March 2022

Modesto Subbasin

Annual Report
WY 2021
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)

First Annual Report

Water Year 2021

(October 2020 through September 2021)

March 28, 2022

SIGNATURE PAGE

Phyllis S. Stanin, PG, CHG, Vice President
Todd Groundwater, Alameda, CA

Elizabeth Elliott, PG, CHG, Senior Hydrogeologist
Todd Groundwater, Alameda, CA

Ali Taghavi, PhD, PE, Senior Principal
Woodard & Curran, Sacramento, CA

Dominick Amador, PE, Associate Principal
Woodard & Curran, Sacramento, CA

Table of Contents

List of Tables

List of Figures

Appendices

Acronyms

AF	Acre-feet
AFY	Acre-feet per year
AWMP	Agricultural Water Management Plan
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
CIMIS	California Irrigation and Management Information System
COC	Constituent of Concern
DBCP	Dibromochloropropane
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
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
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
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 (STRGBA) Groundwater Sustainability Agency (GSA) and the County of Tuolumne GSA (Tuolumne GSA) jointly prepared this First Annual Report (2021 Annual Report) for the Modesto Subbasin (5-22.02), addressing groundwater and surface water conditions during Water Year (WY) 2021. This Annual Report is being submitted to the Department of Water Resources (DWR) by April 1, 2022, 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 2021.

There are inherent limitations to this 2021 Annual Report because the reporting period occurred before the GSP was adopted in January 2022. DWR acknowledges this limitation and understands that some data may be incomplete. Nonetheless, this report presents a useful assessment of the current groundwater conditions in the Subbasin as well as early progress on GSP implementation.

This Annual Report includes an update of the local C2VSimTM model from WY 2016 through WY 2021, a six year period from the end of the GSP historical study period through the current reporting period. This updated model provides the best available method for estimating changes in groundwater in storage, groundwater extractions, and surface water-groundwater interaction during these early stages of GSP implementation. Data from WY 2016 through WY 2021 were collected from the same public and private sources that provided historical data through WY 2015 for the GSP. Updated components of the model include surface water operations, groundwater pumping, population, land use, precipitation, streamflow, boundary conditions, canal and reservoir recharge, and interbasin flows. Model results show that in WY 2021, the Modesto Subbasin experienced a decline in groundwater in storage of 132,500 AFY, primarily due to the critically dry hydrologic conditions. On average during WY 2021, deep percolation from rainfall and irrigation applied water (119,700 AFY) was the largest contributor of inflows to the Modesto Subbasin, while groundwater production (329,100 AFY) accounted for the largest outflow from the Subbasin.

Groundwater elevation data were compiled for this Annual Report from 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 2021 (**Appendix A**) and groundwater elevation contour maps were developed to illustrate seasonal low (Fall 2020) and seasonal high (Spring 2021 – **Figure ES-1**) groundwater elevations during the reporting period.

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

The hydrographs provided in **Appendix A** show available historical water levels from WY 1991 through the reporting period (WY 2021) 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. Water levels in most RMWs are above the MTs during WY 2021. Groundwater levels during WY 2021 were below the MTs in five wells in the monitoring network for chronic lowering of groundwater levels (three wells in the Western Lower Principal Aquifer and two wells in the Eastern Principal Aquifer). Groundwater levels at four wells were below the MTs in the monitoring network for interconnected surface water during WY 2021 (three along the Stanislaus River and one along the Tuolumne River). The groundwater levels during WY 2021 represent pre-GSP conditions that are not yet being managed for sustainable conditions.

Groundwater elevation contour maps show similar groundwater flow patterns in Fall 2020 and Spring 2021 in the Western Upper Principal Aquifer and the Eastern Principal Aquifer.

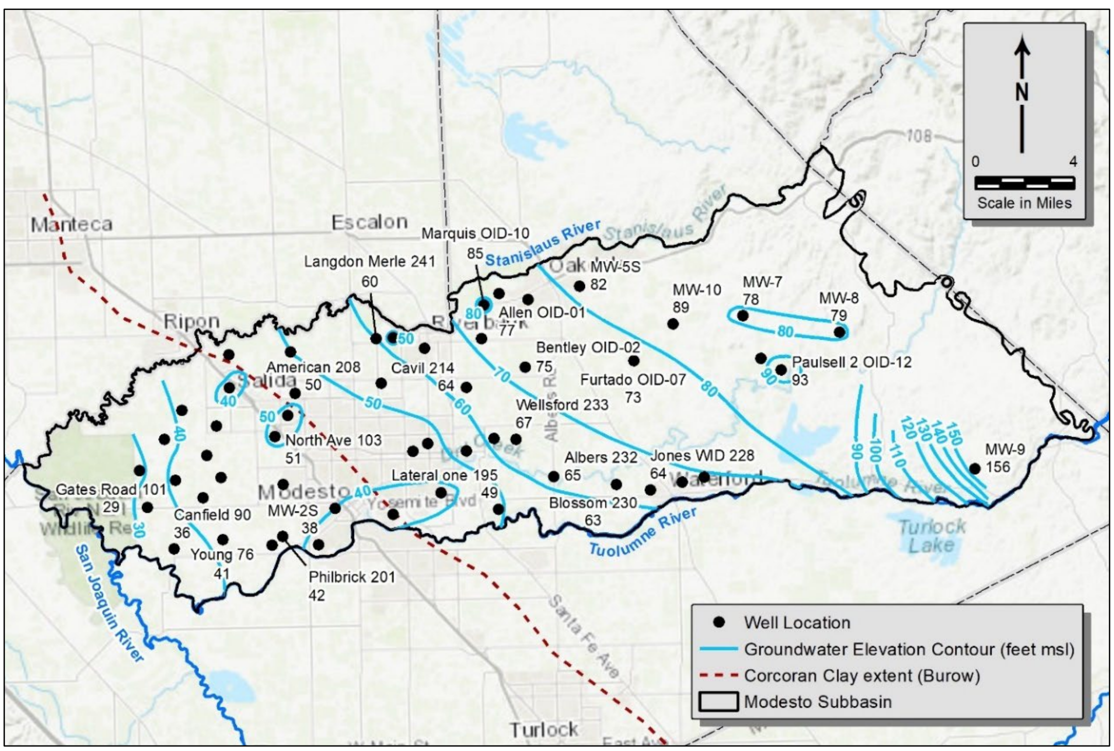


Figure ES-1 Groundwater Elevation Contours, Western Upper and Eastern Principal Aquifers, Spring 2021

As shown on **Figure ES-1**, groundwater flow within the Modesto Subbasin is generally to the west and southwest, with a southerly component of flow towards the Tuolumne River in the central and eastern Subbasin. There are localized groundwater depressions and mounds throughout the Subbasin associated with local pumping and surface water deliveries. At wells with water level measurements in both Fall 2020 and Spring 2021, groundwater elevations increased an average of 1.4 feet. The largest increases, about 4 or 5 feet, occurred in the vicinity of eastern Riverbank to Oakdale, south of Oakdale and in eastern Waterford. Groundwater elevation data in the RMWs in the Western Lower Principal Aquifer are insufficient to generate groundwater elevation contours at this time.

Total groundwater extractions in the Modesto Subbasin during WY 2021 were estimated to be 329,100 AFY. These estimates are based on directly measured groundwater extraction data collected by local water agencies and irrigation districts as well as estimates using the C2VSimTM model. During WY 2021, agricultural groundwater extraction accounts for 86% (284,400 AFY) of the total pumping in the Modesto Subbasin, while urban groundwater extraction accounts for the remaining 14% (44,700 AFY). Industrial water use is included in

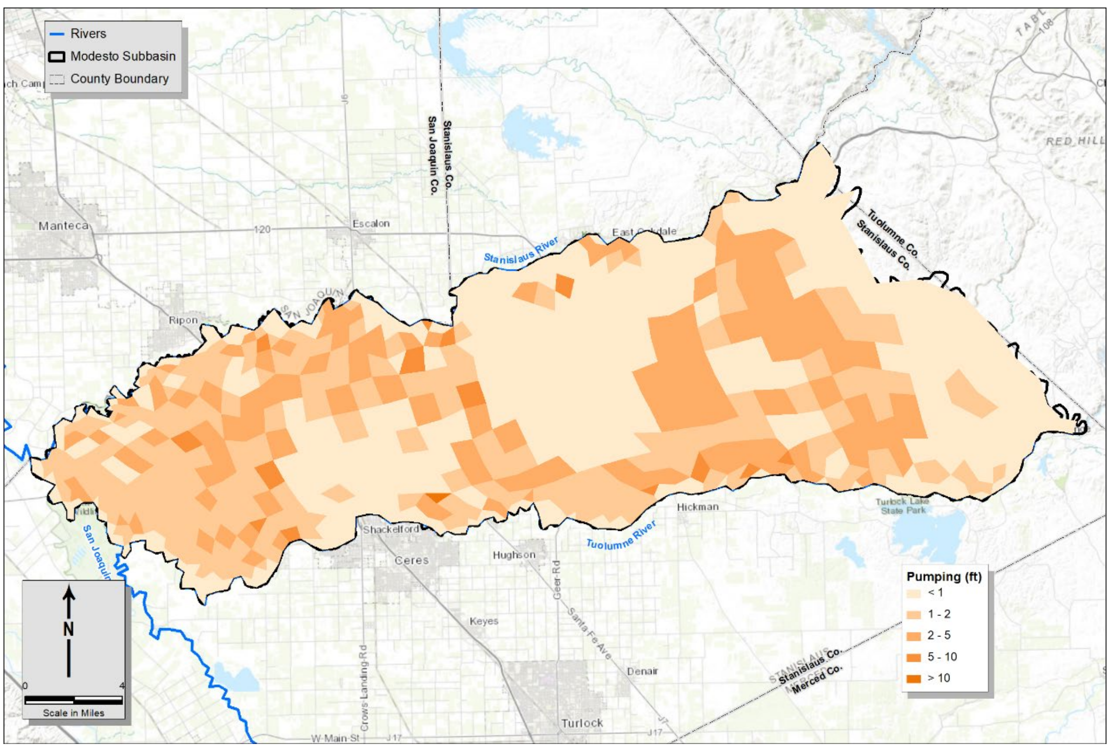


Figure ES-2 Groundwater Extraction, Modesto Subbasin WY 2021

the urban water use for WY 2021. No known groundwater extraction is used for maintaining managed wetlands, supplying managed recharge operations, or maintaining native vegetation in the Modesto Subbasin. **Figure ES-2** illustrates the distribution of groundwater extraction within the Modesto Subbasin during WY 2021. The pumping distribution generally corresponds to irrigated areas where demand is not met by surface water supplies.

Surface water supply in the Modesto Subbasin during WY 2021 is estimated at 301,900 AFY. This surface water supply is comprised of deliveries by Modesto Irrigation District (MID) and Oakdale Irrigation District (OID) and riparian diversions. Riparian deliveries from the Stanislaus, Tuolumne and San Joaquin rivers are based on estimates on the State Water Resources Control Board (SWRCB) Electronic Water Rights Information Management System (eWRIMS) and by the C2VSimTM model. **Figure ES-3** illustrates surface water delivery areas in the Modesto Subbasin.

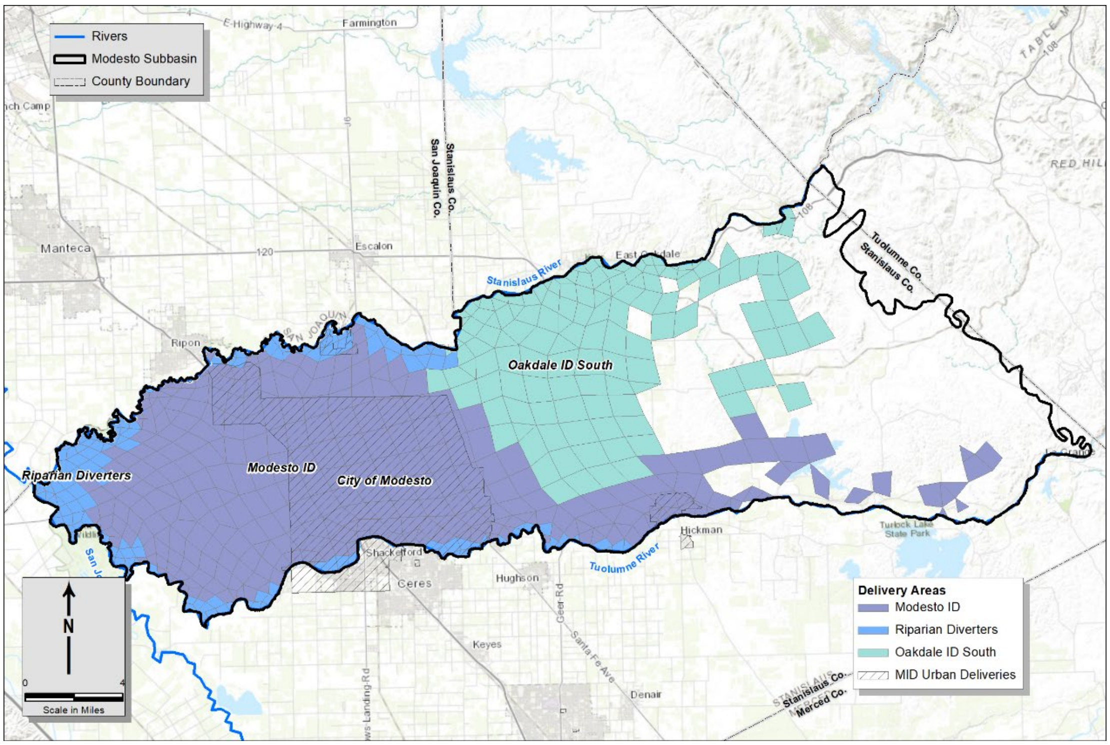


Figure ES-3 Surface Water Deliveries, Modesto Subbasin

During WY 2021, the total water use for the Modesto Subbasin was 631,000 AF. Groundwater extractions represent about 52% of the total supplies (329,100 AF), followed by surface water at 48% (301,900 AF). The total water supply for WY 2016 through WY 2021 is summarized in **Table ES-1**.

Table ES-1: Total Water Use by Water Source for Water Years 2016-2021 (in acre-feet)

	Groundwater[1]	Surface Water[2]	Other	Total Water Use
2016	314,800	238,400	0	553,200
2017	265,900	257,500	0	523,400
2018	294,200	271,100	0	565,300
2019	267,700	266,100	0	533,800
2020	299,200	292,500	0	591,700
2021	329,100	301,900	0	631,000
Average	**295,200**	**271,300**	**0**	**566,400**

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

From WY 2016 through WY 2021, groundwater in storage declined 258,700 AF as estimated by the C2VSimTM model. During this six year period, groundwater in storage increased during the wettest years (WY 2017 and WY 2019) and decreased during the remaining four drier years (WY 2016, WY 2018, WY 2020, and WY 2021). The largest annual decline of groundwater in storage during this period occurred during WY 2021 (132,500 AFY), which is forecasted to be a critically dry year. A change in groundwater in storage map for WY 2021 is provided as **Figure ES-4**.

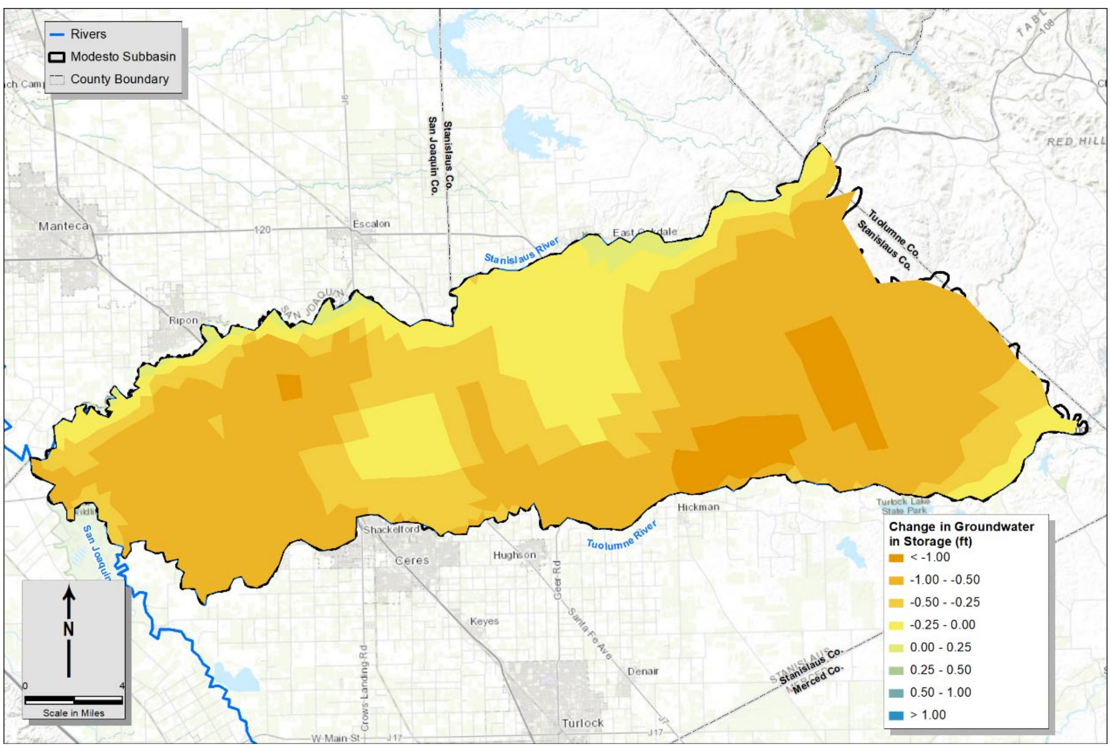


Figure ES-4 Change in Groundwater in Storage, Modesto Subbasin WY 2021

The figure shows that most of the Subbasin is losing storage during WY 2021, with most of the storage loss occurring in the westernmost Subbasin, easternmost Subbasin and along the Tuolumne River.

This first Annual Report establishes a baseline groundwater quality monitoring network for which future data can be compared. The Modesto Subbasin GSP determined that an undesirable result for groundwater quality may be triggered by a new (first-time) exceedance of the MT (i.e., the primary or secondary California maximum contaminant level (MCL)), or a further exceedance above the MT, in a RMW for any of the seven constituents of concern: arsenic, uranium, nitrate, 1,2,3-trichloropropane (TCP), dibromochloropropane, tetrachloroethene (PCE), and total dissolved solids (TDS). Data for these seven COCs were downloaded from the State Groundwater Ambient Monitoring and Assessment Program (GAMA) Groundwater Information System through the State GeoTracker website for WY 1991 to WY 2021. The monitoring network for each COC includes wells that were measured for that constituent during WY 2021. The baseline value for each well is the maximum concentration of a COC analyzed from WY 1991 to WY 2021, as illustrated by the nitrate concentration map shown on **Figure ES-5**.

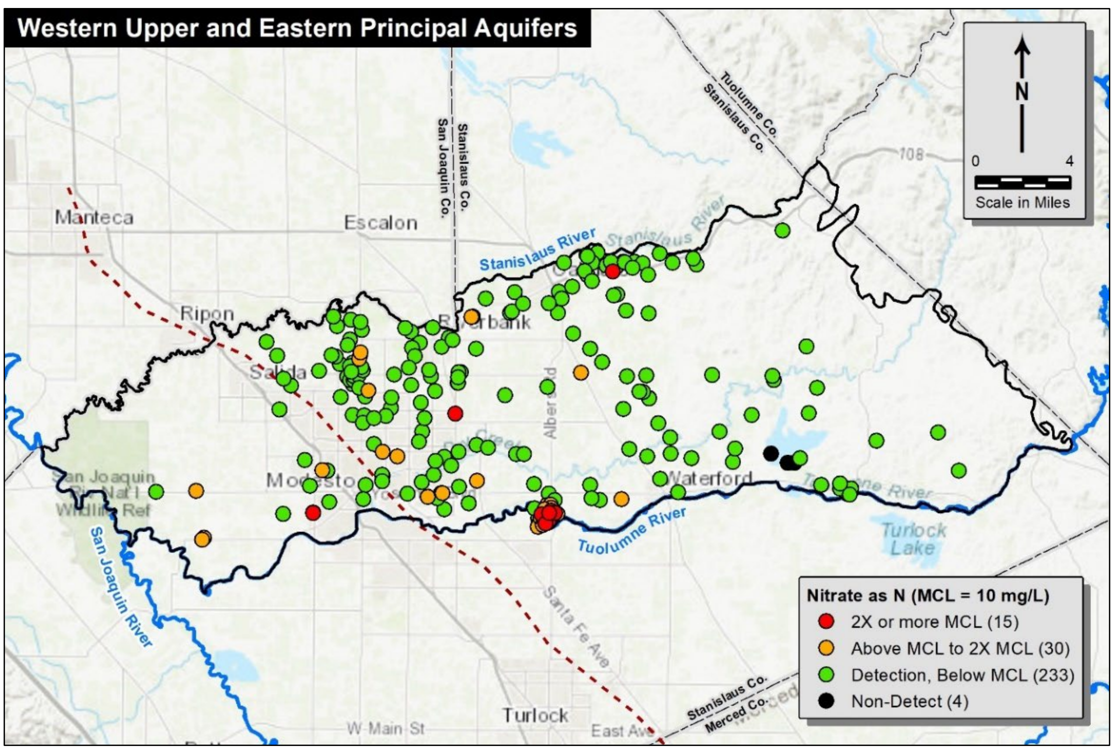


Figure ES-5 Maximum Concentrations of Nitrate in Groundwater, WY 1991 – WY 2021

In total, there were 361 wells sampled during WY 2021 for one or more of the COCs, and these wells comprise the monitoring network for water quality. The maximum concentration measured between WY 1991 and WY 2021 is identified and mapped for each COC in each principal aquifer. The map on **Figure ES-5** represents the baseline conditions for nitrate concentrations in the Western Upper and Eastern Principal Aquifers.

The baseline period from WY 1991 through WY 2021 extends from the beginning of the historical GSP Study Period through the current reporting period and allows the variability in historical COC concentrations to be linked to historical groundwater elevations. Future Annual Reports will compare water quality conditions from the current water year to the baseline condition established in this Annual Report to identify wells with new MCL exceedances. These comparisons will assist with groundwater quality analyses to determine if any of the exceedances above baseline conditions are caused by GSA groundwater management.

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 an additional screening tool to evaluate land subsidence across the entire Subbasin. Groundwater levels in most of the RMWs are above the MTs during WY 2021. Vertical displacement data collected using Interferometric Synthetic Aperture Radar (InSAR) by TRE Altamira Inc., under contract with DWR, indicates no negative vertical displacement (land subsidence) during WY 2021. GPS stations in the Subbasin confirm an absence of land subsidence where measurements exist in the Subbasin.

The C2VSimTM model was used to evaluate interconnected surface water from WY 2016 to WY 2021. Model results from this period indicate that the Stanislaus River and the Tuolumne River are net losing streams, and the San Joaquin River is a net gaining stream. Streamflow loss averaged about 26,000 AFY on the Stanislaus River and 17,000 AFY on the Tuolumne River, while the San Joaquin River averaged a gain of about 11,500 AFY from the Modesto Subbasin. During WY 2021, groundwater levels at 4 out of 20 RMWs in the monitoring network for interconnected surface water were below the MTS. Three of these 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.

To comply with regulations, this Annual Report includes an update on GSP implementation progress. Because the GSP was only recently adopted in January 2022, there has been little time to implement GSP projects before the deadline for this Annual Report (April 1, 2022). Implementation activities over the last few months have focused on updating the C2VSimTM model, developing this Annual Report, planning for the first GSP monitoring event, and planning for future implementation activities. Since submittal of the GSP in January 2022, the landowners in the Non-District East Management Area have been meeting on a regular basis and are in the early stages of planning and developing future water supply projects.

1 INTRODUCTION

With the successful submission of the Modesto Subbasin Groundwater Sustainability Plan (GSP or Plan) on January 31, 2022, the two Groundwater Sustainability Agencies (GSAs) in the Subbasin are now coordinating steps on GSP implementation. One such step is development of this First GSP Annual Report (Annual Report), which is being submitted to the Department of Water Resources (DWR) by April 1, 2022, 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) 2021. The Modesto Subbasin and GSA boundaries are shown on **Figure 1-1**.

1.1 PURPOSE AND TIMING OF THE FIRST 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 year. For this first Annual Report (2021 Annual Report), the preceding water year is WY 2021, extending from October 1, 2020, to September 30, 2021 (reporting period). In addition, certain historical datasets need to be included to illustrate conditions prior to WY 2021. 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)).

For the 2021 Annual Report, the reporting period occurs prior to the GSP submittal deadline of January 2022. The GSP was still under development during the reporting period, and neither the GSP nor monitoring network/protocols had yet been finalized or adopted. Accordingly, some required datasets are incomplete in this initial Annual Report. In addition, this report is being prepared within weeks of GSP completion and will be provided to DWR only two months following submittal of the GSP. This is a short amount of time to initiate GSP implementation. Nonetheless, GSP implementation activities are underway, and the STRGBA GSA and member agencies have made early 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 total Subbasin acres are not identical to the current DWR basin description. Nonetheless, Management Areas cover the entire Subbasin, and approximate acres are shown here for relative comparisons.

Surface water supplies are generally 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

For the 2021 Annual Report, the GSAs have committed significant resources to update the local C2VSimTM model for the six years since the end of the GSP historical Study Period. 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 will provide 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 analyzed for the sustainable management criteria. Some of these hydrographs and other monitoring datasets are incomplete due to the timing of the Annual Report. In WY 2021, monitoring networks were still being developed, monitoring protocols were not yet in place, and routine monitoring had not yet begun. In addition, 14 of the RMWs were constructed in 2021 with Proposition 68 grant funding from DWR and have only preliminary groundwater elevation measurements during the reporting period.

Notwithstanding these limitations and incomplete data sets, significant data compilation and analyses were conducted for this first 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 from WY 2016 through WY 2021,
- update of C2VSimTM integrated water resources model from WY 2016 through WY 2021 to support ongoing analyses,
- preparation of groundwater elevation hydrographs for RMWs from WY 1991 through WY 2021 and comparison to sustainable management criteria,
- development of groundwater elevation contour maps for the seasonal low (Fall 2020) and high (Spring 2021) groundwater levels in each principal aquifer,
- model simulation of groundwater elevation contour maps to supplement data gaps for portions of the contour maps generated from measured elevations in wells,
- tabulation of groundwater extractions, surface water supply, and total water use data for WY 2021 using DWR water use templates,
- mapping of groundwater extractions illustrating volumes and general locations (using C2VSimTM for required map),
- updated analysis of water budgets, including graphical representations of annual and cumulative changes in groundwater in storage from WY 1991 through WY 2021,
- map presentation of groundwater in storage for WY 2021,
- extended analysis (in addition to groundwater elevations) for three sustainability indicators including:
    - degraded water quality analysis to establish a baseline for future Annual Report tracking and analyses,
    - land subsidence screening analysis of InSAR data for WY 2021,
    - interconnected surface water and streamflow depletion analysis using the updated C2VSimTM model for WY 2016 through WY 2021, and
- 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. Even though GSAs had not yet finalized plans for coordination on monitoring and data management, GSA member agencies cooperated to compile local data to support the Annual Report. GSA member agencies are identified on **Figure 1-3** for reference throughout this report. 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 also be uploaded separately to the DWR SGMA Portal, along with other required components of the Annual Report.

1.3.3 Progress Toward Plan Implementation

As required by the regulations, **Section 11** describes early steps toward GSP implementation. The section includes a summary of GSP implementation support activities and initial activities regarding projects and management actions. As demonstrated by the descriptions, the GSAs have already pivoted from GSP development to GSP implementation.

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 towards GSP implementation. The model update is documented in **Section 2**.

1.5 LIMITATIONS

As mentioned previously, the timing of this First GSP Annual Report presents inherent limitations because the Reporting Period (WY 2021) occurred prior to completion and adoption of the GSP. Although most RMWs have a historical record, there are many new wells in the network that were installed during GSP preparation to support ongoing GSP monitoring. Accordingly, some RMWs were not measured for seasonal highs and lows during the reporting period as indicated on incomplete historical hydrographs.

In addition, the GSP recognizes that the monitoring networks contain data gaps and present plans for addressing these in initial years of the GSP implementation period. Future annual reports will provide a more complete monitoring network now that implementation has been initiated.

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

1.6 ANNUAL REPORT PREPARATION AND SUBMITTAL

As required in §353.4, this First 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).

The 2021 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.

The Annual Report was reviewed for GSA member agencies, stakeholders, and the public in a STRGBA GSA public meeting held on March 30, 2022, prior to submittal to DWR by the April 1, 2022, deadline.

2 C2VSimTM UPDATE (THROUGH WATER YEAR 2021)

The C2VSimTM integrated surface water-groundwater model was originally developed and calibrated to simulate historical groundwater conditions for water years (WY) 1991-2015. This period represented average hydrologic conditions and was used as the historical Study Period for water budgets in the GSP. The model was updated for the 2021 Annual Report to reflect more recent data and provide a continuous analysis for the intervening years since the end of the GSP Study Period. Data from water years 2016-2021 were collected from the same public and private sources that had provided the historical data through 2015. As a result of the model update, an extended historical water budget was generated including updated estimates of change in groundwater in storage.

The 2016-2021 continuation 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 the post 2013-2015 drought conditions and operations of the Subbasin. The annual groundwater budget for water years 1991-2021 is presented in **Section** Error! Reference source not found..

Data Sources

Data were requested and received from the following entities in the 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) Electronic Water Rights Information Management System (eWRIMS)
- Oregon State University Climate Group: Precipitation-Elevation Regressions on Independent Slopes Model (PRISM)
- 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 2021 Annual Report.

Precipitation: Monthly precipitation on 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.

Population: The population for each municipality was provided by that municipality for WY 2016-2021. 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 based on the most recent 2020 census due to pandemic-related staffing issues at the US Census Bureau. For this model update, populations were projected based on historical trends and will be revised, if needed, when data are available.

Land Use: Each element within the C2VSimTM is comprised of some fraction of 24 land uses, including 20 agricultural crop categories, native vegetation, riparian vegetation, open water, and urban. For the 2021 update, the model uses annual data based on information available from DWR on the SGMA Data Viewer portal.

Irrigation Management – Applied water conservation and improvements to irrigation efficiency has been a major focus for growers within the Modesto Subbasin. During the 2020 Agricultural Water Management Plan (AWMP) cycle, both MID and OID preformed a detailed analysis of their water use efficiency and found that the consumptive use of applied water to be 73-75%. For the 2016-2021 model update, parameters were refined to reflect this operational change and best represent agricultural water demand within the Subbasin.

Surface Water Operations: Monthly surface water flows were provided from October 2015 through September 2021 by Modesto Irrigation District (MID) and Oakdale Irrigation District (OID). These operational flows included diversions, deliveries, spills, seepage, and evaporative losses. Riparian diversions were estimated from information available on the California State Water Resources Control Board (SWRCB) Electronic Water Rights Information Management System (eWRIMS) and adjusted based on agricultural demand calculated by the C2VSimTM model.

Canal and Reservoir Recharge: C2VSimTM estimates MID and OID conveyance recharge based on historical monthly diversions and the water year index. An in-depth analysis of operations and surficial water budgets was developed as part of the OID and MID 2020 Agricultural Water Management Plans (AWMP). As a result, the C2VSimTM may be updated with further refined datasets in the future.

Groundwater Pumping: Groundwater extractions from October 2015 to September 2021 were provided by 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 land use type, surface water delivery data, 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 into the Subbasin from non-gauged tributaries within and adjacent to the Subbasin were estimated using the Integrated Water Flow Model (IWFM) small-watershed package.

Boundary Conditions: Biannual groundwater elevation contours were downloaded from DWR's SGMA Data Viewer for WY 2016-2021 and used to update the estimated groundwater elevation boundary conditions in the model. As groundwater level contours are only available in semiannual intervals, intermediary months were estimated though linear interpolation.

Interbasin Flows: C2VSimTM simulates groundwater flow between the Modesto Subbasin and the neighboring subbasins to the north (Eastern San Joaquin), west (Delta-Mendota) and south (Turlock). The rate and direction of this interbasin subsurface flow depends on the groundwater operations and levels during the historical and projected periods on both sides of the boundary. Interbasin coordination meetings have been held with all three surrounding subbasins and continued coordination is expected to further refine these flow dynamics in the future.

2.2 MODELED GROUNDWATER BUDGET

Evaluation of the 2021 water year shows that the Modesto Subbasin experienced net 196,600 AF of inflows and 329,100 AF of outflows. Deep percolation from rainfall and irrigation applied water (119,700 AFY) is the largest contributor of groundwater inflow, followed by net-recharge from the canal and reservoir system (48,300 AFY), net inflow from the stream system (16,700 AFY) and net subsurface inflows from local subbasins and the Sierra Nevada foothills (11,900 AFY). Groundwater production (329,100 AFY) accounts for the only water budget component with a net outflow from the Modesto Subbasin. In WY 2021, the Modesto Subbasin experienced a decline in groundwater in storage of 132,500 AFY. Details of the model results are provided in **Section 7**.

3 GROUNDWATER ELEVATIONS

Historical groundwater elevations for GSP monitoring wells in the Modesto Subbasin have been compiled for the 2021 Annual Report to provide the following:

- Water level hydrographs to illustrate long-term trends and fluctuations and to compare pre-GSP 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 2020 and Spring 2021).

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. 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 serves as a proxy for the reduction of groundwater in storage, and land subsidence indicators. **Figure 3-4** provides the groundwater elevation monitoring network for interconnected surface water.

Each RMW on the network maps (**Figures 3-1** through **3-4**) includes the MTs and Measurable Objectives 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.

---

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

Although monitoring protocols had not yet been adopted during the reporting period, water levels were measured in most of the RMWs in WY 2021. In addition, most of these measurements occurred within the two time periods established in GSP monitoring protocols 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.

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 2021), the natural hydrologic conditions for the associated water years have been tabulated. Specifically, DWR has 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 methodology for comparing water year types to the groundwater elevation hydrographs from WY 1991 through WY 2021 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. Precipitation amounts from WY 1990 through WY 2021 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 a specific 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 3-1**.

Table 3-1: 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	**2006**	Wet
1991	Critically Dry	**2007**	Critically Dry
1992	Critically Dry	**2008**	Critically Dry
1993	Wet	**2009**	Below Normal
1994	Critically Dry	**2010**	Above Normal
1995	Wet	**2011**	Wet
1996	Wet	**2012**	Dry
1997	Wet	**2013**	Critically Dry
1998	Wet	**2014**	Critically Dry
1999	Above Normal	**2015**	Critically Dry
2000	Above Normal	**2016**	Dry
2001	Dry	**2017**	Wet
2002	Dry	**2018**	Below Normal
2003	Below Normal	**2019**	Wet
2004	Dry	**2020**	Dry
2005	Wet	**2021**	Not available

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 3-1**, 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 without an extended period of wet or drought conditions. Because WY 2016 through WY 2021 follows a severe drought, groundwater levels were already at or near historical lows. Without consecutive wet years, groundwater elevations have not fully recovered, and some areas continue to decline.

Although water year type was unavailable for WY 2021 (reporting period) at the time of report preparation, the below normal precipitation data shown on **Figure 3-5** indicate a continuation of the dry conditions observed in WY 2020. In part due to the elevated temperatures, conditions in the San Joaquin Valley have been characterized as an extreme drought for WY 2021 (DWR, 2021).

3.3 Groundwater Elevations WY 1991 – WY 2021

Available water level data through WY 2021 from RMWs have been compiled in DWR water level templates and uploaded onto the SGMA portal. For some of these wells, water levels had also been measured in Fall for WY 2022 (i.e., October or November 2021). These recent data are included in the analysis for completeness but are not part of the current reporting period.

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 First GSP Annual Report for the Modesto Subbasin, the time period from WY 1991 through WY 2021 (reporting period) was chosen to meet GSP requirements and allow for consistent hydrograph development. As described previously, this 31-year period includes the historical Study period from the GSP (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 2021 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 gray 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 throughout the historical study period were discussed in detail throughout the Subbasin 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 fluctuate more to the east and 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. Wells in the eastern region of the Eastern Principal Aquifer have indicated historical declining groundwater level trends since about the mid-2000s, with significant declines during the recent drought.

Groundwater levels during WY 2021 have remained consistent with the trends summarized above and described in the GSP. Since the end of the historical Study Period, water levels 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, increasing to the east (see hydrographs Canfield, Machado, and North Ave 103 on **Figure 3-6**).

Water levels in the western portion of the Eastern Principal Aquifer have declined slightly since post-drought recovery, and WY 2021 water levels illustrate this declining trend (see Bangs hydrograph, **Figure 3-6**). Water levels in the eastern portion of the Eastern Principal Aquifer are continuing to decline through WY 2021 (see Furtado and Paulsell-2 hydrographs on **Figure 3-6**).

There are only a few wells that can be used to examine these eastern declines. Four recently-constructed Proposition 68 wells in the eastern Subbasin (MW-7, MW-8, MW-9, and MW-10) fill some of the data gaps but were only installed in Spring 2021 and have only a few measurements to date (**Figure 3-3**). GSAs will be able to track trends more accurately in the future as these and other planned monitoring wells provide more data in this area.

There are five wells in the monitoring network in the Western Lower Principal Aquifer, and recent water levels are most reliably captured by City of Modesto wells MOD-MWD-3 and MOD-MWB-2 (**Figure 3-2** and **Appendix A**). Water levels in both of these wells show a similar fluctuating pattern in WY 2021, where water levels declined after Summer 2020, reached a low in Summer 2021, and then rebounded by Fall 2021. As indicated above, water levels in recently-installed Proposition 68 wells will provide more data for future analysis including MW-1D and MW-2D, which are screened in the Western Lower Principal Aquifer (**Figure 3-2**). In addition, GSAs are working with USGS to gain access to USGS well MRWA-3, which is also screened in the Western Lower Principal Aquifer but has not been measured in the since 2009.

3.3.3 Compliance with Sustainable Management Criteria

As mentioned previously, hydrographs in **Appendix A** and on **Figure 3-6** contain 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. **Table 3-2** provides a summary of the MTs and MOs selected for each applicable sustainability indicator in the GSP.

Table 3-2: 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.

Hydrographs in **Appendix A** show that groundwater levels for most of the RMWs in the monitoring networks are above the MTs during WY 2021.

Groundwater levels for the chronic lowering of groundwater levels indicator were below MTs in 5 out of 61 wells, including 2 out of 39 wells in the Eastern Principal Aquifer and 3 out of 5 wells in the Western Lower Principal Aquifer. Water levels were not below MTs in any wells in the Western Upper Principal Aquifer in WY 2021. Again, these data represent pre-GSP conditions that are not yet being managed for sustainable conditions as defined by the regulations.

As described in the GSP and indicated on **Figure 3-6**, groundwater elevations had 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.

In the Western Lower Principal Aquifer, two of the three wells with measurements below the MTs were constructed during Spring 2021 with Proposition 68 funding (MW-1D and MW-2D). The new monitoring wells are located in areas with sparse historical data and local groundwater conditions are not yet well-understood. Ongoing monitoring data are needed to validate the selected MT designations in the future.

Water levels at 4 wells (out of 20) were below the MTs for interconnected surface water during WY 2021. Three of these wells are part of the monitoring network along the Stanislaus River (Allen OID-1, Birnbaum OID-3, and Marquis OID-10,) and one is along the Tuolumne River (MW-6S). These wells are also in the Eastern Principal Aquifer and affected, in part, from declining groundwater levels in the Non-District East MA.

3.4 Groundwater Elevation Contour Maps

Groundwater elevation data were used to develop water level contours maps for the principal aquifers in the Subbasin. The contour maps are based on groundwater elevation data from RMWs and supplemented by additional SGMA monitoring wells, when available, in the three principal aquifers. For this First GSP Annual Report, data were compiled and contoured for both Fall 2020 and Spring 2021, as shown on **Figures 3-7** through **3-10,** to comply with GSP regulations, as explained in subsequent sections below.

3.4.1 Principal Aquifers

The GSP defined three principal aquifers for the Modesto Subbasin as listed in **Table 3-3**.

Table 3-3: 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

3.4.2 Groundwater Elevations and Flow for Fall 2020

Groundwater elevations measured in Fall 2020 represent seasonal lows during WY 2021. Water levels in most of the wells were measured in November, at the end of the irrigation season.

3.4.2.1 Western Upper Principal Aquifer and Eastern Principal Aquifer

Groundwater elevation contours in Fall 2020 in the Western Upper Principal Aquifer and the Eastern Principal Aquifer are illustrated on **Figure 3-7**.

Groundwater elevations range from 94 feet above mean sea level (msl) in the eastern Subbasin near Modesto Reservoir to 28 feet msl in the northwest Subbasin. Contours indicate that groundwater flows generally to the west and southwest in the Subbasin. Groundwater flows south towards the Tuolumne River in portions of the central and eastern 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. As illustrated on **Figure 3-7**, there is a lack of measured water level data in the eastern Subbasin during WY 2021.

3.4.2.2 Western Lower Principal Aquifer

Groundwater elevations in the Western Lower Principal Aquifer in Fall 2020 are illustrated on **Figure 3-8**. During this time, groundwater elevation data are available in two City of Modesto monitoring wells located in the eastern region of the aquifer. Groundwater elevations in these two wells are similar (41 and 44 feet msl). There is an insufficient amount of data to generate contours for this principal aquifer in WY 2021.

3.4.3 Groundwater Elevations and Flow for Spring 2021

Groundwater elevations measured in Spring 2021 represent seasonal highs during WY 2021. Water levels in most of the wells were measured in late February and early March, prior to increases in groundwater production for summer irrigation.

As mentioned previously, a series of new monitoring wells were constructed throughout the Subbasin with Proposition 68 grant funding from DWR. Spring 2021 groundwater levels for these wells were measured in April and May, after the water levels had time to equilibrate from well construction activities.

3.4.3.1 Western Upper Principal Aquifer and Eastern Principal Aquifer

Groundwater elevation contours in Spring 2021 in the Western Upper Principal Aquifer and Eastern Principal Aquifer are presented on **Figure 3-9**. During this time period, groundwater elevations ranged from 156 feet msl in the eastern Subbasin near the Tuolumne River to 29 feet msl in the northwestern Subbasin. This maximum groundwater elevation was measured in monitoring well MW-9, which was constructed in March 2021. **Figure 3-9** includes water level data from 11 monitoring wells constructed in Spring 2021. Several of these wells are located in the eastern Subbasin and fill some of the data gaps in groundwater elevation data in this area.

In general, groundwater elevations increased throughout the Subbasin from Fall 2020 to Spring 2021. For the 41 wells with measurements for both time periods, the average increase in groundwater elevation was 1.4 feet. The largest increases, on the order of a 4 to 5 feet, occurred in the central Subbasin. Specifically, these increases occurred in wells located in the vicinity of eastern Riverbank to Oakdale, south of Oakdale, and in eastern Waterford.

Groundwater flow directions are similar to Fall 2020. Contours indicate that flow is predominantly to the west and southwest, with a southerly component of flow towards the Tuolumne River in the central and eastern Subbasin. Contours indicate steeper gradients to the east of Modesto Reservoir. Groundwater elevations at two new Proposition 68 monitoring wells in the eastern Subbasin (MW-7 and MW-8) have slightly lower groundwater elevations than other nearby wells, likely due to irrigation pumping. Since there are no data east of these well locations, the size of the pumping depression is not known. The two wells north of Modesto Reservoir (Paulsell-1 and Paulsell-2, with elevations of 89 and 93 feet msl) show little change in groundwater elevation from Fall 2020. There is also an area of lower groundwater elevations near production wells in the City of Modesto along the Tuolumne River.

3.4.3.2 Western Lower Principal Aquifer

Groundwater elevations in the Western Lower Principal Aquifer for Spring 2021 are illustrated on **Figure 3-10**. During this time, groundwater elevation data are available in three monitoring wells located in the eastern portion of the aquifer. Groundwater elevations in these wells are similar, ranging from 31 to 39 feet msl. Two of these monitoring wells are on the Fall 2020 contour map and show a decrease in groundwater elevation from Fall 2020 of 2 and 13 feet, likely due to local pumping. There is an insufficient amount of data to generate contours for this principal aquifer during WY 2021.

4 GROUNDWATER EXTRACTIONS

The volume of groundwater extraction in the Modesto Subbasin is provided for the preceding water year (WY 2021) 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 2021) 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. For additional discussion on model-estimated uncertainties, including a detailed review of model calibration, strengths, and limitations please see Appendix C of the Modesto GSP; The Turlock-Modesto Integrated Water Resources Model, Modesto Subbasin Documentation.

4.2 SUMMARY OF GROUNDWATER EXTRACTIONS WATER YEAR 2021

Using the methods described above, the total groundwater extractions in the Modesto Subbasin for WY 2021 were tabulated. Error! Reference source not found. summarizes the Modesto Subbasin groundwater extractions by water use type and measurement method for WY 2021.

Table 4-1: Groundwater Extractions for Water Years 2016 - 2021 (in acre-feet)

WY	Agricultural Production (Agency)[1]	Agricultural Production (Private)[2]	Urban Production (Agency)[1]	Urban Production (Private)[3]	Total
2016	34,900	229,900	34,600	15,400	314,800
2017	13,100	209,400	28,000	15,400	265,900
2018	20,700	229,400	28,500	15,600	294,200
2019	12,600	211,300	28,100	15,700	267,700
2020	19,400	229,000	34,600	16,200	299,200
2021	42,300	242,100	28,900	15,800	329,100
Average	**23,800**	**225,200**	**30,500**	**15,700**	**295,200**

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 2021). 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 2021). These estimated data are expected to have a qualitative medium level of accuracy.*

The data show that 329,100 acre-feet of groundwater extractions occurred in WY 2021. 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 2021 is 284,400 acre-feet which accounts for about 86% 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 2021 is 44,700 acre-feet which accounts for about 14% 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 2021.
- **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**Error! Reference source not found., 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 device. The total groundwater extraction from metered data in the Modesto Subbasin for WY 2021 is 71,200 acre-feet which accounts for about 22% 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 2021 is 257,900 acre-feet which accounts for about 78% 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 provide 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 2021, a total groundwater extractions map was derived from the simulation results of C2VSimTM. 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 86% 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 2021 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 2021 by water use sector (23 CCR §356.2(b)(2))
- **Part B. Groundwater Extraction Methods** - the volume of groundwater extractions for WY 2021 by different measurement methods (23 CCR §356.2(b)(2)).

Data summarized in Error! Reference source not found. 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 2021 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 2021 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. Because the model has been updated to include surface water supply from WY 2016 through WY 2021, data for those water years are provided in the text to supplement the WY 2021 data entered in the DWR template (Part C).

5.1 Surface Water Data Methods

Surface water supplies for the Subbasin for WY 2021 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 2021 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 Years 2016 - 2021 (in acre-feet)

	Local Supply (Measured)[1]	Local Supply (Estimated)[2]	Other Supply (Estimated)	Total
2016	195,100	43,300	0	238,400
2017	237,000	20,500	0	257,500
2018	242,300	28,800	0	271,100
2019	246,700	19,400	0	266,100
2020	265,200	27,300	0	292,500
2021	251,300	50,600	0	301,900
Average	**239,600**	**31,600**	**0**	**271,200**

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 2021, 301,900 acre-feet 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 are available 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 2021 is forecasted to be a critical 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 2021 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 2021 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 consist 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 2021 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 2021 groundwater extractions and surface water supplies as presented in **Section 4 and 5**. The data show total water use for the Modesto Subbasin was 631,000 acre-feet in WY 2021. The total water supply for water years 2016 through 2021 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 2021, the groundwater supply totaled 329,100 acre-feet representing about 52% of total supplies in WY 2021.
- **Surface water** includes surface water deliveries for all uses. In WY 2021, the surface water supply totaled 301,900 acre-feet representing about 48% of total water supplies in WY 2021.
- **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 Years 2016 - 2021 (in acre-feet)

	Groundwater[1]	Surface Water[2]	Other	Total Water Use
2016	314,800	238,400	0	553,200
2017	265,900	257,500	0	523,400
2018	294,200	271,100	0	565,300
2019	267,700	266,100	0	533,800
2020	299,200	292,500	0	591,700
2021	329,100	301,900	0	631,000
Average	**295,200**	**271,300**	**0**	**566,400**

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 show total water use for the Modesto Subbasin was 631,000 acre-feet in WY 2021. 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 2021, agricultural water use totaled 555,900 acre-feet, 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 2021, urban water use totaled 75,100 acre-feet, 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 2021.
- **Managed Wetlands** would include groundwater extractions or surface water deliveries to manage local wetlands. In WY 2021, 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 2021, 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 2021, 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 2021, no known groundwater extractions or surface water deliveries were used to for other uses in the Modesto Subbasin.

Table 6-2: Total Water Use by Sector for Water Years 2016 - 2021 (in acre-feet)

	Agricultural	Urban	Other	Total Water Use
2016	483,200	70,000	0	553,200
2017	453,000	70,400	0	523,400
2018	490,400	74,900	0	565,300
2019	459,800	74,000	0	533,800
2020	515,900	75,800	0	591,700
2021	555,900	75,100	0	631,000
Average	**493,000**	**73,400**	**0**	**566,400**

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 2021 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 2021) 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 cover the entire Subbasin and are based on the updated C2VSimTM model results. The C2VSimTM model was used to estimate historical change in groundwater storage in the Modesto Subbasin from water years 1991-2015 for the Modesto GSP and then extended through WY 2021 to support quantification of storage change for this annual report.

The methodology and data used to update the C2VSimTM for 2016-2021 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 this 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 2021. 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 31-year period from WY 1991 through WY 2021. 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, 2021, see **Table 3-1**) as follows:

- WY 2016, a dry water year type, had a **decline** of 54,000 acre-feet
- WY 2017, a wet water year type, had an **increase** of 115,200 acre-feet
- WY 2018, a below normal water year type, had a **decline** of 116,200 acre-feet
- WY 2019, a wet water year type, had an **increase** of 38,600 acre-feet
- WY 2020, a dry water year type, had a **decline** of 109,800 acre-feet
- WY 2021, which is forecasted to be a critical year, had a **decline** of 132,500 acre-feet

The total change in groundwater in storage over the six-year period from WY 2016 through WY 2021 was a **decline** of 258,700 acre-feet.

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 3-1**, CDEC, 2021) are summarized as follows:

- **WY 2016**, a dry water year type, had a total groundwater use of 314,800 acre-feet, of which 84% was for agricultural use and 16% for urban use.
- **WY 2017**, a wet water year type, had a total groundwater use of 265,900 acre-feet, of which 84% was for agricultural use and 16% for urban use.
- **WY 2018**, a below normal water year type, had a total groundwater use of 294,200 acre-feet, of which 85% was for agricultural use and 15% for urban use.
- **WY 2019**, a wet water year type, had a total groundwater use of 267,700 acre-feet, of which 84% was for agricultural use and 16% for urban use.
- **WY 2020**, a dry water year type, had a total groundwater use of 299,200 acre-feet, of which 83% was for agricultural use and 17% for urban use.
- **WY 2021,** which is forecasted to be a critical year according to the San Joaquin Valley Index, had a total groundwater use of 329,100 acre-feet, of which 86% was for agricultural use and 14% for urban use.

Total groundwater pumping was about 10% to 20% lower during wet years than during the dry and below normal water year types. This is primarily due to reduced evapotranspiration and increased precipitation in the spring months of wet years, reducing the Subbasin's irrigation demand and subsequent groundwater production. Urban pumping was relatively stable from WY 2016 to WY 2021.

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

Figure 7-3 through **Figure 7-6** show the total change in groundwater in storage by principal aquifer for water year 2021 in a spatial format as estimated by outputs from 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 primarily losing storage, especially in the areas with a darker shade of orange, which show a higher loss of storage in the western Subbasin, eastern Subbasin, and along the Tuolumne River. In the Western Upper Principal Aquifer, the storage loss is relatively consistent, with the highest storage loss occurring in the northeast region of the aquifer. Storage loss in the Western Lower Principal Aquifer is relatively consistent. In the Eastern Principal Aquifer, storage loss is greatest in the northwest region of the aquifer, in the southern Subbasin along the Tuolumne River, and in the eastern region of the Subbasin.

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 in storage of 43,000 AFY. The GSP estimated these data to have a qualitative medium level of accuracy. Under the 2016-2021 period, the average annual change in groundwater in storage is estimated to be 43,100 AFY. Based on similar methodology and data, it is anticipated that simulated results for the 2016-2021 period maintains comparable levels of uncertainty.

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 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, a tracking and analysis process has been established for inclusion in annual reports. Because the WY 2021 reporting period is just prior to GSP implementation in 2022, analysis of data from wells monitored in that period provides a baseline for existing conditions in the Subbasin on which to evaluate potential degradation.

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. Tracking and analyses of the SWRCB-regulated data are being obtained from publicly-available online portals.

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. The monitoring network for groundwater quality uses publicly available groundwater quality data from the State GeoTracker dataset and will be updated annually. Indicators of groundwater quality degradation will be assessed in each Annual Report. This 2021 Annual Report establishes the baseline that will be used to identify indicators for groundwater quality degradation in subsequent annual reports.

8.1 APPROACH

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 is 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, will be 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.

This Annual Report serves to establish baseline conditions for groundwater quality in all three principal aquifers of the Modesto Subbasin. 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 begins with the historical GSP study period (WY 1991 through WY 2015) and extends the data through the current reporting period (WY 2021). The monitoring network for each constituent of concern is composed of the wells that were sampled for that constituent during the reporting period; those wells are the designated RMWs for water quality. The baseline value established for each well is the maximum concentration of a given constituent of concern from WY 1991 to WY 2021.

Future annual reports will compare water quality conditions from the current water year to the baseline water quality conditions established in this annual report. A measurement will be considered an indicator of groundwater degradation if it exceeds the MT for the first time at that well. If the baseline is greater than the MT, any new maximums will be considered groundwater quality degradation indicators. For those wells, historical water quality data will be analyzed, along with changes in water quality in nearby wells, to determine if degradation is likely attributable to GSA management and is resulting in costs to well owners. If so, the GSAs will work with water quality regulators (SWRCB – Division of Drinking Water or others) and drinking water suppliers to discuss issues and options for managing the issues.

8.2 Data Compilation

The groundwater quality monitoring network consists of publicly available data downloaded from GAMA through the State GeoTracker website. The RMWs include drinking water supply wells, monitoring wells at regulated facilities, and monitoring sites associated with other regulatory water quality programs.

Data from WY 1991 (October 1990) through WY 2021 (through September 2021) were downloaded for the seven COCs. There were 361 wells sampled during WY 2021 for at least one of the COCs. These 361 wells comprise the RMWs for water quality and are shown on **Figure 8-1**. A table summarizing these wells is provided in **Appendix B**. This source of the wells in the monitoring network includes 177 public supply wells[3] monitored by water suppliers and regulated by the Division of Drinking Water, 11 wells monitored by the USGS under the GAMA program, 110 monitoring wells at regulated facilities as overseen by the State Water Board, and 63 wells associated with regulatory water quality coalitions (such as under the Irrigated Lands Regulatory Program) and monitored by Aglands.

Wells were classified by principal aquifer using top of screen depth, bottom of screen depth, and total well depth data, when available in the GAMA database. Wells east of the Corcoran Clay extent are classified as Eastern Principal Aquifer wells. Wells were classified as being in the Western Upper Principal Aquifer if the top of the screen was above the Corcoran Clay and the bottom screen was above the bottom of the Corcoran Clay. If screen data were not available but total depth was, wells with a total well depth above the bottom of the Corcoran Clay were classified as Western Upper Principal Aquifer. Wells were classified as being in the Western Lower Principal Aquifer if the top screen depth was below the top of the Corcoran Clay and the bottom screen depth was below the bottom of the Corcoran Clay. Wells overlying the Corcoran Clay that were screened in both aquifers, lacked construction data, or had questionable construction data were classified generally as being in the Western Principal Aquifers. 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.

The maximum measurement of each constituent from WY 1990 to WY 2021 was identified for each well in which the constituent had been measured in WY 2021. Any measurements below that measurement's reporting limit were labeled as "ND" (not detected). The table in **Appendix B** summarizes the 361 RMWs sampled in WY 2021. The table including well name, coordinates, aquifer designation, dataset name (source), and the maximum concentration and corresponding date of each COC that was sampled for in WY 2021.

[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.

8.3 BASELINE ANALYSIS

Baseline values for each well, by constituent, are illustrated on **Figures 8-2 through 8-8**. Each figure is divided by principal aquifer and shows the wells that were monitored for that constituent in WY 2021.

8.3.1 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 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).

The Modesto Subbasin monitoring network for arsenic consists of the 125 wells measured for arsenic in WY 2021 (**Figure 8-2**). Of these wells, 27 (21.6%) had a baseline value, or a maximum measurement during WY 1991 through WY 2021, that was greater than the 10 ug/L MCL and MT for arsenic. Only one of these wells had its maximum arsenic concentration measured in WY 2021. Baseline values for arsenic ranged from ND to 170 ug/L. The average of arsenic baseline values in the Modesto Subbasin was 11.8 ug/L, and the median was 5.45 ug/L.

Arsenic concentrations were higher in the Western aquifers than in the Eastern Principal Aquifer. In the Eastern Principal Aquifer, only eight out of 87 wells (9.2%) had arsenic concentrations greater than the MT. The average baseline value for arsenic in the Eastern Principal Aquifer is 7.3 ug/L. All of these wells were monitoring wells at regulated facilities and likely not representative of drinking water conditions. In the Western Principal Aquifers, 19 out of 38 wells (50%) reported arsenic baseline values over the MT. The average baseline values in the Western Upper aquifer (n wells = 29) is 21.9 ug/L and the median is 10.45 ug/L.

8.3.2 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., 2021).

The groundwater quality monitoring network for uranium contains 26 wells, shown by aquifer in **Figure 8-3**. Uranium concentrations range from ND to 52.5 pCi/L. Only municipal and domestic wells were tested for uranium. The network contains 19 wells in the Eastern Principal Aquifer and seven wells in the Western Principal Aquifers. In total, eight of the 26 wells (30.8%) reported a maximum uranium concentration greater than the 20 pCi/L MT. Five of these wells are in the Western Principal Aquifers. None of the wells with a baseline value greater than 20 pCi/L reported its maximum measurement in WY 2021.

8.3.3 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.

Figure 8-4 shows the 282 wells in the monitoring network for nitrate, with maximum values reported as nitrate as nitrogen. Maximum nitrate concentrations ranged from ND to 64 mg/L. In total, 45 wells (16.0% of all wells) had baseline values that are greater than the 10 mg/L MT, and the maximum nitrate concentration reported was measured during WY 2021 for 11 of these wells. The average of all nitrate baseline values was 7.52 mg/L, and the median was 6.33 mg/L.

Elevated nitrate concentrations occur throughout the Subbasin, in both rural and urban areas. In general, shallower wells are more vulnerable to nitrate contamination. Wells in the Eastern Principal Aquifer had an average nitrate concentration of 7.6 mg/L, and 36 of the 235 wells (15.3%) had baseline values greater than the 10 mg/L MT. In the Western Upper Principal Aquifer, 5 of the 17 wells (29.4%) had concentrations above the MT, with an average concentration of 9.6 mg/L. Two of the ten wells in the Western Lower Principal Aquifer (20.0%) had nitrate levels above the MT, and that aquifer had an average concentration of 7.9 mg/L. Of the 20 other Western Principal Aquifer wells, two (10.0%) had a baseline value above the MT, and the average concentration was 6.6 mg/L.

8.3.4 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 contains 147 wells that were tested for TCP in WY 2021 (**Figure 8-5**). TCP has not been detected in most of the wells (n=98). Maximum TCP concentrations ranged from ND to 2.1 ug/L. The maximum concentration observed in a public supply well was 0.5 ug/L. Of the 147 wells, 31 (21.1%) had TCP concentrations greater than the 0.005 ug/L MT. Six of those wells had their maximum measurement during WY 2021. Of the wells with TCP above the MT, 23 were from municipal wells and 8 were monitoring wells at regulated facilities. TCP has been detected throughout the Modesto Subbasin, but the highest concentrations are in the northern and southeastern regions of the City of Modesto, within the Eastern Principal Aquifer.

8.3.5 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.

The monitoring network for DBCP, shown in **Figure 8-6**, consists of 117 wells, which were monitored for DBCP in WY 2021. Of these, 16 wells, all public supply wells, had DBCP measurements greater than the 0.2 ug/L MT, and the maximum DBCP measurement was 2 ug/L. DBCP was not detected in 88 wells throughout the historical time period. DBCP has been detected in the Western Upper Principal Aquifer and the Eastern Principal Aquifer. DBCP is highest north and southeast of the City of Modesto in the Eastern Principal Aquifer. Its spatial distribution is similar to that of TCP, which is also associated with pesticide products.

8.3.6 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.

The monitoring network includes 142 RMWs with PCE measurements in WY 2021 (**Figure 8-7**). Of these, 97 (68%) of these wells did not have a PCE detection during WYs 1991-2021, and 13 (9.2%) had a maximum PCE measurement greater than the 5 ug/L MT. The maximum PCE measurement was 40 ug/L. Of the 13 wells with maximum concentrations above the MT, only two of them are public supply wells. Elevated PCE concentrations primarily occurred in the Eastern Principal Aquifer, and most are in a cluster near a regulated facility (a landfill) next to the Tuolumne River. Groundwater extraction and treatment is ongoing at that facility for the protection of groundwater and surface water.

8.3.7 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. In the Modesto Subbasin, shallow groundwater generally has a higher TDS concentration than in lower portions of the principal aquifers, and shallow groundwater is more vulnerable to salinization. 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. Elevated concentrations of TDS in shallow groundwater can occur from irrigation return flow percolating through sandy soil but can be related to wastewater discharge or managed aquifer recharge using more saline water.

The monitoring network for TDS contains 107 wells, consisting of 67 monitoring wells and 40 municipal wells (**Figure 8-8**). Of these, 62 (57.9%) wells had TDS concentrations greater than the 500 mg/L MT, and 28 (26.2%) were greater than 1,000 mg/L. Only four of the wells with concentrations greater than the MT had their maximum TDS measurement during WY 2021. The maximum TDS measurement was 20,000 mg/L, at a regulated facility, and the maximum TDS measurement in a public supply well was 1,300 mg/L. The average baseline value for TDS was 1,113 mg/L and the median value was 590 mg/L.

The dataset contains 75 wells in the Eastern Principal Aquifer and 32 wells in the Western Principal Aquifers. Most of the wells are monitoring wells clustered at regulated facilities.

The highest TDS concentrations were recorded in two clusters of monitoring wells at regulated facilities. One is in the southern portion of the Eastern Principal Aquifer along the Tuolumne River, and one is in the Western Upper Principal Aquifer in southwest Modesto. Of the public supply wells with TDS baseline values greater than the MT, three are in the Eastern Principal Aquifer, one is the in the Western Upper Principal Aquifer, and one is in the Western Principal Aquifers.

8.4 LIMITATIONS

The baseline analysis has several limitations including well distribution and incomplete construction data; nonetheless, it makes best use of a wide variety of existing water quality data collected under a regulated program and approved protocols. Other limitations are noted below.

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 GeoTracker database, than wells that have never previously reported a high arsenic concentration.

Variable reporting limits may slightly skew general statistics of this dataset, such as averages or medians. Wells were reported as NDs if the chemical concentration was less than the reporting limit. However, reporting limits can vary, often depending on the lab method or the year that the sample was analyzed (reporting limits in the early 1990's may be higher than those in recent years). NDs were treated as zero in numerical analyses of this dataset.

However, reporting limits are generally well below the MTs, so this will not affect the process for identifying MT exceedances.

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 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 groundwater extractions 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 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 2021 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 WY 2021. As mentioned above, the 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, water levels at three wells in the Western Lower Principal Aquifer (below the Corcoran Clay) were at or below MTs during WY 2021.

Two of the wells with MT exceedances are Proposition 68 monitoring wells constructed in Spring 2021 (MW-1D and MW-2D). Water level data were measured at these wells soon after construction and local groundwater elevations will become better understood as more data are collected in the future. In addition, without historical data, it is difficult to determine an accurate MT at these locations.

Groundwater levels at City of Modesto monitoring well MOD-MWB-2, along the eastern edge of the Western Lower Principal Aquifer, were at the MT during WY 2021. As described below, additional datasets did not indicate the presence of land subsidence in this area , or in any other areas of the Subbasin, during WY 2021. 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 2021 are presented on **Figure 9-1**. The figure illustrates that no negative vertical displacement (land subsidence) was indicated during WY 2021. In fact, vertical displacement estimates were either zero or positive, meaning that land surface elevations were stable or rose slightly during WY 2021. Land surface elevations rose between 0 and 0.05 feet (0.6 inches) throughout most of the Subbasin (light gray shading), with a rise of more than 0.05 feet in the eastern Subbasin (darker gray shading).

The InSAR data analyzed in the GSP, for the period of June 2015 to October 2020, indicates some negative vertical displacement occurred in the central and eastern Subbasin, in the northwest corner of the Subbasin, and in a thin strip along the lower reach of the Stanislaus River. However, negative displacement – land subsidence – was not indicated in these areas, or any other areas of the Subbasin, during WY 2021.

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 2021, the average measurements at Stations CMOD and P306 were 4.8 millimeters (mm) and 12.1 mm, respectively, indicating a positive vertical displacement (rise in ground surface) at rates consistent to those indicated by the InSAR data. Local Stations P260 and P781 were inactive during WY 2021 and no vertical displacement data were measured.

A rise in the ground surface can be related to tectonic processes or land use activities. Nonetheless, both remote sensing data and GPS measurements indicate an absence of land subsidence in the Subbasin during WY 2021.

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

The RMWs are compared to the sustainable management criteria for interconnected surface water. During WY 2021, water levels at 4 out of 20 wells in the monitoring network for interconnected surface water were below the MTs. Three of these wells are along the Stanislaus River within the OID Management Area (Allen OID-1, Birnbaum OID-3 and Marquis OID-10). One well is along the Tuolumne River within the MID Management Area (MW-6S). Well locations are shown on **Figure 3-4**. No wells along the San Joaquin River had water levels below the MTs during WY 2021.

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. As explained in **Section 2**, the C2VSimTM water budget has been updated from WY 2016 through the reporting period of WY 2021 and provides estimates for streamflow depletions since 2015. The model estimates for streamflow depletion are provided below in **Table 10-1**.

Table 10-1: Streamflow Depletion Estimates WY 2016 - WY 2021

Water Year	Net Gain to Groundwater from Streamflow (AFY)		
	Stanislaus River	Tuolumne River	San Joaquin River
2016	16,428	10,133	-10,352
2017	28,252	70,978	2,355
2018	29,404	-9,770	-12,210
2019	34,422	36,065	-13,446
2020	18,084	-10,015	-18,666
2021	29,277	4,033	-16,354
Average	**25,978**	**16,904**	**-11,446**

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).

Between WY 2016 and WY 2021, the Stanislaus River and Tuolumne River are net losing streams, and the San Joaquin River is a net gaining stream. Since WY 2015, streamflow depletions have averaged approximately 26,000 for the Stanislaus River and approximately 17,000 AFY for the Tuolumne River. The San Joaquin River has gained approximately 11,500 AFY from the Modesto Subbasin.

During the historical study period (WY 1991 to WY 2015), the Stanislaus River was a net gaining stream. Since the end of the historical study period, the Stanislaus River has been a net losing stream with relatively similar streamflow depletions. Losses range from approximately 16,500 AFY in WY 2016 (a dry year) to 34,500 AFY in WY 2019 (a wet year).

Prior to 2016, the Tuolumne River was typically a net gaining stream, even during the drought years from WY 2013 to WY 2015. From WY 2016 to WY 2021, the gains/losses on the Tuolumne River have varied significantly with net losing conditions in most years. Streamflow depletion varied from 71,000 AFY in WY 2017 to a net annual gain (i.e., no streamflow depletion) of approximately 10,000 AFY in WY 2020. In the two wettest years, WY 2017 and WY 2019, the Tuolumne River contributed most to the groundwater system, likely due to low groundwater levels and higher river flows. During the driest three years, the Tuolumne River was either a net gaining stream (WY 2018 and WY 2020) or lost a relatively small amount (WY 2021). Annual precipitation and water year type are illustrated on **Figure 3-5**.

The San Joaquin River is on average a net gaining stream from WY 2016 to WY 2021. Its gains ranged from approximately 18,500 AFY in WY 2020, a dry year, to approximately 10,000 in WY 2016, also a dry year. In WY 2017, the wettest year since end of historical study period, the San Joaquin River 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 with regards to the hydrographs, which also show MTs and MOs and compliance with these criteria based on recent water level data, where available. That compliance is summarized in **Section 3** of this report; hydrographs for the RMWs, including sustainable management criteria, are provided in **Appendix A**.

11.1.1 Implementation of GSP Monitoring Network

During the reporting period, the GSP monitoring network was finalized and incorporated into the GSP. Although official GSP monitoring began after adoption in January 2022, many of the network RMWs contained historical data that are provided on the hydrographs in **Appendix A** for context.

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 WY 2021, water levels were measured in most of the representative monitoring wells. Water levels were measured in all but one of the CASGEM wells and all of the City of Modesto wells. Water levels were not measured in CASGEM well Quesenberry 223, located in the Eastern Principal Aquifer near the Tuolumne River, because the sounding port was obstructed. The obstruction was cleared, and water levels were measured in Fall 2021, after the reporting period. The GSAs did not have access to the USGS monitoring wells during WY 2021, and therefore, water levels measurements were not made in these wells. The STRGBA GSA is currently working with the USGS to obtain access to these wells for future monitoring. The Proposition 68 monitoring wells were constructed between February 2021 and June 2021, and water levels were measured following construction.

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 were brought online. 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 recent 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.

During WY 2021, groundwater levels are above IMs in all of the RMWs.

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 2021 are below the MTs in 5 out of 61 wells in the monitoring network for chronic lowering of groundwater levels. Two of these are in the Eastern Principal Aquifer and the other three are in the Western Lower Principal Aquifer. As discussed previously, two of the three wells that exceeded MTs in the Western Lower Principal Aquifer are new monitoring wells (Proposition 68) constructed in Spring 2021 and water levels in these wells will become better understood as future monitoring events provide additional data.

The sustainable management criteria for chronic lowering of groundwater levels are used as a proxy for 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 2021, the InSAR vertical displacement data indicated an absence of land subsidence in the Modesto Subbasin. Additional GSP stations in the Subbasin confirm the indications from the InSAR data.

Groundwater levels in 4 out of 20 wells in the monitoring network for interconnected surface water were below the MTs. Three of these wells are along the Stanislaus River and one is along the Tuolumne River.

This annual report establishes baseline conditions for the degraded water quality sustainability indicator. As discussed in **Section 8**, water quality data for the seven constituents of concern were downloaded from the GAMA database through the State GeoTracker website. There were 361 wells in the Subbasin sampled for one or more of the constituents of concern during WY 2021. These wells comprise the water quality monitoring network and will be used to evaluate future changes in water quality (see **Section 8**).

11.2 Implementation Progress

Although the regulations require a description of progress made on GSP implementation occurring during the reporting period (WY 2021), implementation activities since the submittal of the final GSP are also included. Because of the timing of this First Annual Report, the reporting period occurs prior to the completion and adoption of the GSP. As such, implementation activities were generally not yet underway. However, GSP implementation activities have been prioritized since the January 2022 submittal.

In addition to the details on local GSP implementation described in this section, the GSAs and associated member agencies in the Subbasin have also collaborated and contributed to this First GSP Annual Report including provision of water resources data for an update of the C2VSimTM local model. Accordingly, this submittal of the First GSP Annual Report represents completion of an initial and important GSP implementation step.

During WY 2021, 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.

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 are in the early stages of planning and developing future water supply projects. These projects are focused on this MA to address the most significant area of groundwater level declines in the Subbasin.

11.4 Management Actions

The Modesto Subbasin GSP includes 6 management actions including improvements to the monitoring network. During WY 2021, preliminary improvements were initiated. Between February and June 2021, 17 monitoring wells were constructed at 11 locations throughout the Subbasin using Proposition 68 grant funding from DWR. Almost all of these wells have now been incorporated as RMWs into the GSP monitoring networks. Additional clusters at certain locations were not selected for RMWs but provide useful data on local vertical gradients.

Specifically, two monitoring wells were constructed at six locations, to varying depths, and one monitoring well was constructed at the remaining five locations. Monitoring wells were constructed in each Principal Aquifer: 2 in the Western Upper Principal Aquifer, 2 in the

Western Lower Principal Aquifer and 13 in the Eastern Principal Aquifer. Most of the monitoring wells are RMWs in the monitoring network. The deeper paired monitoring well at three locations in the Eastern Principal Aquifer are not RMWs because groundwater levels thus far are similar to their shallow component. These three wells are designated as SGMA monitoring wells (rather than RMWs), will be monitored at the same frequency as the RMWs, and provide useful information for analysis of groundwater conditions in the future.

12 REFERENCES

American Water Works Association (AWWA), 2006, Flowmeters in Water Supply, Manual of Water Supply Practices Manual M33, Second Edition.

American Water Works Association (AWWA), 2012, Water Meters – Selection, Installation, Testing and Maintenance, Manual of Water Supply Practices Manual M6, Fifth Edition.

California Data Exchange Center (CDEC), 2021, Chronological Reconstructed Sacramento and San Joaquin Valley Water Year Hydrologic Classification Indices, download of public data from California Department of Water Resources (DWR), accessed in March 2022 at weblink: http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST

California Department of Water Resources (DWR), 2021, Water Year 2021: An Extreme Year, September, accessed March 2020 at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Water-Basics/Drought/Files/Publications-And-Reports/091521-Water-Year-2021-broch_v2.pdf

Dogrul, E.C. and T.N. Kadir and C.F. Brush, 2017, Theoretical Documentation and User's Manual for IWFM Demand Calculator (IDC-2015), Revision 63, DWR Technical Memorandum on methods and files used in IDC-2015 Revision 63, released in August 2017, available https://water.ca.gov/Library/Modeling-and-Analysis/Modeling-Platforms/Integrated-Water-Flow-Model-Demand-Calculator

Irrigation Training & Research Center (ITRC), 2012, SBx7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts, ITRC Report No. R12-002, Irrigation Training & Research Center (ITRC) at California Polytechnic State University, San Luis Obispo, August 26, 2012, http://www.itrc.org/reports/sbx7.htm.

Jurgens, B.C., Burow, K.R., Dalgish, B.A., and Shelton, J.L., 2008, Hydrogeology, water chemistry, and factors affecting the transport of contaminants in the zone of contribution of a public-supply well in Modesto, eastern San Joaquin Valley, California: U.S. Geological Survey Scientific Investigations Report 2008-5156, 78 p., https://pubs.usgs.gov/sir/2008/5156/.

Lopez, A. M., Wells, A., & and Fendorf, S., 2020, Soil and aquifer properties combine as predictors of groundwater uranium concentrations within the Central Valley, California. Environmental Science and Technology, no. 1 (2020), pg 352-361.

Maley and Brush, 2020, Assessing Kern County Subbasin Groundwater Sustainability Using C2VSimFG, California Water and Environmental Modeling Forum, Online Technical Sessions, October 6 and 8, 2022.

Shelton, J.L., Pimentel, I., Fram, M.S., and Belitz, K., 2008, Ground-Water Quality Data in the Kern County Subbasin Study Unit, 2006—Results from the California GAMA Program, U.S.

Geological Survey in cooperation with the California State Water Resources Control Board, USGS Data Series 337, 75 p., http://pubs.usgs.gov/ds/337/.

Smith, R., Knight, R., and Fendorf, S., 2018, Overpumping leads to California groundwater arsenic threat, Nature Communications 9(1), December, https://www.nature.com/articles/s41467-018-04475-3.pdf.

State Water Resources Control Board, State of California (SWRCB), 2019, 1,2,3-Trichloropropane, https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP.html.

United States Bureau of Reclamation (USBR), 2001, Water Measurement Manual, A Water Resources Technical Publication, U.S Bureau of Reclamation, Revised Reprint Third Edition, 2001. https://www.usbr.gov/tsc/techreferences/mands/wmm/

FIGURES

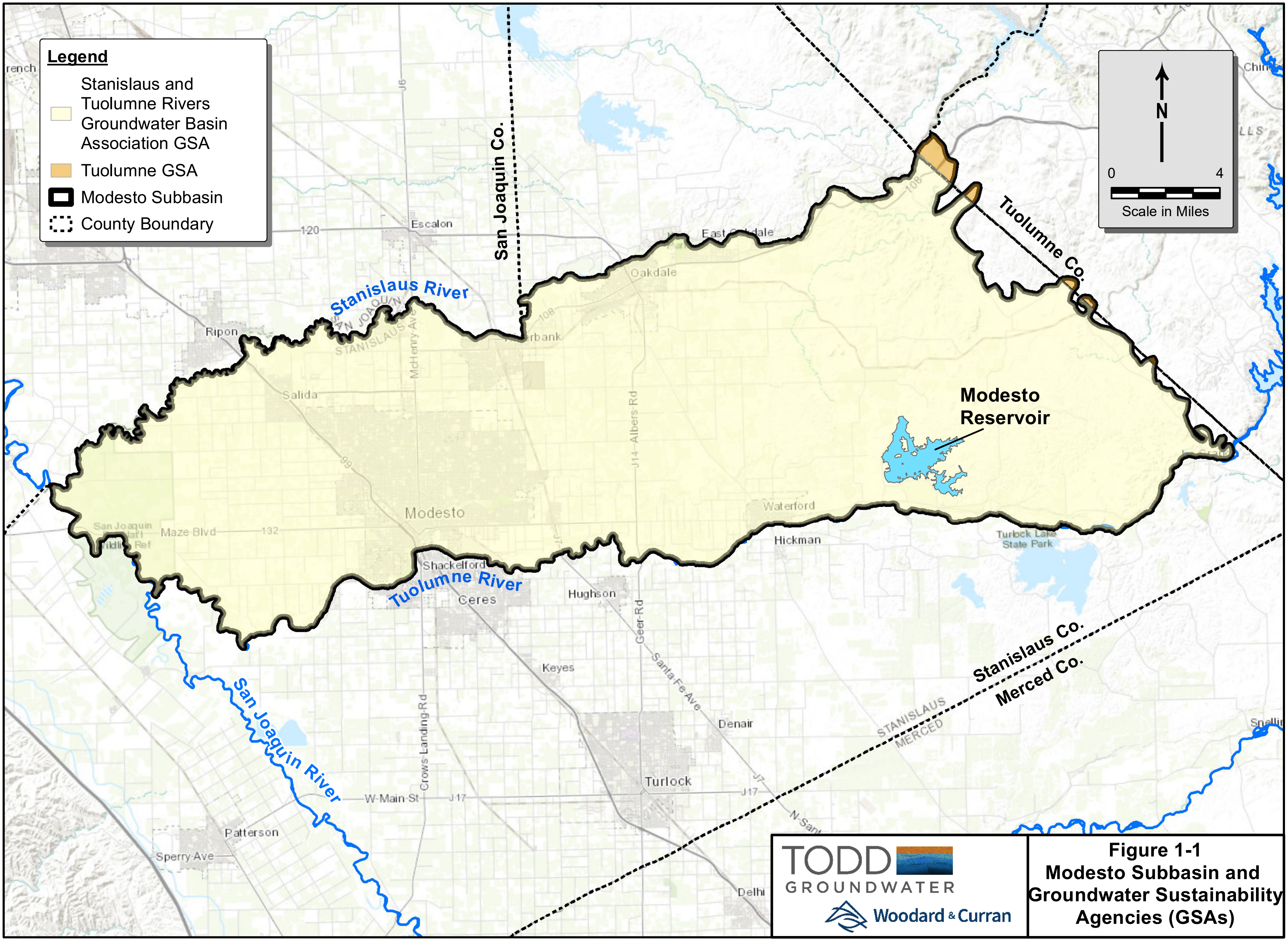


Figure 1-1
Modesto Subbasin and Groundwater Sustainability Agencies (GSAs)

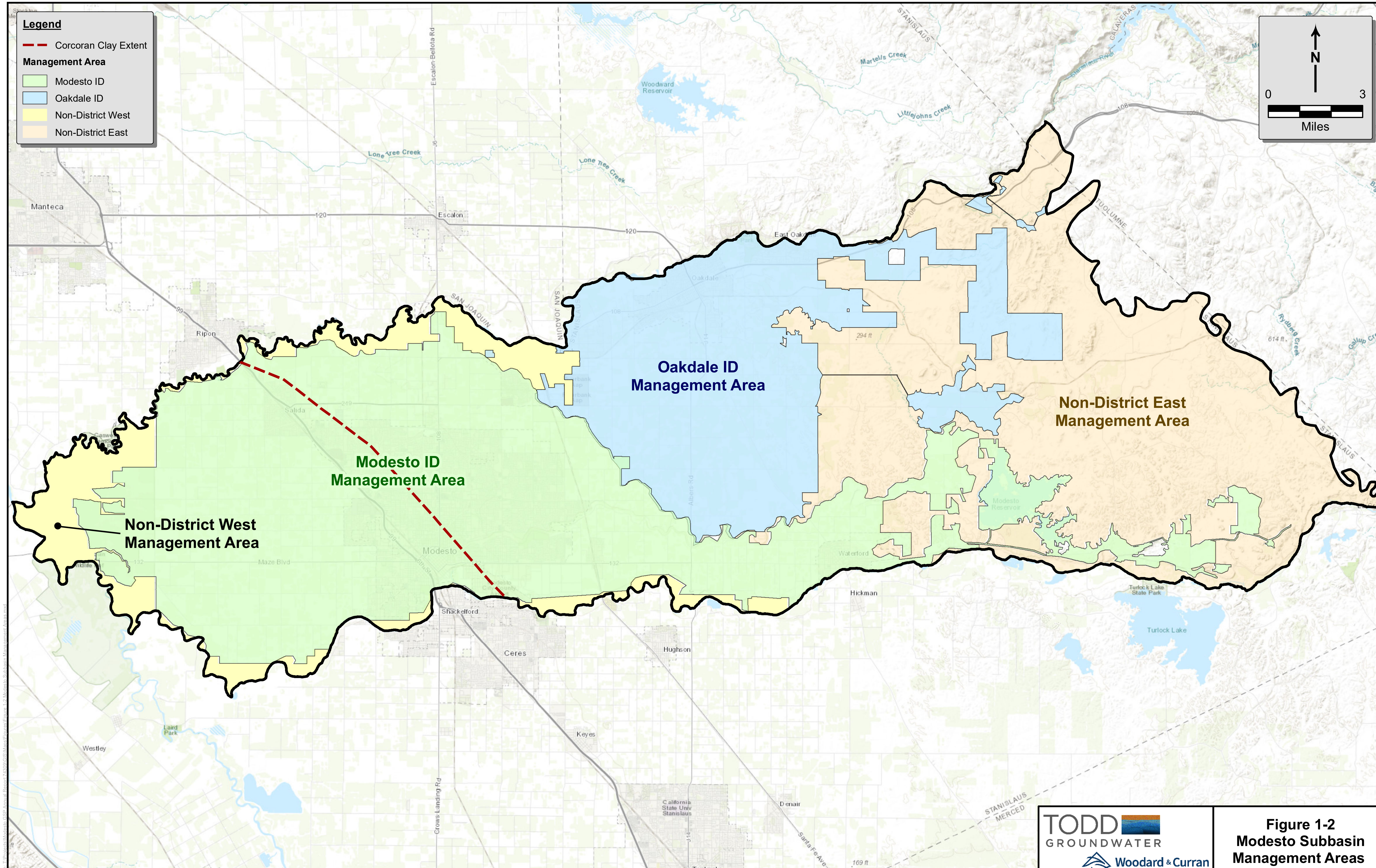


Figure 1-2
Modesto Subbasin
Management Areas

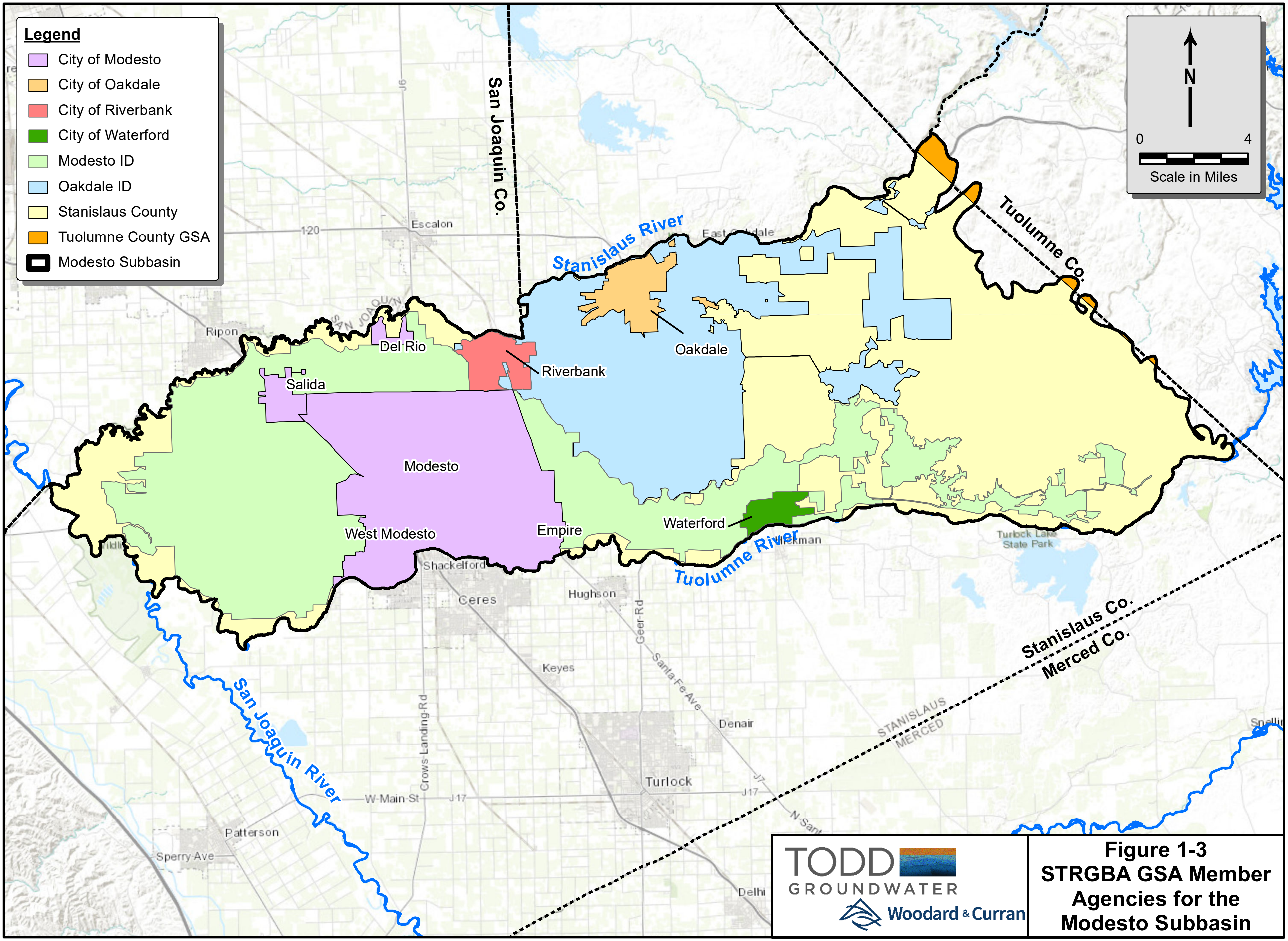


Figure 1-3
STRGBA GSA Member Agencies for the Modesto Subbasin

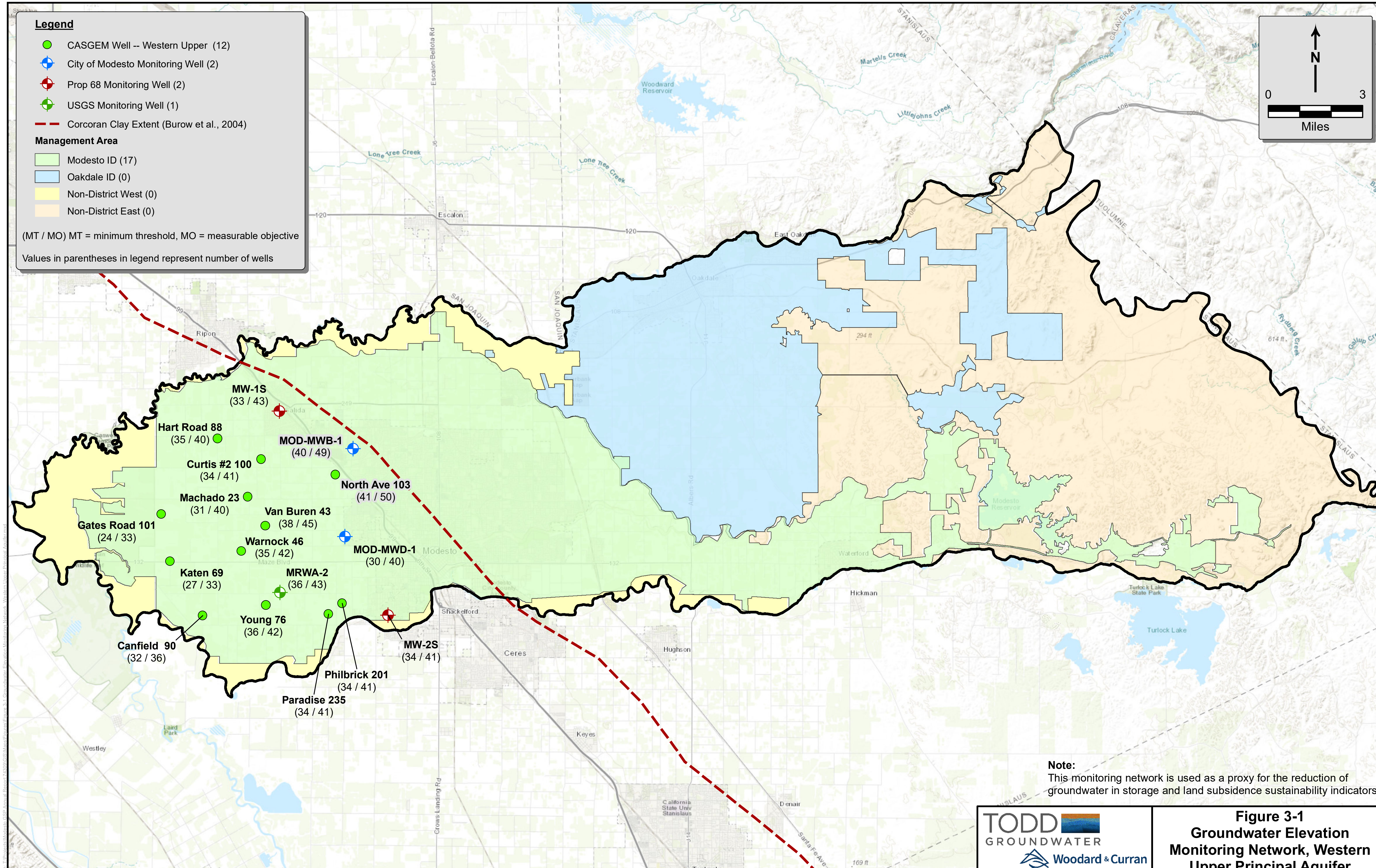


Figure 3-1
Groundwater Elevation Monitoring Network, Western Upper Principal Aquifer

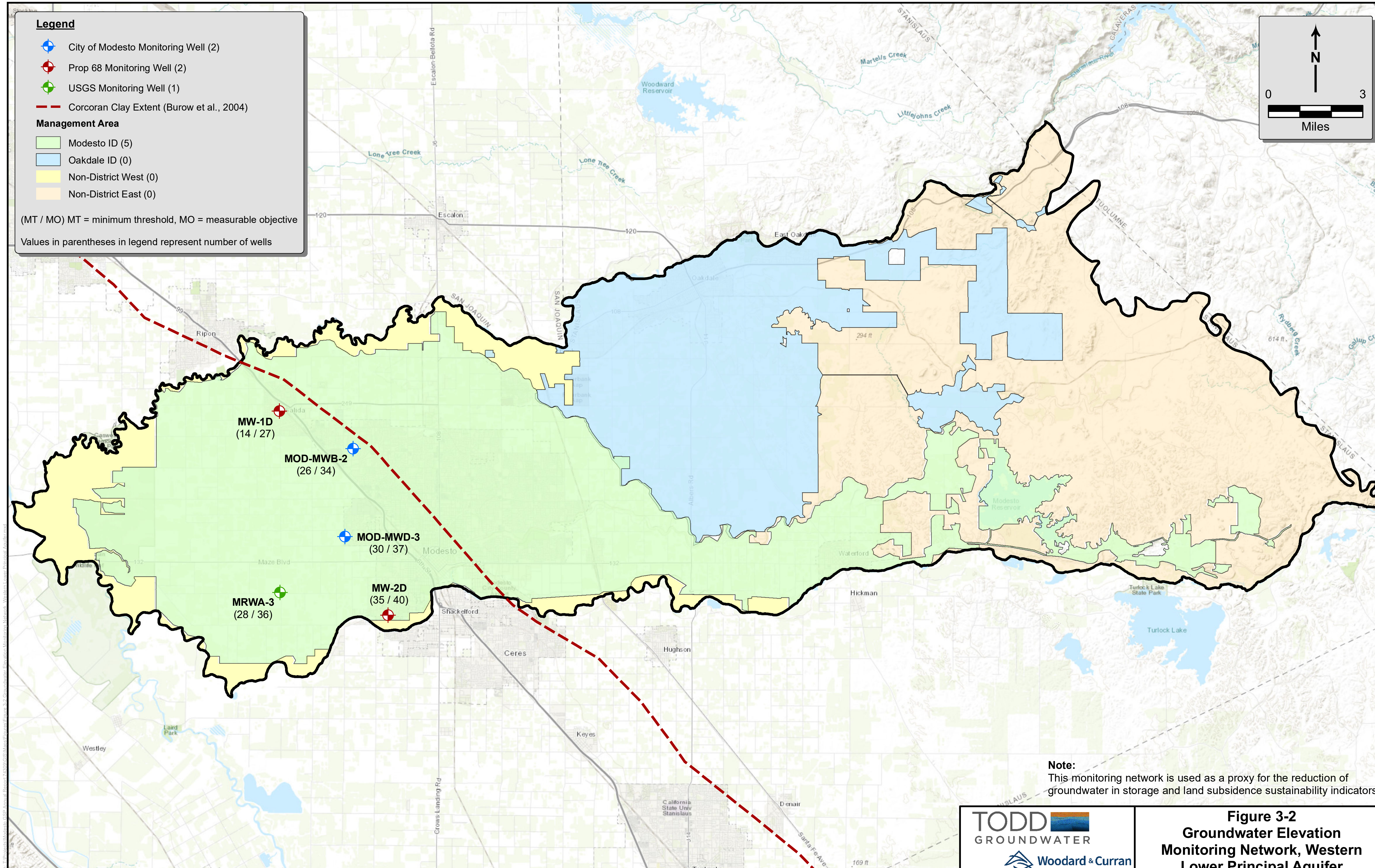


Figure 3-2
Groundwater Elevation Monitoring Network, Western Lower Principal Aquifer

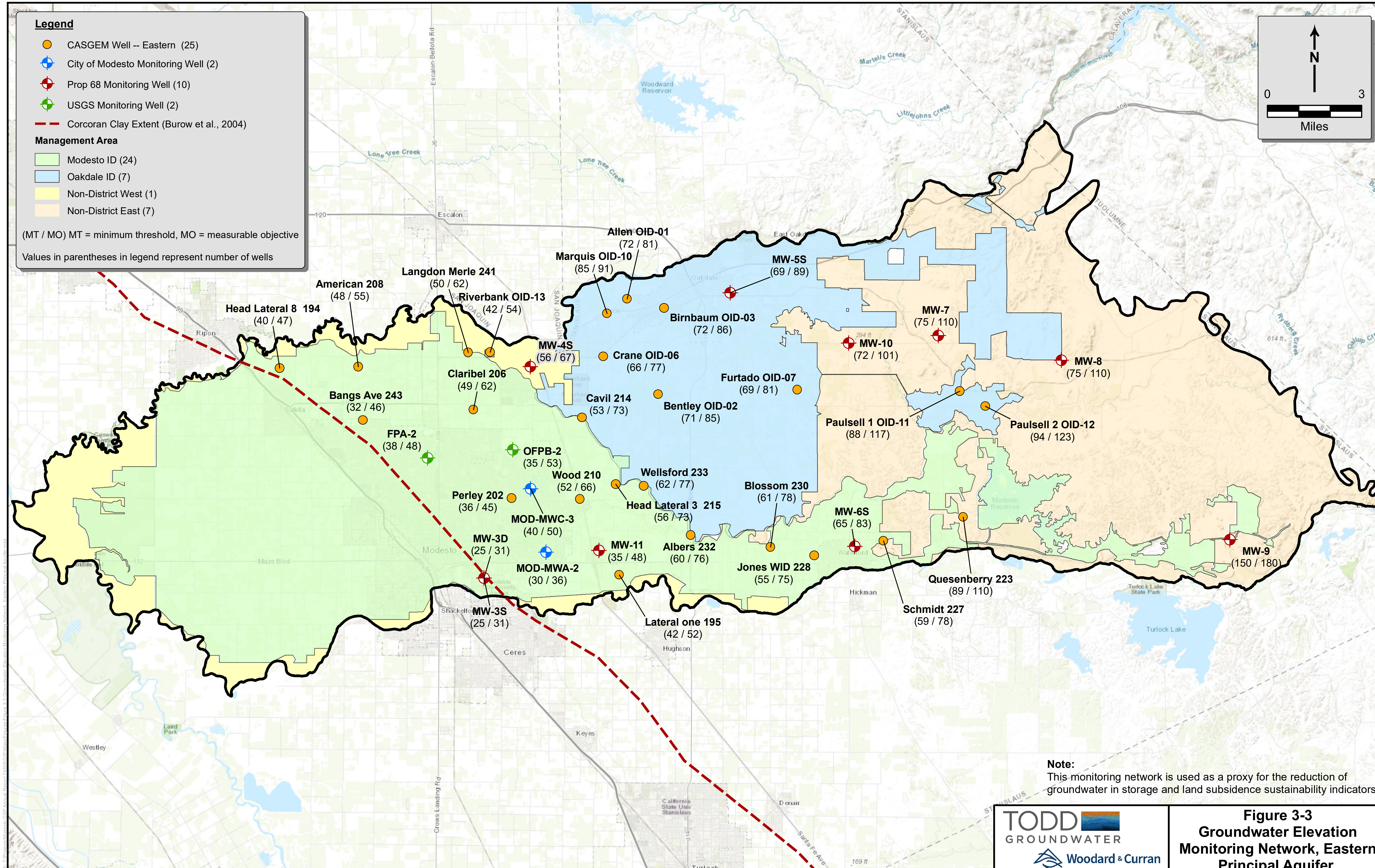


Figure 3-3
Groundwater Elevation Monitoring Network, Eastern Principal Aquifer

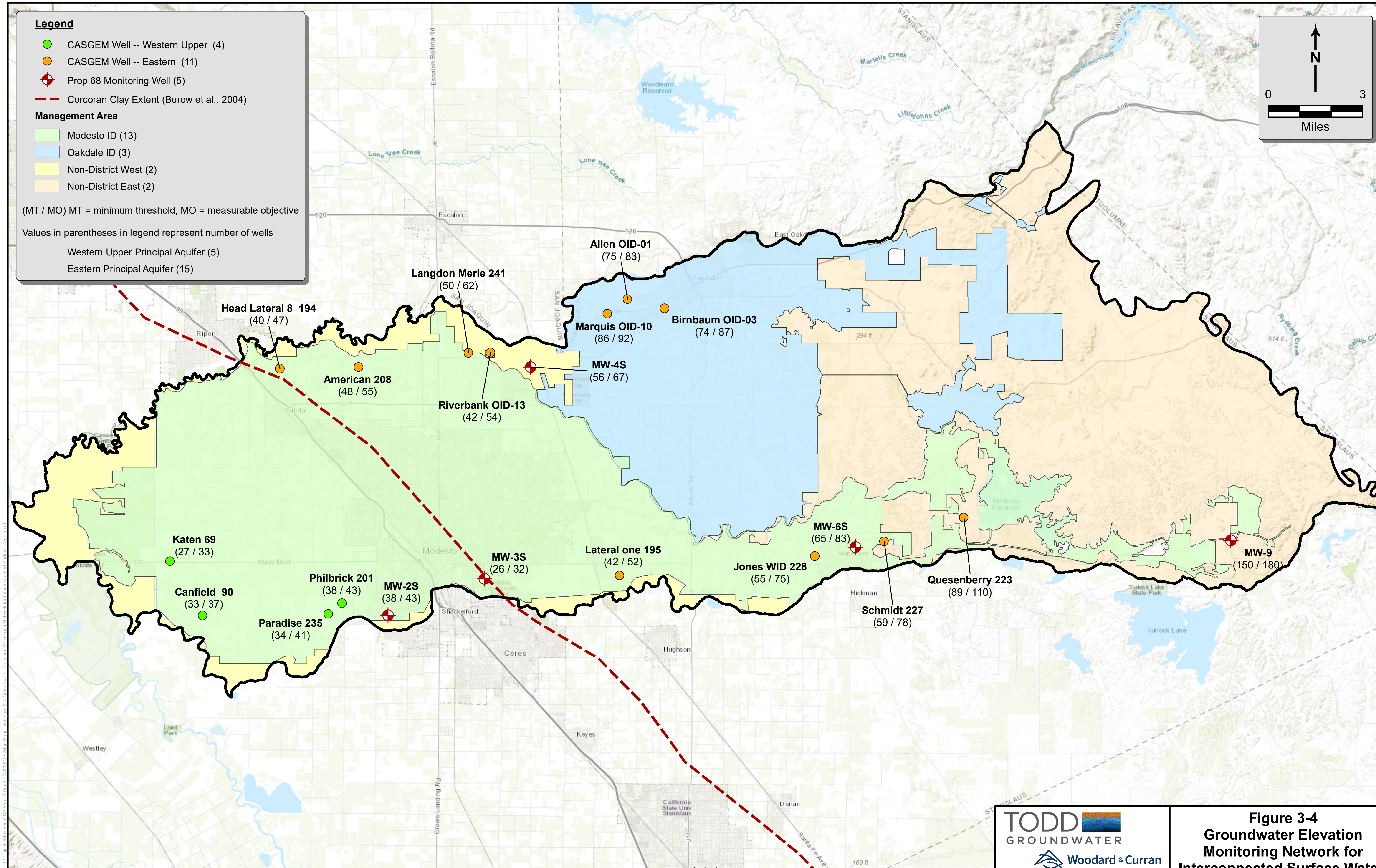
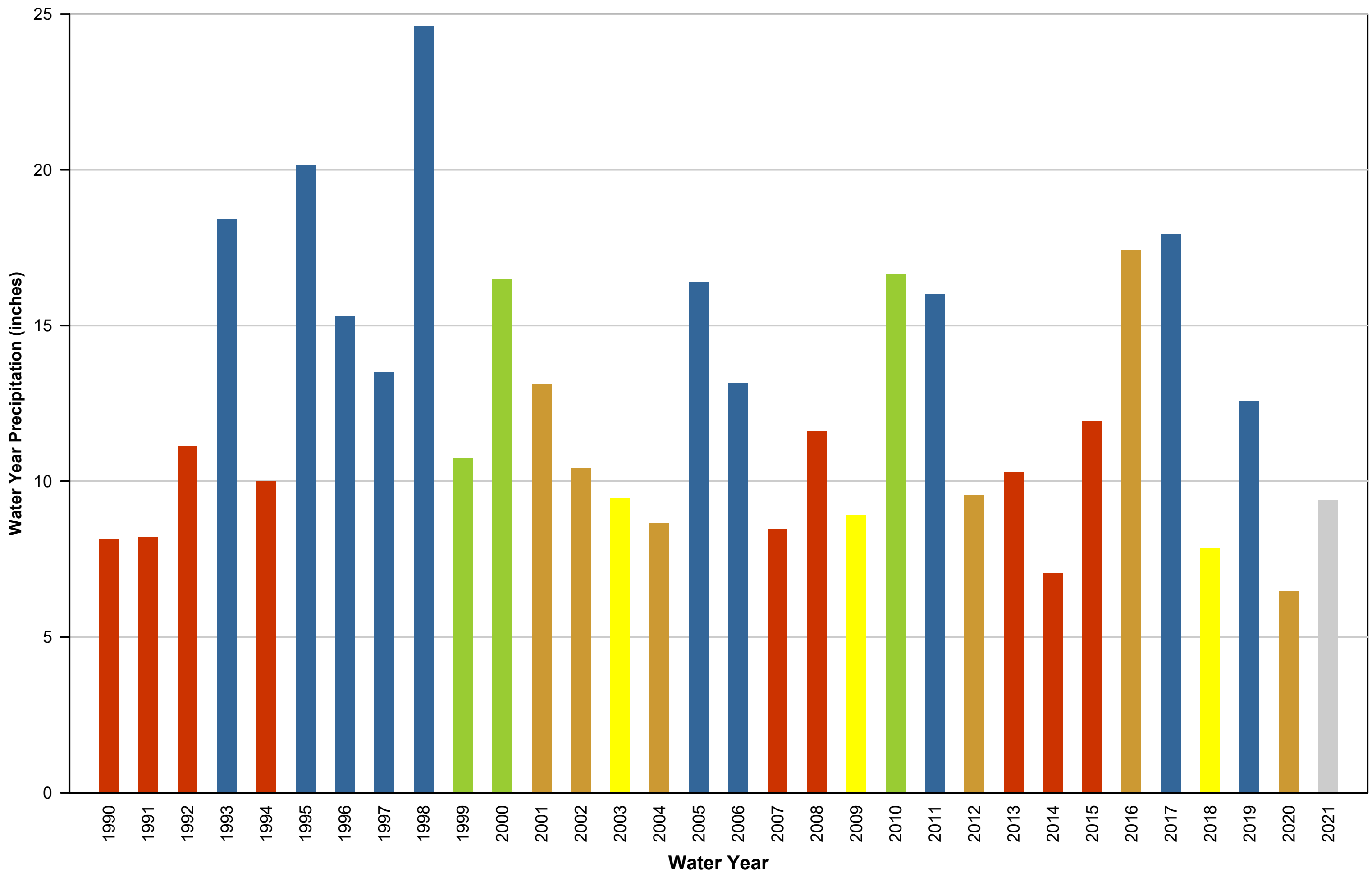


Figure 3-4
Groundwater Elevation Monitoring Network for Interconnected Surface Water



Water Year Type

- Wet
- Above Normal
- Below Normal
- Dry
- Critically Dry

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. The index for WY 2021 is not available yet.

TODD GROUNDWATER
Woodard & Curran

Figure 3-5
Annual Precipitation and Water Year Type
WY 1990-2021

Path: T:\Projects\Modesto GSP Annual Report 74309\GRAPHICS\Figure 2-5 Water Year Types San Joaquin Rivers Index WY 1990-2021.gpj

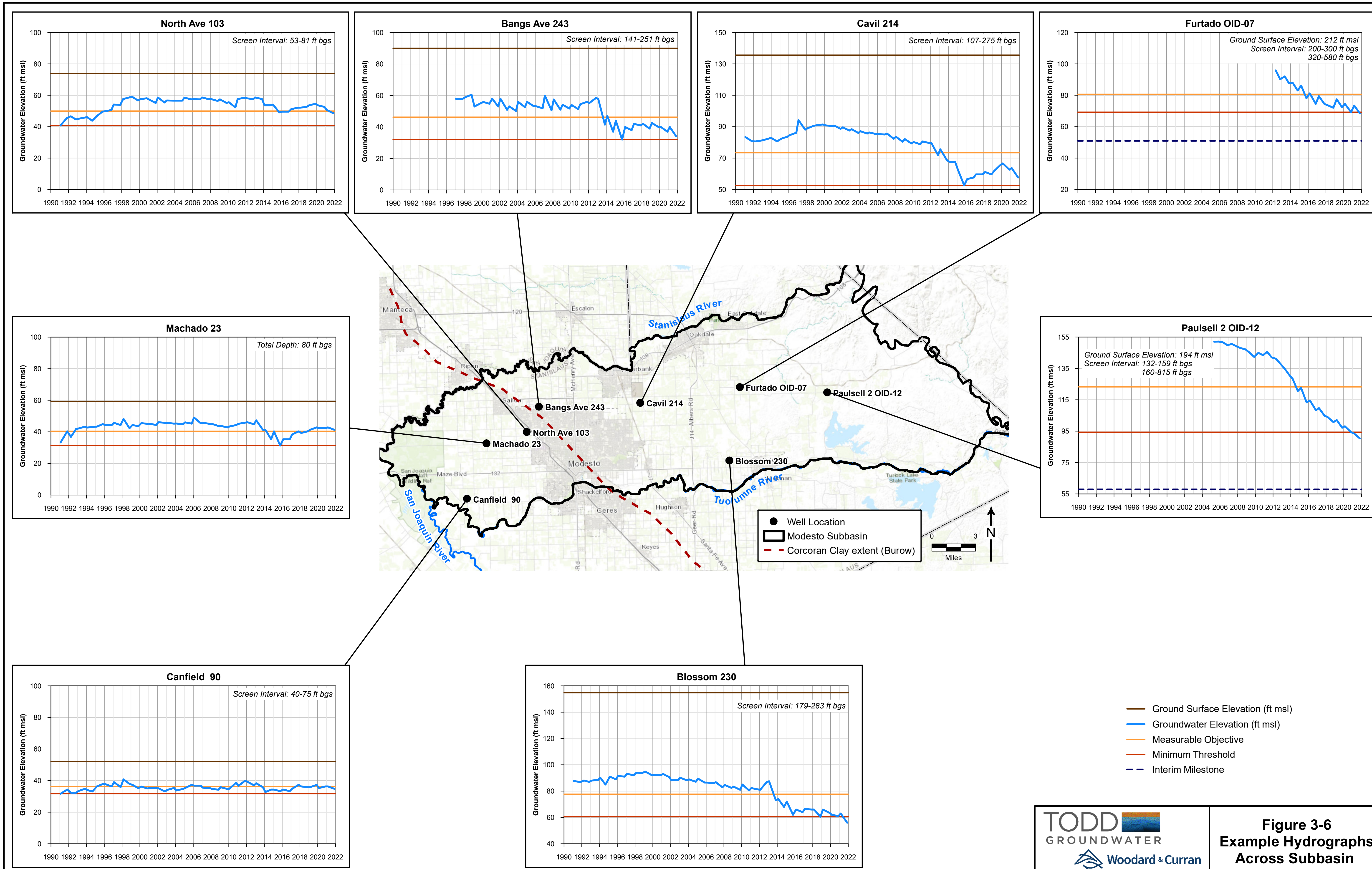


Figure 3-6
Example Hydrographs Across Subbasin

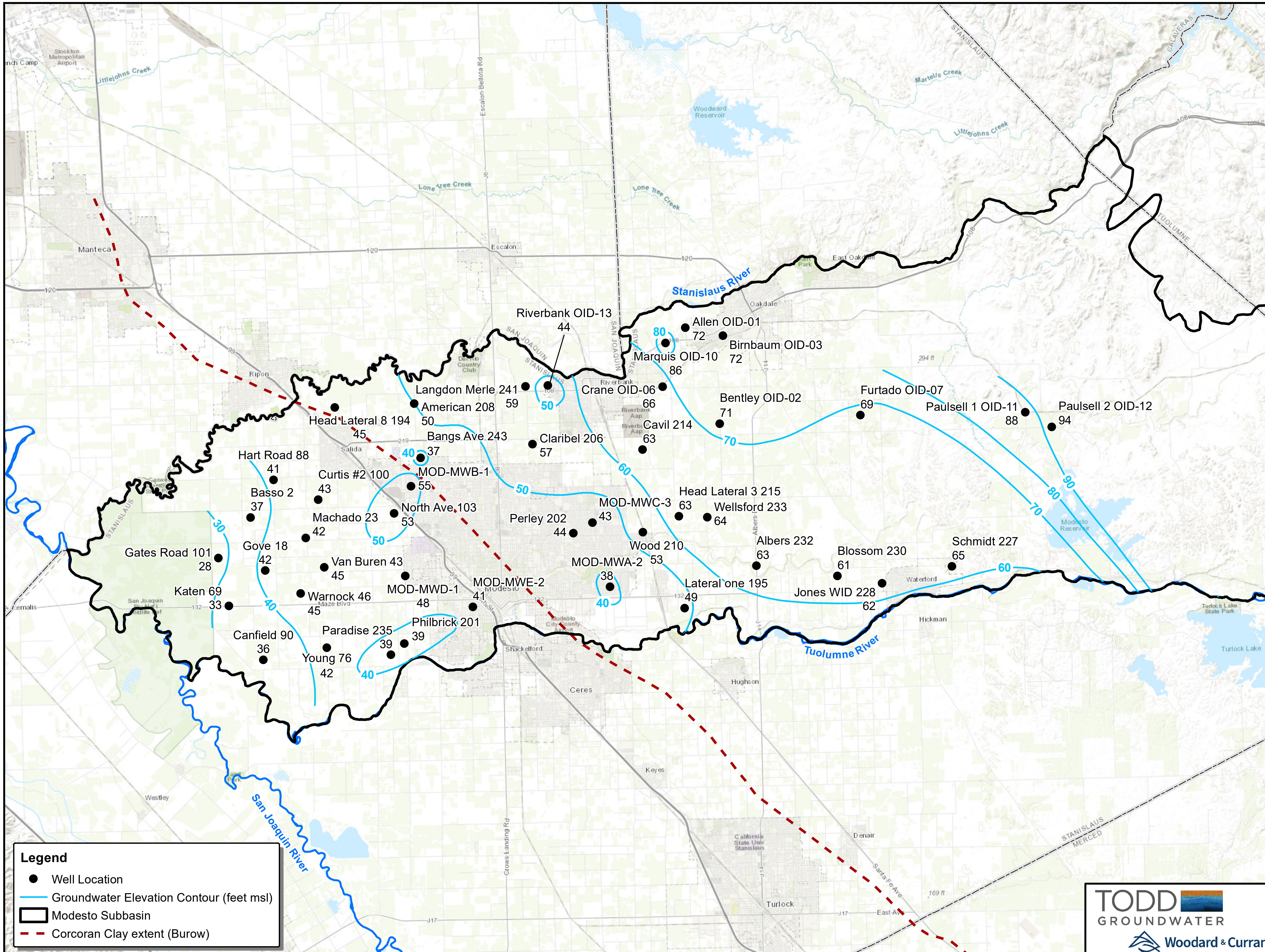


Figure 3-7
Groundwater Elevation Contours
Western Upper and Eastern
Principal Aquifers, Fall 2020

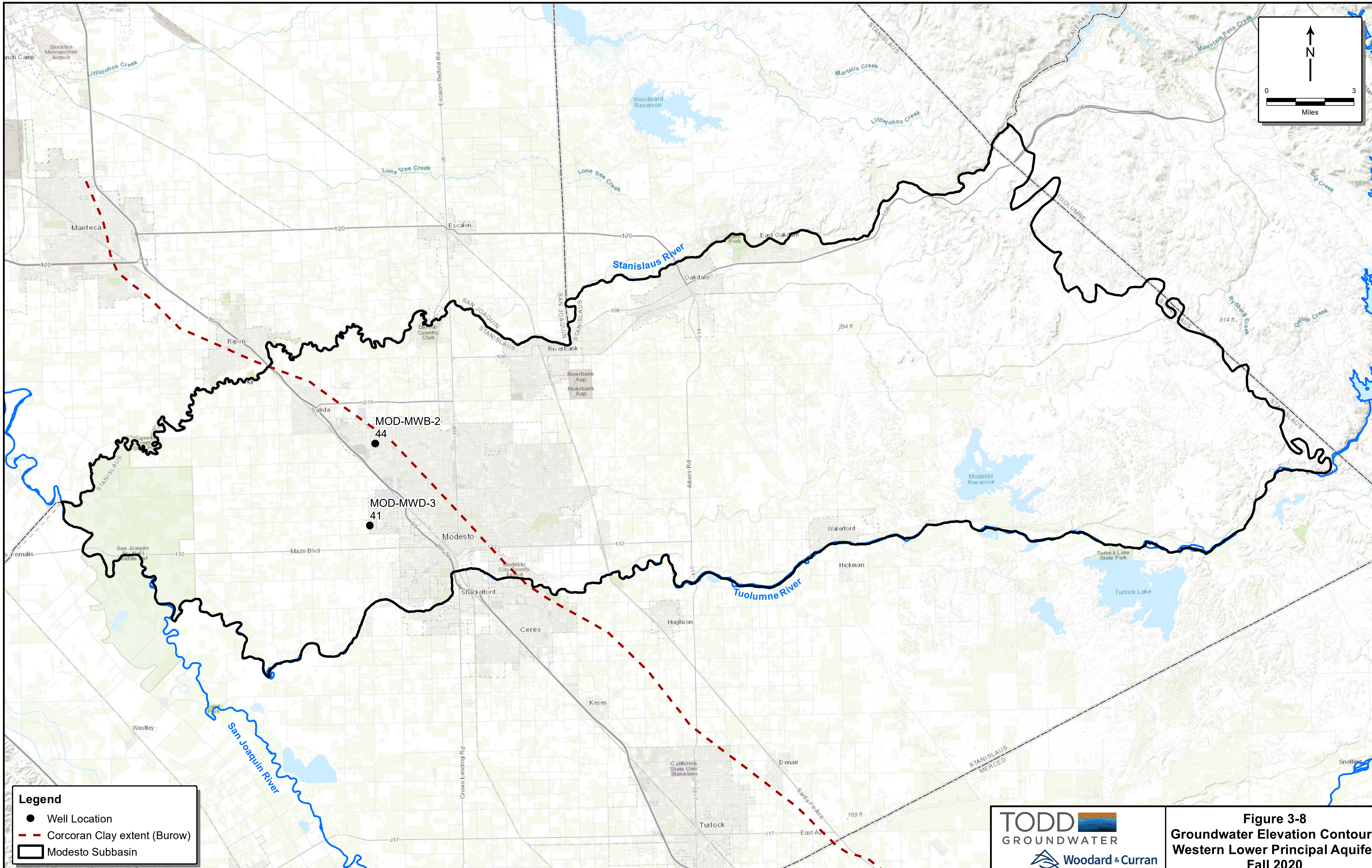


Figure 3-8
Groundwater Elevation Contours
Western Lower Principal Aquifer
Fall 2020

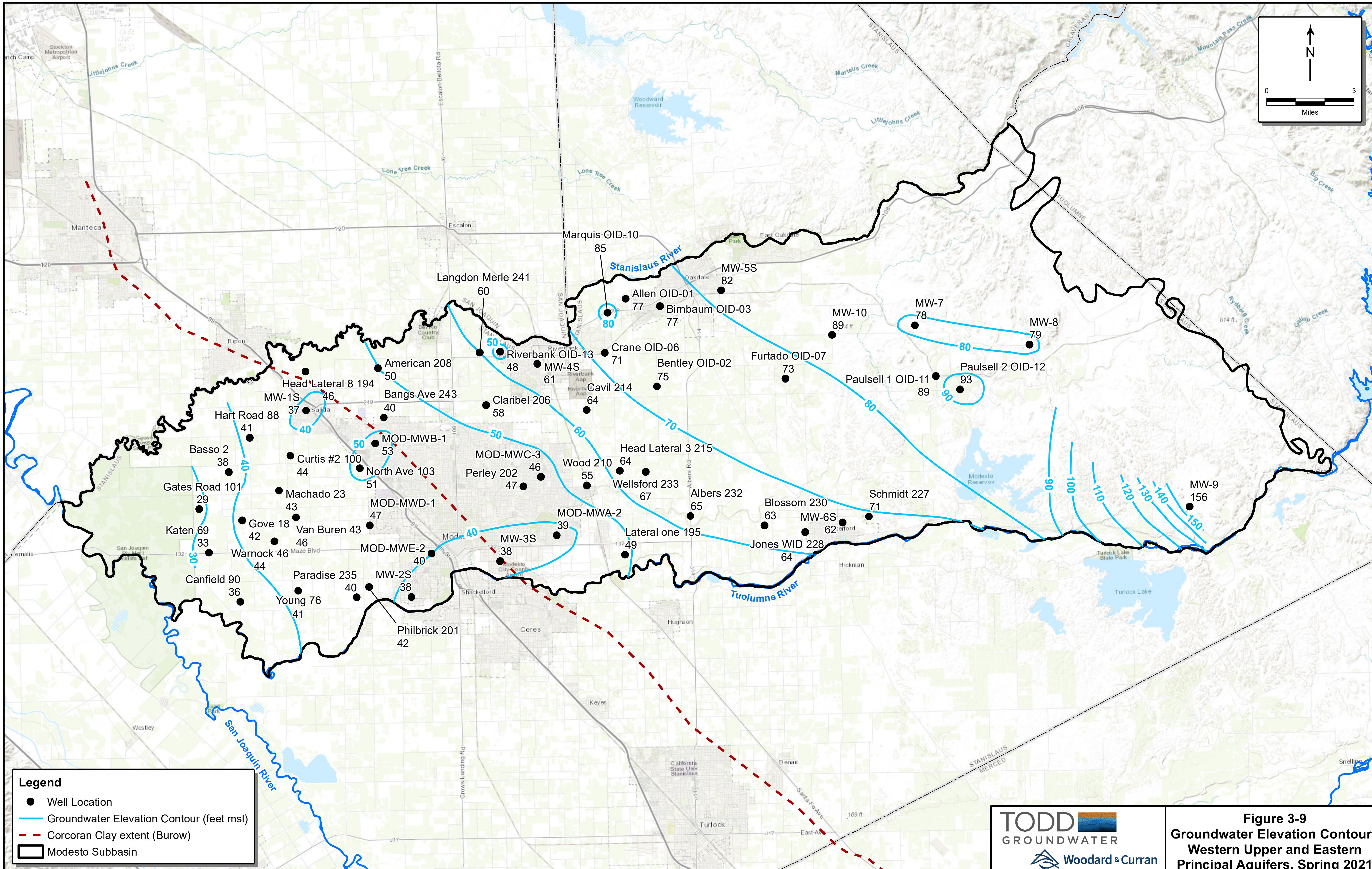


Figure 3-9
Groundwater Elevation Contours
Western Upper and Eastern
Principal Aquifers, Spring 2021

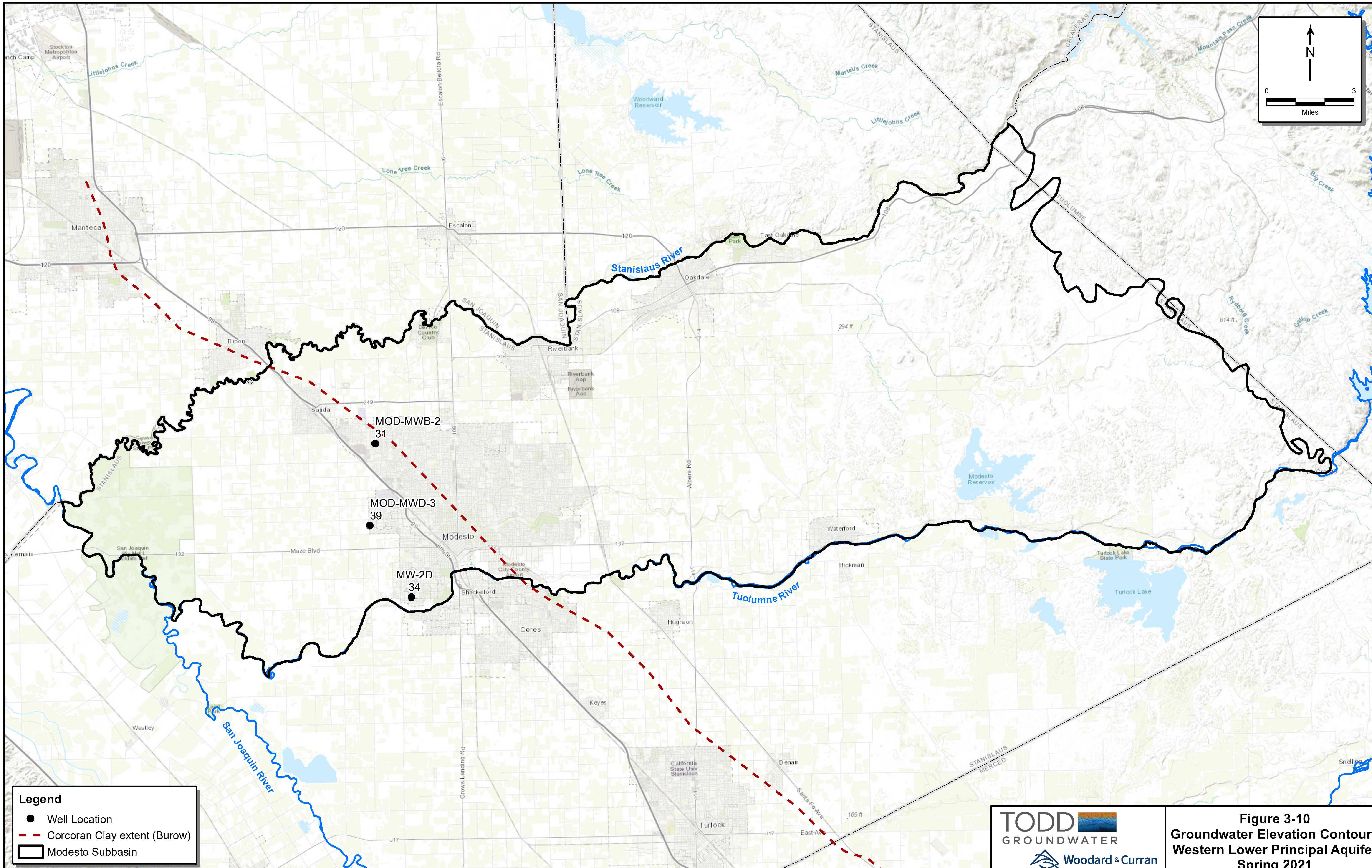


Figure 3-10
Groundwater Elevation Contours
Western Lower Principal Aquifer
Spring 2021

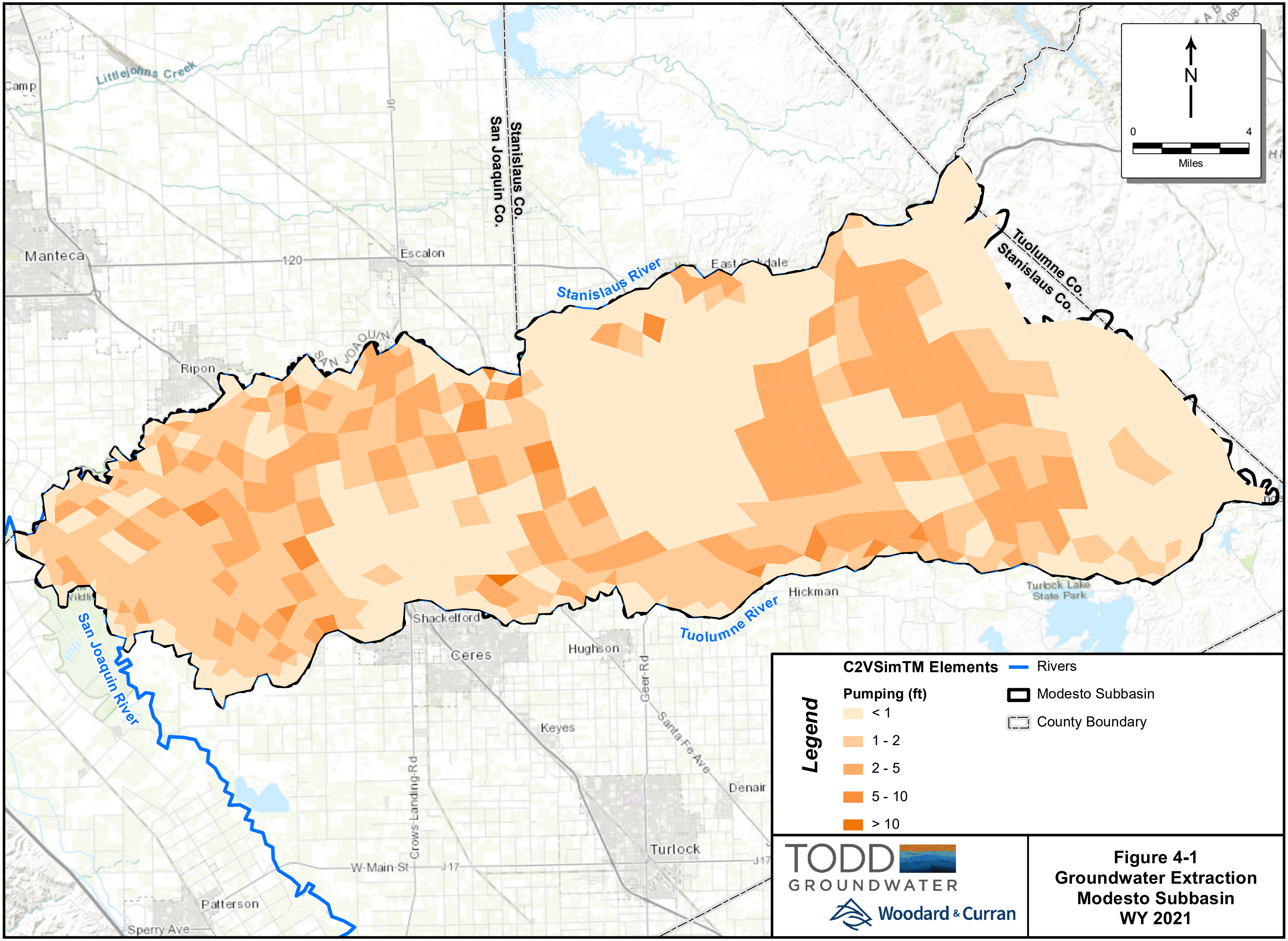


Figure 4-1
Groundwater Extraction
Modesto Subbasin
WY 2021

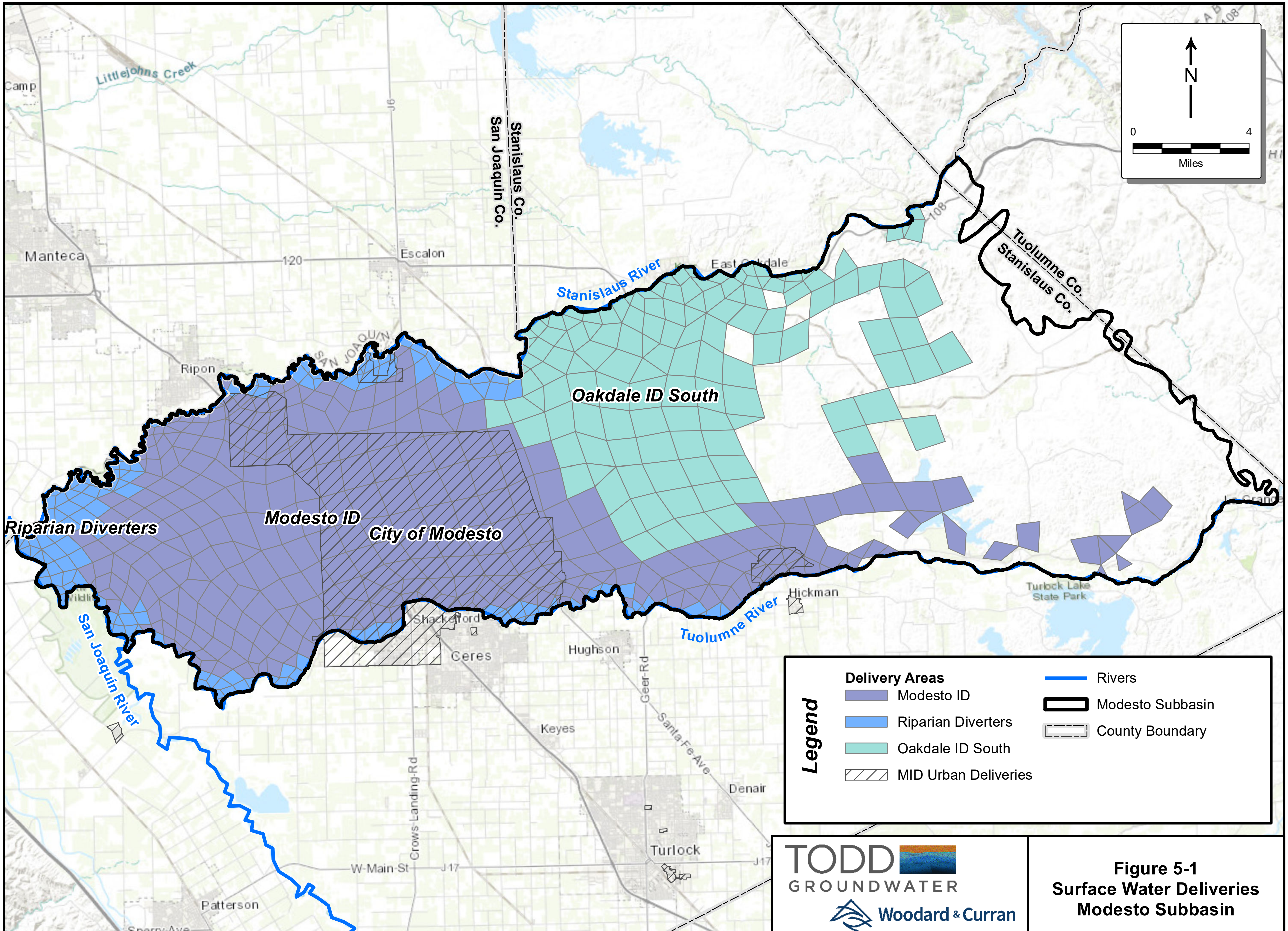
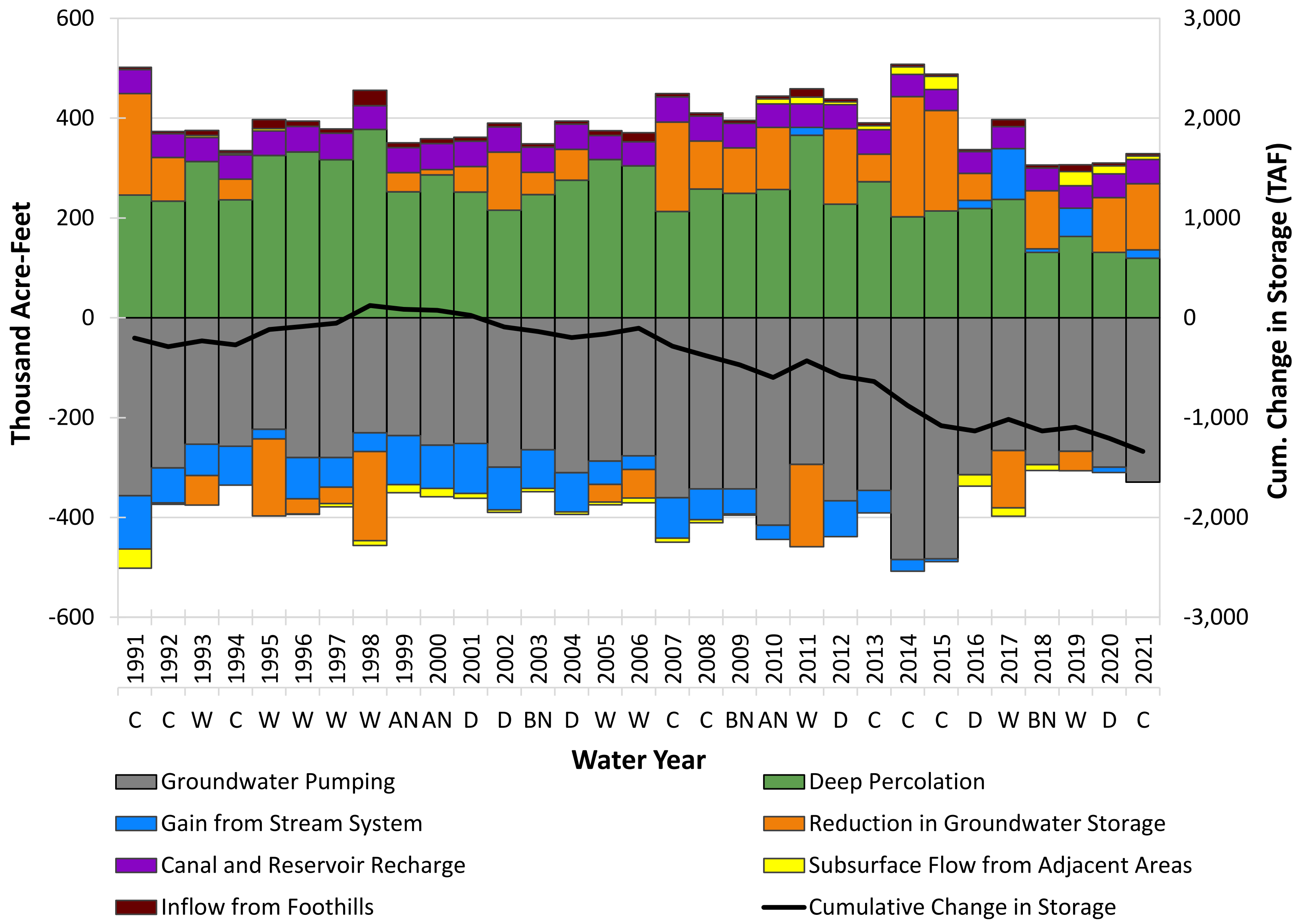


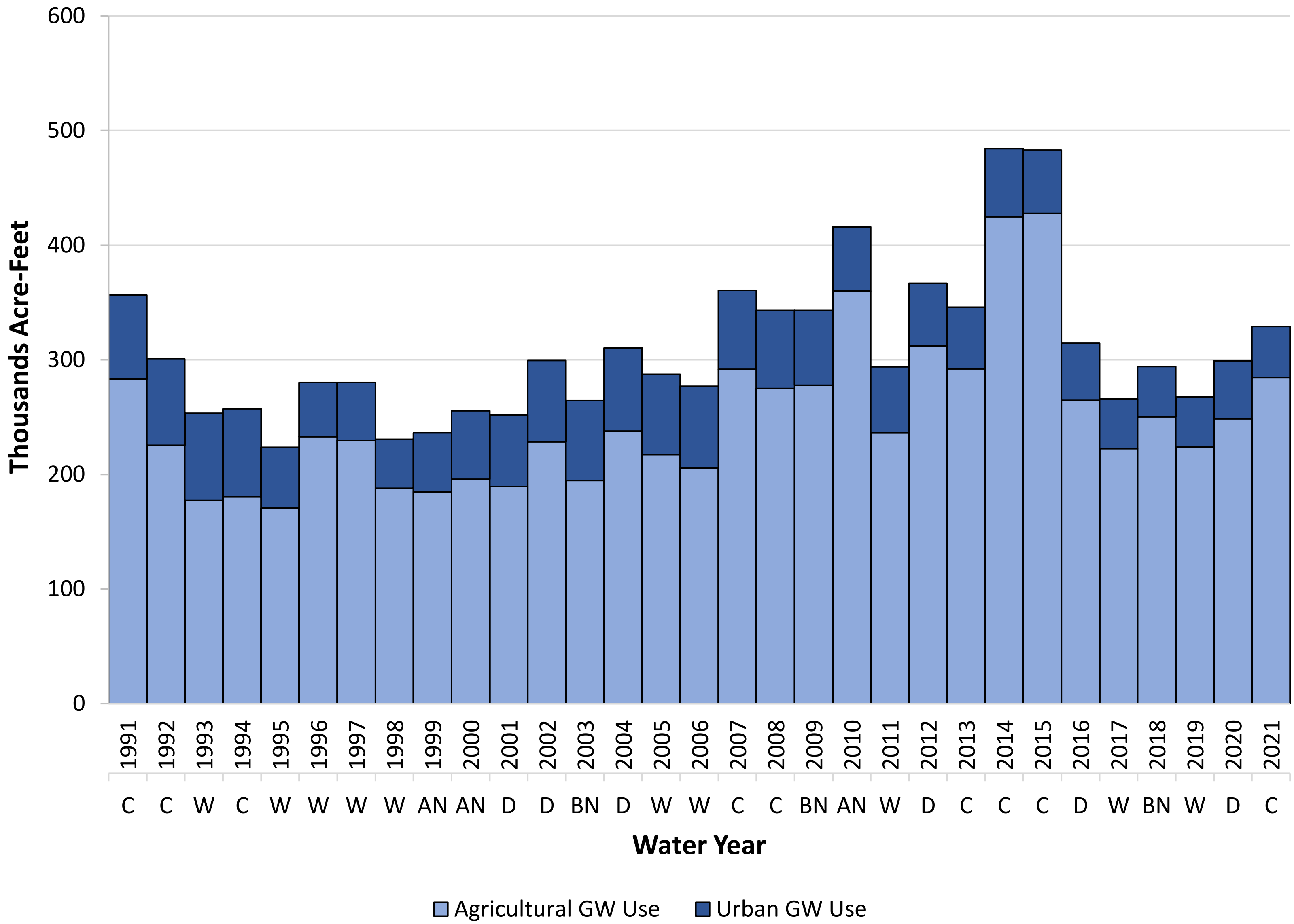
Figure 5-1
Surface Water Deliveries
Modesto Subbasin



TODD GROUNDWATER

Woodard & Curran

Figure 7-1
Groundwater Budget and Cumulative Change in Groundwater in Storage



TODD GROUNDWATER

Woodard & Curran

Figure 7-2
Groundwater Use
Modesto Subbasin
WY 1991 - 2021

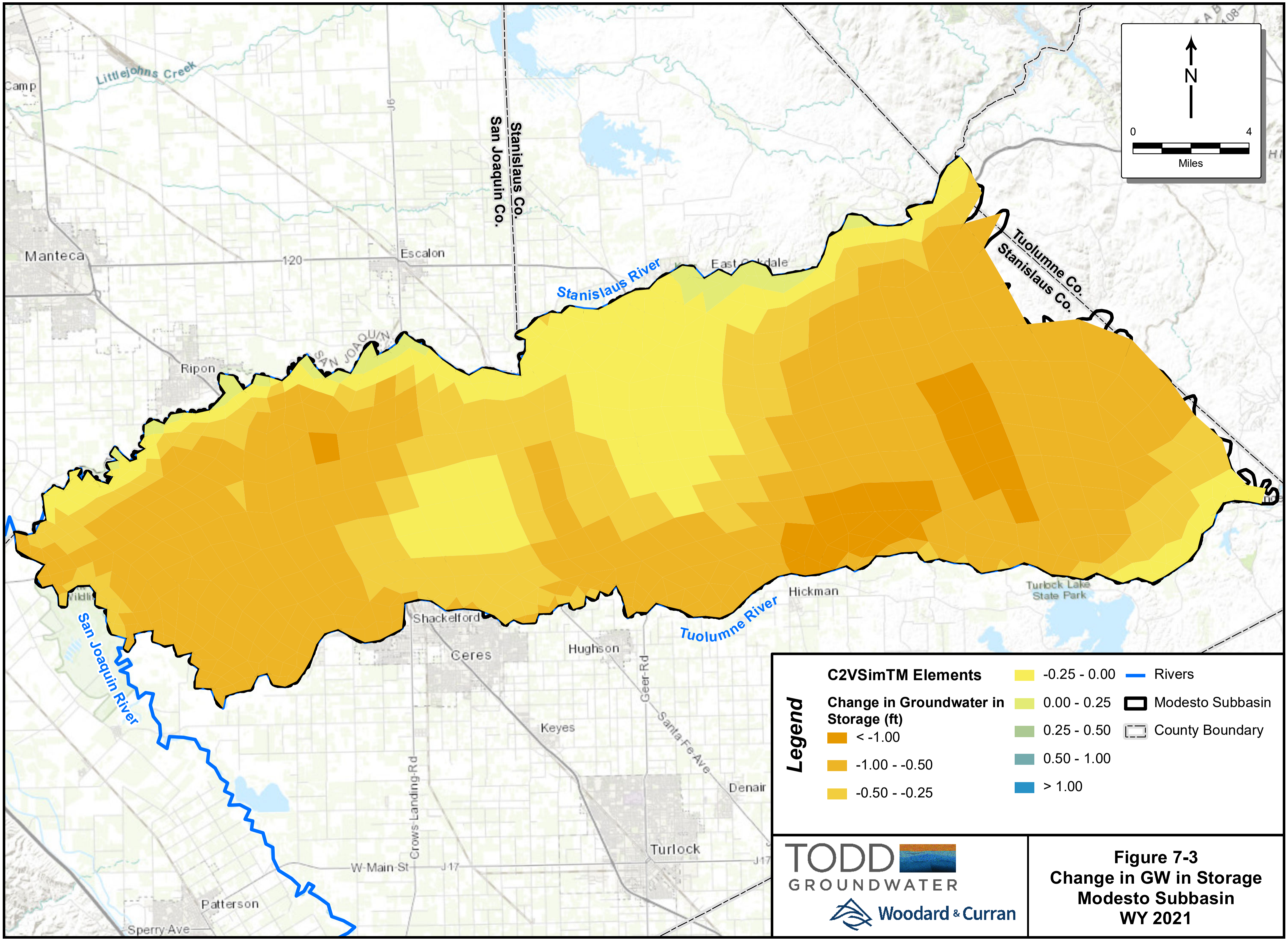


Figure 7-3
Change in GW in Storage
Modesto Subbasin
WY 2021

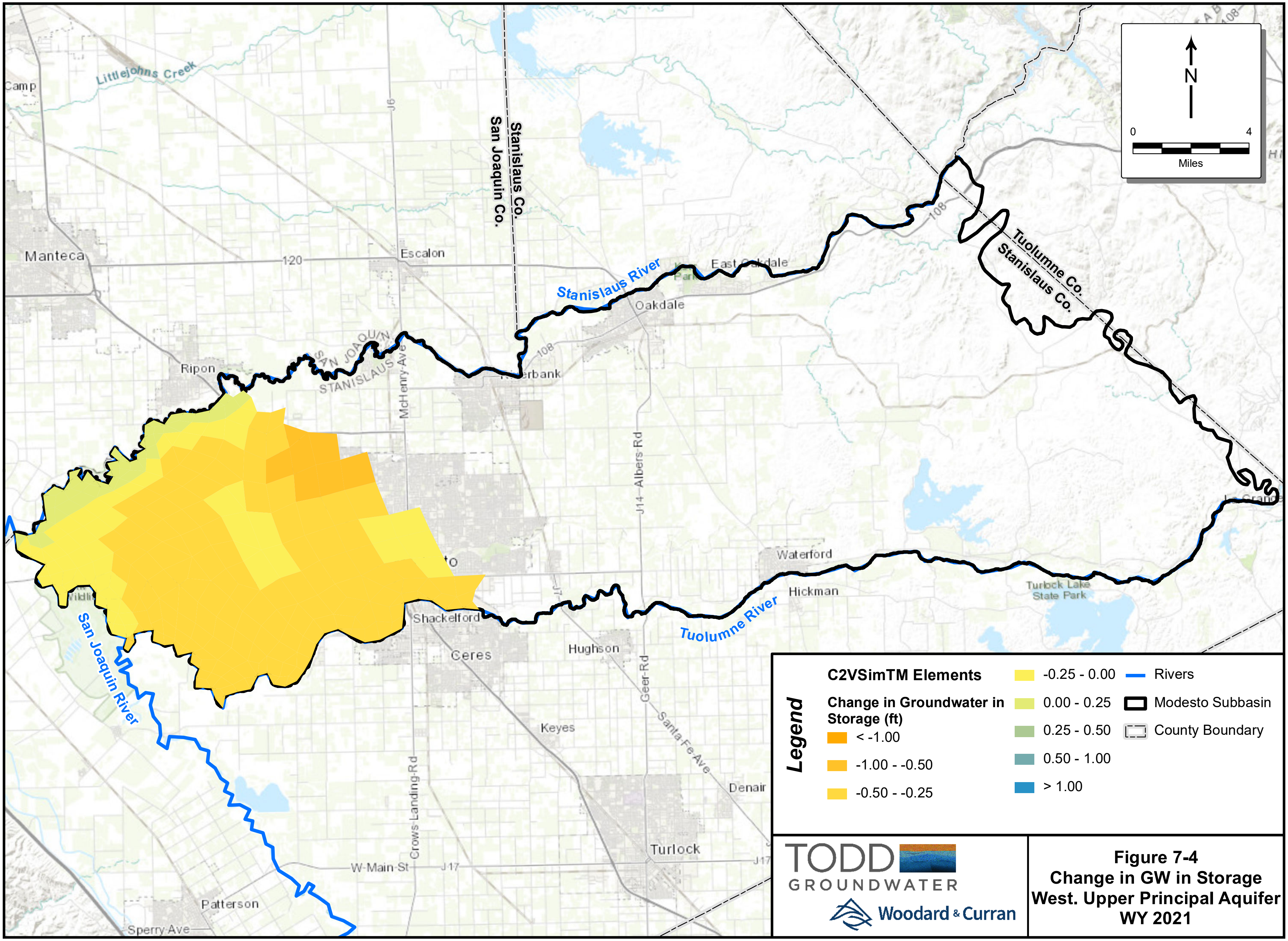


Figure 7-4
Change in GW in Storage
West. Upper Principal Aquifer
WY 2021

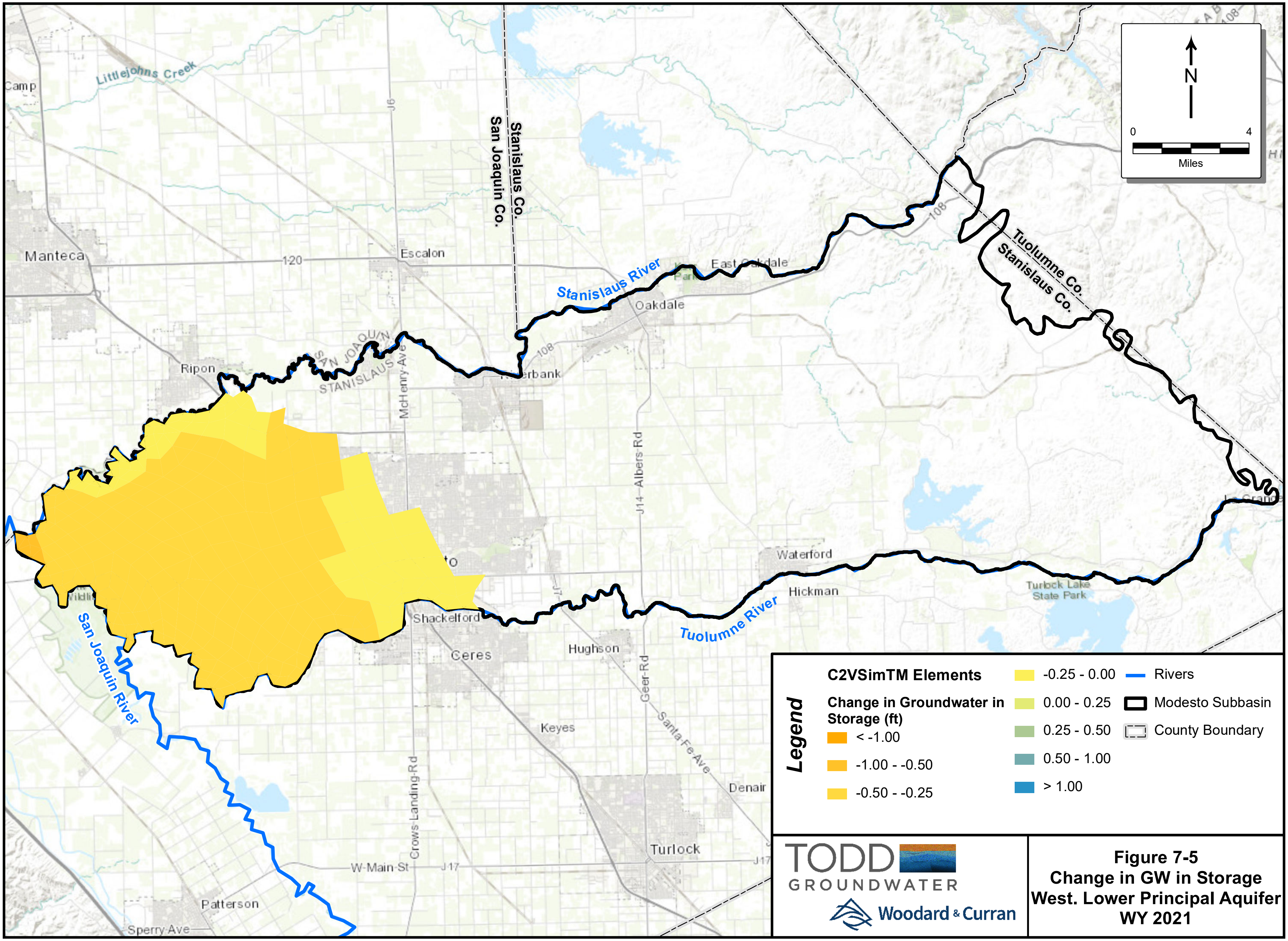


Figure 7-5
Change in GW in Storage
West. Lower Principal Aquifer
WY 2021

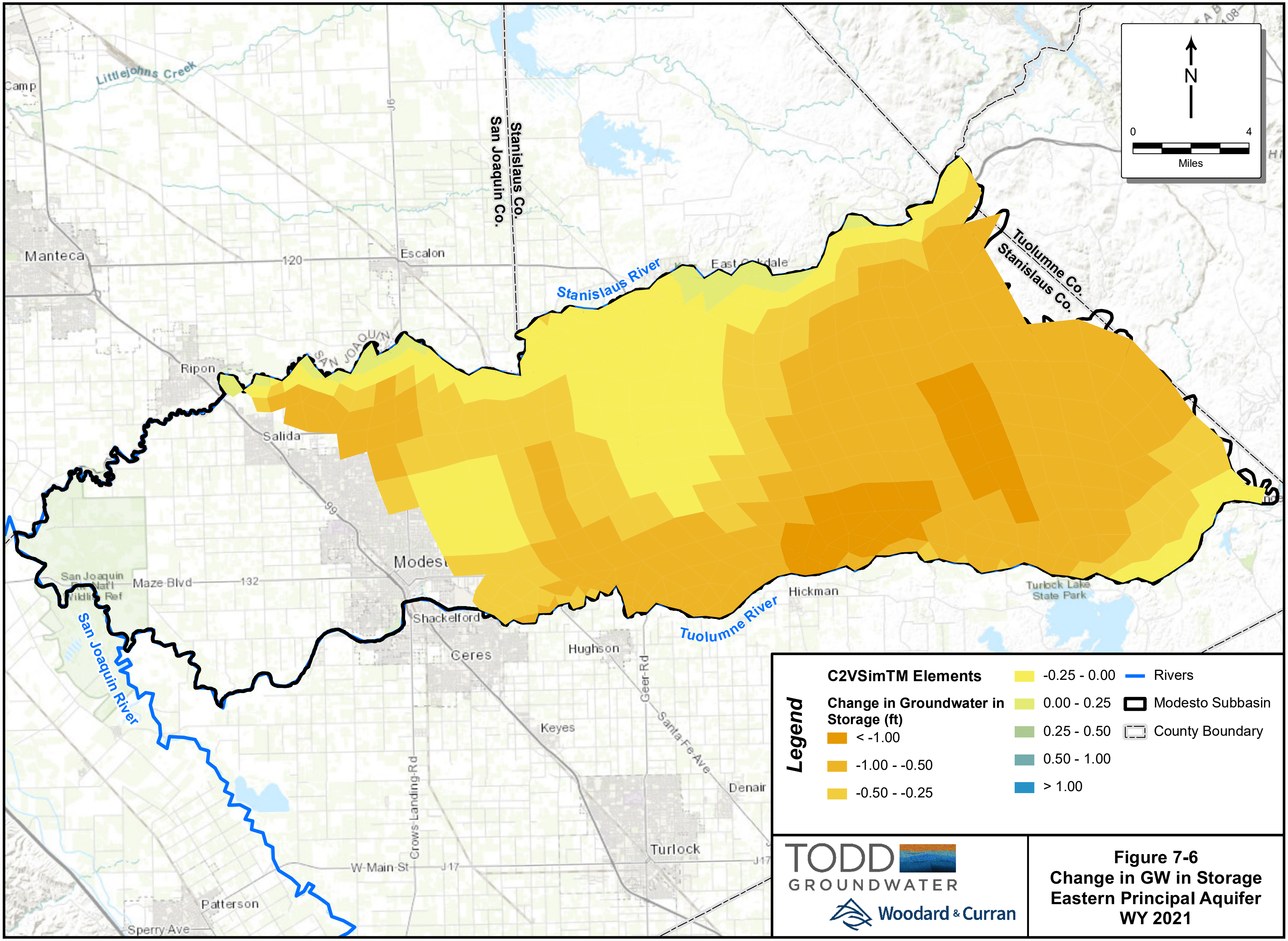


Figure 7-6
Change in GW in Storage
Eastern Principal Aquifer
WY 2021

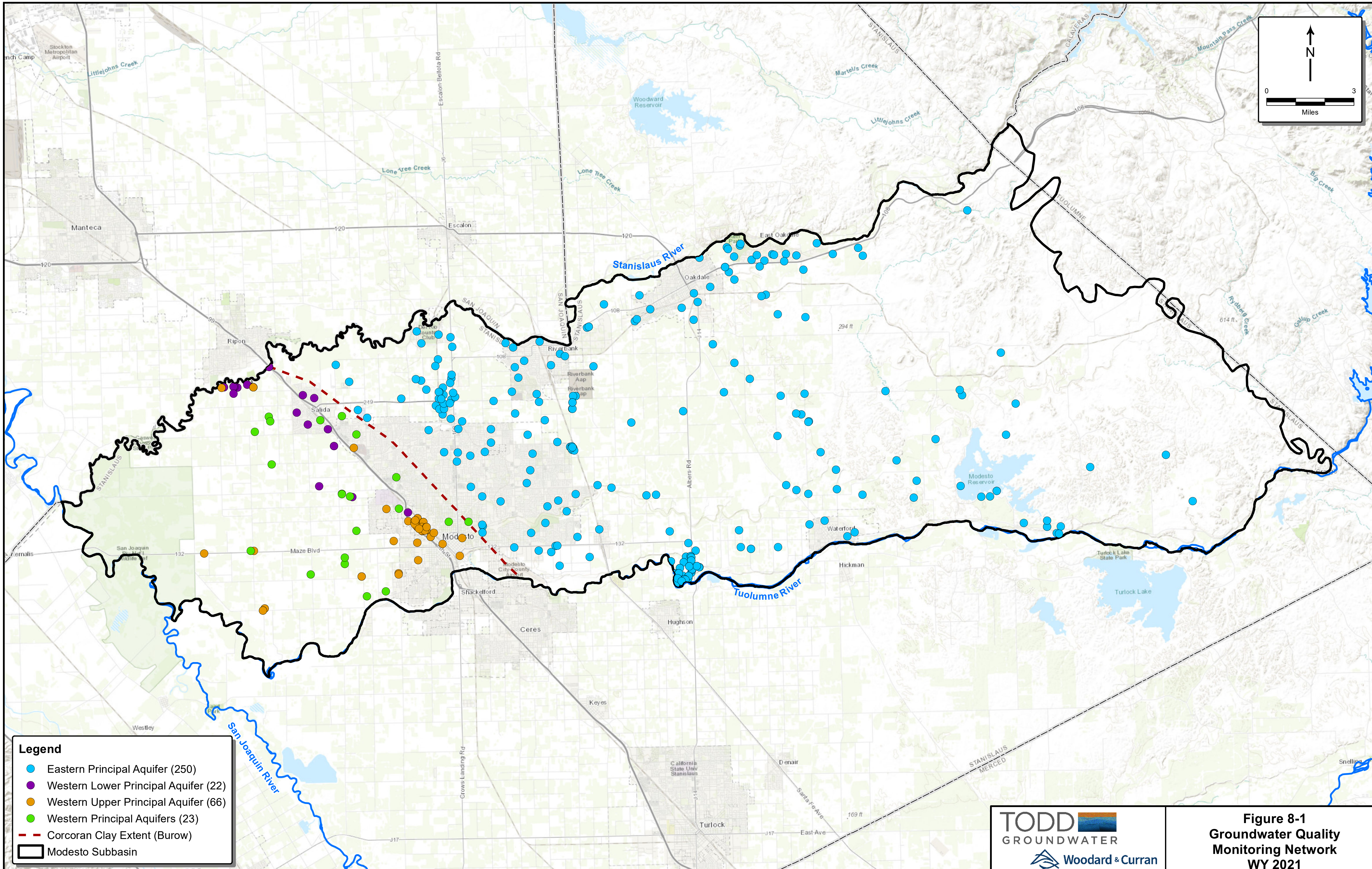
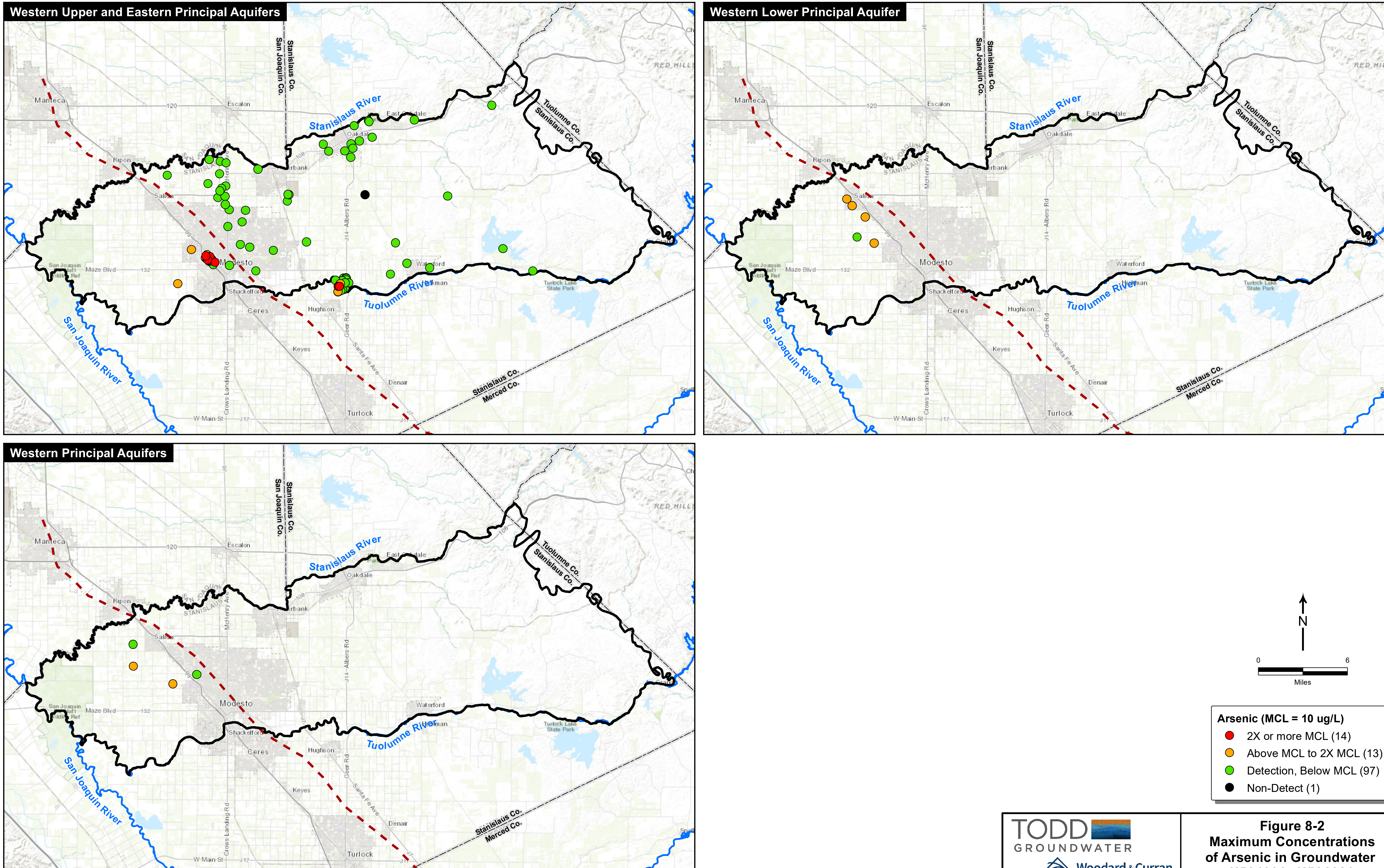


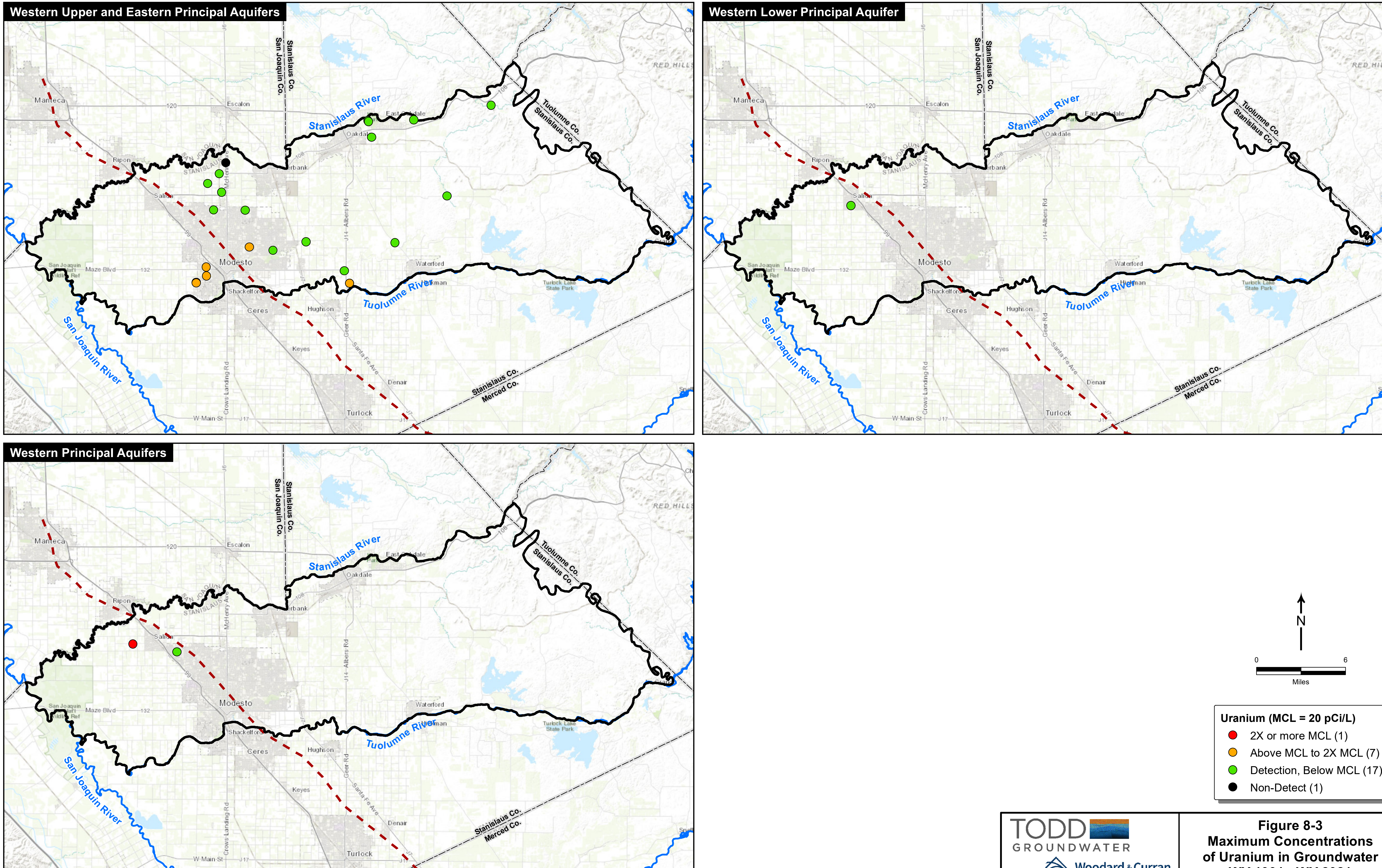
Figure 8-1
Groundwater Quality Monitoring Network
WY 2021



TODD GROUNDWATER

Woodard & Curran

Figure 8-2
Maximum Concentrations of Arsenic in Groundwater
WY 1991 - WY 2021



TODD GROUNDWATER
Woodard & Curran

Figure 8-3
Maximum Concentrations of Uranium in Groundwater
WY 1991 - WY 2021

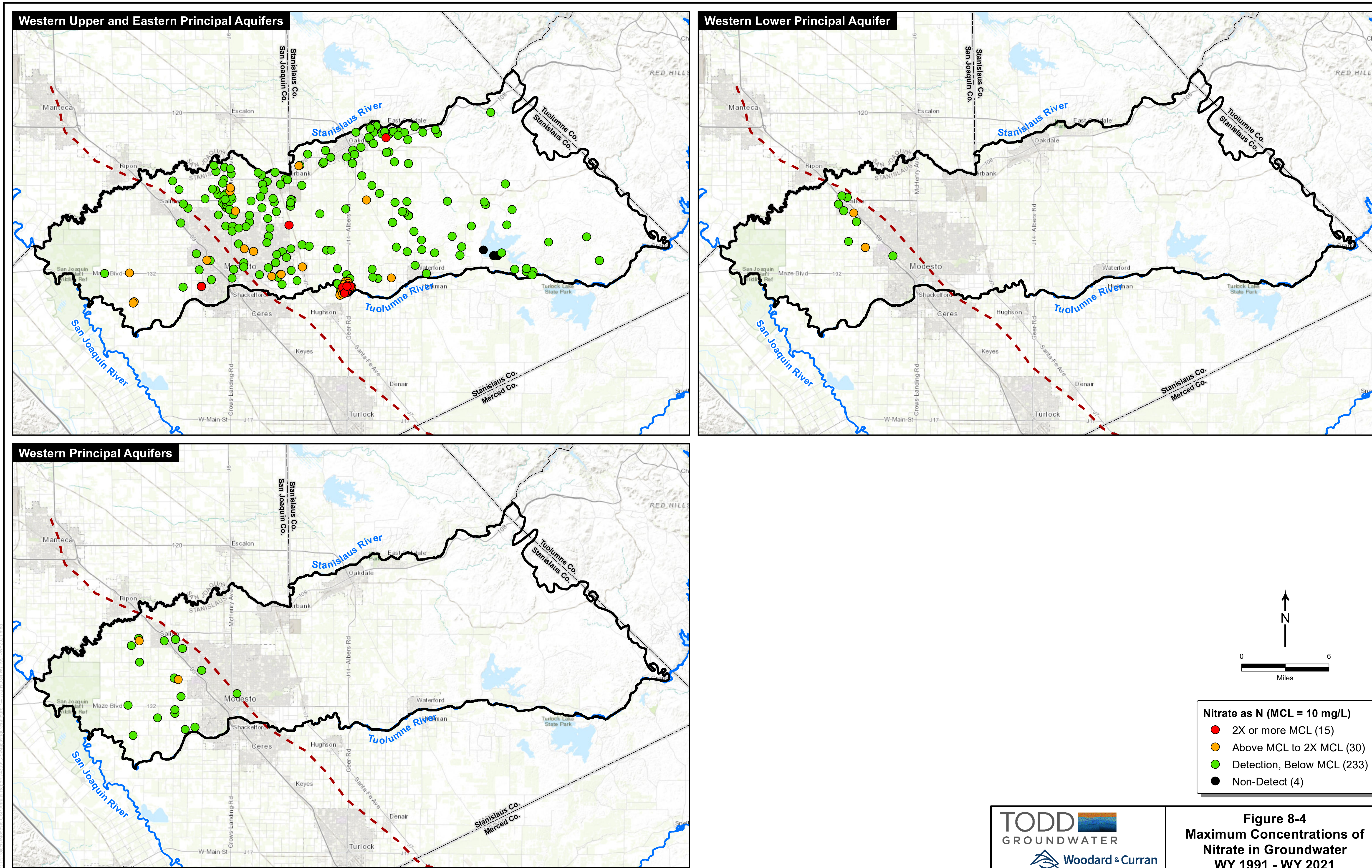


Figure 8-4
Maximum Concentrations of Nitrate in Groundwater
WY 1991 - WY 2021

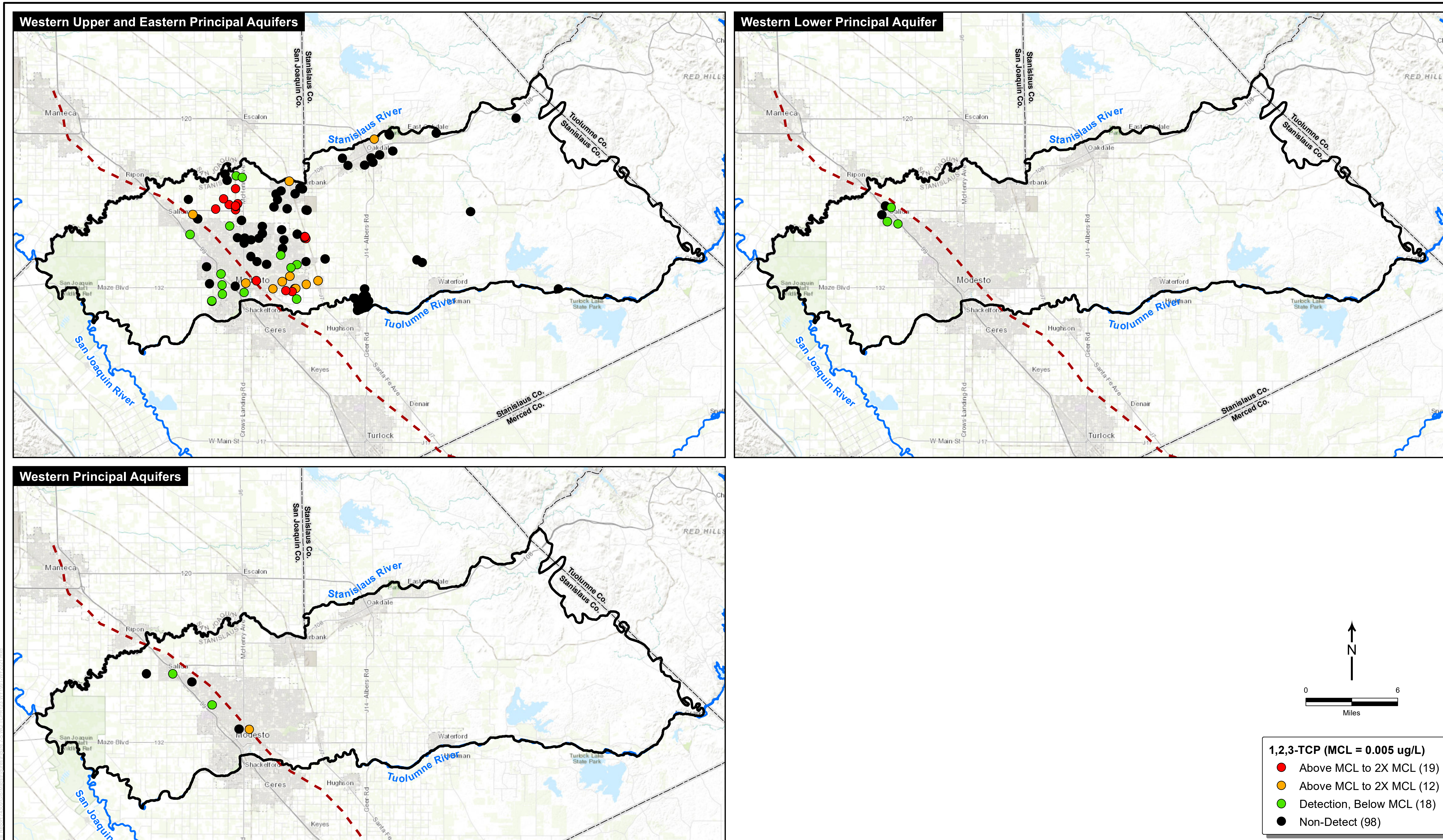


Figure 8-5
Maximum Concentrations of TCP in Groundwater
WY 1991 - WY 2021

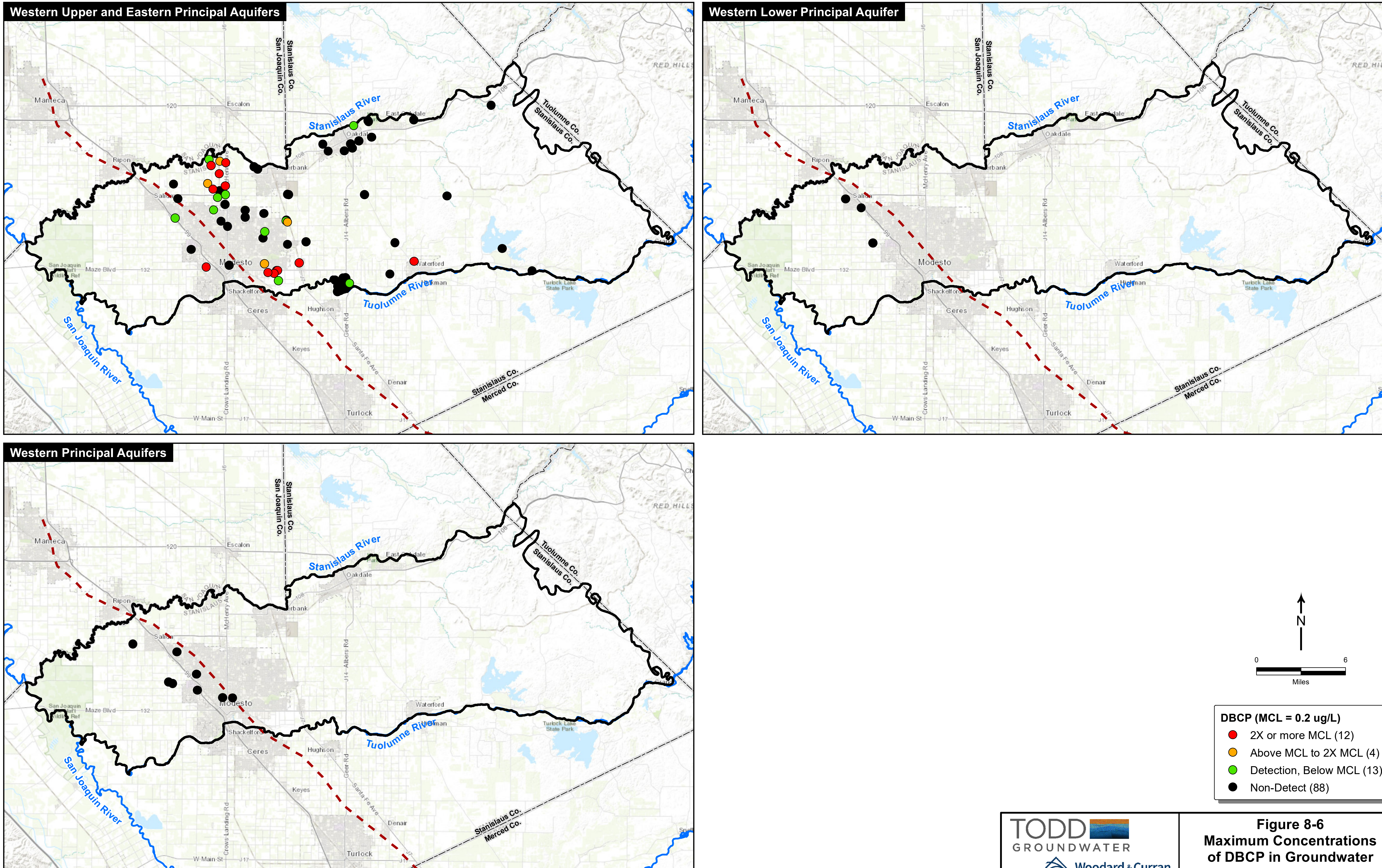
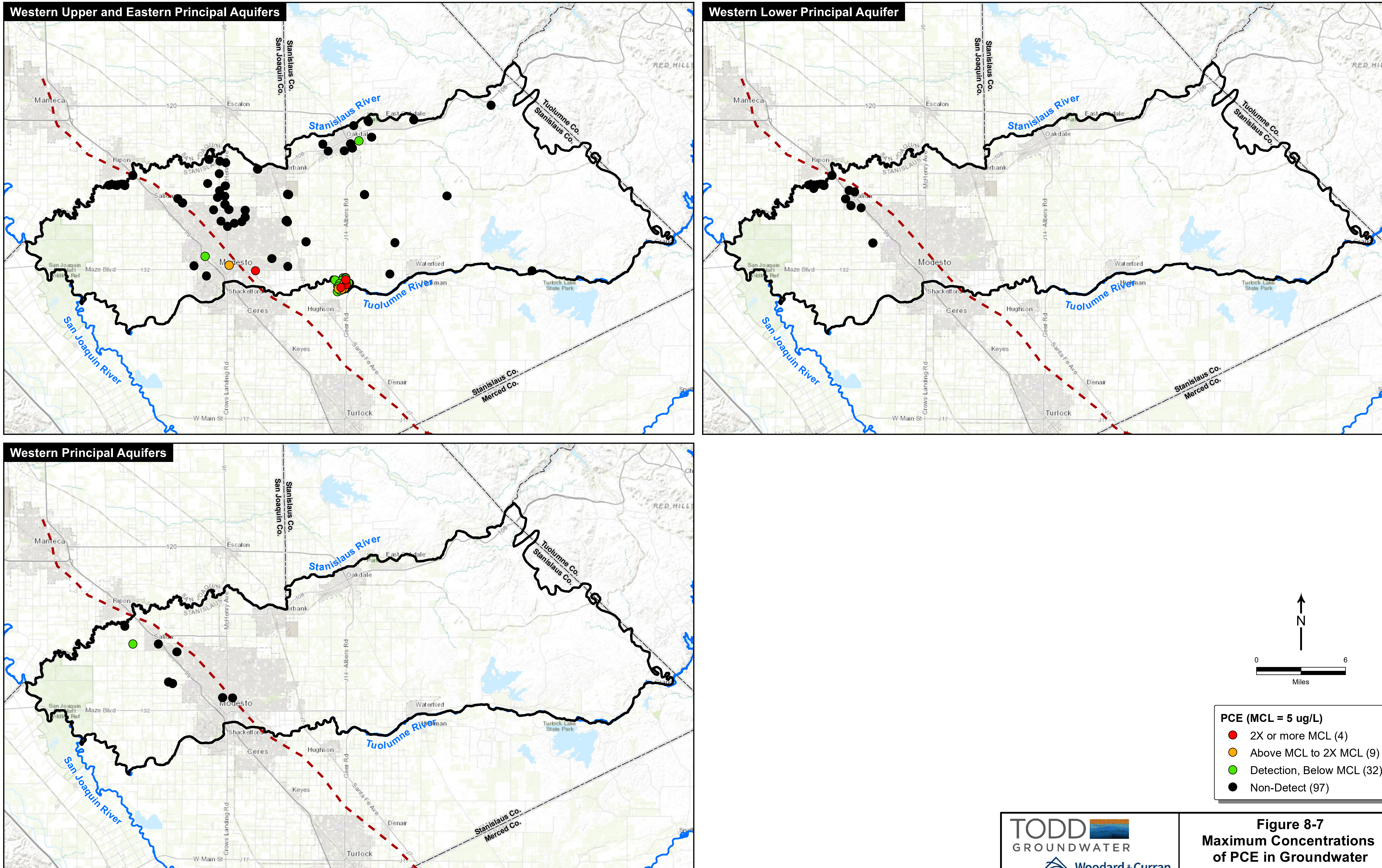


Figure 8-6
Maximum Concentrations of DBCP in Groundwater WY 1991 - WY 2021



TODD GROUNDWATER

Woodard & Curran

Figure 8-7
Maximum Concentrations of PCE in Groundwater
WY 1991 - WY 2021

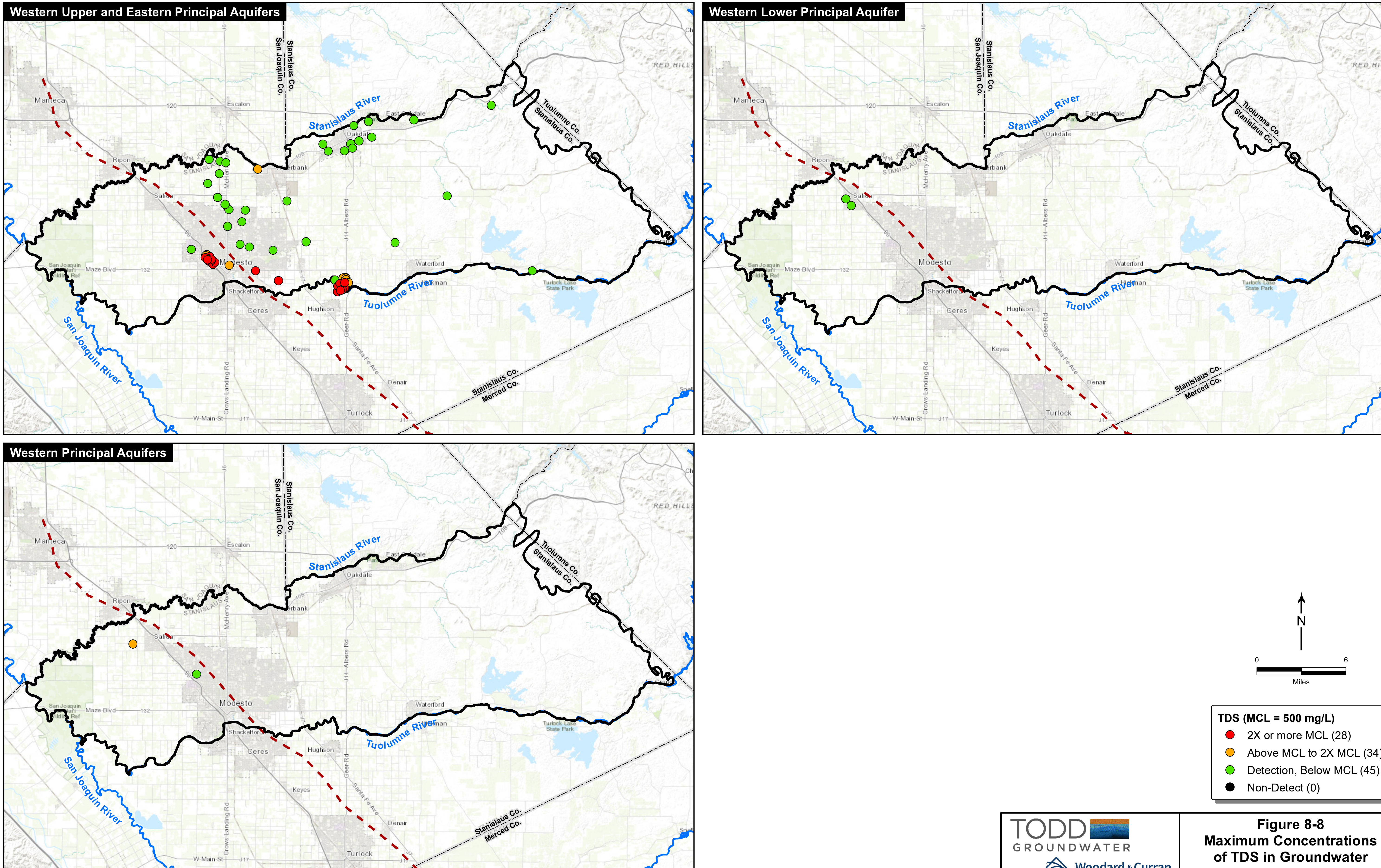


Figure 8-8
Maximum Concentrations of TDS in Groundwater
WY 1991 - WY 2021

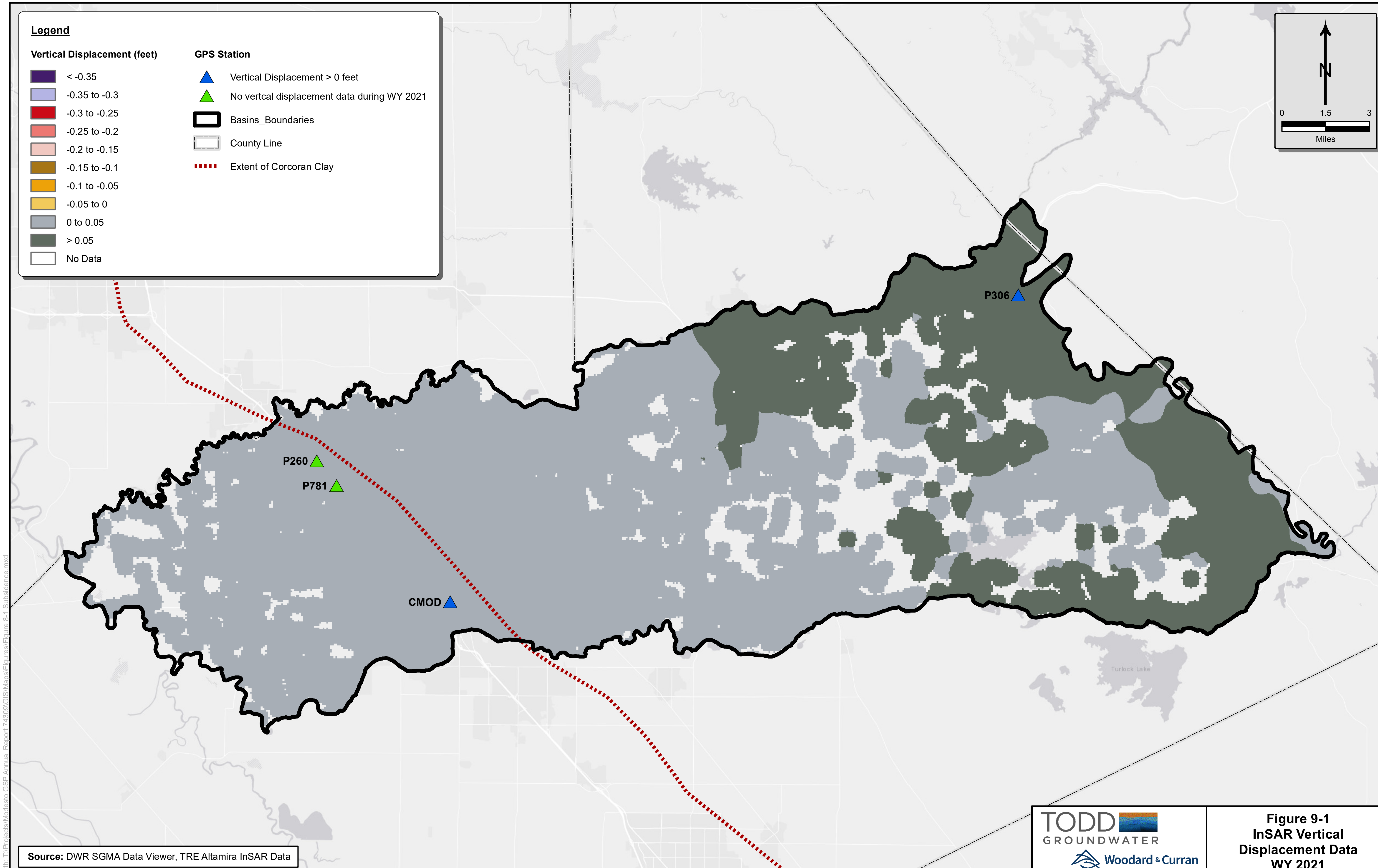


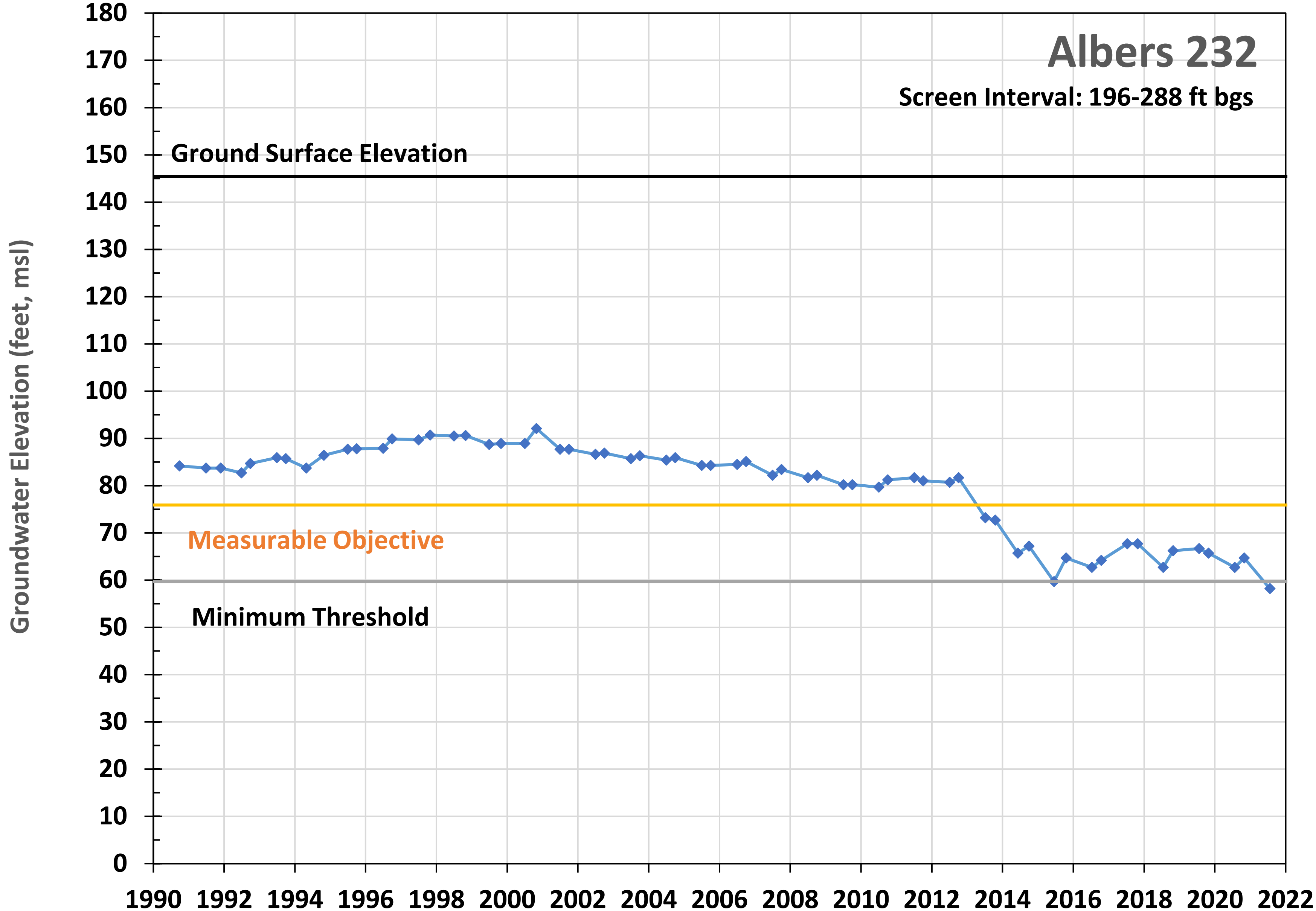
Figure 9-1
InSAR Vertical Displacement Data WY 2021

APPENDIX A

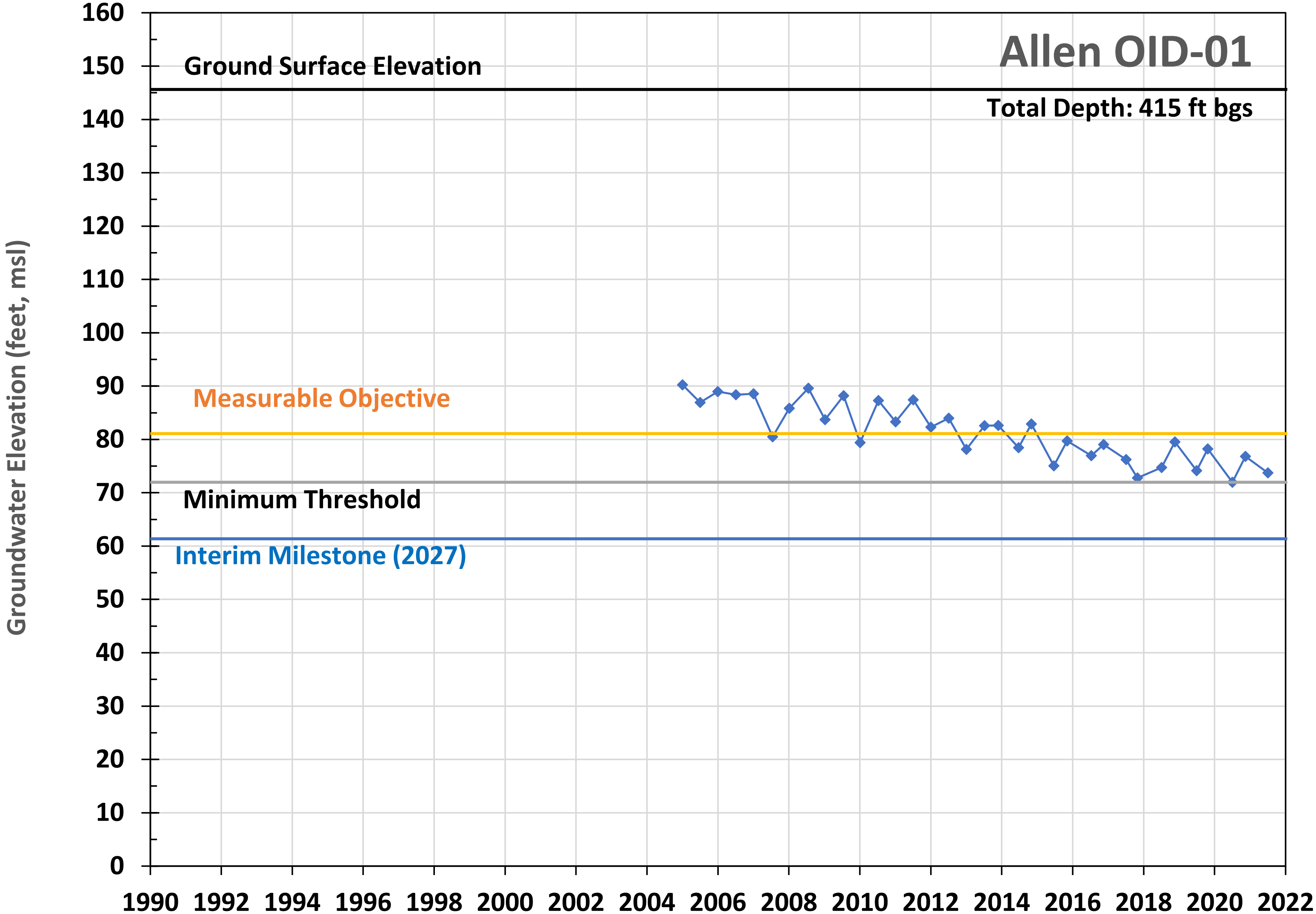
Hydrographs

Representative Monitoring Wells
GSP Groundwater Elevation Monitoring Network

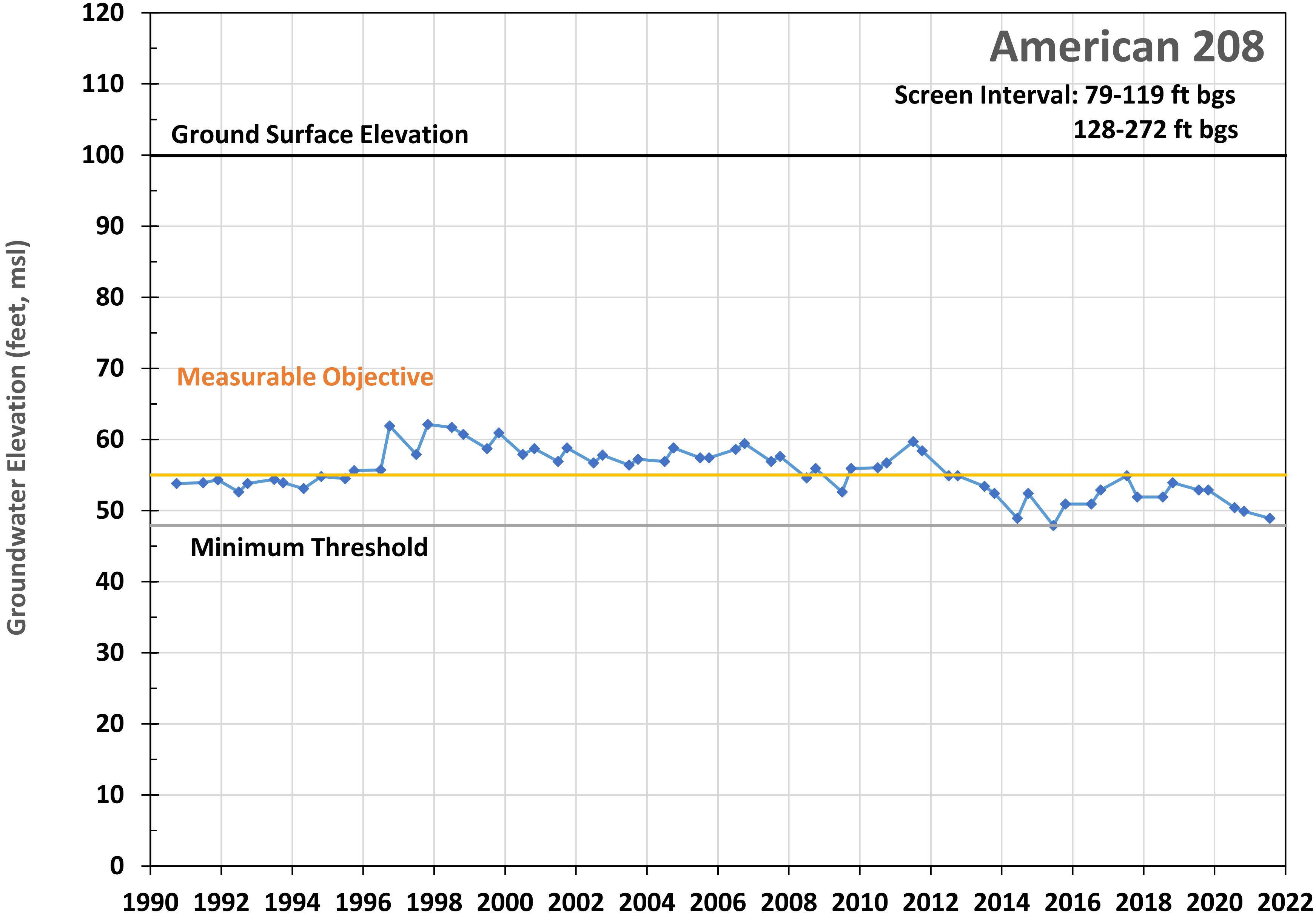
Hydrographs for Wells in the Monitoring Network for:
Chronic Lowering of Groundwater Levels
Reduction of Groundwater in Storage
Land Subsidence



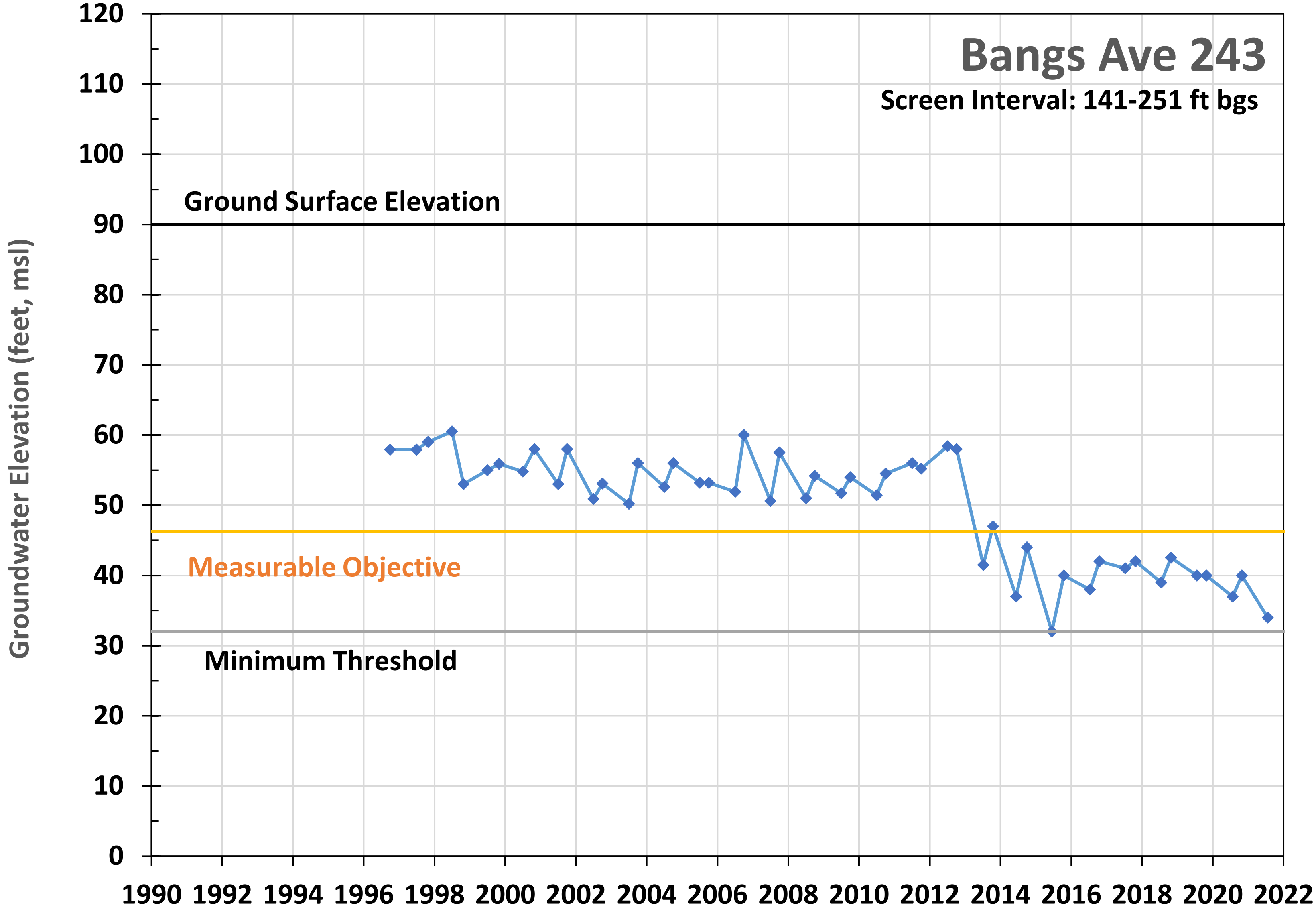
Albers 232
Screen Interval: 196-288 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

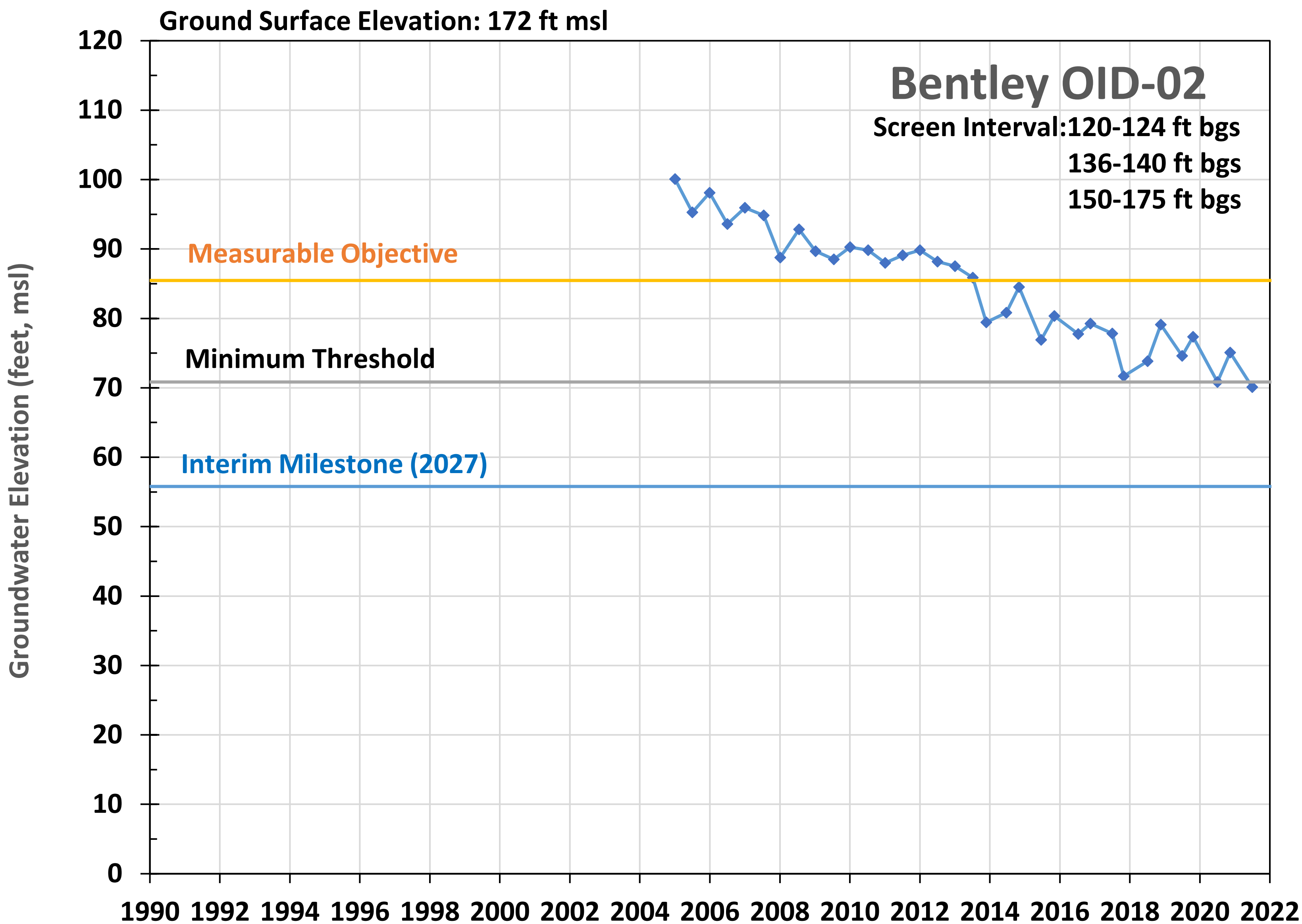


Allen OID-01
Total Depth: 415 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

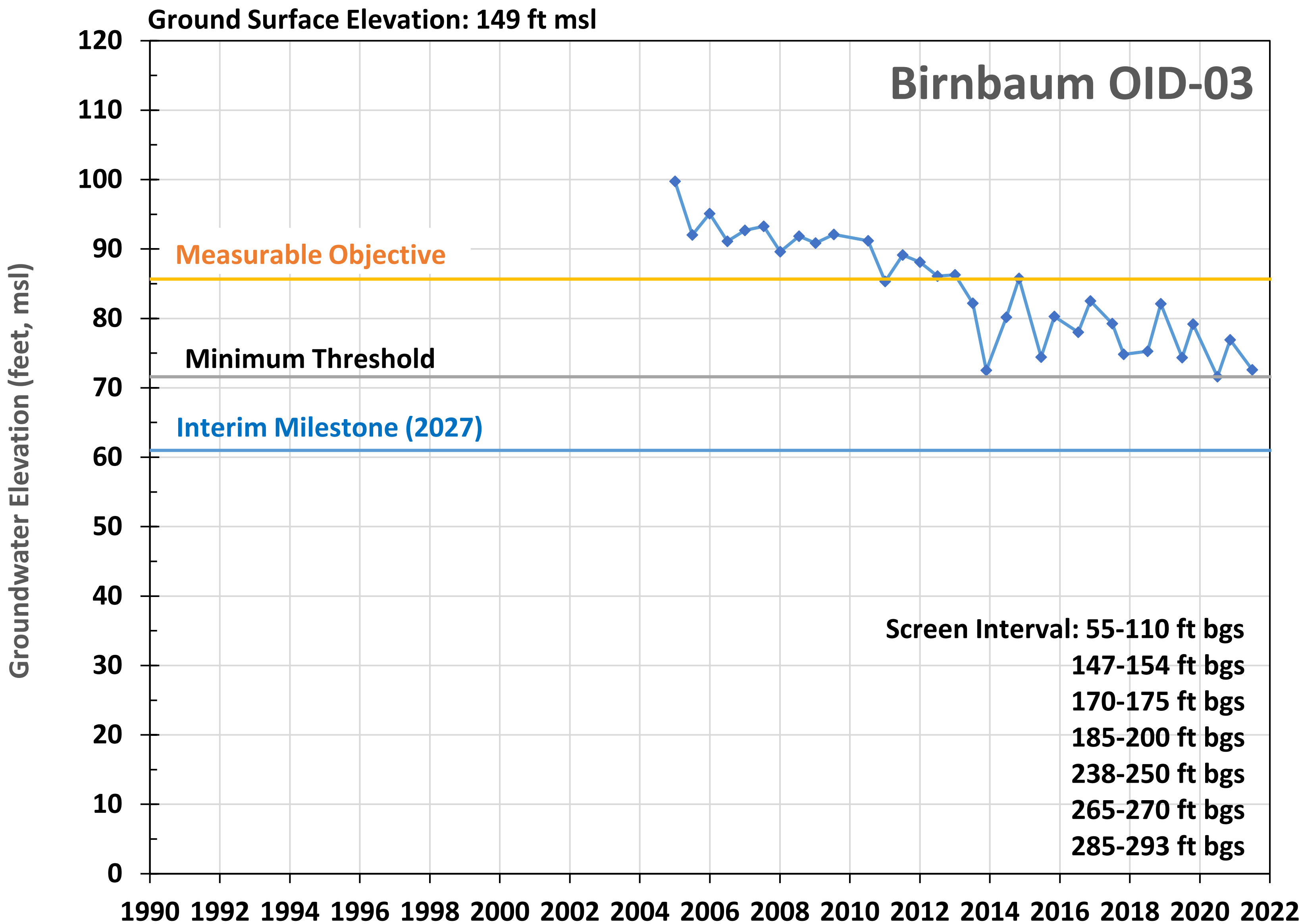


American 208
Screen Interval: 79-119 ft bgs
128-272 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

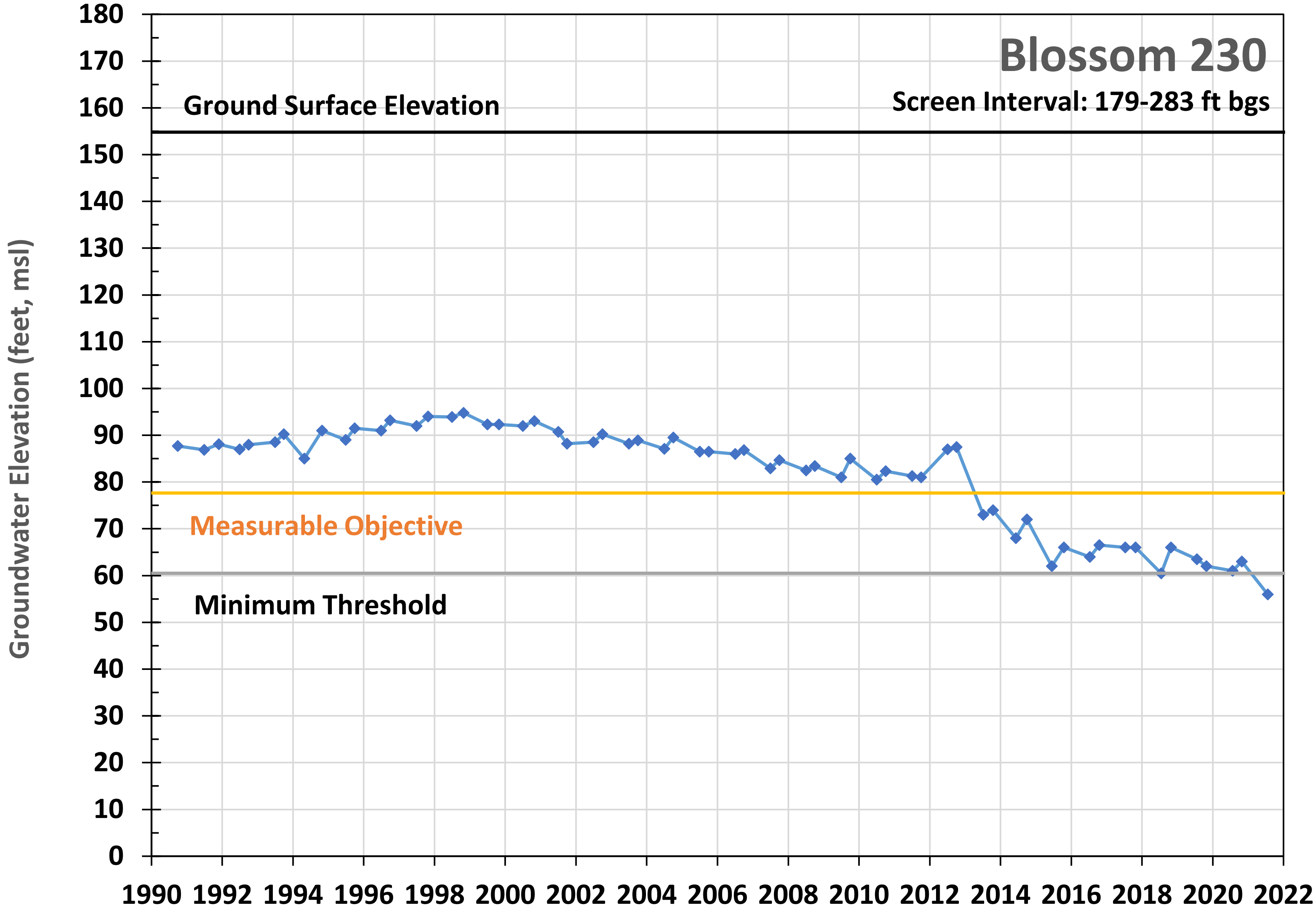

Bangs Ave 243
Screen Interval: 141-251 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

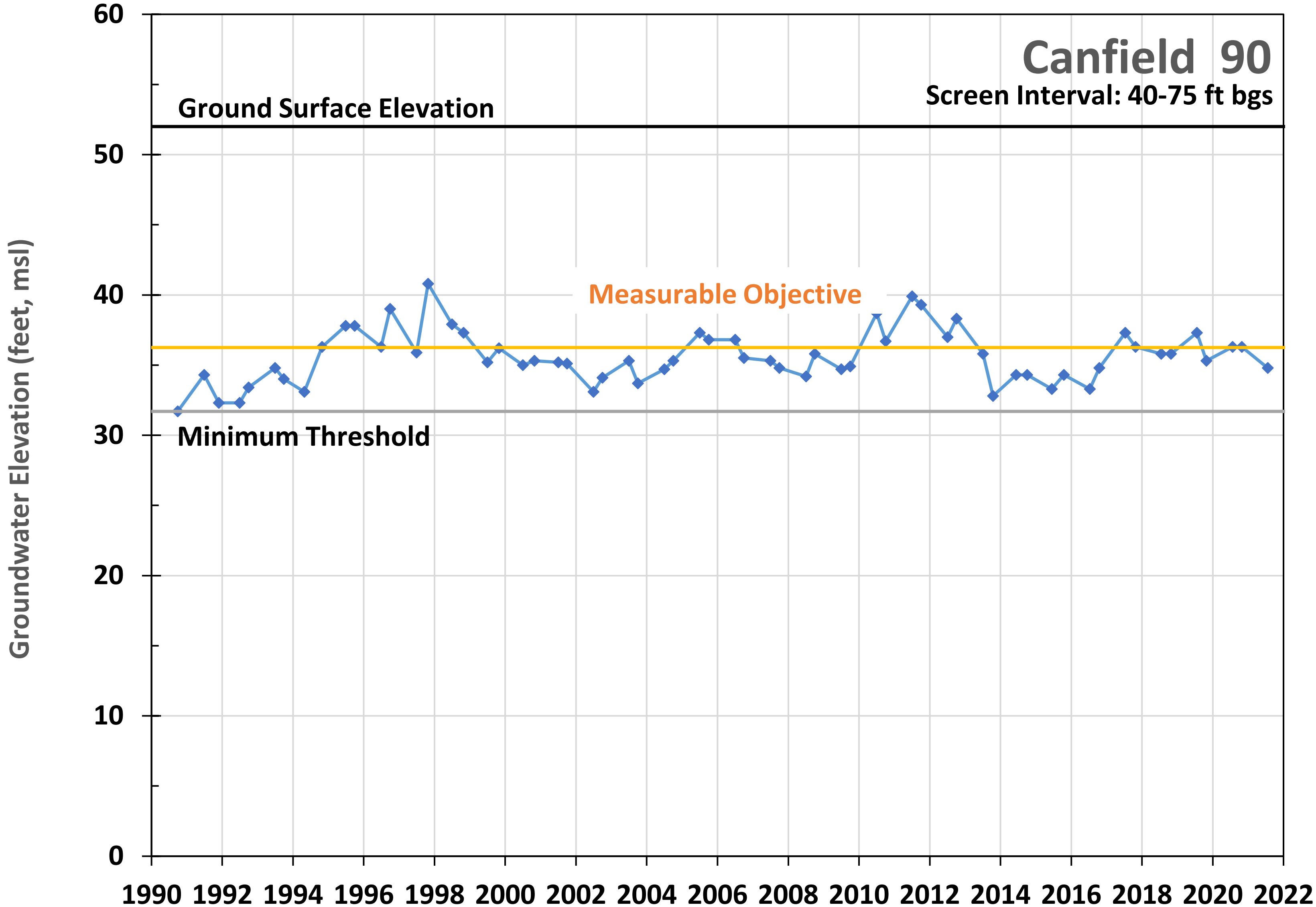


Ground Surface Elevation: 172 ft msl
Bentley OID-02
Screen Interval:120-124 ft bgs
136-140 ft bgs
150-175 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022

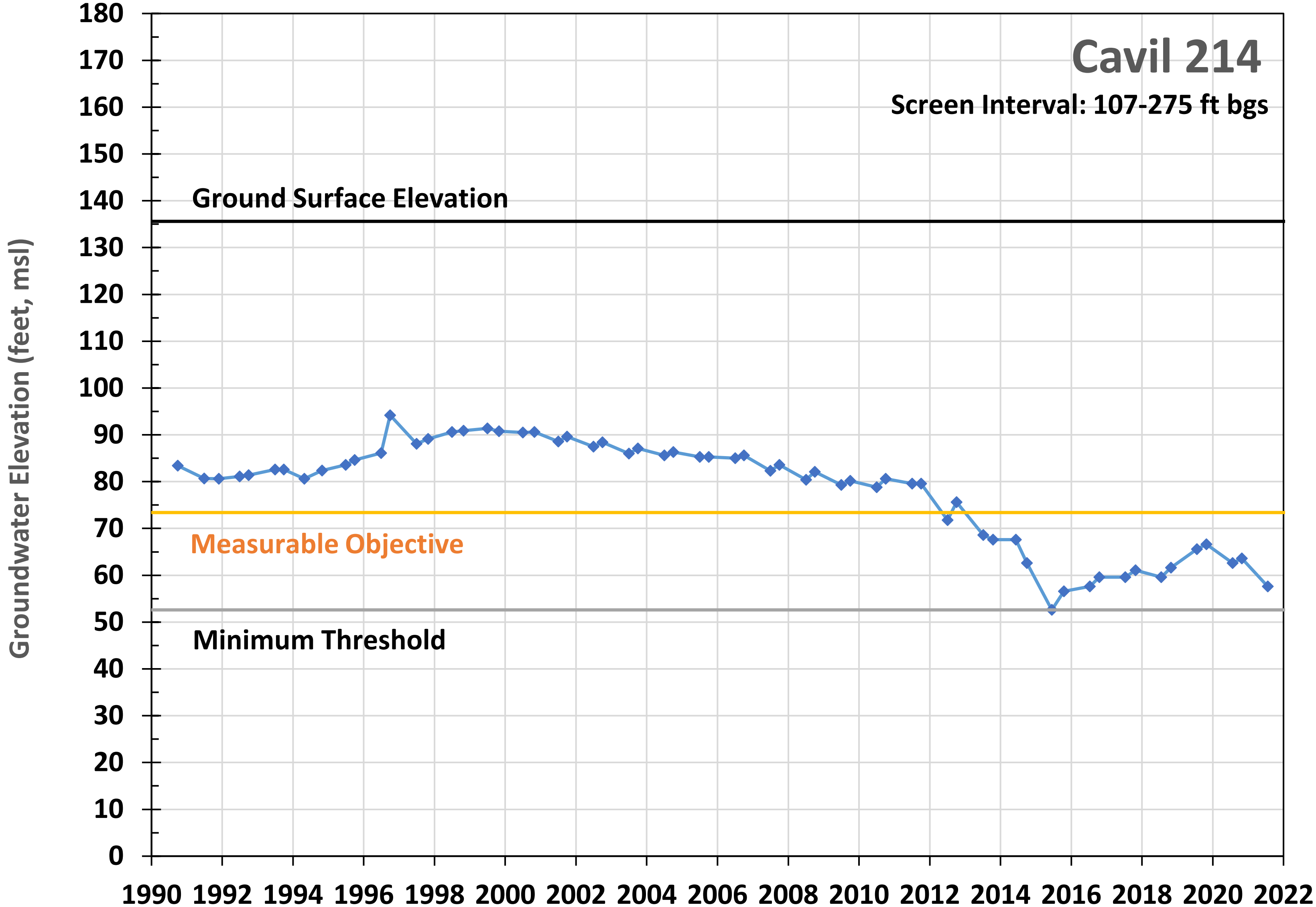


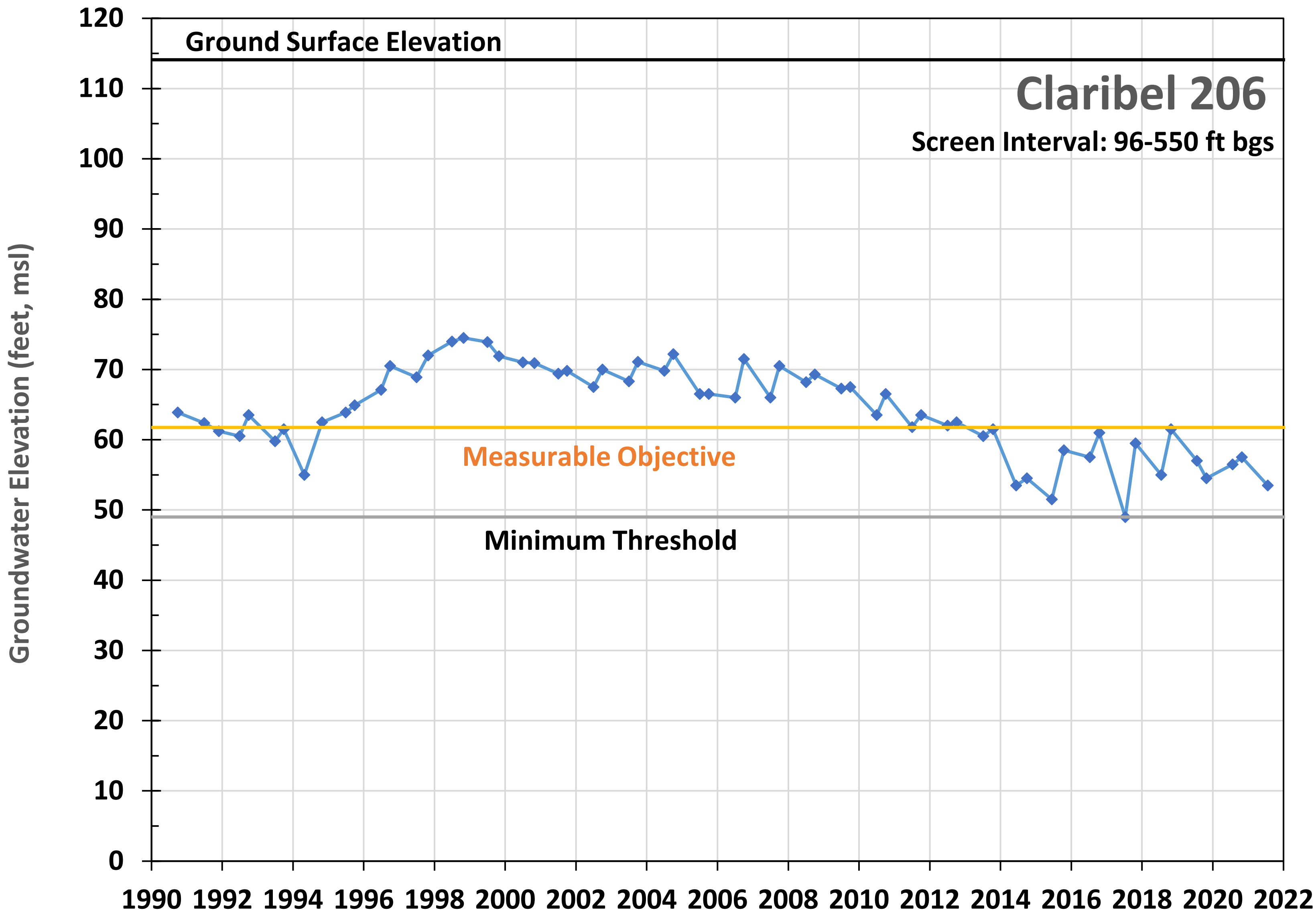
Ground Surface Elevation: 149 ft msl
Birnbaum OID-03
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Screen Interval: 55-110 ft bgs
147-154 ft bgs
170-175 ft bgs
185-200 ft bgs
238-250 ft bgs
265-270 ft bgs
285-293 ft bgs
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022


Blossom 230
Screen Interval: 179-283 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
180
170
160
150
140
130
120
110
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

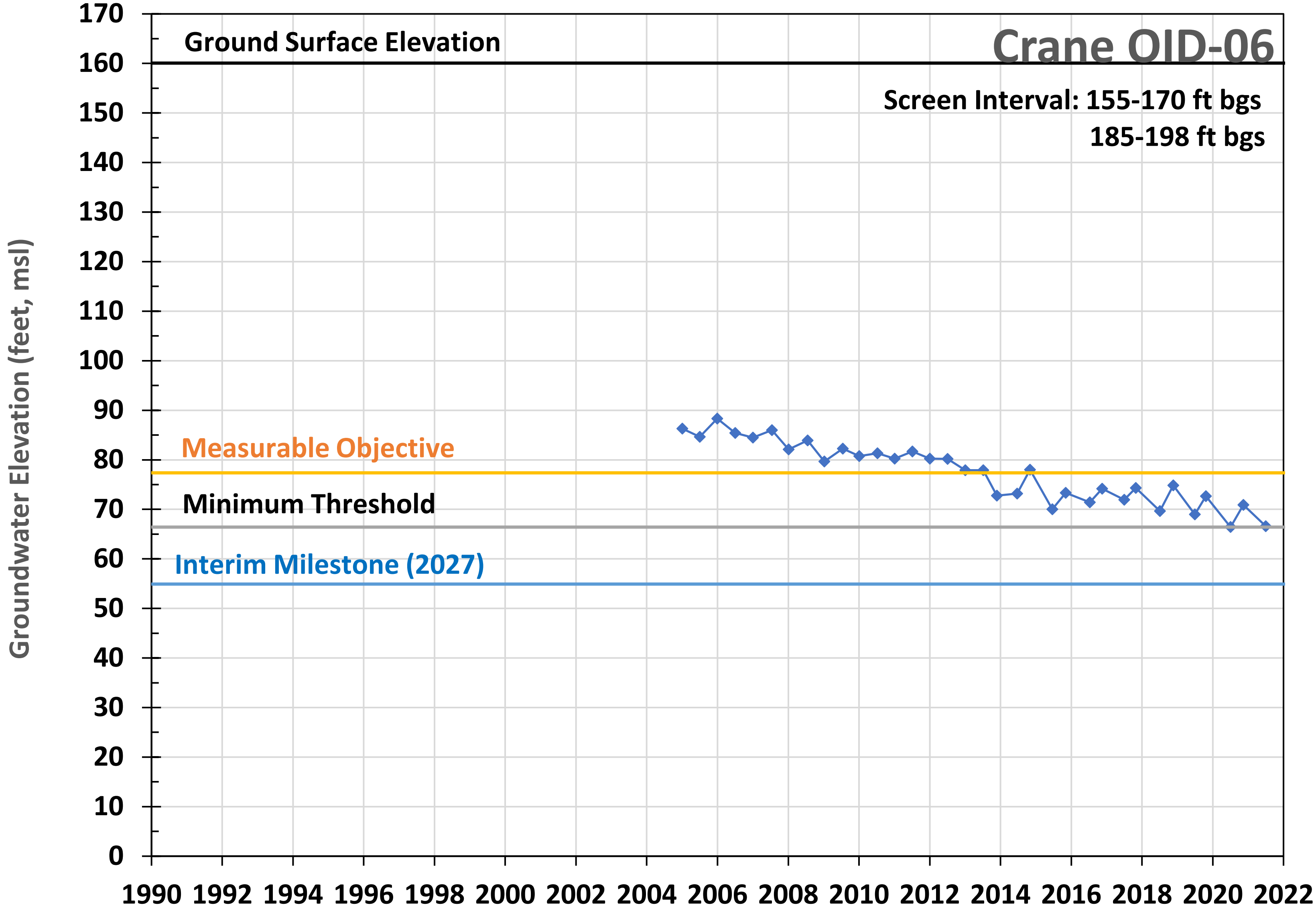


Canfield 90
Screen Interval: 40-75 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
60
50
40
30
20
10
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022

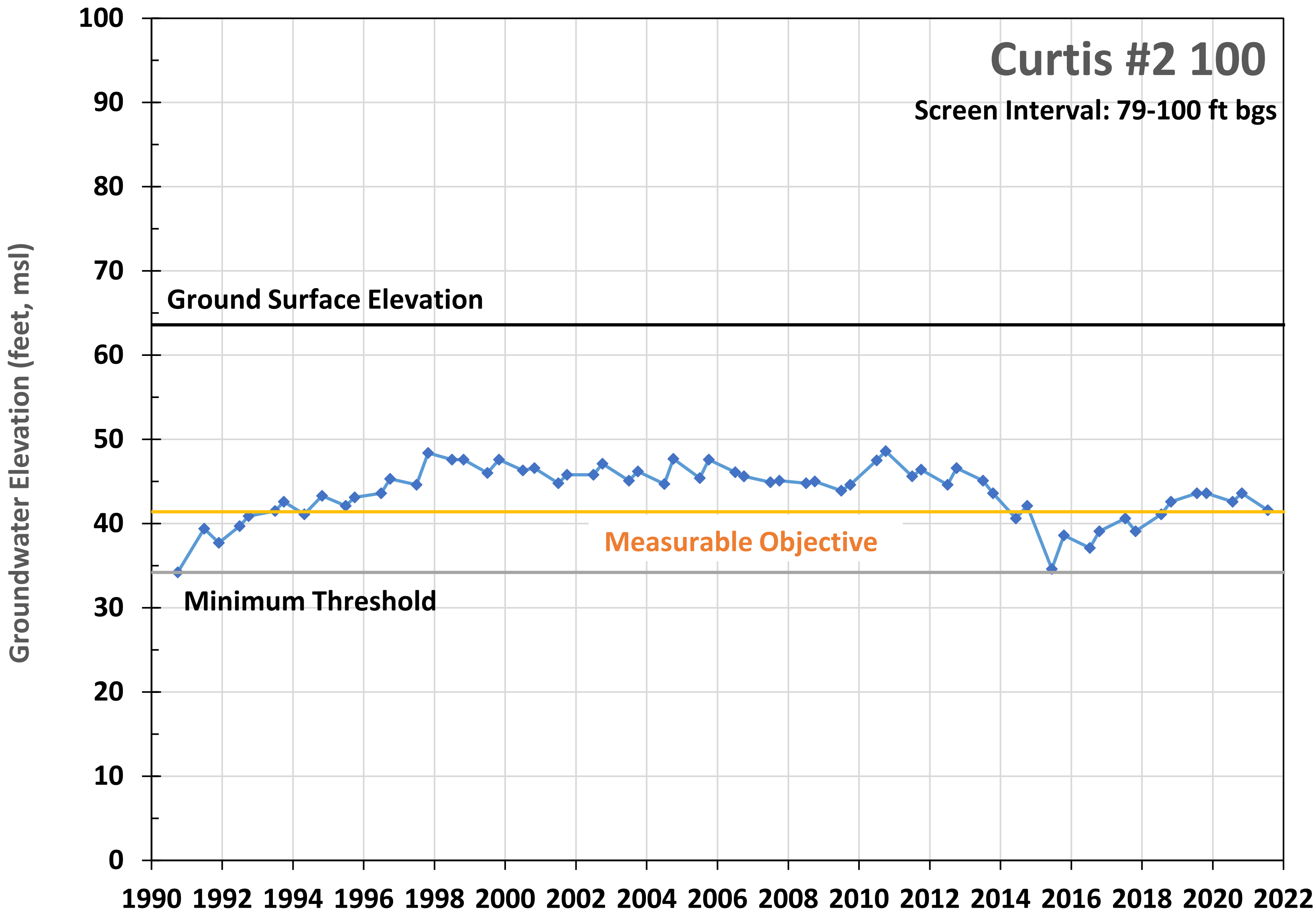

Cavil 214
Screen Interval: 107-275 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



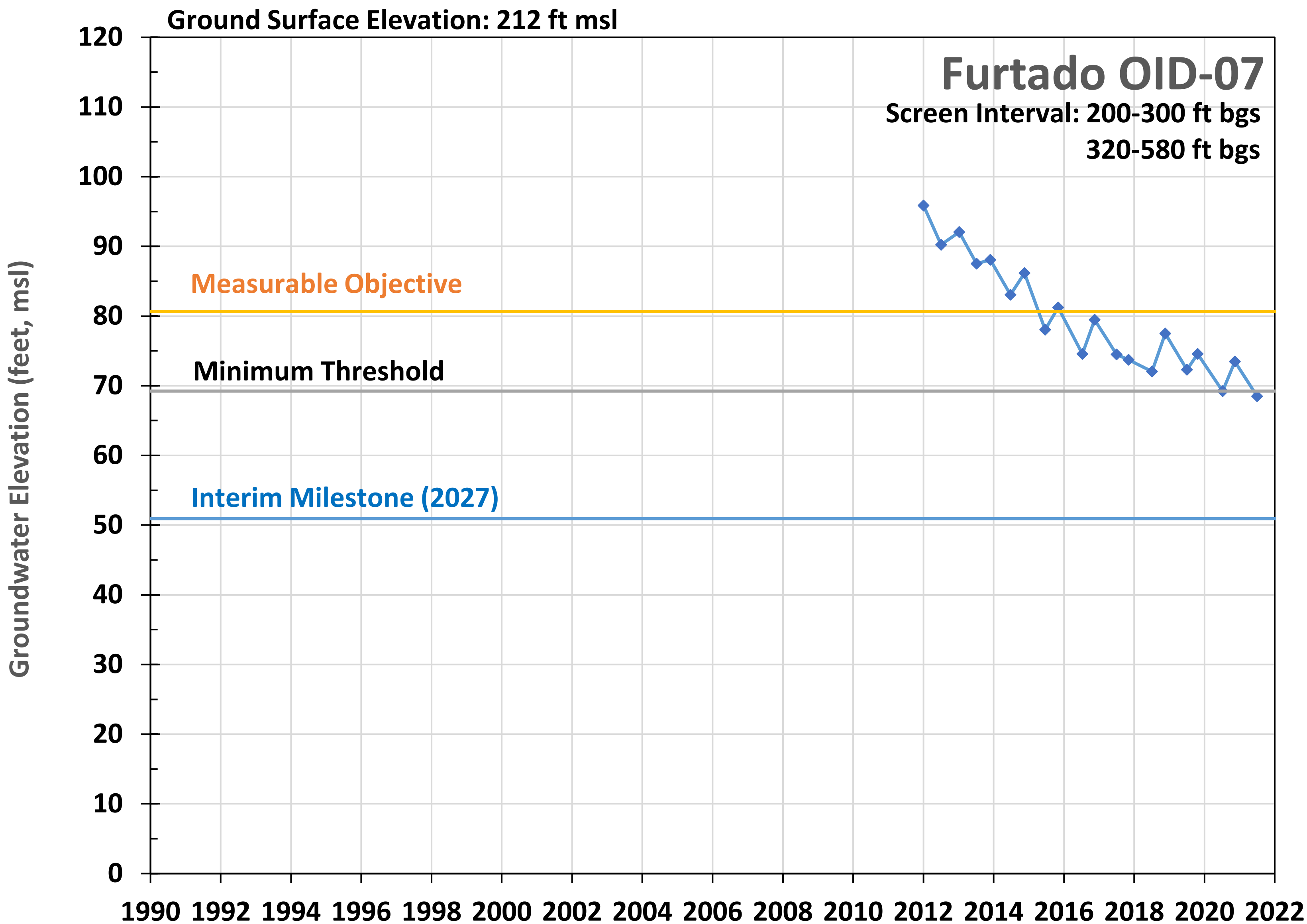
Claribel 206
Screen Interval: 96-550 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022



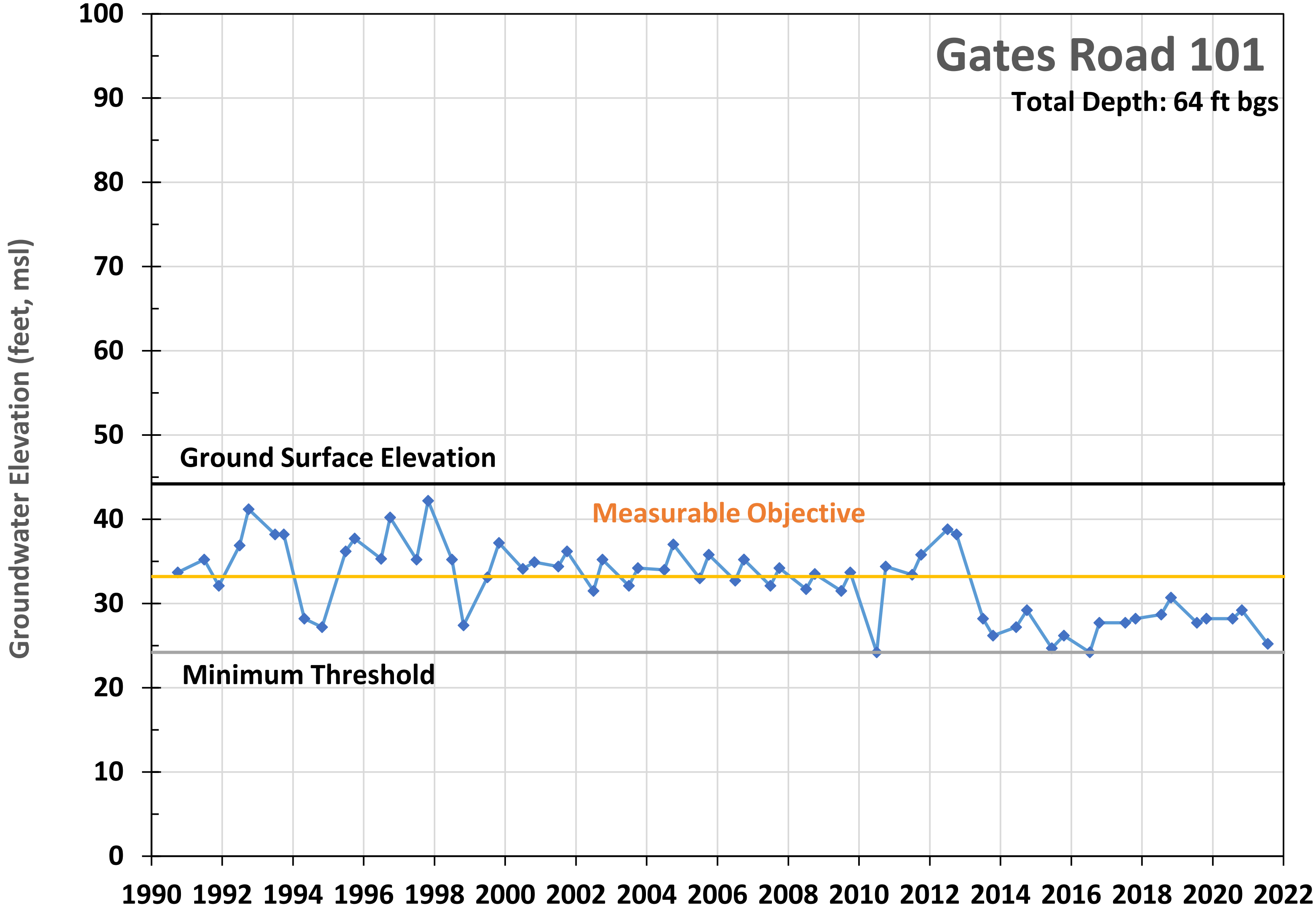
Crane OID-06
Screen Interval: 155-170 ft bgs
185-198 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



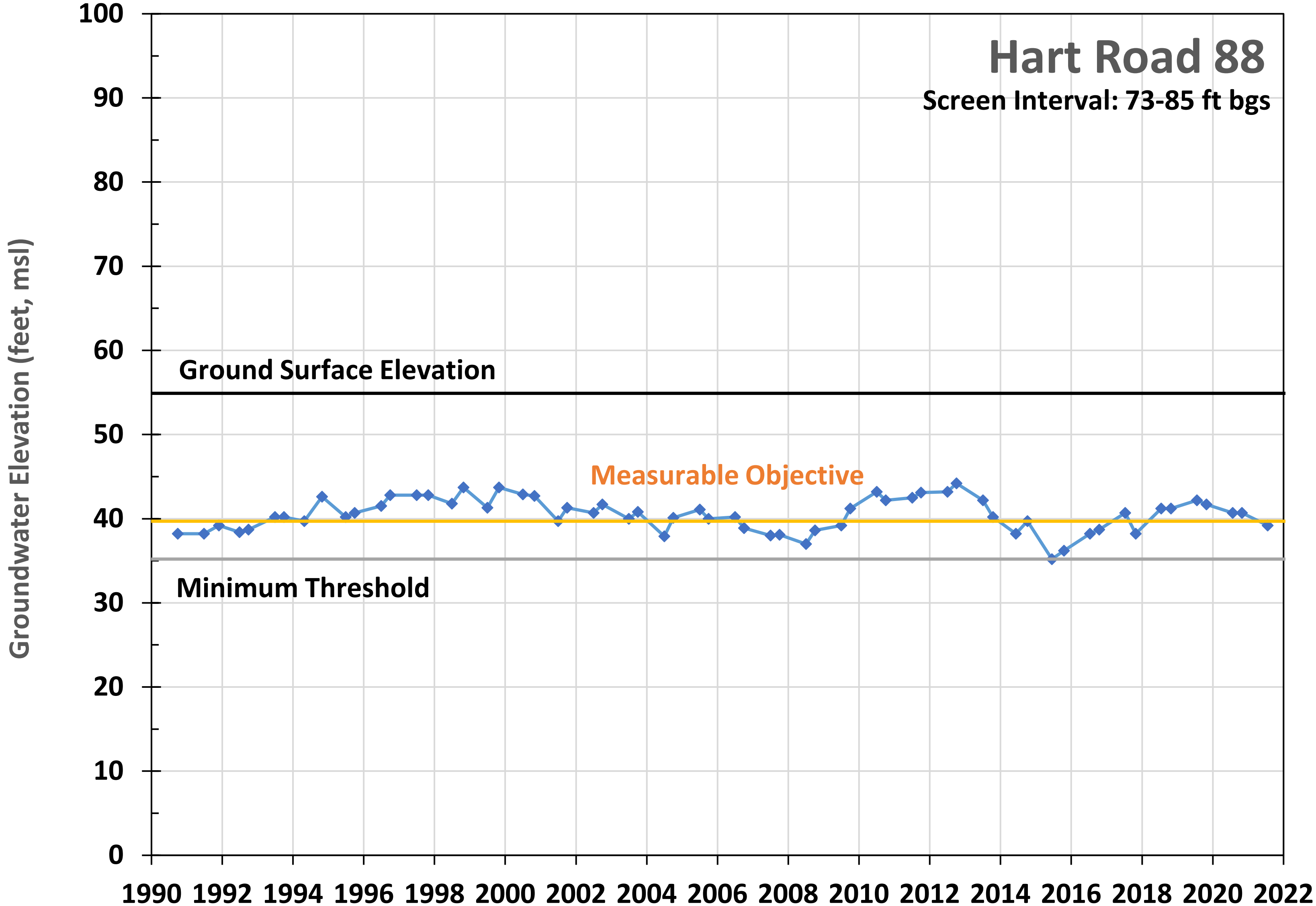
Curtis #2 100
Screen Interval: 79-100 ft bgs
Groundwater Elevation (feet, msl)
Ground Surface Elevation
Measurable Objective
Minimum Threshold
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



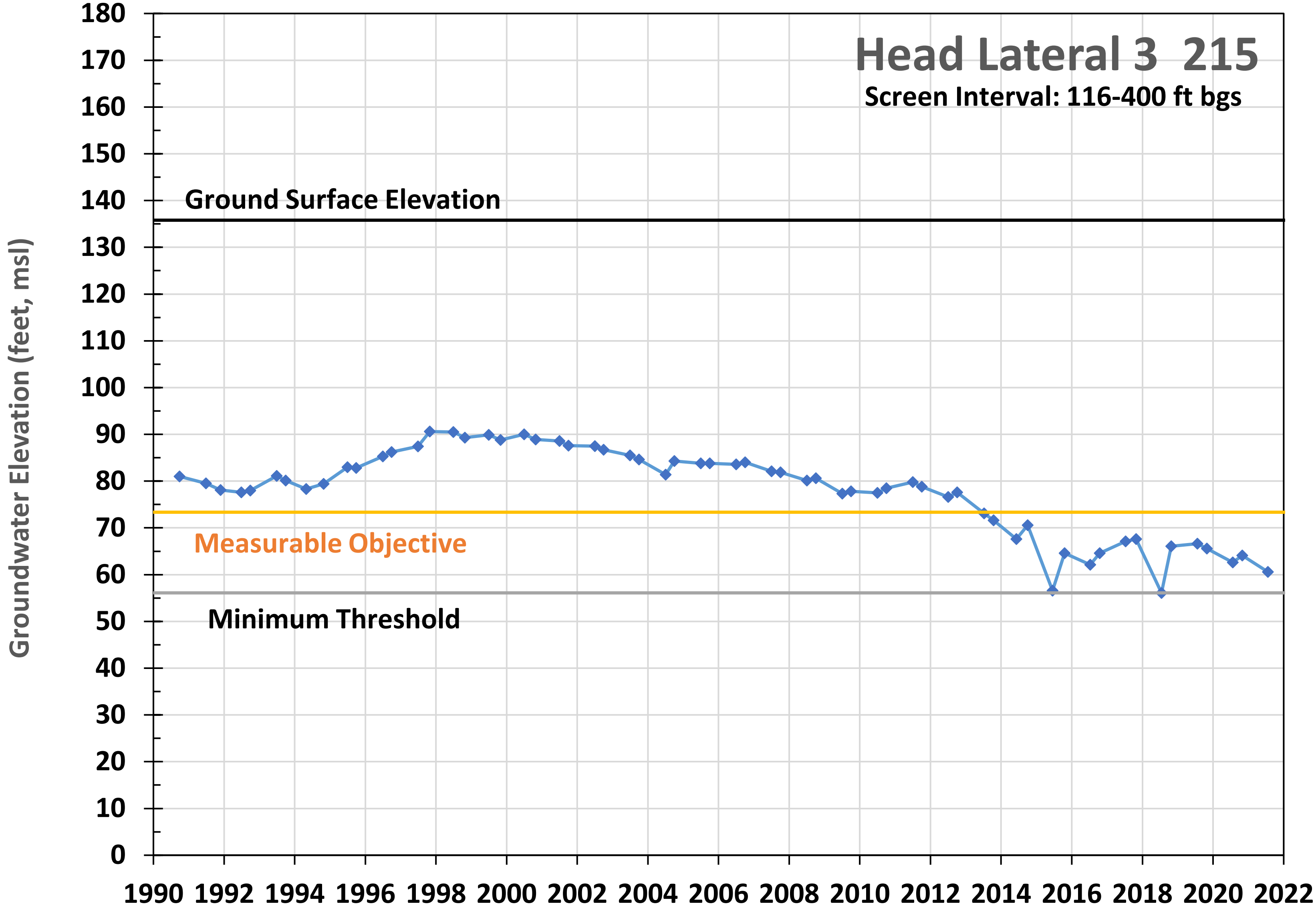
Ground Surface Elevation: 212 ft msl
Furtado OID-07
Screen Interval: 200-300 ft bgs
320-580 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



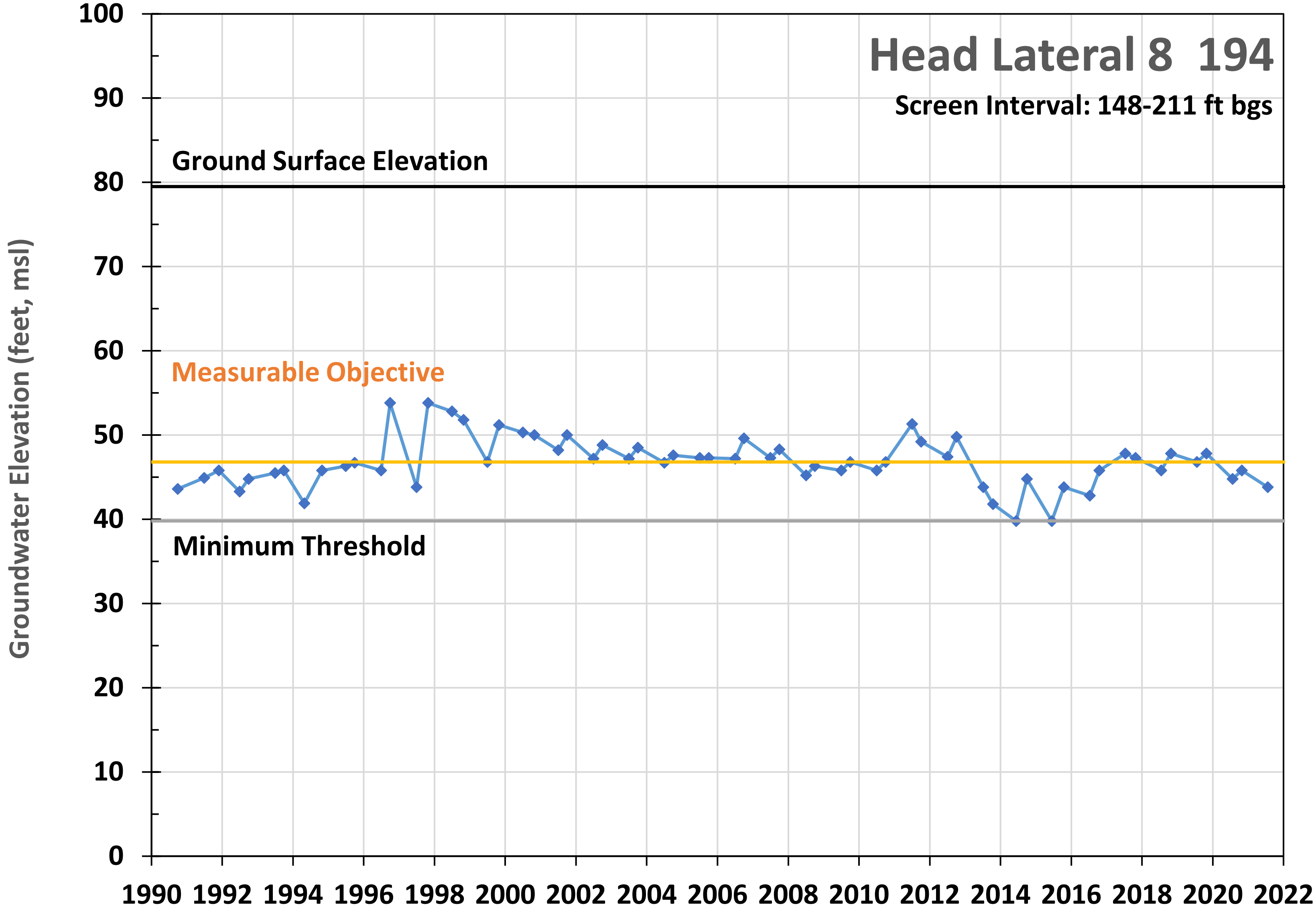
Gates Road 101
Total Depth: 64 ft bgs
Groundwater Elevation (feet, msl)
Ground Surface Elevation
Measurable Objective
Minimum Threshold
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



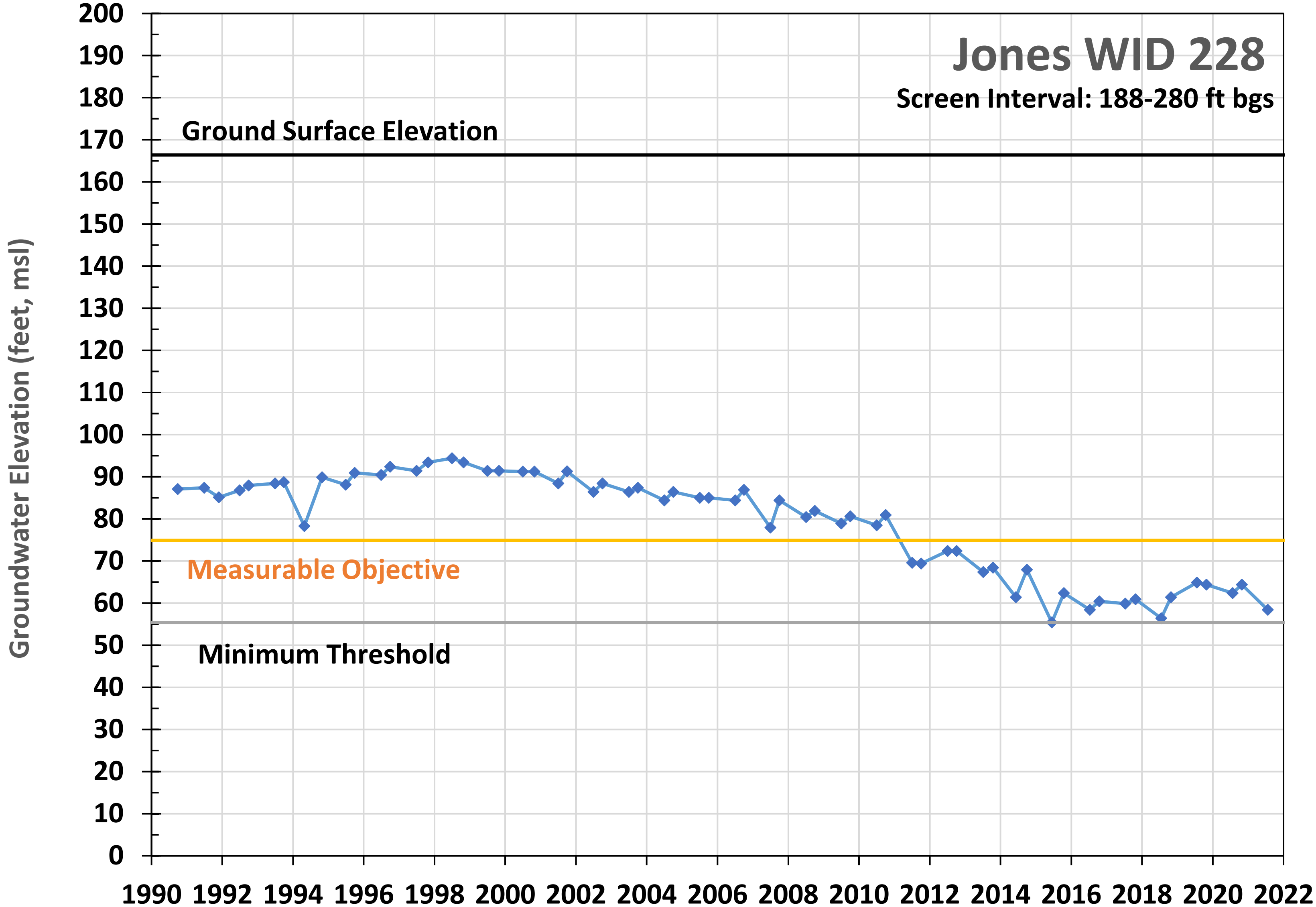
Hart Road 88
Screen Interval: 73-85 ft bgs
Groundwater Elevation (feet, msl)
Ground Surface Elevation
Measurable Objective
Minimum Threshold
100
90
80
70
60
50
40
30
20
10
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022

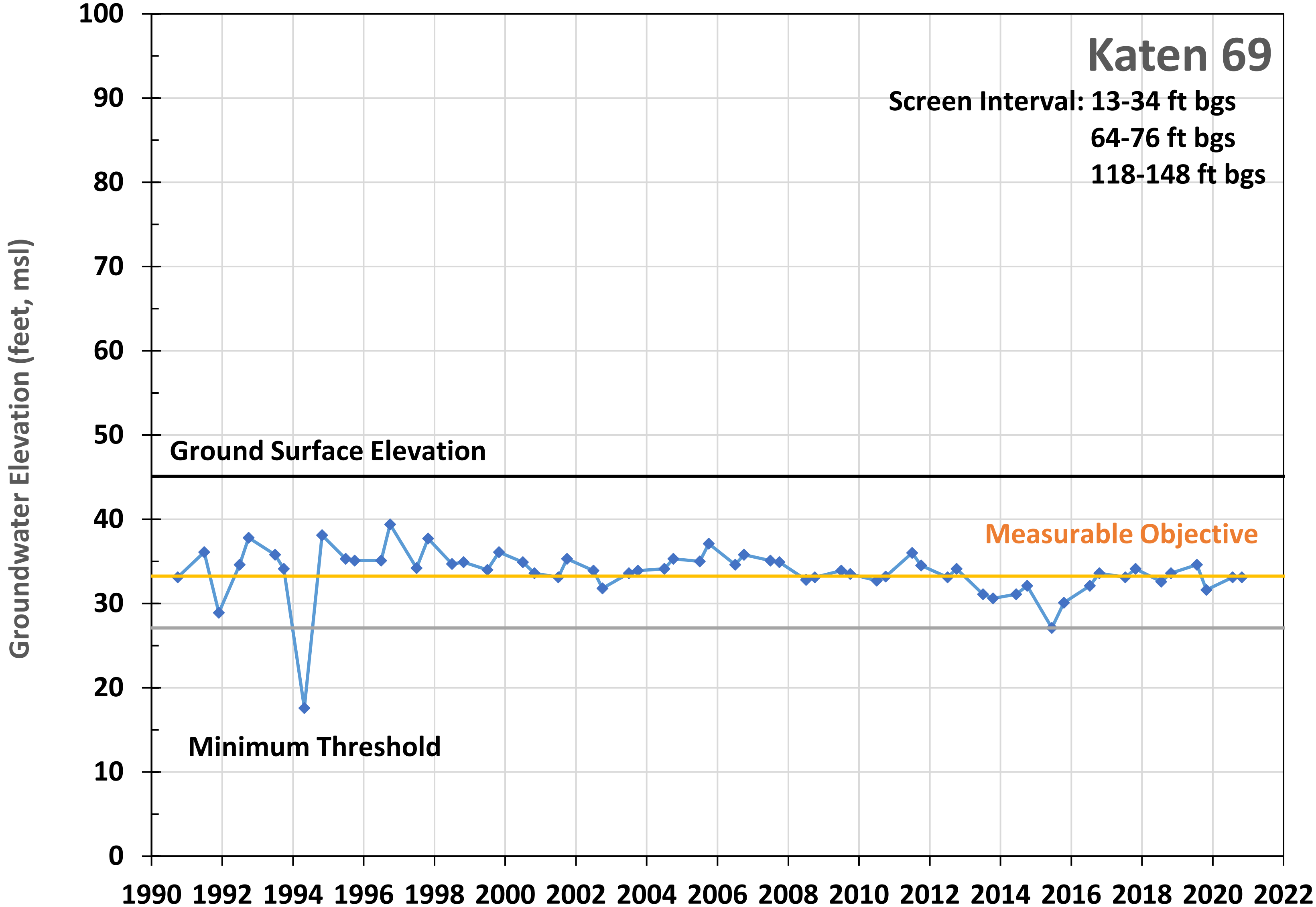


Head Lateral 3 215
Screen Interval: 116-400 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

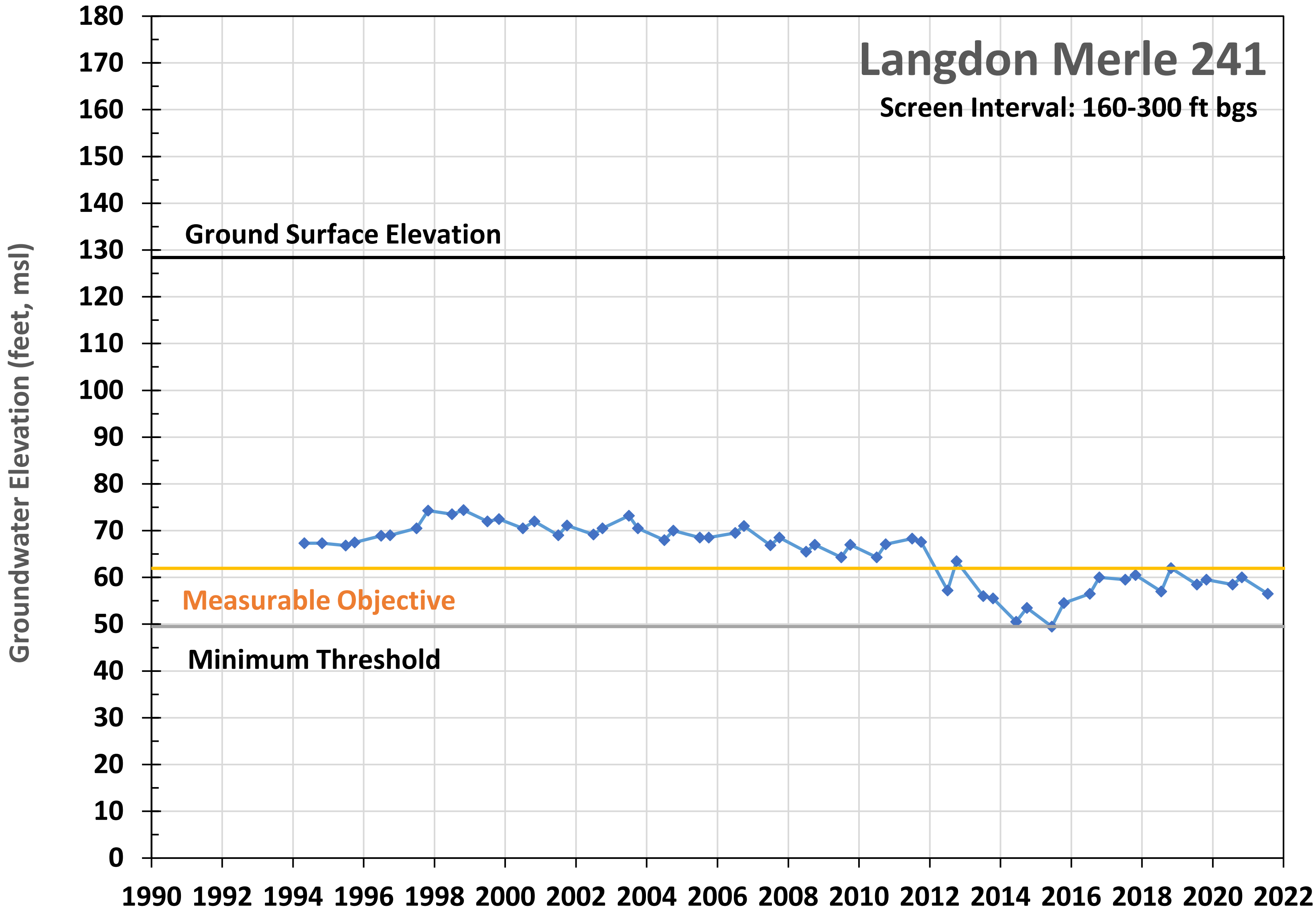


Head Lateral 8 194
Screen Interval: 148-211 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

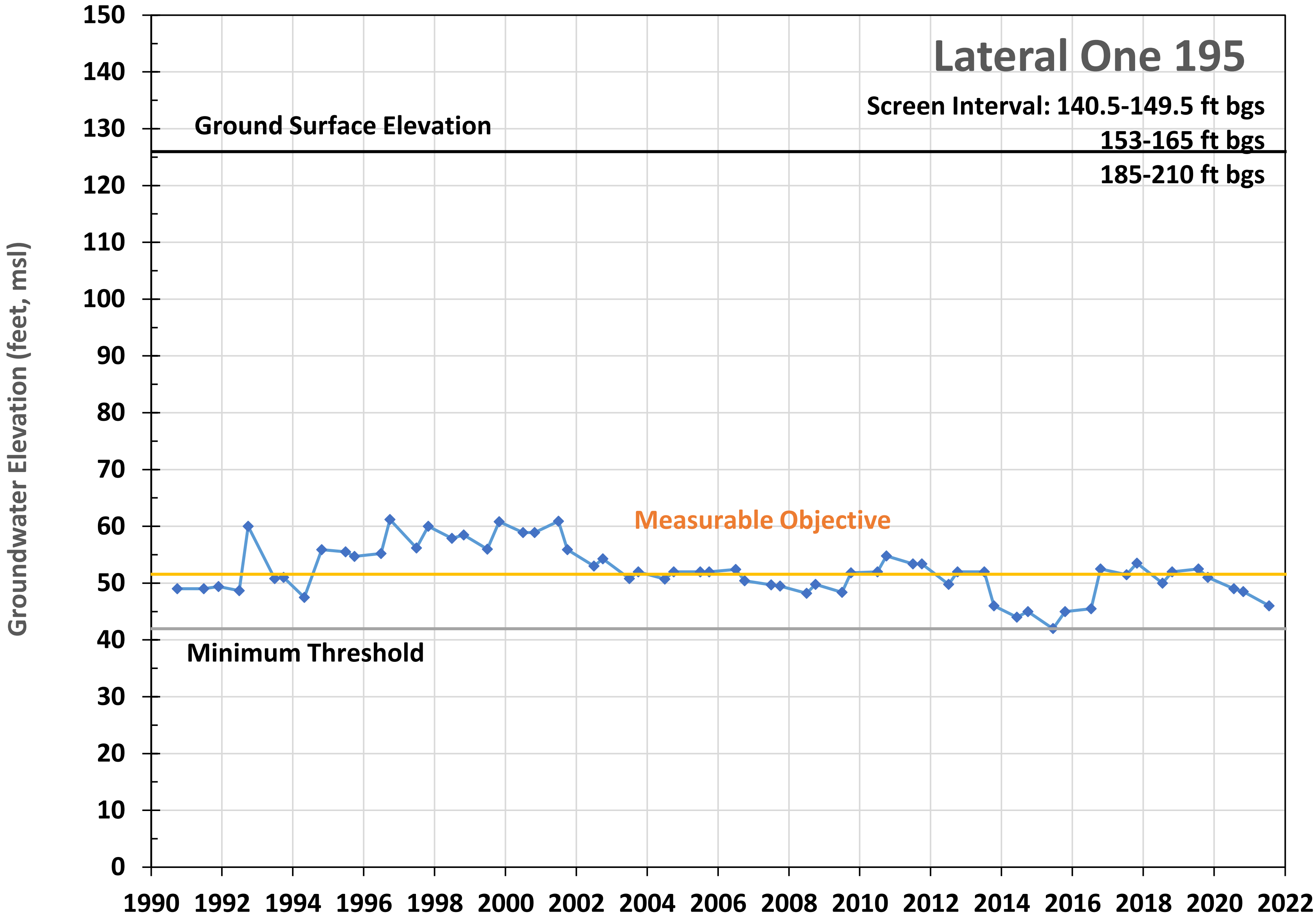

Jones WID 228
Screen Interval: 188-280 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



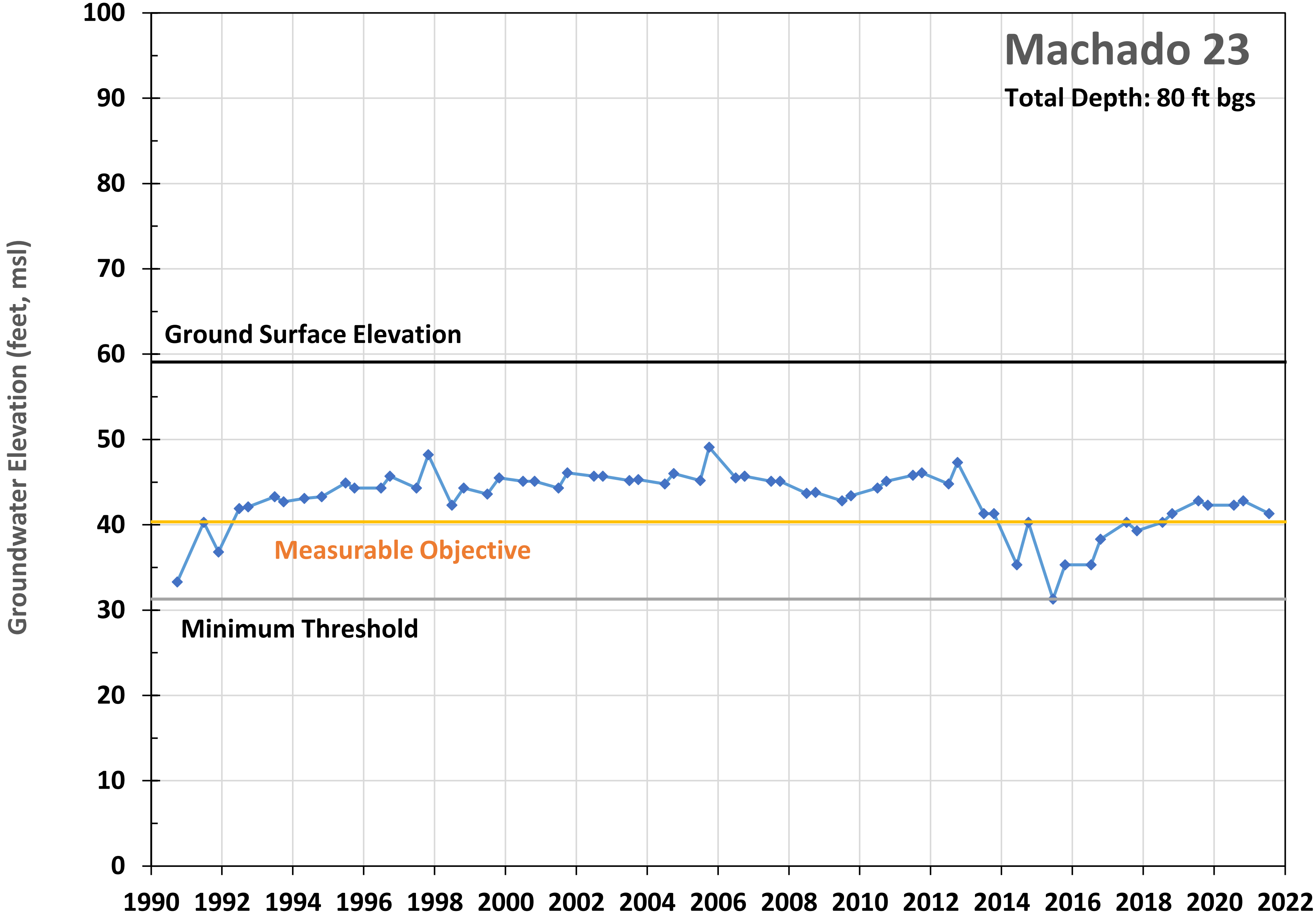
Katen 69
Screen Interval: 13-34 ft bgs
64-76 ft bgs
118-148 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



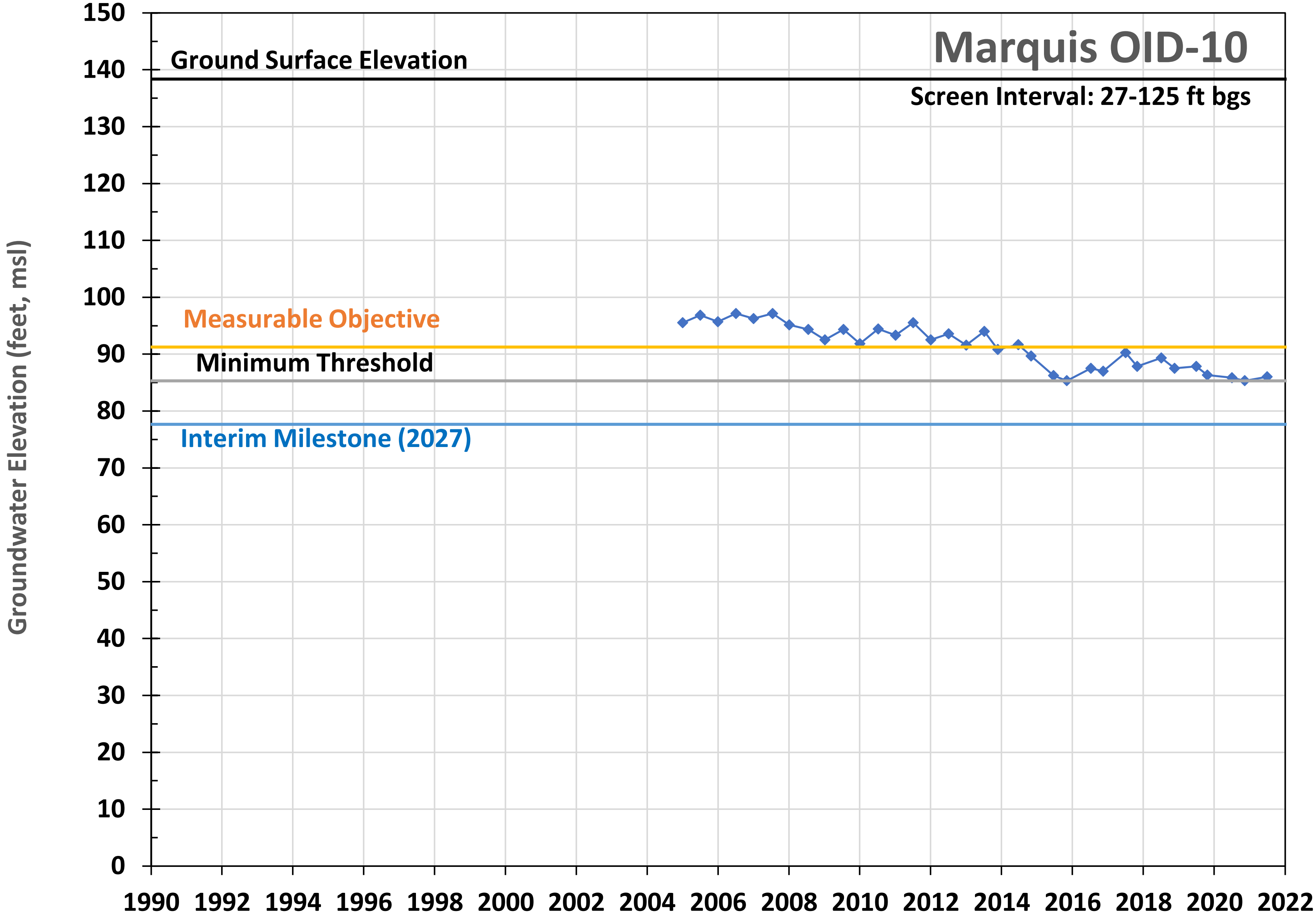
Langdon Merle 241
Screen Interval: 160-300 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022



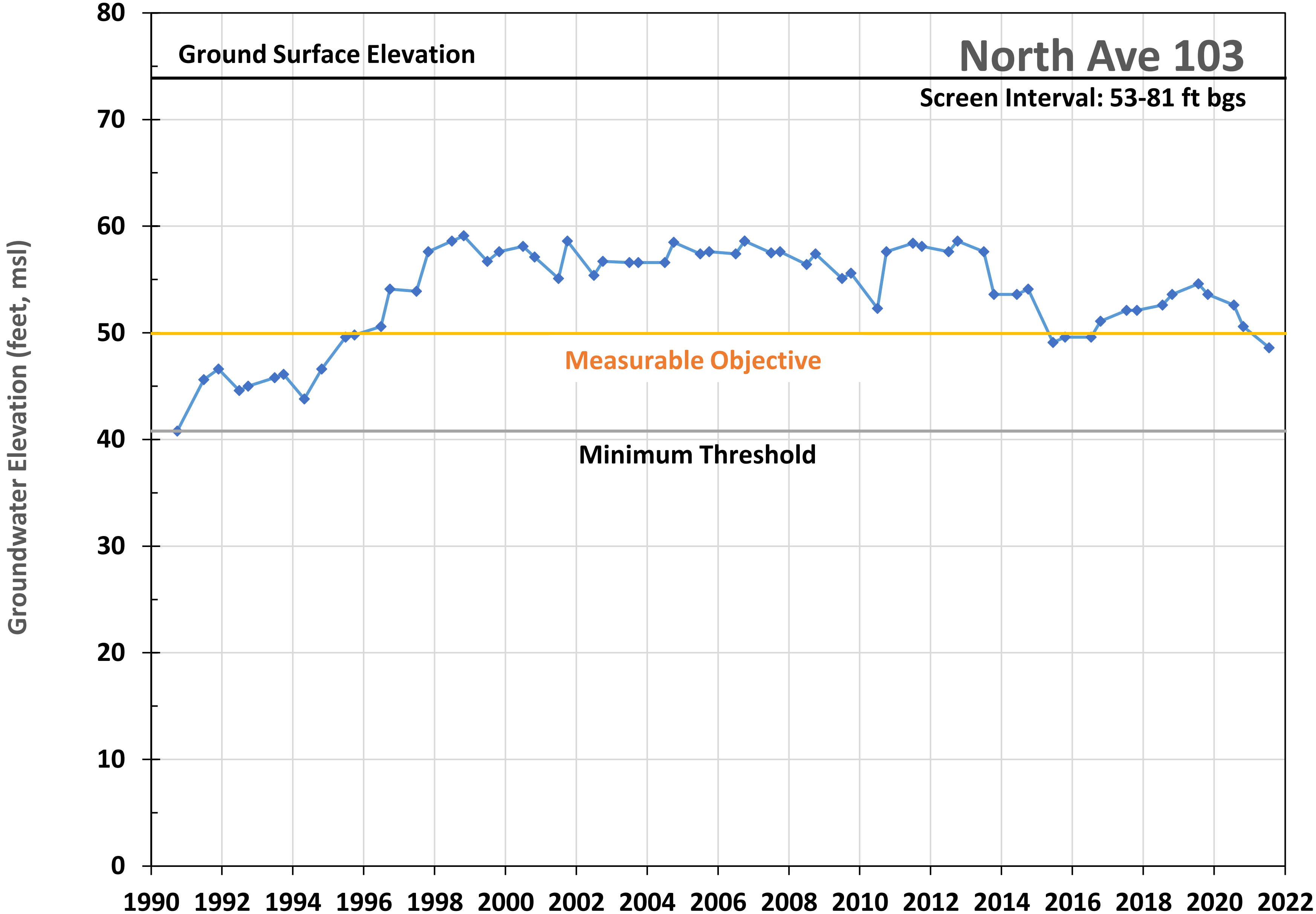
Lateral One 195
Screen Interval: 140.5-149.5 ft bgs
153-165 ft bgs
185-210 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



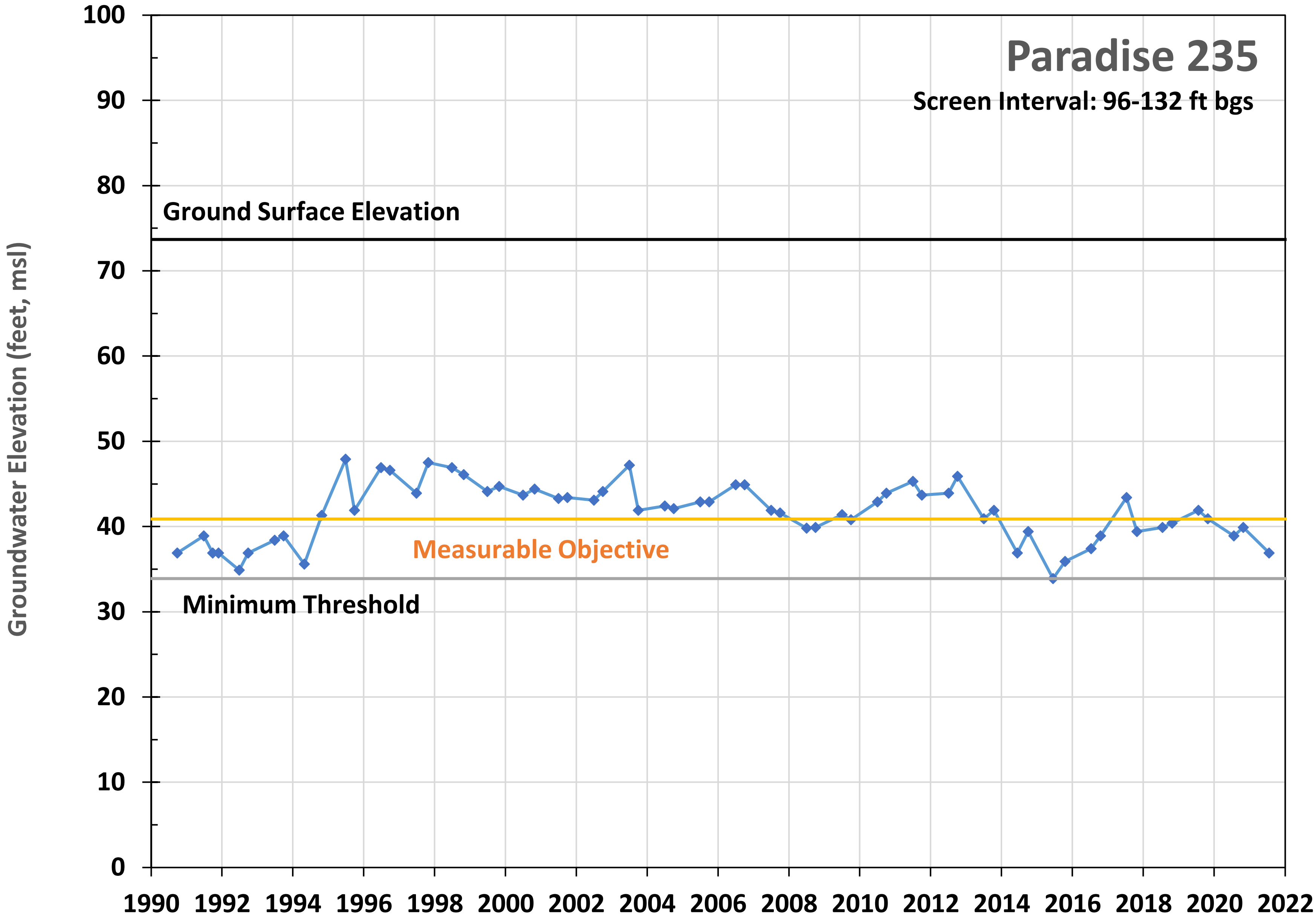
Machado 23
Total Depth: 80 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



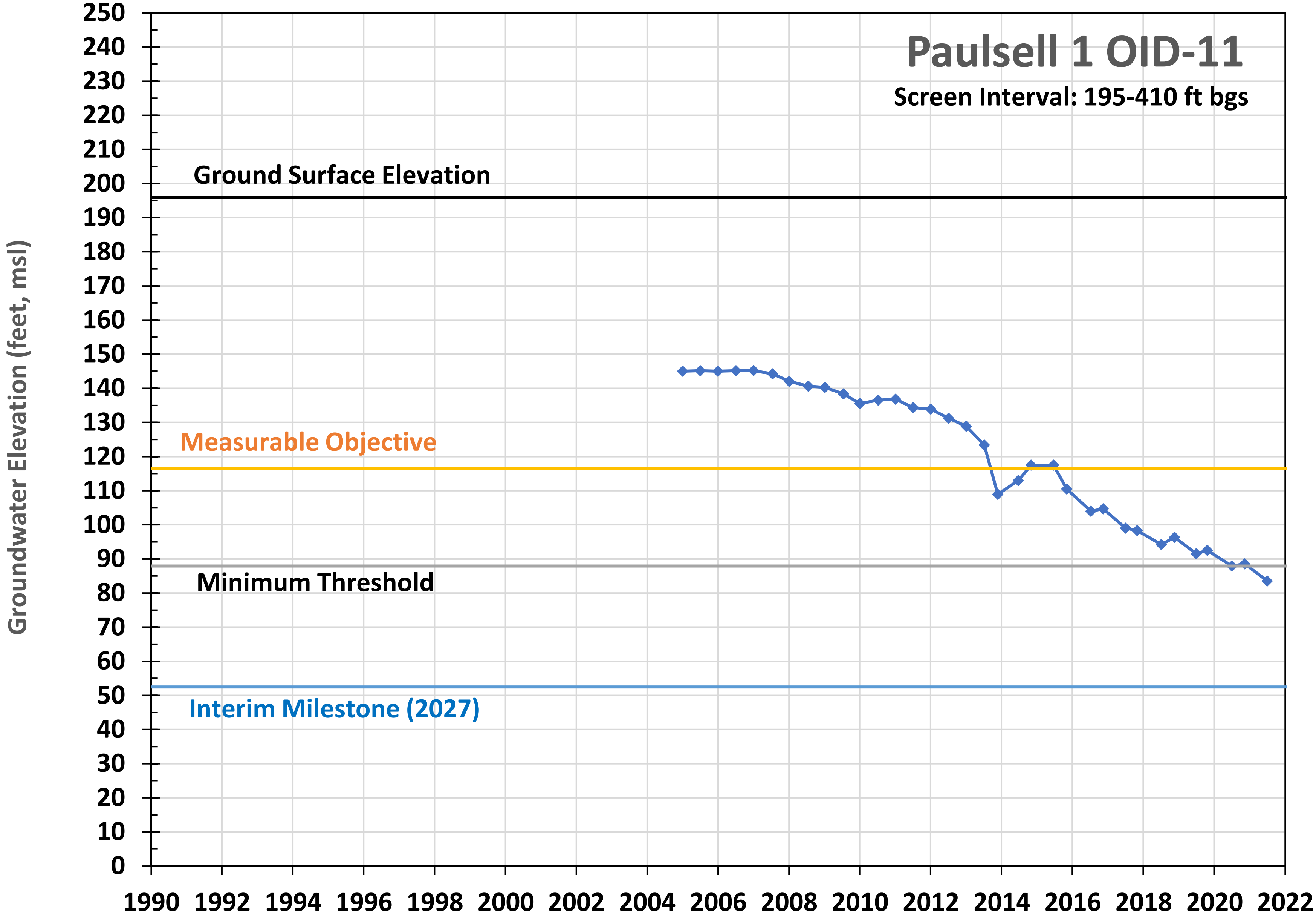
Marquis OID-10
Ground Surface Elevation
Screen Interval: 27-125 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



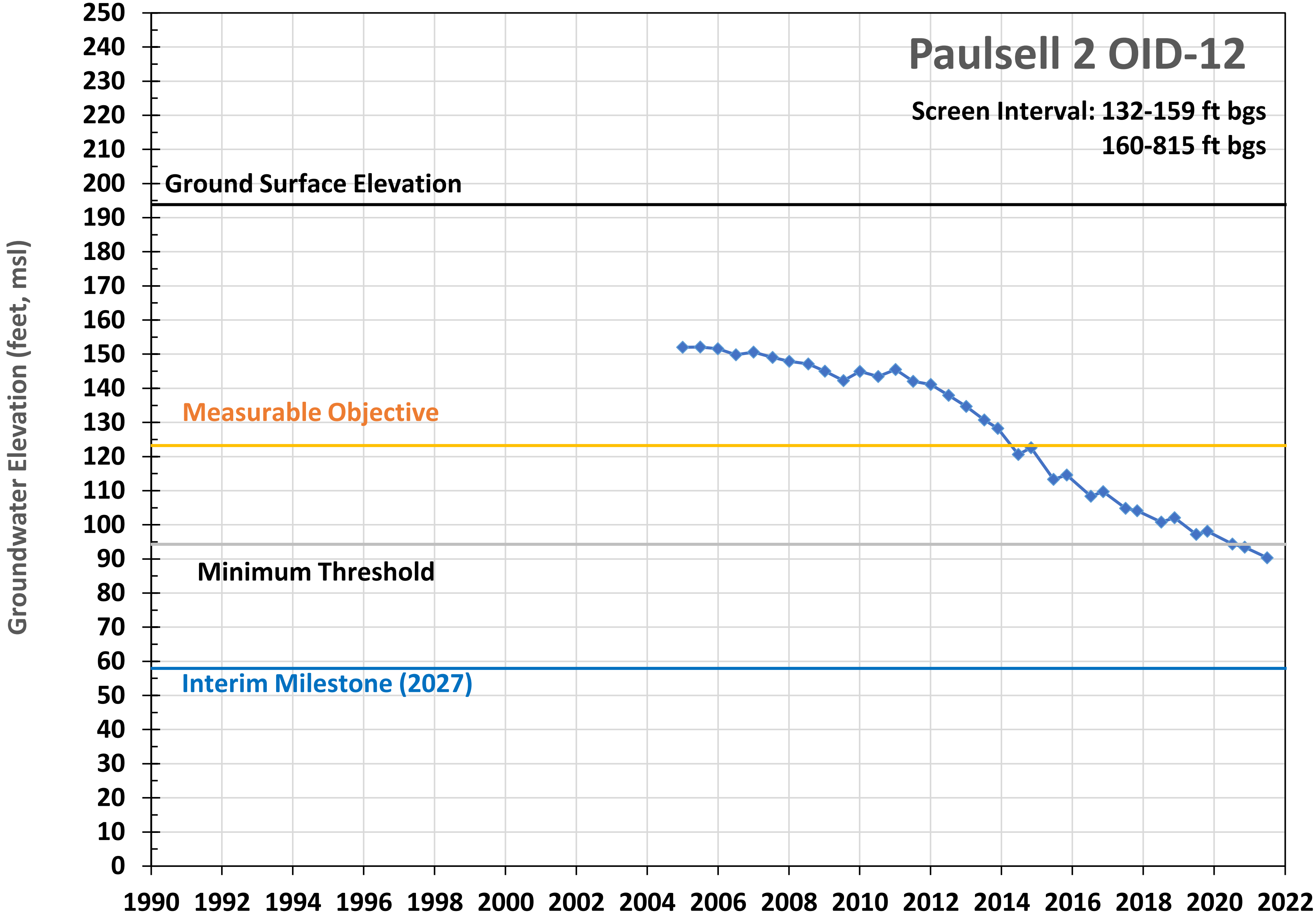
North Ave 103
Ground Surface Elevation
Screen Interval: 53-81 ft bgs
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



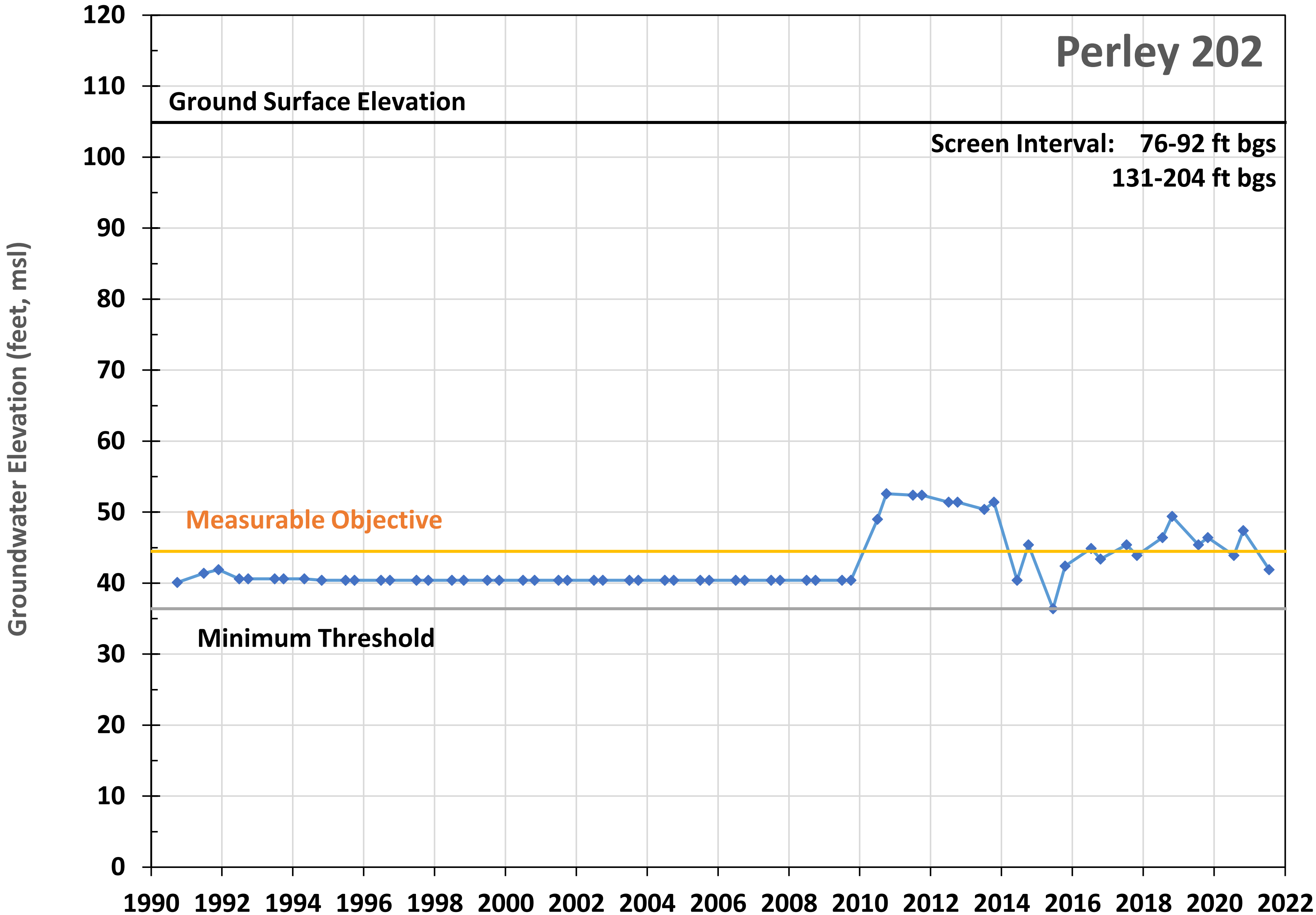
Paradise 235
Screen Interval: 96-132 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

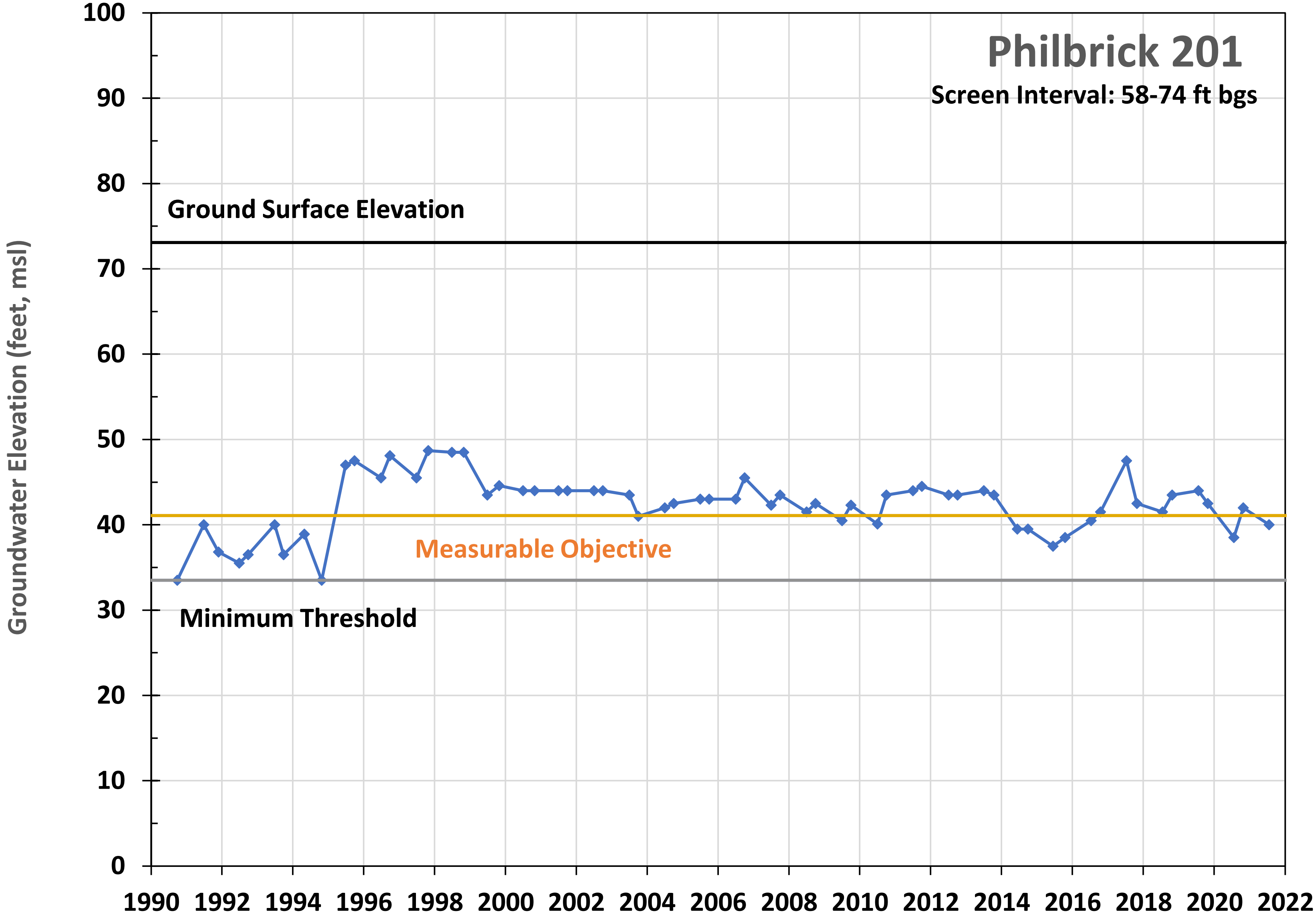


Paulsell 1 OID-11
Screen Interval: 195-410 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

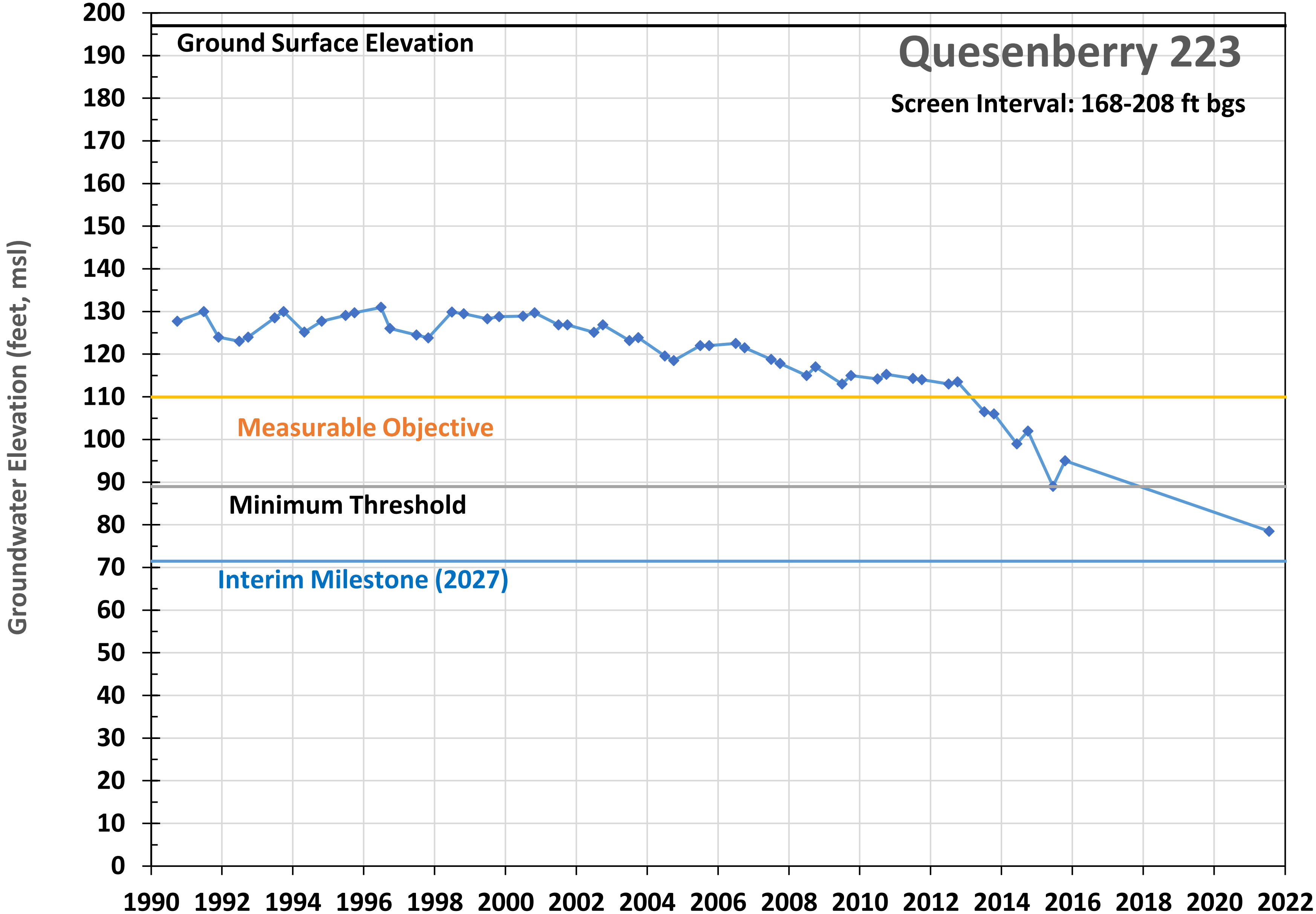


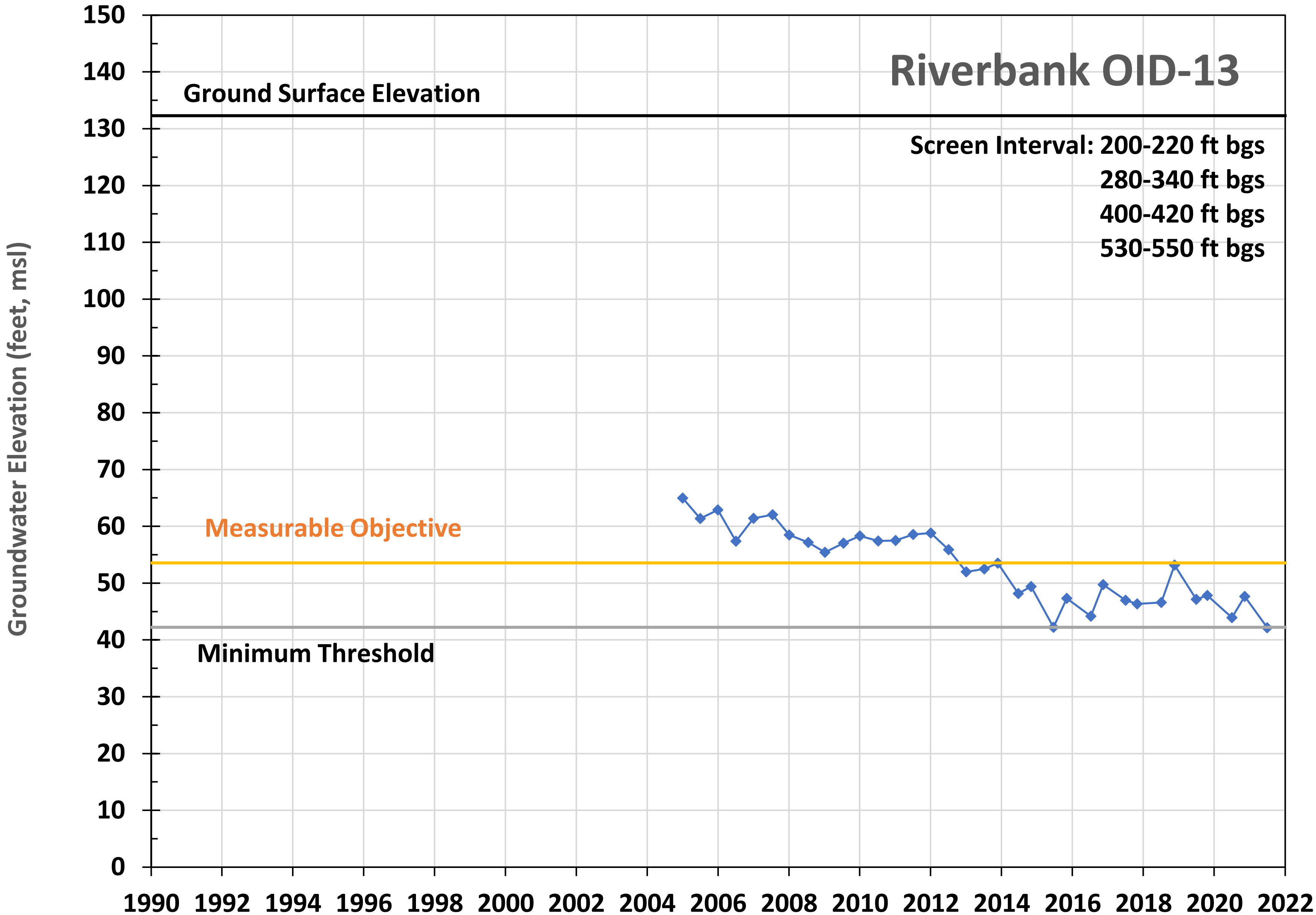
Paulsell 2 OID-12
Screen Interval: 132-159 ft bgs
160-815 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Perley 202
Ground Surface Elevation
Screen Interval: 76-92 ft bgs
131-204 ft bgs
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

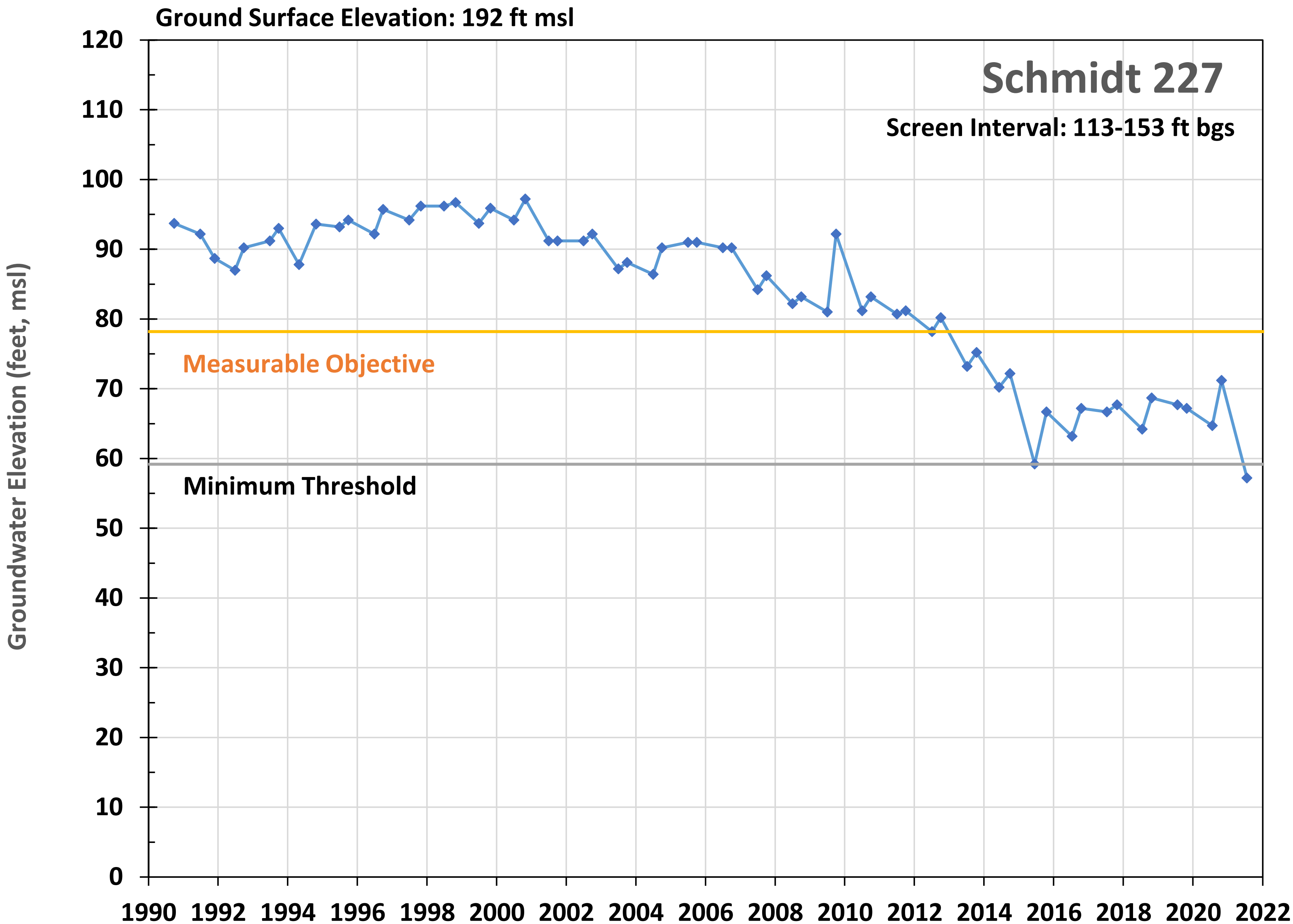


Philbrick 201
Screen Interval: 58-74 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

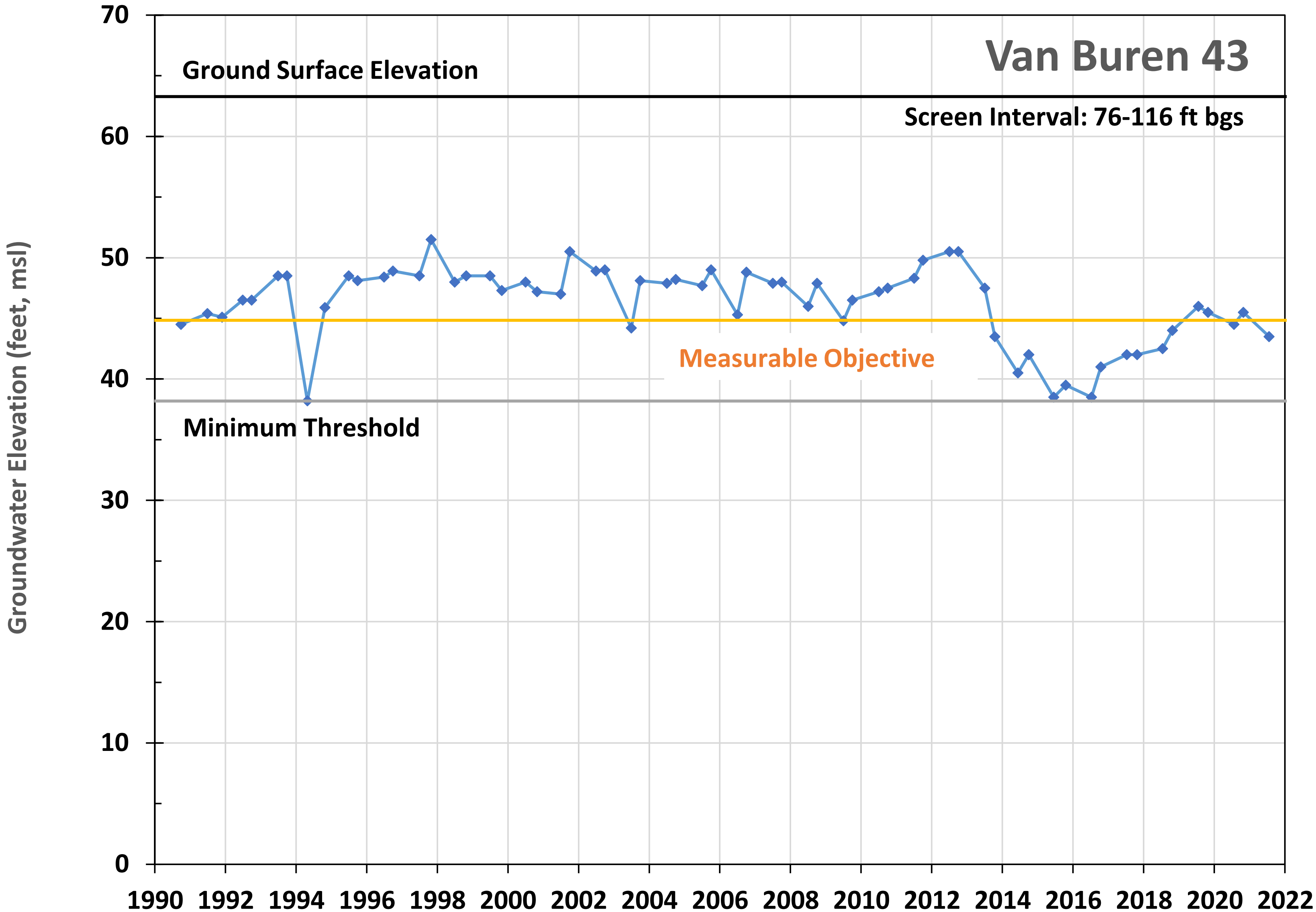

Quesenberry 223
Screen Interval: 168-208 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



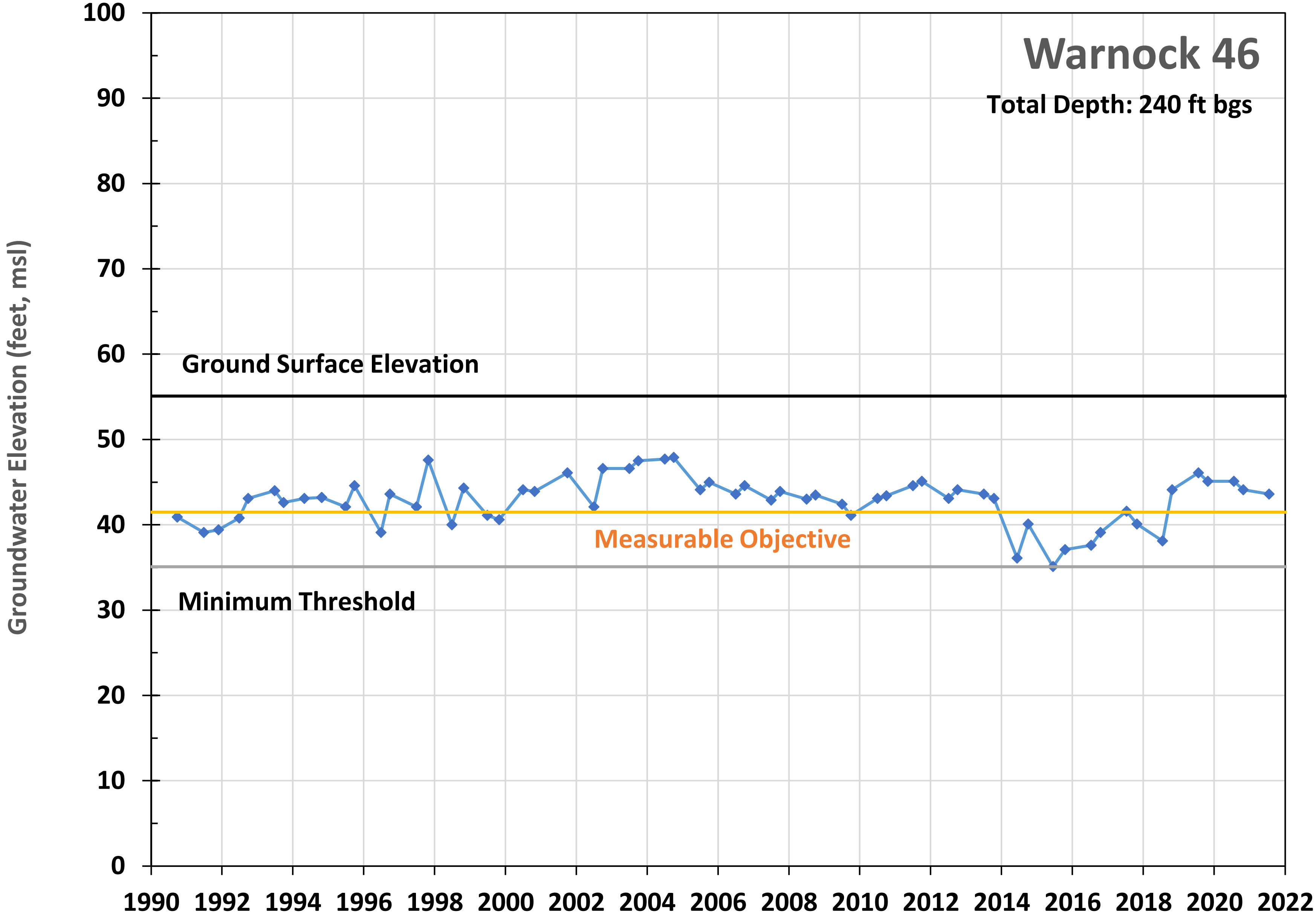
Riverbank OID-13
Ground Surface Elevation
Screen Interval: 200-220 ft bgs
280-340 ft bgs
400-420 ft bgs
530-550 ft bgs
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



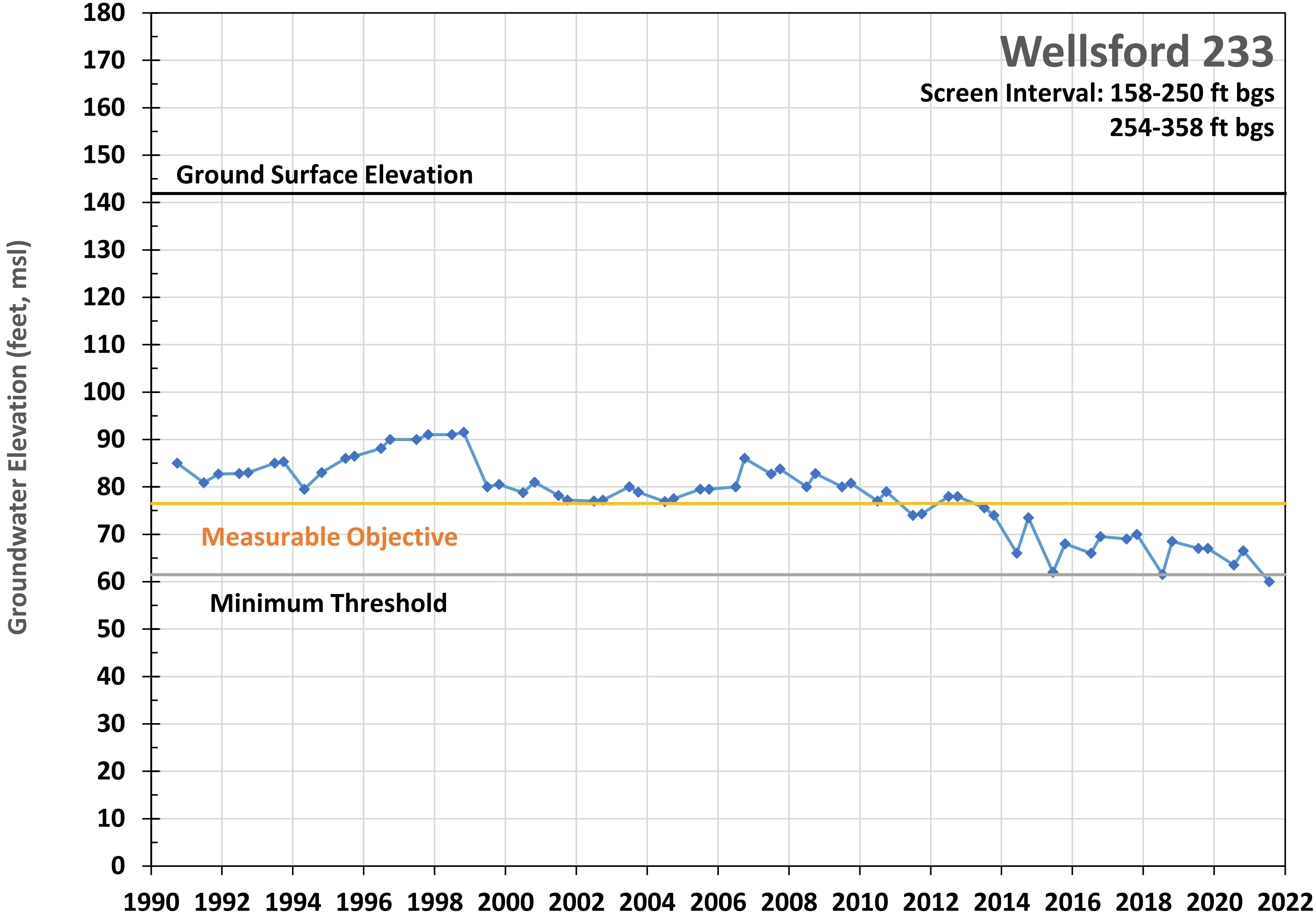
Ground Surface Elevation: 192 ft msl
Schmidt 227
Screen Interval: 113-153 ft bgs
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



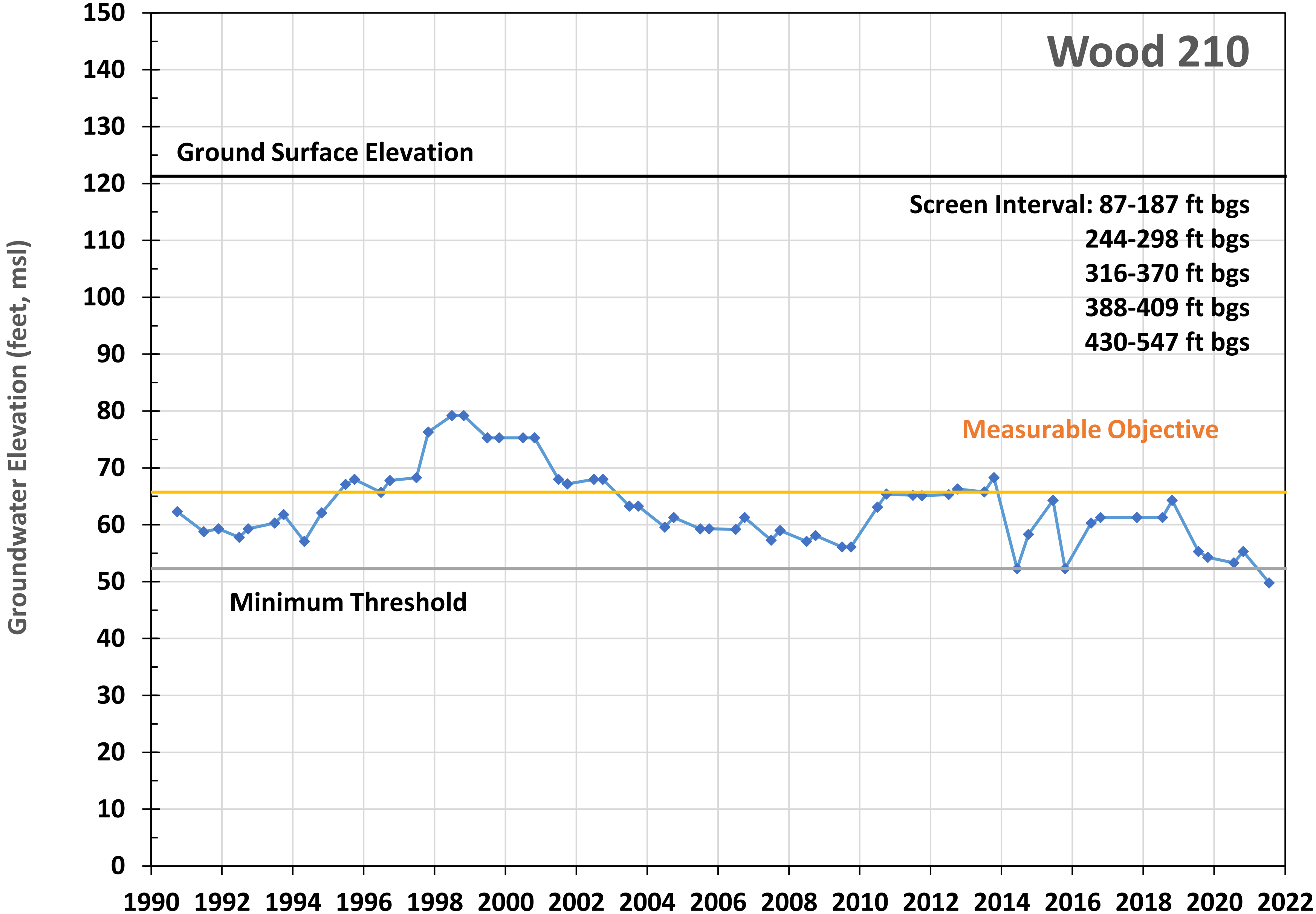
Van Buren 43
Ground Surface Elevation
Screen Interval: 76-116 ft bgs
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



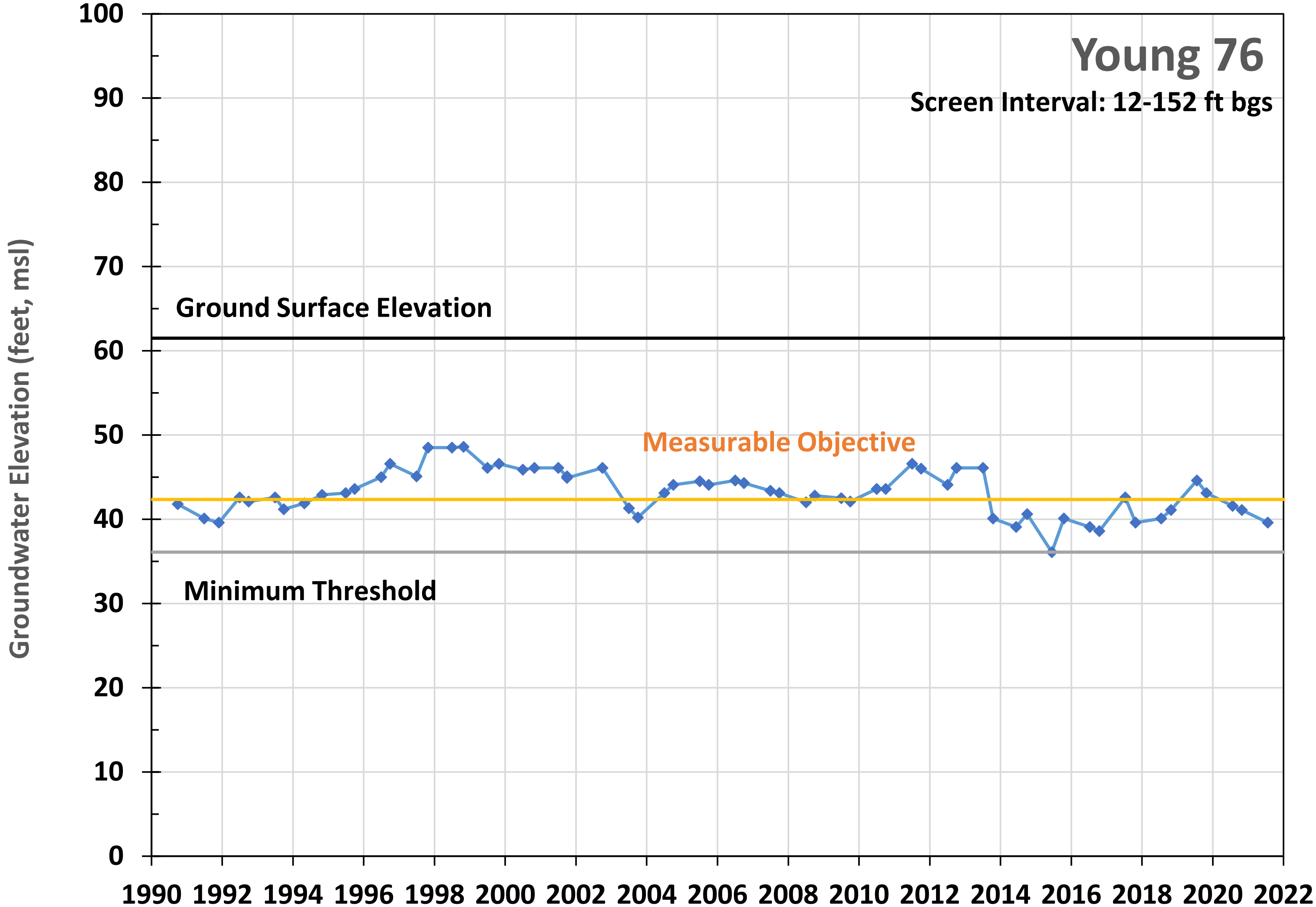
Warnock 46
Total Depth: 240 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



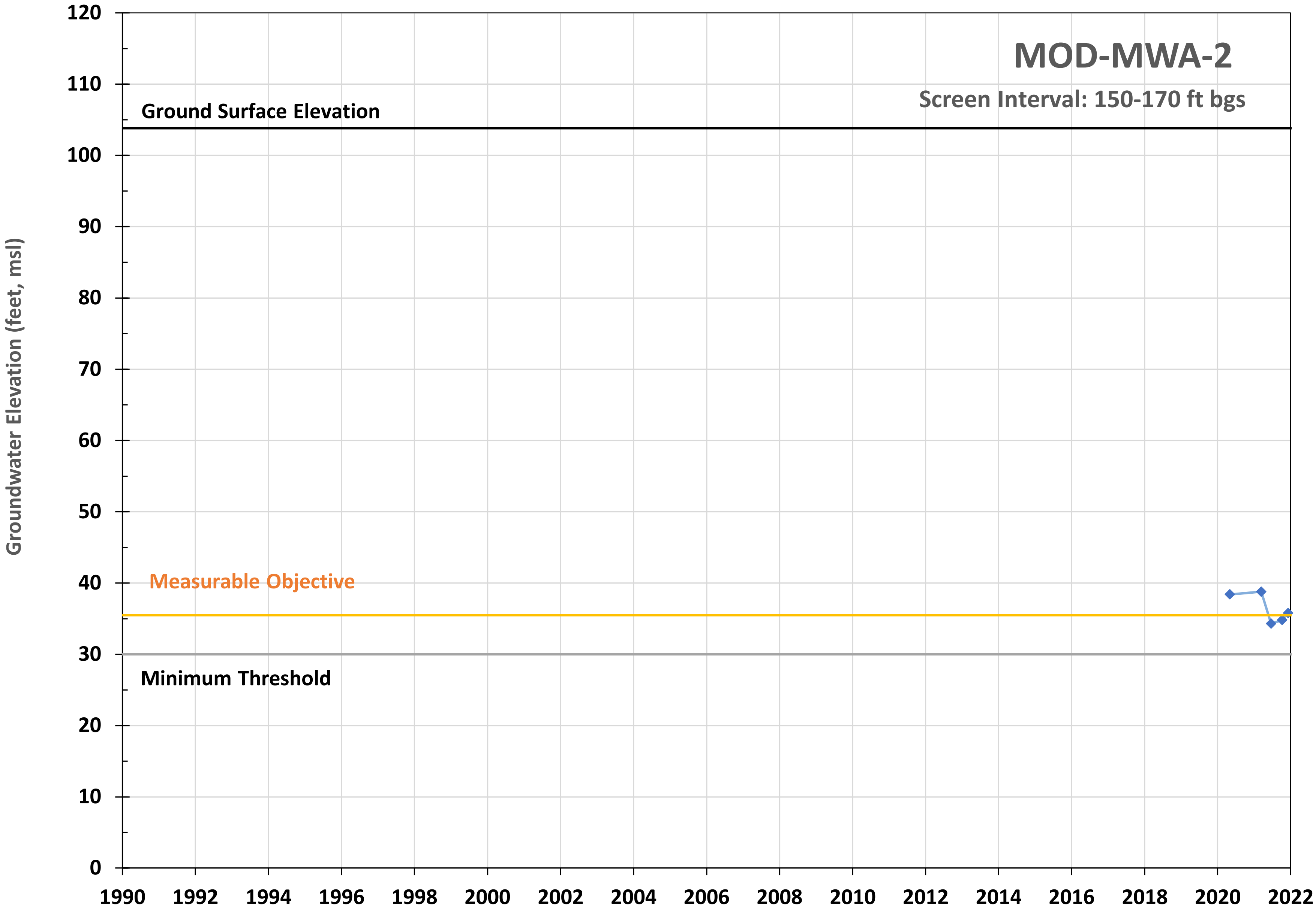
Wellsford 233
Screen Interval: 158-250 ft bgs
254-358 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

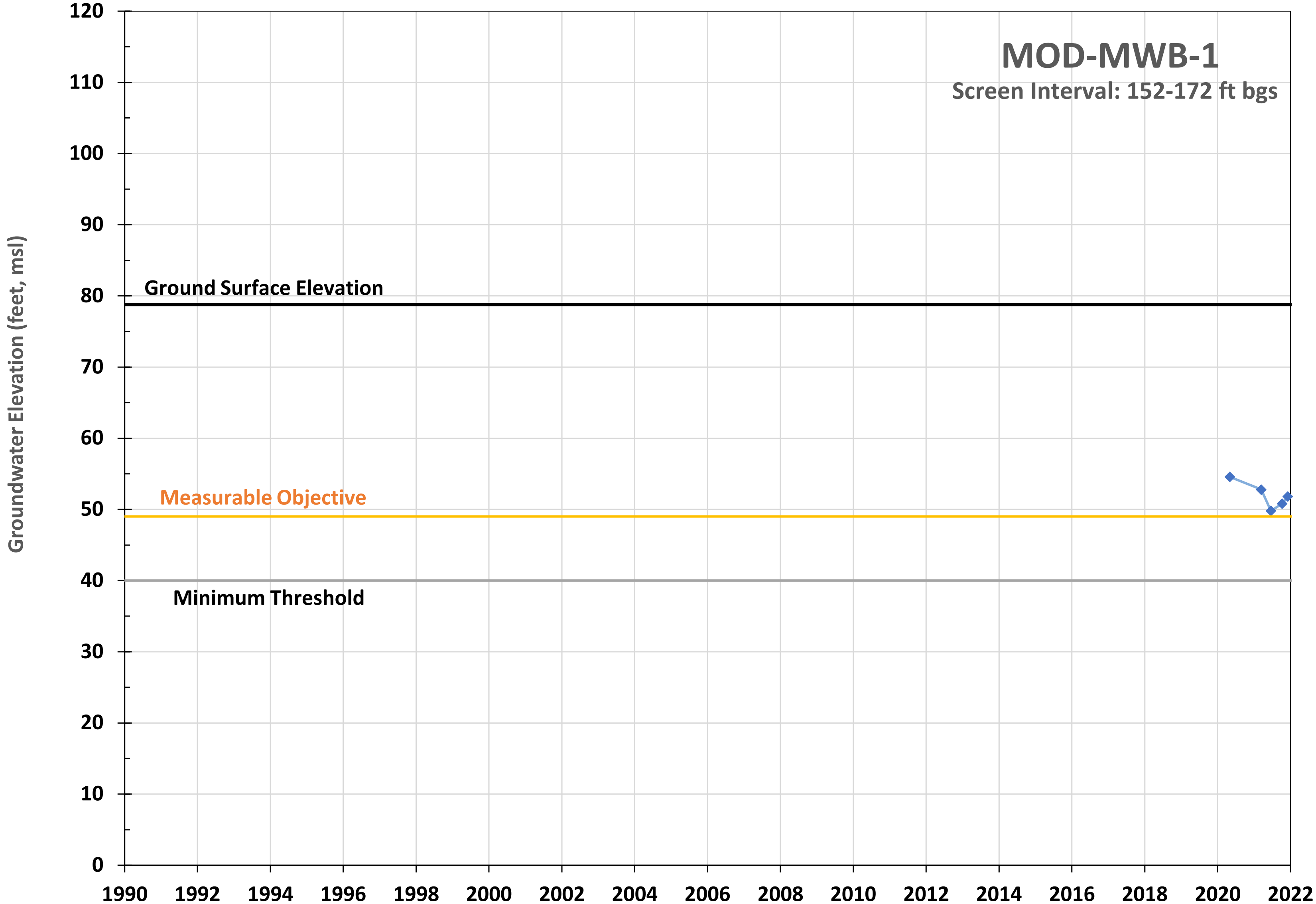


Wood 210
Ground Surface Elevation
Screen Interval: 87-187 ft bgs
244-298 ft bgs
316-370 ft bgs
388-409 ft bgs
430-547 ft bgs
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

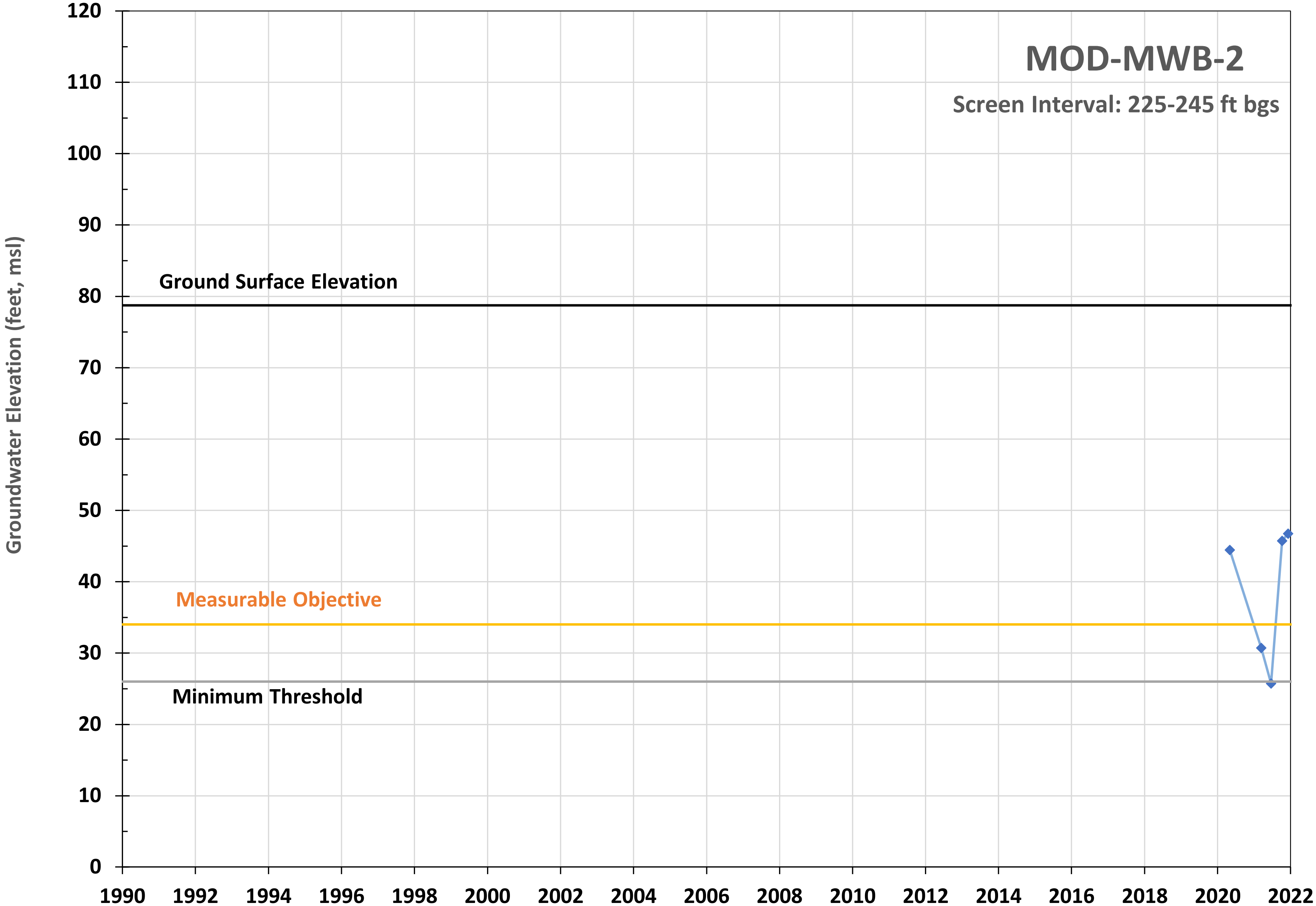


Young 76
Screen Interval: 12-152 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

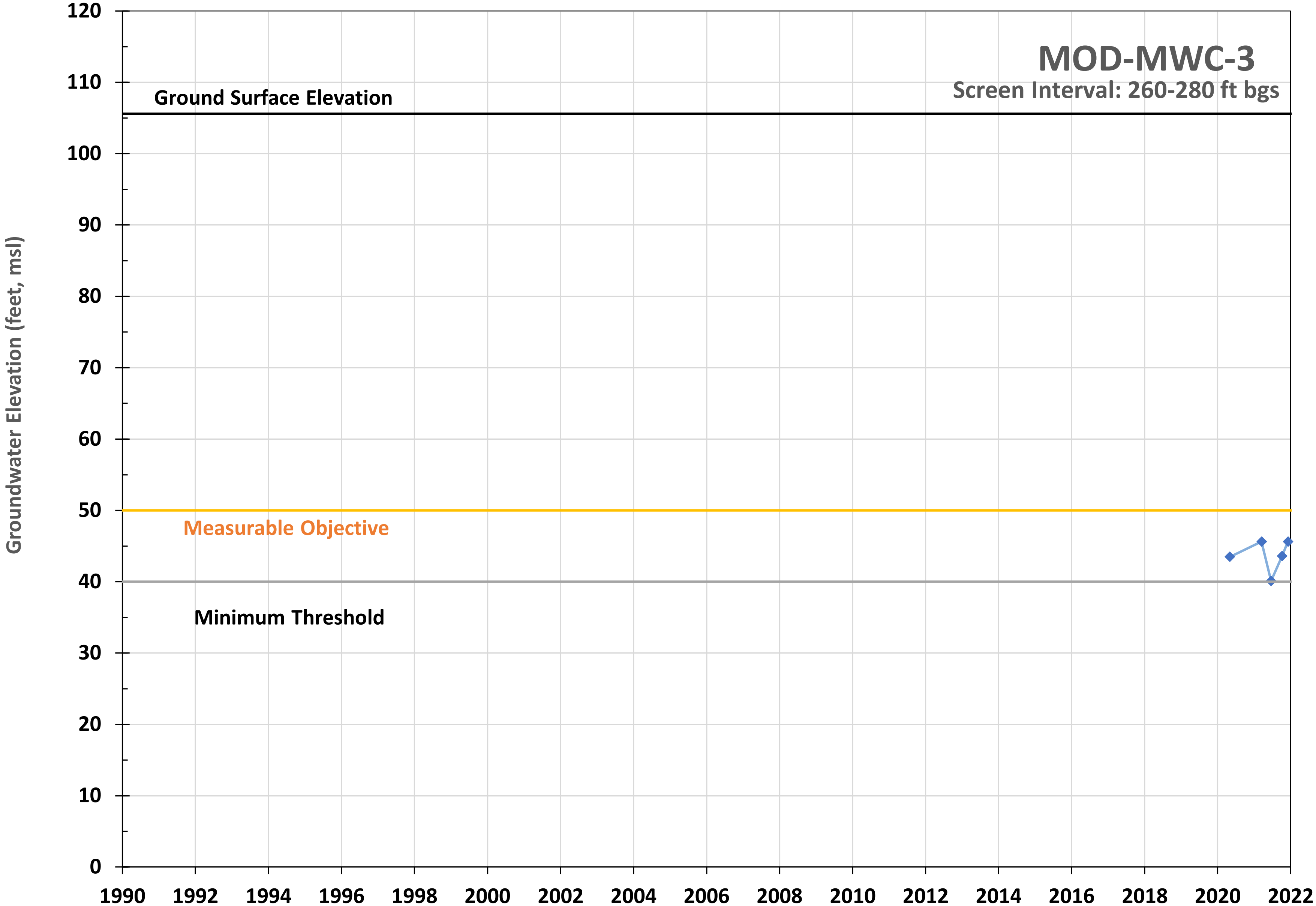

MOD-MWA-2
Screen Interval: 150-170 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

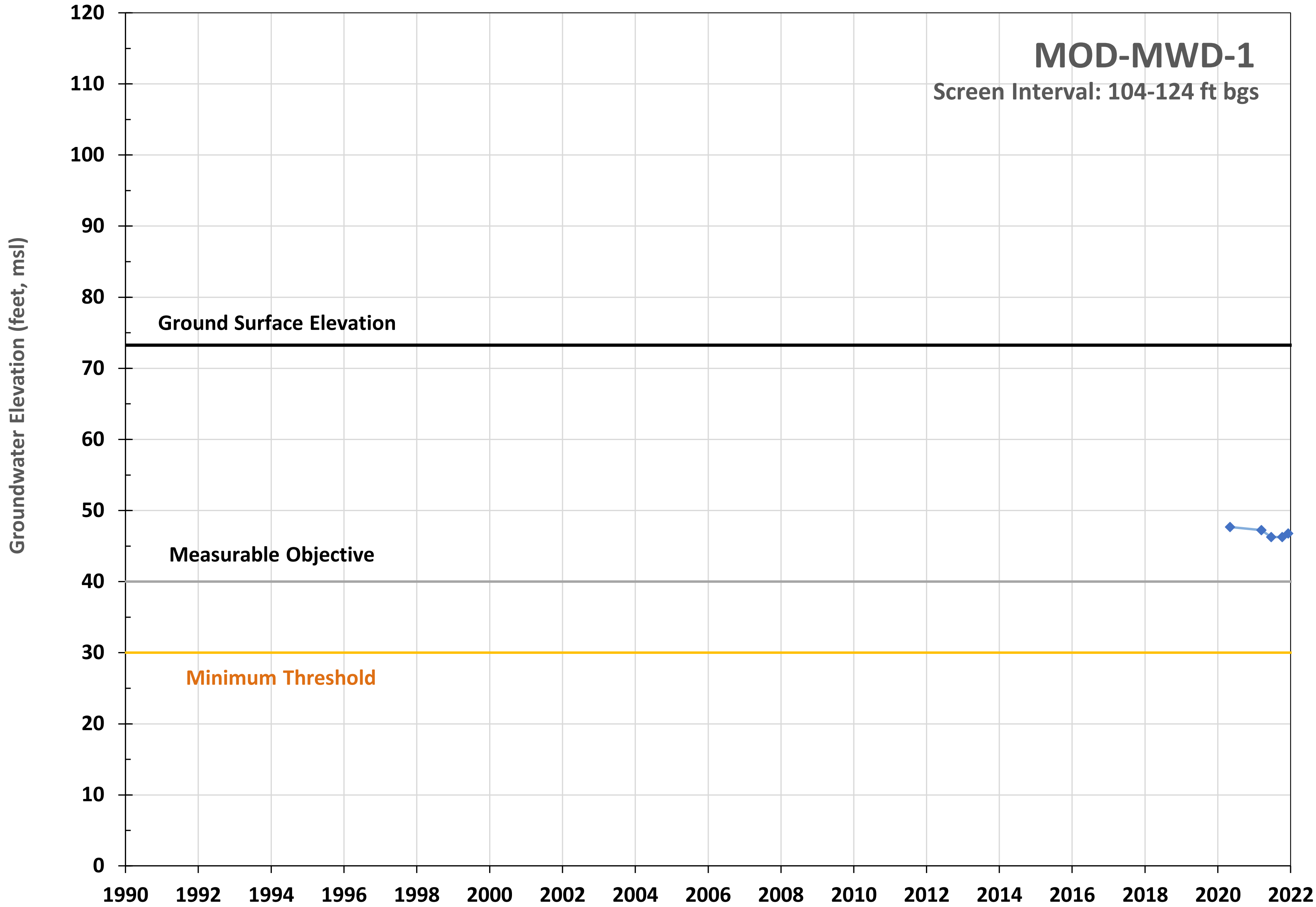


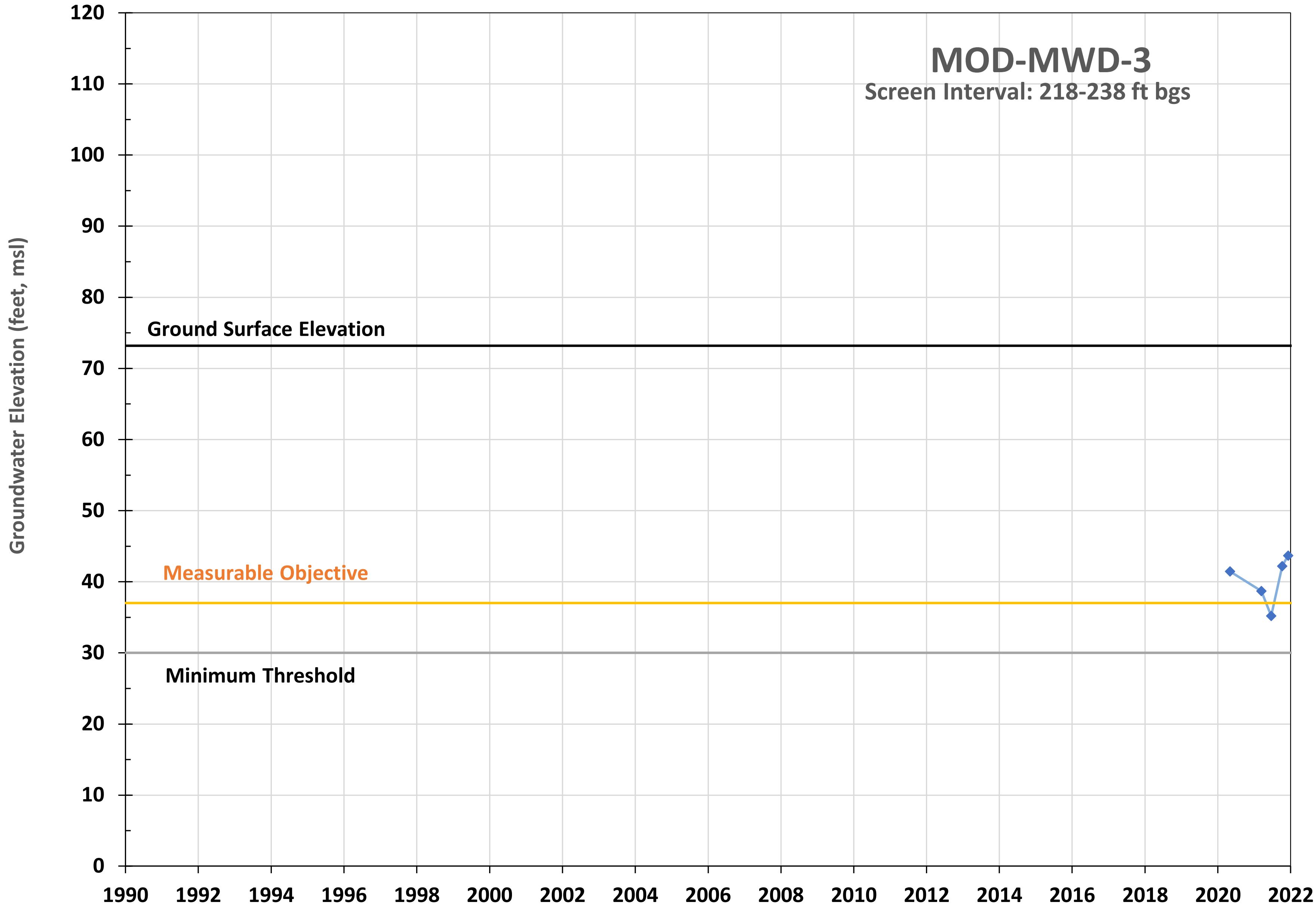
MOD-MWB-1
Screen Interval: 152-172 ft bgs
Groundwater Elevation (feet, msl)
Ground Surface Elevation
Measurable Objective
Minimum Threshold
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



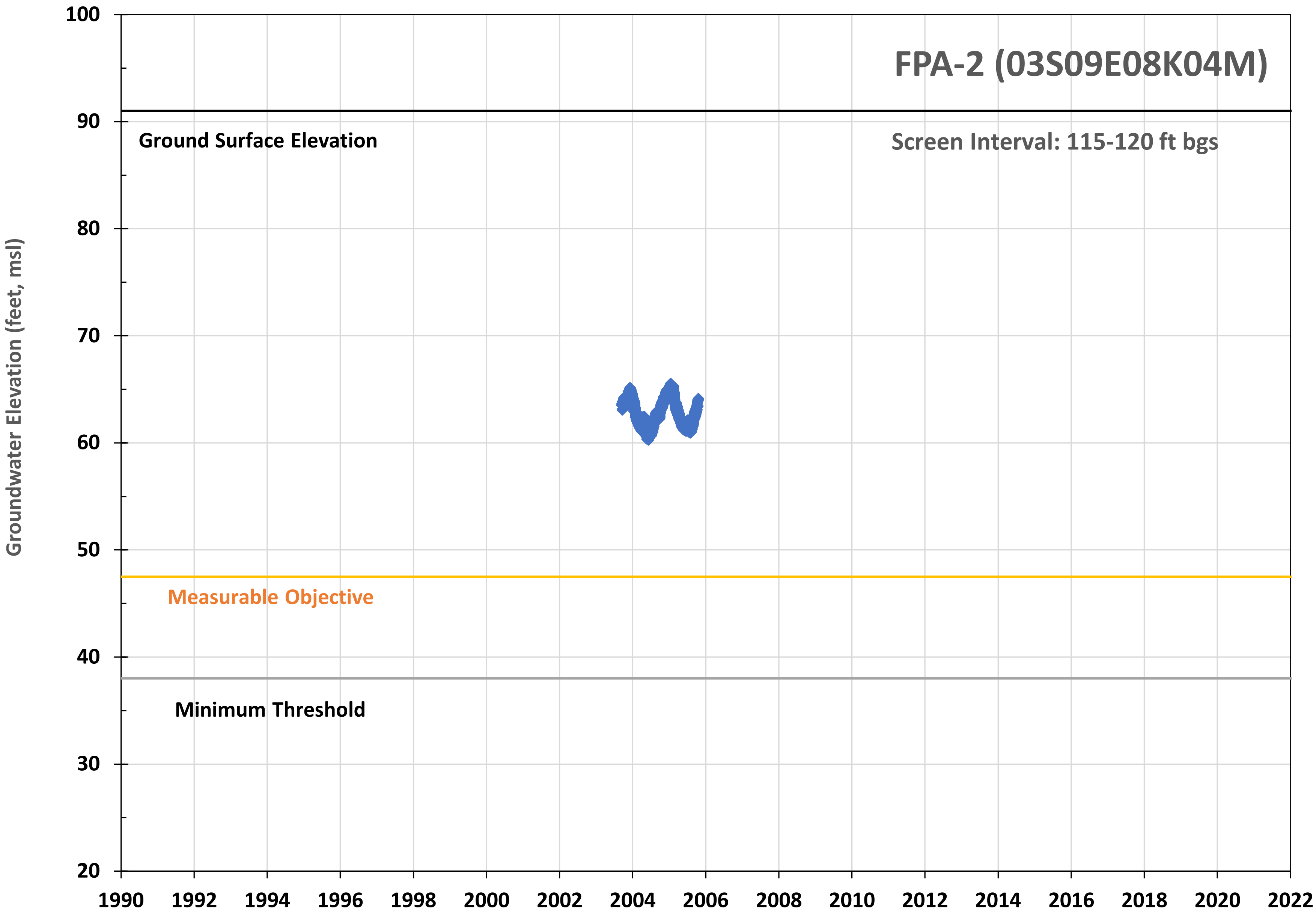
MOD-MWB-2
Screen Interval: 225-245 ft bgs
Groundwater Elevation (feet, msl)
Ground Surface Elevation
Measurable Objective
Minimum Threshold
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


MOD-MWC-3
Screen Interval: 260-280 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
120
110
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

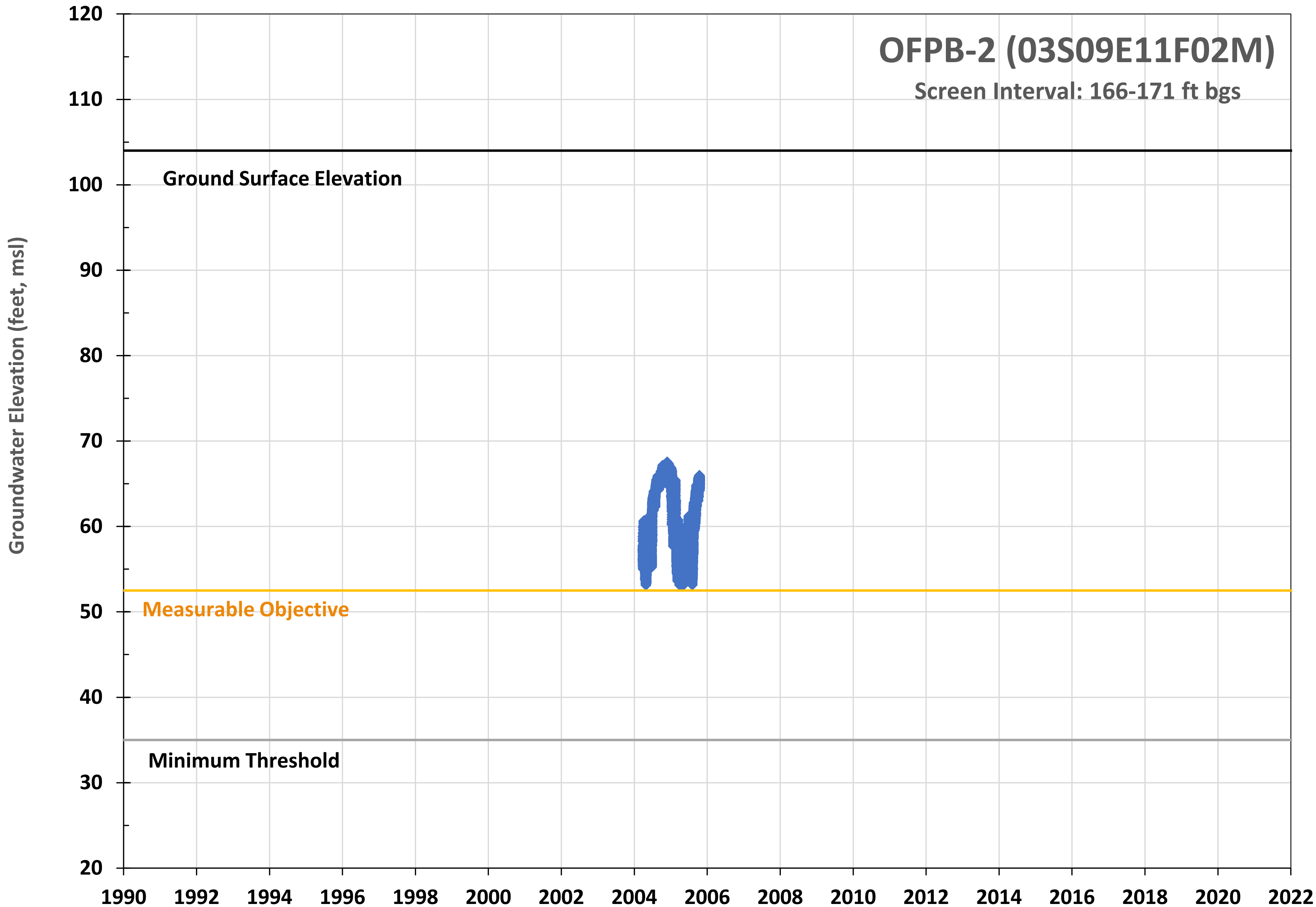

MOD-MWD-1
Screen Interval: 104-124 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

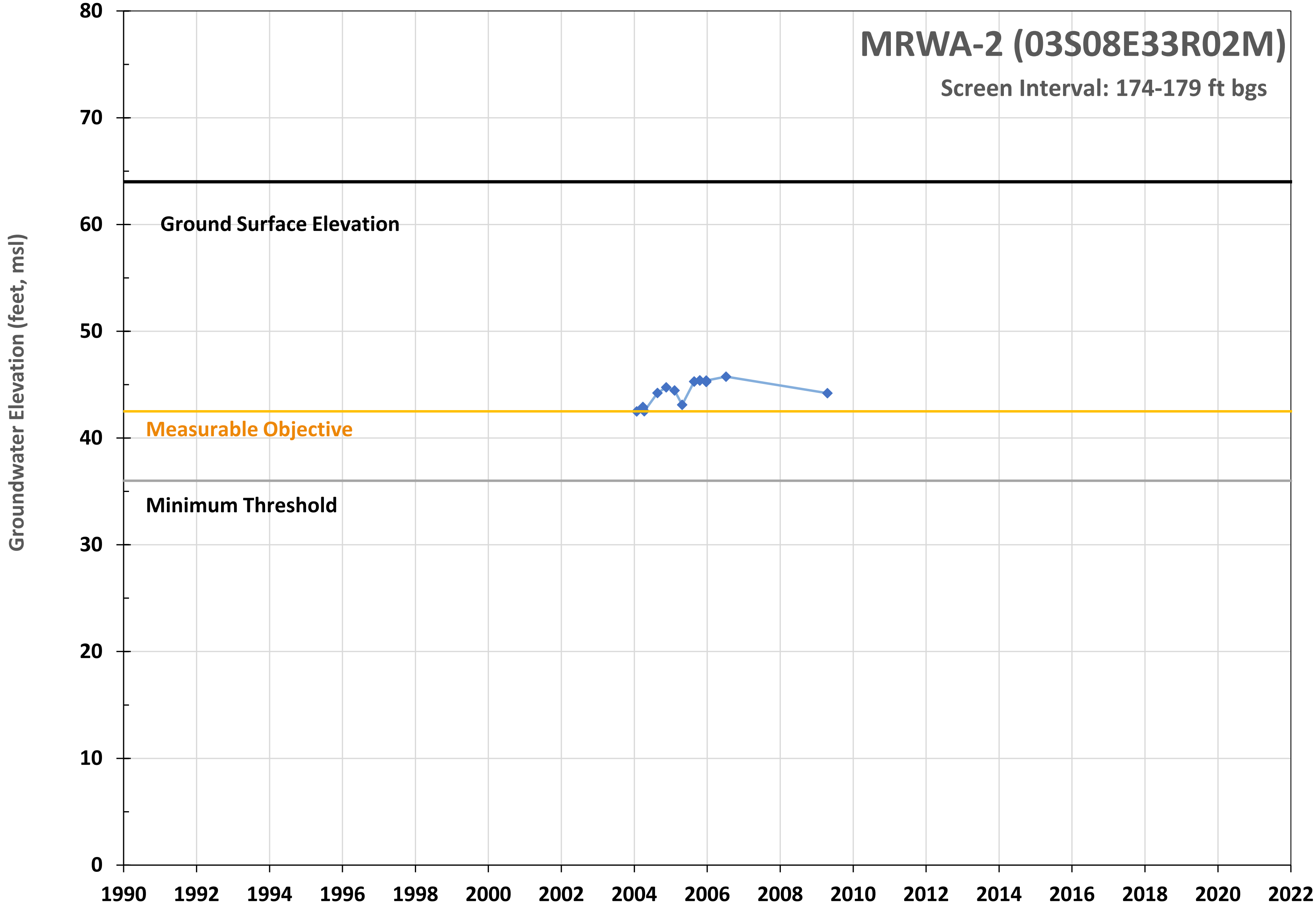


MOD-MWD-3
Screen Interval: 218-238 ft bgs
Groundwater Elevation (feet, msl)
Ground Surface Elevation
Measurable Objective
Minimum Threshold
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

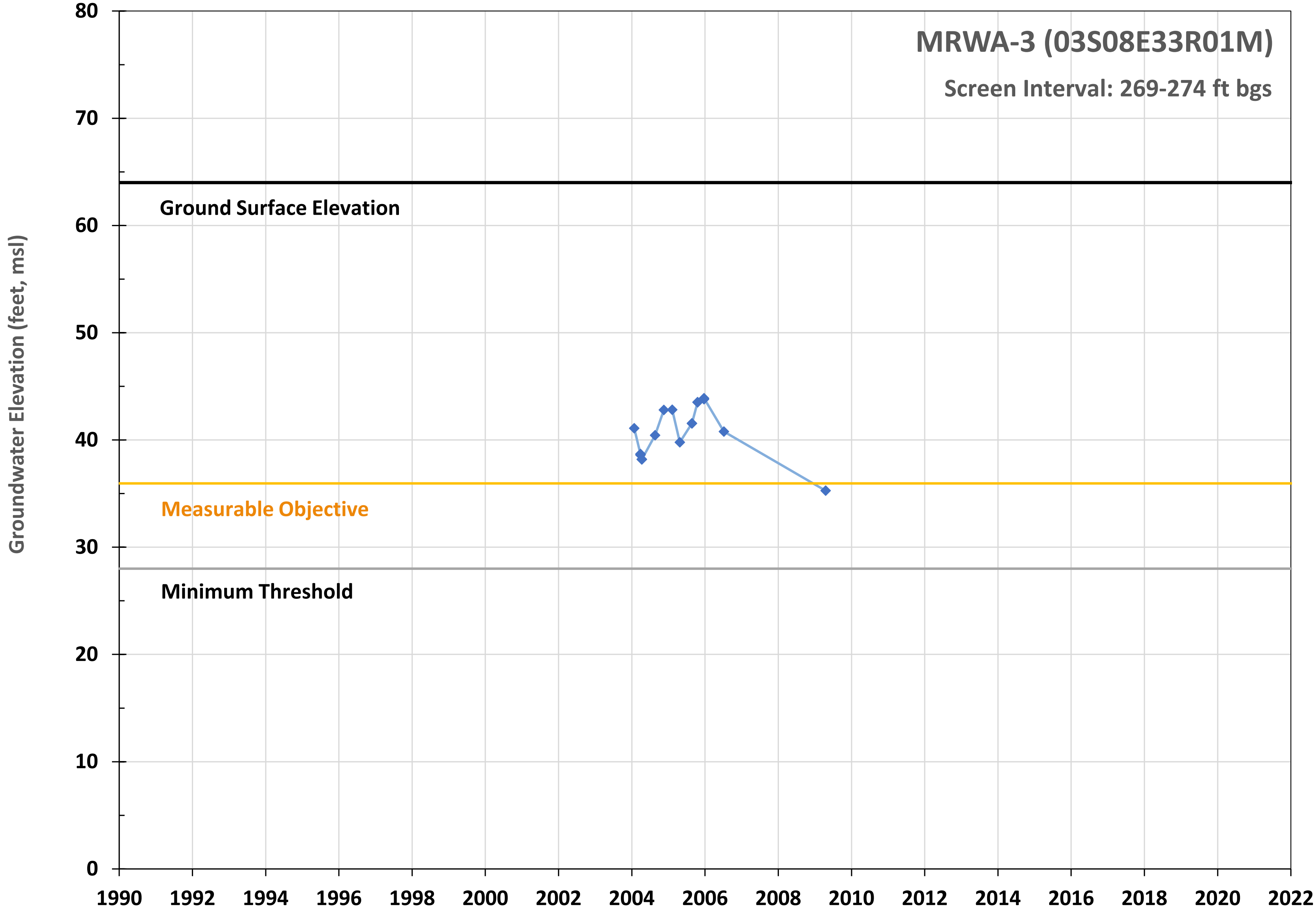


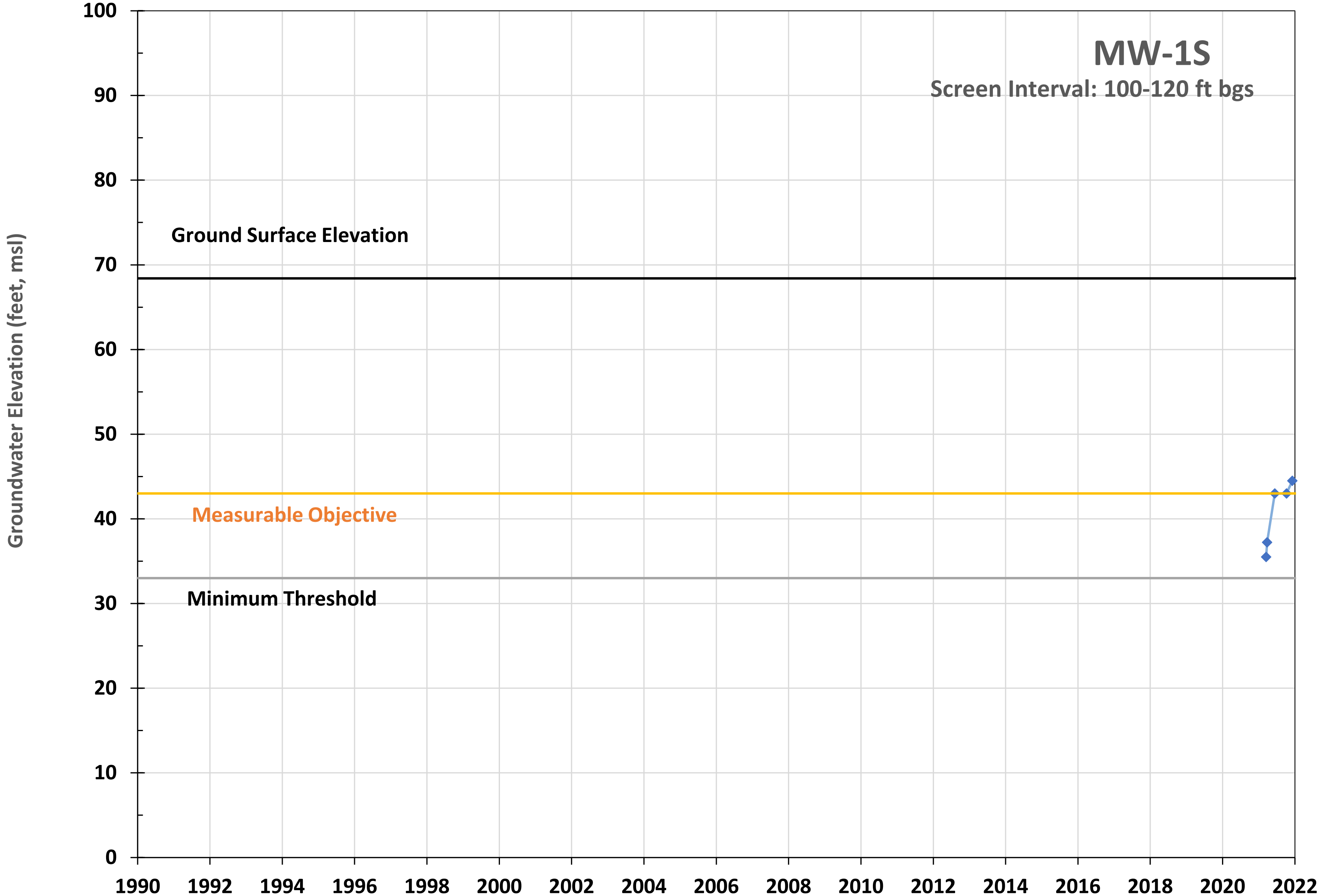
FPA-2 (03S09E08K04M)
Screen Interval: 115-120 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


OFPB-2 (03S09E11F02M)
Screen Interval: 166-171 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, 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

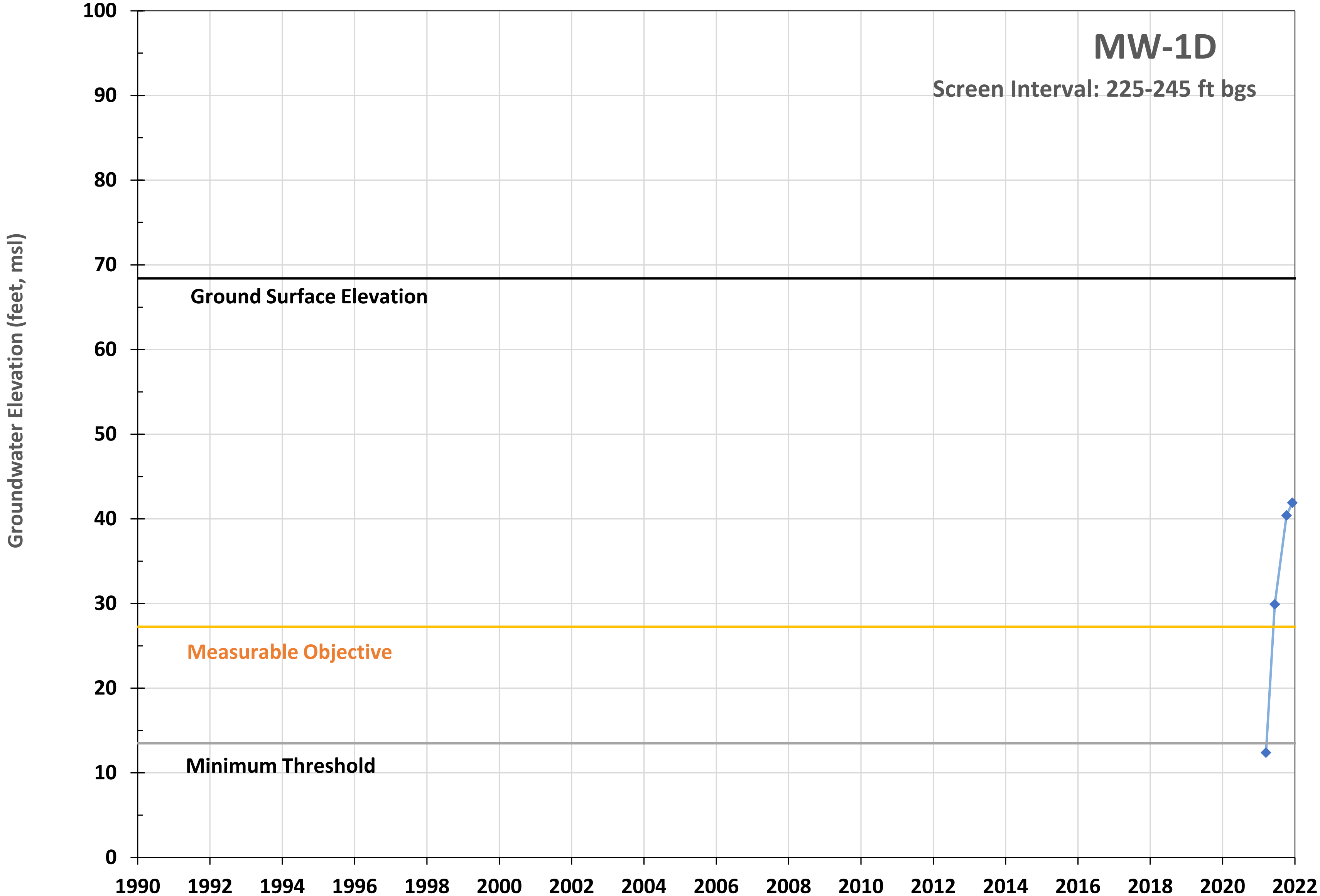


MRWA-2 (03S08E33R02M)
Screen Interval: 174-179 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

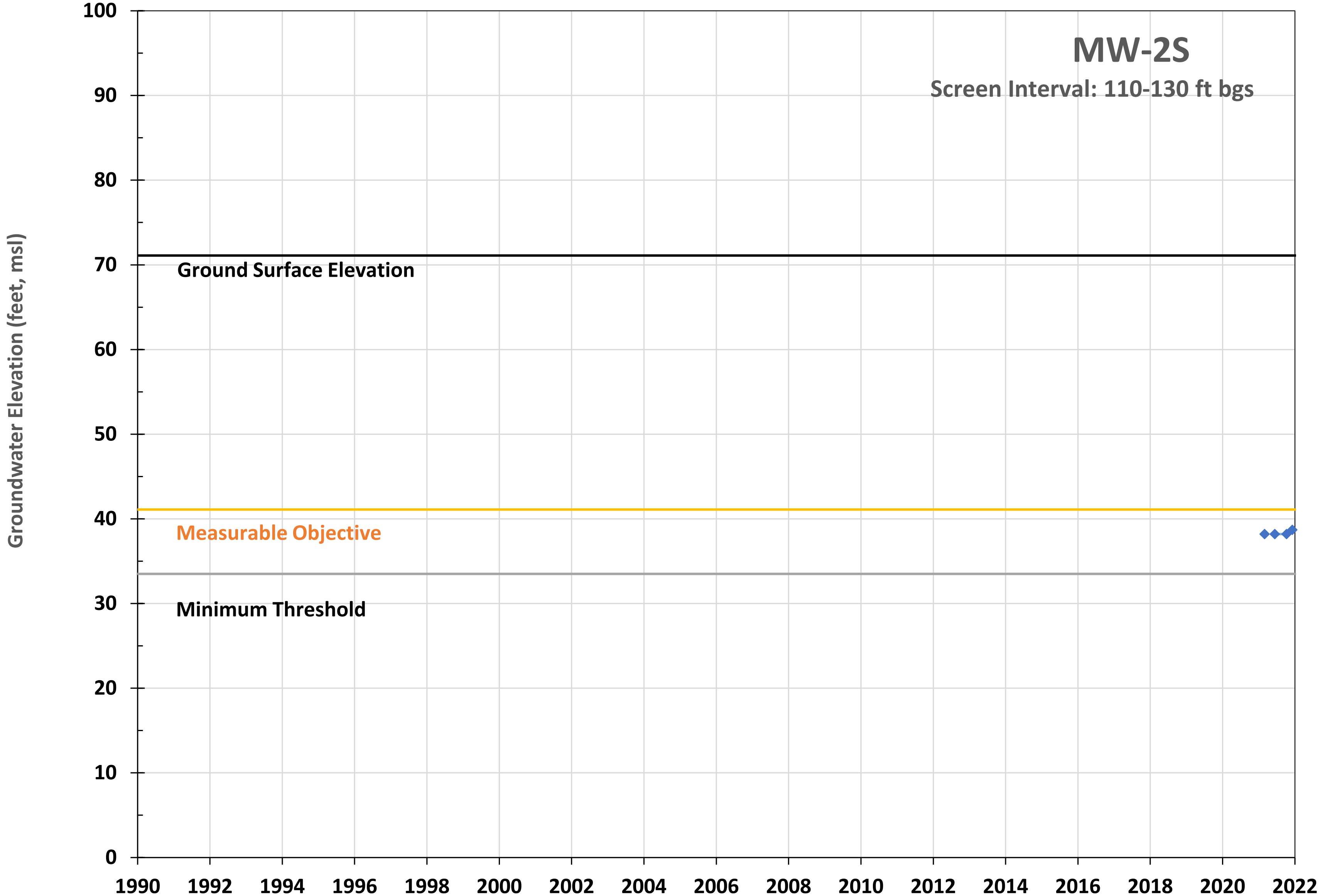

MRWA-3 (03S08E33R01M)
Screen Interval: 269-274 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

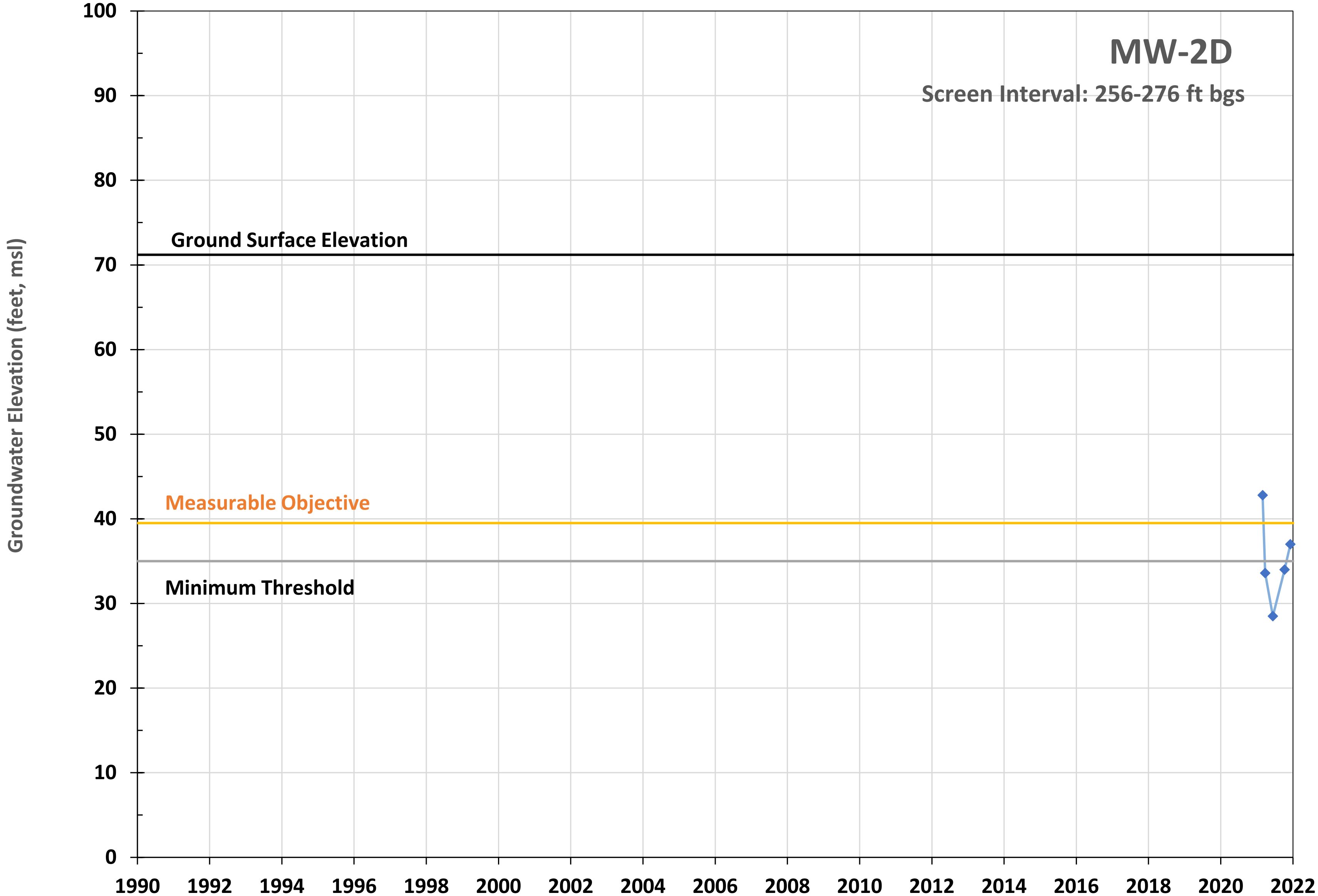


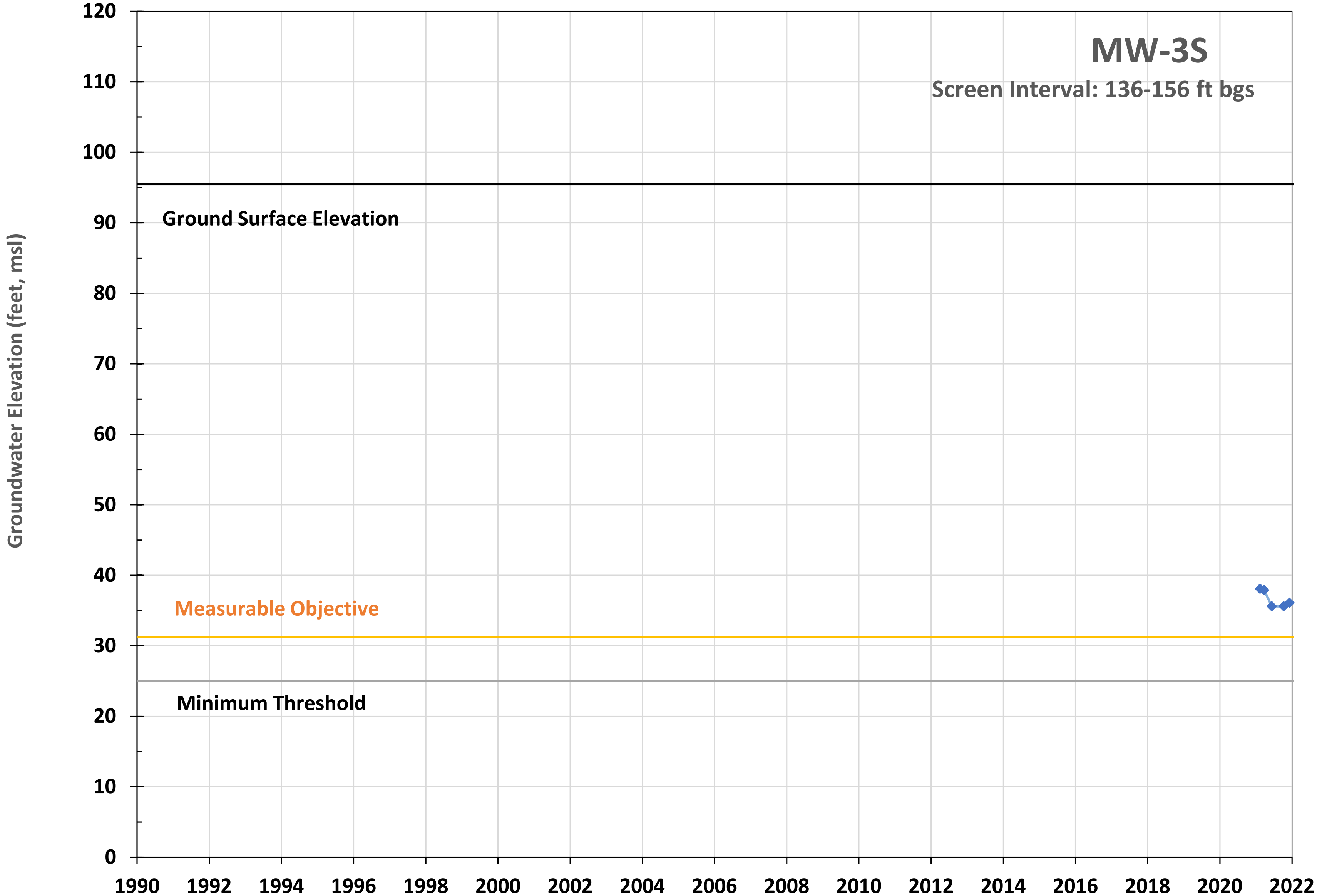
MW-1S
Screen Interval: 100-120 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



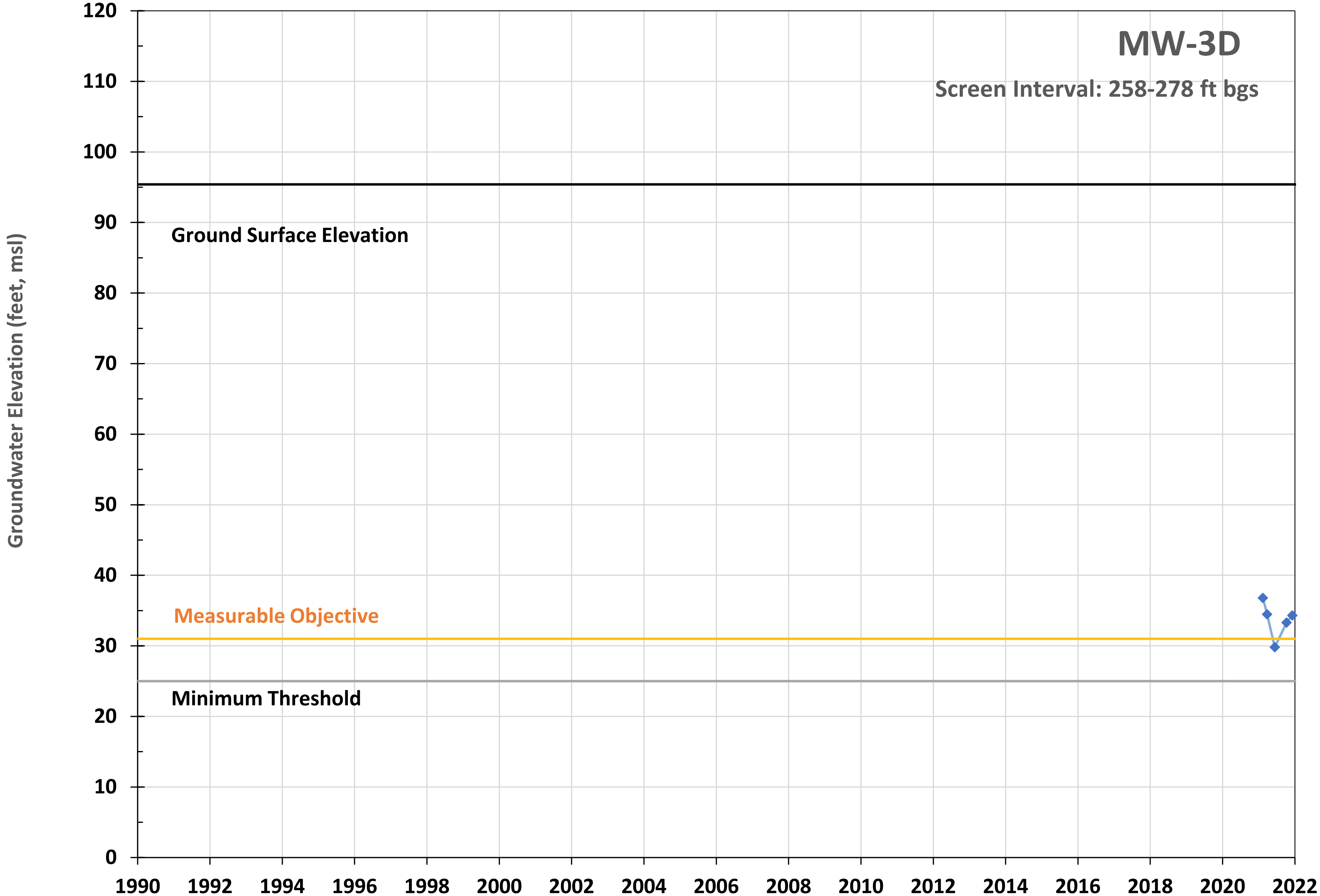
MW-1D
Screen Interval: 225-245 ft bgs
Groundwater Elevation (feet, msl)
Ground Surface Elevation
Measurable Objective
Minimum Threshold
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


MW-2S
Screen Interval: 110-130 ft bgs
Groundwater Elevation (feet, msl)
Ground Surface Elevation
Measurable Objective
Minimum Threshold
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

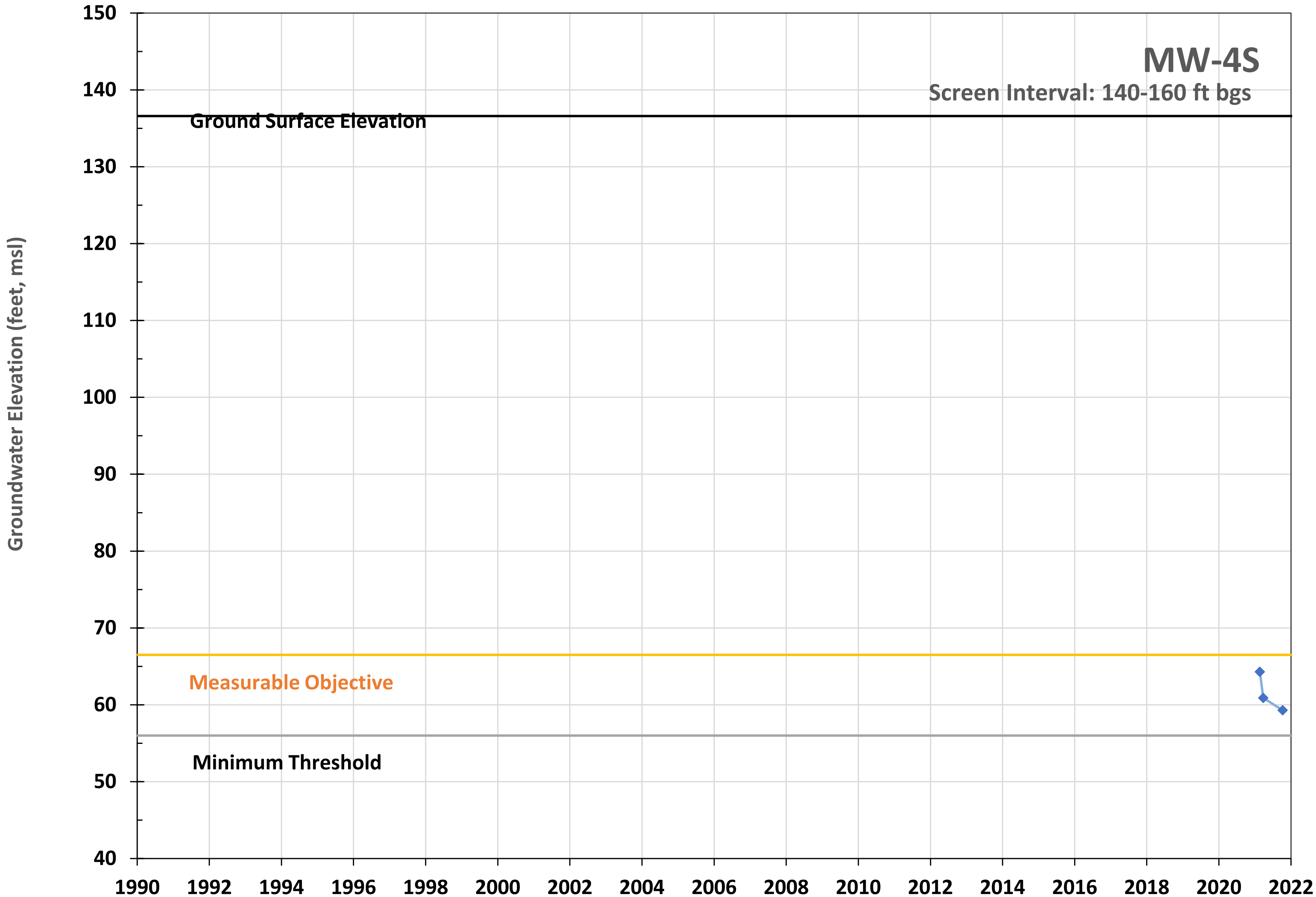

MW-2D
Screen Interval: 256-276 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

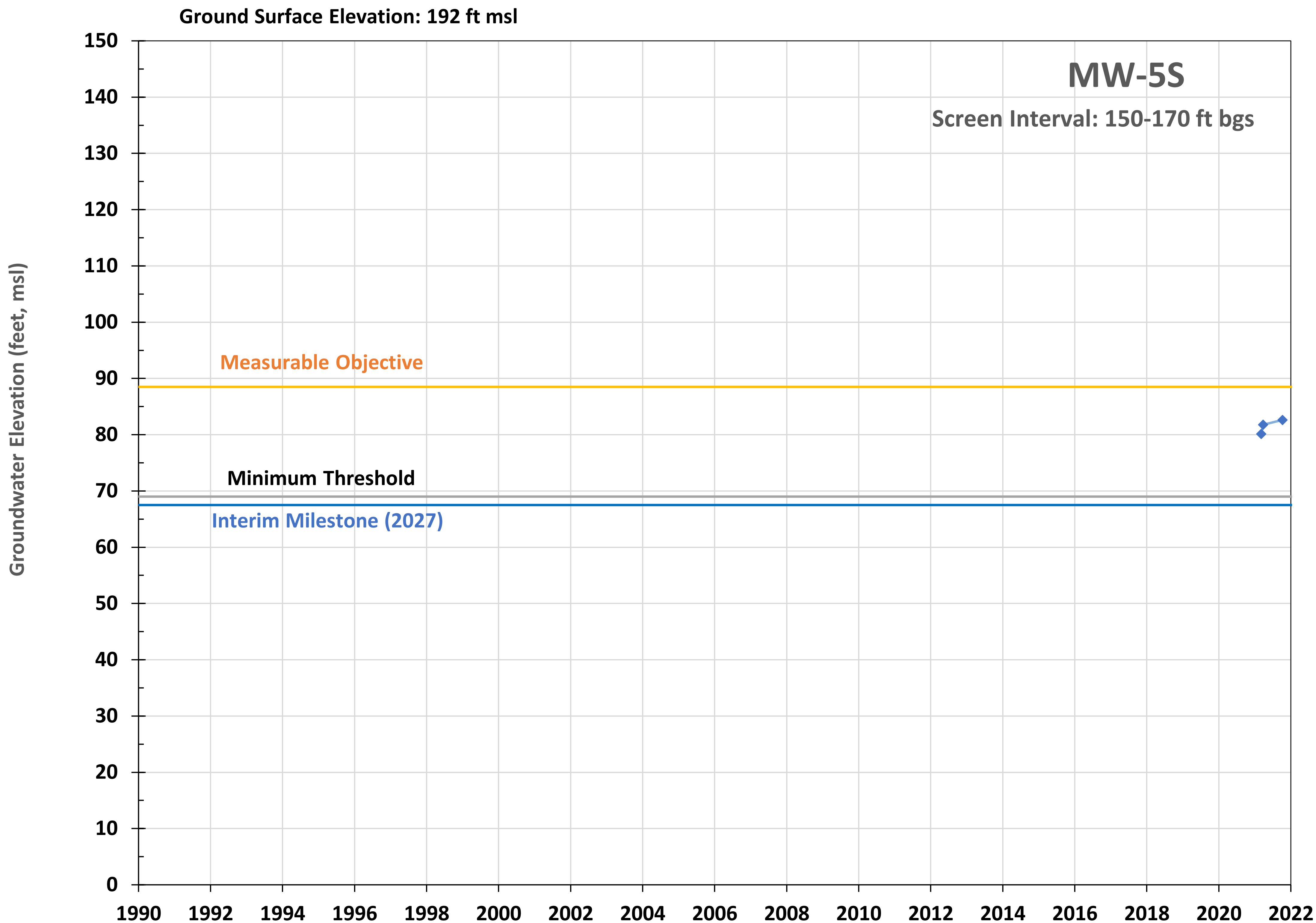


MW-3S
Screen Interval: 136-156 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

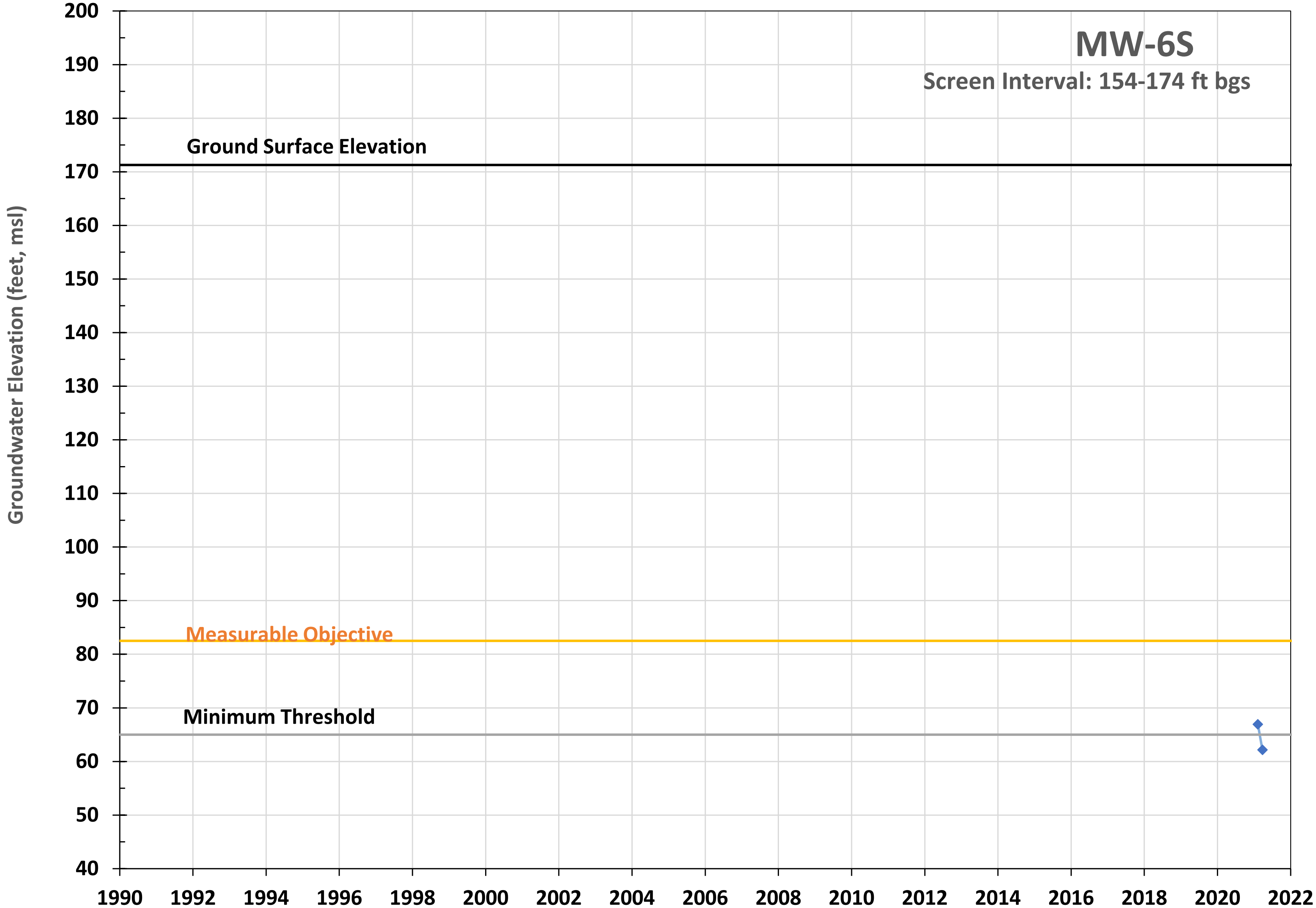


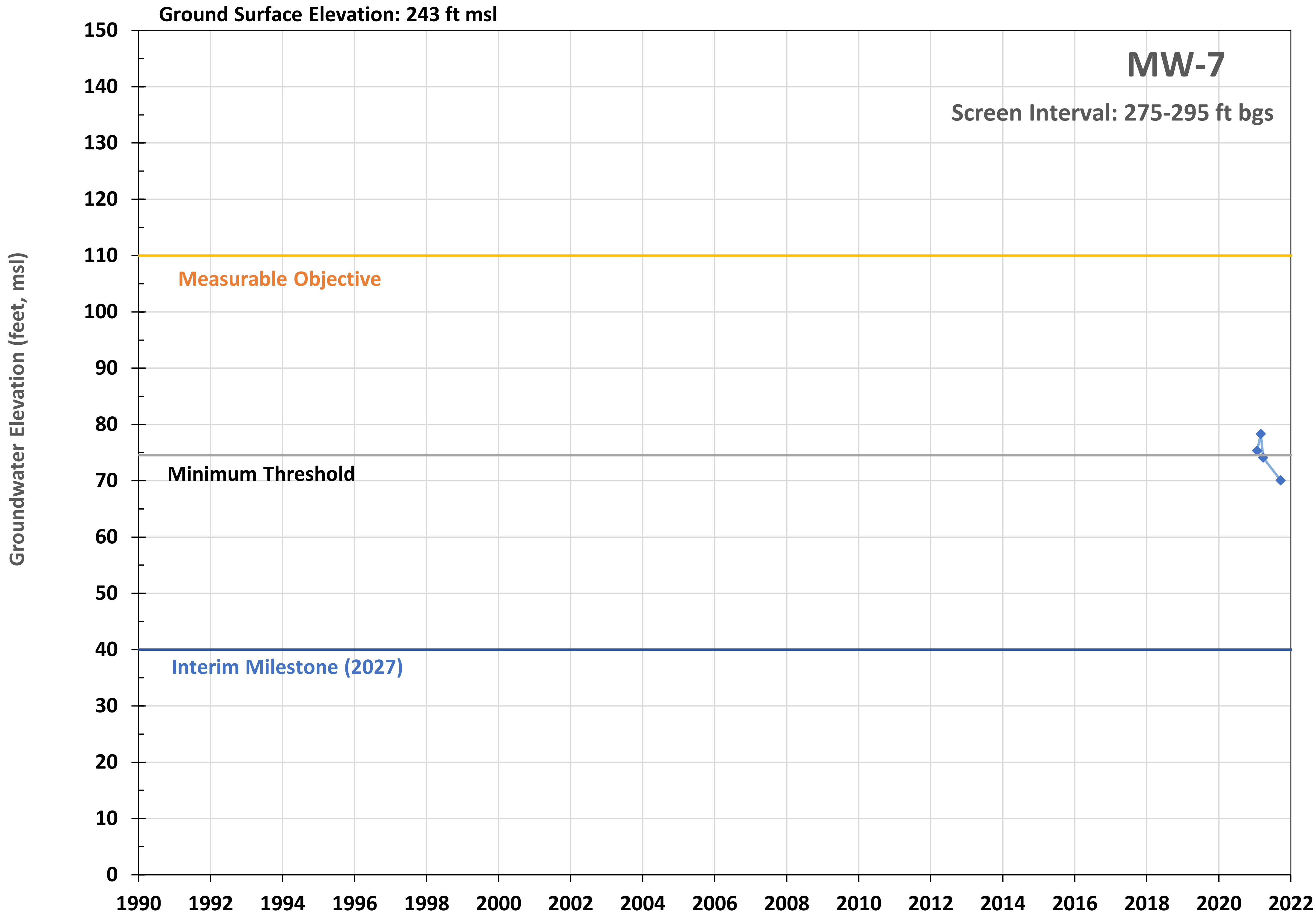
MW-3D
Screen Interval: 258-278 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

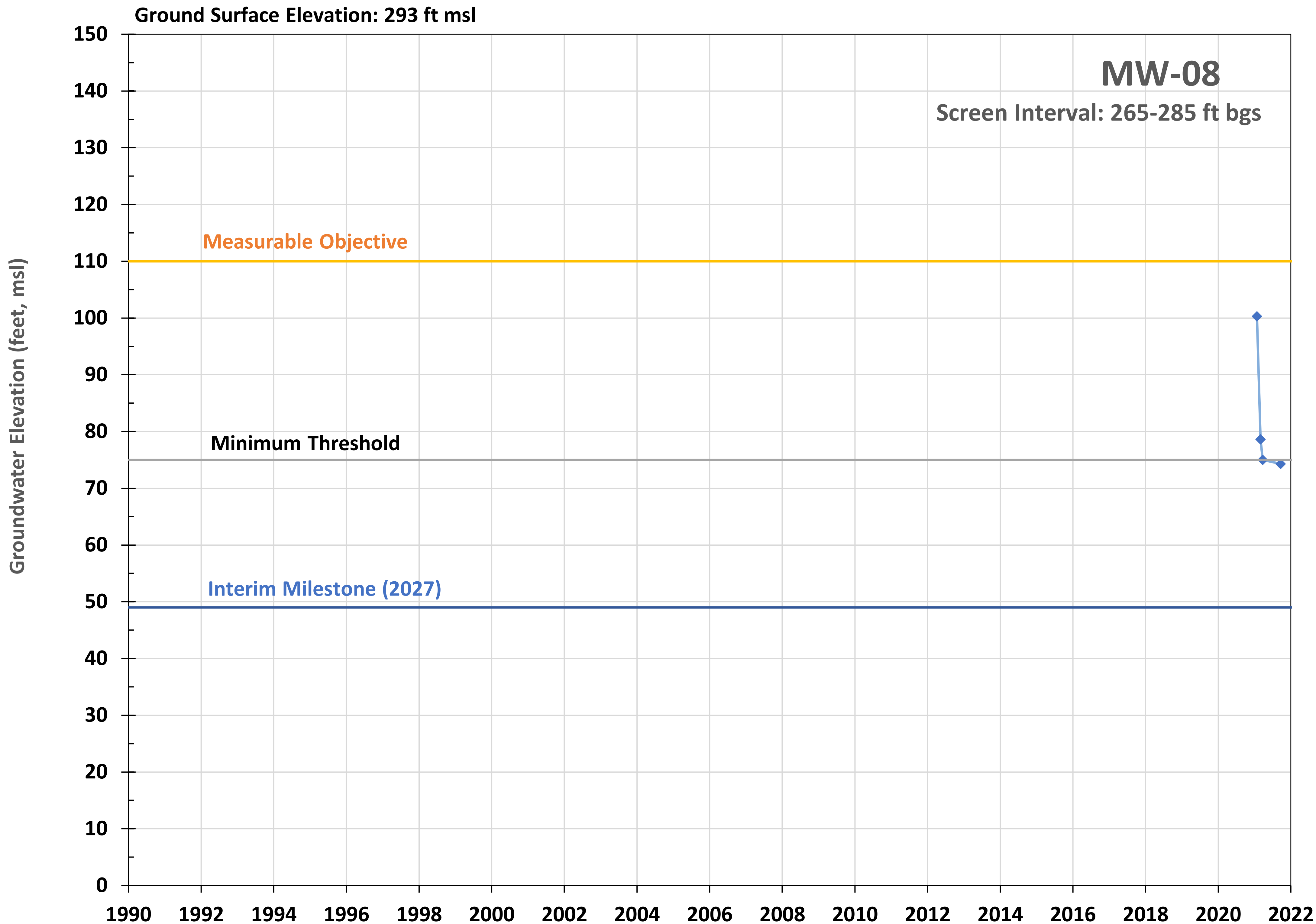

MW-4S
Screen Interval: 140-160 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



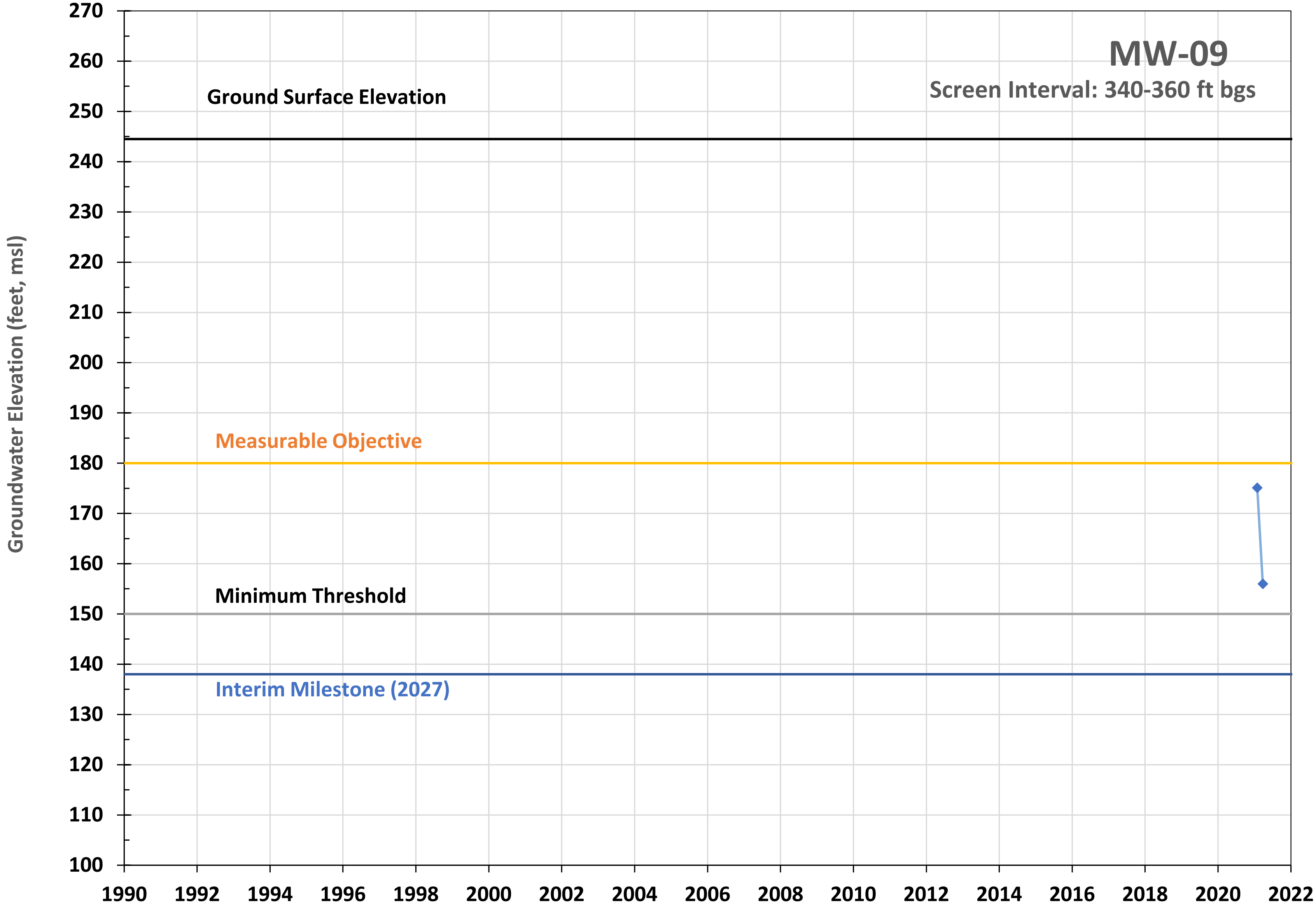
Ground Surface Elevation: 192 ft msl
MW-5S
Screen Interval: 150-170 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

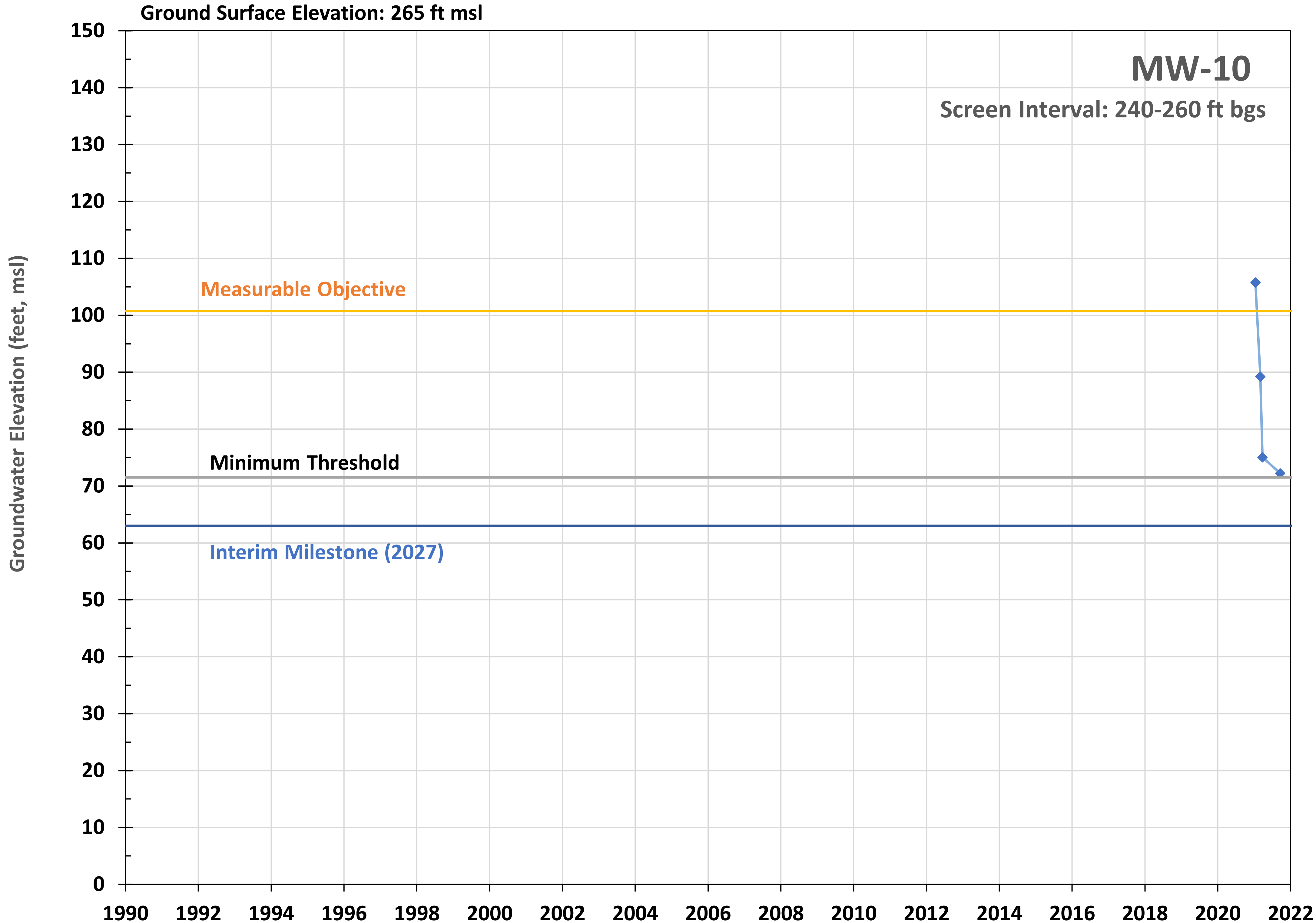

MW-6S
Screen Interval: 154-174 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Ground Surface Elevation: 243 ft msl
MW-7
Screen Interval: 275-295 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
150
140
130
120
110
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

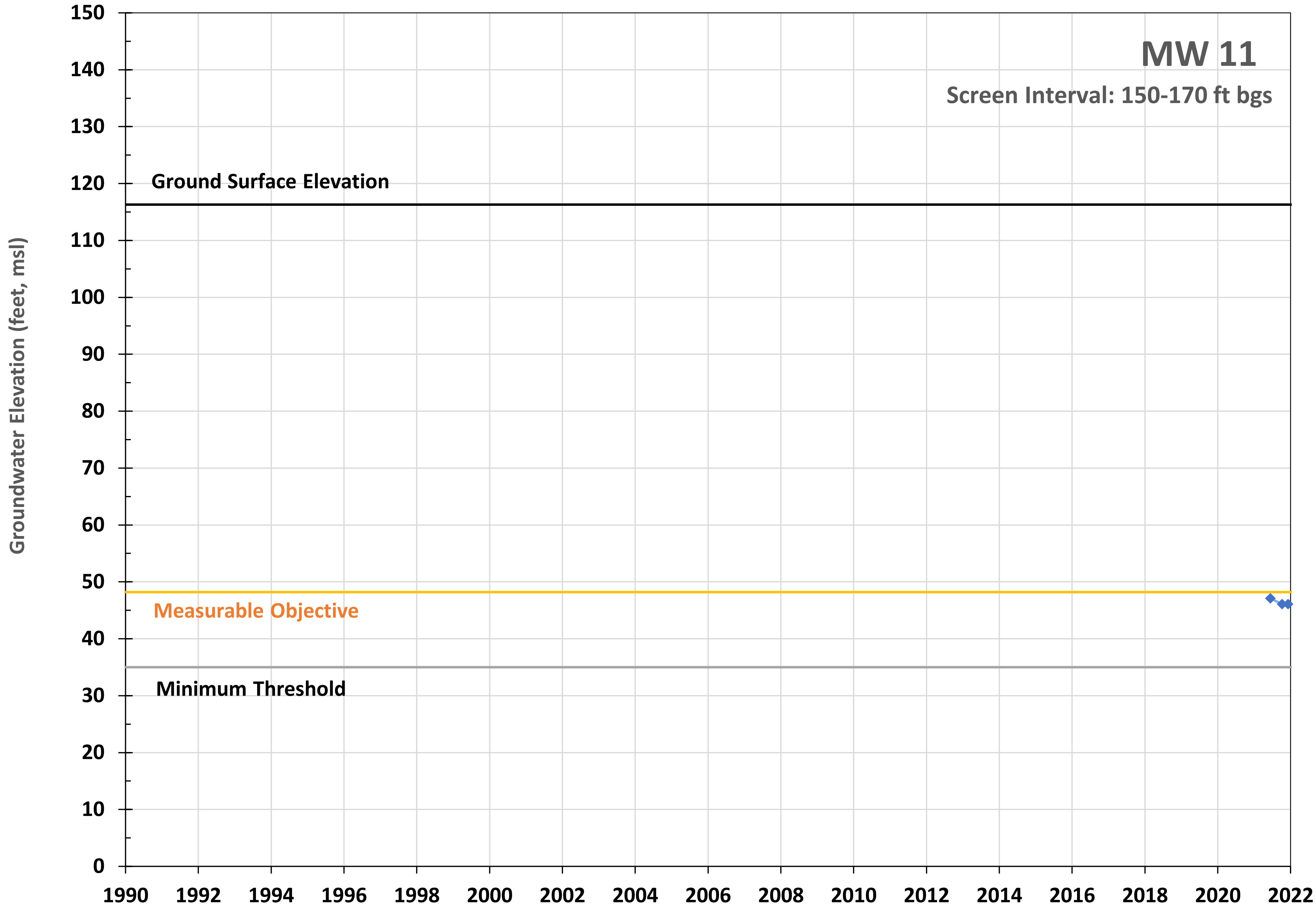


Ground Surface Elevation: 293 ft msl
MW-08
Screen Interval: 265-285 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


MW-09
Screen Interval: 340-360 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

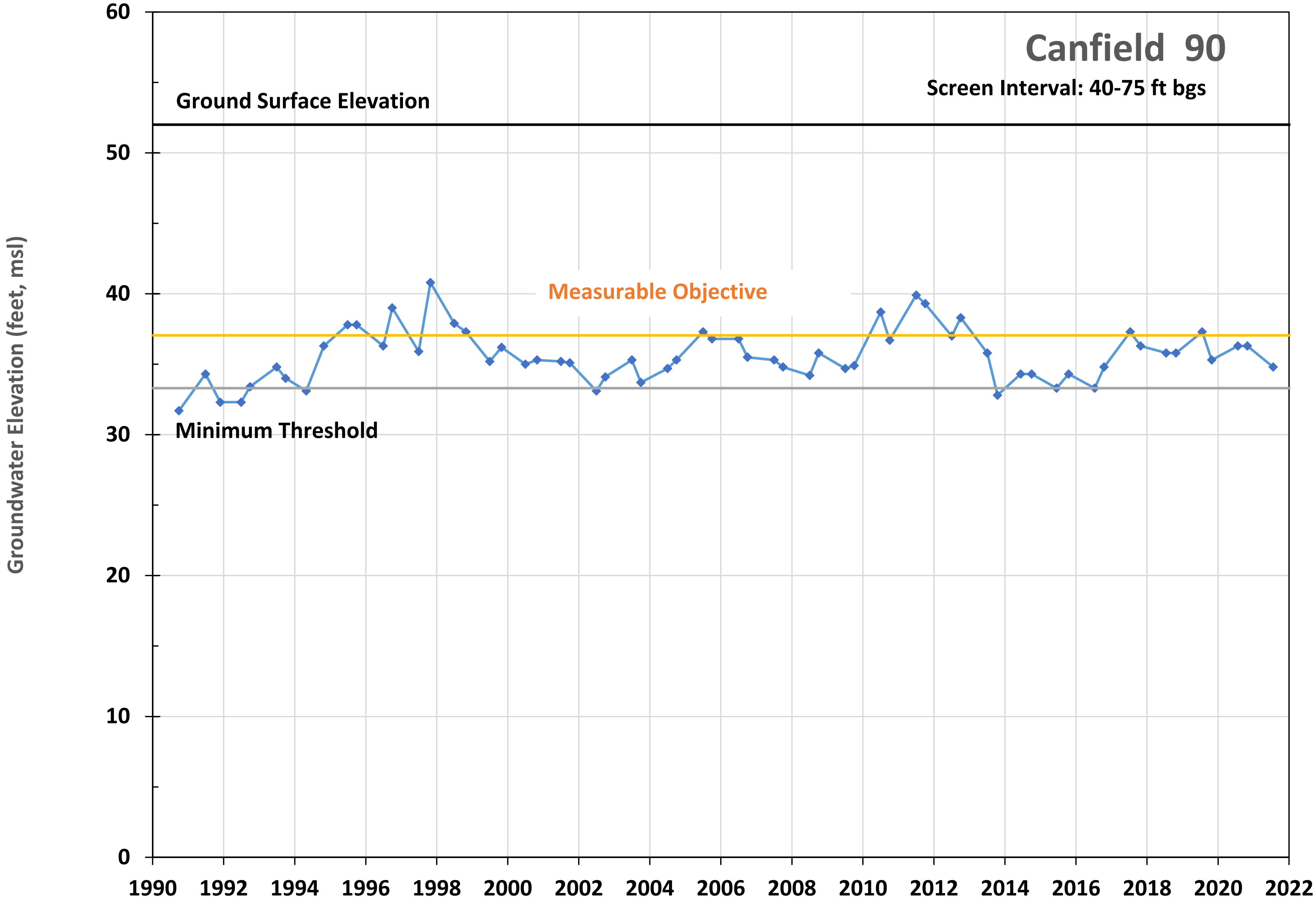


Ground Surface Elevation: 265 ft msl
MW-10
Screen Interval: 240-260 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

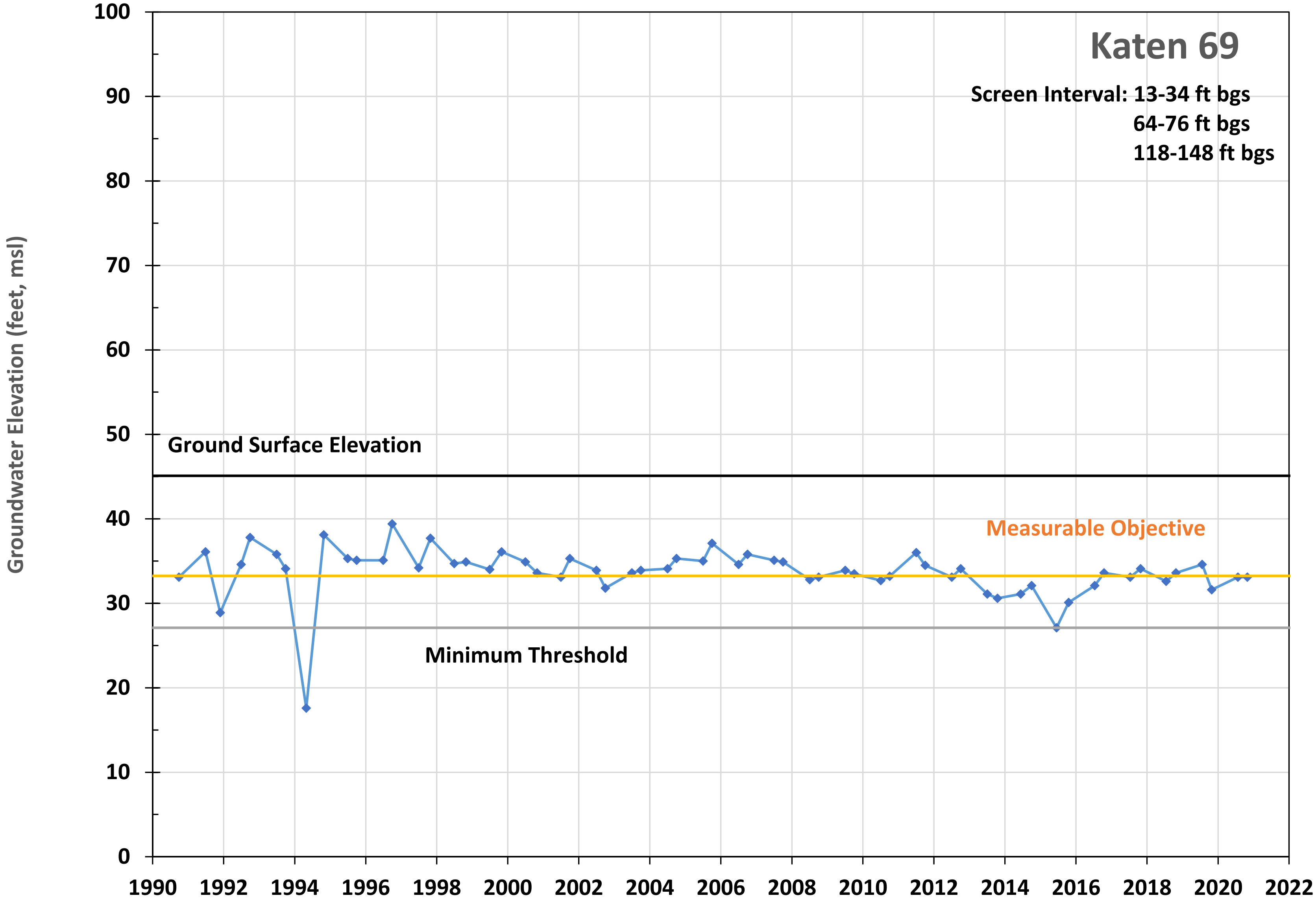


MW 11
Screen Interval: 150-170 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

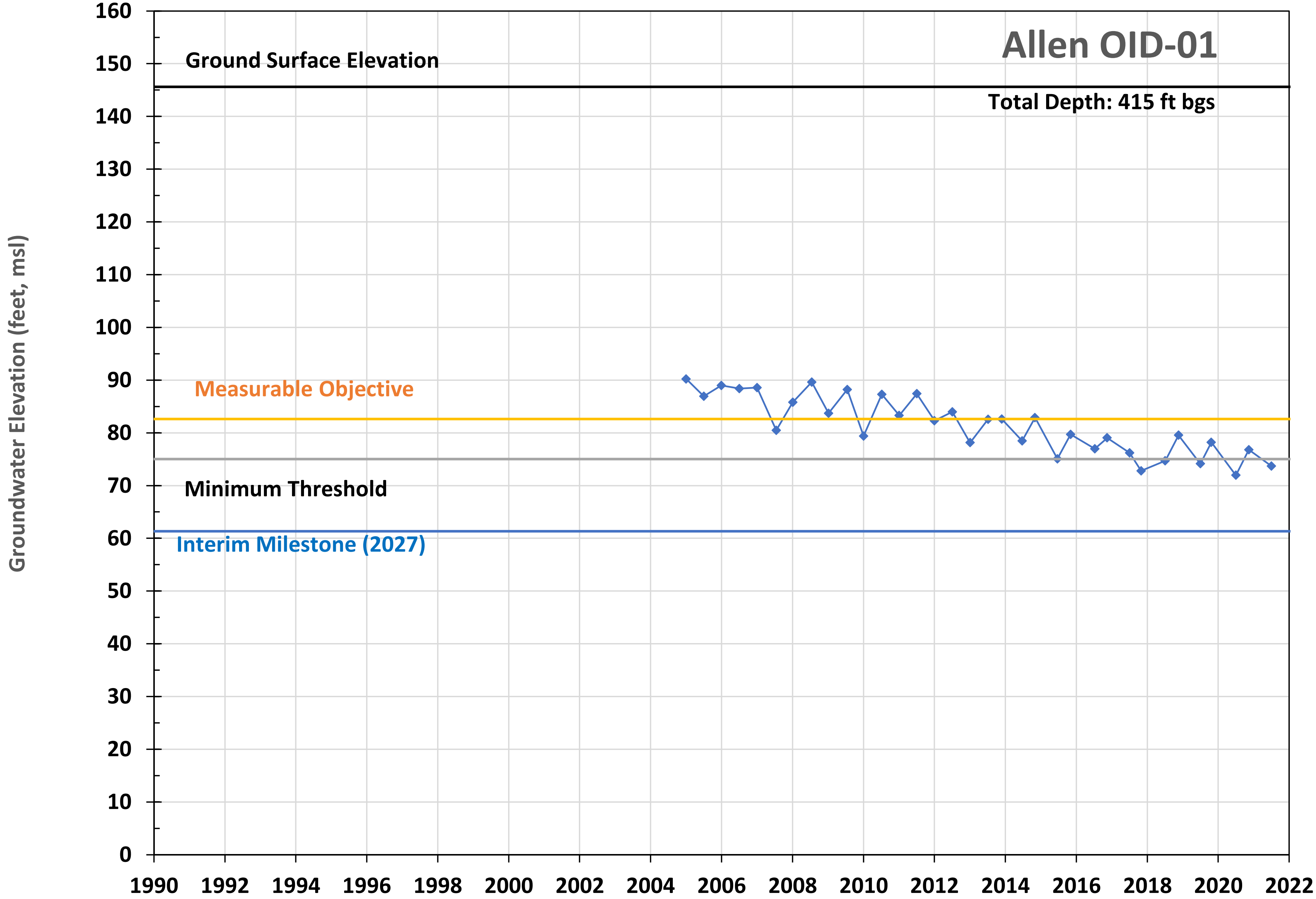
Hydrographs for Wells in the Monitoring Network for Depletions of Interconnected Surface Water



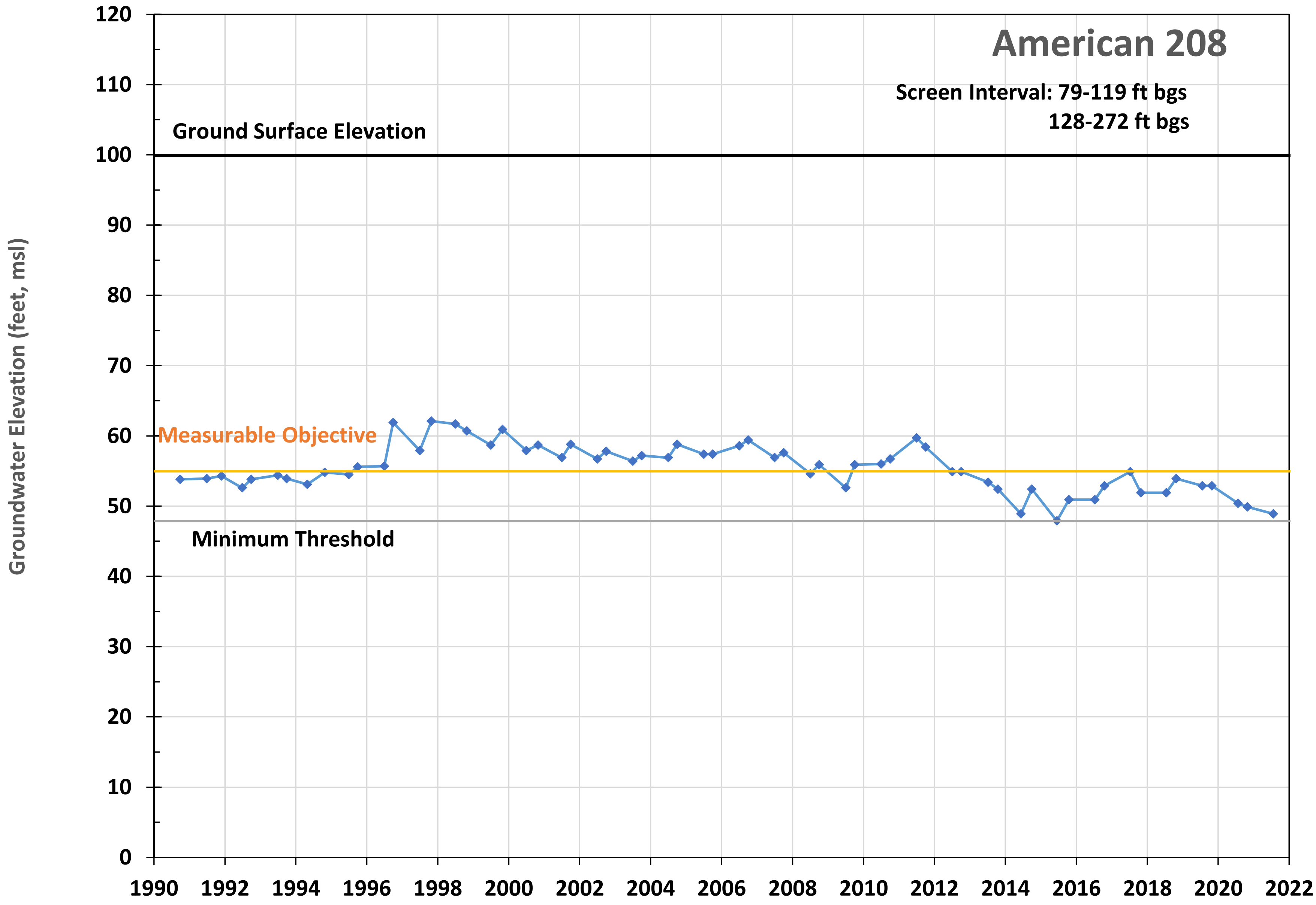
Canfield 90
Screen Interval: 40-75 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



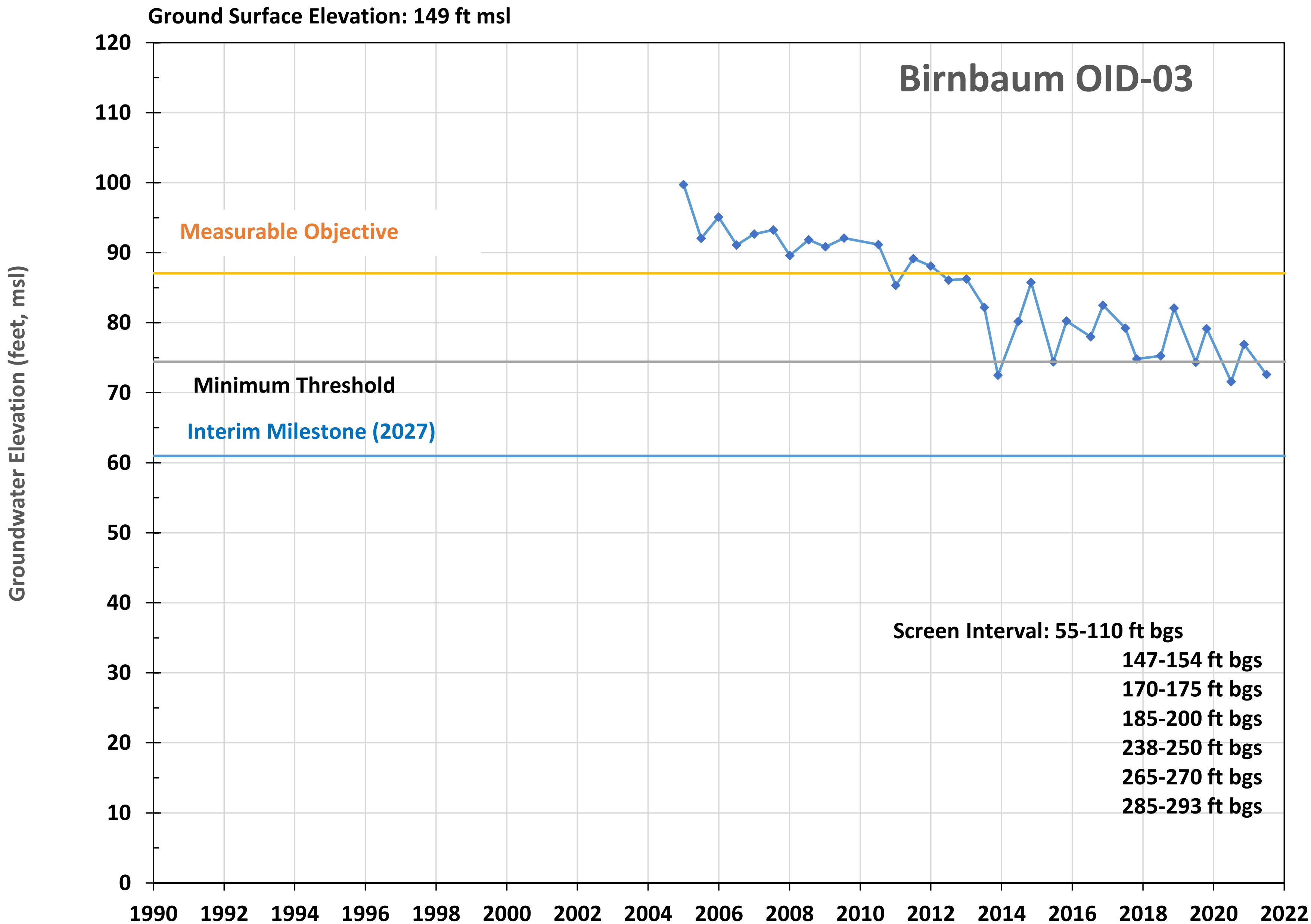
Katen 69
Screen Interval: 13-34 ft bgs
64-76 ft bgs
118-148 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

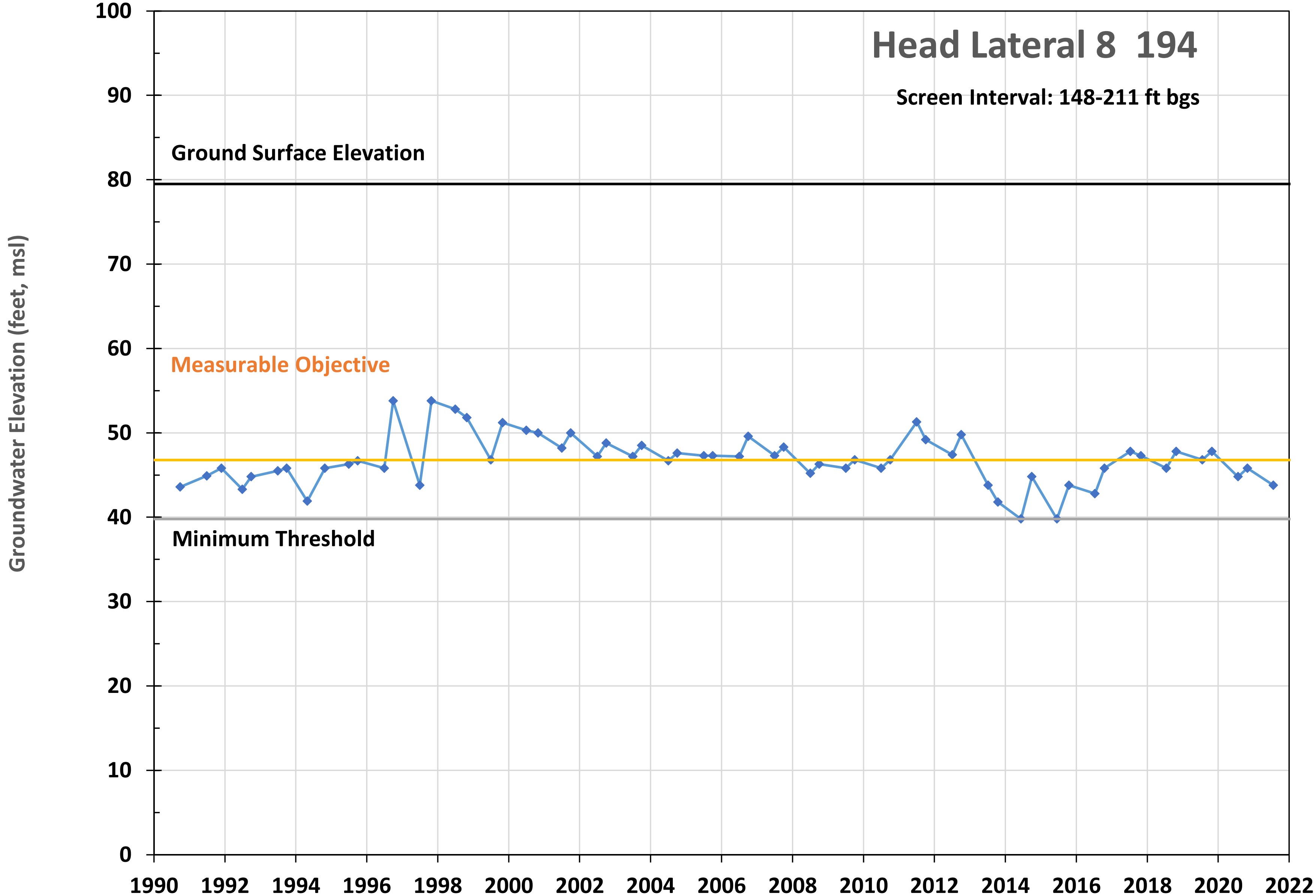


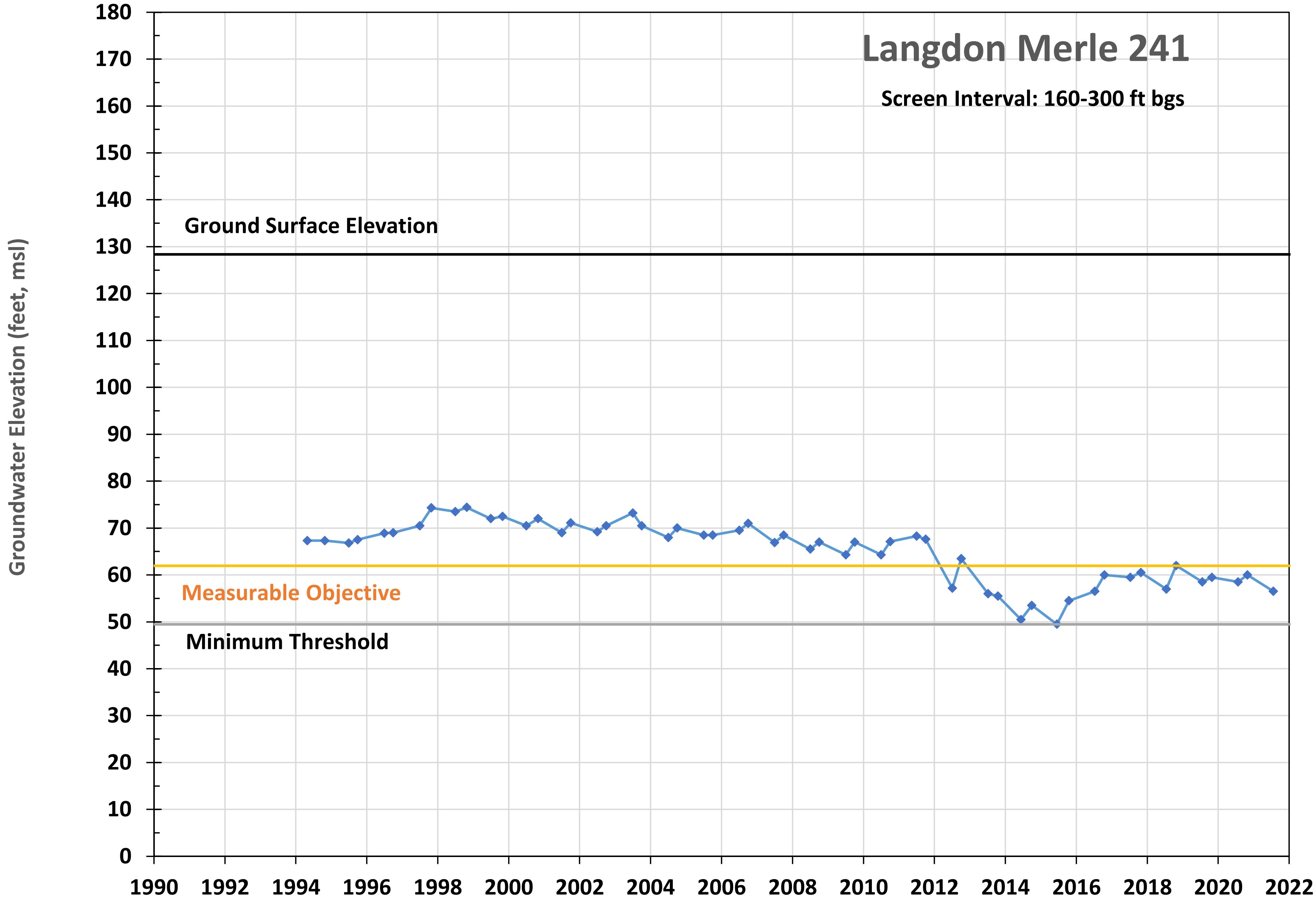
Allen OID-01
Ground Surface Elevation
Total Depth: 415 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



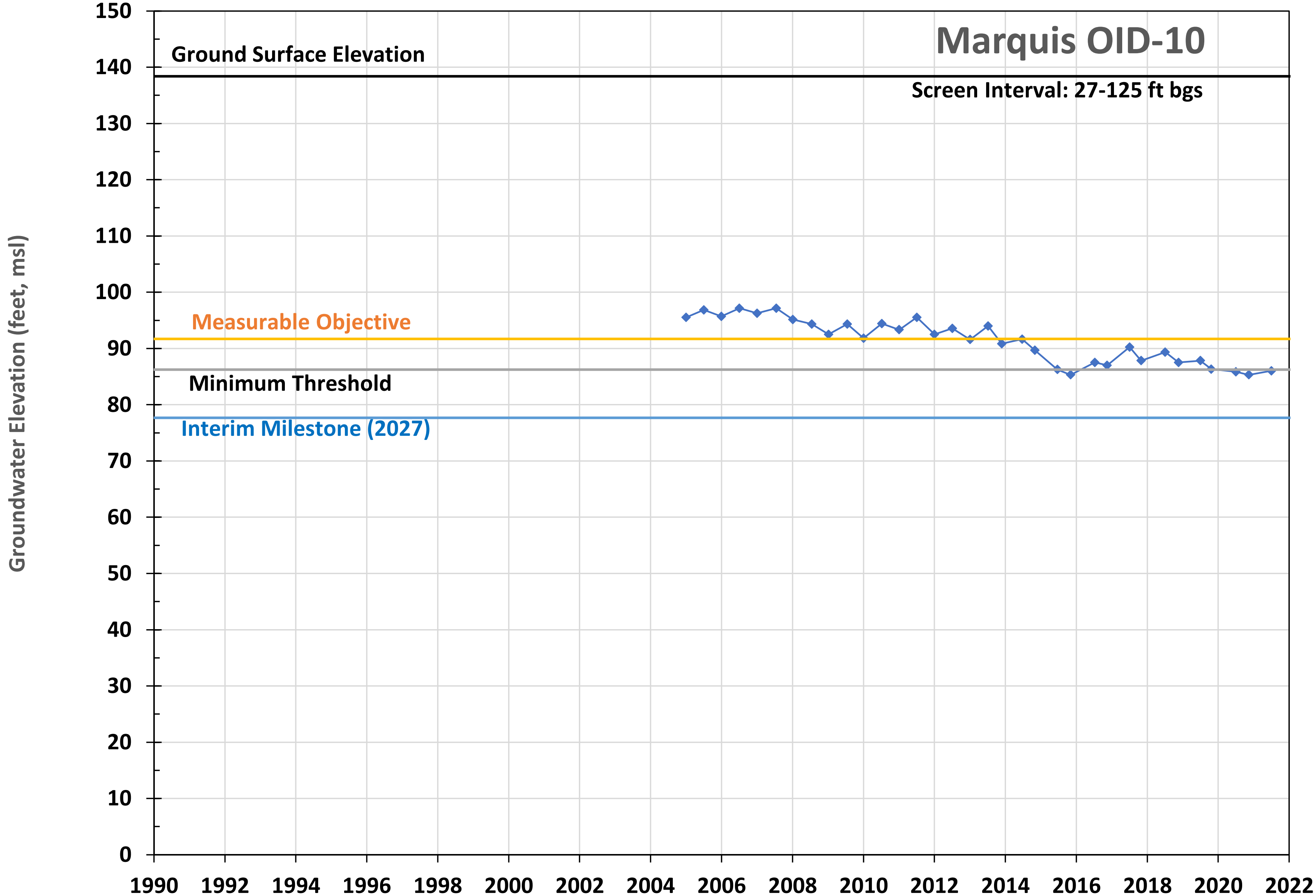
American 208
Screen Interval: 79-119 ft bgs
128-272 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

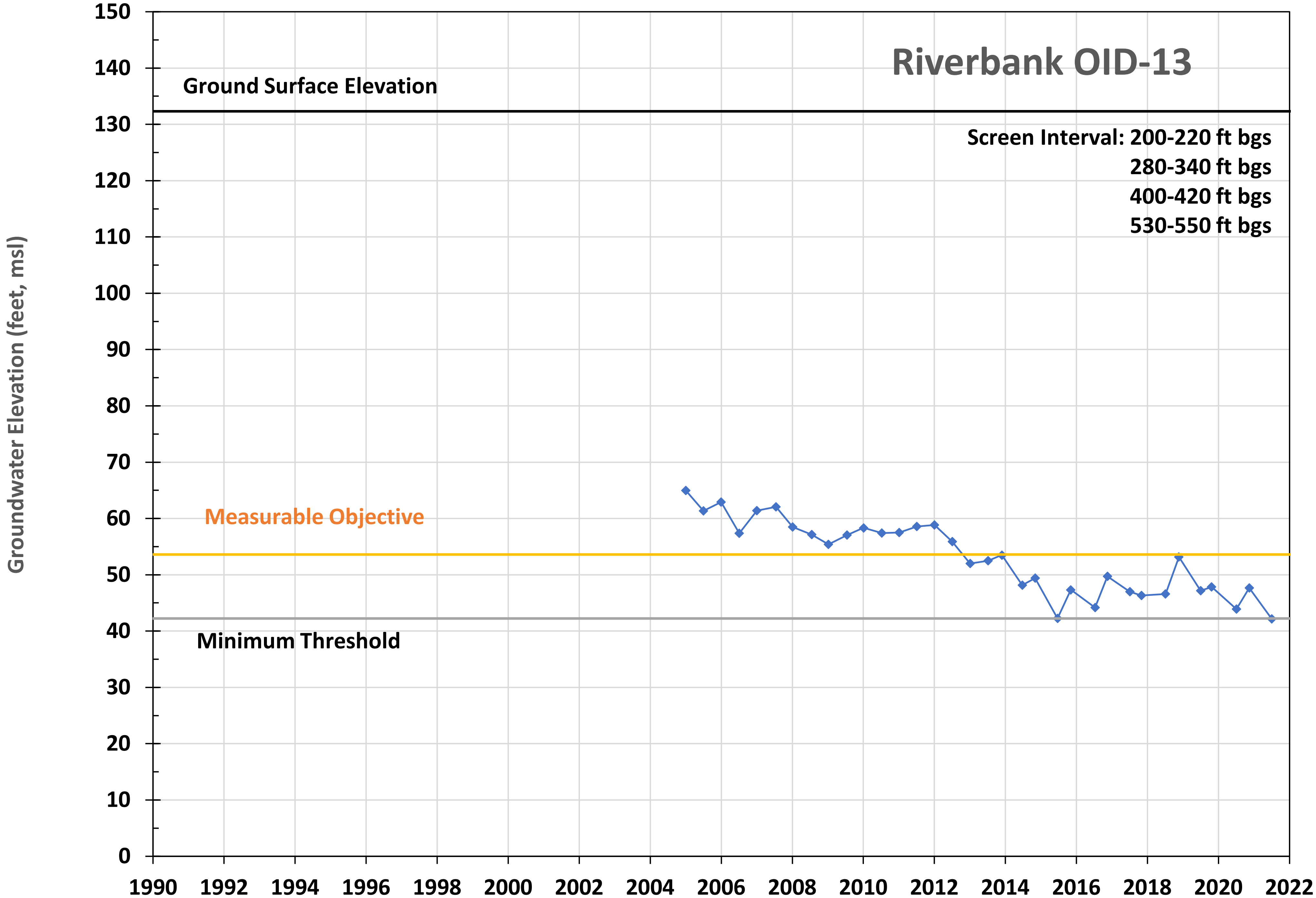

Ground Surface Elevation: 149 ft msl
Birnbaum OID-03
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
Screen Interval: 55-110 ft bgs
147-154 ft bgs
170-175 ft bgs
185-200 ft bgs
238-250 ft bgs
265-270 ft bgs
285-293 ft bgs
0
10
20
30
40
50
60
70
80
90
100
110
120
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


Head Lateral 8 194
Screen Interval: 148-211 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, 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

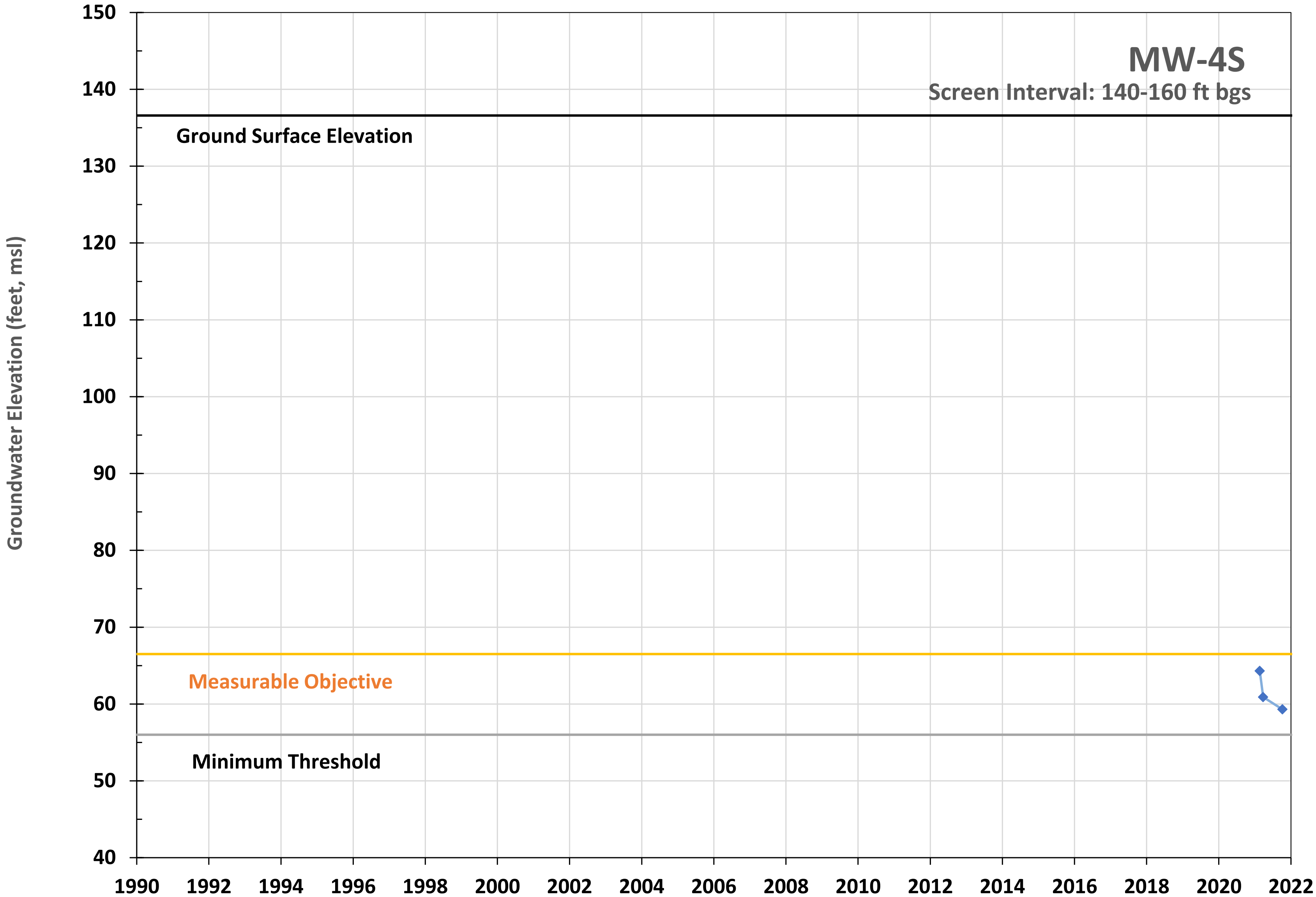


Langdon Merle 241
Screen Interval: 160-300 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

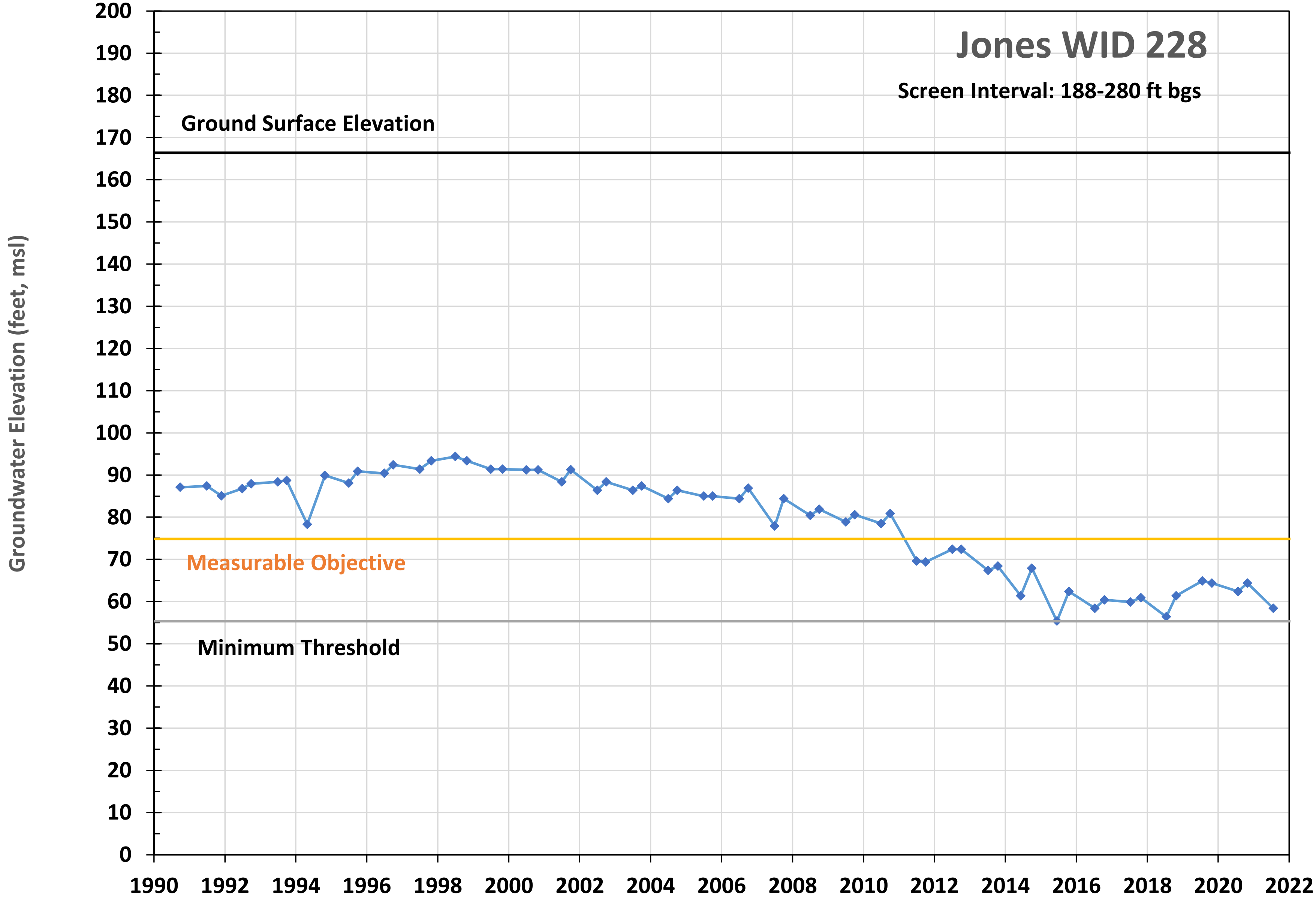

Marquis OID-10
Ground Surface Elevation
Screen Interval: 27-125 ft bgs
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



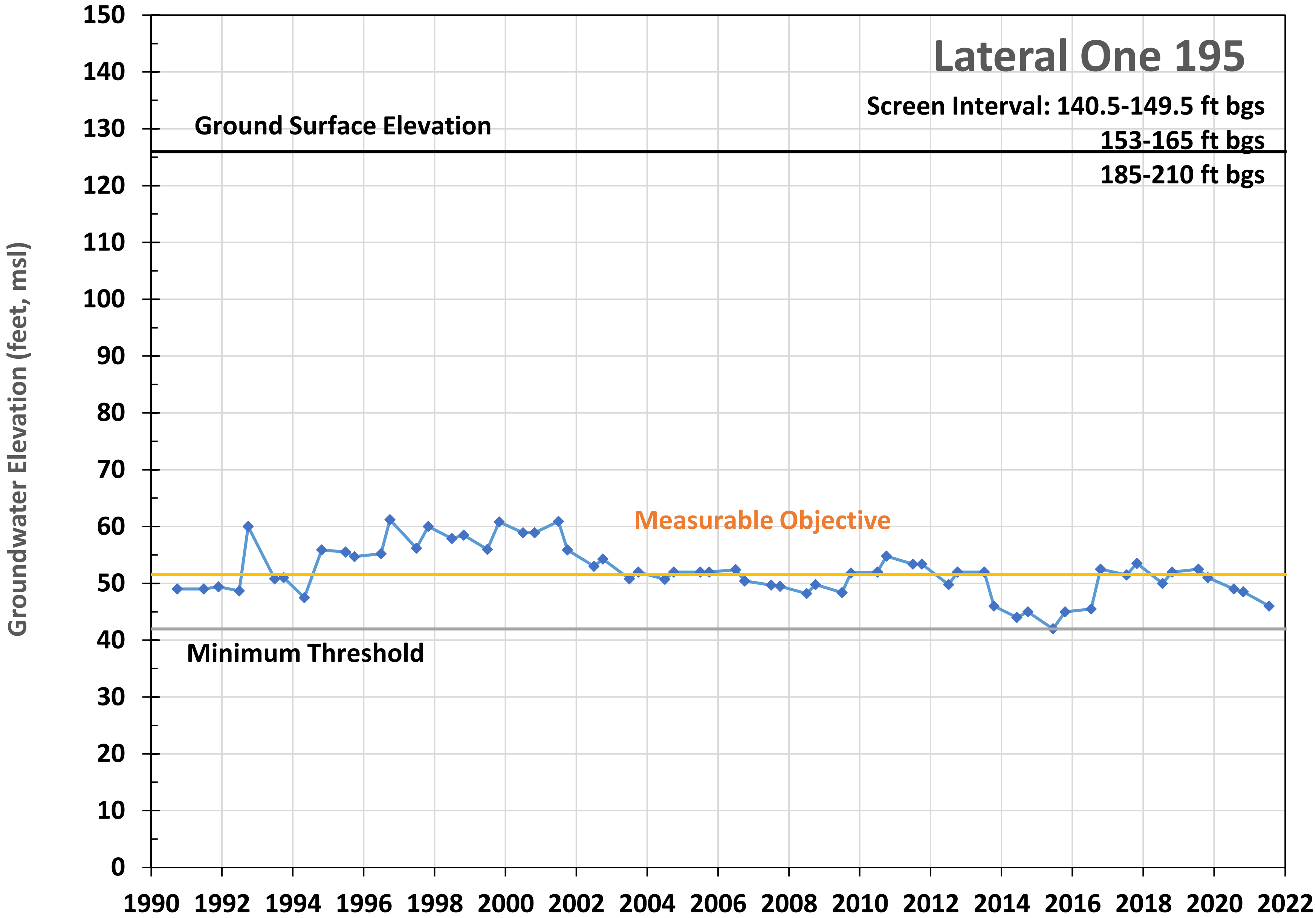
Riverbank OID-13
Ground Surface Elevation
Screen Interval: 200-220 ft bgs
280-340 ft bgs
400-420 ft bgs
530-550 ft bgs
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



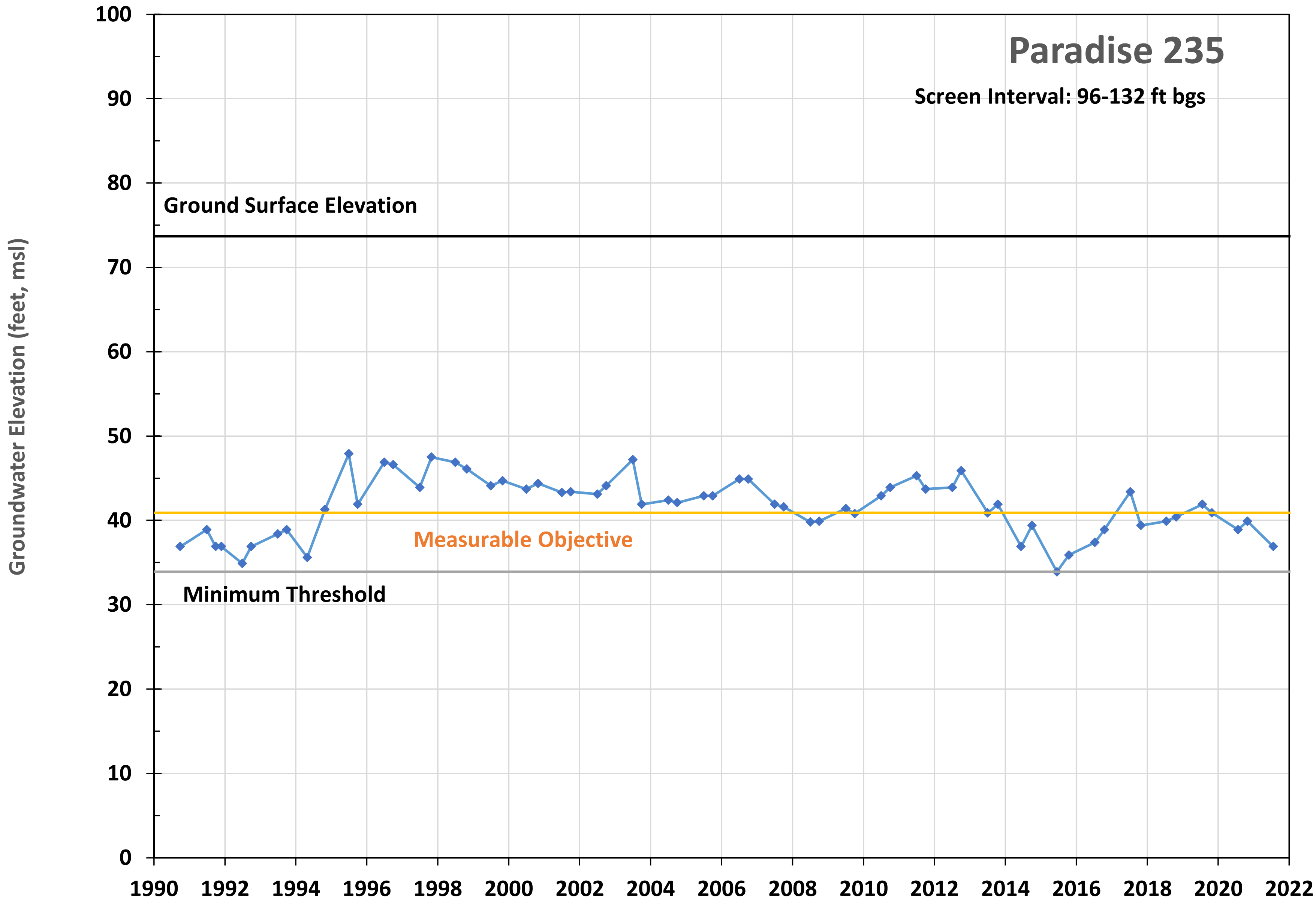
MW-4S
Screen Interval: 140-160 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
150
140
130
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

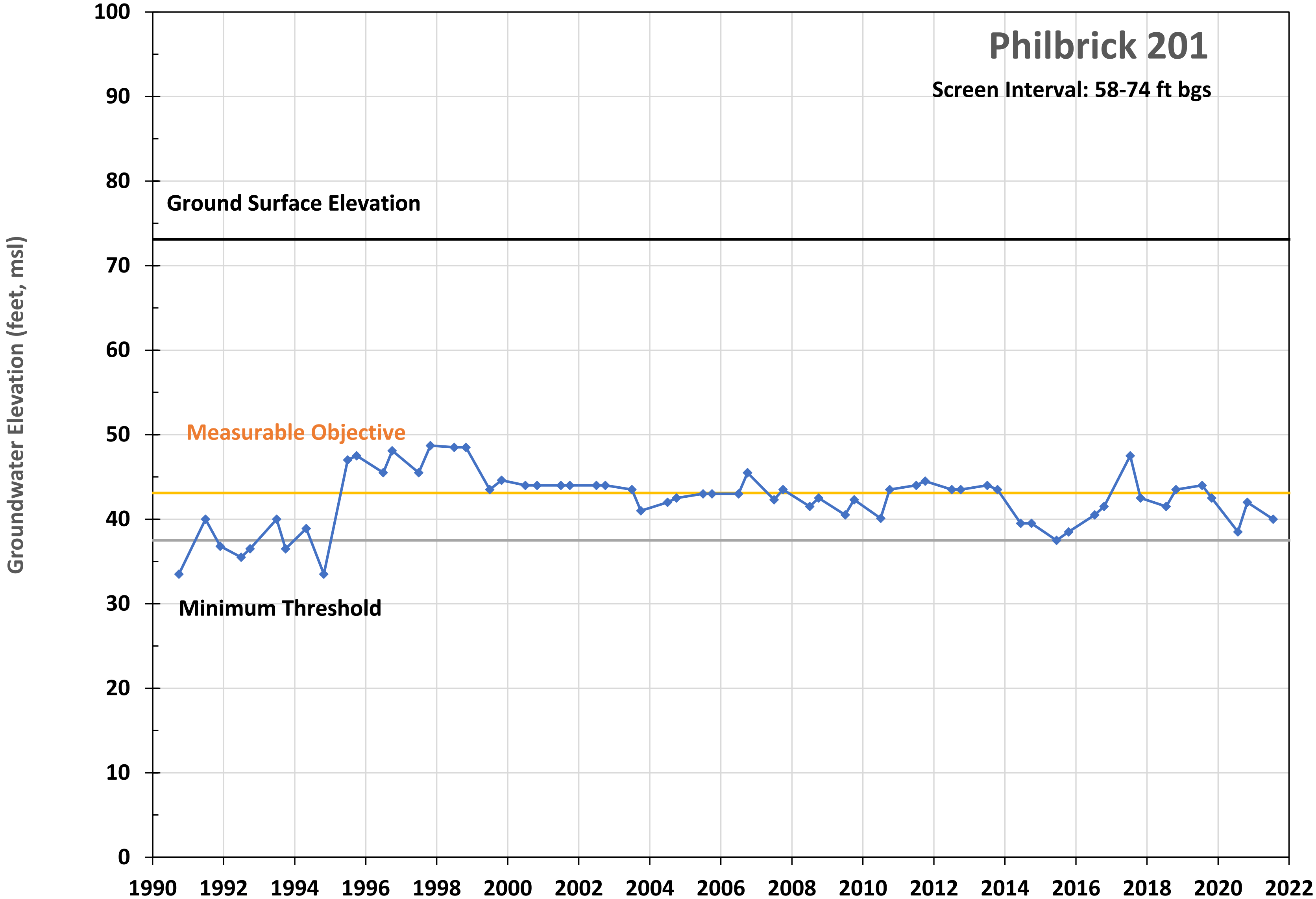


Jones WID 228
Screen Interval: 188-280 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

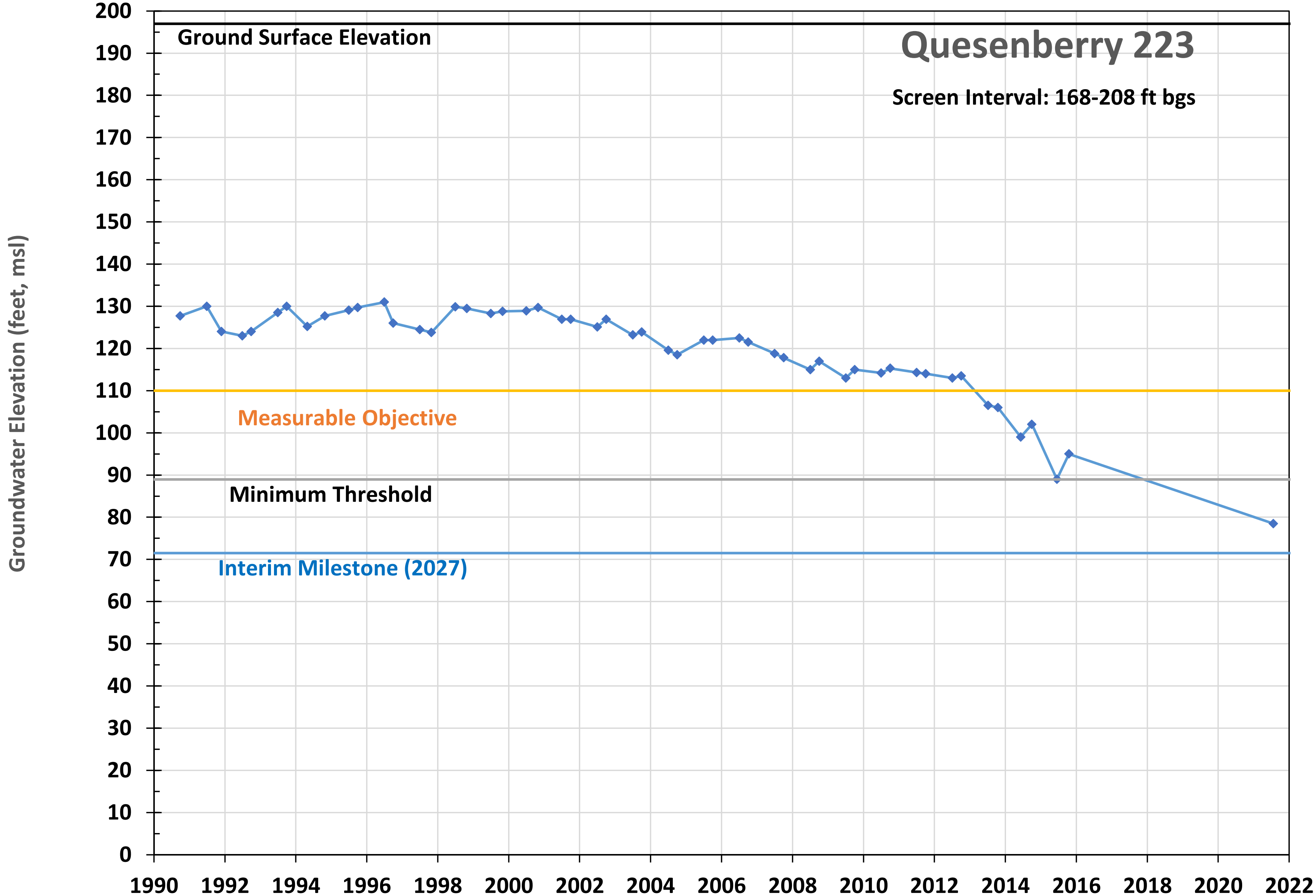


Lateral One 195
Screen Interval: 140.5-149.5 ft bgs
153-165 ft bgs
185-210 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

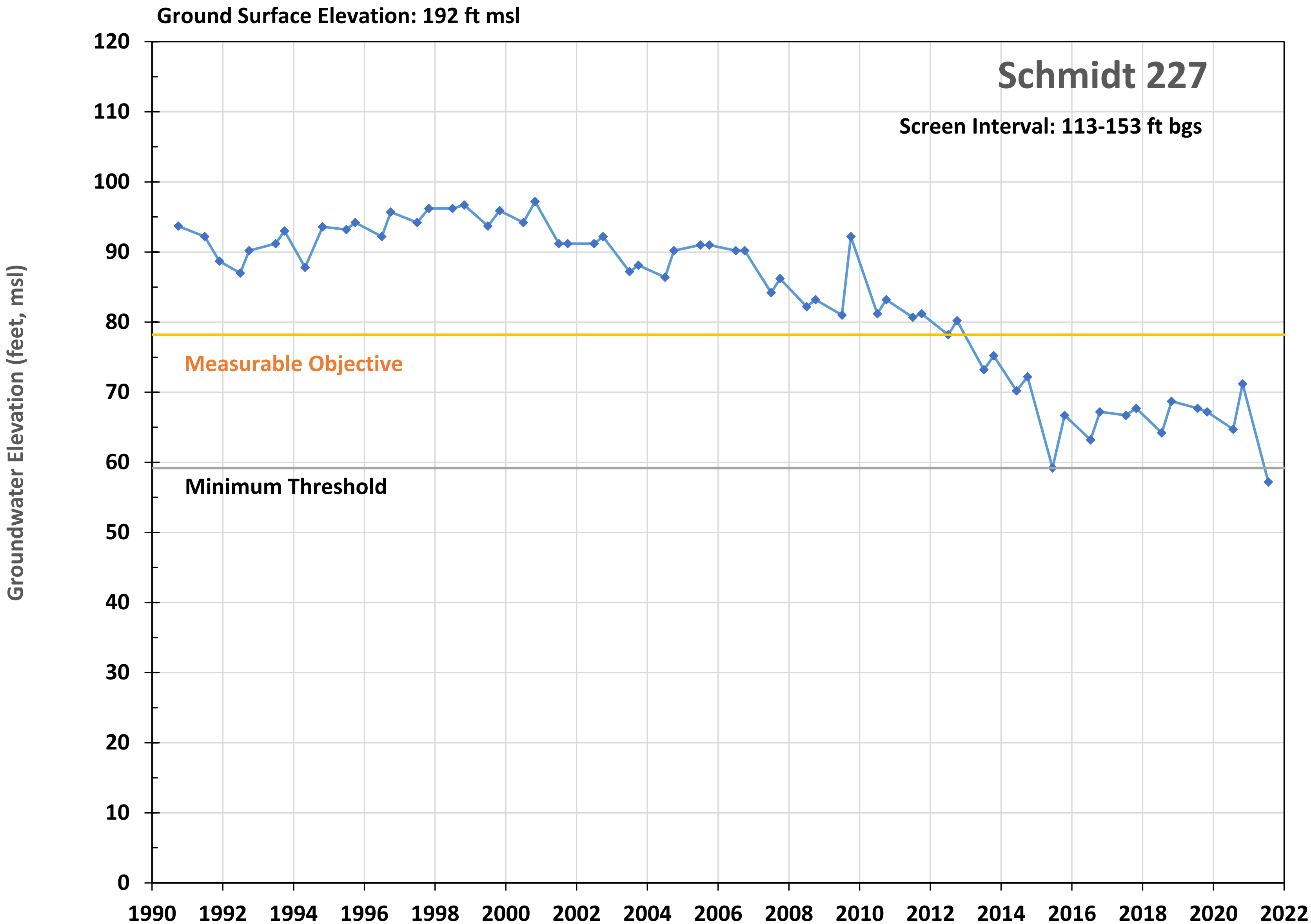

Paradise 235
Screen Interval: 96-132 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

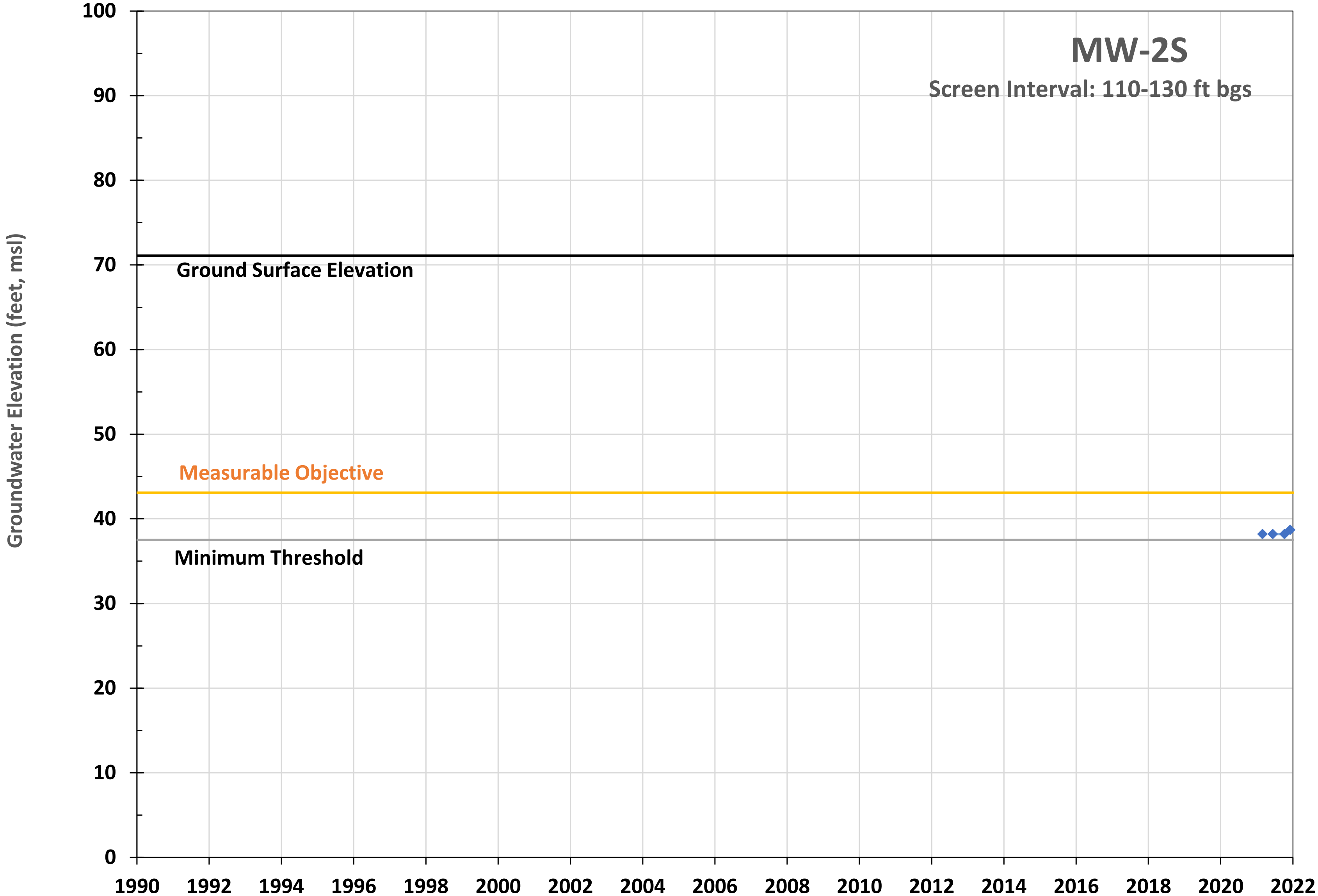


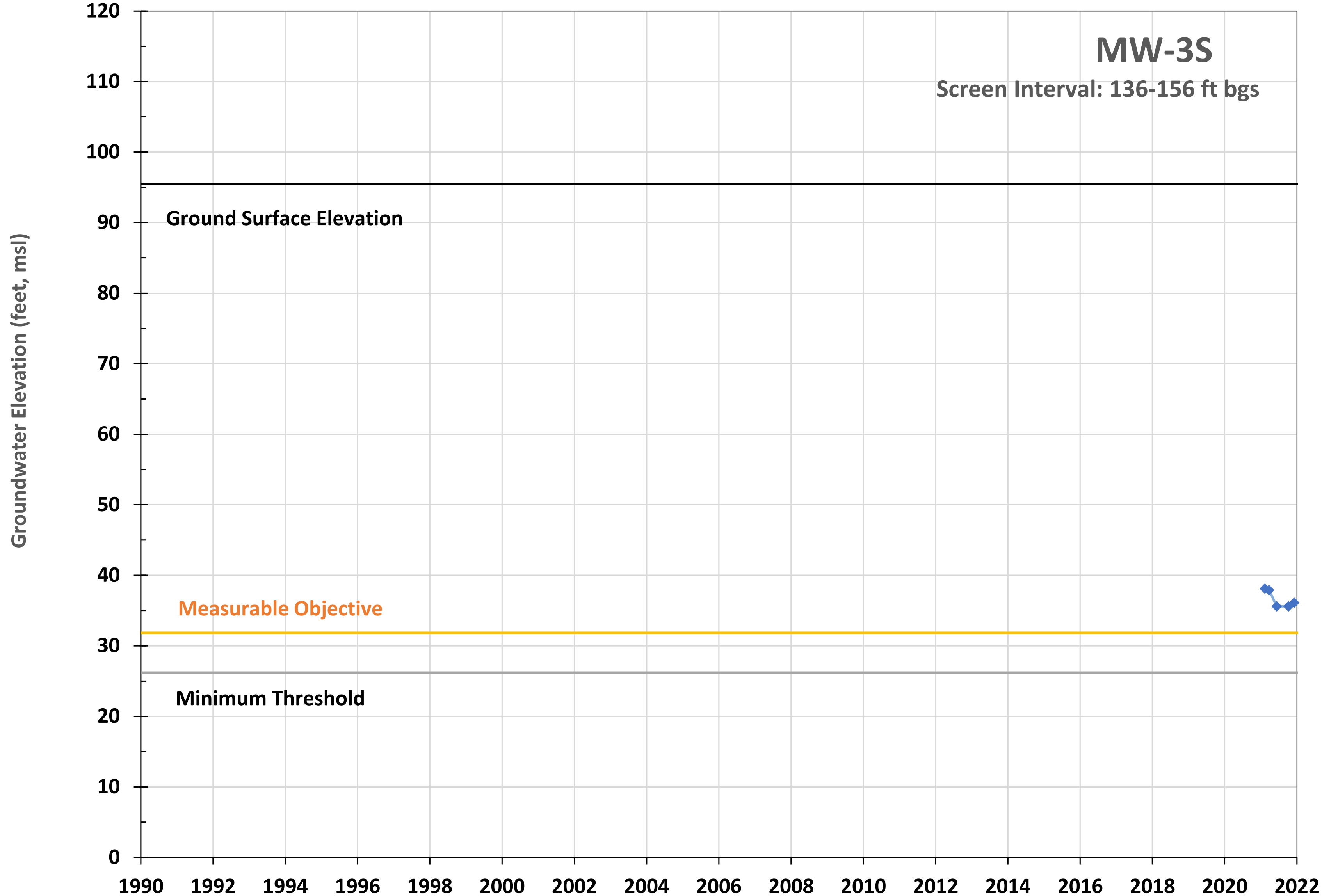
Philbrick 201
Screen Interval: 58-74 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

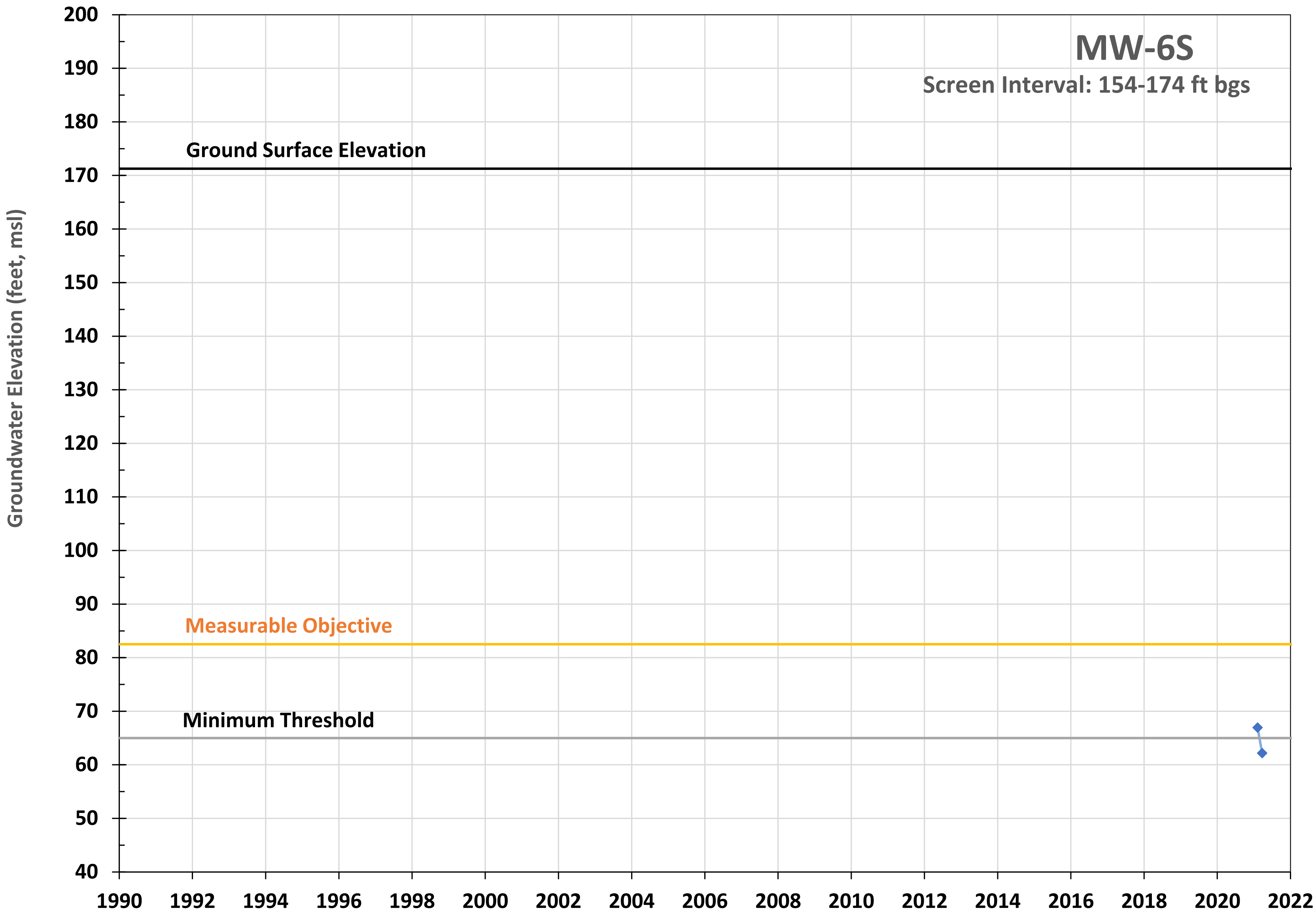


Quesenberry 223
Screen Interval: 168-208 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

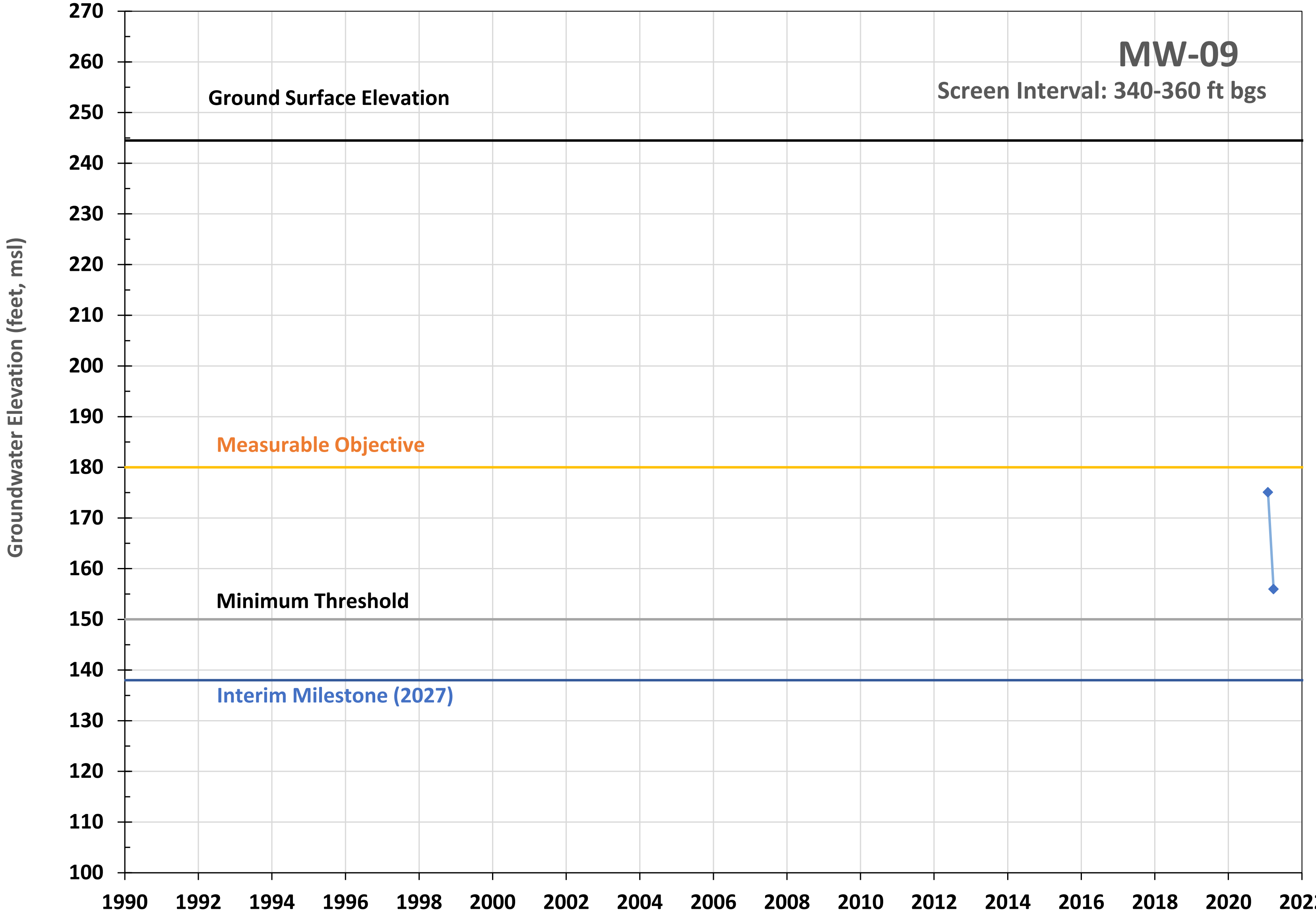

Ground Surface Elevation: 192 ft msl
Schmidt 227
Screen Interval: 113-153 ft bgs
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
120
110
100
90
80
70
60
50
40
30
20
10
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022


MW-2S
Screen Interval: 110-130 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, 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
Screen Interval: 136-156 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
0
10
20
30
40
50
60
70
80
90
100
110
120
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022



MW-6S
Screen Interval: 154-174 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Groundwater Elevation (feet, msl)
200
190
180
170
160
150
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-09
Screen Interval: 340-360 ft bgs
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Interim Milestone (2027)
Groundwater Elevation (feet, msl)
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

APPENDIX B

Water Quality Monitoring Network

Water Year 2021

Appendix B Groundwater Quality Monitoring Network

								Maximum Concentration, WY 1991-2021, and Date of Maximum Concentration													
								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	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (pCi/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					1.60	3/25/2020								
5000014-001	37.78058	-120.79294	Eastern	Municipal	DHS	5000014-001	WELL#1					8.00	2/14/2017								
5000014-002	37.74884	-120.88009	Eastern	Municipal	DHS	5000014-002	WELL#2					3.00	3/8/2019								
5000015-002	37.77225	-120.82033	Eastern	Municipal	DHS	5000015-002	WELL #1 - SOUTH					5.67	5/3/2010								
5000016-001	37.74986	-120.87875	Eastern	Municipal	DHS	5000016-001	WELL#2					5.76	11/1/2010								
5000017-001	37.73708	-120.95675	Eastern	Municipal	DHS	5000017-001	ARROWOOD (EAST) WELL	3.00	5/6/2005	ND	3/10/2021	7.03	5/16/2002	ND	3/10/2021			609.00	12/16/2014		
5000017-002	37.73936	-120.96136	Eastern	Municipal	DHS	5000017-002	PARK RIDGE WEST			ND	3/10/2021	9.35	10/29/2010								
SL185742938-M-109	37.64763	-121.01610	Western Upper	Monitoring	EDF	M-109	M-109	170.00	1/27/2014									3300.00	1/20/2020		
5000048-002	37.74658	-120.90888	Eastern	Municipal	DHS	5000048-002	NORTH EAST WELL #1					8.90	7/6/2017								
5000048-003	37.74622	-120.91000	Eastern	Municipal	DHS	5000048-003	WEST #02					10.90	11/5/2009								
5000049-001	37.77481	-120.82256	Eastern	Municipal	DHS	5000049-001	NORTH WELL					6.60	6/13/2017								
5000049-002	37.77475	-120.82256	Eastern	Municipal	DHS	5000049-002	SOUTH WELL					9.70	4/8/2019								
5000054-002	37.71066	-120.96966	Eastern	Municipal	DHS	5000054-002	SOUTH WELL					8.40	7/11/2017								
5000055-002	37.70583	-120.92042	Eastern	Municipal	DHS	5000055-002	WEST FIELD	3.20	1/28/2002			8.80	11/3/2016					340.00	8/6/2014		
5000055-003	37.70586	-120.92032	Eastern	Municipal	DHS	5000055-003	EAST FIELD					9.50	11/14/2019								
5000058-002	37.74658	-120.90888	Eastern	Municipal	DHS	5000058-002	WEST- MHP WELL					9.70	1/15/2021								
5000066-001	37.69706	-120.99203	Eastern	Municipal	DHS	5000066-001	WELL)	5.30	5/29/2012			6.82	10/14/2014	ND	12/2/2020			186.00	5/7/2009		
5000067-001	37.71702	-121.01164	Eastern	Municipal	DHS	5000067-001	WELL 03			0.60	6/17/2004	6.80	6/18/2015			0.31	6/18/2015				
5000090-002	37.62556	-120.84303	Eastern	Municipal	DHS	5000090-002	SOUTH WELL			0.05	5/13/2002	10.10	2/12/2014	ND	4/5/2021					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	9.00	7/10/2017	ND	4/5/2021					31.20	11/19/2019
5000091-001	37.77980	-120.81679	Eastern	Municipal	DHS	5000091-001	SOUTH WELL					2.80	11/12/2019								
5000110-001	37.64850	-120.97817	Eastern	Municipal	DHS	5000110-001	SOUTH/ MAIN WELL					9.17	10/15/2008								
5000110-002	37.64922	-120.97849	Eastern	Municipal	DHS	5000110-002	NORTH/BACK UP WELL					9.06	10/22/2010								
5000117-001	37.77475	-120.82256	Eastern	Municipal	DHS	5000117-001	DOMESTIC WELL					9.10	6/8/2015								
5000133-003	37.66597	-121.06601	Western Unknown	Municipal	DHS	5000133-003	2011 WELL			ND	7/8/2021	1.90	4/28/2016	ND	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	8.10	10/16/2018	ND	3/10/2021			374.00	3/17/2015		
5000154-002	37.63783	-120.84967	Eastern	Municipal	DHS	5000154-002	WELL 02 OLD EASTERN					9.30	6/1/2010			ND	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	ND	3/15/2021	2.00	12/1/2017	ND	3/15/2021	ND	3/15/2021	170.00	3/15/2021		
5000164-001	37.65733	-120.66006	Eastern	Municipal	DHS	5000164-001	WELL #1					ND	4/26/2021								
5000164-002	37.66297	-120.67831	Eastern	Municipal	DHS	5000164-002	WELL #2					ND	4/26/2021								
5000164-003	37.65726	-120.66549	Eastern	Municipal	DHS	5000164-003	WELL #3					ND	4/26/2021								
5000164-004	37.66001	-120.65574	Eastern	Municipal	DHS	5000164-004	WELL #4					ND	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	ND	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)					8.80	4/6/2020								
5000189-004	37.70716	-121.00371	Eastern	Municipal	DHS	5000189-004	WAY)					7.60	1/12/2017								
5000189-005	37.70721	-121.00081	Eastern	Municipal	DHS	5000189-005	E.WELL, #4 622 GALAXY WAY					5.80	1/7/2019								
5000189-006	37.70981	-121.00082	Eastern	Municipal	DHS	5000189-006	N.WELL, #5, 4825 STRATOS					9.50	4/7/2020								
5000211-003	37.71228	-120.91821	Eastern	Municipal	DHS	5000211-003	WELL NO. 06	3.00	2/19/2009	ND	5/12/2021	7.20	5/13/2020	ND	5/12/2021	ND	5/12/2021				
5000211-004	37.71232	-120.91980	Eastern	Municipal	DHS	5000211-004	WELL NO. 05	3.30	11/13/2008	ND	5/12/2021	7.00	5/13/2020	ND	5/12/2021	ND	5/12/2021				
5000213-001	37.66593	-121.06596	Western Unknown	Municipal	DHS	5000213-001	LPA REPORTED PRIMARY SOURCE					10.00	9/11/2015								
5000249-004	37.71283	-121.02746	Eastern	Municipal	DHS	5000249-004	WELL 02 RAW					1.70	6/24/2021			0.05	2/13/2020				
5000261-003	37.72249	-120.99584	Eastern	Municipal	DHS	5000261-003	2007 WELL					4.20	4/7/2020								
5000263-002	37.71179	-120.99603	Eastern	Municipal	DHS	5000263-002	NEW 2006			0.11	10/14/2020										
SL185742938-M-106	37.64871	-121.01911	Western Upper	Monitoring	EDF	M-106	M-106	78.00	1/18/2012									3800.00	1/20/2009		
SL185742938-M-6R	37.64782	-121.01803	Western Upper	Monitoring	EDF	M-6R	M-6R	72.10	7/10/2014									3200.00	7/13/2016		
SL185742938-M-104	37.64899	-121.01712	Western Upper	Monitoring	EDF	M-104	M-104	52.00	1/10/2007									3600.00	1/20/2009		
SL185742938-M-9R	37.65204	-121.02030	Western Upper	Monitoring	EDF	M-9R	M-9R	42.00	7/17/2007									950.00	1/18/2007		
SL185742938-M-121	37.64566	-121.00876	Western Upper	Monitoring	EDF	M-121	M-121	40.00	1/19/2010									3000.00	1/18/2007		
5000317-001	37.68982	-121.07024	Western Lower	Municipal	DHS	5000317-001	WELL#1					4.02	2/7/2011								
5000317-002	37.78055	-120.78424	Eastern	Municipal	DHS	5000317-002	WELL#2					4.80	3/25/2020								
5000335-001	37.68982	-121.07024	Western Lower	Municipal	DHS	5000335-001	WELL, PUBLIC/SOUTH	14.00	8/16/2007			9.90	7/5/2021								
5000372-001	37.66433	-121.05939	Western Lower	Municipal	DHS	5000372-001	WELL 01	12.00	8/17/2010	ND	2/1/2021	20.00	5/4/2020	ND	2/1/2021						
5000372-003	37.66461	-121.06086	Western Unknown	Municipal	DHS	5000372-003	SW NEW WELL	11.00	8/17/2010	ND	2/1/2021	15.00	2/1/2021	ND	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	38.00	1/29/2006									3500.00	1/20/2020		
5000401-001	37.60867	-121.11690	Western Unknown	Municipal	DHS	5000401-001	LPA REPORTED PRIMARY SOURCE					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	30.00	7/7/2006									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	11.50	2/12/2019	ND	7/19/2021						
5000411-003	37.71786	-121.00124	Eastern	Municipal	DHS	5000411-003	WELL #3 WEST PARK	3.30	11/25/2020			9.80	11/28/2016			0.05	5/25/2021				
5000426-001	37.70085	-120.98959	Eastern	Municipal	DHS	5000426-001	WELL 01					14.80	2/6/2018								
5000433-002	37.77809	-120.80597	Eastern	Municipal	DHS	5000433-002	NO. 02					6.14	3/24/2003								
5000433-003	37.77747	-120.79795	Eastern	Municipal	DHS	5000433-003	NO. 01					6.20	3/25/2020								

Appendix B Groundwater Quality Monitoring Network

								Maximum Concentration, WY 1991-2021, and Date of Maximum Concentration													
								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	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (pCi/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01					3.80	3/8/2019								
5000433-004	37.78037	-120.80252	Eastern	Municipal	DHS	5000433-004	NO. 01					3.30	3/25/2020								
5000433-005	37.78032	-120.79170	Eastern	Municipal	DHS	5000433-005	NO. 01					5.70	3/25/2020								
5000433-006	37.77968	-120.77772	Eastern	Municipal	DHS	5000433-006	01					8.18	8/4/2015								
5000433-007	37.77693	-120.78556	Eastern	Municipal	DHS	5000433-007	01					8.00	2/14/2017								
5000435-002	37.77464	-120.80089	Eastern	Municipal	DHS	5000435-002	NEW WELL 01					23.90	4/15/2020								
5000457-002	37.72415	-120.99566	Eastern	Municipal	DHS	5000457-002	WELL 01					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					9.70	2/27/2018								
5000481-002	37.66285	-120.78124	Eastern	Municipal	DHS	5000481-002	OLD WELL (WESTERN BY PLANT)									ND	6/7/2021				
5000486-001	37.70914	-120.92019	Eastern	Municipal	DHS	5000486-001	LPA REPORTED PRIMARY SOURCE					2.80	5/15/2018								
5000493-002	37.70913	-120.92022	Eastern	Municipal	DHS	5000493-002	2016 WELL					4.60	12/4/2019								
5000499-004	37.68138	-121.10948	Western Unknown	Municipal	DHS	5000499-004	2018 WELL	12.00	9/22/2020			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					2.62	8/12/2003								
5000516-001	37.70967	-120.94115	Eastern	Municipal	DHS	5000516-001	WELL					2.37	5/29/2015								
5000517-001	37.71001	-120.99702	Eastern	Municipal	DHS	5000517-001	WELL	7.00	3/11/2015			3.50	3/15/2017	ND	6/22/2021						
5000529-001	37.70417	-120.95640	Eastern	Municipal	DHS	5000529-001	WELL					3.73	10/19/2015								
5000530-004	37.63466	-120.79356	Eastern	Municipal	DHS	5000530-004	2011 WELL	5.60	3/23/2012	ND	6/1/2021	14.00	3/1/2021	ND	6/1/2021						
5000535-001	37.71417	-121.00101	Eastern	Municipal	DHS	5000535-001	2003 WELL 01					6.70	2/4/2020							15.00	5/5/2021
5000538-001	37.66759	-120.90568	Eastern	Municipal	DHS	5000538-001	2003 WELL					7.70	8/11/2020								
5000551-001	37.70059	-120.93784	Eastern	Municipal	DHS	5000551-001	WELL					10.00	3/11/2020								
5000552-001	37.71237	-121.00386	Eastern	Municipal	DHS	5000552-001	WELL									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					5.80	2/7/2019								
5000563-001	37.71561	-121.00339	Eastern	Municipal	DHS	5000563-001	WELL	4.70	4/6/2021	ND	5/5/2021	6.80	5/5/2020	ND	5/5/2021	0.05	1/31/2018				
5000565-001	37.71575	-121.00392	Eastern	Municipal	DHS	5000565-001	NEW WELL					5.70	4/13/2021			0.09	8/14/2018				
5000568-001	37.72180	-121.05999	Eastern	Municipal	DHS	5000568-001	WELL #1 2007			ND	4/19/2021	0.90	4/17/2018			ND	4/19/2021				
5000573-002	37.71230	-121.00251	Eastern	Municipal	DHS	5000573-002	SCS 2007 WELL					4.31	1/28/2011								
5000580-001	37.73025	-121.06814	Eastern	Municipal	DHS	5000580-001	WELL	7.00	11/14/2017			3.10	11/3/2020								
5000584-001	37.73803	-120.99481	Eastern	Municipal	DHS	5000584-001	NEW WELL 2009					2.80	11/7/2016								
5000585-001	37.63855	-121.12369	Western Unknown	Municipal	DHS	5000585-001	1999 DOMESTIC WELL					4.60	2/3/2020								
5000588-001	37.65809	-121.03037	Western Unknown	Municipal	DHS	5000588-001	WELL 01			ND	6/9/2021										
5000592-001	37.71245	-120.82519	Eastern	Municipal	DHS	5000592-001	2014 WELL	ND	4/20/2021	ND	4/20/2021	12.00	1/3/2018	ND	4/20/2021						
5010005-001	37.70083	-121.08642	Western Lower	Municipal	DHS	5010005-001	WELL 250 - SALIDA GAS	12.00	6/12/2000			3.50	6/3/2008	ND	5/5/2021	0.001	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	ND	5/5/2021	4.10	11/3/1999	ND	5/5/2021	ND	5/5/2021	290.00	11/3/1999		
5010005-006	37.71402	-121.08200	Western Lower	Municipal	DHS	5010005-006	WELL 290 - CLARENDON					7.84	9/4/2018	ND	5/5/2021	0.002	2/3/2021				
5010005-007	37.69834	-121.07377	Western Lower	Municipal	DHS	5010005-007	WELL 297			ND	5/5/2021	11.10	7/5/2013	ND	5/5/2021	0.001	2/3/2021				
5010005-008	37.71553	-121.08905	Western Lower	Municipal	DHS	5010005-008	WELL 298					5.72	3/17/2009	ND	5/5/2021	ND	5/5/2021				
5010005-017	37.70294	-121.07842	Western Unknown	Municipal	DHS	5010005-017	WELL 313 - RAW					8.62	9/6/2017	ND	5/5/2021	0.001	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			0.50	7/17/2003	7.48	5/2/2006								
SL185742938-M-119	37.65112	-121.01527	Western Upper	Monitoring	EDF	M-119	M-119	22.00	1/16/2020									20000.00	1/31/2008		
SL185742938-M-151	37.64856	-121.01341	Western Upper	Monitoring	EDF	M-151	M-151	19.00	7/12/2011									1300.00	1/26/2006		
5010010-008	37.65071	-120.98702	Western Unknown	Municipal	DHS	5010010-008	WELL 006			ND	7/14/2021	7.05	7/11/2007	ND	7/14/2021	0.01	8/22/2018				
5010010-009	37.65093	-120.99944	Western Unknown	Municipal	DHS	5010010-009	WELL 007			ND	7/14/2021			ND	7/14/2021	ND	7/14/2021				
5010010-027	37.68571	-121.00140	Eastern	Municipal	DHS	5010010-027	WELL 025			ND	5/5/2021	9.63	4/21/1999	ND	5/5/2021	ND	5/5/2021				
5010010-035	37.67377	-121.03156	Western Unknown	Municipal	DHS	5010010-035	WELL 033	9.90	1/4/1994	ND	2/3/2021	6.96	7/5/2017			0.001	5/5/2021	340.00	6/1/2021		
5010010-041	37.69001	-120.97187	Eastern	Municipal	DHS	5010010-041	WELL 039			ND	5/12/2021	6.80	11/15/2012	ND	5/12/2021	ND	5/12/2021				
5010010-042	37.64458	-120.94783	Eastern	Municipal	DHS	5010010-042	WELL 040			0.33	1/11/1995	9.96	7/20/2016			0.01	8/22/2018				
5010010-043	37.66040	-120.93046	Eastern	Municipal	DHS	5010010-043	WELL 041					7.08	3/8/1995			0.002	5/19/2021				
5000316-001	37.62464	-121.05458	Western Upper	Municipal	DHS	5000316-001	WELL 01	16.10	8/5/2002			7.00	3/10/2003								
5010010-047	37.66340	-120.91952	Eastern	Municipal	DHS	5010010-047	WELL 045			ND	5/19/2021	6.40	7/17/2019			ND	5/19/2021				
5010010-048	37.67571	-120.94764	Eastern	Municipal	DHS	5010010-048	WELL 046			0.01	4/14/2009	4.17	2/22/2018			ND	5/19/2021				
5010010-049	37.64931	-120.93879	Eastern	Municipal	DHS	5010010-049	WELL 047					6.14	7/21/2009	ND	7/21/2021	0.01	8/22/2018				
5010010-050	37.70231	-120.99673	Eastern	Municipal	DHS	5010010-050	WELL 048	8.00	1/4/1996	ND	5/5/2021	2.69	2/19/2008	ND	5/5/2021	ND	5/5/2021	190.00	5/2/2018		
5010010-052	37.69679	-121.01066	Eastern	Municipal	DHS	5010010-052	WELL 050			0.09	7/3/1995	9.50	5/16/2005	ND	7/6/2021	0.001	5/5/2021			13.12	5/16/2002
5010010-053	37.70363	-121.04910	Eastern	Municipal	DHS	5010010-053	WELL 051					9.93	1/4/1994	ND	7/6/2021	ND	7/6/2021				
5010010-124	37.65796	-121.03818	Western Upper	Municipal	DHS	5010010-124	WELL 241 - HAMMET	12.00	6/13/2000	ND	7/6/2021	5.12	6/7/2017			ND	7/6/2021	220.00	7/9/1993		
5010010-062	37.68394	-120.94584	Eastern	Municipal	DHS	5010010-062	WELL 052					3.90	2/16/2021			ND	5/19/2021				
5010010-068	37.69341	-120.94873	Eastern	Municipal	DHS	5010010-068	WELL 054			ND	5/19/2021	2.60	2/19/2020			ND	5/19/2021				
SL185742938-M-2R	37.65010	-121.02073	Western Upper	Monitoring	EDF	M-2R	M-2R	12.00	7/22/2010									2300.00	1/20/2009		
5010010-097	37.66944	-120.95000	Eastern	Municipal	DHS	5010010-097	WELL 65 - RAW			ND	5/19/2021	5.20	10/6/2004			0.002	2/16/2021				
SL185742938-M-161	37.64677	-121.01631	Western Upper	Monitoring	EDF	M-161	M-161	9.70	1/24/2017									530.00	1/11/2007		

Appendix B Groundwater Quality Monitoring Network

								Maximum Concentration, WY 1991-2021, and Date of Maximum Concentration													
								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	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (pCi/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01					3.80	3/8/2019								
5010010-127	37.65759	-120.93726	Eastern	Municipal	DHS	5010010-127	WELL 265 - LINCOLN ESTATES	3.00	1/20/2005			6.77	10/10/2001			0.002	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			5.60	2/12/2014	ND	5/12/2021	ND	5/12/2021	390.00	5/9/2018		
5010010-130	37.68534	-120.99272	Eastern	Municipal	DHS	5010010-130	WELL 264 - SHERWOOD FOREST					2.18	10/9/2013			ND	5/12/2021				
5010010-131	37.68089	-120.99341	Eastern	Municipal	DHS	5010010-131	WELL 262 - HART WELL 02	7.30	2/11/2015	ND	5/12/2021	5.82	2/14/2018	ND	5/12/2021	ND	5/12/2021	210.00	7/6/2005		
SL185742938-M-118	37.65303	-121.01877	Western Upper	Monitoring	EDF	M-118	M-118	9.50	7/7/2011									340.00	1/25/2010		
SL185742938-M-102	37.64854	-121.01611	Western Upper	Monitoring	EDF	M-102	M-102	9.40	7/13/2021									4800.00	7/12/2006		
SL185742938-M-108	37.65060	-121.01623	Western Upper	Monitoring	EDF	M-108	M-108	9.20	7/13/2010									970.00	1/10/2007		
SL185742938-M-150	37.64871	-121.01612	Western Upper	Monitoring	EDF	M-150	M-150	9.10	1/20/2020									1320.00	7/23/2012		
SL185742938-M-152	37.64703	-121.01359	Western Upper	Monitoring	EDF	M-152	M-152	9.10	1/21/2013									1100.00	7/14/2010		
5010010-170	37.62793	-120.93048	Eastern	Municipal	DHS	5010010-170	WELL 308			0.06	10/10/2006	6.35	11/9/1998			0.001	5/19/2021	1200.00	11/20/2018		
5010010-172	37.66808	-120.98508	Eastern	Municipal	DHS	5010010-172	WELL 300					3.66	3/28/2001			ND	5/12/2021				
5010010-178	37.63784	-120.93285	Eastern	Municipal	DHS	5010010-178	WELL 292 - MARIPOSA WEST			2.00	1/20/2005	9.42	6/2/2009			0.02	12/13/2016				
5010010-180	37.63785	-120.93172	Eastern	Municipal	DHS	5010010-180	WELL 291 - MARIPOSA EAST			1.02	10/11/1990	10.10	5/14/2007			0.01	7/3/2019				
5010010-184	37.63483	-120.93568	Eastern	Municipal	DHS	5010010-184	WELL 279 - FARRAR (OLD 06)			1.00	9/5/2000	9.85	9/26/2007			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			10.70	6/25/1993			ND	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			10.60	10/15/2016			ND	5/12/2021	490.00	3/11/2015		
5010010-191	37.64560	-120.90525	Eastern	Municipal	DHS	5010010-191	WELL 247 - NORTH EMPIRE			0.49	8/7/1995	10.60	10/19/2016			0.01	8/22/2018				
5010010-192	37.63757	-120.95876	Eastern	Municipal	DHS	5010010-192	WELL 225 - BUDGET PACK	4.00	9/1/2005			9.06	10/12/2016	32.00	6/1/2011	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			0.44	7/5/2006	10.10	7/9/2007			0.01	8/24/2016				
5010010-196	37.64526	-120.97845	Eastern	Municipal	DHS	5010010-196	WELL 211 - THOUSAND OAKS					8.30	1/15/2020			0.50	3/10/1994				
5010010-221	37.68369	-120.98493	Eastern	Municipal	DHS	5010010-221	WELL 058					2.30	3/2/2011	ND	5/12/2021	ND	5/12/2021				
5010010-226	37.64198	-120.91903	Eastern	Municipal	DHS	5010010-226	WELL 059					8.90	2/2/2011	ND	3/17/2021	0.01	6/13/2018				
5010010-241	37.70767	-121.05488	Eastern	Municipal	DHS	5010010-241	WELL 61			ND	3/3/2021	2.70	12/7/2006	ND	3/3/2021	0.01	8/24/2016				
5010010-243	37.69540	-121.05603	Western Unknown	Municipal	DHS	5010010-243	WELL 63			ND	5/5/2021	2.30	12/2/2015	ND	5/5/2021	ND	5/5/2021			1.70	2/1/2012
5010010-245	37.68948	-120.93022	Eastern	Municipal	DHS	5010010-245	WELL NO. 67									ND	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	4.10	7/17/2013	ND	7/14/2021	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	ND	7/14/2021	4.70	8/6/2003	ND	7/14/2021	ND	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	ND	7/14/2021	4.61	7/19/1995	ND	7/14/2021	ND	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	ND	7/14/2021	3.60	1/18/2010	ND	7/14/2021	ND	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	ND	7/14/2021	6.80	8/22/2012	2.20	4/15/2011	ND	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	ND	7/14/2021	8.25	4/26/2012	ND	7/14/2021	ND	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	ND	7/14/2021	4.00	7/12/2018	ND	7/14/2021	ND	7/14/2021	240.00	7/14/2021		
5010018-002	37.73336	-120.92734	Eastern	Municipal	DHS	5010018-002	WELL 02					3.80	11/12/2015			ND	7/7/2021				
5010018-003	37.73033	-120.94992	Eastern	Municipal	DHS	5010018-003	WELL 03					6.57	8/21/2008			ND	7/7/2021				
5010018-004	37.73973	-120.93995	Eastern	Municipal	DHS	5010018-004	WELL 04					5.40	6/9/2009			0.01	10/31/2002				
5010018-006	37.72784	-120.93318	Eastern	Municipal	DHS	5010018-006	WELL 06					4.90	12/14/2017			ND	7/7/2021				
5010018-007	37.72726	-120.95580	Eastern	Municipal	DHS	5010018-007	WELL 07					9.60	10/14/2020			ND	7/7/2021				
5010018-008	37.72194	-120.95380	Eastern	Municipal	DHS	5010018-008	WELL 08					7.40	10/11/2018			ND	7/7/2021				
5010018-009	37.71361	-120.94250	Eastern	Municipal	DHS	5010018-009	WELL 09					8.00	10/10/2016			ND	7/7/2021				
5010018-010	37.71508	-120.95810	Eastern	Municipal	DHS	5010018-010	WELL 10					8.50	10/11/2018			ND	7/7/2021				
5010018-012	37.73216	-120.92441	Eastern	Municipal	DHS	5010018-012	WELL NO. 12					2.50	12/14/2017			ND	7/7/2021				
5010029-001	37.74016	-121.01405	Eastern	Municipal	DHS	5010029-001	WELL 271 - HILLCREST ESTATES			1.00	3/19/1992	4.30	3/19/1992			ND	5/5/2021				
5010029-002	37.74611	-121.01690	Eastern	Municipal	DHS	5010029-002	WELL 282 - DEL RIO	7.00	7/1/2020	0.06	9/13/2005	9.41	10/16/2017	ND	5/5/2021	ND	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	0.25	10/2/1990	3.90	1/6/2021	ND	3/3/2021	0.001	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	ND	4/21/2021	0.002	4/21/2021	180.00	4/21/2021	ND	4/21/2021
5010029-010	37.73200	-121.00397	Eastern	Municipal	DHS	5010029-010	WELL NO. 68	6.90	5/4/2021	0.87	5/13/2020	3.90	5/4/2021	ND	7/6/2021	0.01	12/2/2020	170.00	5/13/2020	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					0.63	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					0.46	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								

Appendix B Groundwater Quality Monitoring Network

								Maximum Concentration, WY 1991-2021, and Date of Maximum Concentration													
								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	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (pCi/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01					3.80	3/8/2019								
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					2.33	8/19/2019								
AGW080010990-BACK 40	37.67261	-120.75605	Eastern	Domestic	AGLAND	BACK 40	BACK 40					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	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	11/18/2021								
AGW080011852-6106	37.72682	-120.90655	Eastern	Domestic	AGLAND	6106	6106					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					7.01	12/18/2019								
AGW080012136-SDW	37.77879	-120.73608	Eastern	Domestic	AGLAND	SDW	SDW					1.35	11/18/2021								
AGW080012137-NDW	37.78267	-120.73881	Eastern	Domestic	AGLAND	NDW	NDW					1.05	11/18/2021								
AGW080012192-848	37.72874	-121.00560	Eastern	Domestic	AGLAND	848	848					3.27	12/12/2019								
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								
CRABTREE	37.63413	-120.81047	Eastern	Domestic	AGLAND	CRABTREE	CRABTREE					8.98	12/9/2019								
AGW080012448-MCEWEN	37.63413	-120.81047	Eastern	Domestic	AGLAND	MCEWEN	MCEWEN					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					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					2.60	10/28/2021								
AGW080012942-DW1	37.65250	-120.53320	Eastern	Domestic	AGLAND	DW1	DW1					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	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	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	ND	5/13/2021	19.00	11/18/2020	0.57	5/14/2014	ND	5/13/2021	740.00	5/28/2020		
L10005824413-MW-11S	37.62294	-120.84817	Eastern	Monitoring	EDF	MW-11S	MW-11S	3.10	11/5/2014	ND	5/12/2021	9.30	11/29/2006	1.60	6/4/2009	ND	5/12/2021	620.00	11/5/2014		
L10005824413-MW-12S	37.62429	-120.84759	Eastern	Monitoring	EDF	MW-12S	MW-12S	1.80	6/7/2008	ND	5/12/2021	25.00	6/7/2008	40.00	11/30/2006	ND	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	ND	5/12/2021	25.00	6/7/2008	1.40	5/4/2012	ND	5/12/2021	610.00	11/13/2007		
L10005824413-MW-14SR	37.62154	-120.85382	Eastern	Monitoring	EDF	MW-14SR	MW-14SR	6.10	8/20/2015	ND	5/14/2021	6.90	2/10/2017	16.00	7/20/2012	ND	5/14/2021	720.00	5/24/2013		
L10005824413-MW-15D	37.61766	-120.85800	Eastern	Monitoring	EDF	MW-15D	MW-15D	11.00	5/13/2021	ND	5/13/2021	0.98	11/18/2020	0.75	5/14/2014	ND	5/13/2021	530.00	11/17/2010		
L10005824413-MW-15S	37.61763	-120.85804	Eastern	Monitoring	EDF	MW-15S	MW-15S	7.00	11/4/2014	ND	5/13/2021	18.00	11/18/2020	0.49	11/10/2011	ND	5/13/2021	1600.00	5/15/2018		
L10005824413-MW-16S	37.62618	-120.84678	Eastern	Monitoring	EDF	MW-16S	MW-16S	2.00	5/2/2012	ND	5/11/2021	30.00	11/8/2011	0.66	5/12/2014	ND	5/11/2021	860.00	11/13/2007		
L10005824413-MW-17D	37.63090	-120.85130	Eastern	Monitoring	EDF	MW-17D	MW-17D	4.60	11/18/2010	ND	5/12/2021	11.00	6/2/2009	1.30	6/2/2009	ND	5/12/2021	500.00	6/2/2009		
L10005824413-MW-17S	37.63090	-120.85130	Eastern	Monitoring	EDF	MW-17S	MW-17S	3.60	6/5/2008	ND	5/12/2021	12.00	11/10/2011	2.80	5/14/2014	ND	5/12/2021	660.00	5/12/2021		
L10005824413-MW-18D	37.63122	-120.84827	Eastern	Monitoring	EDF	MW-18D	MW-18D	5.00	12/1/2006	ND	5/12/2021	9.50	12/1/2006	0.70	6/5/2008	ND	5/12/2021	460.00	12/1/2006		
L10005824413-MW-18S	37.63122	-120.84827	Eastern	Monitoring	EDF	MW-18S	MW-18S	4.40	12/1/2006	ND	5/12/2021	11.00	12/1/2006	1.00	5/9/2007	ND	5/12/2021	440.00	12/1/2006		
L10005824413-MW-19D	37.62471	-120.84766	Eastern	Monitoring	EDF	MW-19D	MW-19D	4.30	6/7/2008	ND	5/12/2021	8.50	11/19/2007	5.20	11/19/2007	ND	5/12/2021	530.00	11/19/2007		
L10005824413-MW-19S	37.62471	-120.84767	Eastern	Monitoring	EDF	MW-19S	MW-19S	4.50	6/7/2008	ND	5/12/2021	28.00	11/17/2020	6.30	5/12/2015	ND	5/12/2021	780.00	11/20/2019		
L10005824413-MW-1D	37.62137	-120.84984	Eastern	Monitoring	EDF	MW-1D	MW-1D	2.90	8/20/2014	ND	5/13/2021	9.30	6/7/2008	5.70	7/19/2012	ND	5/13/2021	1700.00	11/19/2008		
L10005824413-MW-1S	37.62139	-120.84983	Eastern	Monitoring	EDF	MW-1S	MW-1S	3.10	11/18/2020	ND	5/13/2021	27.00	5/18/2017	2.80	11/16/2007	ND	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	ND	5/12/2021	7.30	11/30/2006	0.29	11/20/2008	ND	5/12/2021	530.00	11/16/2010		

Appendix B Groundwater Quality Monitoring Network

								Maximum Concentration, WY 1991-2021, and Date of Maximum Concentration													
								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	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (pCi/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01					3.80	3/8/2019								
L10005824413-MW-21S	37.63065	-120.84806	Eastern	Monitoring	EDF	MW-21S	MW-21S	4.90	6/5/2008	ND	5/12/2021	7.00	11/16/2007	0.63	5/13/2014	ND	5/12/2021	490.00	11/16/2007		
L10005824413-MW-22D	37.62909	-120.84804	Eastern	Monitoring	EDF	MW-22D	MW-22D	4.70	6/5/2008	ND	5/12/2021	9.60	11/19/2007	6.80	11/19/2007	ND	5/12/2021	580.00	11/19/2007		
L10005824413-MW-22S	37.62909	-120.84804	Eastern	Monitoring	EDF	MW-22S	MW-22S	4.20	5/13/2014	ND	5/12/2021	17.00	5/16/2018	23.00	11/19/2007	ND	5/12/2021	730.00	11/19/2007		
L10005824413-MW-23D	37.62281	-120.85772	Eastern	Monitoring	EDF	MW-23D	MW-23D	22.00	5/15/2018	ND	5/13/2021	2.90	11/17/2020	1.40	8/9/2017	ND	5/13/2021	760.00	8/3/2011		
L10005824413-MW-23S	37.62277	-120.85776	Eastern	Monitoring	EDF	MW-23S	MW-23S	34.00	5/15/2018	ND	5/13/2021	10.00	11/20/2019	0.51	10/9/2012	ND	5/13/2021	1400.00	5/27/2020		
L10005824413-MW-24D	37.62620	-120.84469	Eastern	Monitoring	EDF	MW-24D	MW-24D	4.60	11/18/2019	ND	5/11/2021	22.00	11/9/2011	1.30	5/12/2014	ND	5/11/2021	590.00	5/10/2016		
L10005824413-MW-24S	37.62620	-120.84461	Eastern	Monitoring	EDF	MW-24S	MW-24S	4.10	5/10/2016	ND	5/11/2021	25.00	8/18/2014	0.14	2/17/2015	ND	5/11/2021	690.00	5/14/2018		
L10005824413-MW-25D2	37.62269	-120.85618	Eastern	Monitoring	EDF	MW-25D2	MW-25D2	33.00	5/15/2018	ND	5/13/2021	2.50	11/19/2019	1.20	5/15/2014	ND	5/13/2021	630.00	2/19/2014		
L10005824413-MW-25D3	37.62267	-120.85618	Eastern	Monitoring	EDF	MW-25D3	MW-25D3	18.00	5/15/2018	ND	5/13/2021	0.44	11/12/2018	0.39	8/20/2015	ND	5/13/2021	530.00	5/22/2019		
L10005824413-MW-26D	37.62830	-120.85280	Eastern	Monitoring	EDF	MW-26D	MW-26D	4.30	11/14/2018	ND	5/13/2021	6.80	11/20/2019	1.10	11/14/2017	ND	5/13/2021	440.00	8/29/2019		
L10005824413-MW-26S	37.62829	-120.85277	Eastern	Monitoring	EDF	MW-26S	MW-26S	4.30	8/17/2012	ND	5/13/2021	11.00	11/18/2020	1.70	11/19/2015	ND	5/13/2021	400.00	5/13/2021		
L10005824413-MW-27D	37.62883	-120.86088	Eastern	Monitoring	EDF	MW-27D	MW-27D	3.50	8/13/2013	ND	5/13/2021	6.40	11/20/2019	ND	5/13/2021	ND	5/13/2021	390.00	8/13/2013		
L10005824413-MW-27S	37.62885	-120.86090	Eastern	Monitoring	EDF	MW-27S	MW-27S	4.40	2/17/2015	ND	5/13/2021	5.40	2/20/2018	1.20	11/13/2018	ND	5/13/2021	340.00	10/4/2012		
L10005824413-MW-2D	37.61980	-120.85249	Eastern	Monitoring	EDF	MW-2D	MW-2D	4.30	6/7/2008	ND	5/13/2021	24.00	8/14/2013	4.60	11/15/2007	ND	5/13/2021	610.00	8/4/2011		
L10005824413-MW-2S	37.61982	-120.85246	Eastern	Monitoring	EDF	MW-2S	MW-2S	4.00	12/10/2009	ND	5/13/2021	50.00	11/15/2018	5.20	11/29/2006	ND	5/13/2021	1800.00	5/28/2020		
L10005824413-MW-3D	37.62532	-120.85532	Eastern	Monitoring	EDF	MW-3D	MW-3D	4.80	6/7/2008	ND	5/14/2021	3.70	7/19/2012	1.40	2/10/2016	ND	5/14/2021	960.00	7/19/2012		
L10005824413-MW-3S	37.62534	-120.85531	Eastern	Monitoring	EDF	MW-3S	MW-3S	11.00	5/18/2017	ND	5/14/2021	64.00	11/15/2017	2.10	11/19/2015	ND	5/14/2021	3000.00	8/10/2017		
L10005824413-MW-4D	37.62277	-120.85618	Eastern	Monitoring	EDF	MW-4D	MW-4D	48.00	11/28/2006	ND	5/13/2021	3.30	11/21/2019	2.30	11/21/2019	ND	5/13/2021	680.00	8/4/2011		
L10005824413-MW-4S	37.62283	-120.85614	Eastern	Monitoring	EDF	MW-4S	MW-4S	110.00	2/28/2019	ND	5/13/2021	11.00	11/15/2017	1.90	6/7/2008	ND	5/13/2021	980.00	2/21/2018		
L10005824413-MW-5S	37.61952	-120.85203	Eastern	Monitoring	EDF	MW-5S	MW-5S	2.70	2/9/2017	ND	5/13/2021	24.00	11/18/2020	1.70	8/29/2019	ND	5/13/2021	1200.00	5/28/2020		
L10005824413-MW-7D	37.62611	-120.84943	Eastern	Monitoring	EDF	MW-7D	MW-7D	8.00	5/17/2018	ND	5/11/2021	13.00	11/16/2007	5.80	11/14/2017	ND	5/11/2021	2800.00	4/30/2012		
L10005824413-MW-7S	37.62610	-120.84943	Eastern	Monitoring	EDF	MW-7S	MW-7S	5.60	6/4/2009	ND	5/12/2021	21.00	11/19/2020	7.10	5/28/2010	ND	5/12/2021	680.00	6/4/2009		
L10005824413-MW-8S	37.62040	-120.85687	Eastern	Monitoring	EDF	MW-8S	MW-8S	4.70	11/19/2015	ND	5/13/2021	8.30	5/23/2019	5.30	11/29/2006	ND	5/13/2021	640.00	2/28/2019		
L10005824413-MW-9S	37.61878	-120.85437	Eastern	Monitoring	EDF	MW-9S	MW-9S	2.40	6/7/2008	ND	5/13/2021	14.00	11/14/2017	0.92	7/18/2012	ND	5/13/2021	2600.00	8/2/2011		
S12-MO05	37.69658	-120.97175	Eastern	Municipal	USGS	S12-MO05	S12-MO05	8.90	10/19/2020	ND	10/19/2020	4.98	10/19/2020	ND	10/19/2020	ND	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	ND	10/19/2020	15.80	10/19/2020	0.01	10/19/2020	ND	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	ND	10/21/2020	3.69	10/21/2020	ND	10/21/2020	ND	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	ND	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	ND	12/3/2020	2.93	12/3/2020	ND	12/3/2020	ND	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	ND	12/15/2020	2.39	12/15/2020	ND	12/15/2020	ND	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	ND	1/28/2021	5.99	1/28/2021	ND	1/28/2021	ND	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	ND	2/25/2021	2.13	2/25/2021	ND	2/25/2021	ND	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	ND	2/25/2021	4.00	2/25/2021	ND	2/25/2021	ND	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	ND	10/20/2020	5.50	10/20/2020	ND	10/20/2020	ND	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	ND	11/4/2020	2.36	11/4/2020	ND	11/4/2020	ND	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	8.20	1/6/2011									960.00	1/8/2019		
SL185742938-M-160	37.64939	-121.01989	Western Upper	Monitoring	EDF	M-160	M-160	8.10	7/11/2008									840.00	1/11/2007		
SL185742938-M-120	37.65110	-121.01524	Western Upper	Monitoring	EDF	M-120	M-120	8.00	1/19/2010									380.00	1/16/2020		
SL185742938-M-105	37.65301	-121.01874	Western Upper	Monitoring	EDF	M-105	M-105	7.80	1/17/2013									620.00	1/16/2020		
SL185742938-M-162	37.64693	-121.01441	Western Upper	Monitoring	EDF	M-162	M-162	7.80	7/19/2006									1100.00	7/19/2016		
SL185742938-M-101	37.64664	-121.01610	Western Upper	Monitoring	EDF	M-101	M-101	7.30	1/29/2006									1500.00	1/29/2006		
SL185742938-M-112	37.64369	-121.01082	Western Upper	Monitoring	EDF	M-112	M-112	7.20	1/7/2010									4800.00	7/14/2009		
SL185742938-M-163	37.64860	-121.01338	Western Upper	Monitoring	EDF	M-163	M-163	7.10	1/20/2011									1400.00	1/25/2006		
SL185742938-M-113	37.64365	-121.01084	Western Upper	Monitoring	EDF	M-113	M-113	6.20	7/26/2007									800.00	7/19/2006		
5010010-003	37.64277	-120.99117	Western Upper	Municipal	DHS	5010010-003	WELL 001	5.00	1/10/2001	ND	5/12/2021	5.85	9/6/2005	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					7.60	12/1/2020								
5000274-001	37.62464	-121.05458	Western Upper	Municipal	DHS	5000274-001	NEW WELL					8.00	2/15/2002								
5000284-001	37.60964	-121.11564	Western Upper	Municipal	DHS	5000284-001	WELL 01					9.83	5/1/2008								
5000290-001	37.63844	-121.12181	Western Upper	Municipal	DHS	5000290-001	LPA REPORTED PRIMARY SOURCE					10.10	12/11/2014								
5000295-001	37.60964	-121.11564	Western Upper	Municipal	DHS	5000295-001	WELL 01					17.40	1/6/2020								
5000388-001	37.65169	-121.02475	Western Upper	Municipal	DHS	5000388-001	WELL 01					15.40	11/7/2018								
5000409-001	37.60867	-121.11690	Western Upper	Municipal	DHS	5000409-001	LPA REPORTED PRIMARY SOURCE					12.00	7/5/2021								
5010010-005	37.64003	-121.00358	Western Upper	Municipal	DHS	5010010-005	WELL 003									ND	5/12/2021				
5010010-044	37.68880	-121.05788	Western Upper	Municipal	DHS	5010010-044	WELL 042			0.09	5/5/2003	9.20	4/7/2021			0.001	5/5/2021				
5010010-061	37.65147	-121.02083	Western Upper	Municipal	DHS	5010010-061	WELL 056					2.90	1/4/1993	0.54	10/11/2001	0.001	2/10/2021				
5010010-070	37.63391	-120.99295	Western Upper	Municipal	DHS	5010010-070	WELL 057					5.70	11/13/2018			0.001	2/10/2021				
5010010-146	37.62581	-121.03147	Western Upper	Municipal	DHS	5010010-146	WELL 304					7.84	1/6/2016			0.002	2/3/2021			27.80	7/22/2004
5010010-147	37.62531	-121.03148	Western Upper	Municipal	DHS	5010010-147	WELL 301					21.00	10/2/2019			ND	5/5/2021			22.00	10/4/2017
5010010-148	37.63222	-121.01908	Western Upper	Municipal	DHS	5010010-148	WELL 283 - ANWAR MANOR					9.30	5/12/1993	ND	6/1/2021	0.002	2/3/2021			27.00	9/16/1992
5010010-149	37.64199	-121.03415	Western Upper	Municipal	DHS	5010010-149	WELL 237 - ELM					8.99	1/6/2016	ND	5/5/2021	ND	5/5/2021				
5010010-151	37.64091	-121.01933	Western Upper	Municipal	DHS	5010010-151	WELL 236 - EMERALD			1.50	1/6/2016					0.002	2/3/2021			21.00	9/3/1992
SL205012989-M-19C1	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-19C1	M-19C1							ND	4/15/2021						
SL205012989-M-20C1	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-20C1	M-20C1							ND	4/14/2021						
SL205012989-M-20D	37.72000	-121.12000	Western Lower	Monitoring	EDF	M-20D	M-20D							ND	10/7/2021						

Appendix B Groundwater Quality Monitoring Network

								Maximum Concentration, WY 1991-2021, and Date of Maximum Concentration													
								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	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (ug/L)	Date	Max Conc (ug/L)	Date	Max Conc (mg/L)	Date	Max Conc (pCi/L)	Date
5000013-001	37.78530	-120.81297	Eastern	Municipal	DHS	5000013-001	WELL 01					3.80	3/8/2019								
SL205012989-M-21C1	37.72000	-121.13000	Western Upper	Monitoring	EDF	M-21C1	M-21C1							ND	10/7/2021						
SL205012989-M-21D	37.72000	-121.13000	Western Lower	Monitoring	EDF	M-21D	M-21D							ND	10/7/2021						
SL205012989-M-23A	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-23A	M-23A							ND	4/14/2021						
SL205012989-M-23C1	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-23C1	M-23C1							ND	4/14/2021						
SL205012989-M-23D	37.72000	-121.12000	Western Lower	Monitoring	EDF	M-23D	M-23D							ND	4/14/2021						
SL205012989-M-26C2	37.73000	-121.11000	Western Lower	Monitoring	EDF	M-26C2	M-26C2							ND	10/8/2021						
SL205012989-M-30C1	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-30C1	M-30C1							ND	10/8/2021						
SL205012989-M-30C2	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-30C2	M-30C2							ND	10/8/2021						
SL205012989-M-31C1	37.72000	-121.12000	Western Upper	Monitoring	EDF	M-31C1	M-31C1							ND	10/7/2021						
SL205012989-M-31C2D	37.72000	-121.12000	Western Unknown	Monitoring	EDF	M-31C2D	M-31C2D							ND	4/15/2021						
SL205012989-M-32D	37.72050	-121.13170	Western Lower	Monitoring	EDF	M-32D	M-32D							ND	10/8/2021						
SL205012989-M-34A	37.72050	-121.13240	Western Upper	Monitoring	EDF	M-34A	M-34A							ND	4/9/2021						
SL205012989-M-34C	37.72050	-121.13240	Western Upper	Monitoring	EDF	M-34C	M-34C							ND	10/8/2021						
SL205012989-M-34D	37.72050	-121.13240	Western Lower	Monitoring	EDF	M-34D	M-34D							ND	10/8/2021						
SL205012989-M-34D1	37.72050	-121.13240	Western Lower	Monitoring	EDF	M-34D1	M-34D1							ND	4/9/2021						
SL205012989-M-35A	37.72030	-121.13850	Western Upper	Monitoring	EDF	M-35A	M-35A							ND	10/8/2021						
SL205012989-M-35B	37.72030	-121.13850	Western Upper	Monitoring	EDF	M-35B	M-35B							ND	4/9/2021						
SL205012989-M-35D	37.72030	-121.13850	Western Lower	Monitoring	EDF	M-35D	M-35D							ND	4/9/2021						
SL205012989-M-36C	37.72130	-121.12380	Western Upper	Monitoring	EDF	M-36C	M-36C							ND	10/8/2021						
SL205012989-M-36D	37.72130	-121.12380	Western Lower	Monitoring	EDF	M-36D	M-36D							ND	4/9/2021						
SL205012989-M-37D	37.71700	-121.13250	Western Lower	Monitoring	EDF	M-37D	M-37D							ND	4/9/2021						
SL205012989-M-5A	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-5A	M-5A							ND	10/8/2021						
SL205012989-M-5B	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-5B	M-5B							ND	4/14/2021						
SL205012989-M-5C1	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-5C1	M-5C1							ND	10/8/2021						
SL205012989-M-5C2	37.73000	-121.11000	Western Lower	Monitoring	EDF	M-5C2	M-5C2							ND	10/8/2021						
SL205012989-M-7A	37.73000	-121.11000	Western Upper	Monitoring	EDF	M-7A	M-7A							ND	4/15/2021						
SL205012989-MW-11	37.72000	-121.14000	Western Upper	Monitoring	EDF	MW-11	MW-11							ND	10/7/2021						
SL205012989-MW-7	37.73000	-121.11000	Western Upper	Monitoring	EDF	MW-7	MW-7							ND	10/7/2021						
SL205012989-TH-1	37.73000	-121.11000	Western Lower	Monitoring	EDF	TH-1	TH-1							ND	4/15/2021						
SL205012989-TH-10	37.72000	-121.12000	Western Upper	Monitoring	EDF	TH-10	TH-10							ND	10/7/2021						
SL205012989-TH-9	37.72000	-121.12000	Western Upper	Monitoring	EDF	TH-9	TH-9							ND	10/7/2021						
SL205833043-MMW-01A	37.68713	-120.92128	Eastern	Monitoring	EDF	MMW-01A	MMW-01A			0.20	8/17/2018					0.04	8/17/2018				
SL205833043-MMW-02A	37.68549	-120.92007	Eastern	Monitoring	EDF	MMW-02A	MMW-02A									0.01	2/19/2016				
SL205833043-MMW-14A	37.68550	-120.92110	Eastern	Monitoring	EDF	MMW-14A	MMW-14A									0.01	8/18/2016				
SL205833043-MMW-18A	37.68647	-120.92049	Eastern	Monitoring	EDF	MMW-18A	MMW-18A									0.02	8/19/2016				
SL205833043-MMW-21A	37.68613	-120.92034	Eastern	Monitoring	EDF	MMW-21A	MMW-21A									ND	3/22/2021				
SL205833043-MMW-24A	37.68665	-120.92103	Eastern	Monitoring	EDF	MMW-24A	MMW-24A			0.06	2/19/2016			ND	3/23/2021	1.80	2/19/2016				
SL205833043-MMW-27A	37.68517	-120.91972	Eastern	Monitoring	EDF	MMW-27A	MMW-27A			0.21	12/19/2015			ND	3/23/2021	0.06	1/25/2019				
SL205833043-MMW-28A	37.68629	-120.92163	Eastern	Monitoring	EDF	MMW-28A	MMW-28A			0.07	8/16/2018			ND	3/22/2021	0.90	3/22/2021				
SL205833043-MMW-29A	37.68677	-120.92084	Eastern	Monitoring	EDF	MMW-29A	MMW-29A			ND	3/23/2021			ND	3/23/2021	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