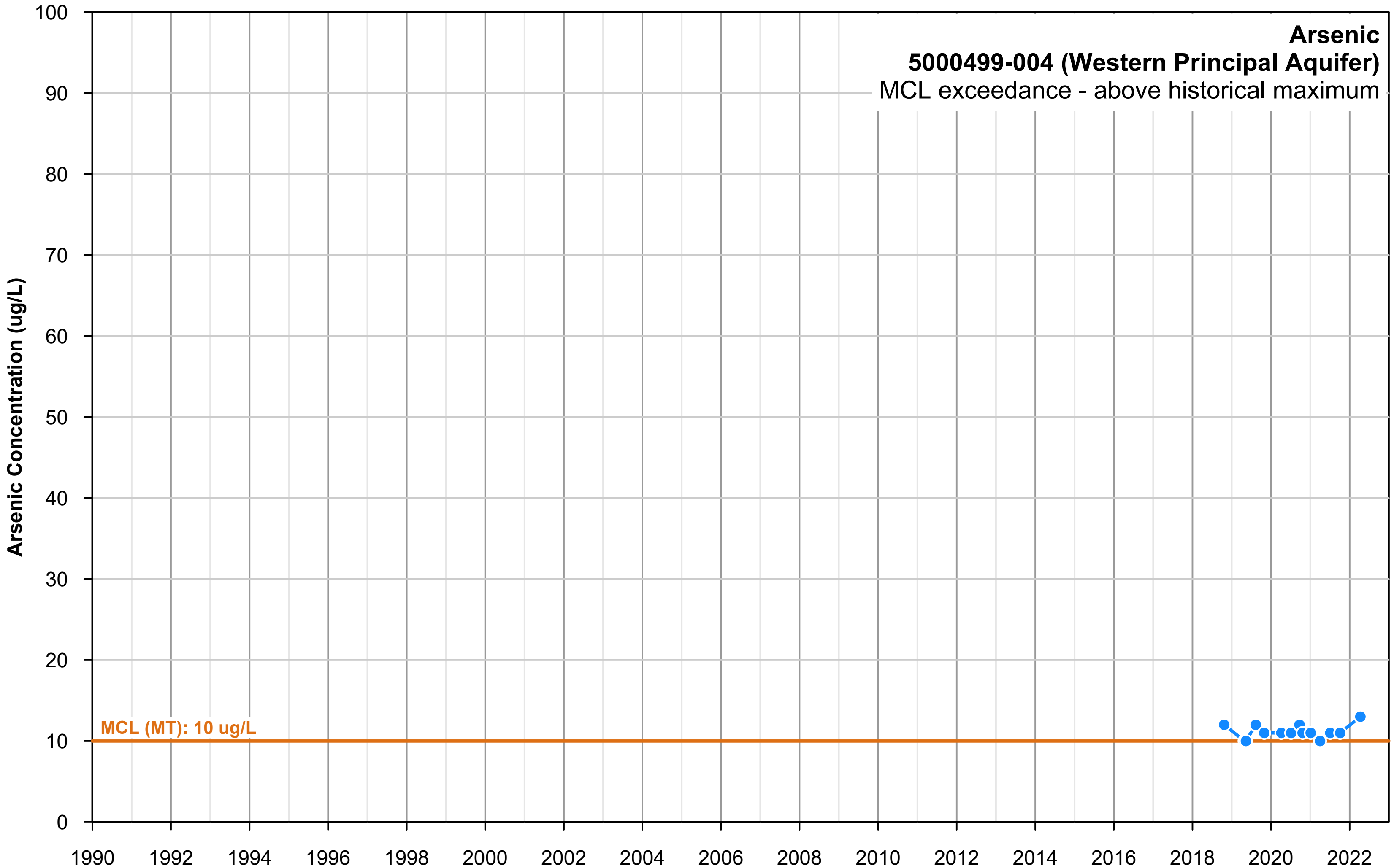
DHS- Untreated and unblended groundwater sampled from public supply wells and reported to the Division of Drinking Water, formerly Department of Health Services

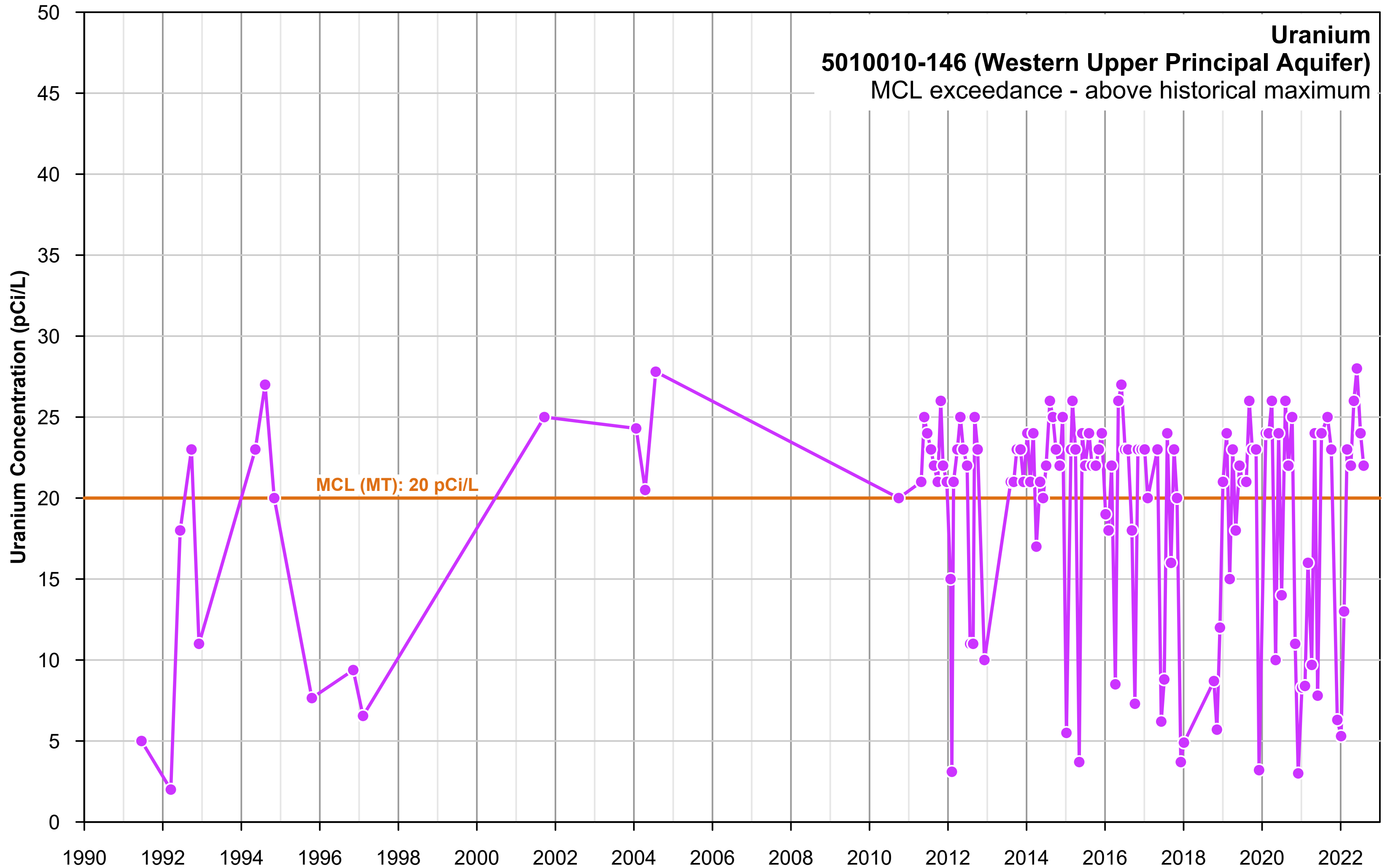
EDF- Monitoring wells at regulated facilities reported by State Water Resources Control Board, submitted in Electronic Deliverable Format

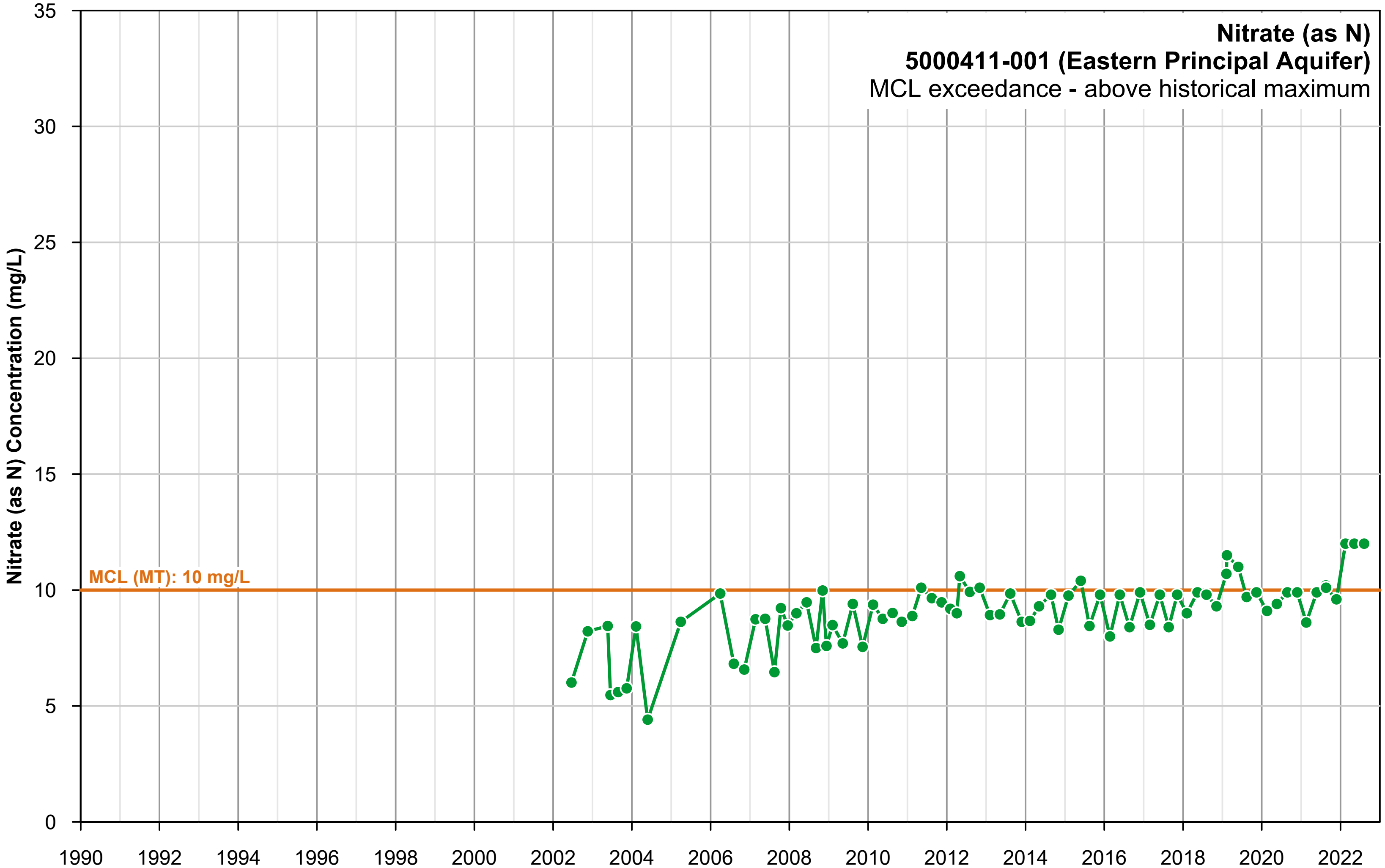
USGS- Wells monitored by United States Geological Survey Groundwater Ambient Monitoring and Assessment (USGS-GAMA) program

APPENDIX C

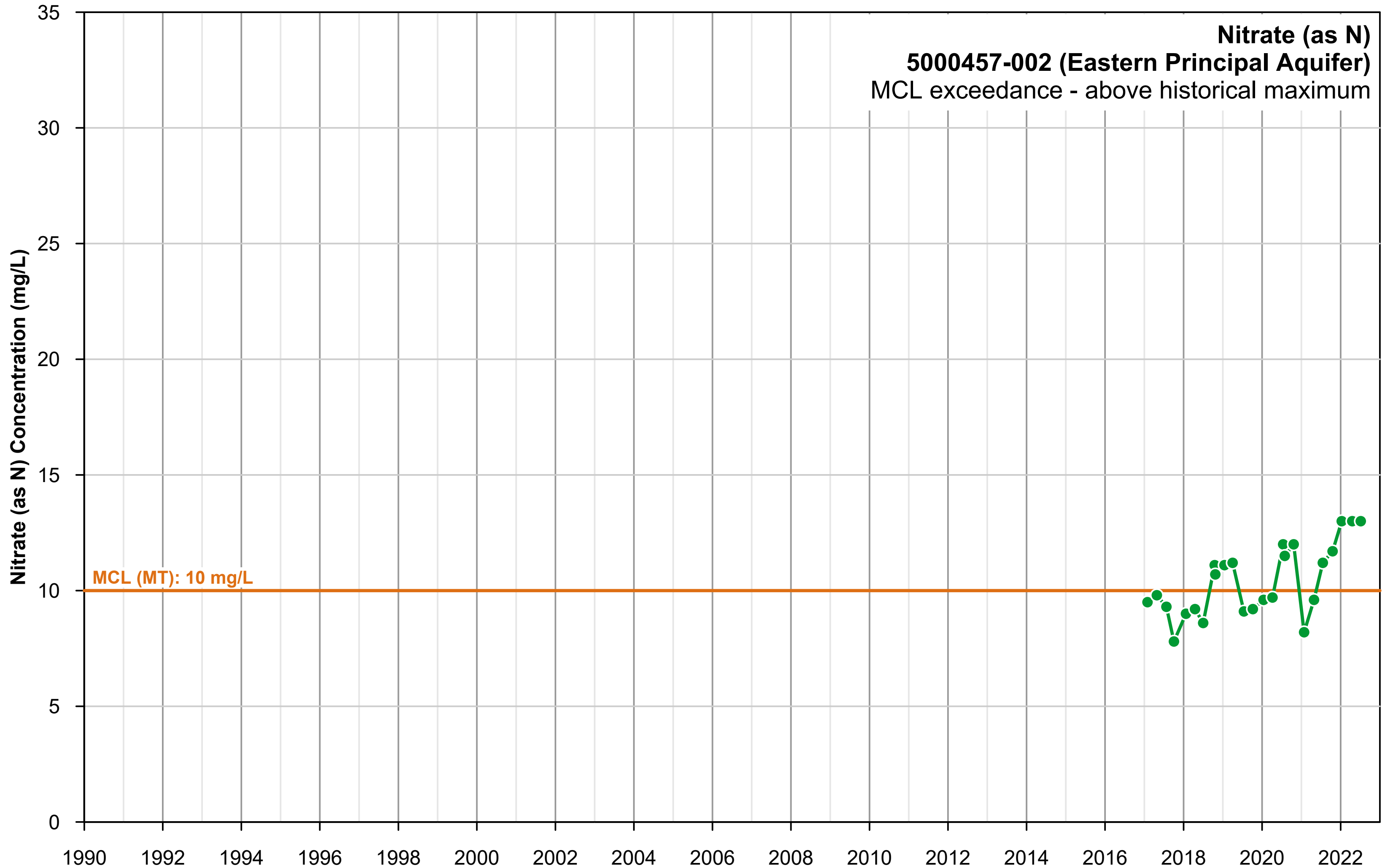
Water Quality Time-Concentration Plots


Arsenic
5000499-004 (Western Principal Aquifer)
MCL exceedance - above historical maximum
Arsenic Concentration (ug/L)
MCL (MT): 10 ug/L
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

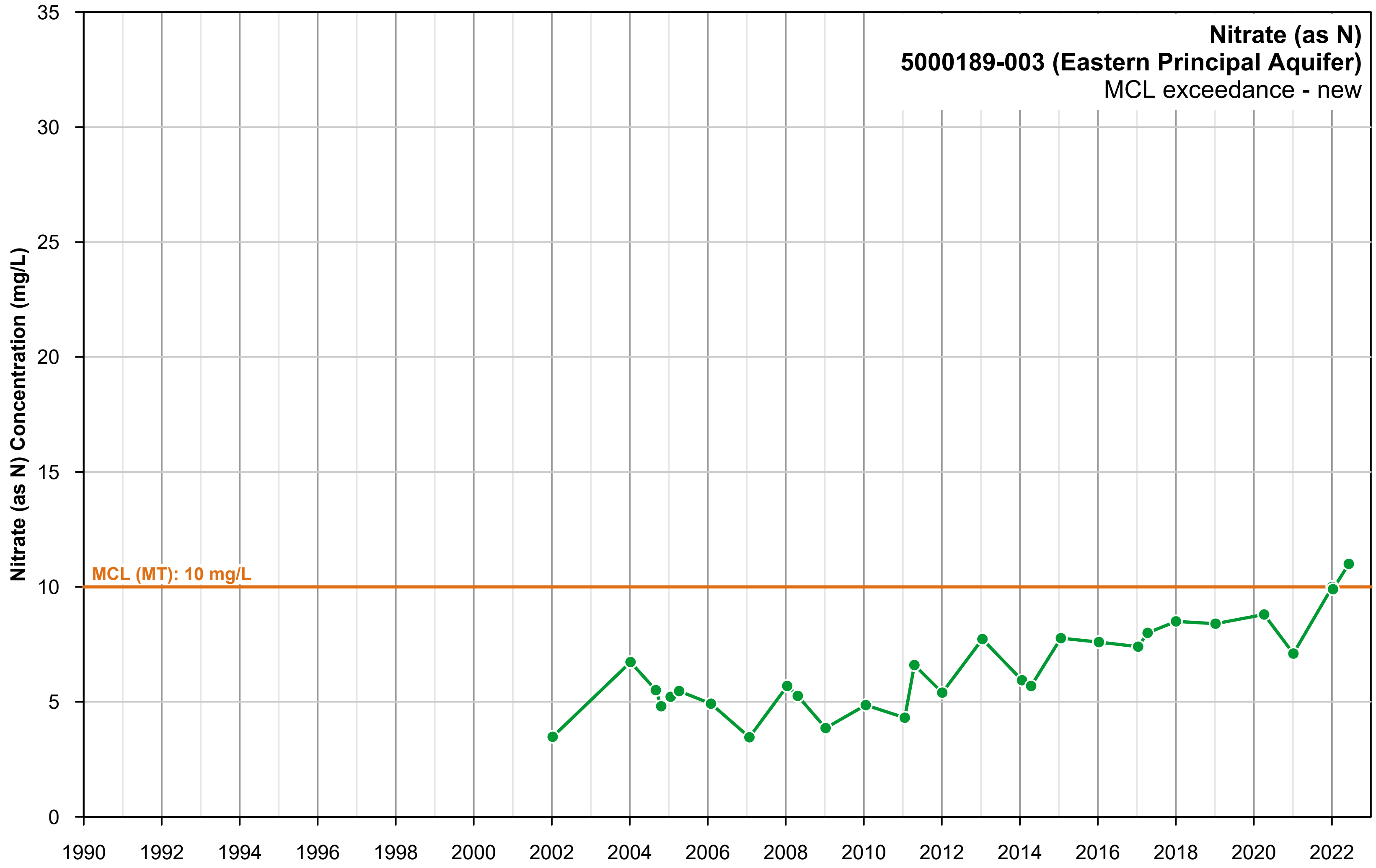

Uranium
5010010-146 (Western Upper Principal Aquifer)
MCL exceedance - above historical maximum
MCL (MT): 20 pCi/L
Uranium Concentration (pCi/L)
0
5
10
15
20
25
30
35
40
45
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



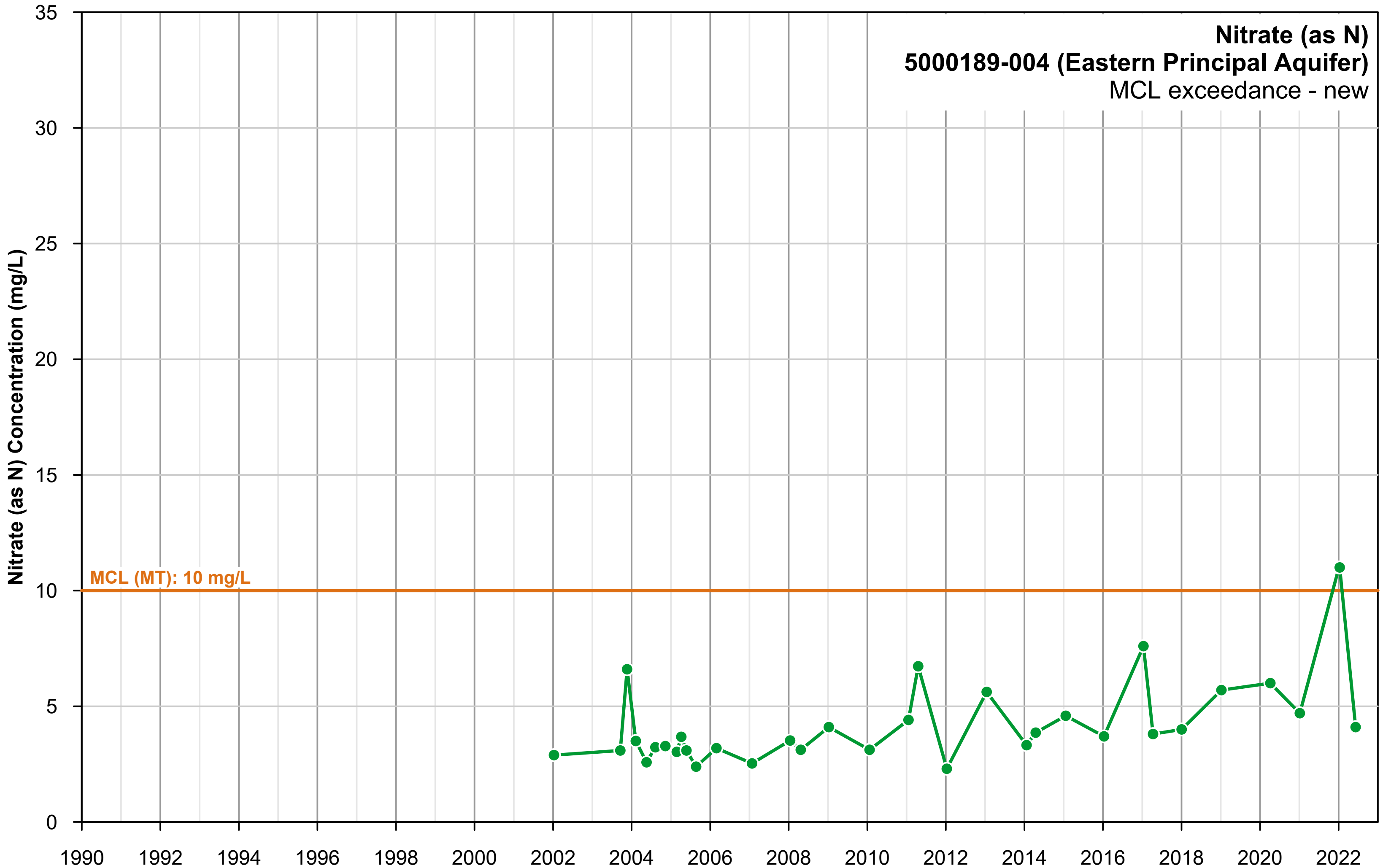
Nitrate (as N)
5000411-001 (Eastern Principal Aquifer)
MCL exceedance - above historical maximum
MCL (MT): 10 mg/L
Nitrate (as N) Concentration (mg/L)
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



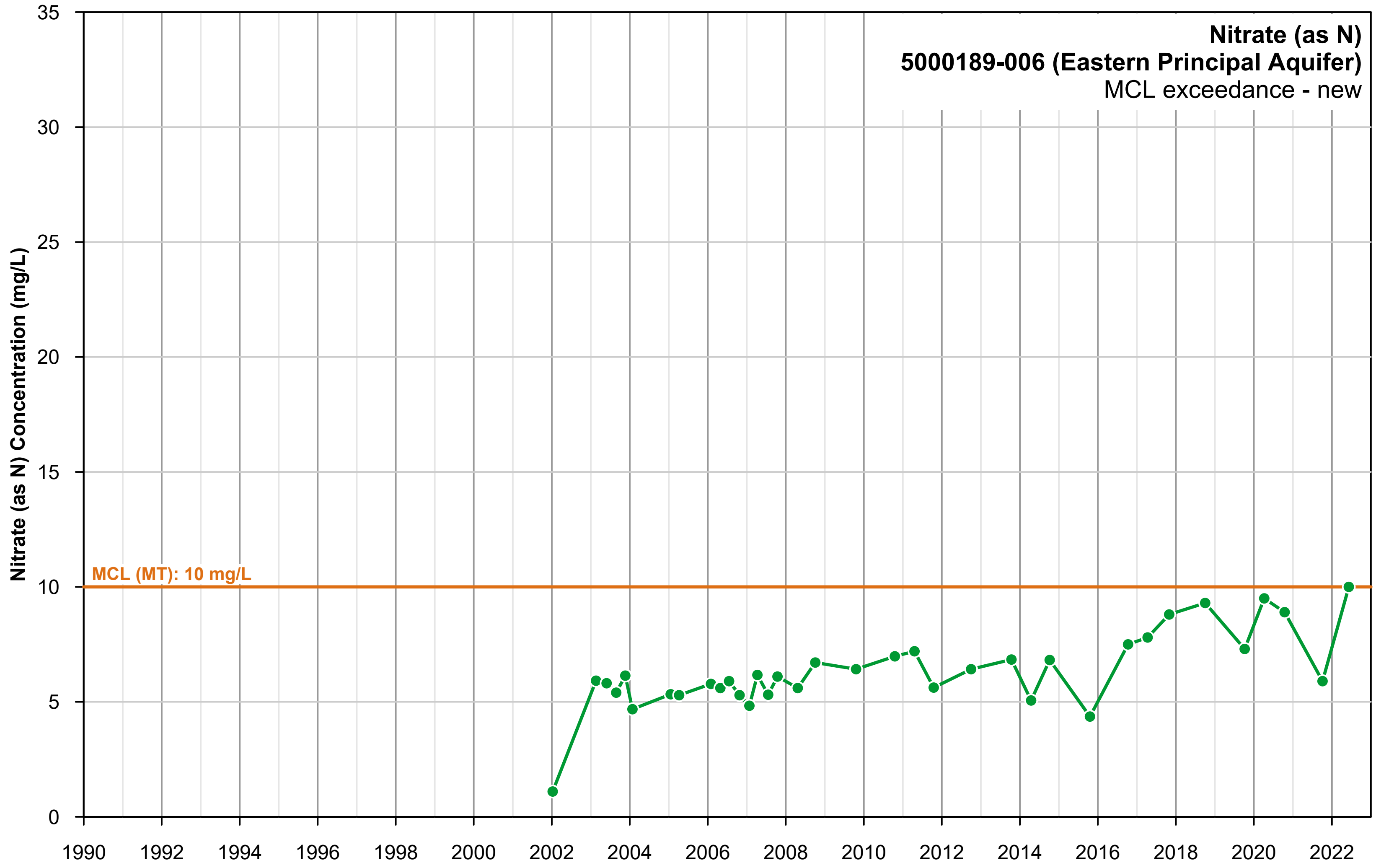
Nitrate (as N)
5000457-002 (Eastern Principal Aquifer)
MCL exceedance - above historical maximum
Nitrate (as N) Concentration (mg/L)
MCL (MT): 10 mg/L
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



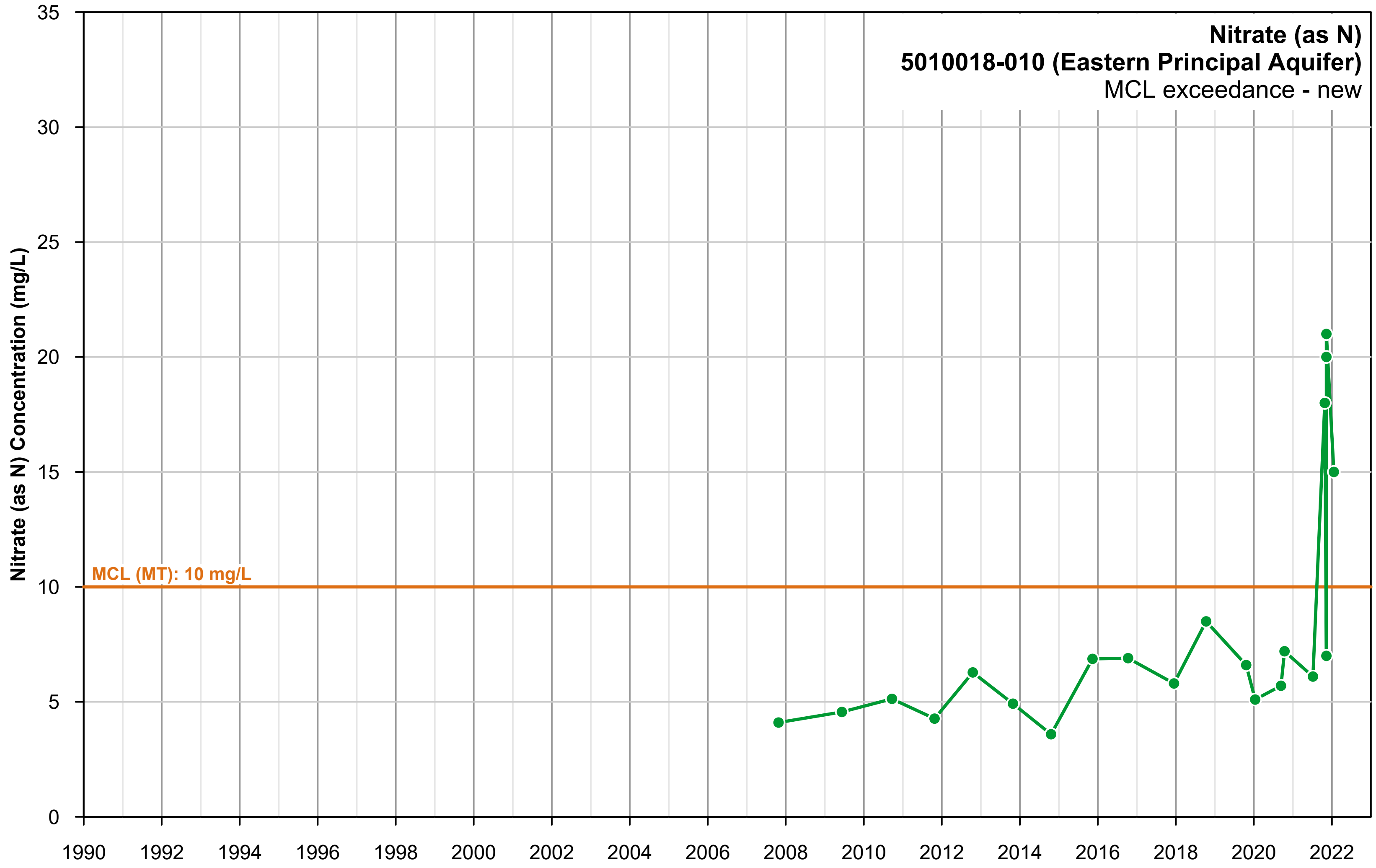
Nitrate (as N)
5000189-003 (Eastern Principal Aquifer)
MCL exceedance - new
MCL (MT): 10 mg/L
Nitrate (as N) Concentration (mg/L)
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



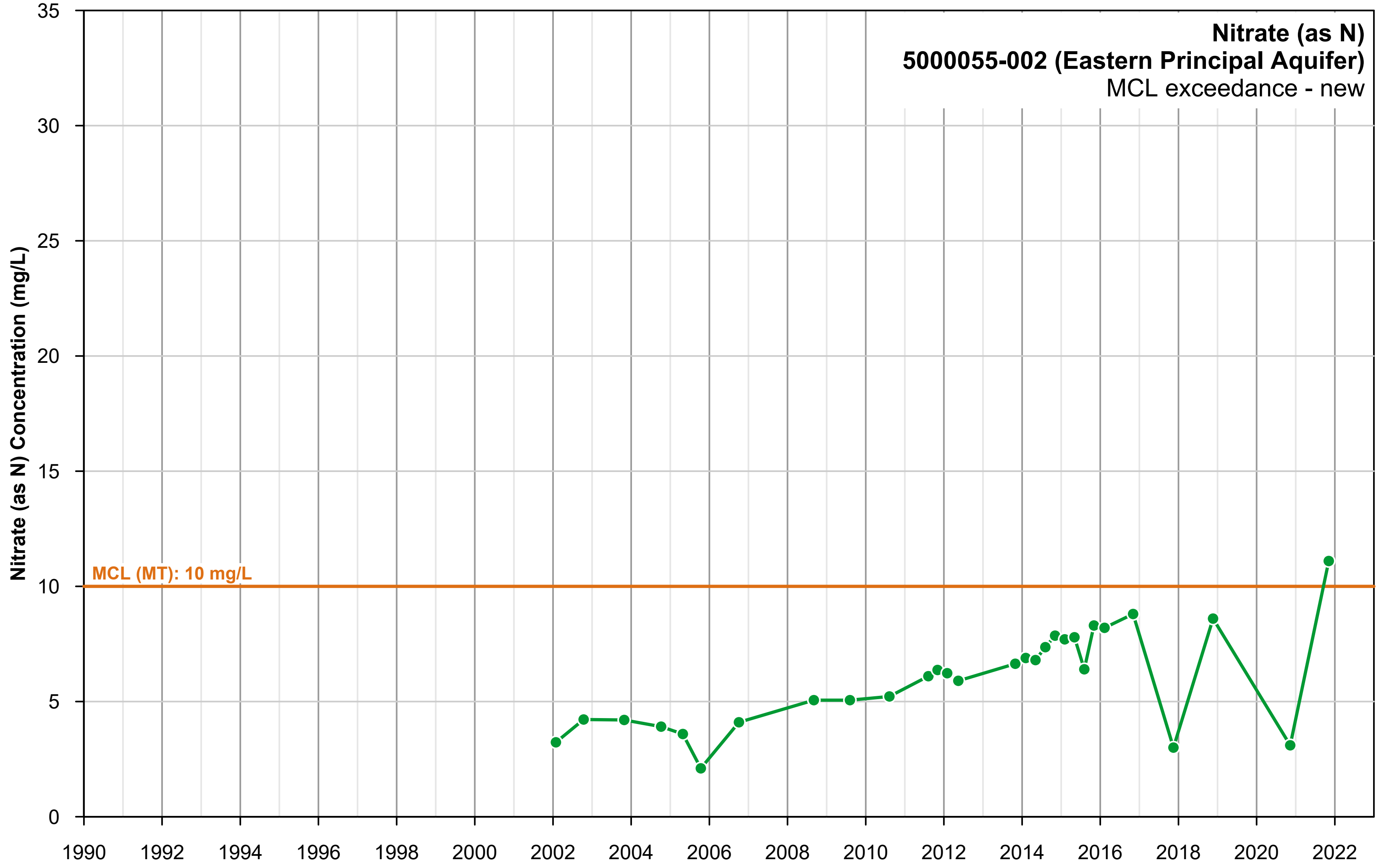
Nitrate (as N)
5000189-004 (Eastern Principal Aquifer)
MCL exceedance - new
MCL (MT): 10 mg/L
Nitrate (as N) Concentration (mg/L)
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

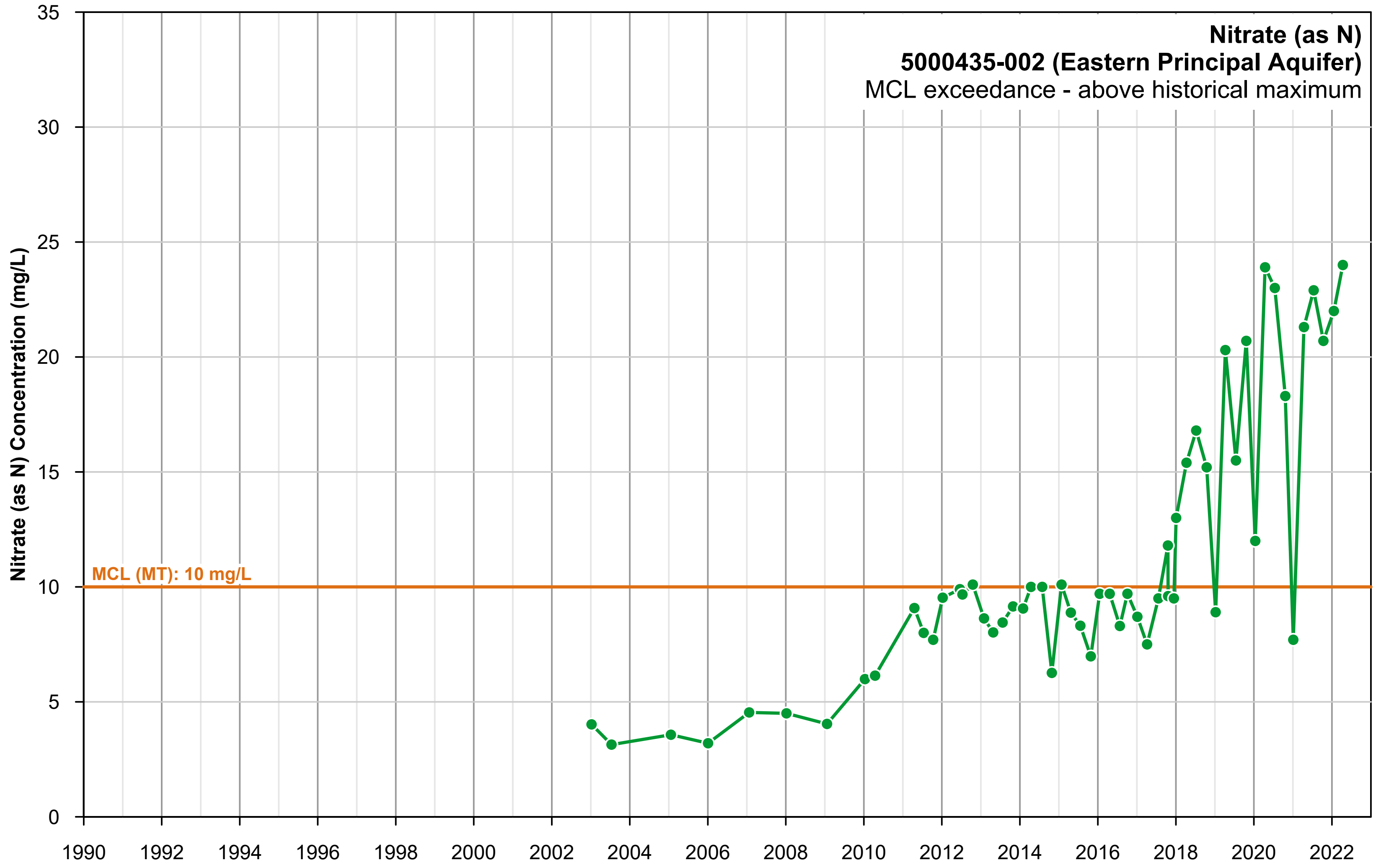


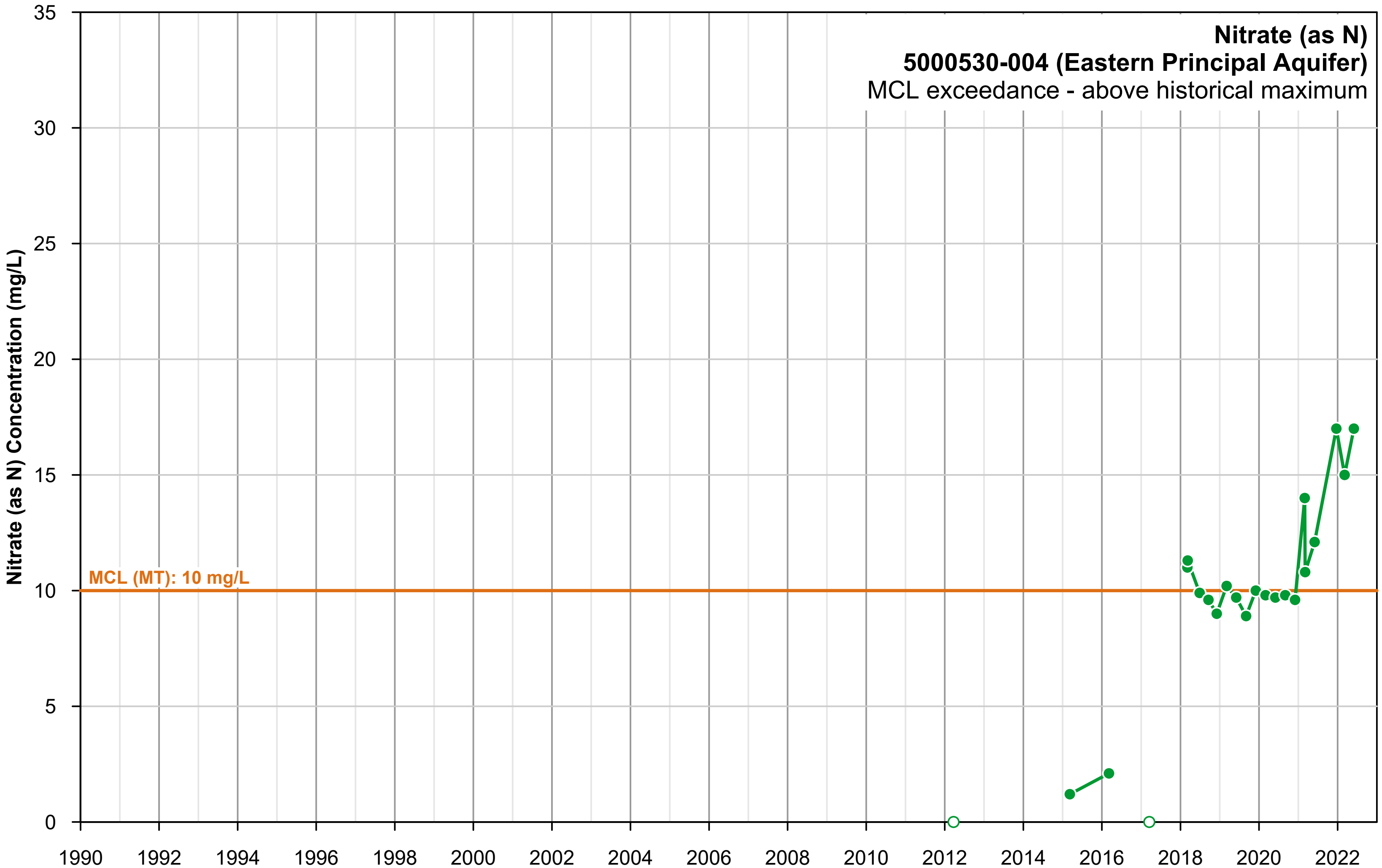
Nitrate (as N)
5000189-006 (Eastern Principal Aquifer)
MCL exceedance - new
MCL (MT): 10 mg/L
Nitrate (as N) Concentration (mg/L)
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



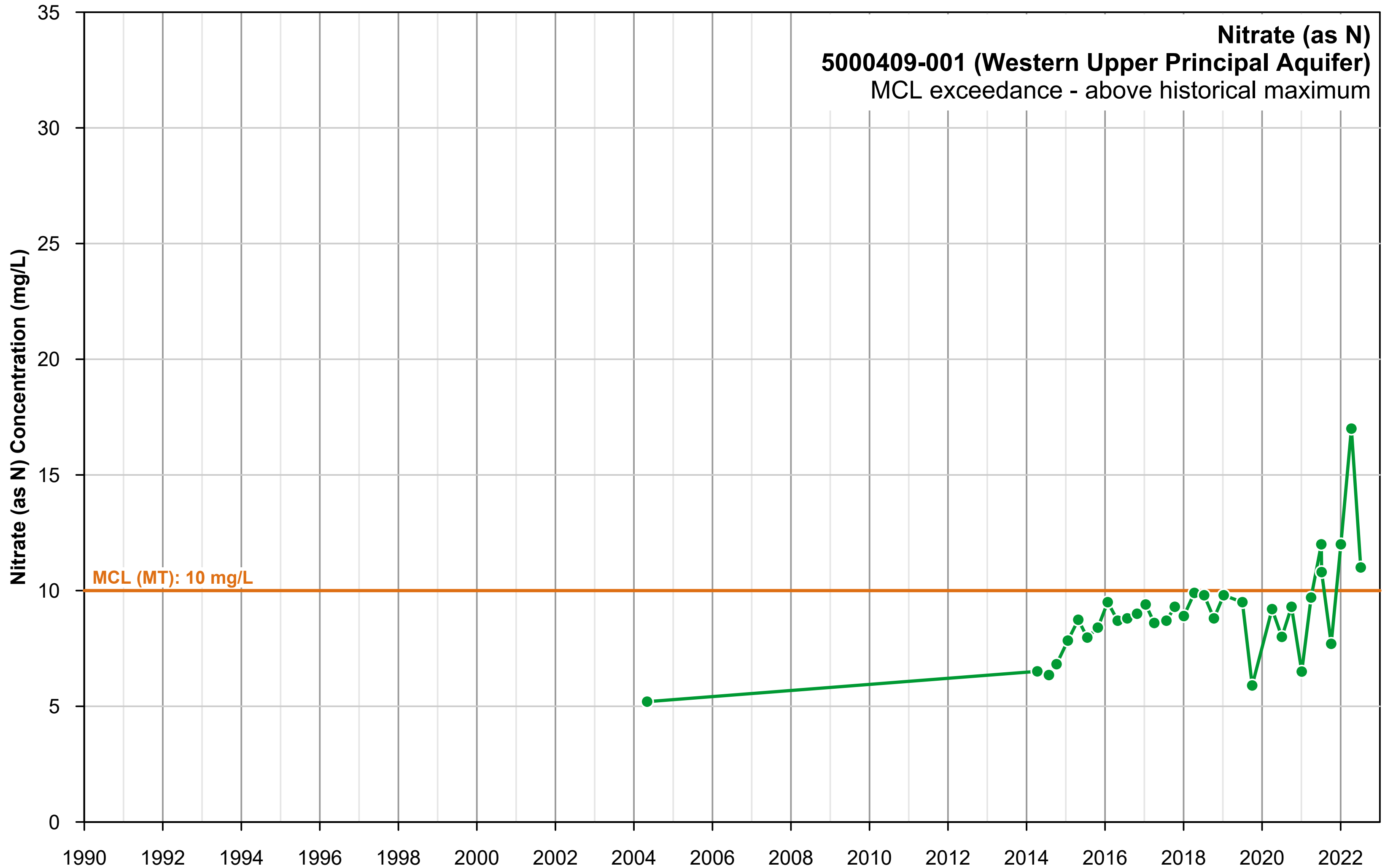
Nitrate (as N)
5010018-010 (Eastern Principal Aquifer)
MCL exceedance - new
MCL (MT): 10 mg/L
Nitrate (as N) Concentration (mg/L)
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

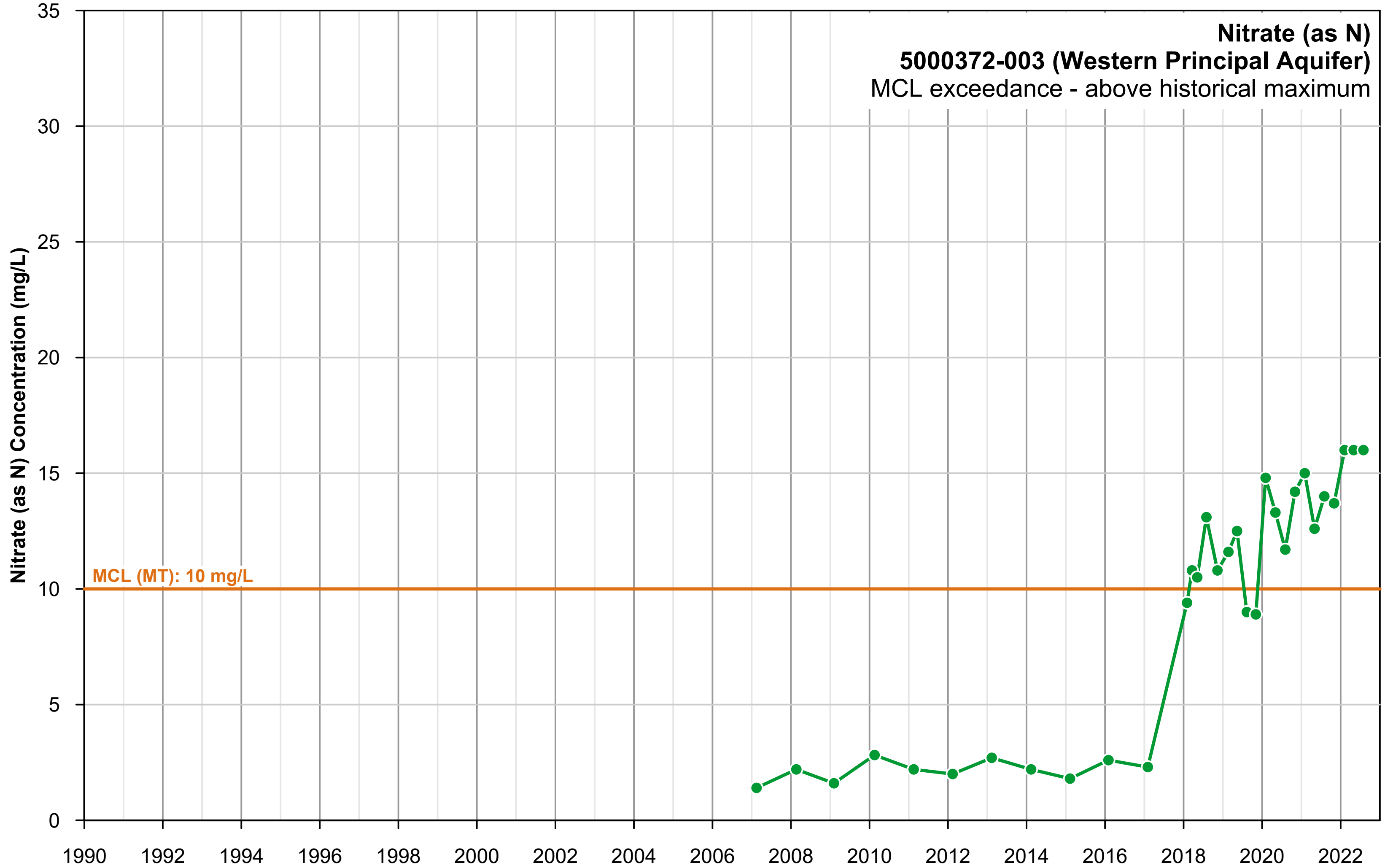

Nitrate (as N)
5000055-002 (Eastern Principal Aquifer)
MCL exceedance - new
MCL (MT): 10 mg/L
Nitrate (as N) Concentration (mg/L)
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Nitrate (as N)
5000435-002 (Eastern Principal Aquifer)
MCL exceedance - above historical maximum
Nitrate (as N) Concentration (mg/L)
MCL (MT): 10 mg/L
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

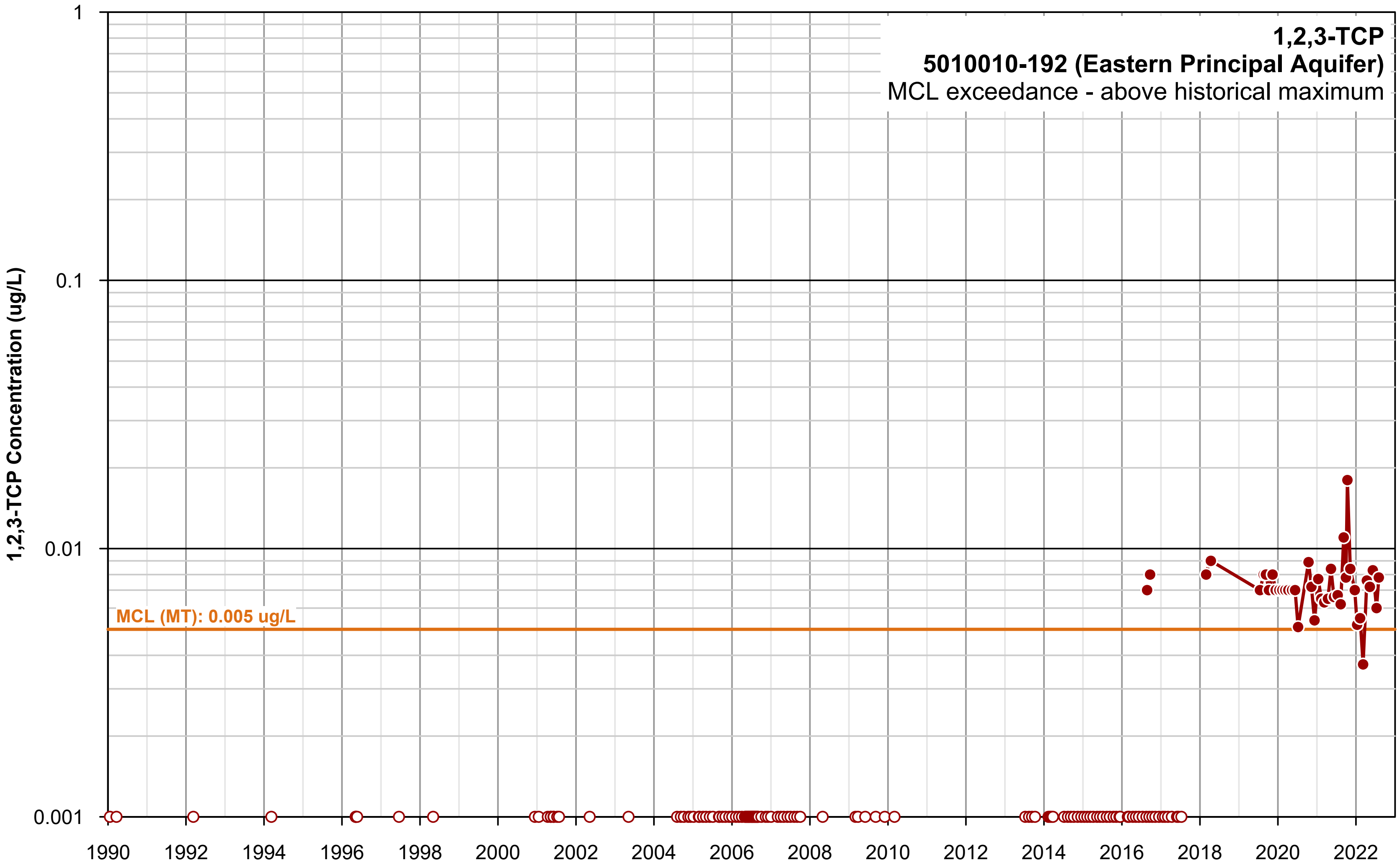


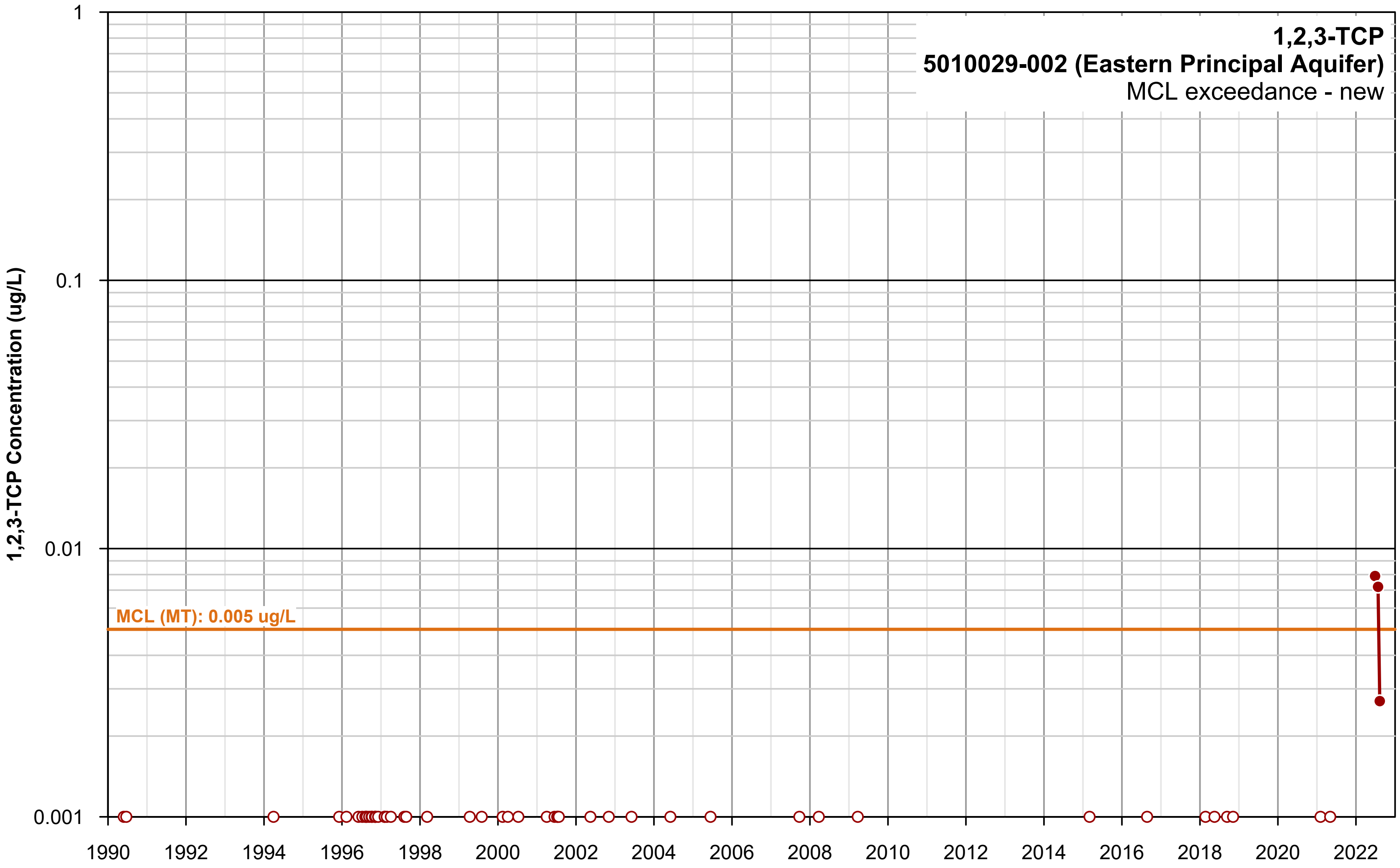
Nitrate (as N)
5000530-004 (Eastern Principal Aquifer)
MCL exceedance - above historical maximum
Nitrate (as N) Concentration (mg/L)
MCL (MT): 10 mg/L
35
30
25
20
15
10
5
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

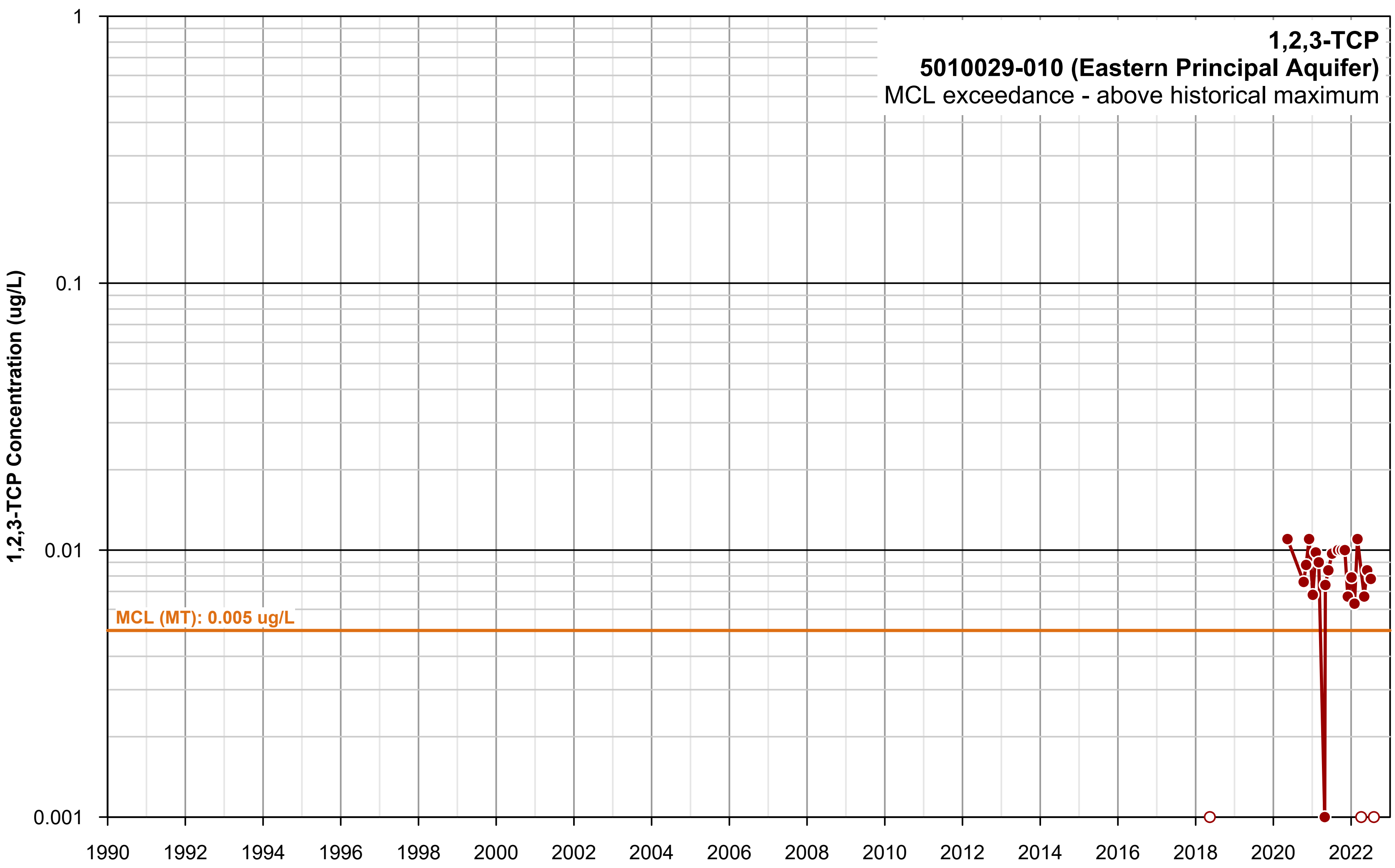

Nitrate (as N)
5000409-001 (Western Upper Principal Aquifer)
MCL exceedance - above historical maximum
Nitrate (as N) Concentration (mg/L)
MCL (MT): 10 mg/L
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

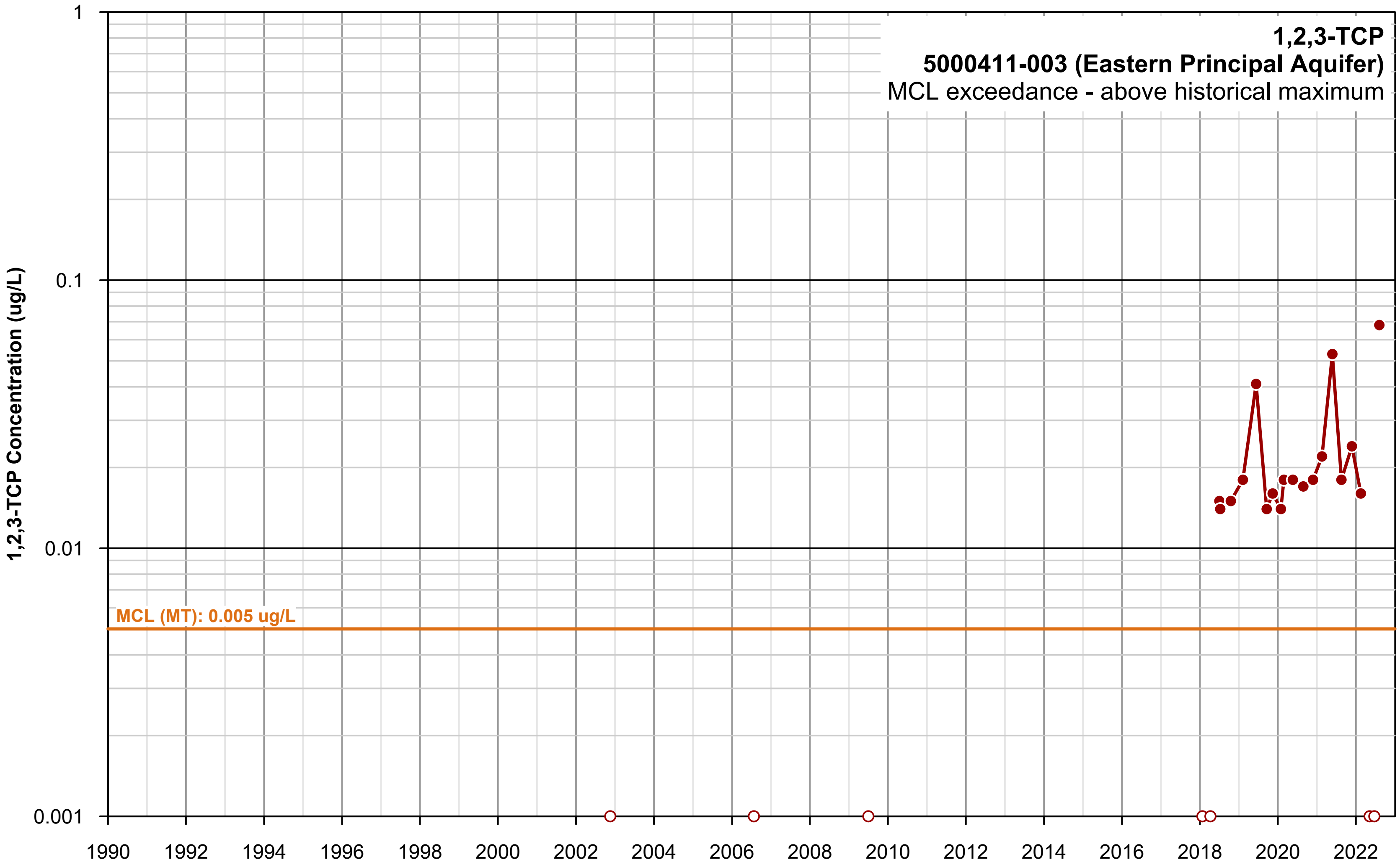


Nitrate (as N)
5000372-003 (Western Principal Aquifer)
MCL exceedance - above historical maximum
MCL (MT): 10 mg/L
Nitrate (as N) Concentration (mg/L)
0
5
10
15
20
25
30
35
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

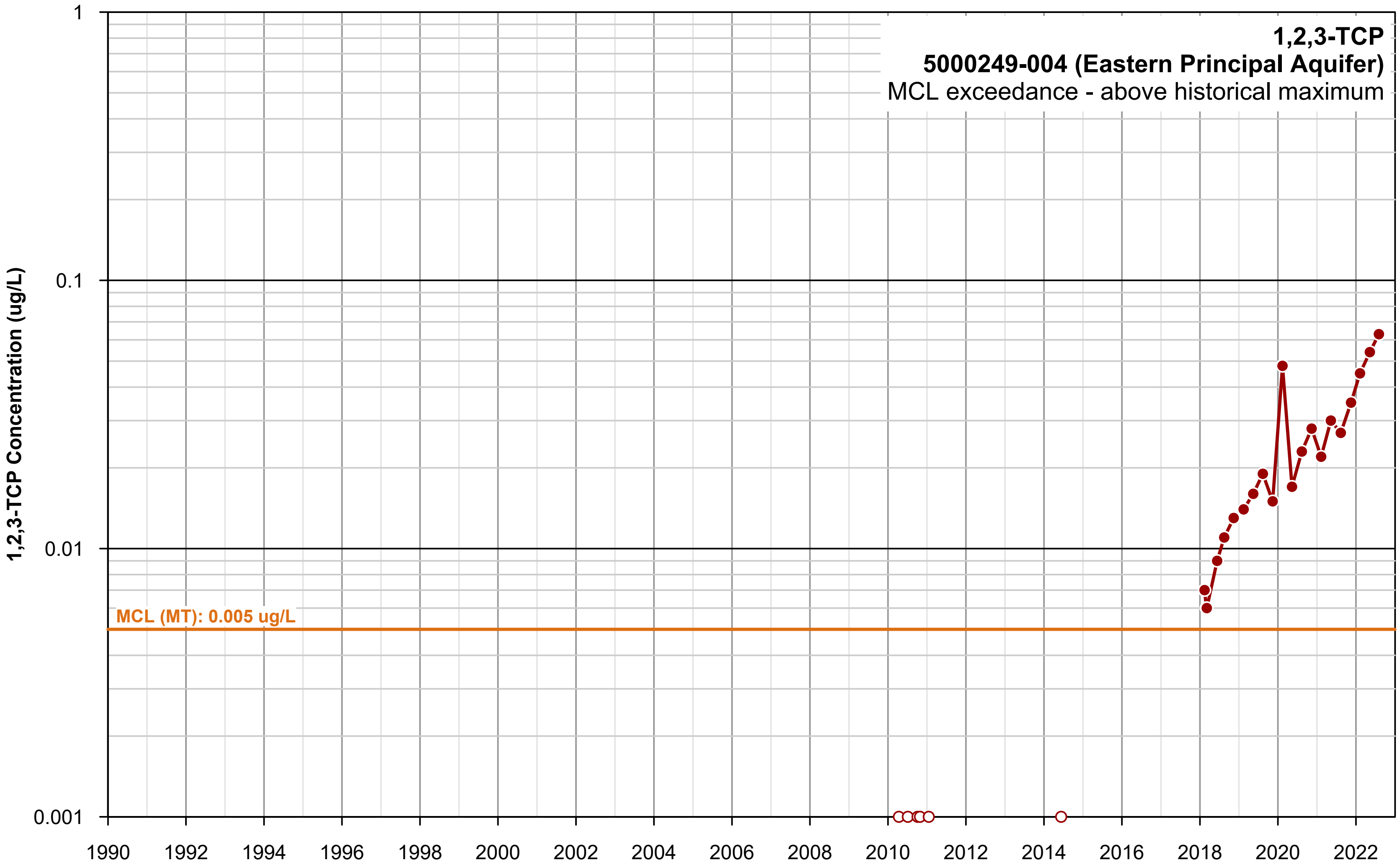

1,2,3-TCP
5010010-192 (Eastern Principal Aquifer)
MCL exceedance - above historical maximum
1,2,3-TCP Concentration (ug/L)
MCL (MT): 0.005 ug/L
1
0.1
0.01
0.001
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


1,2,3-TCP
5010029-002 (Eastern Principal Aquifer)
MCL exceedance - new
1,2,3-TCP Concentration (ug/L)
1
0.1
0.01
0.001
MCL (MT): 0.005 ug/L
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


1,2,3-TCP
5010029-010 (Eastern Principal Aquifer)
MCL exceedance - above historical maximum
MCL (MT): 0.005 ug/L
1,2,3-TCP Concentration (ug/L)
1
0.1
0.01
0.001
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



1,2,3-TCP
5000411-003 (Eastern Principal Aquifer)
MCL exceedance - above historical maximum
1,2,3-TCP Concentration (ug/L)
MCL (MT): 0.005 ug/L
1
0.1
0.01
0.001
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



1,2,3-TCP
5000249-004 (Eastern Principal Aquifer)
MCL exceedance - above historical maximum
MCL (MT): 0.005 ug/L
1,2,3-TCP Concentration (ug/L)
1
0.1
0.01
0.001
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022