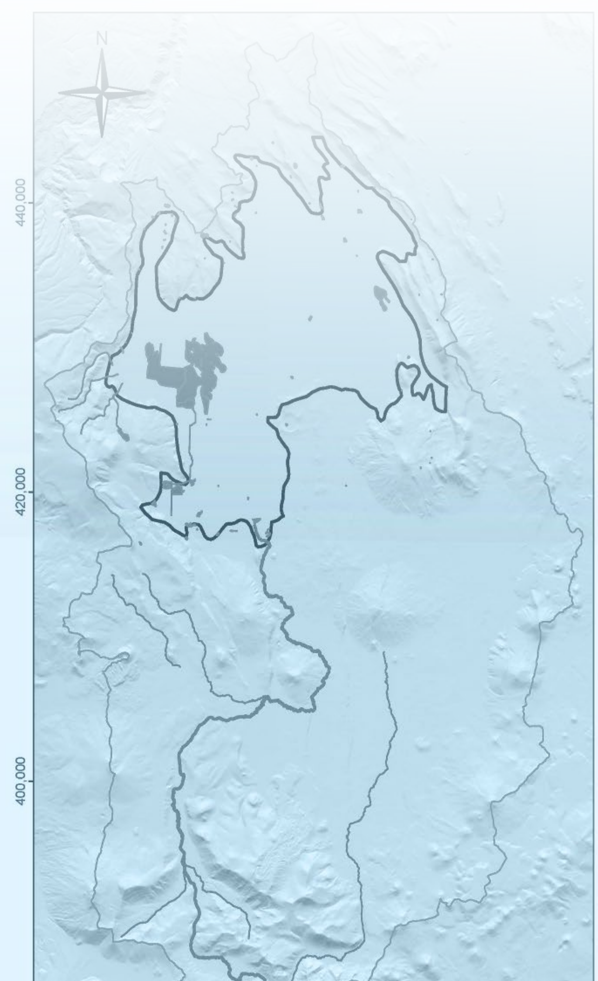
APRIL 2024

SISKIYOU COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

Butte Valley Groundwater Sustainability Plan – WY 2023 Annual Report



Contents

List of Figures

List of Tables

Executive Summary

The Butte Valley Groundwater Sustainability Plan (GSP) was adopted in December 2021 by the Siskiyou County Flood Control and Water Conservation District, the Groundwater Sustainability Agency (GSA) for the Butte Valley groundwater basin (Basin; see Figure 1). The GSA formed in accordance with the Sustainable Groundwater Management Act (SGMA) of 2014 to coordinate, develop, and implement a GSP for the Basin (DWR Basin No. 1-003). The GSP was submitted to the California Department of Water Resources (DWR) in January 2022, ahead of the January 31, 2022 deadline for high and medium priority basins.

California Water Code (CWC) §356.2 requires the submission of an annual report to DWR by April 1 of each year following the adoption of the GSP. The annual report includes information for the proceeding water year. This report is the third annual report submitted to DWR and provides an update on Basin conditions and GSP implementation progress within the Basin for water year (WY) 2023 (October 1, 2022 to September 30, 2023). It also includes changes in conditions that have occurred between the baseline year assessed in the GSP and the conditions in WY 2023. CWC §356.2 requires annual reports to include general information about the Basin and GSP, groundwater elevation data (contour maps and hydrographs), groundwater extraction, surface water supply, changes in groundwater storage, and a description of progress towards implementation of the GSP since the adoption of the previous annual report. Table 1 provides a summary of the definition of undesirable results included in Chapter 3 of the GSP.

In WY 2023 the neighboring valleys continued to experience drought. The precipitation measured at the Dorris NOAA station for WY 2023 is above the long-term mean recorded at the station. The State Water Resources Control Board issued a drought emergency curtailing order in the adjacent Shasta and Scott Valley watersheds [1].

Groundwater Levels

This section describes general observations of groundwater level declines or increases in the reporting water year. This summary includes quantified changes observed during the water year and include hydrographs and contour maps of groundwater elevation. Additional hydrographs are included in Appendix A.

[1] https://www.waterboards.ca.gov/drought/scott_shasta_rivers/

Groundwater Storage

This section provides quantified changes observed in groundwater storage based on groundwater levels and aquifer properties (i.e., specific yield) in the reporting water year. This summary includes a map of change in groundwater level between the current and previous WY and a time series plot of change in groundwater storage by water year.

Land Subsidence

This section describes the status of land subsidence for the reporting year. This summary includes available subsidence values from InSAR data for the entire Basin during the water year 2023.

Groundwater Quality

This section evaluates water quality samples collected in the Basin, and evaluates compliance with the sustainable management criteria defined in the GSP.

Plan Implementation Progress

This section describes progress made in the implementation of the GSP, including implementation of projects and management actions, and any additional implementation support actions. This section also includes an overview of plan implementation activities anticipated for the coming year.

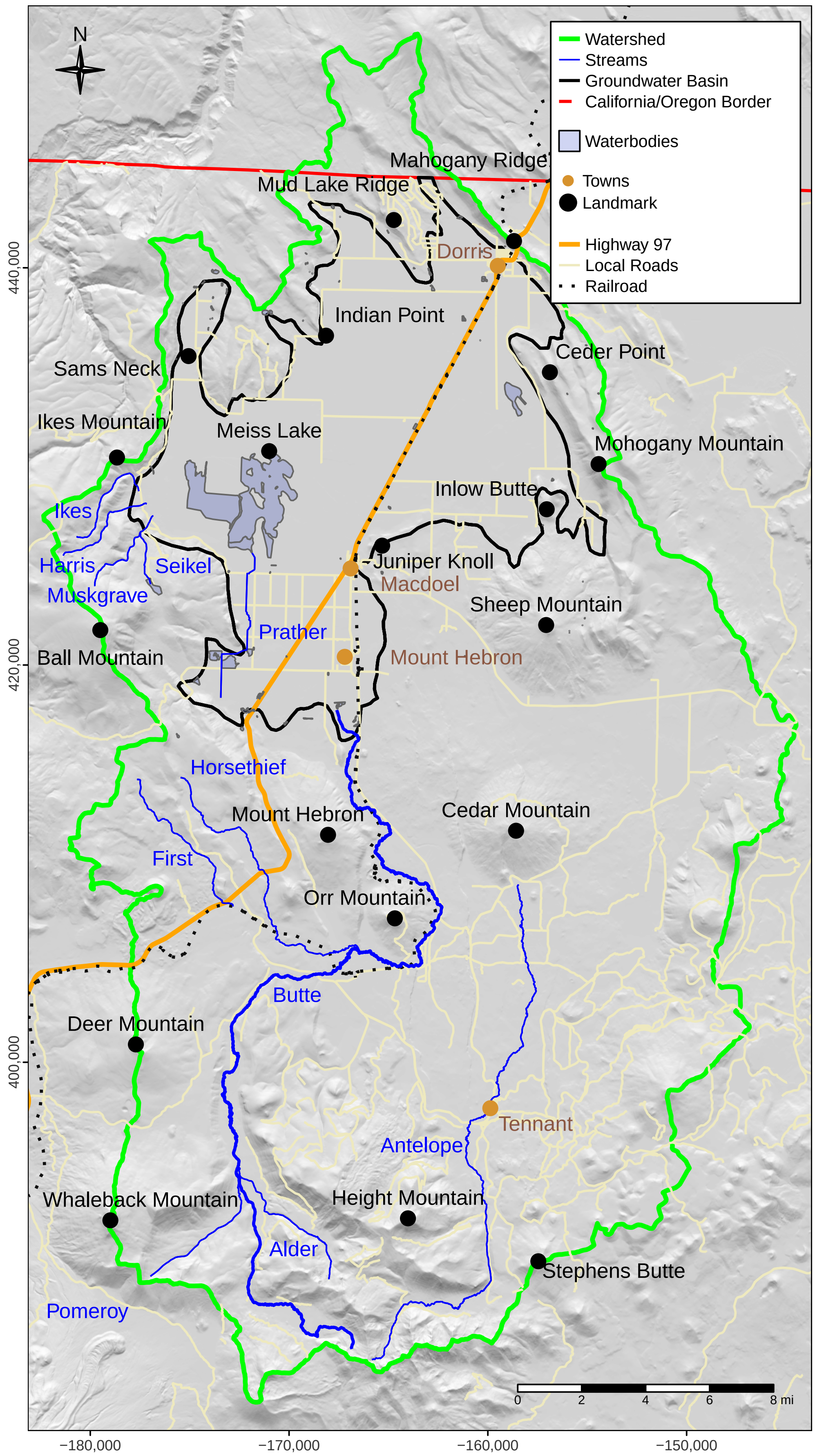


Figure 1: Butte Valley Watershed and Groundwater Basin Boundary

Table 1: Summary of Sustainable Management Criteria.

Sustainability Indicator	Minimum/Maximum Threshold (MT)	Measurable Objective (MO)	Occurrence of Undesirable Results	WY 2023 Annual Report Status
Groundwater Levels	Regression calculated from fall water level measurements between 1999-2014 was used to project the average rate of decline from fall 2014 to fall 2041. 75 percent of the projected decline during this extended period, minus 15 feet, is determined to be the MT for each RMP.	The upper limit of the MO is the highest observed water level at a RMP during the period 1991 to 2014 and the lower limit of the MO is the lowest observed water level at a RMP during the period 1991 to 2014, regardless of whether the water level was observed in the spring or fall season.	The fall low water level observation at any RMP in the Basin falls below the respective MT for 2 consecutive years.	No occurrence of undesirable results.
Groundwater Storage	Groundwater levels used as a proxy for this sustainability indicator.		Same as ”Chronic Lowering of Groundwater Levels.”	No occurrence of undesirable results.
Seawater Intrusion	This sustainability indicator is not applicable in the Subbasin.		Not applicable for the Basin.	

Table 1: Summary of Sustainable Management Criteria. *(continued)*

Sustainability Indicator	Minimum/Maximum Threshold (MT)	Measurable Objective (MO)	Occurrence of Undesirable Results	WY 2023 Annual Report Status
Degraded Water Quality	Nitrate = 10 mg/L, Specific Conductivity = 900 umhos/cm, Arsenic (only near Dorris) = 10 ug/L	More than 75% of wells monitored for water quality maintain their range of water quality measurements measured during 1990 to 2020. No significant increasing long-term trends should be observed in levels of constituents of concern.	More than 25% of groundwater quality wells exceed the respective MT for concentration and/or concentrations in over 25% of groundwater quality wells increase by more than 15% per year, on average over ten years.	No occurrence of undesirable results.
Land Subsidence	<0.1 ft of subsidence in any one year.	Maintain current ground surface elevations.	Groundwater pumping induced subsidence is greater than the MT of 0.1 ft (0.03 m) in any single year.	No occurrence of undesirable results.

Table 1: Summary of Sustainable Management Criteria. *(continued)*

Sustainability Indicator	Minimum/Maximum Threshold (MT)	Measurable Objective (MO)	Occurrence of Undesirable Results	WY 2023 Annual Report Status
Depletions of Interconnected Surface Waters	Sustainability Management Criteria (SMCs) were not developed for this sustainability indicator due to lack of information on interconnected-ness of surface water and groundwater in the Basin. Depending on funding and the filling of data gaps, SMCs may be set in a future GSP update.			Not completed for 2023, waiting for additional data to set SMCs.

Chapter 1

Introduction

1.1 Purpose

Annual reports will be completed throughout the course of GSP implementation. The purpose of these reports is to provide periodic updates on the progress towards Basin sustainability, current Basin conditions, and any improvements and/or additions to the monitoring networks.

1.2 Butte Valley GSA

The Siskiyou County Flood Control and Water Conservation District is the sole GSA for the Basin. The Siskiyou County Flood Control and Water Conservation District Act (Cal Uncod. Water Deer, Act 1240 §§ 1-38) was adopted by the State Legislature in 1959. This Act established a special district of the same name, and of limited powers that could provide flood protection, water conservation, recreation and aesthetic enhancement within its boundaries. At the time of its creation, the jurisdictional boundaries of the Flood District were smaller than those of the County. In 1983, following County of Siskiyou Local Agency Formation Commission (LAFCO) action, the balance of the County was annexed into the District, making its jurisdictional boundaries coincide with the County. The District is governed by a Board of Directors that is composed of the Board of Supervisors; however, the District is a separate legal entity from the County, with independent rights and limited powers set forth in its originating act. The District's purpose is the conservation and control of storm, flood, and other waters and ensuring beneficial use thereof.

The Siskiyou County Flood Control and Water Conservation District approved the GSP for the Basin in December 2021 and submitted the GSP to DWR in January 2022. The GSA will submit an annual report to DWR documenting the progress in achieving groundwater sustainability, by April 1st, for each preceding water year. The monitoring data for the preceding water year will be compiled to present the most current groundwater conditions to identify whether the Sustainable Management Criteria (SMC) were met. Additionally, all progress in project management action implementation will be presented.

1.3 Basin Description

The Basin is a 79,700 acre (125 square mile [sq mi]; 326 square kilometer [sq km]) subbasin within the upper Klamath Groundwater Basin that extends between California and Oregon (Wood 1960; Gannett, Wagner, and Lite Jr. 2012). Under the 2019 basin prioritization conducted by DWR, the Basin (DWR Basin 1-003) is designated as medium priority (DWR 2019). The Butte Valley watershed (Watershed) is roughly three times larger than the Basin and contains two other DWR recognized groundwater basins: Bray Town Area and Red Rock Valley. The Watershed is the drainage area that recharges surface water in the Basin, shown in Figure 1. The Watershed is located immediately northeast of Mount Shasta, whose flank can be seen in the bottom left corner of Figure 1.

The predominately agricultural Basin is in northern Siskiyou County, California, just south of the Oregon border (see Figure 1). The 2010 County land use survey assessed 60.8% of the Basin area and identified the following land use percent coverage: agriculture (38.7%), idle land (5.3%), and urban (10.6%). As of 2010 the major crops in Butte Valley were alfalfa, hay, and strawberry, which occupied approximately 18,400 acres, 8,000 acres, and 3,300 acres (7,450 hectares, 3,240 hectares, 1,300 hectares) respectively (DWR 2010).

The Basin has three notable population centers, all of which are severely disadvantaged communities (SDACs): the City of Dorris (Population: 962), Macdoel (Population: 155), and Mount Hebron (Population: 81) [Figure 1.1; see DWR (2016)]. Due to their small populations, Macdoel and Mount Hebron are described as census-designated places by the United States (U.S.) Census Bureau. These SDACs suffer from a combination of economic, health, and environmental burdens. By definition, disadvantaged communities (DACs) have a median household income (MHI) less than 80% of the statewide MHI while SDACs are below 60%. Dorris has a MHI of $28,963, Macdoel has a MHI of $35,294, and Mount Hebron has a MHI of $28,170 (DWR 2016). All SDAC communities in the Basin rely on groundwater as their sole source of drinking water, using a combination of municipal water district, small water suppliers, and domestic wells.

Butte Valley is a closed drainage basin and the valley floor is almost flat, with elevations spanning a narrow range from 4,226 to 4,236 ft (1,288 to 1,291 m) amsl, shown in Figure 1.2 (Bryant 1990; County of Siskiyou 1996). It is topographically closed and bounded by topographic highs in all directions: the Cascade Mountains in the north, south and west, the Mahogany Mountain ridge in the east and Sheep Mountain and Red Rock Valley in the southeast (DOI 1980; DWR 2004). Butte Valley experiences east-west directed extensional tectonics and north-trending normal faults expressed as block faulting (Bryant 1990).

The Basin contains Meiss Lake, the remnant of a prehistoric lake that once filled Butte Valley, and several streams that all flow into the Basin from the surrounding Watershed, as shown in Figure 1 (King 1994). Butte Creek is the largest stream flowing into Butte Valley.

The Basin contains one principle aquifer with various water-bearing geologic formations consisting of a mixture of alluvial and volcanic formations. Water bearing formations within the Basin aquifer are described in Chapter 2 of the GSP, where the principal water bearing formations are Lake Deposits, Butte Valley Basalt, and High Cascade Volcanics, and minor formations are Alluvial Fan Deposits and Pyroclastic Rocks (DWR 1998; DWR 2004). The surface geology of Butte Valley and adjacent regions are primarily volcanic with lake deposits, alluvial fan deposits, and alluvium with some deposits of dune sand and talus (Wood 1960).

1.3.1 Climate

Butte Valley has a semiarid climate characterized by warm, dry summers and cool, wet winters, however brief summer showers are not uncommon. The Cascade Range on the west side of the Basin casts a rain shadow across the Basin, where precipitation is highest on the west side of the valley and decreases eastward (Novick 1996). Annual precipitation also increases northward (DWR 2004). Snow can occur during any month of the year but normally falls between November and March (Novick 1996). July through September are historically the driest months [DOI (1980); see Figure 1.3].

The Basin has experienced decreasing precipitation during much of the period between 1970 to 2020. From the 1940s to 2019, the NOAA station in Mount Hebron has an average annual precipitation of 9.3 inches (Figure 1.3). Between 1942 and 1979, the 10-year trailing rolling average precipitation ranged from 9.5 to 12.4 in (24.1 to 31.5 cm; water years 1953 and 1971, respectively); since 1980, it has ranged between 5.7 to 10.8 in (14.5 to 27.4 cm; water years 2018 and 1980, respectively; see Figure 1.3). Much of the expansion in agricultural land in Butte Valley occurred before 1976, with irrigated land expanding to 11,130 hectares (27,500 acres), during a period when average rainfall was relatively stable and significantly greater.

The Mount Hebron NOAA station has a data gap for WY 2020 and 2021, and recorded relatively low precipitation during the WYs 2022 and 2023 compared to the historical conditions recorded in the basin (Figure 1.3). Therefore, data at Dorris NOAA station is included as a reference of more recent years' climate condition in the basin (Figure 1.4). the precipitation measured at the Dorris NOAA station for water year 2023 was 11.9 inches which is above the long-term mean recorded at the station.

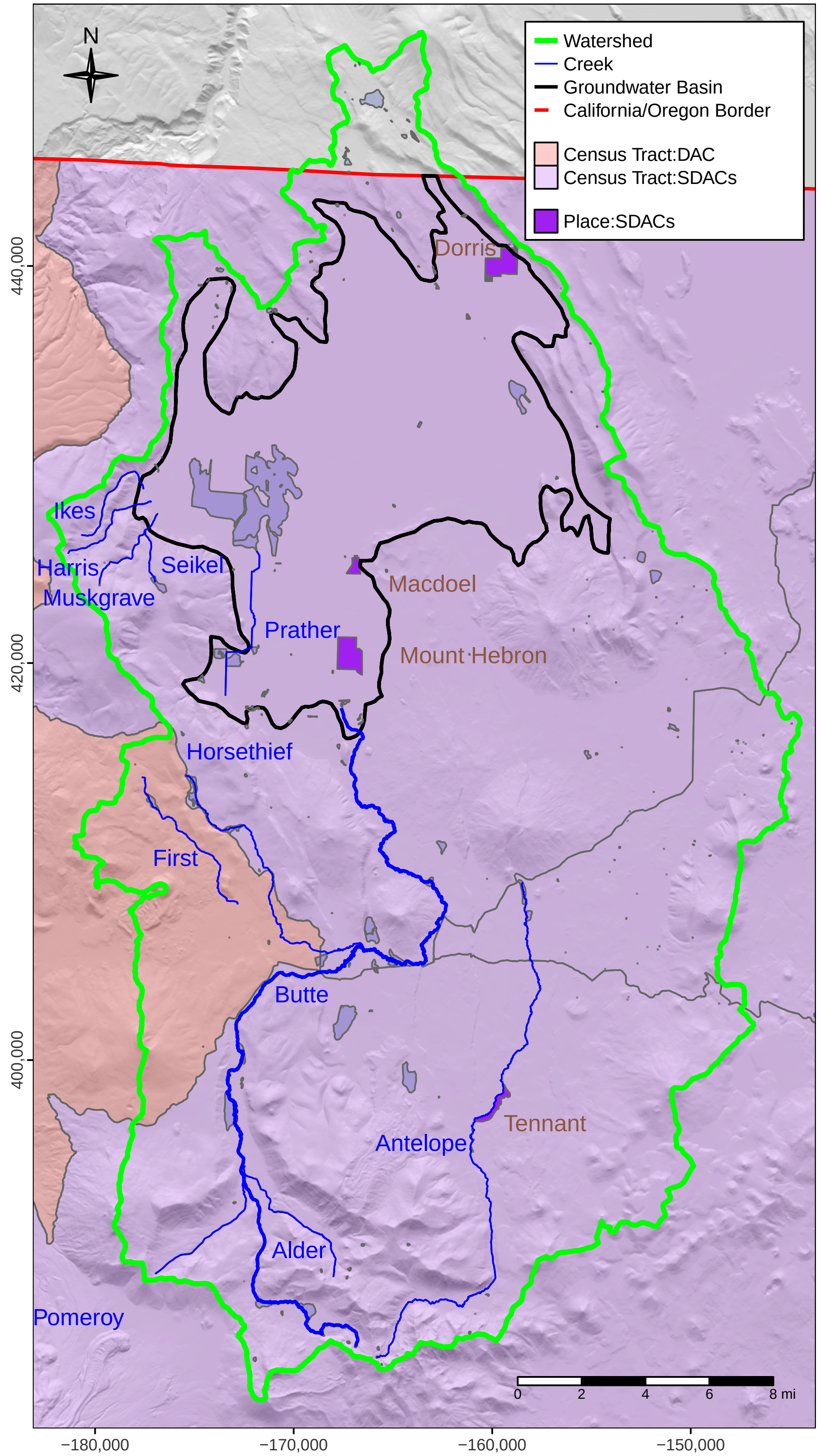


Figure 1.1: Based on the 2016 U.S. Census, place and tract boundaries of Disadvantaged Communities (DACs: $42,737 <= MHI < $56,982) and Severely Disadvantaged Communities (SDACs: MHI < $42,737) in the Butte Valley watershed, using data from the DWR DAC Mapping Tool (DWR 2016b).

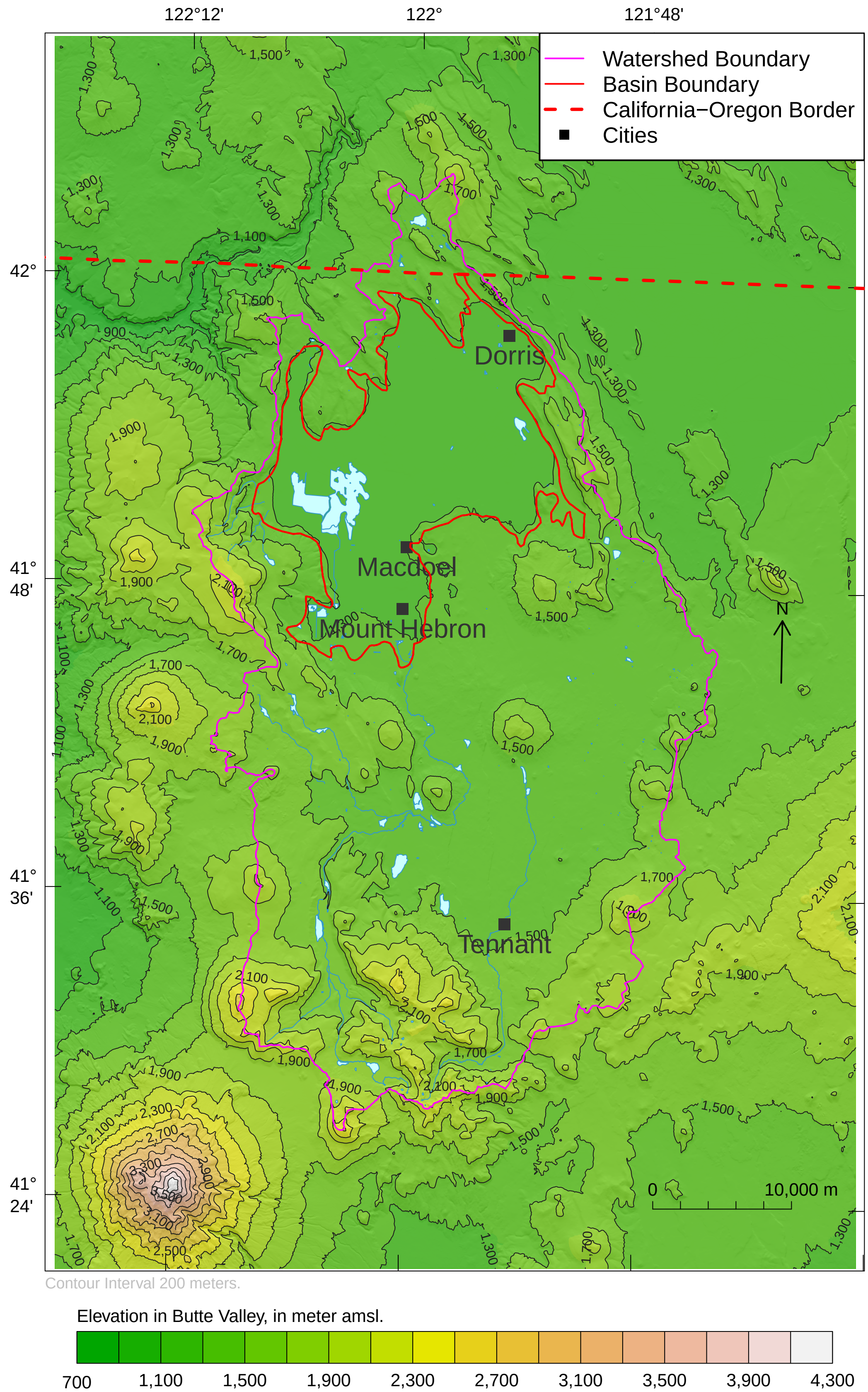


Figure 1.2: Topography of the Butte Valley Groundwater Basin and surrounding Watershed.

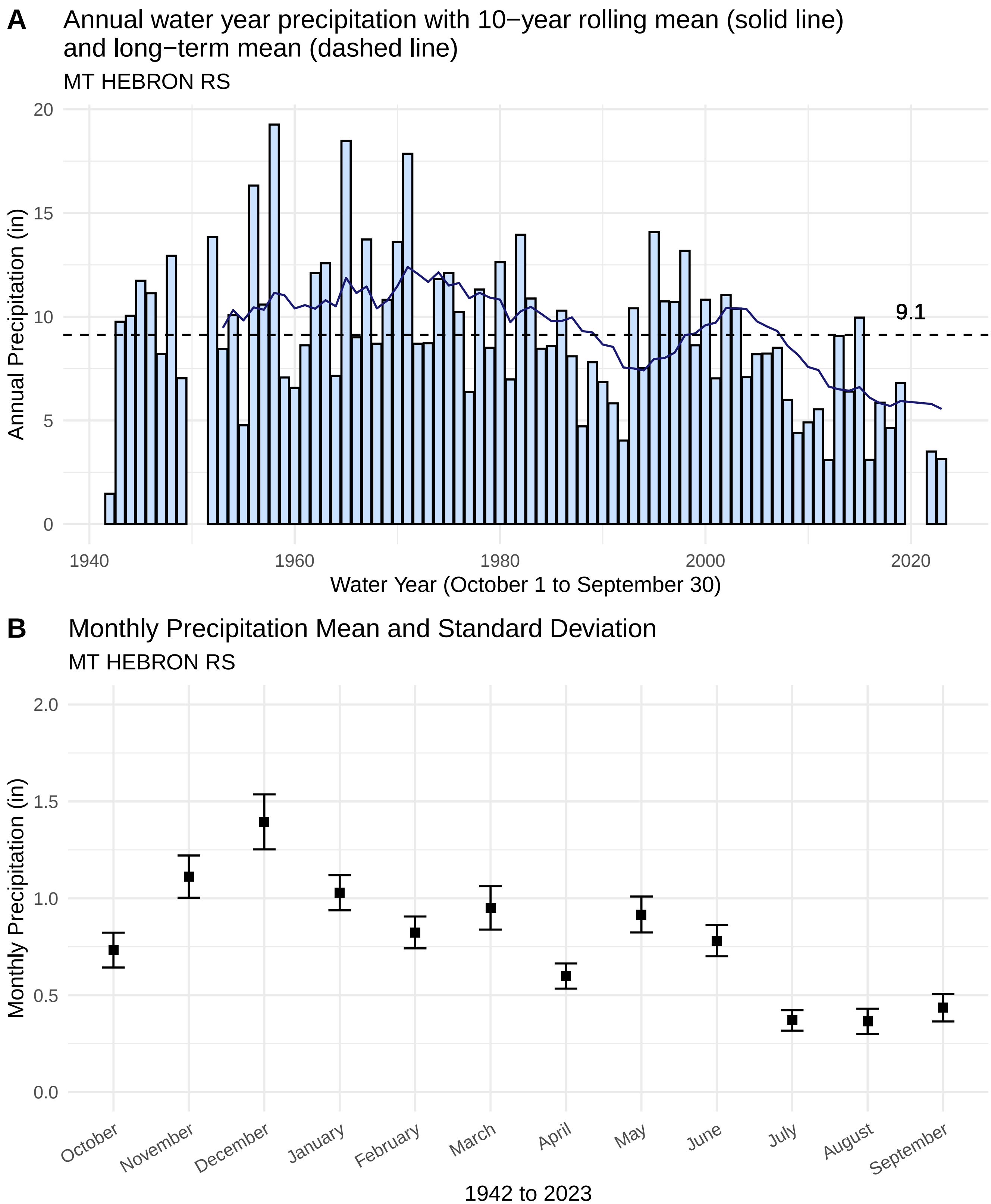


Figure 1.3: Annual (Panel A) and monthly precipitation (Panel B) over the 1942 to 2023 record as measured at the Mount Hebron Ranger weather station (USC00045941). In Panel A, the 10-year rolling average is shown as the average over the entire period of record. Each bar represents one water year, the total precipitation during the period between October 1 and September 30. The years 1950, 1951, 2020, and 2021 had significant data gaps and were removed.

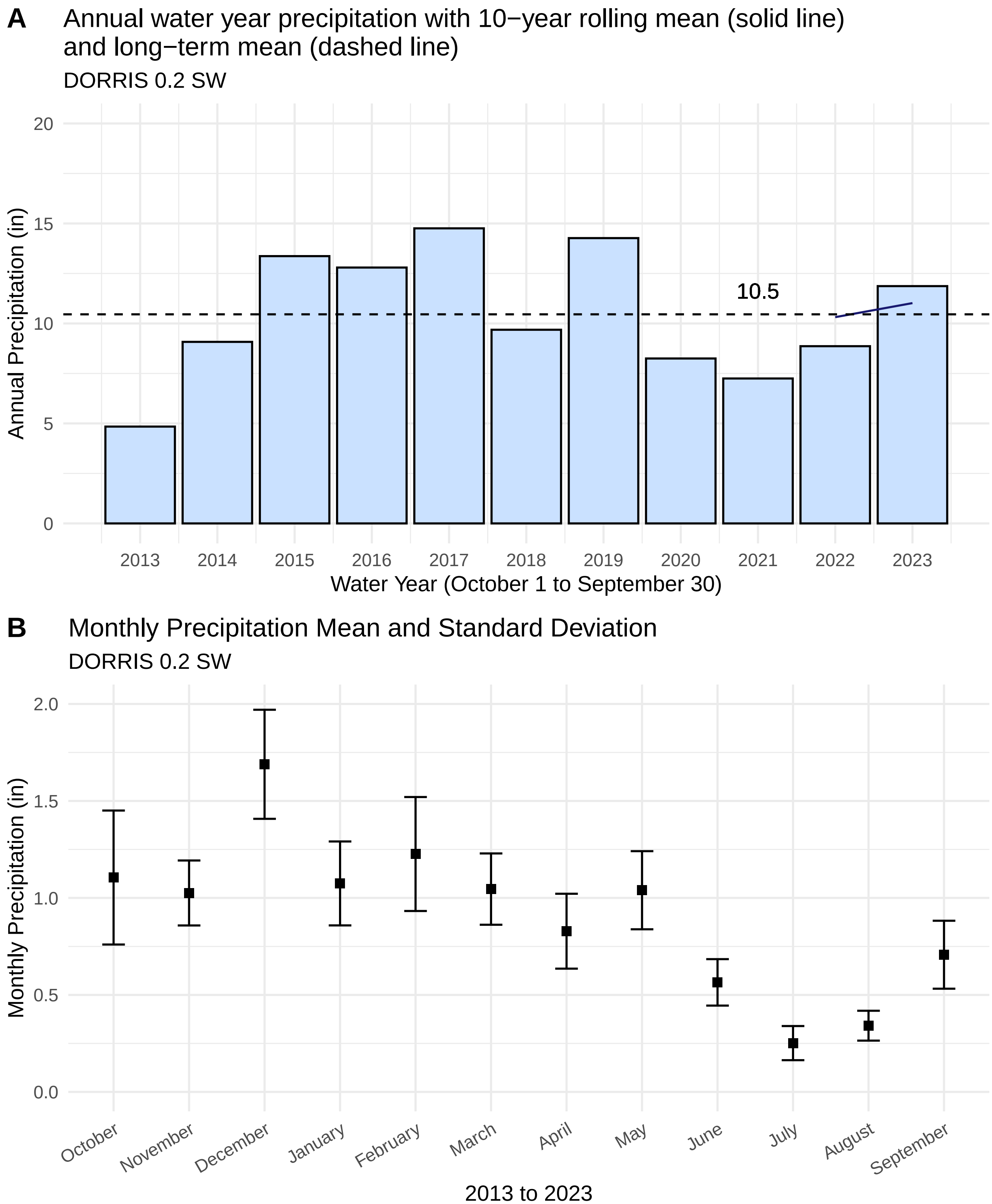


Figure 1.4: Annual (Panel A) and monthly precipitation (Panel B) over the 2013 to 2023 record as measured at the Dorris weather station (US1CASK0010). In Panel A, the 10-year rolling average is shown as the average over the entire period of record. Each bar represents one water year, the total precipitation during the period between October 1 and September 30.

Chapter 2

Groundwater Basin Conditions

2.1 Groundwater Elevations

This section describes the change in groundwater elevations in WY 2023 and summarizes general observations of groundwater level declines or increases in the reporting water year. This summary includes quantified changes observed during the water year, hydrographs and contour maps of groundwater elevation. The contour maps and hydrographs below include available data that has undergone quality assurance and quality control processes. As such, coverage is limited and only part of the Basin is represented.

The groundwater level representative monitoring point (RMP) network consist of thirteen wells in the Basin. The distribution of monitoring wells is shown in Figure 2.1. The currently designed network satisfies DWR requirements with respect to spatial distribution and can be expanded using recently installed new instruments that will be evaluated over the first five years of implementation.

Figure 2.2 shows groundwater elevation timeseries for select wells in each hydrogeologic zone to illustrate the historical record of these wells. Appendix A.1, Groundwater Elevation Hydrographs for the RMP Network, provides hydrographs of water level wells in the RMP monitoring network. The hydrographs include measurable objectives, management triggers, and minimum thresholds for each RMP. All interim milestones are set to remain within the MO for each RMP. Wells show rising water levels consistent with the above normal precipitation compared to prior drought conditions. Nine wells have measured water levels out of 13 wells in the RMP network for Fall 2023 (Table 2.1). Three wells do not have data because of nearby pumping or temporary inaccessibility. The status of the water levels measured at the RMPs in comparison to their SMCs is shown in Figure 2.3. As displayed, all fall water year 2023 water level measurements are above their minimum thresholds. Of the nine RMPs measured with measured water level in water year 2023, four were above their MO, and five were above their MT.

Wells in addition to the water level RMP wells are used to evaluate groundwater level conditions in the basin. These wells are not RMPs as they do not have defined SMC. Hydrographs for these wells are provided in Appendix A.2, Additional Groundwater Elevation Hydrographs. Figure 2.4 and Figure 2.5 display groundwater elevation contours for the seasonal high and low groundwater conditions, typically observed in March and October, respectively. If available, water level data from additional wells not included in the RMP network is used to create these contour maps. As displayed in the figures, during both seasons measured groundwater levels were low in the eastern portion of the Basin near the towns of Mount Hebron, Macdoel, and Dorris and highest in the central northern and southwest areas of the Basin.

2.1.1 Water level monitoring network status update

One well in the DWR maintained CASGEM network was removed at the landowner's request. The RMP with CASGEM ID 419021N1219431W001 was removed after collecting twice-annual data almost continuously since 1978. Considerable redundancy was built into the RMP network in the event of a well loss in the RMP and no replacement is currently available for this well. This was the third deepest well in the RMP network and represented a data point in the East side of the valley between Macdoel and the City of Dorris. It was completed to a depth of 1,031 feet bgs making it slightly deeper than nearby irrigation wells which are typically completed between 400 and 600 feet bgs, and significantly deeper than nearby domestic wells which are completed less than 100 feet bgs. Currently, two other wells exist which continue to monitor this depth interval in Butte Valley. No suitable replacement monitoring well is currently available for inclusion in the CASGEM network.

As detailed above, three wells do not have water level measurements because of nearby pumping or temporary inaccessibility. If issues with well access or measurements continue, appropriate steps will be taken to determine if the well should be removed from the network, and if a future replacement well is needed. An additional option the GSA is considering is the installation of a sensor for continuous measurements at these wells. Updates on the status of the water level monitoring network will be provided in following Annual Reports.

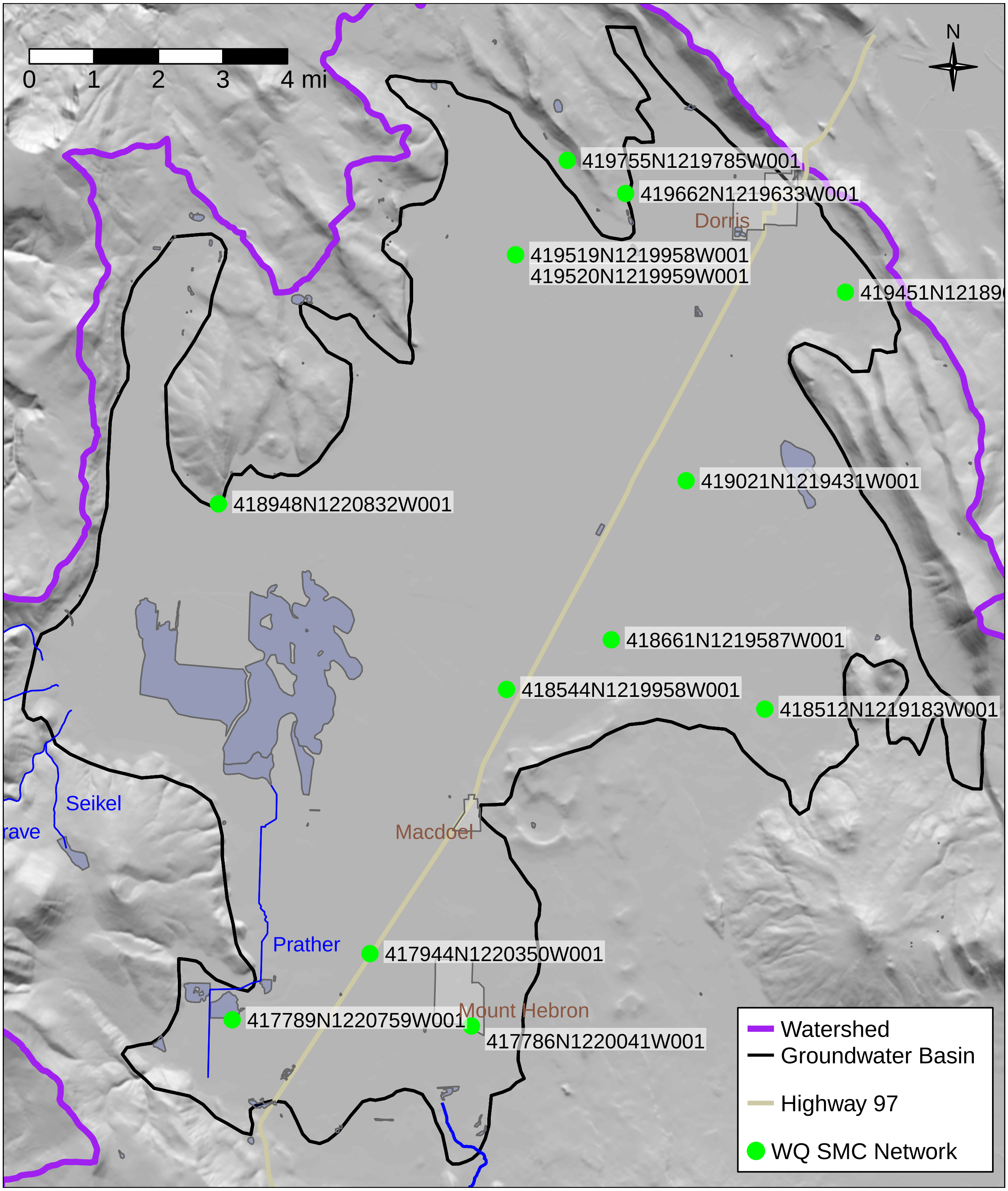


Figure 2.1: RMP Wells in the Water Level Monitoring Network.

Table 2.1: Comparison of Fall 2023 groundwater level measurements to SMC values. Measurements represent units of feet above mean sea level (ft amsl) and fall low is defined as the maximum depth to groundwater during the period September 15 - October 31, 2023.

Representative Monitoring Point/Well	WY 2023 Fall Low (ft amsl)	Measurable Objective Minimum (ft)	Measurable Objective Maximum (ft)	First Management Action Trigger (ft)	Soft Landing Trigger (ft)	Extended Minimum Threshold (ft)	Status
417786N1220041W001	4181.53	4181	4225	4163.0	4145	4130	Above MO
417789N1220759W001	NA	4213	4237	4208.0	4203	4188	No measurement
417944N1220350W001	4219.83	4190	4225	4187.5	4185	4170	Above MO
418512N1219183W001	NA	4193	4214	4187.0	4181	4166	No measurement
418544N1219958W001	4205.92	4211	4224	4203.0	4195	4180	Above MT
418661N1219587W001	4187.50	4186	4214	4174.5	4163	4148	Above MO
418948N1220832W001	4205.57	4193	4216	4181.5	4170	4155	Above MO
419021N1219431W001	NA	4203	4216	4196.0	4189	4174	No measurement
419451N1218967W001	NA	4129	4158	4126.5	4124	4109	No measurement
419519N1219958W001	4224.74	4229	4237	4226.0	4223	4208	Above MT
419520N1219959W001	4228.64	4231	4242	4228.5	4226	4211	Above MT
419662N1219633W001	4155.76	4161	4199	4150.0	4139	4124	Above MT
419755N1219785W001	4173.90	4187	4217	4179.0	4171	4156	Above MT

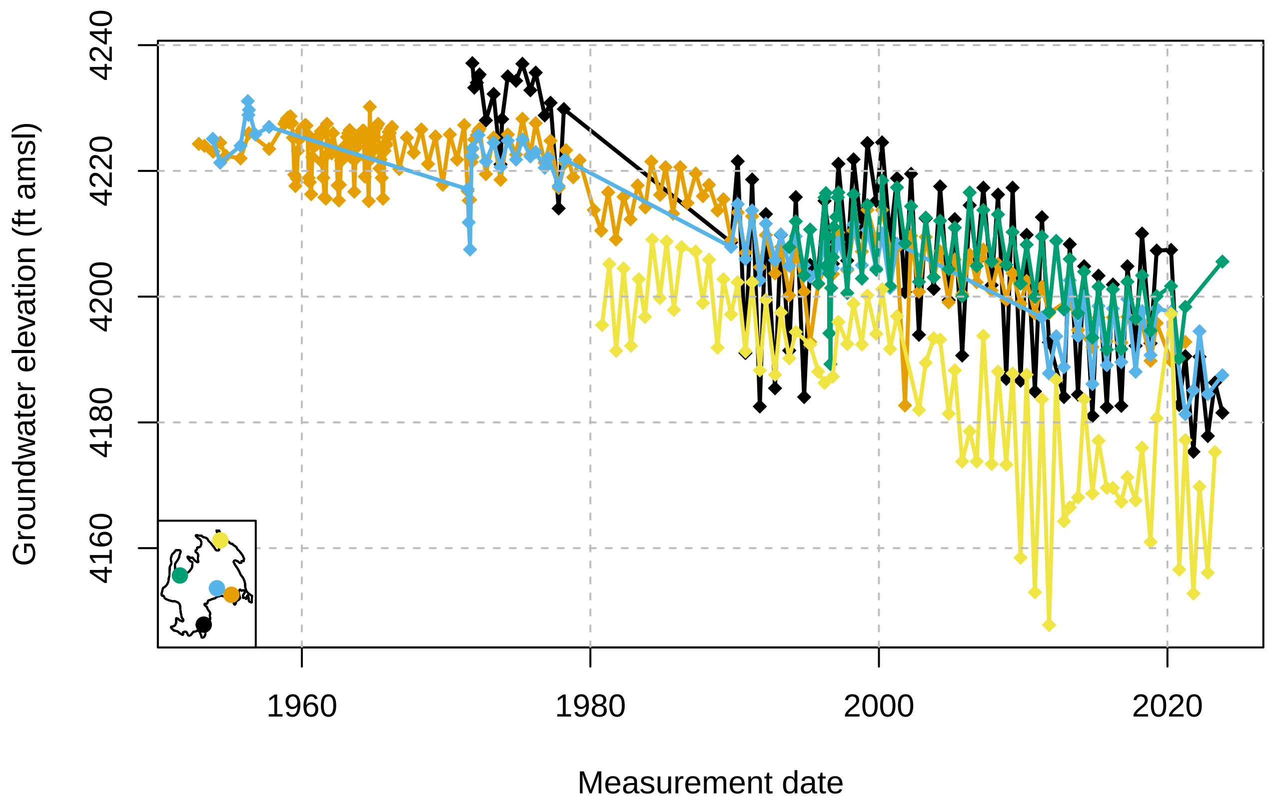


Figure 2.2: Groundwater elevation measurements over time in five wells, one located in each hydrogeologic zone.

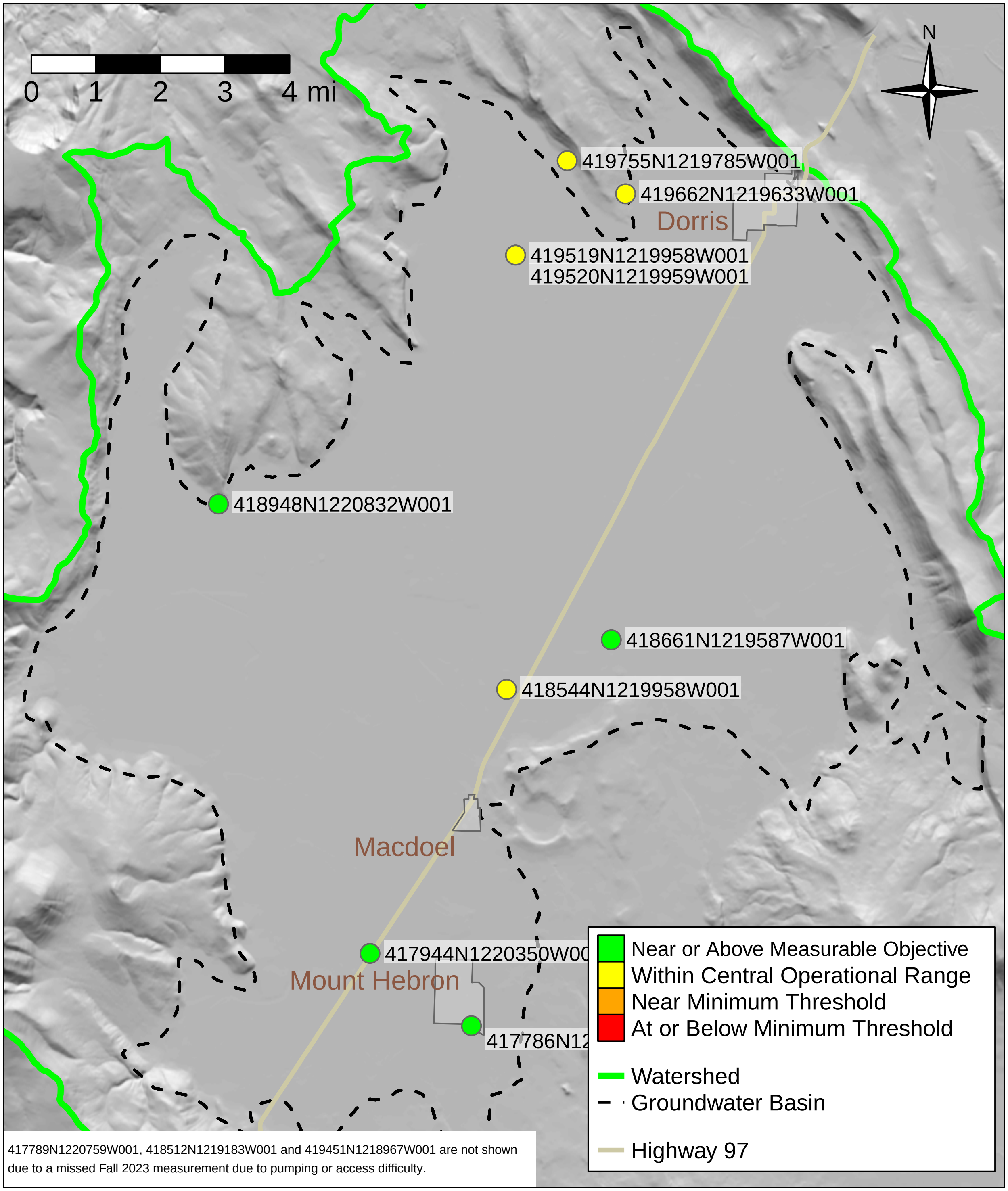


Figure 2.3: Status of the groundwater level RMP networks for Fall 2023.

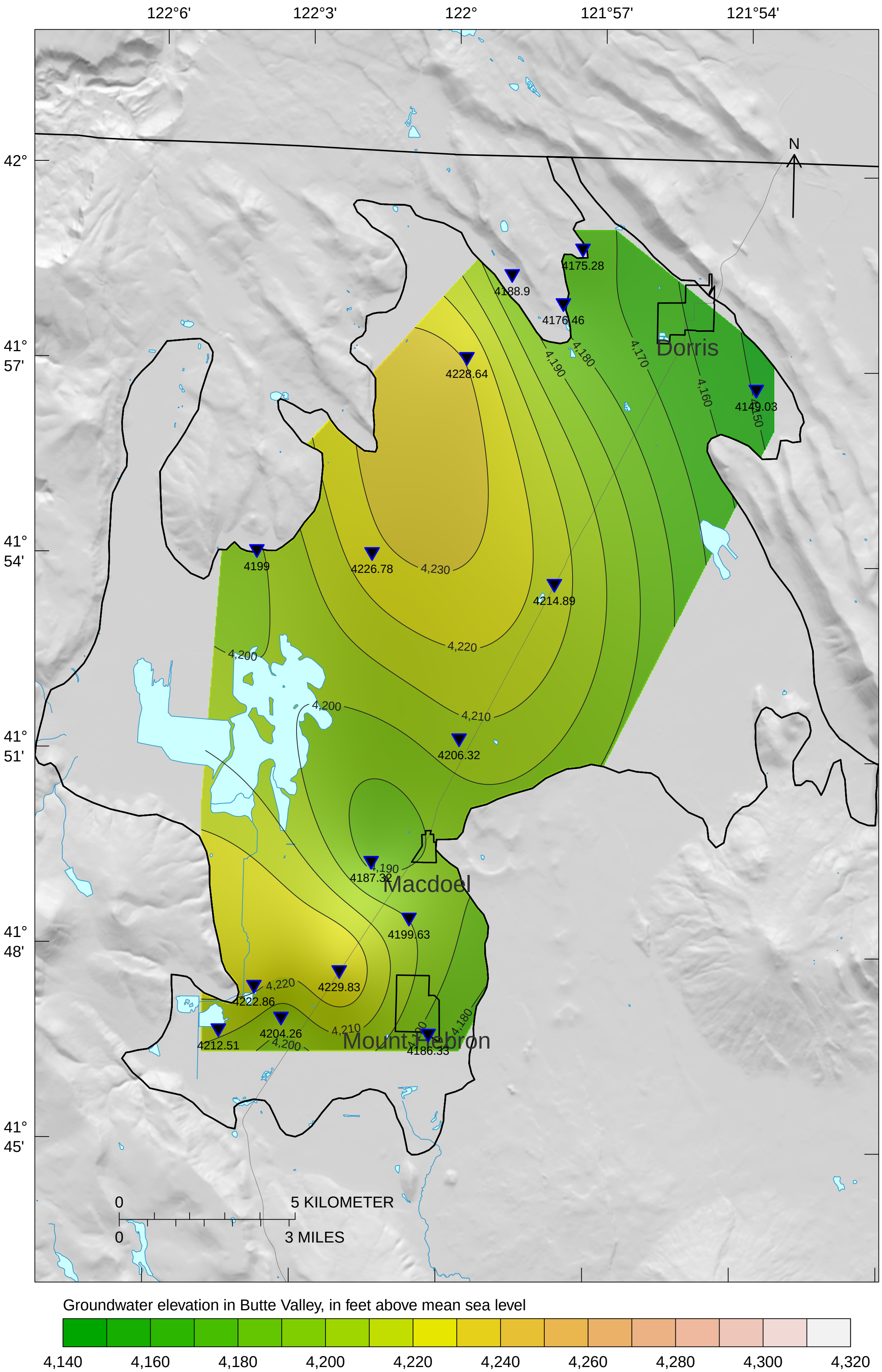


Figure 2.4: Butte Valley Groundwater Elevations, Spring 2023 in terms of feet above mean sea level (ft amsl).

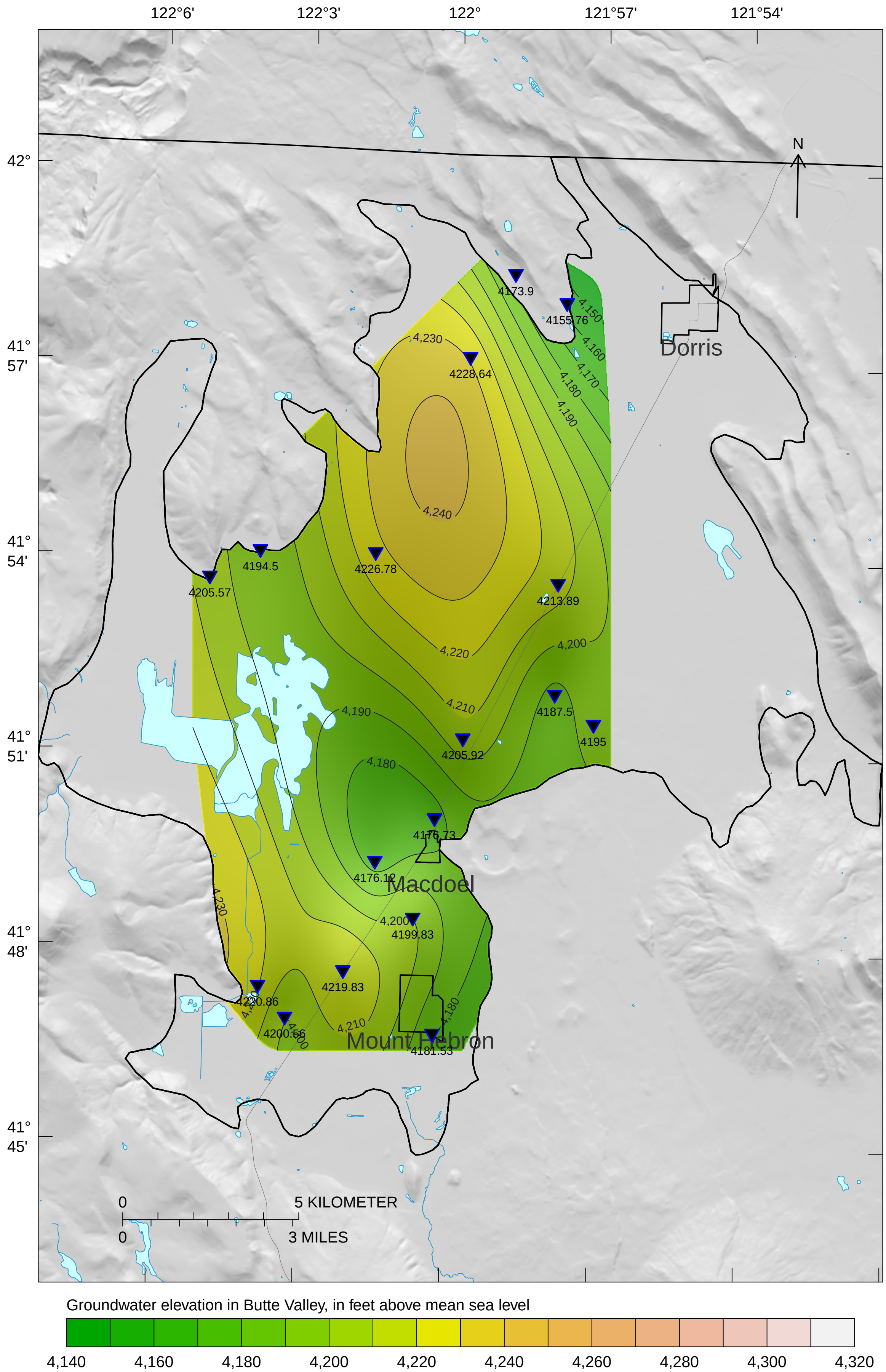


Figure 2.5: Butte Valley Groundwater Elevations, Fall 2023 in terms of feet above mean sea level (ft amsl).

2.2 Groundwater Extractions

For WY 2023 (October 1, 2022 to September 30, 2023), groundwater pumping was estimated using the Butte Valley Integrated Hydrologic Model (BVIHM). The WY 2023 estimate groundwater extraction from BVIHM in Butte Valley is provided in Figure 2.6. Agricultural groundwater pumping is extracted from BVIHM based on the 2020 County Land Use Survey and annual precipitation and is estimated to be 63,000 AF for water year 2023. The general location of agricultural pumping is presented in Figure 2.6. An estimate for urban/domestic groundwater extraction is 400 acre-feet based on the basin population reported by DWR [1] (1,464 people) and assuming an average annual water use of 1 acre-foot per 3.5 persons. In Figure 2.7, areas of agricultural land use correspond with regions of agricultural pumping, while Figure 2.8 (panel B) displays the number of production wells in each Public Land Survey System (PLSS) section. The locations of urban and domestic land use is presented in Figure 2.7, and the density of domestic wells is shown in 2.8.

The amount of groundwater pumped for the managed wetlands in the Butte Valley Wildlife Area (BVWA) is estimated to be 3,000 AF, based on the amount needed to flood and maintain 2,000 acres of BVWA land. The location of the managed wetlands managed by the California Department of Fish and Wildlife (CDFW) and native vegetation managed by the United States Forest Service, including the Butte Valley National Grasslands, are presented in Figure 2.9.

The estimated value for overall groundwater extraction in WY 2023 is 66,400 acre-feet, based on an average of the estimated agriculture pumping range, urban/domestic groundwater extraction, and pumping for managed wetlands. A breakdown of groundwater extraction by water use sector for water year 2023 is provided in Table 2.2 and 2.3. Notable data missing from this estimate is the amount of groundwater used by native vegetation, such as the Butte Valley National Grasslands. The BVIHM is currently undergoing substantial redevelopment, including the addition and evaluation of new data, in response to conversations with DWR staff.

2.3 Surface Water Supply Used for Groundwater Recharge or In-Lieu Use

Surface water supply is a data gap that will be addressed in WY 2024. All surface water entering the Basin is in-lieu use or recharged to groundwater, however the Basin does not have any stream gages on any surface waters entering the Basin. One stream gage was installed in WY 2021 on the Butte Creek diversion, outside the Basin near Cedar Mountain. However in WY 2022 the stream gauge was damaged and the record is incomplete and only stage data was collected with no flow data. If the stream gauge is repaired and data is available, it will be provided in the annual report for WY 2024.

2.4 Total Water Use

The total water use estimated in WY 2023 is shown in Table 2.3 by water use sector. Note that the estimate does not include groundwater used by native vegetation and surface water supply, which

[1] {https://gis.water.ca.gov/app/bp-dashboard/final/}

are data gaps pending to be addressed.

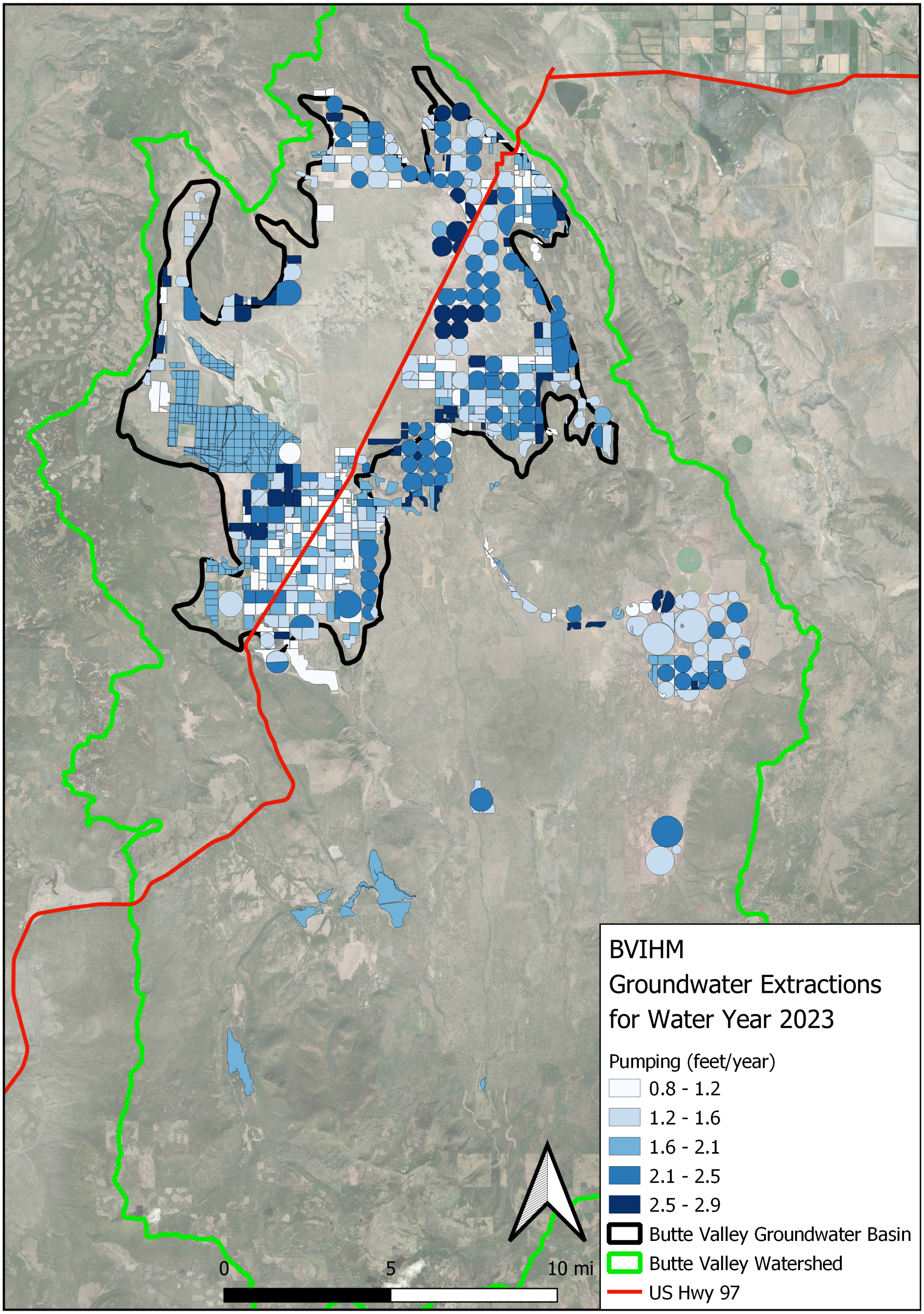


Figure 2.6: Spatial distribution of groundwater extraction based on the BVIHM groundwater model simulation for WY 2023.

Table 2.2: Groundwater Extraction in WY 2023 by water use sector.

Water Use Sector	Groundwater Extraction (AF)	Method	Accuracy
Urban / Domestic	400	Estimate	80-90%
Industrial	0		
Agricultural	63000	Estimate	60-70%
Managed Wetlands	3000	Estimate	90-100%
Managed Recharge	0		
Native Vegetation	Data Gap		

Table 2.3: Total Water Use in WY 2023 by water use sector.

Category	Water Use Type/Sector	Applied Water (AF)	Method	Accuracy
WY 2023 Total	Total Water Use	66400	Estimate	60-70%
Water Source Type	Groundwater	66400	Estimate	60-70%
	Surface Water	Data Gap		
	Recycled Water	0		
	Reused Water	0		
	Other	0		
Water Use Sector	Urban / Domestic	400	Estimate	80-90%
	Industrial	0		
	Agricultural	63000	Estimate	60-70%
	Managed Wetlands	3000	Estimate	90-100%
	Managed Recharge	0		
	Native Vegetation	Data Gap		
	Other	0		

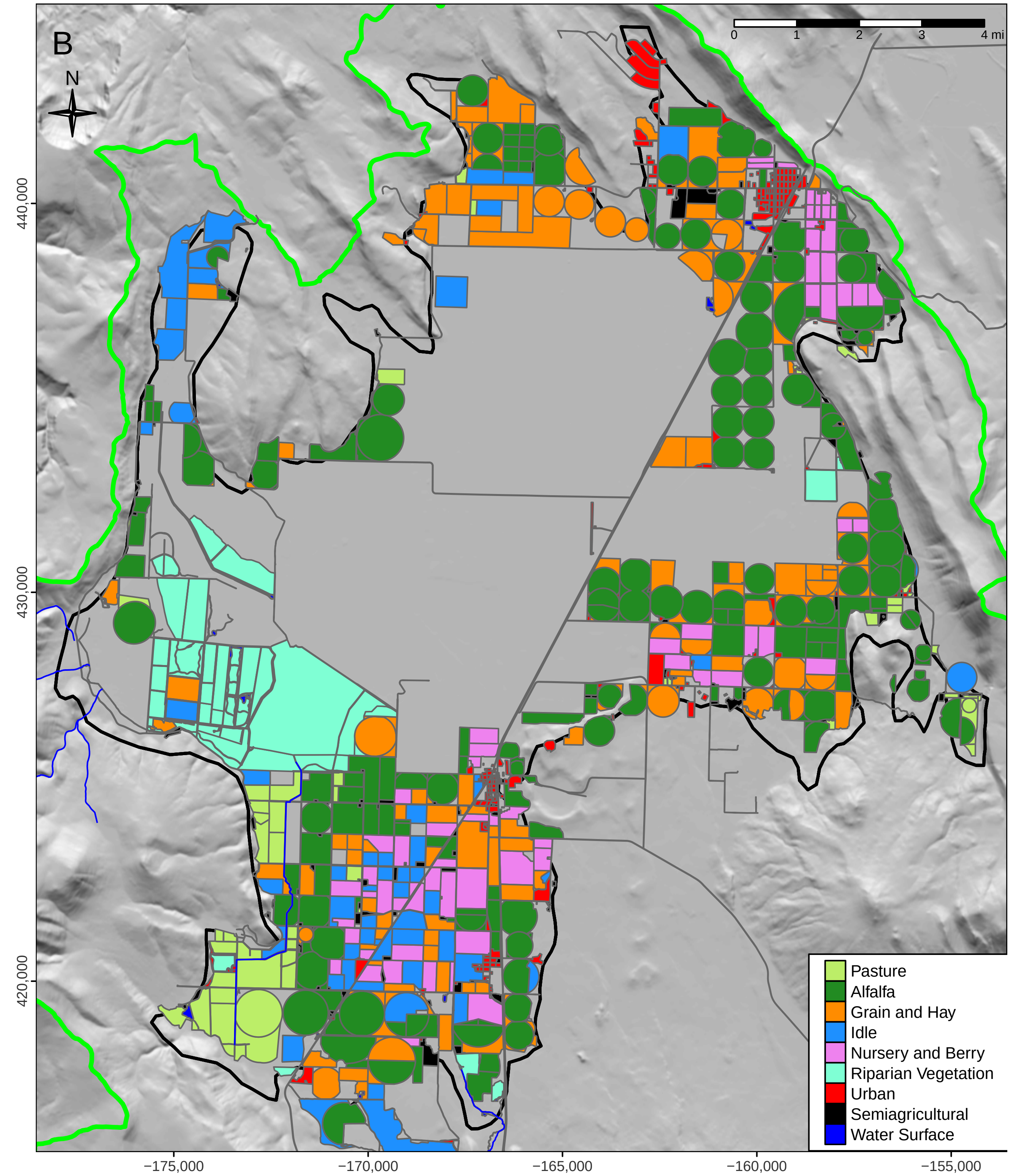


Figure 2.7: Land uses within the Butte Valley Groundwater Basin boundary taken from the DWR 2010 Land Use Survey.

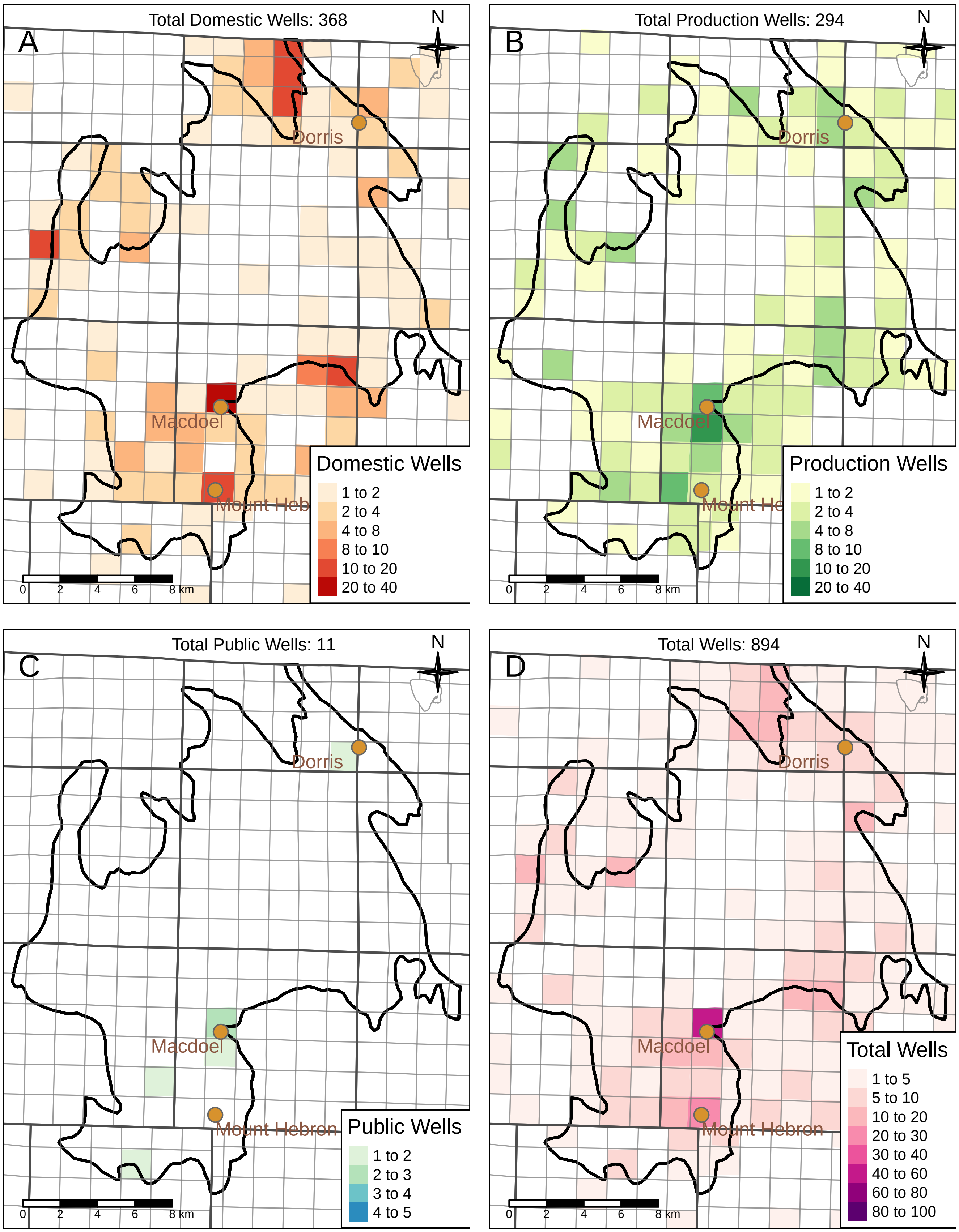


Figure 2.8: Choropleth maps indicating number of domestic (panel A), agricultural production (panel B), and public (panel C) Well Completion Reports present in each Public Land Survey System (PLSS) section, based on data from the DWR Online System for Well Completion Reports (OSWCR). Panel D shows the sum of panels A-C. PLSS sections delineated on maps are nominally one square mile.

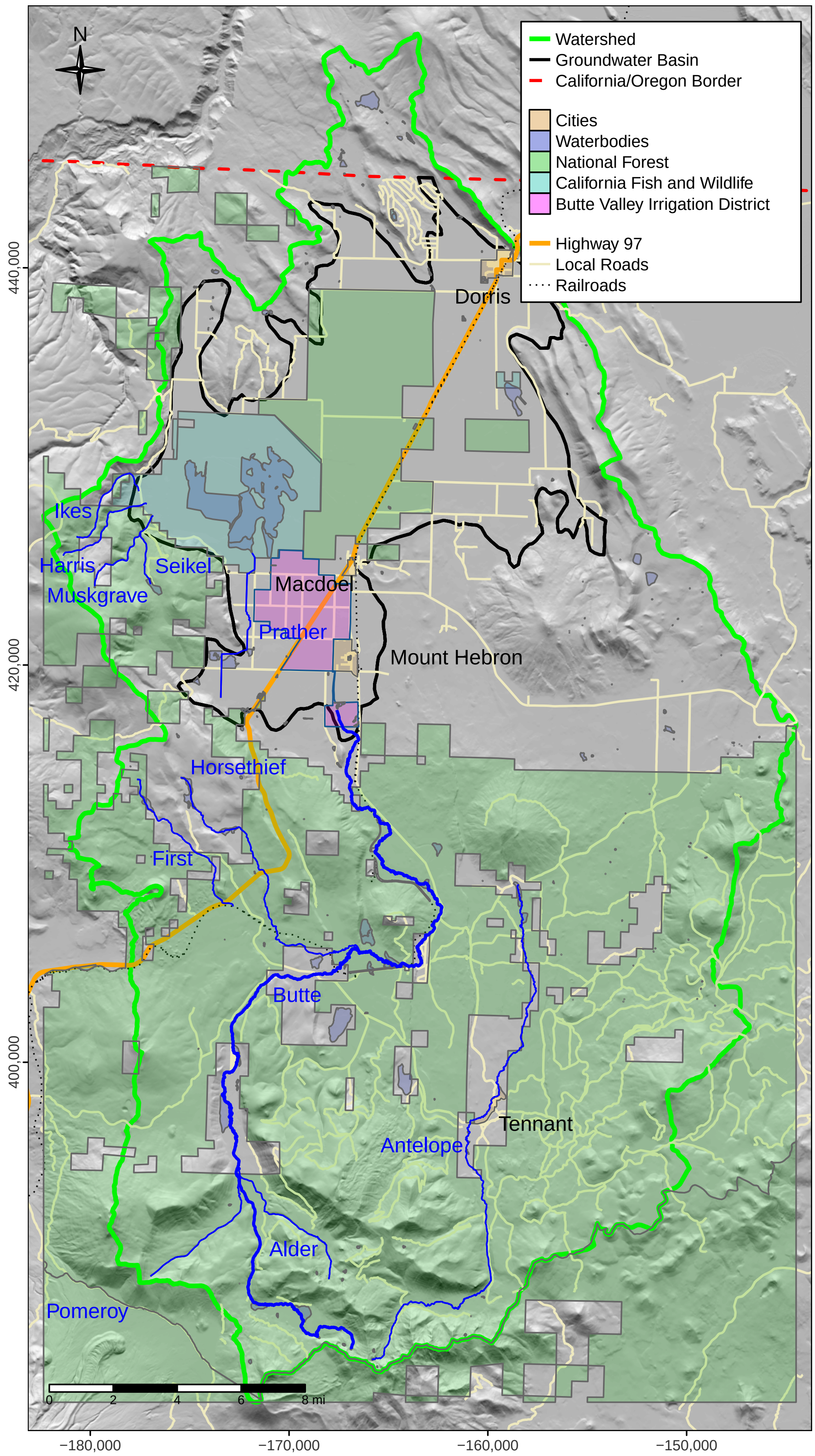


Figure 2.9: Butte Valley Watershed Jurisdictional Authorities.

2.5 Change in Groundwater Storage

This section provides quantified changes observed in groundwater storage based on BVIHM in WY 2023. The path to achieve MOs and interim milestones for the reduction in groundwater storage sustainability indicator are the same MOs and interim milestones as for the chronic lowering of groundwater levels sustainability indicator. Figure 2.10 depicts water year type, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the Basin. Results are extracted from the BVIHM based on historical data to the greatest extent available. The change in storage for WY 2023 is estimated to be 16 TAF (Figure 2.10). The groundwater storage has partially recovered due to the above normal precipitation in WY 2023 compared to the prior three years of drought.

The spatial map showing change in groundwater storage for the Basin is calculated based on the change in groundwater levels between fall of this report's water year (WY 2023) and previous water year (Figure 2.11). Figure 2.11 indicates that between water year 2022 and 2023, groundwater levels increased in most areas within the Basin with the exception of the central northwest region where measurements indicate groundwater level decline. Groundwater contours are cropped to the extent of the groundwater level monitoring points to avoid low accuracy contours, thus the groundwater storage change is only presented for the portion of the Basin where there is sufficient groundwater level data. Additionally, groundwater level stations are only used if they include data in both the current and previous year to avoid discrepancies in groundwater contour due to a lack of historic data. As previously noted, the BVIHM is currently undergoing substantial redevelopment in response to conversations with DWR staff, including the addition and evaluation of new data.

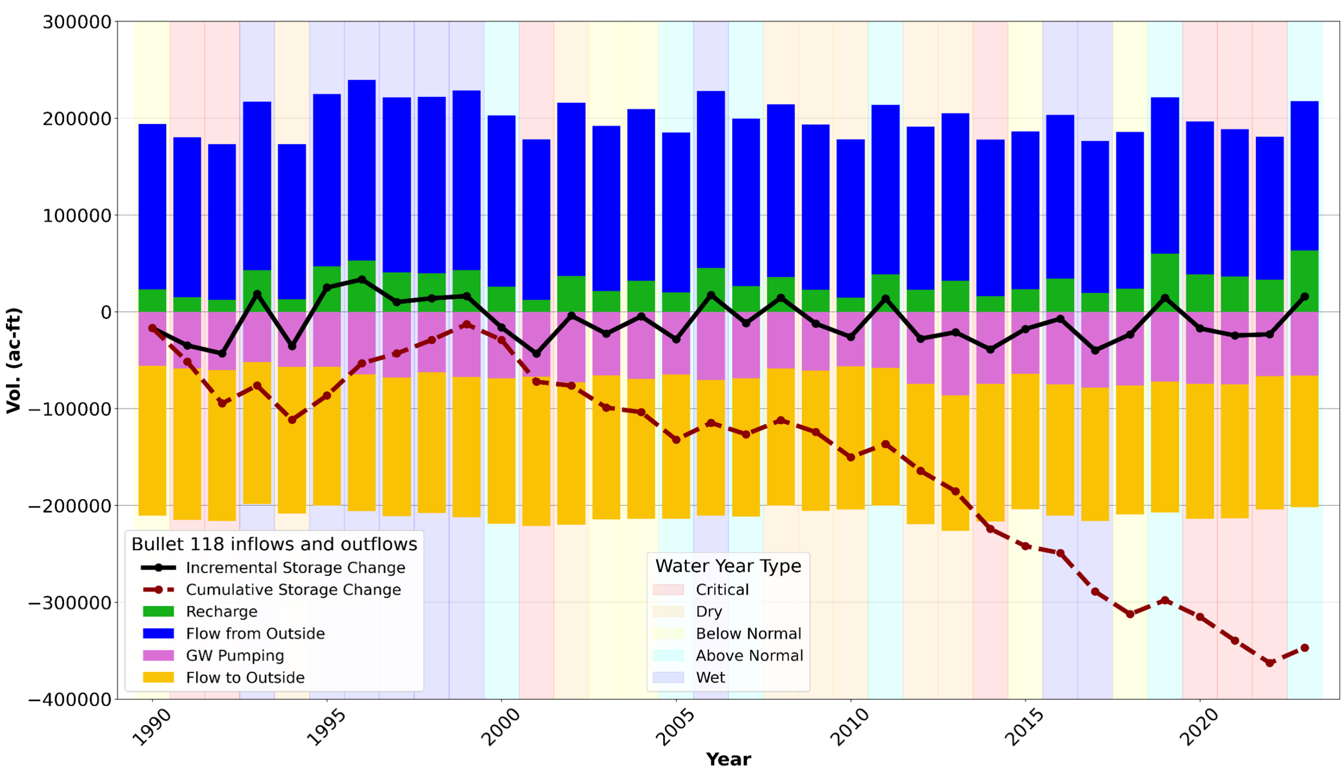


Figure 2.10: Groundwater storage change based on the BVIHM groundwater model simulation. Budget terms 'Flow from Outside' and 'Flow to Outside' refer to flow entering and exiting the groundwater basin boundary. Incremental storage change is equal to annual storage change.

2.6 Seawater Intrusion

This sustainability indicator is not applicable in this Basin.

2.7 Groundwater Quality

This section compares groundwater quality monitoring to the GSP's SMC and provides a summary of ongoing water quality coordination activities conducted by the GSA. Groundwater quality data for the evaluation is obtained from the Groundwater Ambient Monitoring and Assessment (GAMA) Groundwater Information System. Existing wells used for monitoring groundwater quality in the Basin include public water supply wells and monitoring wells, which are shown in Figure 2.12. The groundwater quality monitoring network is based on wells that are regularly sampled as part of existing monitoring programs for the constituents for which SMCs are set: arsenic (for selected wells near Dorris), nitrate, and specific conductivity.

Water quality data sampled within the RMP network in WY 2023 is shown in Table 2.4. The results are compared to the MT and MO for each of the groundwater quality RMPs in the network. The MT for nitrate as N is 10 mg/L (the Title 22 Primary Maximum Contaminant Level, or MCL), the MT for specific conductivity is 900 micromhos/cm (Title 22 Recommended Secondary Maximum Contaminant Level, or SMCL), and the MT for arsenic (for selected wells near Dorris) is 10 ug/L (the Title 22 Primary MCL). Interim milestones are set equivalent to the MO of each RMP well with the goal of maintaining water quality within the historical range of values. All data collected in water year 2023 is below its respective SMC. As shown in Table 2.4, only one RMP had water quality data for WY 2023, well CA4710001_003_003 which is a public supply well for the City of Dorris. The data for this well is below its defined SMC.

The two RMP wells "NEW HQ DOM" and "R168 DOM WELL" which were identified in the GSP are no longer monitored. California Department of Fish and Wildlife was intending to regularly monitor these two wells, but due to staffing changes the regular monitoring is no longer planned to occur. To ensure that current water quality data is available for future annual reports, efforts will be made to contact the monitoring entities of the wells with missing measurements to facilitate continued data collection. If this communication is not successful, a process to plan for the continued collection of representative water quality data will be developed. Options may include planning alternate monitoring entities for the wells, or inclusion of different wells in the network.

The GSP identifies constituents of interest within the groundwater basin: 1,2 Dibromoethane, Arsenic, Benzene, Boron, Nitrate and Specific Conductivity. As per the GSP, SMC are only set for Arsenic, Nitrate, and Specific Conductivity within the RMP network. 1,2 Dibromoethane (ethylene dibromide; EDB) and benzene are already being monitored and managed by the NCRWQCB through the Leaking Underground Storage Tank (LUST) program. Boron is naturally occurring. As such, SMC for EDB, benzene and boron are not needed. An SMC is defined for arsenic because, while it can be naturally occurring, there is arsenic contamination near Dorris from an unknown historical industrial source. Due to the localized contamination, arsenic SMCs are only defined for wells near Dorris. The GSA will monitor the naturally occurring constituents to track any possible mobilization of elevated concentrations. Constituents of interest with no SMCs but tracked by the GSA for mobilization are listed and compared to their MCL in Table 2.5.

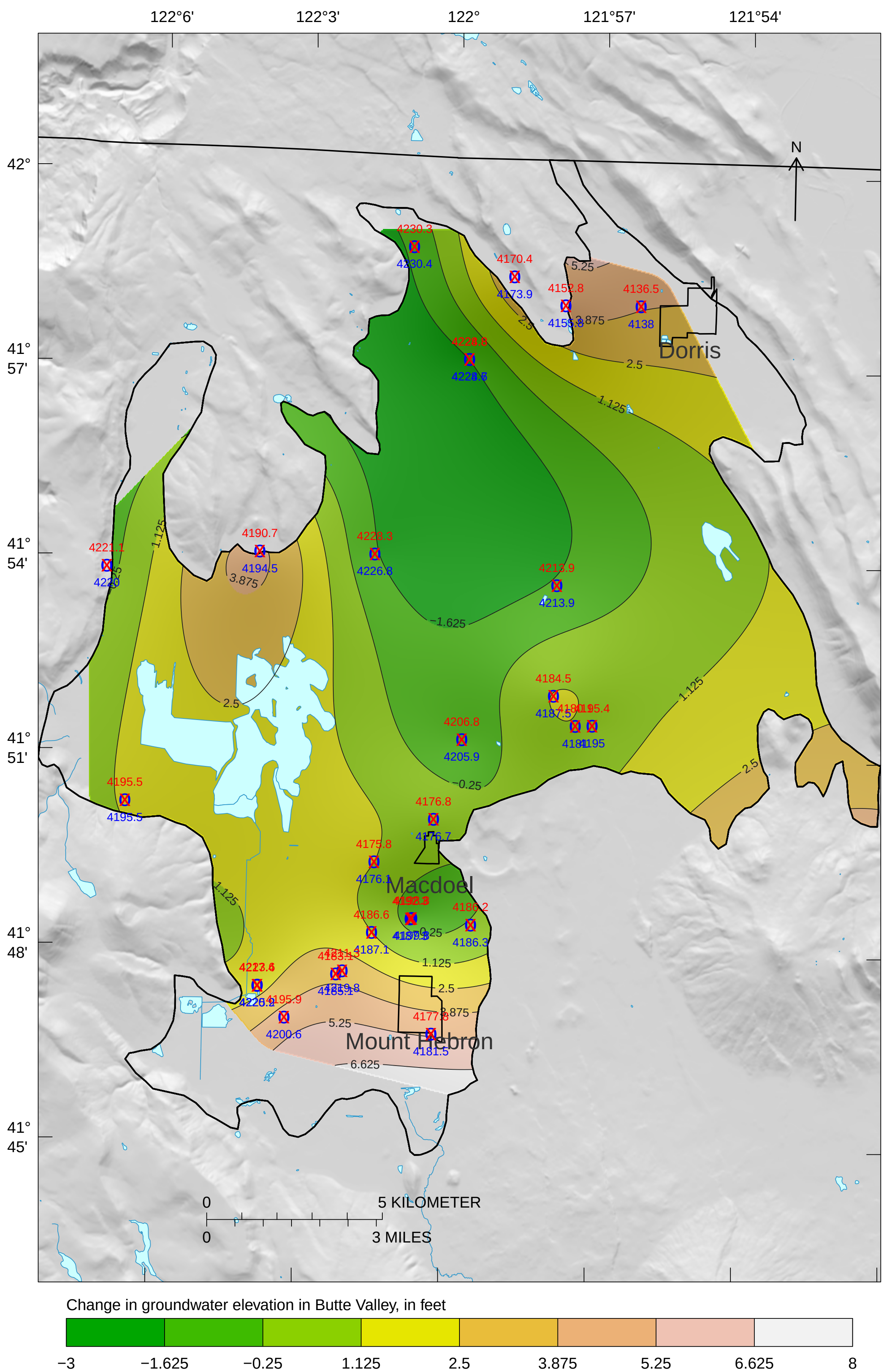


Figure 2.11: Fall groundwater elevation change between water years 2022 and 2023. WY 2023 is represented with blue text and WY 2022 is red.

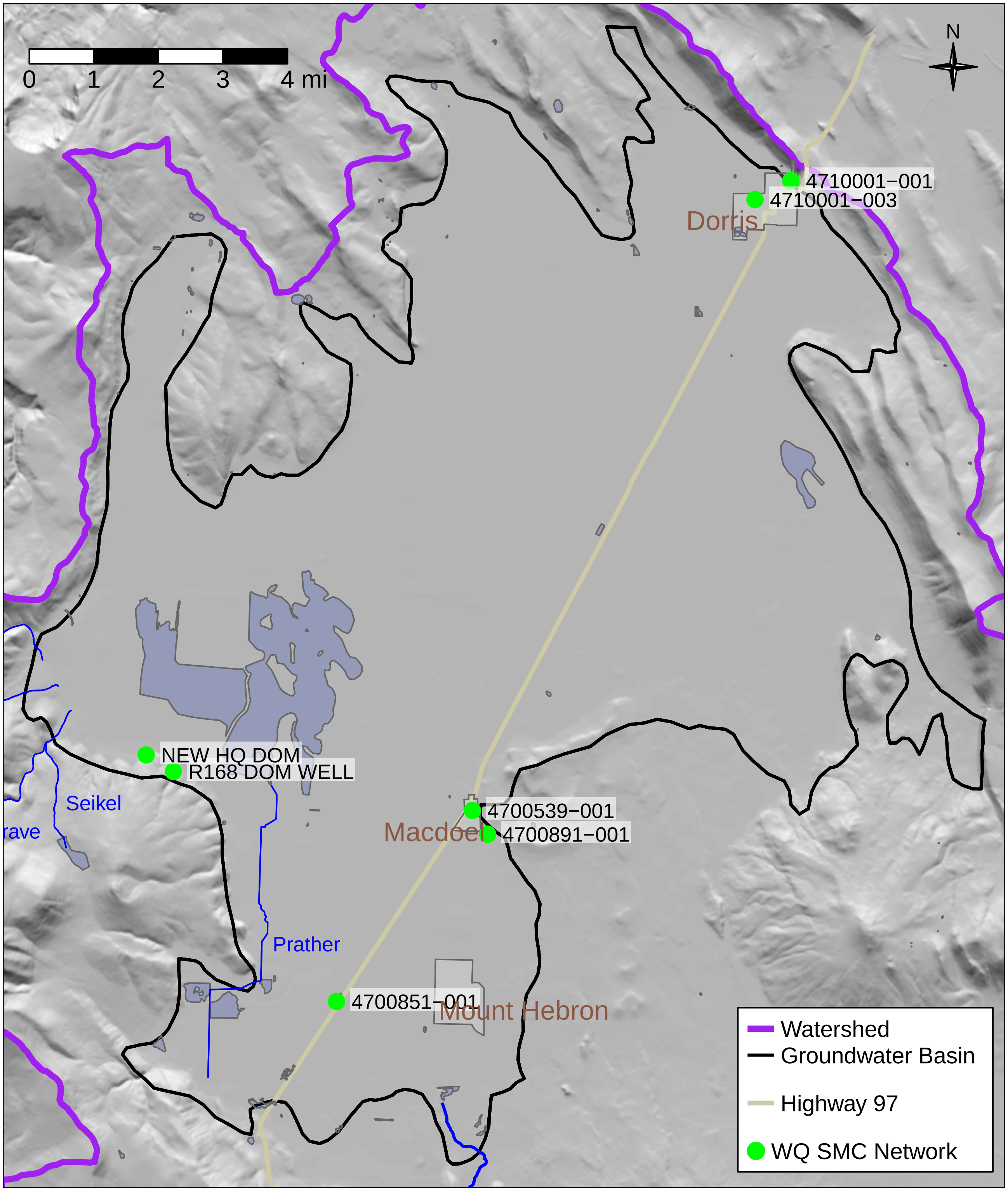


Figure 2.12: RMP wells in the Water Quality Monitoring Network.

Table 2.4: Water quality data from WY 2023 in the RMP network (Nitrate MT is 10 mg/L; Specific Conductance MT is 900 micromhos/cm; Arsenic MT (only near Dorris) = 10 ug/L).

Well ID	GSP ID	Nitrate MO (mg/L)	Nitrate WY 2023 Max Measurement (mg/L)	Status Nitrate	SC MO (umho/cm)	SC WY 2023 Max Measurement (umho/cm)	Status SC	Arsenic MO (ug/L)	Arsenic WY 2023 Max Measurement (ug/L)	Status Arsenic
CA4700539_001_001	4700539-001	5.2	NA	No measurement	430	NA	No measurement	No SMC	No SMC	No SMC
CA4700851_001_001	4700851-001	12	NA	No measurement	560	NA	No measurement	No SMC	No SMC	No SMC
CA4700891_001_001	4700891-001	4.7	NA	No measurement	NA	NA	No measurement	No SMC	No SMC	No SMC
CA4710001_001_001	4710001-001	0.71	NA	No measurement	460	NA	No measurement	18.6	NA	No measurement
CA4710001_003_003	4710001-003	0.4	<0.1	Within MO	349	NA	No measurement	2	NA	No measurement
NEW HQ DOM	NEW HQ DOM	0.26	NA	No measurement	192	NA	No measurement	No SMC	No SMC	No SMC
R168 DOM WELL	R168 DOM WELL	0.22	NA	No measurement	NA	NA	No measurement	No SMC	No SMC	No SMC

Note:
(*) MOs with NAs indicate that the analyte is not historically monitored at the well. Measurements equal to NA indicate that well was not monitored for the analyte in WY2023.

Table 2.5: Water quality data from WY 2023 for constituents without SMCs but tracked by the GSA.

Well ID	Analyte	Date	Result	Units	MCL
CA4700531_003_003	Arsenic	2023-03-03	<2	UG/L	10
CA4700531_003_003	Nitrate as N	2023-03-03	0.29	MG/L	10
CA4700531_003_003	Iron	2023-04-13	<50	UG/L	300
CA4700531_003_003	Manganese	2023-04-13	<0.5	UG/L	50
CA4700531_003_003	Benzene	2023-04-13	<0.5	UG/L	1

Table 2.5: Water quality data from WY 2023 for constituents without SMCs but tracked by the GSA. *(continued)*

Well ID	Analyte	Date	Result	Units	MCL
CA4700851_001_001	Benzene	2023-05-24	<0.5	UG/L	1

2.8 Subsidence

To monitor subsidence, the Basin relies on data provided by DWR based on Interferometric Synthetic Aperture Radar (InSAR), a satellite-based remote sensing technique that measures vertical ground surface displacement changes at high degrees of measurement resolution and spatial detail. This data is made available through the DWR SGMA Data Viewer [2] and shows overall subsidence less than 0.1 feet for the entire Basin during the water year 2023, which is within the statistical margin of error for this method based on analysis conducted for the Butte Valley GSP (Figure 2.13). This avoids the occurrence of undesirable results as defined by the GSP.

2.9 Interconnected Surface Water

Potential interconnected surface waters in the Basin cannot be determined without filling previously identified data gaps, as described in the GSP. With the receipt of grant funding though DWR's SGM Program Implementation Program, funds have been acquired to better evaluate and identify interconnected surface waters in the Basin. Results from this effort will be used to report on this sustainability indicator in future annual reports.

[2] https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#currentconditions

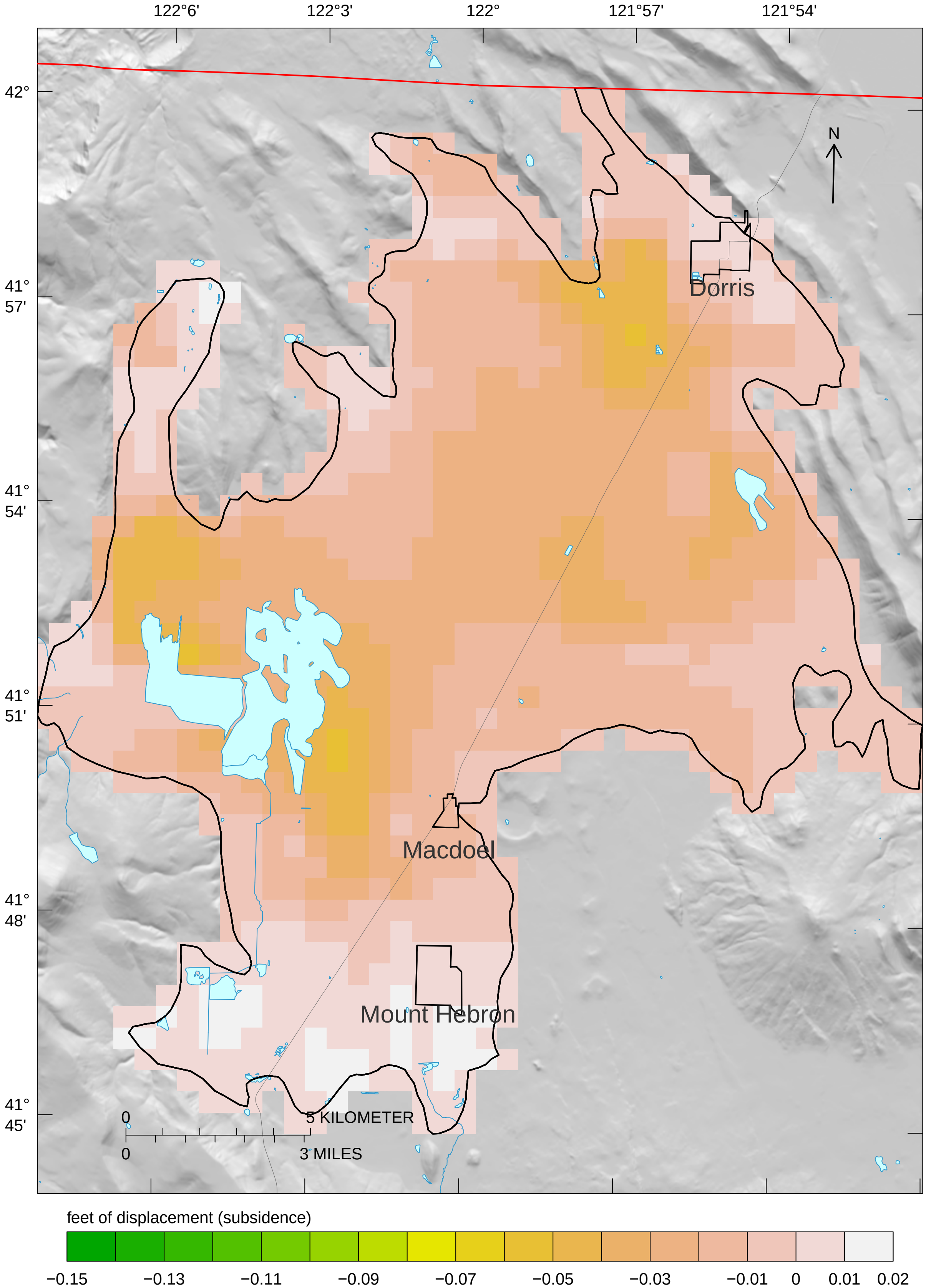


Figure 2.13: InSAR satellite measured total vertical subsidence (feet) in WY 2023. Note that the processed InSAR instrument and GIS conversion error is roughly +/-0.1 feet (https://gis.water.ca.gov/arcgisimg/rest/services/SAR).

Chapter 3

Plan Implementation Progress

3.1 Interim Milestones

Interim Milestones are anticipated to be achieved over the course of GSP implementation in increments of five years, pursuant to the CCR definition “Target values representing measurable groundwater conditions, in increments of five years, set by Agency as part of a Plan” [CCR Title 23, Division 2 §351(q)]. Progress toward achieving Interim Milestones since submitting the GSP are provided in the AR Section “Groundwater Basin Conditions”. Further updates are expected in the first Five Year Assessment for the GSP, with status checks provided in future annual reporting.

3.2 Implementation of Projects and Management Actions

This section provides updates on progress towards implementing the GSP, including implementation of projects and management actions since adoption of the GSP and the most recent annual report. This section also describes projects and management actions that the GSA is coordinating with other agencies:

Water Level Monitoring Network - The expanded monitoring network is being used to collect new data from new locations across Butte Valley. A voluntary monitoring program has been started to measure 24 wells for depth to groundwater. This data is currently being collected on an evaluation basis for future inclusion in the GSP 5-year update and numerical groundwater models. Currently, the hand-collected voluntary monitoring network is concentrated in the vicinity of the Butte Valley Irrigation District, Macdoel, and northeast of Macdoel near Shady Dell Road. None of these wells have sufficient history for use as RMPs, however they may be included during a future GSP update. The continuous monitoring network developed during the first four years of GSP development and three years of implementation is undergoing continued maturation and data collection. During water year 2023, ten continuous groundwater monitoring stations were active in the Butte Valley basin. None of these wells have sufficient history for use as RMPs, however they may be included during a future GSP update.

Data Gaps and Data Collection - Steps were taken to reduce data gaps in the Basin including the installation of continuous groundwater level and surface water monitoring sites to monitor and support the implementation of planned projects and management actions. These sites will also be used to improve representation of the Basin's different hydrogeologic units. During the August 2023 Advisory Committee meeting an ad hoc group was formed with members of the public to address data gaps in the Basin. In fall 2023 the group met to identify and prioritize the Basin's existing data gaps and provided input on how to fill the gaps. Data gaps discussed by the ad hoc group include the groundwater quality and level monitoring network, lack of spring and flow monitoring as related to interconnected surface water, and the need to identify groundwater dependent ecosystems. Lack of groundwater extraction data and the need for additional precipitation data were also discussed. Geophysical data collected during airborne electromagnetic (AEM) surveys was collected and analysis was conducted by the technical team. The AEM data partially covered the Basin, but will increase confidence in the model. Additionally, the surface water-groundwater transect monitoring was continued by the Shasta Valley Resource Conservation District.

Butte Valley Integrated Hydrogeologic Model (BVIHM) Model Update - Evaluation and further calibration of the current groundwater surface water model was conducted. Geophysical data collected during the AEM surveys was used to develop and inform the new geological model. The runoff and recharge components of the Butte Valley Precipitation Runoff Modeling System (PRMS) model was extended to water year 2023.

Grant Applications - In late summer 2023, the GSA was awarded a grant from DWR's Sustainable Groundwater Management (SGM) SGMA Implementation Program (SGM Implementation Grant Program), which includes components covering a range of PMA's including additional surface water-groundwater characterization and to increase the monitoring network. The Implementation Grant plans to help achieve groundwater sustainability by increasing groundwater availability, reducing water losses, improving understanding of surface water-groundwater interaction, and creating an inventory of all wells in the basin. Development of the Implementation Grant required subcommittees to prioritize PMAs and GSP activities for funding.

Small Community Drought Relief Grant Funding - This grant was awarded to the City of Dorris in response to drought and well outages, to create a domestic well deepening program and complete repairs to the City water distribution network. Work conducted during WY 2023 included development and distribution of a domestic well survey, initial field work to identify domestic wells, review of well surveys received, and efforts to identify drillers to conduct the repairs and site visits to wells reporting problems based on survey responses. In early 2023, a well outage survey was developed and distributed to approximately 400 local addresses. Of the 20 survey responses that were received, 10 reported wells needing repair or replacement. Site visits were conducted in June and September 2023 to evaluate the repairs needed. The City of Dorris is currently seeking qualified drillers for the well repair or replacement.

Well Drilling Permits - The GSA is continuing to work with the Siskiyou County Environmental Health Department's well permitting staff to develop a new "Well Permitting Guidance Document" that will update the County well permitting policies and comply with the Governors Executive Order (N-7-22, which language specific to well permitting is now under EO N-3-23). The County presented information related to the well permitting process at the Advisory Committee meetings, and input was received and incorporated into the draft process. Information included updated definitions of replacement wells and well deepening projects, clarification on well types, and how impacts to nearby wells will be evaluated

Public Outreach - The GSA has continued public outreach by visiting local well owners who report concerns about groundwater levels in their wells and also worked to develop opportunities to improve monitoring and data collection to aid the GSA in characterizing and improving groundwater reliability. Quarterly Advisory Committee meetings, open to the public, were also conducted.

3.3 Activities Anticipated for WY 2024

The GSA intends to continue activities necessary to implement the GSP and put the Basin on a path toward sustainable management. This section provides an overview of implementation activities anticipated over WY 2024.

- Data Gaps and Data Collection - The GSA plans to continue the installation of continuous groundwater level and surface water monitoring sites to support the implementation of planned projects and management actions. These new monitoring sites will improve the representation of groundwater levels throughout the Basin and improve the representation of the different hydrogeologic units. Data gaps related to groundwater-surface water connectivity will continue to be evaluated and addressed in the Basin. The installation of permanent stream gages to measure surface flows will occur at multiple sites. New stream gages are planned to be installed on Harris, Ikes, Musgrave, and Prather Creeks during WY 2024. Information and data will be provided in the annual report for WY 2024 when they becomes available.
- Domestic Well Deepening (Small Community Drought Relief grant funding) - The City is in the process of issuing a contract for the replacement of 3-4 domestic wells. The well replacements will be scheduled for the Spring of 2024. This funding is not anticipated to meet the full demand for well deepening in the Basin.
- TSS well installation - multi-depth nested well installed at the Butte airport by DWR in 2023 will begin submitting data online in 2024.
- Stream gage repair - The damaged stream gage on the Butte Creek diversion is scheduled to be repaired during early WY 2024. Information and data will be provided in the annual report fo WY 2024 when they becomes available. Development of a rating curve will continue in 2024.
- Well inventory program - During the upcoming water year the GSA is initiating the Well Inventory Program. The Program will utilize datasets from the County and Department of Water Resources to identify wells in the Basin and create a database to store relevant data related to the inventory. Information from the Well Inventory will be incorporated into the model and also be used to inform an upcoming Fee Study that will be conducted to identify options to fund groundwater management in the Basin.
- Butte Valley Integrated Hydrogeologic Model (BVIHM) Model Update - Evaluation and further calibration of the current groundwater surface water model will be conducted. The geologic model will continue to be refined and calibrated, and will be incorporated to the groundwater model.
- Irrigation Efficiency Improvements - In early 2024 an Efficient Agricultural Water Management Workshop will be held in coordination with the University of California Cooperative Extension and the Tehama Resource Conservation District. The Workshop will provide information on a Mobile Irrigation Lab that can provide on-site evaluations of irrigation systems and provide comprehensive reports to producers that detail how their irrigation system is performing, including tips, suggestions, and recommendations based on data collected during the inspection.
- Well Permitting - The GSA is working with Siskiyou County Environmental Health Department's well permitting staff to develop a new "Well Permitting Guidance Document" that will update the county well permit- ting policies, along with complying with the Governors Executive Order (N-7-22, which language specific to well permitting is now under EO N-3-23).

3.3.1 Coordination

3.3.1.1 State Water Resources Control Board

GSA staff meets biweekly with SWRCB staff to discuss updates and activities related to SWRCB's Emergency Regulation Curtailments. The two parties discuss updates to curtailment actions in place, including Local Cooperative Extensions (LCS) and activities that may have impacts on groundwater management.

3.3.1.2 Technical Support Services Well

The Technical Support Services well was drilled in Butte Valley during spring 2023 by the California DWR. At the time of this report the data for this well is not yet available online, but preliminary data has been shared with the GSA. The well is located near the County owned airport in Butte Valley and is completed to multiple depths with target depths of 120 feet, 235 feet, 870 feet, and 1095 feet below ground surface, providing discrete data on shallow, intermediate shallow, intermediate, and deeper aquifer systems. Although no distinct aquifers were identified in Butte Valley, ages and compositions of water vary with depth, as do the users of water throughout the valley. Domestic wells are typically shallow while irrigation and city production wells are typically deeper.

3.3.1.3 Aerial Electro-Magnetic Survey

The data and report from the DWR funded Aerial Electro-Magnetic (AEM) Survey conducted in Butte Valley prior to the release of the GSP was published in late 2022. Data from this report has been reviewed and is included in the revised geologic models or hydrogeologic models of the Basin. Based on initial review, AEM data in the Bulletin 118 study area is sufficient to refine the thickness of some basalt features critical to hydrogeological modeling. Due to a limited number of well logs in the study area and obstacles encountered during flight path selections, some areas needing additional study do not have significant refinement. Critical recharge areas in Butte Valley are in the basin boundary and the upland to the south and south west. These areas were outside the DWR funded AEM study area. The AEM method is most effective at defining sedimentary features, but due to the geology of Butte Valley, significant pumping, transport, and recharge occur in volcanic structures which are poorly defined by AEM study. Additional work is needed to determine the dimensions and interconnectivity of recharge areas around the Bulletin 118 boundary which will be critical for long term water management.

3.3.1.4 Dorris Water Meter Installation Project

The City of Dorris has received construction funding through the Drinking Water State Revolving Fund (SRF) for installation of residential water meters, school water meters, and replacement of aging water mains. The project quantities are as follows:

- Residential meter installation - 410
- School meters - 2
- 6" water main - 3,850 lineal feet (approximately 7% of the system's piping)

The domestic meter installation and pipeline replacement programs are ongoing.

Additionally, the City of Dorris was awarded a State of California Department of Housing and Community Development (CDBG) grant for construction of an additional 1 MG water storage reservoir which was completed in 2018.

3.3.2 Addressing Deficiencies for Butte Valley GSP

On January 18, 2024, DWR determined that the Butte Valley GSP is “incomplete” and provided the Basin’s GSA with corrective actions with 180 days (by July 16, 2024) to address the identified deficiencies. The major deficiencies are as follows:

A. The GSA should revise the GSP to provide a reasonable assessment of overdraft conditions using the best available information and describe a reasonable means to mitigate overdraft.

B. The GSA must provide a more detailed explanation and justification regarding the selection of the sustainable management criteria for groundwater levels, particularly minimum thresholds and measurable objectives, and quantitatively describe the effects of those criteria on the interests of beneficial uses and users of groundwater.

The Butte Valley GSA and its technical team will collaborate closely with DWR to address the deficiencies and get the Basin on an approved path towards sustainable management. The first consultation meeting between GSA and DWR’s Sustainable Groundwater Management Office’s (SGMO) staff was conducted on February 5, 2024. And the second consultation meeting will be conducted on March 11, 2024.

Appendix A - Groundwater Elevation Hydrographs

The hydrographs used to set the minimum thresholds (MT) and measurable objectives (MO) for each representative monitoring point are shown in the following figures (Appendix A.1). Data points used to calculate the MTs and MOs are marked with a red dot. The groundwater level data used in the regression to calculate minimum thresholds have gone through a quality assurance and quality control (QAQC) process that removes data from the analysis for the following reasons:

- Oil or other foreign substances were floating at the groundwater surface inside the well and the data had high uncertainty as a result.
- The well was pumped recently.
- During the minimum threshold process and generation of a regression equation, a data point was deemed an outlier, which may result from the interference of drawdown from nearby wells.

Appendix A.2 shows general hydrographs for the larger GSP monitoring network, including wells for which SMCs were not defined. Water Year Types from WY 2019−2023 have been updated in hydrographs below. Note that these are preliminary results calculated based on SGMA Water Year Type Dataset Development Report. The results will be finalized once DWR updates the water year type dataset for these years.

Appendix A.1 - Groundwater Elevation Hydrographs for the RMP Network.

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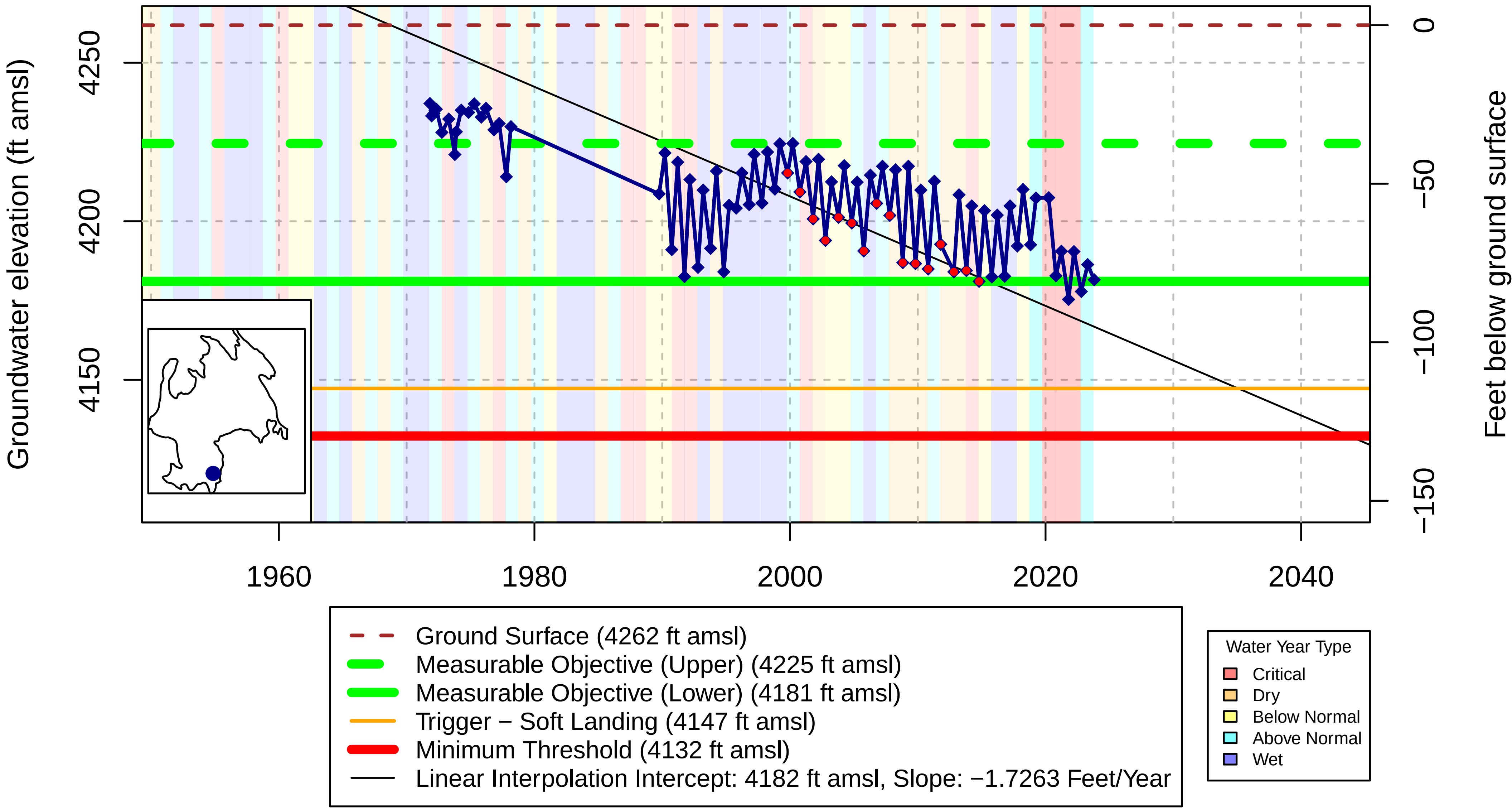
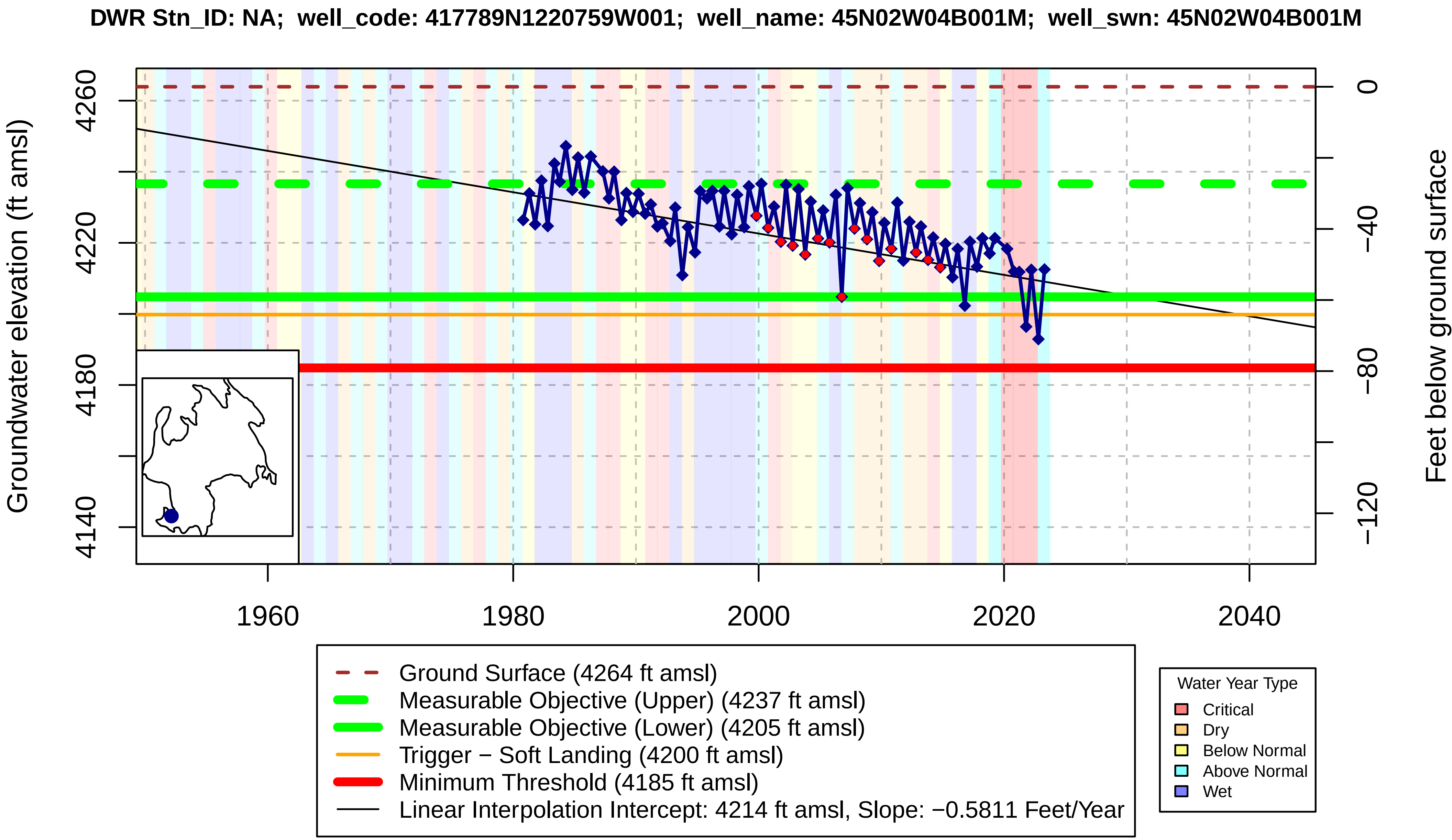


Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
The results will be finalized once DWR updates the water year type dataset for these years.



Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
The results will be finalized once DWR updates the water year type dataset for these years.

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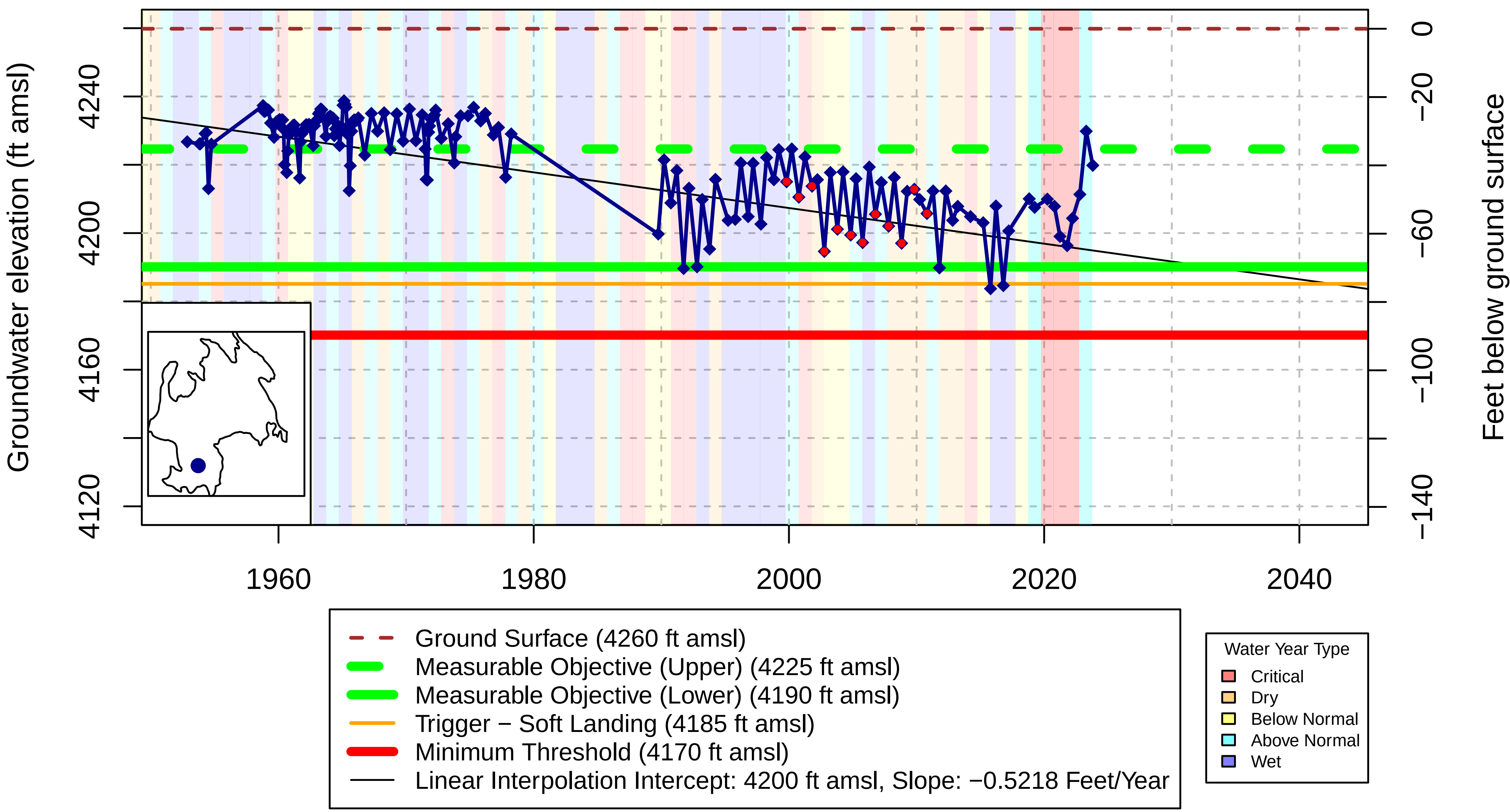

Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
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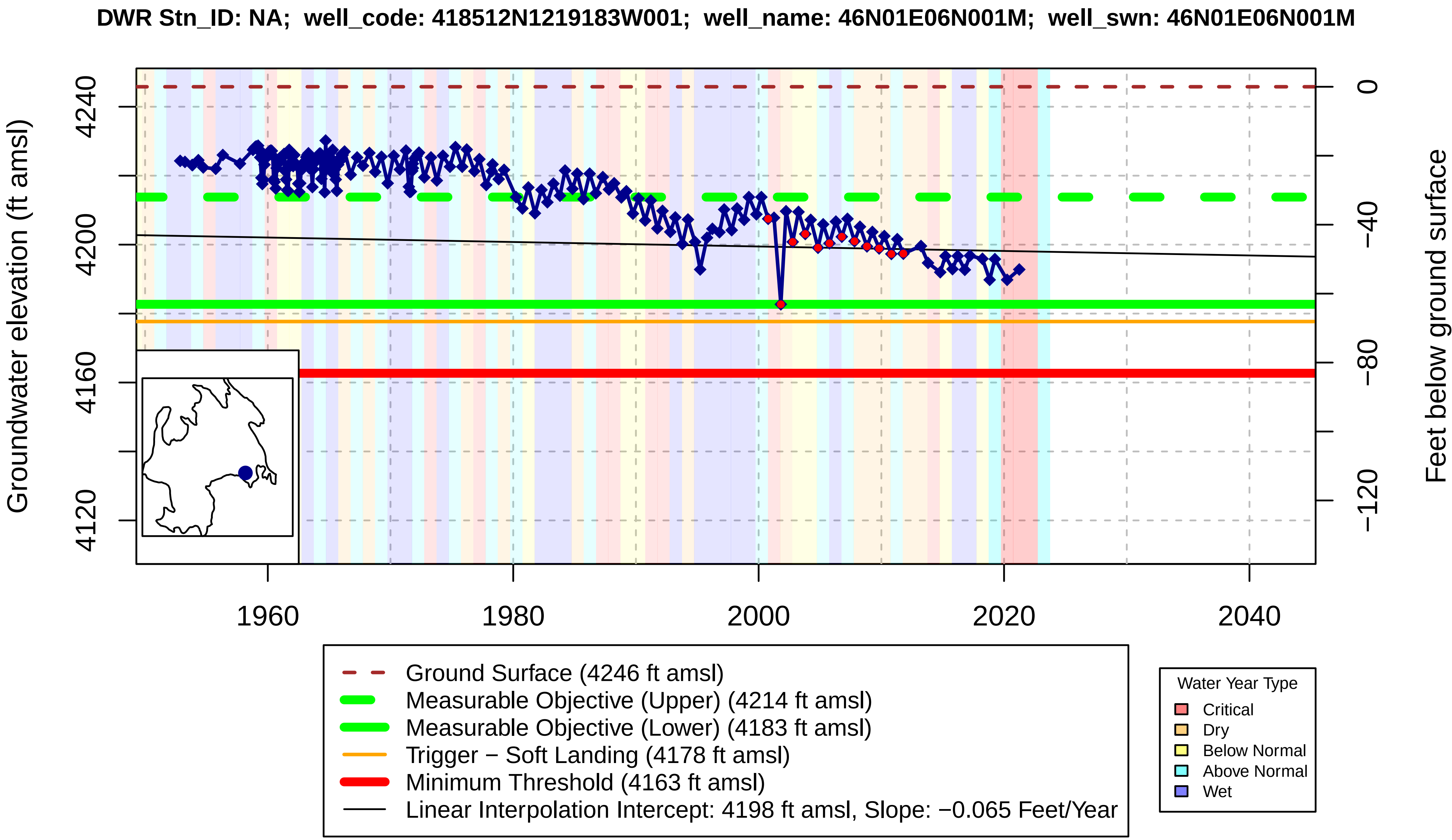

Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
The results will be finalized once DWR updates the water year type dataset for these years.

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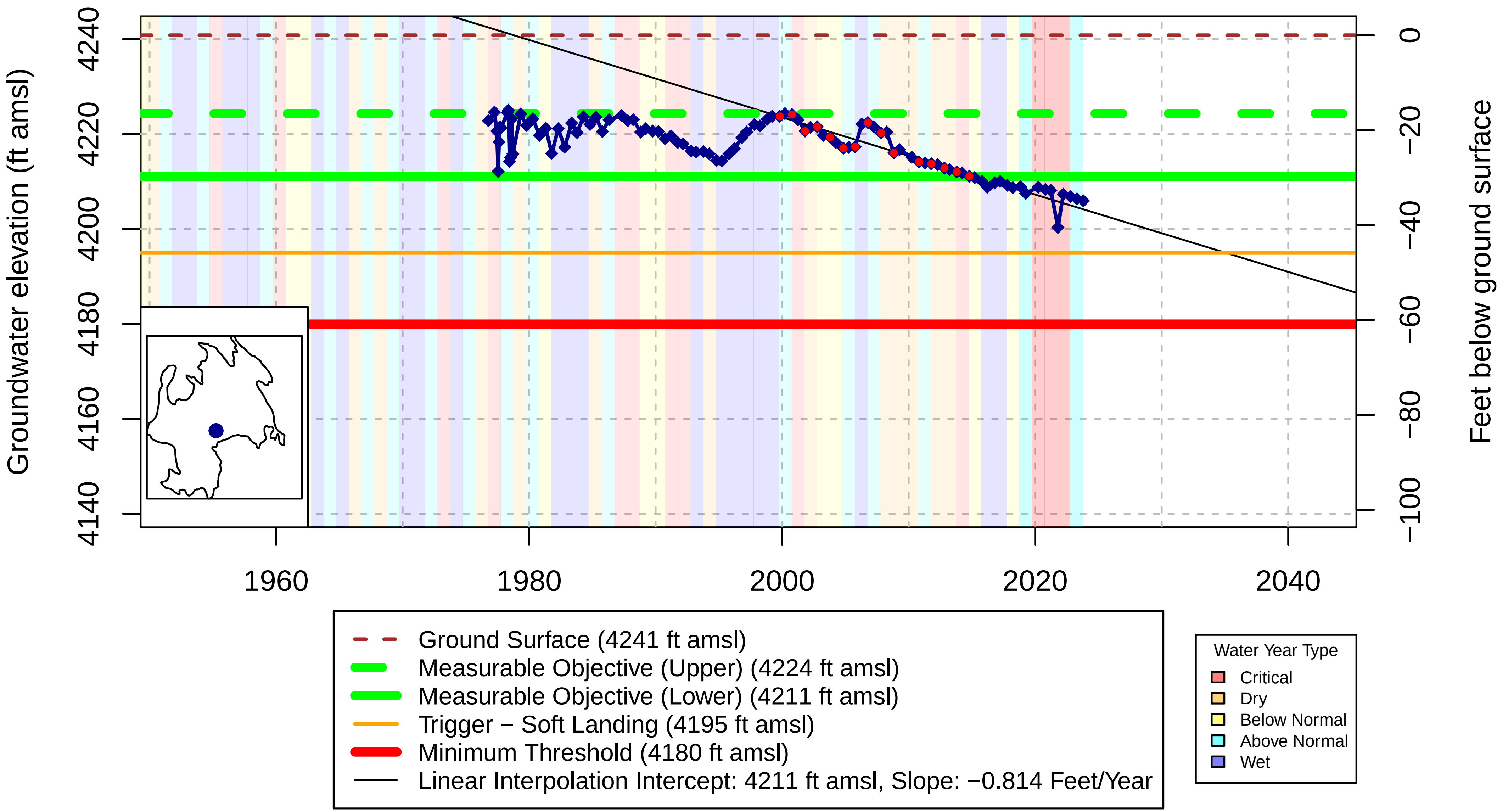

Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
The results will be finalized once DWR updates the water year type dataset for these years.

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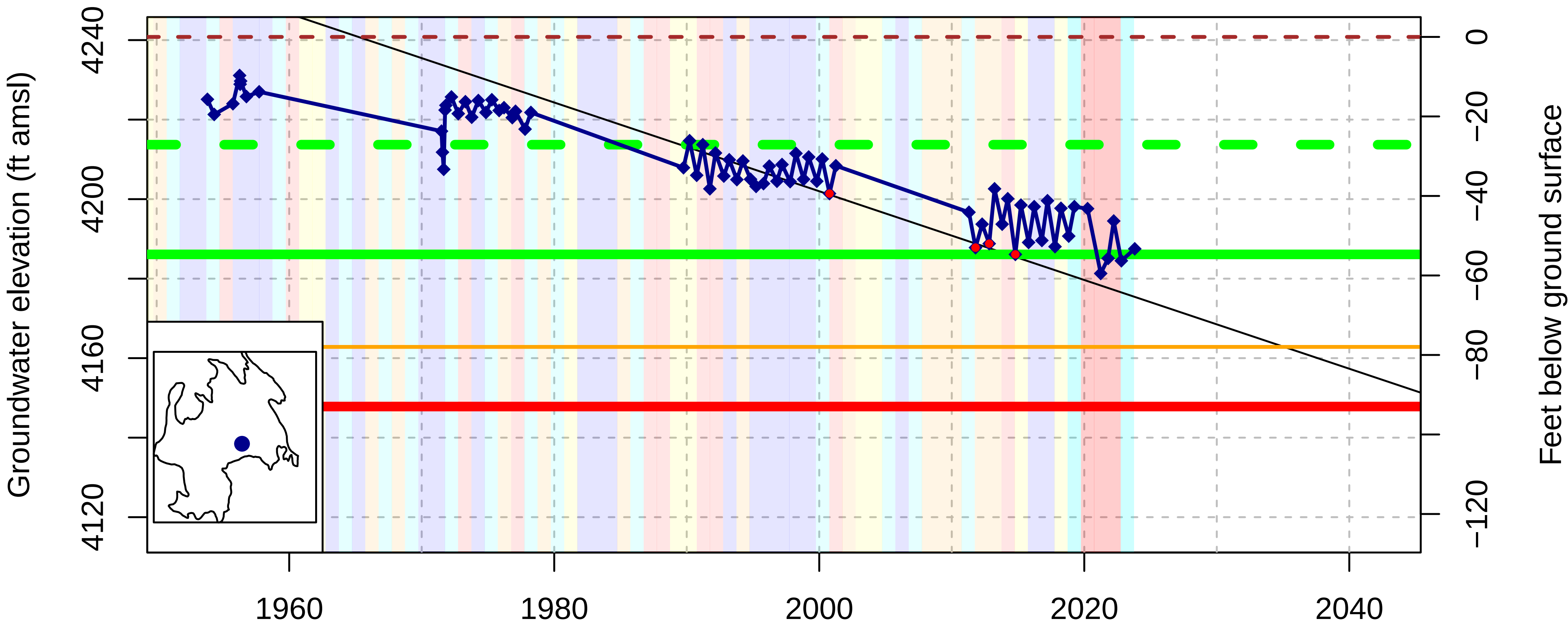
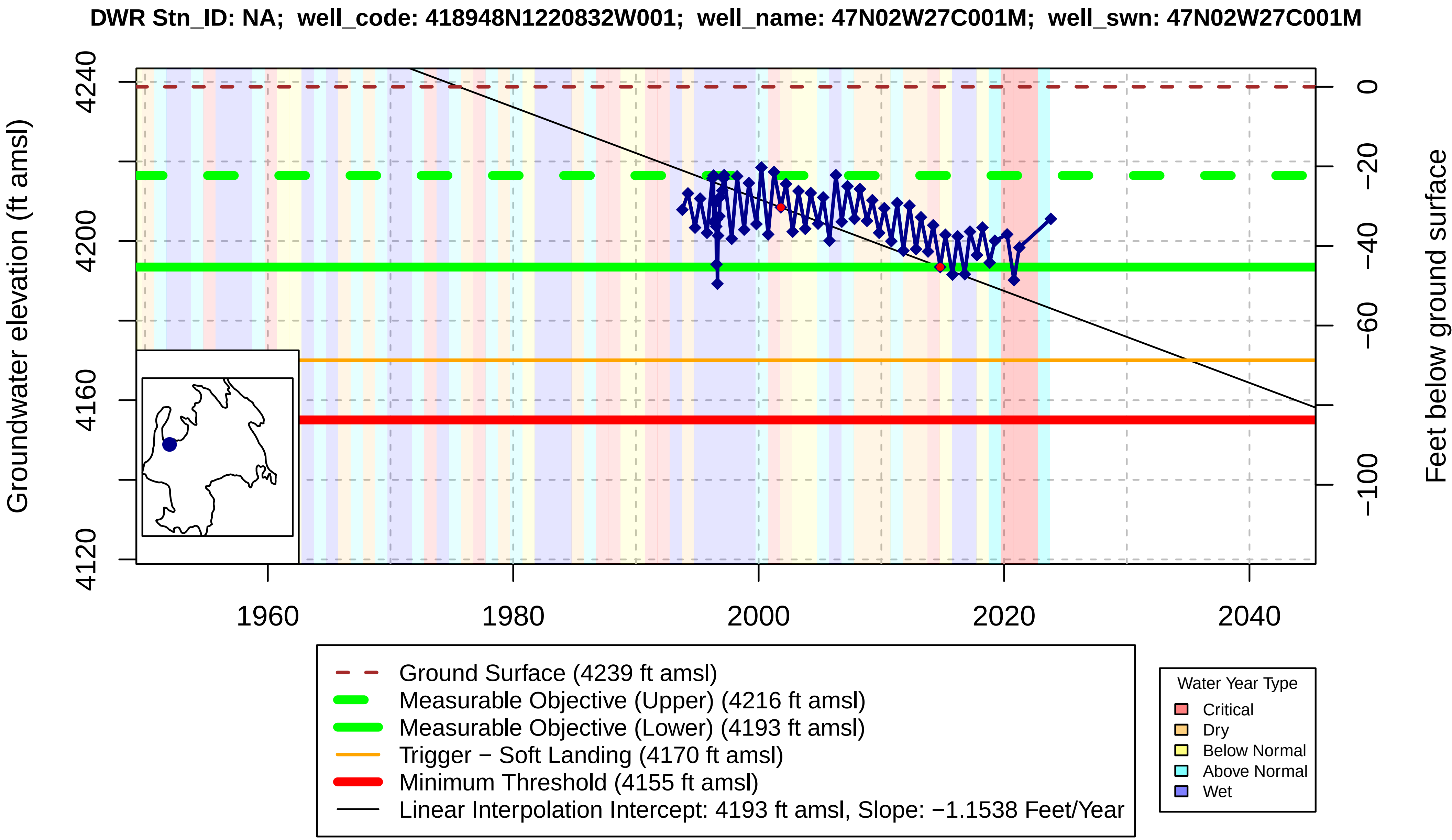


Ground Surface (4241 ft amsl)
Measurable Objective (Upper) (4214 ft amsl)
Measurable Objective (Lower) (4186 ft amsl)
Trigger − Soft Landing (4163 ft amsl)
Minimum Threshold (4148 ft amsl)
Linear Interpolation Intercept: 4185 ft amsl, Slope: −1.1154 Feet/Year

Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet

Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
The results will be finalized once DWR updates the water year type dataset for these years.



Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
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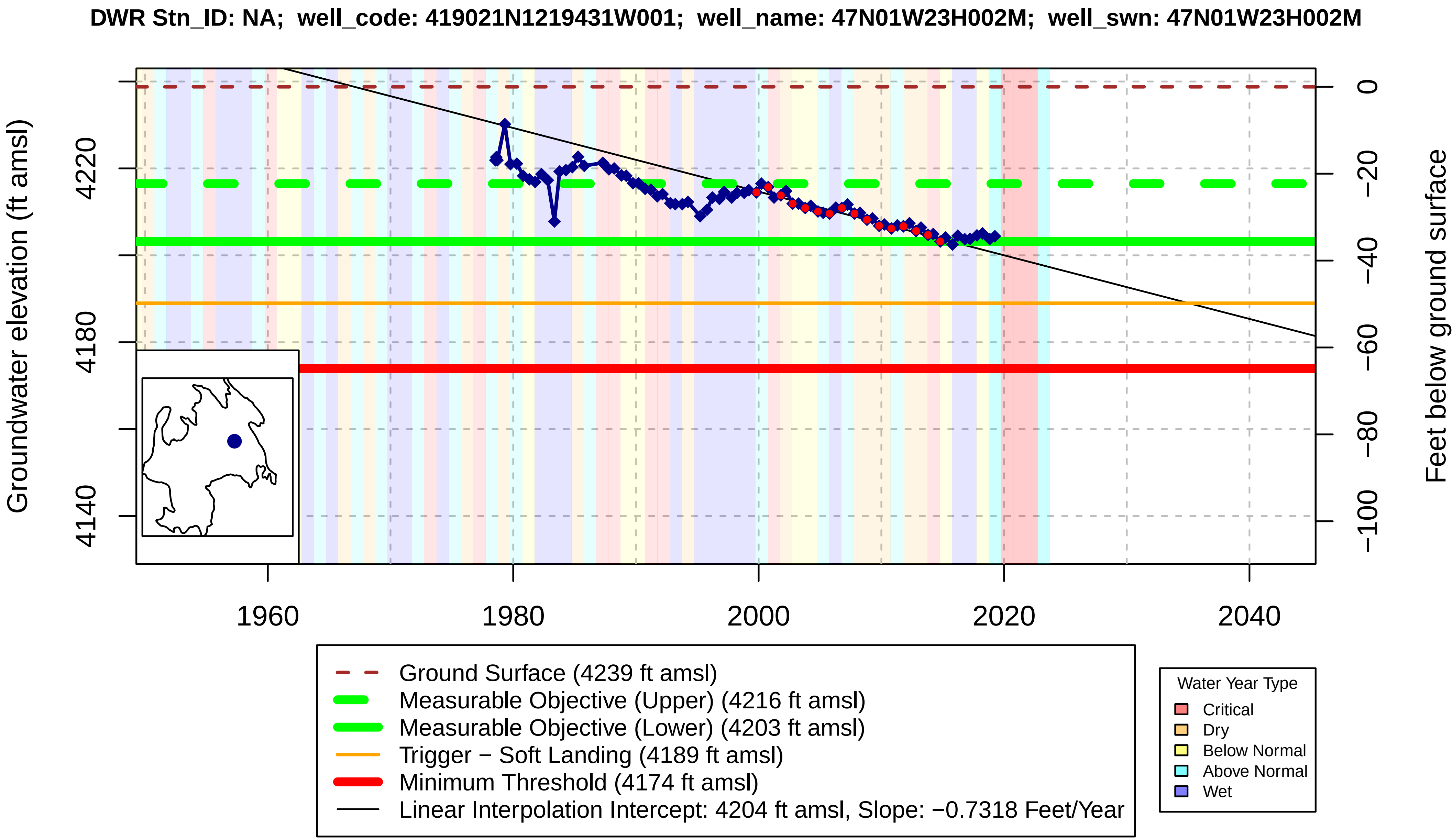

Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
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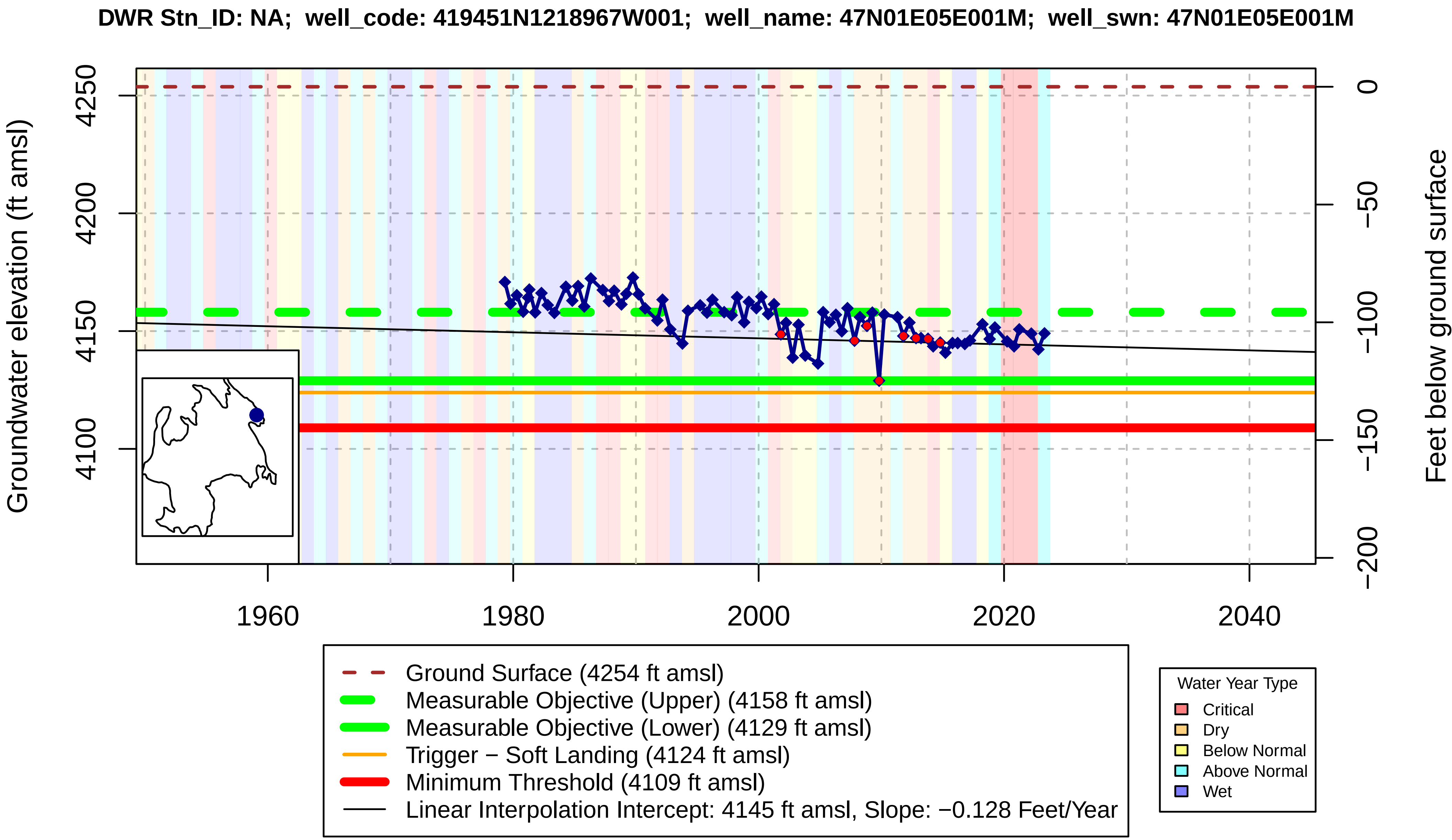

Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
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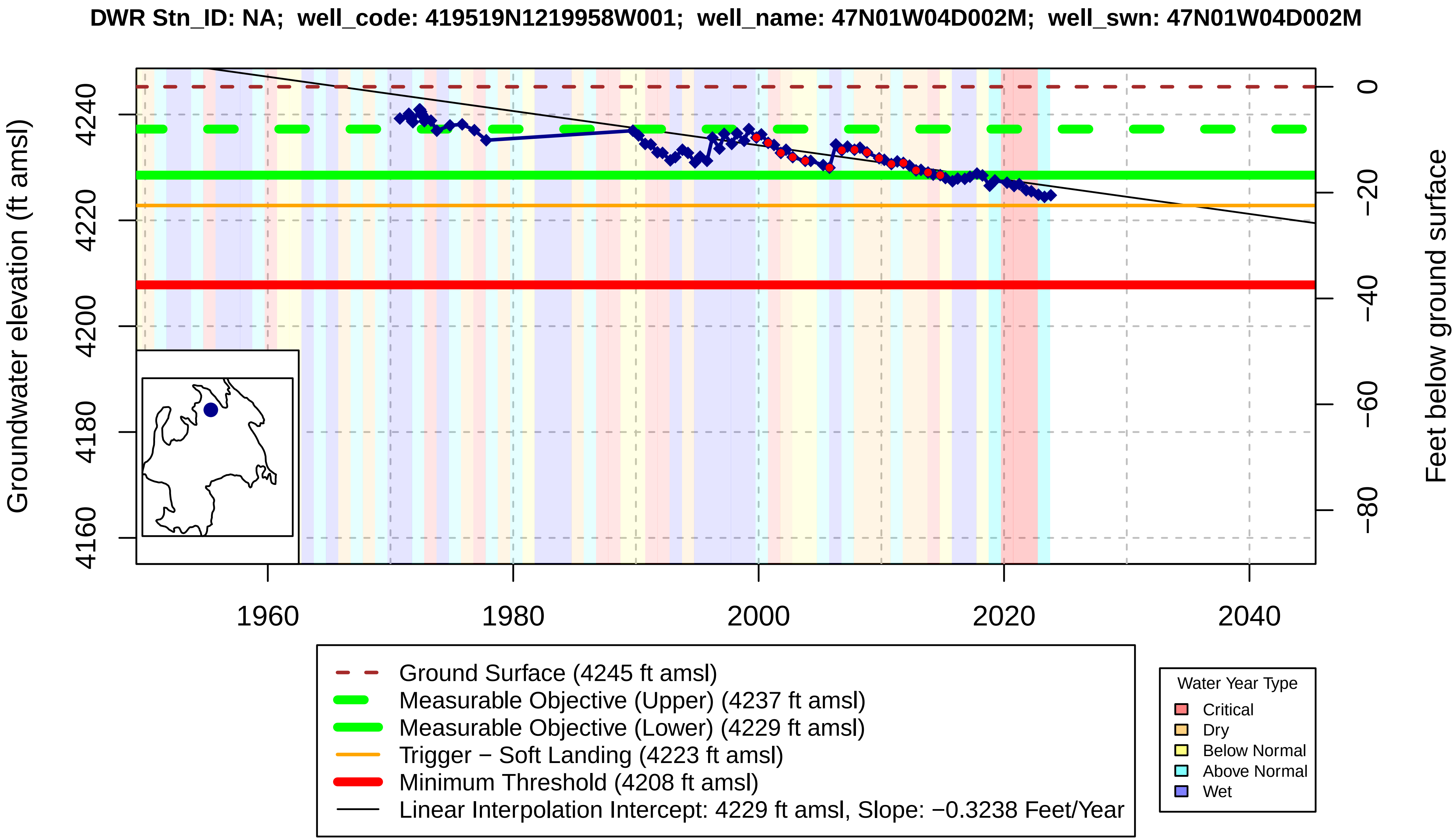

Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
The results will be finalized once DWR updates the water year type dataset for these years.

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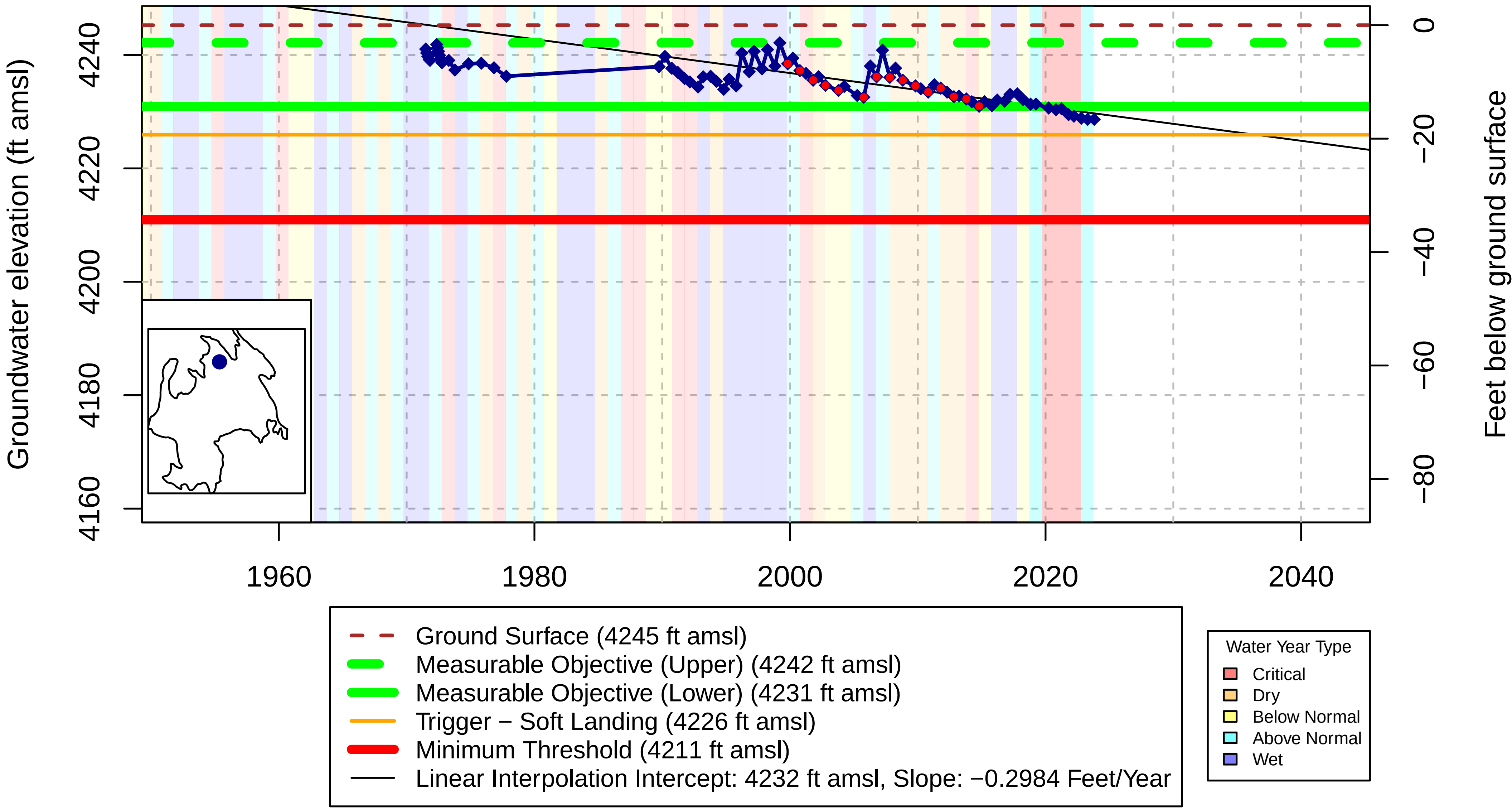

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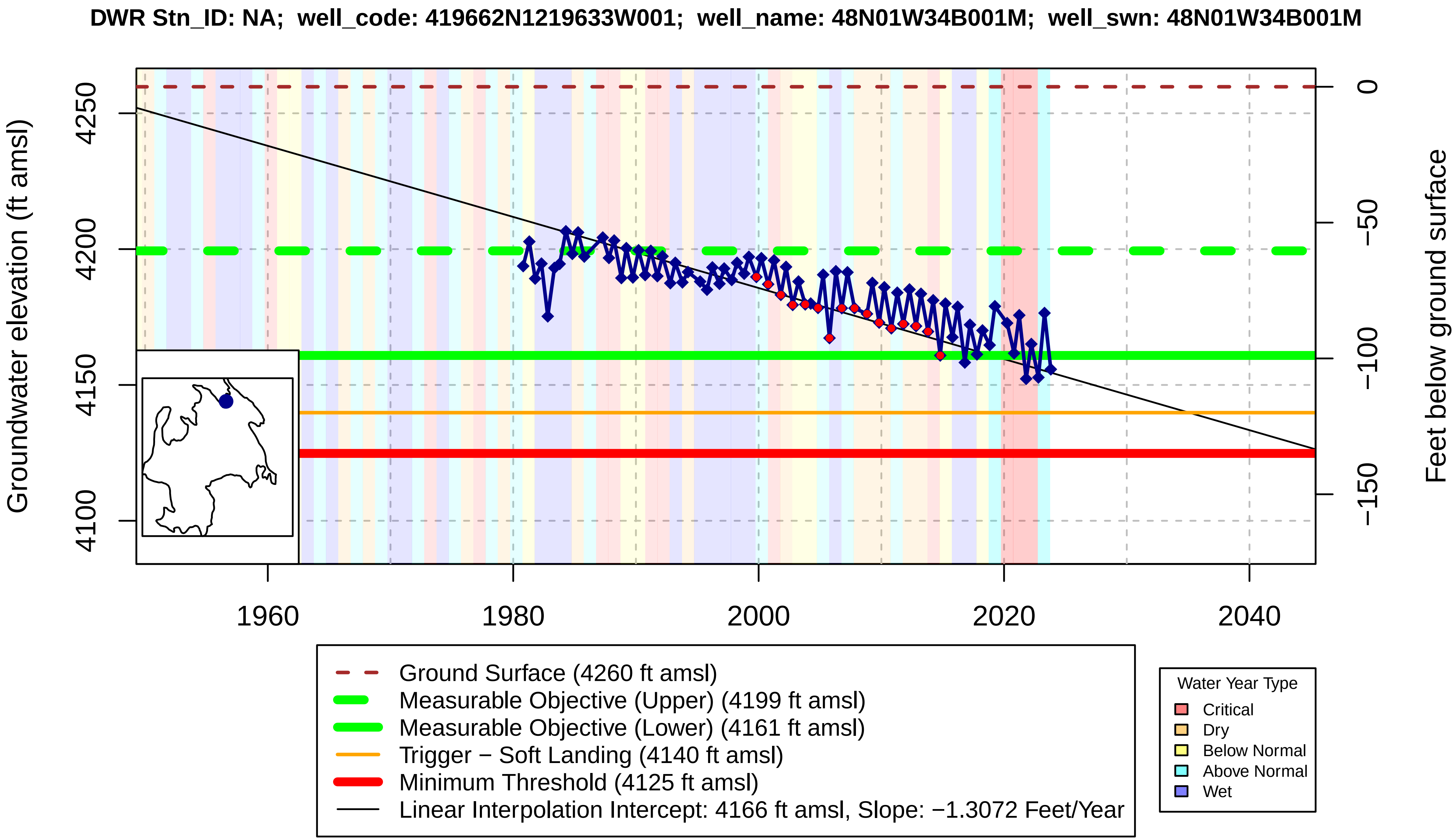

Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
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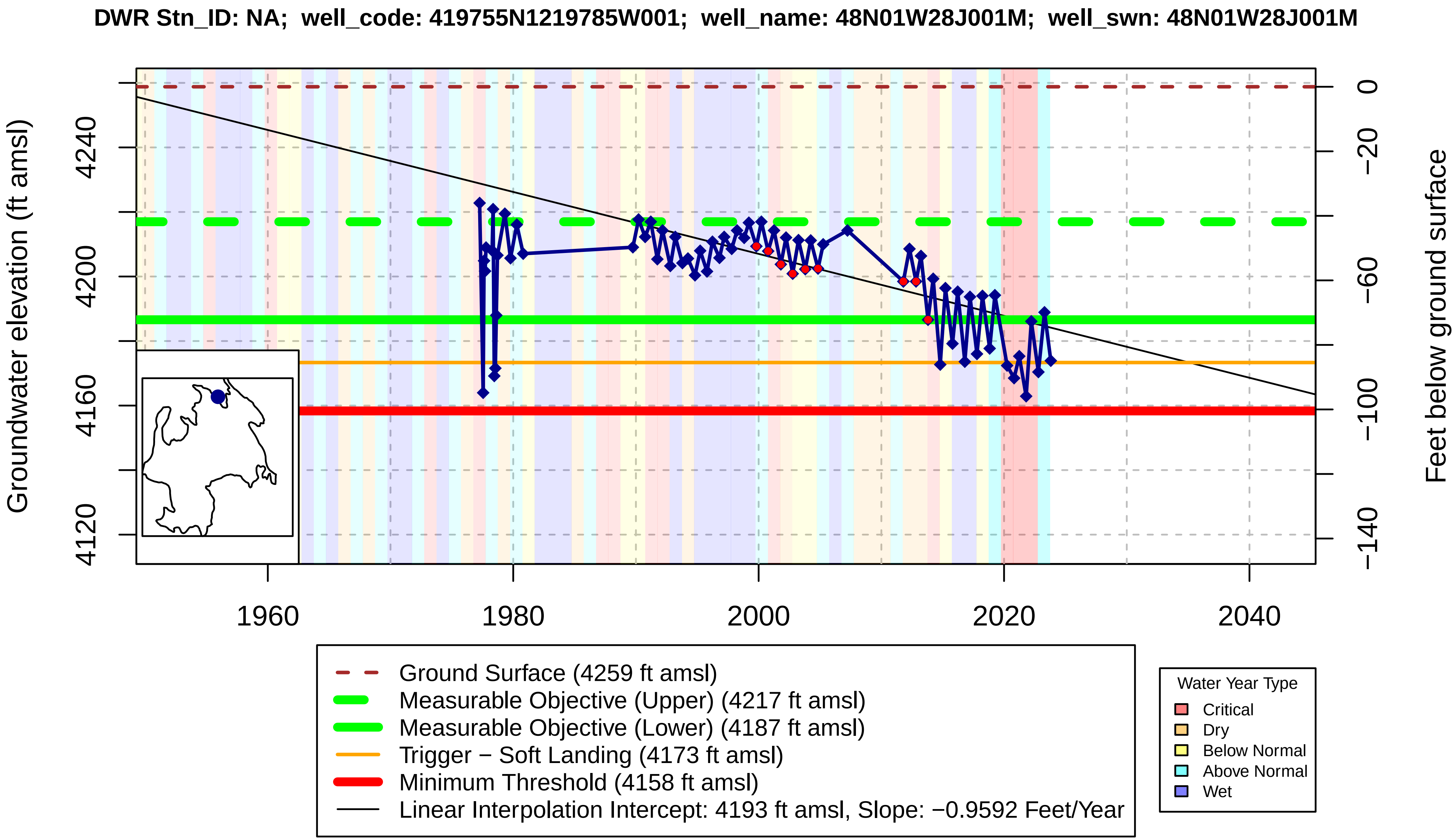
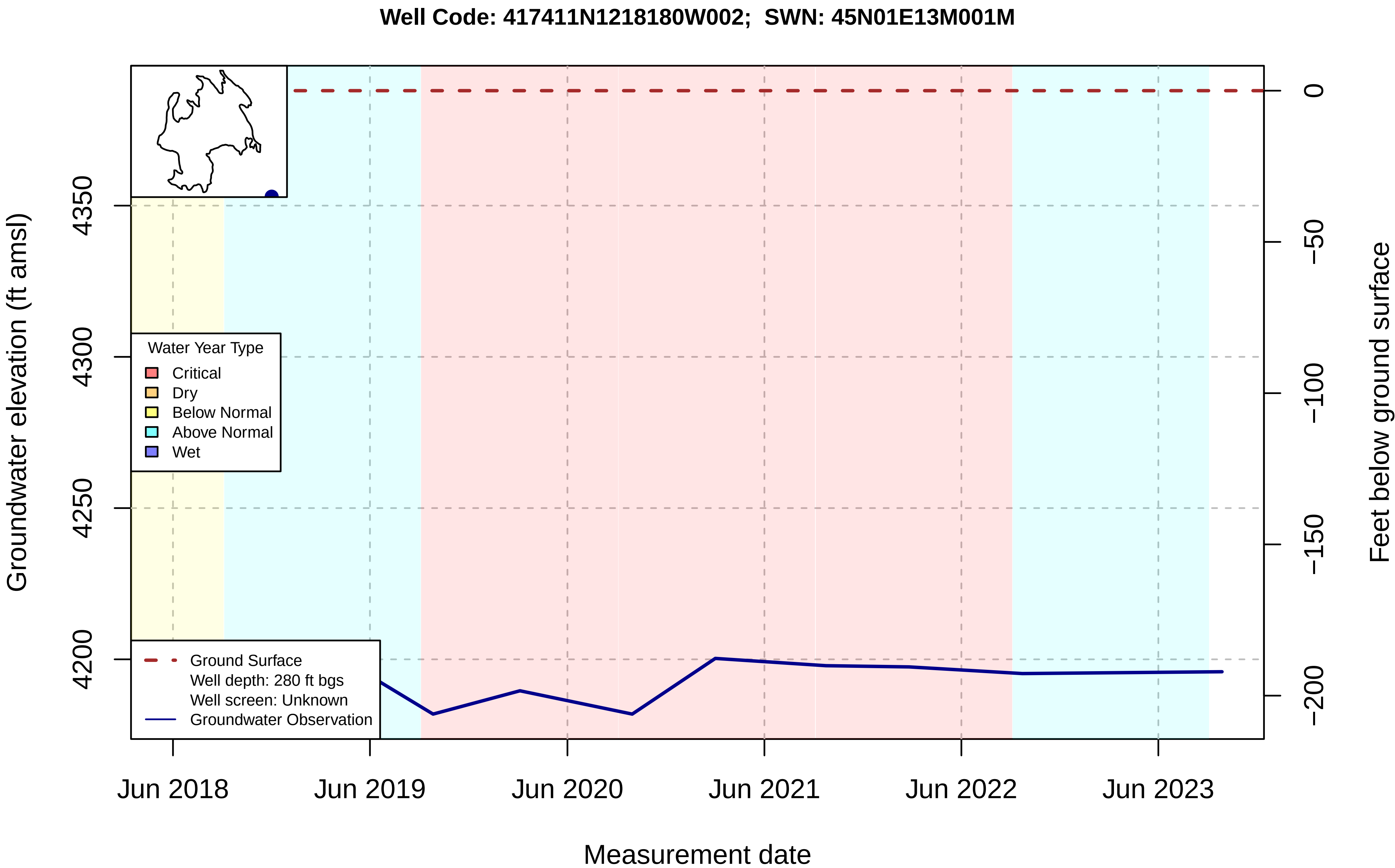
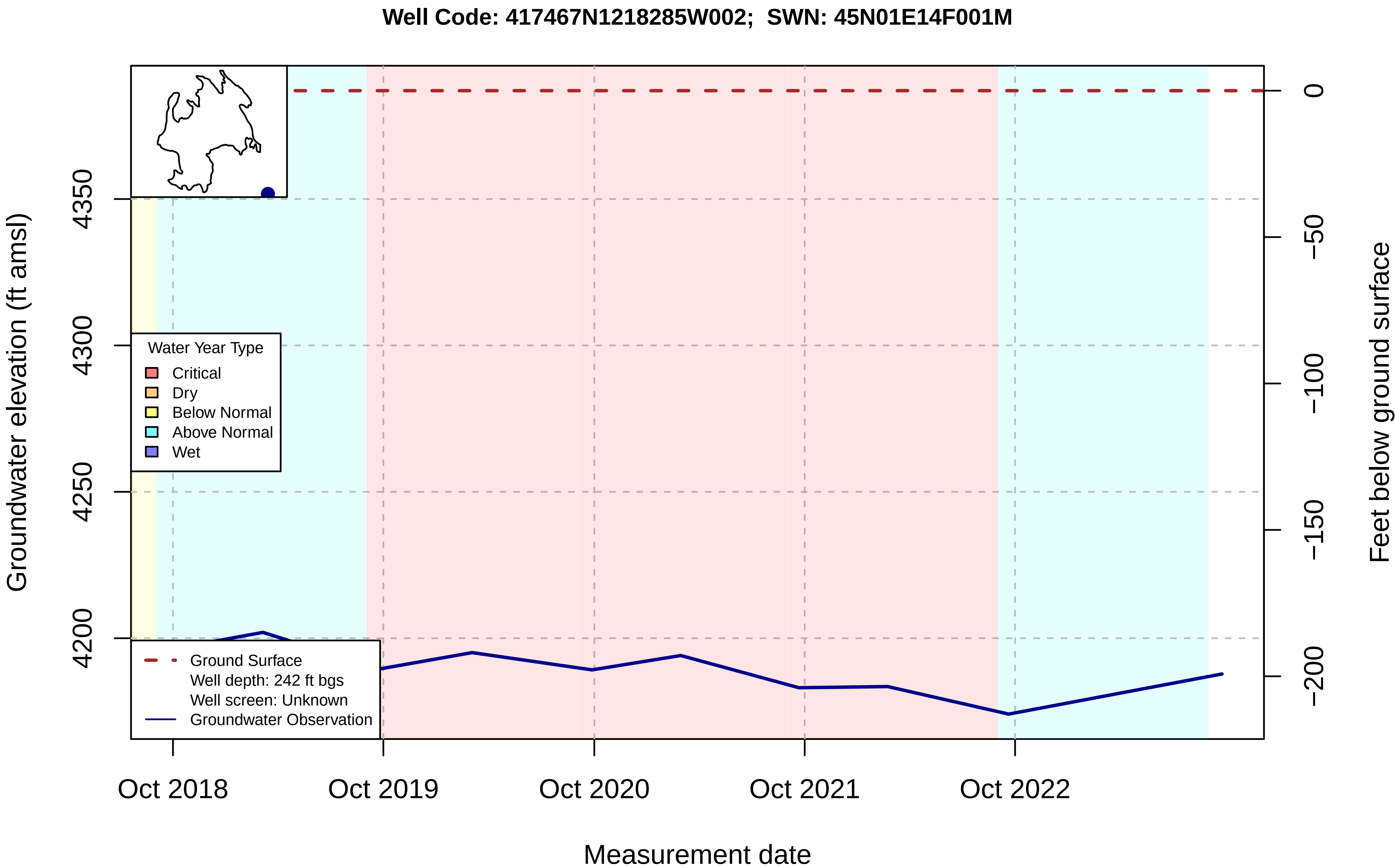


Water Year Types from WY 2019−2023 are preliminary results calculated based on SGMA Water Year Type Dataset Development Report.
The results will be finalized once DWR updates the water year type dataset for these years.

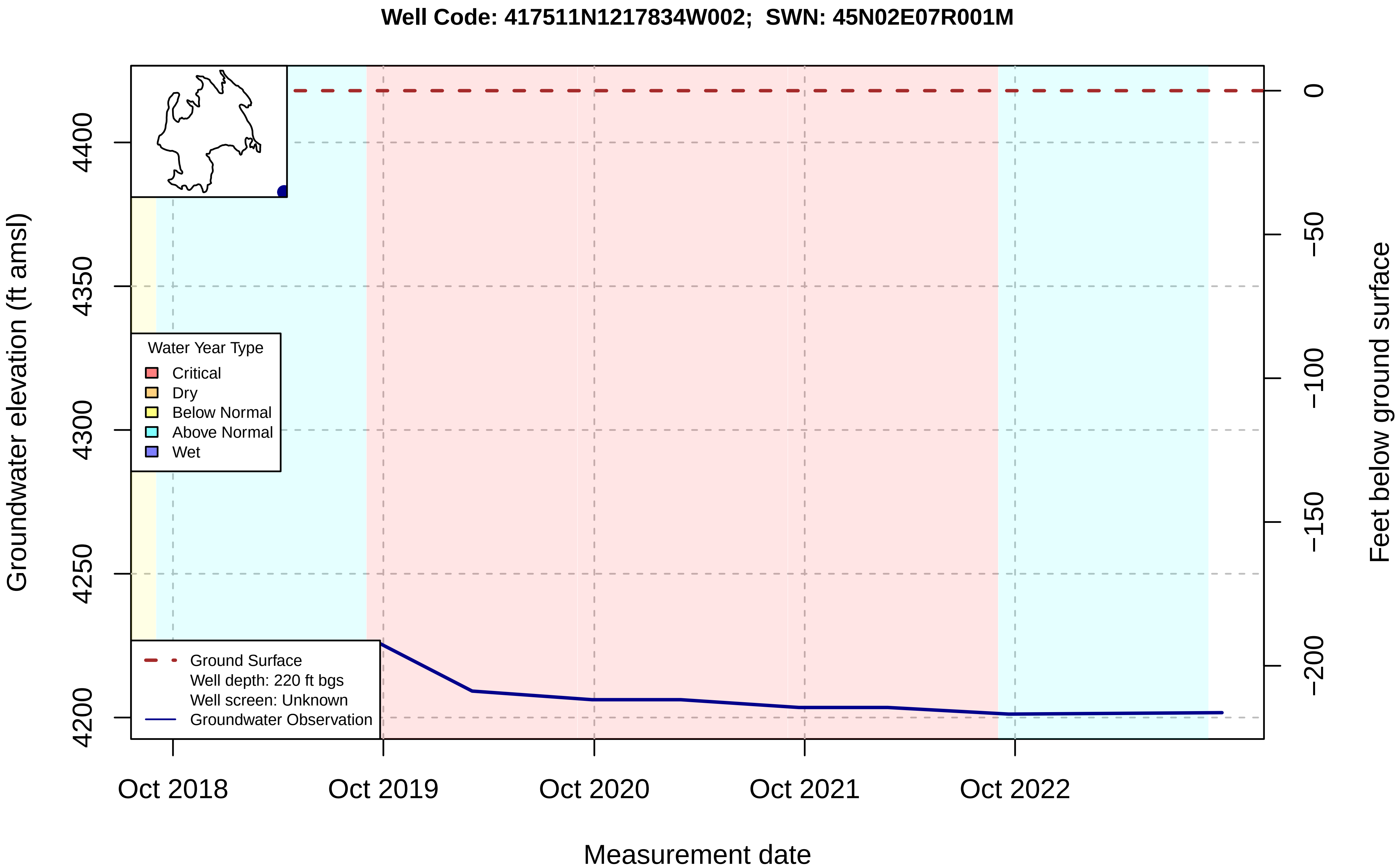
Appendix A.2 - Additional Groundwater Elevation Hydrographs



Well Code: 417411N1218180W002; SWN: 45N01E13M001M
Groundwater elevation (ft amsl)
4350
4300
4250
4200
Feet below ground surface
0
−50
−100
−150
−200
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 280 ft bgs
Well screen: Unknown
Groundwater Observation
Jun 2018
Jun 2019
Jun 2020
Jun 2021
Jun 2022
Jun 2023
Measurement date

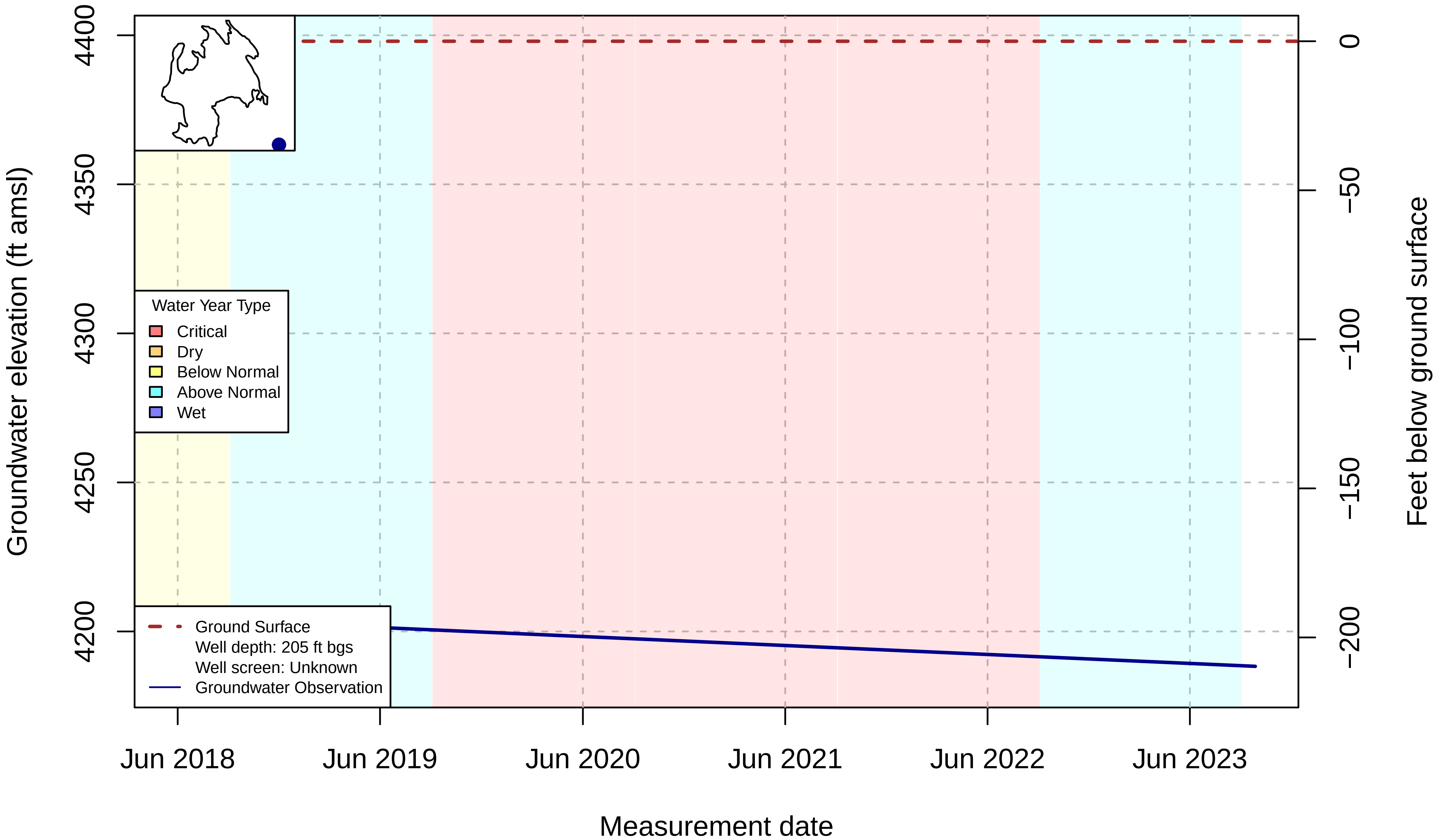


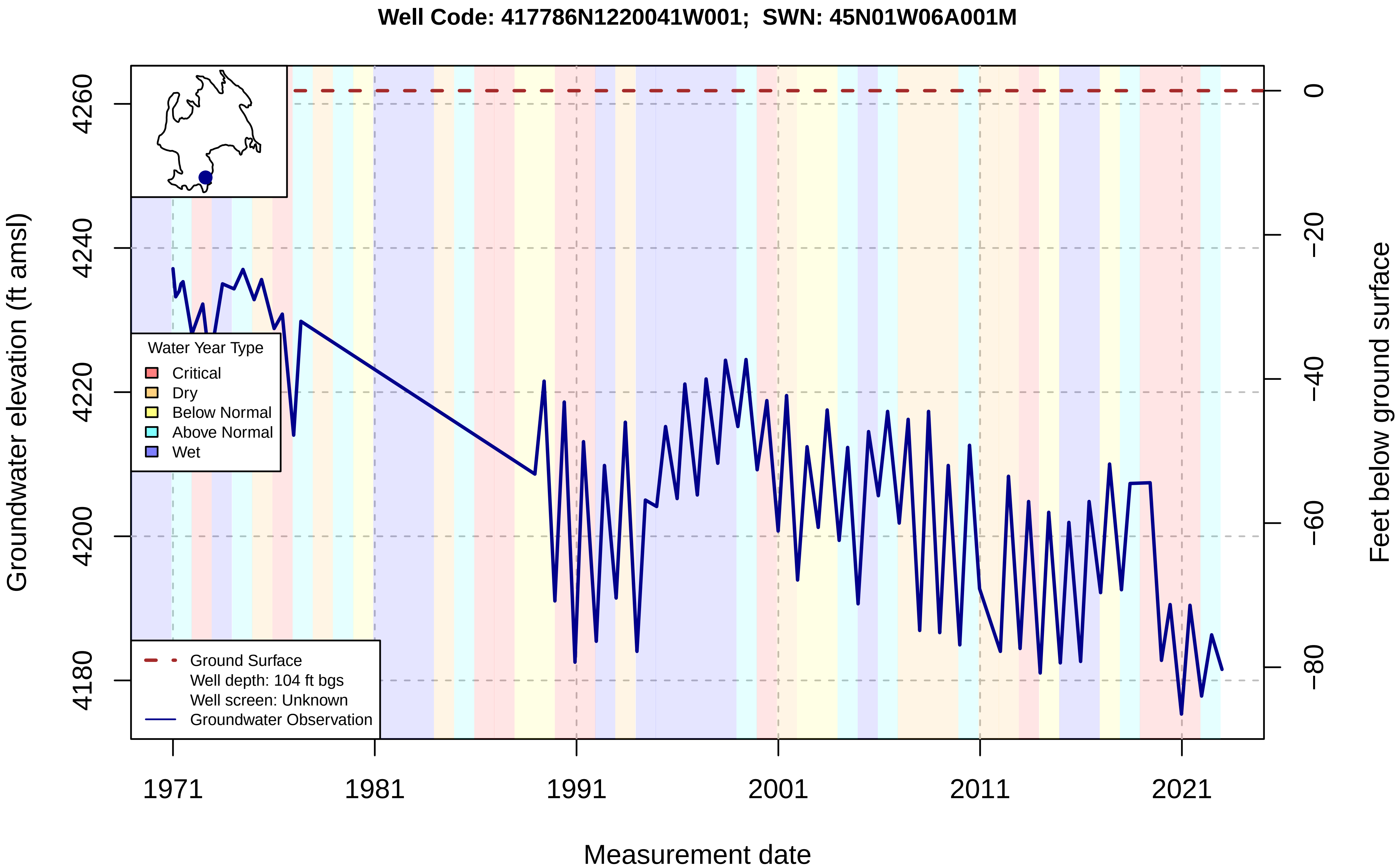
Well Code: 417467N1218285W002; SWN: 45N01E14F001M
Groundwater elevation (ft amsl)
4350
4300
4250
4200
Feet below ground surface
0
−50
−100
−150
−200
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 242 ft bgs
Well screen: Unknown
Groundwater Observation
Oct 2018
Oct 2019
Oct 2020
Oct 2021
Oct 2022
Measurement date



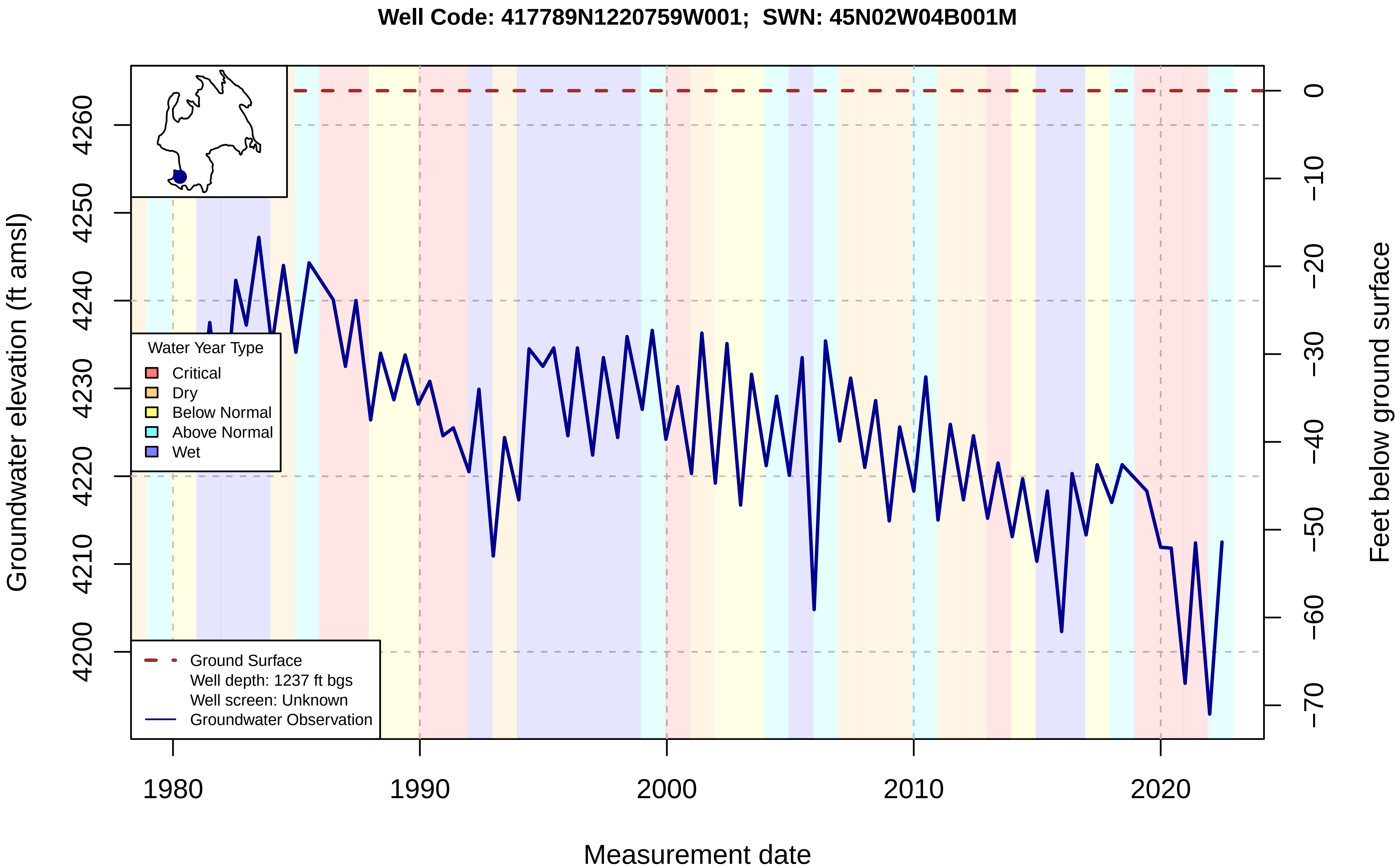
Well Code: 417511N1217834W002; SWN: 45N02E07R001M
Groundwater elevation (ft amsl)
4200
4250
4300
4350
4400
Feet below ground surface
0
−50
−100
−150
−200
Oct 2018
Oct 2019
Oct 2020
Oct 2021
Oct 2022
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 220 ft bgs
Well screen: Unknown
Groundwater Observation

Well Code: 417522N1218184W002; SWN: 45N01E12N001M

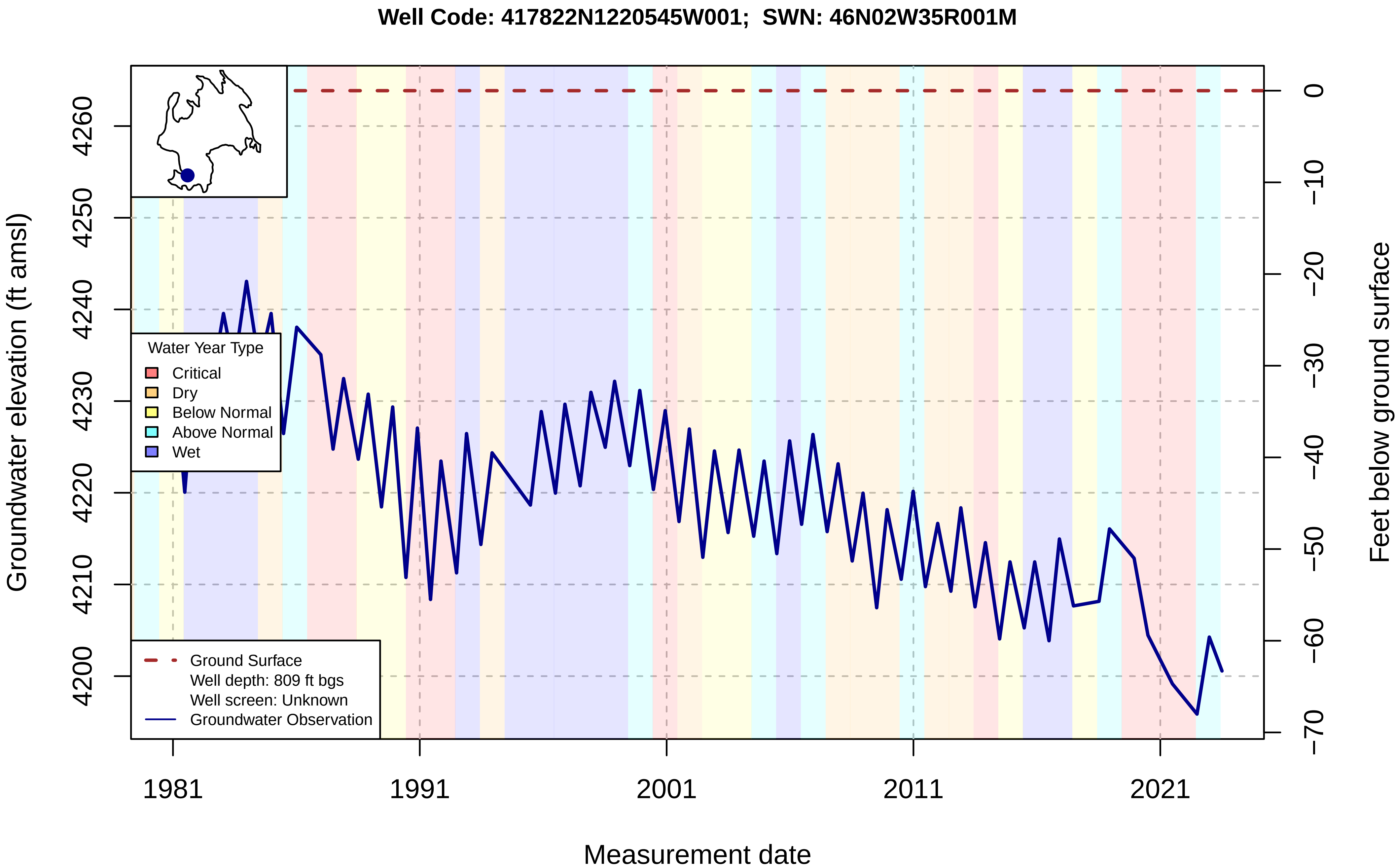




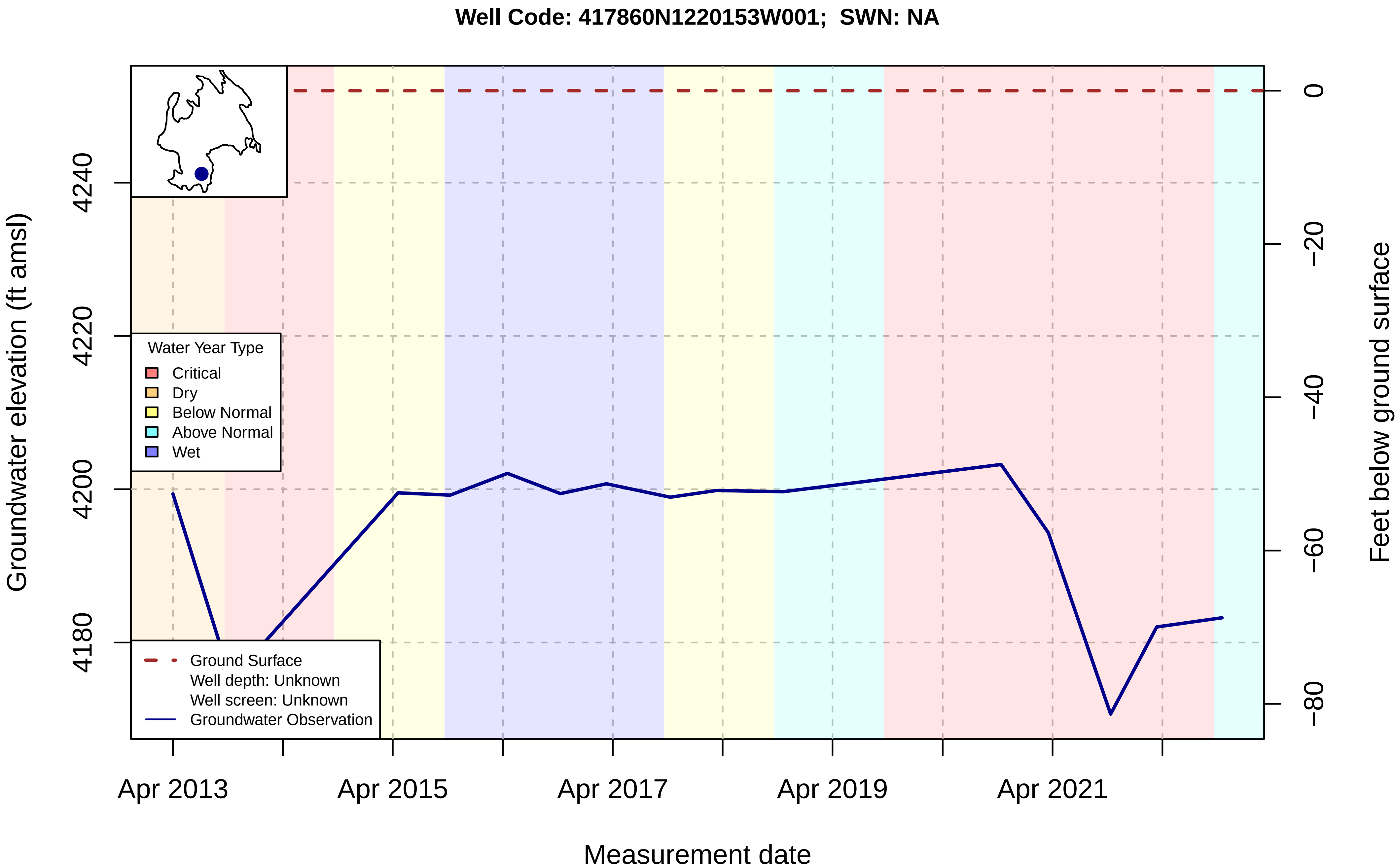
Well Code: 417786N1220041W001; SWN: 45N01W06A001M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4260
4240
4220
4200
4180
0
−20
−40
−60
−80
1971
1981
1991
2001
2011
2021
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 104 ft bgs
Well screen: Unknown
Groundwater Observation



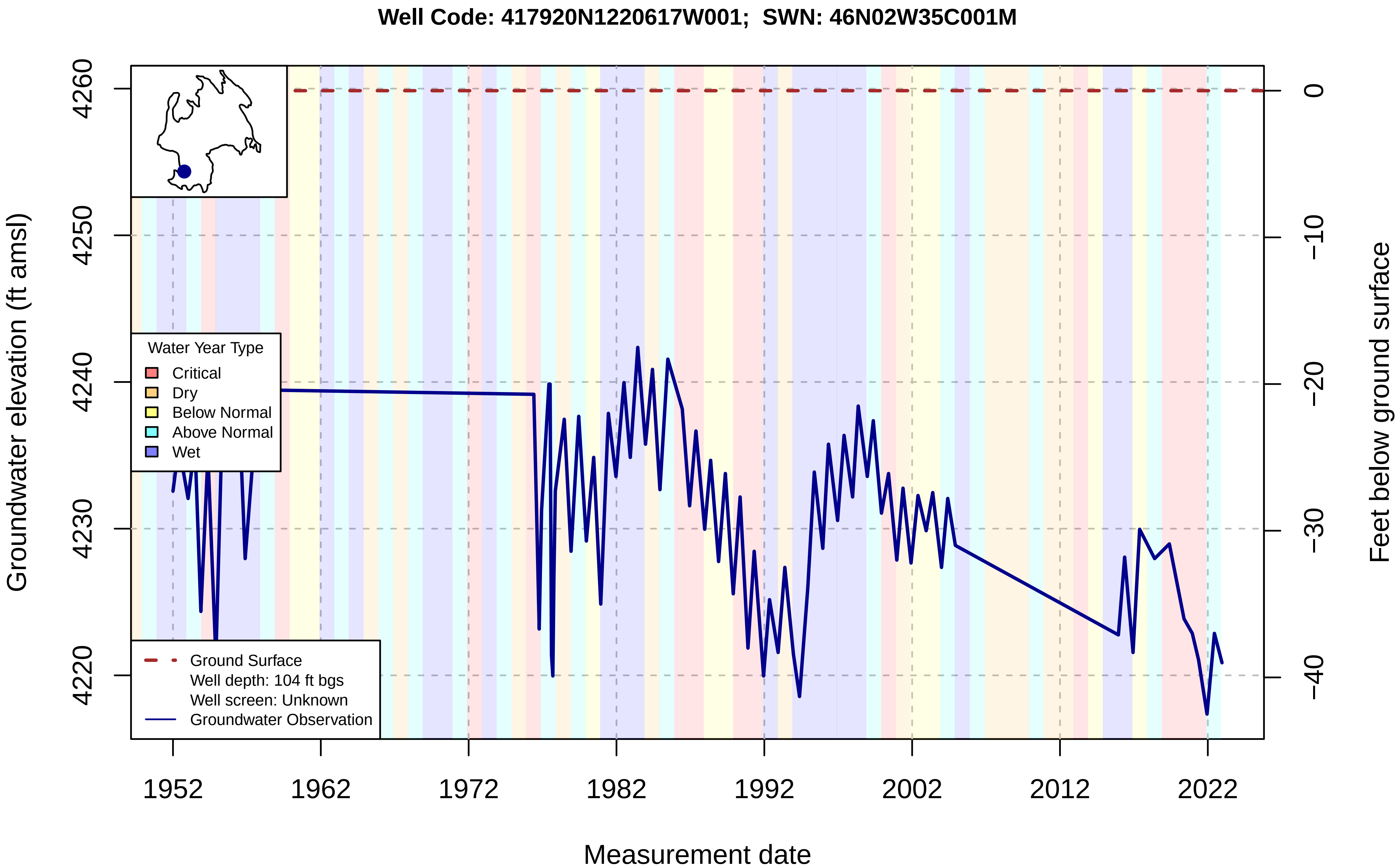
Well Code: 417789N1220759W001; SWN: 45N02W04B001M
Groundwater elevation (ft amsl)
4200
4210
4220
4230
4240
4250
4260
Feet below ground surface
0
−10
−20
−30
−40
−50
−60
−70
1980
1990
2000
2010
2020
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 1237 ft bgs
Well screen: Unknown
Groundwater Observation



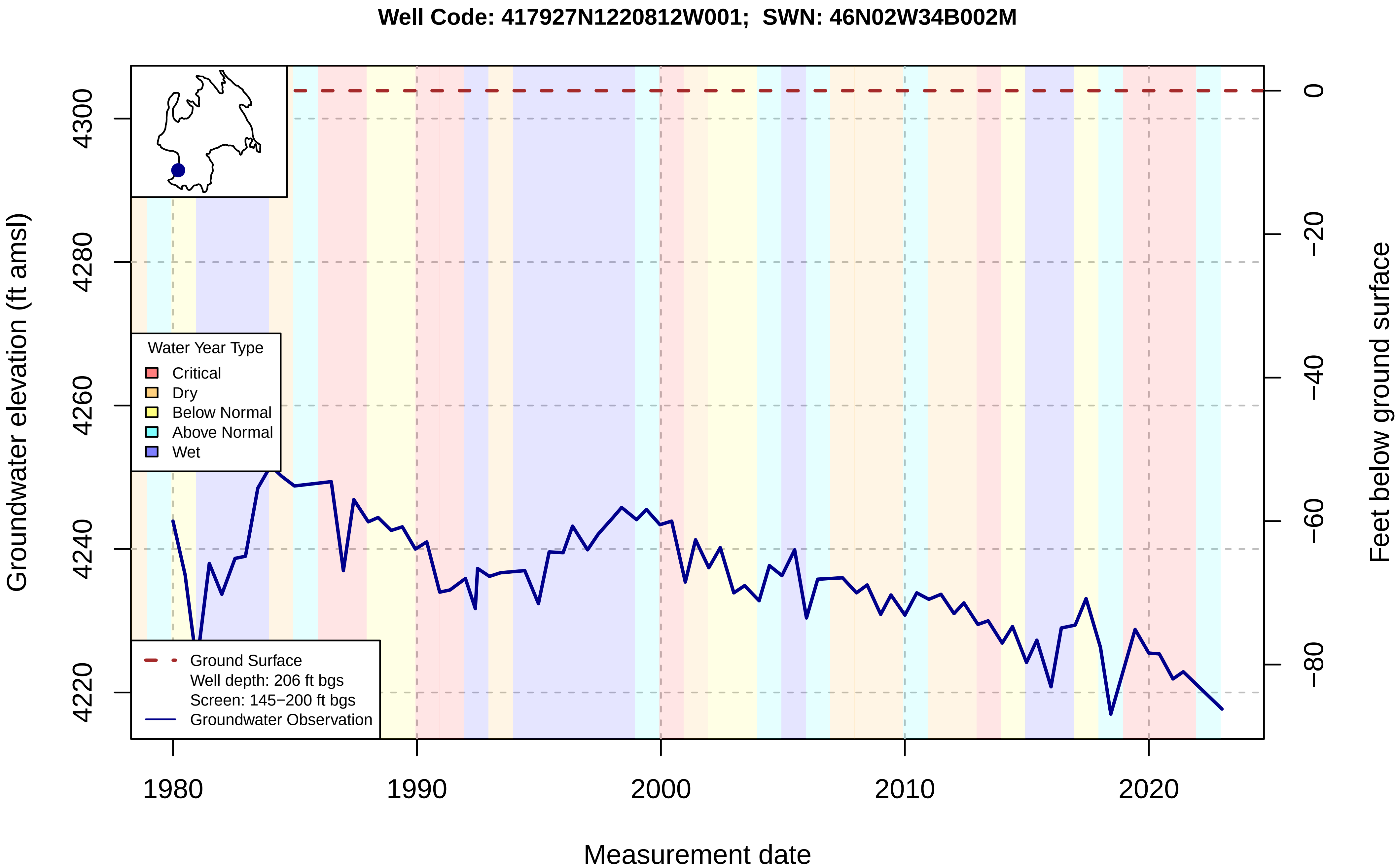
Well Code: 417822N1220545W001; SWN: 46N02W35R001M
Groundwater elevation (ft amsl)
4200
4210
4220
4230
4240
4250
4260
Feet below ground surface
0
−10
−20
−30
−40
−50
−60
−70
1981
1991
2001
2011
2021
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 809 ft bgs
Well screen: Unknown
Groundwater Observation



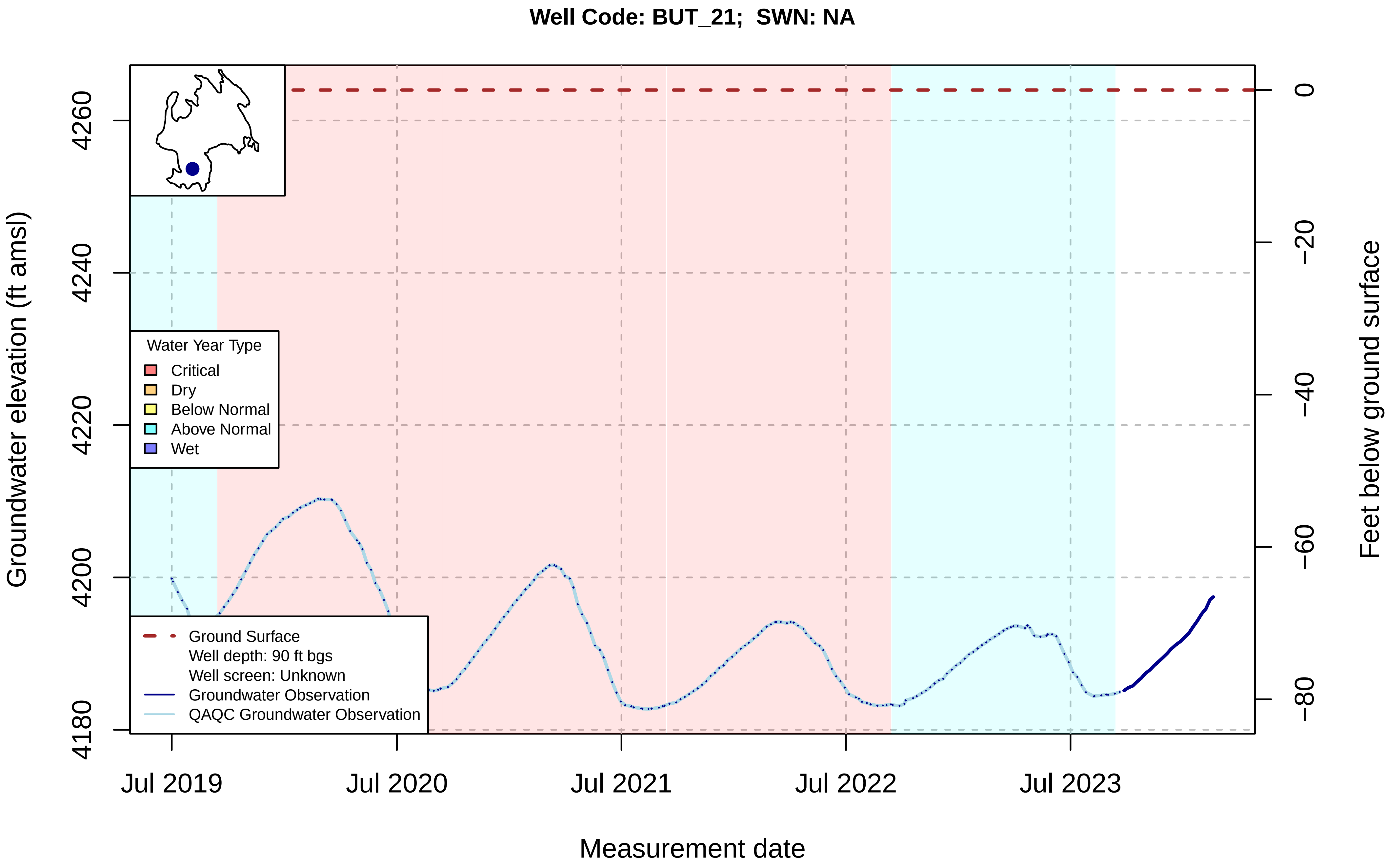
Well Code: 417860N1220153W001; SWN: NA
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation
Groundwater elevation (ft amsl)
4180
4200
4220
4240
Feet below ground surface
0
−20
−40
−60
−80
Apr 2013
Apr 2015
Apr 2017
Apr 2019
Apr 2021
Measurement date


Well Code: 417920N1220617W001; SWN: 46N02W35C001M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4260
4250
4240
4230
4220
0
−10
−20
−30
−40
1952
1962
1972
1982
1992
2002
2012
2022
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 104 ft bgs
Well screen: Unknown
Groundwater Observation

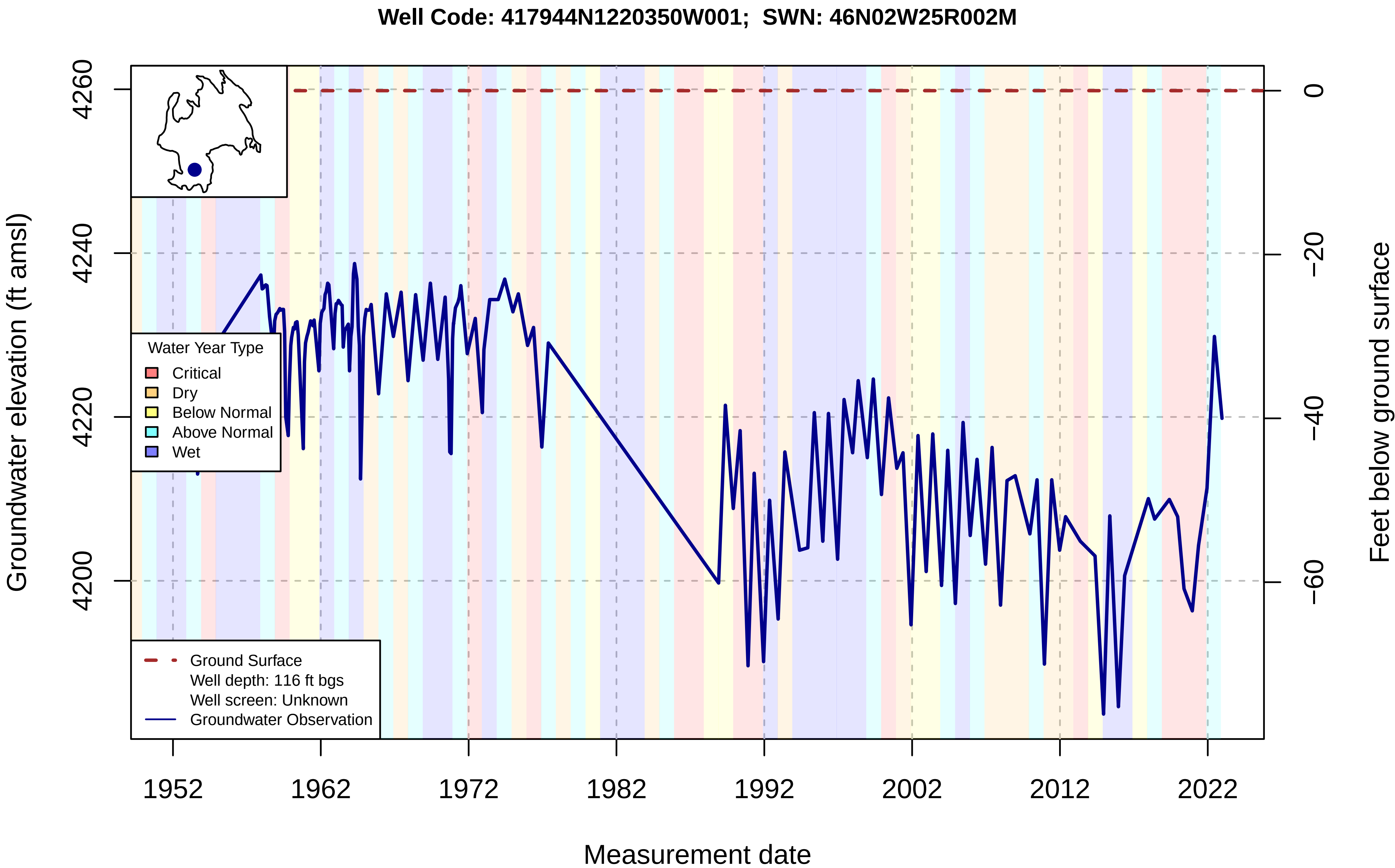
Well Code: BUT_194; SWN: NA
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4220
4230
4240
4250
4260
0
−10
−20
−30
−40
Apr 2021
Apr 2022
Apr 2023
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 104 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation



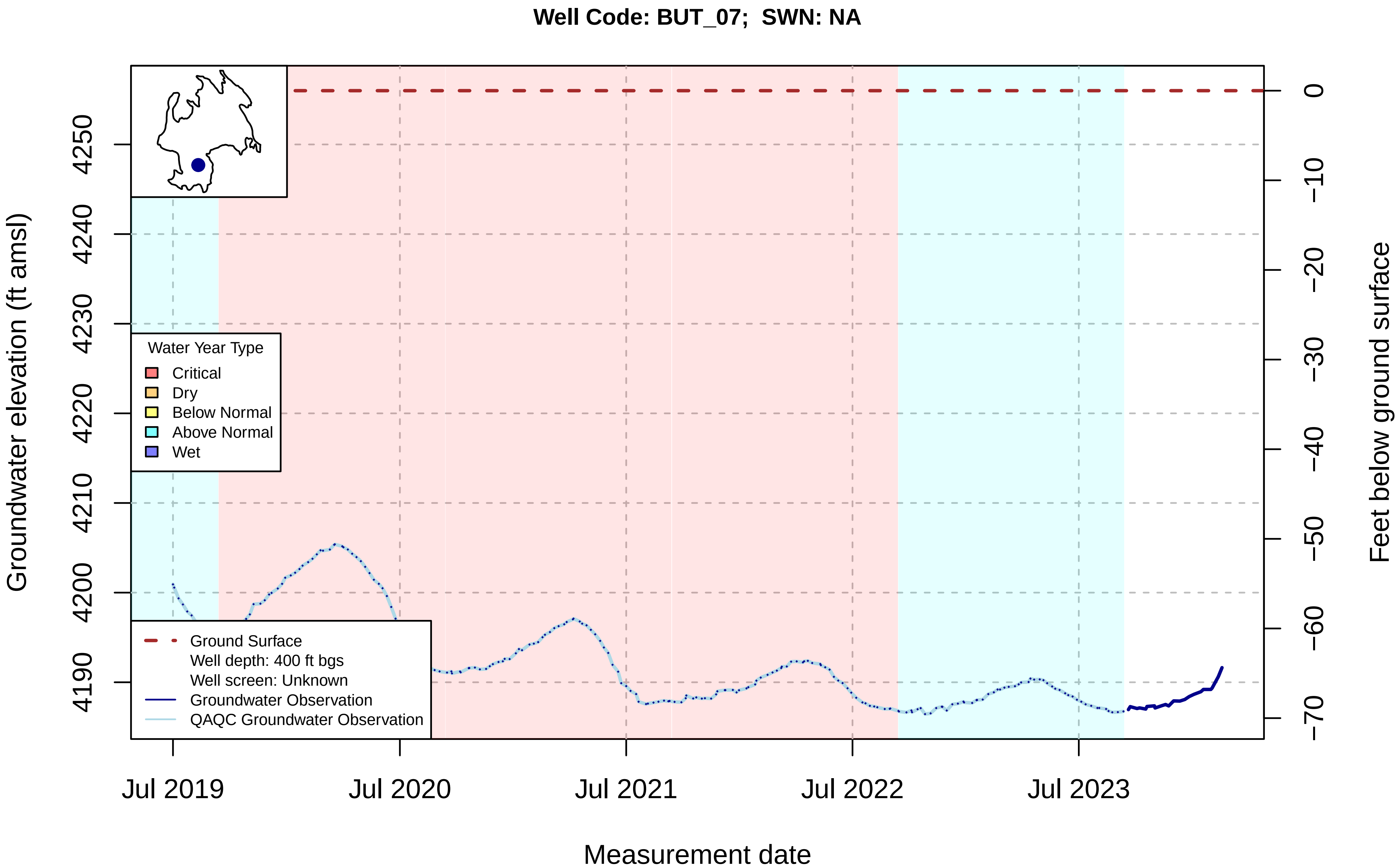
Well Code: 417927N1220812W001; SWN: 46N02W34B002M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 206 ft bgs
Screen: 145−200 ft bgs
Groundwater Observation
1980
1990
2000
2010
2020
4220
4240
4260
4280
4300
0
−20
−40
−60
−80



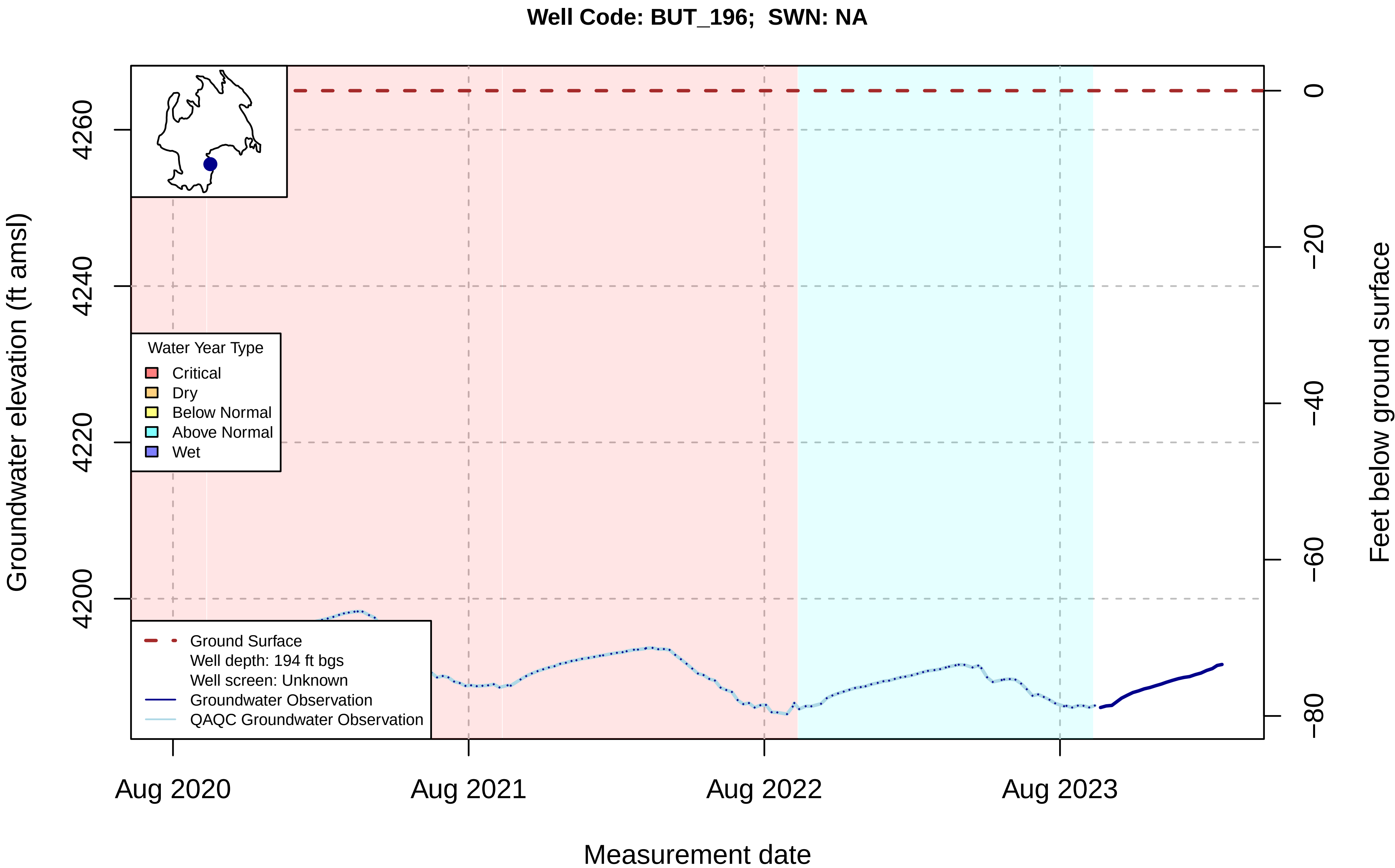
Well Code: BUT_21; SWN: NA
Groundwater elevation (ft amsl)
4260
4240
4220
4200
4180
Feet below ground surface
0
−20
−40
−60
−80
Jul 2019
Jul 2020
Jul 2021
Jul 2022
Jul 2023
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 90 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation



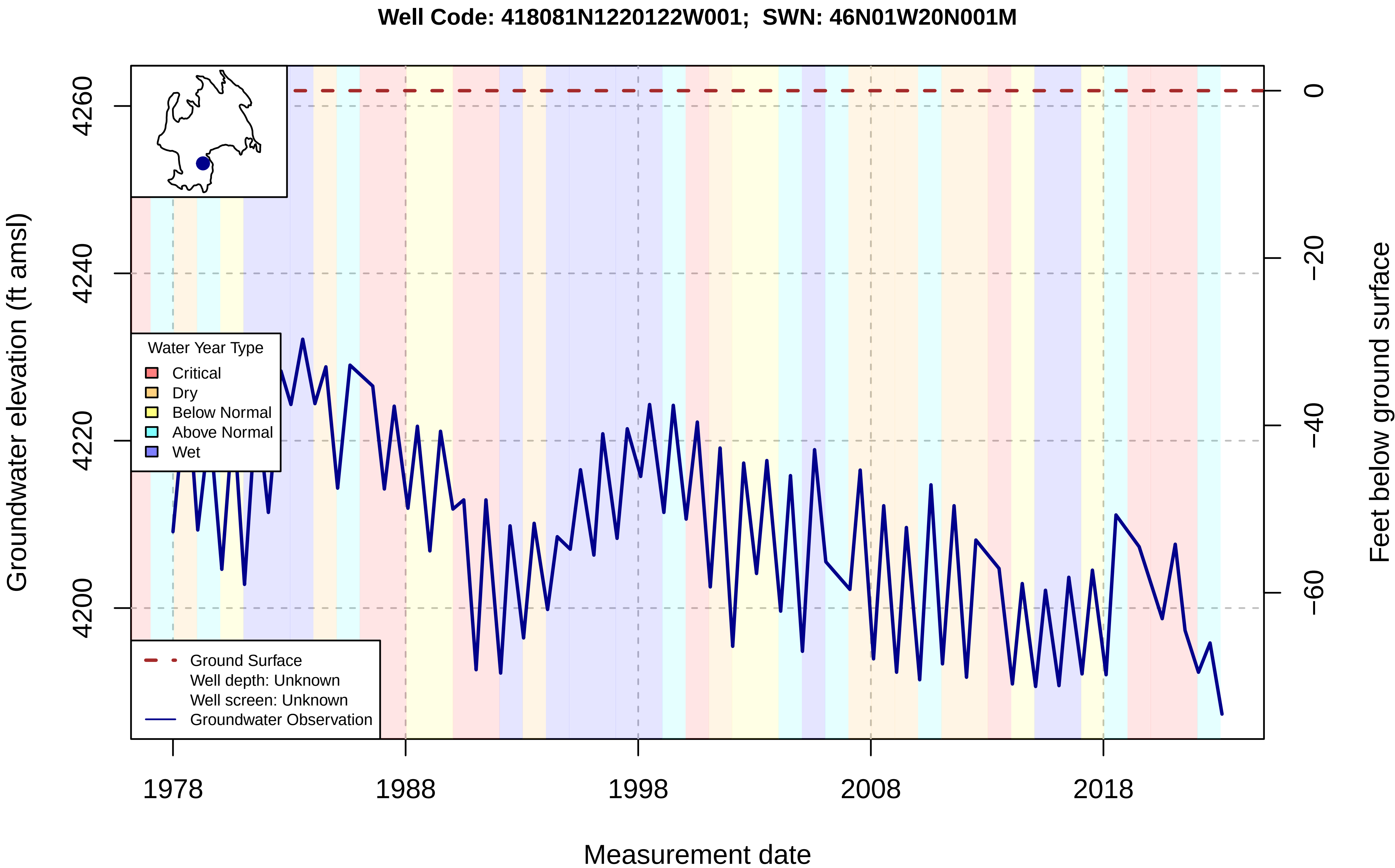
Well Code: 417944N1220350W001; SWN: 46N02W25R002M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4260
4240
4220
4200
0
−20
−40
−60
1952
1962
1972
1982
1992
2002
2012
2022
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 116 ft bgs
Well screen: Unknown
Groundwater Observation



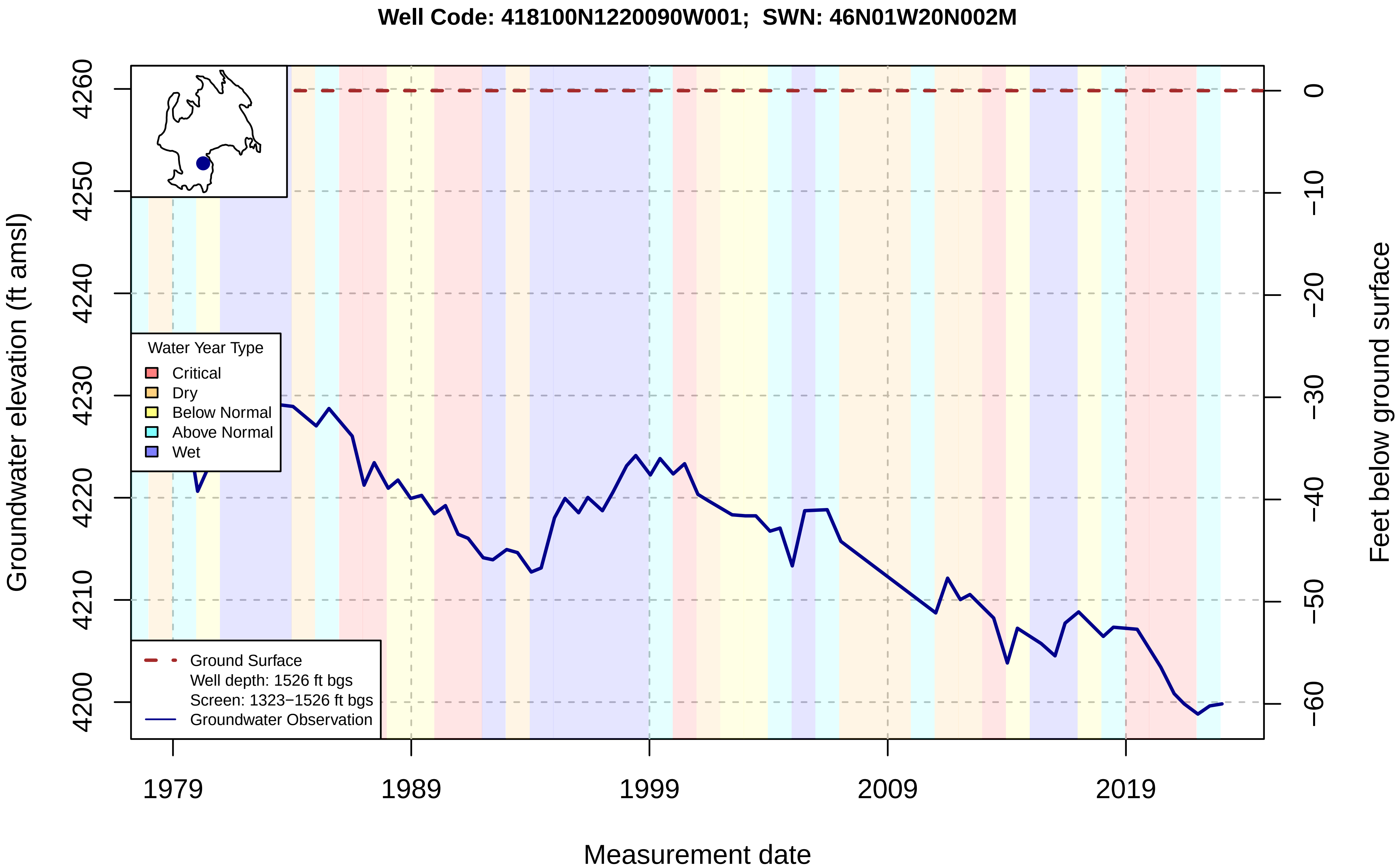
Well Code: BUT_07; SWN: NA
Groundwater elevation (ft amsl)
4190
4200
4210
4220
4230
4240
4250
Feet below ground surface
0
−10
−20
−30
−40
−50
−60
−70
Jul 2019
Jul 2020
Jul 2021
Jul 2022
Jul 2023
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 400 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation

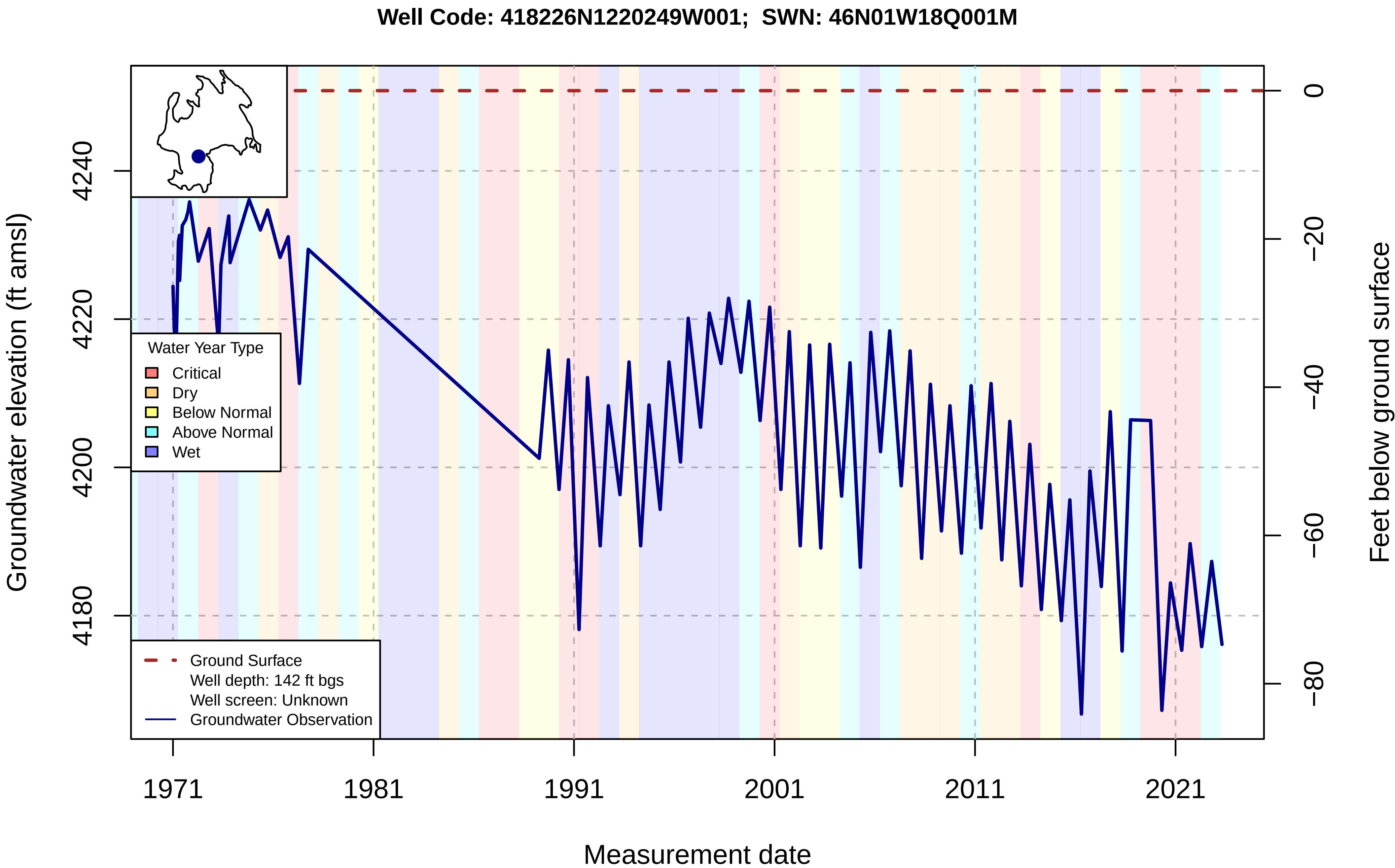


Well Code: BUT_196; SWN: NA
Groundwater elevation (ft amsl)
4260
4240
4220
4200
Feet below ground surface
0
−20
−40
−60
−80
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 194 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation
Aug 2020
Aug 2021
Aug 2022
Aug 2023
Measurement date

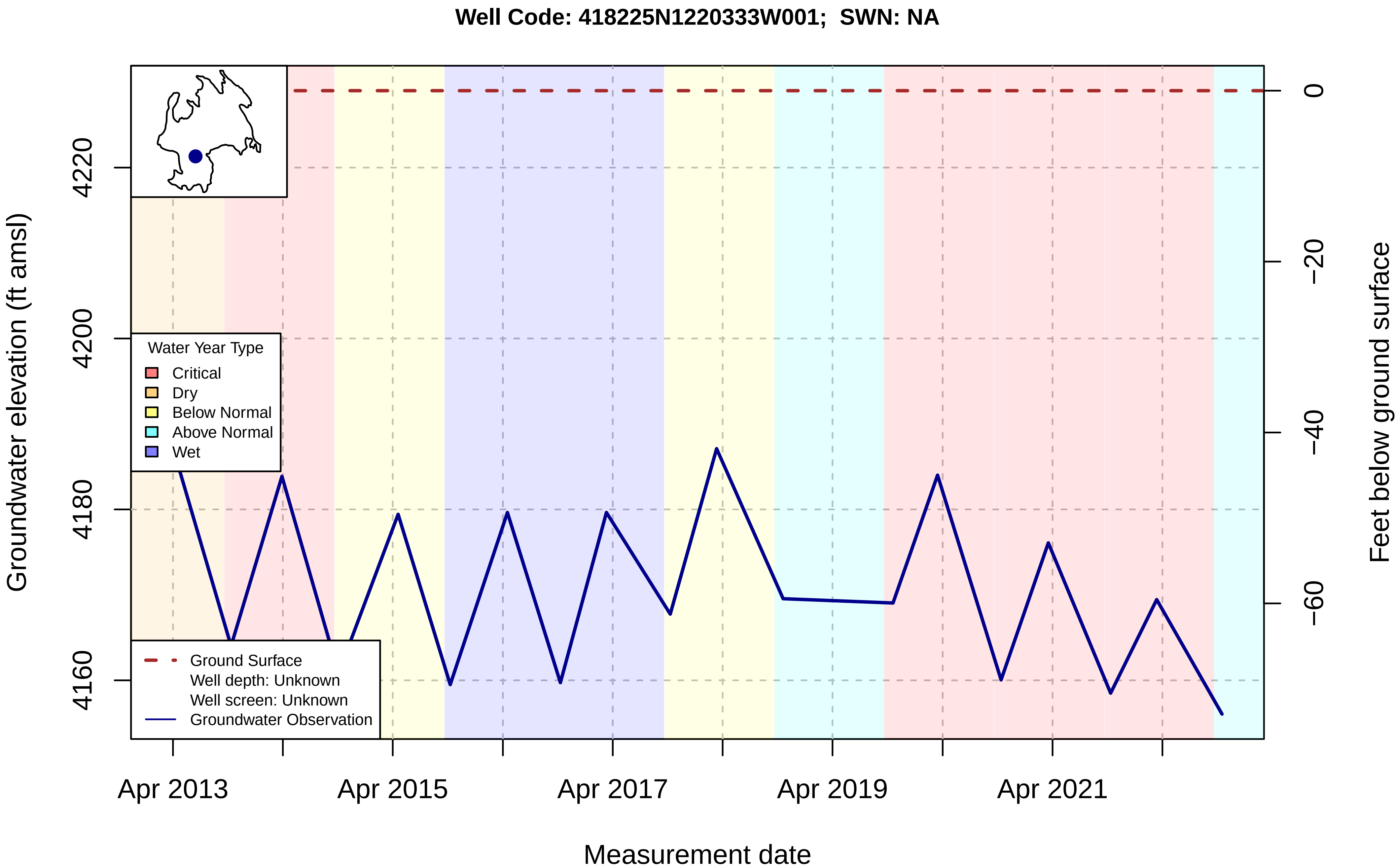


Well Code: 418081N1220122W001; SWN: 46N01W20N001M
Groundwater elevation (ft amsl)
4260
4240
4220
4200
Feet below ground surface
0
−20
−40
−60
1978
1988
1998
2008
2018
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation

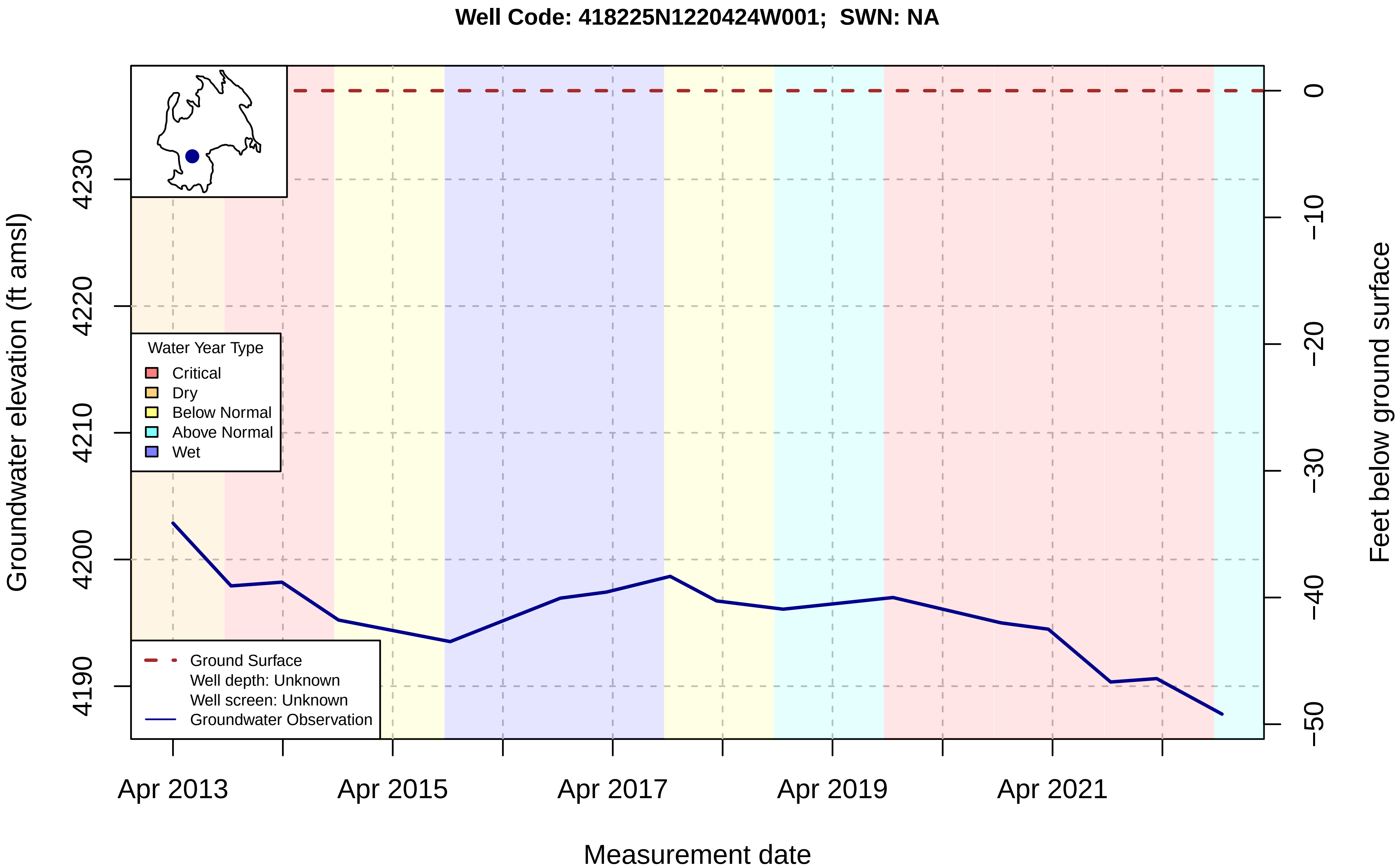

Well Code: 418100N1220090W001; SWN: 46N01W20N002M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4260
4250
4240
4230
4220
4210
4200
0
−10
−20
−30
−40
−50
−60
1979
1989
1999
2009
2019
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 1526 ft bgs
Screen: 1323−1526 ft bgs
Groundwater Observation



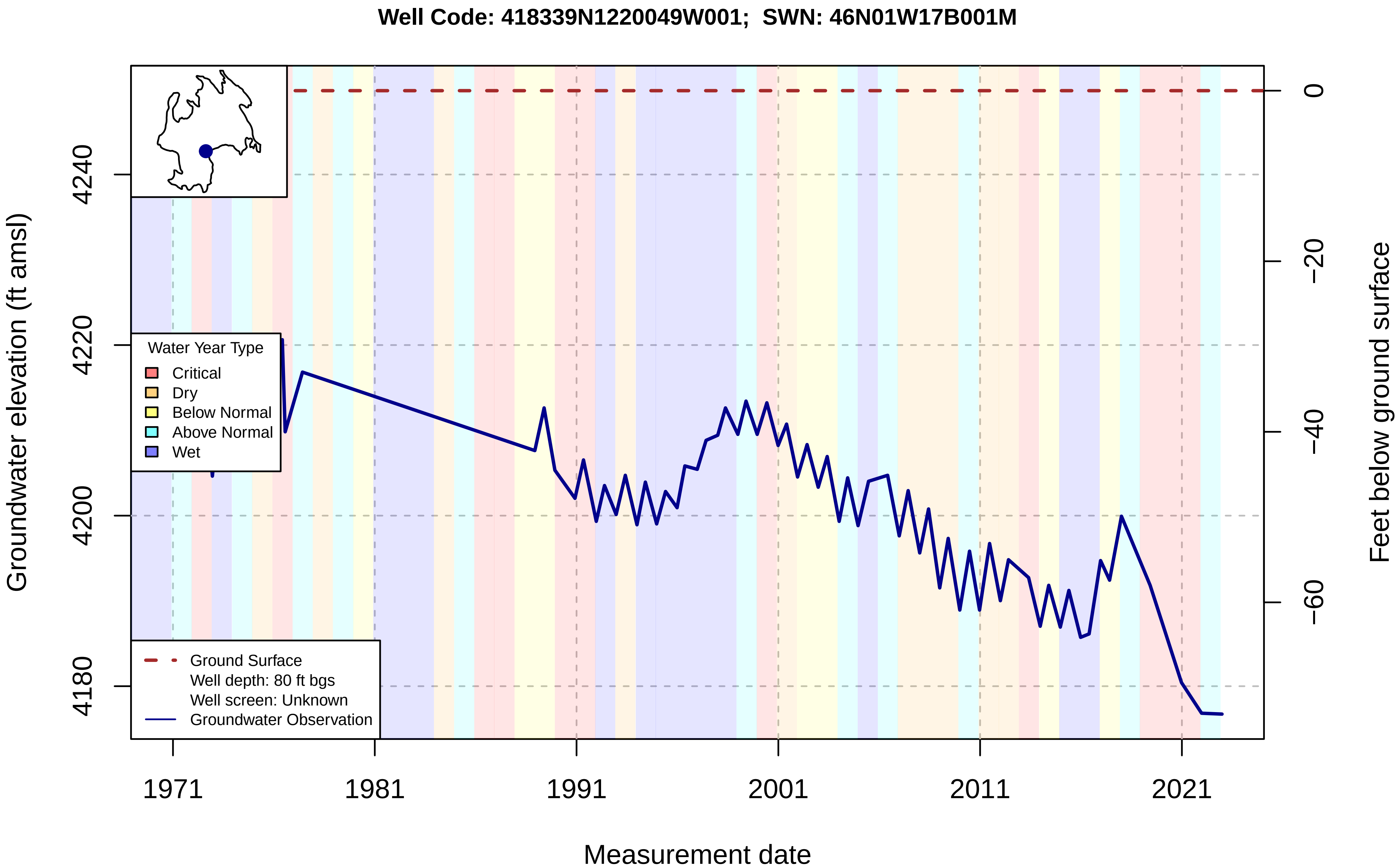
Well Code: 418226N1220249W001; SWN: 46N01W18Q001M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4180
4200
4220
4240
0
−20
−40
−60
−80
1971
1981
1991
2001
2011
2021
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 142 ft bgs
Well screen: Unknown
Groundwater Observation



Well Code: 418225N1220333W001; SWN: NA
Groundwater elevation (ft amsl)
4220
4200
4180
4160
Feet below ground surface
0
−20
−40
−60
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation
Apr 2013
Apr 2015
Apr 2017
Apr 2019
Apr 2021
Measurement date

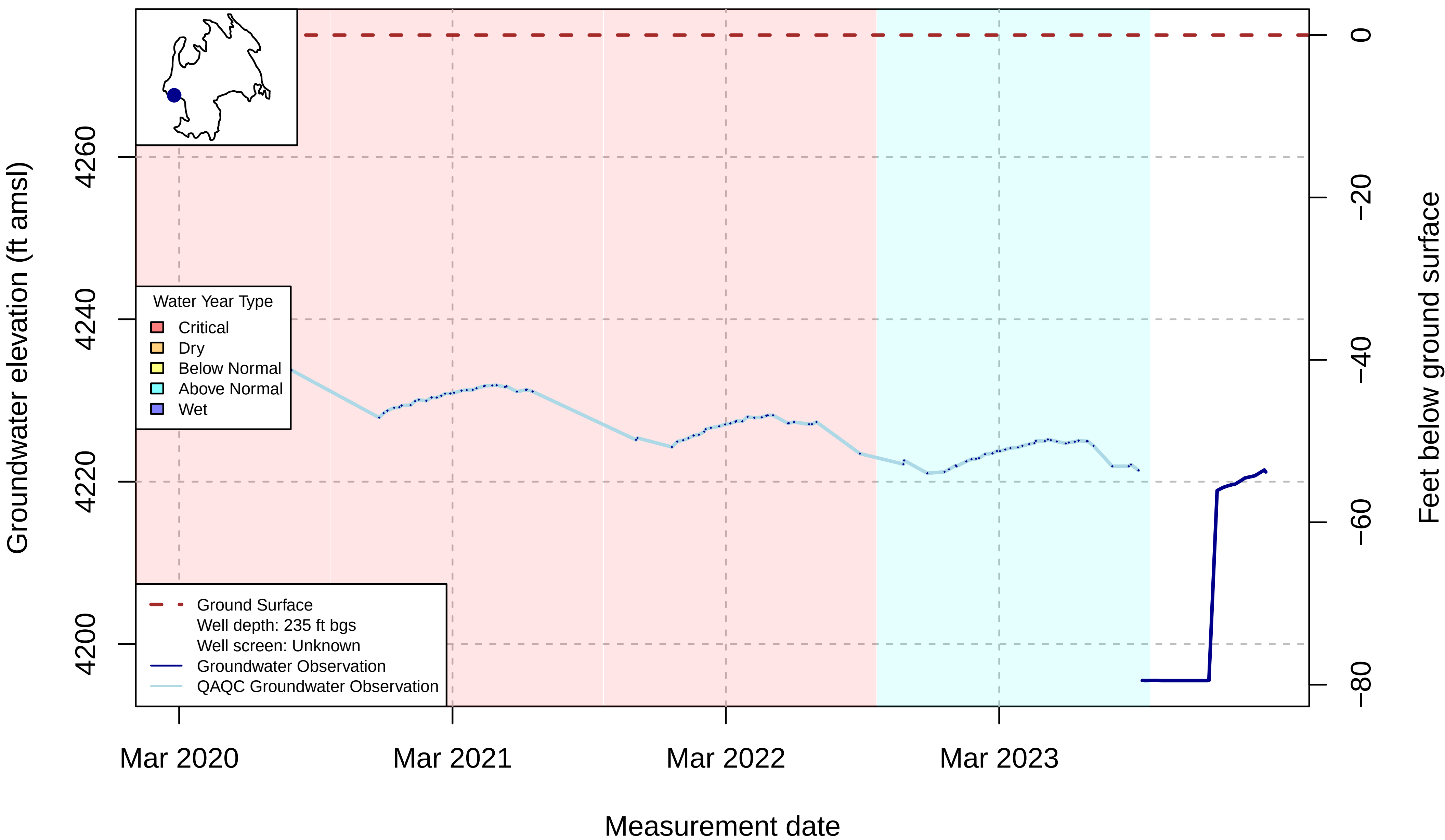


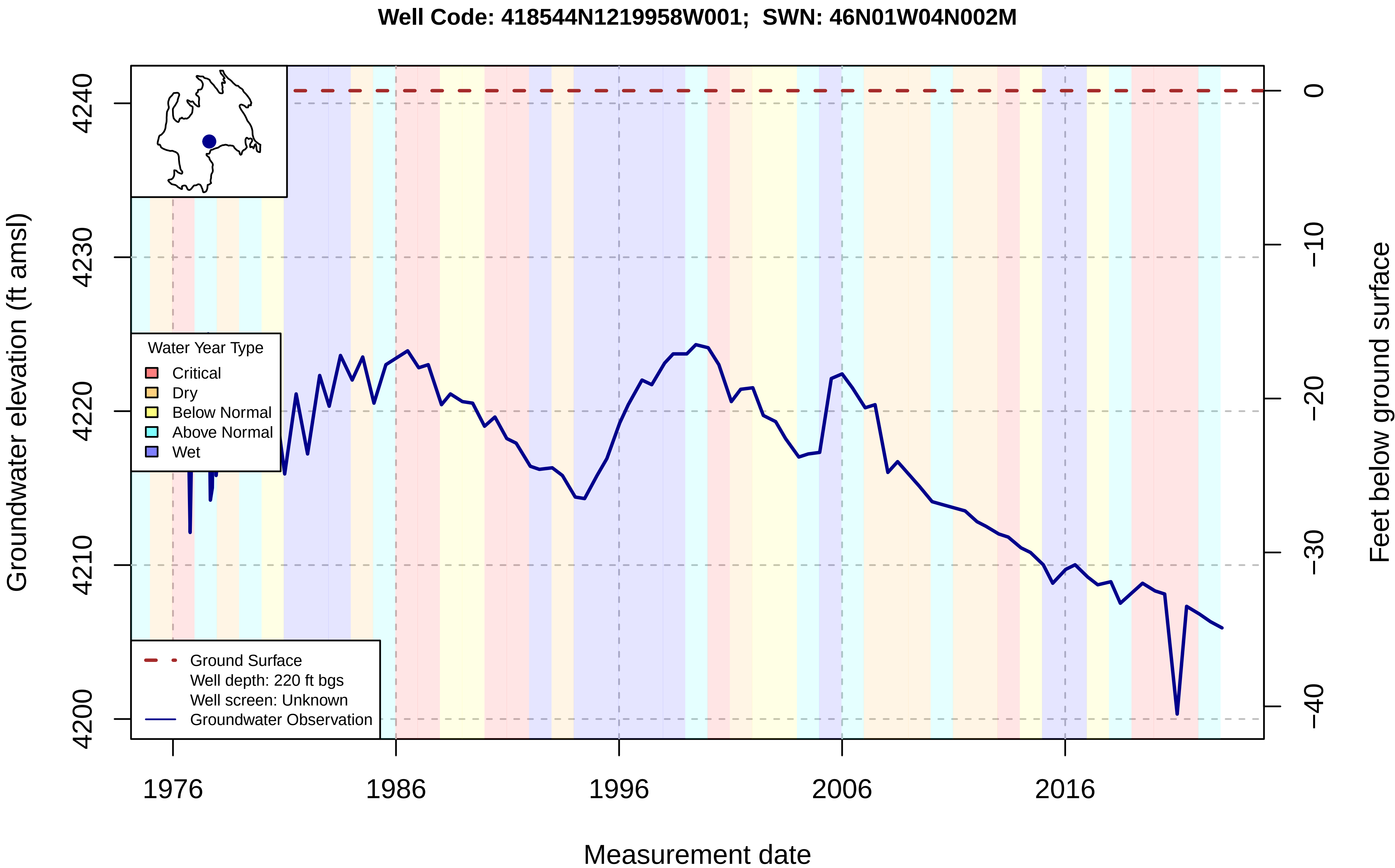
Well Code: 418225N1220424W001; SWN: NA
Groundwater elevation (ft amsl)
4190
4200
4210
4220
4230
Feet below ground surface
0
−10
−20
−30
−40
−50
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation
Apr 2013
Apr 2015
Apr 2017
Apr 2019
Apr 2021
Measurement date



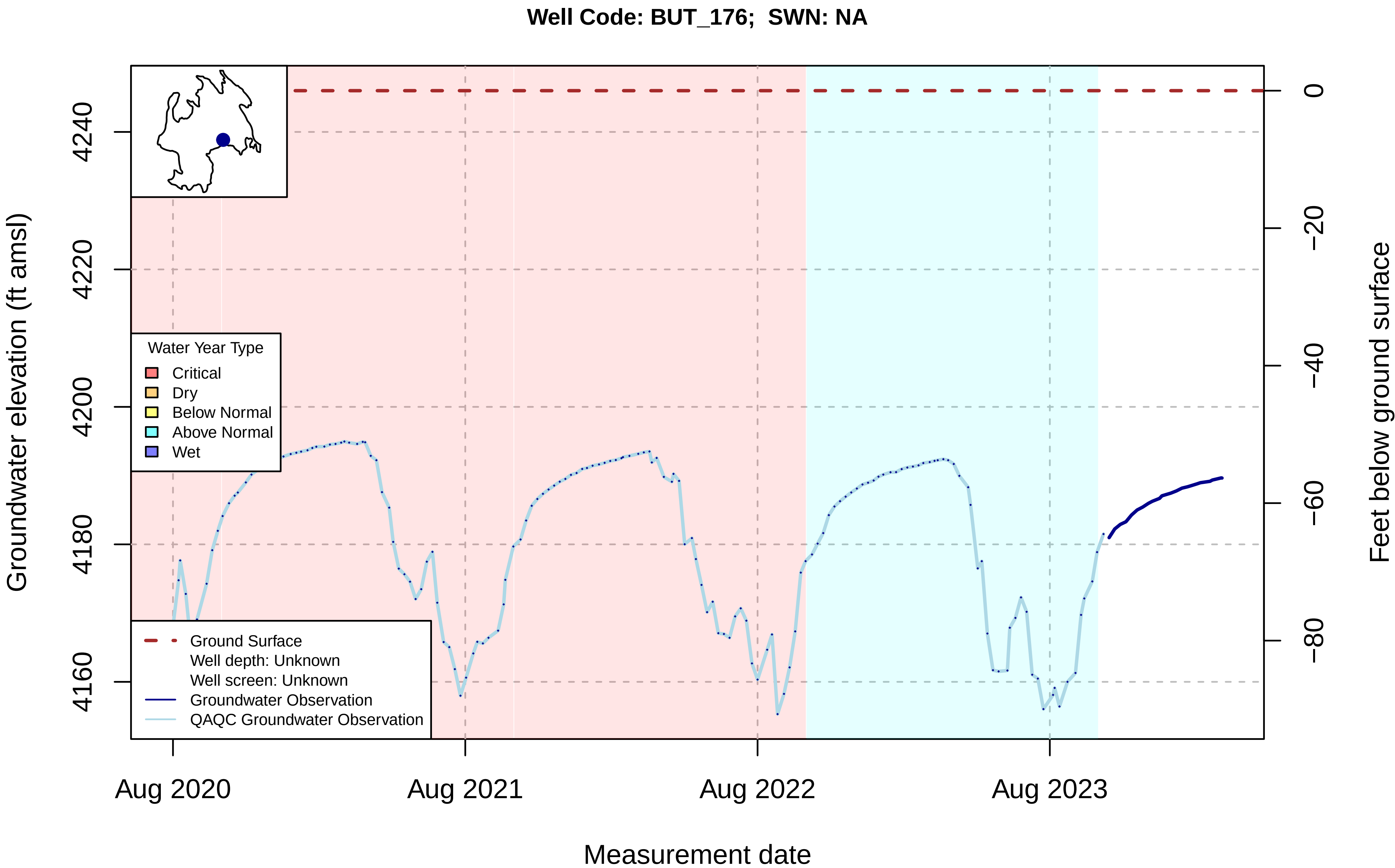
Well Code: 418339N1220049W001; SWN: 46N01W17B001M
Groundwater elevation (ft amsl)
4240
4220
4200
4180
Feet below ground surface
0
−20
−40
−60
1971
1981
1991
2001
2011
2021
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 80 ft bgs
Well screen: Unknown
Groundwater Observation

Well Code: BUT_179; SWN: NA

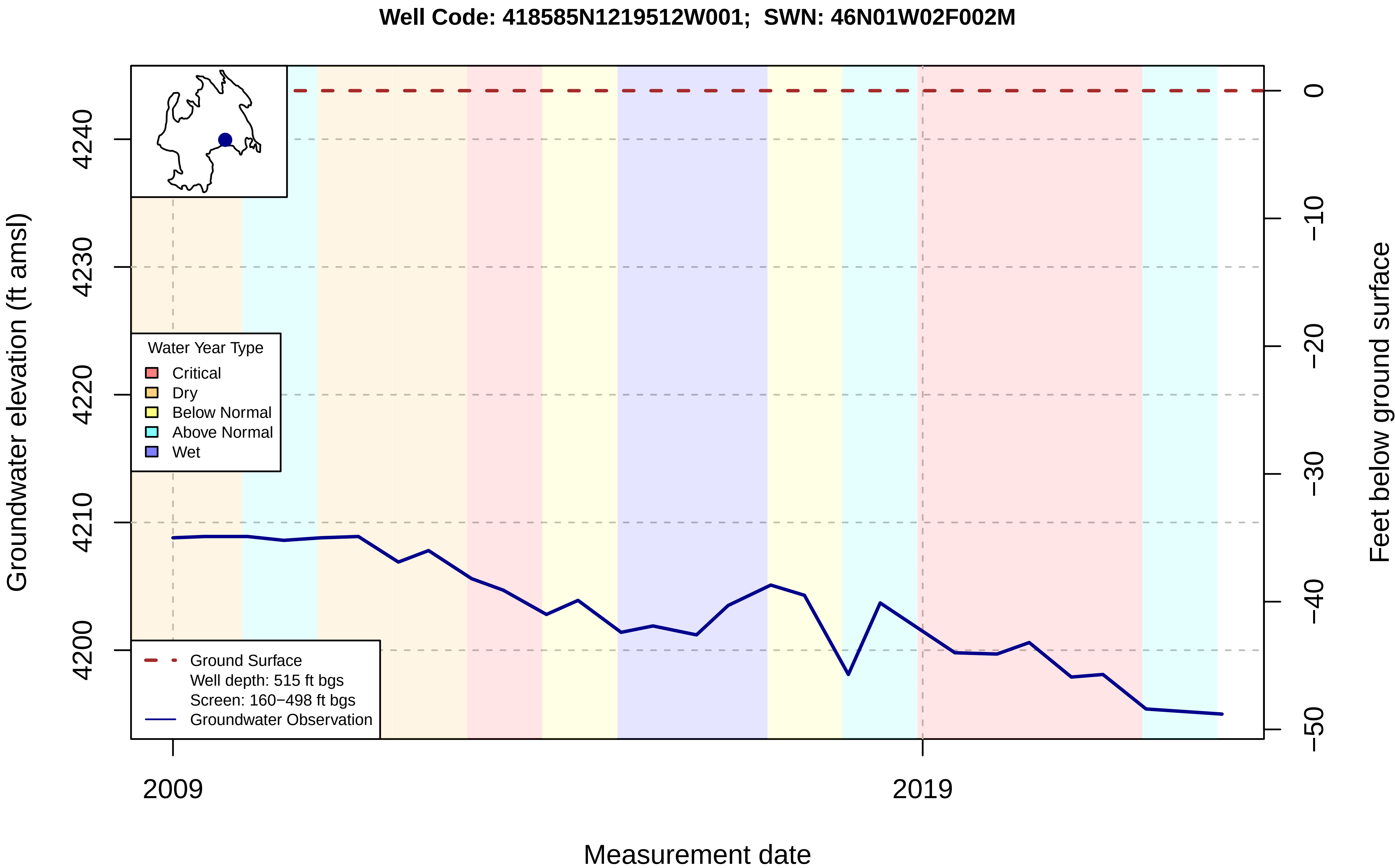


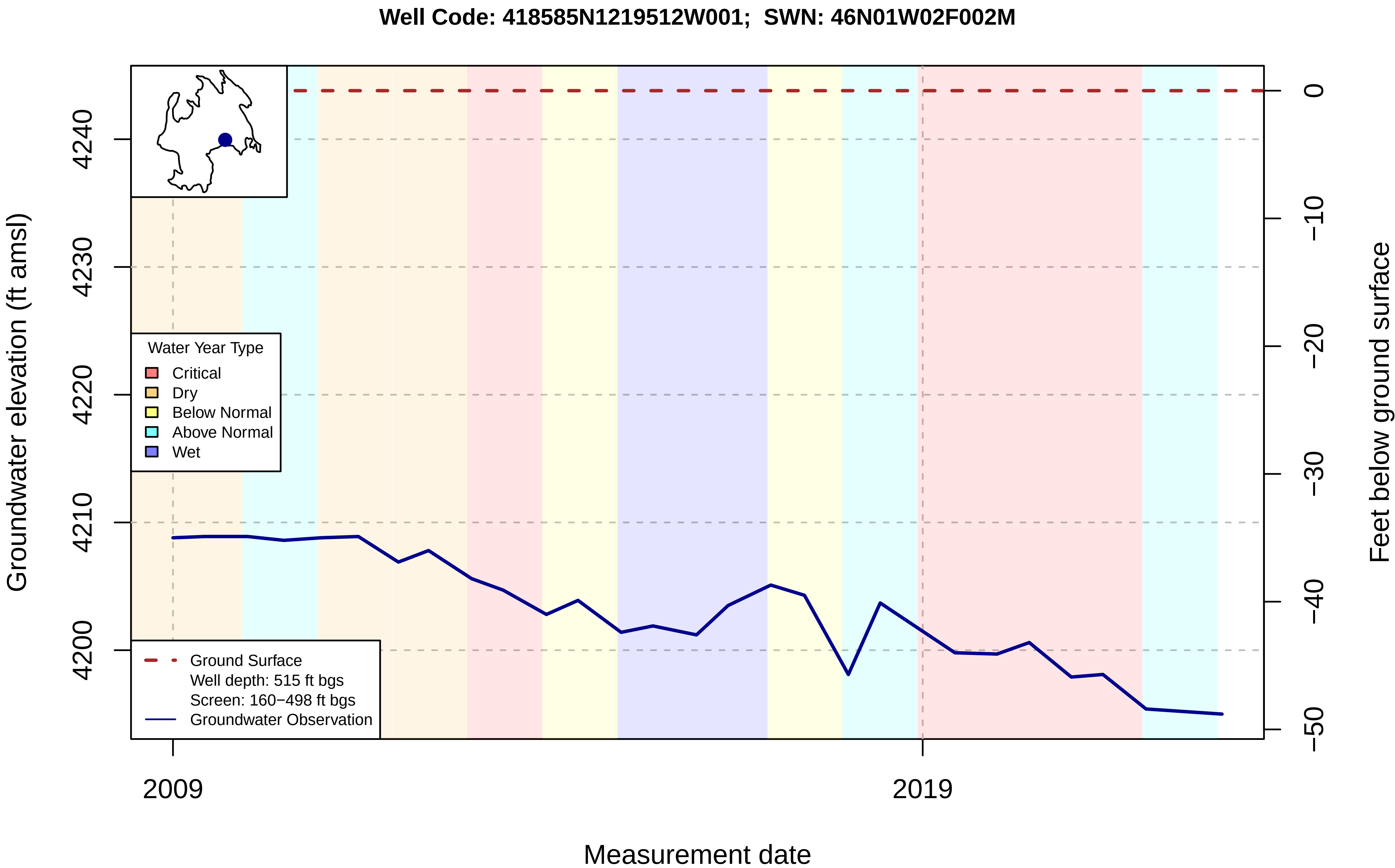


Well Code: 418544N1219958W001; SWN: 46N01W04N002M
Groundwater elevation (ft amsl)
4200
4210
4220
4230
4240
Feet below ground surface
0
−10
−20
−30
−40
1976
1986
1996
2006
2016
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 220 ft bgs
Well screen: Unknown
Groundwater Observation

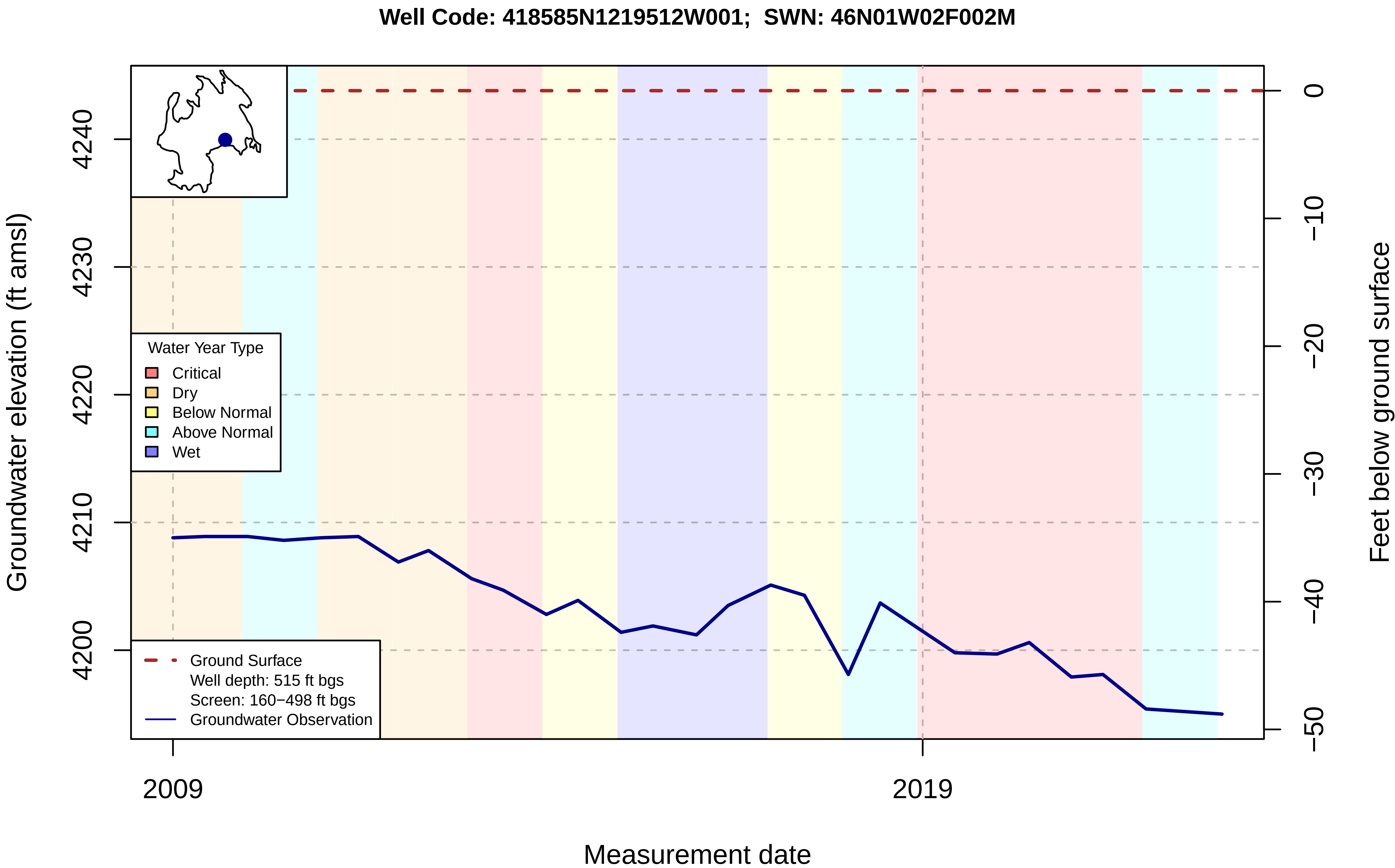


Well Code: BUT_176; SWN: NA
Groundwater elevation (ft amsl)
4160
4180
4200
4220
4240
Feet below ground surface
0
−20
−40
−60
−80
Aug 2020
Aug 2021
Aug 2022
Aug 2023
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation

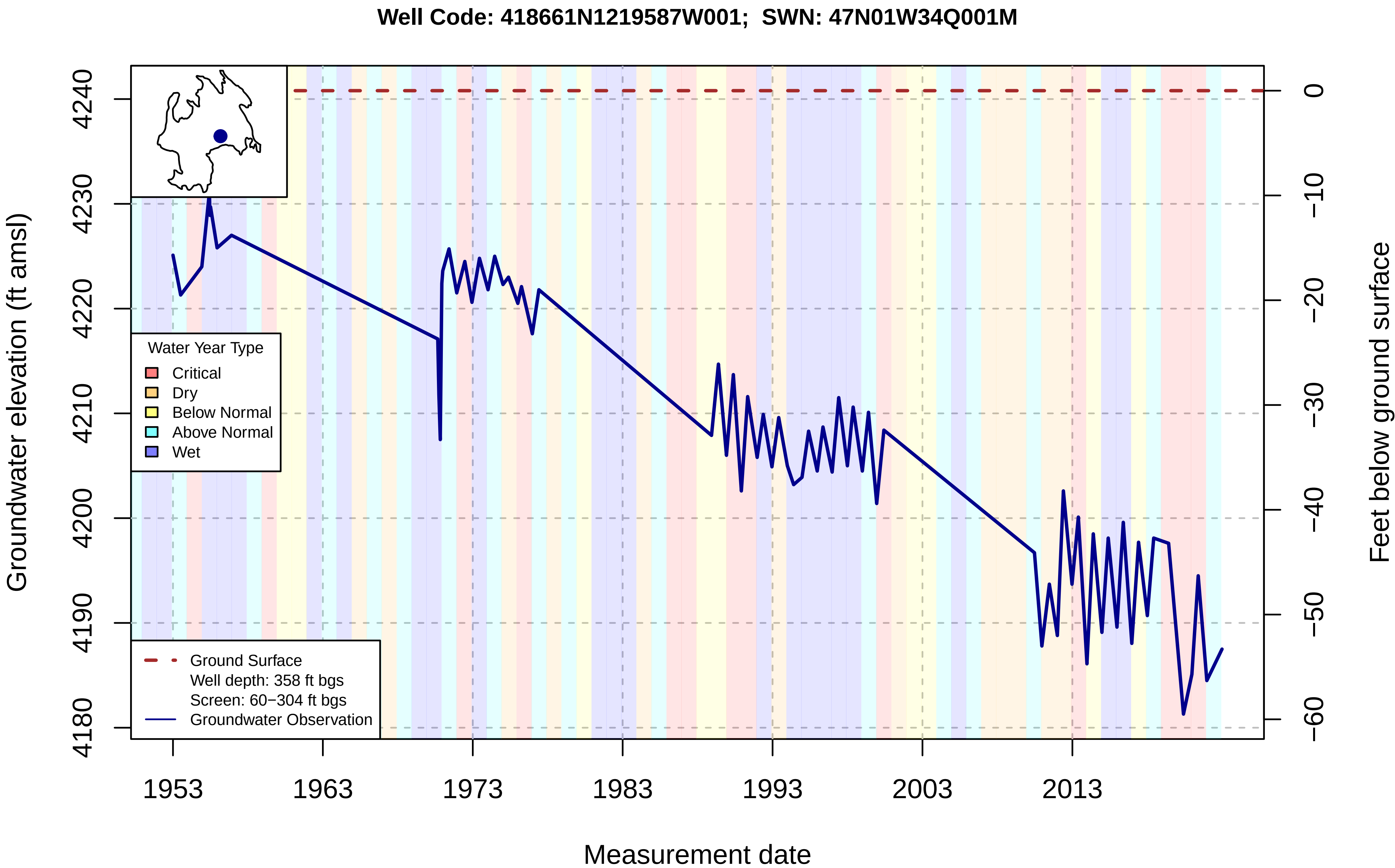

Well Code: 418585N1219512W001; SWN: 46N01W02F002M
Groundwater elevation (ft amsl)
4240
4230
4220
4210
4200
Feet below ground surface
0
−10
−20
−30
−40
−50
2009
2019
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 515 ft bgs
Screen: 160−498 ft bgs
Groundwater Observation



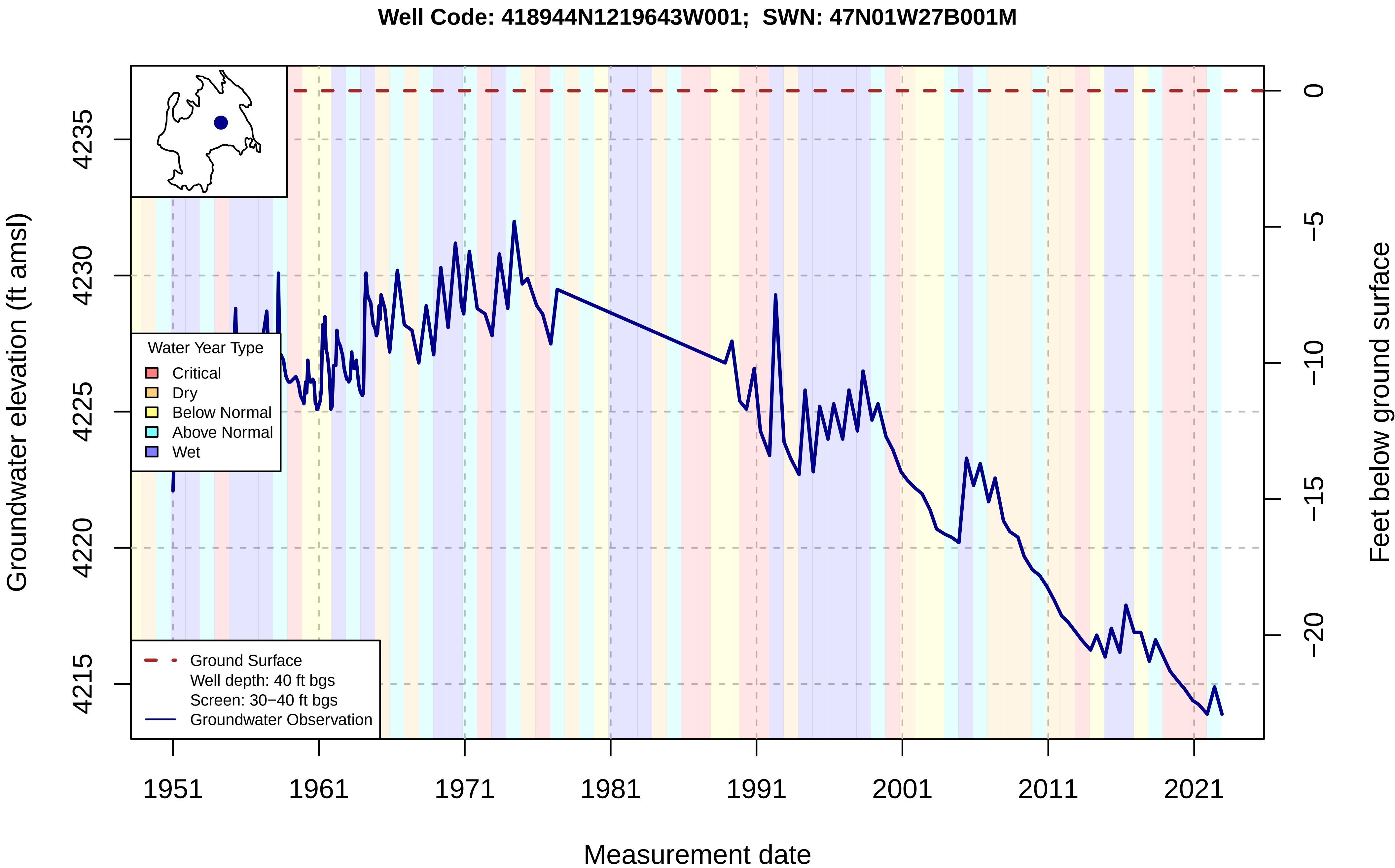
Well Code: 418585N1219512W001; SWN: 46N01W02F002M
Groundwater elevation (ft amsl)
4240
4230
4220
4210
4200
Feet below ground surface
0
−10
−20
−30
−40
−50
2009
2019
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 515 ft bgs
Screen: 160−498 ft bgs
Groundwater Observation



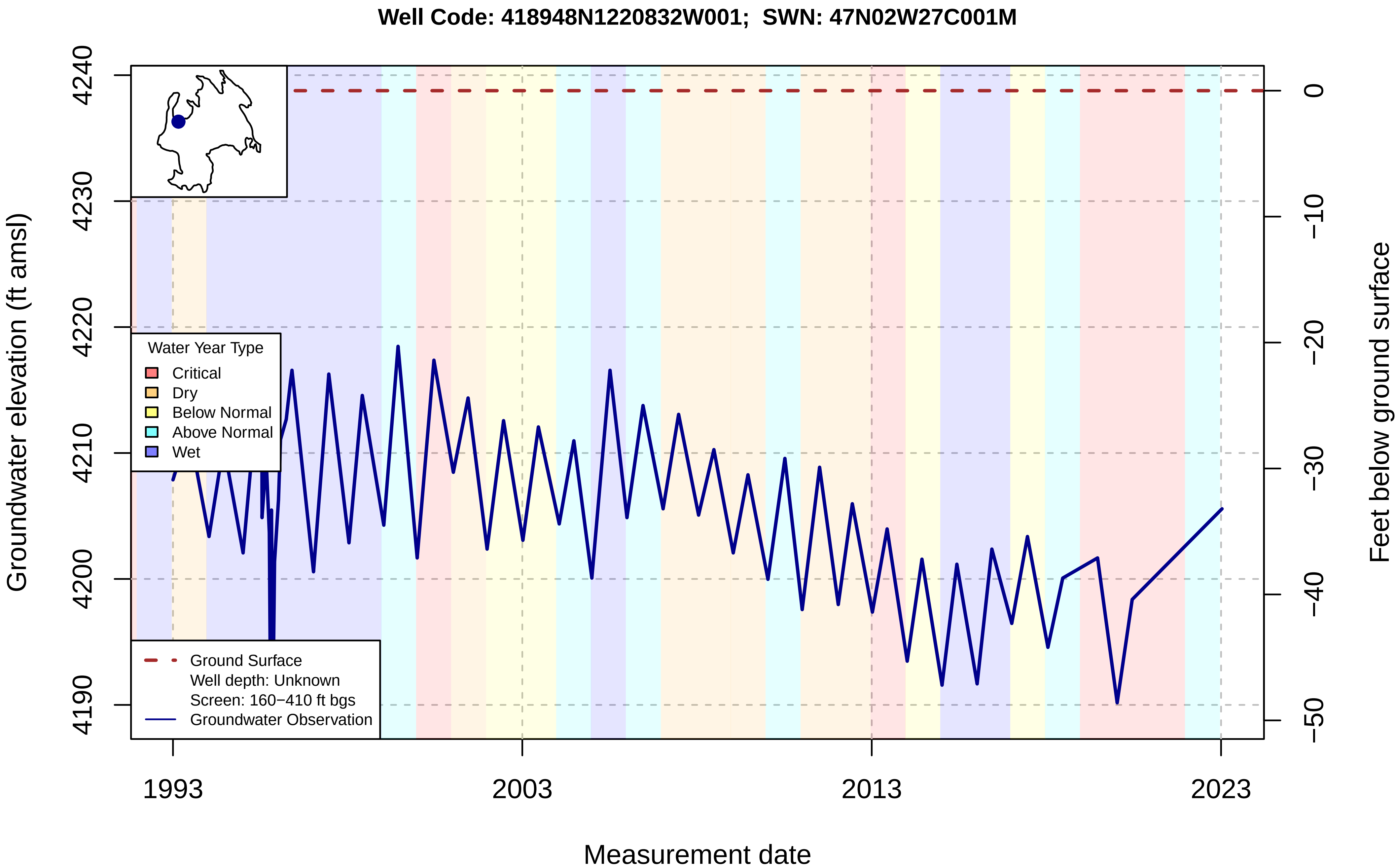
Well Code: 418585N1219512W001; SWN: 46N01W02F002M
Groundwater elevation (ft amsl)
4240
4230
4220
4210
4200
Feet below ground surface
0
−10
−20
−30
−40
−50
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 515 ft bgs
Screen: 160−498 ft bgs
Groundwater Observation
2009
2019
Measurement date



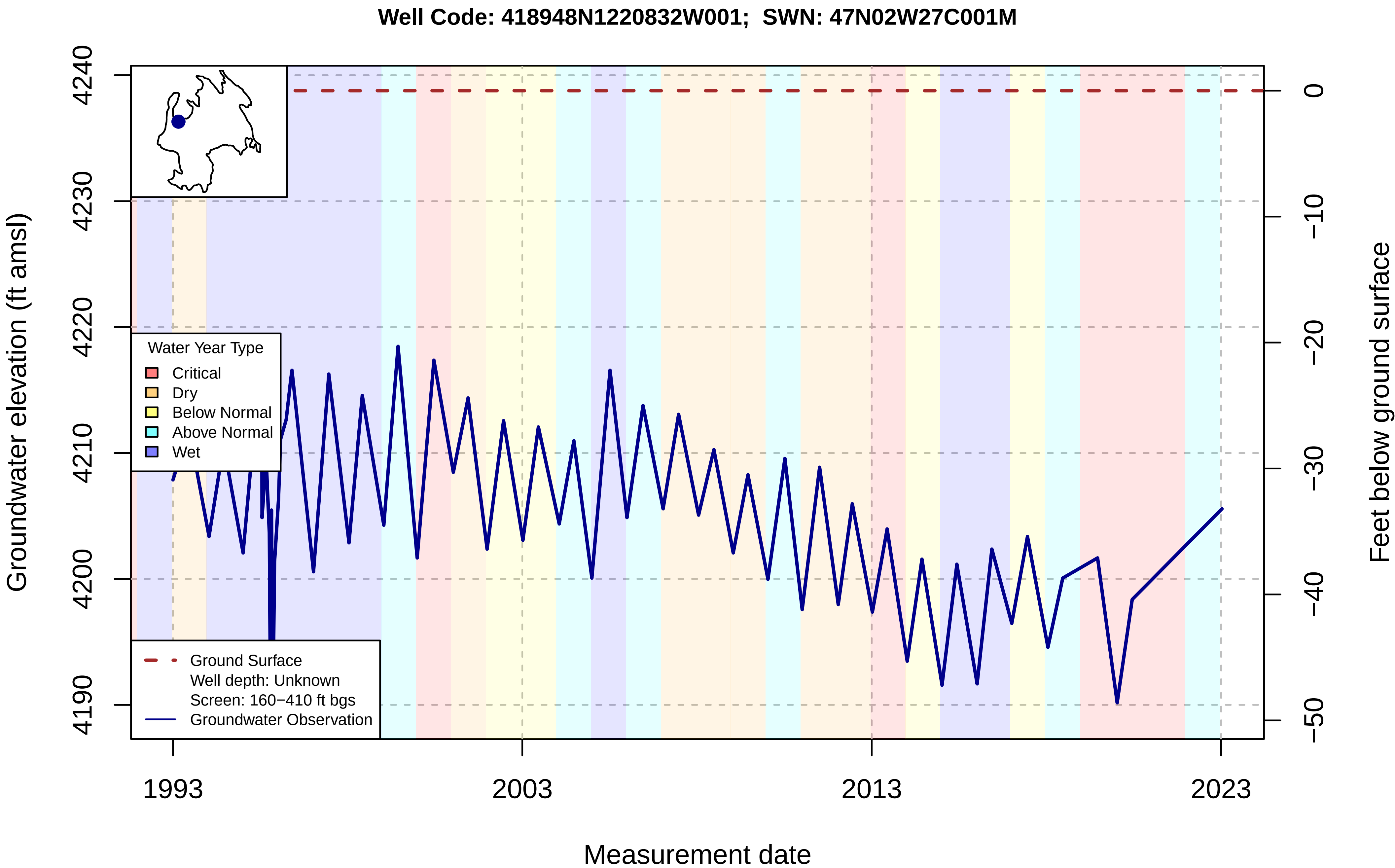
Well Code: 418661N1219587W001; SWN: 47N01W34Q001M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4180
4190
4200
4210
4220
4230
4240
0
−10
−20
−30
−40
−50
−60
1953
1963
1973
1983
1993
2003
2013
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 358 ft bgs
Screen: 60−304 ft bgs
Groundwater Observation



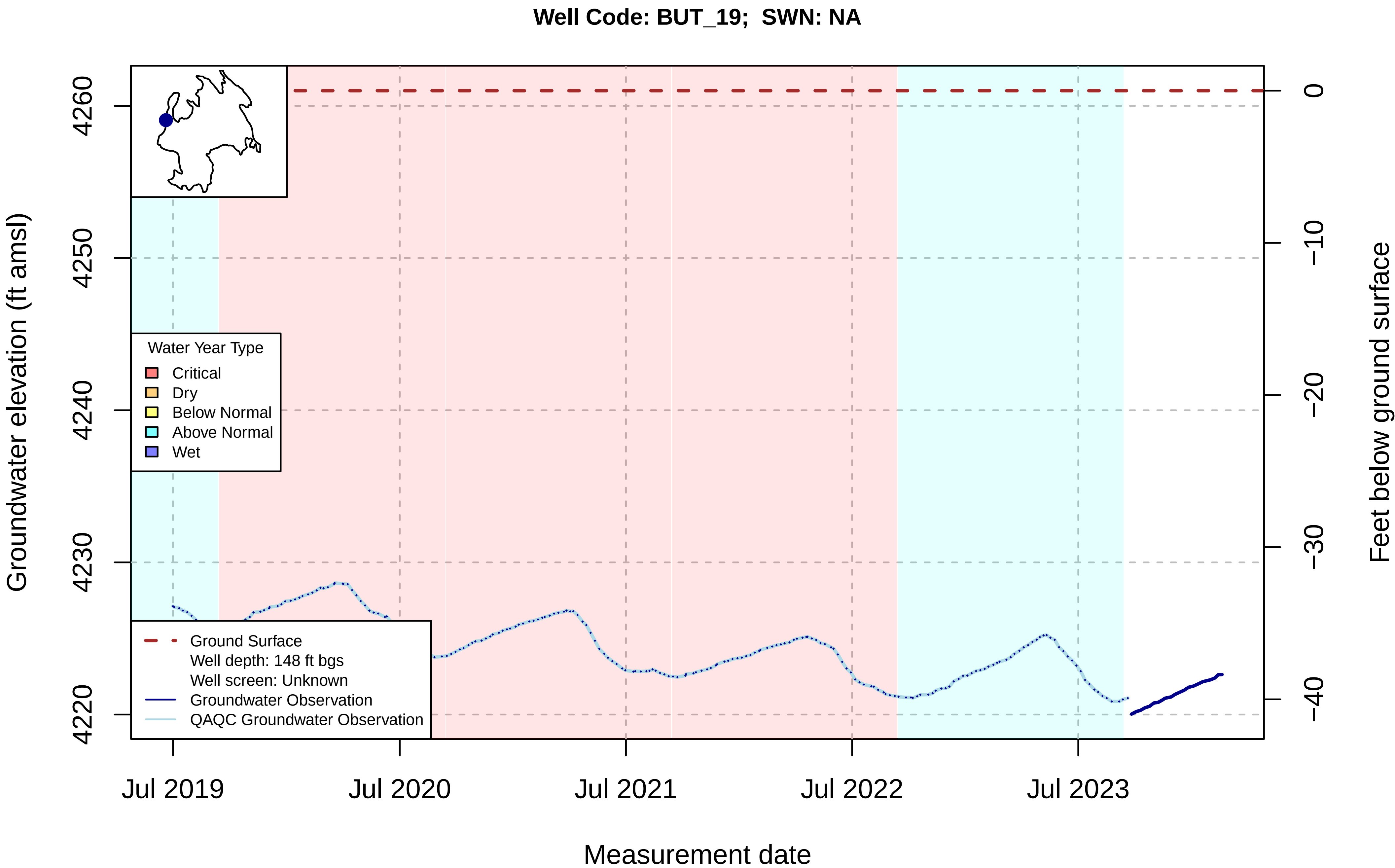
Well Code: 418944N1219643W001; SWN: 47N01W27B001M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4215
4220
4225
4230
4235
0
−5
−10
−15
−20
1951
1961
1971
1981
1991
2001
2011
2021
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 40 ft bgs
Screen: 30−40 ft bgs
Groundwater Observation

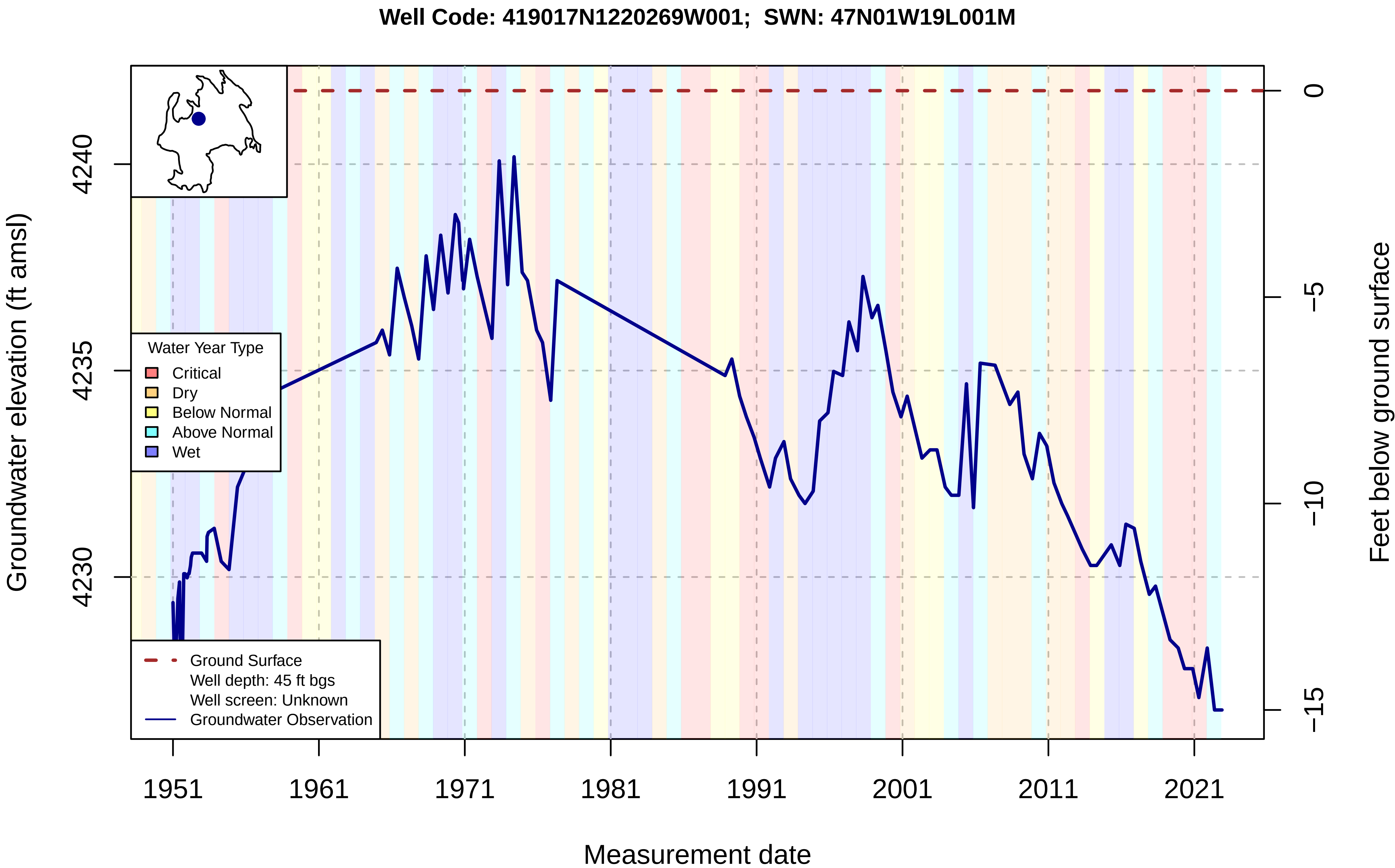


Well Code: 418948N1220832W001; SWN: 47N02W27C001M
Groundwater elevation (ft amsl)
4240
4230
4220
4210
4200
4190
Feet below ground surface
0
−10
−20
−30
−40
−50
1993
2003
2013
2023
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Screen: 160−410 ft bgs
Groundwater Observation

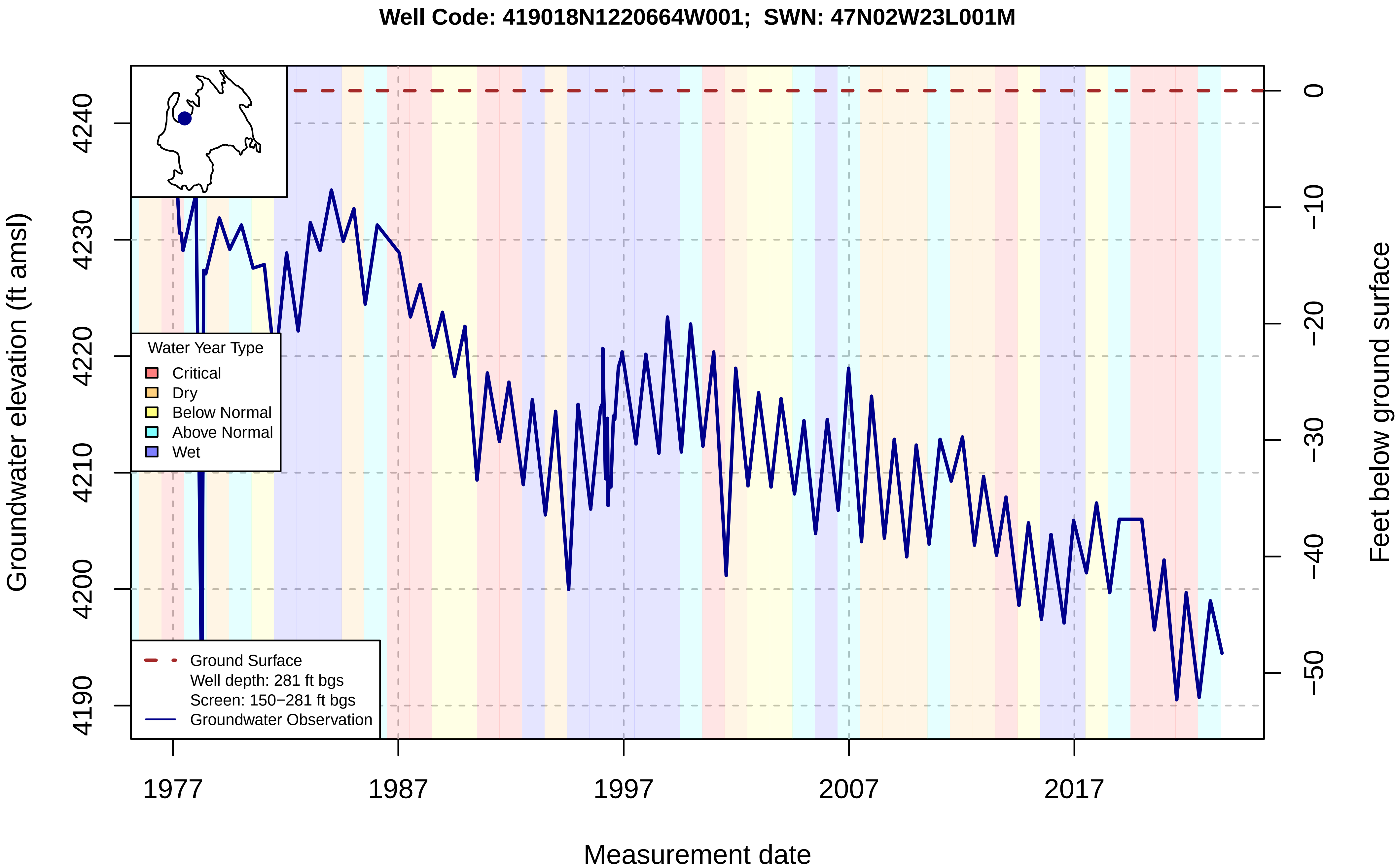


Well Code: 418948N1220832W001; SWN: 47N02W27C001M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4240
4230
4220
4210
4200
4190
0
−10
−20
−30
−40
−50
1993
2003
2013
2023
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Screen: 160−410 ft bgs
Groundwater Observation

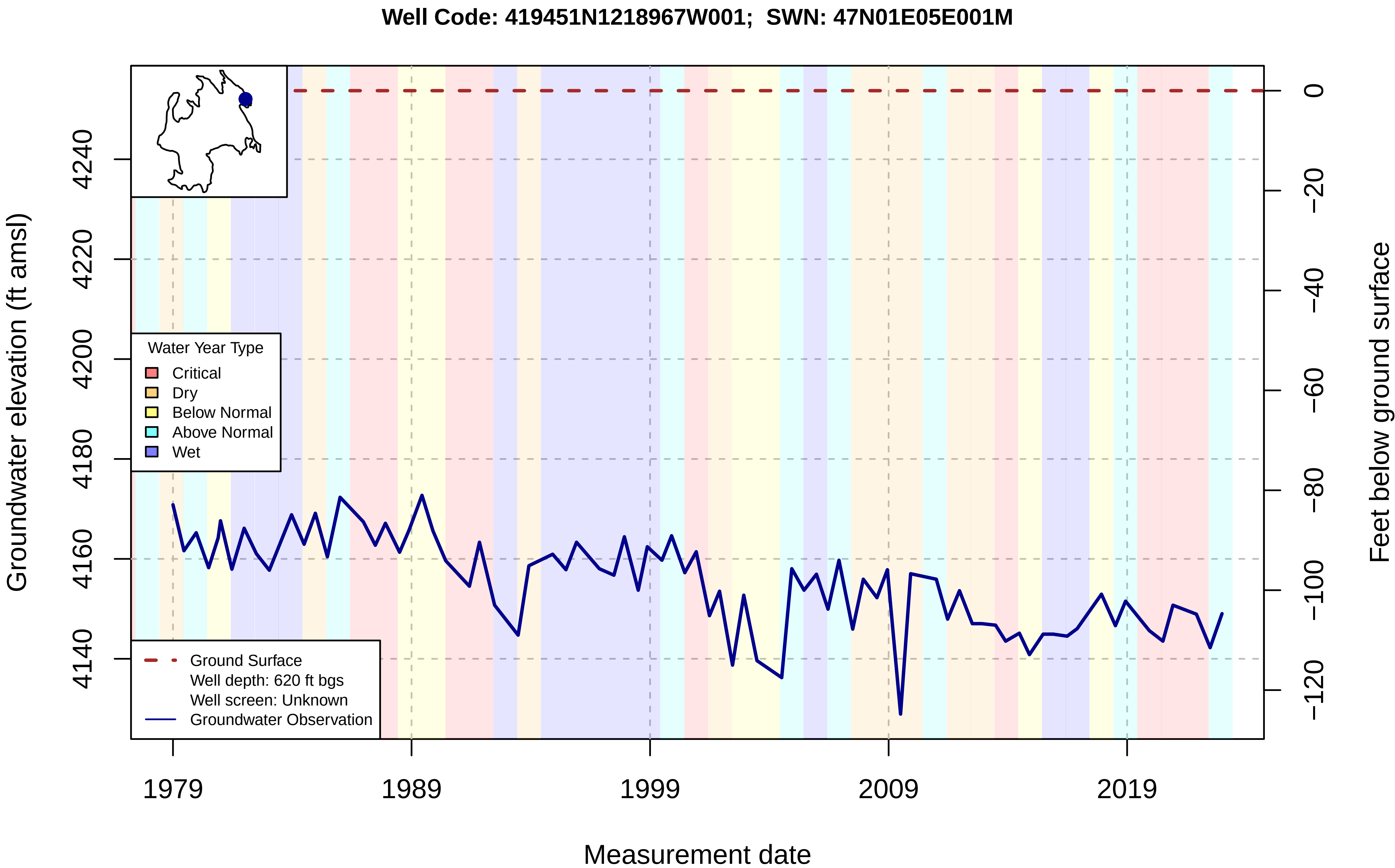

Well Code: BUT_19; SWN: NA
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4260
4250
4240
4230
4220
0
−10
−20
−30
−40
Jul 2019
Jul 2020
Jul 2021
Jul 2022
Jul 2023
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 148 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation



Well Code: 419017N1220269W001; SWN: 47N01W19L001M
Groundwater elevation (ft amsl)
4230
4235
4240
Feet below ground surface
0
−5
−10
−15
Measurement date
1951
1961
1971
1981
1991
2001
2011
2021
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 45 ft bgs
Well screen: Unknown
Groundwater Observation

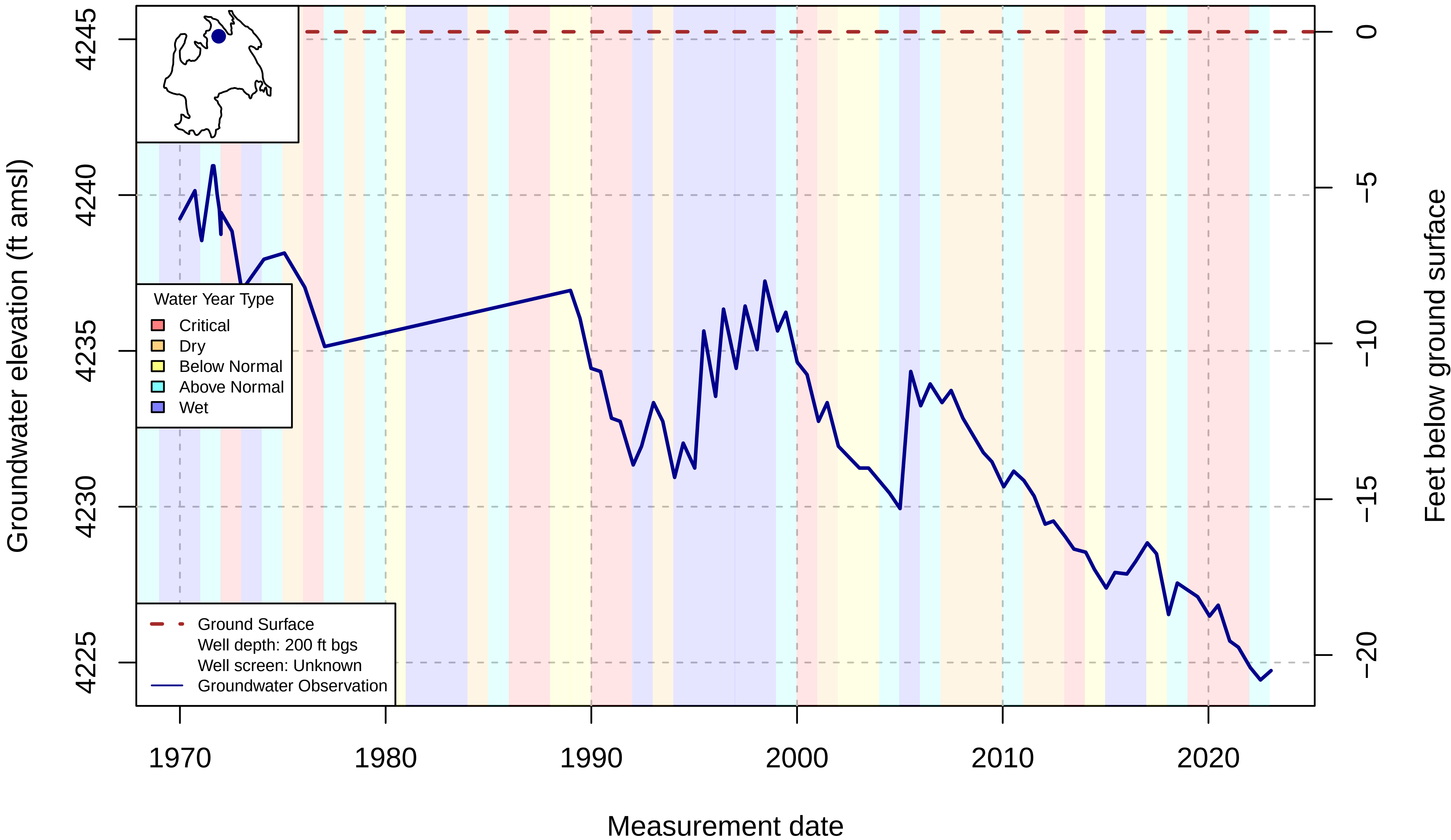


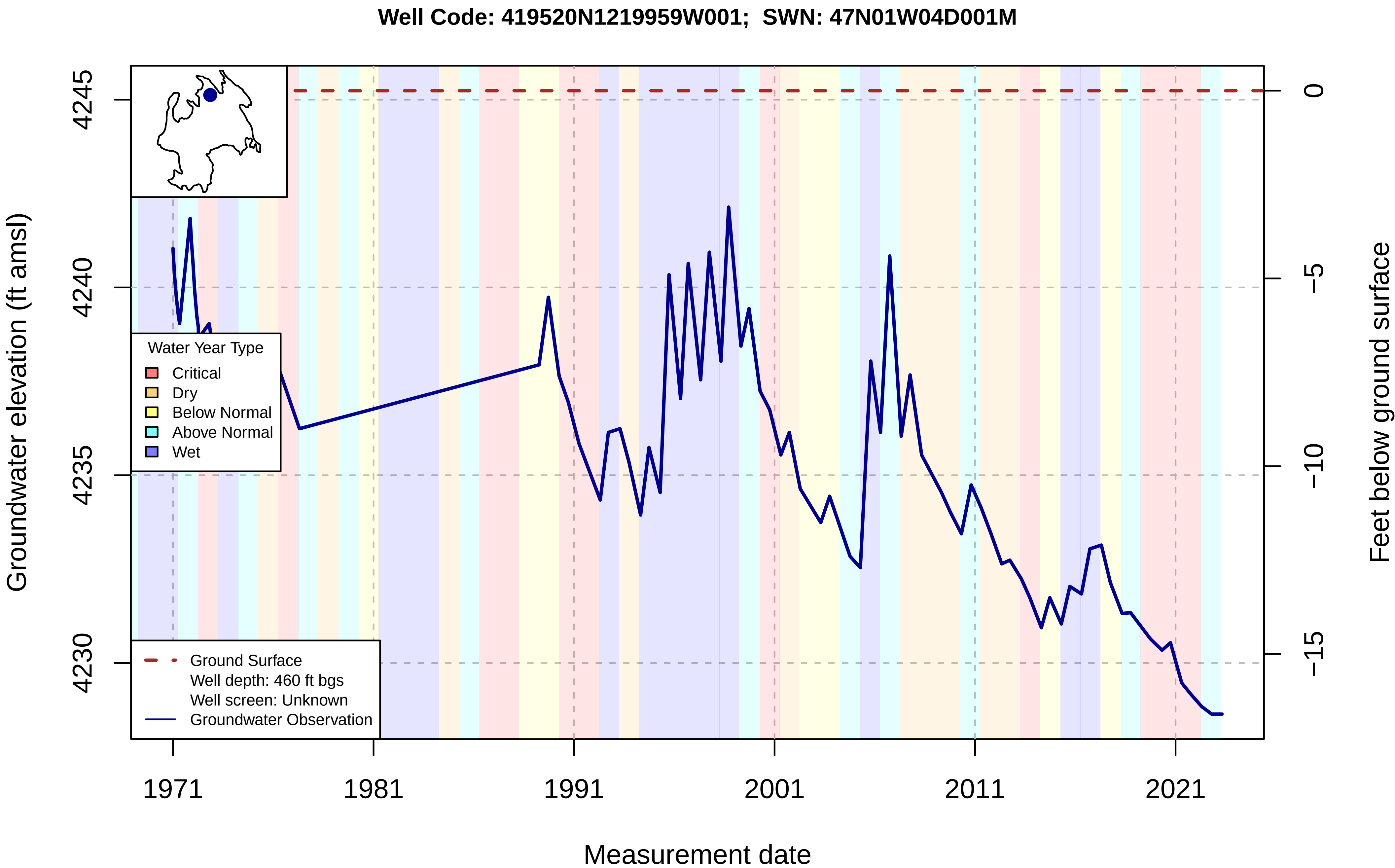
Well Code: 419018N1220664W001; SWN: 47N02W23L001M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4190
4200
4210
4220
4230
4240
0
−10
−20
−30
−40
−50
1977
1987
1997
2007
2017
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 281 ft bgs
Screen: 150−281 ft bgs
Groundwater Observation



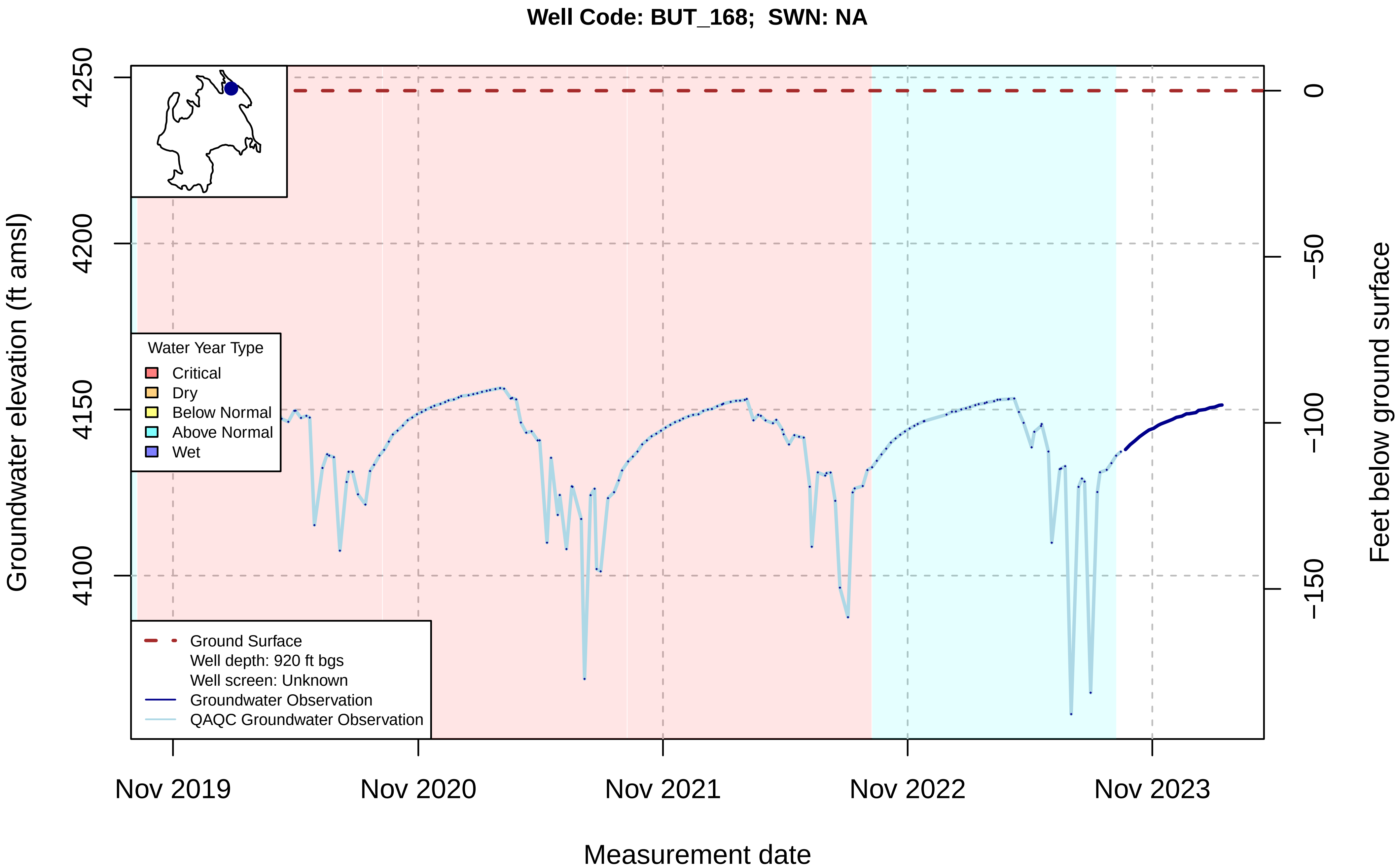
Well Code: 419451N1218967W001; SWN: 47N01E05E001M
Groundwater elevation (ft amsl)
4140
4160
4180
4200
4220
4240
Feet below ground surface
0
−20
−40
−60
−80
−100
−120
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 620 ft bgs
Well screen: Unknown
Groundwater Observation
1979
1989
1999
2009
2019
Measurement date

Well Code: 419519N1219958W001; SWN: 47N01W04D002M

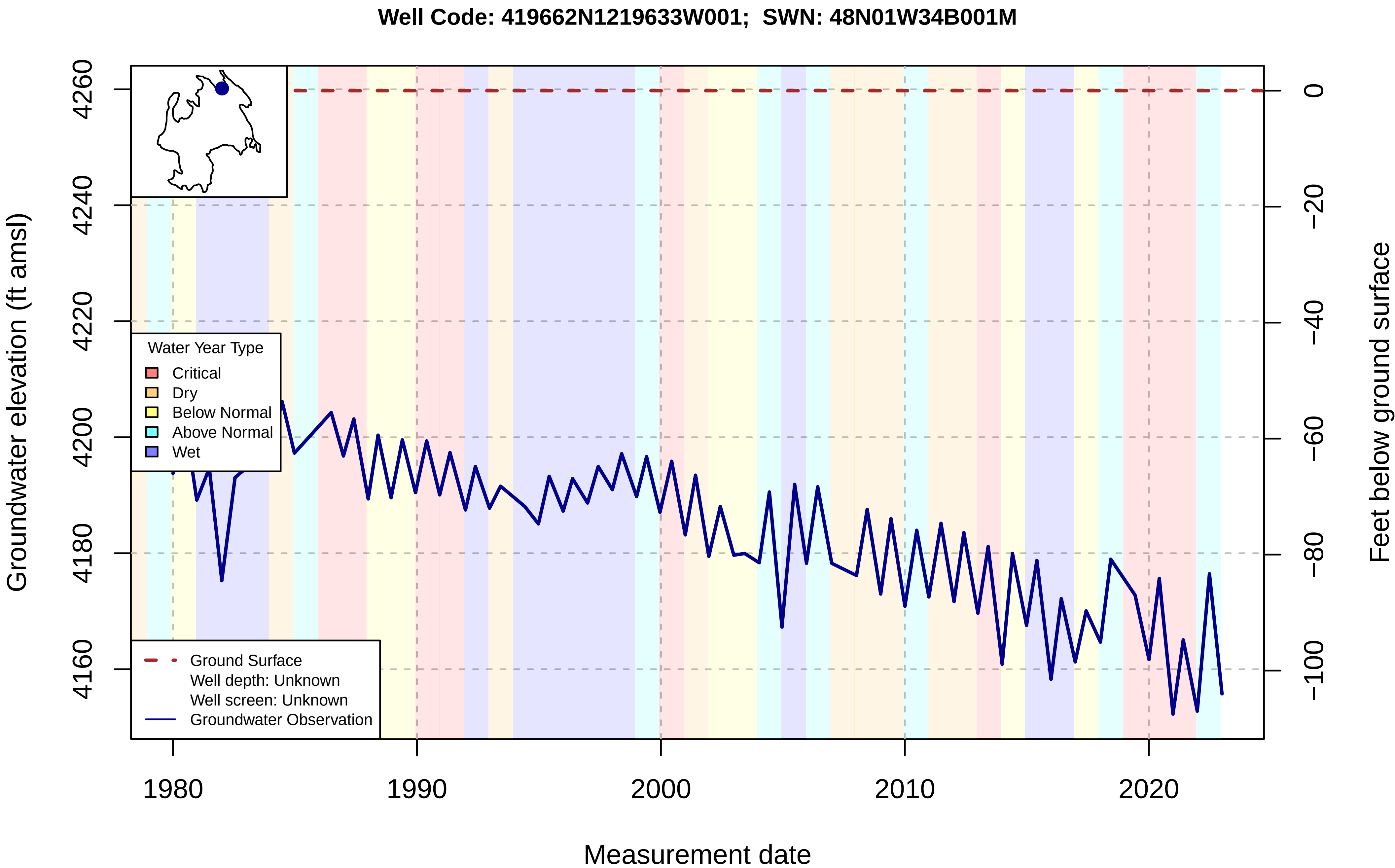




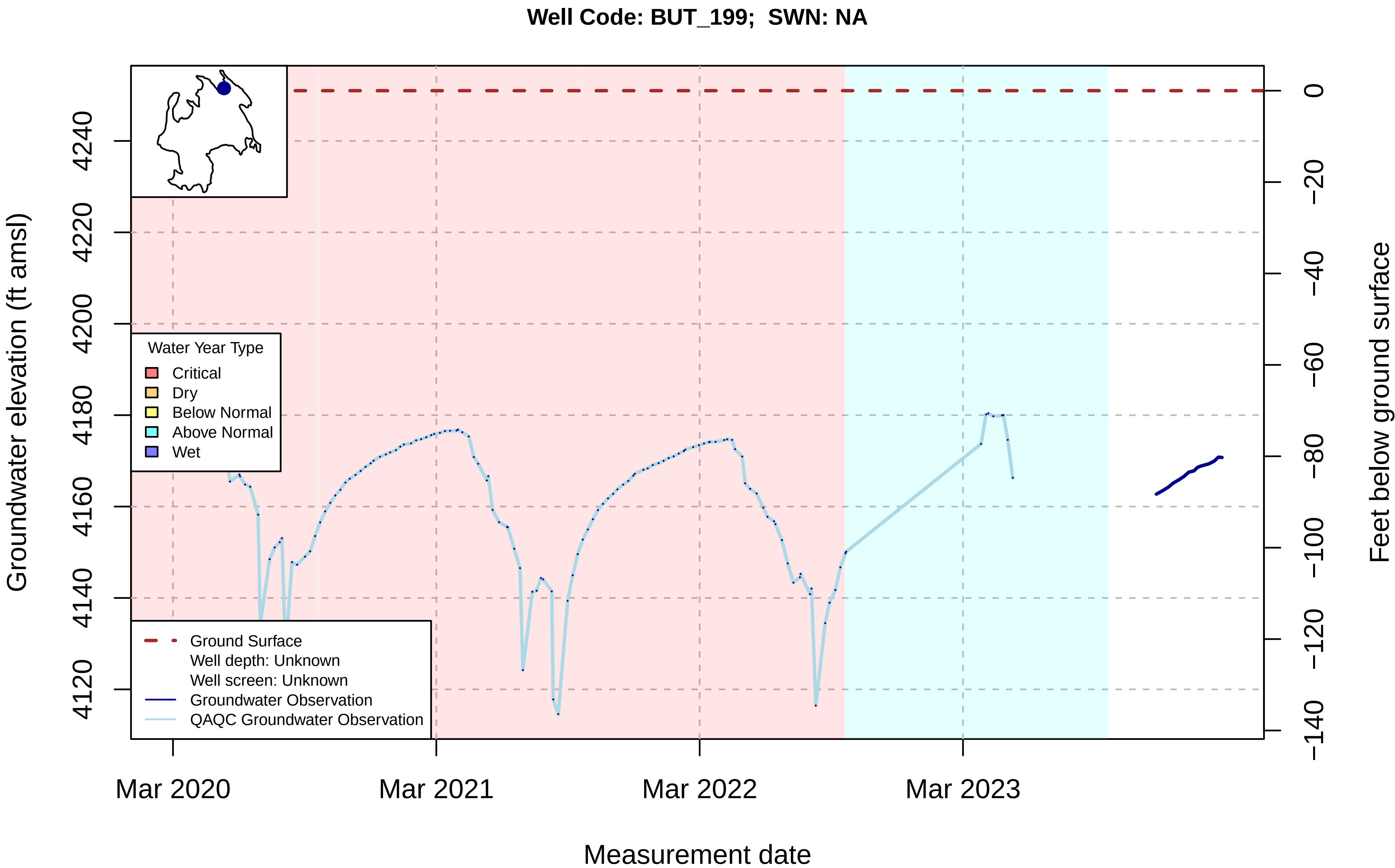
Well Code: 419520N1219959W001; SWN: 47N01W04D001M
Groundwater elevation (ft amsl)
4230
4235
4240
4245
Feet below ground surface
0
−5
−10
−15
Measurement date
1971
1981
1991
2001
2011
2021
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 460 ft bgs
Well screen: Unknown
Groundwater Observation



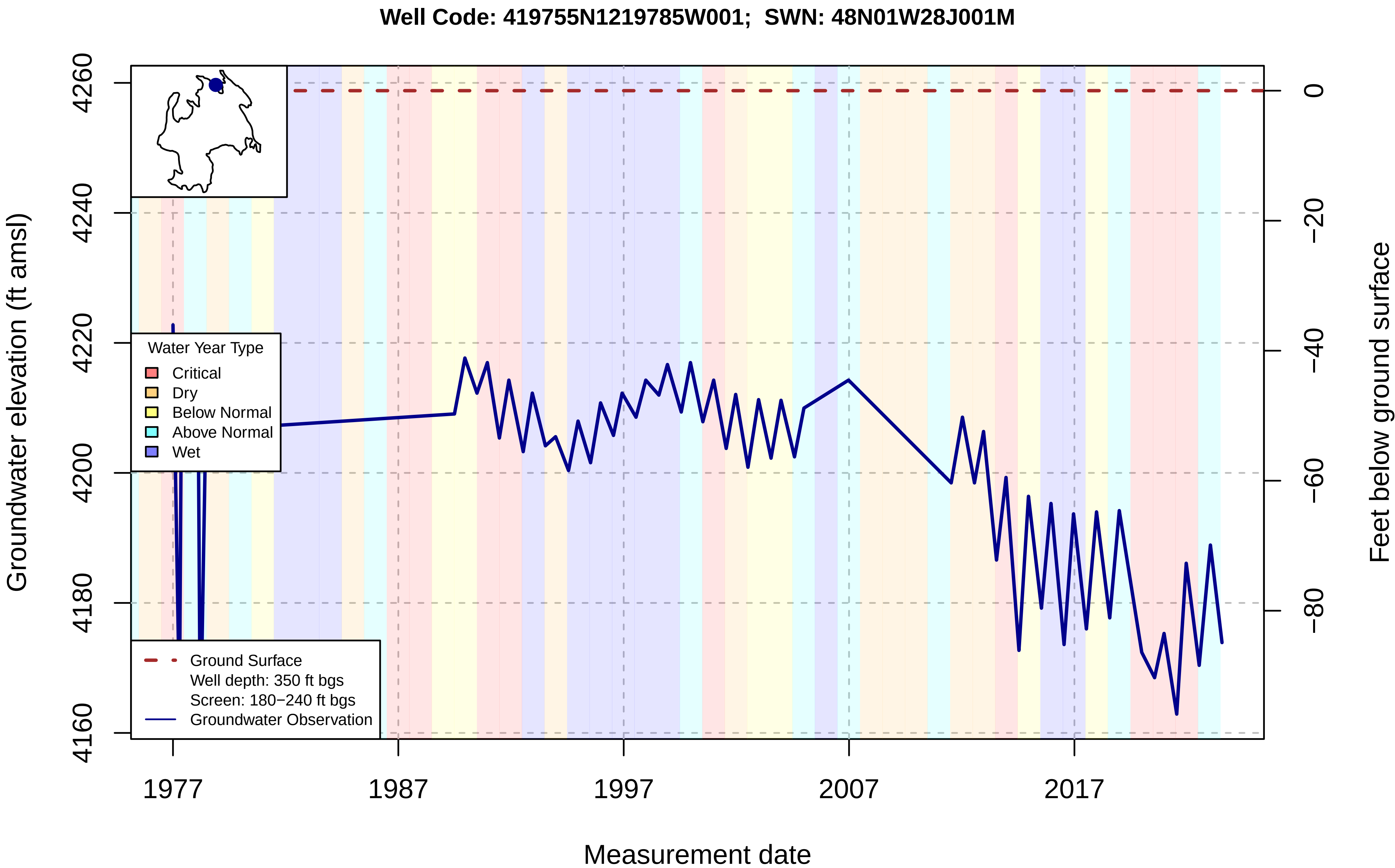
Well Code: BUT_168; SWN: NA
Groundwater elevation (ft amsl)
4250
4200
4150
4100
Feet below ground surface
0
−50
−100
−150
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 920 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation
Nov 2019
Nov 2020
Nov 2021
Nov 2022
Nov 2023
Measurement date



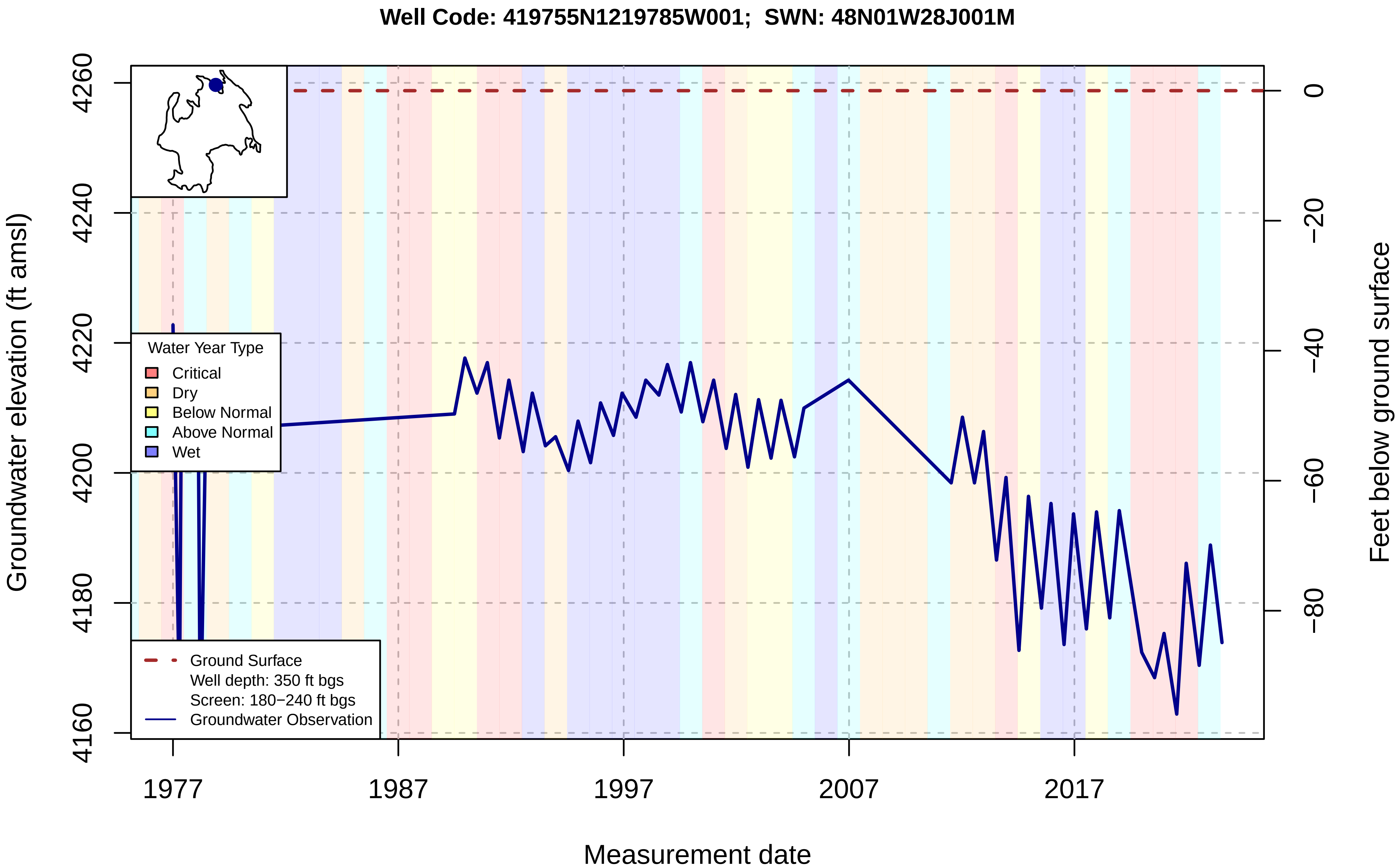
Well Code: 419662N1219633W001; SWN: 48N01W34B001M
Groundwater elevation (ft amsl)
4260
4240
4220
4200
4180
4160
Feet below ground surface
0
−20
−40
−60
−80
−100
1980
1990
2000
2010
2020
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation



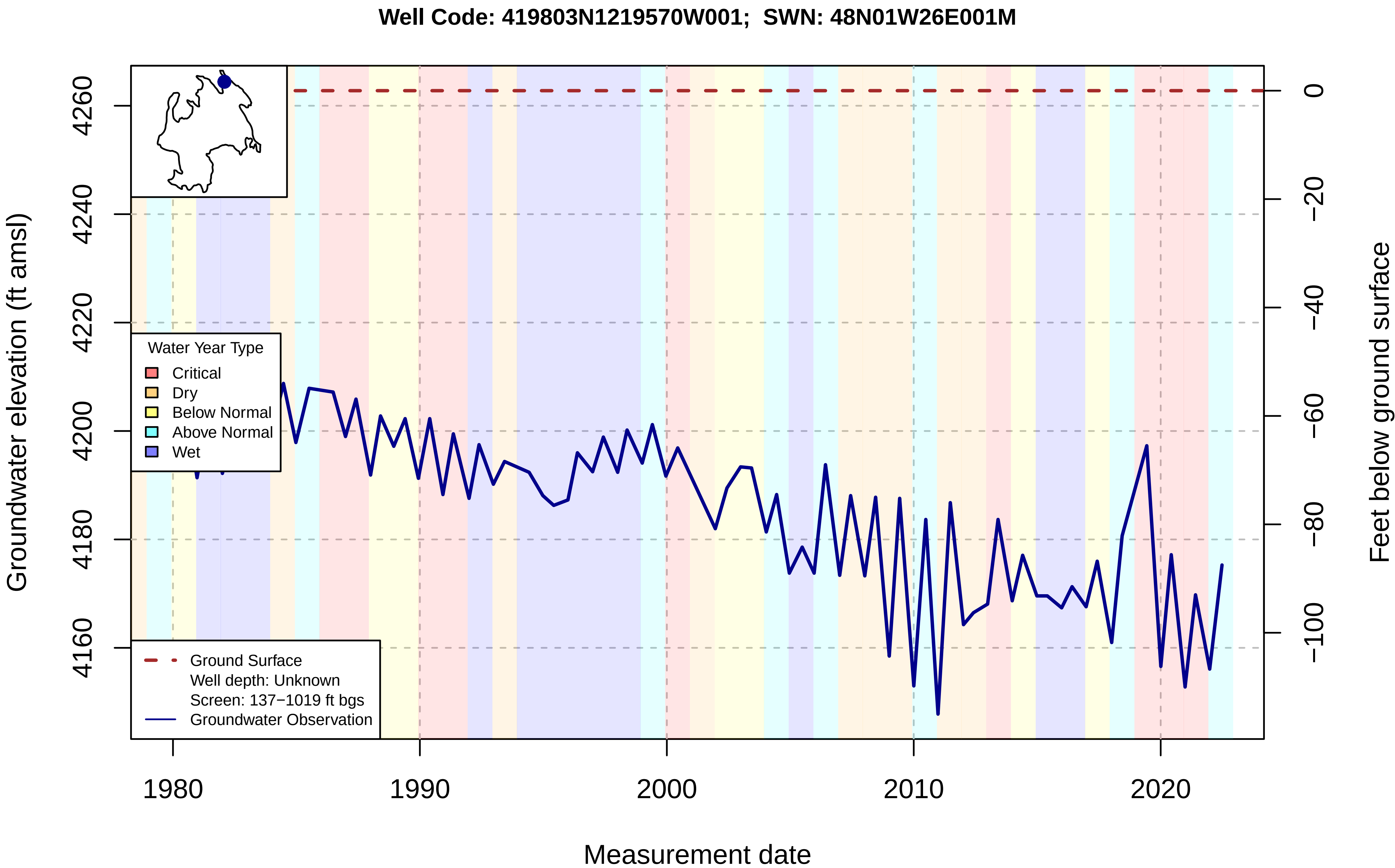
Well Code: BUT_199; SWN: NA
Groundwater elevation (ft amsl)
4120
4140
4160
4180
4200
4220
4240
Feet below ground surface
0
−20
−40
−60
−80
−100
−120
−140
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation
Mar 2020
Mar 2021
Mar 2022
Mar 2023
Measurement date

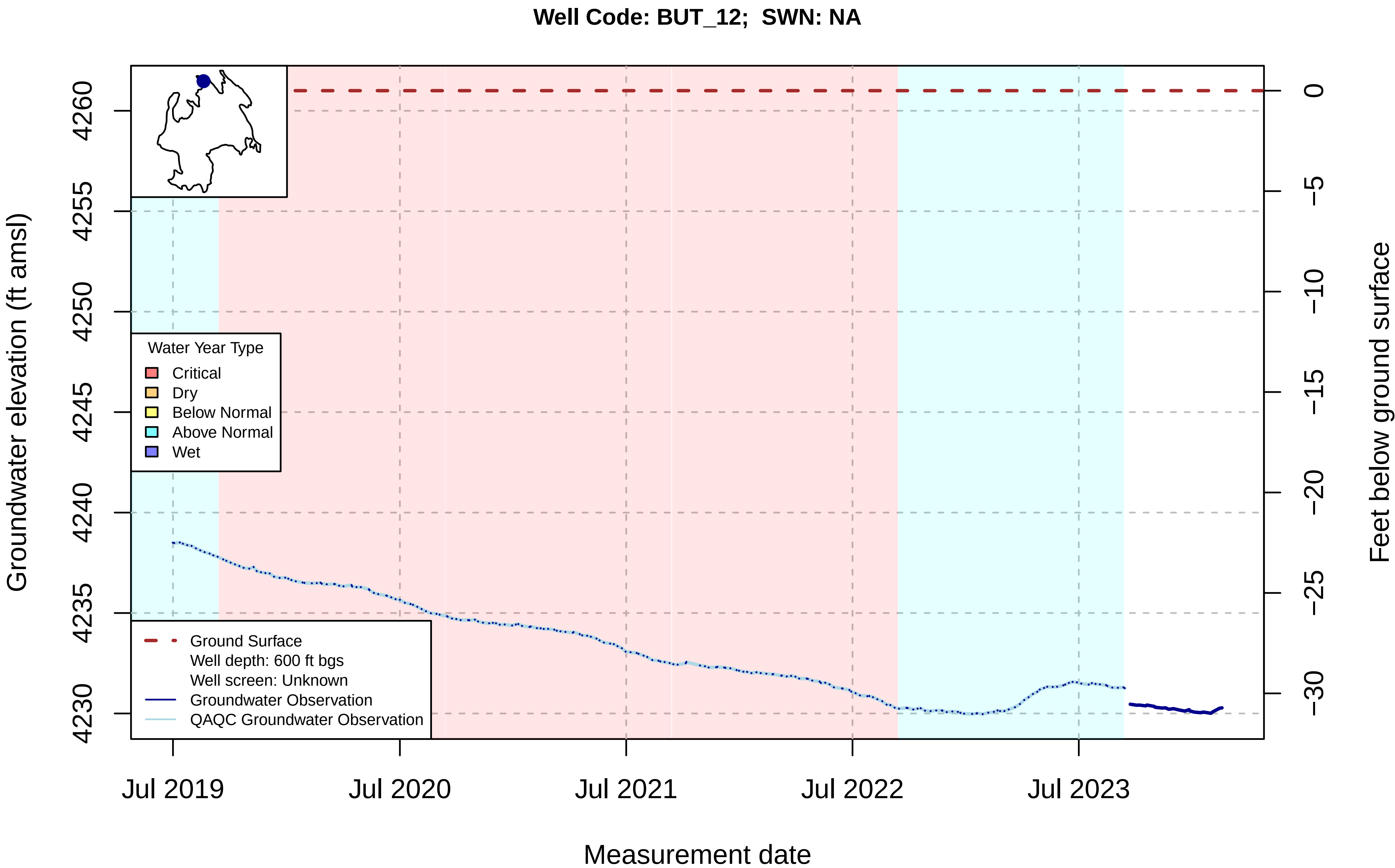


Well Code: 419755N1219785W001; SWN: 48N01W28J001M
Groundwater elevation (ft amsl)
4260
4240
4220
4200
4180
4160
Feet below ground surface
0
−20
−40
−60
−80
Measurement date
1977
1987
1997
2007
2017
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 350 ft bgs
Screen: 180−240 ft bgs
Groundwater Observation



Well Code: 419755N1219785W001; SWN: 48N01W28J001M
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4160
4180
4200
4220
4240
4260
0
−20
−40
−60
−80
1977
1987
1997
2007
2017
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 350 ft bgs
Screen: 180−240 ft bgs
Groundwater Observation


Well Code: 419803N1219570W001; SWN: 48N01W26E001M
Groundwater elevation (ft amsl)
4260
4240
4220
4200
4180
4160
Feet below ground surface
0
−20
−40
−60
−80
−100
1980
1990
2000
2010
2020
Measurement date
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: Unknown
Screen: 137−1019 ft bgs
Groundwater Observation



Well Code: BUT_12; SWN: NA
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
4230
4235
4240
4245
4250
4255
4260
0
−5
−10
−15
−20
−25
−30
Jul 2019
Jul 2020
Jul 2021
Jul 2022
Jul 2023
Water Year Type
Critical
Dry
Below Normal
Above Normal
Wet
Ground Surface
Well depth: 600 ft bgs
Well screen: Unknown
Groundwater Observation
QAQC Groundwater Observation

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