SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY

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April 1, 2022

To: California Department of Water Resources

From: Santa Cruz Mid-County Groundwater Agency

Subject: Submittal of Third Annual Report for the Santa Cruz Mid-County Groundwater Agency

The Santa Cruz Mid-County Groundwater Agency (MGA) is the Groundwater Sustainability Agency for the Santa Cruz Mid-County Groundwater Basin (Basin) number 3-001. The Basin is classified by the California Department of Water Resources (DWR) as a high priority basin in a state of critical overdraft.

The MGA formed in March 2016 as a Joint Powers Authority, with four member agencies: Central Water District, City of Santa Cruz, County of Santa Cruz, and Soquel Creek Water District. The MGA Board of Directors includes two representatives from each member agency and three private well owner representatives. The MGA initiated development of the Groundwater Sustainability Plan (GSP) in 2017 to guide ongoing management of the Basin with a goal to achieve and maintain groundwater sustainability over a 50-year planning and implementation horizon. GSP development was a collaborative effort among the member agencies and technical consultants, and was informed by input from resource management agencies, community members, and stakeholders.

The GSP was adopted by the MGA Board on November 21, 2019, and submitted to DWR on January 30, 2020. The first Annual Report was submitted in April 2020, the second annual report in April 2021. The GSP was approved by DWR in June 2021.

As required by the California Code of Regulations for Groundwater Sustainability Plans, the MGA is pleased to submit the third Annual Report to the Department of Water Resources.

Feel free to contact me if you have any questions,

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MONTGOMERY
& ASSOCIATES
Water Resource Consultants

March 21, 2022

Santa Cruz Mid-County Basin
Water Year 2021 Annual Report

Requirement of Groundwater Sustainability Plan Implementation

Prepared for:

Santa Cruz Mid-County Groundwater Agency

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MONTGOMERY & ASSOCIATES

Contents

Tables

Figures

Appendices

MONTGOMERY & ASSOCIATES

ACRONYMS & ABBREVIATIONS

ASR.....Aquifer Storage and Recovery
Basin .....Santa Cruz Mid-County Basin
County.....County of Santa Cruz
CWD .....Central Water District
DSWMAR.....Distributed Storm Water Managed Aquifer Recharge
DWR .....California Department of Water Resources
EIR .....Environmental Impact Report
GSP .....Groundwater Sustainability Plan
MGA .....Santa Cruz Mid-County Groundwater Agency
Model .....Santa Cruz Mid-County Basin's integrated surface water/groundwater model
PWS .....Pure Water Soquel Groundwater Replenishment and Seawater Intrusion Prevention Project
RMP .....representative monitoring point
SCWD……City of Santa Cruz Water Department
SGMA .....Sustainable Groundwater Management Act
SMC .....sustainable management criteria
SqCWD .....Soquel Creek Water District
SWIP .....Seawater Intrusion Prevention
WUF.....water use factor
WY .....Water Year

EXECUTIVE SUMMARY

The Santa Cruz Mid-County Groundwater Agency (MGA) is required to submit an annual report for the Santa Cruz Mid-County Basin (Basin) to the California Department of Water Resources (DWR) by April 1 of each year following the MGA's 2019 adoption of its Groundwater Sustainability Plan (GSP or Plan). DWR approved the GSP on June 3, 2021 (DWR, 2021). This third annual report covers Water Year (WY) 2021.

As described in the GSP, DWR lists the Basin as a high priority basin in critical overdraft. The high priority designation indicates that water users in the Basin have high dependence on groundwater. The Basin is listed in critical overdraft principally because active seawater intrusion impacts its productive aquifers as a result of over-pumping.

WY 2021 was a critically dry year following a dry year in WY 2020. Below average rainfall means there is reduced aquifer recharge. However, coastal groundwater levels in the semi-confined to confined Purisima aquifers do not typically show a clear response to annual changes in recharge. Instead, groundwater levels respond more directly to changes in groundwater extraction than precipitation. An approximately decade-long period (WY 2005-2014) of increasing groundwater levels corresponding with reductions in extraction has been followed by a period of relatively stable and high groundwater levels during a period of historically low extraction (WY 2015-2020). Groundwater levels at a majority of wells declined in WY 2021, which is likely related to a slight increase in extraction. While still lower than pre-WY 2015 totals, WY 2021 extraction was the second highest Basin extraction total in the last 7 years.

The Basin continues to be in a state of overdraft, resulting in significant and unreasonable risk of seawater intrusion. There are undesirable results for seawater intrusion because 6 coastal representative monitoring points (RMPs) with 5-year moving average groundwater elevations are below their respective groundwater elevation proxies for minimum thresholds. For these 6 RMPs, their 5-year moving averages generally leveled out or declined over WY 2021 after showing an increasing trend in prior years.

Chloride concentrations at 2 monitoring wells in the Seascape area, SC-A2RB and SC-A5B, exceeded minimum thresholds for seawater intrusion. Of the 4 samples taken at each well in WY 2021, SC-A5B exceeded the minimum threshold twice and SC-A2RB exceeded the minimum threshold once. As there are 2 or more exceedances in an RMP, there are undesirable results for chloride concentrations in WY 2021. Furthermore, because SC-A5B has an increasing chloride trend, it indicates inland movement of seawater intrusion. This condition warrants early management action, which the GSP recommends is to reduce extraction from the nearest municipal well. Since it is possible local non-municipal extractions are influencing groundwater hydraulic gradients that drive seawater intrusion in this area more than current municipal

pumping, it is recommended that instead of further reducing nearby municipal pumping at this time, the MGA evaluate local non-municipal pumping to assess the magnitude of total extractions influencing seawater intrusion in the area.

There are undesirable results for depletion of interconnected surface water as groundwater levels at 3 of 5 RMPs are below minimum threshold groundwater elevation proxies. There are no undesirable results for the chronic lowering of groundwater levels and water quality degradation indicators.

Net groundwater pumping remains greater than sustainable yields in 2 of 3 aquifer groups: Aromas Red Sands and Purisima F aquifer group and Purisima DEF, BC, A, and AA aquifer group. Projects included in the GSP to reduce net groundwater pumping to achieve sustainability are expected to reduce net extraction of groundwater once they are implemented. Work to plan and implement these projects continued in 2021. The projects include:

- Pure Water Soquel (PWS) – Construction on treatment plant, pipelines, and wells by Soquel Creek Water District (SqCWD) is expected to continue with start-up by end of 2023.
- Aquifer Storage and Recovery (ASR) – It is expected that the City of Santa Cruz Water Department (SCWD) will receive California State Water Resources Control Board action in 2022 or early 2023 on water rights petitions for change that will lead to phased implementation of full-scale ASR at the SCWD's existing Beltz wells starting in 2023.
- Water Transfers / In-Lieu Groundwater Recharge - another 5-year extension of the pilot project agreement between the SCWD and SqCWD was executed on March 3, 2021, and will run through May 1, 2026.

1 INTRODUCTION

1.1 Purpose of Annual Report

This annual report is a requirement of Water Code §10733.6 and pertains to the Sustainable Groundwater Management Act (SGMA). As the groundwater sustainability agency for the Santa Cruz Mid-County Basin (Basin), the Santa Cruz Mid-County Groundwater Agency (MGA) is required to submit an annual report to the California Department of Water Resources (DWR) by April 1 of each year following the adoption of its Groundwater Sustainability Plan (GSP or Plan). The MGA Board of Directors unanimously adopted the final GSP after a public hearing on November 21, 2019. The GSP was submitted online to DWR on January 30, 2020, and posted for public comment by DWR on February 19, 2020. DWR approved the GSP on June 3, 2021.

The purpose of annual reports is to demonstrate to DWR during GSP implementation that progress is being made towards meeting interim milestones that are defined in the GSP and that lead to achieving groundwater sustainability. The content requirements of the annual report are outlined in §356.2 of the GSP Regulations.

This third annual report covers Water Year (WY) 2021 (October 1, 2020 through September 30, 2021) and includes a description of basin conditions through text, hydrographs, contour maps, estimation of change in groundwater in storage, and distribution of groundwater extraction across the Basin. A comparison of WY 2021 data against sustainability management criteria (SMC) is provided as a measure of the Basin's progress toward the sustainability goal that must be reached by January 2040.

1.2 Santa Cruz Mid-County Groundwater Sustainability Agency

The MGA was created in March 2016 under a Joint Exercise of Powers Agreement. The MGA is governed by an 11-member Board of Directors consisting of representatives from each member agency and private well representatives within the boundaries of the MGA. The MGA Board is composed of:

- Two representatives from the Central Water District (CWD) appointed by the CWD Board of Directors.
- Two representatives from the City of Santa Cruz appointed by the City of Santa Cruz City Council.
- Two representatives from the County of Santa Cruz (County) appointed by the County of Santa Cruz Board of Supervisors.

- Two representatives from the Soquel Creek Water District (SqCWD) appointed by the SqCWD Board of Directors.
- Three representatives of private well owners in the Basin appointed by majority vote of the 8 public agency MGA directors.
- In addition, an alternate representative for each member agency and for the private well owners are appointed to act in the absence of a representative at Board meetings.

The MGA's jurisdictional area coincides exactly with the Santa Cruz Mid-County Basin depicted on Figure 1.

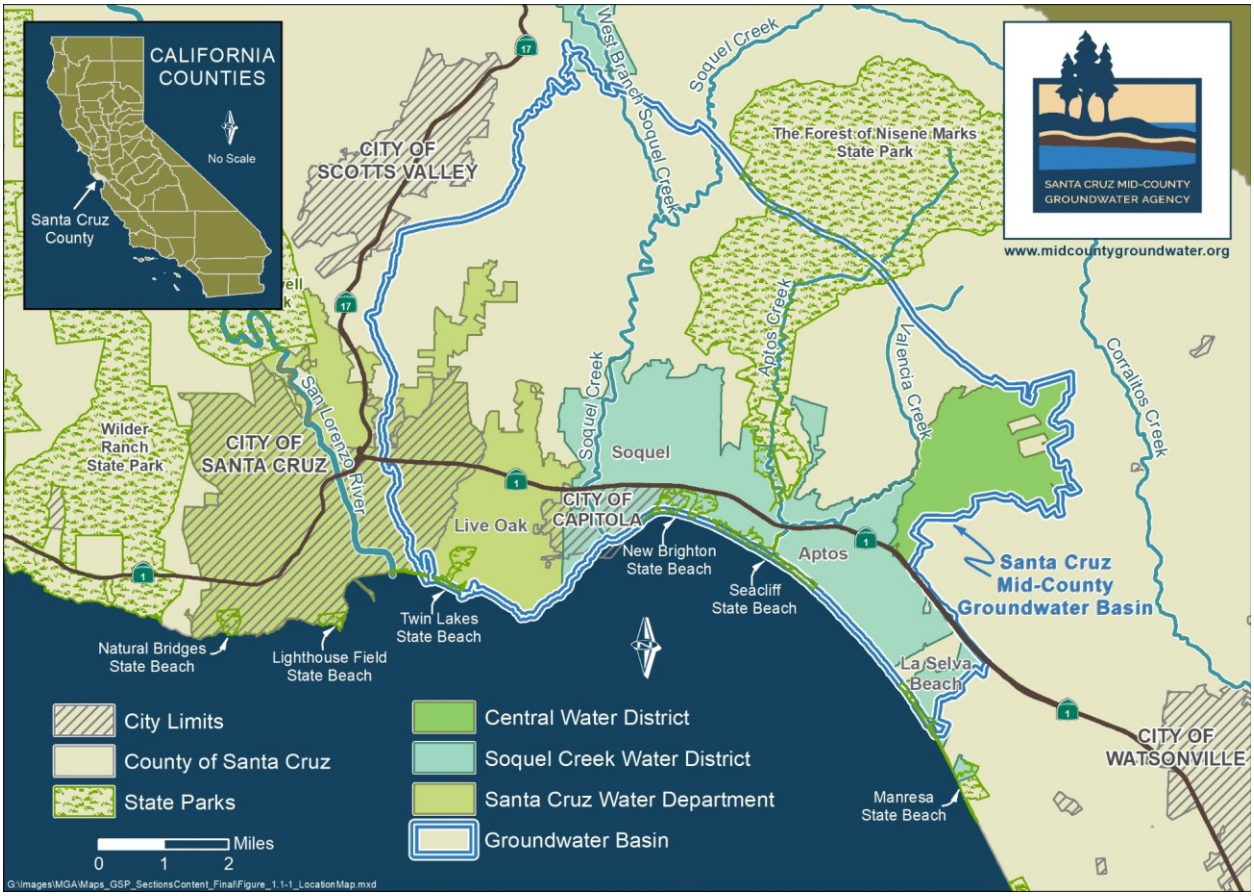

Figure 1. Santa Cruz Mid-County Basin Boundaries

2 BASIN SETTING

2.1 Basin Description

The Santa Cruz Mid-County Basin is identified by DWR as Basin 3-001 in Bulletin 118 Update 2020. The Basin extends from the Santa Cruz Mountains to the Pacific Ocean and from the edge of the City of Santa Cruz near Twin Lakes in the west to La Selva Beach in the east (Figure 1). The Basin includes portions of the City of Santa Cruz, the entire City of Capitola, and Santa Cruz County census designated places of Twin Lakes, Live Oak, Pleasure Point, Soquel, Seacliff, Aptos, and Rio Del Mar. The Basin also includes portions of Santa Cruz County unincorporated census designated places of Day Valley, Corralitos, Aptos Hills-Larkin Valley, and La Selva Beach (DWR, Bulletin 118 Update 2020).

The Basin boundary includes all areas where the stacked aquifer system of the Purisima Formation, Aromas Red Sands, and certain other Tertiary-age aquifer units underlying the Purisima Formation constitute the shared groundwater resource to be managed by the MGA. The Basin is defined by both geologic and jurisdictional boundaries. Basin boundaries to the west are primarily geologic. Basin boundaries to the east, adjacent to the Pajaro Valley Subbasin managed by Pajaro Valley Water Management Agency, are primarily jurisdictional.

As described in the GSP, DWR lists the Basin as a high priority basin in critical overdraft. The high priority designation indicates that water supply in the Basin has high dependence on groundwater. The Basin is listed in critical overdraft principally because active seawater intrusion impacts its productive aquifers as a result of historical over-pumping of the aquifers.

2.2 Precipitation and Water Year Type

Precipitation reported at the Santa Cruz Cooperative climate station in WY 2021 was 15.8 inches. This is 53% of the long-term average annual precipitation at this station of 29.7 inches per year. Figure 2 charts annual rainfall at the Santa Cruz Cooperative climate station and water year type from WY 1984 to WY 2021. The annual average rainfall of 28.9 inches displayed on Figure 2 is the average since WY 1984, which is lower than the long-term average of 29.7 inches starting in WY 1942.

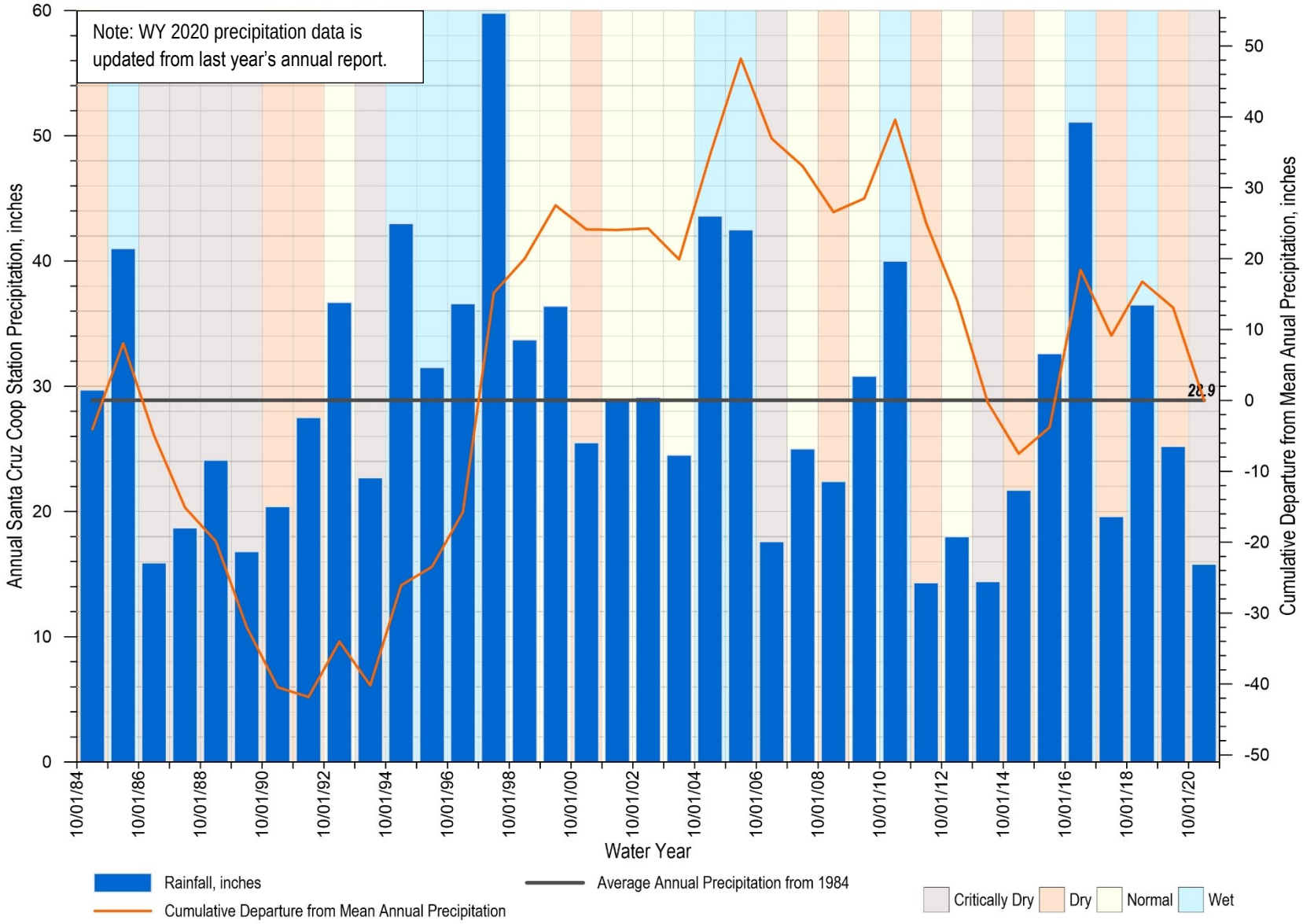

Figure 2. Annual Precipitation and Cumulative Change in Precipitation at Santa Cruz Cooperative Climate Station with Water Year Type

The water year type in the Santa Cruz area is based on a classification used by the City of Santa Cruz Water Department (SCWD). The classification uses total annual runoff in the San Lorenzo River, the SCWD's most important water source, measured at the Big Trees gage in the Santa Margarita Basin. Under this classification system, WY 2021 is designated as a critically dry year. It follows a dry year in WY 2020 and a wet year in WY 2019. Because the water year type is based on runoff, the amount of rainfall in the preceding years influences water year type classification. For example, there was more rainfall in 2021 than in 2012, but 2012 is classified as a dry year while 2021 is classified as critically dry. This is because the 2 years preceding 2012 were average/wet rainfall years that resulted in more runoff in 2012.

3 BASIN CONDITIONS

3.1 Groundwater Elevations

Contour maps representing spring and fall groundwater elevations for WY 2021 in each principal aquifer are included on Figure 3 through Figure 12. Spring groundwater elevations represent seasonal high conditions while fall groundwater elevations represent seasonal low conditions.

The contour maps intend to represent seasonal average conditions in the aquifer units. Sustainability with respect to seawater intrusion is evaluated based on average groundwater elevations. Therefore, data used for the contour maps are based on the following:

1. Average transducer groundwater elevations calculated over March (spring) or September (fall) from monitoring wells, where available.
2. Manual monthly measurements from monitoring wells where transducer data are not available, which are less accurate but are the best available representation of seasonal average conditions in the aquifers.
3. Groundwater elevations from monitoring wells adjacent to production wells. Using average groundwater elevations calculated from transducer data that include levels recorded when the adjacent production well is pumping is the best representation of conditions in the aquifer over this time period.
4. Static groundwater elevations from production wells without adjacent monitoring wells. Pumping groundwater elevations from production wells are not representative of groundwater elevations in the aquifers due to pumping inefficiencies. Therefore, static groundwater elevations are preferable over pumping elevations, but are less accurate than average groundwater elevations from adjacent monitoring wells. Static elevations are therefore the best available representation of seasonal average aquifer conditions for these locations without adjacent monitoring wells.

The contour maps include groundwater elevation proxies of minimum thresholds (green text) for representative monitoring points (RMP) for seawater intrusion. RMPs with groundwater elevation proxies for seawater intrusion are included only in the principal aquifer unit where nearby municipal pumping takes place. This is because municipal pumping wells are assumed to be the deepest wells in the coastal areas. Groundwater elevation proxies are displayed for reference only as they cannot be directly compared to contours representing seasonal conditions to evaluate exceedances of minimum thresholds and undesirable results. For that purpose, groundwater elevation proxies are compared to 5-year moving averages at the seawater intrusion RMPs as described in Section 4.3.

Hydrographs for RMPs and other monitoring network wells used to evaluate the Basin are updated through WY 2021 and are provided in Appendix A. The hydrographs indicate the water year type and extend back through the full period of record for each well. For RMPs, the minimum threshold and measurable objectives are included on the hydrographs (Figures A-1 through A-40).

Hydrographs in Appendix A are grouped based on the sustainability indicator for which groundwater elevations are used as SMC as follows:

- Figures A-1 through A-17: Chronic Lowering of Groundwater Levels
- Figures A-18 through A-34: Seawater Intrusion Groundwater Elevation Proxies
- Figures A-35 through A-40: Depletion of Interconnected Surface Water Groundwater Elevation Proxies
- Figures A-41 through A-169: Wells in Monitoring Network not used as RMPs for Groundwater Elevations

Below average rainfall over the past 2 years has resulted in reduced aquifer recharge. However, coastal groundwater levels in the semi-confined to confined Purisima aquifers do not typically show a clear response to annual changes in recharge. Instead, groundwater levels respond more directly to changes in groundwater extraction than precipitation. An approximately decade-long period (WY 2005-2014) of increasing groundwater levels corresponding with reductions in extraction has been followed by a period of relatively stable and high groundwater levels during a period of historically low extraction (WY 2015-2020). Groundwater levels at a majority of wells declined in WY 2021, which is likely related to a slight increase in extraction. While still lower than pre-WY 2015 totals, WY 2021 extraction was the second highest Basin extraction total in the last 7 years.

3.1.1 Aromas Red Sands

Contour maps for the Aromas Red Sands are shown on Figure 3 and Figure 4 for spring and fall, respectively. Groundwater generally flows from inland areas towards the coast with effects from pumping on contours at CWD's Rob Roy wellfield (CWD #10 and #12) and SqCWD's Bonita and San Andreas production wells. Flow from inland includes flow from a portion of the Pajaro Valley Subbasin inland of SqCWD's service area. Groundwater also flows out of the Basin southeastwards into the Pajaro Valley Subbasin, flowing roughly parallel to the coast. Because there are more outflows from the Basin in the Pajaro Valley Subbasin than inflows, there is net outflow to Pajaro Valley Subbasin. Groundwater elevations in the Aromas Red Sands are above sea level but lower than 10 feet near the coast.

At the SC-A3A seawater intrusion RMP, 2021 groundwater elevations are above the seawater intrusion minimum threshold (Appendix Figure A-18). Both fall and spring groundwater elevations, including CWD and SqCWD extraction wells (Country Club, Bonita, San Andreas, and Seascape), present stable groundwater elevations relative to last year.

3.1.2 Purisima F and DEF Units

Contour maps for the Purisima F and DEF units are shown on Figure 5 and Figure 6 for spring and fall, respectively. The contour maps show localized pumping depressions around SqCWD's Bonita and San Andreas wells screened in both the Purisima F and Aromas Red Sands aquifer, around SqCWD's Aptos Jr. High well and CWD's Rob Roy #12 (CWD #12) well screened in the Purisima F unit, and around SqCWD's T. Hopkins well screened in the Purisima DEF unit. Compared to WY 2020, the depressions around the Bonita and San Andreas wells and around the T. Hopkins wells are slightly smaller. In particular, in WY 2021 the T. Hopkins well experienced some of the highest elevations on record, correlated with its reduced pumping (Appendix Figure A-83). Despite localized pumping depressions, groundwater in the Purisima F and DEF units flows towards the coast. There is also groundwater flow into the Basin from the Pajaro Valley Subbasin.

Groundwater elevations at most coastal wells increased or remained similar to the previous year. At SC-8RD, spring elevations increased by nearly 3 feet, although fall elevations decreased by 1 foot from fall last year (Appendix Figure A-22). Elevations at this well remain above minimum threshold. Well SC-A7A continues to experience declines, with elevation decreasing 1 to 2 feet from last year (Appendix Figure A-141).

All 4 coastal RMP wells in the Purisima F and DEF units are above their respective seawater intrusion minimum thresholds. This reflects an increase in elevations at monitoring well SC-A8A, which was below its minimum threshold last year (Appendix Figure A-20).

In WY 2021, monitoring well SC-23 recovered from its 21-foot decline in the previous year with its elevation rising above its measurable objective for the first time since WY 2017. The increases are related to reduced pumping at the T. Hopkins and Granite Way wells.

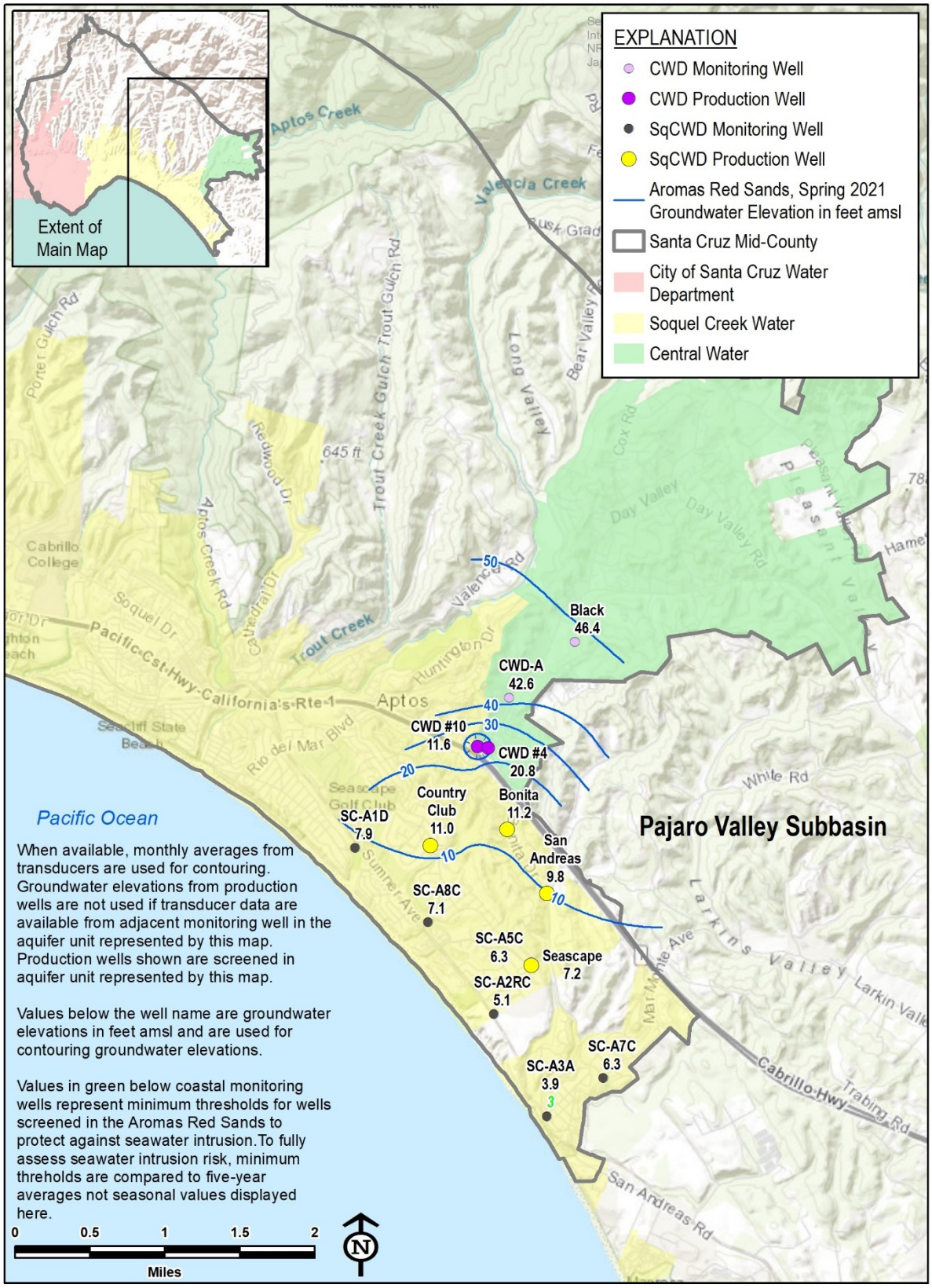

Figure 3. Aromas Red Sands Groundwater Elevations, Spring 2021

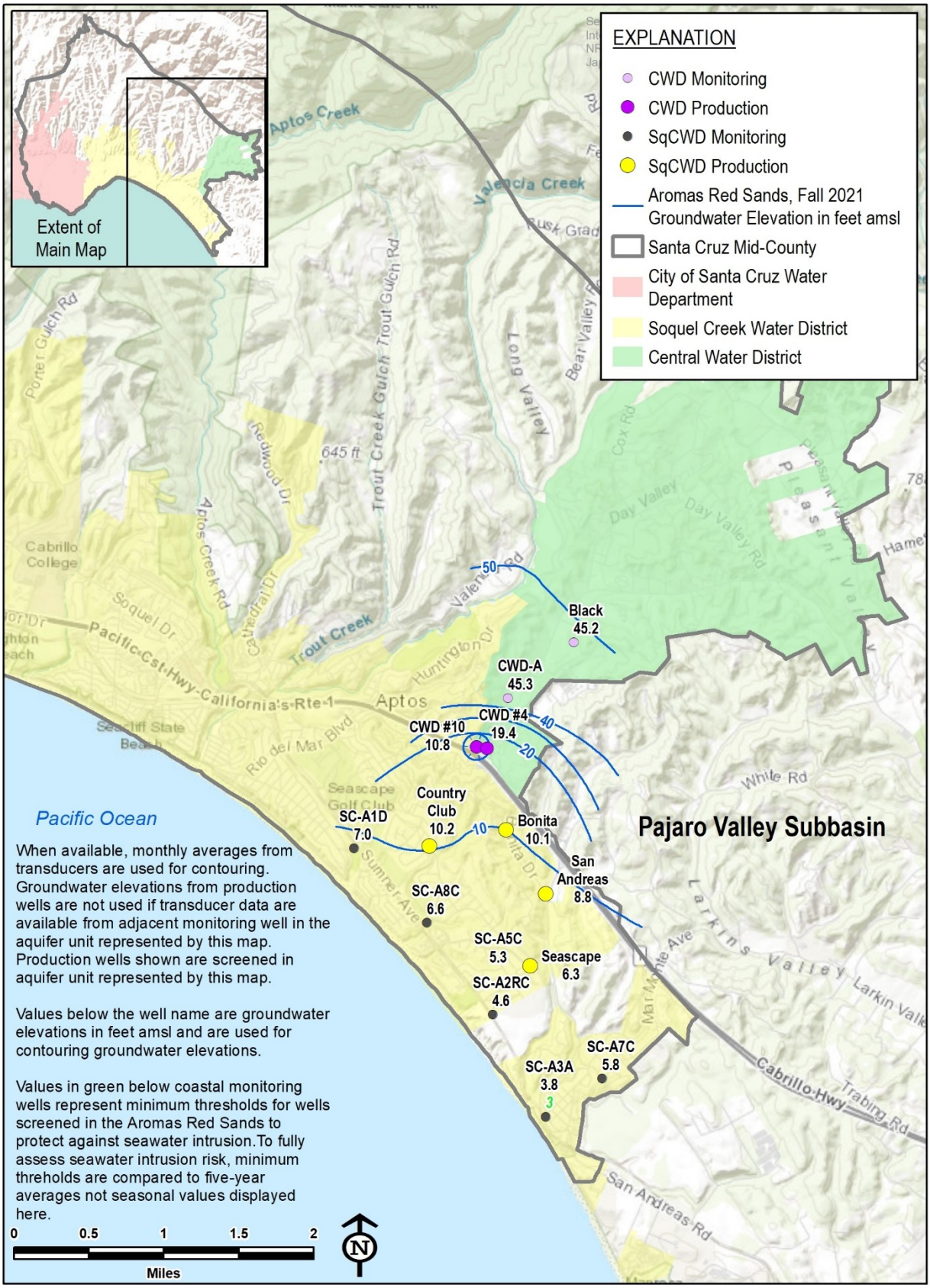

Figure 4. Aromas Red Sands Groundwater Elevations, Fall 2021

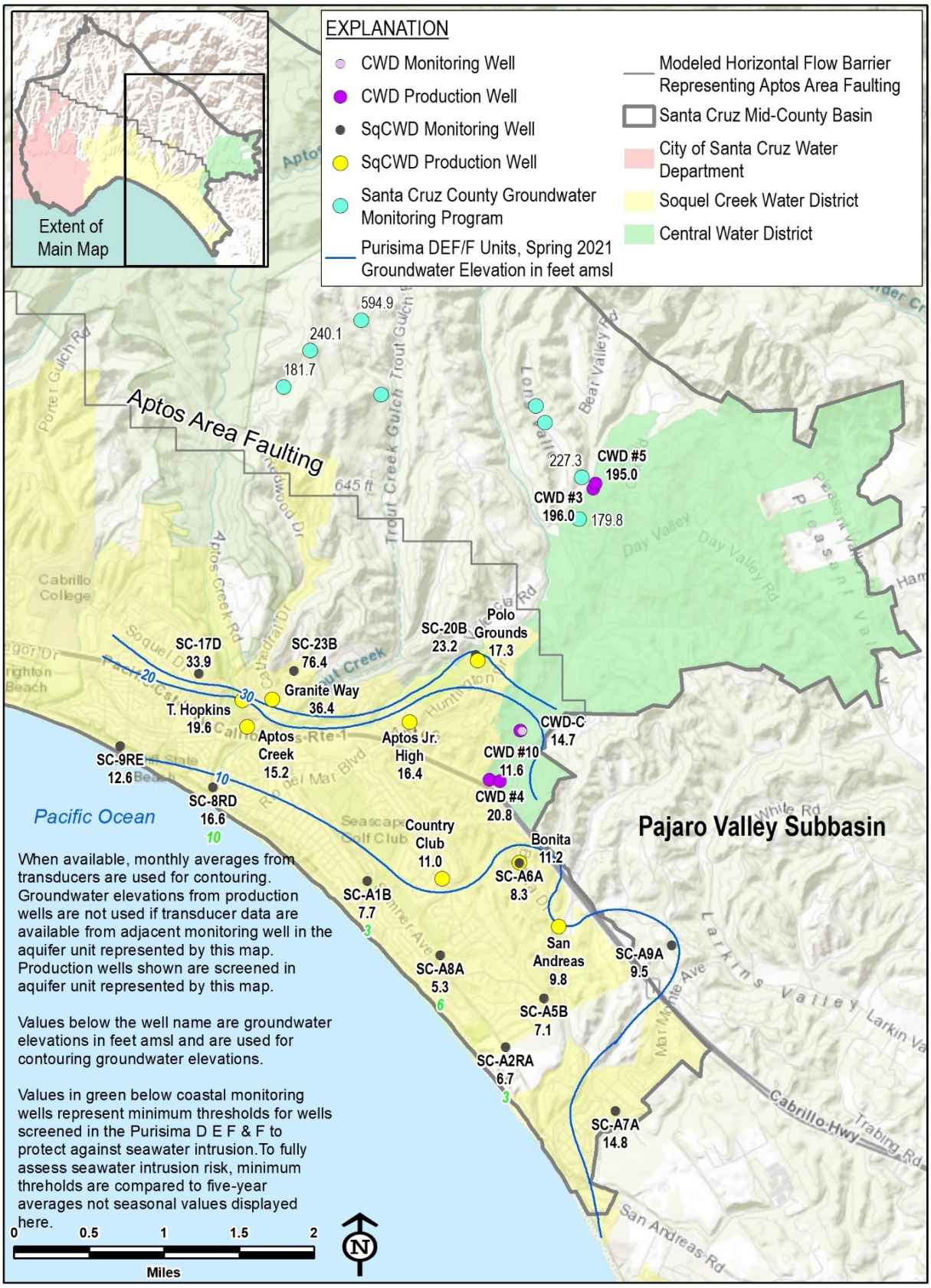

Figure 5. Purisima F and DEF Unit Groundwater Elevations, Spring 2021

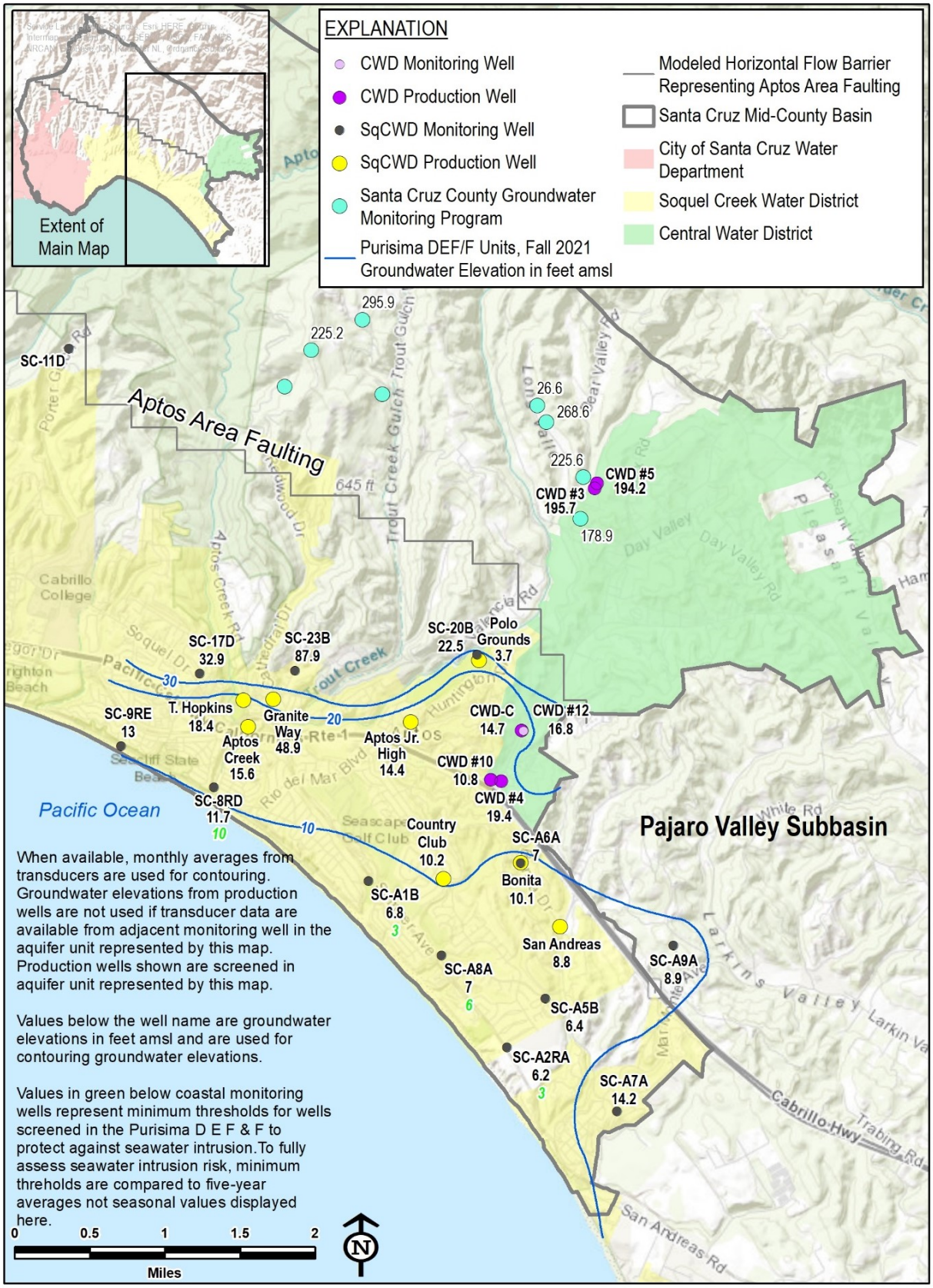

Figure 6. Purisima F and DEF Unit Groundwater Elevations, Fall 2021

3.1.3 Purisima BC Unit

Contour maps for the Purisima BC unit are shown on Figure 7 and Figure 8 for spring and fall, respectively. The contour maps show a prominent pumping depression around SqCWD's Ledyard and Madeline production wells. The pumping depression is more developed in the fall when demand is greater. The spring and fall 2021 depressions are smaller than 2020 largely due to reduced extraction at the Ledyard well, which was reduced 67% from the previous water year. Groundwater continues to flow inland towards the pumping depression instead of towards the coast.

Despite the continued presence of an inland pumping depression, coastal monitoring wells in the Purisima BC unit had groundwater elevation increases of around 3 to 9 feet. Elevations at SC-9RC and SC-8RB remained below their seawater intrusion minimum thresholds (Appendix Figure A-23; Appendix Figure A-24).

3.1.4 Purisima A and AA Unit

Contour maps for the Purisima A and AA units are shown on Figure 9 and Figure 10 for spring and fall, respectively. Groundwater generally flows from inland towards the coast with localized depressions due to pumping at SqCWD and SCWD production wells. Pumping depressions are more defined in the fall, particularly at SqCWD's Main Street and Estates production wells. Relatively low groundwater elevations also occur at an inland location around the SC-10RA monitoring well, potentially a result of non-municipal pumping.

Groundwater elevations at coastal wells SC-3A and SC-5A in the Purisima A unit are well above seawater intrusion minimum thresholds in the spring, but below in the fall (Appendix Figures A-25 and A-26). At the coastal Purisima A unit Pleasure Point, Moran Lake, and SC-1A RMPs, groundwater elevations are higher than seawater intrusion minimum thresholds. However, groundwater elevations at the Soquel Point Deep RMP remain below its seawater intrusion minimum threshold (Appendix Figure A-32). Extraction at the SCWD's Beltz wellfield was reduced in the previous 2 years, partially due to alternative well operations while ASR pilot testing takes place. The resumption of more typical operations during WY 2021 and as expected higher SCWD pumping with reduced surface water supplies during a critically dry year may have contributed to lower groundwater elevations at the Soquel Point Deep RMP. Groundwater elevation declines of between 1 to 3 feet inland near SCWD's Beltz wells compared to 2020 are likely related to increased Beltz wellfield extraction in the Purisima A and AA units.

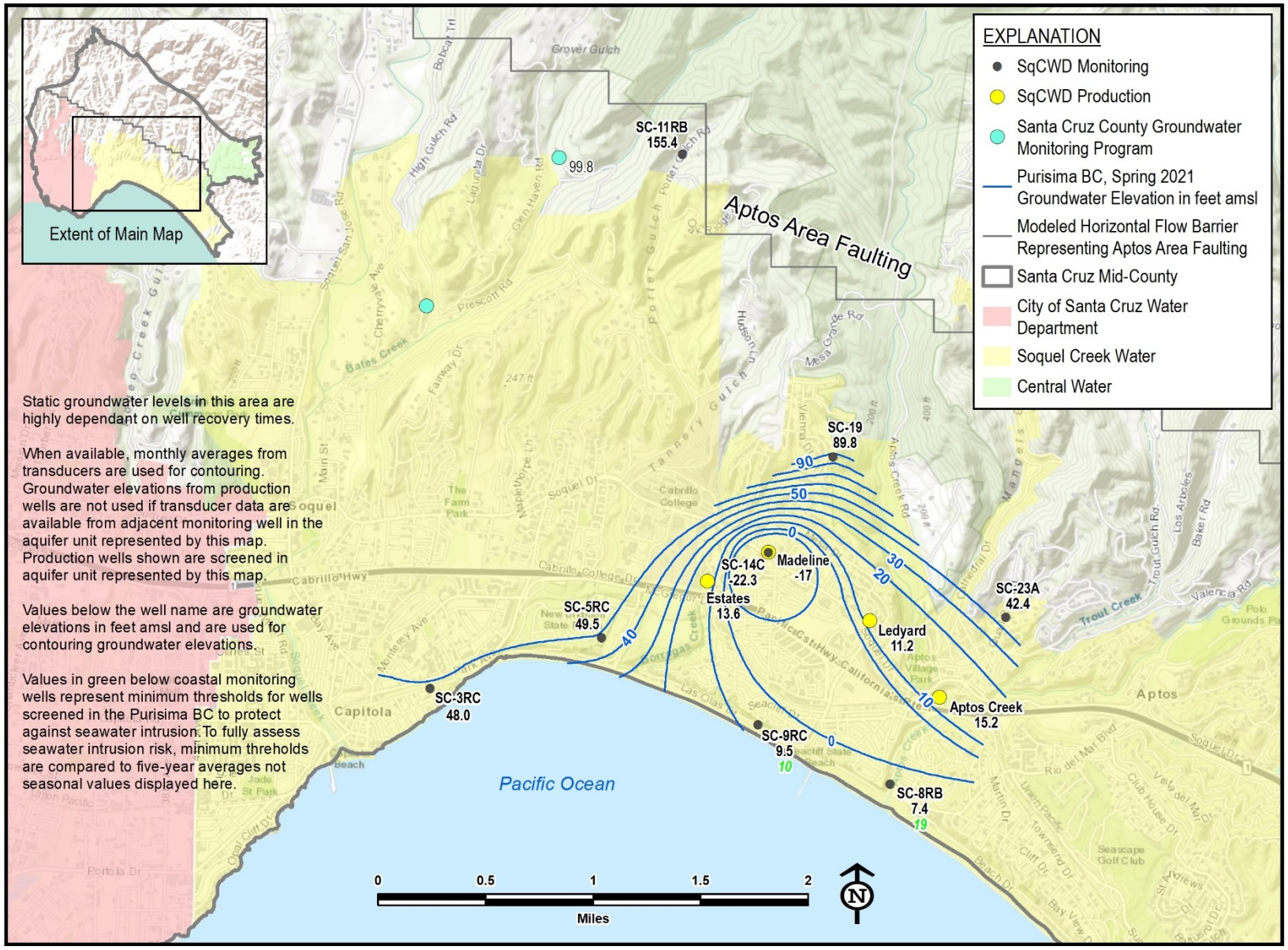

Figure 7. Purisima BC Unit Groundwater Elevations, Spring 2021

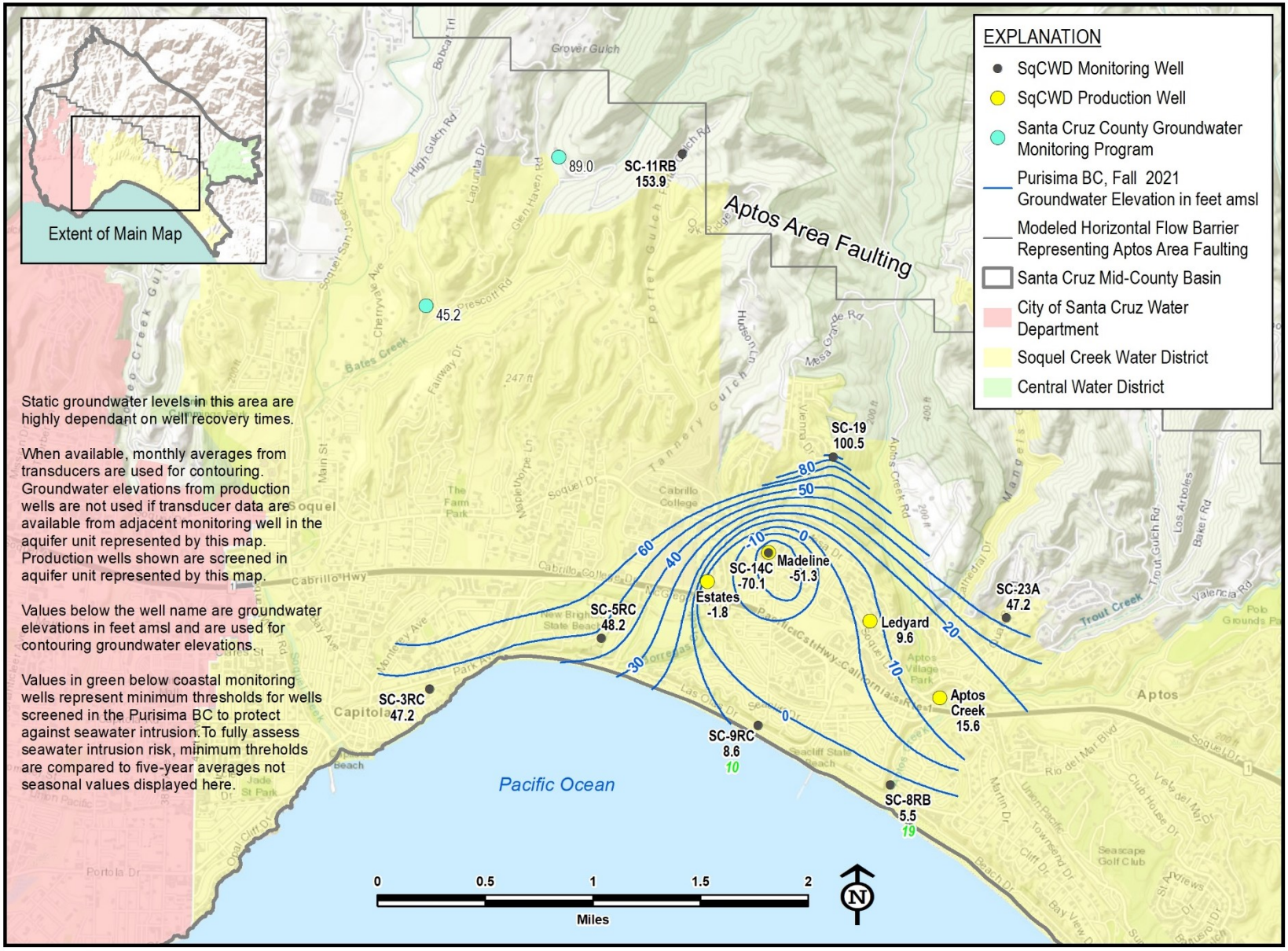

Figure 8. Purisima BC Unit Groundwater Elevations, Fall 2021

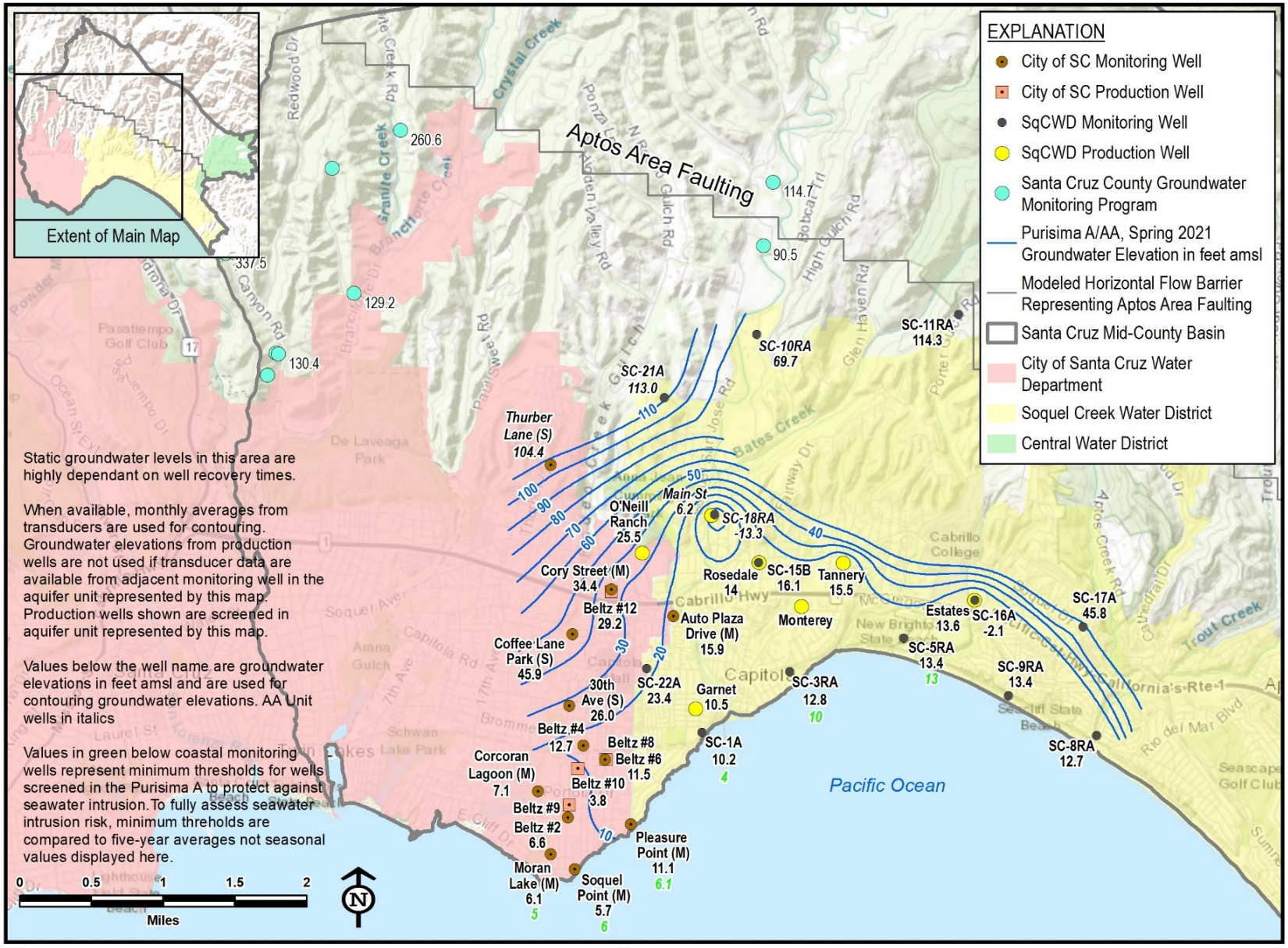

Figure 9. Purisima A and AA Unit Groundwater Elevations, Spring 2021

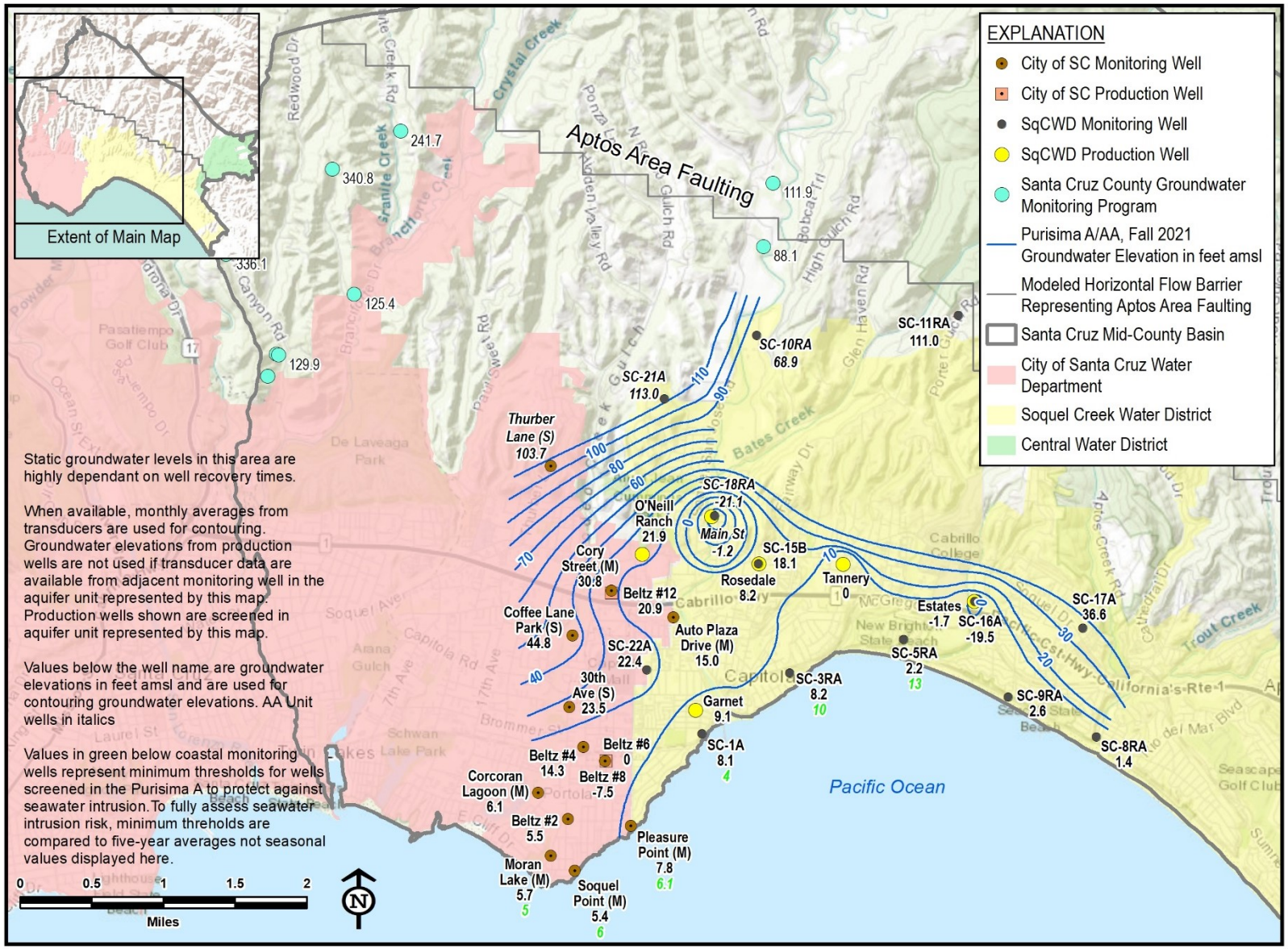

Figure 10. Purisima A and AA Unit Groundwater Elevations, Fall 2021

3.1.5 Tu Unit

Contour maps for the Tu unit are included on Figure 11 (Spring 2021) and Figure 12 (Fall 2021). Overall, groundwater flows from inland towards the coast with localized spring and fall pumping depressions around the Main Street extraction well, and the Beltz #12 extraction well in the fall.

Spring groundwater elevations in the Tu unit declined by 1 to 3 feet from spring 2020, potentially due to increased extraction at Main Street and Beltz #12 wells compared to 2020. Fall groundwater elevations on Figure 12 are generally higher than fall 2020, however late summer elevations (typically August) are lower than 2020 at many wells including Thurber Lane Deep (Appendix Figure A-17), O'Neill Ranch (Appendix Figure A-61), and SC-22AAA (Appendix Figure A-67).

Spring groundwater elevations at the coastal RMP well SC-13A decreased from 2020 elevations but are still approximately 2 feet above its seawater intrusion minimum threshold (Appendix Figure A-34). Fall groundwater elevations at the end of the water year are 6 feet higher than elevations at the same time in 2020 but are still below its minimum threshold. As with the other Tu unit wells noted above, while fall groundwater elevations are higher than 2020, late summer elevations are about 2 to 3 feet lower than 2020.

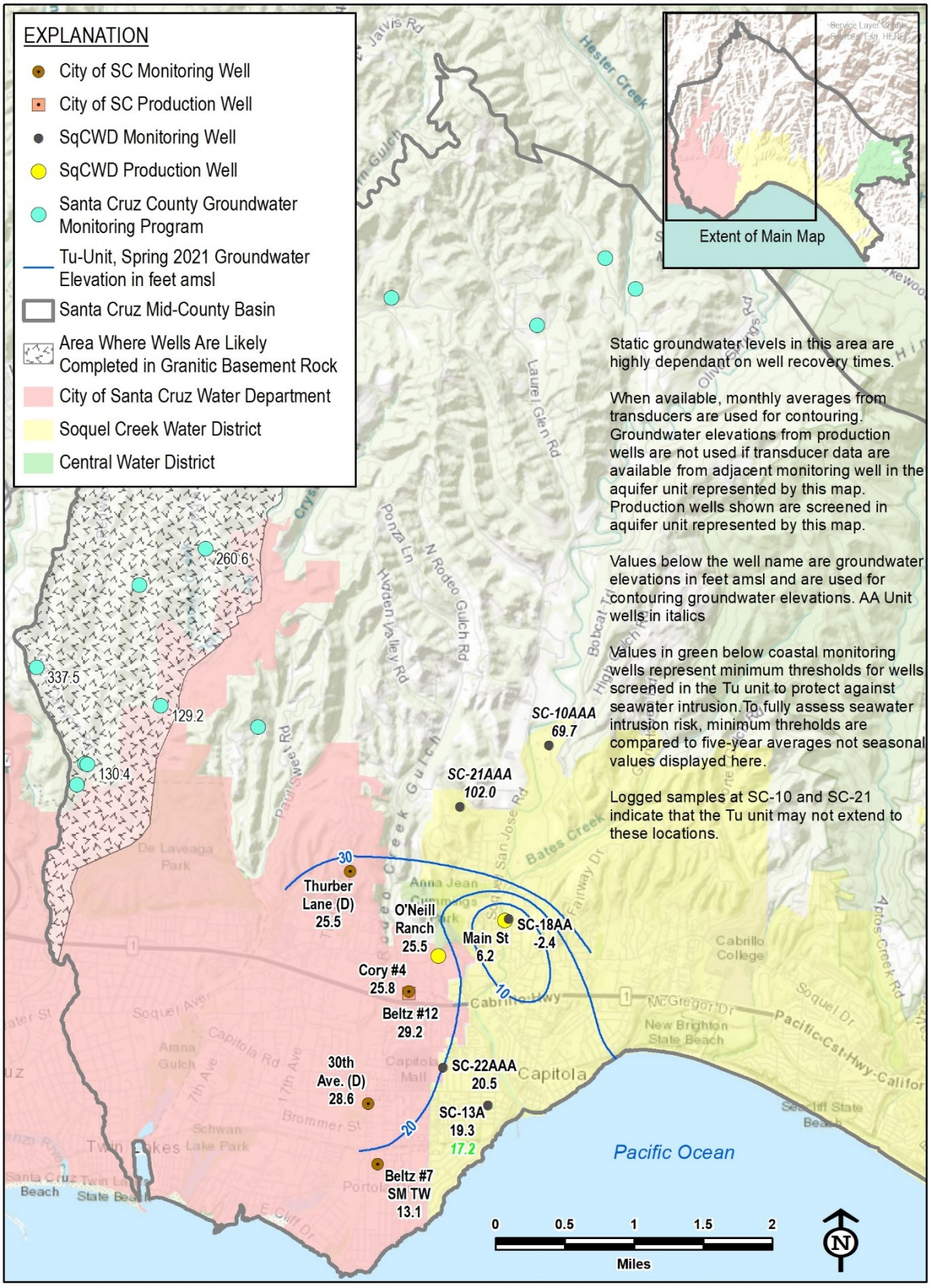

Figure 11.Tu Unit Groundwater Elevations, Spring 2021

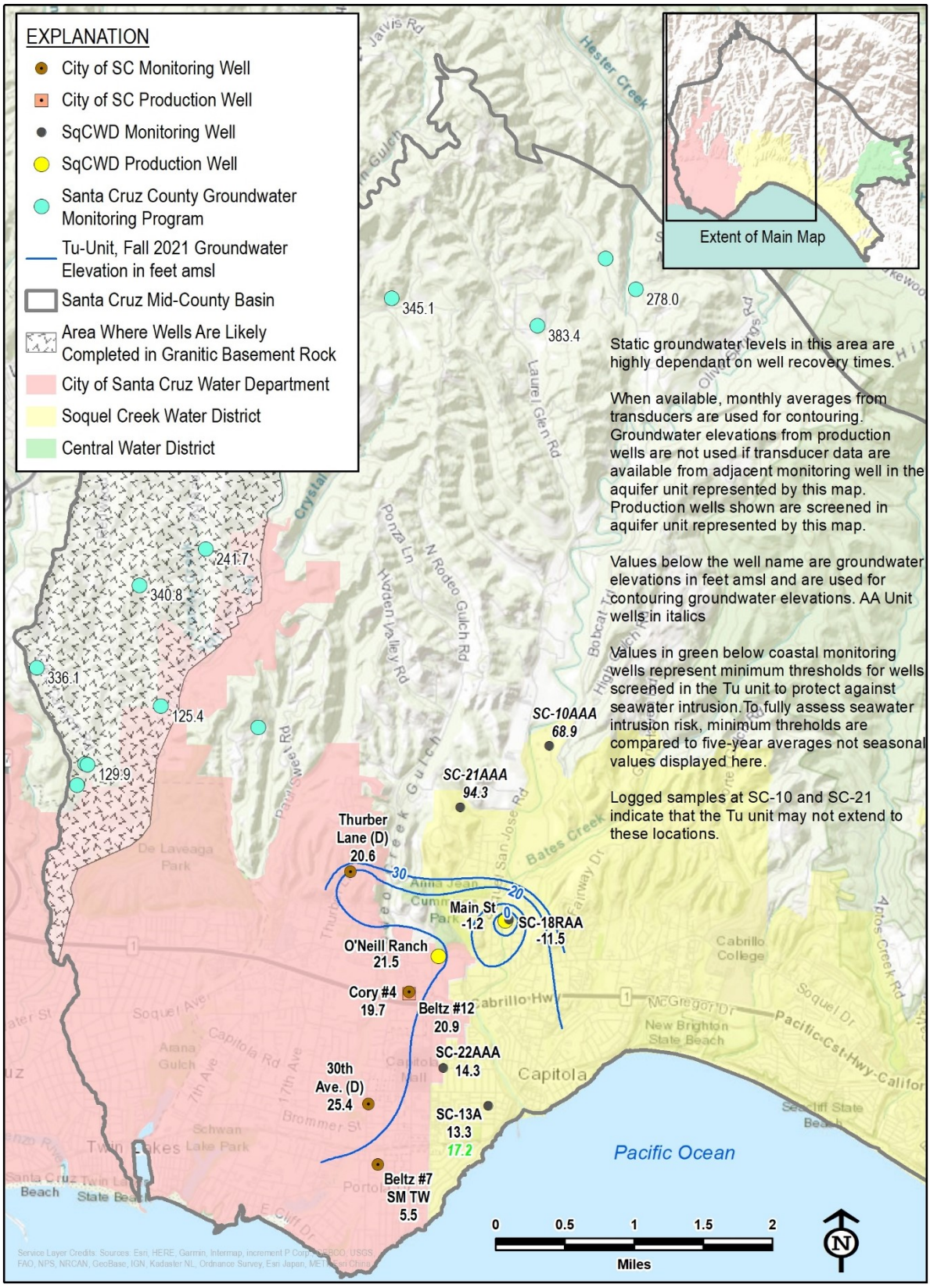

Figure 12.Tu Unit Groundwater Elevations, Fall 2021

3.2 Groundwater Extraction

The volume of Santa Cruz Mid-County Basin groundwater extracted in WY 2021 is included in Table 1. The table summarizes groundwater extractions by water use sector and aquifer group. Table 1 also identifies the method of measurement, and accuracy of measurements. Appendix 2-B of the GSP describes the methodology for estimates. Figure 13 shows the general location and volume of groundwater extractions by use type. To meet requirements for annual reports in the SGMA regulations, Table 1 and Figure 13 only include groundwater extractions and do not account for injection at Beltz #8 during SCWD's Aquifer Storage and Recovery testing in WY 2021.

Table 1. Water Year 2021 Groundwater Extracted in the Santa Cruz Mid-County Basin

Water Use Sector	Aquifer Group			Total (acre-feet)	Percentage
	Aromas Red Sands and Purisima F	Purisima DEF, BC, A and AA	Tu		
Private Domestic [1]	52	361	173	586	10%
Agricultural [2]	202	148	21	371	7%
Institutional [3]	197	62	6	265	5%
Municipal [4]	1,683	1,990	754	4,427	78%
Total	2,134	2,561	954	*5,649*	
Percentage	38%	45%	17%		

[1] Estimated based on annual water use factor (WUF) per connection determined from metered Small Water Systems and applied to each residence outside of municipal water service areas (less accurate). WUF for WY 2021 was 0.25 acre-feet per connection.
[2] Estimated based on irrigation demand determined using the GFLOW model, crop acreage, and crop coefficient (less accurate).
[3] Most water systems in this category reported metered extractions to the County but timing of reporting is too late for inclusion into the Annual Report. Therefore, 2020 data are used for 2021 extractions (less accurate). The volumes from year to year generally do not vary significantly. Where data are not reported to the County, groundwater extraction is estimated based on historical water usage for facility use including an estimate of turf irrigation based on irrigation demand determined using the GFLOW model, irrigation acreage, and turf's crop coefficient (less accurate)
[4] Direct measurement by meters (most accurate); includes 27.9 acre-feet extracted under SCWD's Aquifer Storage and Recovery testing and 9.7 acre-feet for aquifer testing of SqCWD Seawater Prevention recharge wells.

Overall, 460 acre-feet more groundwater was extracted in WY 2021 compared to WY 2020. The Purisima DEF, BC, A, and AA units account for 45% of groundwater pumped, the Aromas Red Sands and Purisima F unit provides 38%, and the Tu unit provides 17% of groundwater pumped (Table 1). The 3 municipal water supply agencies extract an estimated 78% of groundwater extracted from the Basin. For WY 2021, municipal extraction in Table 1 includes 27.9 acre-feet extracted under SCWD's Aquifer Storage and Recovery testing and 9.7 acre-feet extracted groundwater from aquifer testing of SqCWD Seawater Prevention recharge wells.

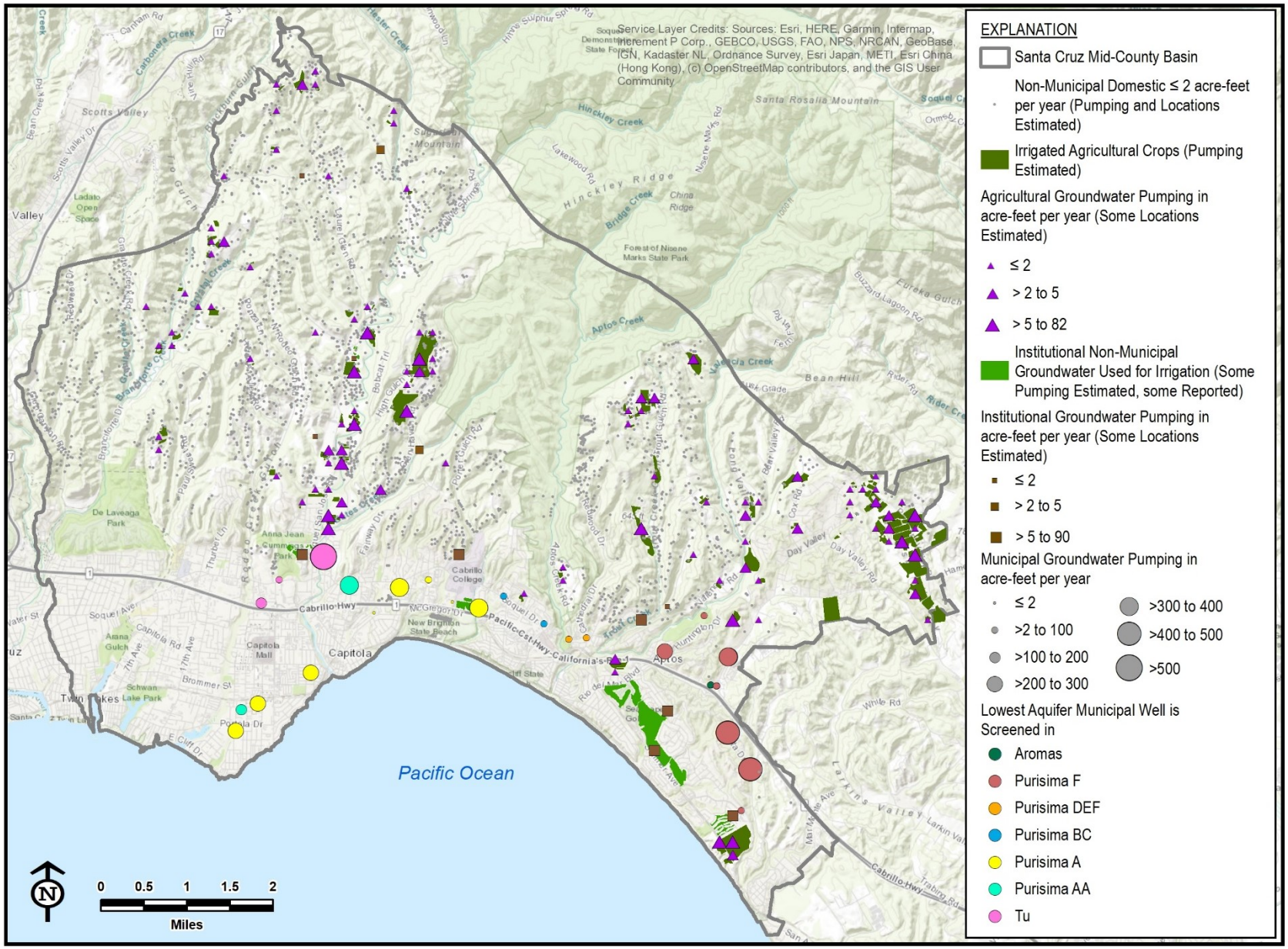

Figure 13. General Location of Water Year 2021 Groundwater Extracted in the Santa Cruz Mid-County Basin

Unmetered domestic use extraction is estimated to be 10% of all extractions and is fairly constant from year to year due to assumed water use factor for these uses being constant over the past few years (0.25 acre-foot per year, per home). A population decline of about 3.7% from 2020 to 2021 in unincorporated areas of Santa Cruz County, as estimated by the California Department of Finance, is used to adjust use thereby resulting in slightly less private domestic extraction compared to WY 2020. Groundwater extraction reporting by small water systems included in the institutional category has improved over the past year which has improved accuracy of the extraction estimate for the intuitional use type. Estimates of extraction to meet landscape and agricultural irrigation demand are variable each year because they are based on measured climate data.

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

No surface water from the SCWD to SqCWD for in-lieu use was transferred in WY 2021 because the agreement between the water districts had expired. Surface water was only used in the Basin for SCWD's continued pilot testing of Aquifer Storage and Recovery that included injection of some of its surface water supply at the Beltz #8 well into the Purisima A unit and potentially into the Purisima AA unit.

Table 2 summarizes surface water supply used in the Basin for groundwater recharge and in-lieu use for WY 2021.

Table 2. Water Year 2021 Surface Water Supply for Groundwater Recharge or In-Lieu Use

Purpose	Water User	Description	Total (acre-feet) [1]
Groundwater Recharge	City of Santa Cruz	Pilot Test of ASR at Beltz #8 Well	19
In-Lieu Use	Soquel Creek Water District	Pilot Transfer from City of Santa Cruz	0
Emergency Use	Soquel Creek Water District	Emergency use due to Public Safety Power Shutoffs	0
Total			*19*

[1] Direct measurement by meters

3.4 Total Water Use

WY 2021 water use volumes in the Santa Cruz Mid-County Basin are included in Table 1. The table summarizes total water use by water use sector, water source type, and identifies the method of measurement. The groundwater portion of water use does not include water extracted as part of the SCWD's ASR pilot tests nor aquifer testing of SqCWD's Seawater Prevention recharge wells because the water was pumped to waste and not used for water supply.

Table 3. Water Year 2021 Water Use in the Santa Cruz Mid-County Basin

Water Use Sector	Groundwater Use	Surface Water Use[1]	Total Water Use	Percentage of Basin Water Use
	Acre-feet			
Private Domestic[2]	586	Unknown but minimal	586	7%
Agricultural[3]	371	0	371	4%
Institutional[4]	265	0	265	3%
Municipal[5]	4,392	2,954	7,448	86%
Total	5,614	2,954	8,670	

[1] All municipal surface water used in the Basin is sourced outside of the Basin.
[2] Estimated based on annual water WUF per connection determined from metered Small Water Systems and applied to each residence outside of municipal water service areas (less accurate). WUF for WY 2021 was 0.25 acre-feet per connection
[3] Estimated based on irrigation demand determined using the GFLOW model, crop acreage, and crop coefficient (less accurate).
[4] Estimated based on historical water usage for facility use including an estimate of turf irrigation based on irrigation demand determined using the GFLOW model, irrigation acreage, and turf's crop coefficient (less accurate).
[5] Direct measurement by meters (most accurate) for groundwater; estimated for surface water based on a proportion of metered consumption that falls within the Basin less groundwater pumped at the Beltz wellfield.

The accuracy of water use measurements is directly correlated with the method used to determine the water use. Metered municipal data have the greatest accuracy while estimates of water use based on various assumptions (GSP Appendix 2-B) are less accurate. Although to the extent possible, reasonable checks are made to minimize order of magnitude inaccuracies.

Total estimated water use from WY 2015 through 2021 is lower compared to previous years (Table 4). As the majority of supply is provided by Basin groundwater, reduced water use has resulted in less groundwater extracted from the Basin over the same period (Table 4). However, WY 2021 had the second highest annual groundwater use over this 7-year period, primarily related to increased pumping by SCWD during the critically dry year. In WY 2021, 66% of water supply was provided by groundwater from the Basin and 39% by surface water supply from outside the Basin.

MONTGOMERY & ASSOCIATES

Table 4. Annual Water Use in the Santa Cruz Mid-County Basin

Water Year	Sources Within the Basin							Sources Outside of the Basin		Total Water Use, acre-feet per year
	Groundwater Use, acre-feet per year							Surface Water Use, acre-feet per year		
	Private Domestic Use [1]	Agricultural Use [2]	Institutional Use [3]	Central Water District	City of Santa Cruz	Soquel Creek Water District	Total	City of Santa Cruz[5]	Soquel Creek Water District[4]	
				Municipal Use [4]				Municipal Use		
1985	980	352	408	394	181	4,319	6,634	6,413	0	13,047
1986	1,001	329	382	404	102	4,272	6,490	6,561	0	13,051
1987	1,022	398	445	444	526	5,235	8,070	6,415	0	14,485
1988	1,031	372	444	438	943	4,859	8,087	5,314	0	13,401
1989	1,004	355	410	406	756	4,797	7,728	4,993	0	12,721
1990	1,022	361	420	429	842	4,818	7,892	4,295	0	12,187
1991	1,012	349	397	426	254	4,703	7,141	4,628	0	11,769
1992	1,017	394	438	467	716	4,908	7,940	4,695	0	12,635
1993	1,025	331	390	481	260	4,863	7,350	5,191	0	12,541
1994	1,033	329	389	482	463	5,089	7,785	5,178	0	12,963
1995	1,036	273	334	459	212	4,855	7,169	5,564	0	12,733
1996	1,042	337	397	526	143	5,183	7,628	5,998	0	13,626
1997	1,035	386	442	604	245	5,571	8,283	6,381	0	14,664
1998	1,041	249	325	534	268	4,966	7,383	5,616	0	12,999
1999	1,048	304	363	539	359	5,211	7,824	5,829	0	13,653
2000	1,058	325	380	547	593	5,271	8,174	5,587	0	13,761
2001	1,044	337	383	557	95	5,175	7,591	6,157	0	13,748
2002	1,039	336	397	593	336	5,376	8,077	5,731	0	13,808
2003	1,031	327	390	584	416	5,332	8,080	5,653	0	13,733
2004	1,019	380	422	633	421	5,372	8,247	5,765	0	14,012
2005	937	275	330	514	316	4,544	6,916	5,459	0	12,375

Water Year	Sources Within the Basin							Sources Outside of the Basin		Total Water Use, acre-feet per year
	Groundwater Use, acre-feet per year							Surface Water Use, acre-feet per year		
	Private Domestic Use [1]	Agricultural Use [2]	Institutional Use [3]	Central Water District	City of Santa Cruz	Soquel Creek Water District	Total	City of Santa Cruz[5]	Soquel Creek Water District[4]	
				Municipal Use [4]				Municipal Use		
2006	935	305	359	544	296	4,549	6,988	5,278	0	12,266
2007	933	362	408	596	420	4,626	7,345	5,054	0	12,399
2008	939	380	439	584	561	4,557	7,460	4,971	0	12,431
2009	874	371	416	594	582	4,162	6,999	4,254	0	11,253
2010	879	304	360	481	451	3,933	6,408	4,311	0	10,719
2011	882	270	311	487	637	4,011	6,598	3,931	0	10,529
2012	890	361	400	535	494	4,159	6,839	4,374	0	11,213
2013	828	423	326	559	515	4,218	6,869	4,560	0	11,429
2014	691	436	310	500	510	3,703	6,150	3,571	0	9,721
2015	553	431	300	391	613	3,154	5,442	3,222	0	8,664
2016	552	375	293	383	450	3,094	5,147	3,472	0	8,619
2017	600	218	288	383	463	3,169	5,121	3,726	0	8,847
2018	599	375	313	377	635	3,340	5,639	3,489	0	9,128
2019	595	336	308	385	83	3,019	4,726	3,794	165	8,685
2020	594	407	318	411	244	3,197	5,171	3,487	111	8,769
2021	586	371	265	406	724	3,262	5,614	2,954	0	8,568

[1] Estimated based on annual WUF per connection determined from metered Small Water Systems and applied to each residence outside of municipal water service areas (less accurate). WUF for WY 2019 was 0.25 acre-feet per connection

[2] Estimated based on irrigation demand determined using the GFLOW model, crop acreage, and crop coefficient (less accurate).

[3] Estimated based on historical water usage for facility use including an estimate of turf irrigation based on irrigation demand determined using the GFLOW model, irrigation acreage, and turf's crop coefficient (less accurate).

[4] Direct measurement by meters (most accurate).

[5] SCWD surface water use in the Basin is not directly metered since the City service area is also outside of the Basin. For purposes of reporting, surface water use in the Basin is estimated based on a proportion of metered consumption that falls within the Basin less groundwater pumped at the Beltz wellfield.

3.5 Change of Groundwater in Storage

In order to estimate change of groundwater in storage, the Basin's integrated surface water/groundwater model (Model) was updated with climate data, metered extraction and injection, and estimates of non-municipal pumping through WY 2021. Change of groundwater in storage is based on water budget output calculated by the updated Basin Model. Appendix 2-D, 2-E, 2-F, and 2-G of the GSP describe development of the Model that incorporated data through WY 2016.

Updated climate data included the following:

- Precipitation data from the Santa Cruz Co-op and Watsonville Waterworks stations sourced from NOAA. Missing data at the Santa Cruz Co-op station were filled using measurements from neighboring stations at Santa Cruz 1.6E, Santa Cruz 0.5 ENE, and Live Oak 1.3 stations, resulting in a complete dataset.
- Temperature data from the Santa Cruz Co-op station sourced from NOAA. Missing data were filled using temperature data from the Watsonville Waterworks station.
- Temperature data for the upper watershed location through December 2020 from DAYMET. Because DAYMET data are only available through December 2020, January 2021 through September 2021 temperature data are derived from a regression of historical DAYMET data (1 km by 1 km grid) with coarser gridded (4 km by 4 km grid) Parameter-elevation Relationships on Independent Slopes Model (PRISM) data, which are available through September 2021.

Updated pumping data included the following:

- Metered municipal pumping and recharge volumes provided by CWD, SCWD, and SqCWD.
- Domestic water use factor of 0.25 acre-feet/year.
- Non-municipal irrigation demand estimated based on Precipitation Runoff Modeling system watershed simulation of potential and actual evapotranspiration using updated climate data.

As described in Appendix 2-F, the Model was calibrated based on simulation of WY 1985-2015. The Model has not been completely recalibrated for the update through WY 2021. However, a small portion of the Model near the Pure Water Soquel project was recalibrated based on information from pilot testing.

Based on the updated Model simulation through WY 2021, Figure 14 shows the annual groundwater budget for the Basin including annual change of groundwater in storage and cumulative change of groundwater in storage. Cumulative change of groundwater in storage has remained fairly stable since 2005. The Basin's cumulative change in storage decreases in dry and critically dry years such as WY 2021, and increases in average and wet years.

Figure 15 through Figure 20 show modeled WY 2021 change of groundwater in storage across the Basin for the principal aquifer units represented by model layers: Aromas Red Sands, Purisima F/DEF units, Purisima BC unit, Purisima A unit, Purisima AA unit, and Tu unit. While these maps are required for the annual report, their main utility is for evaluating how recharge over the water year has changed groundwater in storage in the unconfined areas of the Basin (Figure 15). As WY 2021 was a critically dry year with limited recharge, groundwater in storage in the unconfined Aromas Red Sands aquifer decreased over the year. For the other aquifers, areas with the greatest change in storage mostly correspond with where the aquifer outcrops at the surface and there are large areas represented by uncolored cells indicating little change in stored groundwater.

Overall results from the Model simulation show a decrease (orange and red colors) of groundwater in storage for much of the Basin consistent with the WY 2021 Basin-wide storage shown on Figure 14. Groundwater in storage in the Purisima A unit decreased over WY 2021 (Figure 18) around the Beltz wellfield because 480 acre-feet more groundwater was pumped than 2020 (Table 4).

In general, larger changes of groundwater in storage are limited to unconfined areas for the aquifer units. Therefore, these maps do not fully represent groundwater conditions in the Basin as many of the SMC defining undesirable results relate to groundwater elevations in the confined areas of the aquifer units. In confined areas, groundwater elevations can change substantially with very small changes of groundwater in storage. For example, RMPs with groundwater elevation proxies for the seawater intrusion sustainability indicator are located in the confined area and this indicator cannot be evaluated by these maps. The maps also do not represent where more groundwater is extracted at wells as reduction of groundwater in storage can be a relatively small contribution of flow to wells. Reduction of groundwater in storage can be greater where flows are lower due to lower transmissivity of the aquifer unit.

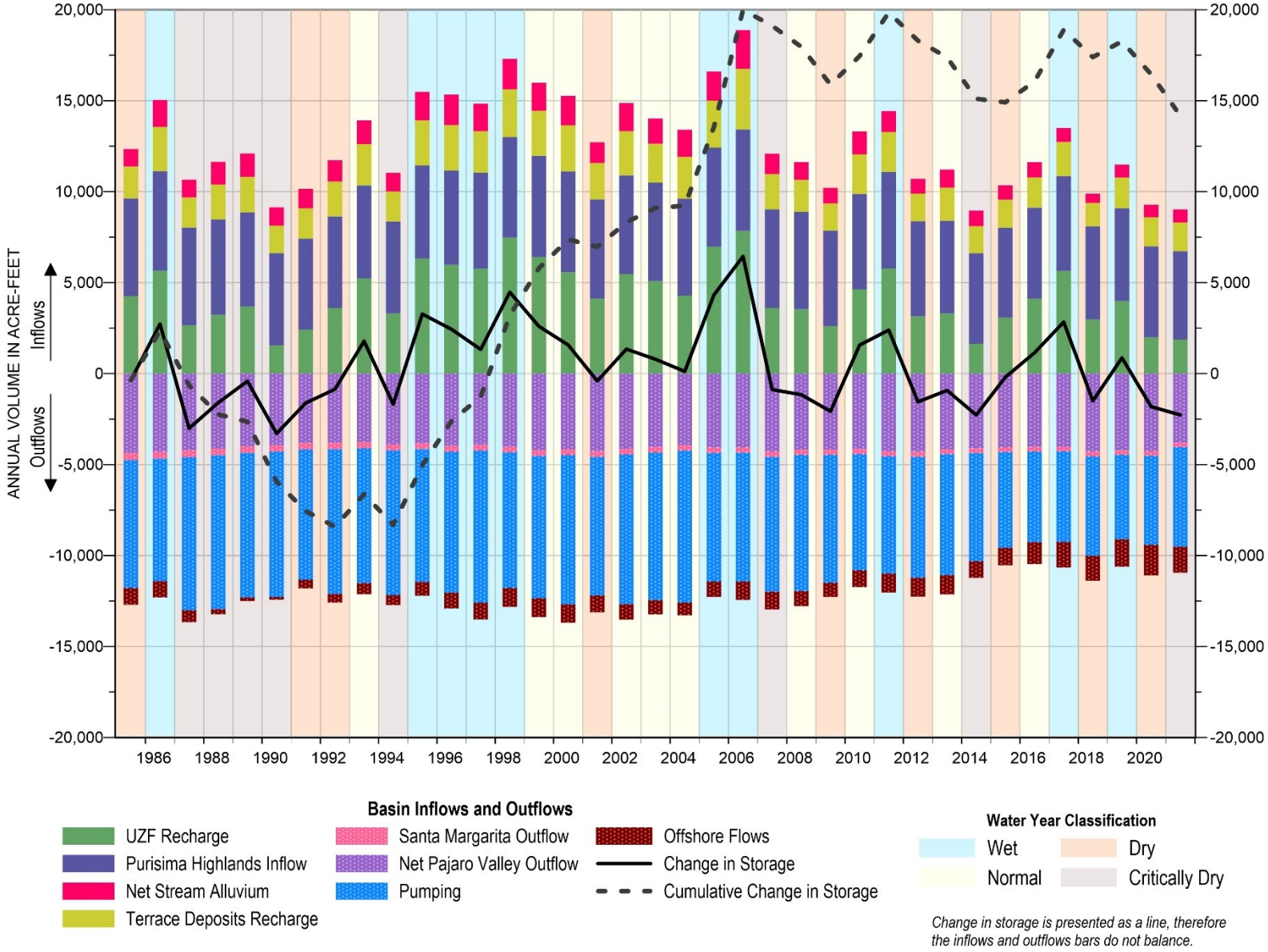

Figure 14. Annual Change in Groundwater in Storage for Santa Cruz Mid-County Basin

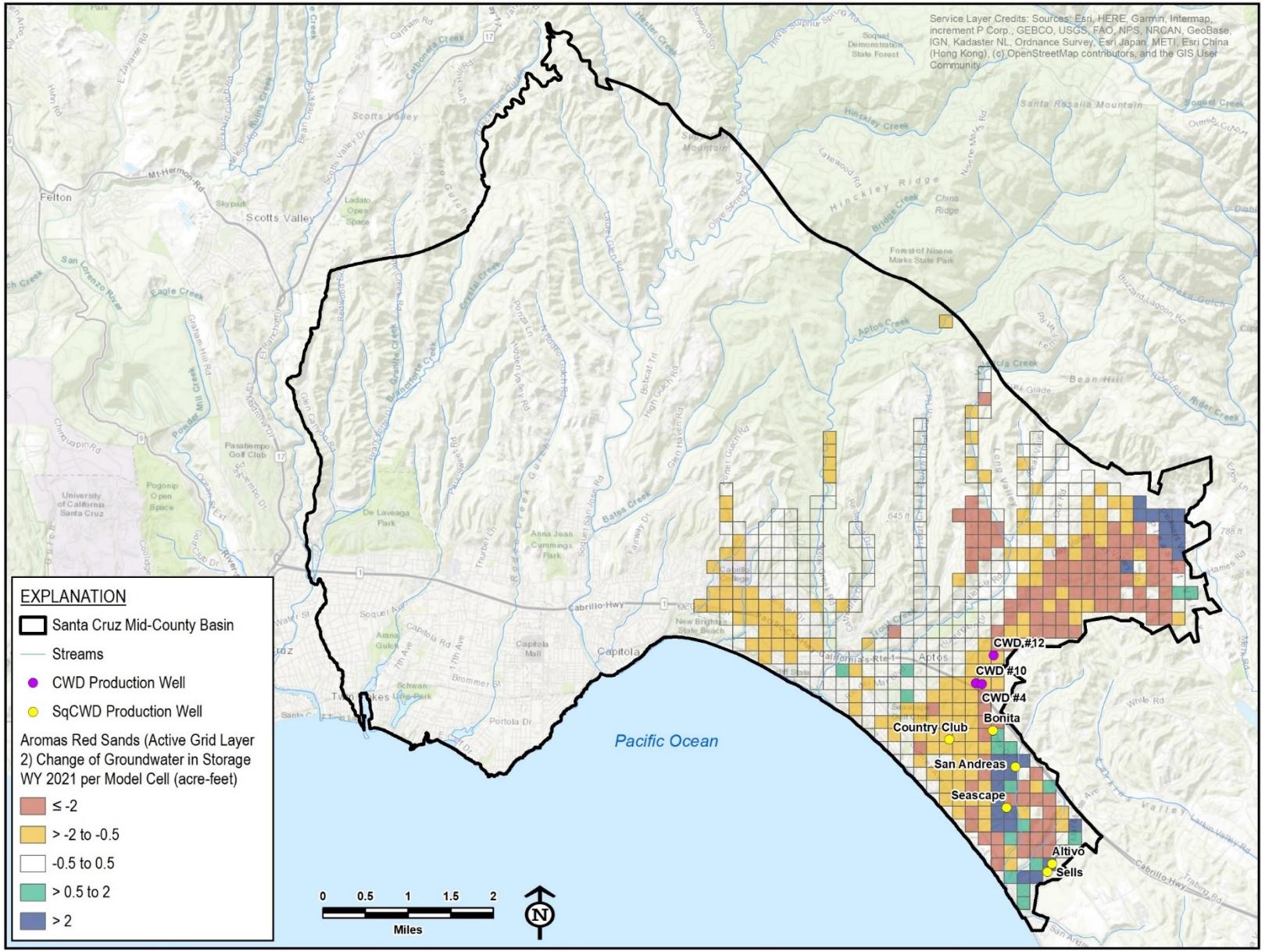

Figure 15. Water Year 2021 Change of Groundwater in Storage in Aromas Red Sands

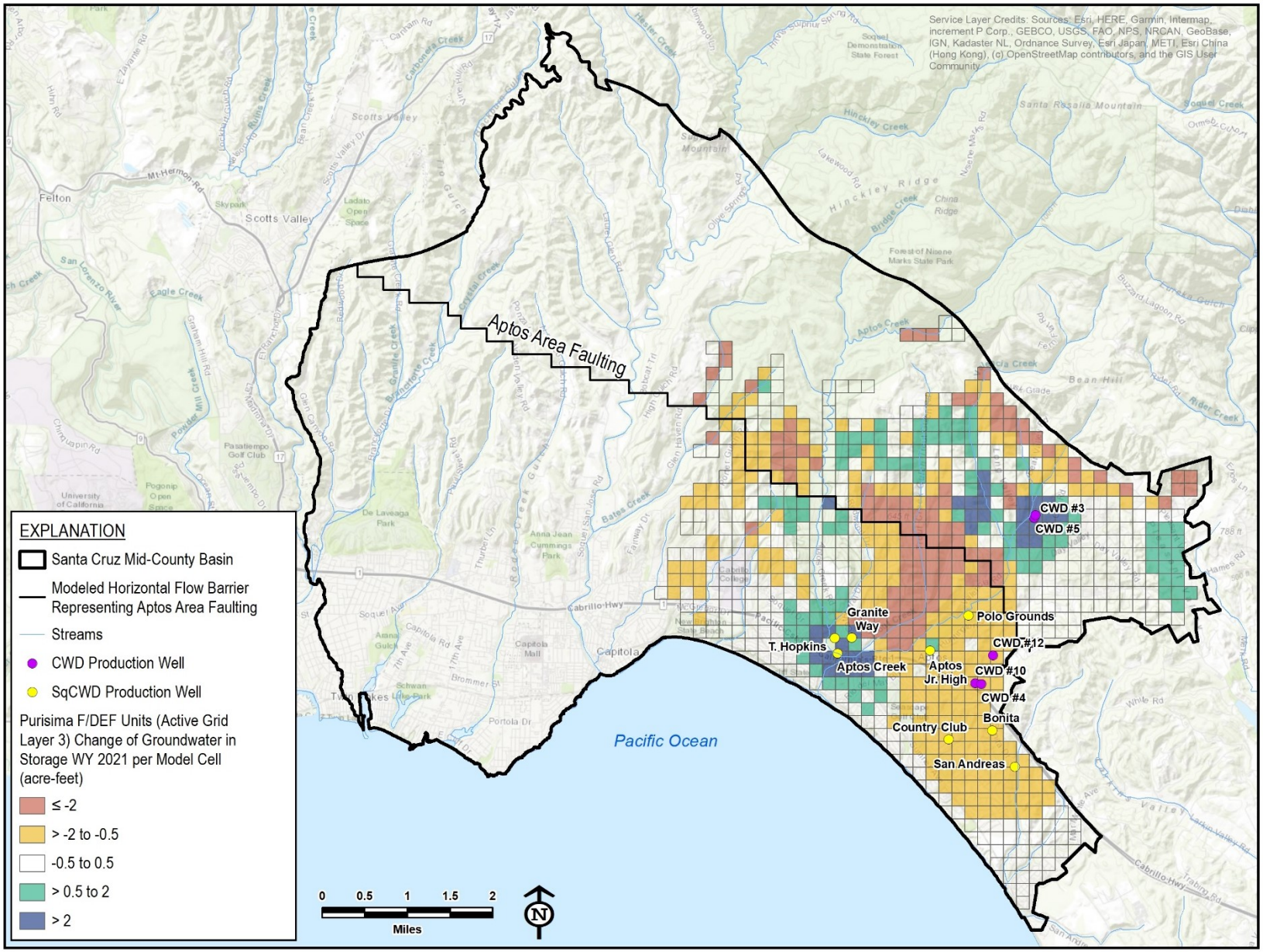

Figure 16. Water Year 2021 Change of Groundwater in Storage in Purisima F/DEF Units

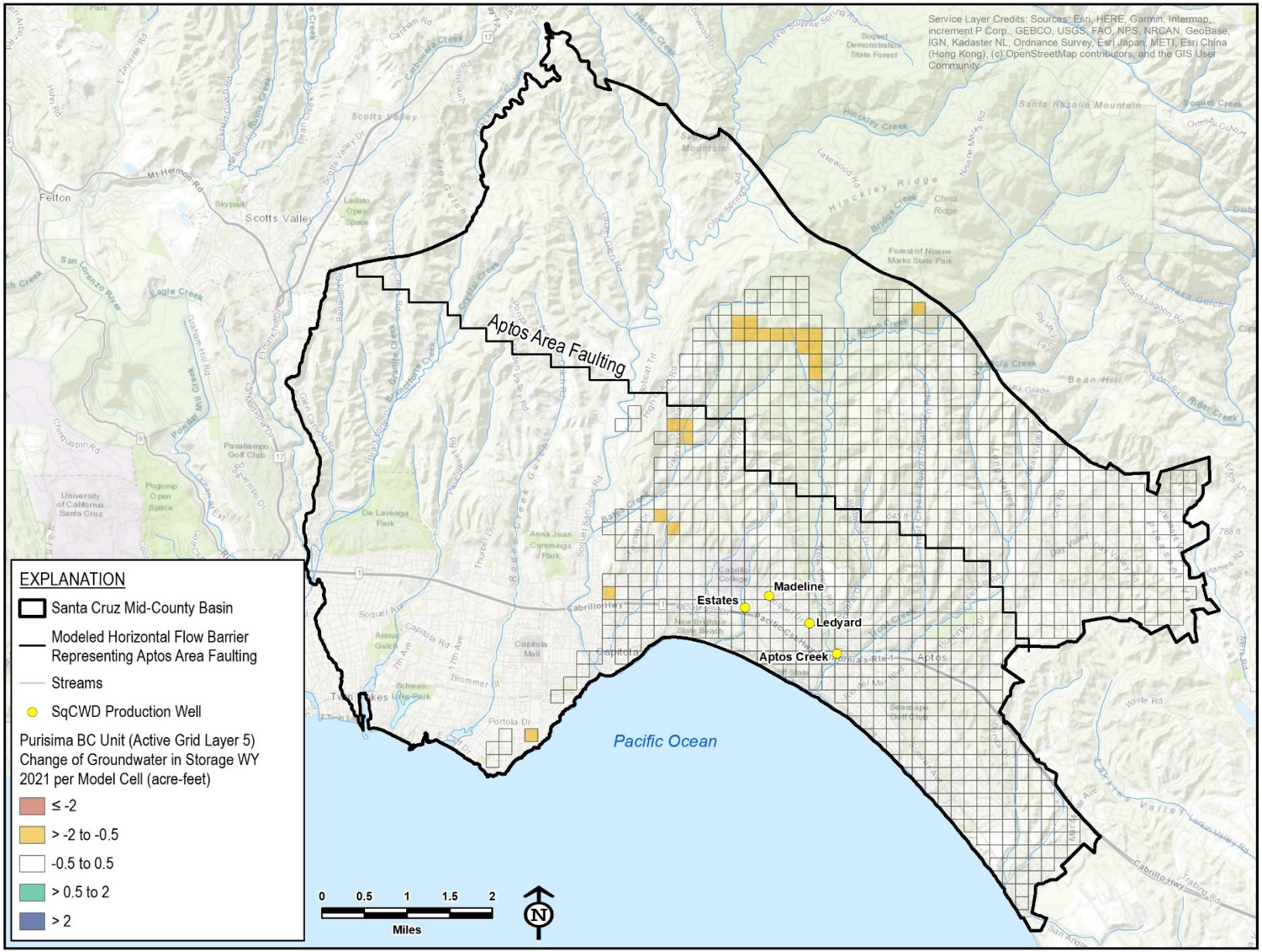

Figure 17. Water Year 2021 Change of Groundwater in Storage in Purisima BC Unit

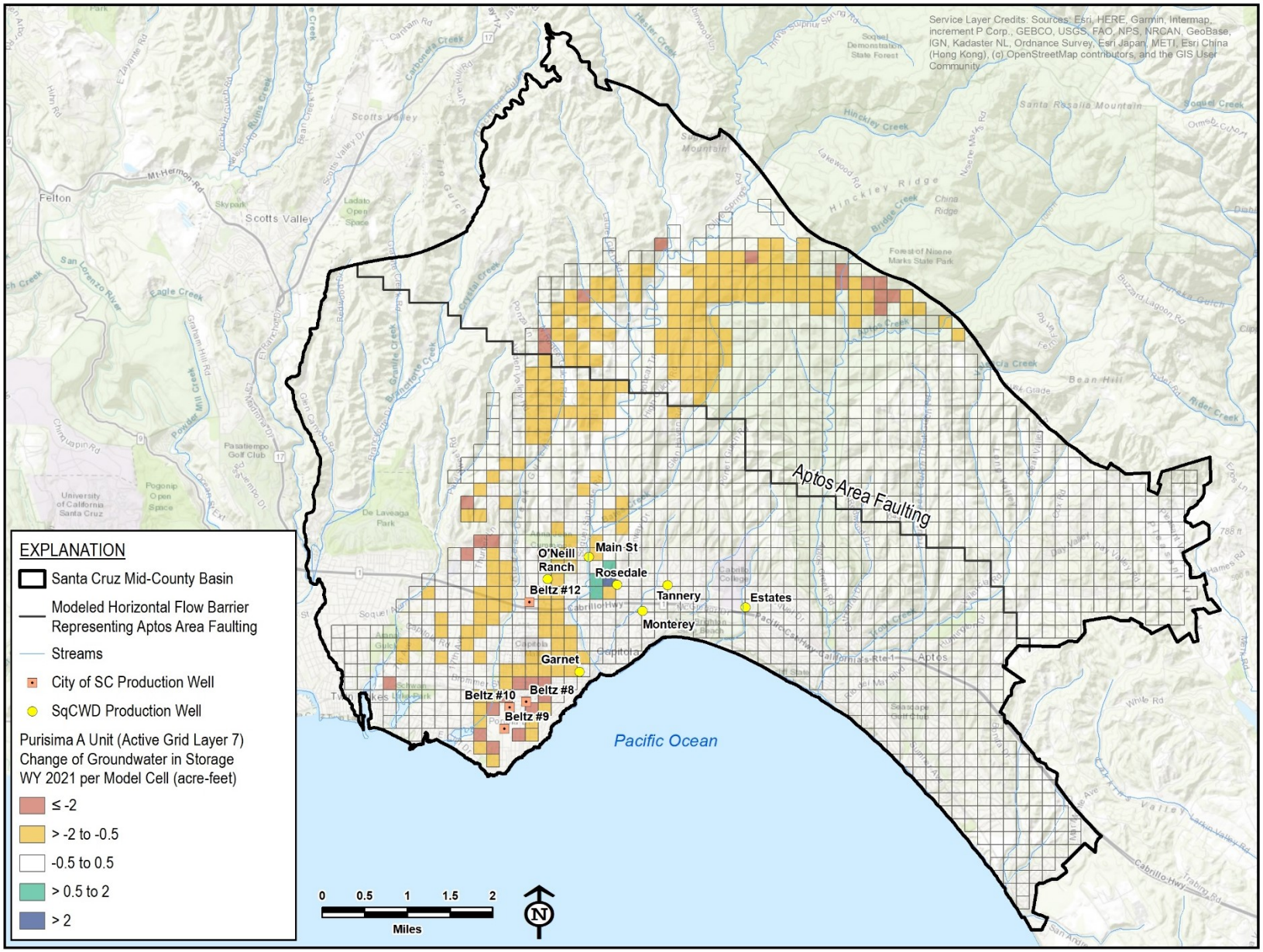

Figure 18. Water Year 2021 Change of Groundwater in Storage in Purisima A Unit

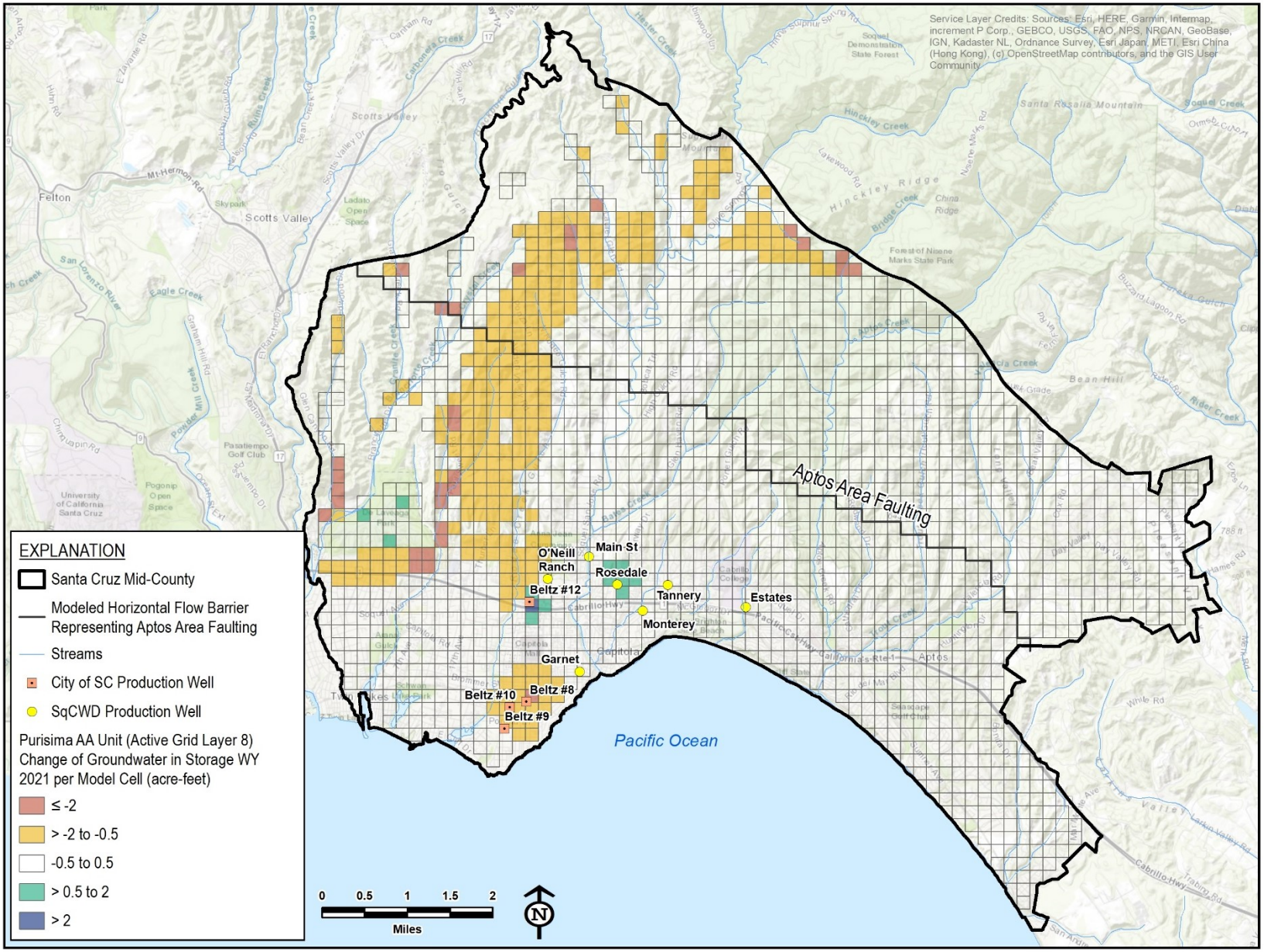

Figure 19. Water Year 2021 Change of Groundwater in Storage in Purisima AA Unit

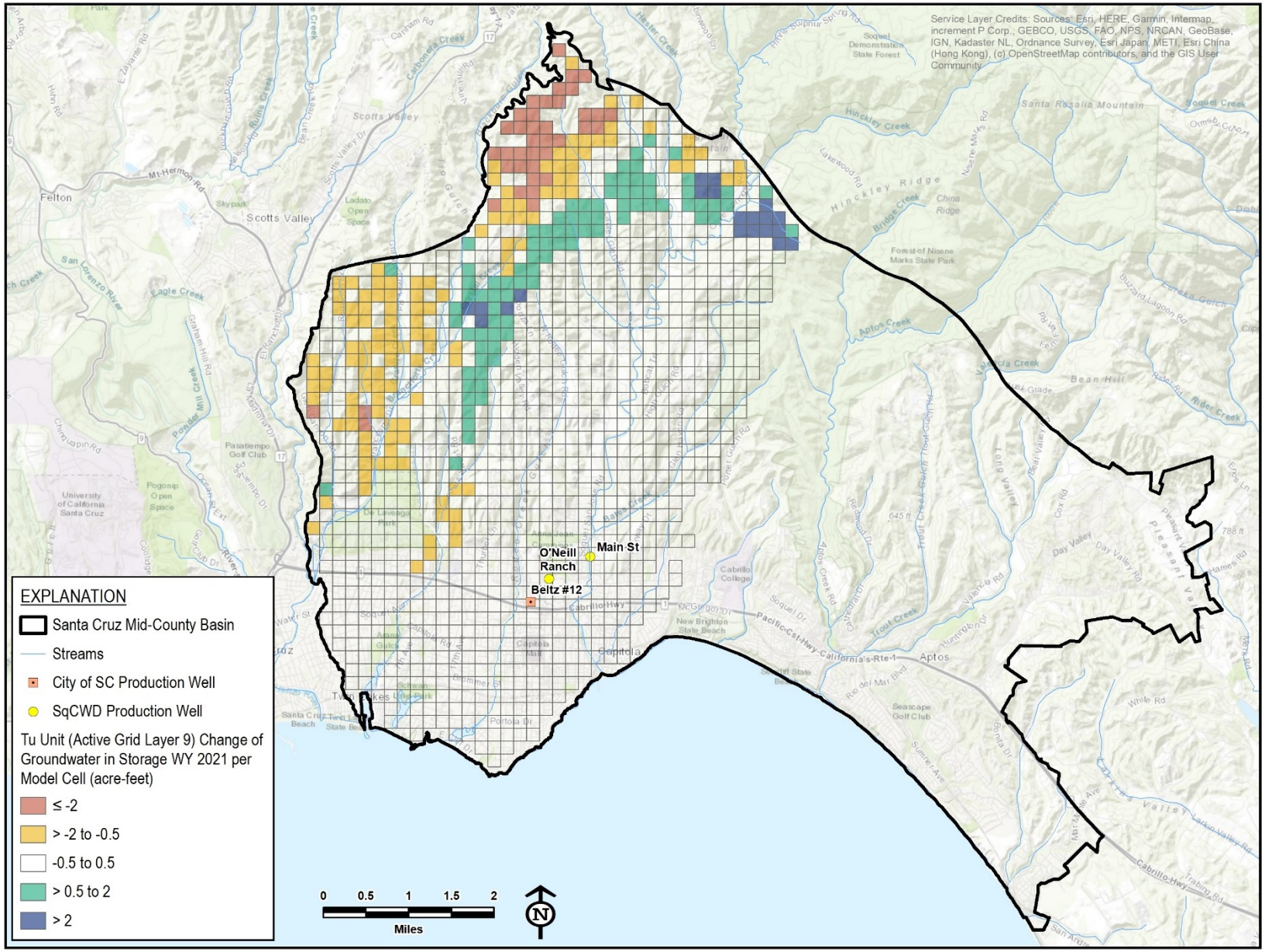

Figure 20. Water Year 2021 Change of Groundwater in Storage in Tu Unit

4 PROGRESS TOWARDS IMPLEMENTING THE PLAN

This section evaluates progress towards implementing the GSP by comparing groundwater conditions in WY 2021 to SMC for each of the sustainability indicators required for SGMA. The section concludes with an update of implementation of projects and management actions to achieve sustainability.

4.1 Chronic Lowering of Groundwater Levels

Table 5 shows SMC at RMPs for chronic lowering of groundwater levels. Sustainable management criteria for this indicator are met when groundwater elevations are at or above the criteria. Hydrographs for chronic lowering of groundwater levels RMPs (Appendix Figures A-1 through A-17) plot groundwater elevations above minimum thresholds at all wells so there are no undesirable results for chronic lowering of groundwater levels. Groundwater elevations are above measurable objectives for 2 of the 17 RMPs for this indicator. Interim milestones are the same as the long-term measurable objectives based on recent conditions so the GSP has a goal to meet measurable objectives throughout the GSP implementation period.

Table 5. Chronic Lowering of Groundwater Levels Sustainable Management Criteria Compared to Representative Monitoring Point Groundwater Elevations

Representative Monitoring Point	Well Type	Aquifer	Minimum Threshold	Measurable Objective	Interim Milestone 2025	WY 2017	WY 2018	WY 2019	WY 2020	WY 2021
			Groundwater Elevation, feet above mean sea level			Minimum Average Monthly Groundwater Elevation, feet above mean sea level				
SC-A7C	Monitoring	Aromas	0	8	8	5.4	4.7	6.0	6.0	5.8
Private Well #2	Production	Purisima F	562	596	596	592.4	592.8	596.0	596.4	594.9
Black	Monitoring		10	41	41	41.0	40.5	42.0	46.1	44.1
CWD-5	Monitoring		140	194	194	191.7	192.0	195.3	195.1	194.2
SC-23C	Monitoring		15	49	49	46.5	46.3	45.9	45.8	44.5
SC-11RD	Monitoring	Purisima DEF	295	318	318	313.7	314.3	315.3	315.2	315.2
SC-23B	Monitoring		50	85	85	77.7	81.4	80.2	78.8	62.7
SC-11RB	Monitoring	Purisima BC	120	157	157	152.4	155.9	155.3	154.8	152.6
SC-19	Monitoring		56	95	95	87.2	89.8	88.5	78.4	78.5
SC-23A	Monitoring		0	44	44	30.5	41.6	39.8	38.8	39.6
Coffee Lane Shallow	Monitoring	Purisima A	27	47	47	43.3	43.6	45.3	44.7	44.8
SC-22A	Monitoring		2	24	24	20.9	20.9	22.3	22.2	22.4
SC-22AA	Monitoring	Purisima AA	0	22	22	18.7	18.6	20.4	20.3	20.7
SC-10RAA	Monitoring		35	76	76	71.5	70.8	70.3	69.3	69.1
Private Well #1	Production	Purisima AA/Tu	362	387	387	376.4	378.8	387.2	383.5	382.6
30th Ave Deep	Monitoring	Tu	0	30	30	22.2	20.7	24.0	27.4	21.3
Thurber Lane Deep	Monitoring		-10	33	33	6.3	10.4	12.8	19.1	-1.1

Minimum threshold not met
Minimum threshold achieved but measurable objective not met
Measurable objective met

4.2 Reduction of Groundwater in Storage

Table 6 shows SMC for reduction of groundwater in storage, which is based on sustainable yields estimated in the GSP for 3 aquifer groups. Sustainable management criteria for this indicator are met when net extraction (all groundwater extraction less injection) is at or below criteria or sustainable yields. As sustainable yield is primarily based on eliminating critical overdraft related to seawater intrusion, the 5-year moving average net extraction is used to be consistent with 5-year moving averages used for seawater intrusion groundwater elevation proxies. Five-year moving average net extraction below the minimum threshold is considered sustainable.

The 5-year net extraction through WY 2021 for the Tu unit is less than the sustainable yield for the aquifer thereby meeting the minimum threshold. The 5-year average net extraction amounts for the Aromas Red Sands and Purisima F aquifer group and Purisima DEF, BC, A, and AA aquifer group are greater than their respective minimum thresholds. These exceedances indicate undesirable results for this sustainability indicator. Net extraction for these aquifer groups would need to be reduced to or below minimum thresholds to eliminate undesirable results.

The interim milestone for 2025 is based on planned schedule for implementation of projects and management actions to reduce net extraction to below sustainable yield. The 5-year net extraction for all 3 aquifer groups through WY 2021 did not meet these interim milestones as planned projects and management actions have not been implemented yet.

The measurable objective is based on annual net extraction that could occur while ensuring net annual groundwater extractions greater than the minimum threshold will not occur for any 1 of the 3 aquifer groups even if there were 4 subsequent years of maximum projected net groundwater extraction. Net extraction in WY 2021 did not meet measurable objectives for the 3 aquifer groups.

Table 6. Reduction in Groundwater in Storage Sustainable Management Criteria Compared to Net Extraction

Aquifer Unit Group	Minimum Threshold	Interim Milestone 2025	WY 2017-2021	Measurable Objective	WY 2021
	Five-Year moving average Net Extraction, acre-feet per year			Net Extraction, acre-feet per year	
Aromas Red Sands and Purisima F	1,740	1,930	2,031	1,680	2,134
Purisima DEF, BC, A and AA	2,280	2,110	2,410	960	2,532
Tu	930	720	830	620	954

Minimum threshold not met	Measurable objective not met
Minimum threshold met	Measurable objective met

4.3 Seawater Intrusion

4.3.1 Chloride Concentrations

Table 7 shows the SMC for chloride concentrations compared to maximum concentrations for the past 5 years, including WY 2021. Sustainable management criteria for this indicator are met when chloride concentrations are at or below criteria concentrations. There are 2 wells with exceedances of minimum thresholds during WY 2021: SC-A2RB and SC-A5B both in the Purisima F unit near SqCWD's Seascape well. Monitoring well SC-A2RB had only 1 exceedance out of 4 samples taken during the year. Monitoring well SC-A5B had chloride concentrations in 2 of 4 consecutive samples greater than the minimum threshold. Any RMP with consecutive samples greater than the minimum threshold constitute an undesirable result for chloride concentrations in WY 2021.

Interim milestones are the same as measurable objectives for chloride concentrations. At wells in the Aromas Red Sands and Purisima F units other than those mentioned above, chloride concentrations met minimum thresholds but did not meet the measurable objective. All RMPs in the deeper Purisima units met measurable objectives except at the Soquel Point Deep well in the Purisima AA unit.

Figure 21 shows maximum chloride concentrations mapped with the chloride isocontour established as a minimum threshold in the GSP. Appendix B includes chemographs for chloride concentrations at coastal monitoring wells.

Table 7. Chloride Concentrations Adjacent to 250 mg/L Chloride Isocontour for Seawater Intrusion

Representative Monitoring Point	Aquifer	Minimum Threshold	Measurable Objective	Interim Milestone 2025	WY 2017	WY 2018	WY 2019	WY 2020	WY 2021
		Chloride Concentration, mg/L			Water Year Maximum Chloride Concentration, mg/L				
Coastal Monitoring Wells – Intruded (undesirable results if > minimum threshold in >=2 of 4 consecutive quarterly samples)									
SC-A3A	Aromas	22,000	17,955	17,955	18,000	18,000	18,400	18,500	18,600
SC-A3B	Aromas	4,330	676	676	1,200	1,000	1,100	767	1,070
SC-A8A	Purisima F	8,000	7,258	7,258	7,200	7,500	7,670	7,670	7,710
SC-A2RA	Purisima F	18,480	14,259	14,259	14,000	15,000	15,000	15,000	15,200
SC-A2RB	Purisima F	470	355	355	370	410	470	564*	480
Moran Lake Med	Purisima A	700	147	147	120	78	60	53	47
Soquel Point Med	Purisima A	1,300	1,104	1,104	1,100	1,100	1,000	1,200	1,100
Coastal Monitoring Wells - Unintruded (undesirable results if > 250 mg/L in >=2 of 4 consecutive quarterly samples)									
SC-A8B	Aromas	250	100	100	33	32	39	35	53
SC-A1B	Purisima F	250	100	100	26	26	28	29	28
SC-A1A	Purisima DEF	250	100	100	28	26	28	29	28
SC-8RD	Purisima DEF	250	100	100	21	66	21	21	20
SC-9RC	Purisima BC	250	100	100	36	31	32	32	31
SC-8RB	Purisima BC	250	100	100	17	not sampled	19	15	13
Pleasure Point Medium	Purisima A	250	100	100	37	36	35	36	not sampled
SC-1A	Purisima A	250	100	100	38	38	44	49	48
SC-5RA	Purisima A	250	100	100	56	58	58	57	56
SC-3RA	Purisima A	250	100	100	64	63	65	51	40
Moran Lake Deep	Purisima AA	250	100	100	63	65	66	66	66
Pleasure Point Deep	Purisima AA	250	100	100	23	22	23	22	22

Representative Monitoring Point	Aquifer	Minimum Threshold	Measurable Objective	Interim Milestone 2025	WY 2017	WY 2018	WY 2019	WY 2020	WY 2021
		Chloride Concentration, mg/L			Water Year Maximum Chloride Concentration, mg/L				
Soquel Point Deep	Purisima AA	250	100	100	140	160	160	170	160
Inland Monitoring Well- Intruded (undesirable results if > minimum threshold in >=2 of 4 consecutive quarterly samples)									
SC-A5A	Purisima F	9,800	8,575	8,575	9,100	9,310	9,220	10,800*	9,240
Inland Production and Monitoring Wells- Unintruded (undesirable results if > 150 mg/L in >=2 or more consecutive quarterly samples)									
SC-A5B	Purisima F	150	100	100	120	130	159	133	173*
San Andreas PW	Purisima F	150	100	100	21	29	30	22	22
Seascape PW	Purisima F	150	100	100		18	19	19	17
T. Hopkins PW	Purisima DEF	150	100	100	44	24	42	50	25
Estates PW	Purisima BC & A	150	100	100	49	50	45	48	13
Ledyard PW	Purisima BC	150	100	100	38	31	33	35	12
Garnet PW	Purisima A	150	100	100	81	76	84	85	86
Beltz #2	Purisima A	150	100	100	61	63	64	69	68
Beltz #8 PW	Purisima A	150	100	100	52	49	50	53	52
SC-22AA	Purisima AA	150	100	100	39	38	46	41	39
Corcoran Lagoon Deep	Purisima AA	150	100	100	20	21	22	23	23
Schwan Lake	Purisima AA	150	100	100	94	93	94	97	93

Minimum threshold not met ; * indicates undesirable result (2 of 4 minimum threshold exceedances)

Minimum threshold achieved but measurable objective not met

Measurable objective met

Figure 21. Water Year 2021 Maximum Chloride Concentration Map Compared to Minimum Threshold Isocontour

4.3.2 Groundwater Elevation Proxies

Table 8 lists groundwater elevation proxies used for seawater intrusion SMC. These groundwater elevations are protective elevations estimated to prevent further seawater intrusion over the long-term. Sustainable management criteria for this indicator are met at a specific RMP when 5-year moving average groundwater elevations are at or above the groundwater elevation proxy for the RMP.

Hydrographs for seawater intrusion groundwater elevation proxy RMPs (Figures A-18 through A-34) show 5-year moving averages in comparison to groundwater elevation proxies for seawater intrusion SMC. The annual minimums of the 5-year moving averages for groundwater elevations in most of the Tu, Purisima AA, A, BC, and DEF unit coastal RMPs increased in WY 2021. The Purisima F unit and Aromas coastal monitoring wells have fairly stable groundwater elevations. The 5-year moving average groundwater elevation in SC-A3A in the Aromas unit was above its minimum threshold for an entire water year for the first time since its installation in 1986.

Coastal RMPs with 5-year moving average groundwater elevations below minimum thresholds include:

- One of 3 Purisima F unit RMPs (SC-A8A)
- Both RMPs in the Purisima BC unit: SC-9RC and SC-8RB
- Two of 6 RMPs in the Purisima A unit: SC-5RA and Soquel Point Medium
- One of 3 Purisima AA RMPs (Soquel Point Deep)
- The Tu unit RMP (SC-13A)

Since there are RMPs with 5-year moving average groundwater elevations below minimum thresholds, undesirable results for seawater intrusion continue to occur and the Basin remains in a state of critical overdraft. For the RMPs with undesirable results, the 5-year moving averages generally leveled out or declined over WY 2021 after showing an increasing trend in prior years.

Measurable objectives for groundwater elevation proxies are met at several RMPs screened in the Purisima F, DEF, and A units.

Interim milestones for WY 2025 are based on modeled groundwater level recovery as a result of implementation of projects in the GSP. Table 8 shows that 13 of 17 RMPs have groundwater elevations higher than WY 2025 interim milestones. Two of those have 5-year moving average groundwater elevations that are below minimum thresholds. The 4 RMPs with groundwater elevations below their 2025 interim milestones are SC-8RB, SC-5RA, Soquel Point Medium, and Soquel Point Deep (Table 8).

Table 8. Groundwater Elevation Proxies for Seawater Intrusion

Representative Monitoring Point	Aquifer	Minimum Threshold	Measurable Objective	Interim Milestone 2025	WY 2017	WY 2018	WY 2019	WY 2020	WY 2021
		Groundwater Elevation, feet above mean sea level			Annual Minimum of Five-Year Moving Average Groundwater Elevation, feet above mean sea level				
SC-A3A	Aromas	3	4	3	2.9	2.9	2.9	2.9	3.1
SC-A1B	Purisima F	3	5	3	7.4	7.5	7.5	7.5	7.4
SC-A8A	Purisima F	6	7	4.5	5.3	5.3	5.4	5.3	5.0
SC-A2RA	Purisima F	3	4	3	3.8	4.5	5.7	6.5	6.6
SC-8RD	Purisima DEF	10	11	10	7.5	9.4	10.1	12.6	13.9
SC-9RC	Purisima BC	10	11	4.6	-1.6	2.2	5.2	8.9	9.6
SC-8RB	Purisima BC	19	20	8.4	-2.4	0.2	2.7	5.8	5.2
SC-5RA	Purisima A	13	15	13	6.3	7.8	8.5	9.3	10.2
SC-3RA	Purisima A	10	12	10	8.8	9.6	10.6	11.7	11.5
SC-1A	Purisima A	4	6	4	9.6	9.5	9.5	9.7	10.4
Moran Lake Medium	Purisima A	5	6.8	5	5.5	5.6	5.6	5.9	6.2
Soquel Point Medium	Purisima A	6	7.1	6	5.1	5.2	5.3	5.7	5.9
Pleasure Point Medium	Purisima A	6.1	6.5	6.1	6.5	6.8	7.1	7.9	9.3
Moran Lake Deep	Purisima AA	6.7	16	6.7	6.2	6.4	6.5	6.8	7.0
Soquel Point Deep	Purisima AA	7.5	16	7.5	5.8	5.9	6.0	6.3	6.8
Pleasure Point Deep	Purisima AA	7.7	16	7.7	7.4	7.8	8.2	8.7	10.1
SC-13A	Tu	17.2	19	8.3	not previously measured		17.1	18.3	15.1

Minimum threshold not met

Minimum threshold achieved but measurable objective not met

Measurable objective met

4.3.3 Seawater Intrusion Triggers

Although not required by the SGMA regulations, the GSP includes triggers for preemptive actions to prevent significant and unreasonable conditions of seawater intrusion, the indicator for which the Basin is in critical overdraft. Chloride concentration triggers are exceeded when annual average concentrations exceed average concentration for 2013-2017 (i.e., measurable objective) and show an increasing trend. In WY 2021, there are 3 wells whose chloride concentrations are above their measurable objectives: Soquel Point Deep in the Purisima A unit (Appendix Figure B-20), and Purisima F unit SC-A5A (Appendix Figure B-21) and SC-A5B (Appendix Figure B-22). Of those 3 wells, SC-A5B in the Purisima F unit is the only well with a clear increasing trend. This indicates there is inland movement of seawater intrusion that may lead to undesirable results and therefore warrants early management action.

The GSP recommends a reduction of extractions from the nearest municipal well as early management action. SqCWD's Seascape well is the nearest municipal well as it is on the same site as SC-A5B, but has a shallower screen. Groundwater extractions at the Seascape well have been limited to less than 47 acre-feet per year since 2015, which is much less than previous years, and is consistent with sustainable pumping described in the GSP. It is also possible local non-municipal extractions are influencing groundwater hydraulic gradients that drive seawater intrusion in this area more than current municipal pumping. Since the Seascape area has the Basin's highest chloride concentrations, it is recommended that the MGA evaluate local non-municipal pumping to assess causes of seawater intrusion in the area. Chloride concentrations at SC-A2RB, had for the past 3 years been greater than its measurable objective of 355 mg/L, but in WY 2021 there were 2 samples with concentrations below 150 mg/L.

The GSP also includes triggers for groundwater elevation proxies that are at lower elevations than minimum thresholds. These triggers are evaluated using 30-day average elevations, rather than the 5-year moving average, to prompt a management action on a shorter time scale. The only RMP to reach a trigger elevation in WY 2020 was SC-8RB (Aptos Creek) in the Purisima BC unit, when its 30-day average groundwater elevation fell below the trigger level of 2 feet above mean sea level temporarily in October 2020 (see Appendix Figure A-24). Groundwater elevations in SC-8RB recovered early in WY 2021, ending the water year around 4 feet above mean sea level. Because it recovered quickly, it does not warrant early management action.

There are 2 wells with WY 2021 30-day average groundwater elevations that temporarily fell below the trigger level of 2 feet above mean sea level during the year: SC-5RA (Purisima A) and SC-13A (Tu unit). Both wells exceeded the trigger in the summer to early fall timeframe. The extraction wells in the Purisima A unit near SC-5RA are SqCWD's Tannery II and

Estates. The groundwater level decline in the Tu unit corresponded with increases in total Tu unit pumping. Overall pumping from the Purisima A unit and Tu unit increased in WY 2021 due to limitations of pumping at the Ledyard, T. Hopkins, and Granite Way wells from the Purisima BC and DEF units. Restored ability to pump from those wells should reduce stress on Purisima A unit and Tu unit and reduce the risk groundwater levels falling below trigger elevations in WY 2022. It is recommended SqCWD continues to monitor groundwater levels at SC-5RA and SqCWD and SCWD monitor groundwater levels at SC-13A. If groundwater levels approach the trigger elevation, the response will be pumping redistributions to avoid 30-day averages below the elevation.

4.4 Groundwater Quality

Table 9 shows SMC compared to WY 2021 maximum concentrations at RMPs for degraded groundwater quality. Sustainable management criteria for this indicator are met when concentrations are at or below criteria. Minimum thresholds are based on drinking water standards for each constituent. Maximum concentrations at RMPs are also compared to measurable objectives specific to each well based on average concentrations observed during WY 2013-2017. Interim milestones for groundwater quality are the same as measurable objectives. Exceedances of minimum threshold (red shading in the table) for chloride and total dissolved solids are related to seawater intrusion and addressed by that indicator.

In WY 2021, iron and manganese concentrations at several RMPs exceed measurable objectives that are higher than minimum thresholds, indicating an increase in concentration since WYs 2013-2017. This is not considered an undesirable result because it is a preexisting natural condition not associated with pumping or managed aquifer recharge.

There were no detects of organic compounds, including 1,2,3-TCP in any active municipal extraction wells in the Basin.

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Table 9. Water Year 2021 Groundwater Quality

Aquifer	Representative Monitoring Point	Total Dissolved Solids, mg/L	Chloride, mg/L	Iron, µg/L	Manganese, µg/L	Arsenic, µg/L	Chromium (Total), µg/L	Nitrate as Nitrogen, mg/L	Organic Compound Detects, µg/L
	Minimum Threshold	1,000	250	300	50	10	50	10	various
		Water Year 2021 Maximum Concentration							
Aromas	CWD-10 PW	NA	NA	NA	NA	NA	NA	6.8	NA
	SC-A1C	366	31.3	21	1260	NA	NA	1.1	NA
	SC-A2RC	1,140	503	620	40	NA	NA	0.5	NA
	SC-A3A	34,300	18,600	465	241	NA	NA	7.8	NA
	SC-A3C	474	101	178	24	NA	NA	7.8	NA
	SC-A8B	13,300	52.7	482	4,150	NA	NA	non-detect	NA
	SC-A8C	372	66.6	10	5	NA	NA	6.2	NA
Aromas/ Purisima F	Polo Grounds PW	294	22.1	31	198	0.5	1.1	0.1	non-detect
	Aptos Jr. High 2 PW	320	32.8	14	235	0.9	1.2	non-detect	non-detect
	Country Club PW	Well not used for extraction in Water Year 2021, to be replaced in 2022							
	Bonita PW	324	29.9	10	5	0.6	12.7	2.4	non-detect
	San Andreas PW	266	21.9	10	11	0.7	18.6	1.4	non-detect
	Seascape PW	268	17.3	10	5	0.5	18.3	0.9	non-detect
Purisima F	CWD-4 PW	NA	NA	NA	NA	NA	NA	5	NA
	CWD-12 PW	NA	NA	NA	NA	NA	NA	1.6	NA
	SC-A2RA*	35,000	15,200	280	742	NA	NA	8.5	NA
	SC-A8A	13,800	7,710	14	179	NA	NA	non-detect	NA
Purisima BC	SC-8RD	374	20.3	34	3	NA	NA	non-detect	NA
	SC-9RE	512	48.5	NA	NA	NA	NA	NA	NA
	SC-A1A	244	28.1	141	48	NA	NA	non-detect	NA
	T. Hopkins PW	374	24.9	43	176	2.3	0.3	0.4	non-detect
	Granite Way PW	282	27.6	31	21	0.5	0.7	non-detect	non-detect
	Madeline 2 PW	450	15.5	271	9.8	0.5	0.3	0.3	non-detect
	Aptos Creek PW	Well not used for extraction in Water Year 2021							
	Ledyard PW	388	12.2	86	15	0.5	0.3	0.2	non-detect
	SC-23A	260	19.8	6	3	NA	NA	non-detect	NA
	SC-8RB	522	13.3	28	3	NA	NA	non-detect	NA
	SC-9RC	408	31.4	12	3	NA	NA	non-detect	NA

Aquifer	Representative Monitoring Point	Total Dissolved Solids, mg/L	Chloride, mg/L	Iron, µg/L	Manganese, µg/L	Arsenic, µg/L	Chromium (Total), µg/L	Nitrate as Nitrogen, mg/L	Organic Compound Detects, µg/L
Purisima A	30th Ave Shallow	780	49	130	1300	NA	NA	non-detect	NA
	Pleasure Point Shallow	250	33	100	100	NA	NA	non-detect	NA
	Estates PW	518	12.6	154	90	0.5	0.3	0.1	non-detect
	Garnet PW	650	86.3	1420	410	0.7	0.3	non-detect	non-detect
	Tannery 2 PW	552	62.3	207	142	0.5	0.3	non-detect	non-detect
	Rosedale 2 PW	542	10.7	776	290	0.5	0.3	0.02	non-detect
	Beltz #8 PW	NA	52	1400	210	3.1	non-detect	non-detect	non-detect
	Beltz #9 PW	NA	45	1000	230	non-detect	non-detect	non-detect	non-detect
	SC-3RC	454	47.3	117	96	NA	NA	non-detect	NA
	SC-5RA	556	55.7	293	171	NA	NA	non-detect	NA
	SC-9RA	414	13.7	43	9	NA	NA	non-detect	NA
	SC-10RA	428	29.7	607	644	NA	NA	non-detect	NA
	SC-22A	404	17	1430	1460	NA	NA	non-detect	NA
Purisima A/AA	Beltz #10 PW	NA	58	1400	340	1.6	non-detect	non-detect	non-detect
Purisima AA	SC-10RAA	244	9.9	141	57	NA	NA	non-detect	NA
	SC-22AAA	640	62.3	24	43	NA	NA	non-detect	NA
	Coffee Lane Deep	960	39	16	140	NA	NA	non-detect	NA
	Pleasure Point Deep	610	22	620	230	NA	NA	non-detect	NA
	Thurber Lane Shallow	Not sampled since 2006							
	Schwan Lake	400	93	410	120	NA	NA	non-detect	NA
Purisima AA/Tu	O'Neill Ranch PW	Well not used for extraction in Water Year 2021							
	Main Street PW	354	10.3	98	30	0.5	0.3	0.2	non-detect
	Beltz #12 PW	510	48	840	450	NA	NA	non-detect	non-detect
Tu	SC-18RAA	240	14.3	53	19	NA	NA	0.02	NA
	Thurber Lane Deep	Not sampled since 2006							

Maximum of minimum threshold and measurable objective not met

Minimum threshold met but measurable objective not met

Measurable objective met

NA = not analyzed

4.5 Subsidence

Subsidence is not applicable in the Santa Cruz Mid-County Basin as an indicator of groundwater sustainability.

4.6 Interconnected Surface Water

Table 10 shows groundwater elevation proxies for SMC at RMPs for depletion of interconnected surface water. Sustainable management criteria for this indicator are met when groundwater elevations are at or above proxy elevations.

Hydrographs for 5 depletion of interconnected surface water groundwater elevation proxy RMPs are shown on Figures A-35 through A-39. Of the 5 RMPs, 3 have groundwater elevations below their minimum threshold groundwater elevation proxies (Balogh, Main St. Shallow, and Nob Hill). The other 2 shallow RMPs along Soquel Creek (Wharf Road and SC-10RA) have WY 2021 groundwater elevations above minimum threshold groundwater elevation proxies. Since undesirable results are defined as any depletion of interconnected surface water RMP having groundwater elevations below its minimum threshold, undesirable results for surface water depletion are occurring. None of the RMPs have groundwater elevations above measurable objectives, though the Wharf Road shallow well is only 0.1 feet lower than its measurable objective.

Table 10. Groundwater Elevation Proxy for Depletion of Interconnected Surface Water

Well Name	Aquifer	Minimum Threshold	Measurable Objective	Interim Milestone 2025	WY 2017	WY 2018	WY 2019	WY 2020	WY 2021
		Groundwater Elevation, feet above mean sea level			Minimum Average Monthly Groundwater Elevation, feet above mean sea level				
Balogh	Shallow Groundwater	29.1	30.6	29.1	29.7	29.2	29.1	29.1	28.7
Main St. Shallow		22.4	25.3	20.7	22.7	22.8	22.5	22.8	22.3
Wharf Road		11.9	12.1	11.3	12.1	12.2	12.1	12.4	12.0
Nob Hill		8.6	10.3	7.3	8.8	8.7	8.7	5.5	8.2
SC-10RA	Purisima A	68	70	68	69.6	69.2	69.2	69.0	69.9

Minimum threshold not met

Minimum threshold achieved but measurable objective not met

Measurable objective met

4.7 Update on Implementation of Projects and Management Actions

Below are current updates for WY 2021 for projects and management actions planned to reach sustainability, including eliminating existing undesirable results, described as Group 2 in the GSP.

4.7.1 Pure Water Soquel

The Pure Water Soquel (PWS) project will inject purified water at 3 Seawater Intrusion Prevention (SWIP) wells to replenish the aquifer and aid in raising groundwater levels above seawater intrusion minimum thresholds in the Basin. The project has completed California Environmental Quality Act environmental review with a certified EIR. The project components include:

- 3 SWIP wells – Twin Lakes, Willowbrook, and Monterey SWIP wells.
- 9 Monitoring wells – 9 well monitoring system for the PWS project strategically located adjacent to SWIP wells. The monitoring wells will be used to monitor groundwater quality and groundwater levels throughout the operation of Pure Water Soquel.
- Conveyance – construction of about 8 miles of pipelines to convey water to and from the Santa Cruz Wastewater Treatment Facility to the Chanticleer Water Purification Center, and to convey purified water from the Water Purification Center to the 3 SWIP wells to recharge the Basin.
- Treatment facilities - 2 new water treatment facilities. One is a recycled water treatment facility, and the other is a water purification center.
    - New Recycled Water Facility: located at the Santa Cruz Wastewater Treatment Facility. A pump station (source water pump station and electrical transformer) and brine return pipeline, PG&E metering enclosure near the corner of Bay Street and California Street, a radio communication pole, and tertiary treatment system (cloth filter and UV system) to produce recycled water to be used on-site as well for a future construction water fill-station and irrigation at a nearby park.
    - New Water Purification Center located in the Live Oak area, at the corner of Soquel Avenue and Chanticleer Avenue This new center is where recycled water will pass through a state-of-the-science, three-step advanced purification process: microfiltration, reverse osmosis, and ultraviolet light with advanced oxidation with an ozone pre-treatment. This treatment process produces ultra-

clean, purified water, to be pumped to SWIP wells, and then underground to replenish the groundwater basin. The new center will also be home to an educational learning center.

Table 11 summarizes construction progress of PWS components for WY 2021 and in prior years. It is expected construction of all PWS components will be completed in calendar year 2023.

Table 11. Status of Pure Water Soquel Project Construction

Project Component	Completed in Prior Water Years	Water Year 2021 Progress
3 SWIP wells	Twin Lakes Church Well constructed and developed in WY 2019, redeveloped in WY 2020 Willowbrook Well started construction in WY 2020	Willowbrook Well completed construction and development in WY 2021 Monterey Well constructed and developed in WY 2021
9 monitoring wells	-	Technical specifications and drilling contractor selected. Work on first well started October 2021 and remaining wells will be completed in WY 2022.
Conveyance pipelines	-	Started in May 2021 and will be completed in WY 2022
Treatment facilities	-	Site preparation and foundation work started in WY 2022

SqCWD maintains a robust outreach and education program specific to the PWS that includes a dedicated section on its website: https://www.soquelcreekwater.org/pws and PWS Project updates in the SqCWD's monthly email blast. Weekly construction updates are also emailed out and included on the website: https://www.soquelcreekwater.org/256/Construction-Updates

4.7.2 Aquifer Storage and Recovery

The SCWD completed the pilot test program for Aquifer Storage and Recovery (ASR) at its Beltz #8 well in WY 2021. Also, the SCWD prepared a Draft Environmental Impact Report (EIR) for proposed water rights changes and released it for a 45-day public review period. The water rights project includes analysis of ASR in the existing Beltz wells at a project level. The Final EIR was certified by Santa Cruz City Council on December 14, 2021. It is expected the City will receive California State Water Resources Control Board action in calendar year 2022 or early 2023 on water rights petitions for change that will lead to phased implementation of full-scale ASR at the SCWD's existing Beltz wells. The SCWD is implementing demonstration studies at both Beltz # 8 and #12 wells. Unlike a pilot test that uses lower rates of injection and extraction, the purpose of demonstration studies is to reveal any operational

issues associated with full-scale injection and extraction rates prior to implementing permanent design changes to these facilities.

4.7.3 Water Transfers / In-Lieu Groundwater Recharge

As described in the GSP, a water transfer pilot test has been underway the past few years. The water transfer involves SCWD delivering treated drinking water to SqCWD to serve a portion of SqCWD's service area. No water was transferred in WY 2021 because the agreement had expired. Another 5-year extension of the pilot project agreement was executed on March 3, 2021, which allows for transfers starting November 1, 2021, and will run through May 1, 2026.

Longer-term implementation of water transfers will require a new agreement, including compliance with Proposition 218 requirements to set the cost of service for water delivered and, depending on the annual quantity transferred, waiting for resolution of the places of use changes of the SCWD's San Lorenzo River water rights.

4.7.4 Distributed Storm Water Managed Aquifer Recharge

The County continues to operate 2 Distributed Storm Water Managed Aquifer Recharge (DSWMAR) projects, 1 in Aptos at Polo Grounds County Park and another in Live Oak at Brommer Street Park. The dry wells are not currently instrumented. Total estimated average recharge is 20 acre-feet per year though was likely less in WY 2021 given the below average precipitation.

The timetable for development at additional DSWMAR project sites is not available and continues to be speculative at this time.

4.8 Update on Improvement of Monitoring Network

Table 12 summarizes implementation progress of the monitoring feature data gaps identified in the GSP (MGA, 2019). It is expected all GSP-identified new monitoring features will be installed and collecting data by mid-WY 2023.

Table 12. Status of Monitoring Features Identified as Data Gaps in the Groundwater Sustainability Plan

Monitoring Feature	Status
Deep Tu unit well (SP-5) near Soquel Point	Completed in WY 2020
Deep Tu unit well near SC-3A	To be completed in WY 2022 in conjunction with the PWS monitoring wells construction project (see Section 4.7.1)
7 shallow streamflow interaction monitoring wells	Siting completed in early 2022 and wells to be installed by the end of calendar year 2022
5 stream gages	Sited in 2021 and expected to be installed by the end of calendar year 2022, establishing ratings curves will be completed in WY 2023

REFERENCES

[DWR] California Department of Water Resources, 2020. DWR Bulletin 118 Update 2020. Accessed on March 3, 2022 at https://data.cnra.ca.gov/dataset/calgw_update2020

[DWR] California Department of Water Resources, 2021. Santa Cruz Mid-County Groundwater Agency Groundwater Sustainability Plan Determination. Accessed on March 3, 2022 at https://sgma.water.ca.gov/portal/service/gspdocument/download/4472

[MGA] Santa Cruz Mid-County Groundwater Agency, 2019. *Santa Cruz Mid-County Basin Groundwater Sustainability Plan*. November.

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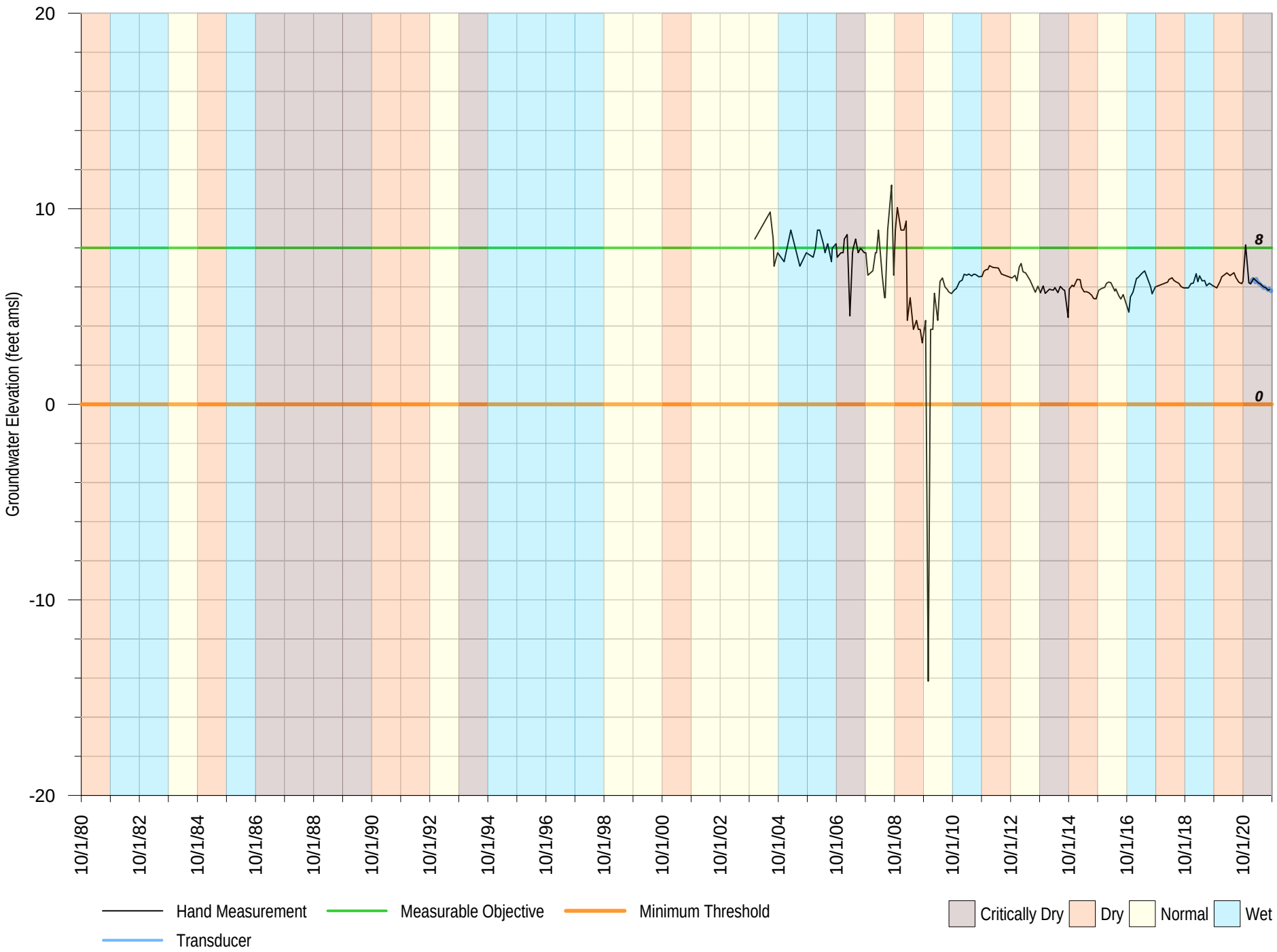
Appendix A

Well Hydrographs

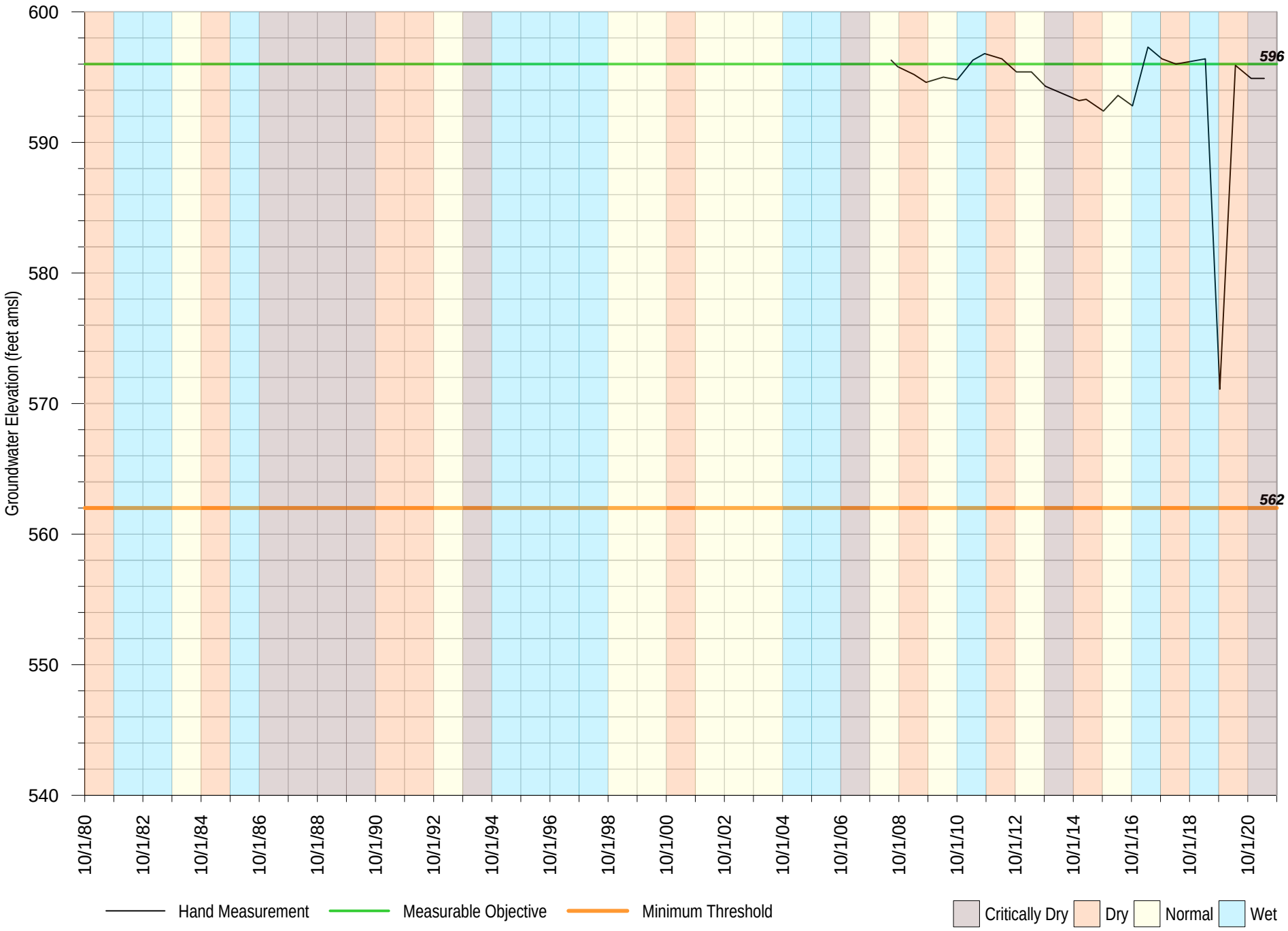
SC-A7C at Canon Del Sol
Aquifer Screened: Aromas

FIGURE A-1



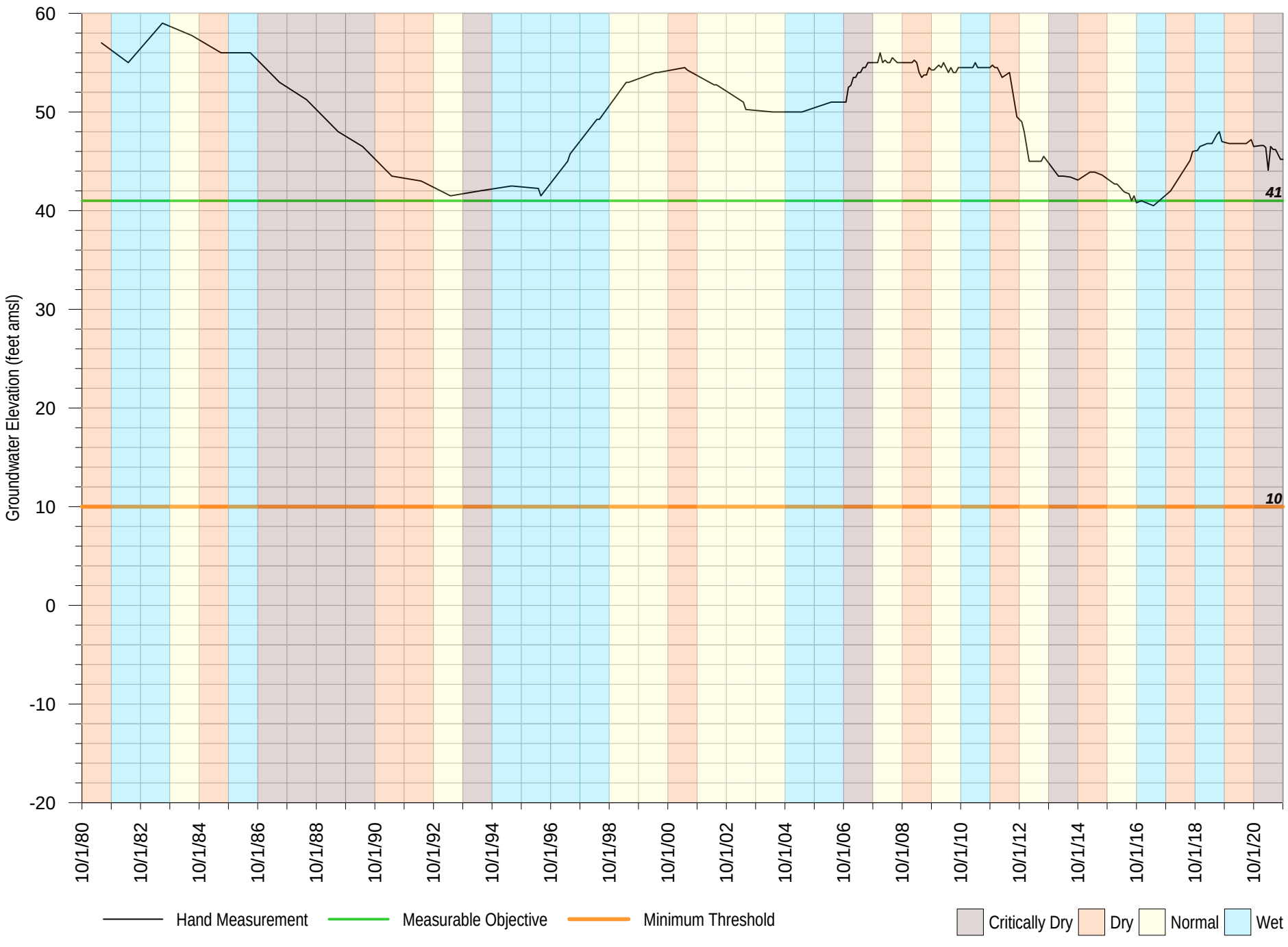
Private Well 2
Aquifer Screened:

FIGURE A-2



Black
Aquifer Screened: Purisima F

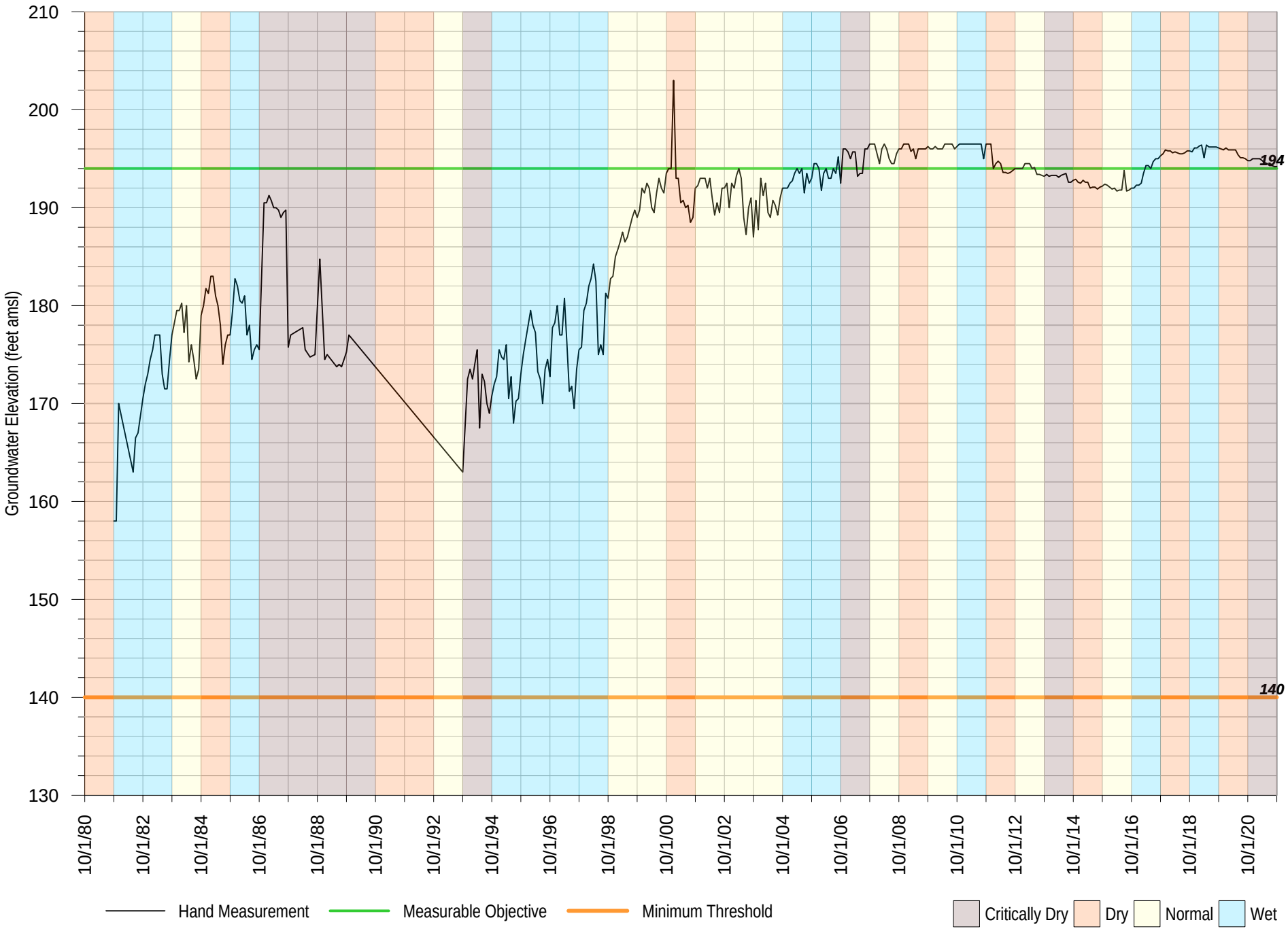
FIGURE A-3



CWD-5

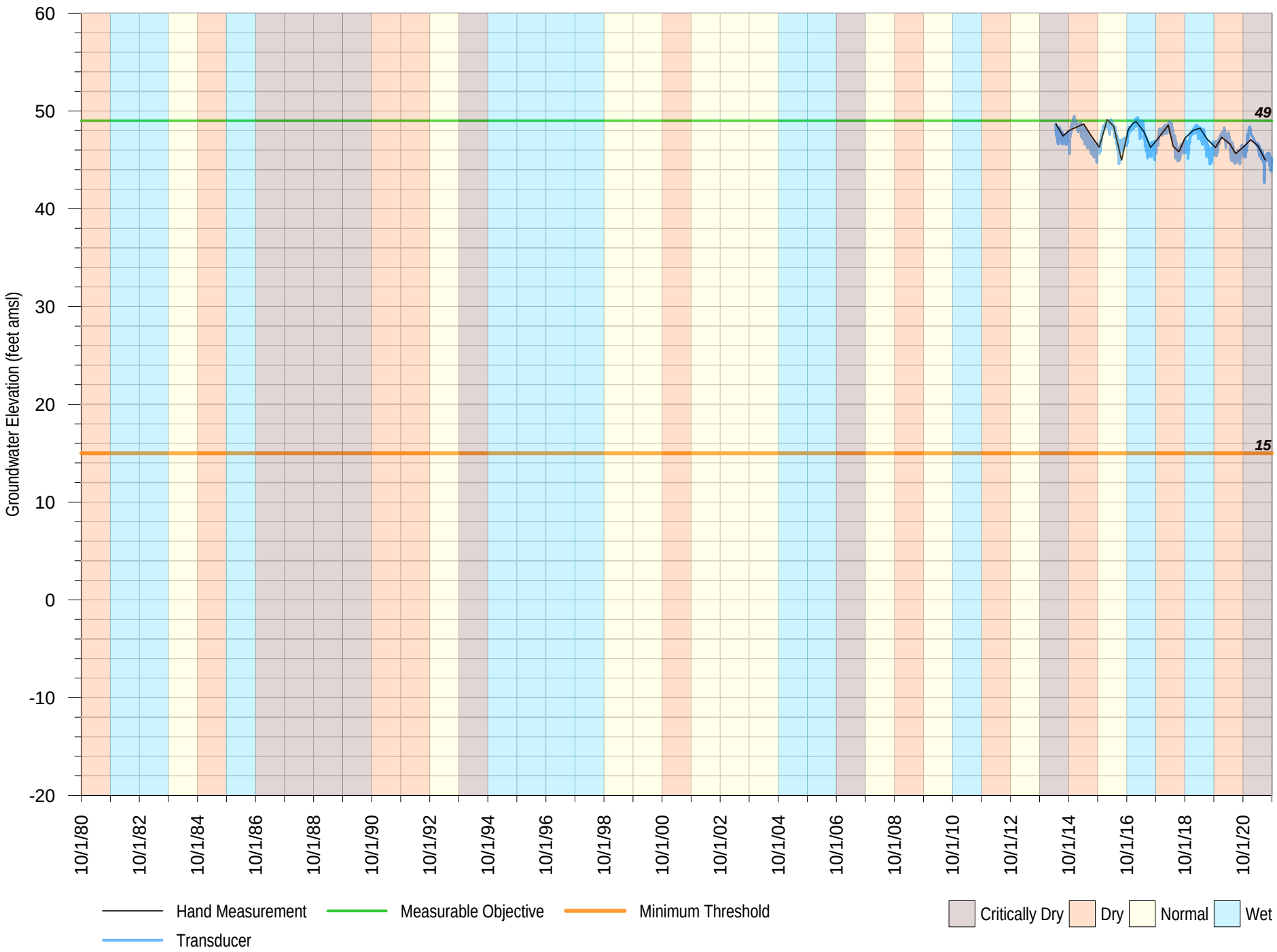
Aquifer Screened: Purisima F

FIGURE A-4



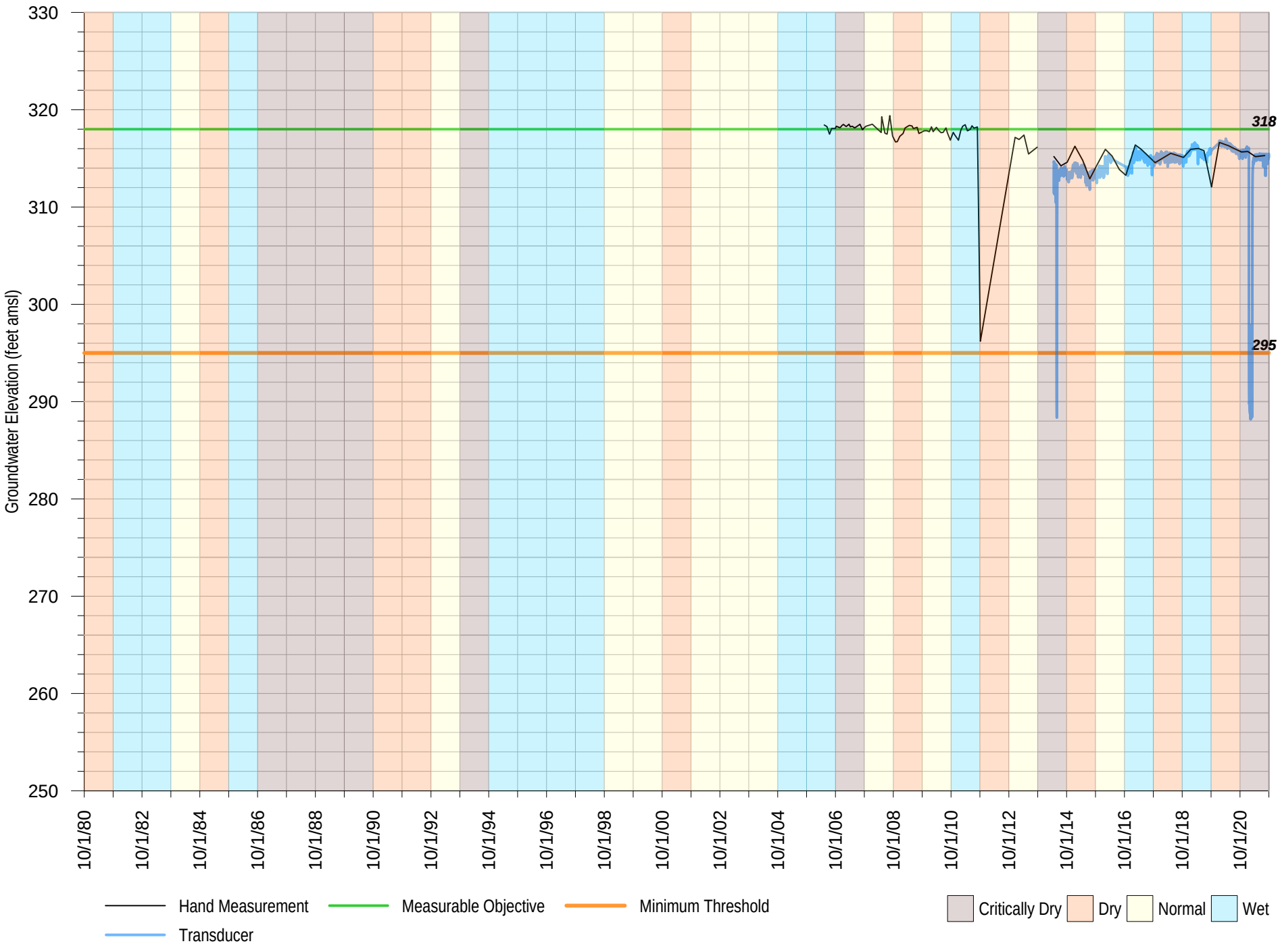
SC-23C at Quail Run
Aquifer Screened: Purisima F

FIGURE A-5



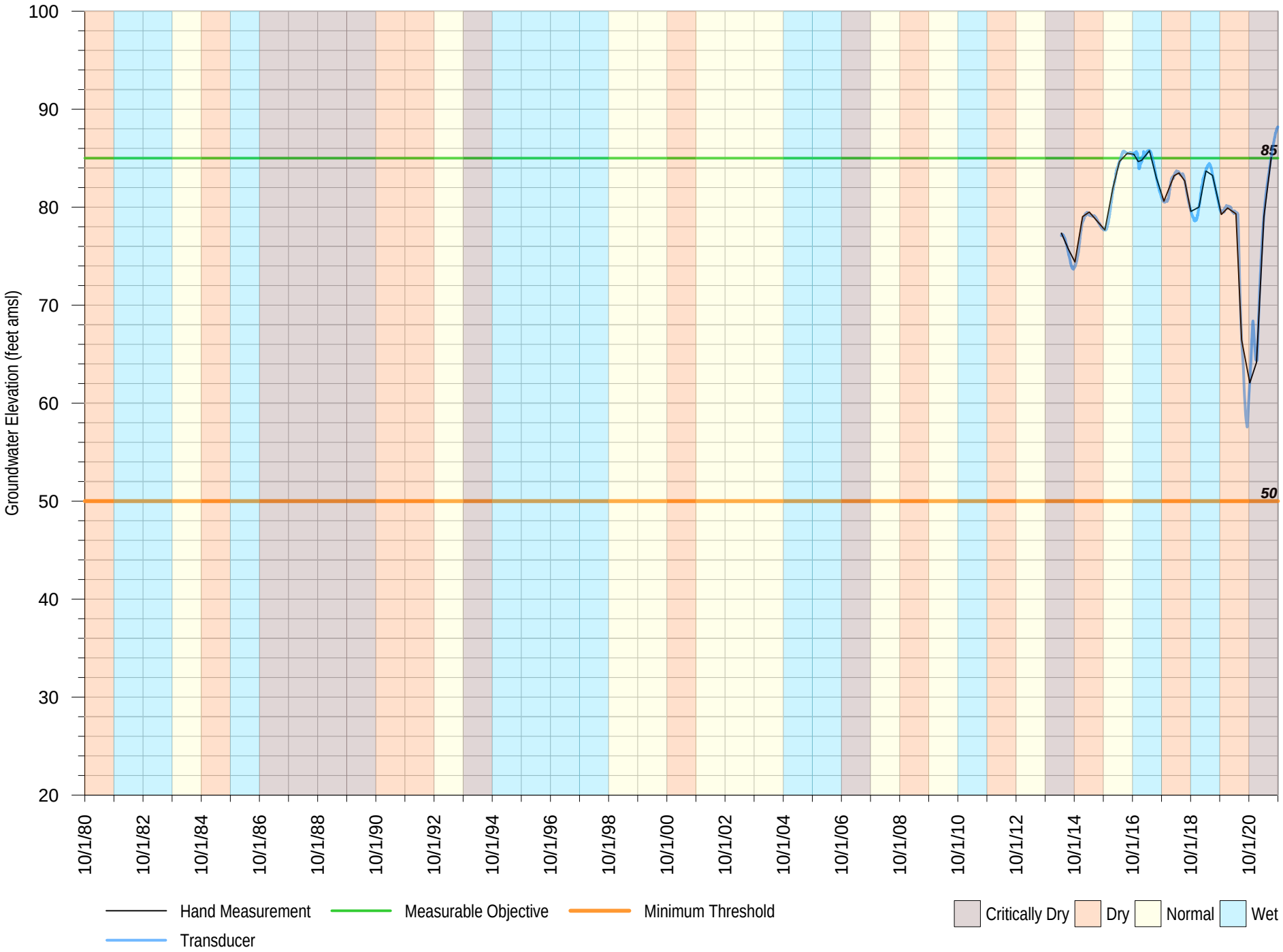
SC-11D & SC-11RD at Porter Gulch
Aquifer Screened: Purisima DEF

FIGURE A-6



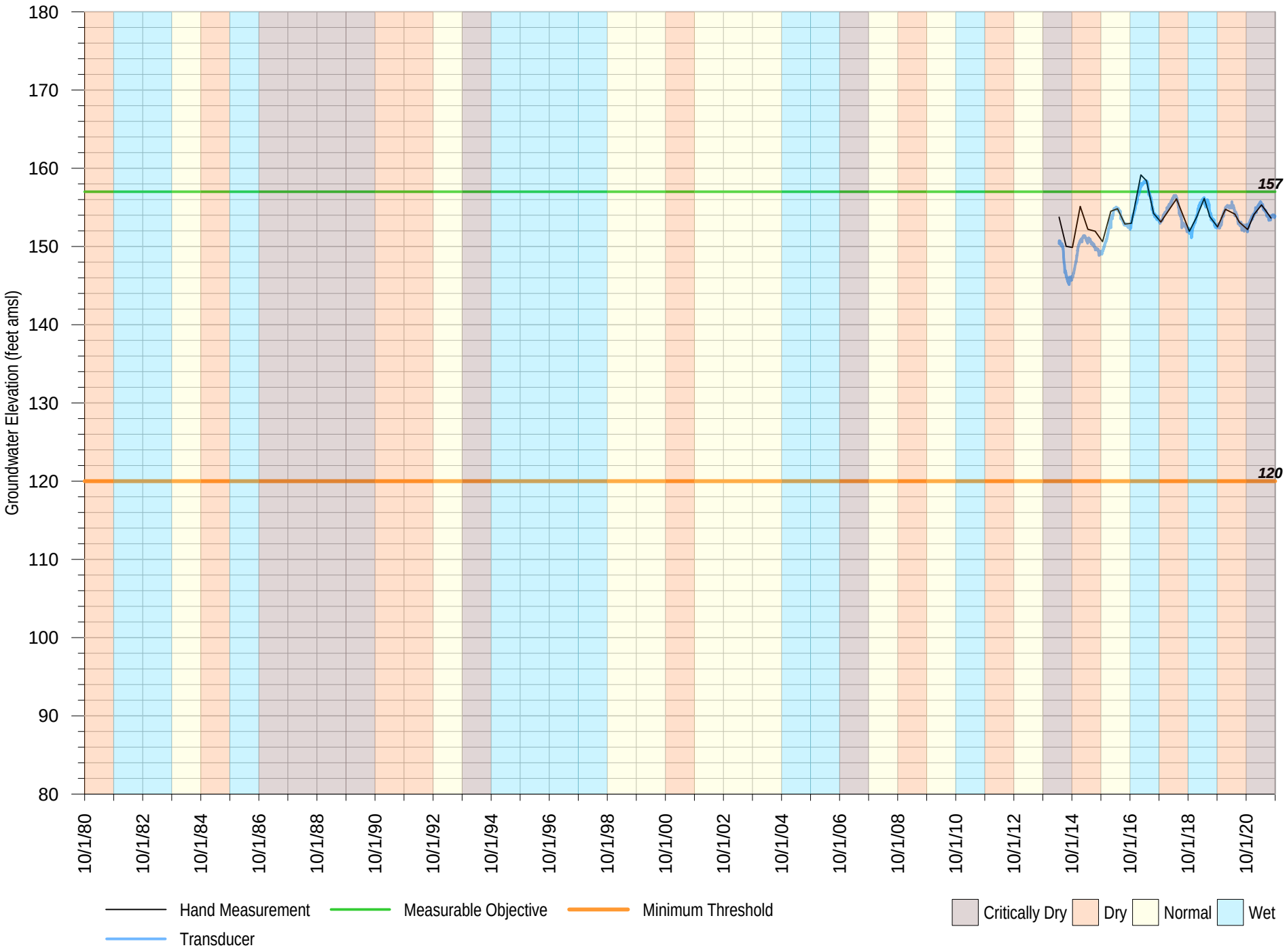
SC-23B at Quail Run
Aquifer Screened: Purisima DEF

FIGURE A-7



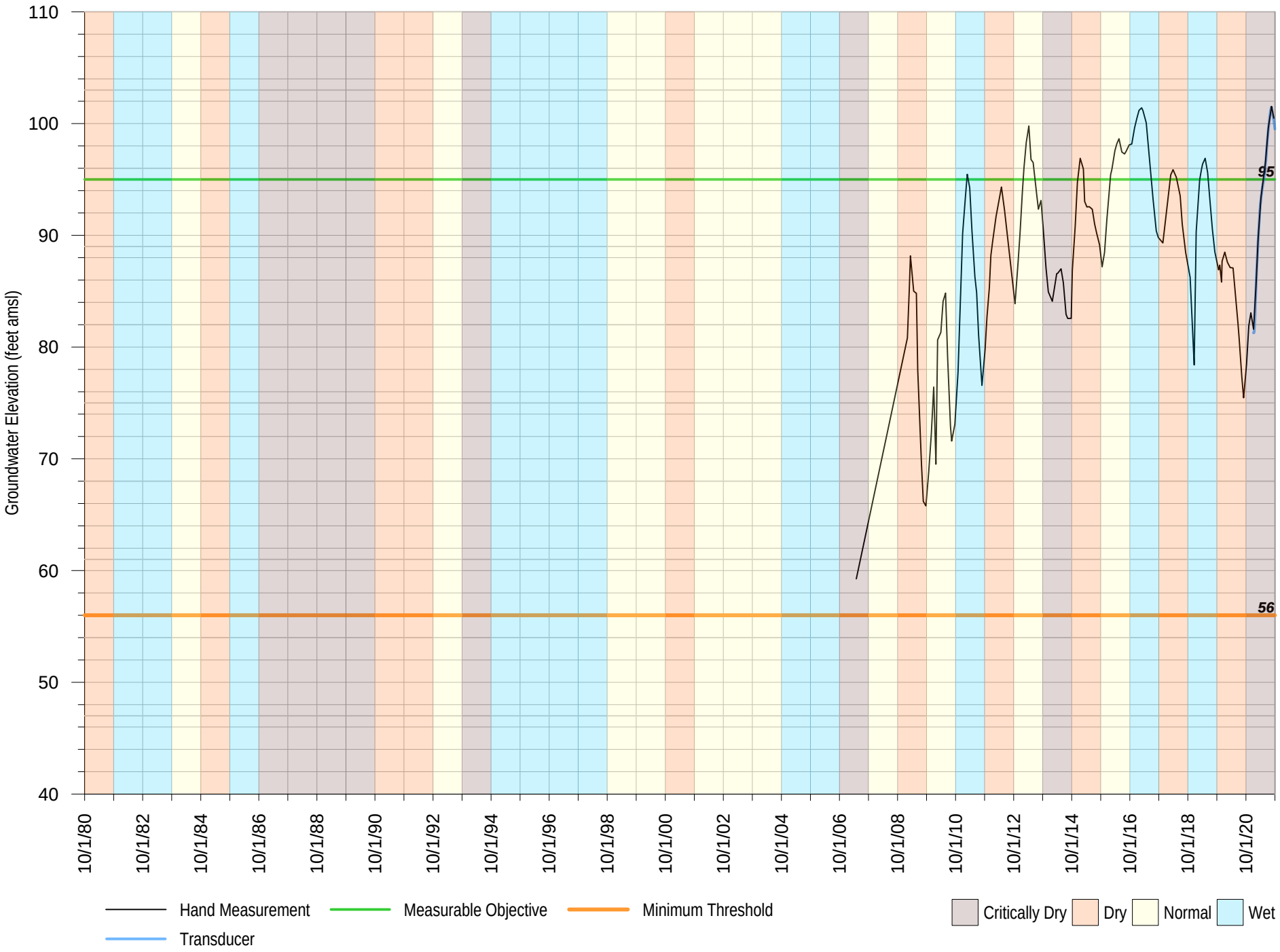
SC-11B at Porter Gulch
Aquifer Screened: Purisima BC

FIGURE A-8



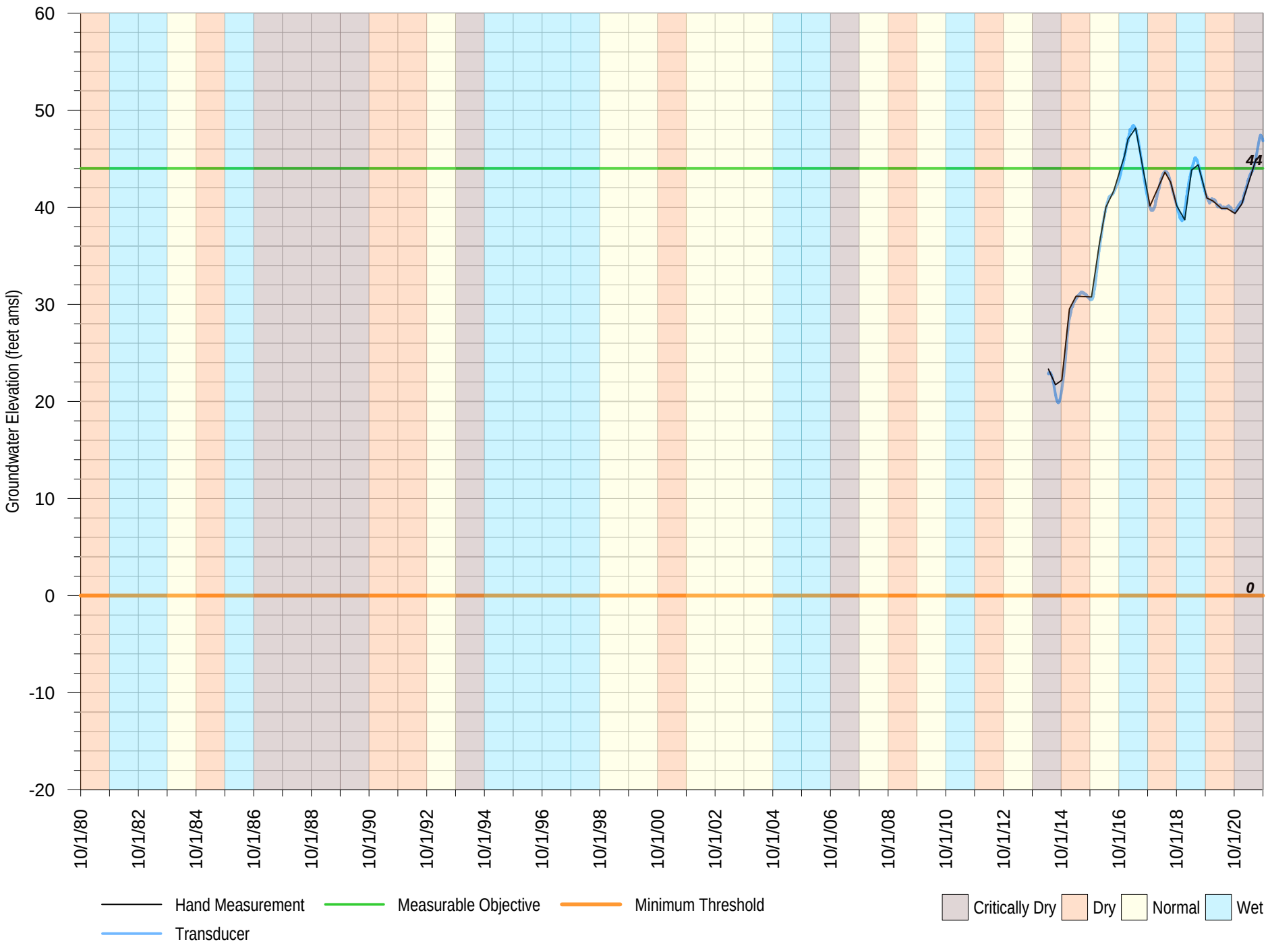
SC-19 at Austrian
Aquifer Screened: Purisima BC

FIGURE A-9



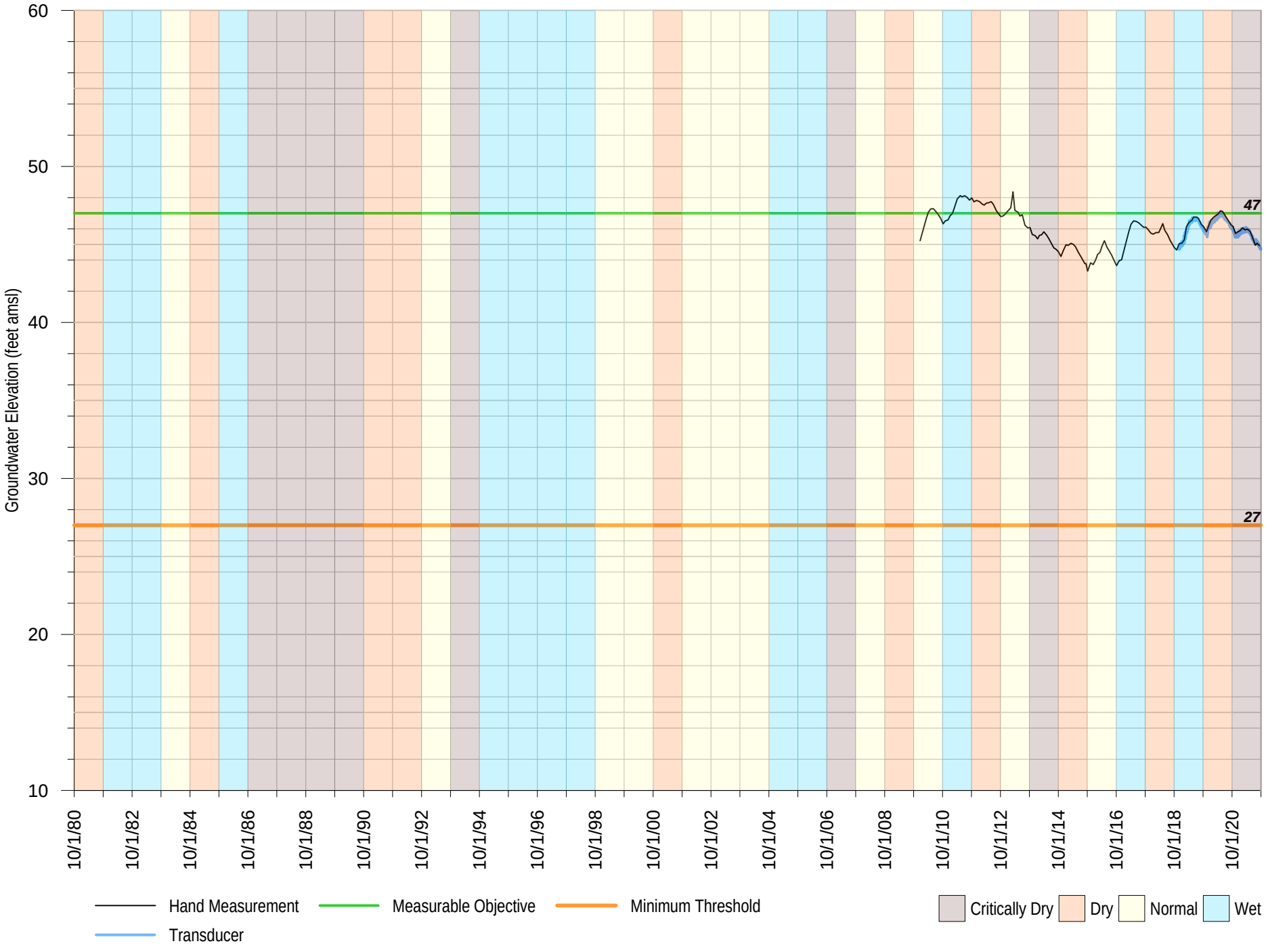
SC-23A at Quail Run
Aquifer Screened: Purisima BC

FIGURE A-10



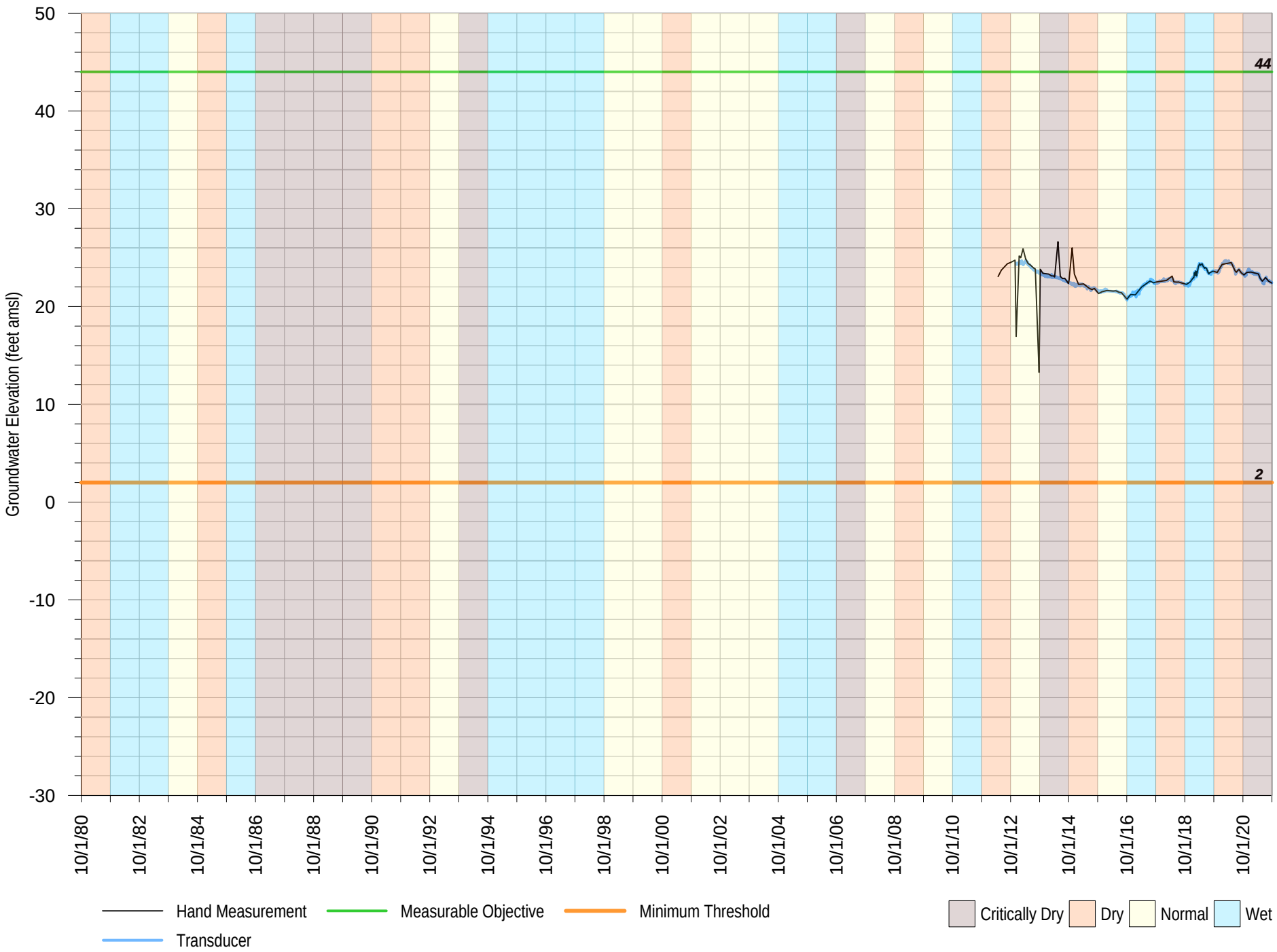
Coffee Lane Shallow
Aquifer Screened: Purisima A

FIGURE A-11



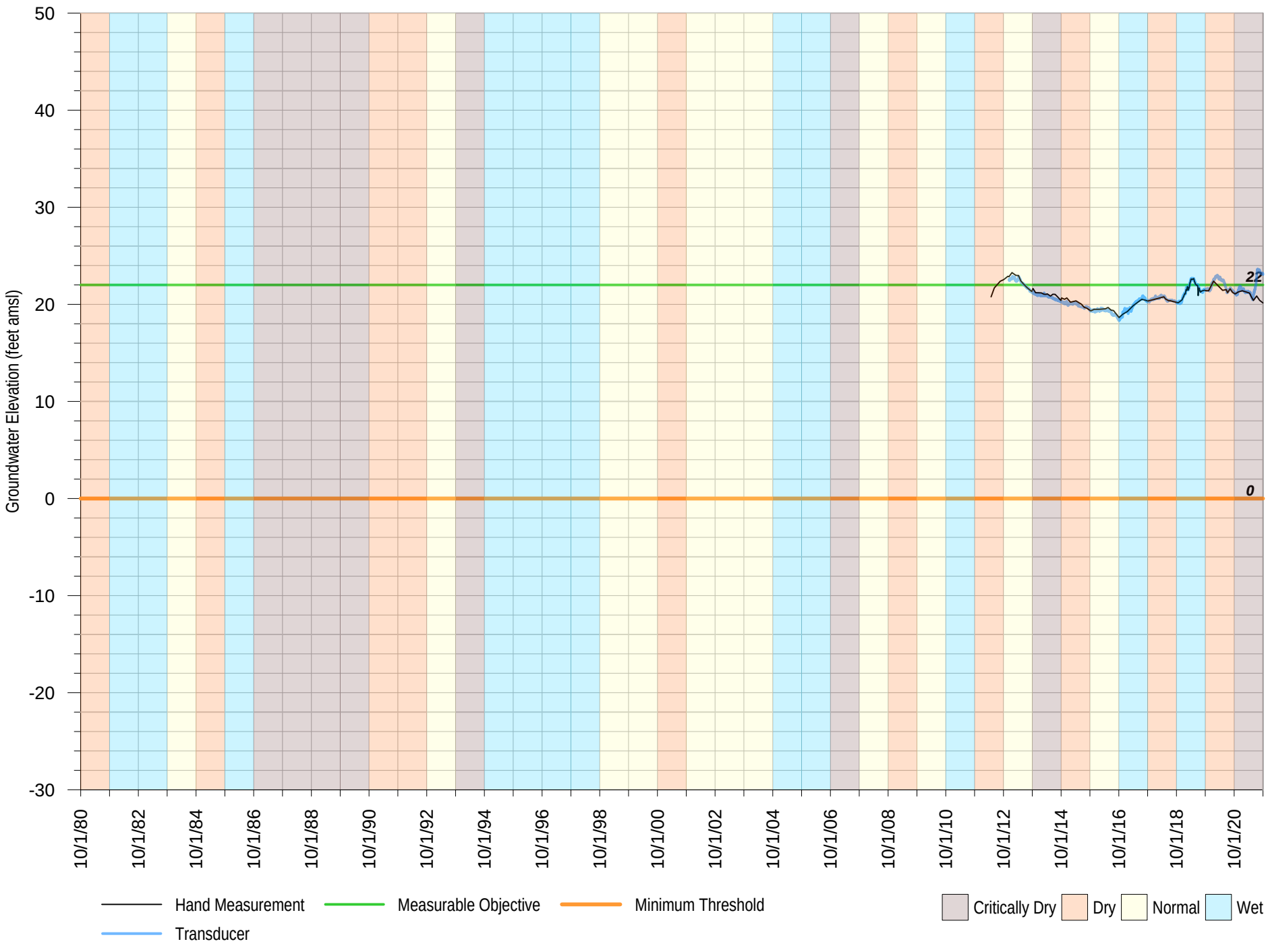
SC-22A at 41st Ave
Aquifer Screened: Purisima A

FIGURE A-12



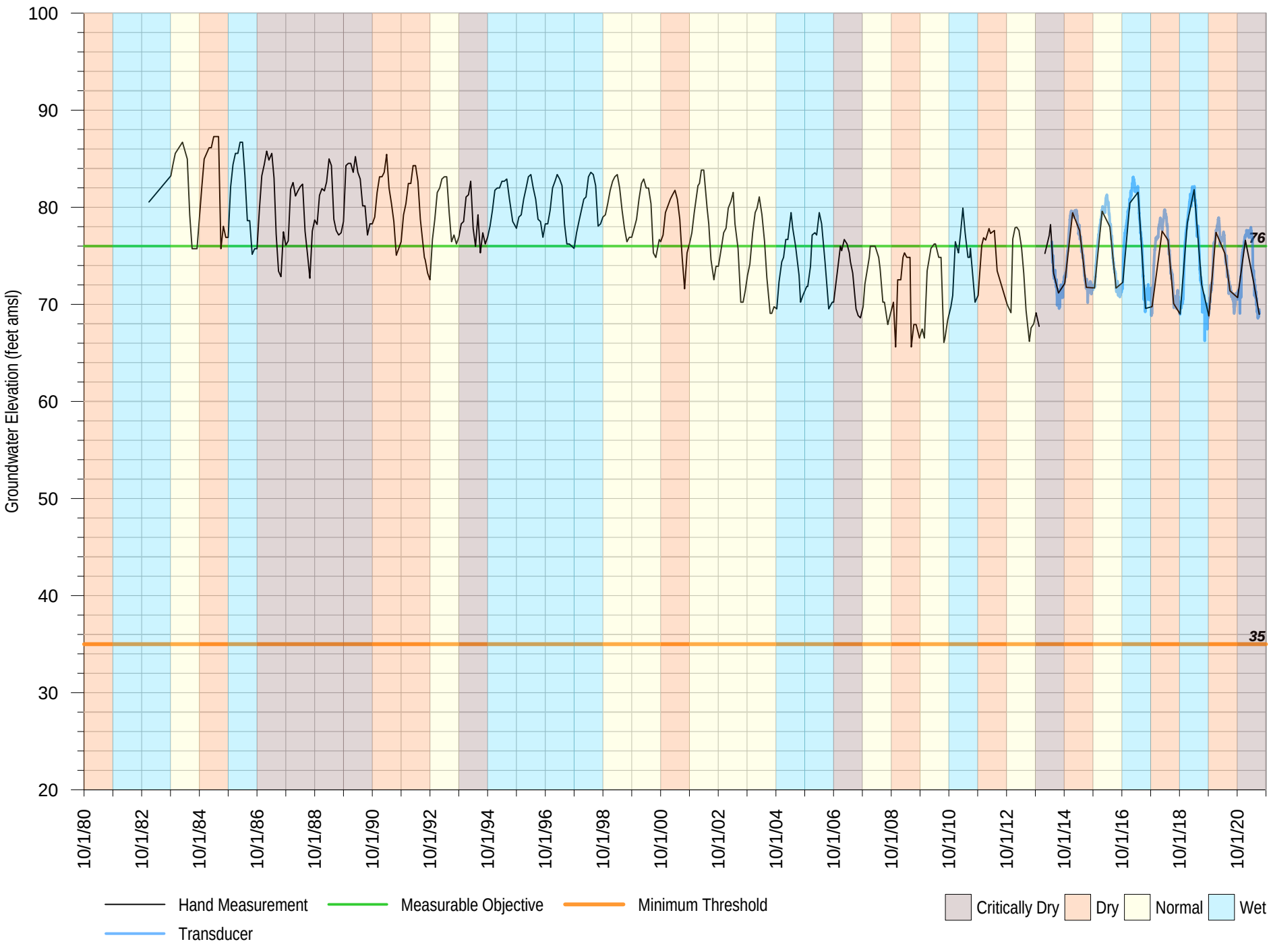
SC-22AA at 41st Ave
Aquifer Screened: Purisima AA

FIGURE A-13



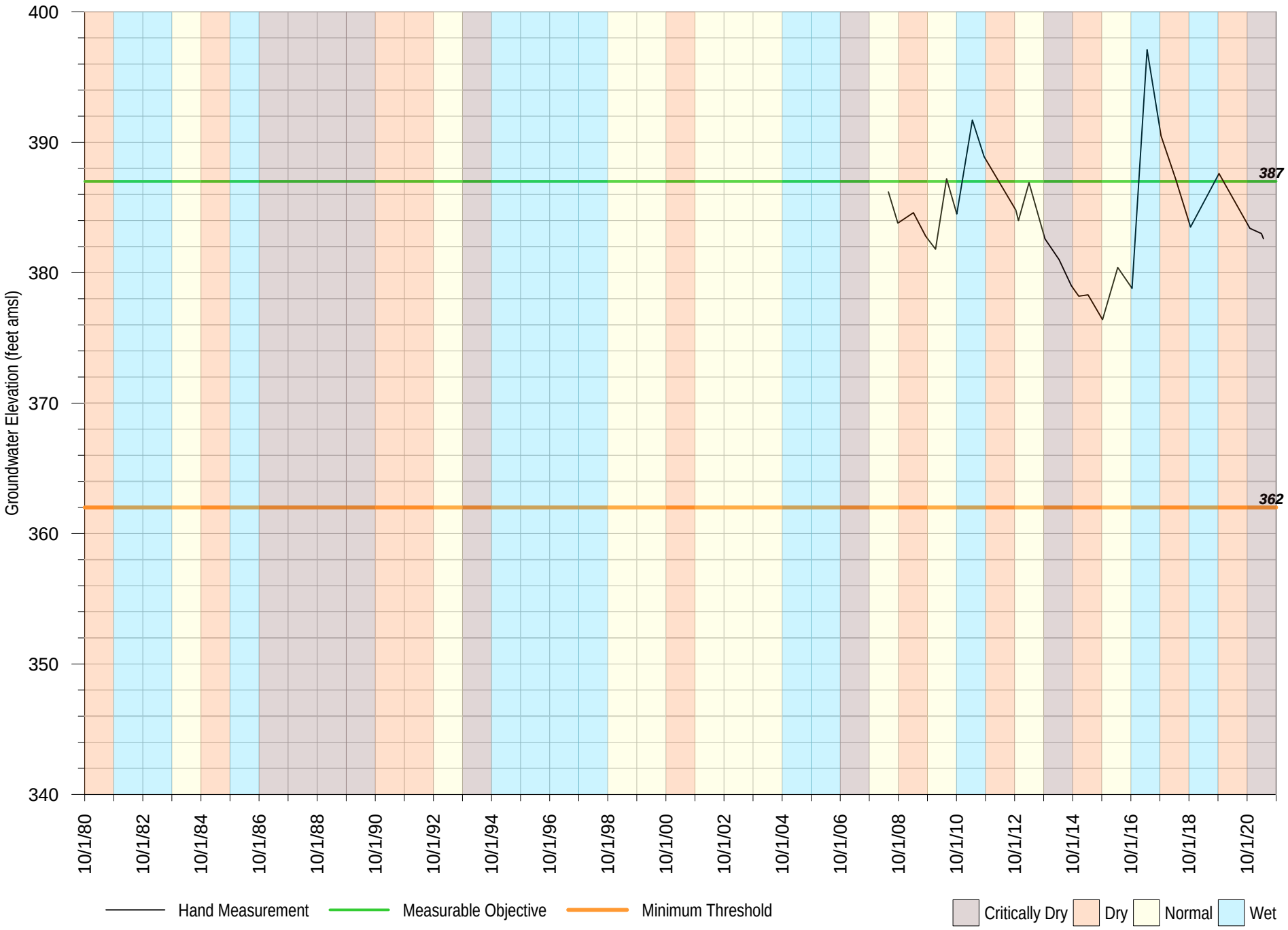
SC-10AA & SC-10RAA at Cherryvale
Aquifer Screened: Purisima AA

FIGURE A-14



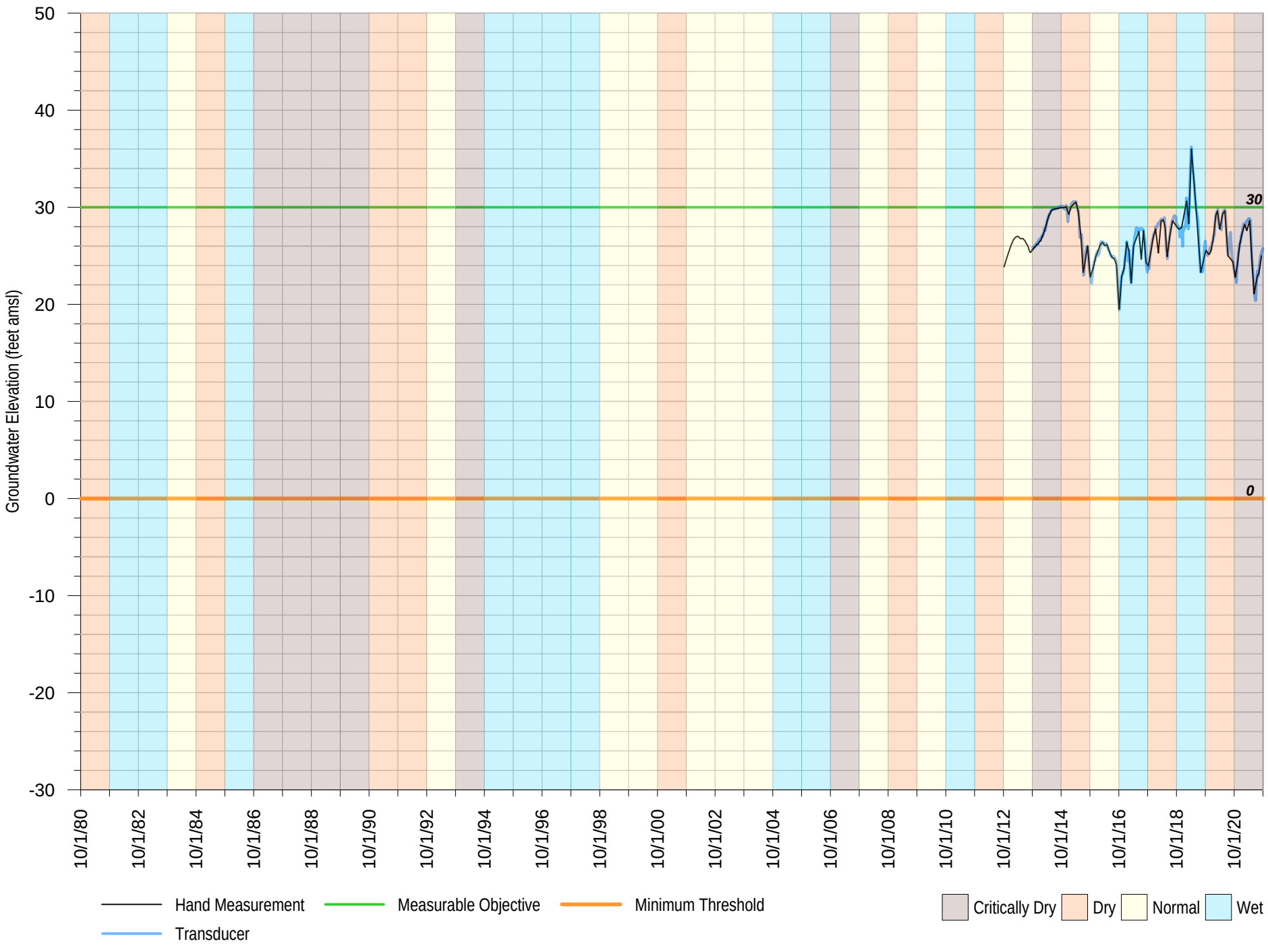
Private Well 1
Aquifer Screened:

FIGURE A-15



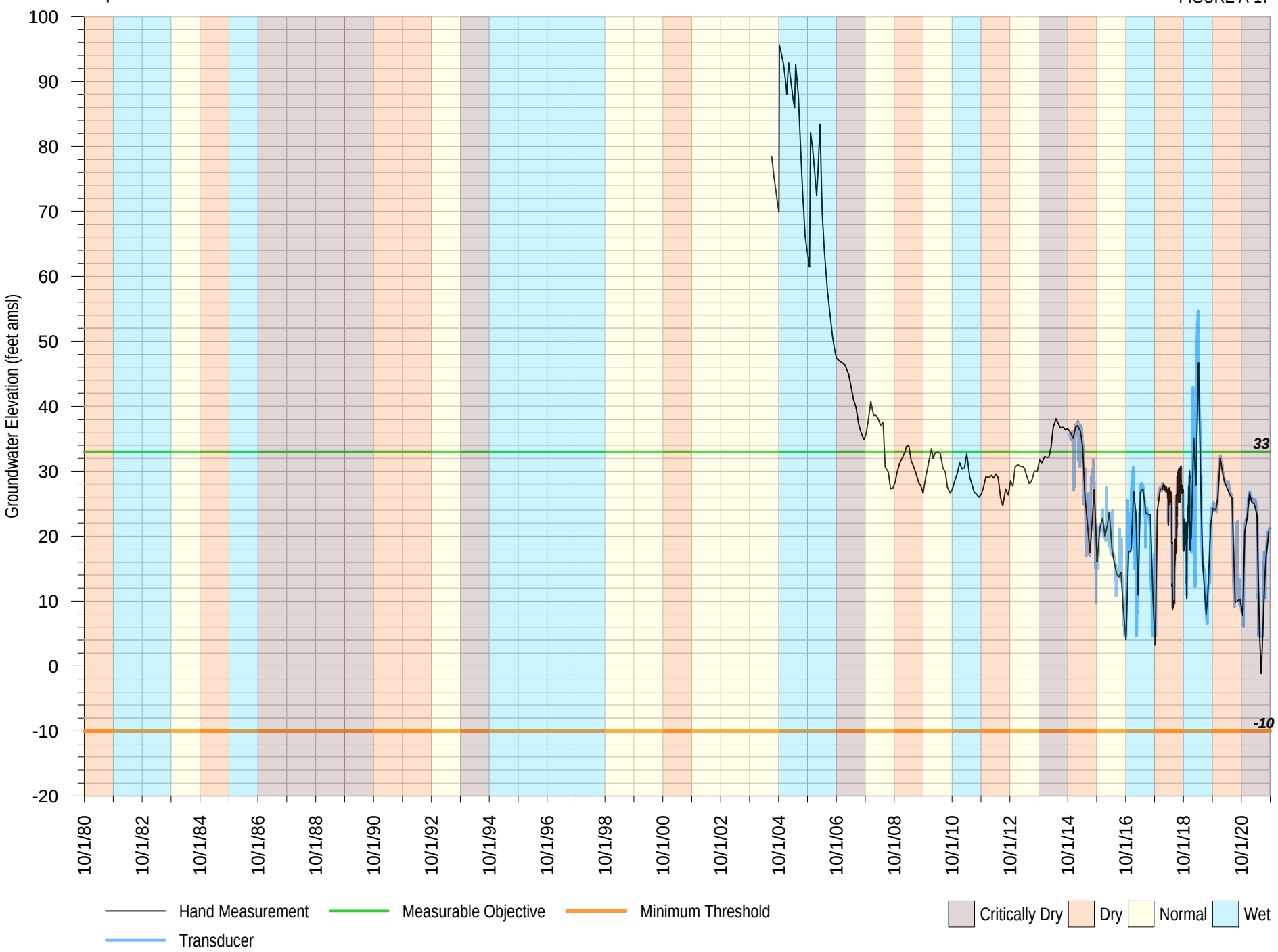
30th Ave Deep
Aquifer Screened: Tu

FIGURE A-16



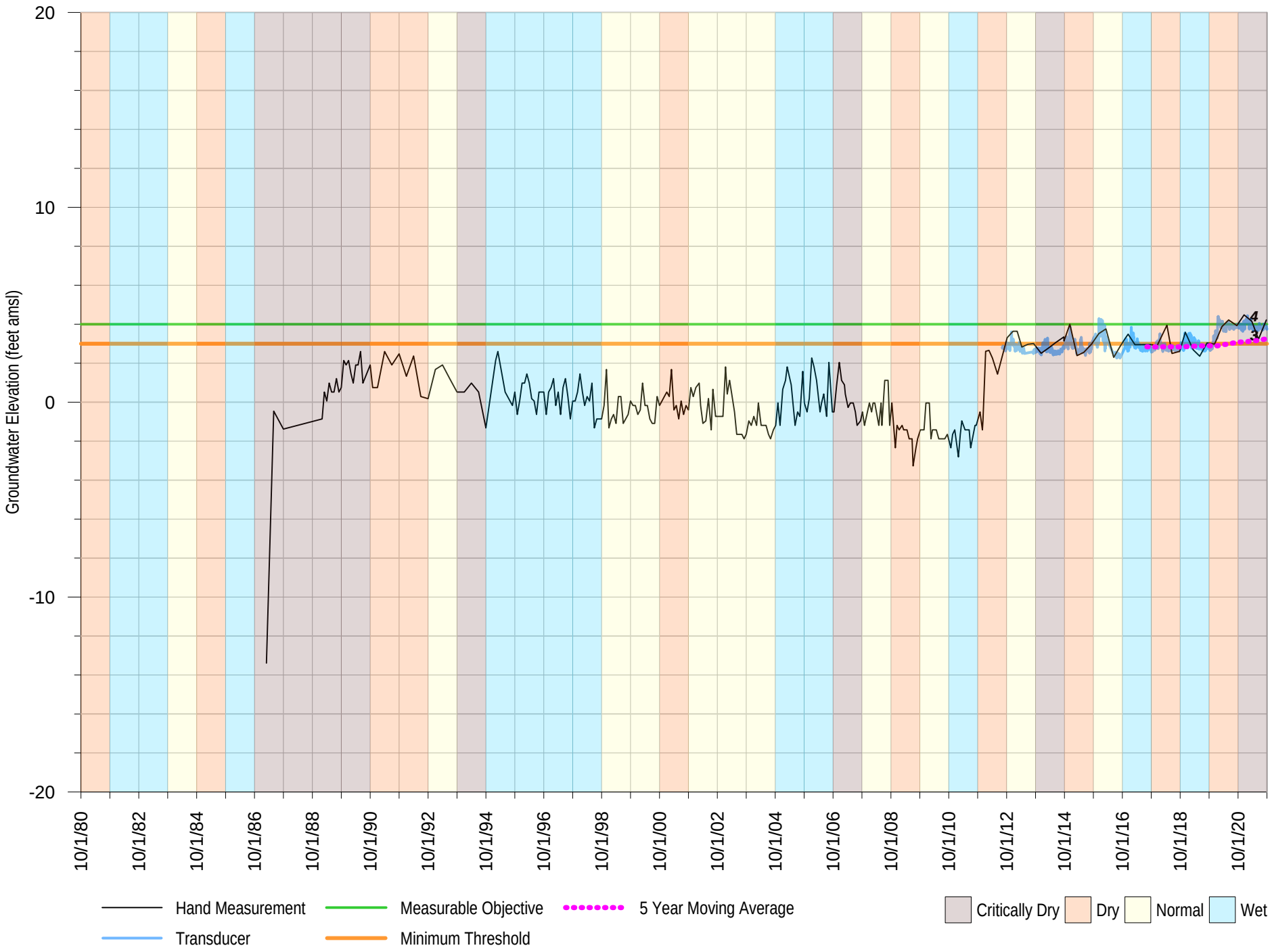
Thurber Deep
Aquifer Screened: Tu

FIGURE A-17



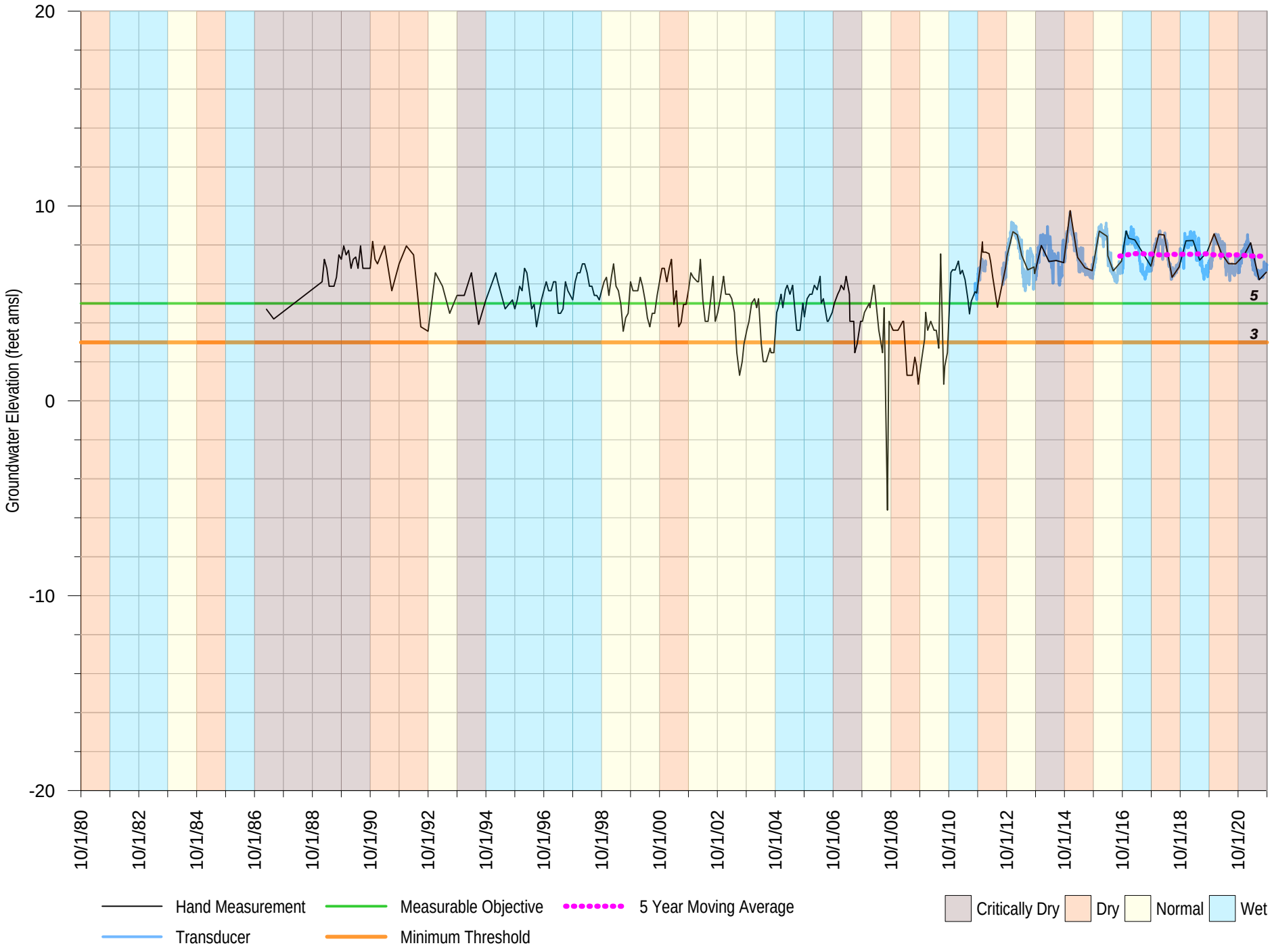
SC-A3A at Playa Visa
Aquifer Screened: Aromas

FIGURE A-18



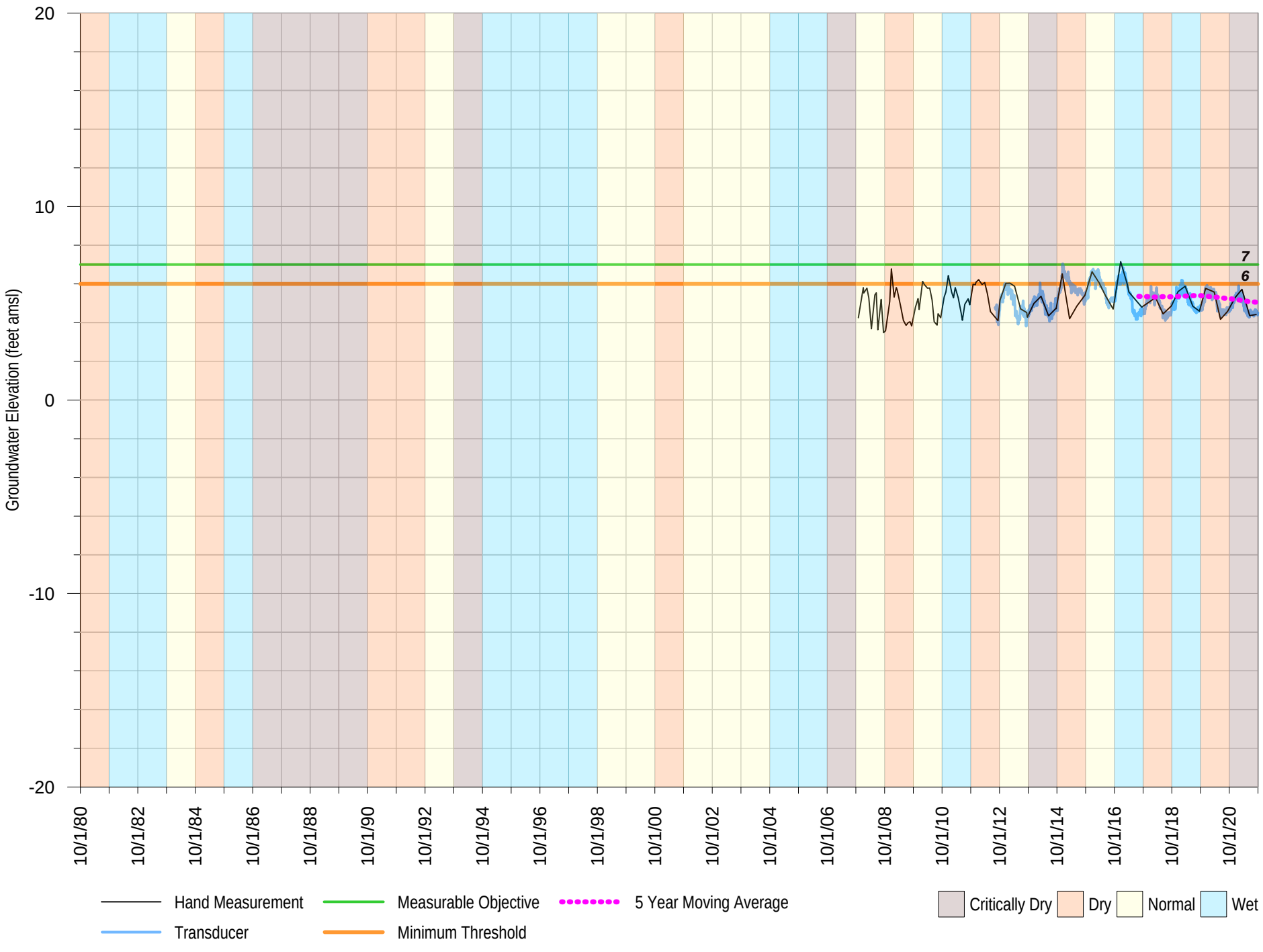
SC-A1B at Cliff Drive
Aquifer Screened: Purisima F

FIGURE A-19



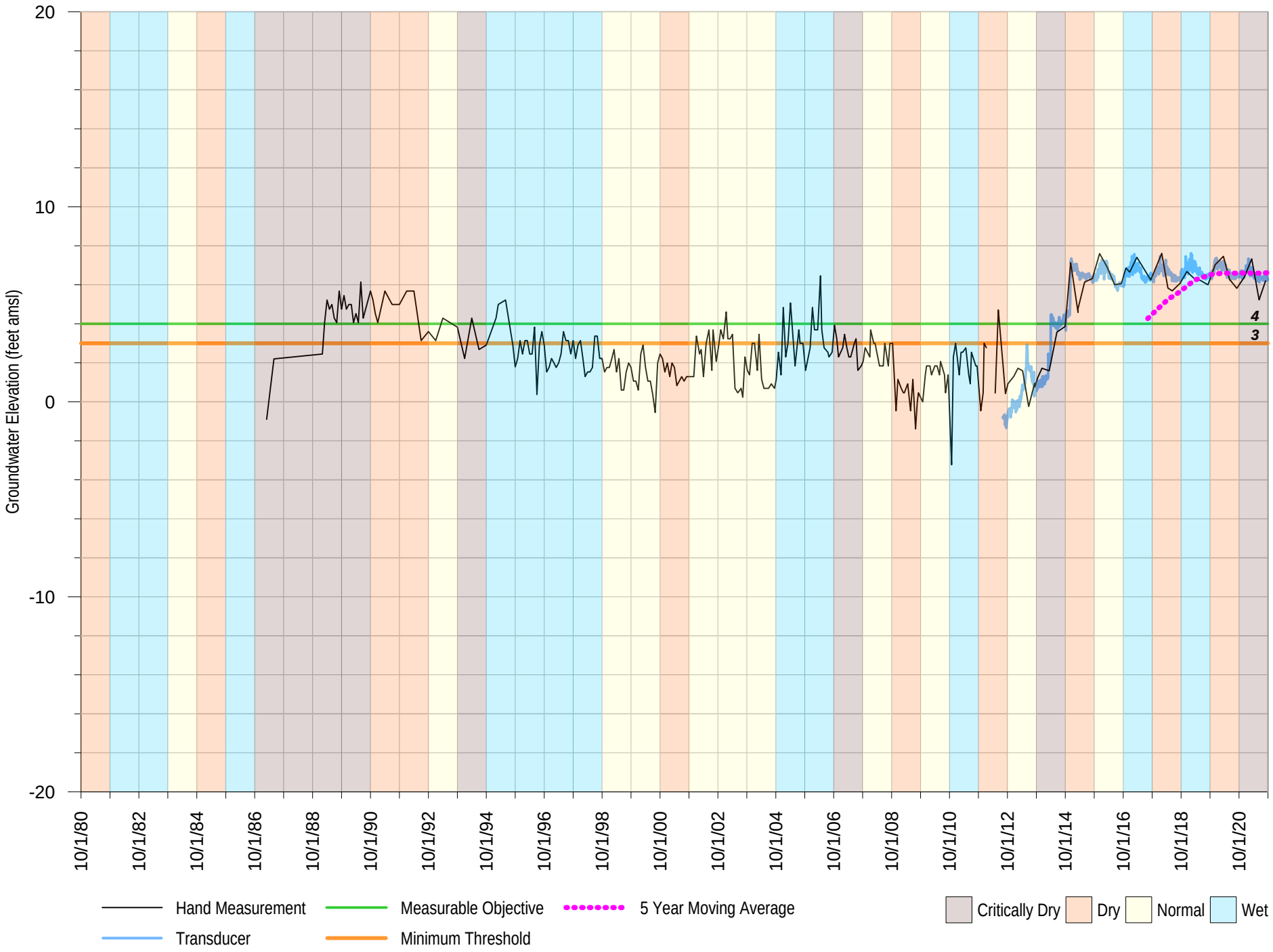
SC-A8A at Dolphin
Aquifer Screened: Purisima F

FIGURE A-20



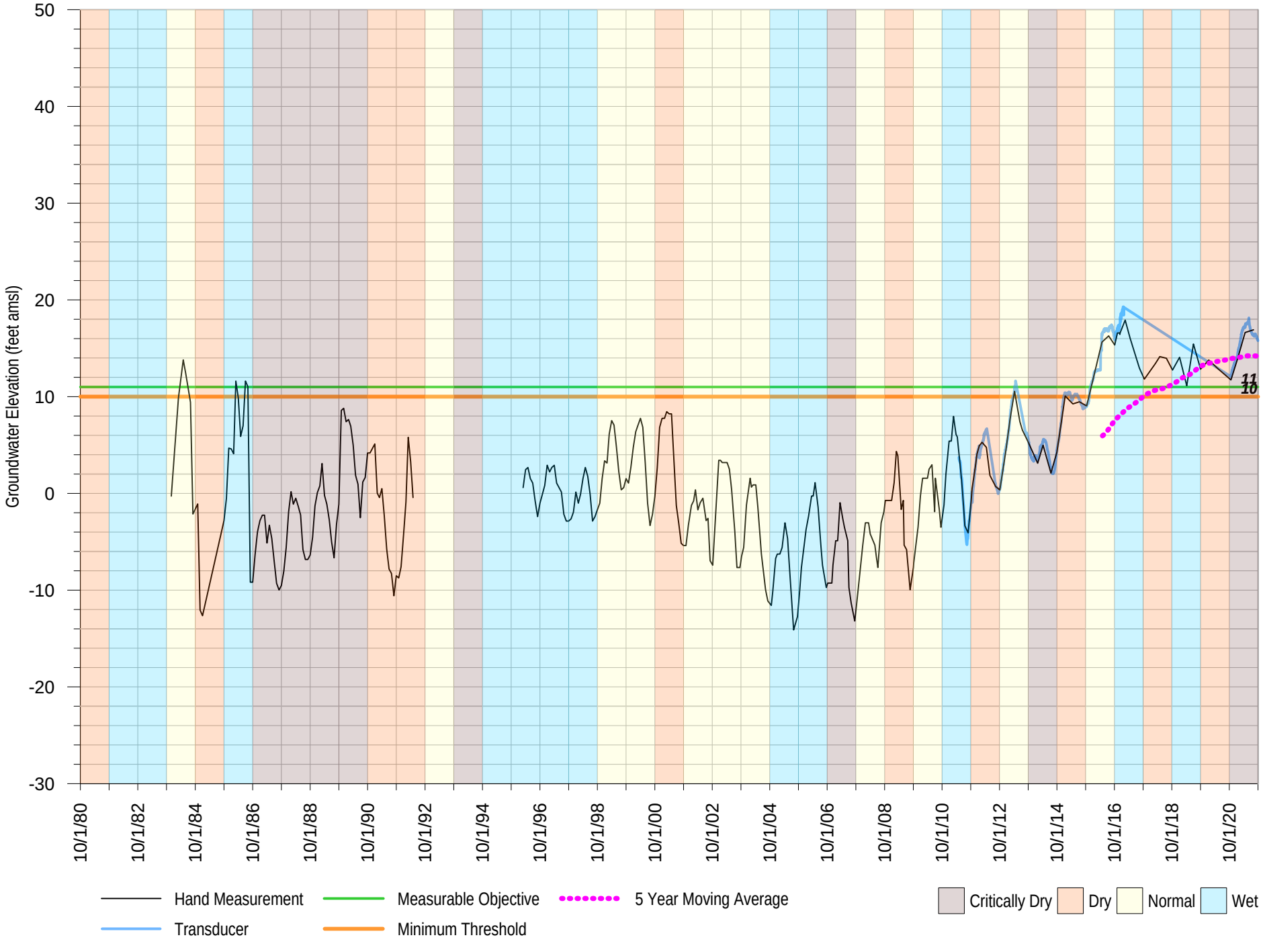
SC-A2A & SC-A2RA at Sumner
Aquifer Screened: Purisima F

FIGURE A-21



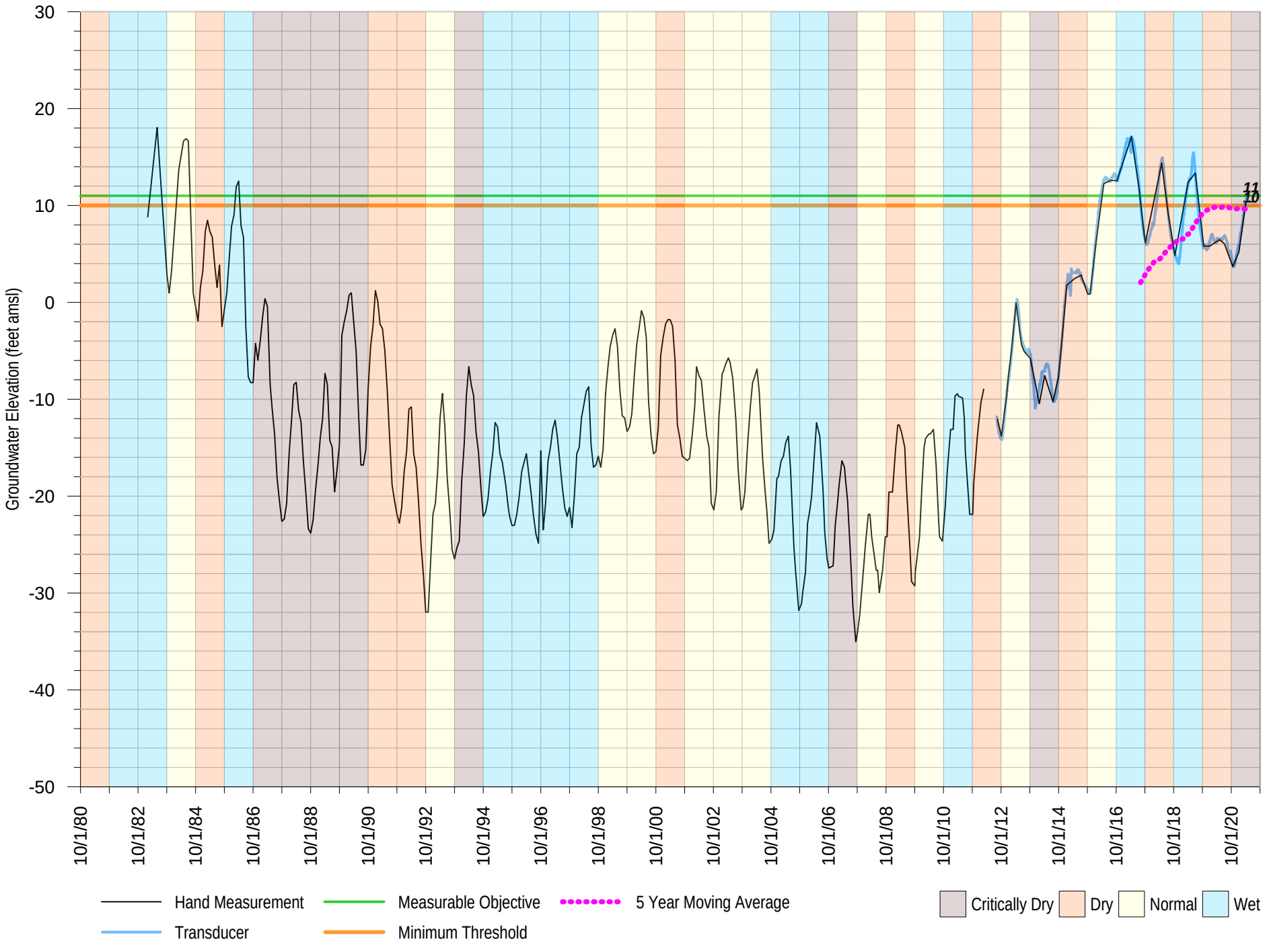
SC-8D & SC-8RD at Aptos Creek
Aquifer Screened: Purisima DEF

FIGURE A-22



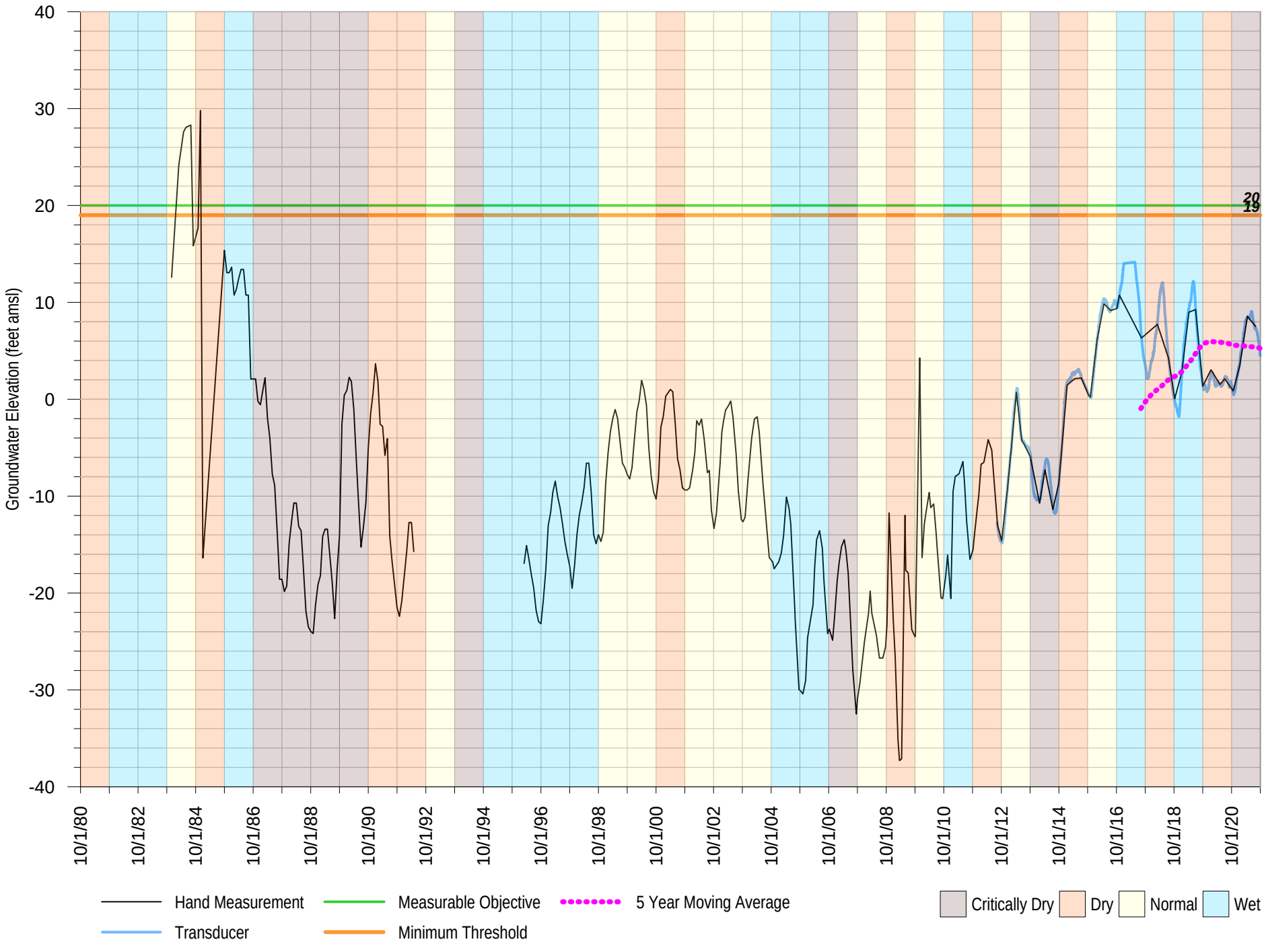
SC-9C & SC-9RC at Seacliff
Aquifer Screened: Purisima BC

FIGURE A-23



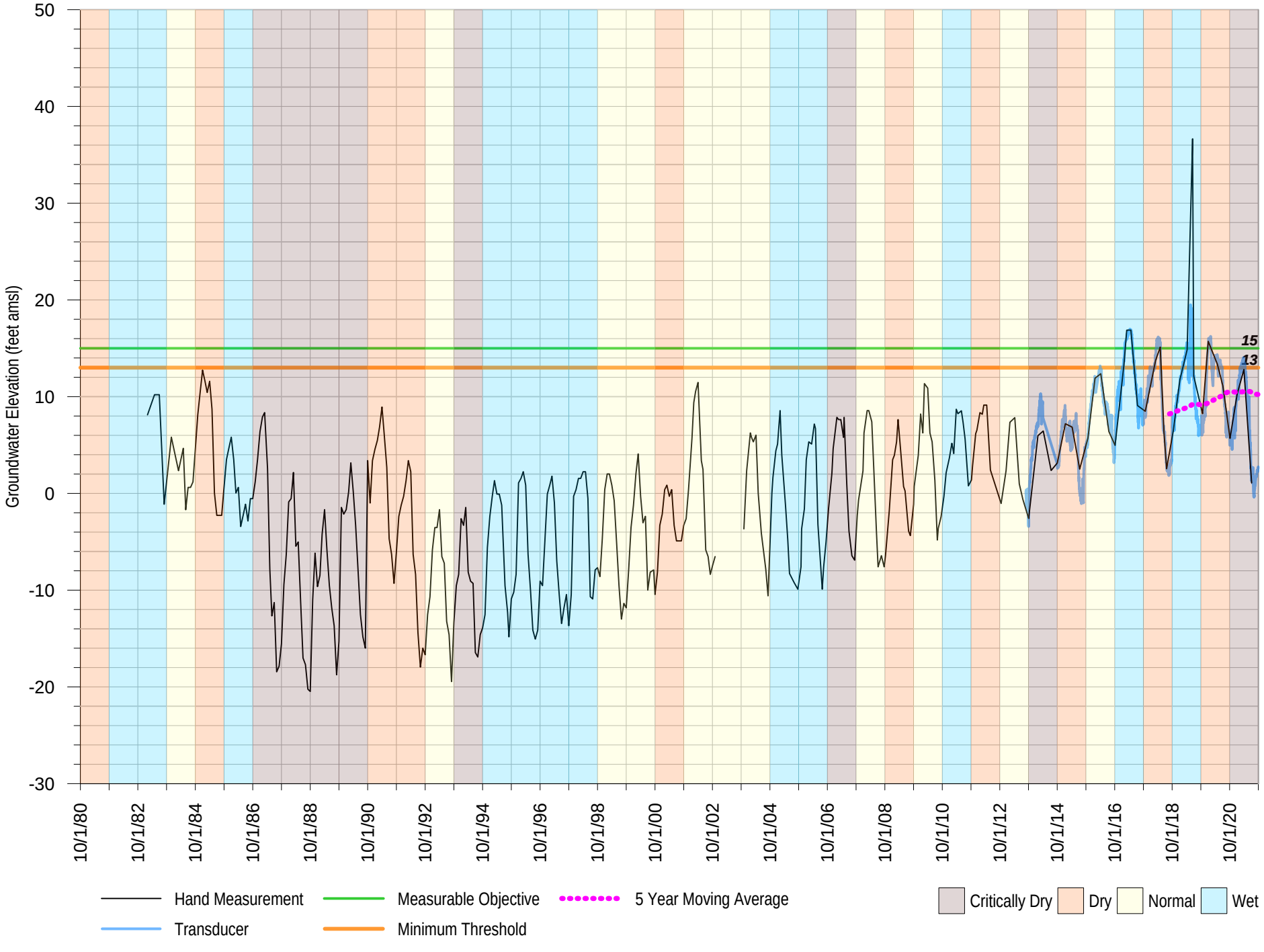
SC-8B & SC-8RB at Aptos Creek
Aquifer Screened: Purisima BC

FIGURE A-24



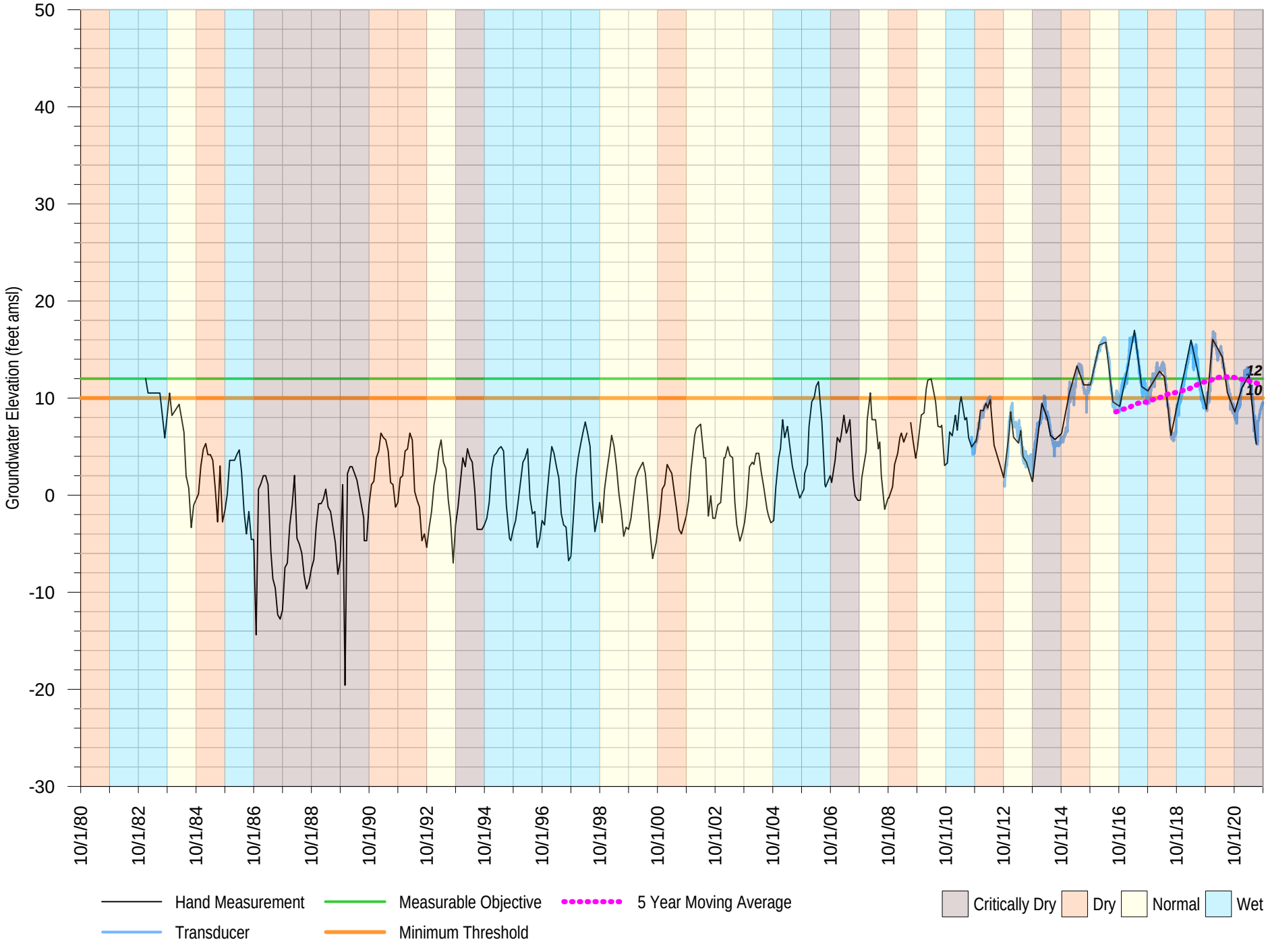
SC-5A & SC-5RA at New Brighton
Aquifer Screened: Purisima A

FIGURE A-25



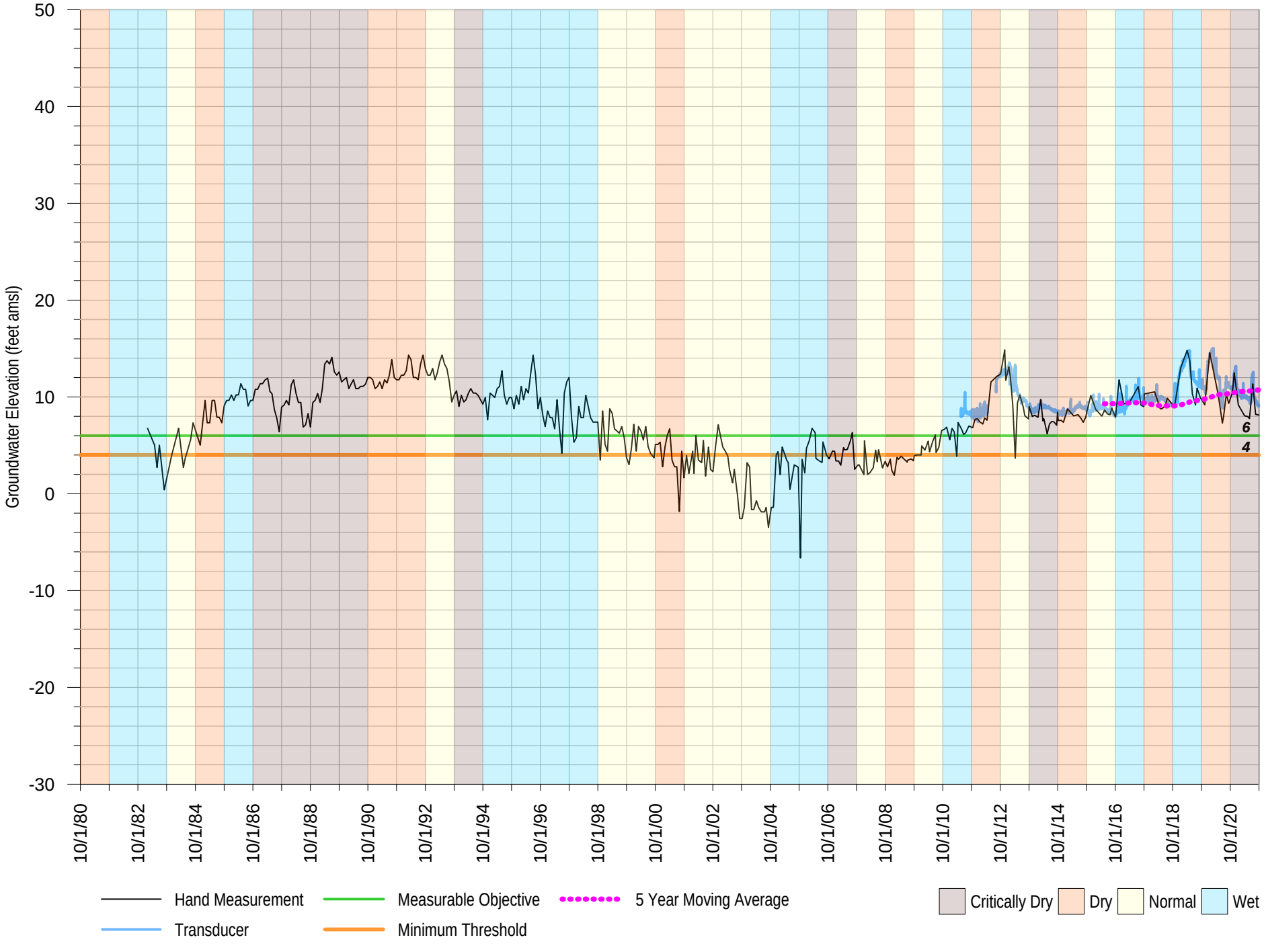
SC-3A & SC-3RA at Escalona
Aquifer Screened: Purisima A/AA

FIGURE A-26



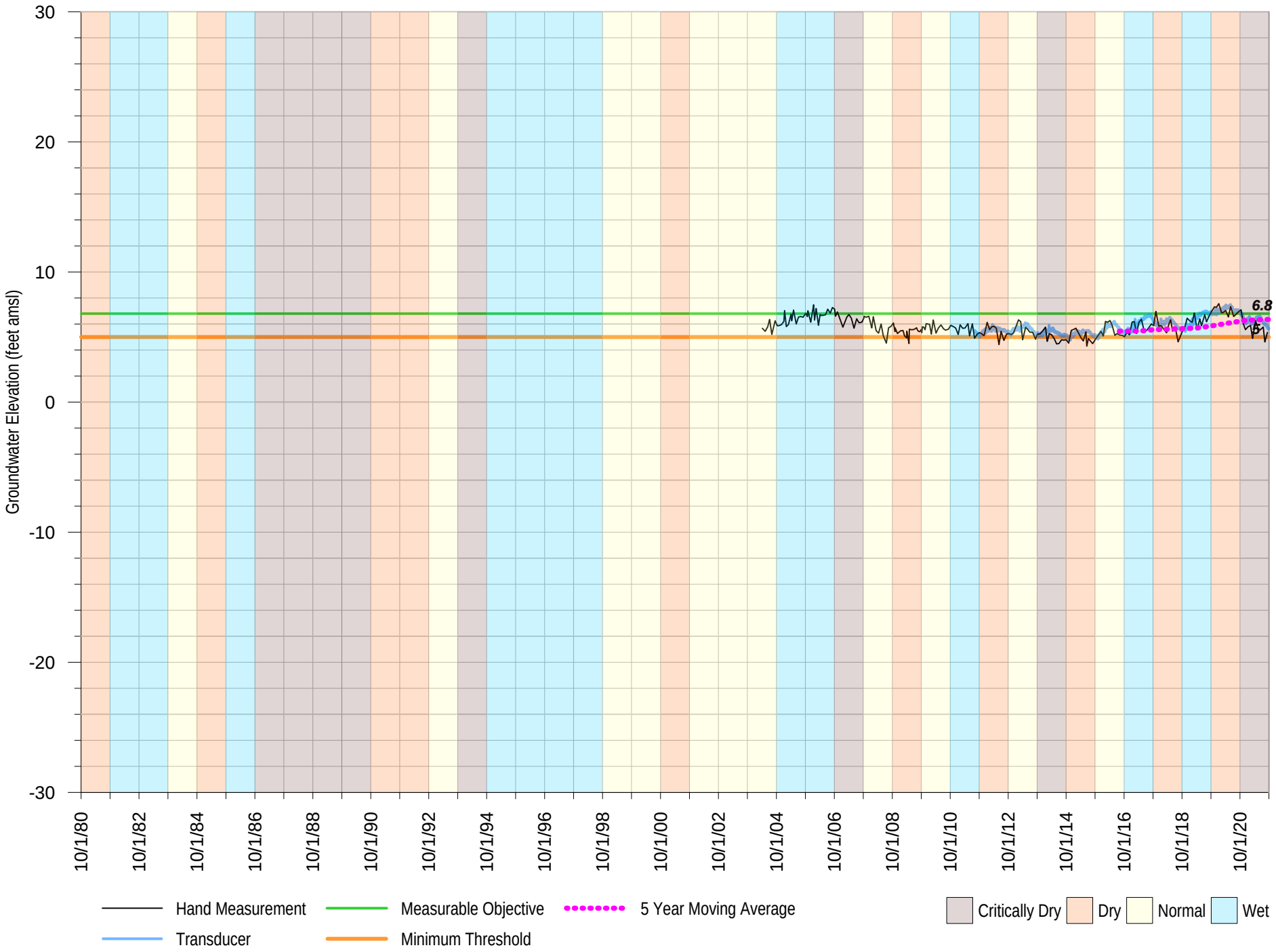
SC-1A at Prospect
Aquifer Screened: Purisima A

FIGURE A-27



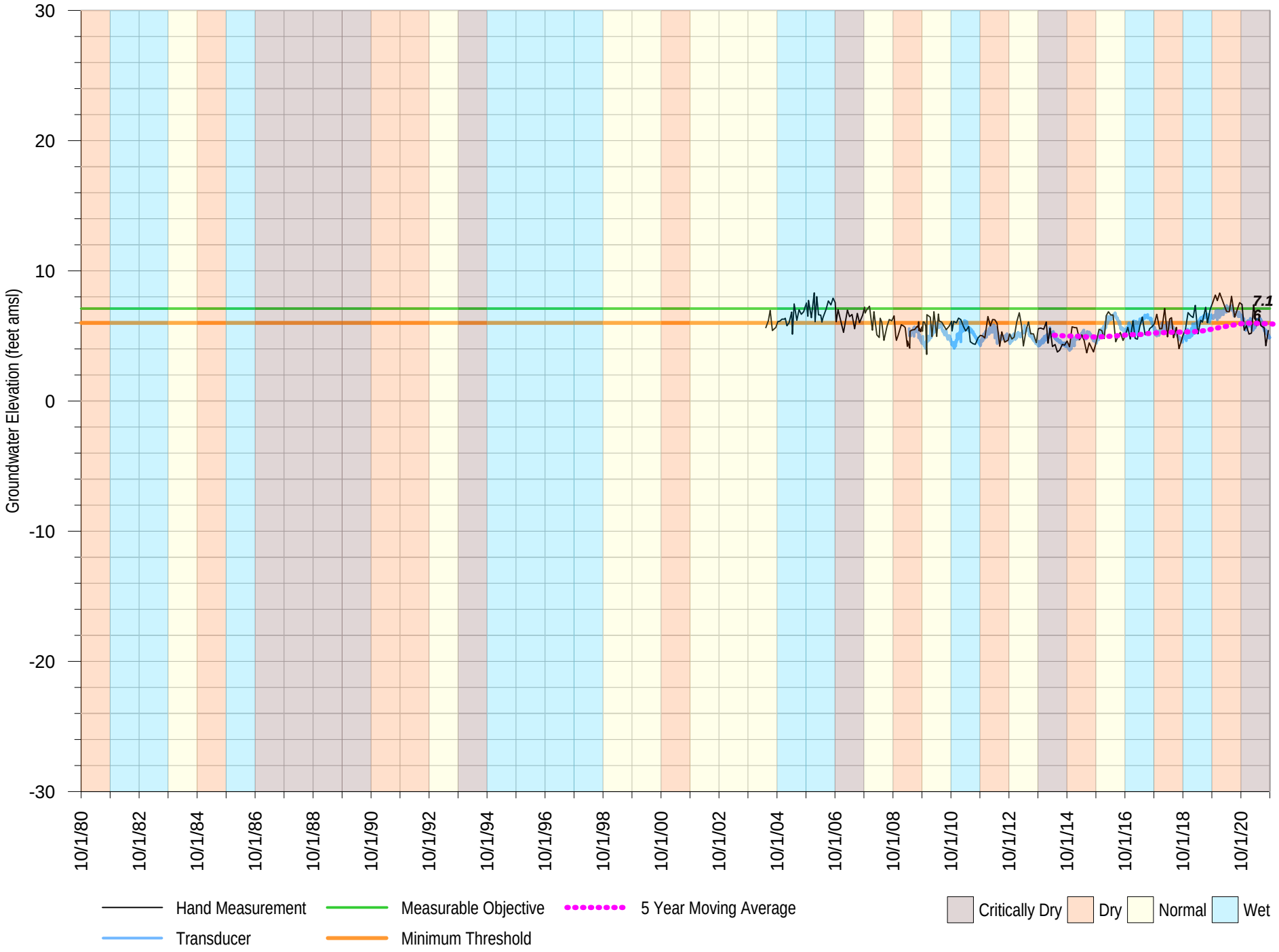
Moran Lake Medium
Aquifer Screened: Purisima A

FIGURE A-28



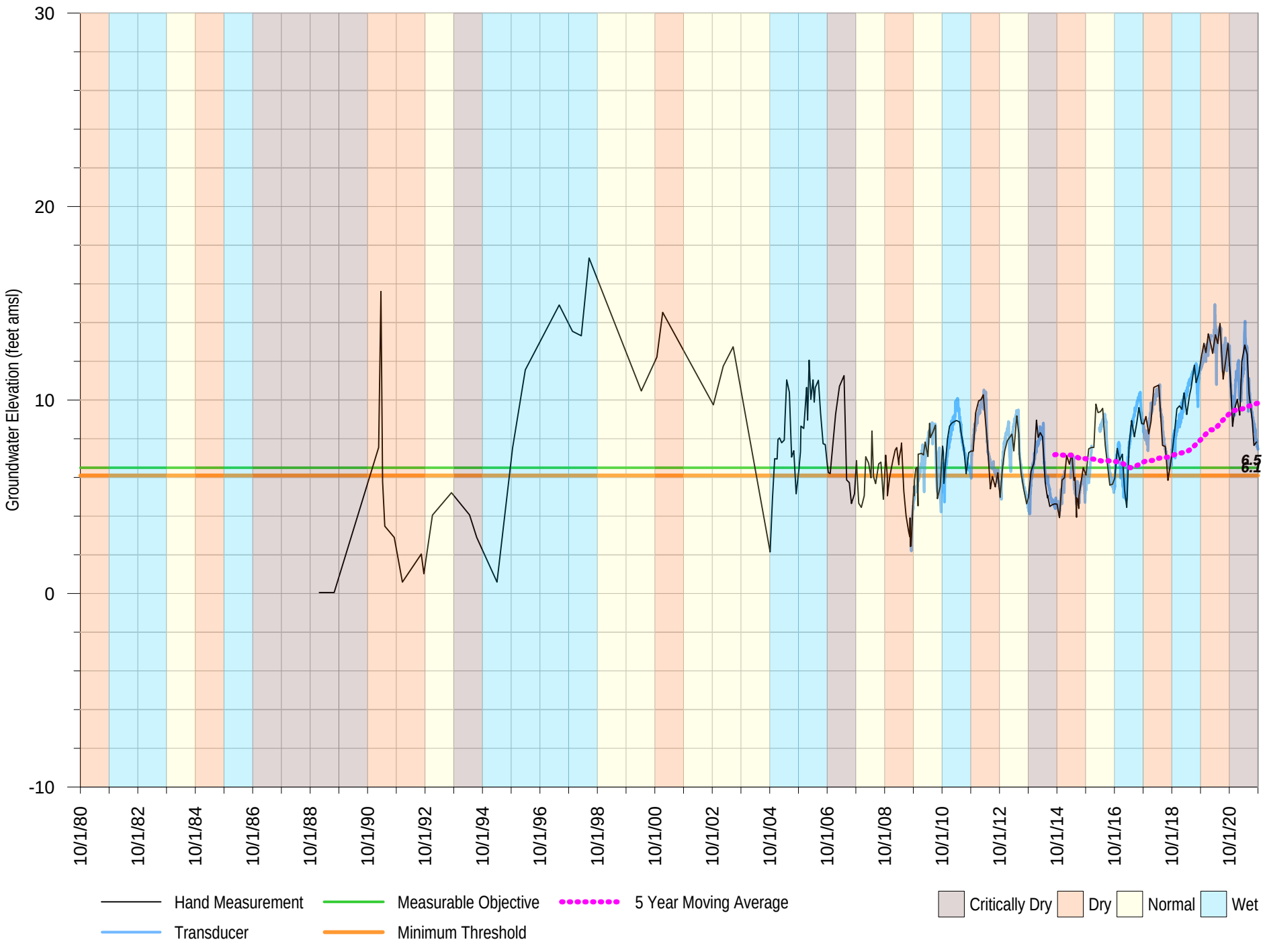
Soquel Point Medium
Aquifer Screened: Purisima A

FIGURE A-29



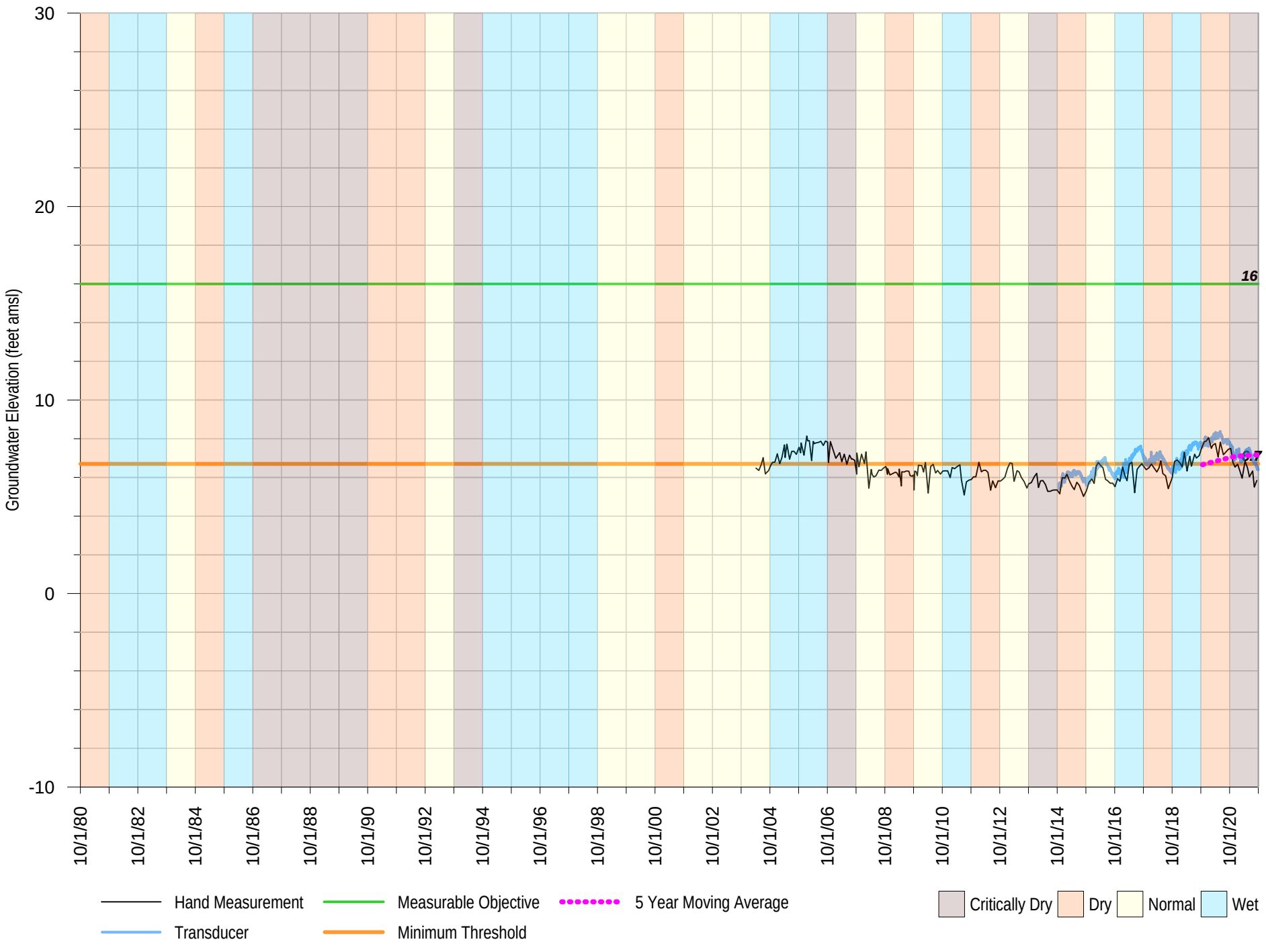
Pleasure Point Medium
Aquifer Screened: Purisima A

FIGURE A-30



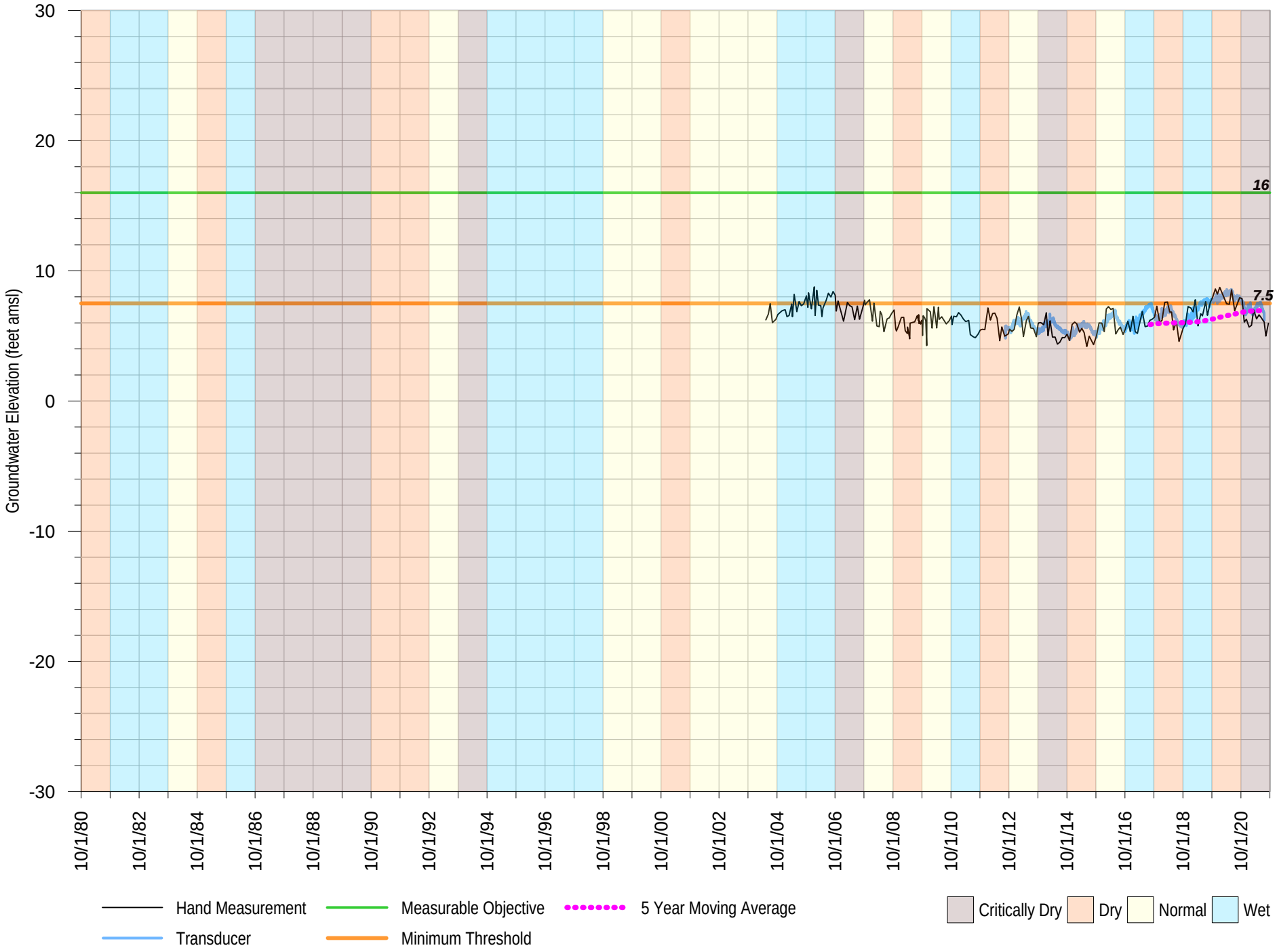
Moran Lake Deep
Aquifer Screened: Purisima AA

FIGURE A-31



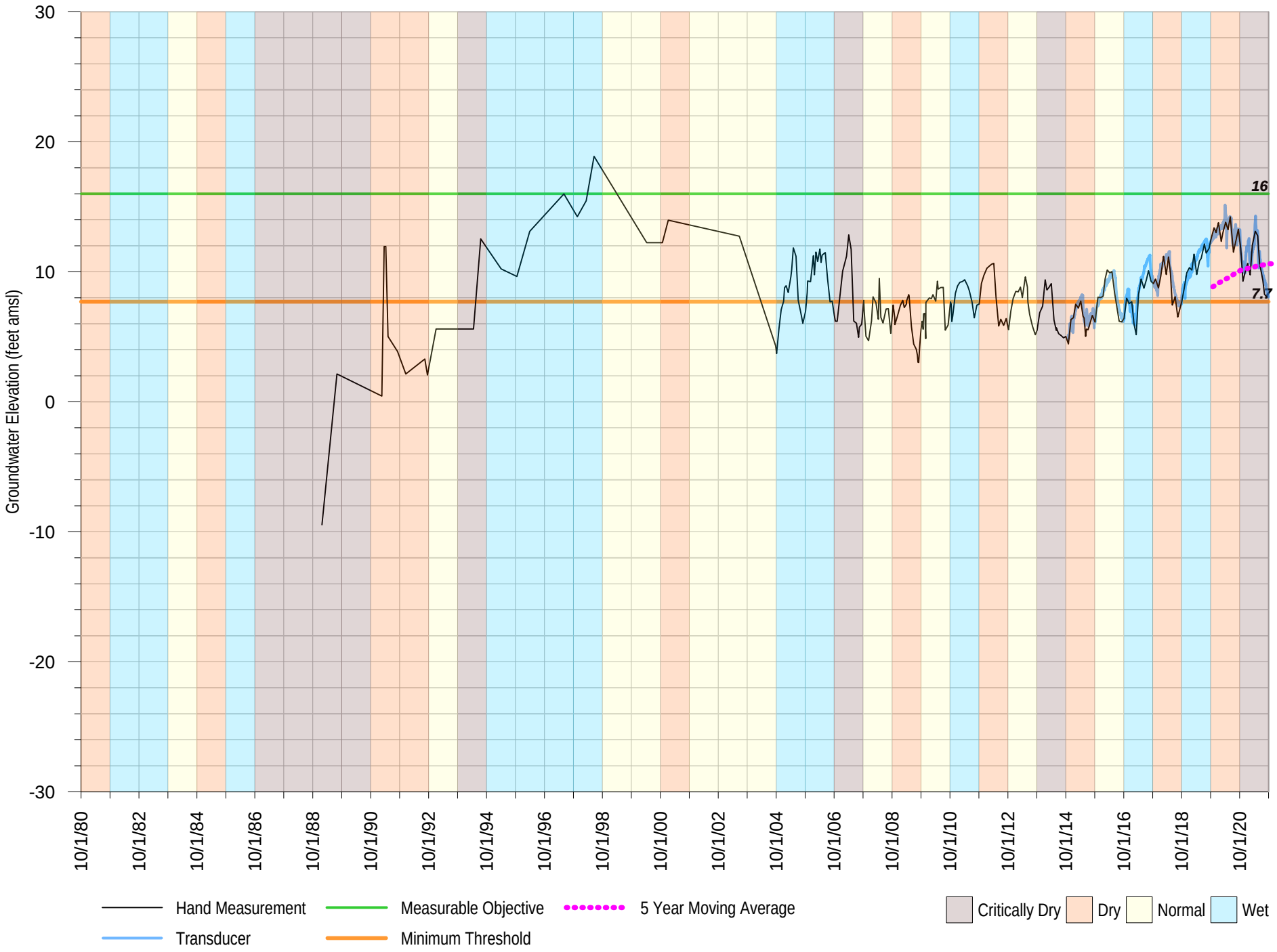
Soquel Point Deep
Aquifer Screened: Purisima AA

FIGURE A-32



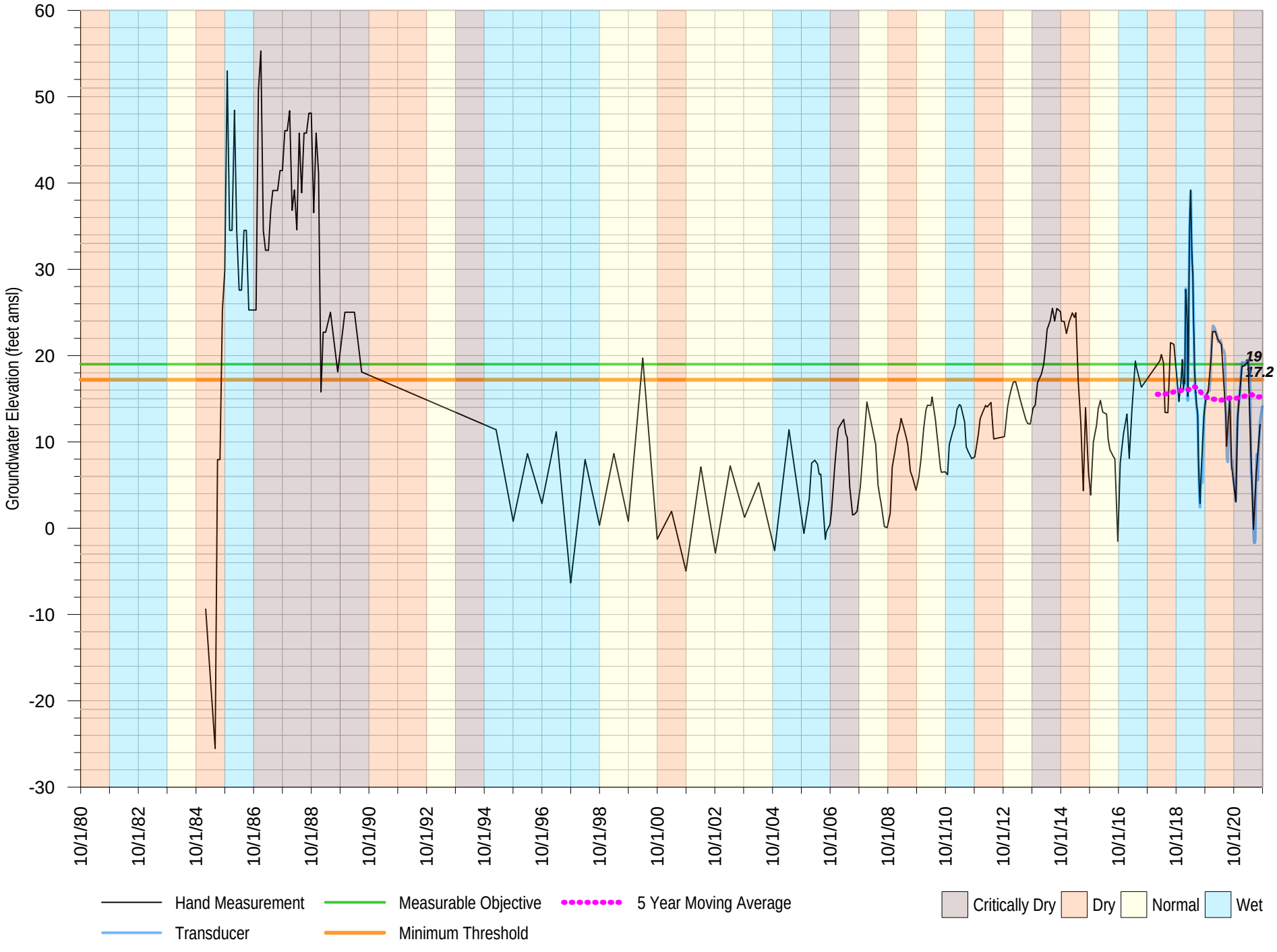
Pleasure Point Deep
Aquifer Screened: Purisima AA

FIGURE A-33



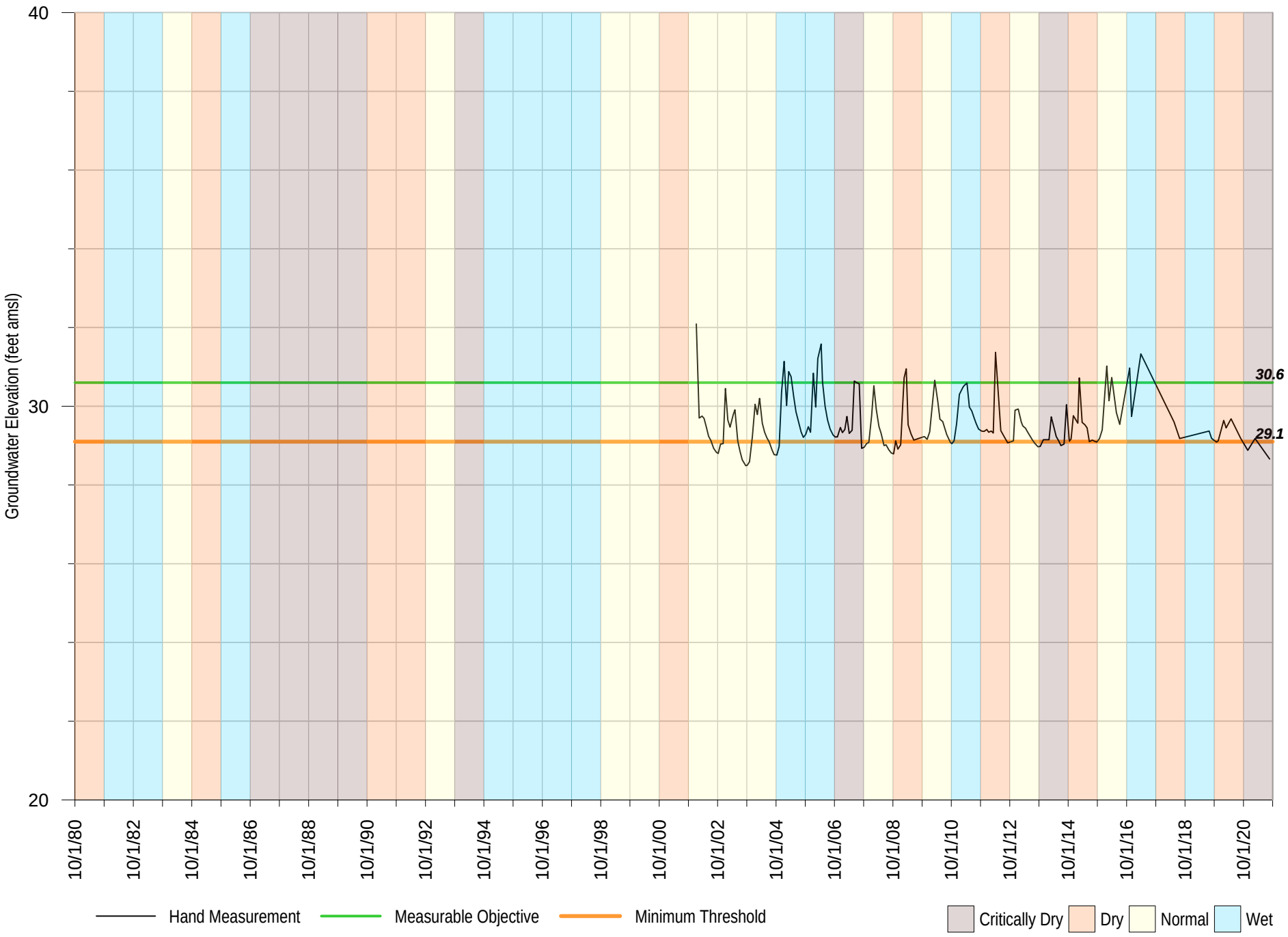
SC-13A at Garnet
Aquifer Screened: Tu

FIGURE A-34



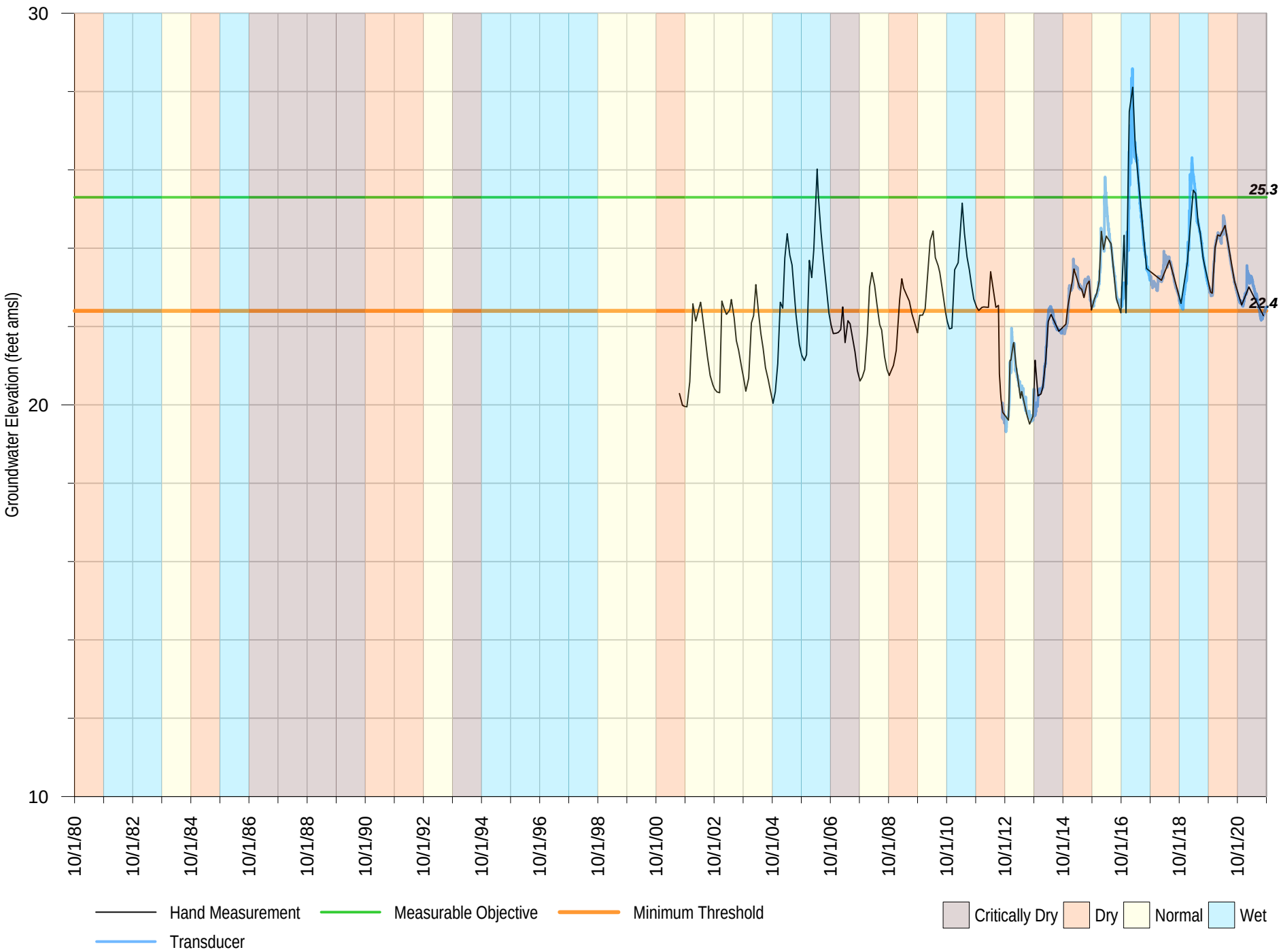
Balogh Shallow Well
Aquifer Screened: Shallow Well for Surface Water Interactions

FIGURE A-35



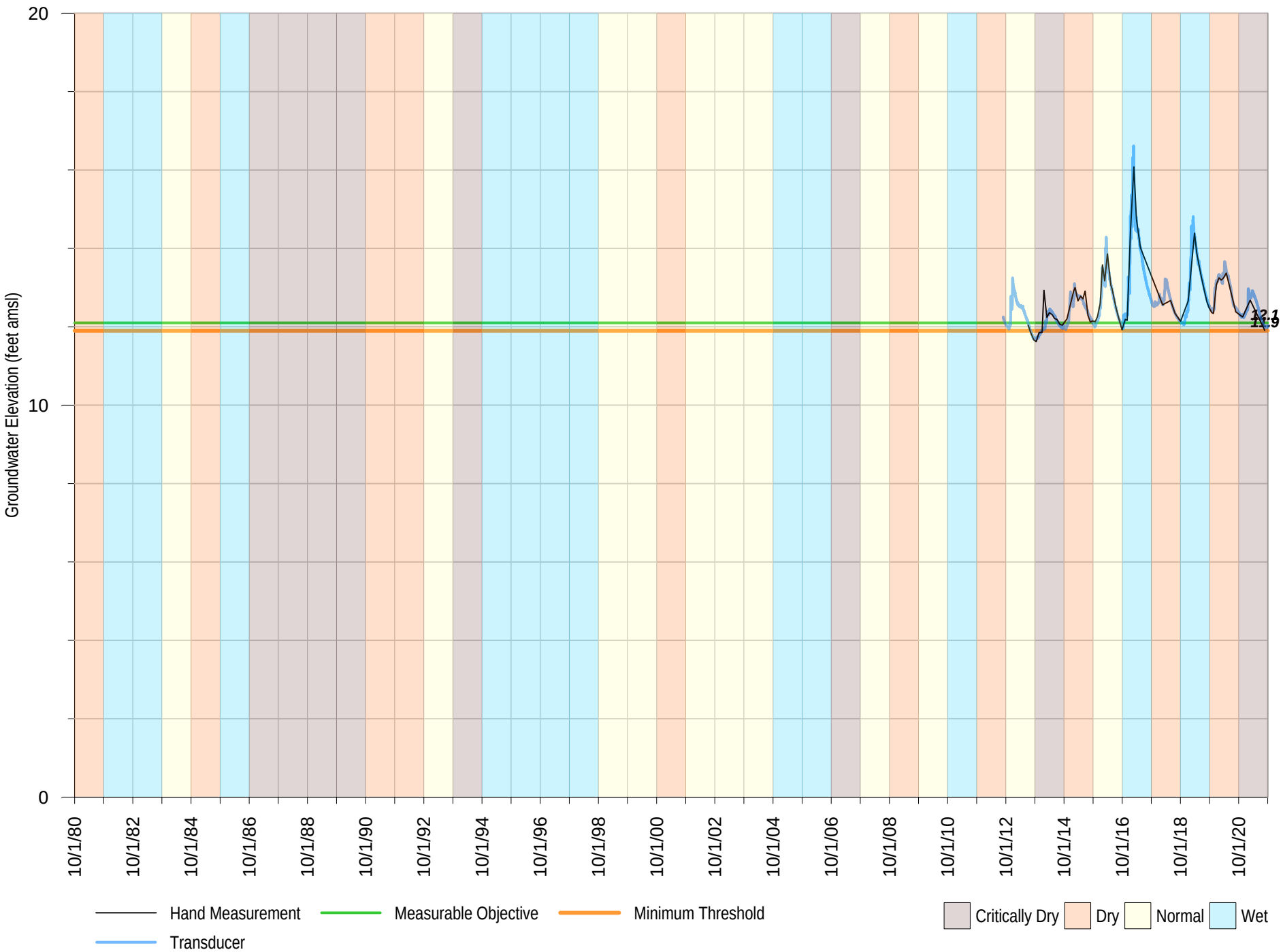
Main Street Shallow Well 1
Aquifer Screened: Shallow Well for Surface Water Interactions

FIGURE A-36



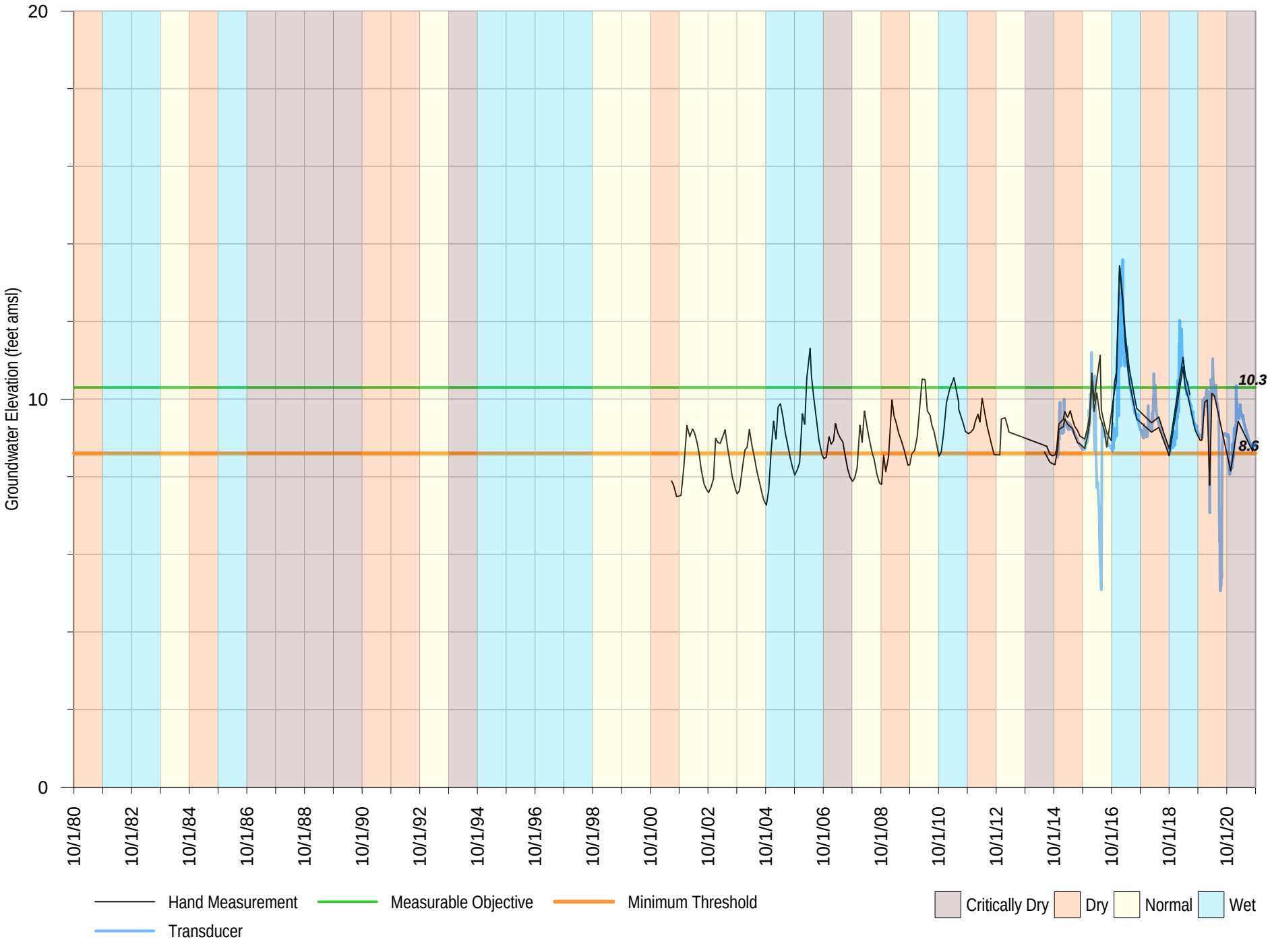
Soquel Wharf Shallow Well
Aquifer Screened: Shallow Well for Surface Water Interactions

FIGURE A-37



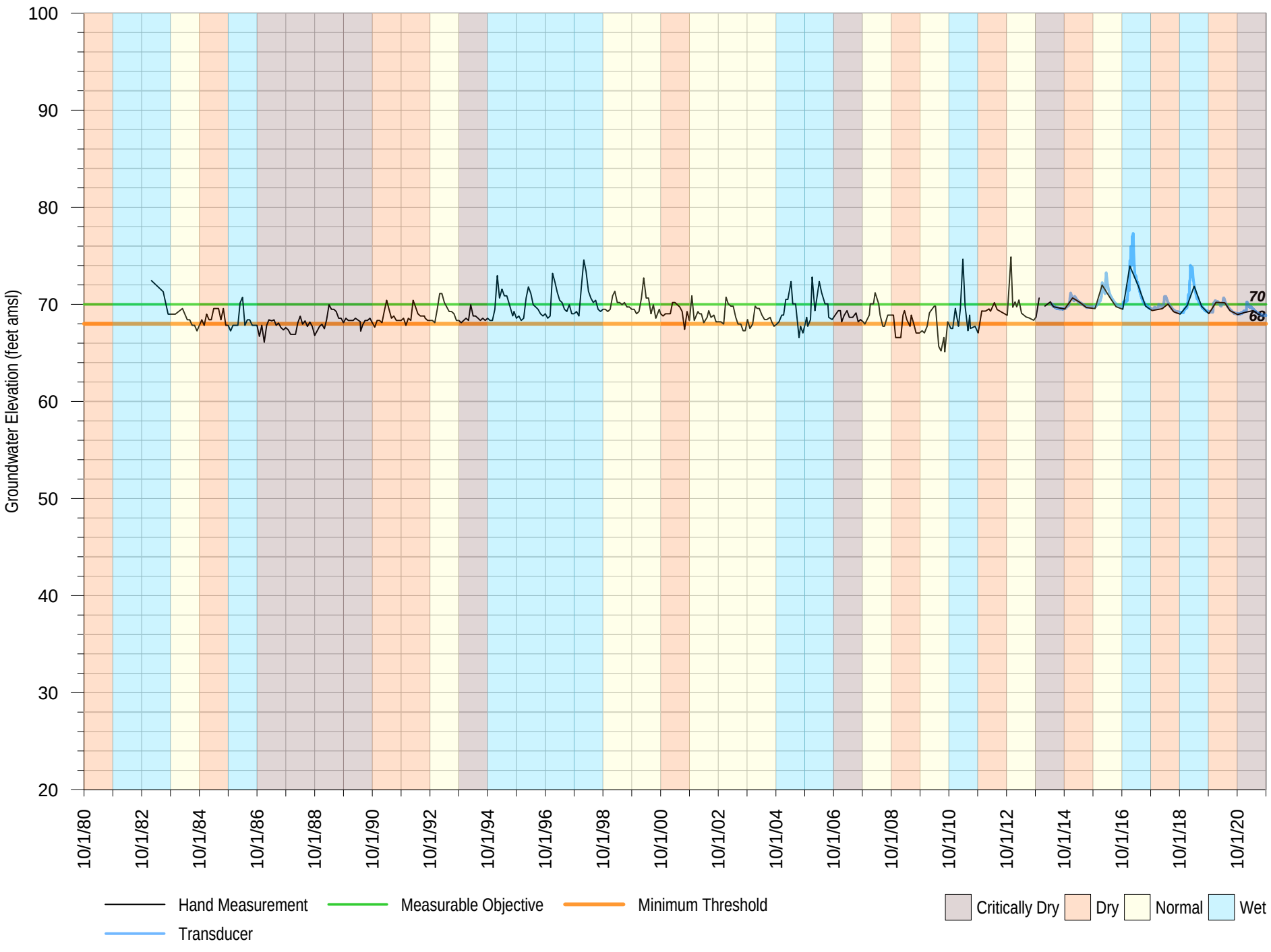
Nob Hill Shallow Well 1 & Nob Hill Shallow Well 2
Aquifer Screened: Shallow Well for Surface Water Interactions

FIGURE A-38



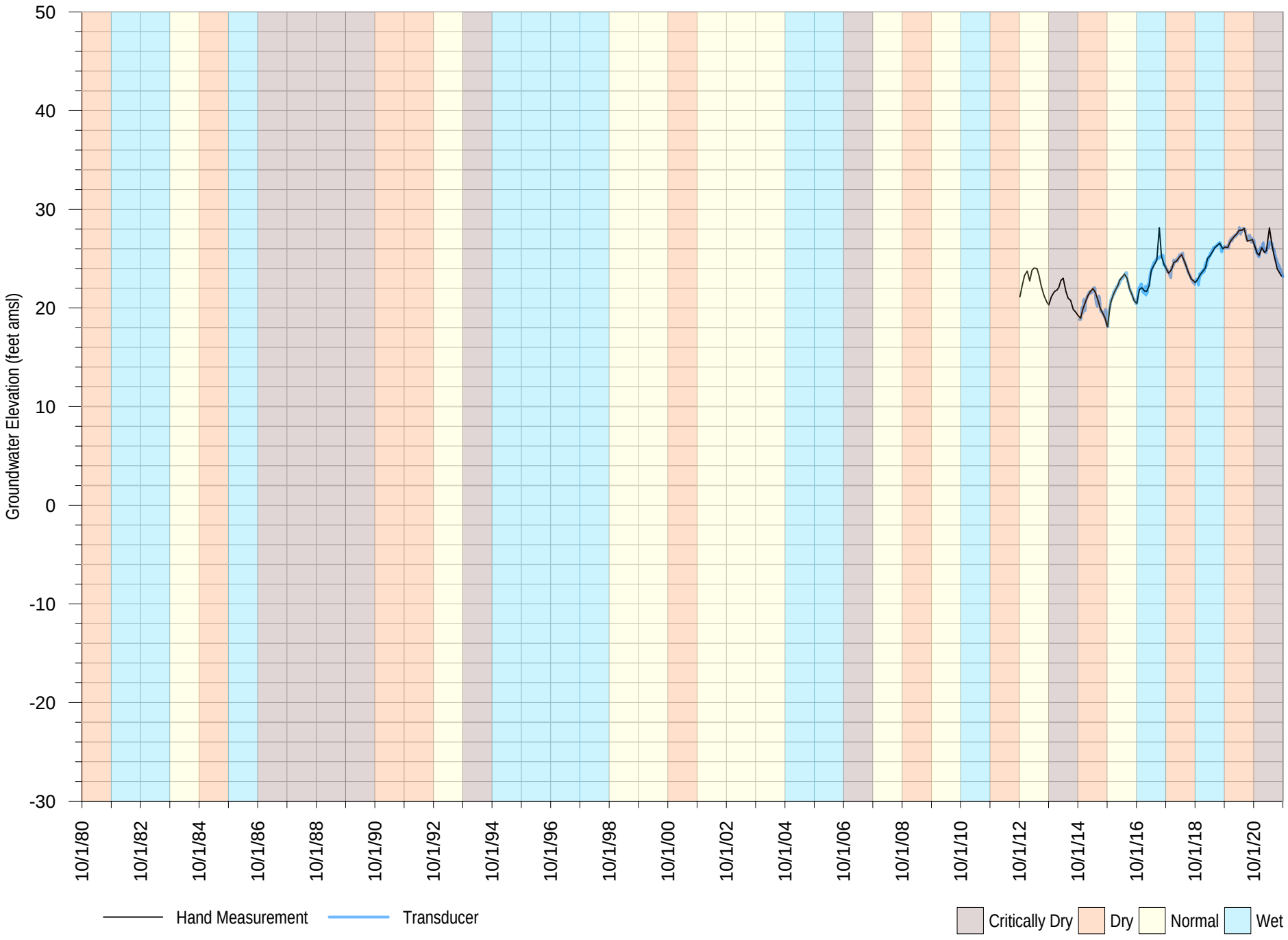
SC-10A & SC-10RA at Cherryvale
Aquifer Screened: Purisima A

FIGURE A-39



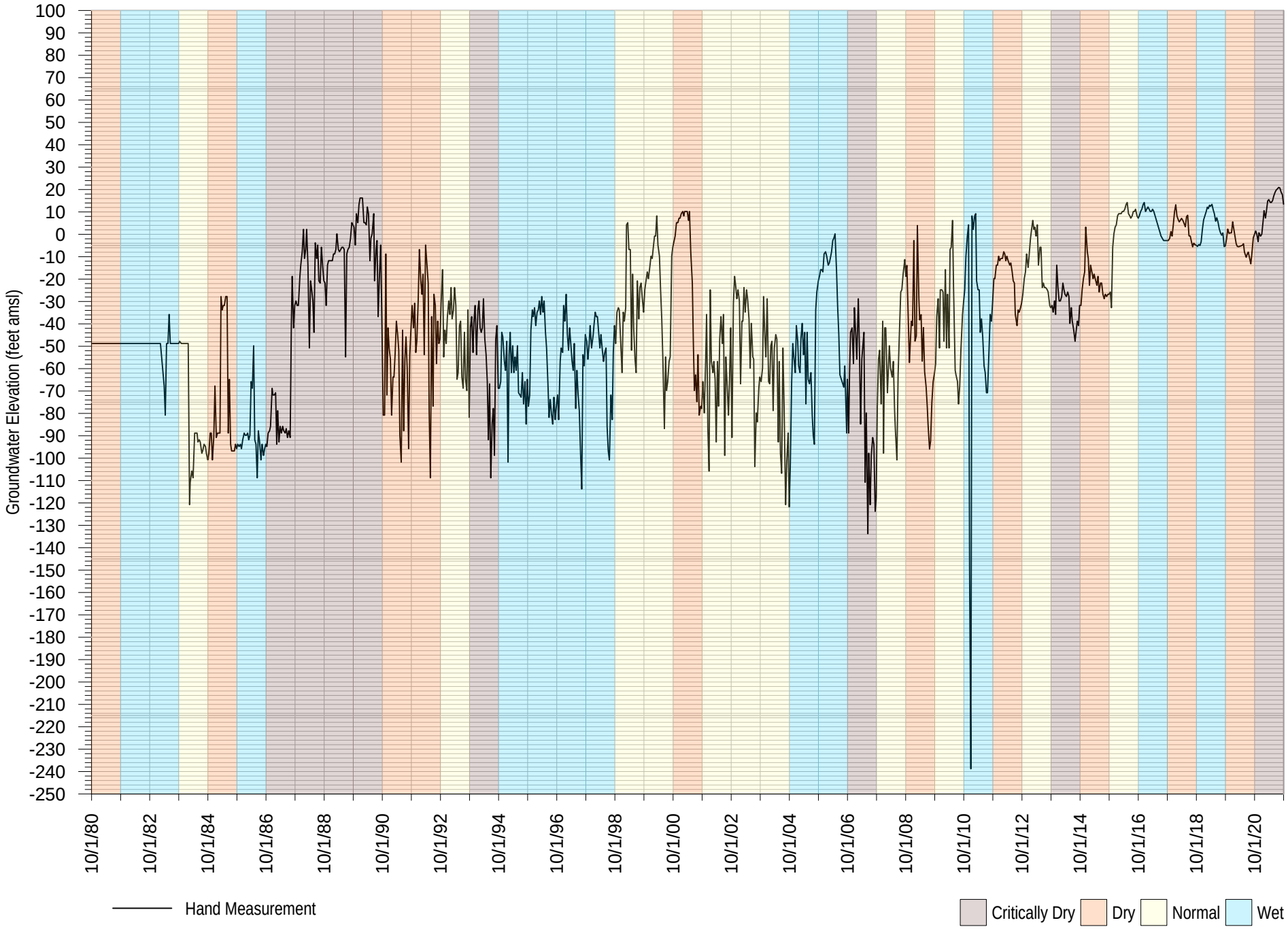
30th Ave Shallow
Aquifer Screened: Purisima A

FIGURE A-40



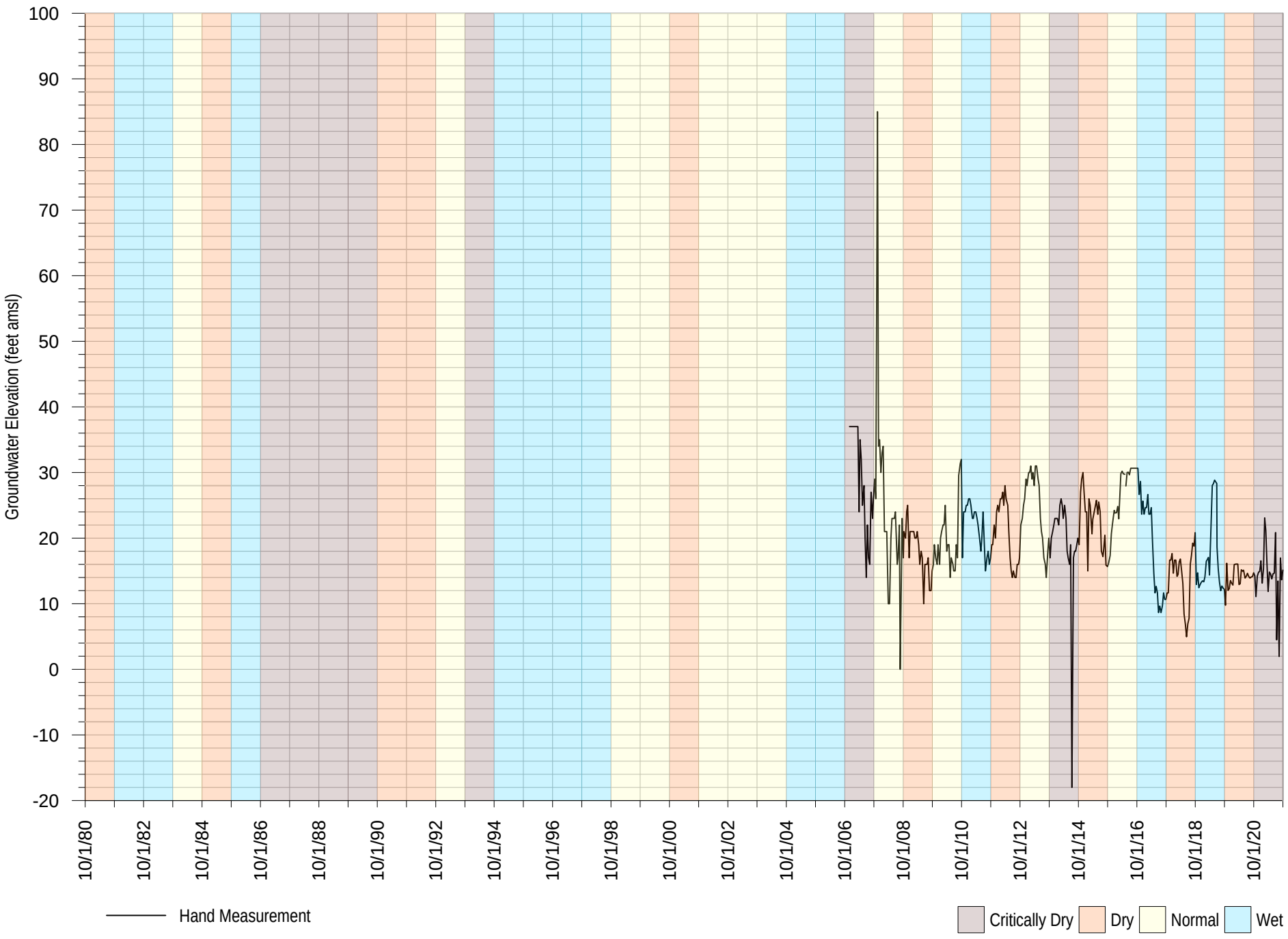
Aptos Creek PW
Aquifer Screened: Purisima BC

FIGURE A-41



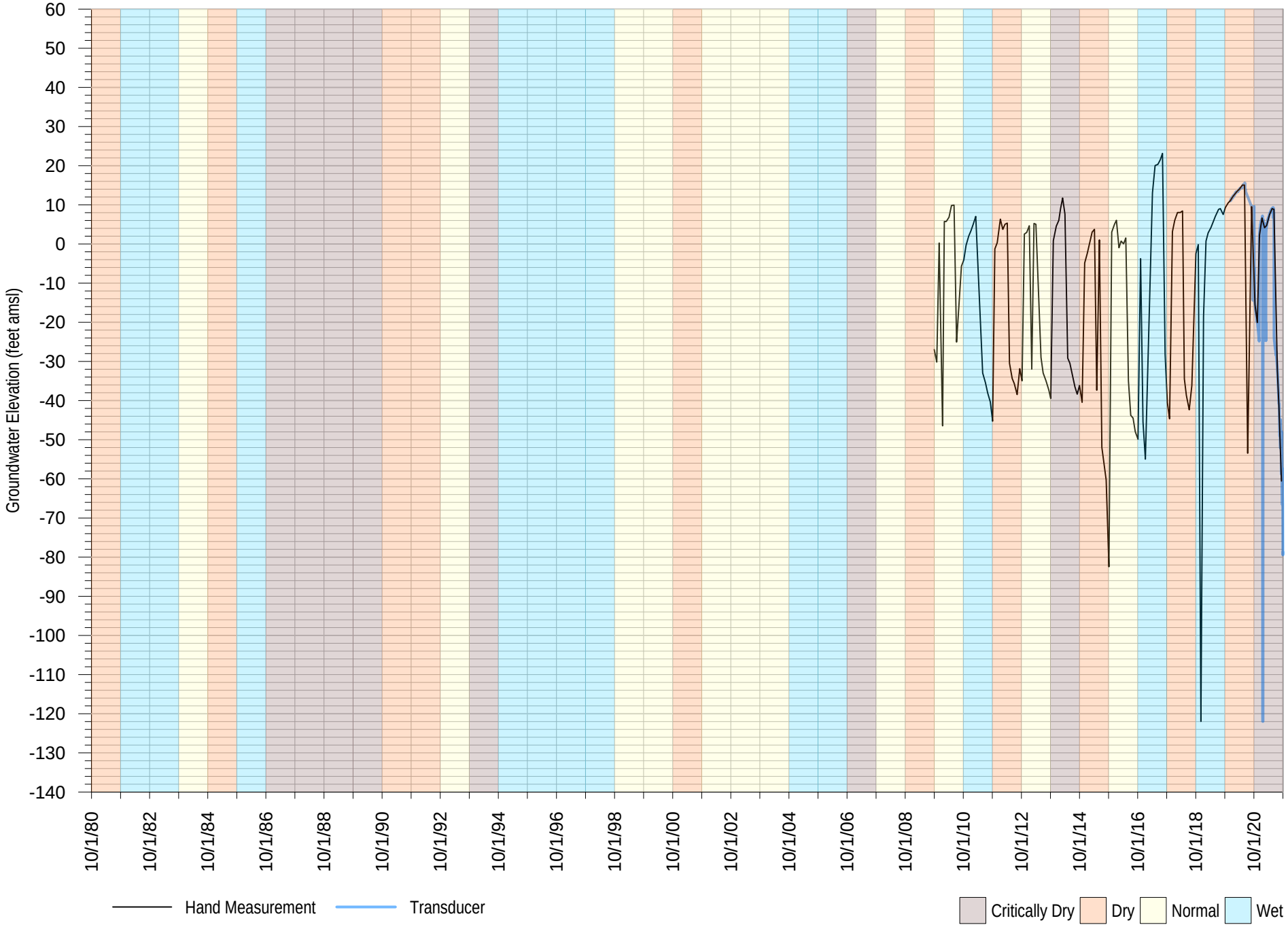
Aptos Jr High & Aptos Jr High 2 PW
Aquifer Screened: Aromas/ Purisima F

FIGURE A-42



Beltz 10 PW
Aquifer Screened: Purisima A/AA

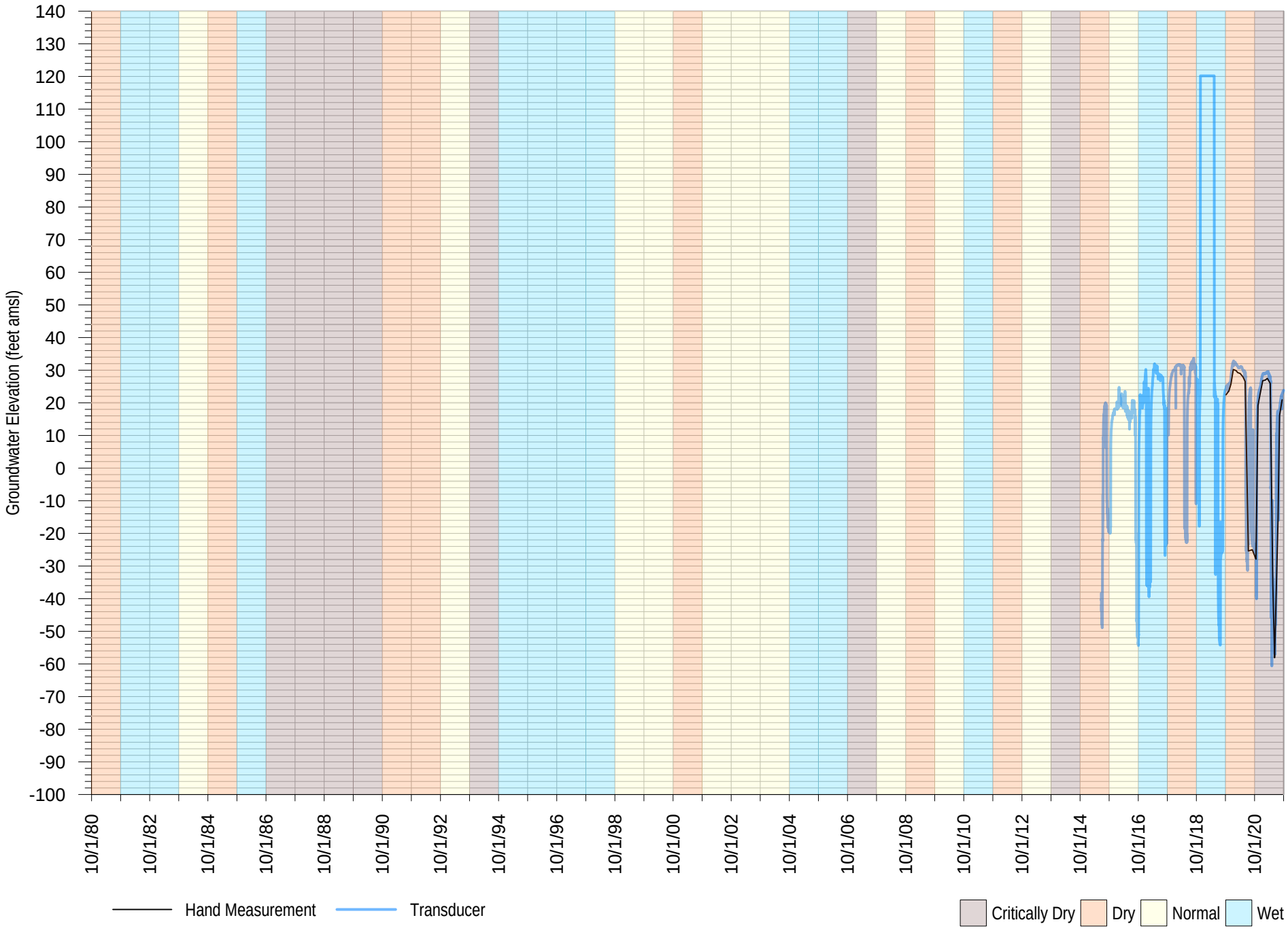
FIGURE A-43



Beltz 12 PW

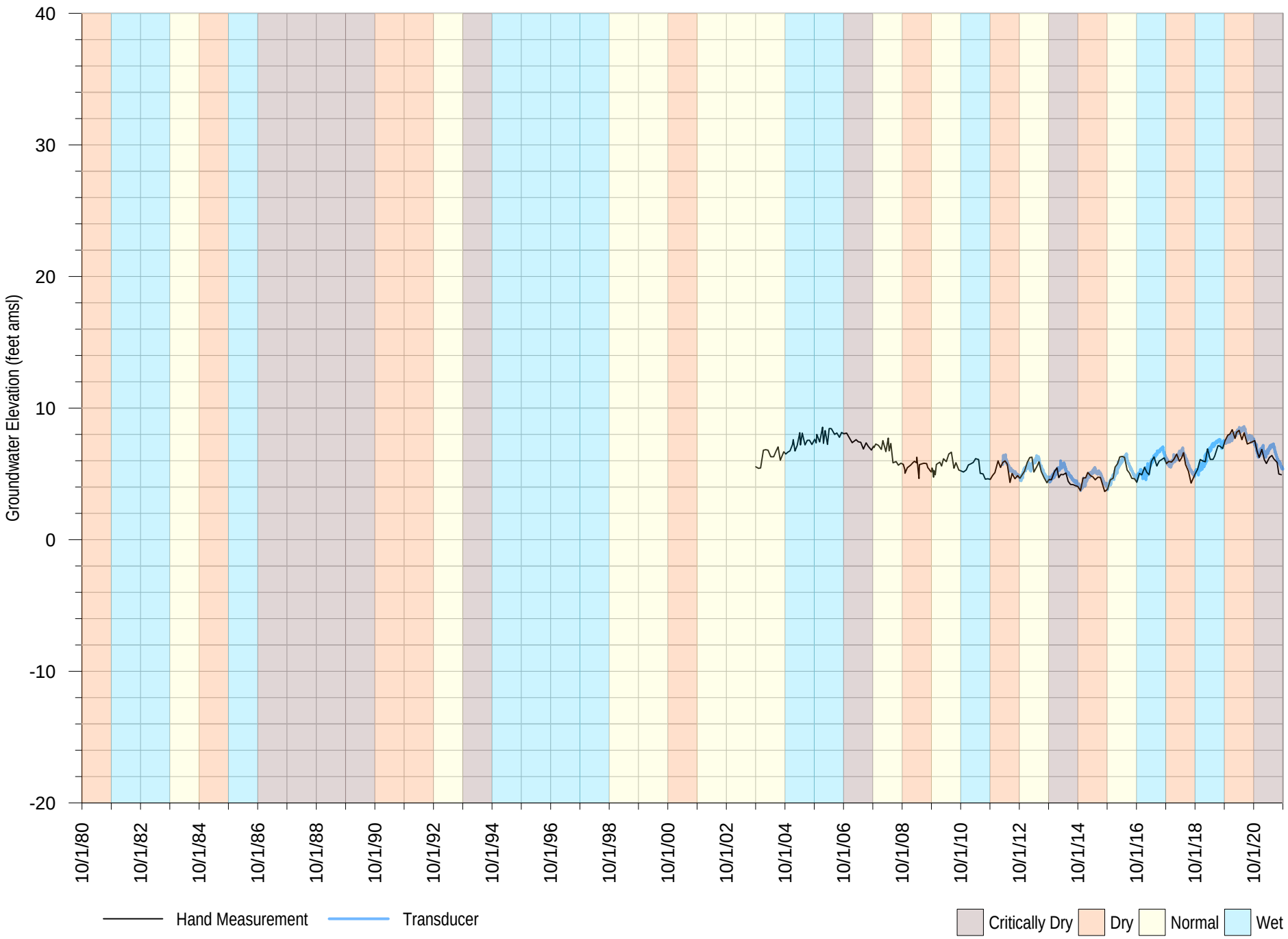
Aquifer Screened: Purisima AA/Tu

FIGURE A-44



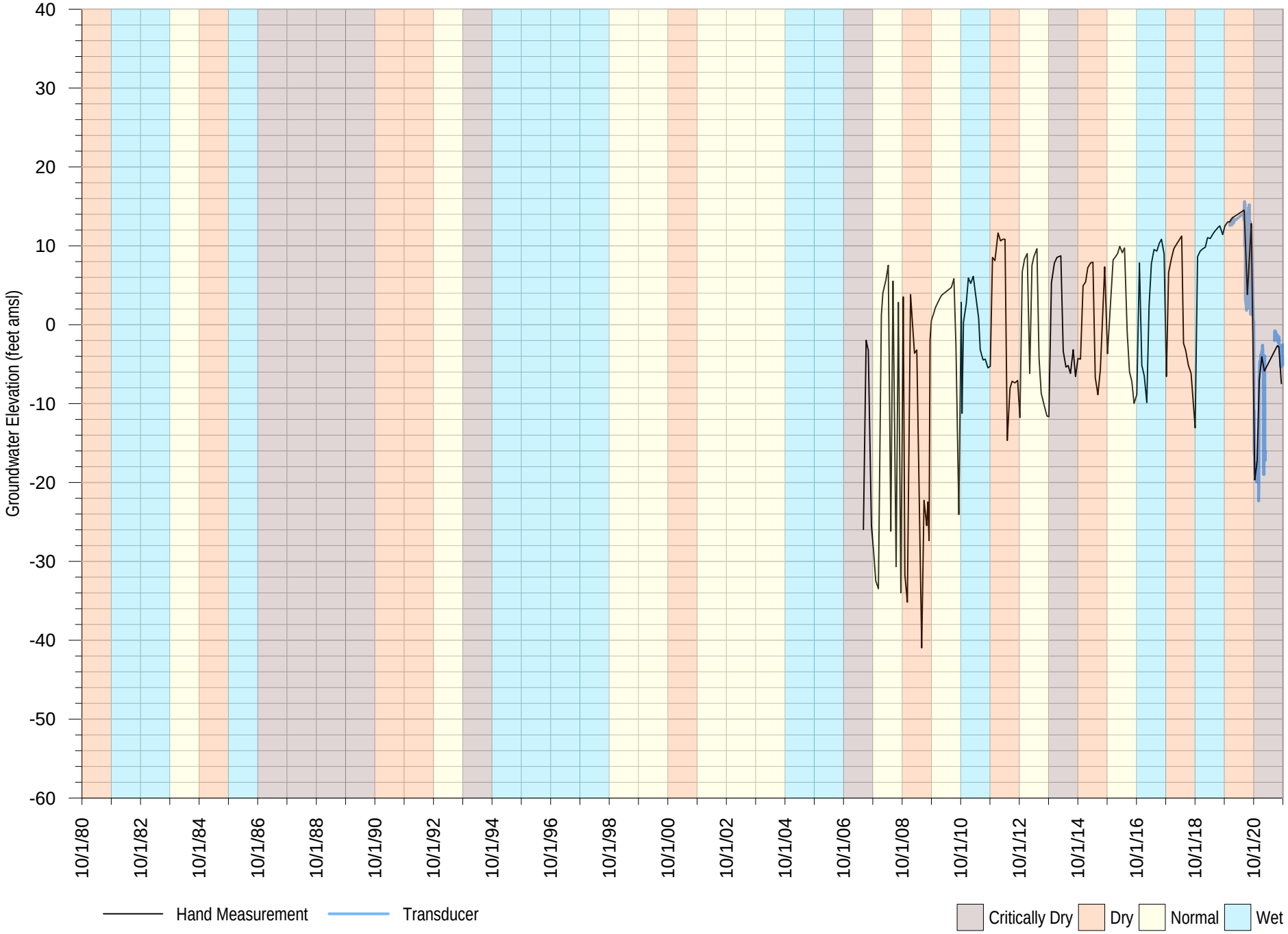
Beltz 2
Aquifer Screened: Purisima A

FIGURE A-45



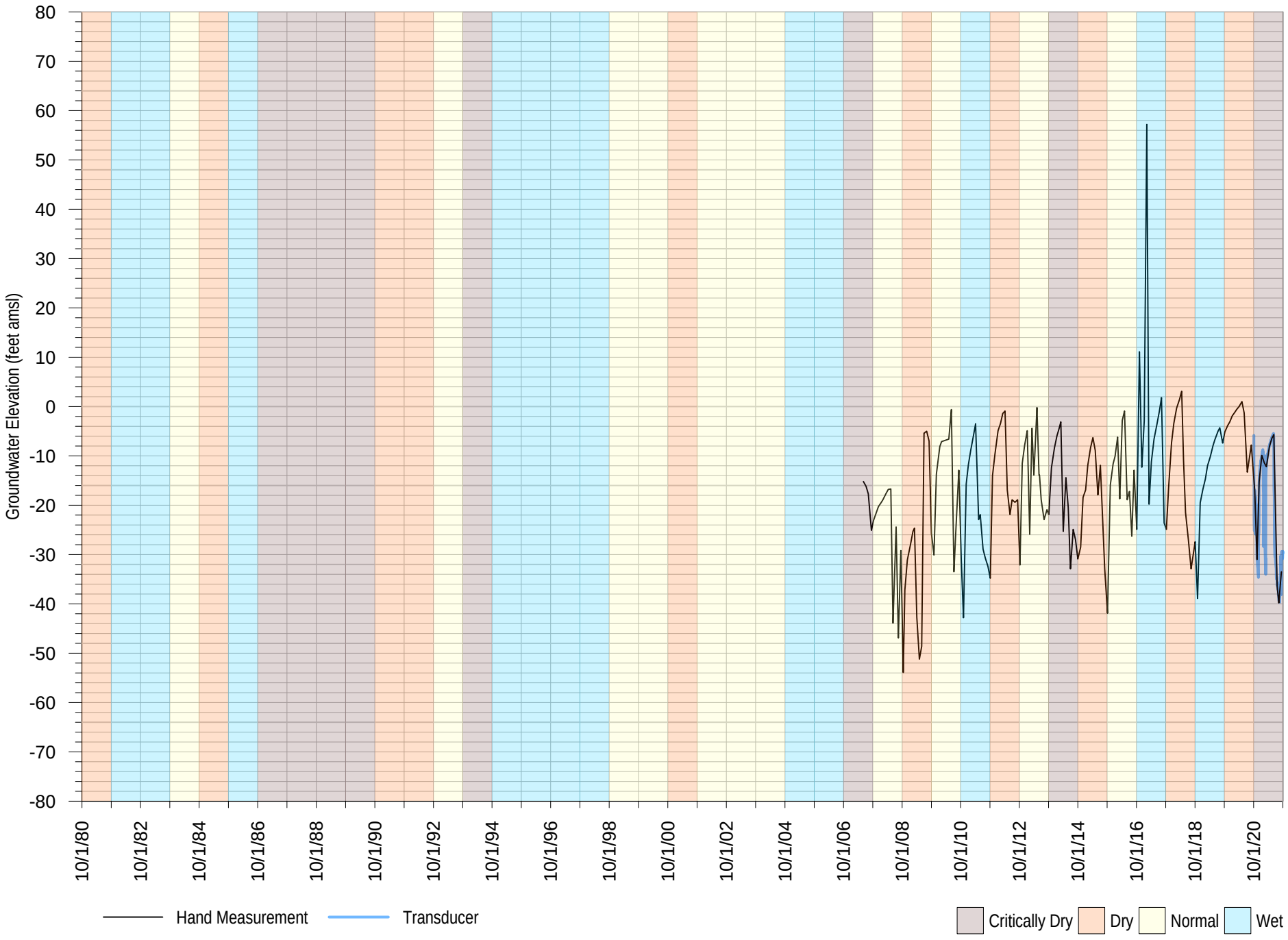
Beltz 8 PW
Aquifer Screened: Purisima A

FIGURE A-46



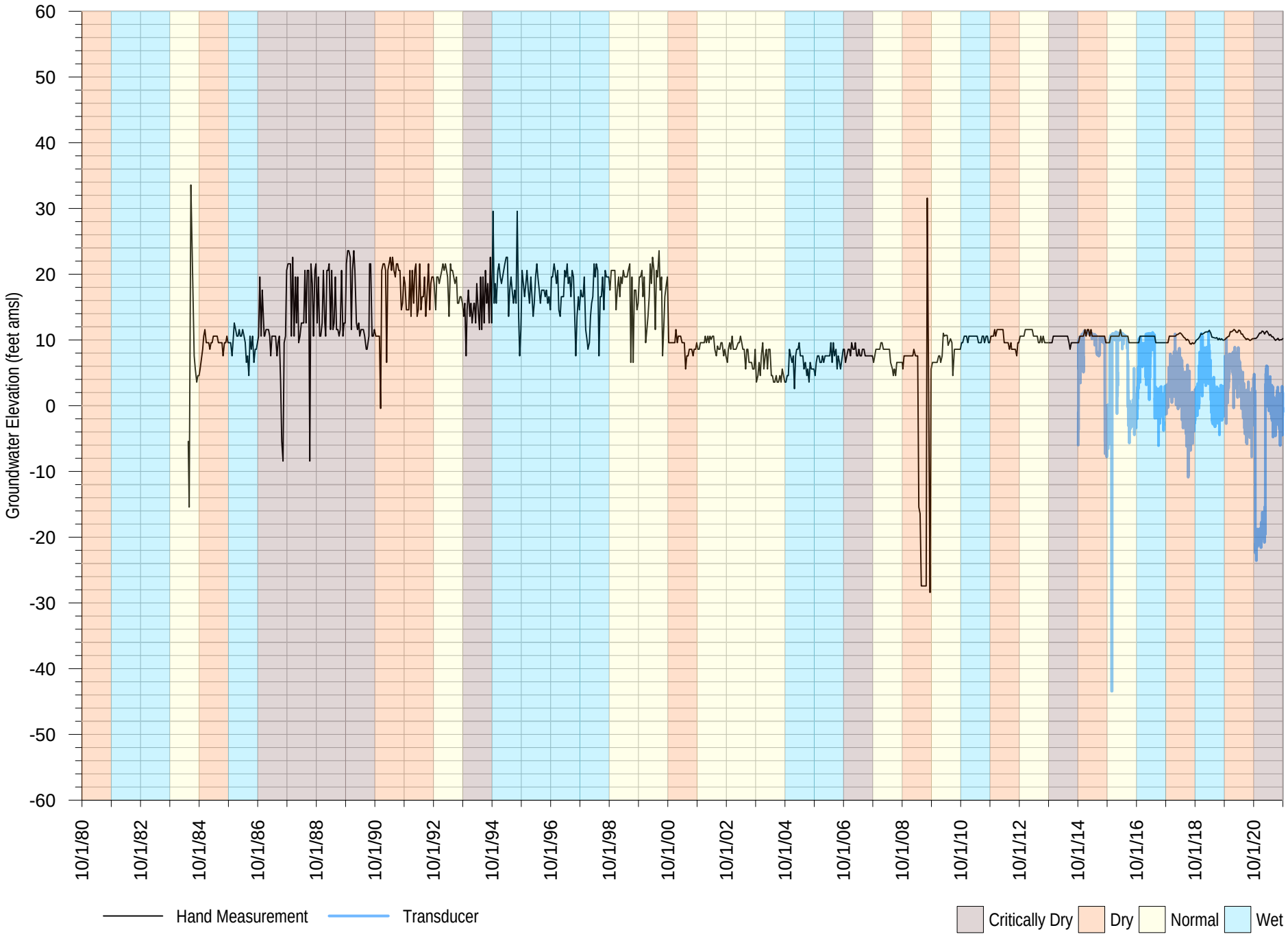
Beltz 9 PW
Aquifer Screened: Purisima A

FIGURE A-47



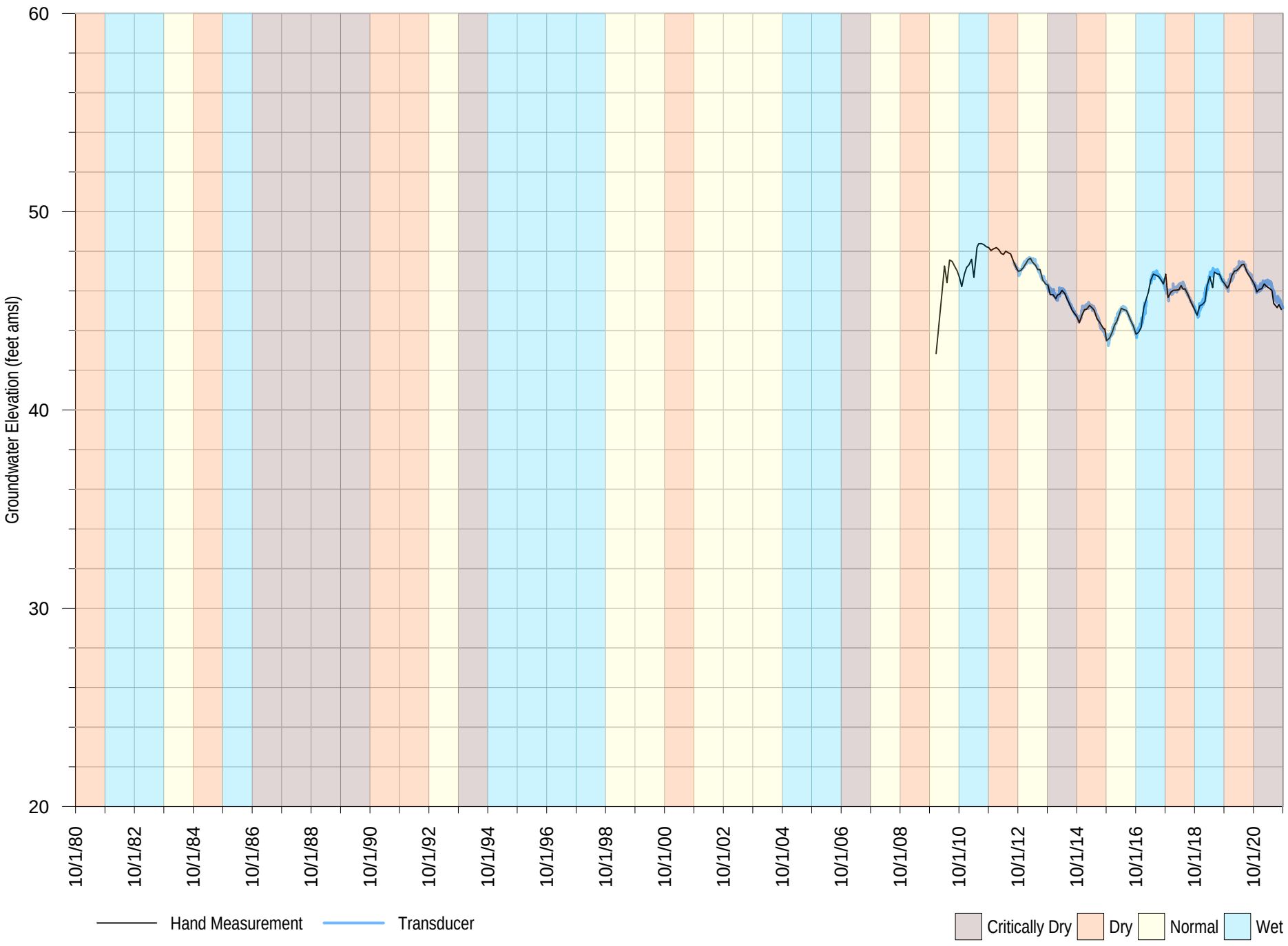
Bonita PW
Aquifer Screened: Aromas/ Purisima F

FIGURE A-48



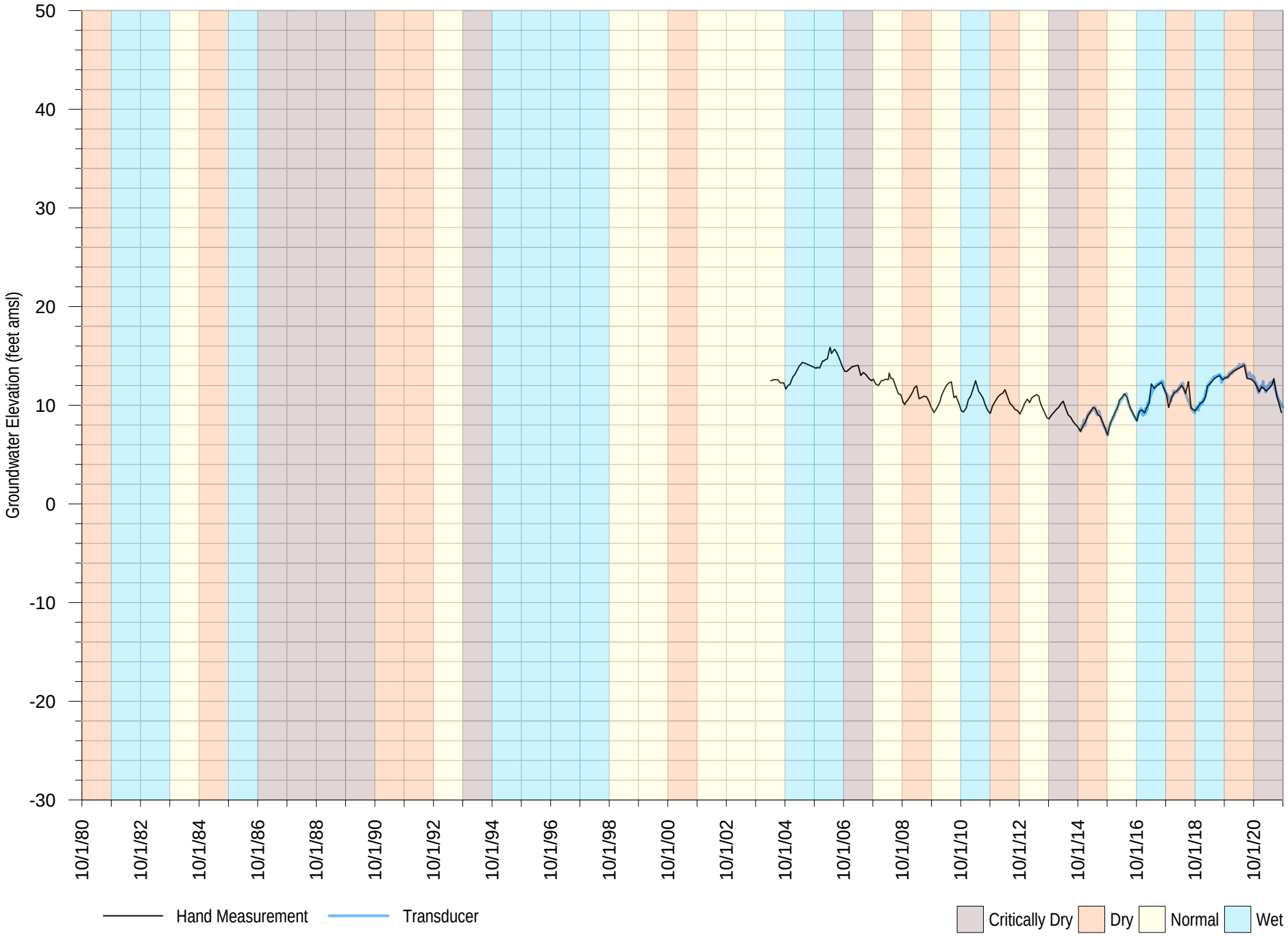
Coffee Lane Deep
Aquifer Screened: Purisima AA

FIGURE A-49



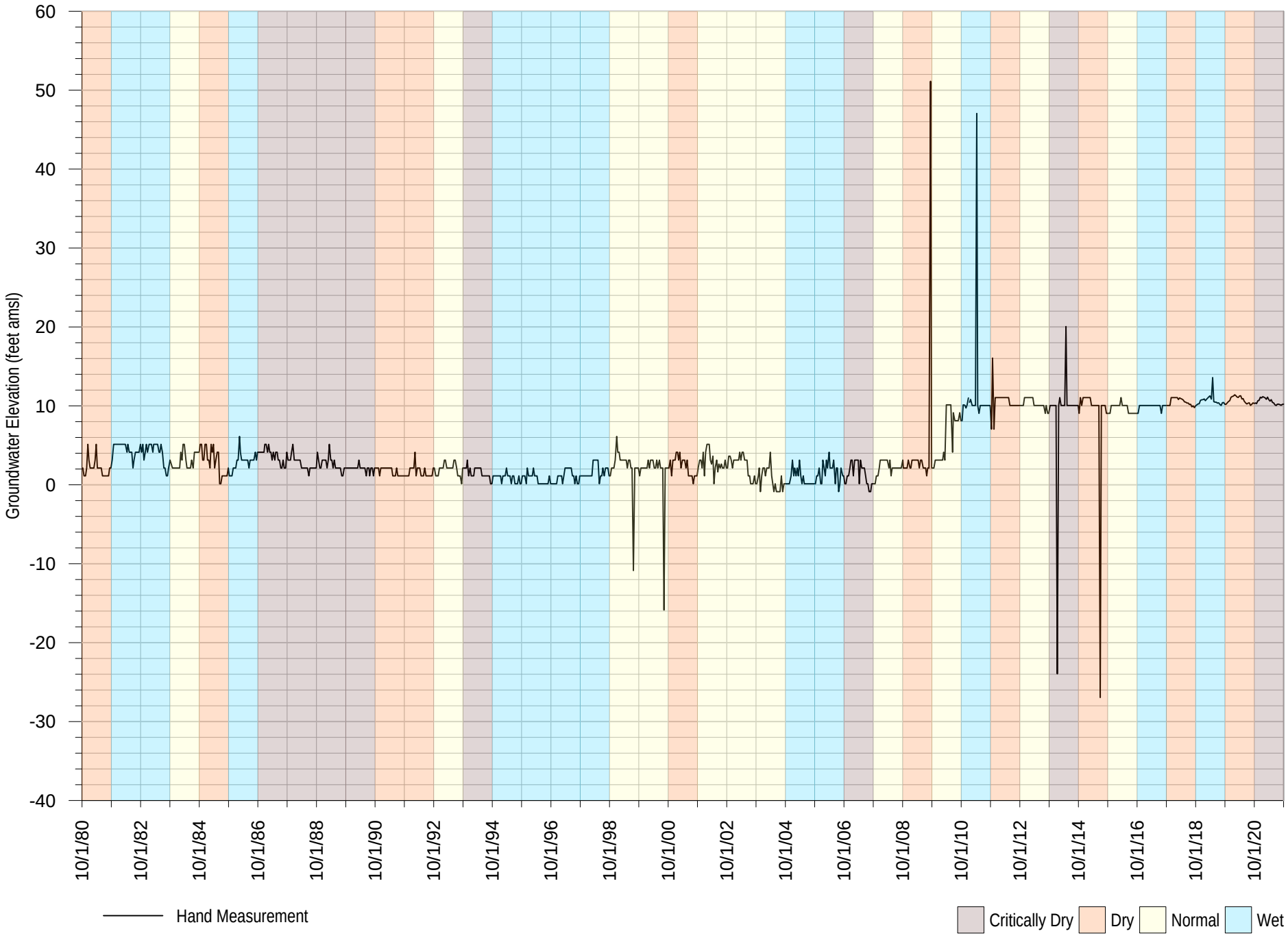
Corcoran Deep
Aquifer Screened: Purisima AA

FIGURE A-50



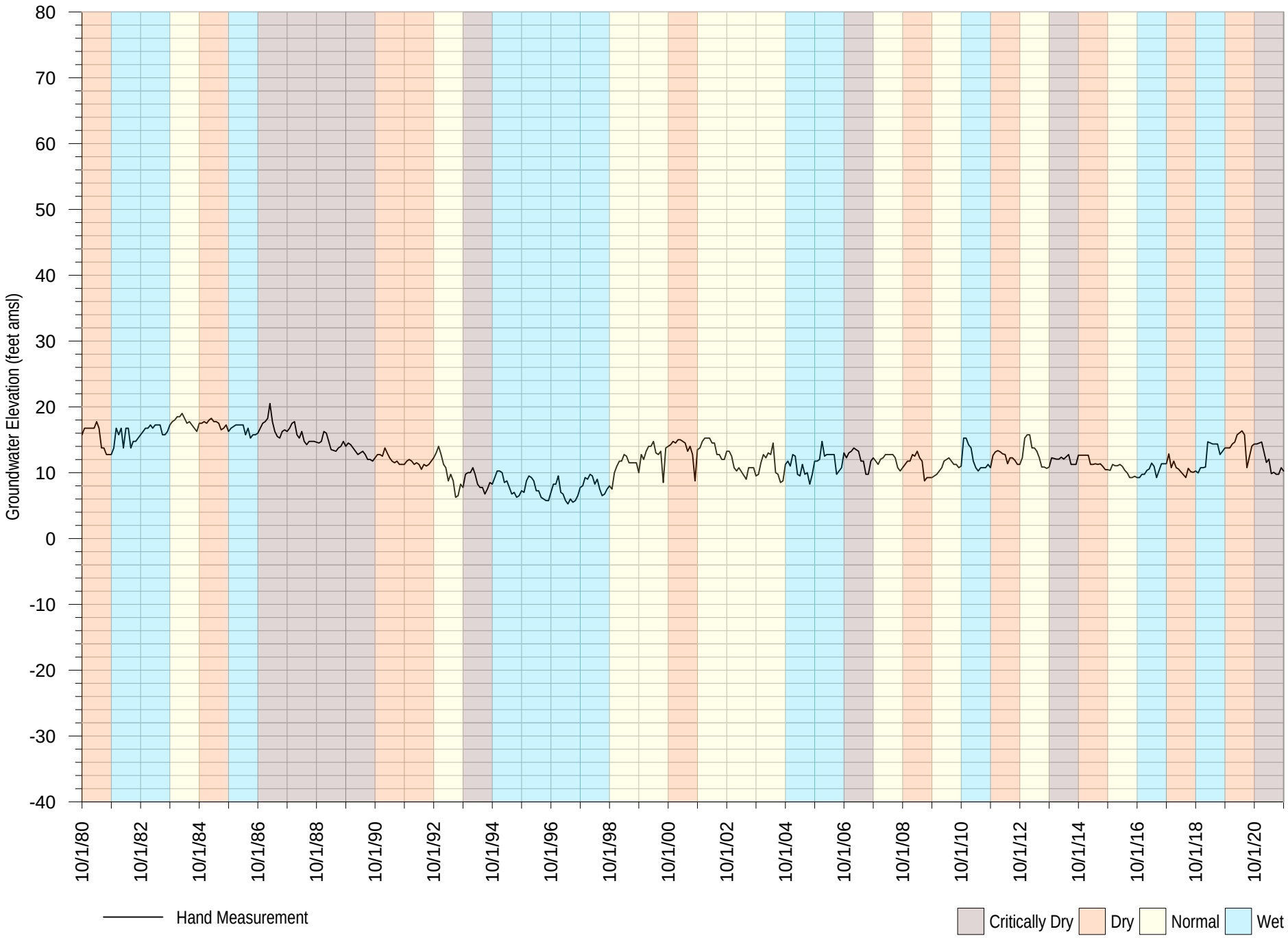
Country Club PW
Aquifer Screened: Aromas/ Purisima F

FIGURE A-51



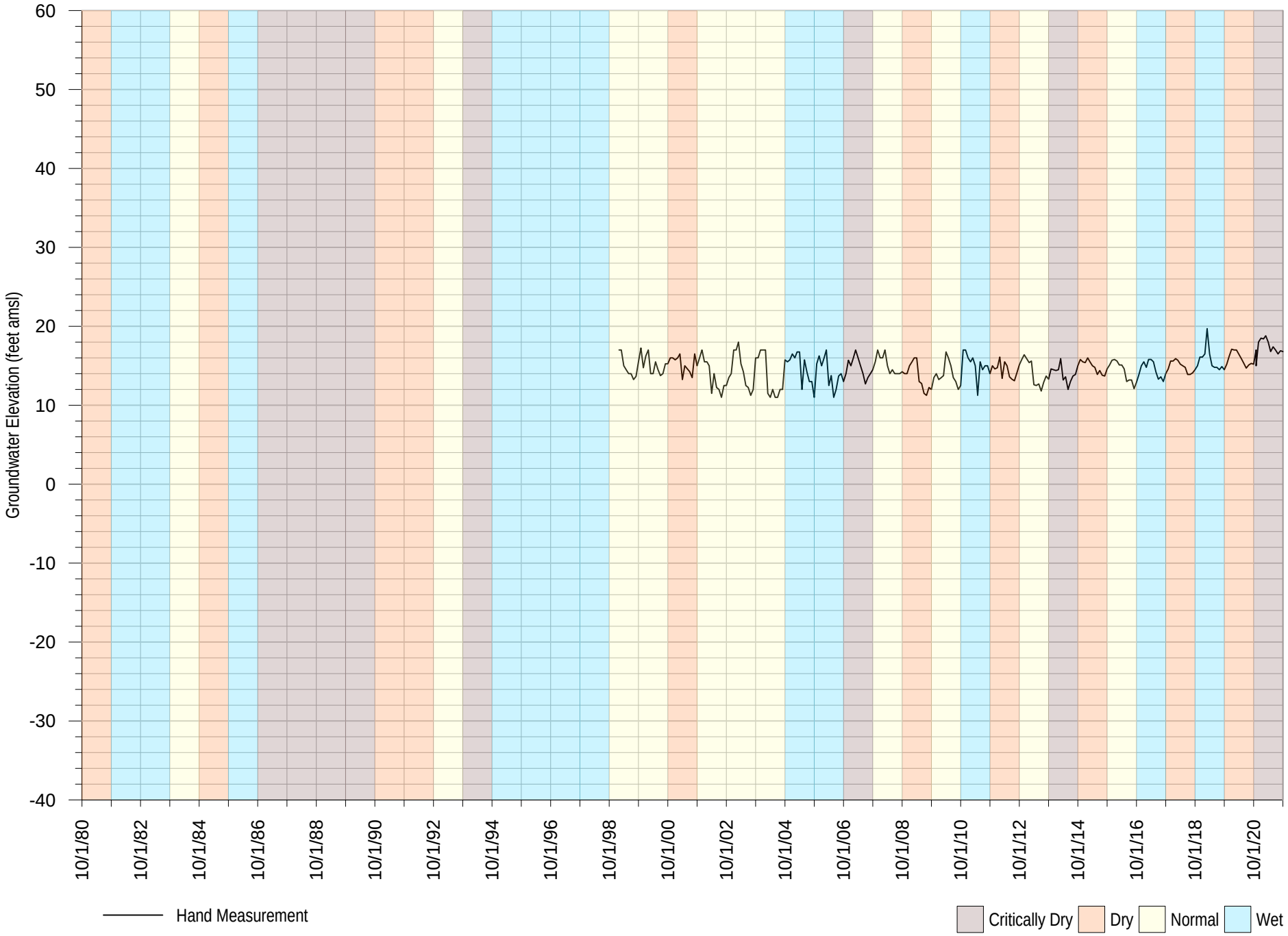
CWD-10 PW
Aquifer Screened: Aromas

FIGURE A-52



CWD-12 PW
Aquifer Screened: Aromas/ Purisima F

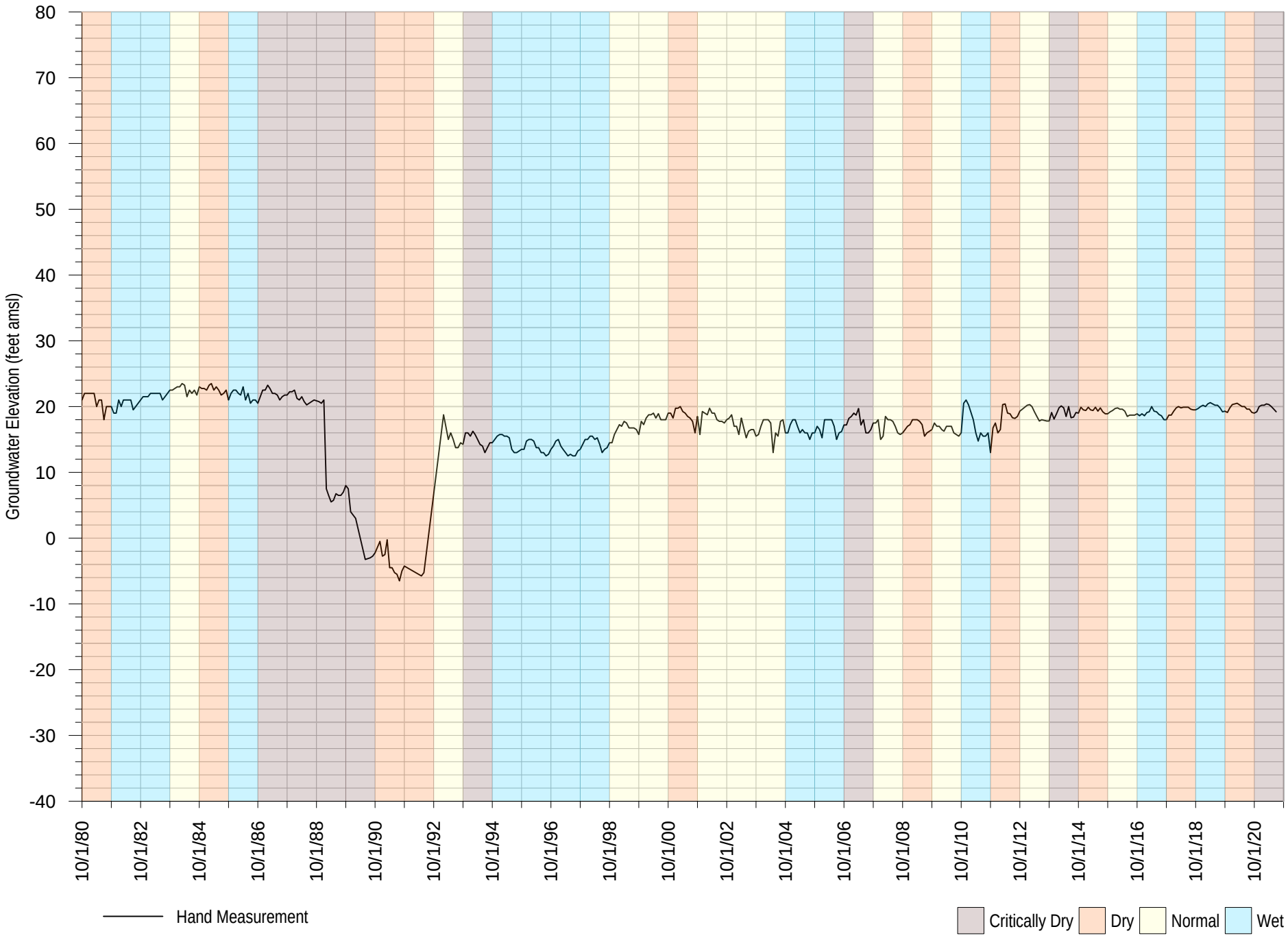
FIGURE A-53



CWD-4 PW

Aquifer Screened: Aromas/ Purisima F

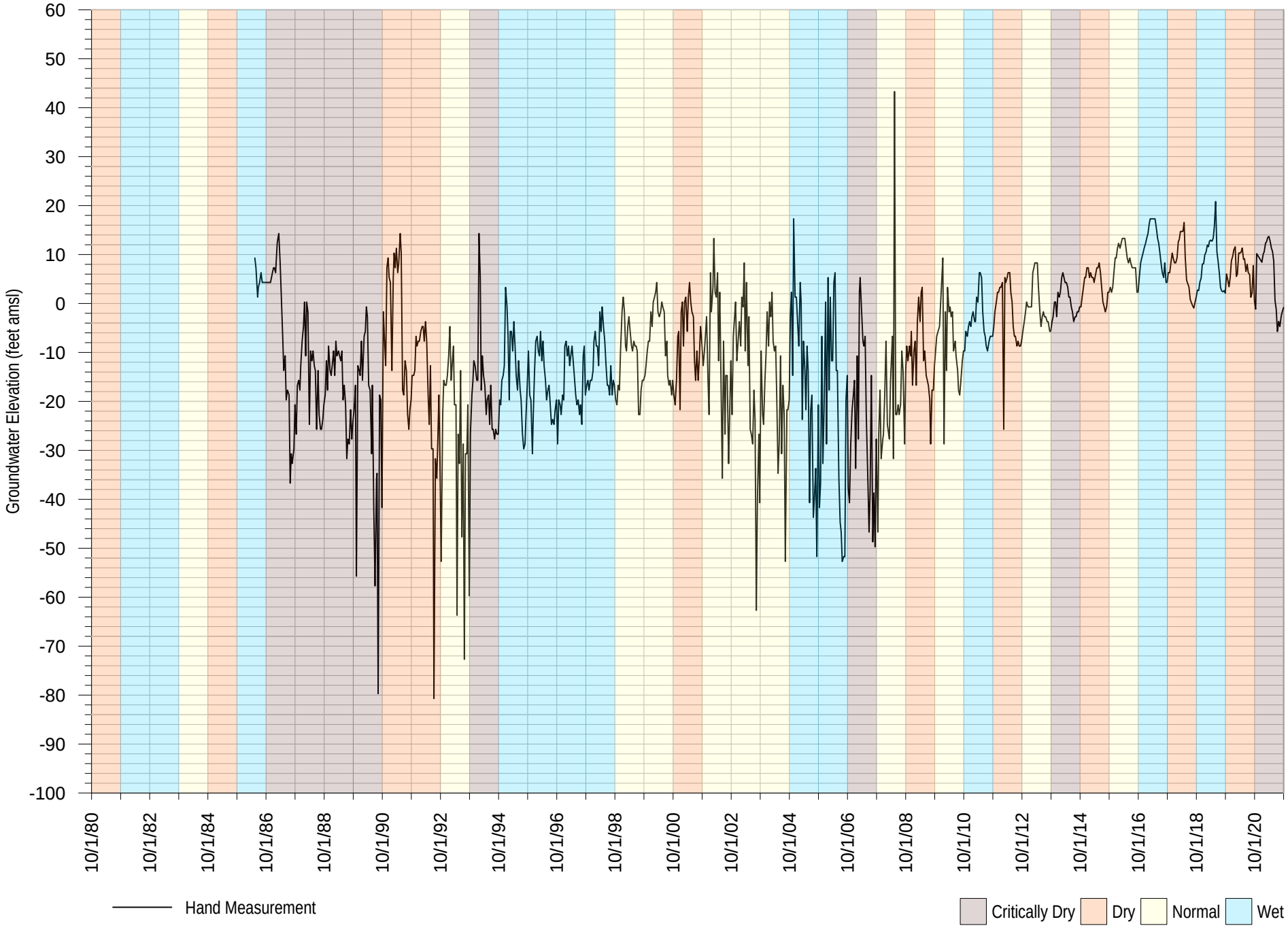
FIGURE A-54



Estates

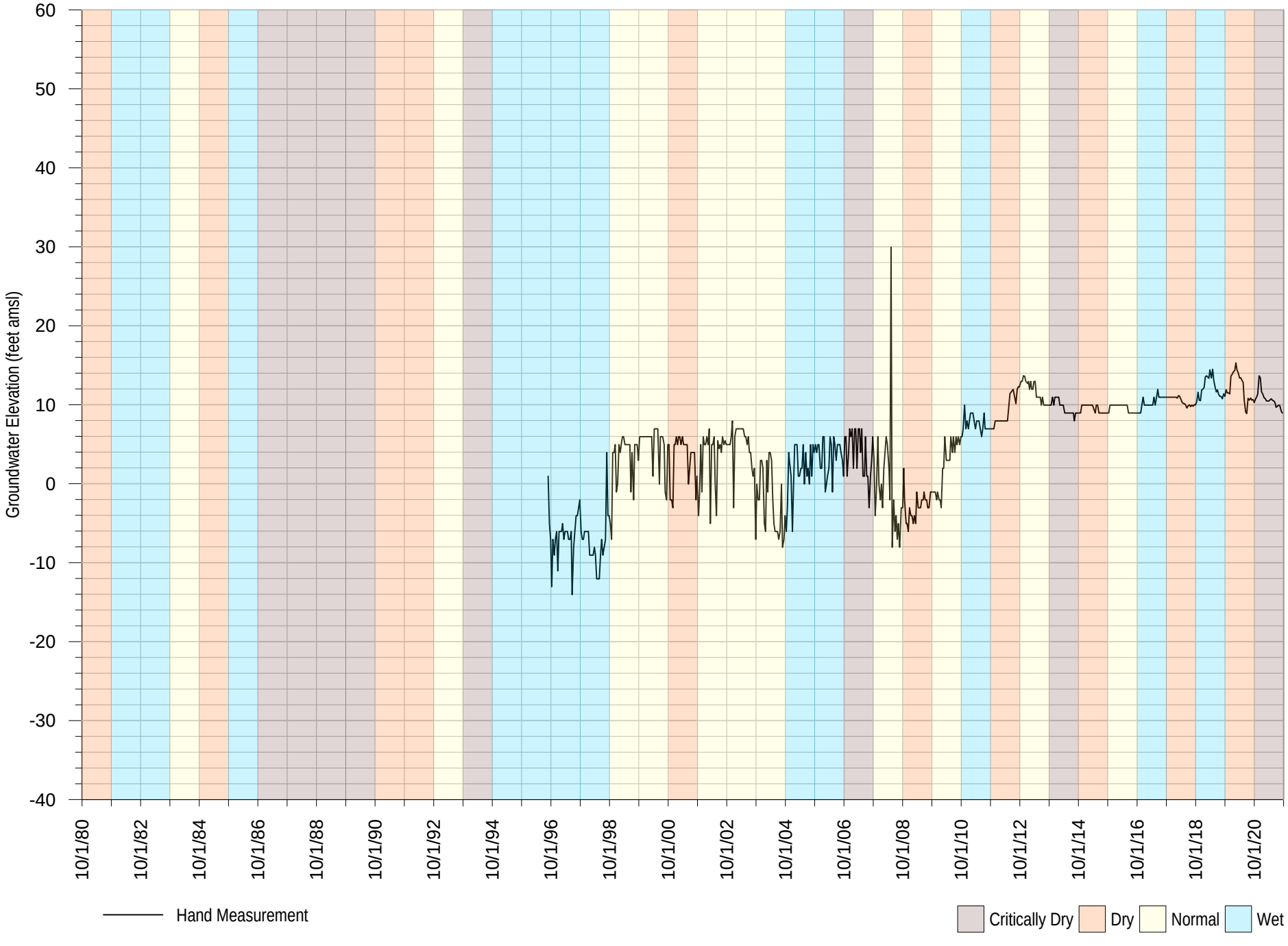
Aquifer Screened: Purisima A

FIGURE A-55



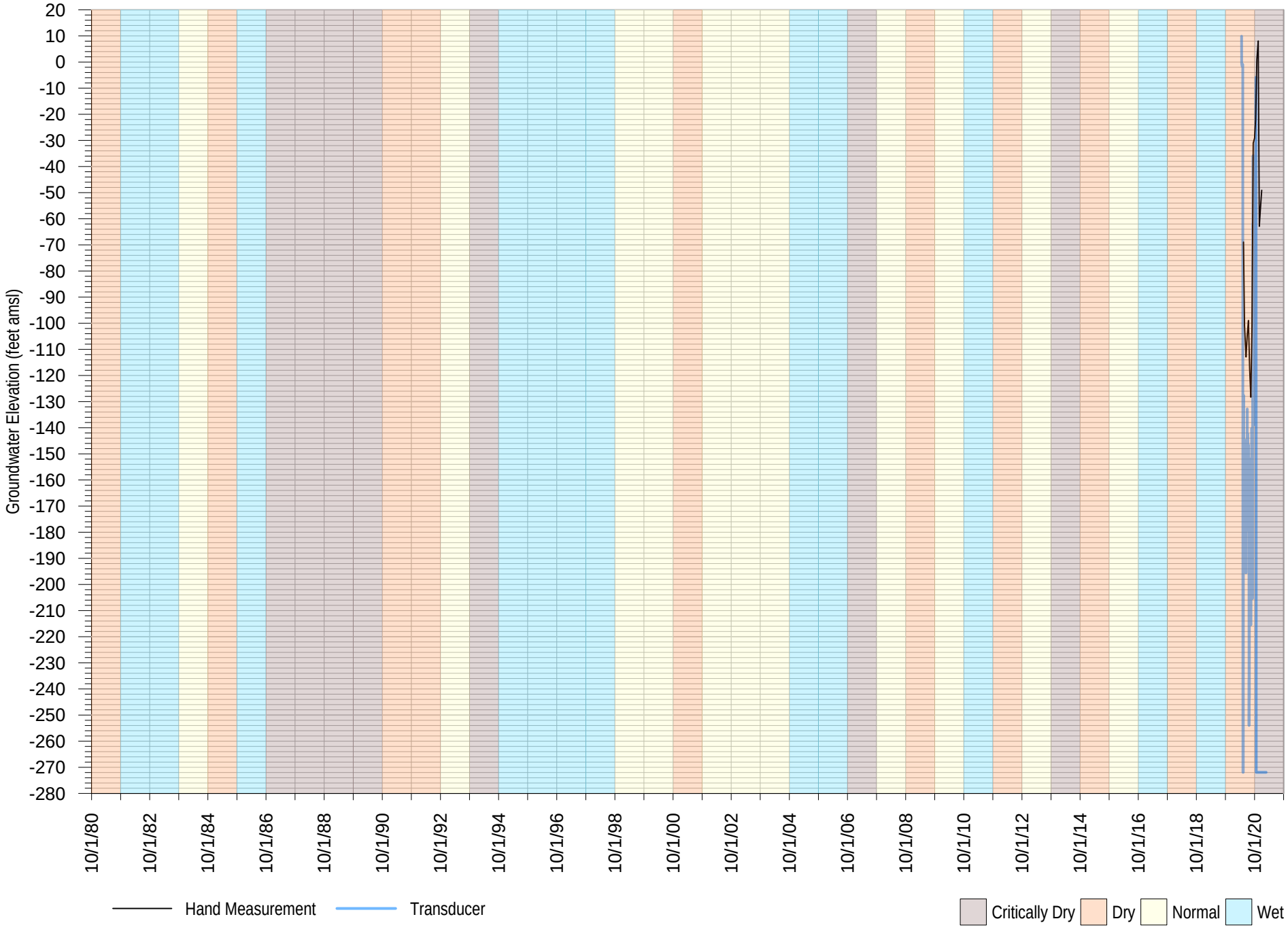
Garnet
Aquifer Screened: Purisima A

FIGURE A-56



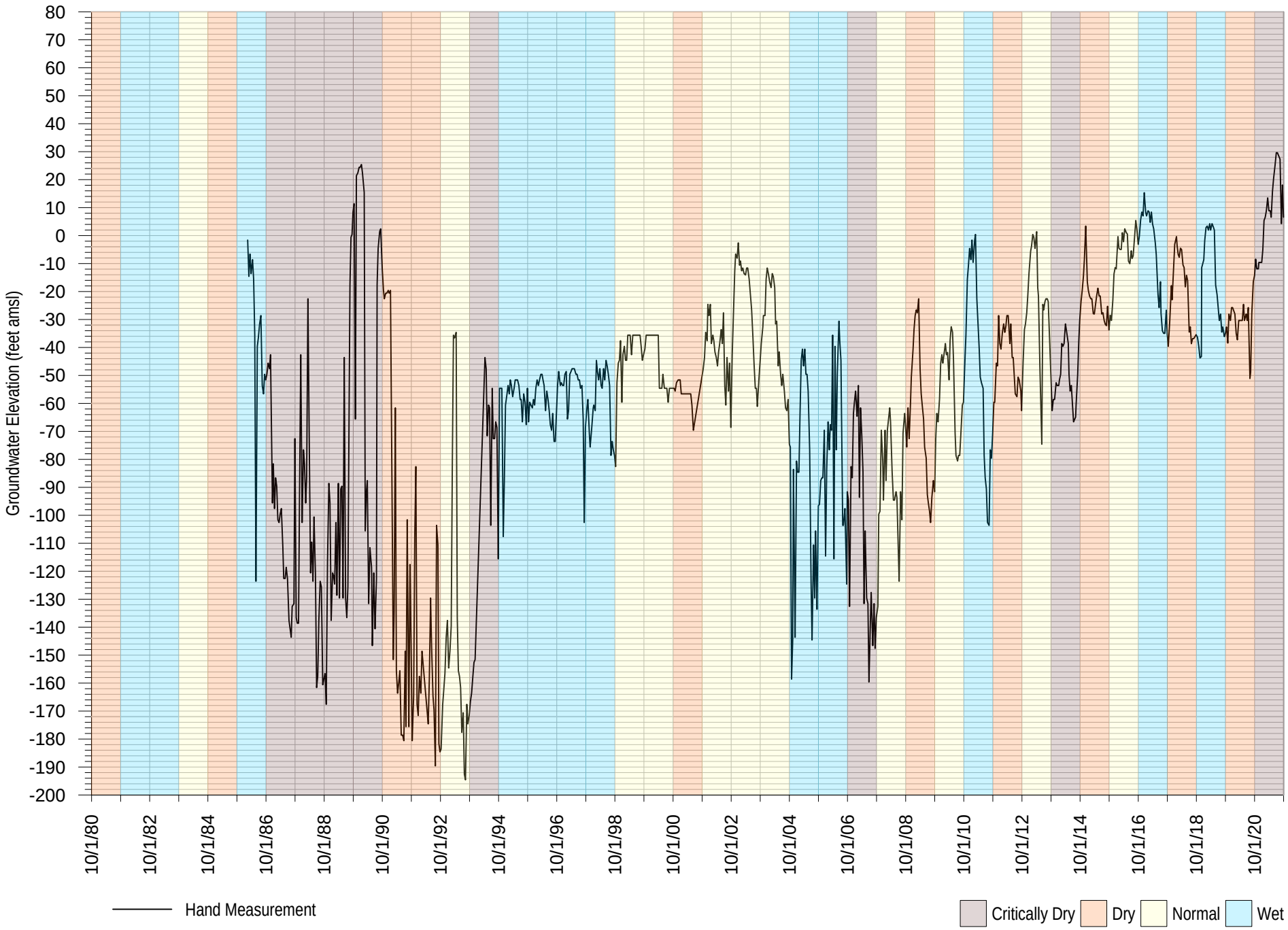
Granite Way PW
Aquifer Screened: Purisima DEF

FIGURE A-57



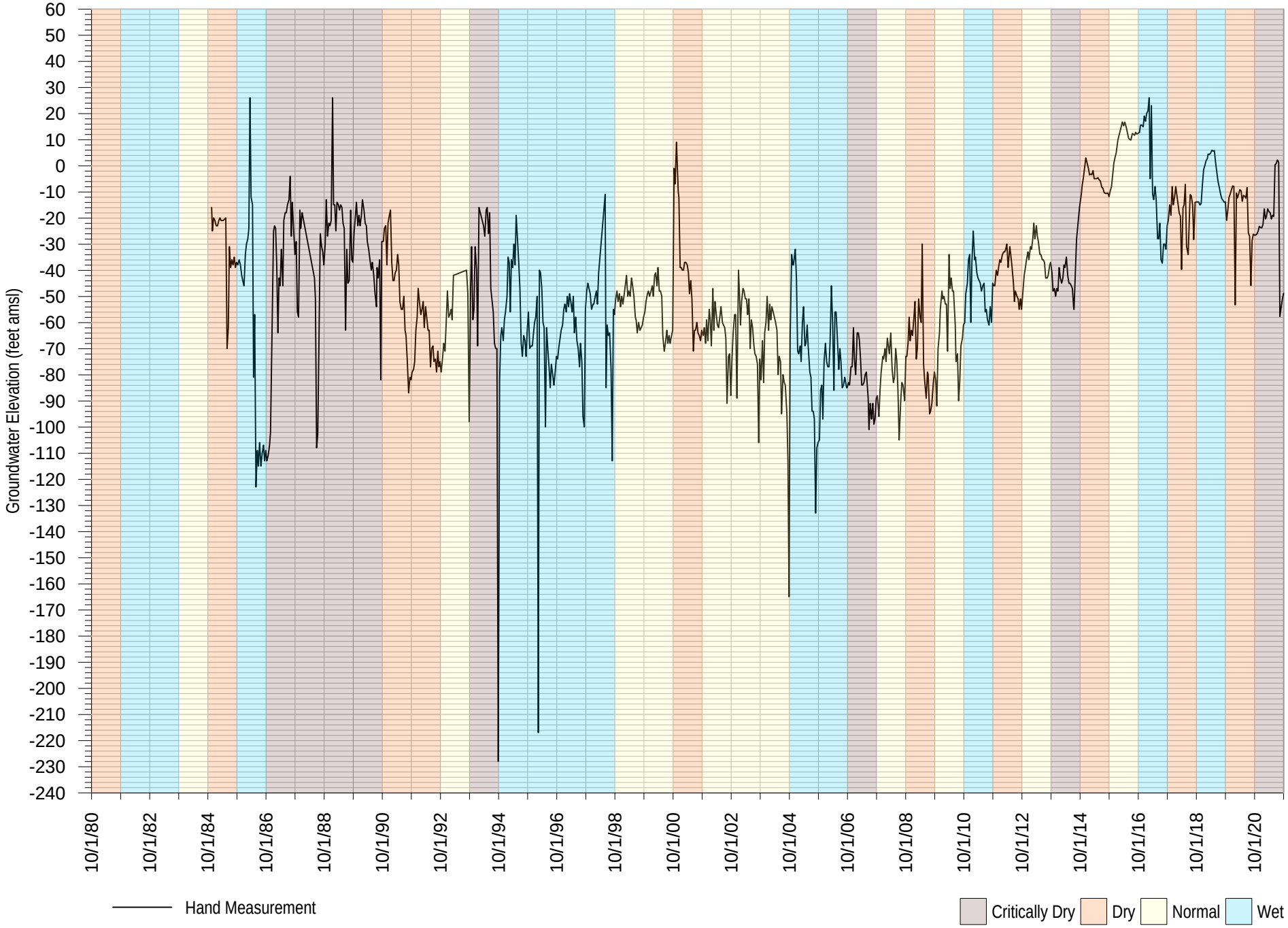
Ledyard
Aquifer Screened: Purisima BC

FIGURE A-58



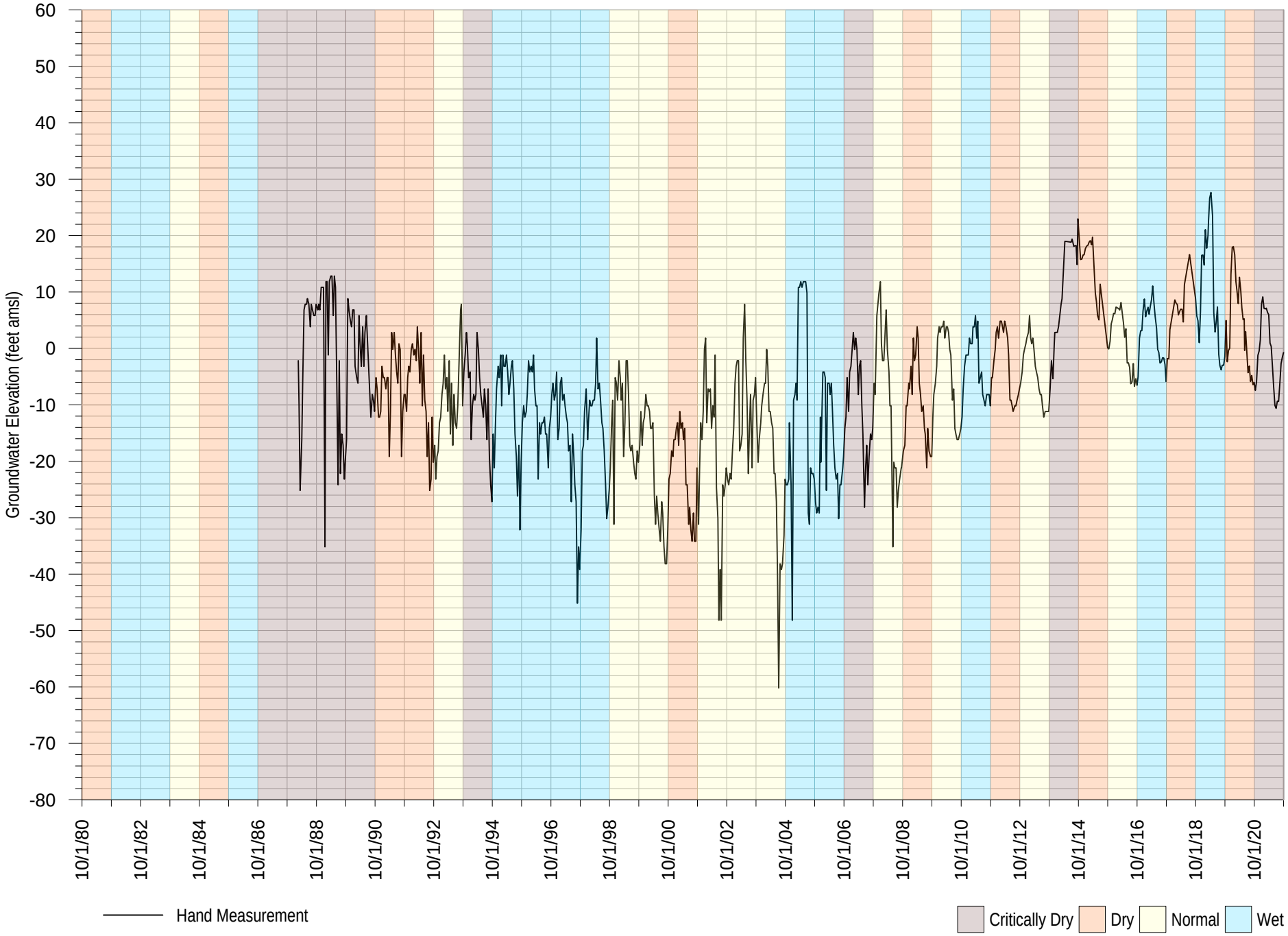
Madeline PW
Aquifer Screened: Purisima BC

FIGURE A-59



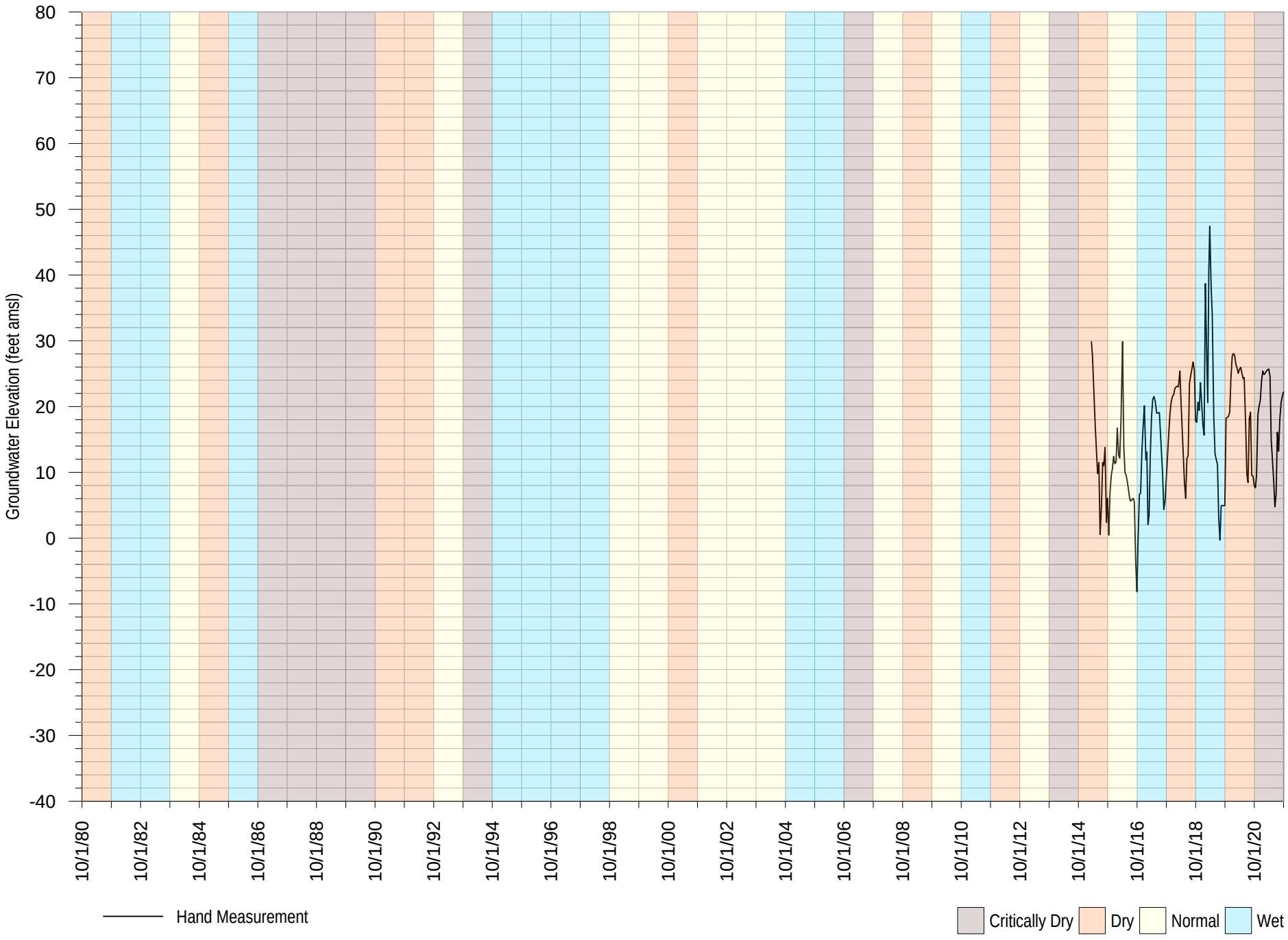
Main Street PW
Aquifer Screened: Purisima A

FIGURE A-60



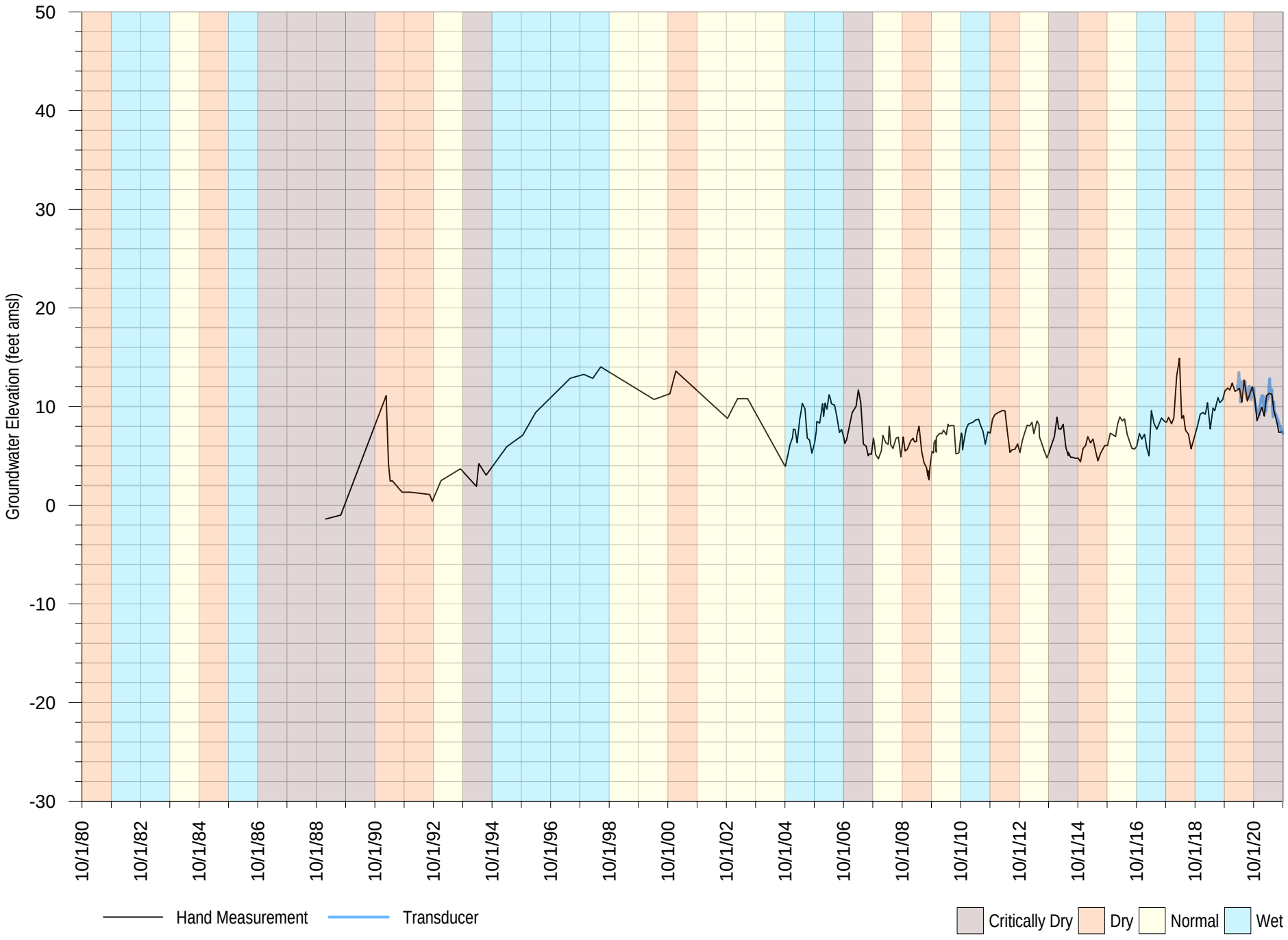
O'Neill Ranch PW
Aquifer Screened: Purisima AA/Tu

FIGURE A-61



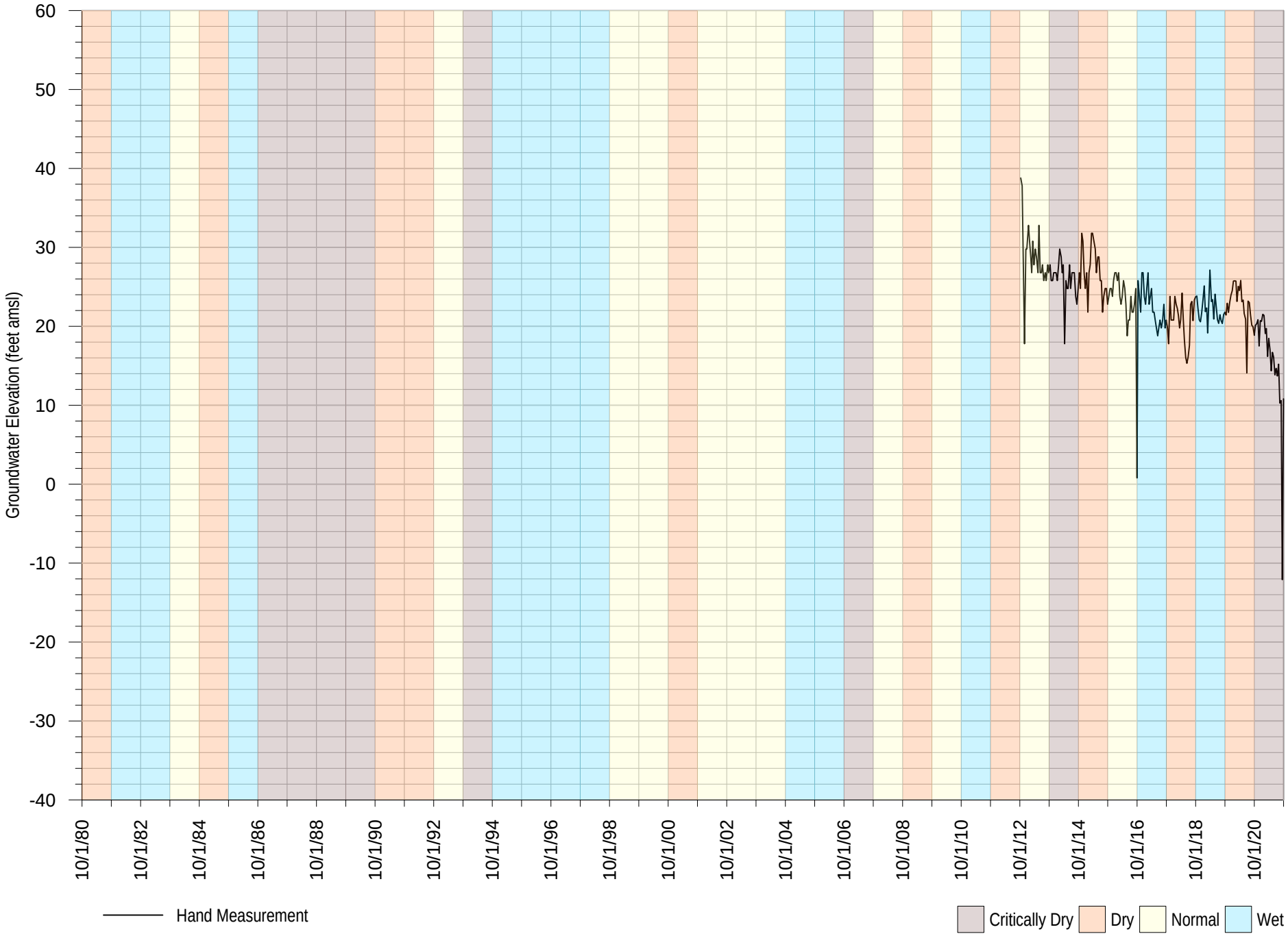
Pleasure Point Shallow
Aquifer Screened: Purisima A

FIGURE A-62



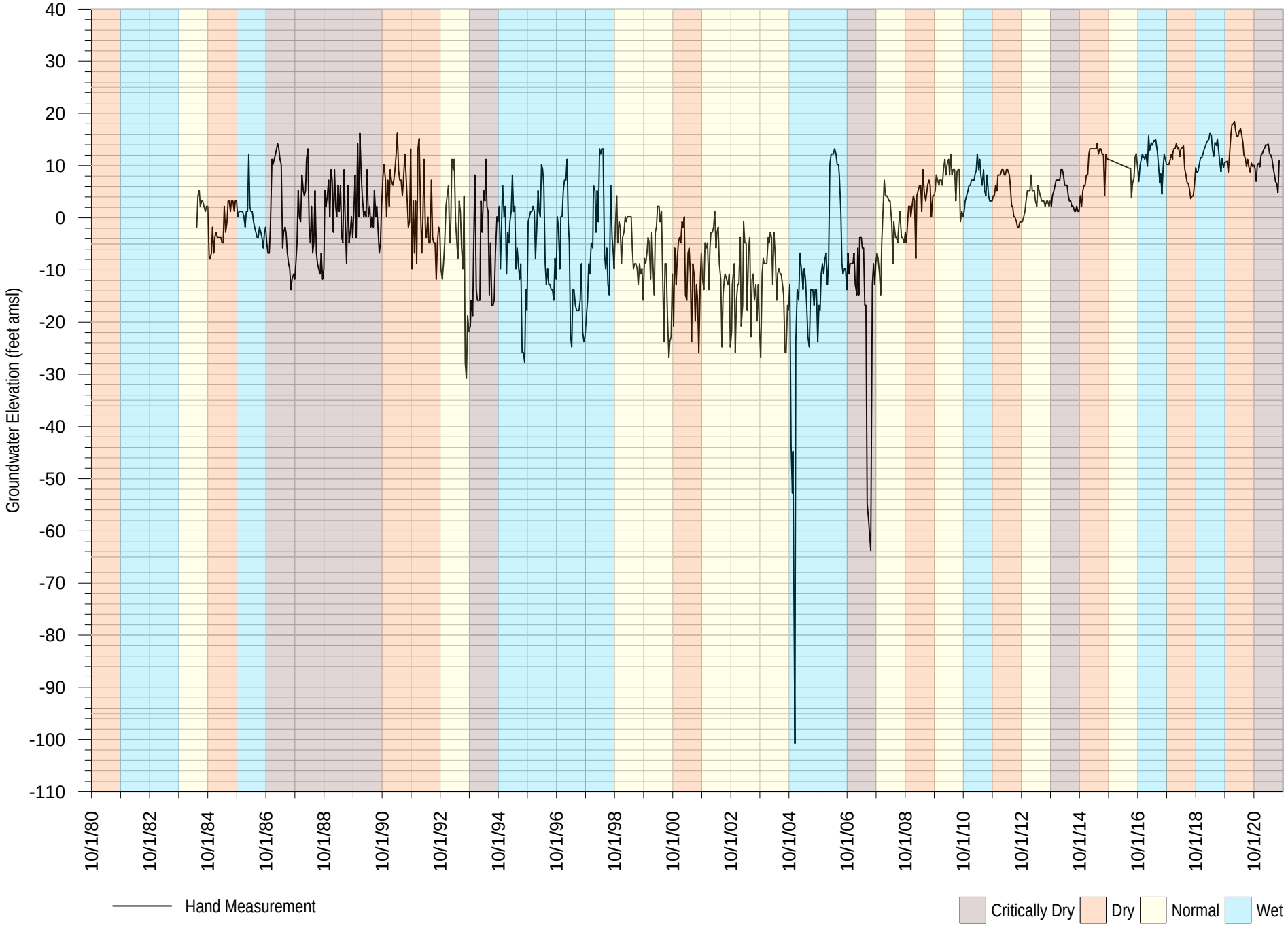
Polo Grounds PW
Aquifer Screened: Aromas/ Purisima F

FIGURE A-63



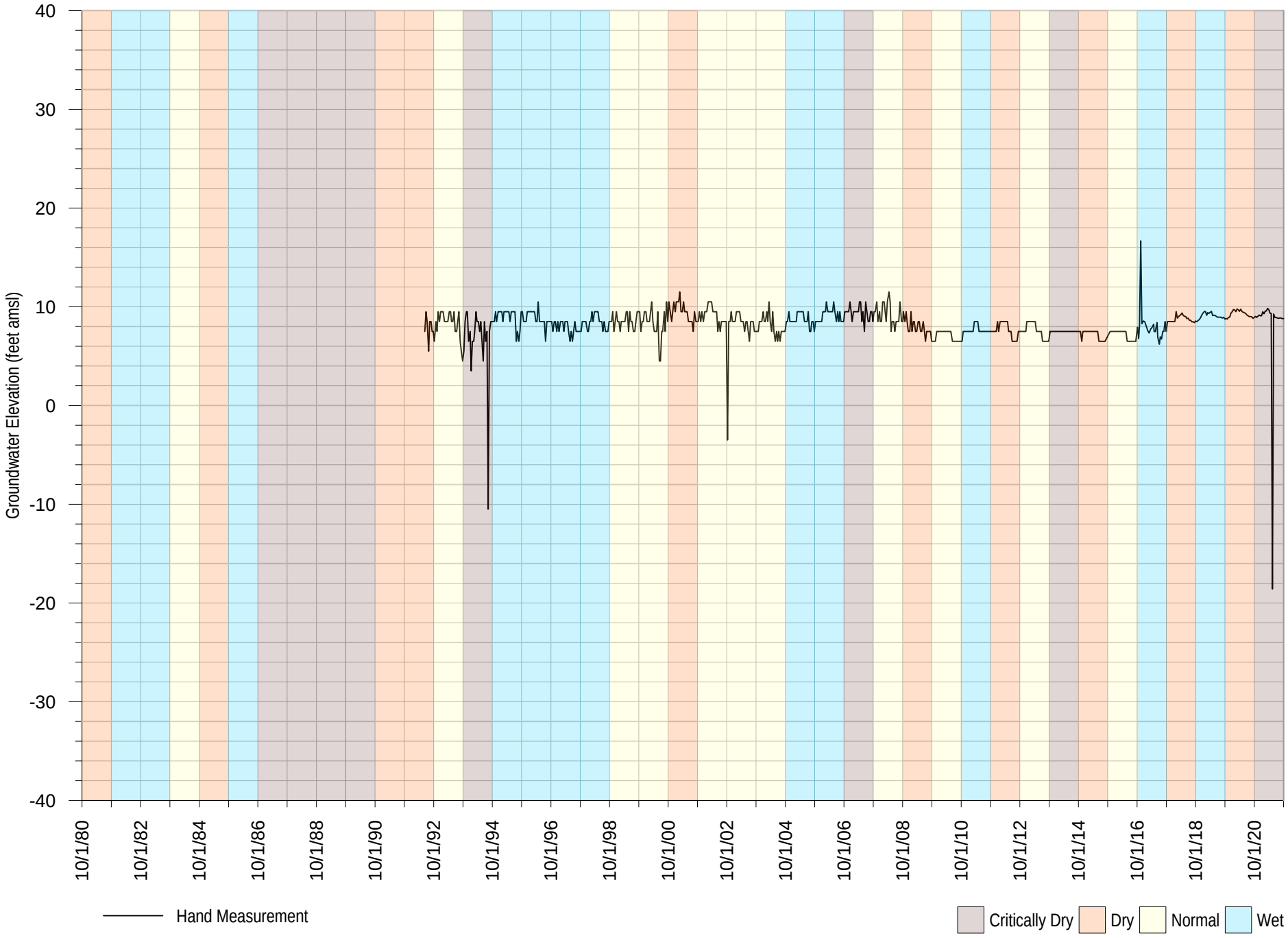
Rosedale PW
Aquifer Screened: Purisima A

FIGURE A-64



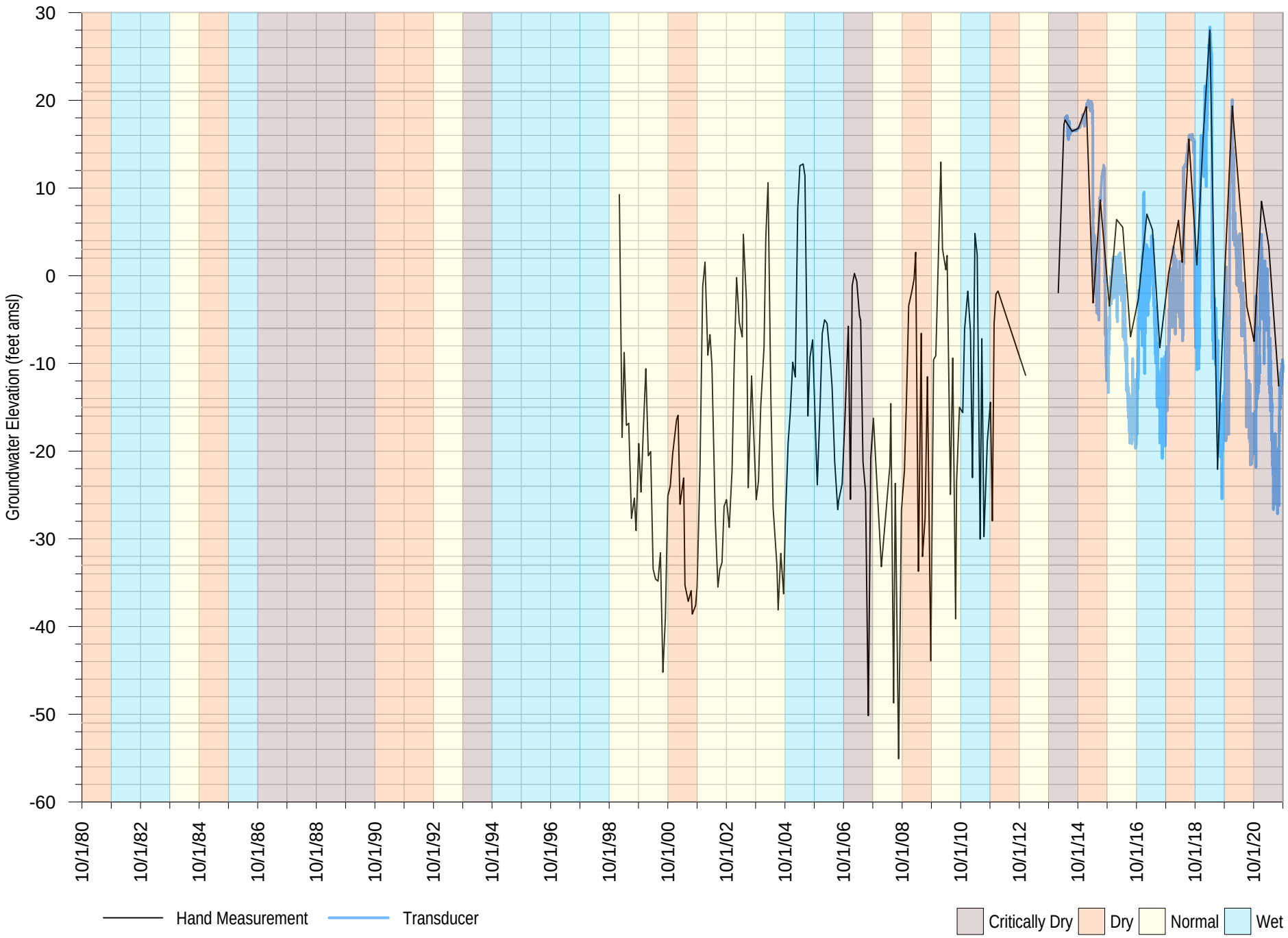
San Andreas PW
Aquifer Screened: Aromas/ Purisima F

FIGURE A-65



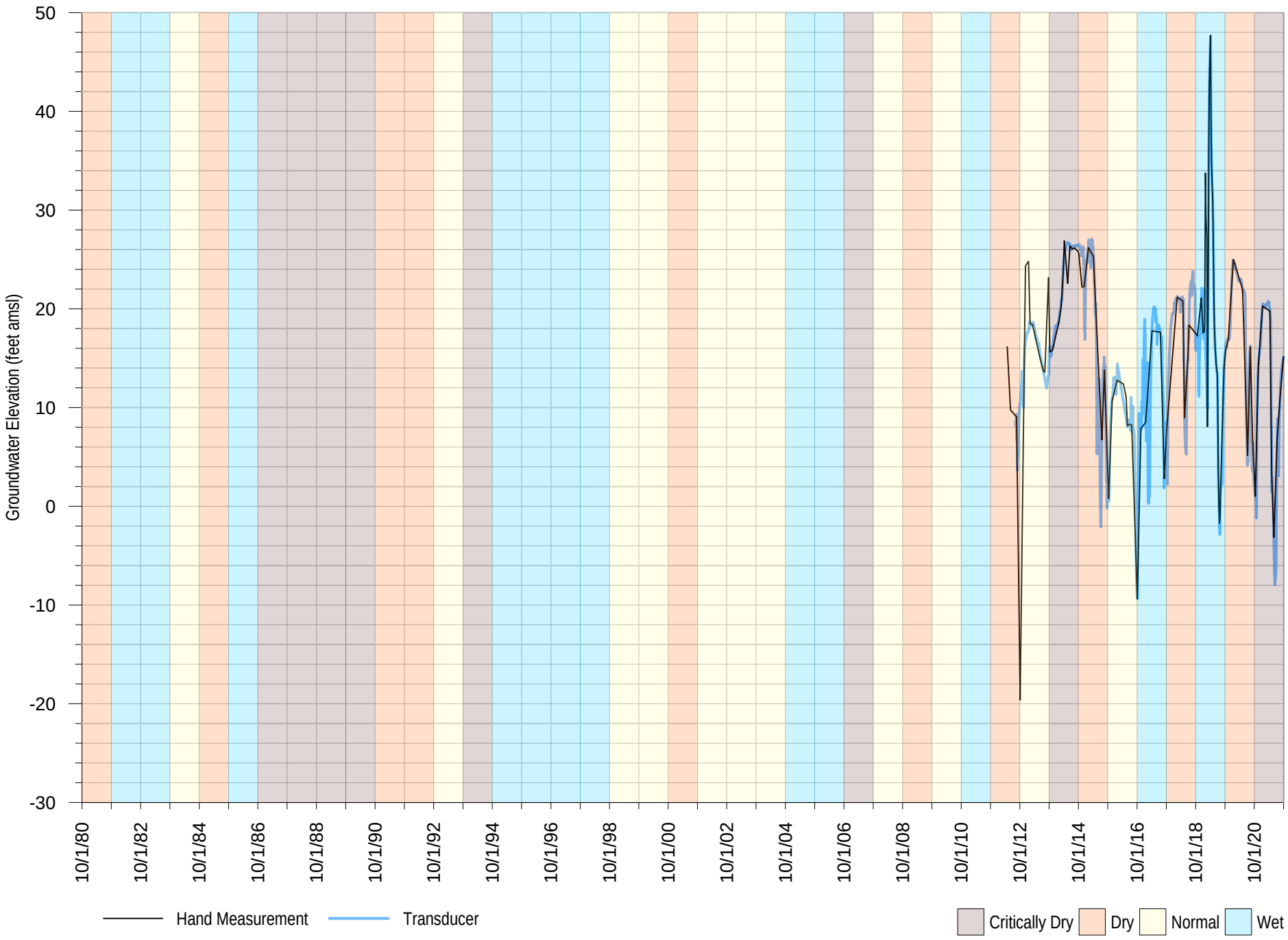
SC-18AA & SC-18RAA at Main Street
Aquifer Screened: Tu

FIGURE A-66



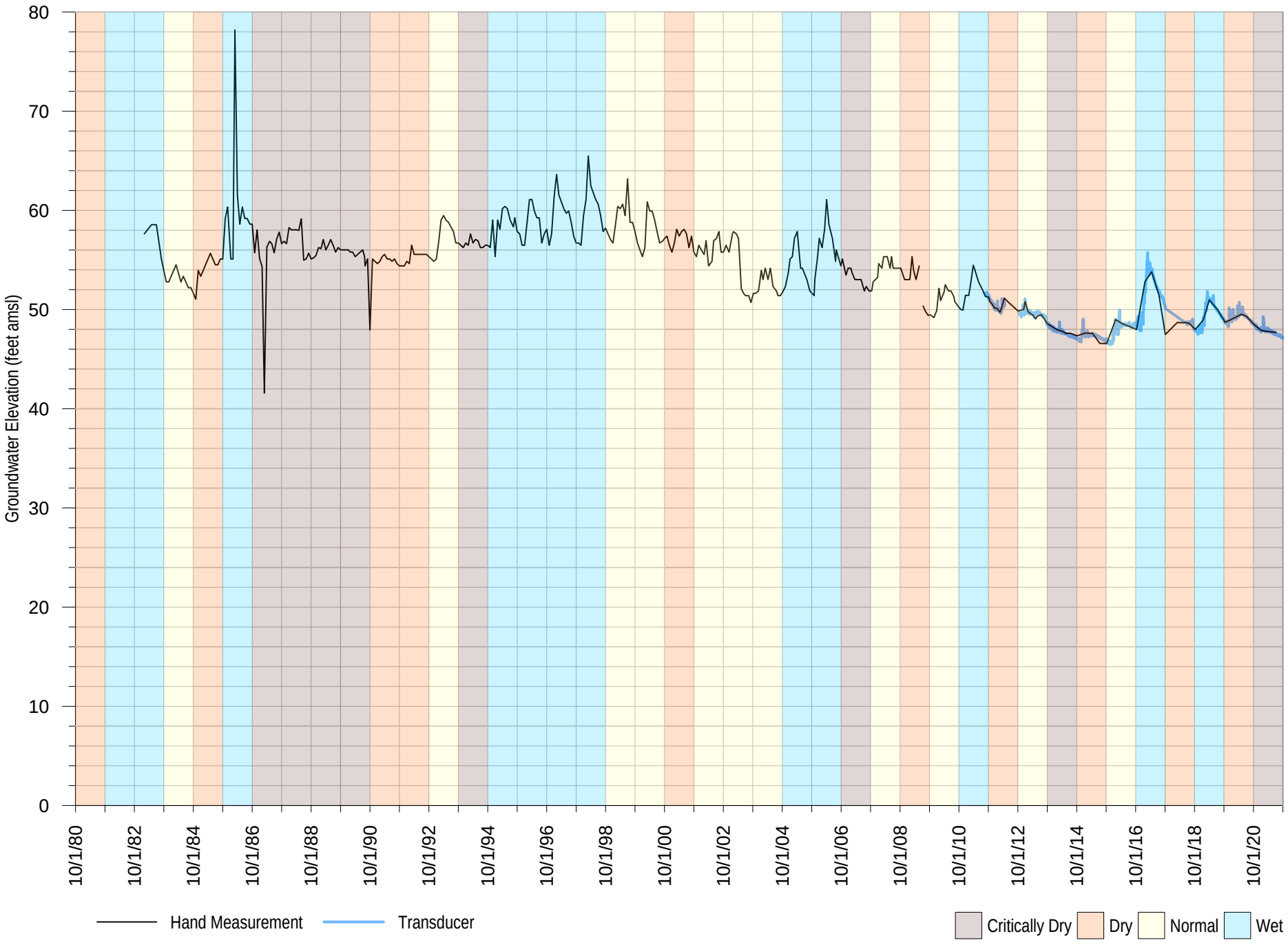
SC-22AAA at 41st Ave
Aquifer Screened: Purisima AA

FIGURE A-67



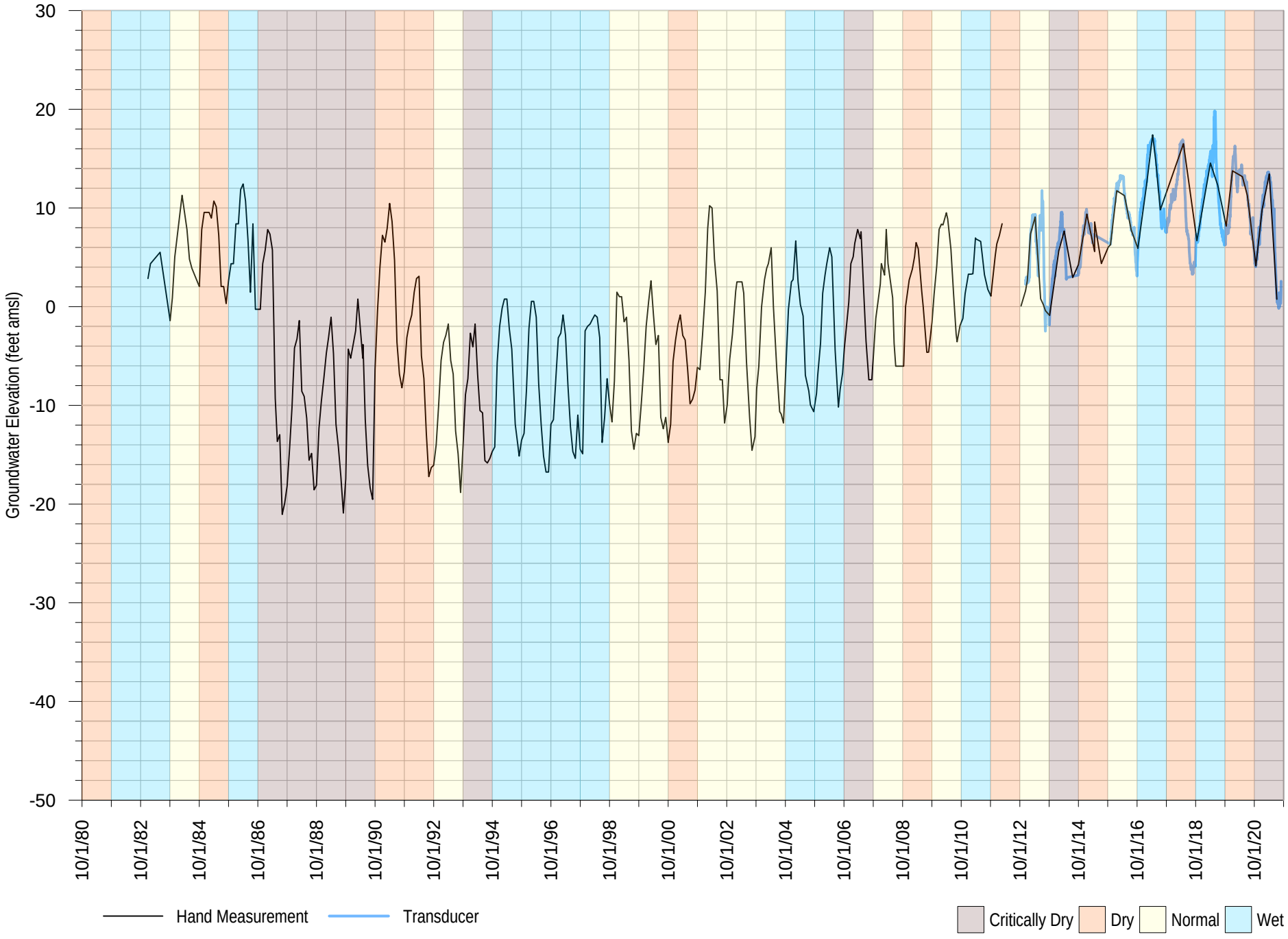
SC-3C & SC-3RC at Escalona
Aquifer Screened: Purisima BC

FIGURE A-68



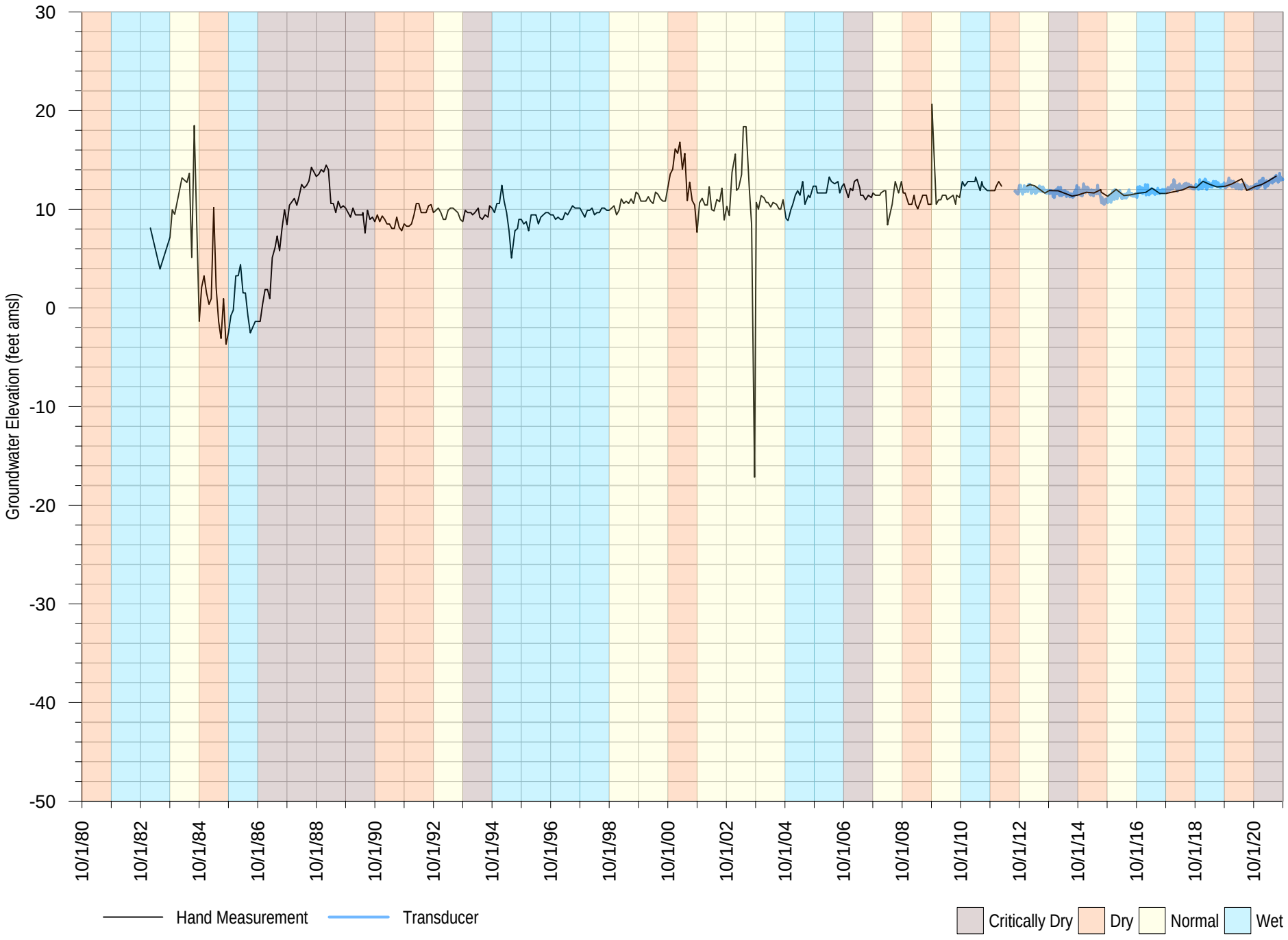
SC-9A & SC-9RA at Seacliff
Aquifer Screened: Purisima A

FIGURE A-69



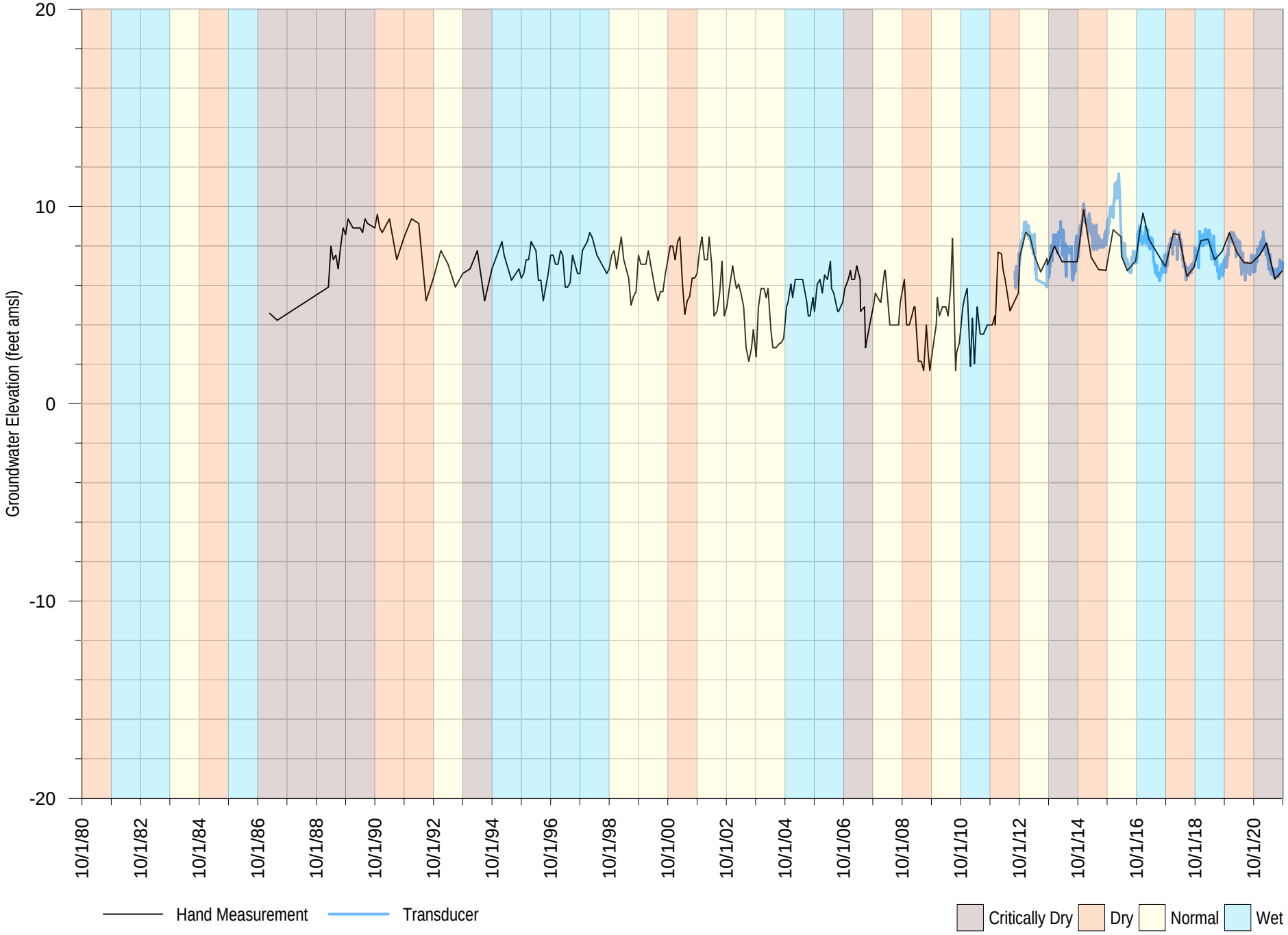
SC-9E & SC-9RE at Seacliff
Aquifer Screened: Purisima DEF

FIGURE A-70



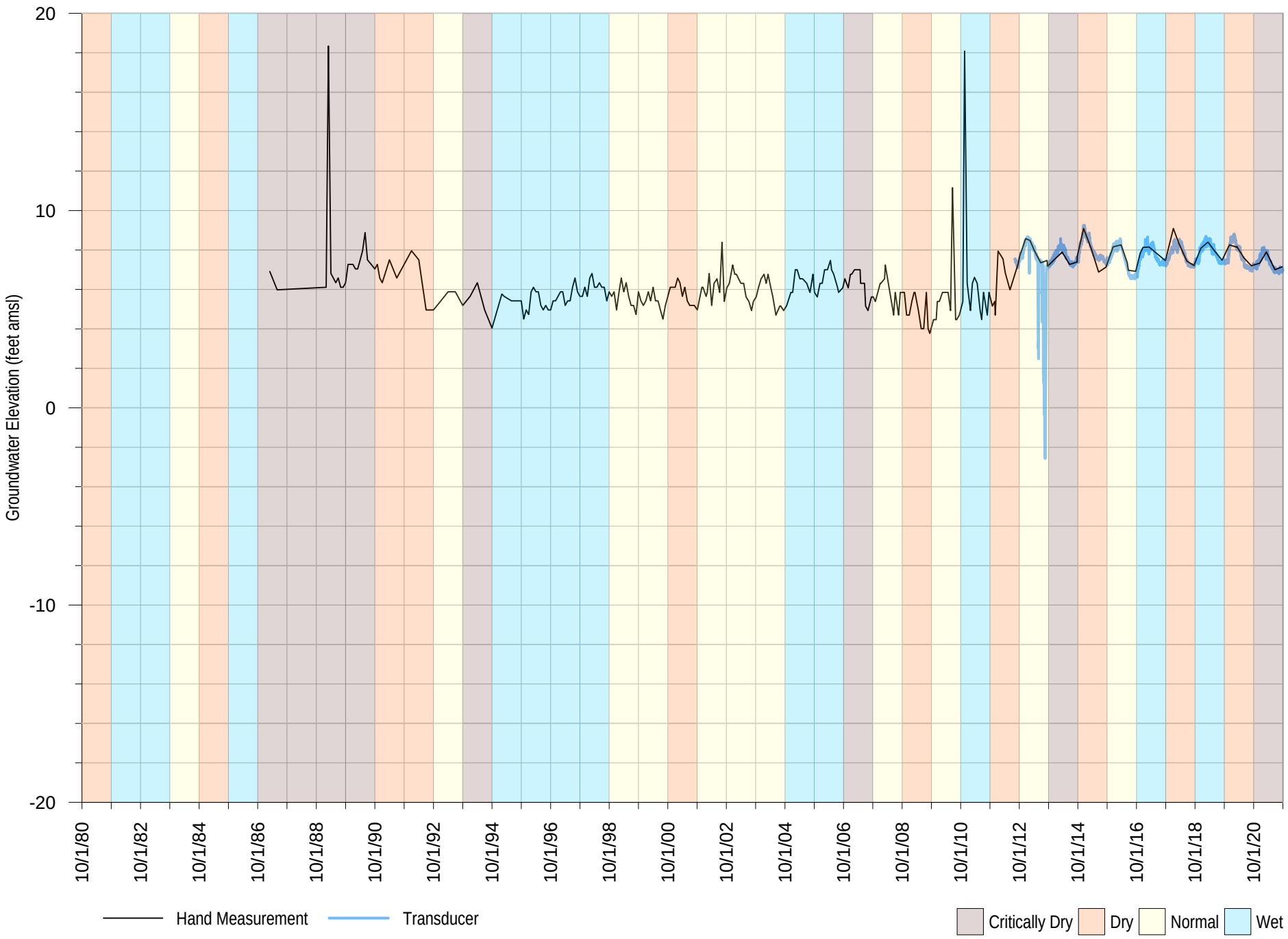
SC-A1A at Cliff Drive
Aquifer Screened: Purisima DEF

FIGURE A-71



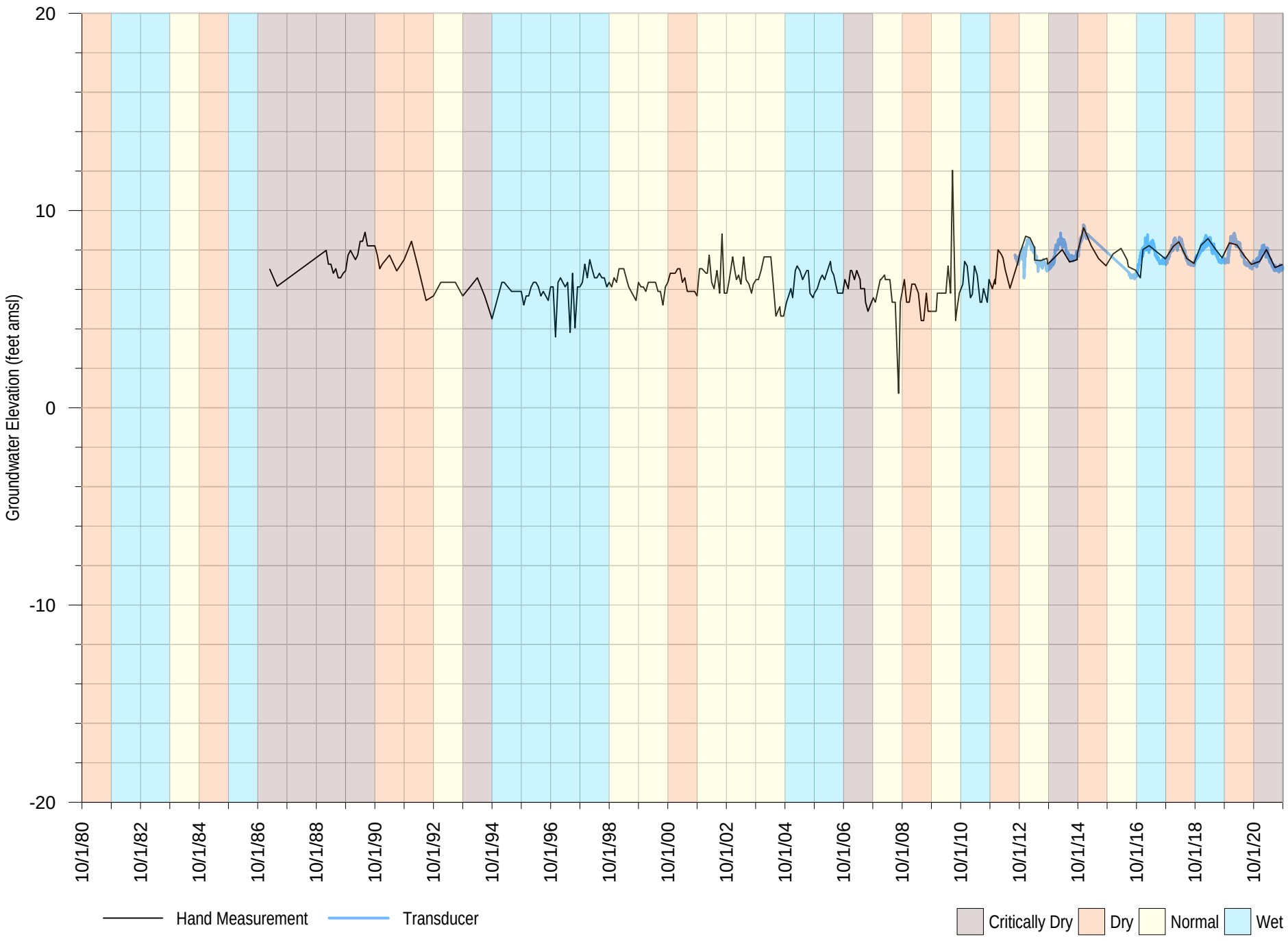
SC-A1C at Cliff Drive
Aquifer Screened: Aromas

FIGURE A-72



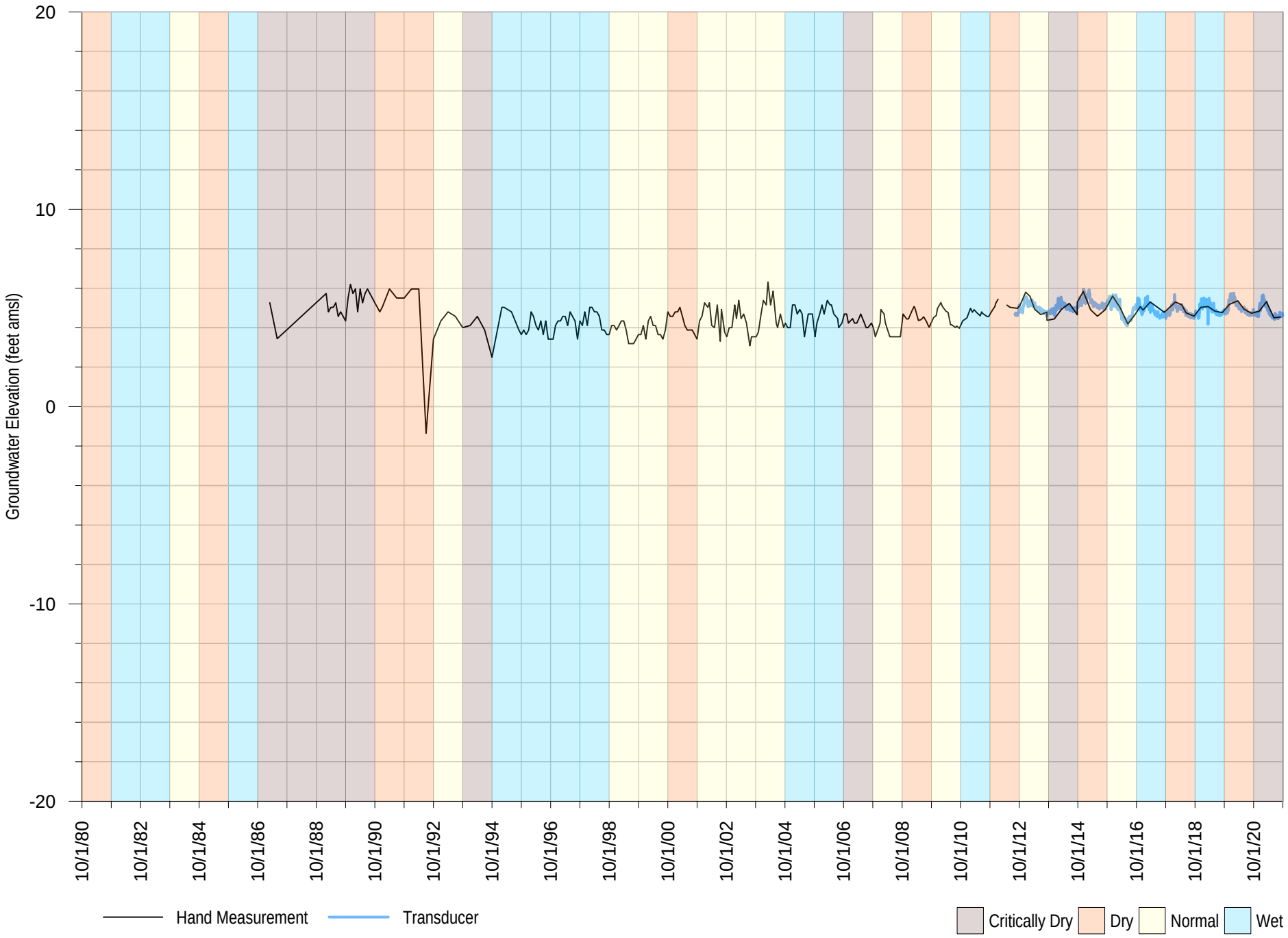
SC-A1D at Cliff Drive
Aquifer Screened: Aromas

FIGURE A-73



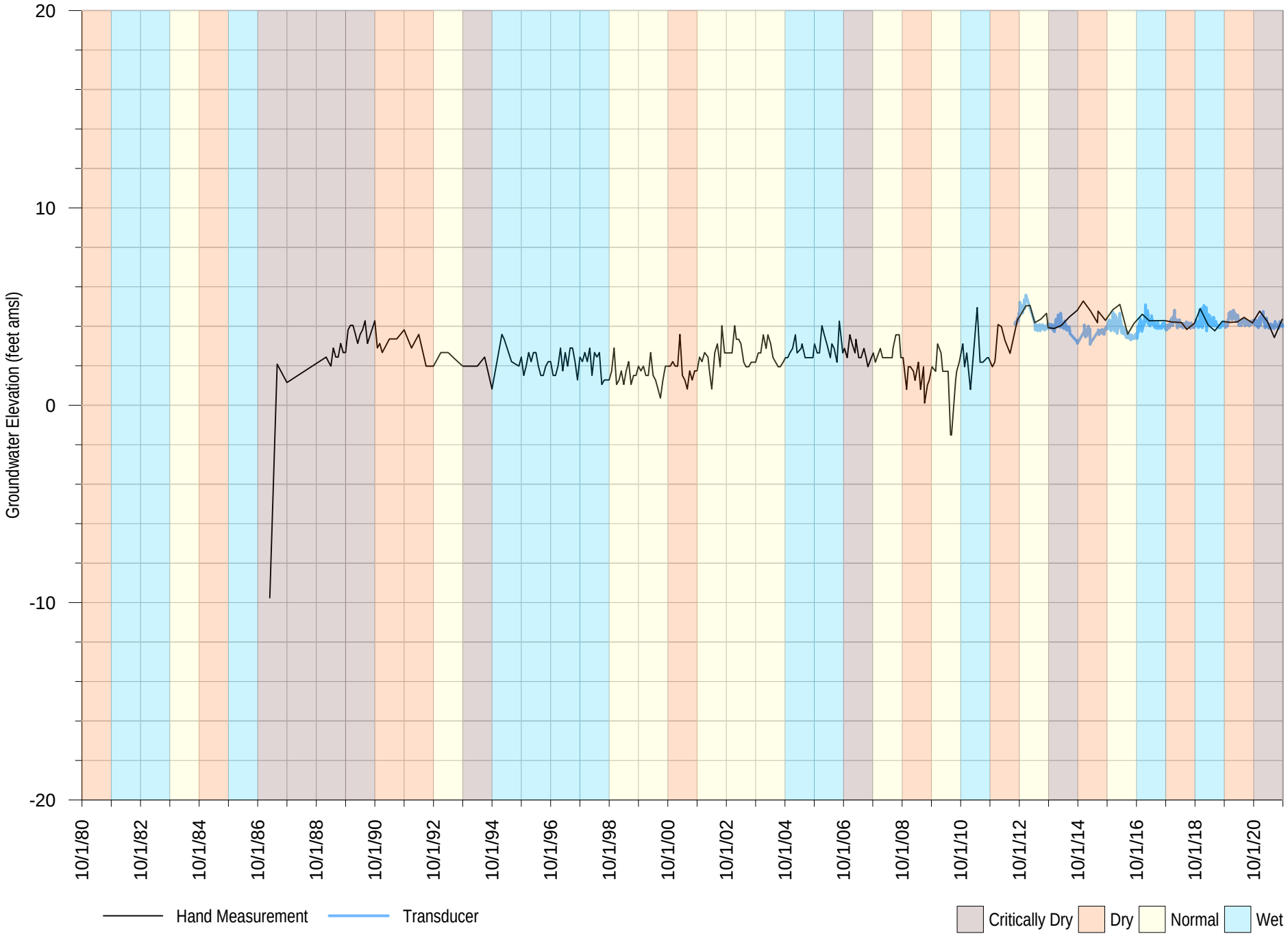
SC-A2C & SC-A2RC at Sumner
Aquifer Screened: Aromas

FIGURE A-74



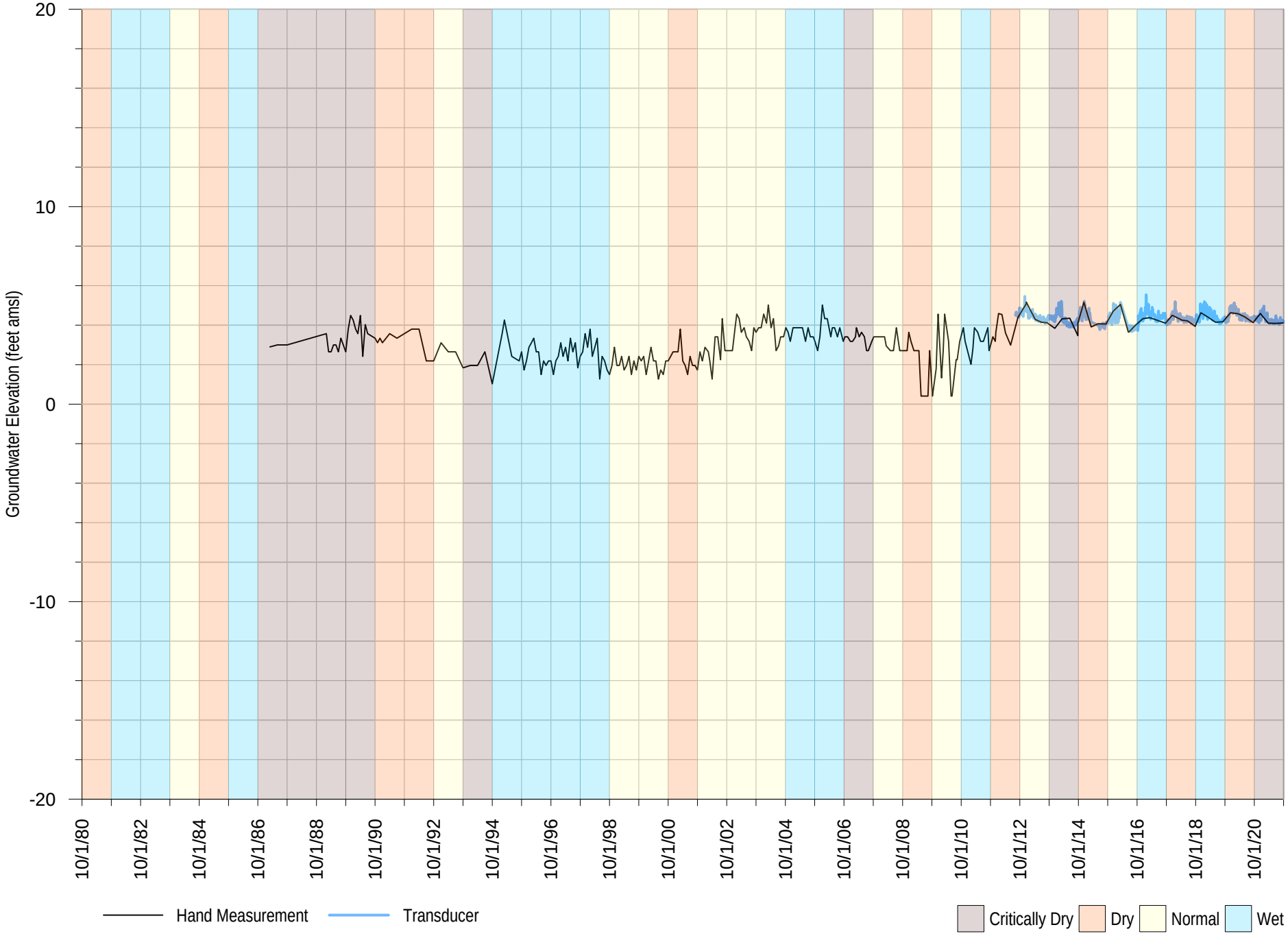
SC-A3B at Playa Vista
Aquifer Screened: Aromas

FIGURE A-75



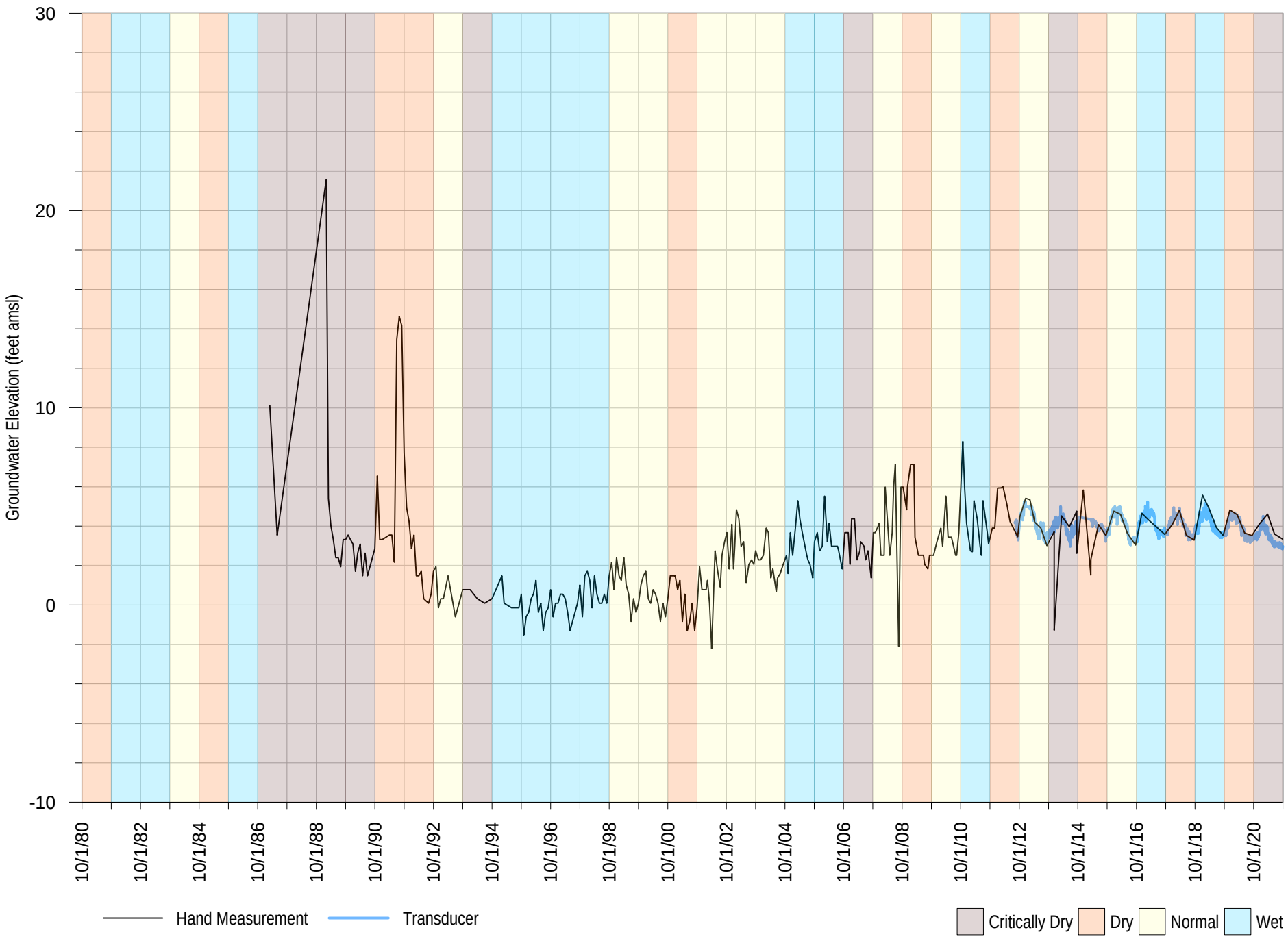
SC-A3C at Playa Vista
Aquifer Screened: Aromas

FIGURE A-76



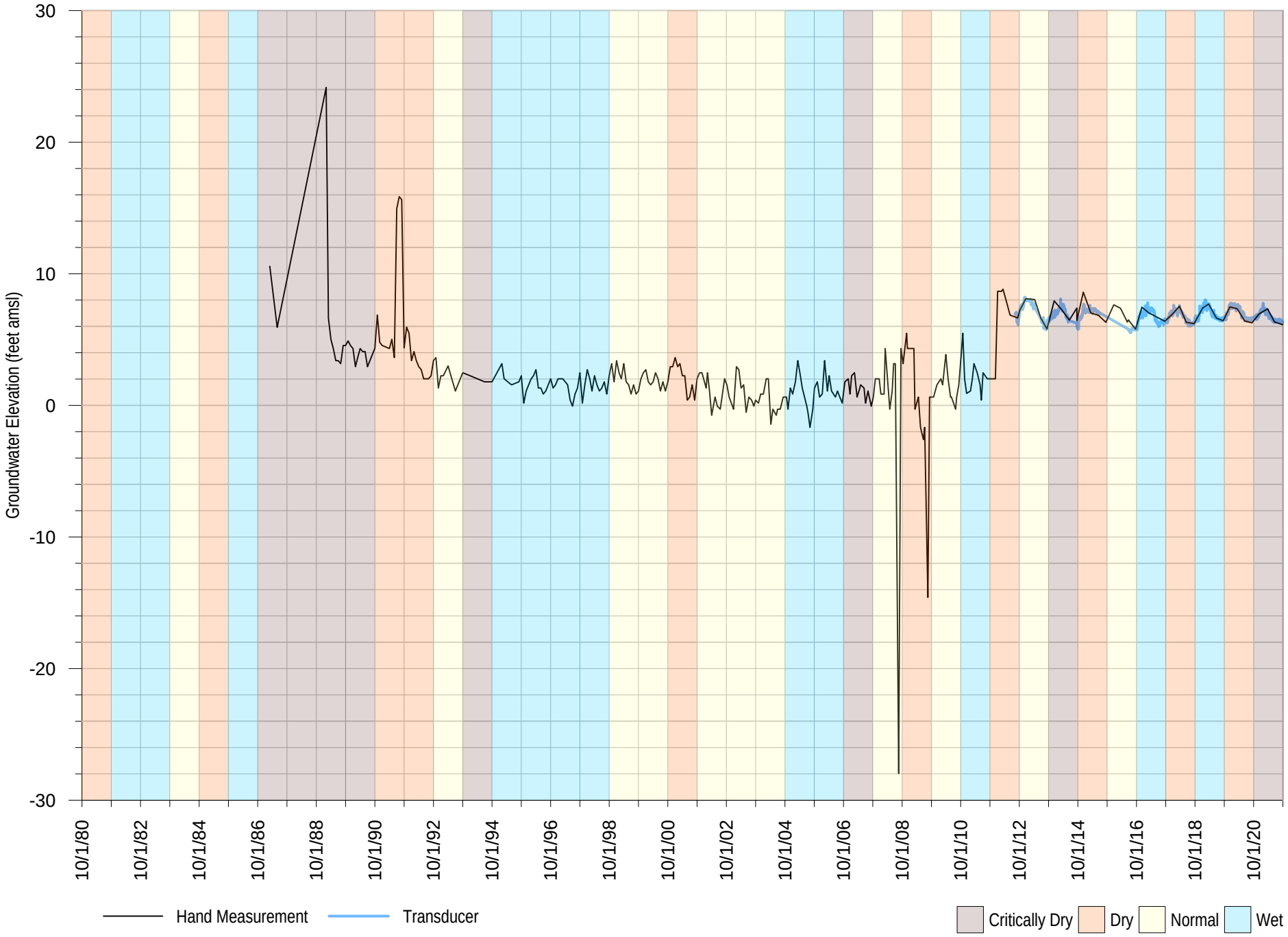
SC-A5A at Seascape
Aquifer Screened: Purisima F

FIGURE A-77



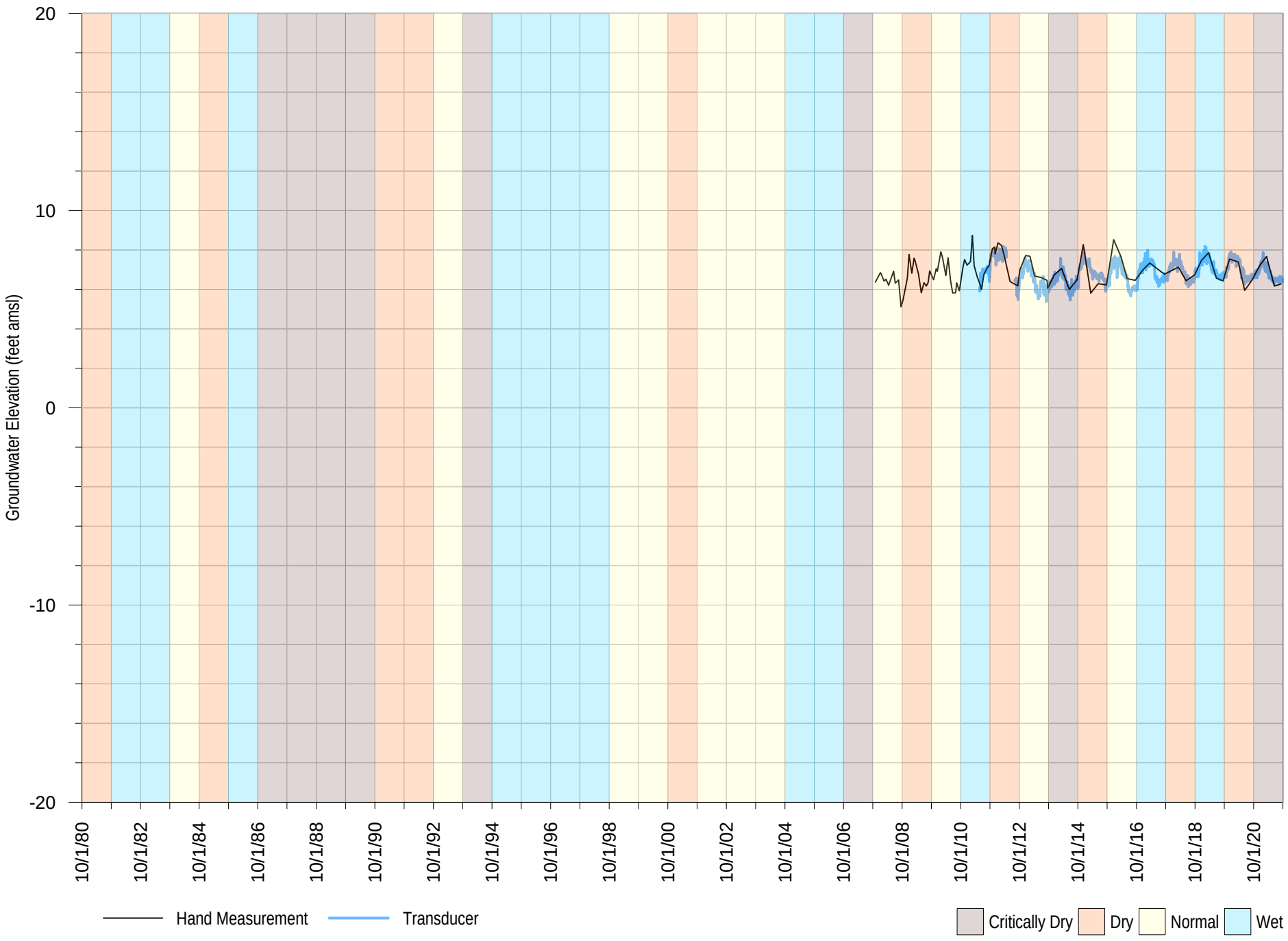
SC-A5B at Seascape
Aquifer Screened: Purisima F

FIGURE A-78



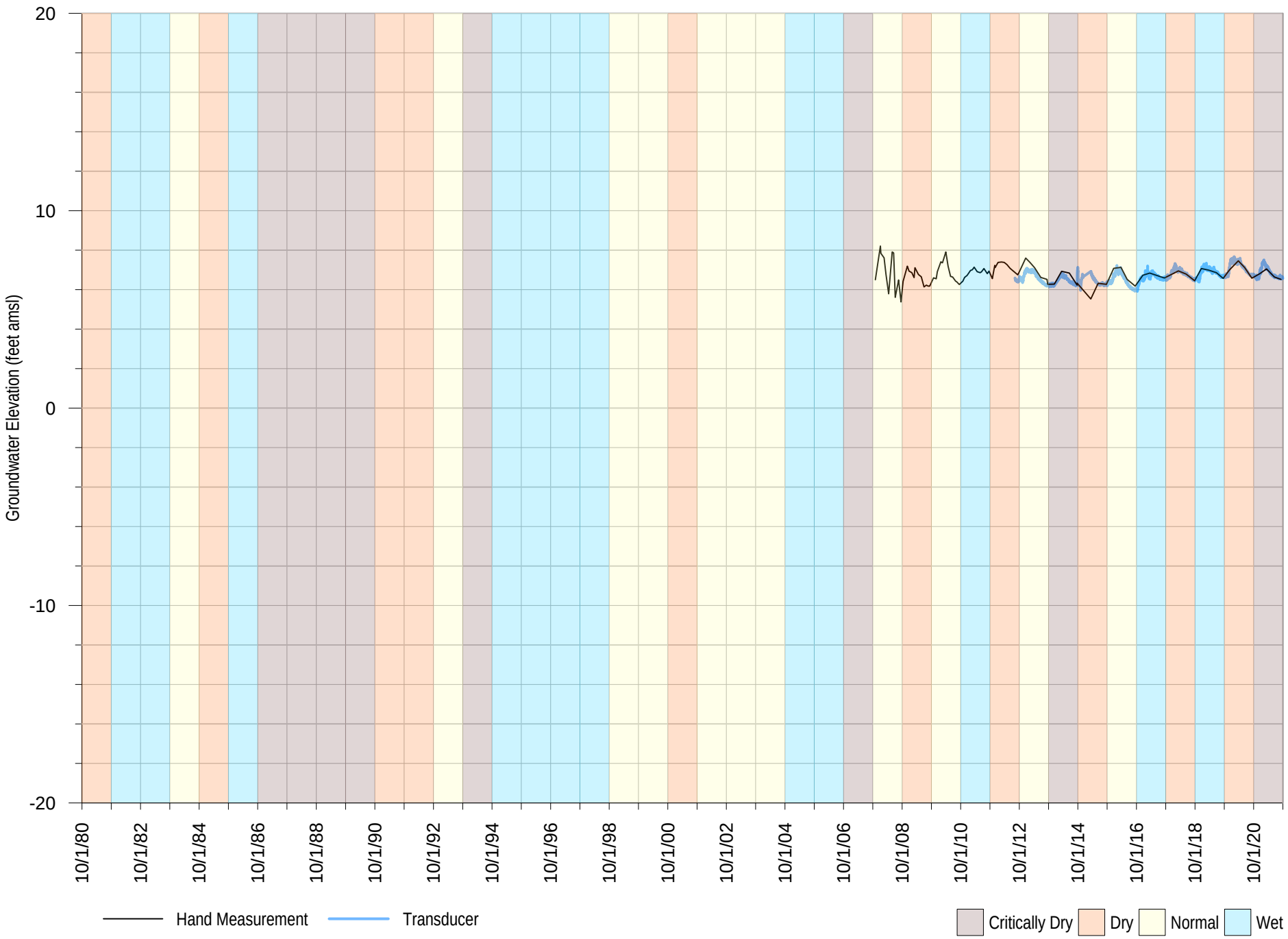
SC-A8B at Dolphin
Aquifer Screened: Aromas

FIGURE A-79



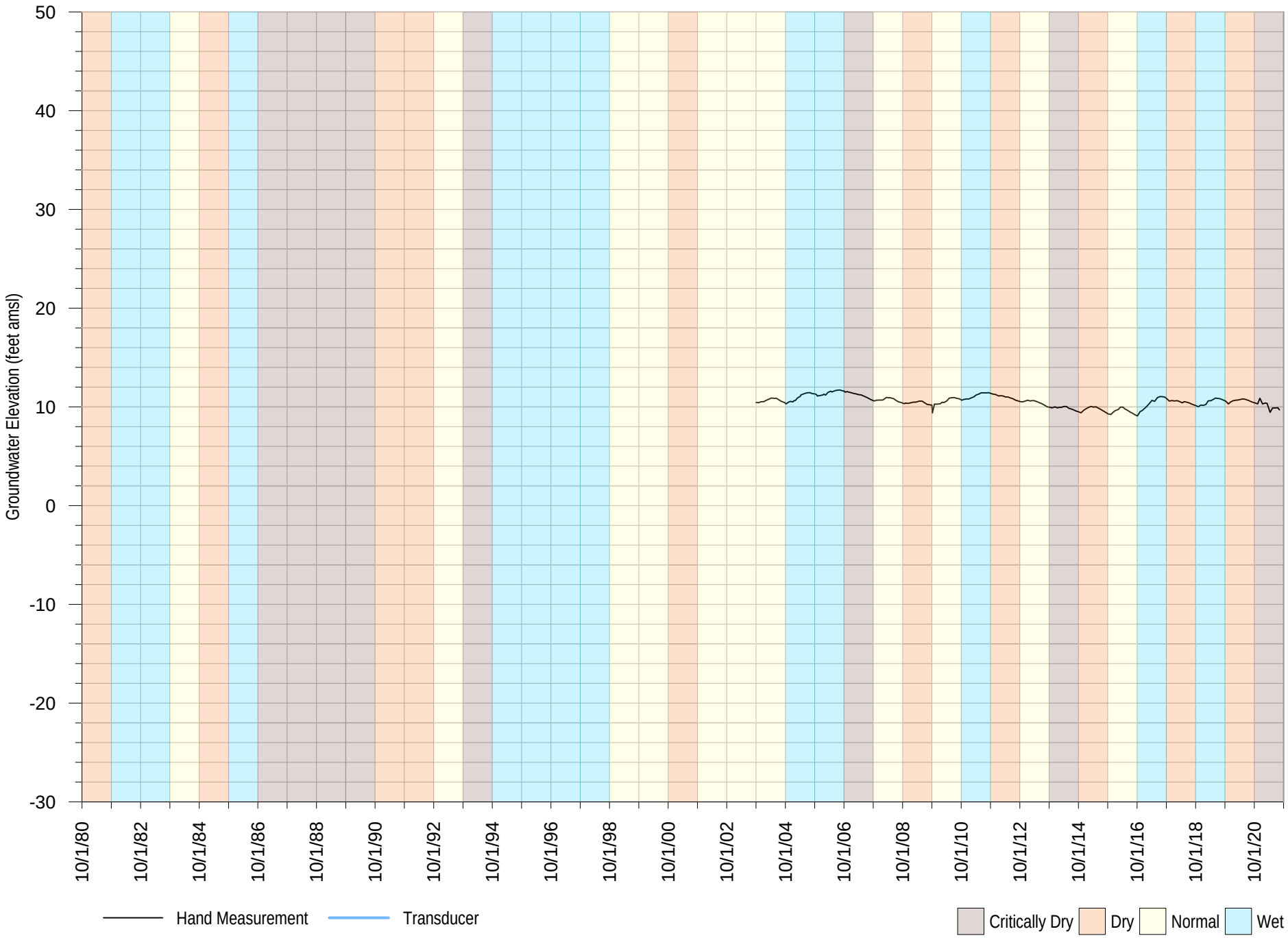
SC-A8C at Dolphin
Aquifer Screened: Aromas

FIGURE A-80



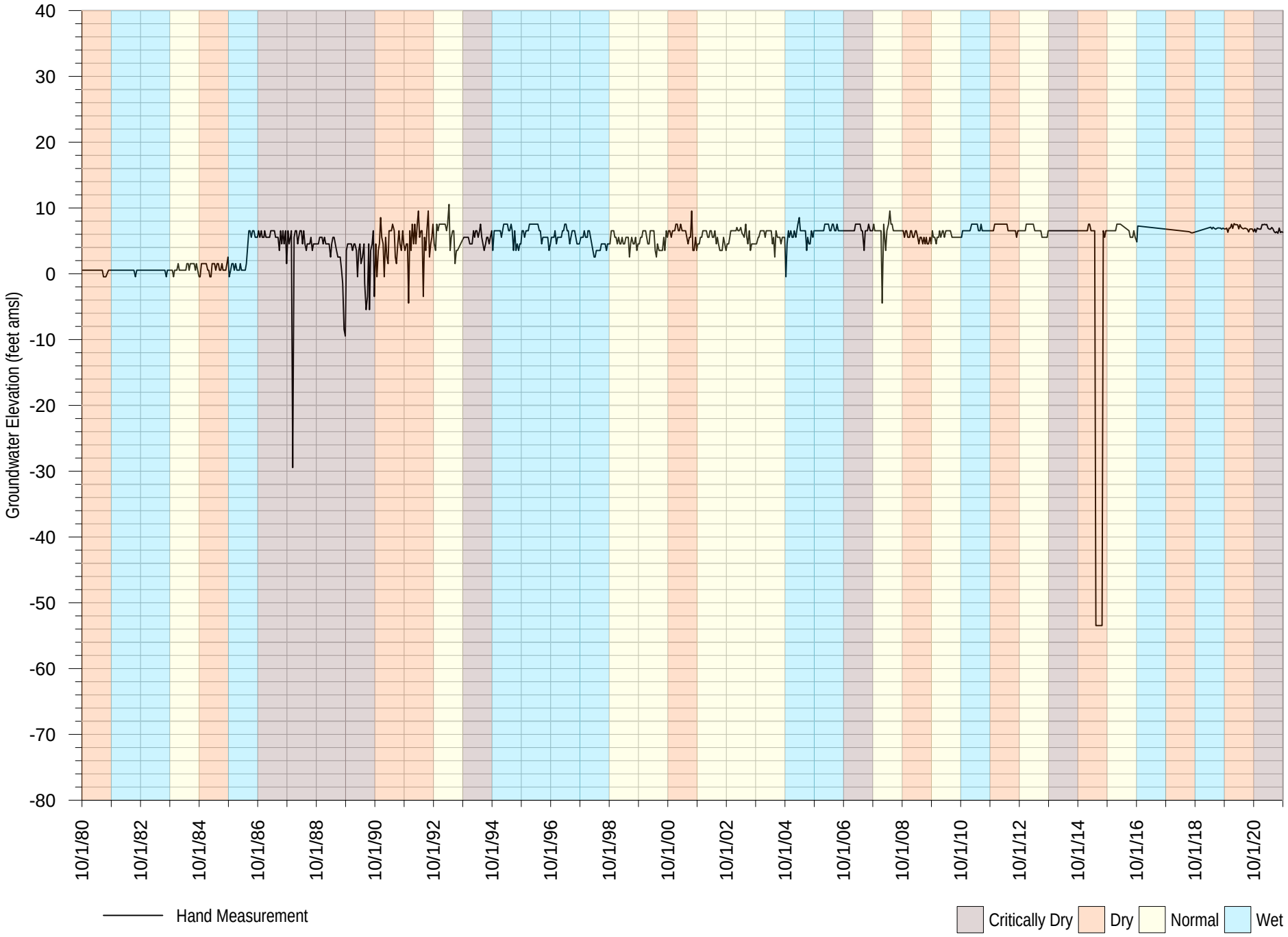
Schwan
Aquifer Screened: Purisima AA

FIGURE A-81



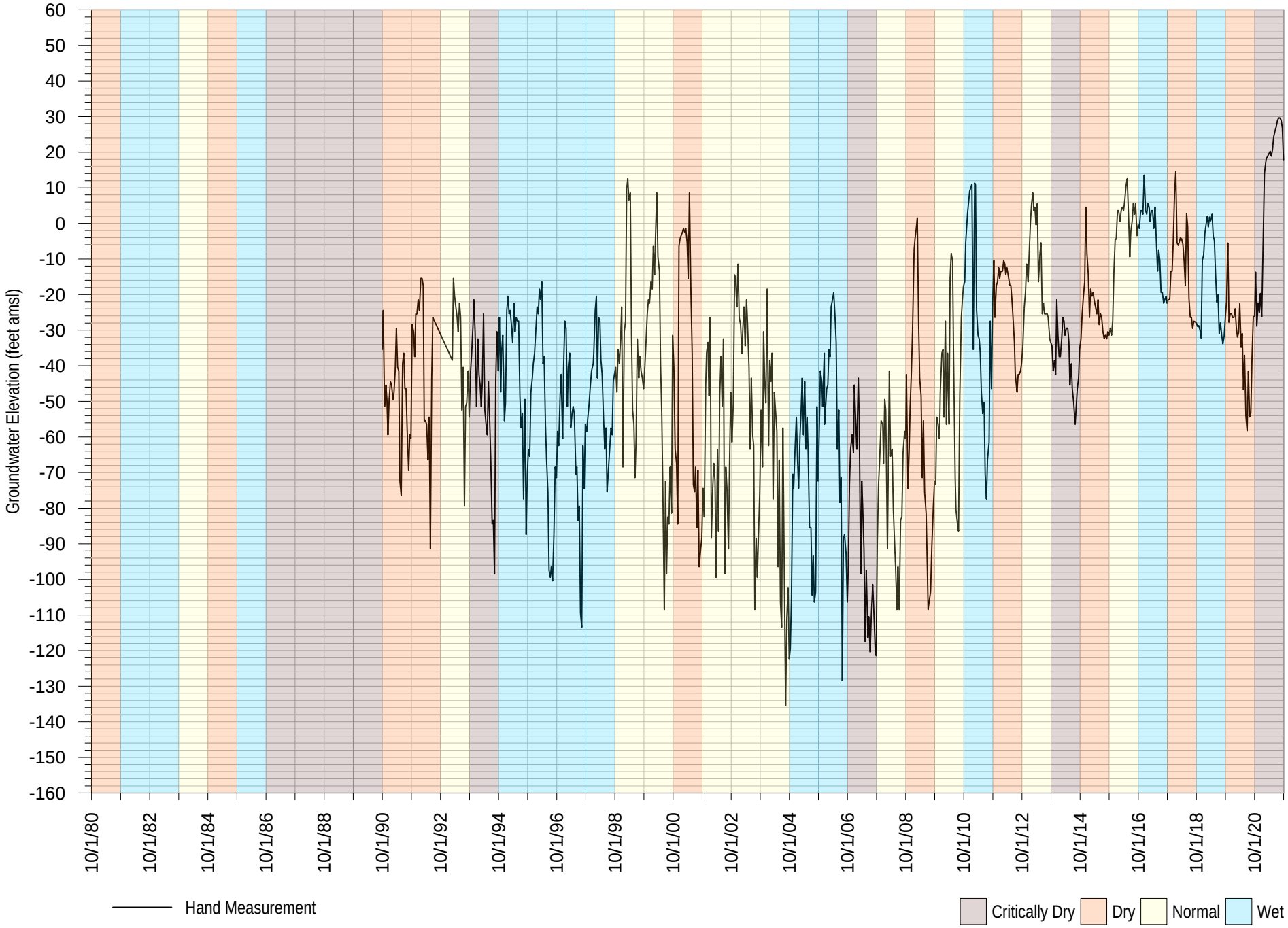
Seascape PW
Aquifer Screened: Aromas/ Purisima F

FIGURE A-82



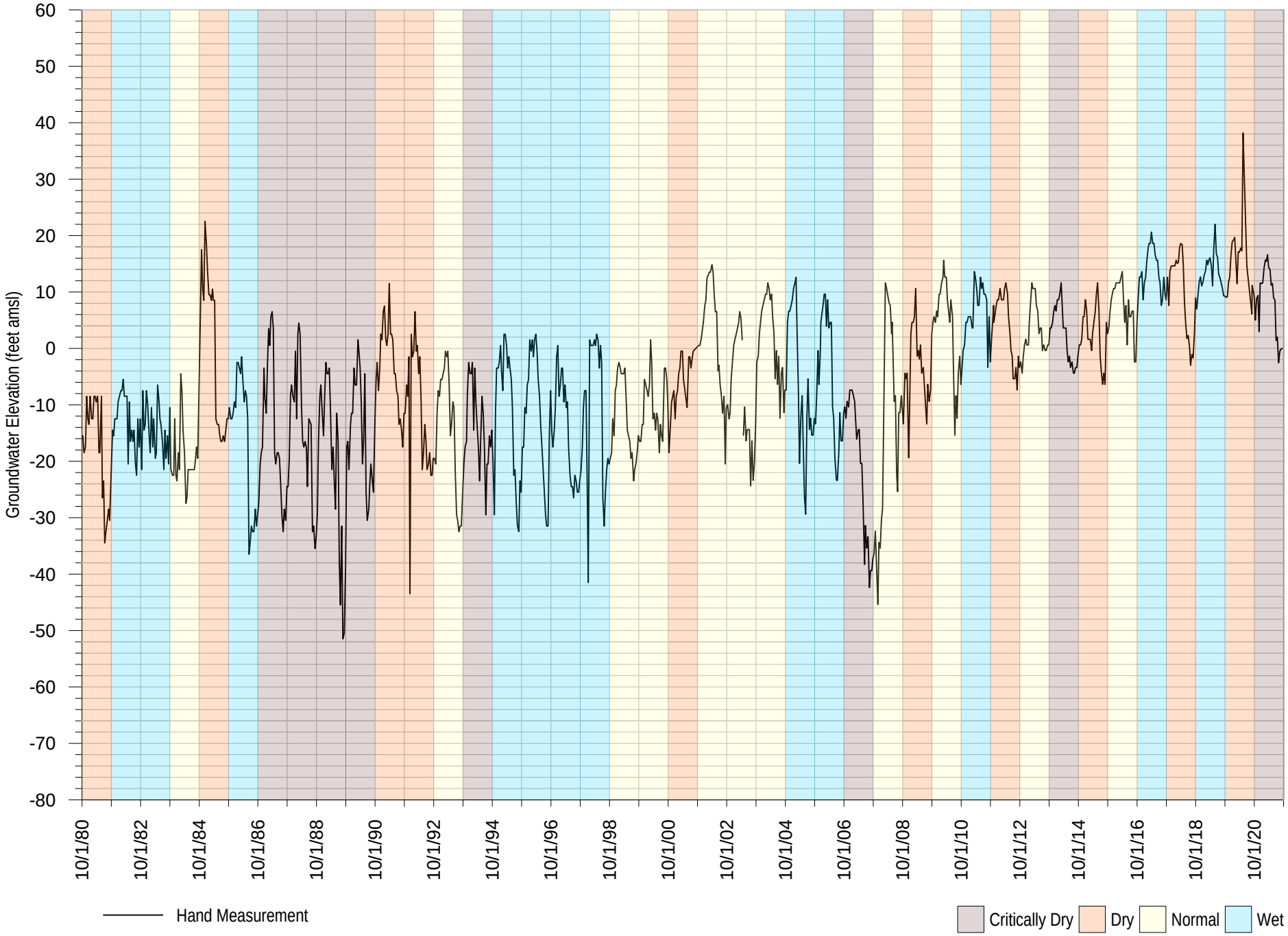
T.Hopkins PW
Aquifer Screened: Purisima DEF

FIGURE A-83



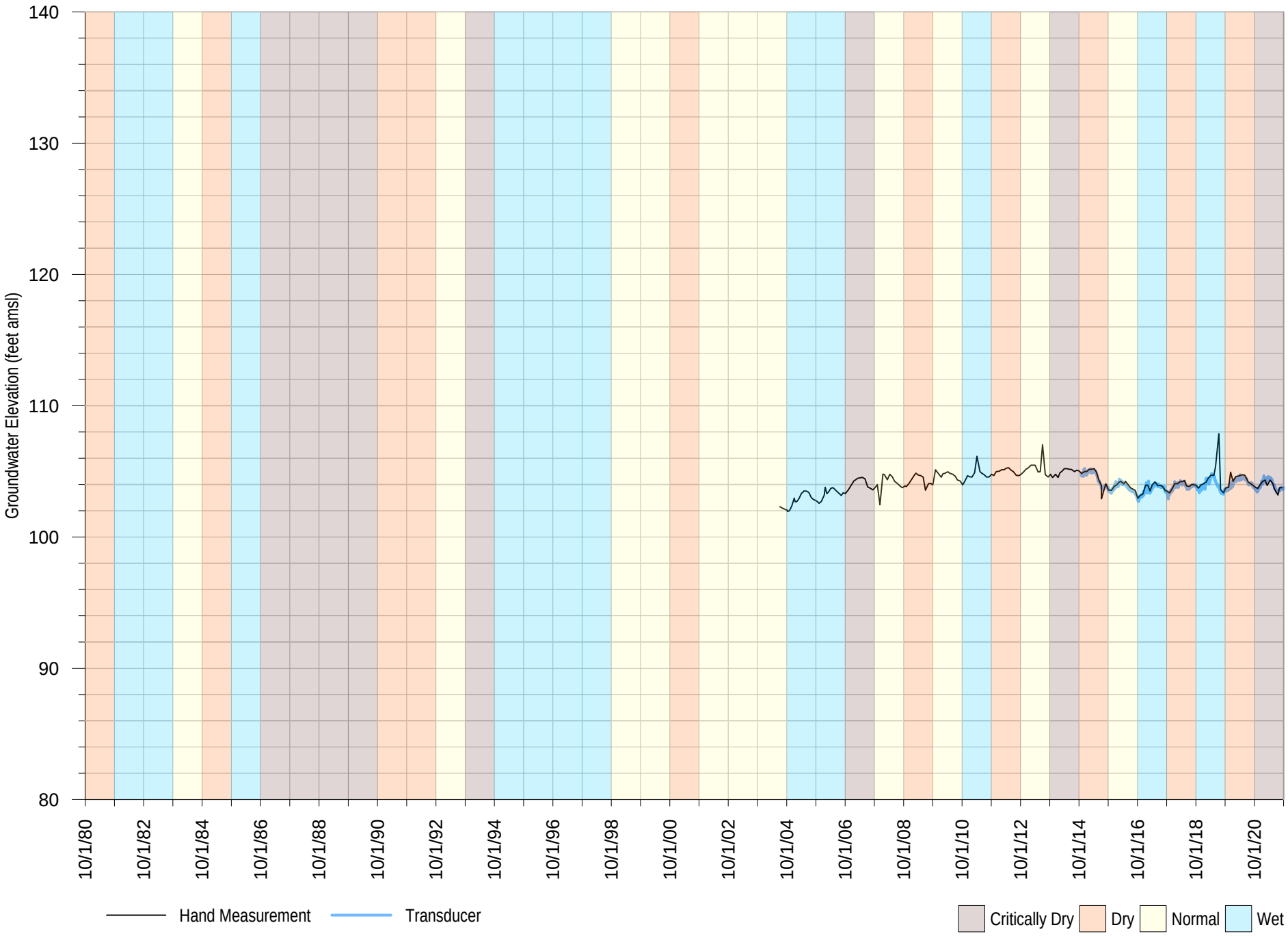
Tannery & Tannery 2 PW
Aquifer Screened: Purisima A

FIGURE A-84



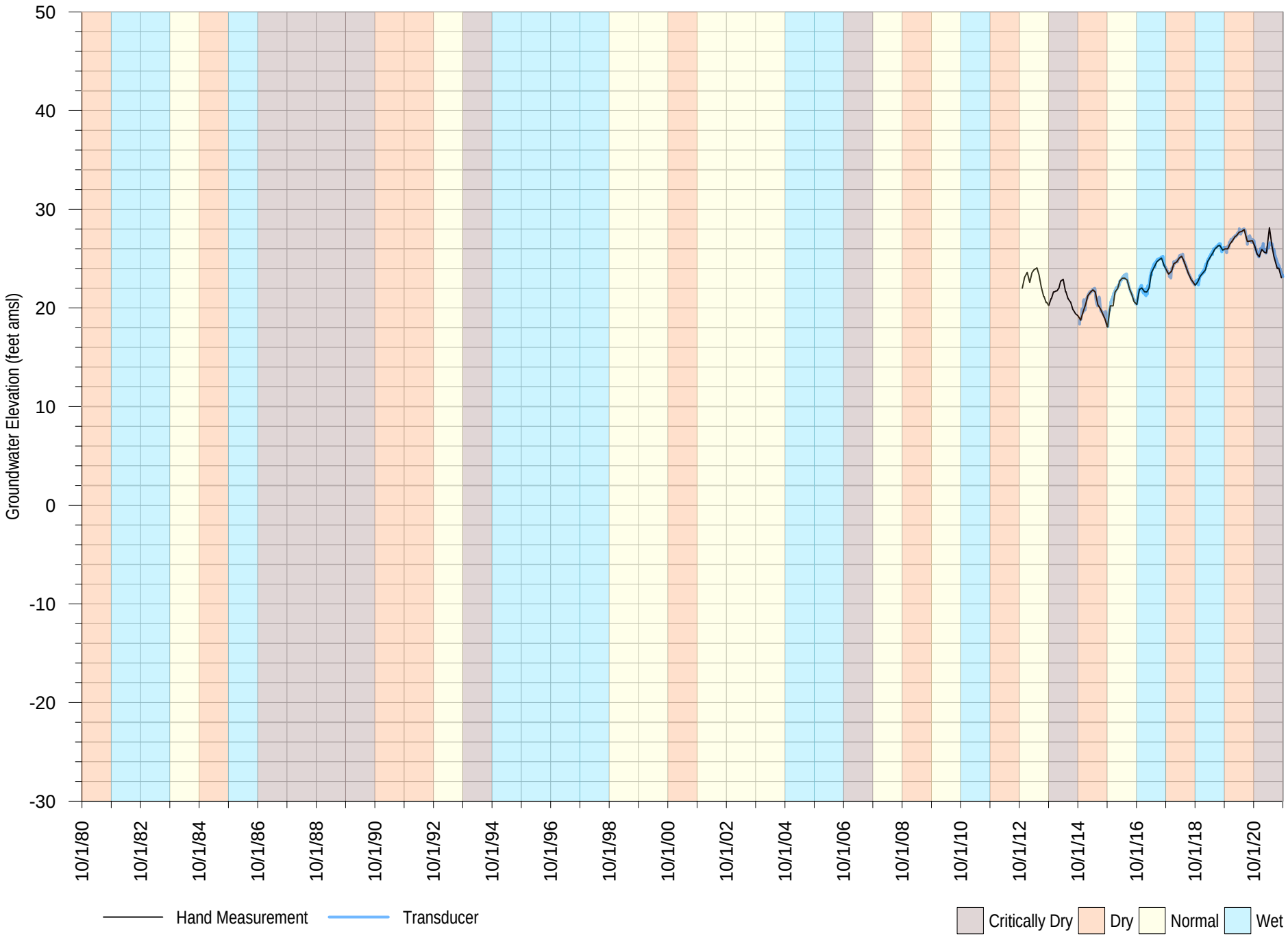
Thurber Shallow
Aquifer Screened: Purisima AA

FIGURE A-85



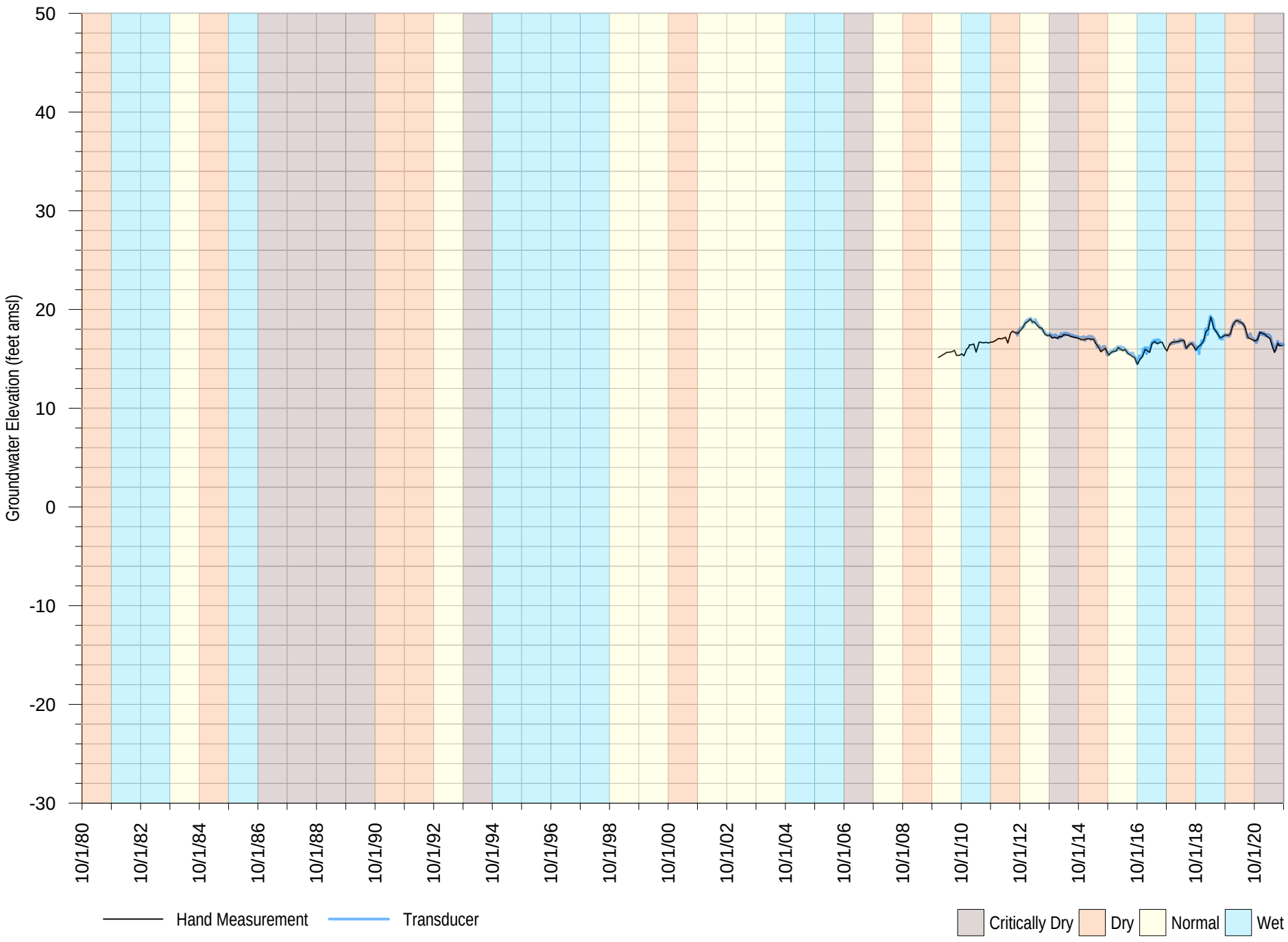
30th Ave Medium
Aquifer Screened: Purisima AA

FIGURE A-86



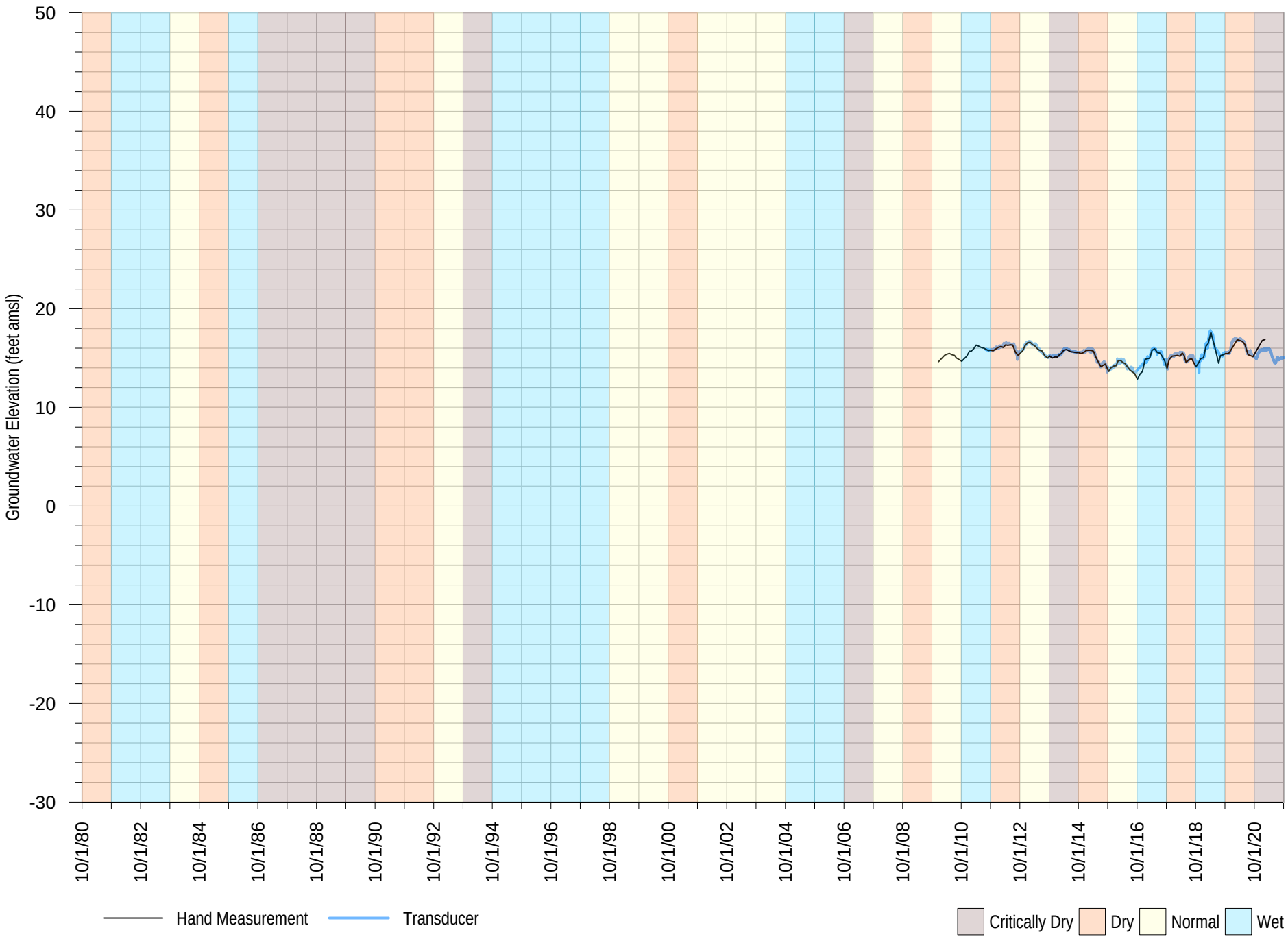
Auto Plaza Deep
Aquifer Screened: Purisima AA

FIGURE A-87



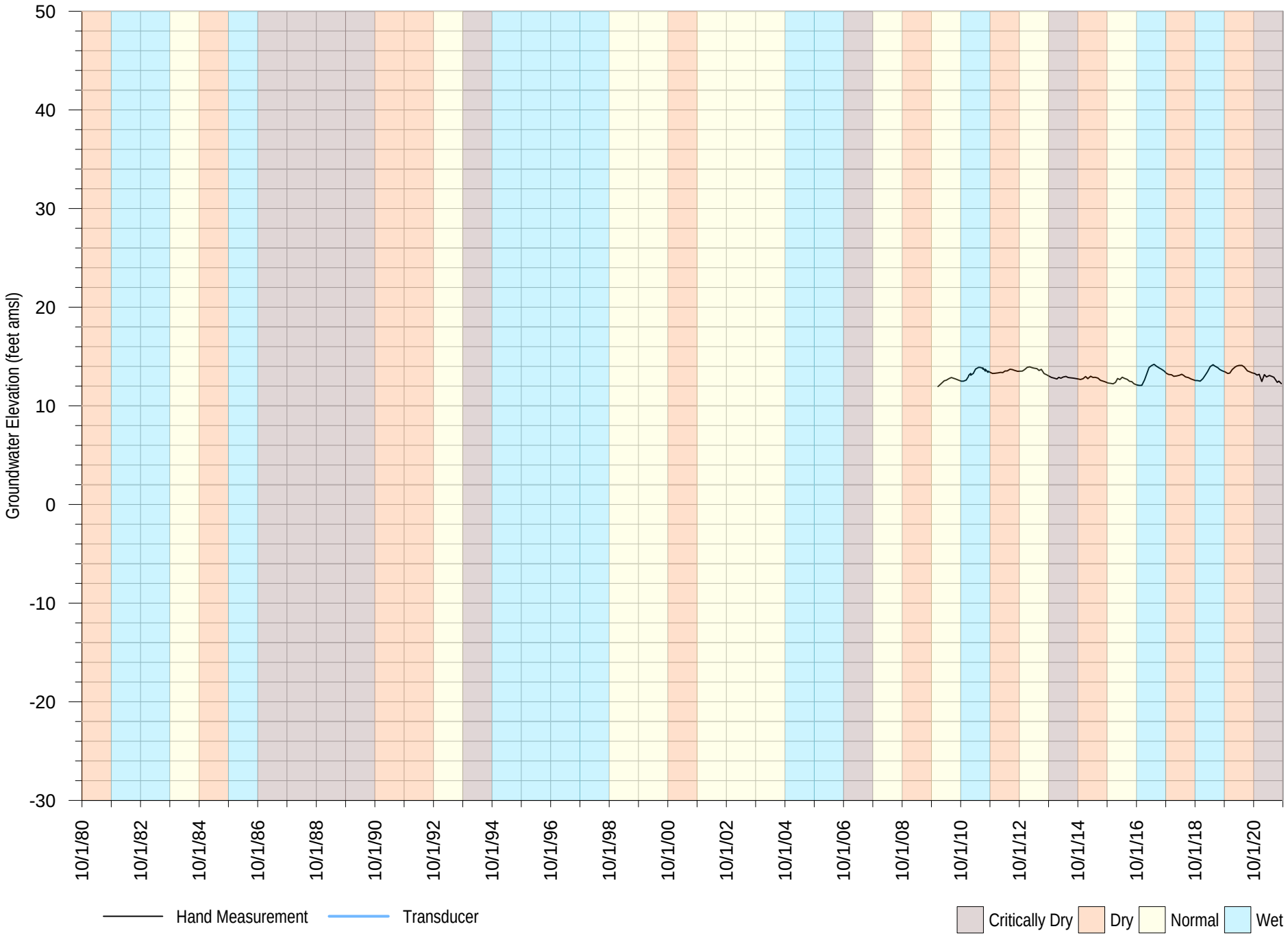
Auto Plaza Medium
Aquifer Screened: Purisima A

FIGURE A-88



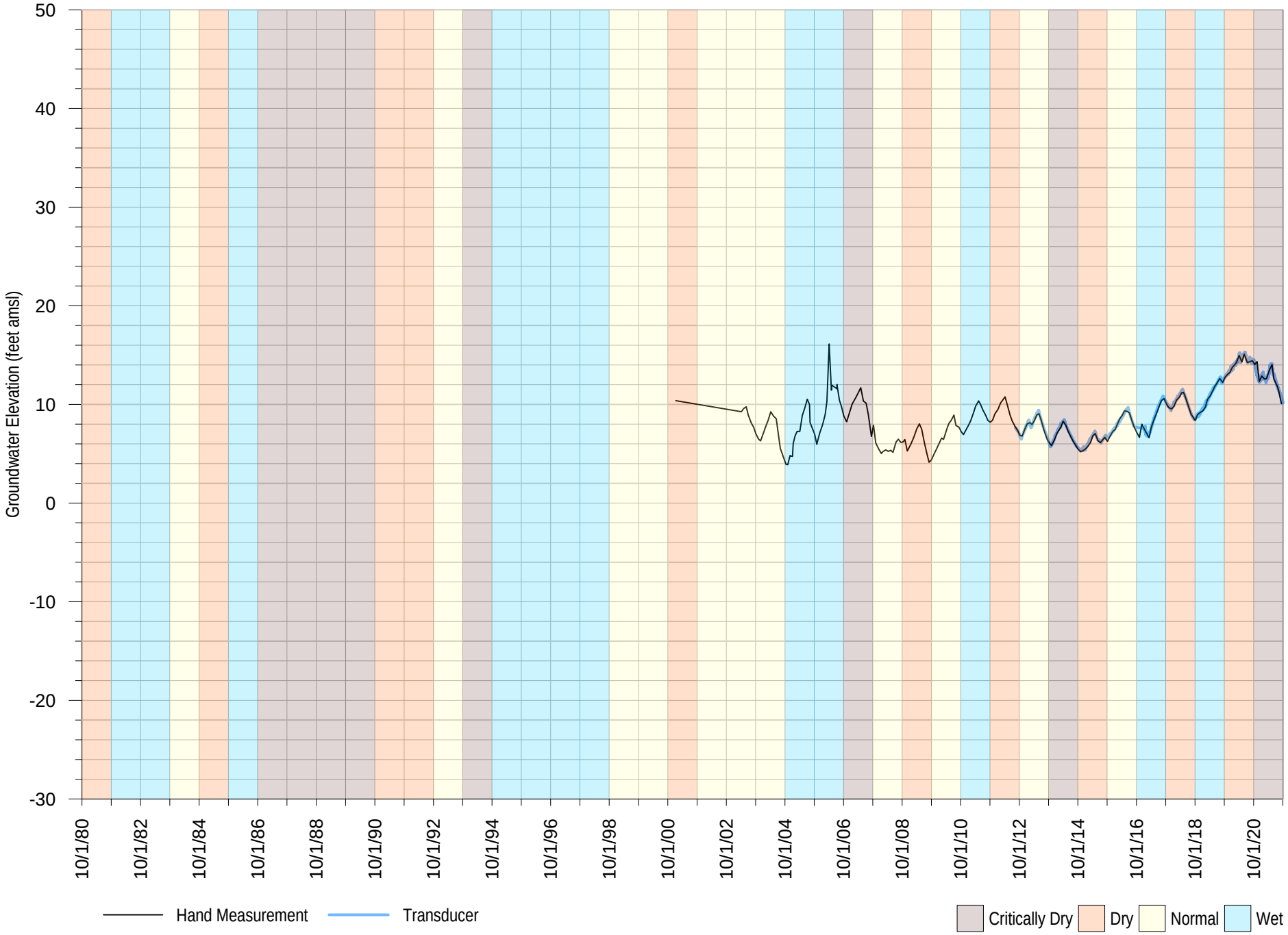
Auto Plaza Shallow
Aquifer Screened: Purisima A

FIGURE A-89



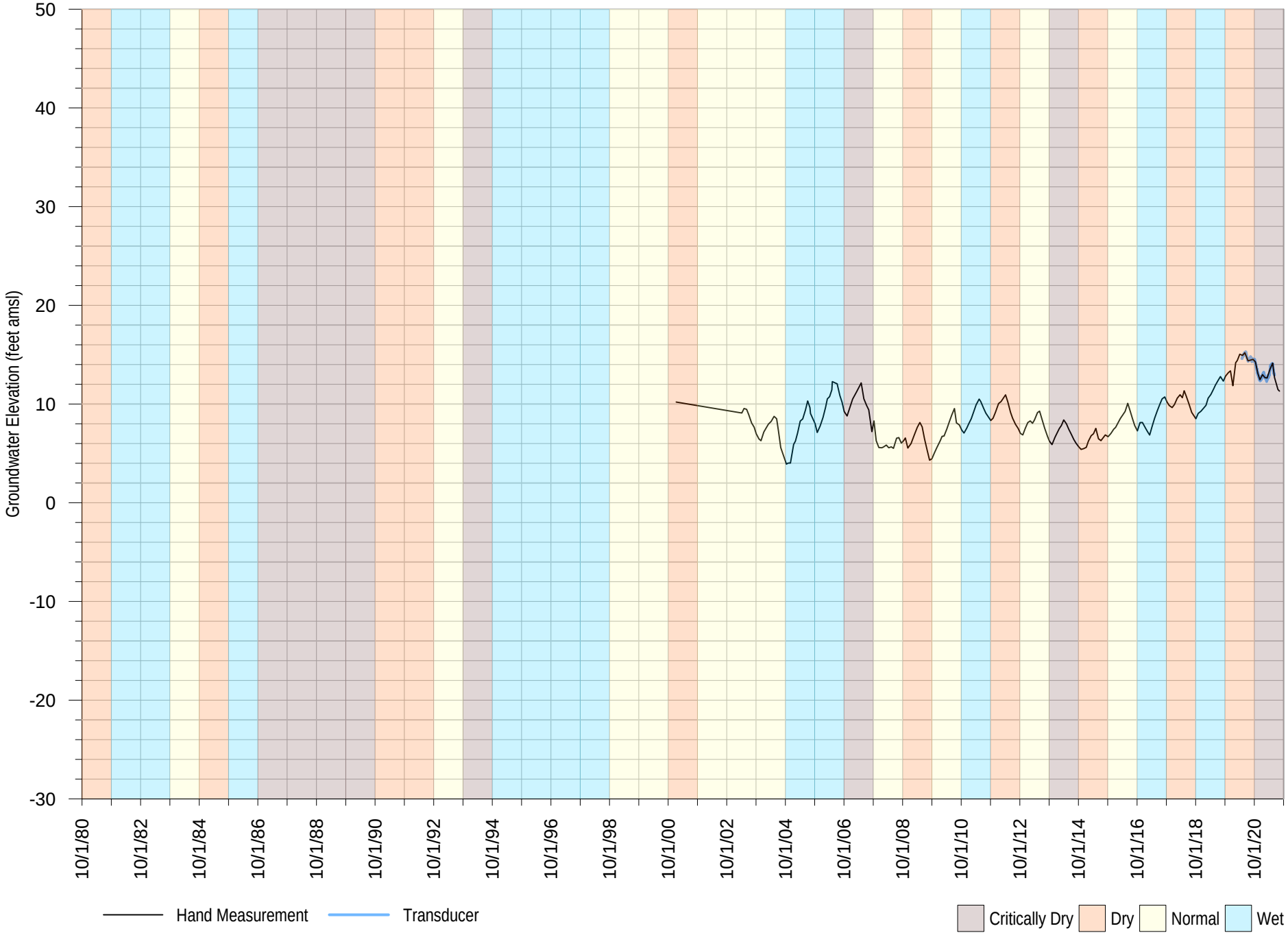
Beltz 4 Deep
Aquifer Screened: Purisima A

FIGURE A-90



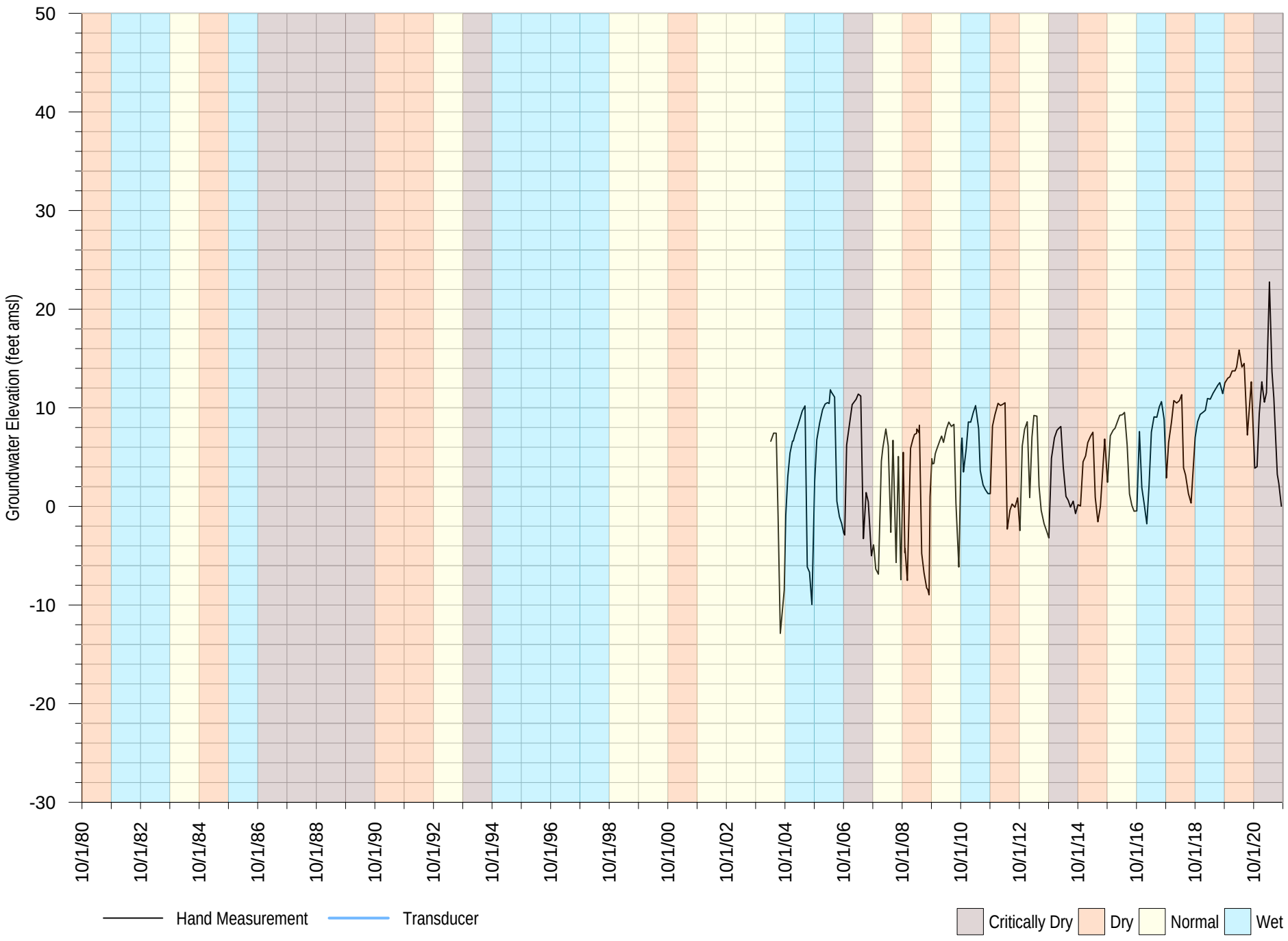
Beltz 4 Shallow
Aquifer Screened: Purisima A

FIGURE A-91



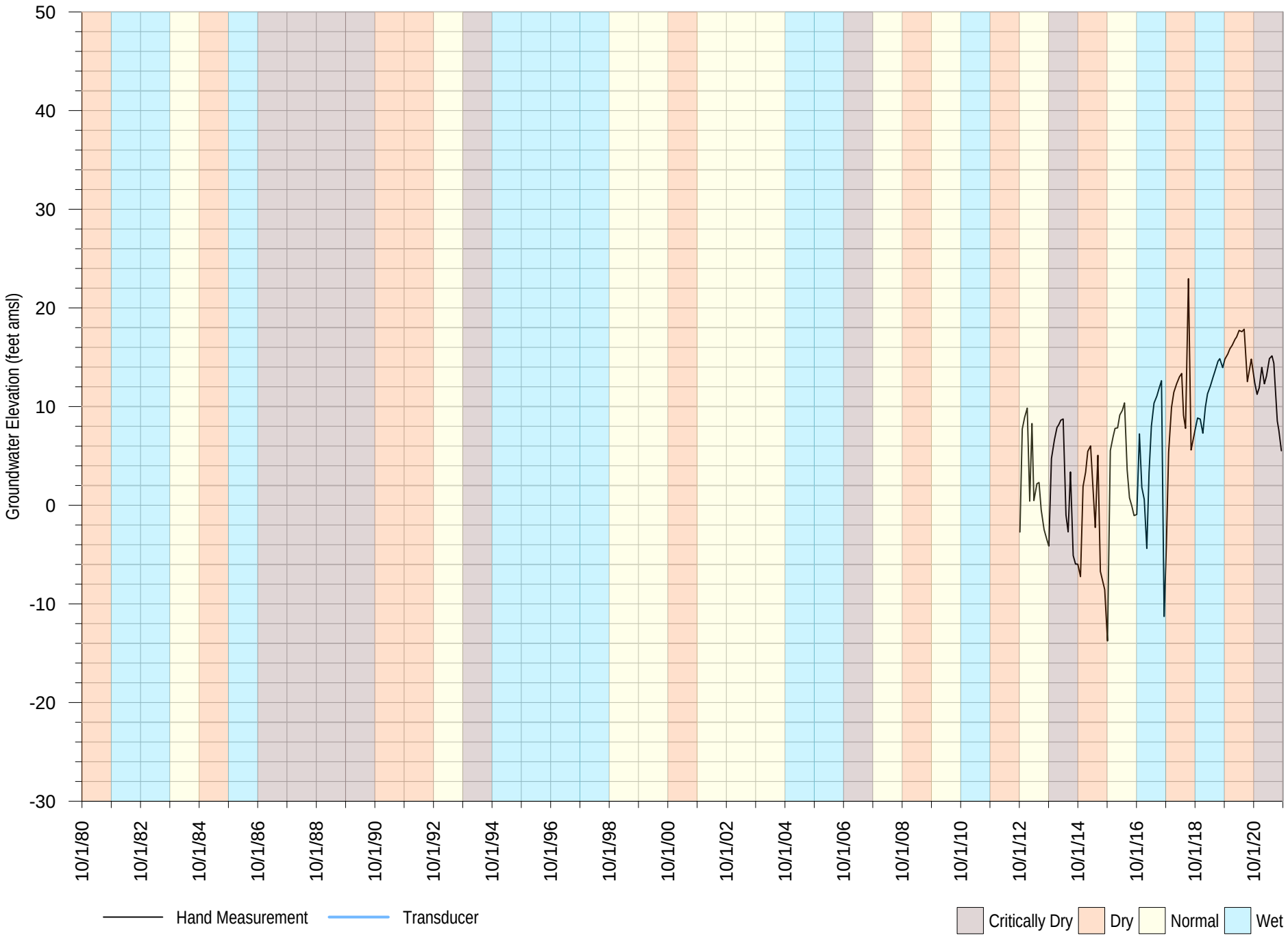
Beltz 6
Aquifer Screened: Purisima A

FIGURE A-92



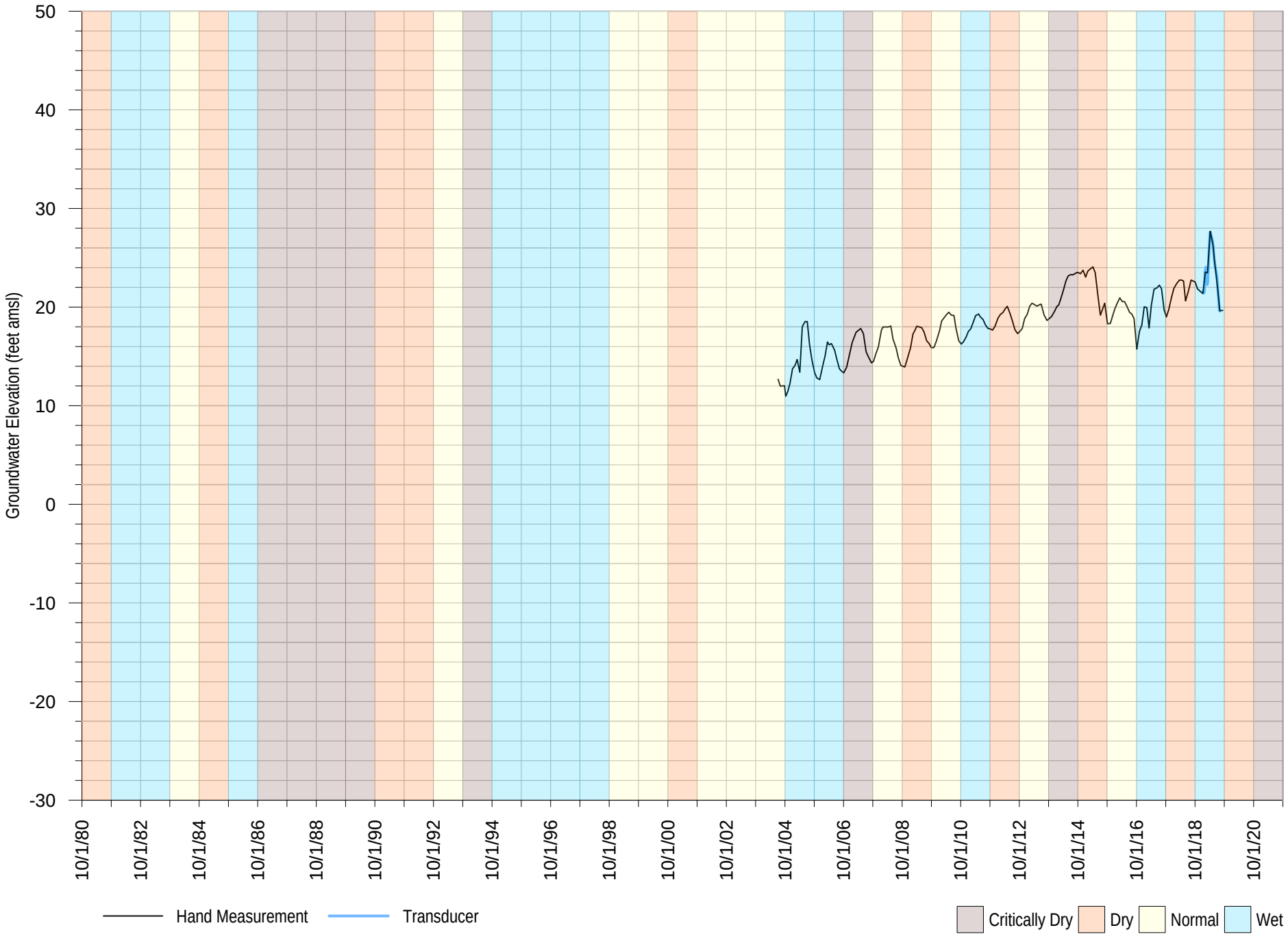
Beltz 7 Deep
Aquifer Screened: Purisima A/AA

FIGURE A-93



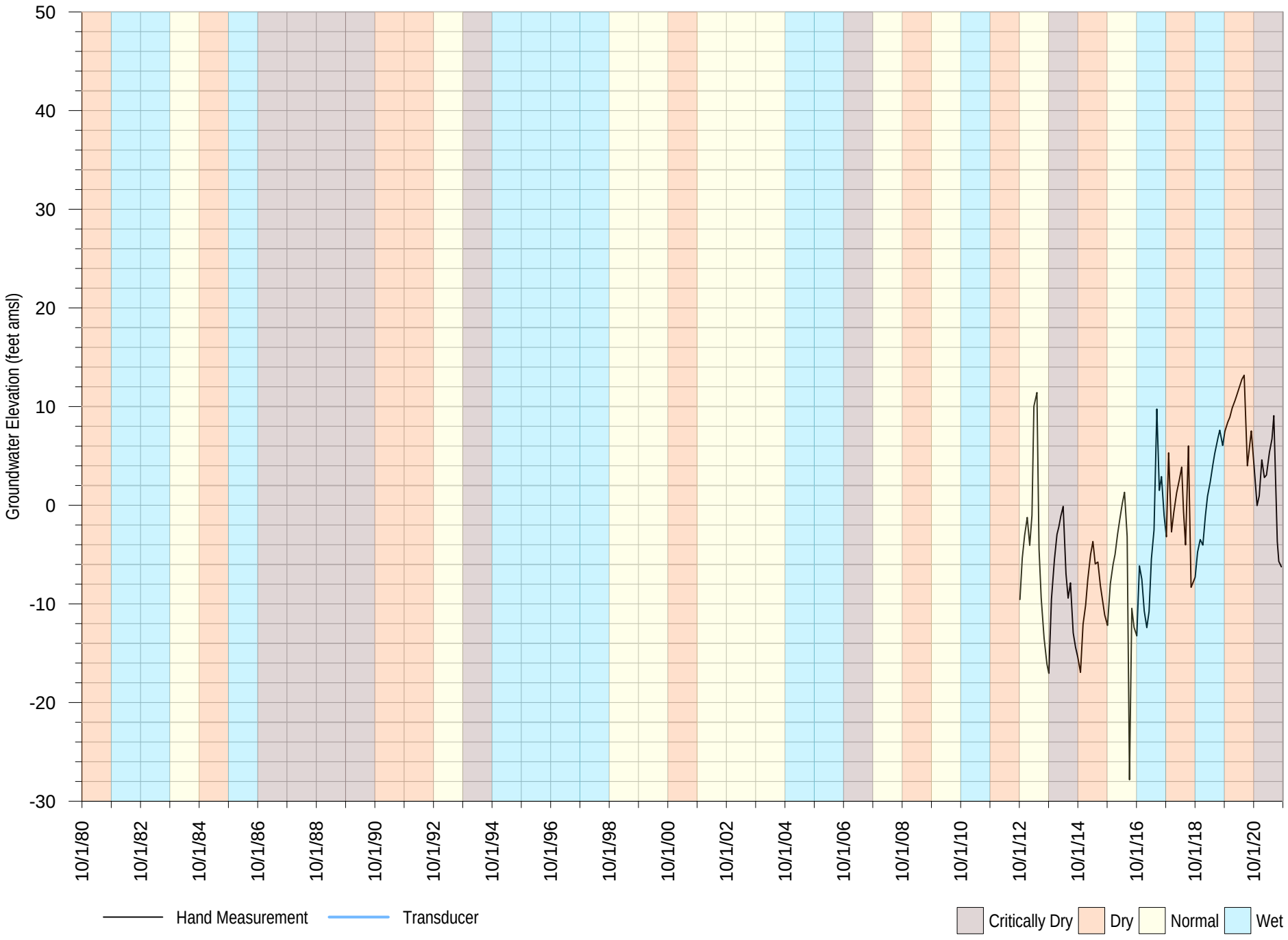
Beltz 7 Santa Margarita Test Well
Aquifer Screened: Tu

FIGURE A-94



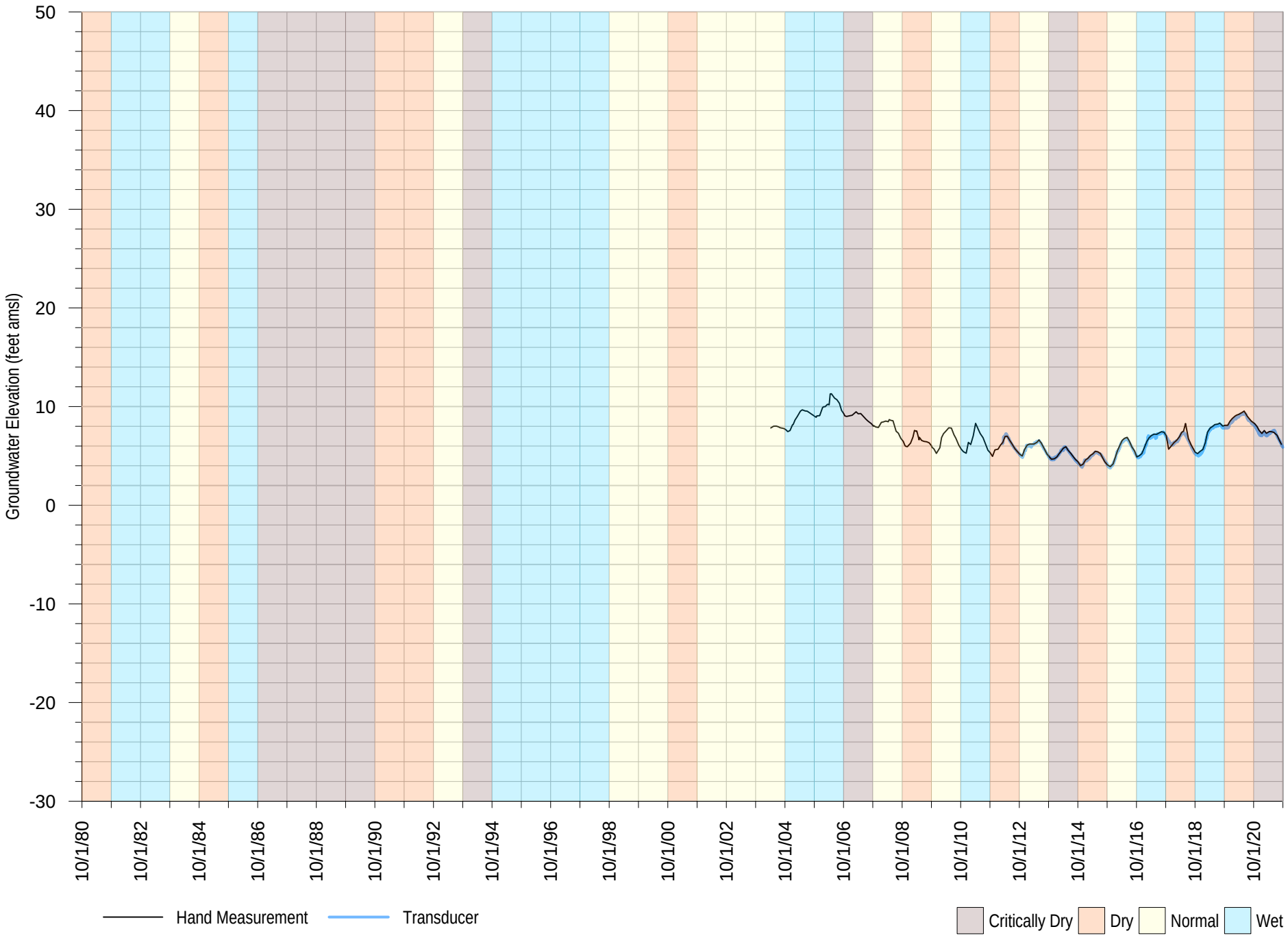
Beltz 7 Shallow
Aquifer Screened: Purisima A

FIGURE A-95



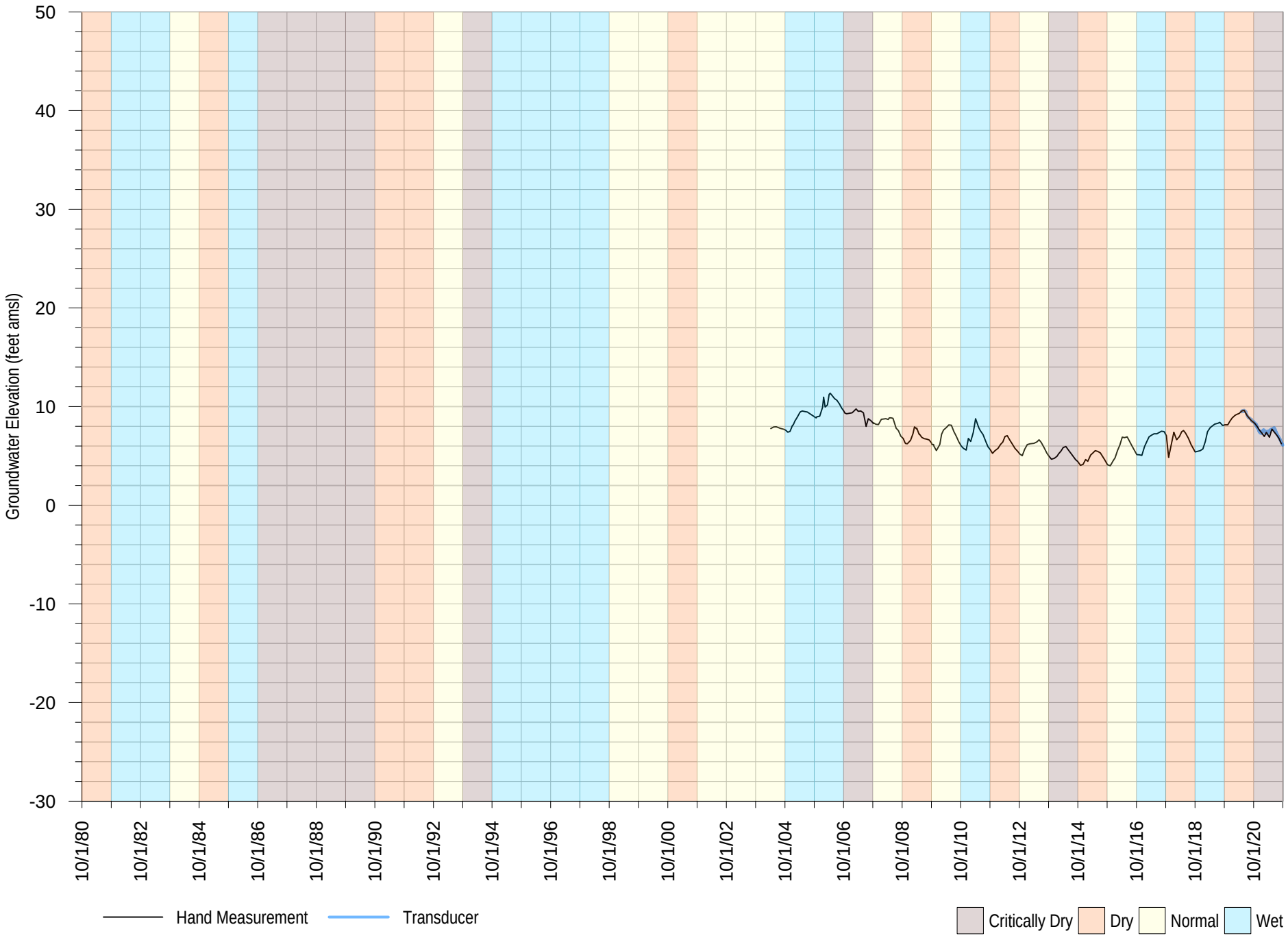
Corcoran Medium
Aquifer Screened: Purisima A

FIGURE A-96



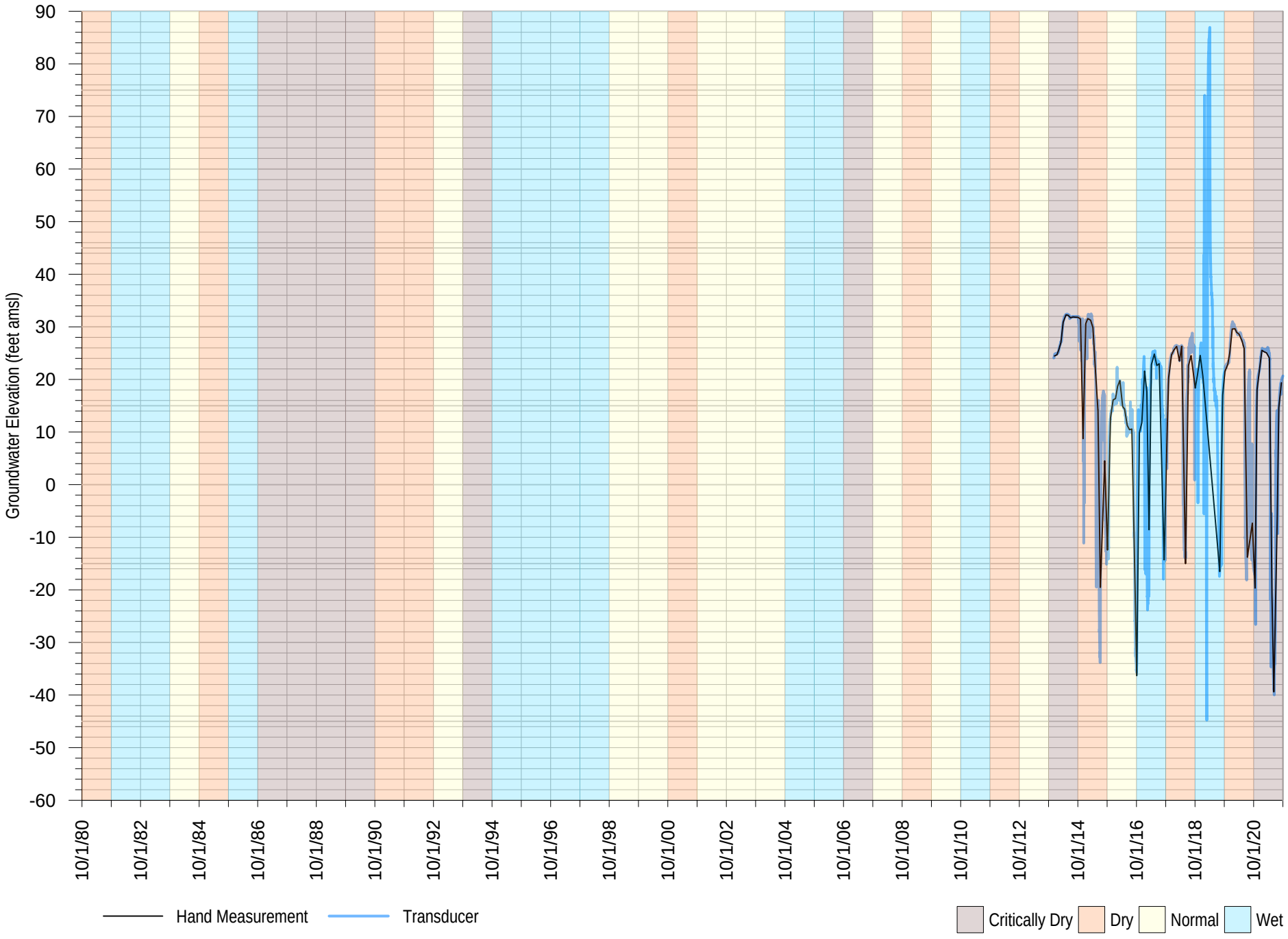
Corcoran Shallow
Aquifer Screened: Purisima A

FIGURE A-97



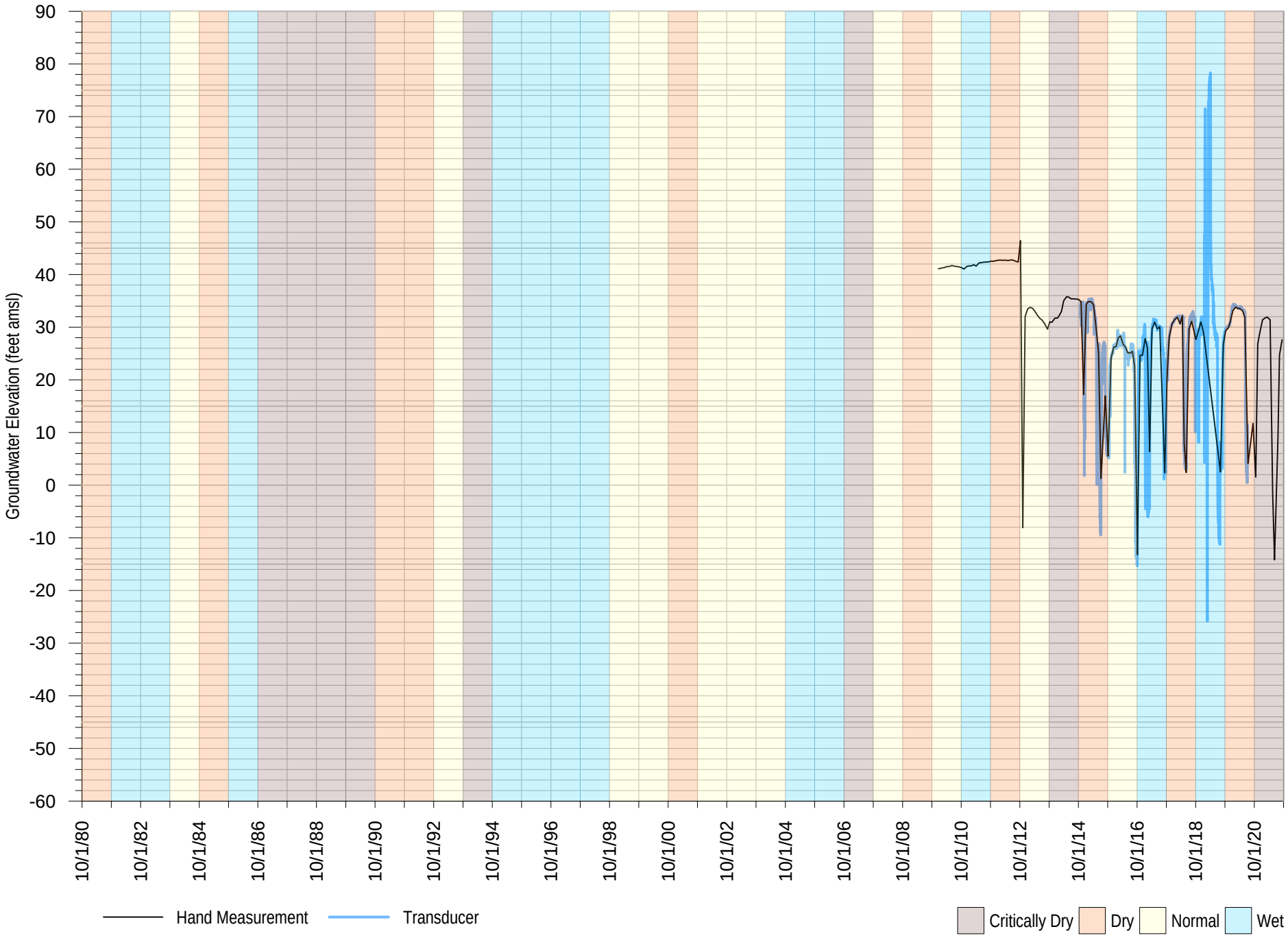
Cory 4
Aquifer Screened: Tu

FIGURE A-98



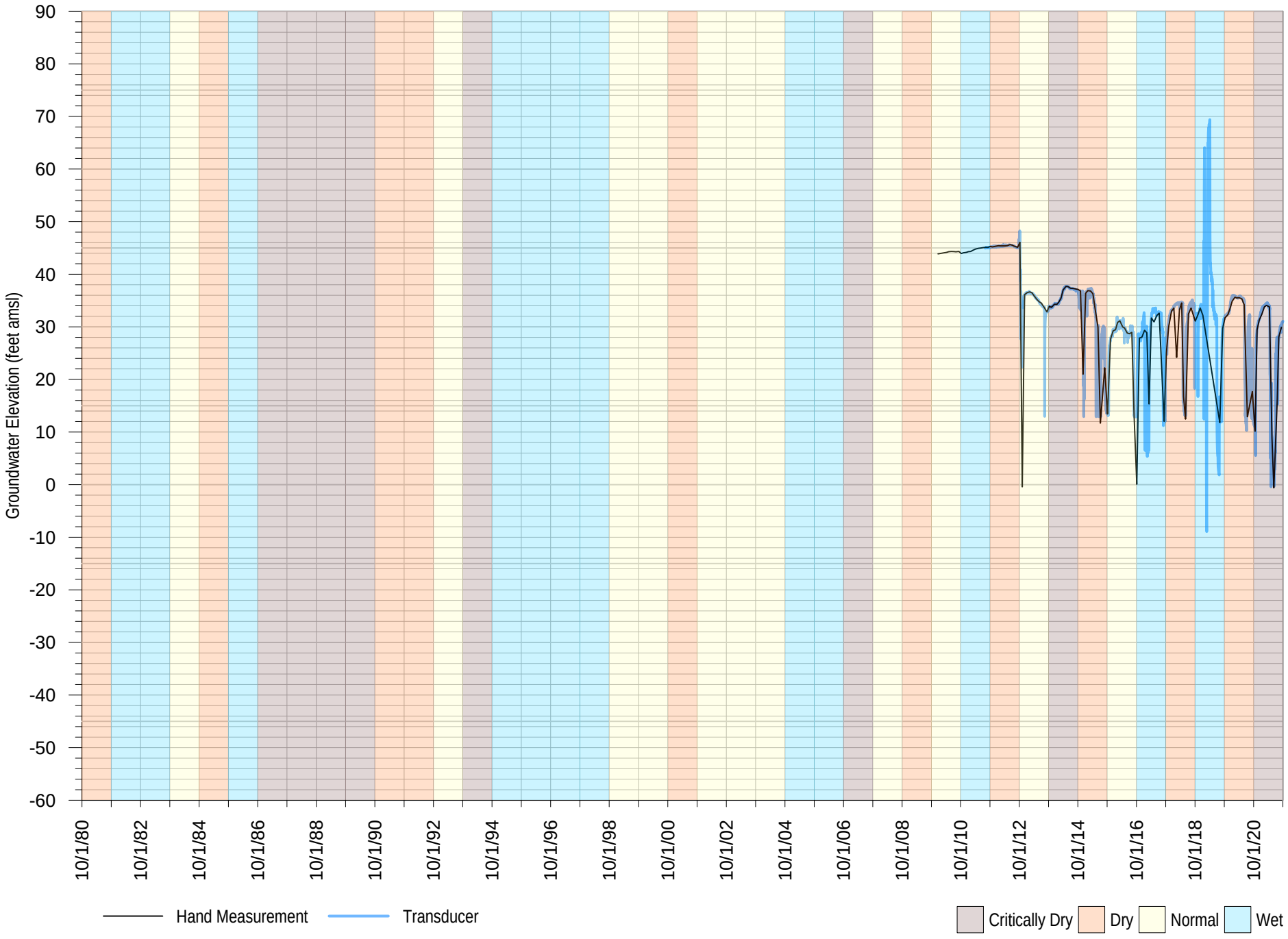
Cory Deep
Aquifer Screened: Purisima AA

FIGURE A-99



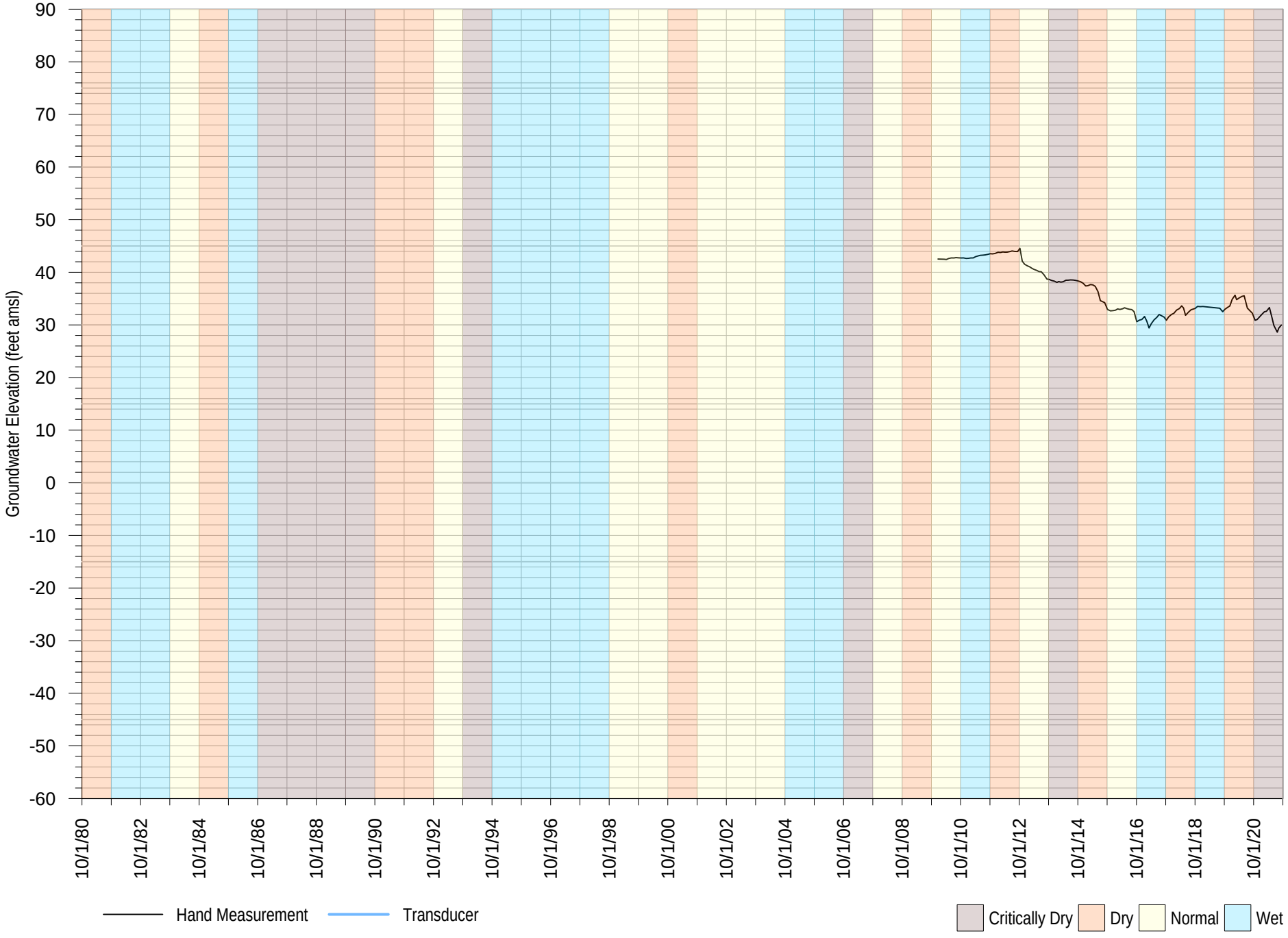
Cory Medium
Aquifer Screened: Purisima A

FIGURE A-100



Cory Shallow
Aquifer Screened: Purisima A

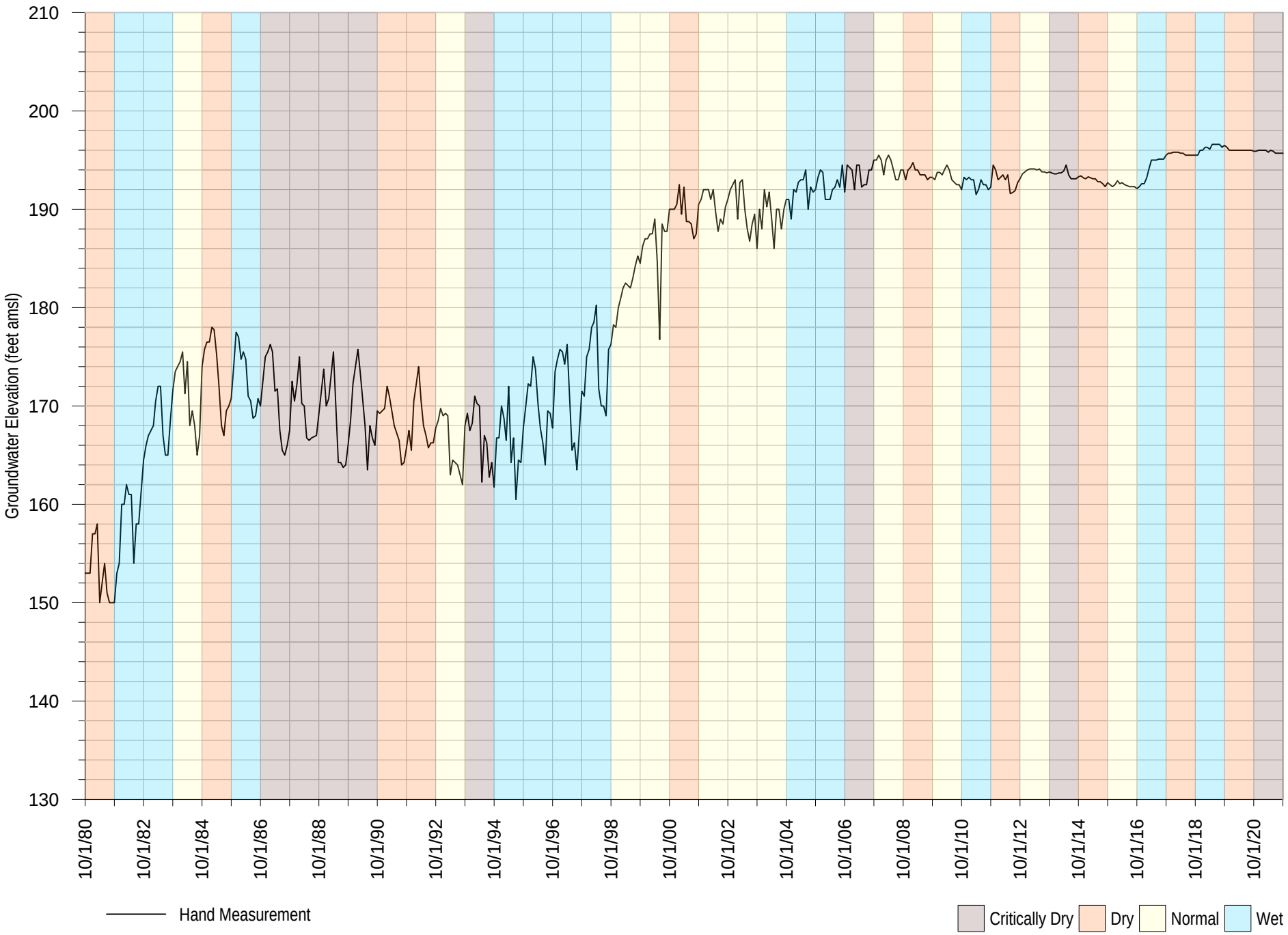
FIGURE A-101



CWD-3

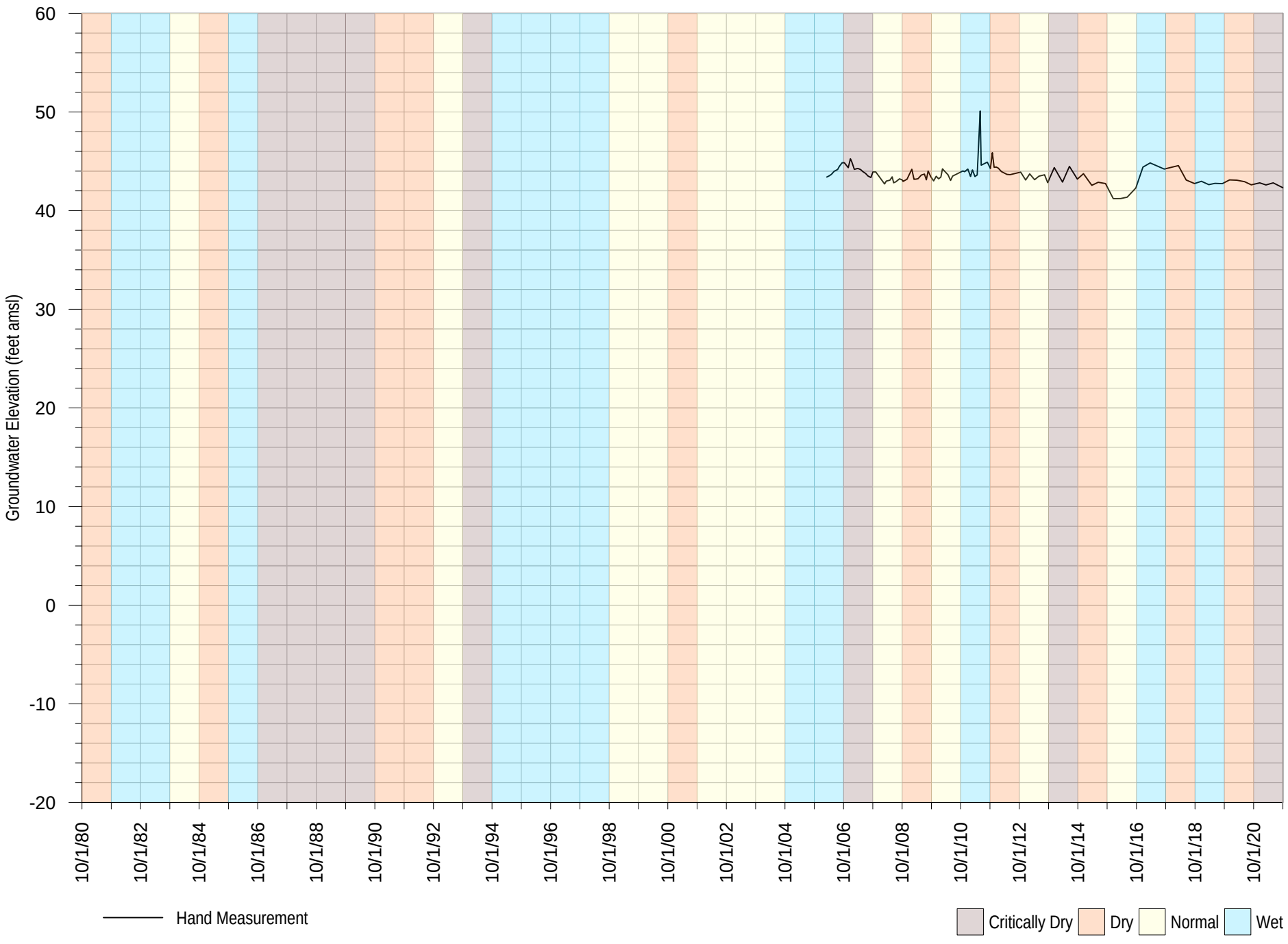
Aquifer Screened: Purisima F

FIGURE A-102



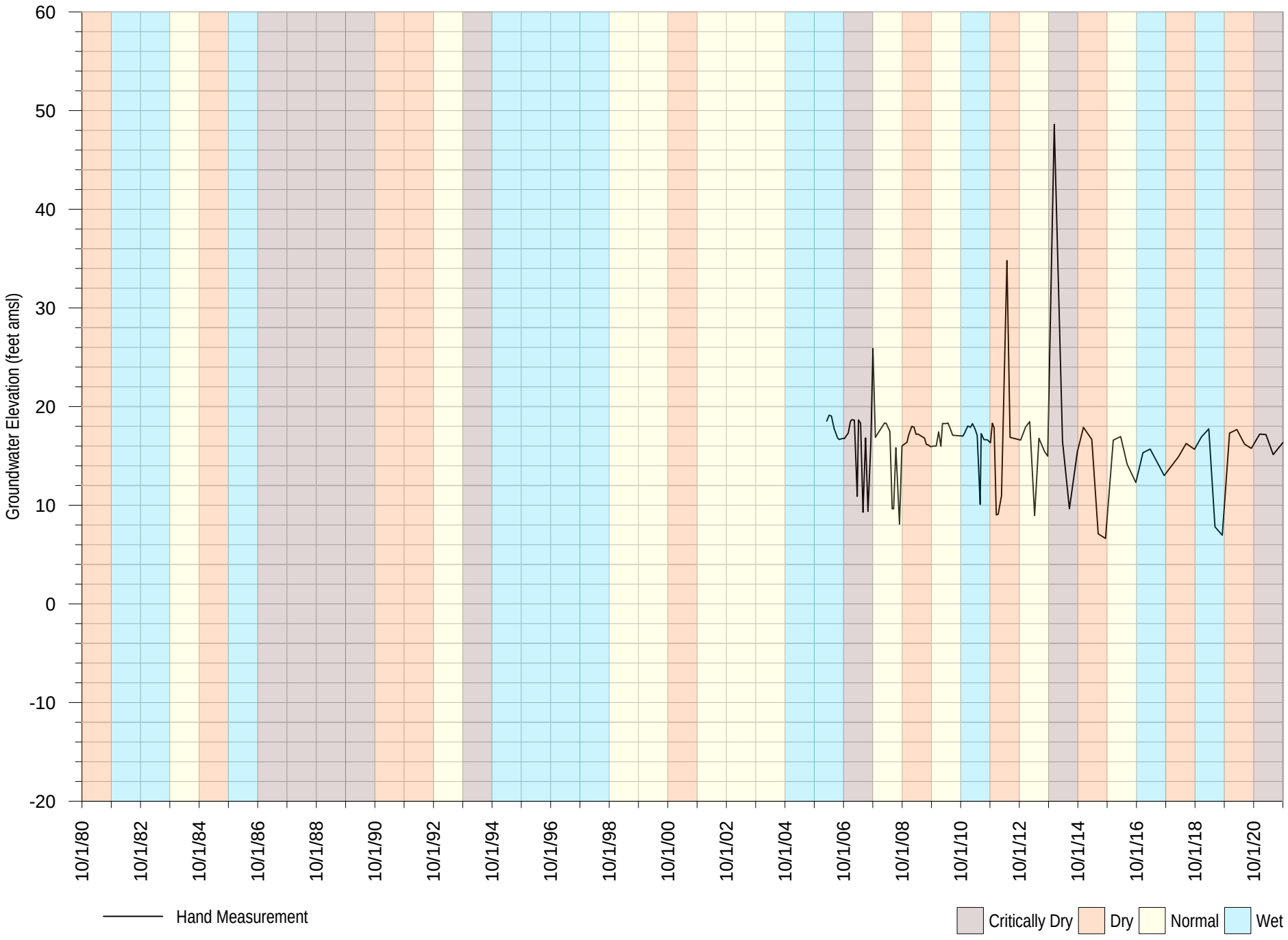
CWD-12A
Aquifer Screened: Aromas

FIGURE A-103



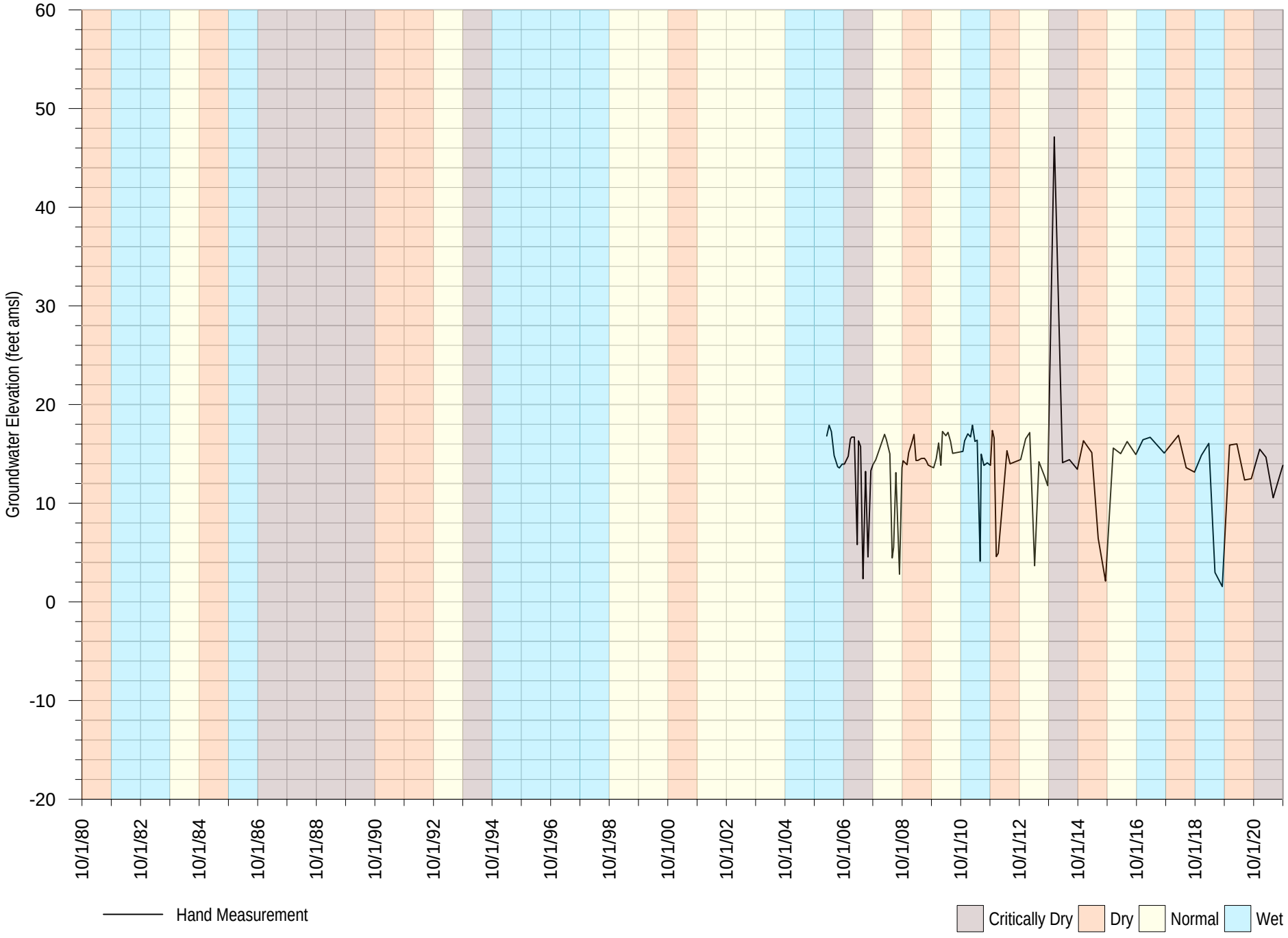
CWD-12B
Aquifer Screened: Aromas

FIGURE A-104



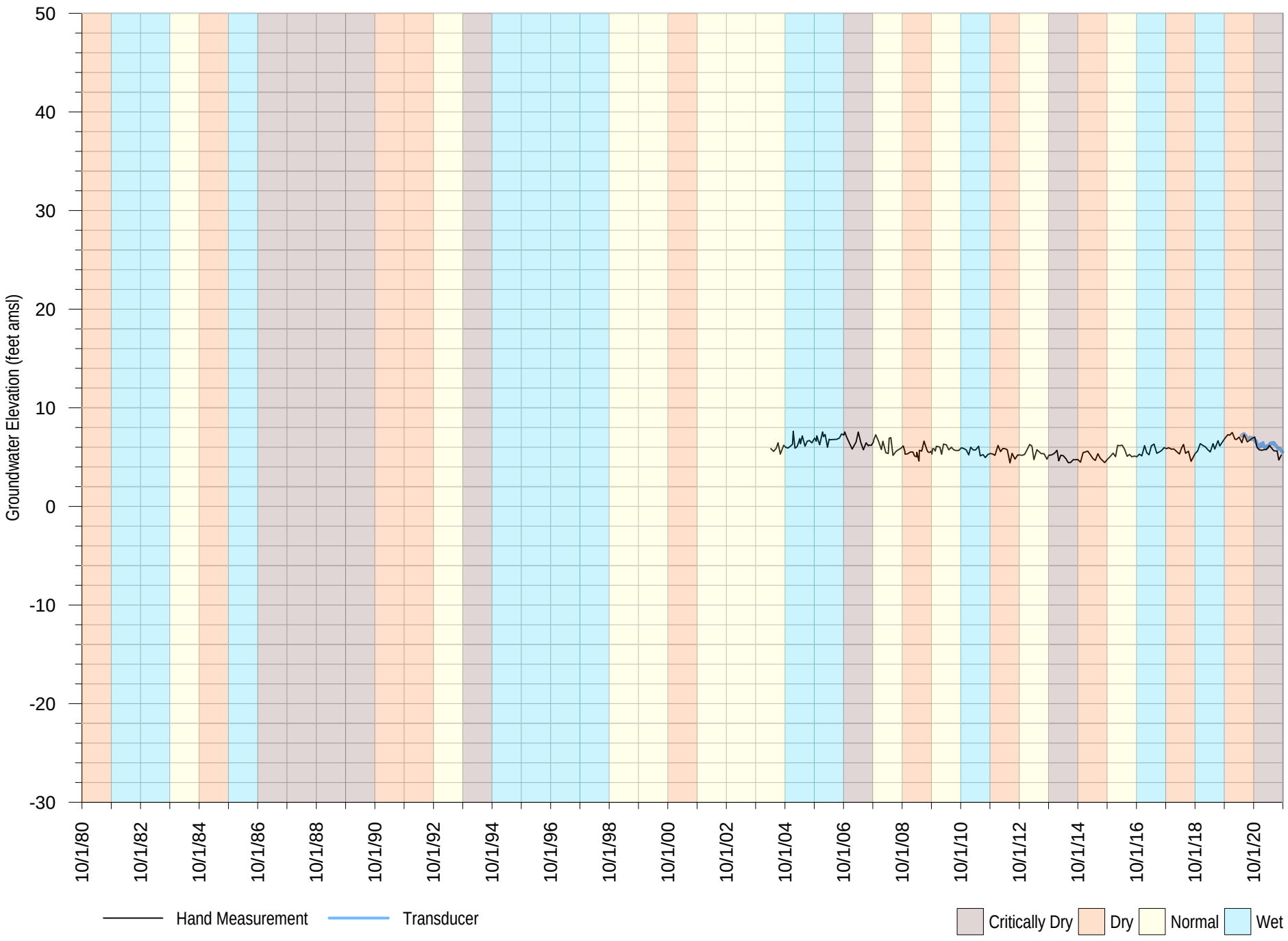
CWD-12C
Aquifer Screened: Purisima F

FIGURE A-105



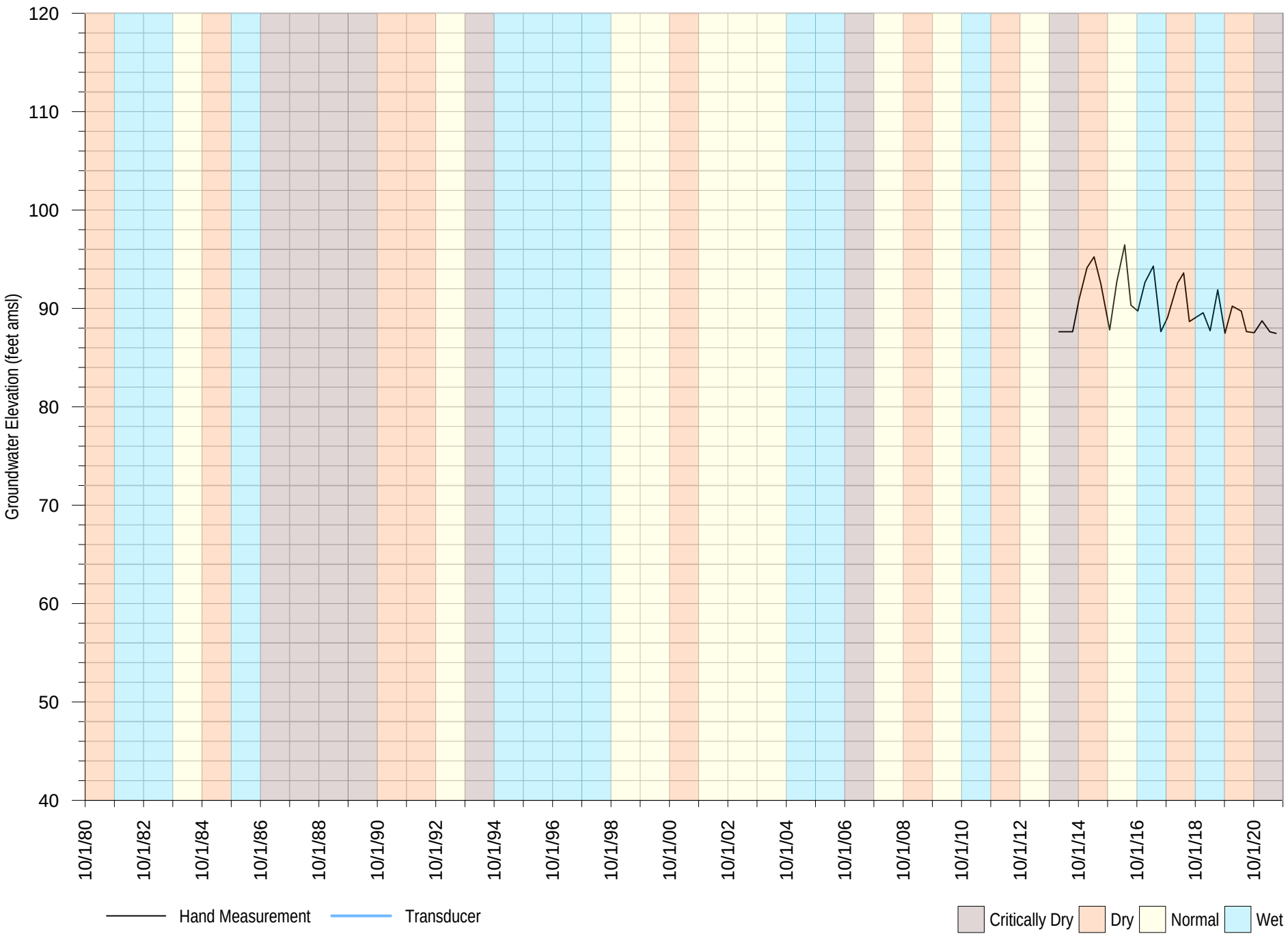
Moran Lake Shallow
Aquifer Screened: Purisima A

FIGURE A-106



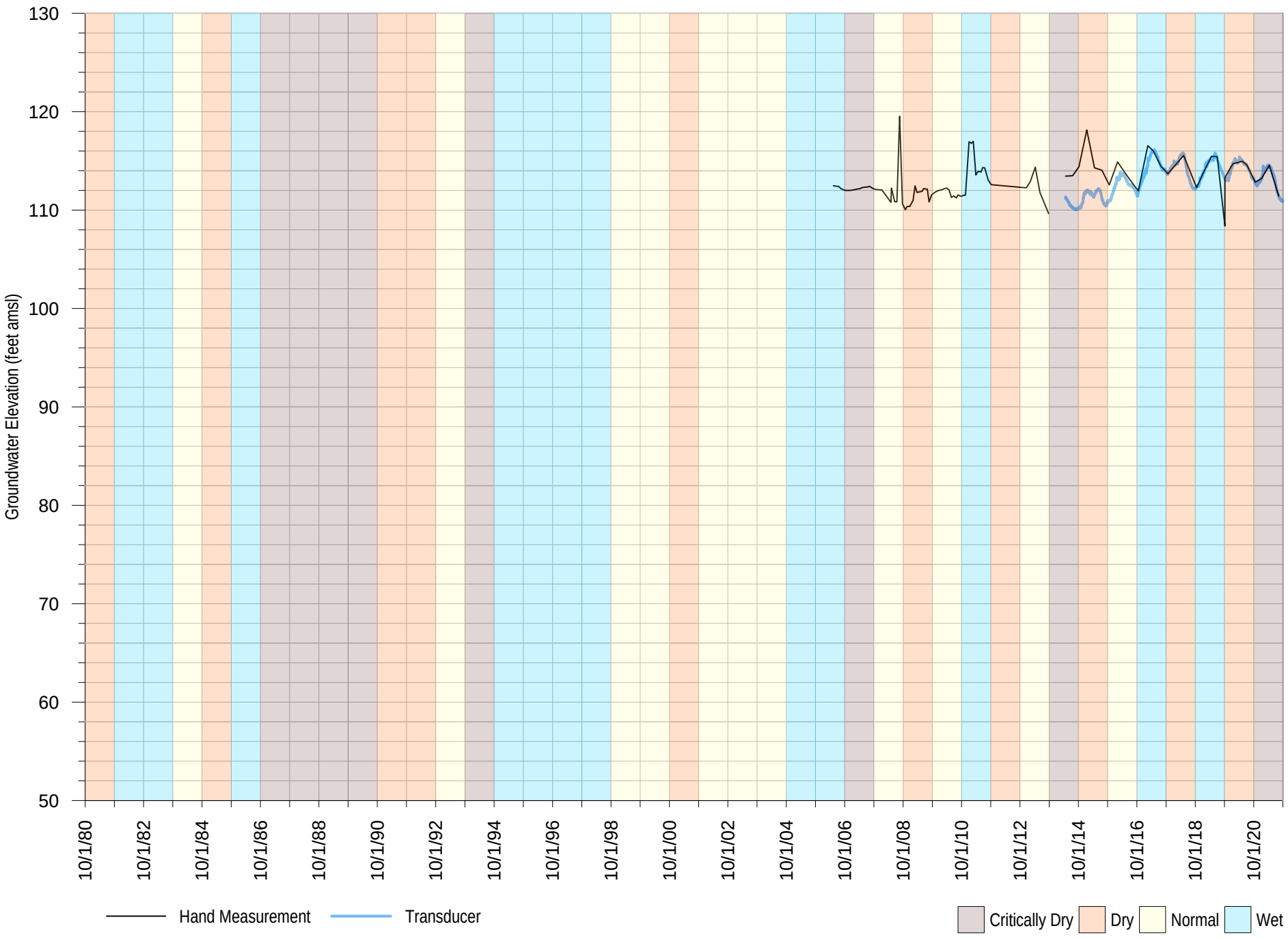
SC-10AAA at Cherryvale
Aquifer Screened: Tu

FIGURE A-107



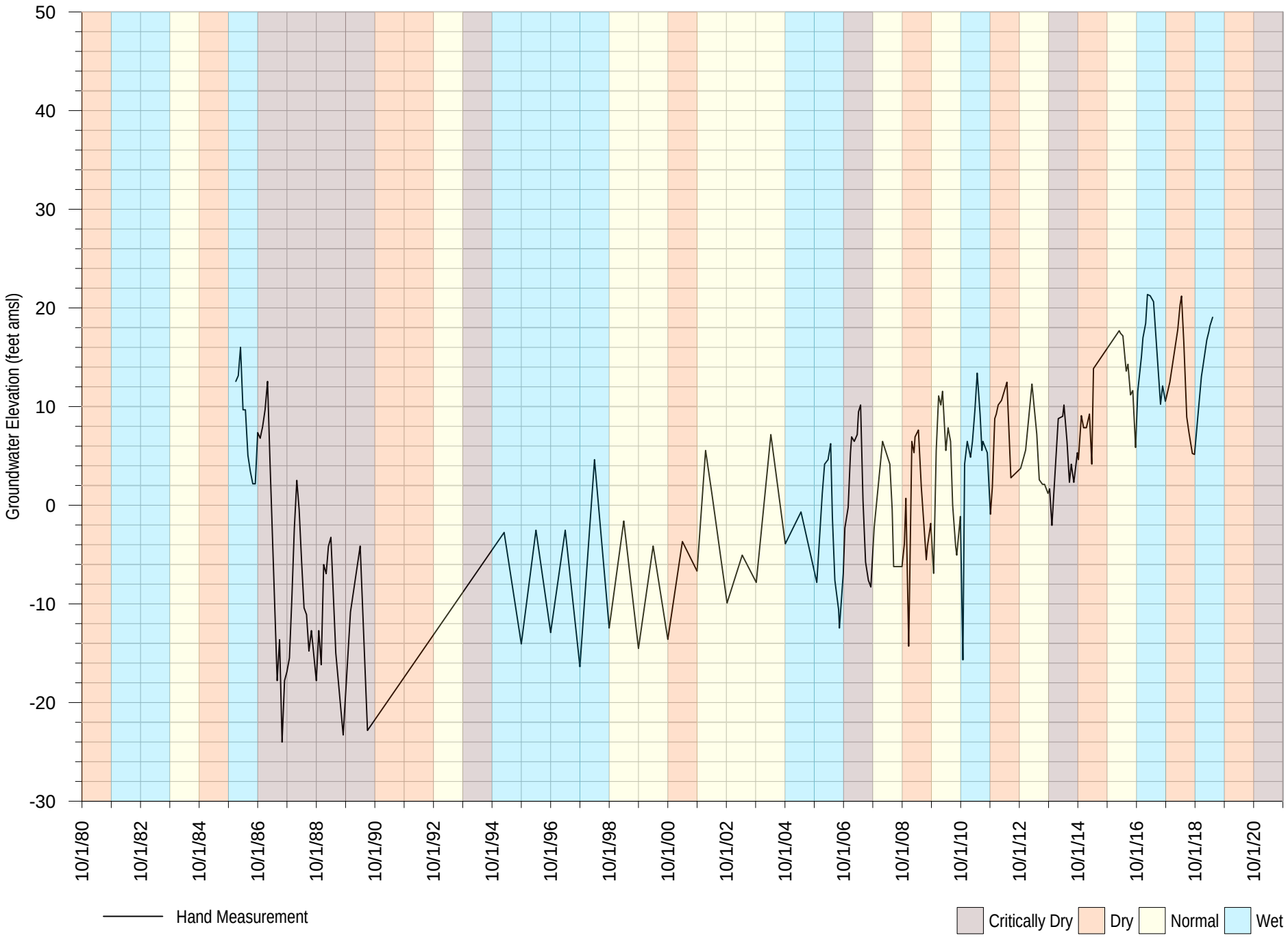
SC-11A & SC-11RA at Porter Gulch
Aquifer Screened: Purisima A/AA

FIGURE A-108



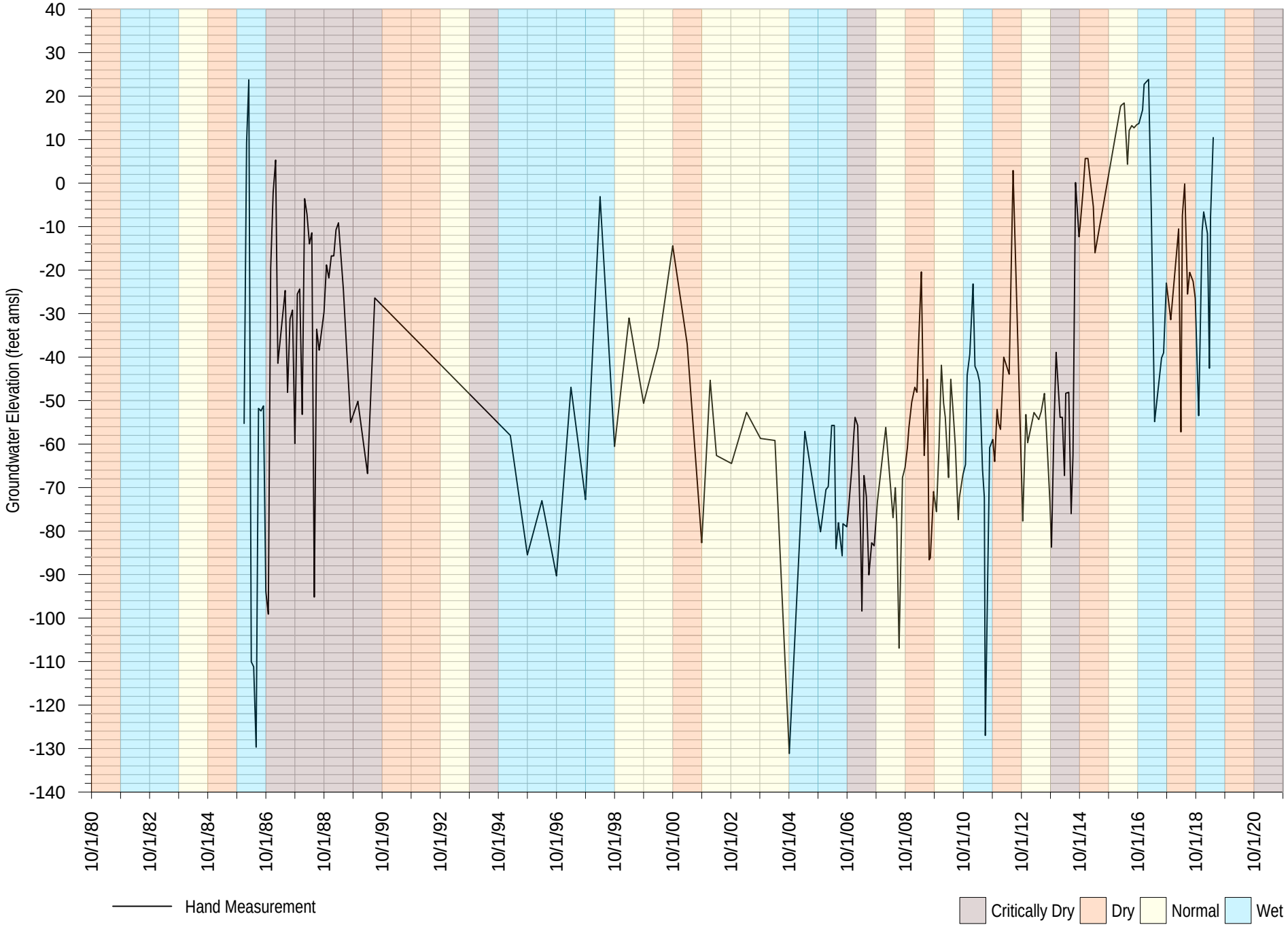
SC-14A at Madeline
Aquifer Screened: Purisima A/AA

FIGURE A-109



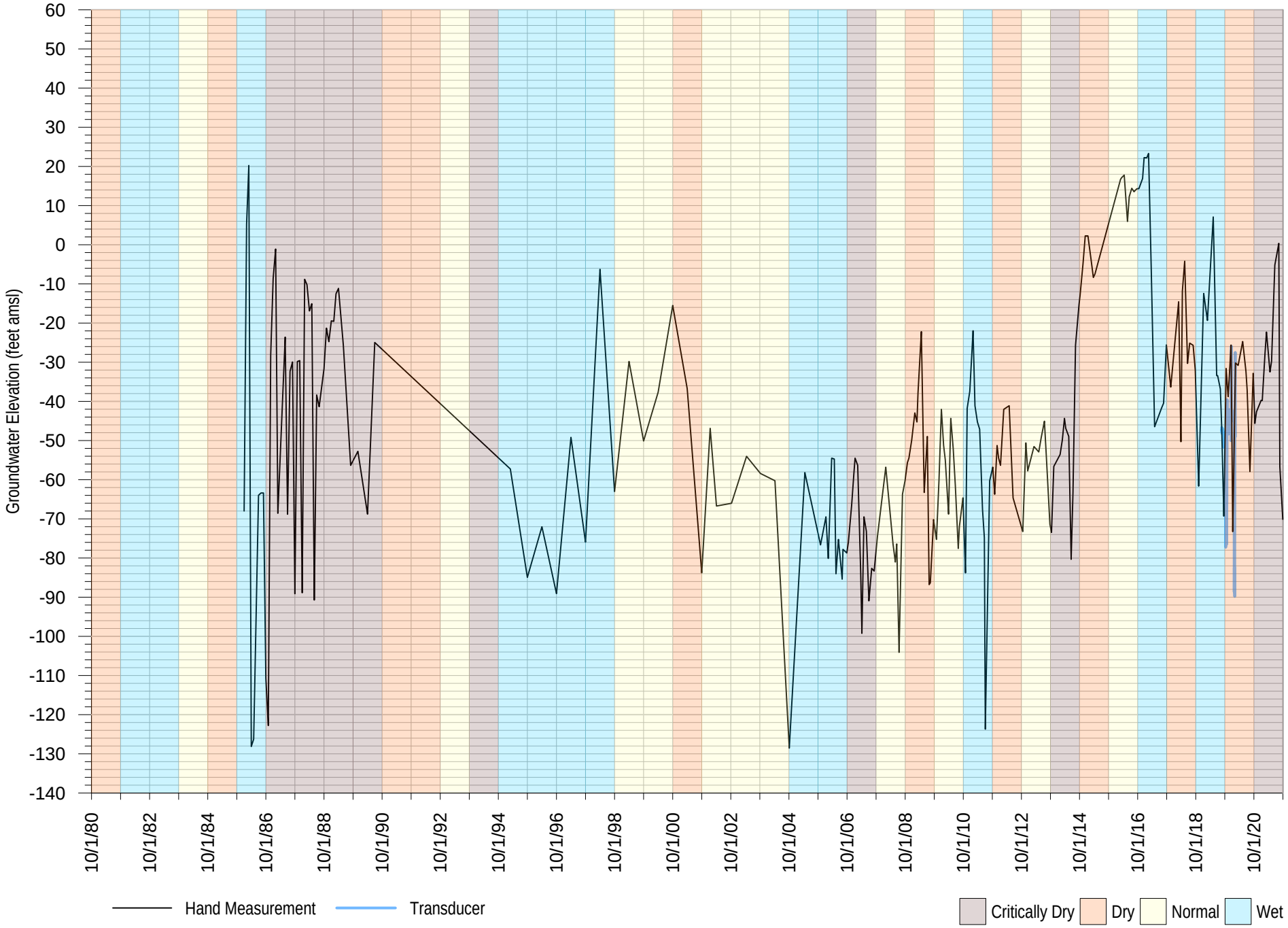
SC-14B at Madeline
Aquifer Screened: Purisima BC

FIGURE A-110



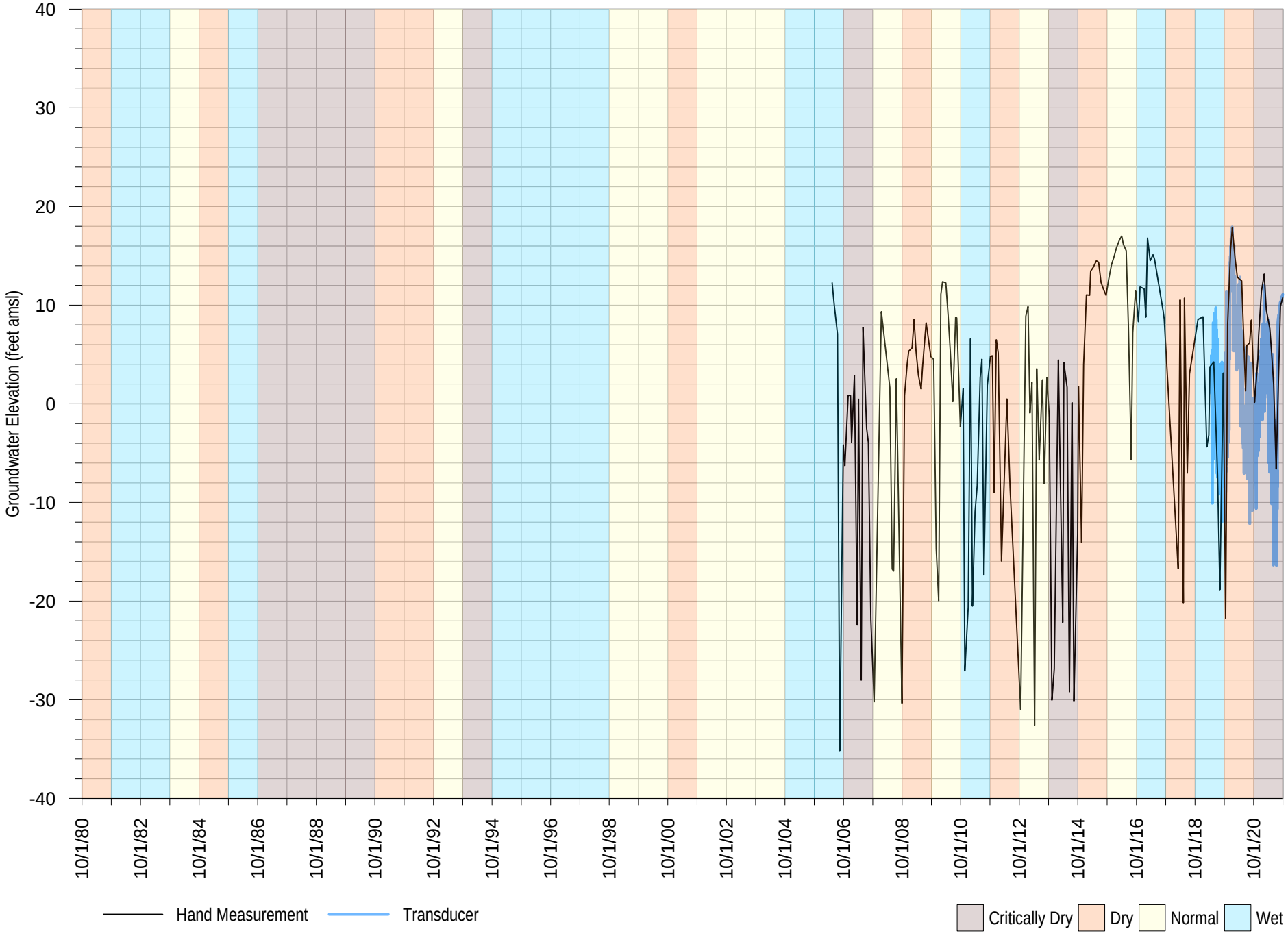
SC-14C at Madeline
Aquifer Screened: Purisima BC

FIGURE A-111



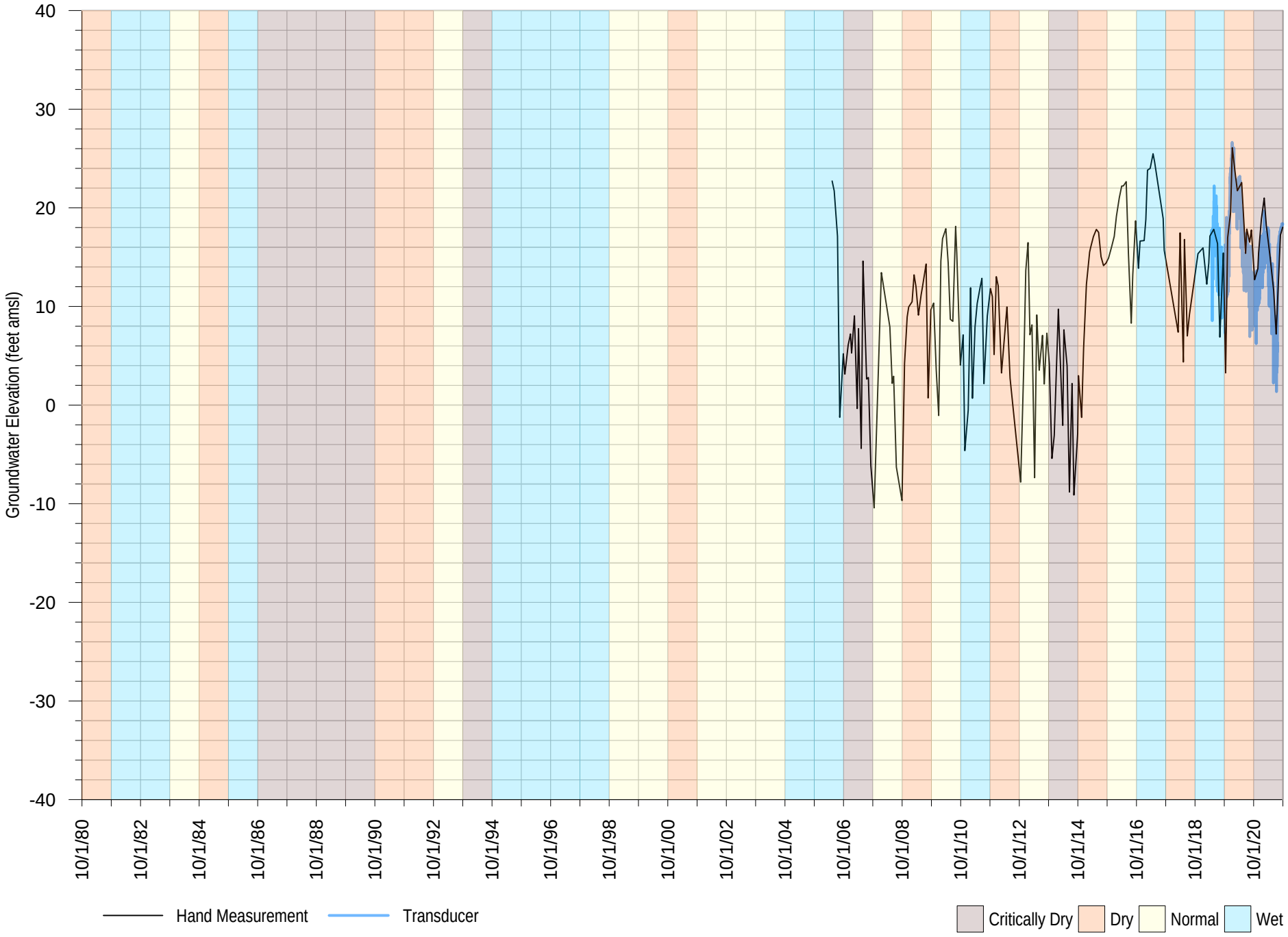
SC-15A at Rosedale
Aquifer Screened: Purisima AA

FIGURE A-112



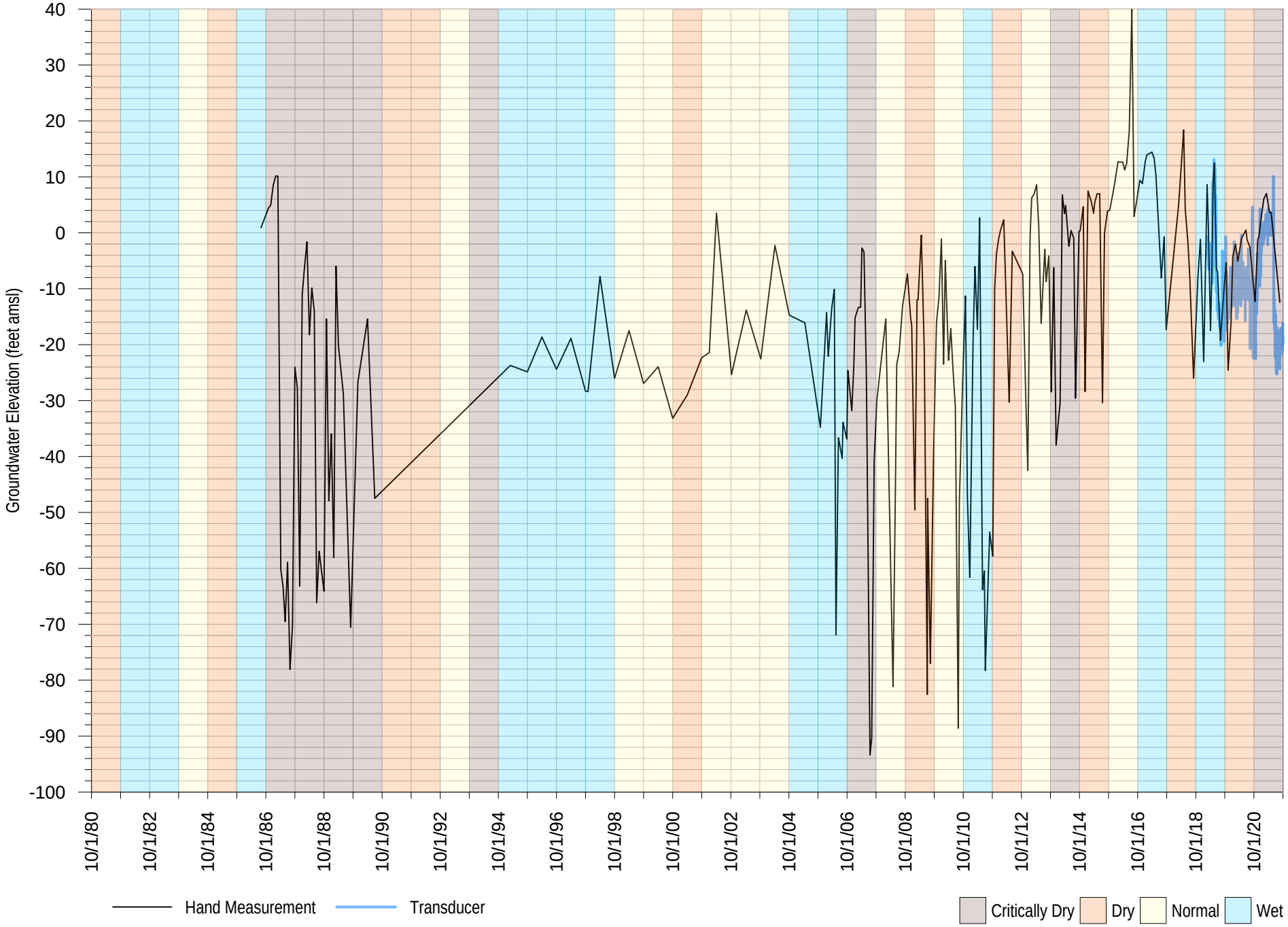
SC-15B at Rosedale
Aquifer Screened: Purisima A

FIGURE A-113



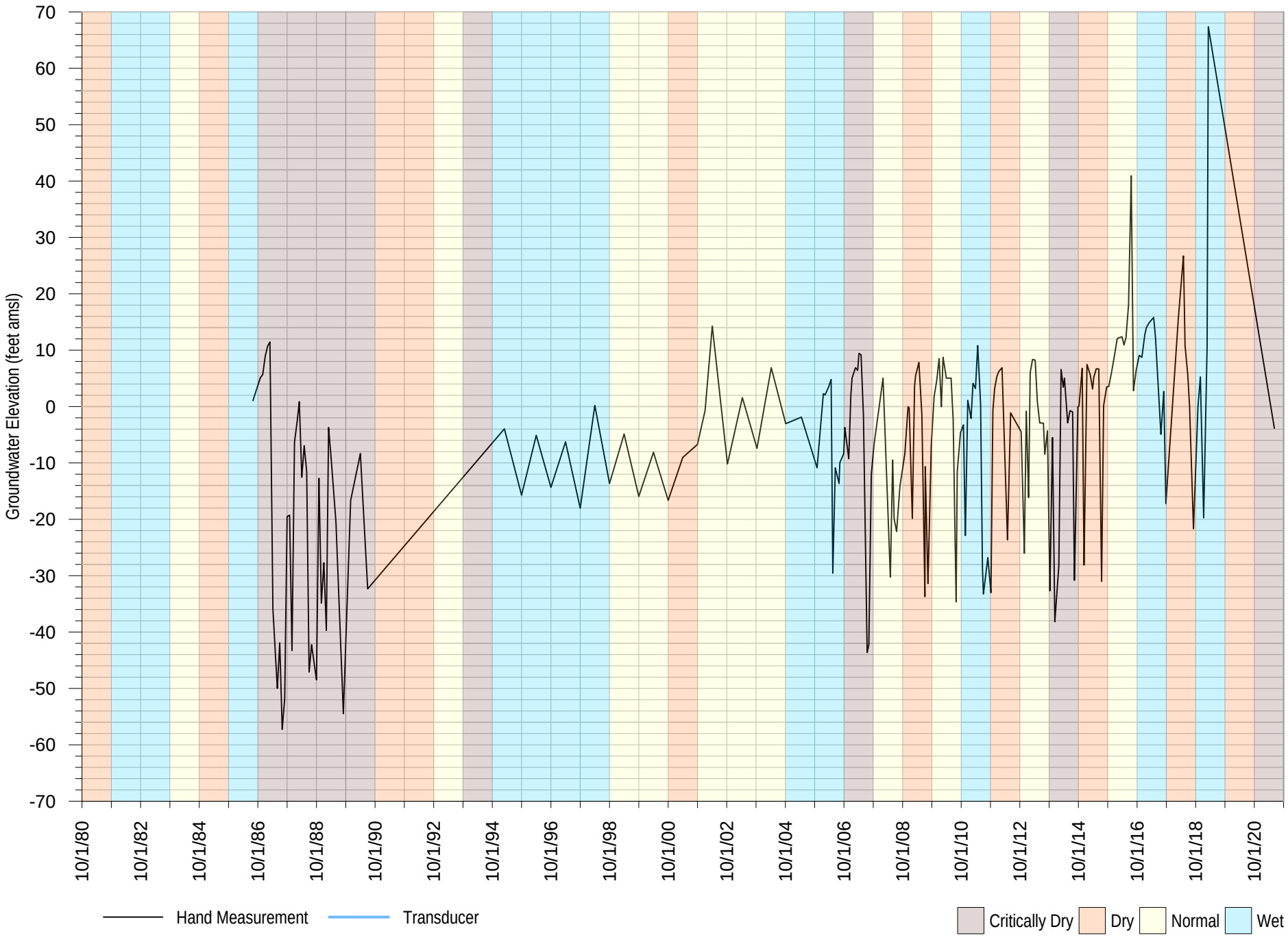
SC-16A at Estates
Aquifer Screened: Purisima A/AA

FIGURE A-114



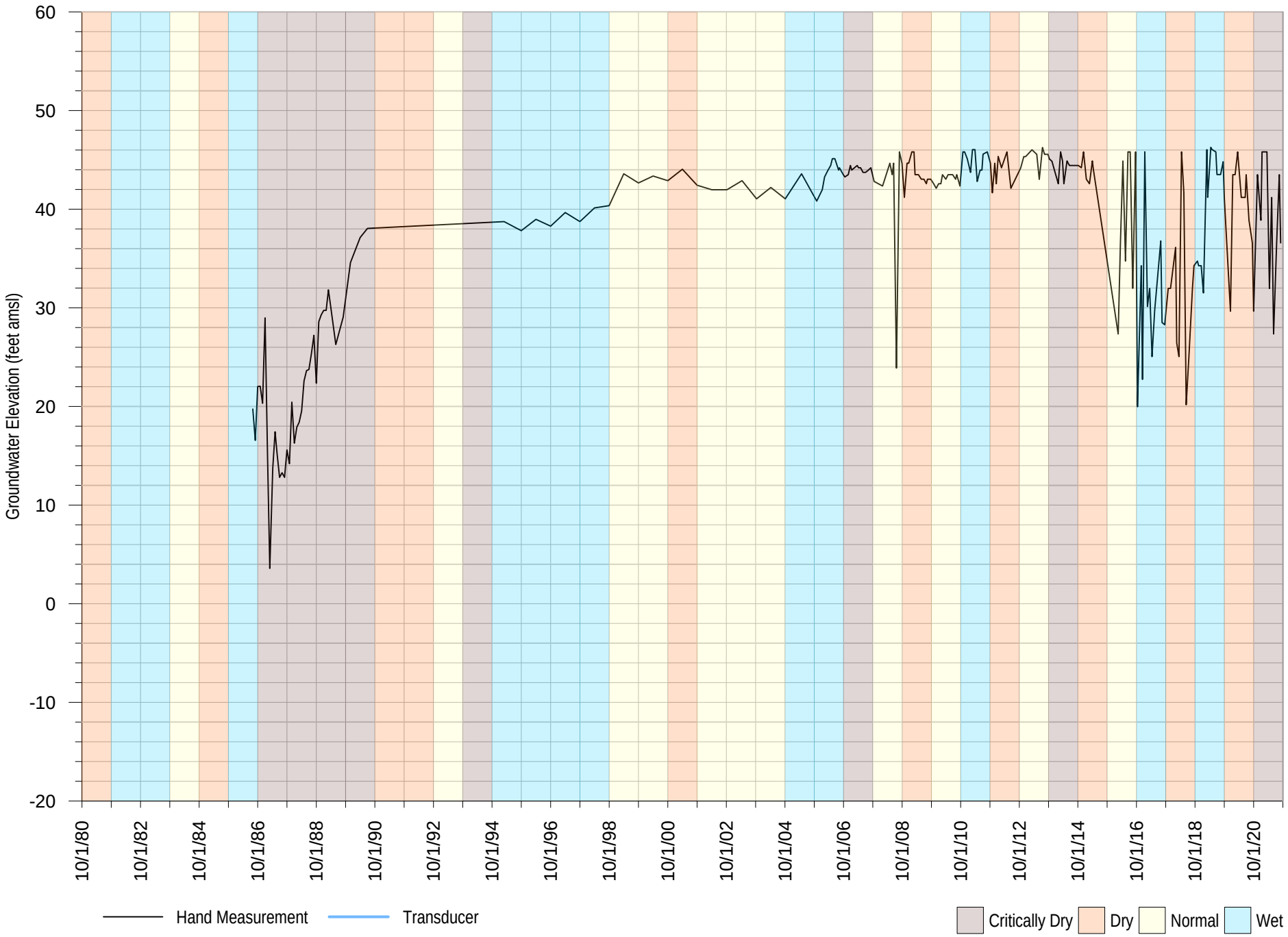
SC-16B at Estates
Aquifer Screened: Purisima BC

FIGURE A-115



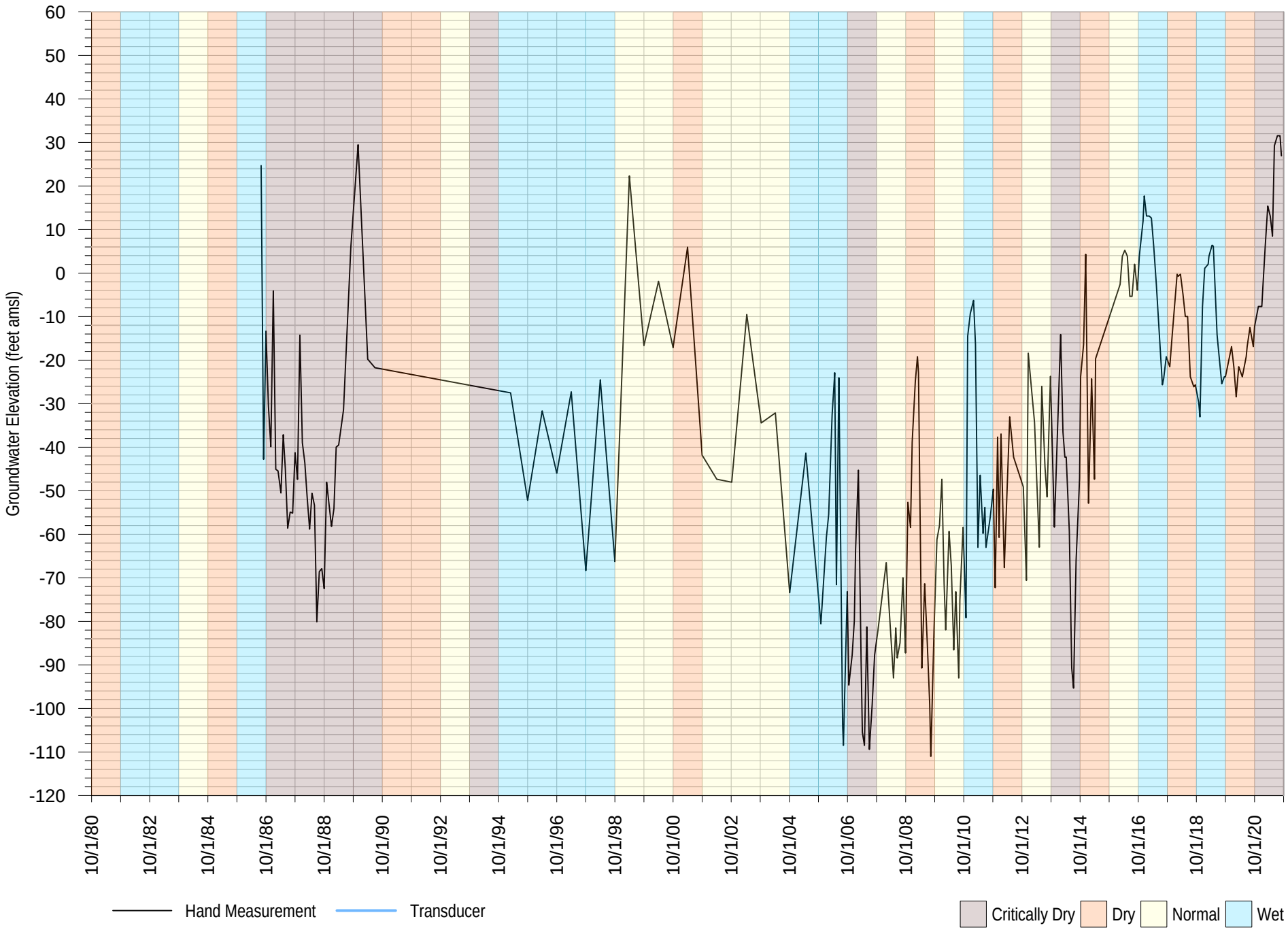
SC-17A at Ledyard
Aquifer Screened: Purisima A

FIGURE A-116



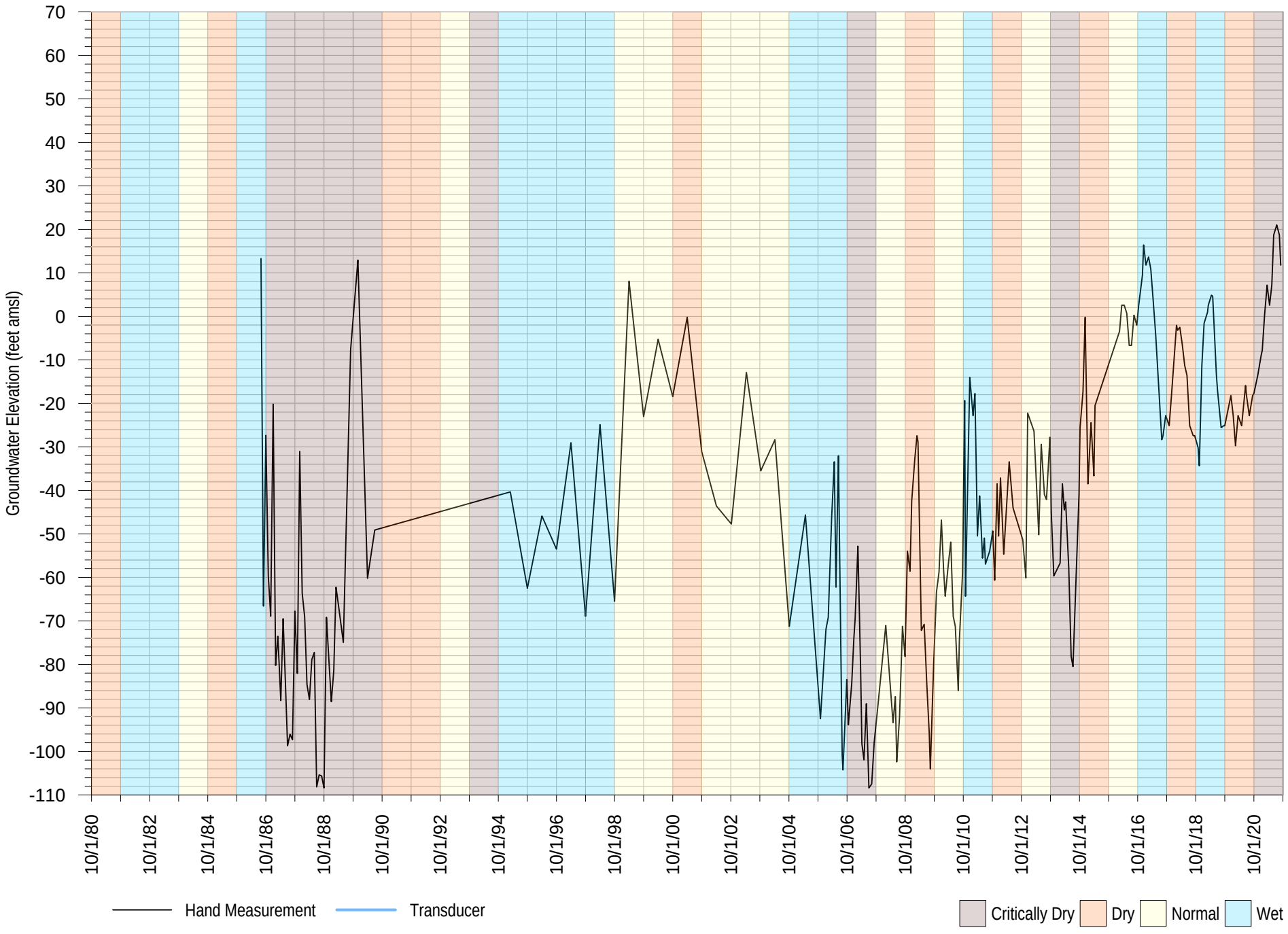
SC-17B at Ledyard
Aquifer Screened: Purisima BC

FIGURE A-117



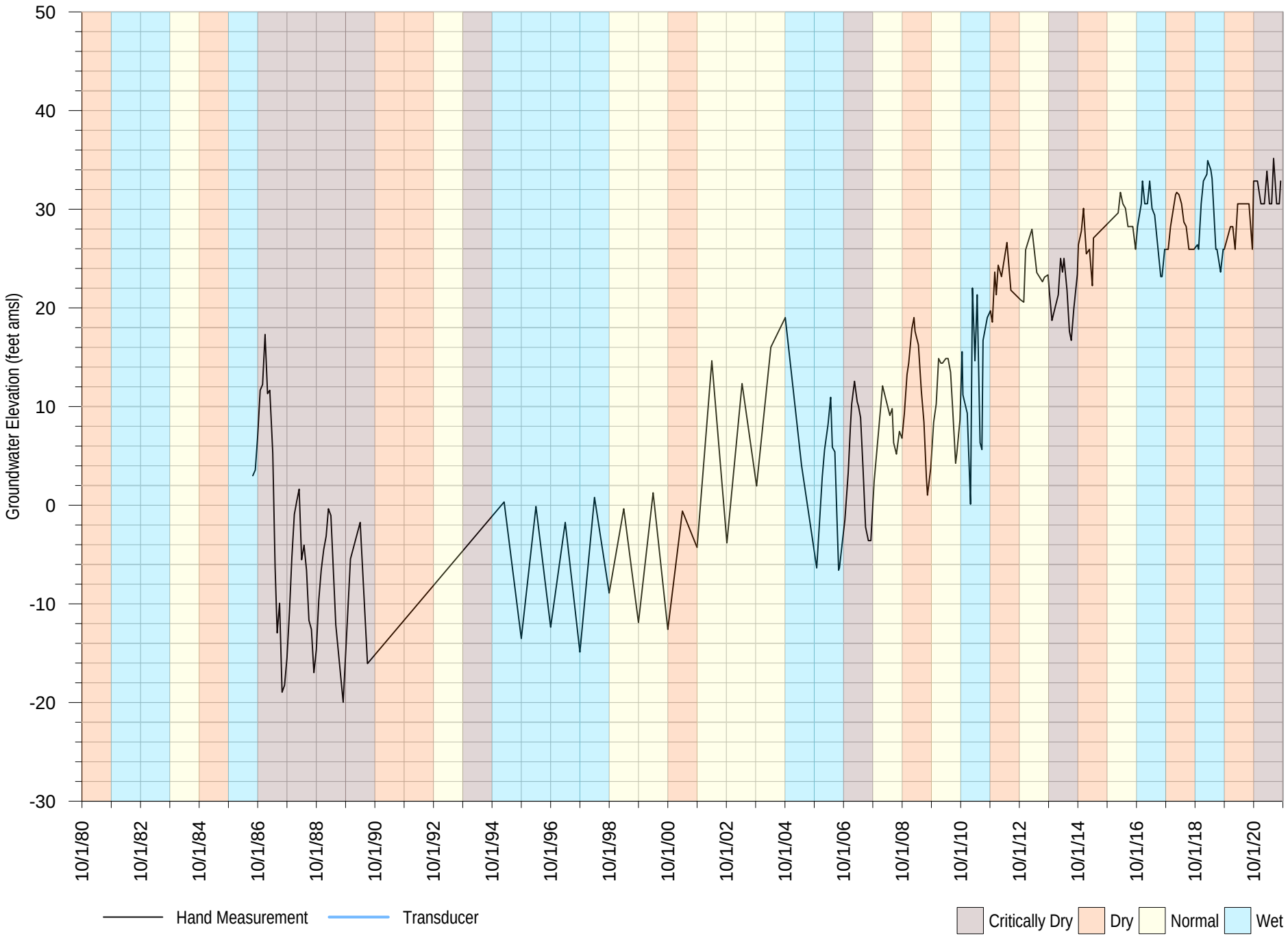
SC-17C at Ledyard
Aquifer Screened: Purisima DEF

FIGURE A-118



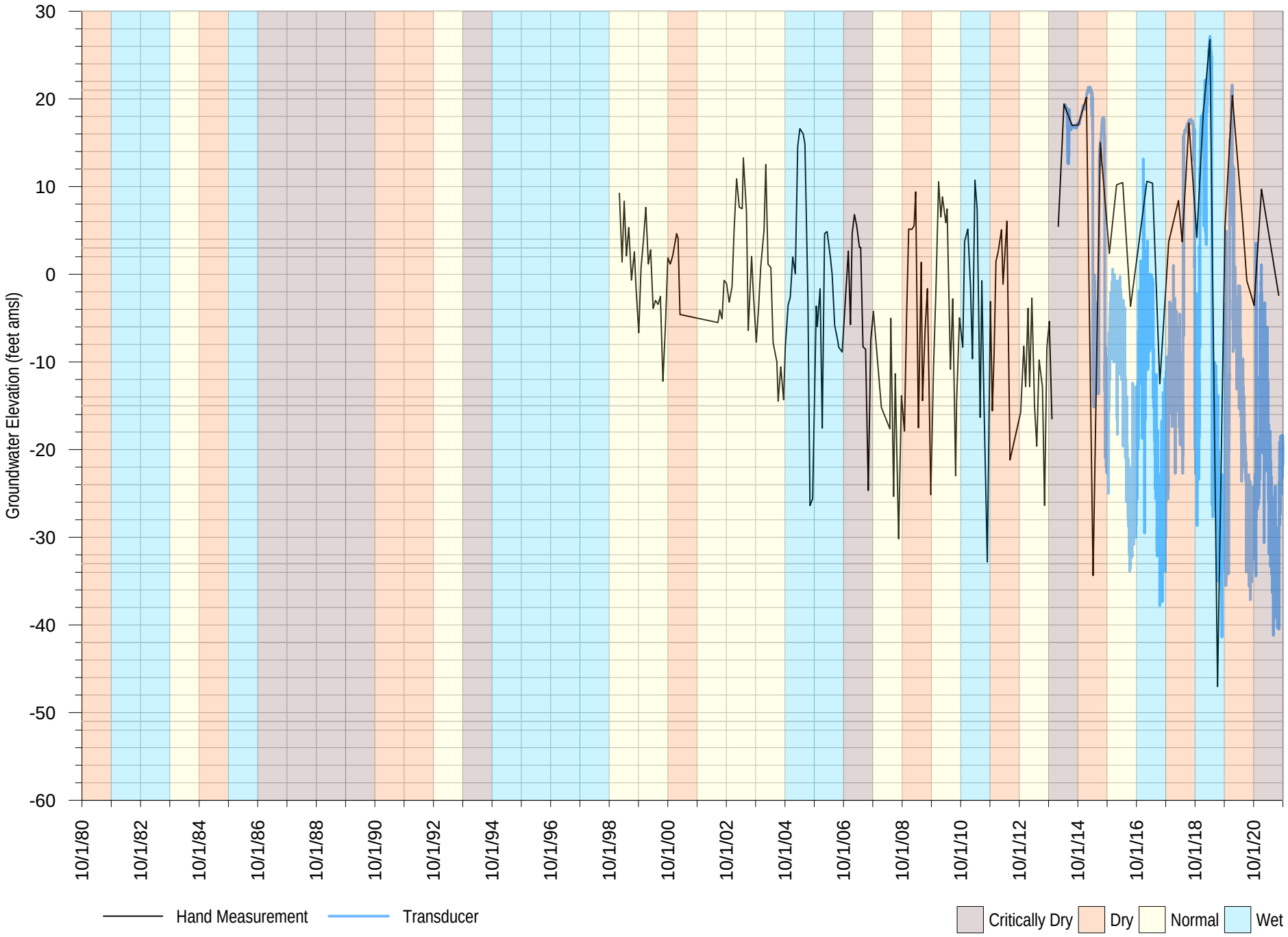
SC-17D at Ledyard
Aquifer Screened: Purisima DEF

FIGURE A-119



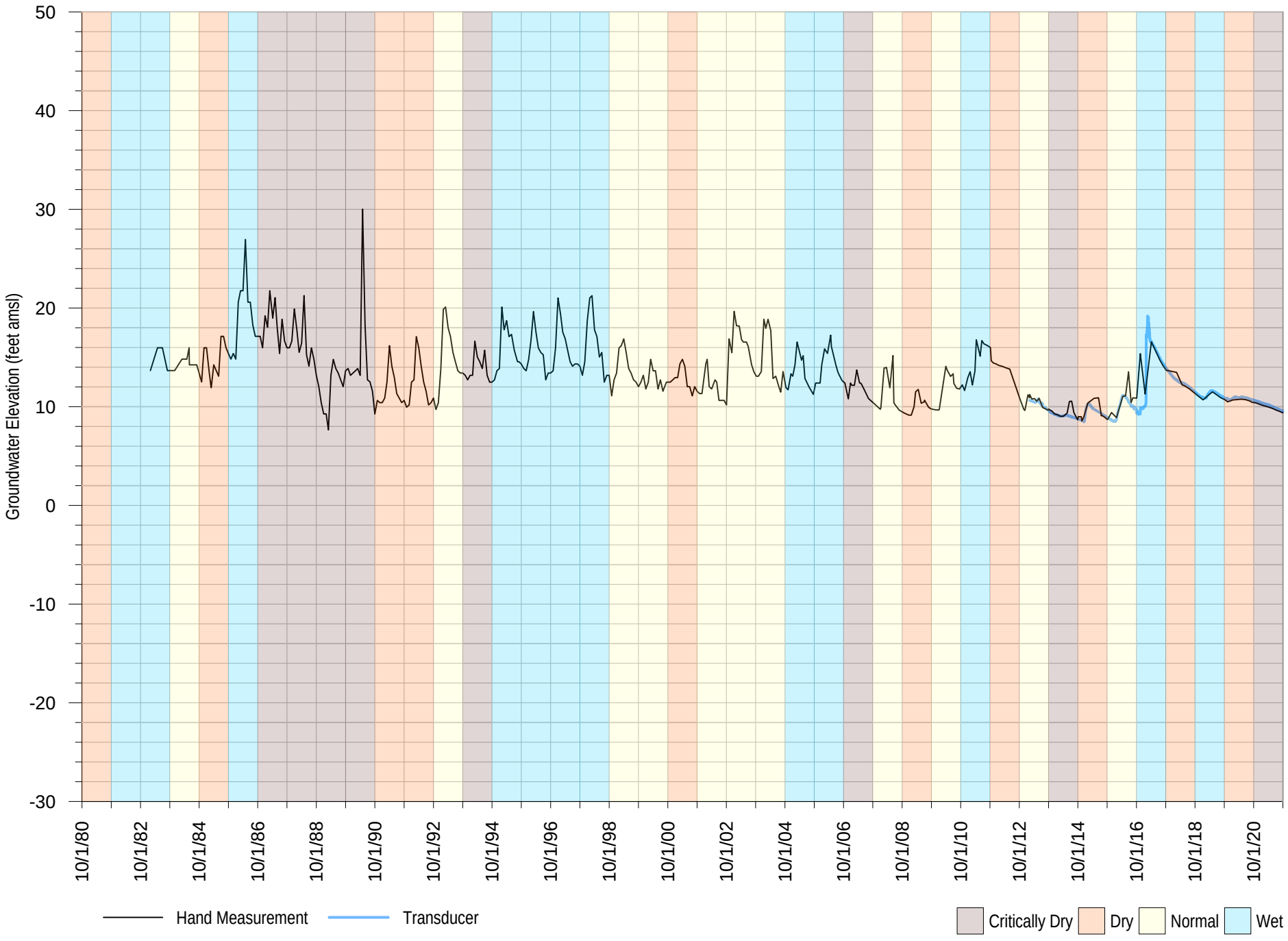
SC-18A & SC-18RA at Main Street
Aquifer Screened: Purisima AA

FIGURE A-120



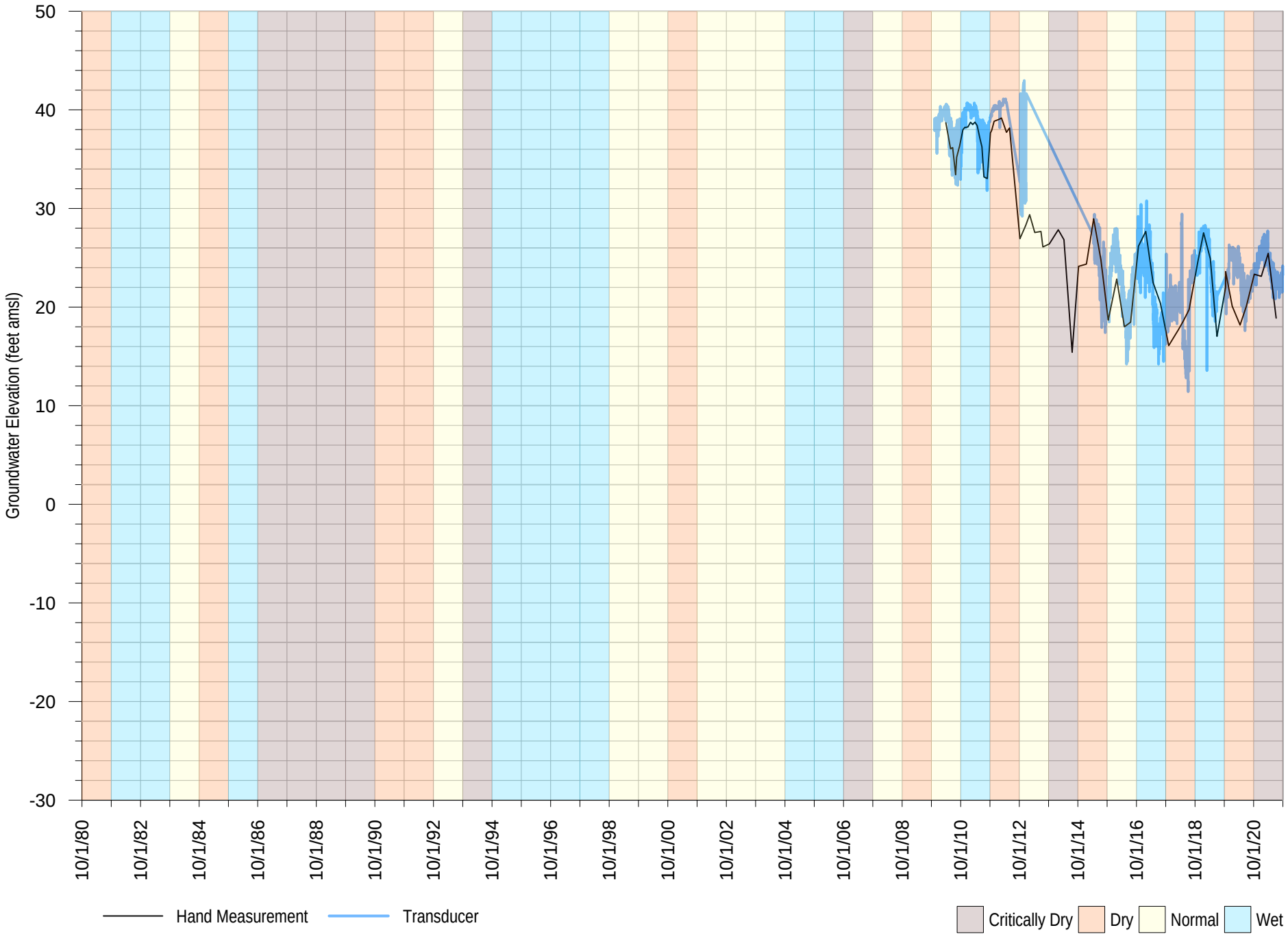
SC-1B at Prospect
Aquifer Screened: Purisima BC

FIGURE A-121



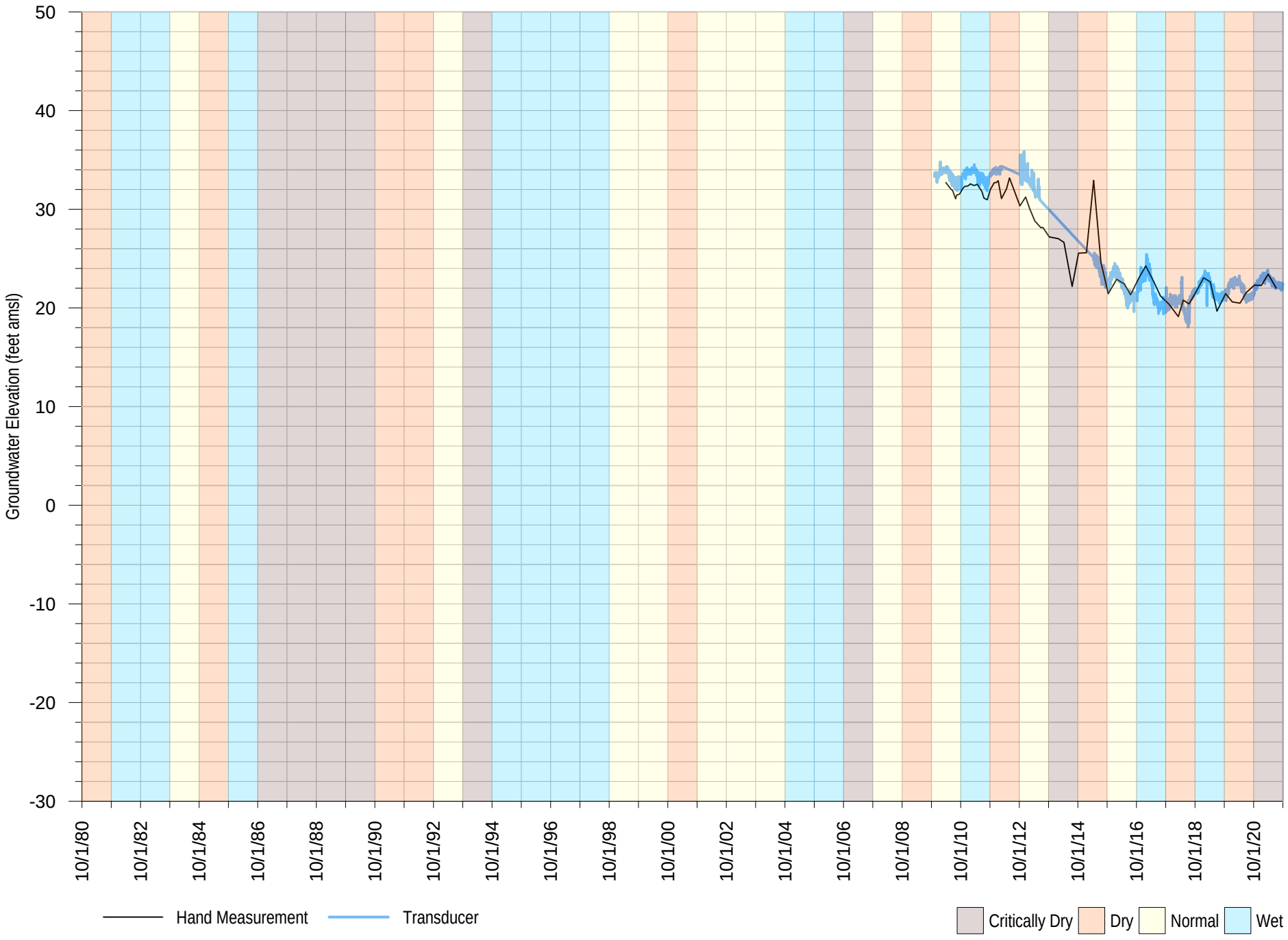
SC-20A at Polo Grounds
Aquifer Screened: Purisima F

FIGURE A-122



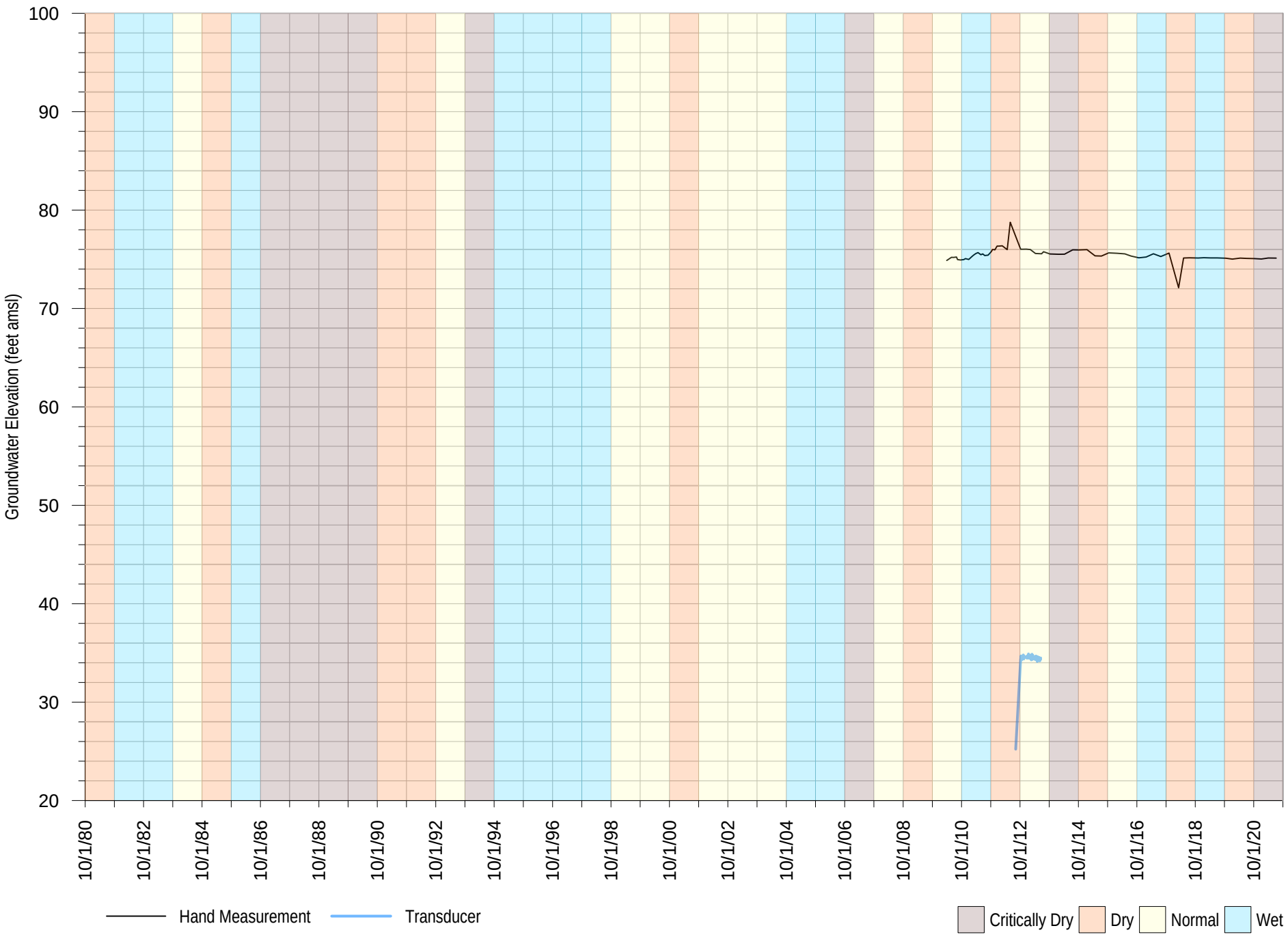
SC-20B at Polo Grounds
Aquifer Screened: Purisima F

FIGURE A-123



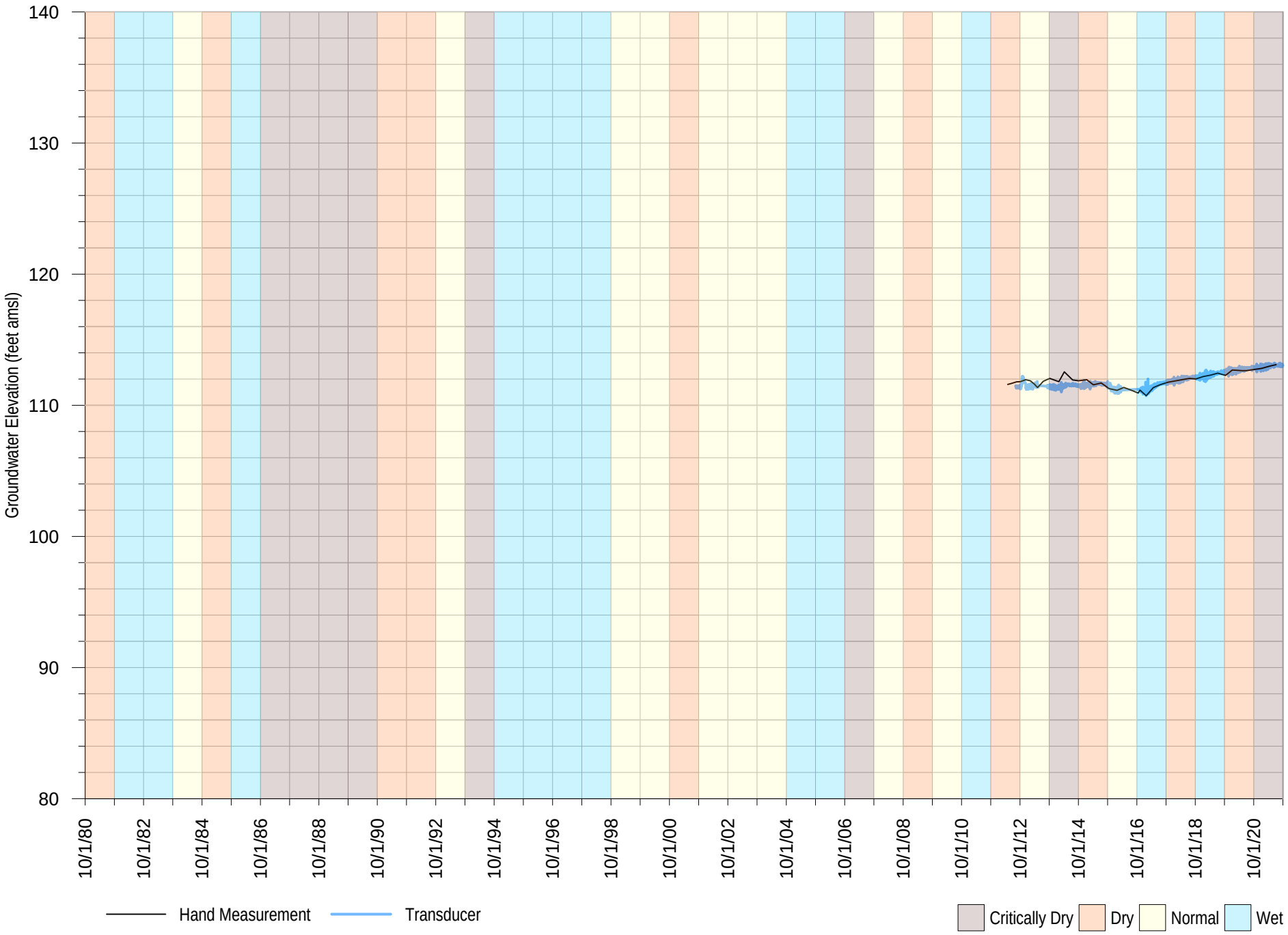
SC-20C at Polo Grounds
Aquifer Screened: Purisima F

FIGURE A-124



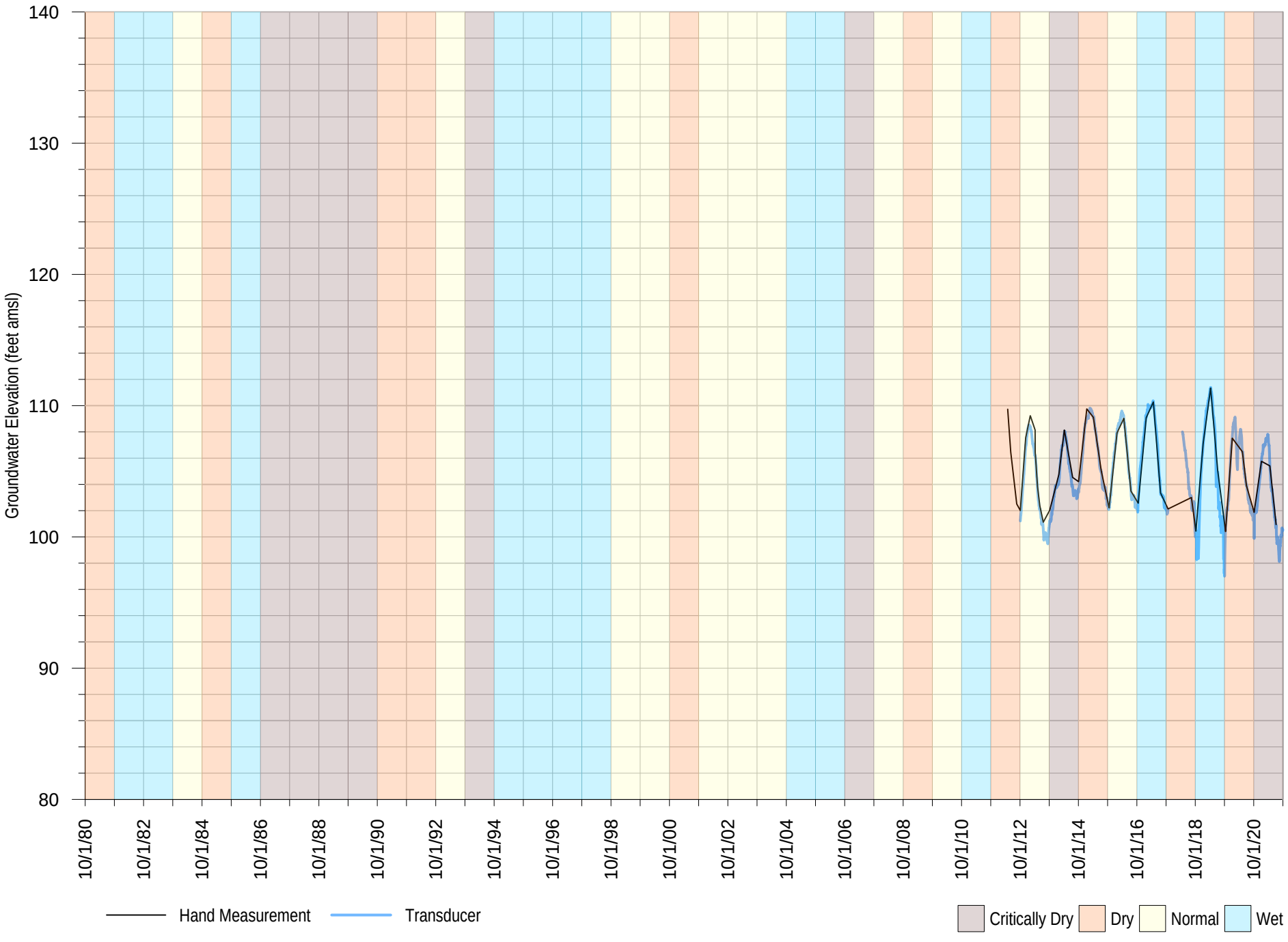
SC-21A at Cornwell
Aquifer Screened: Purisima A

FIGURE A-125



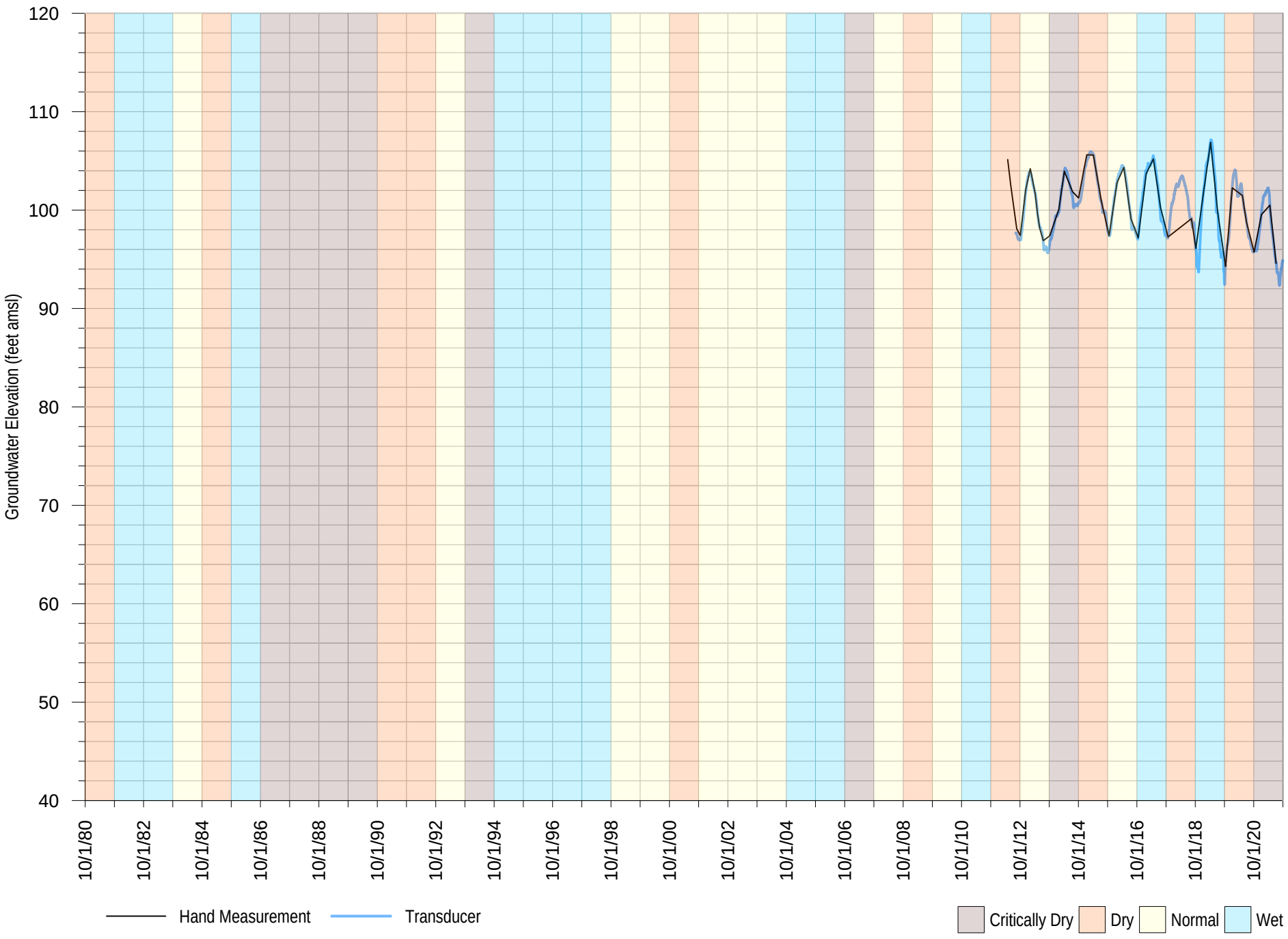
SC-21AA at Cornwell
Aquifer Screened: Purisima AA

FIGURE A-126



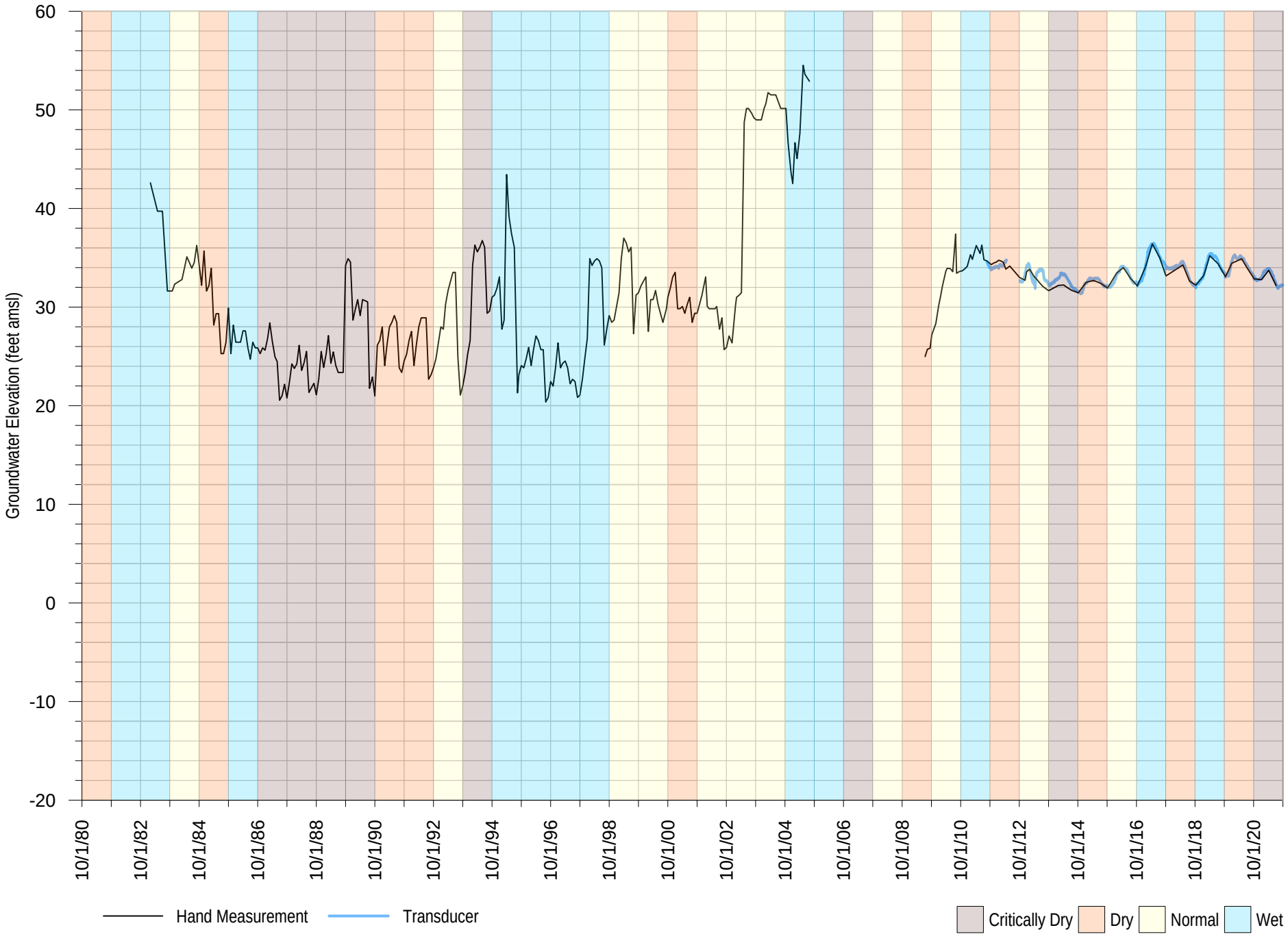
SC-21AAA at Cornwell
Aquifer Screened: Purisima AA

FIGURE A-127



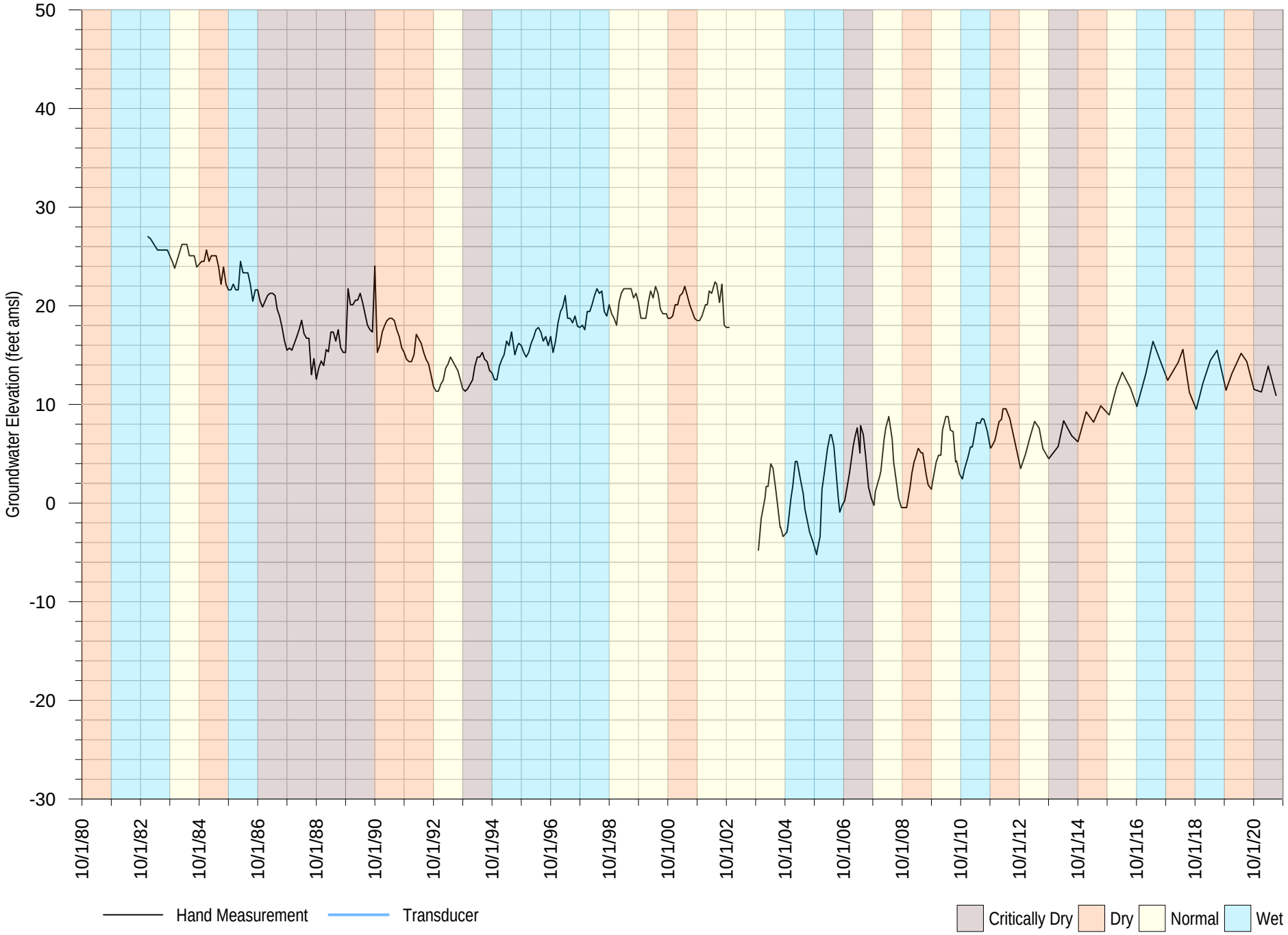
SC-3B & SC-3RB at Escalona
Aquifer Screened: Purisima B

FIGURE A-128



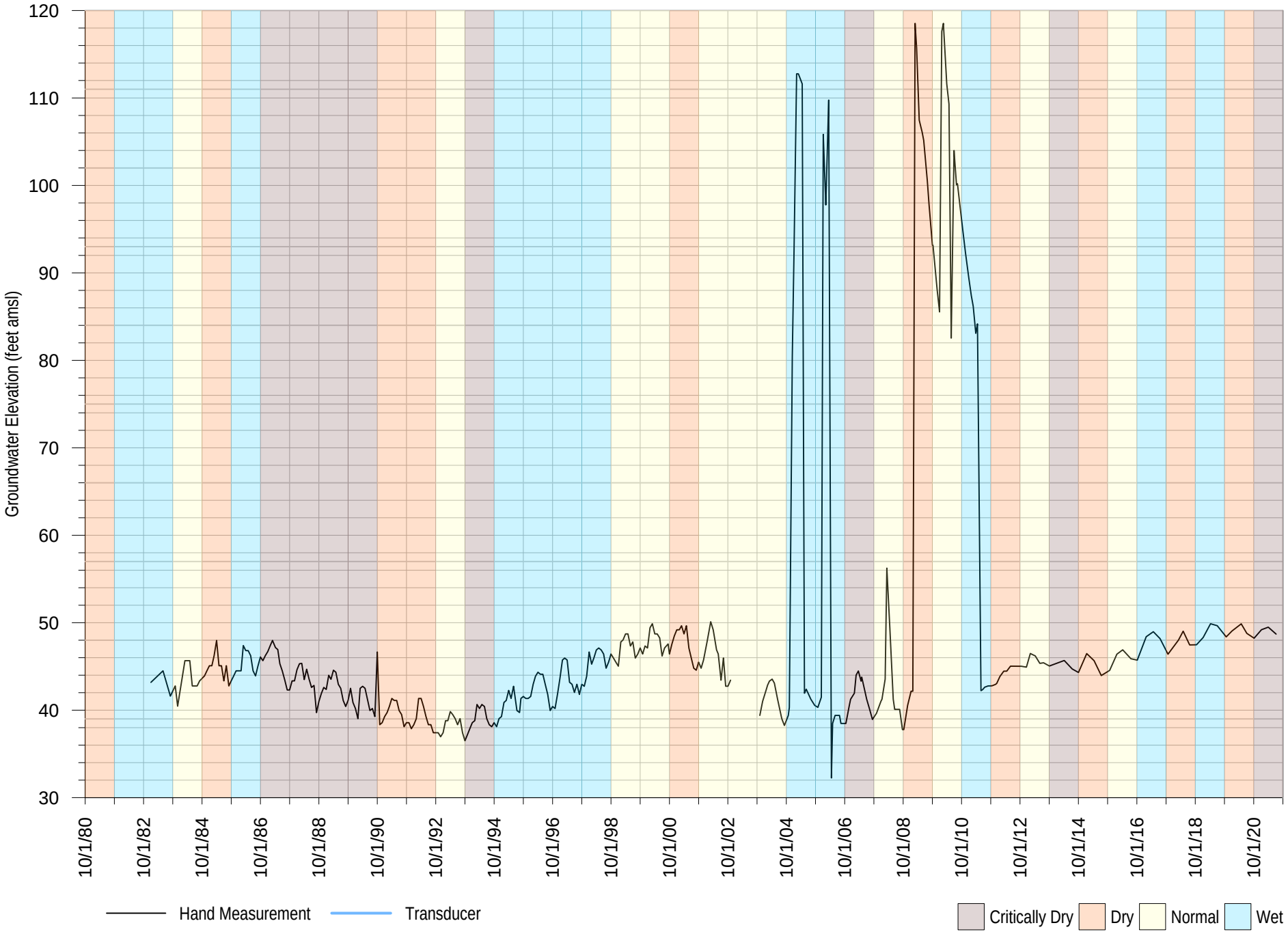
SC-5B & SC-5RB at New Brighton
Aquifer Screened: Purisima B

FIGURE A-129



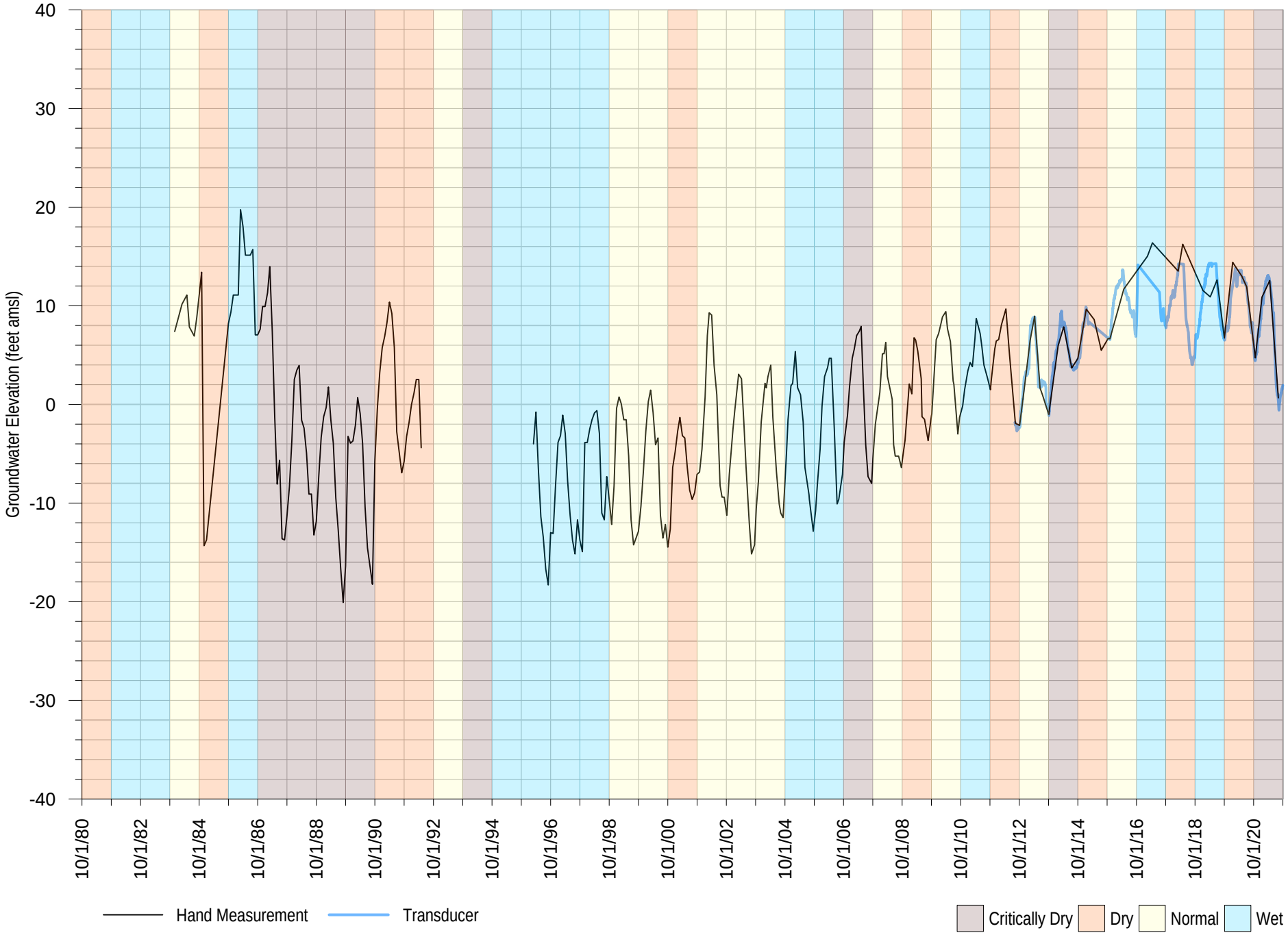
SC-5C & SC-5RC at New Brighton
Aquifer Screened: Purisima BC

FIGURE A-130



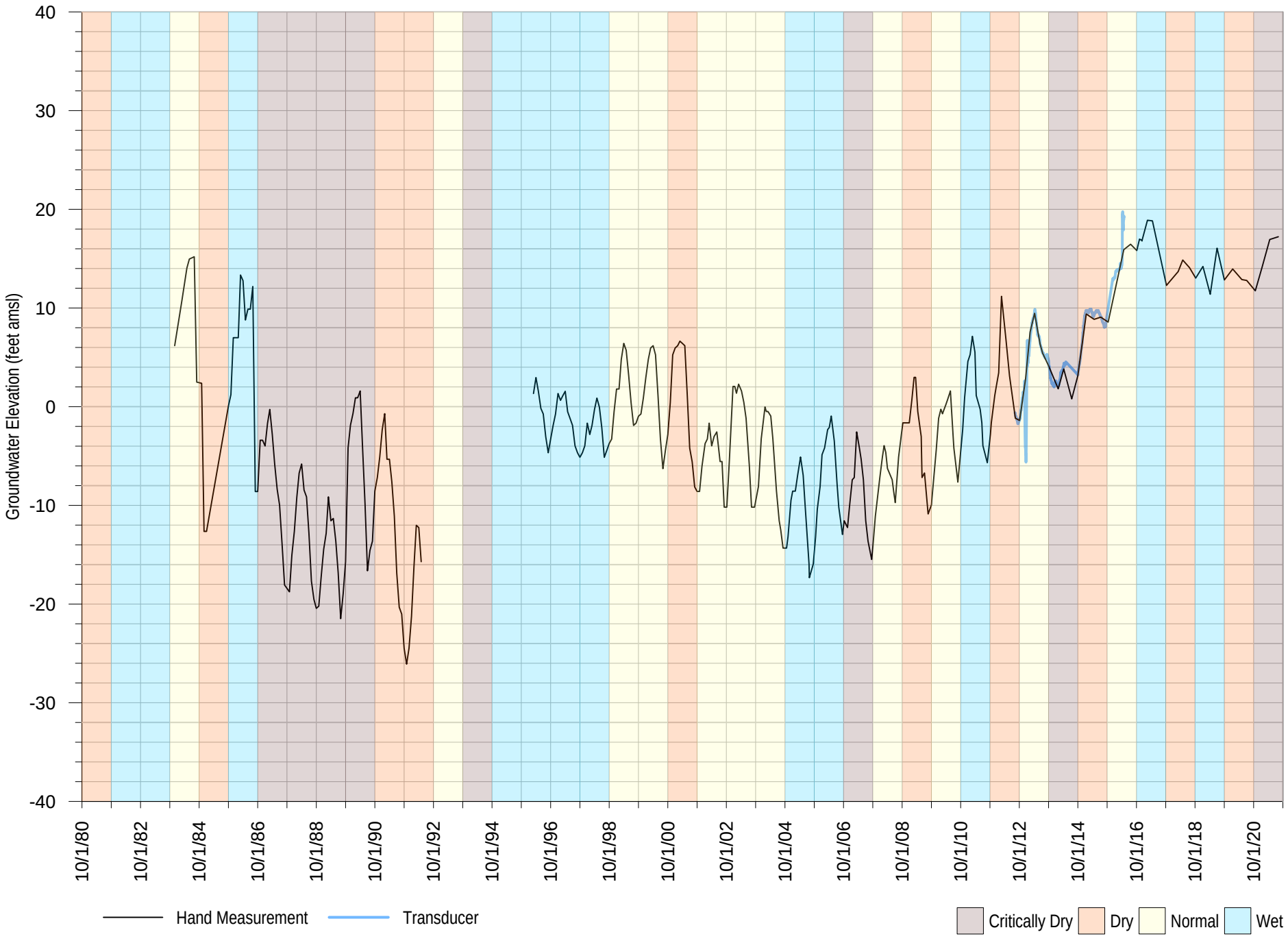
SC-8A & SC-8RA at Aptos Creek
Aquifer Screened: Purisima A

FIGURE A-131



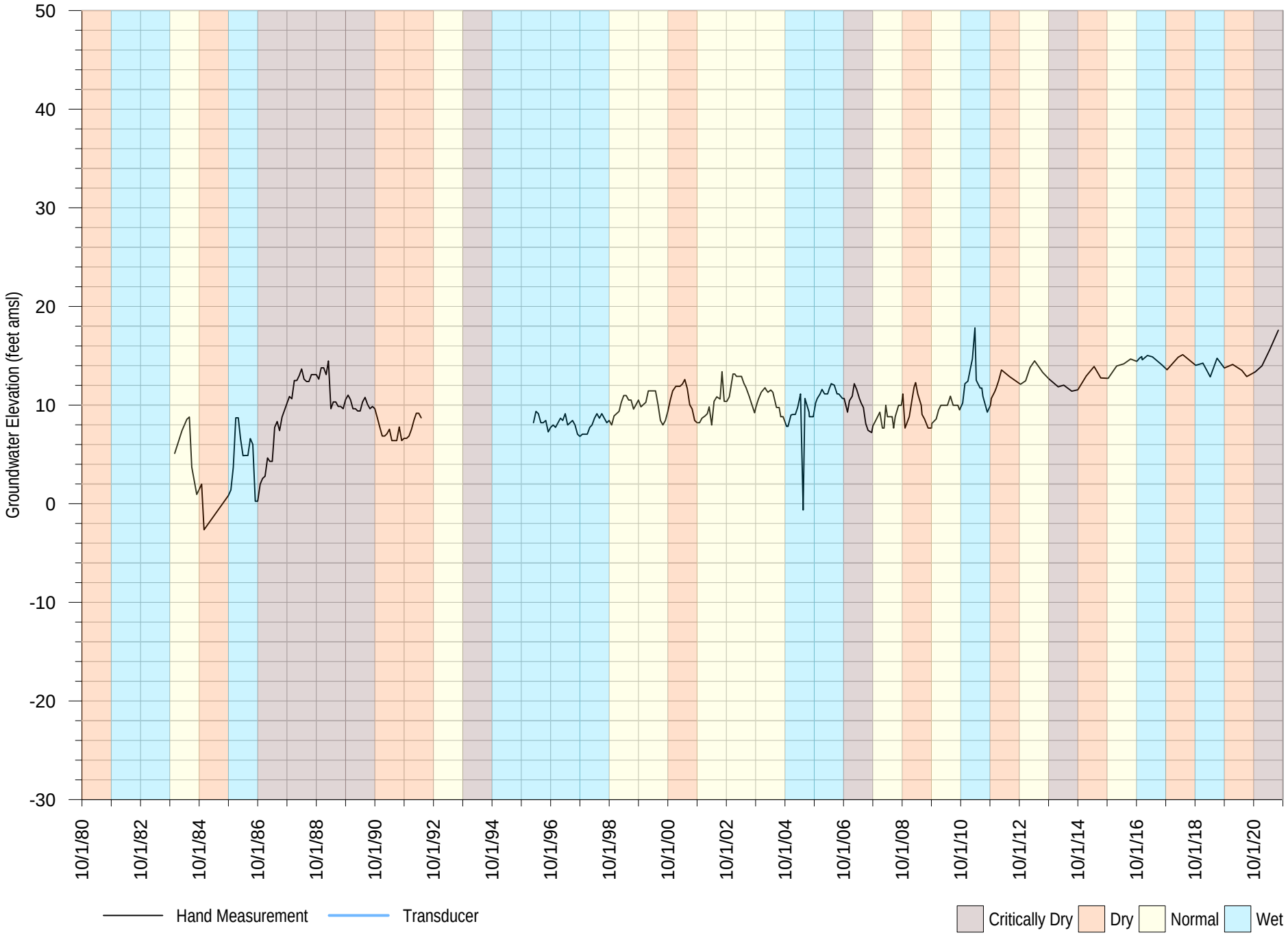
SC-8C & SC-8RC at Aptos Creek
Aquifer Screened: Purisima BC

FIGURE A-132



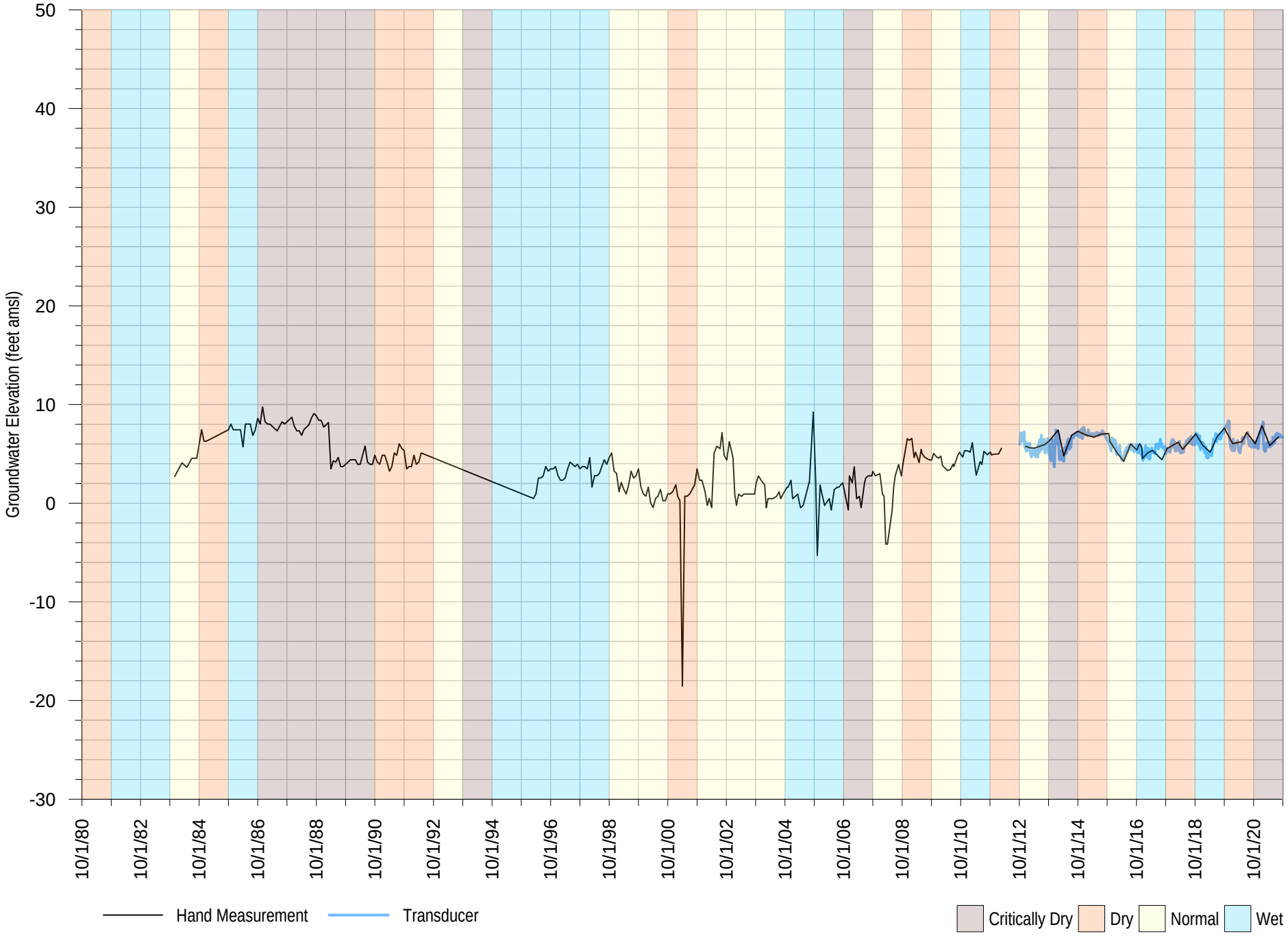
SC-8E & SC-8RE at Aptos Creek
Aquifer Screened: Purisima DEF

FIGURE A-133



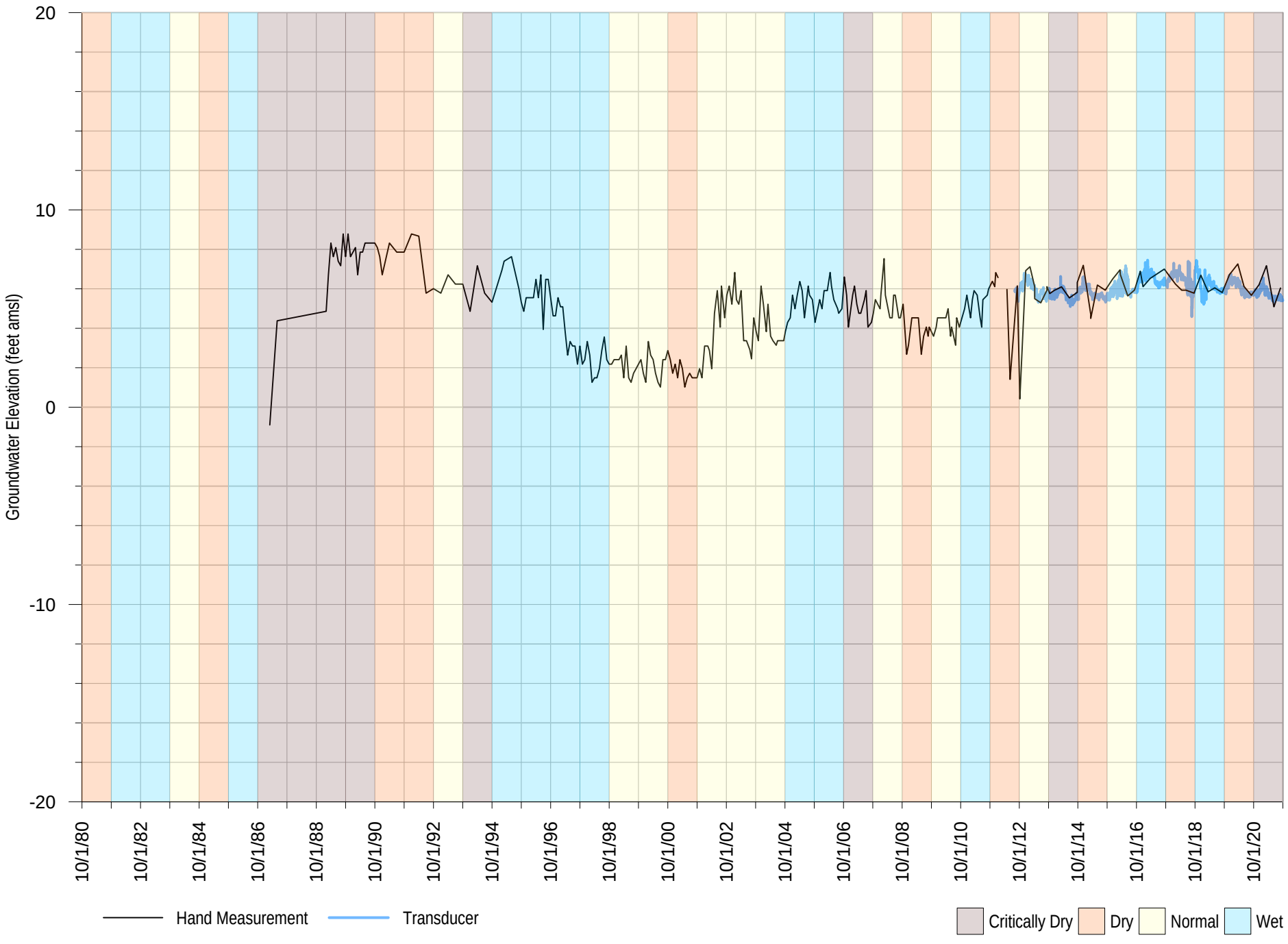
SC-8F & SC-8RF at Aptos Creek
Aquifer Screened: Purisima F

FIGURE A-134



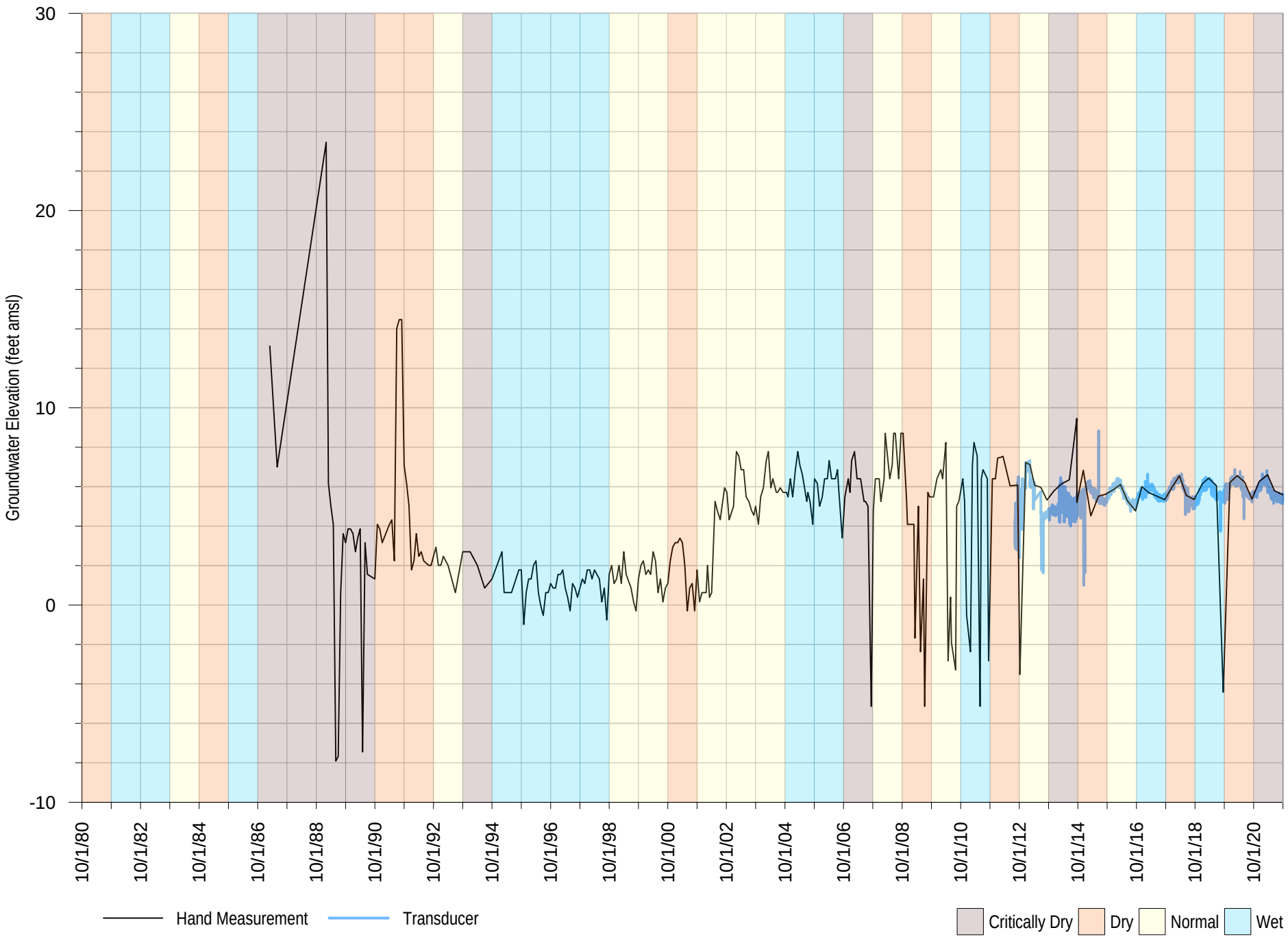
SC-A2B & SC-A2RB at Sumner
Aquifer Screened: Purisima F

FIGURE A-135



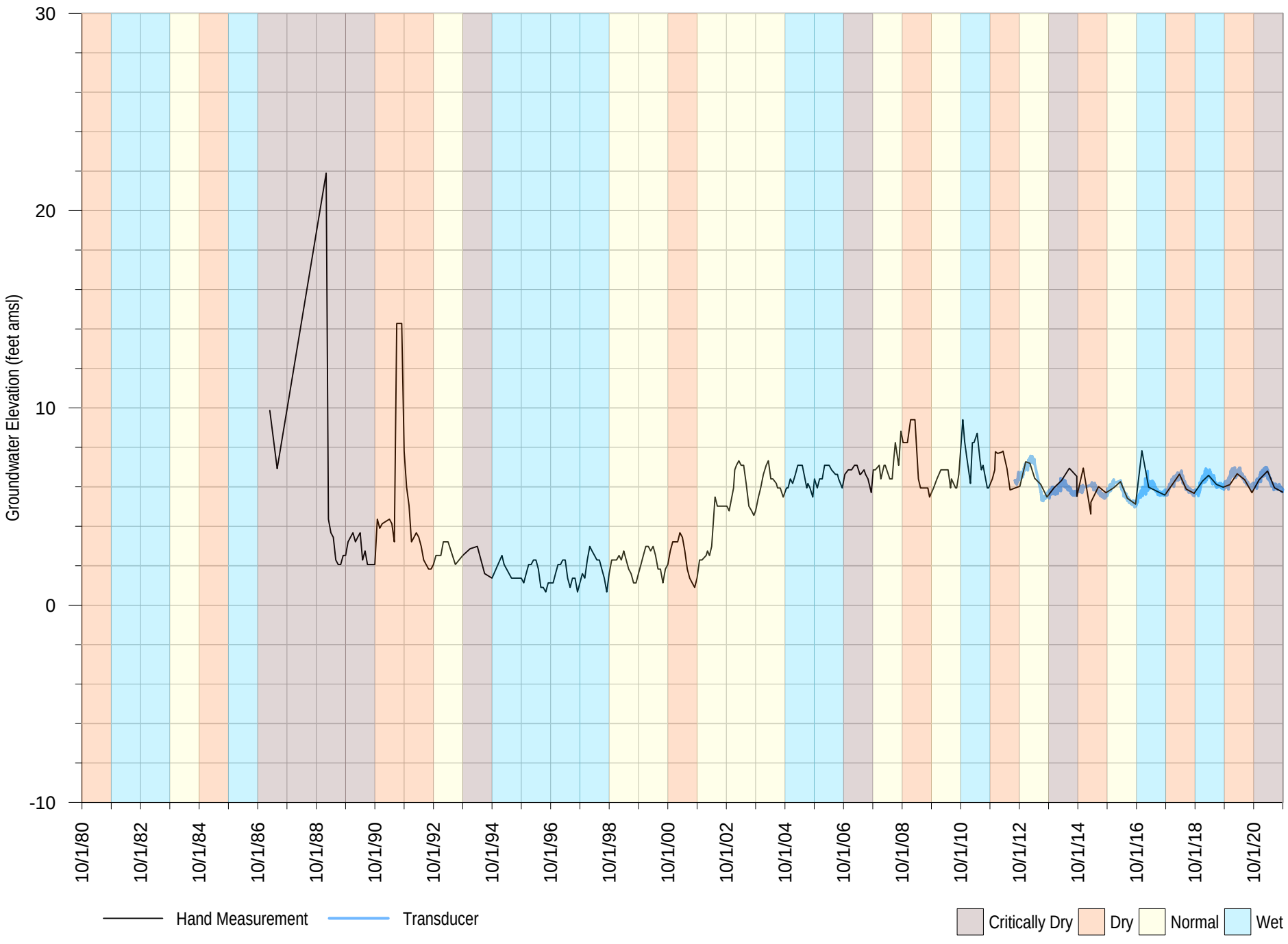
SC-A5C at Seascape
Aquifer Screened: Aromas

FIGURE A-136



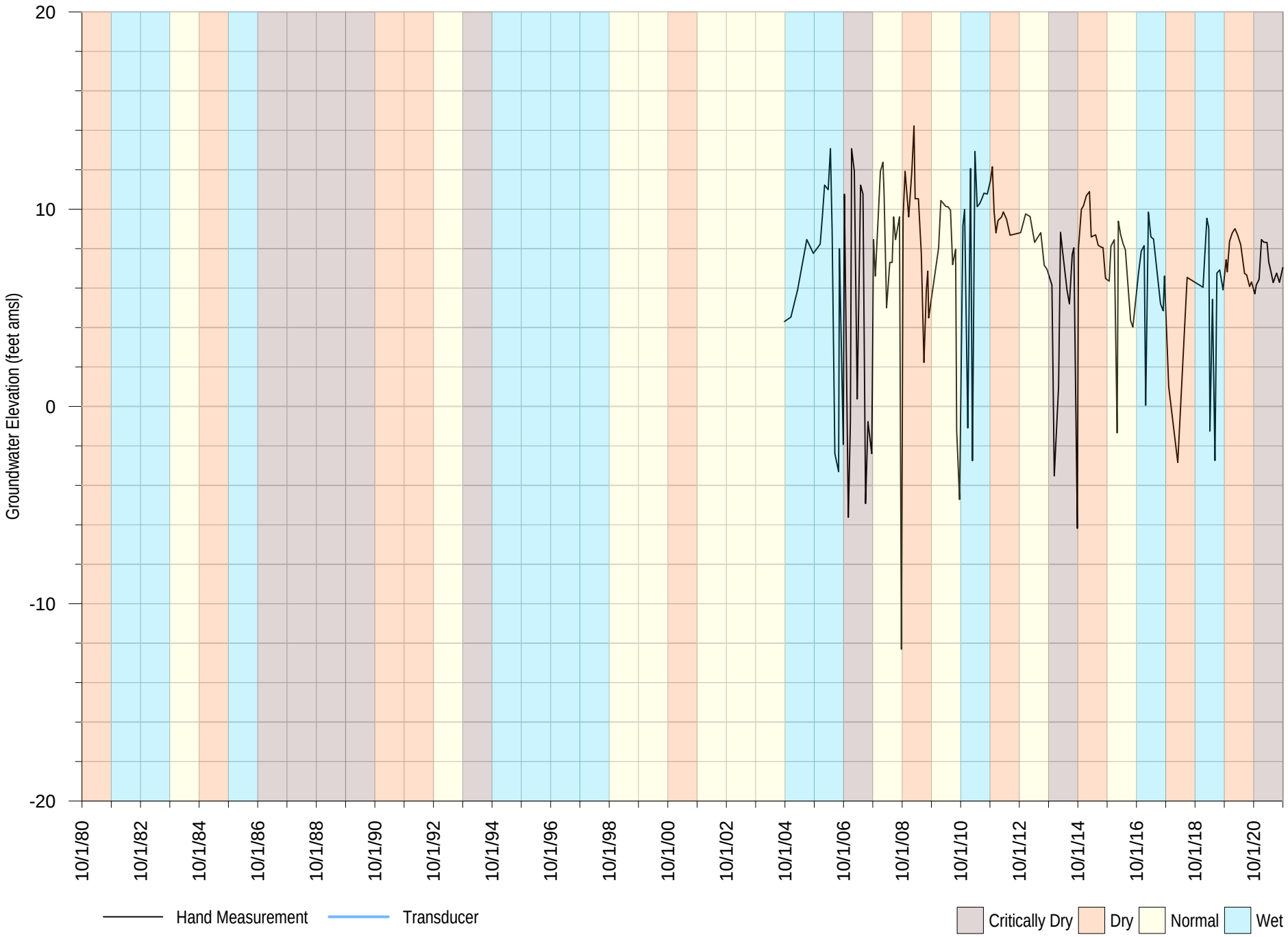
SC-A5D at Seascape
Aquifer Screened: Aromas

FIGURE A-137



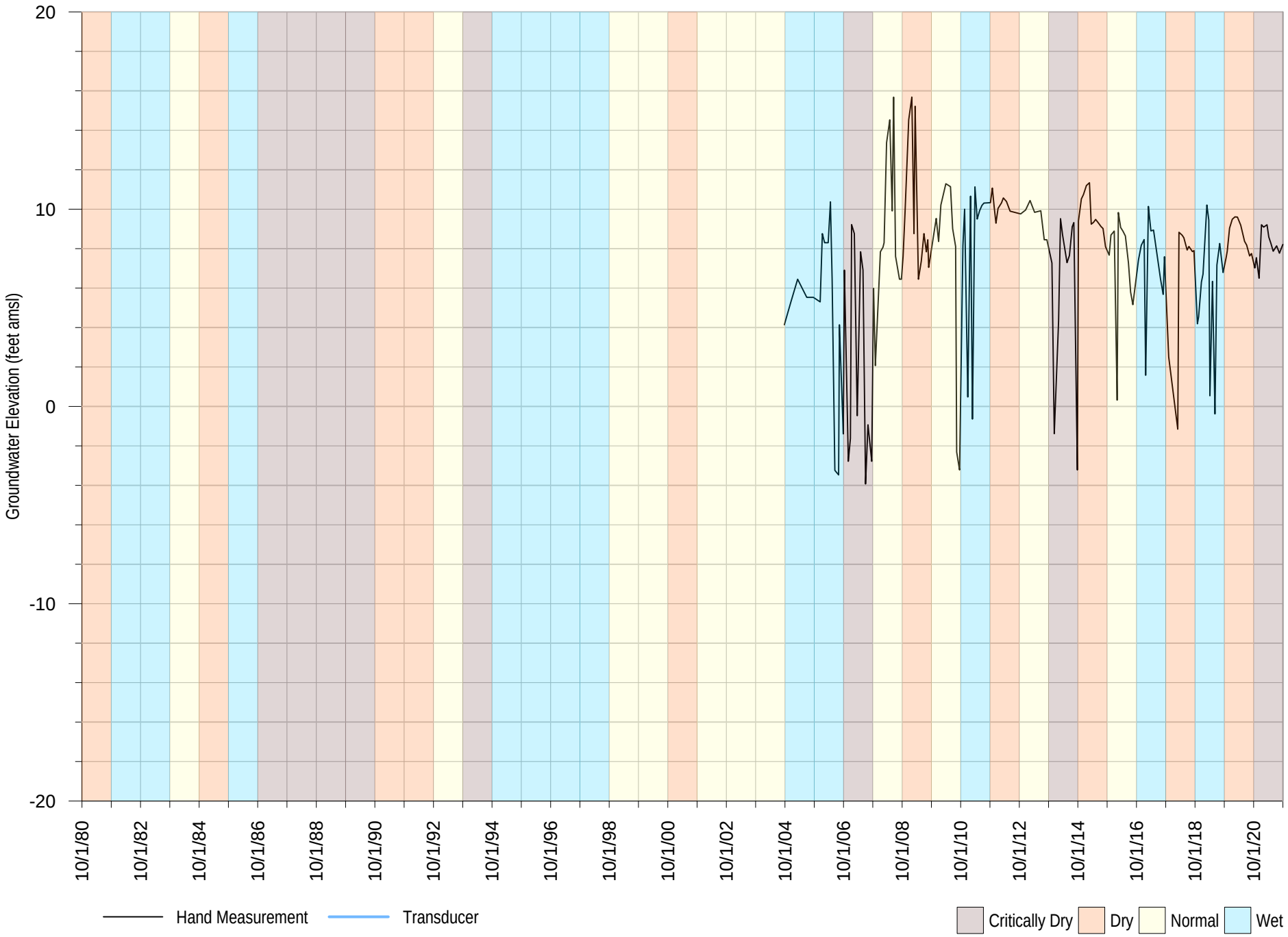
SC-A6A at Bonita
Aquifer Screened: Purisima F

FIGURE A-138



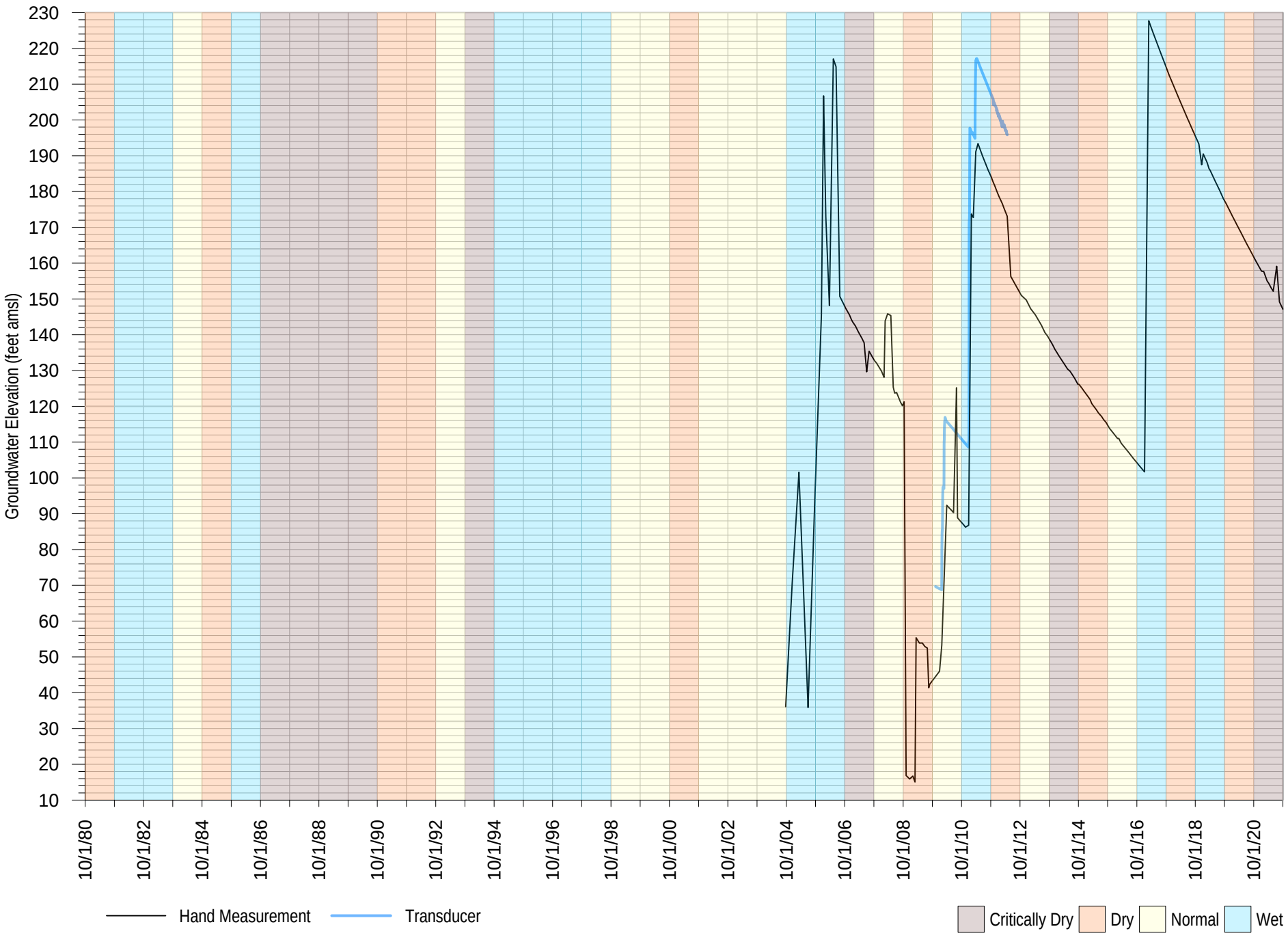
SC-A6B at Bonita
Aquifer Screened: Purisima F

FIGURE A-139



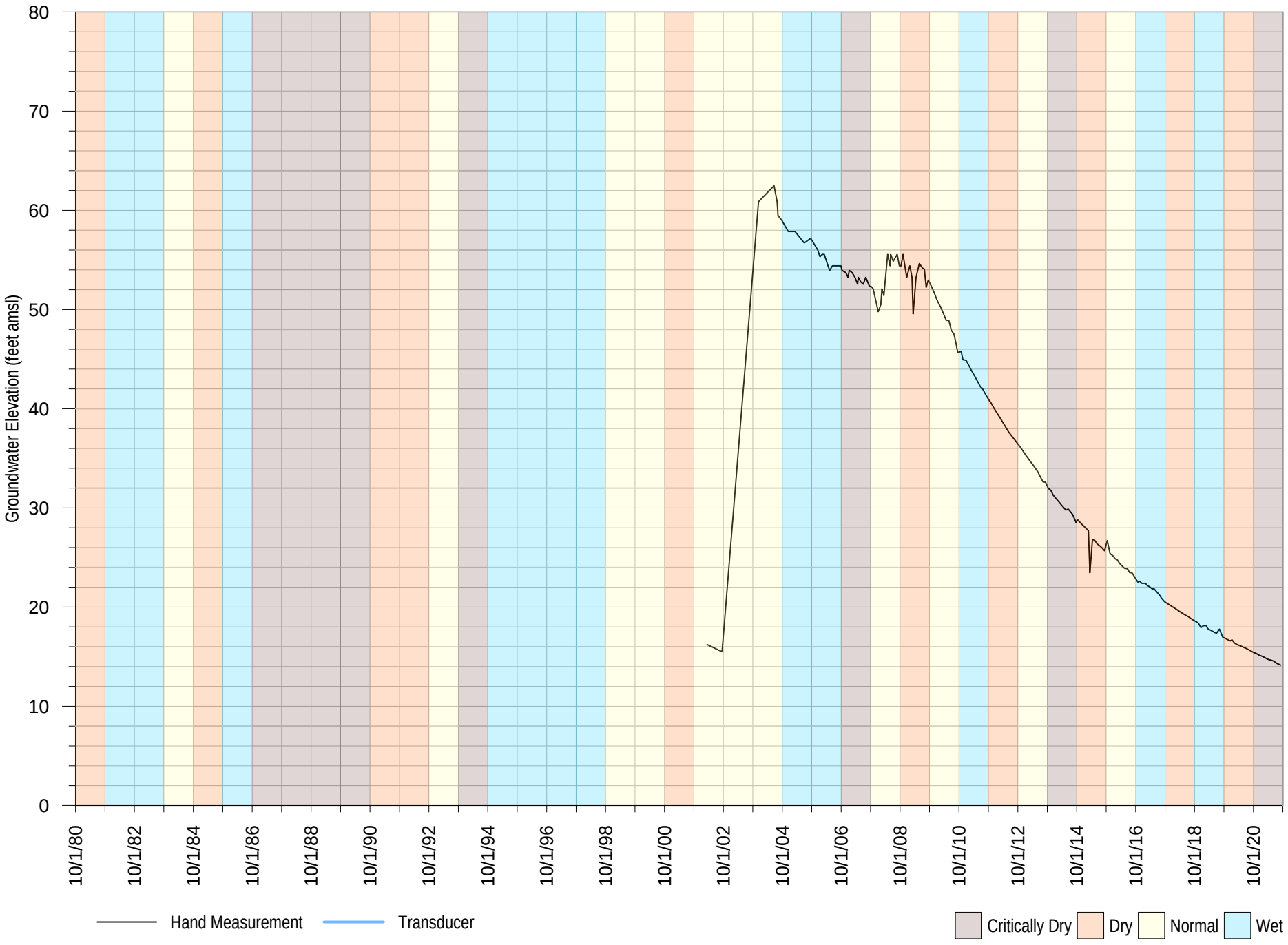
SC-A6C at Bonita
Aquifer Screened: Aromas

FIGURE A-140



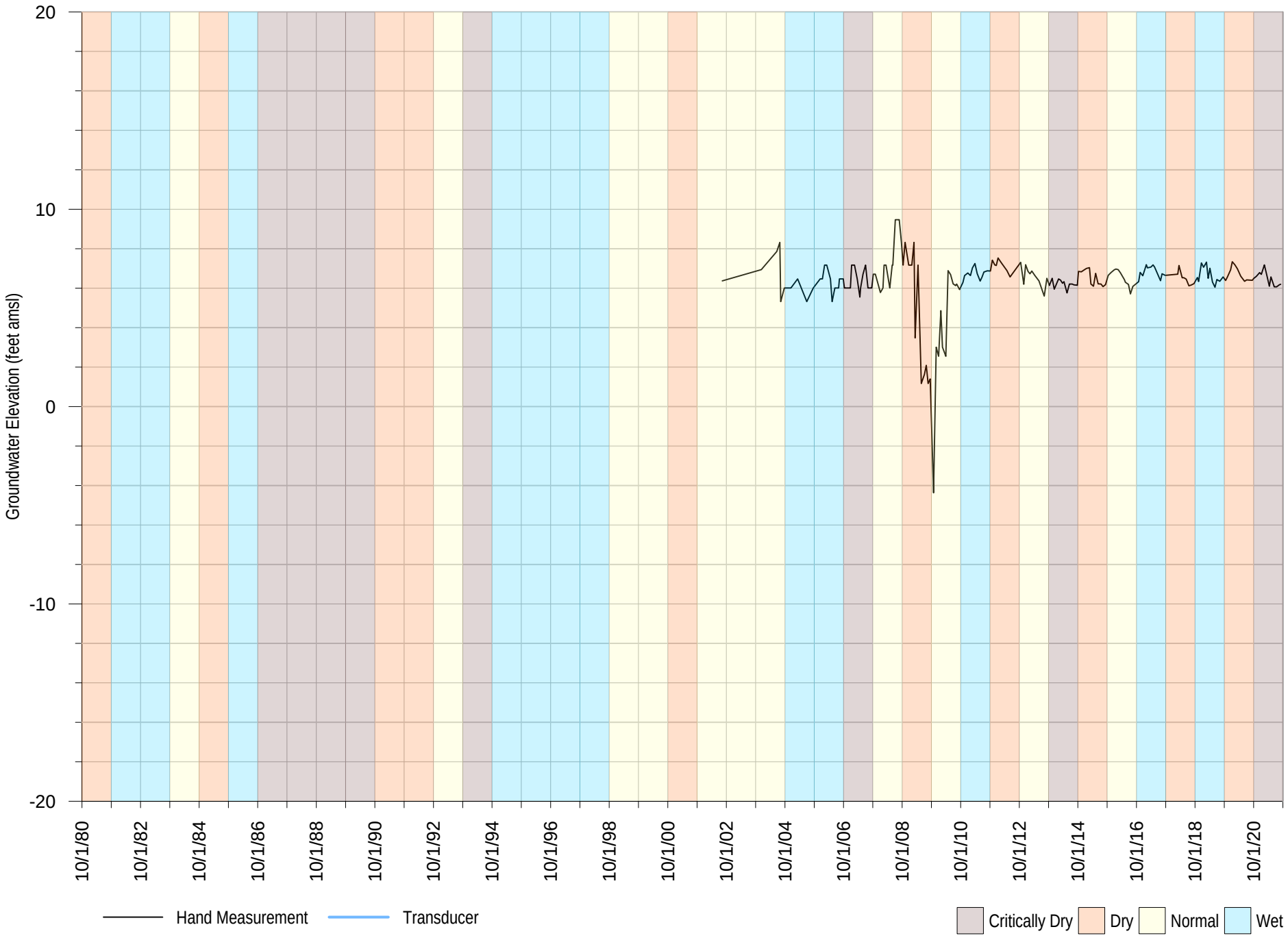
SC-A7A at Sells
Aquifer Screened: Purisima F

FIGURE A-141



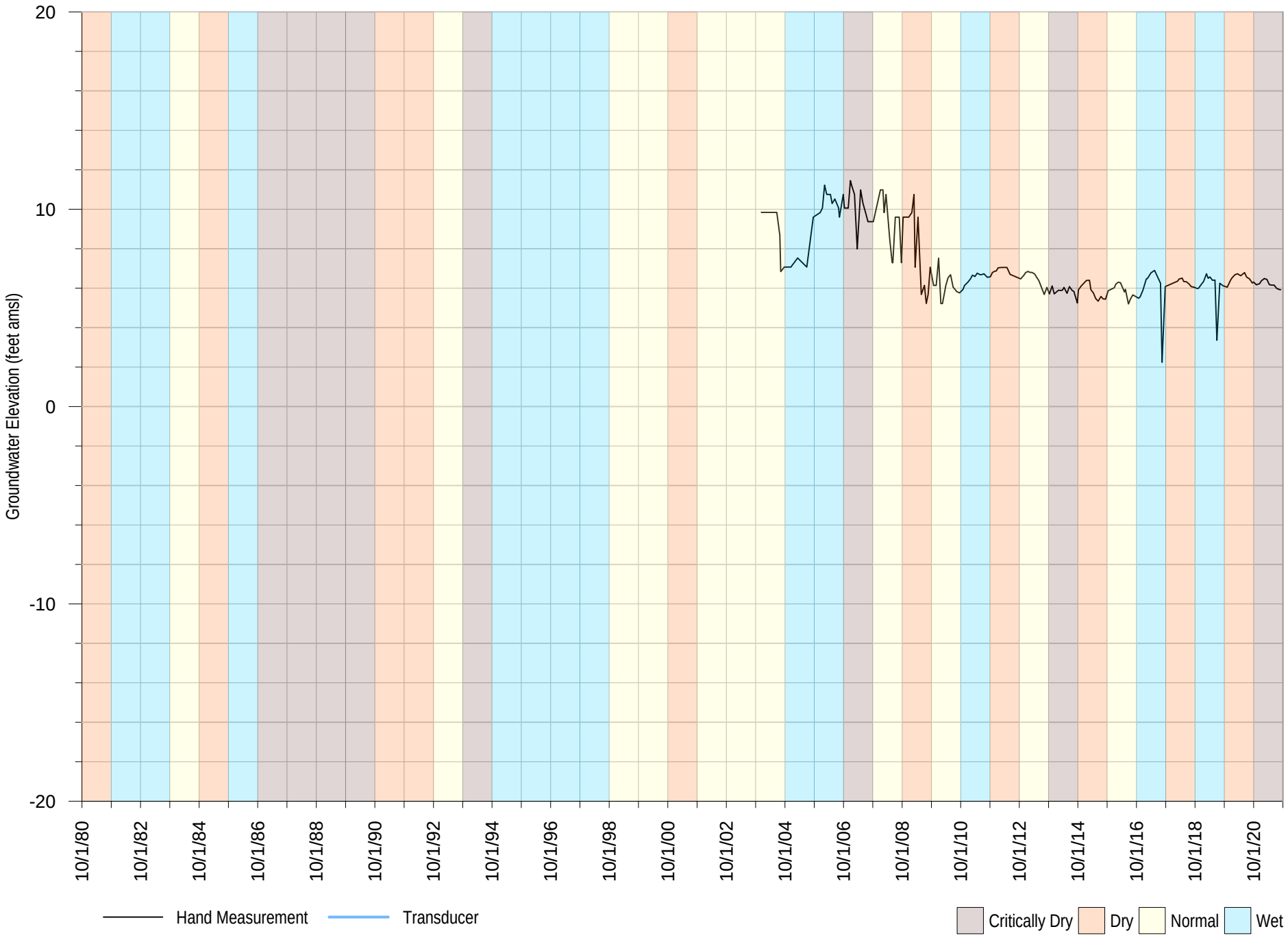
SC-A7B at Sells
Aquifer Screened: Purisima F

FIGURE A-142



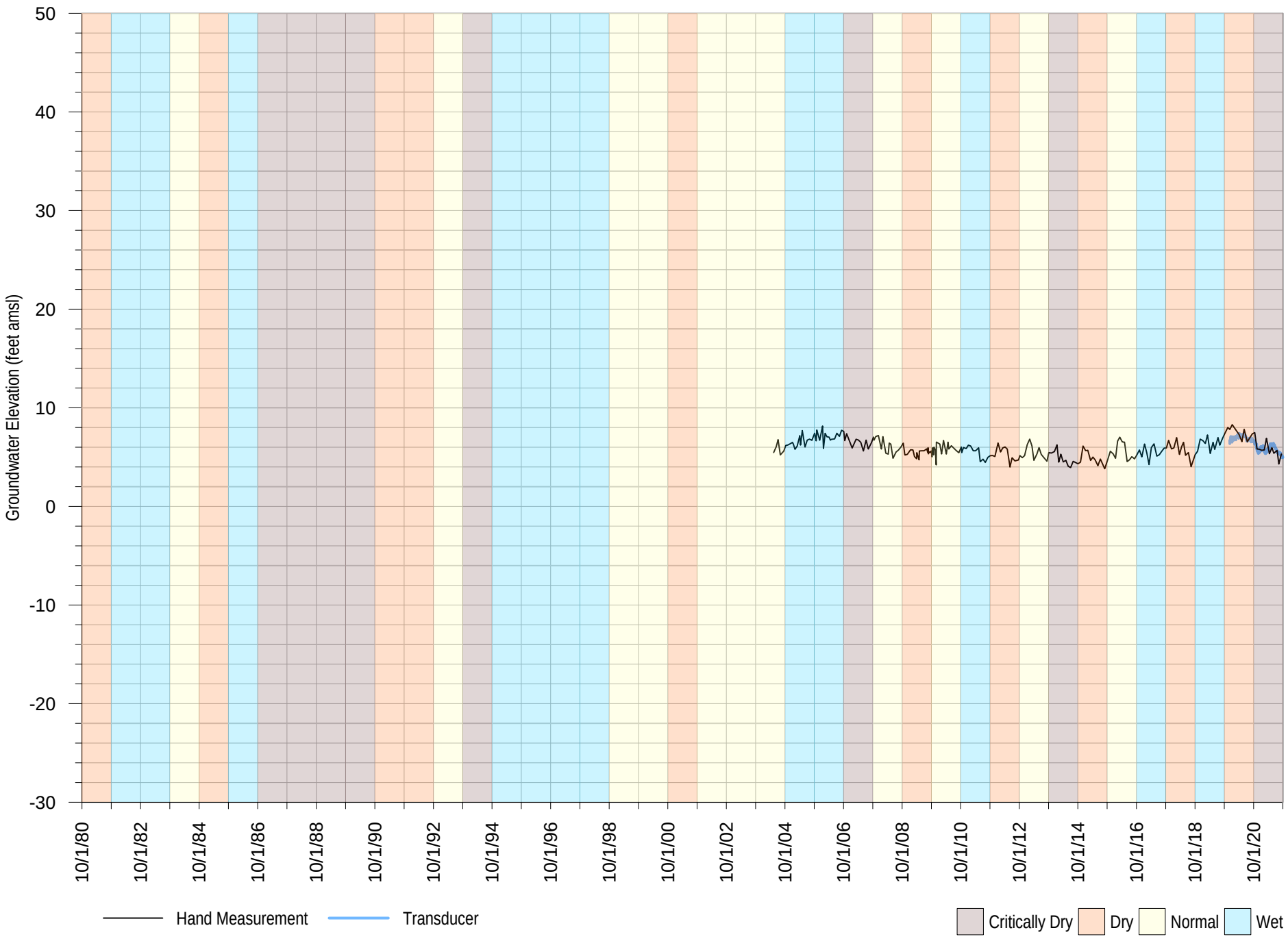
SC-A7D at Sells
Aquifer Screened: Aromas

FIGURE A-143



Soquel Point Shallow
Aquifer Screened: Purisima A

FIGURE A-144



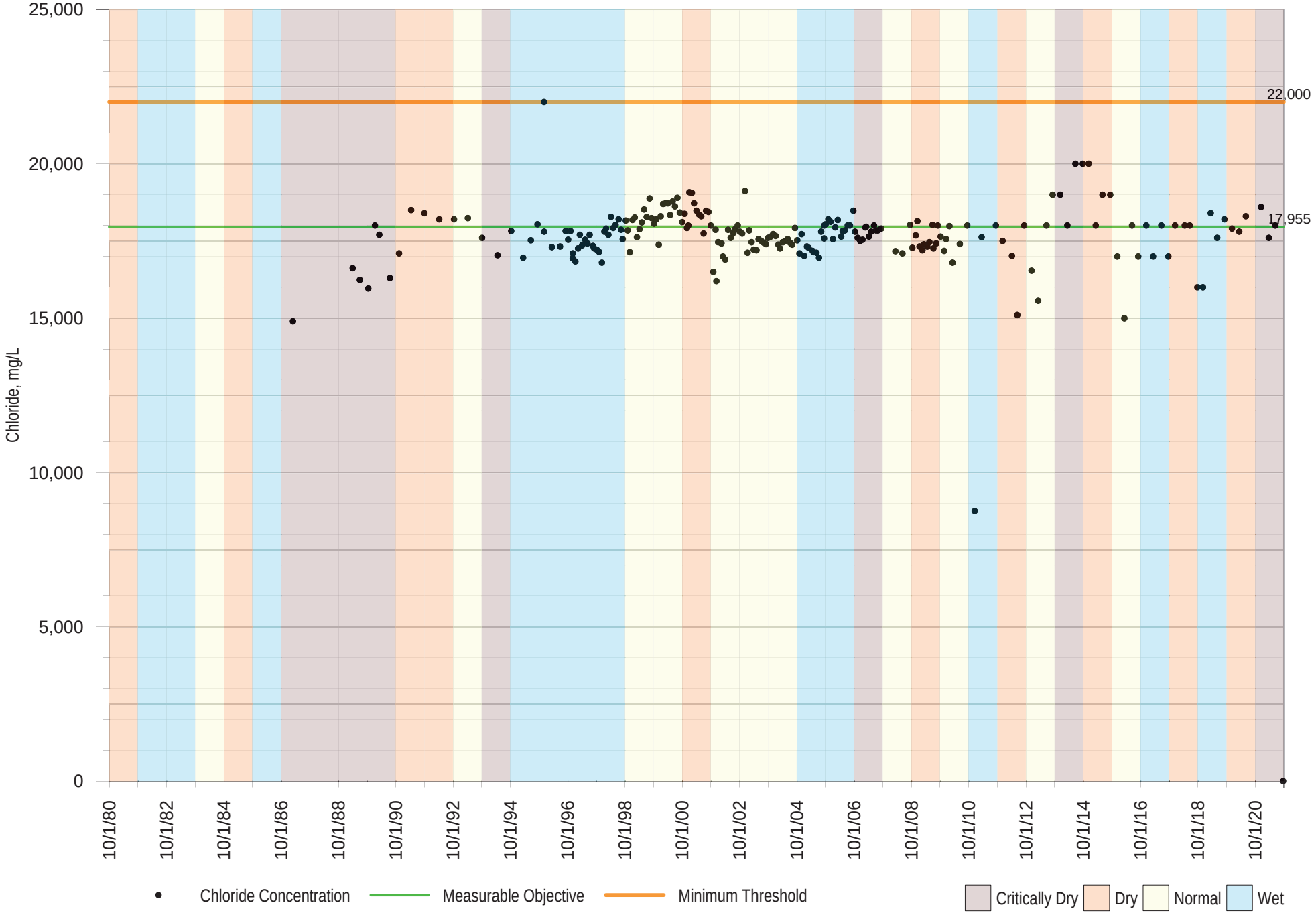
MONTGOMERY & ASSOCIATES

Appendix B

Coastal Monitoring Well Chemographs

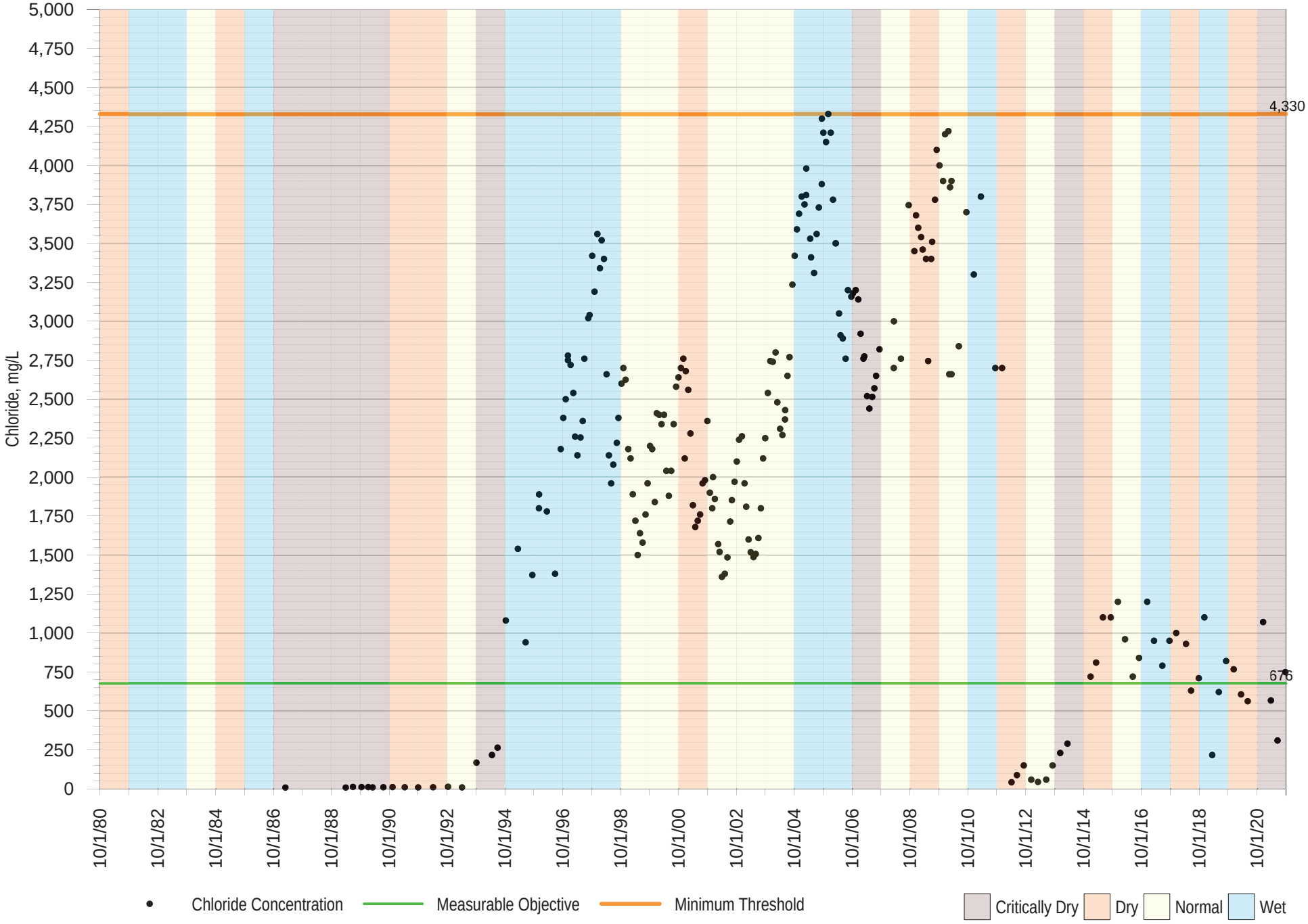
SC-A3A

FIGURE B-1



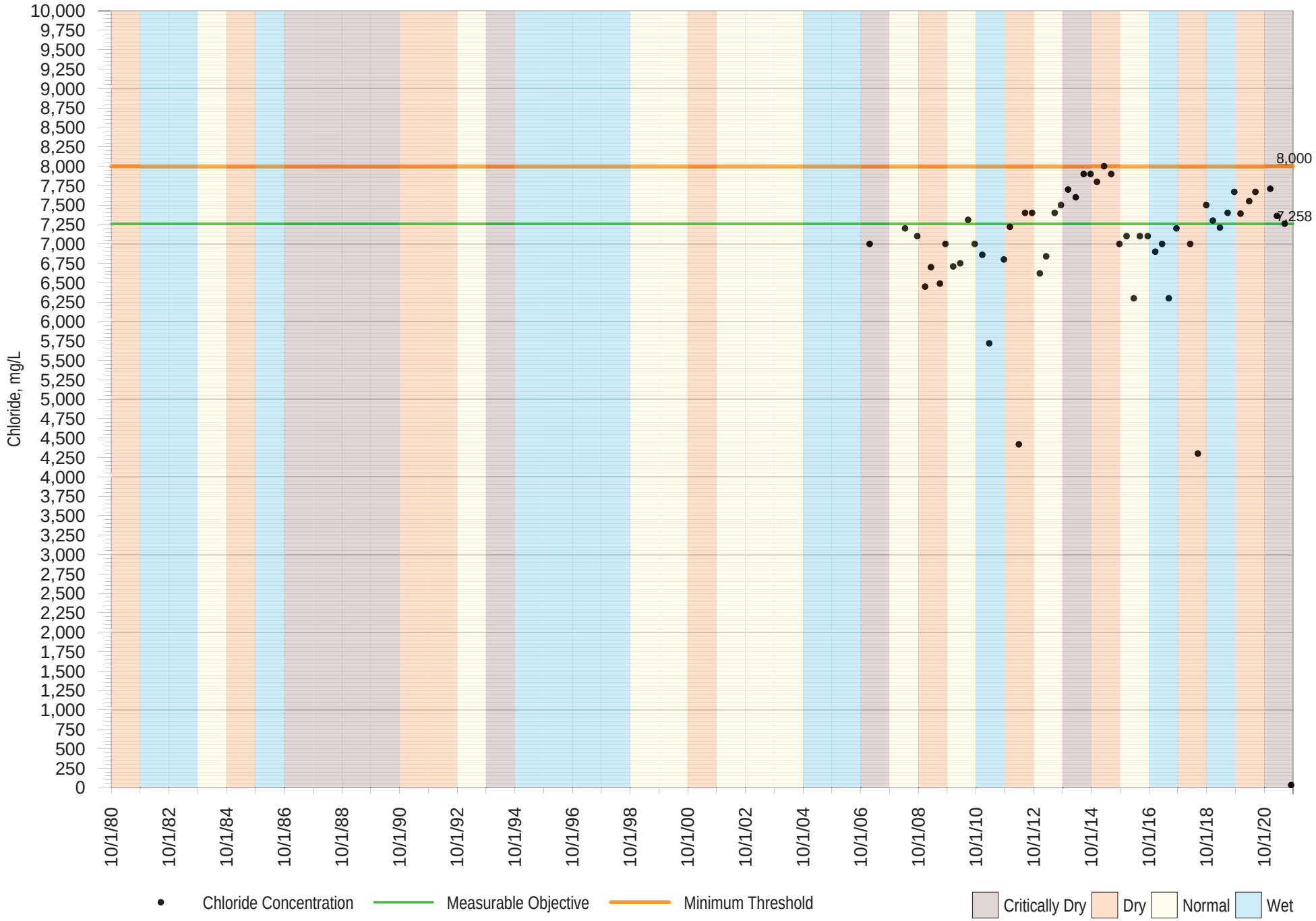
SC-A3B

FIGURE B-2



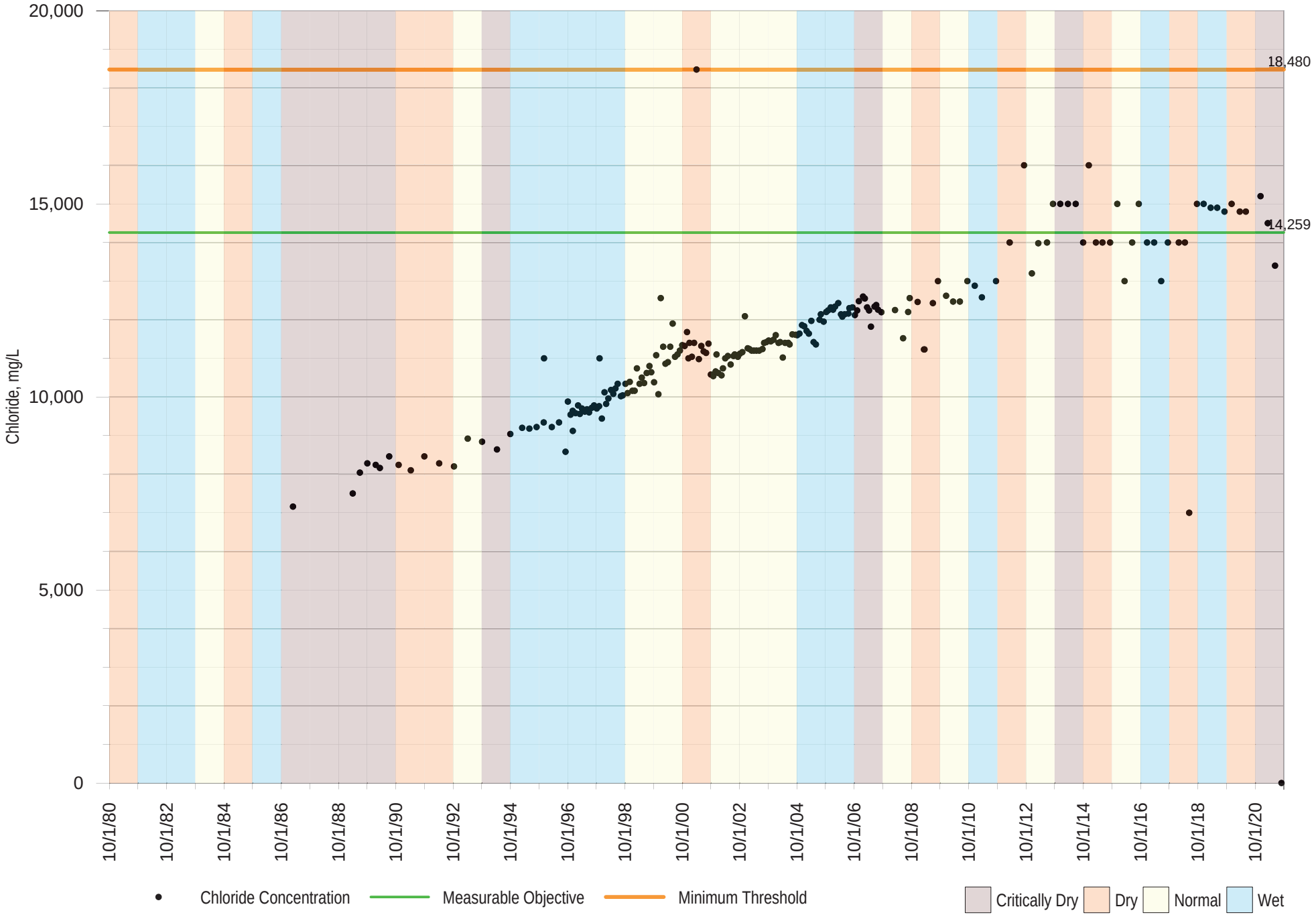
SC-A8A

FIGURE B-3



SC-A2A & SC-A2RA

FIGURE B-4



SC-A2B & SC-A2RB

FIGURE B-5

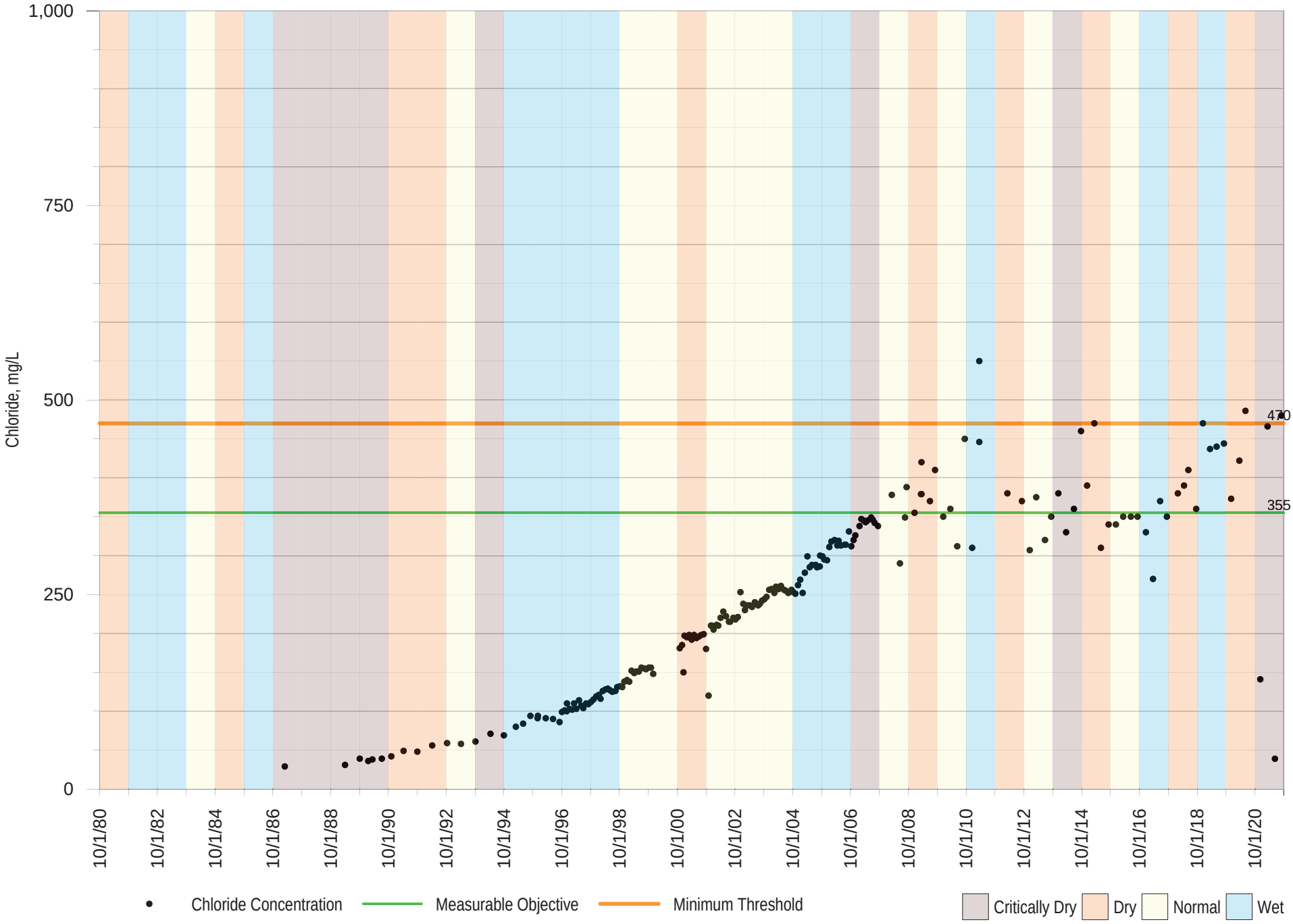
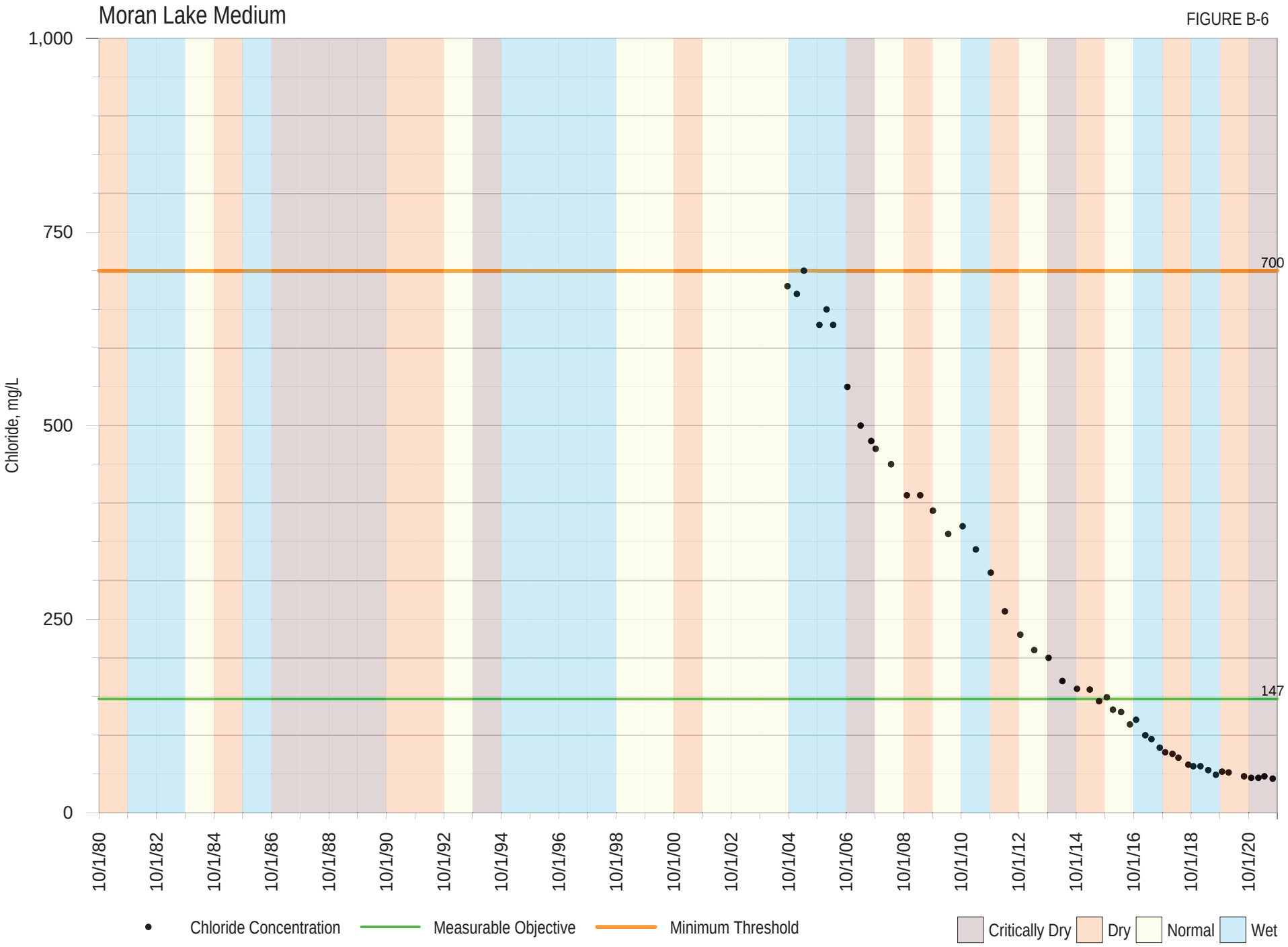
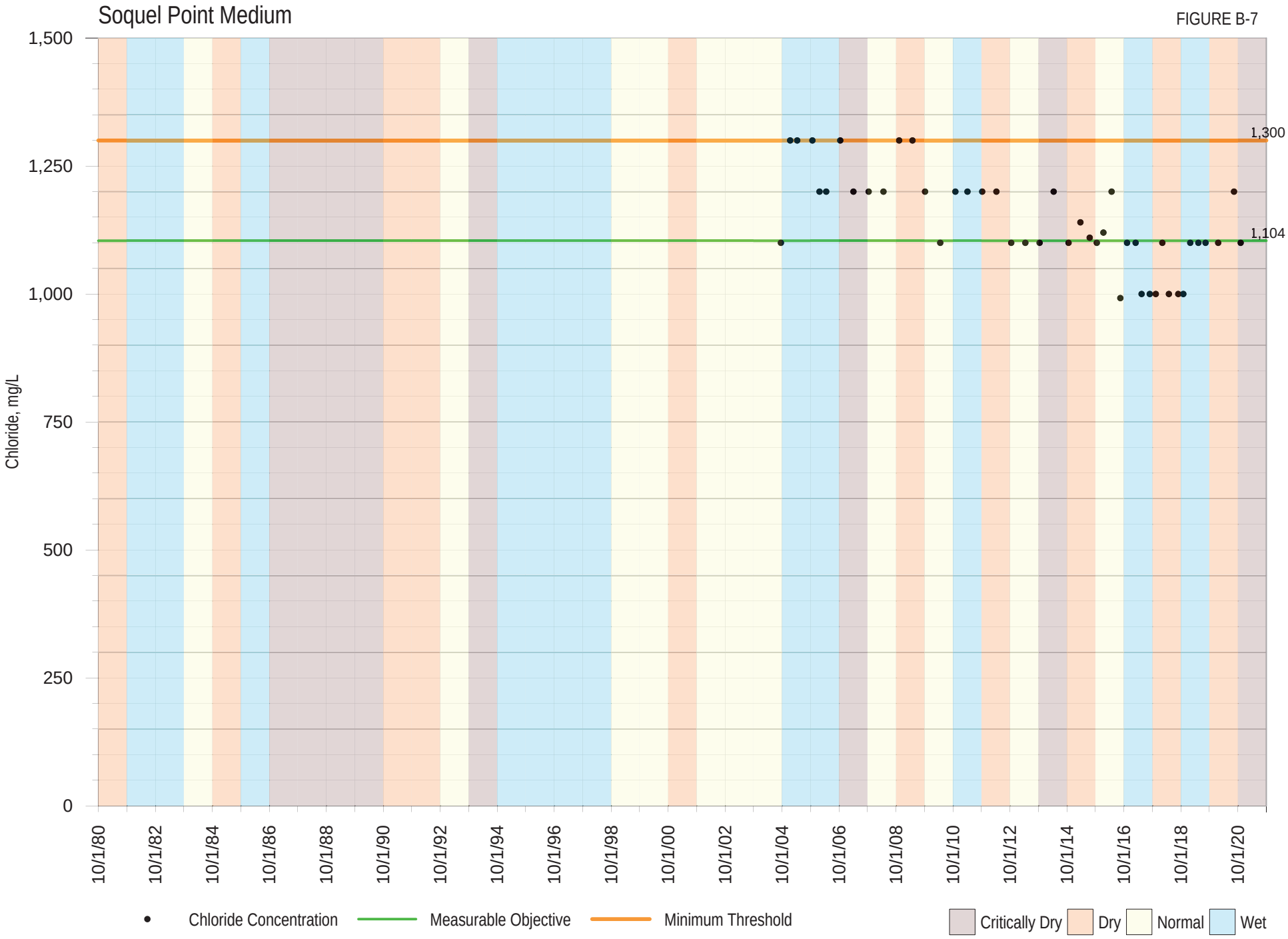


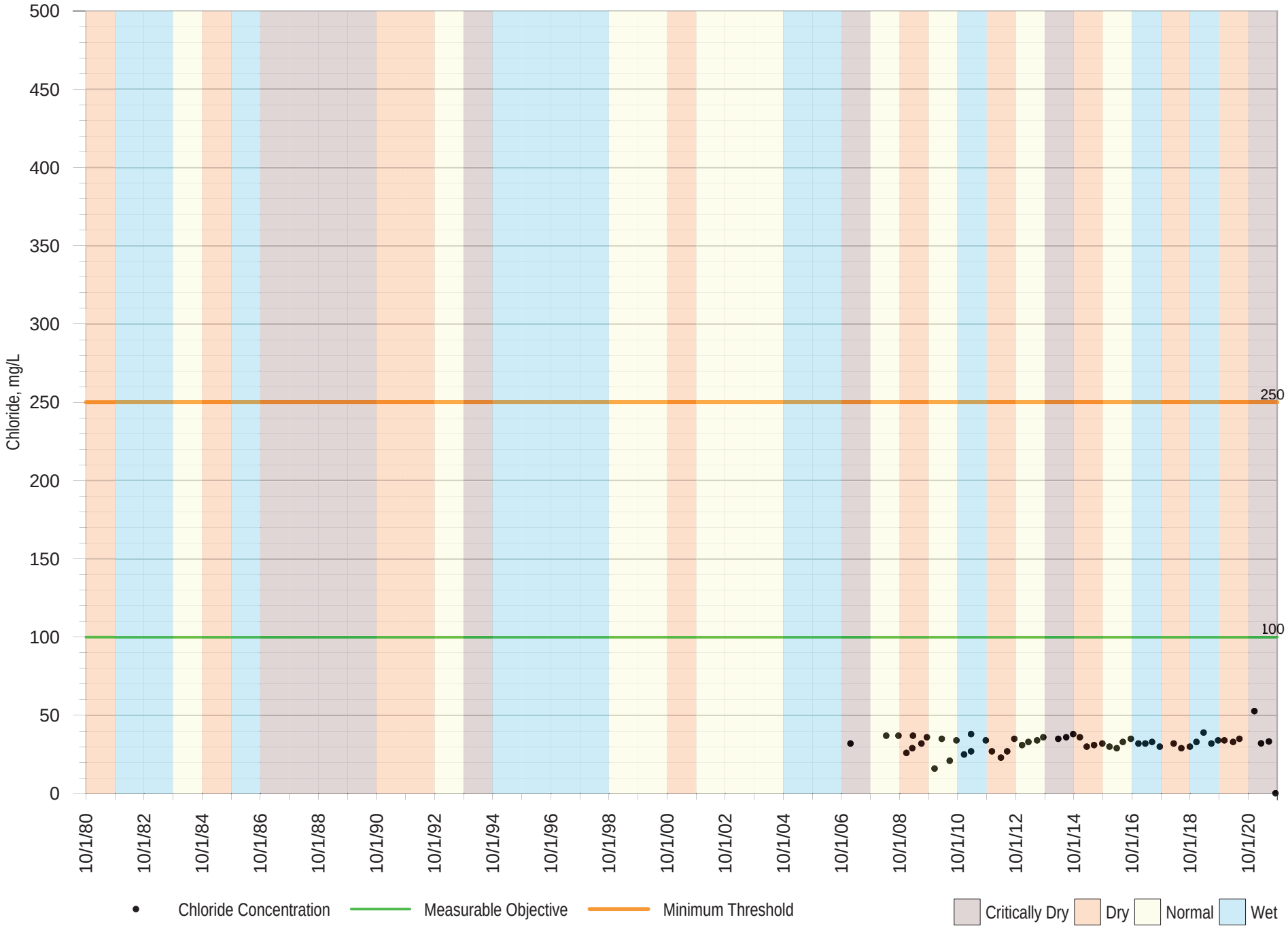
FIGURE B-6


Moran Lake Medium
1,000
750
500
250
0
Chloride, mg/L
700
147
10/1/80
10/1/82
10/1/84
10/1/86
10/1/88
10/1/90
10/1/92
10/1/94
10/1/96
10/1/98
10/1/00
10/1/02
10/1/04
10/1/06
10/1/08
10/1/10
10/1/12
10/1/14
10/1/16
10/1/18
10/1/20
Chloride Concentration
Measurable Objective
Minimum Threshold
Critically Dry
Dry
Normal
Wet


Soquel Point Medium
FIGURE B-7
1,500
1,250
1,000
750
500
250
0
Chloride, mg/L
1,300
1,104
10/1/80
10/1/82
10/1/84
10/1/86
10/1/88
10/1/90
10/1/92
10/1/94
10/1/96
10/1/98
10/1/00
10/1/02
10/1/04
10/1/06
10/1/08
10/1/10
10/1/12
10/1/14
10/1/16
10/1/18
10/1/20
Chloride Concentration
Measurable Objective
Minimum Threshold
Critically Dry
Dry
Normal
Wet

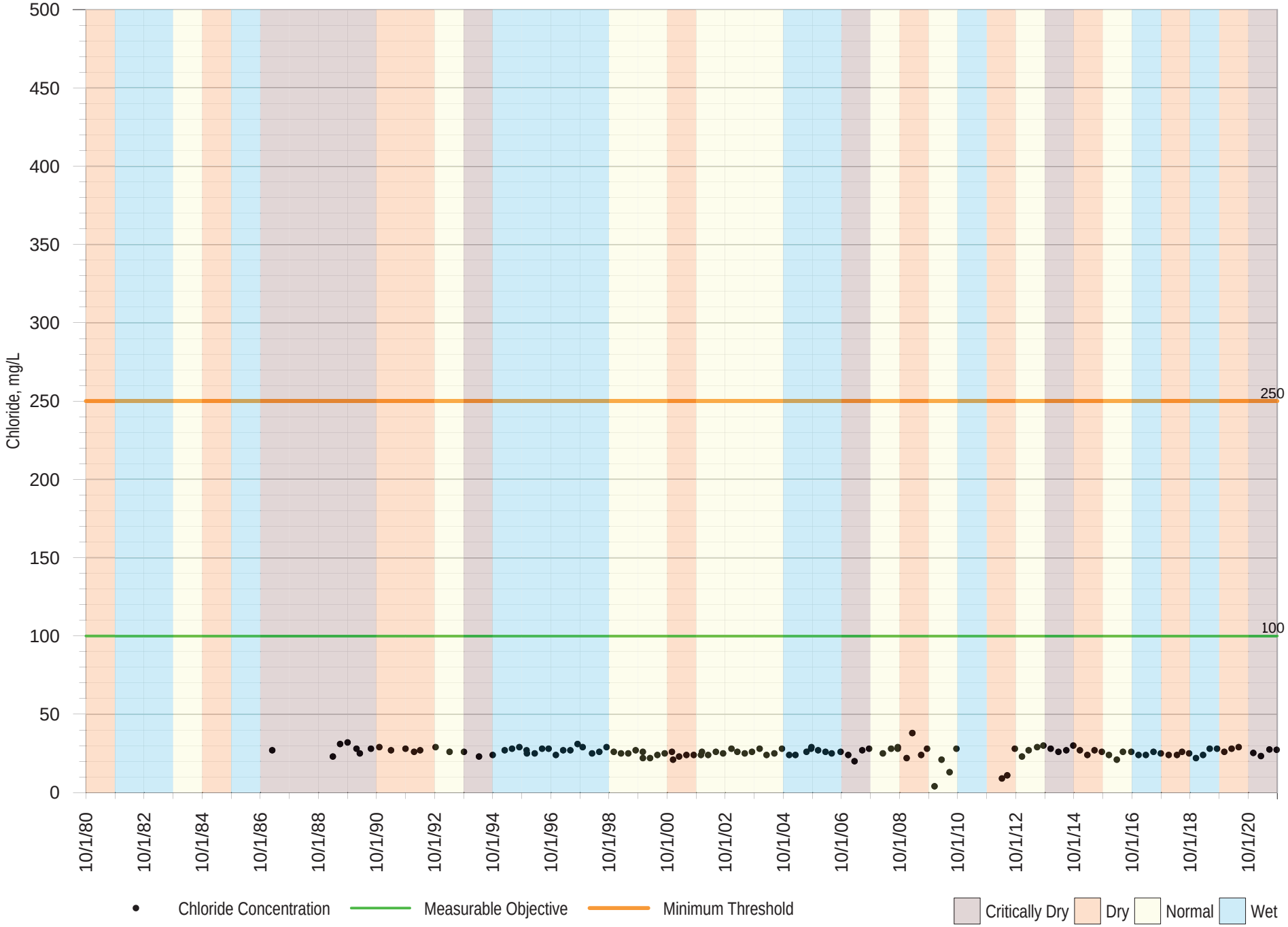
SC-A8B

FIGURE B-8



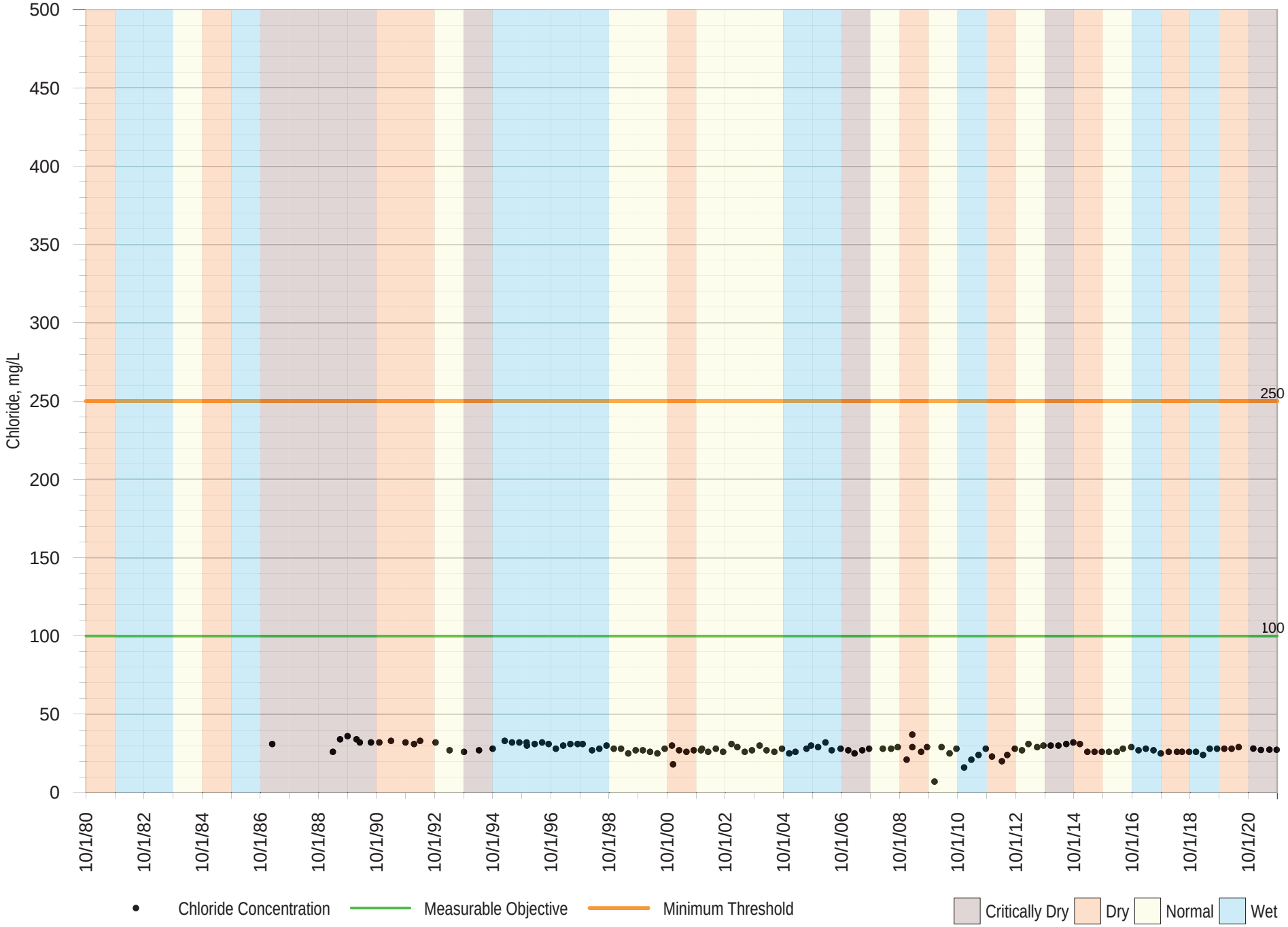
SC-A1B

FIGURE B-9



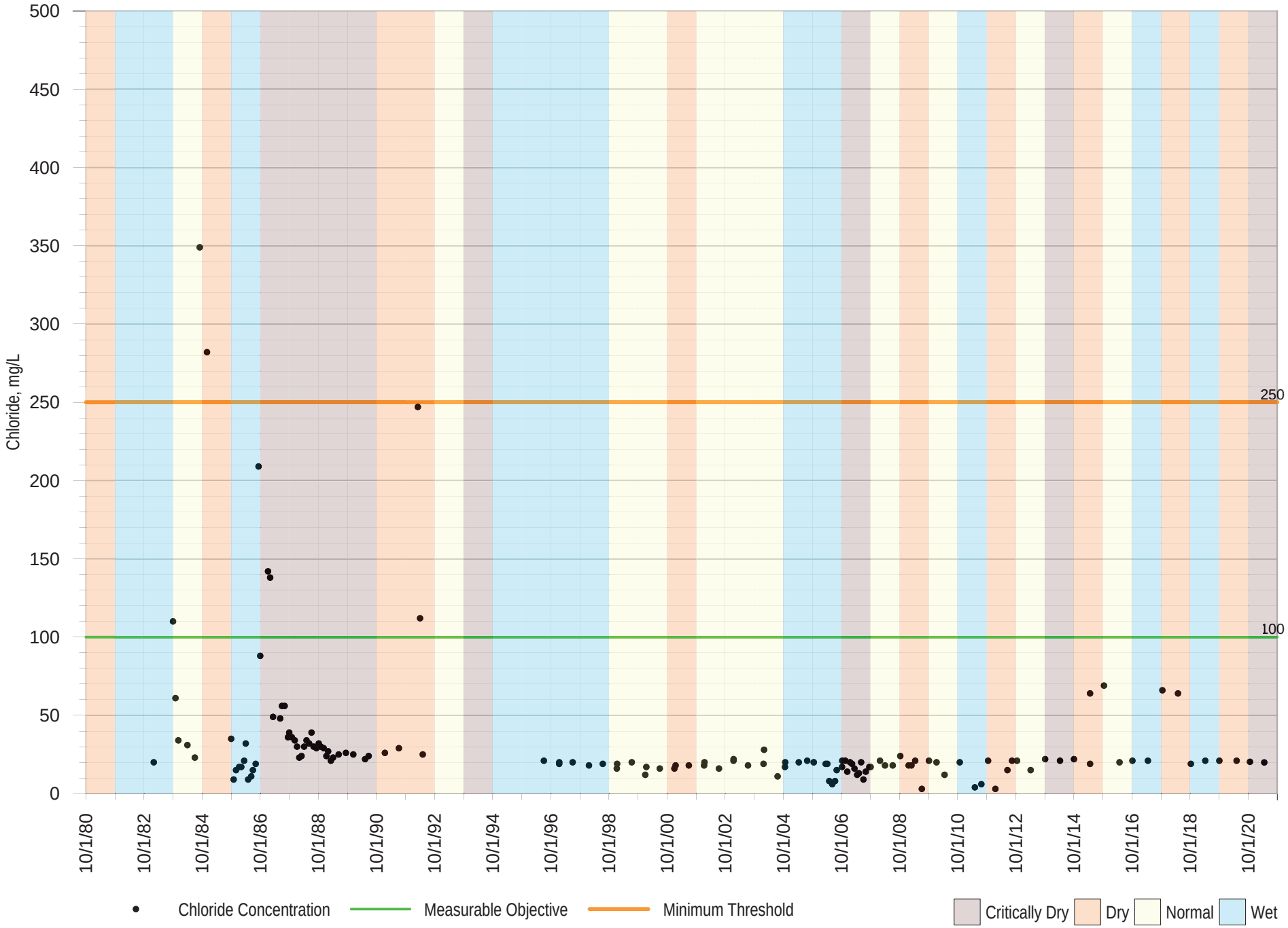
SC-A1A

FIGURE B-10



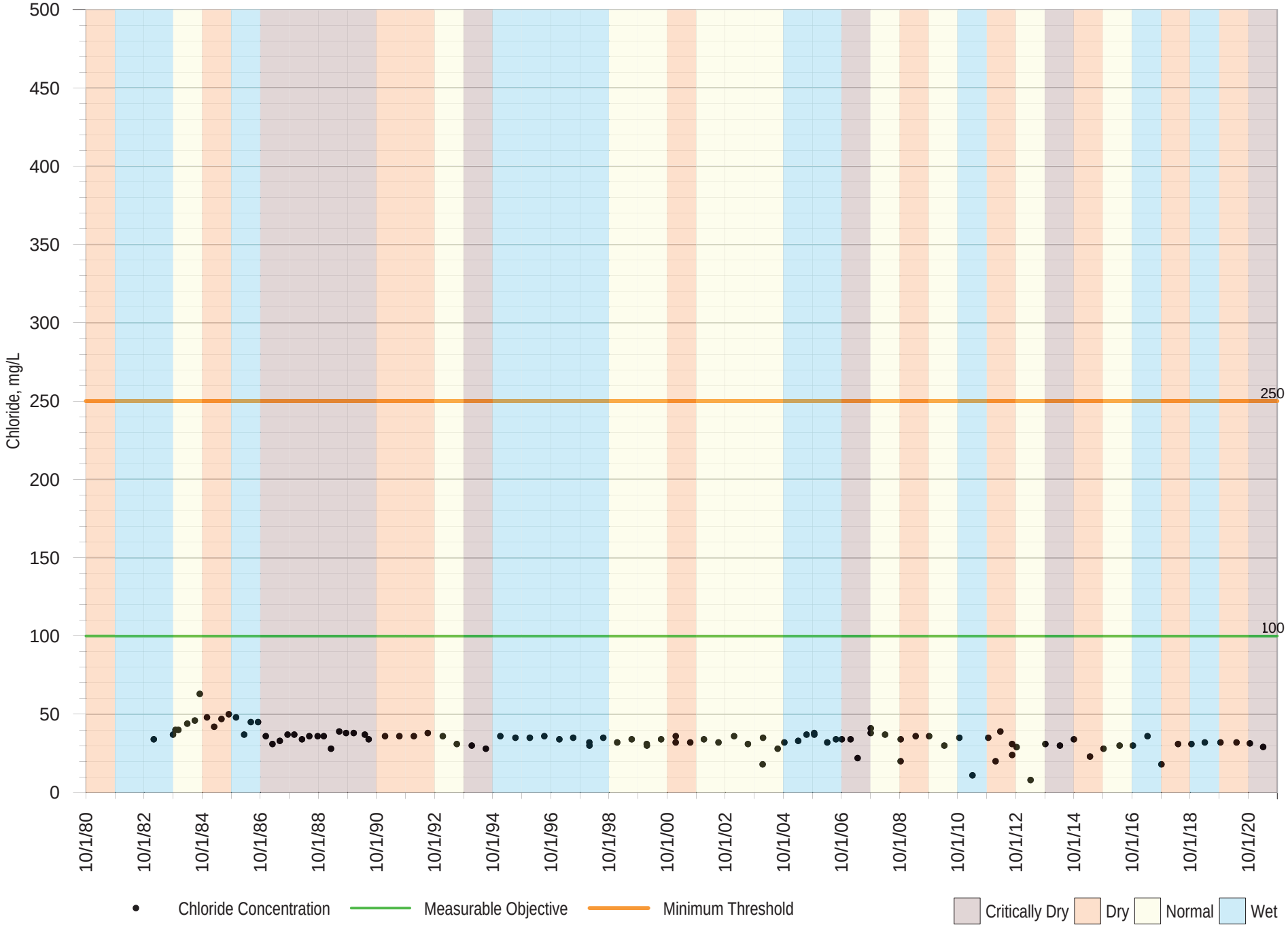
SC-8D & SC-8RD

FIGURE B-11



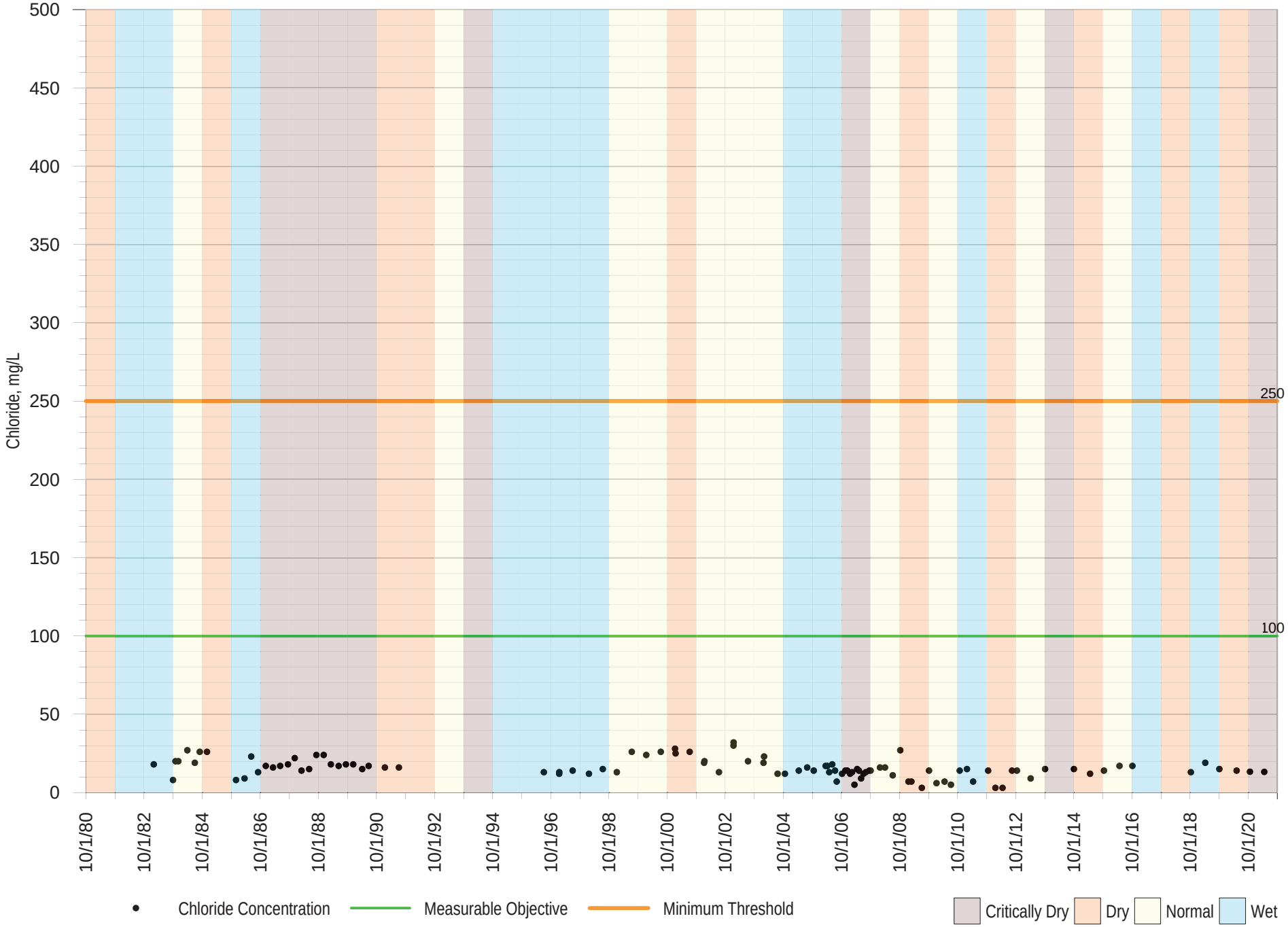
SC-9C & SC-9RC

FIGURE B-12



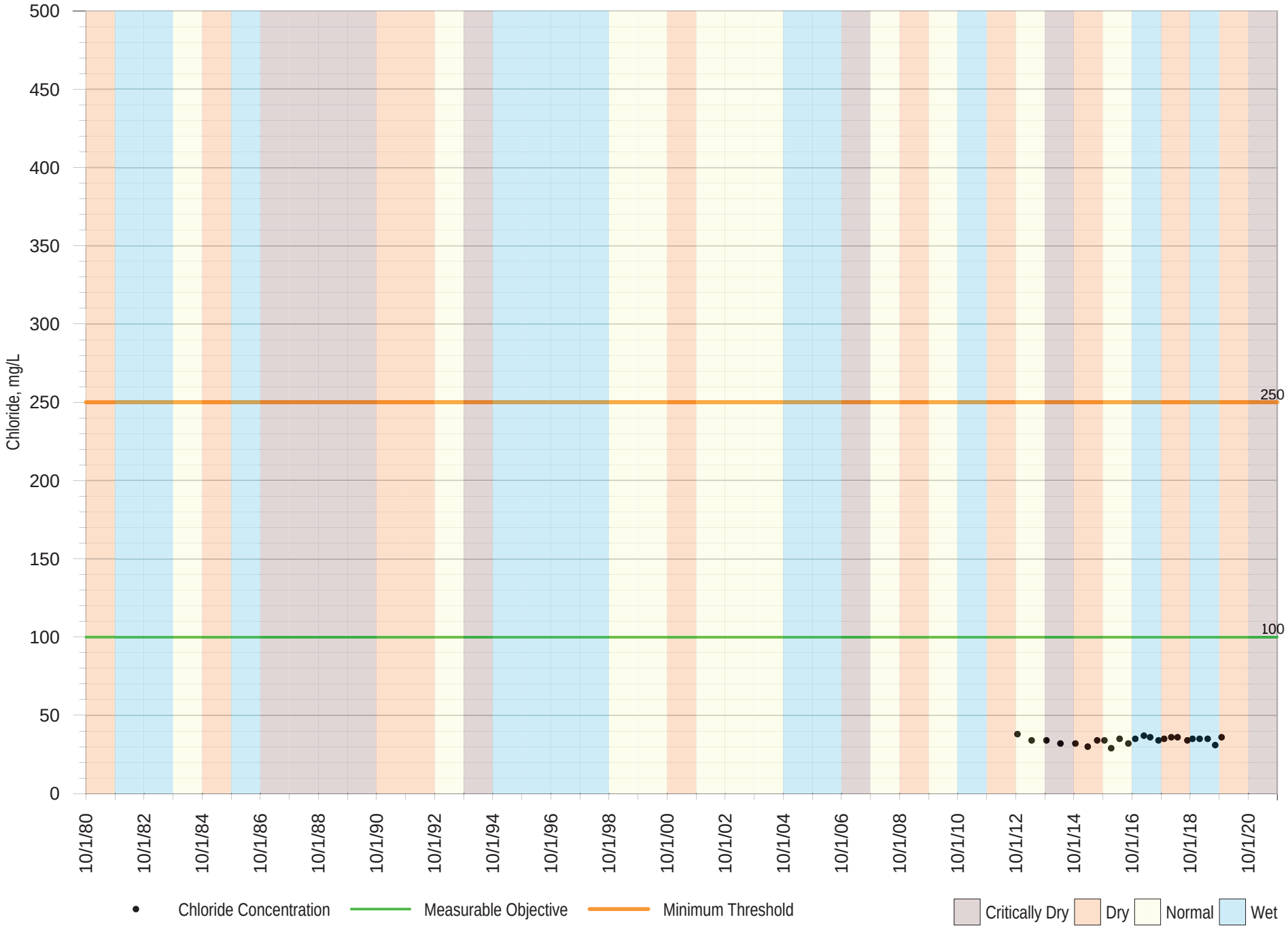
SC-8B & SC-8RB

FIGURE B-13



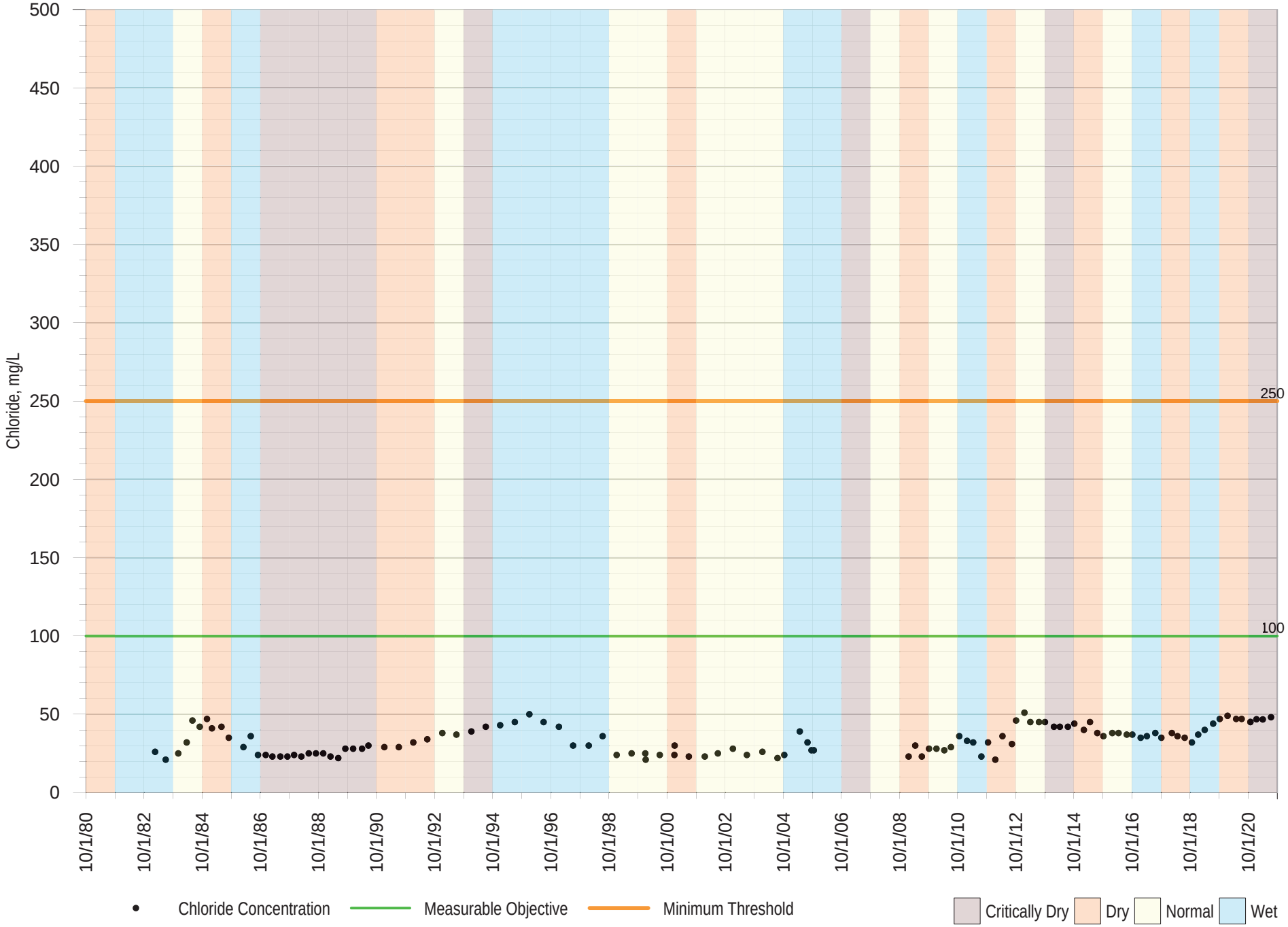
Pleasure Point Medium

FIGURE B-14



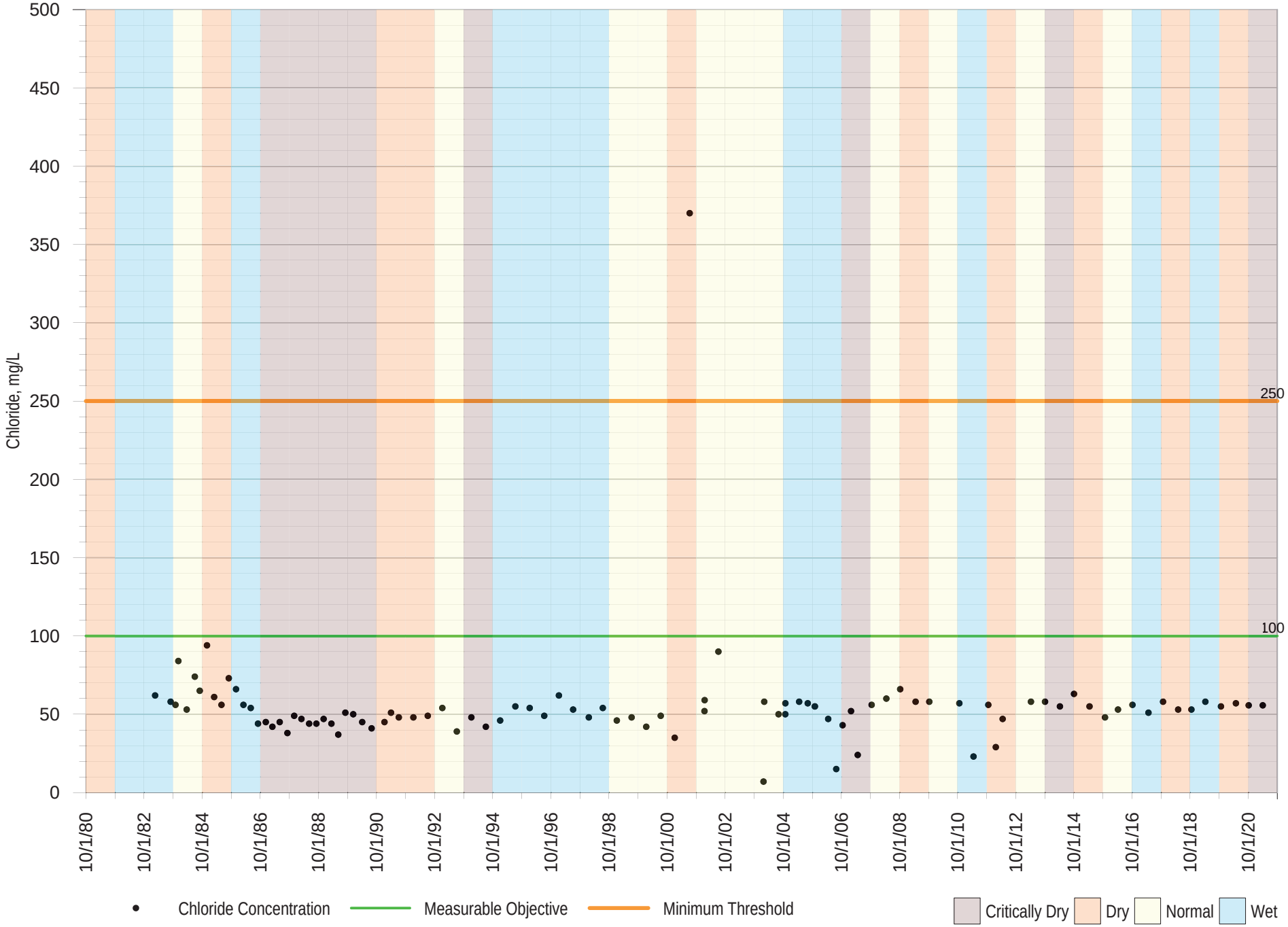
SC-1A

FIGURE B-15



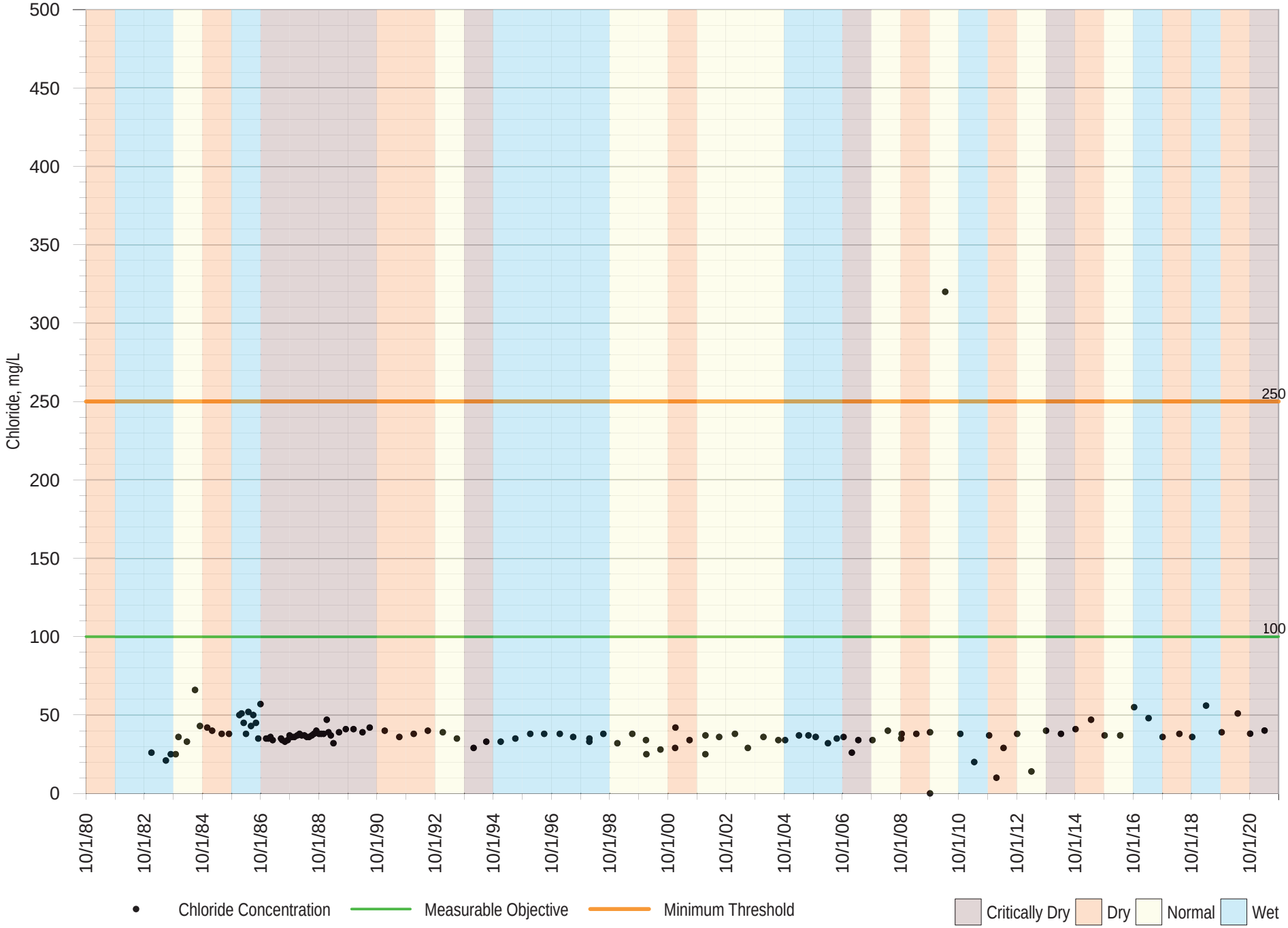
SC-5A & SC-5RA

FIGURE B-16



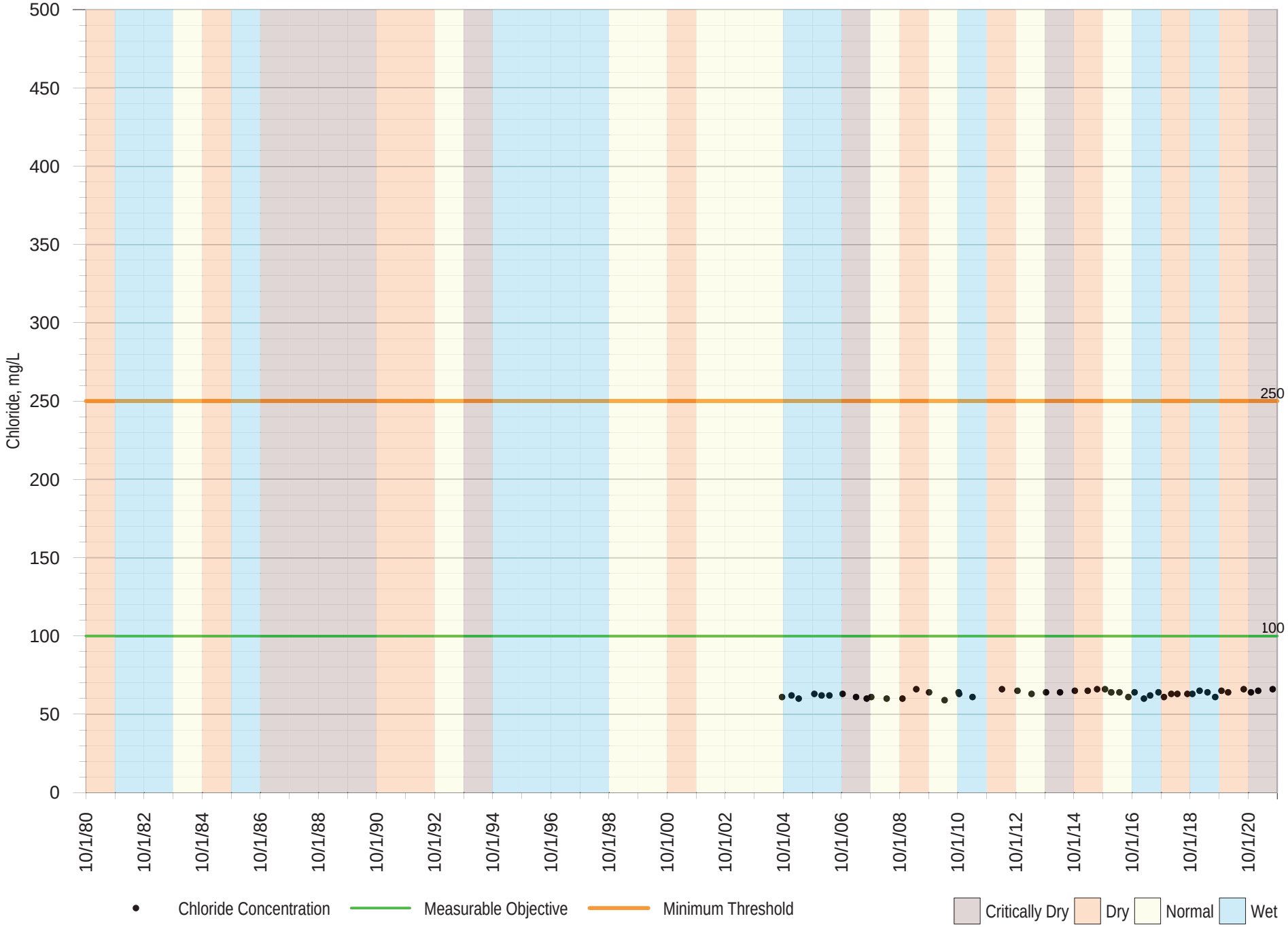
SC-3A & SC-3RA

FIGURE B-17



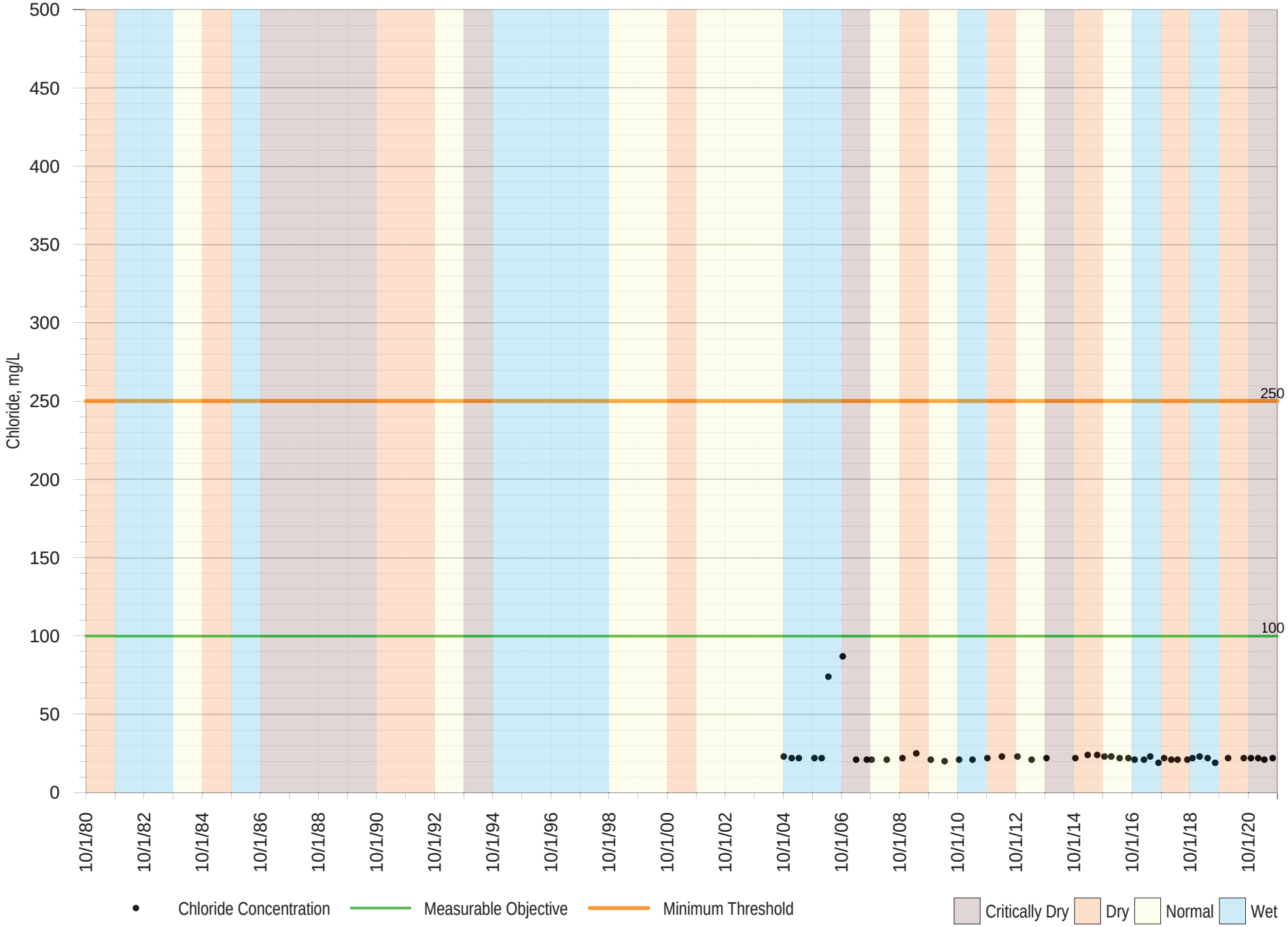
Moran Lake Deep

FIGURE B-18



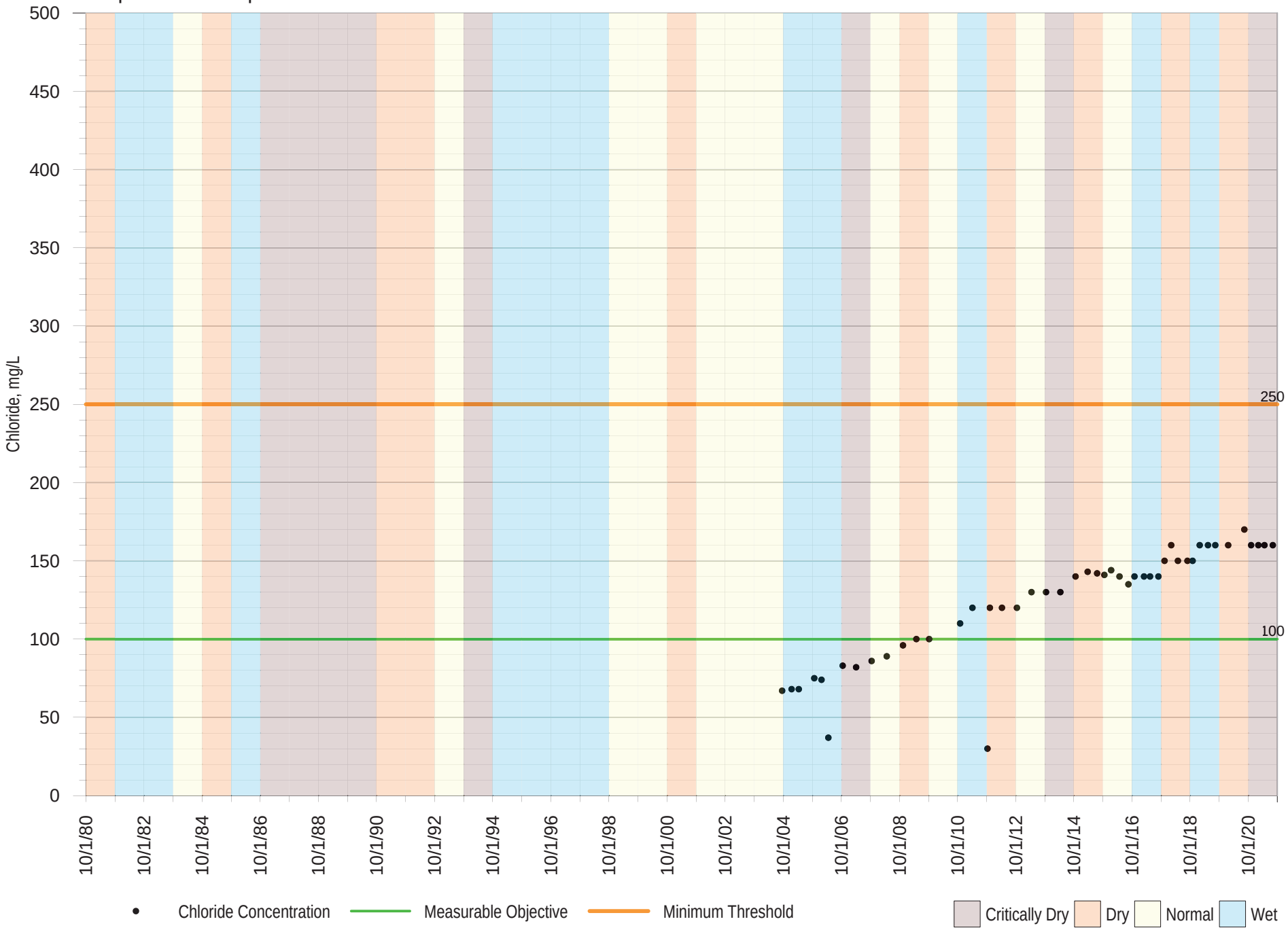
Pleasure Point Deep

FIGURE B-19



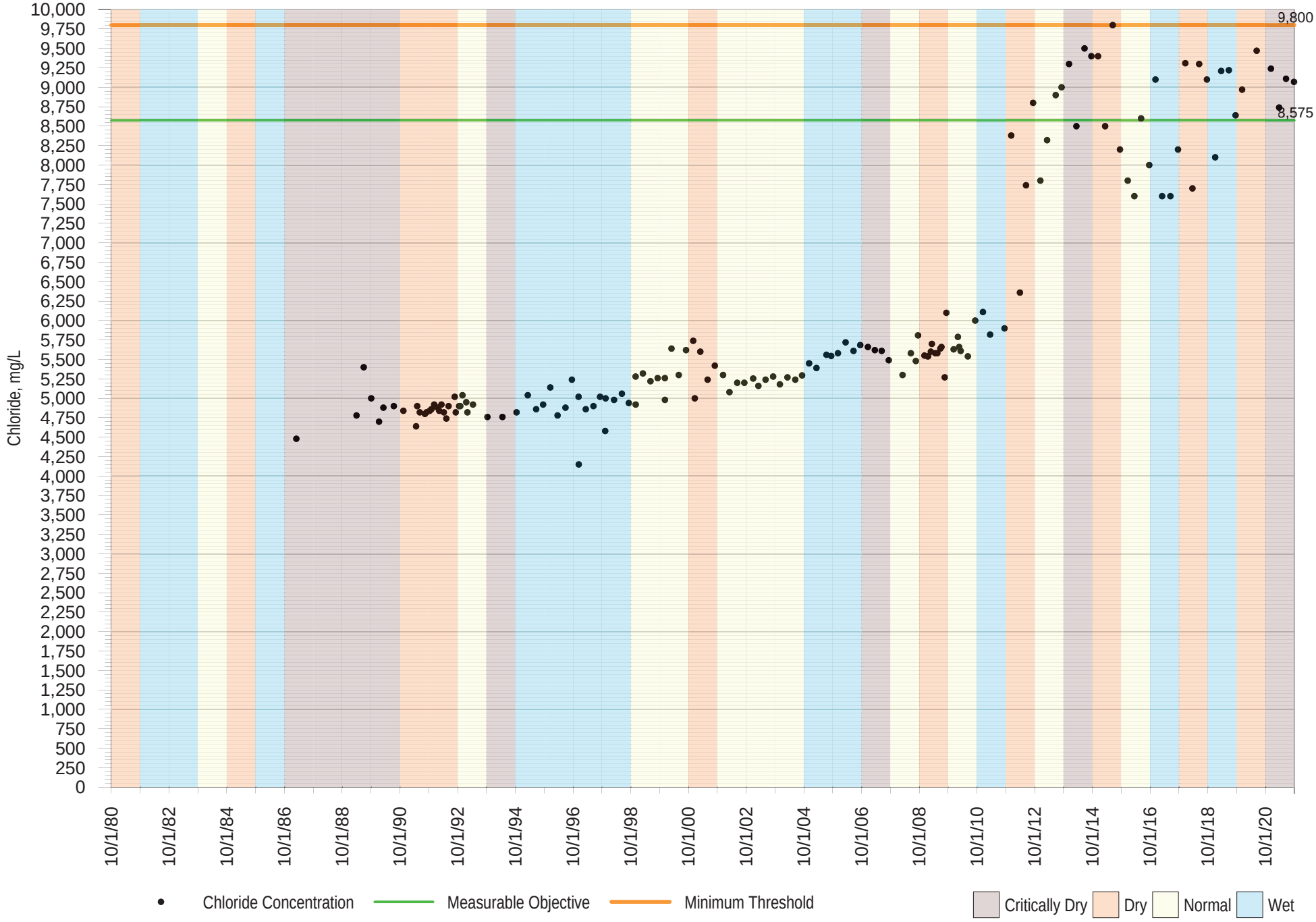
Soquel Point Deep

FIGURE B-20



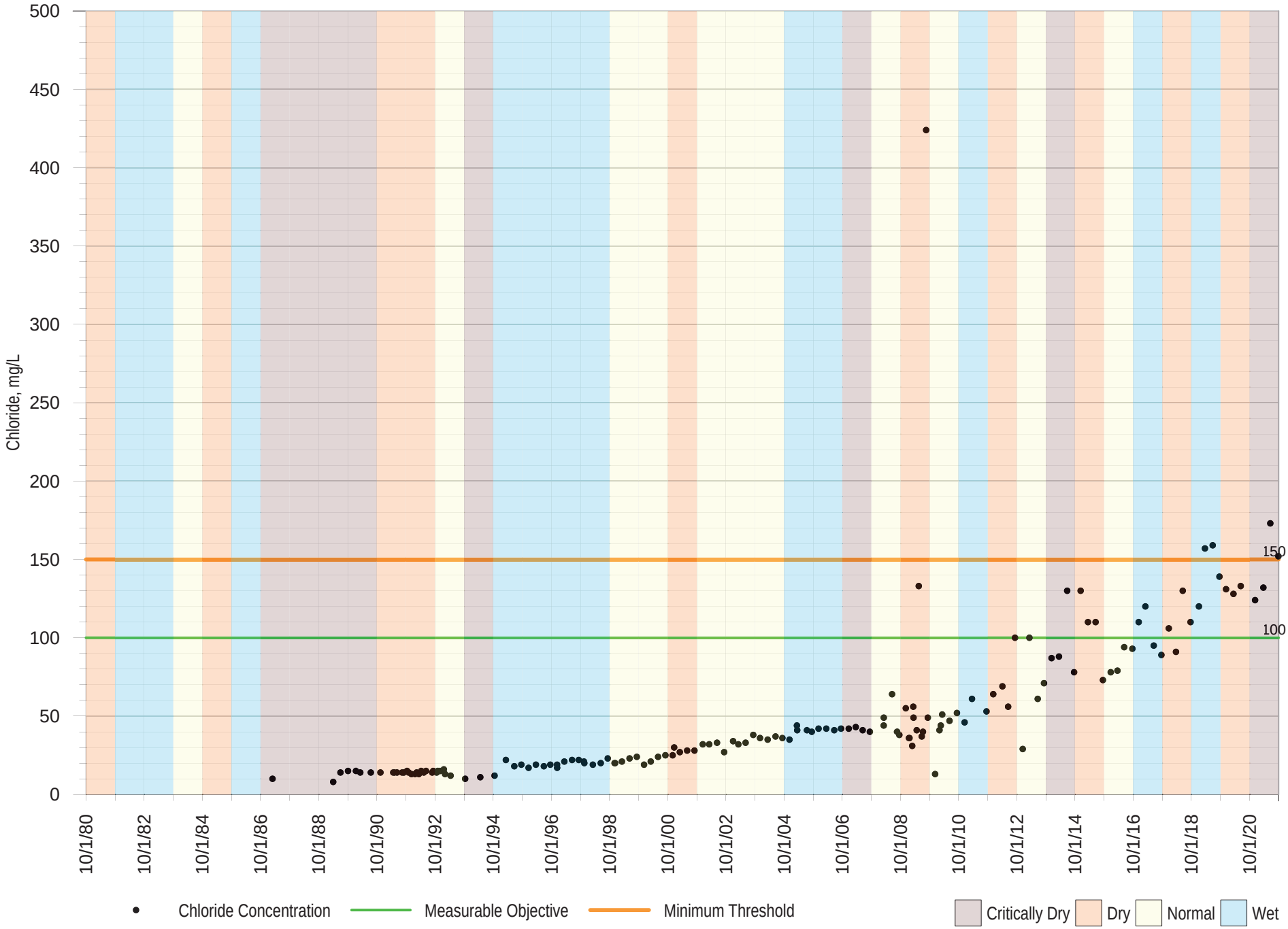
SC-A5A

FIGURE B-21



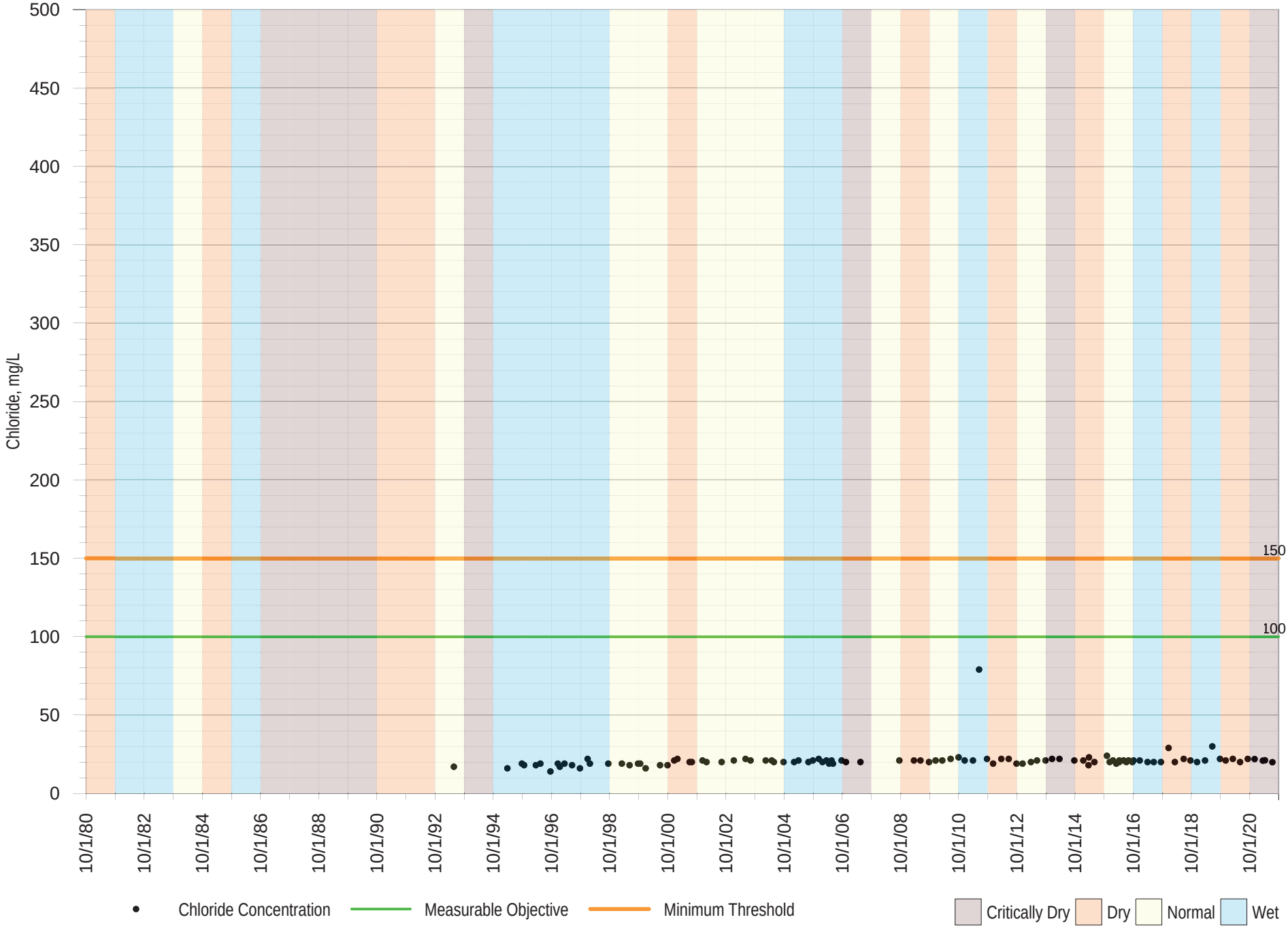
SC-A5B

FIGURE B-22



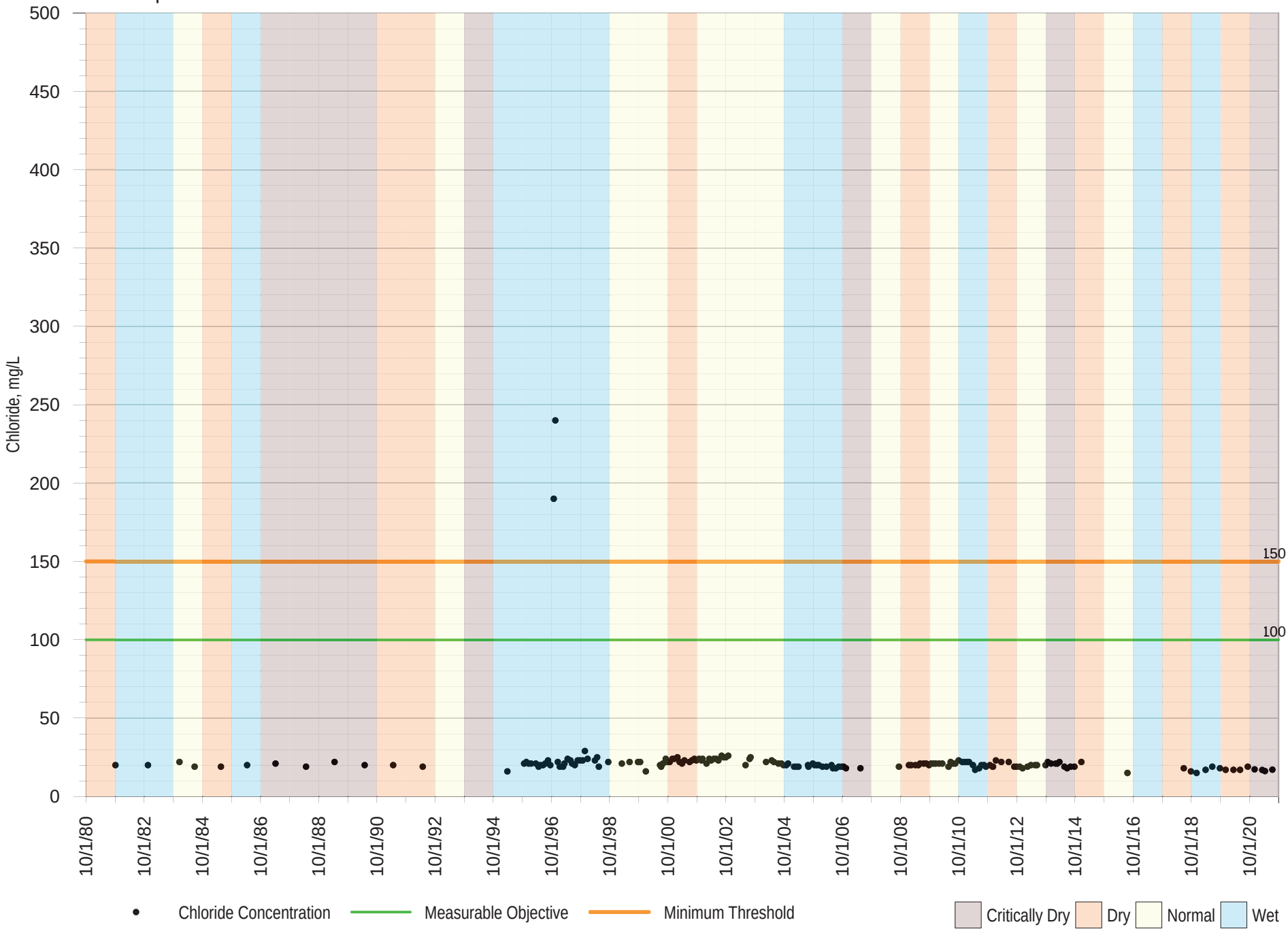
San Andreas

FIGURE B-23



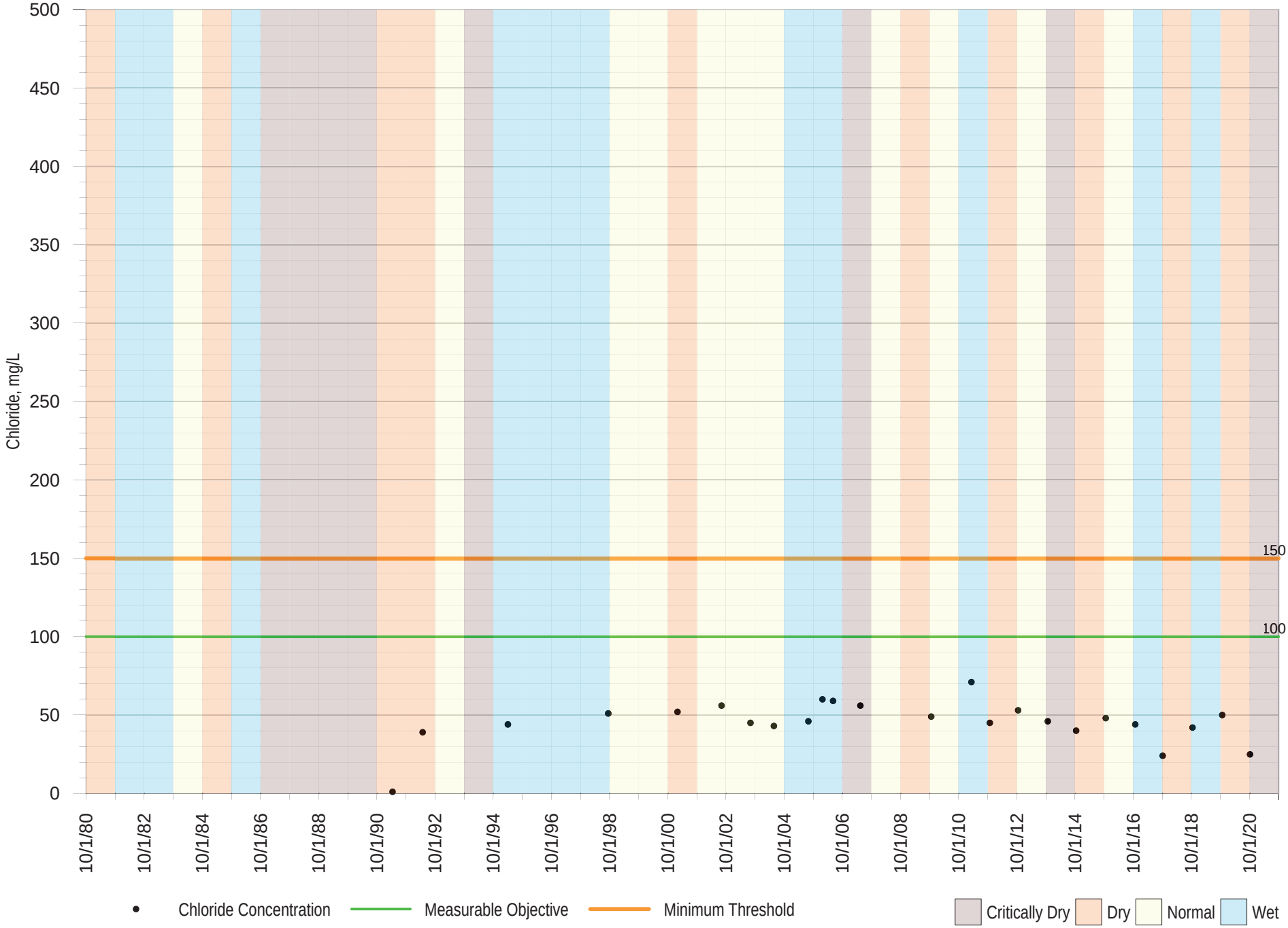
Seascape

FIGURE B-24



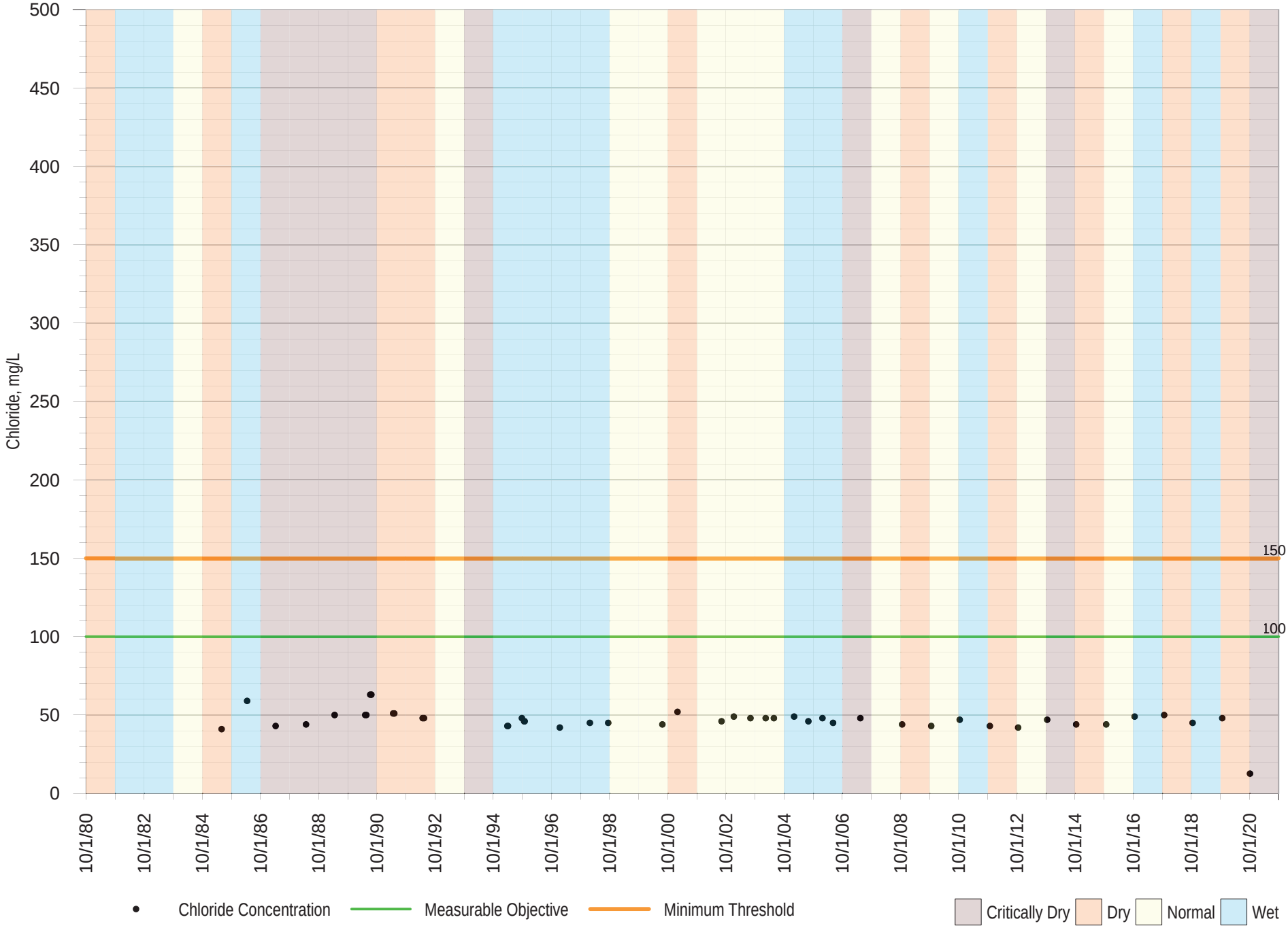
T.Hopkins

FIGURE B-25



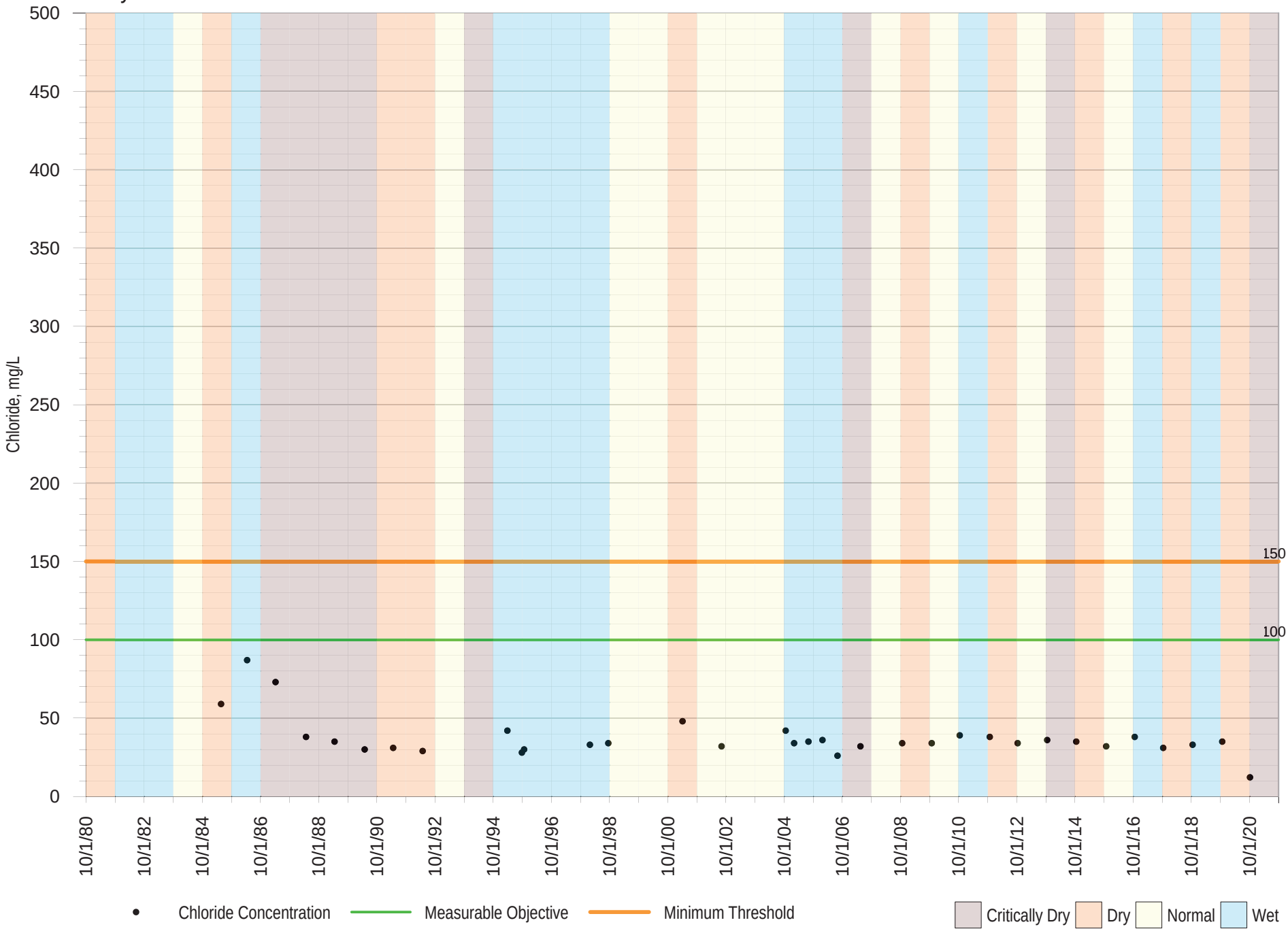
Estates

FIGURE B-26



Ledyard

FIGURE B-27



Garnet

FIGURE B-28

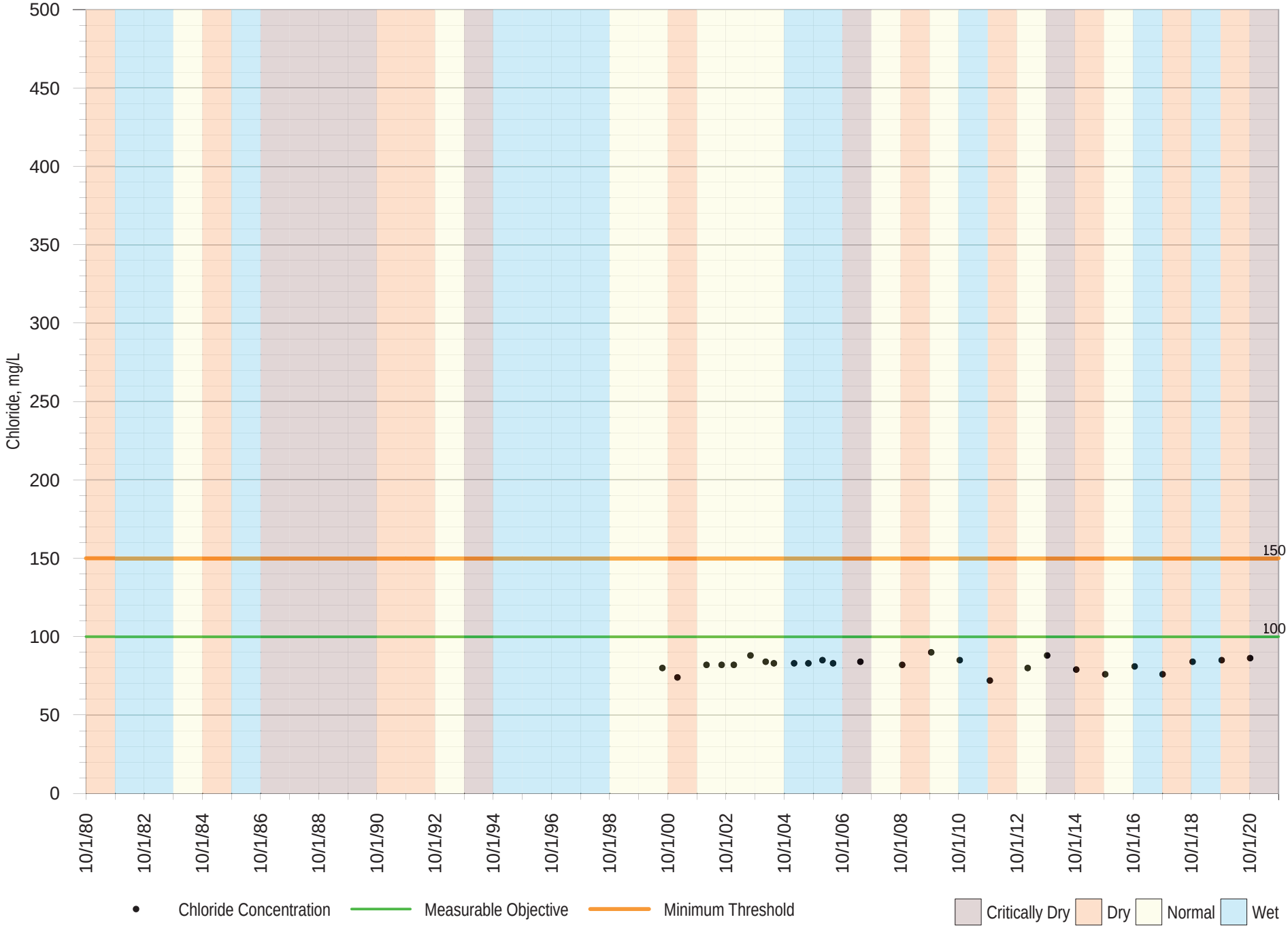
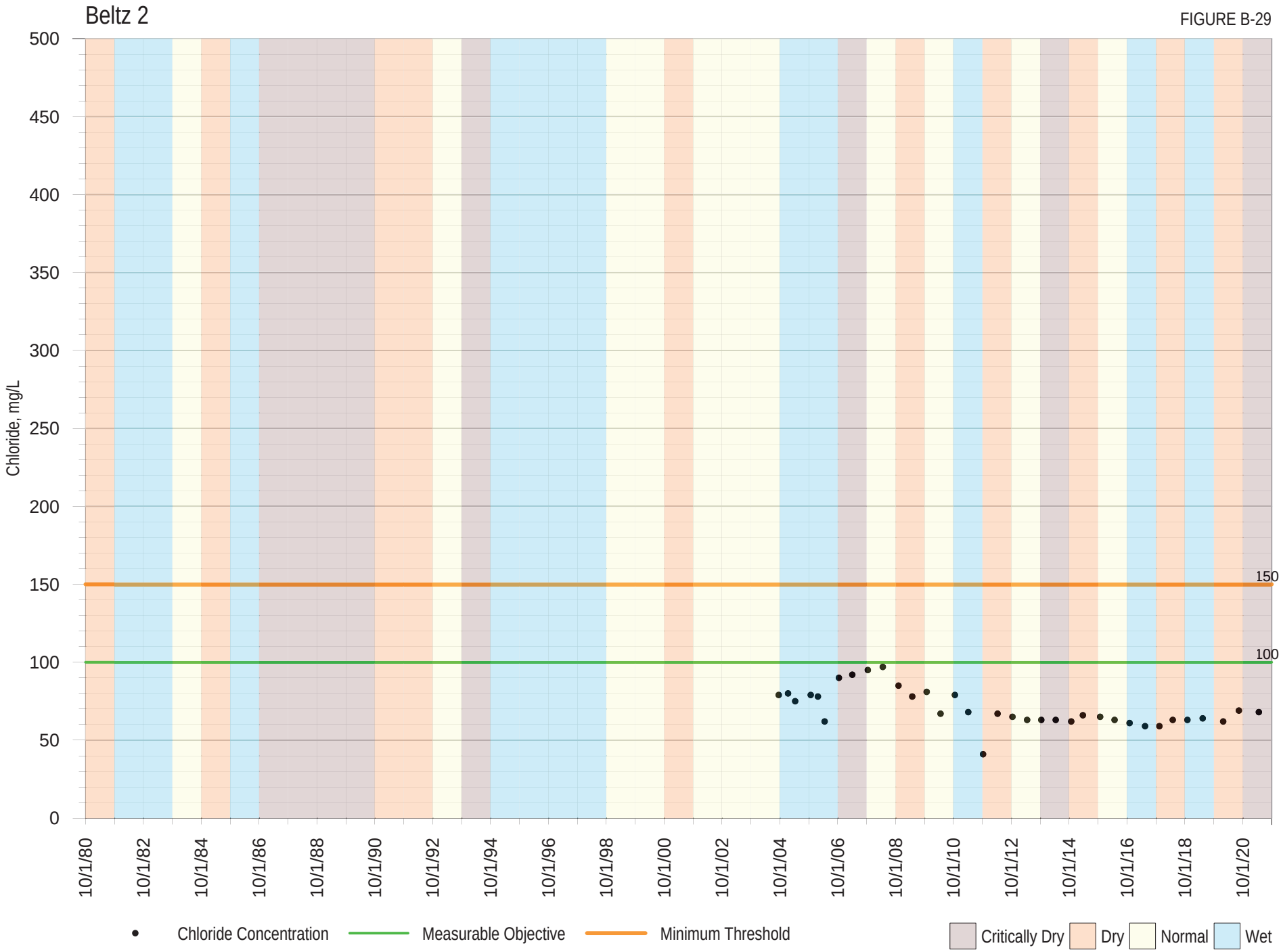
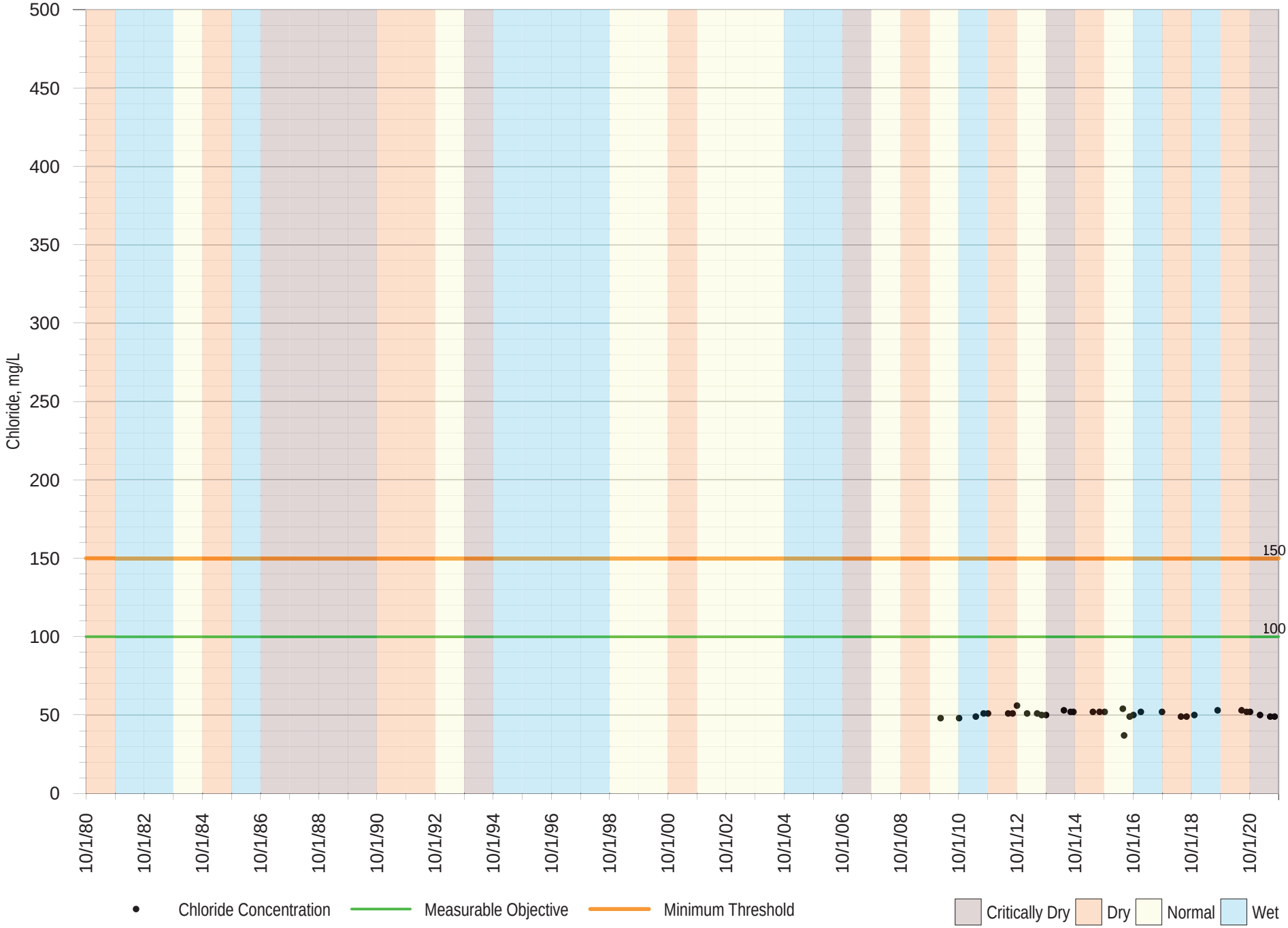


FIGURE B-29


Beltz 2
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
150
100
10/1/80
10/1/82
10/1/84
10/1/86
10/1/88
10/1/90
10/1/92
10/1/94
10/1/96
10/1/98
10/1/00
10/1/02
10/1/04
10/1/06
10/1/08
10/1/10
10/1/12
10/1/14
10/1/16
10/1/18
10/1/20
Chloride Concentration
Measurable Objective
Minimum Threshold
Critically Dry
Dry
Normal
Wet

Beltz 8

FIGURE B-30



SC-22AA

FIGURE B-31

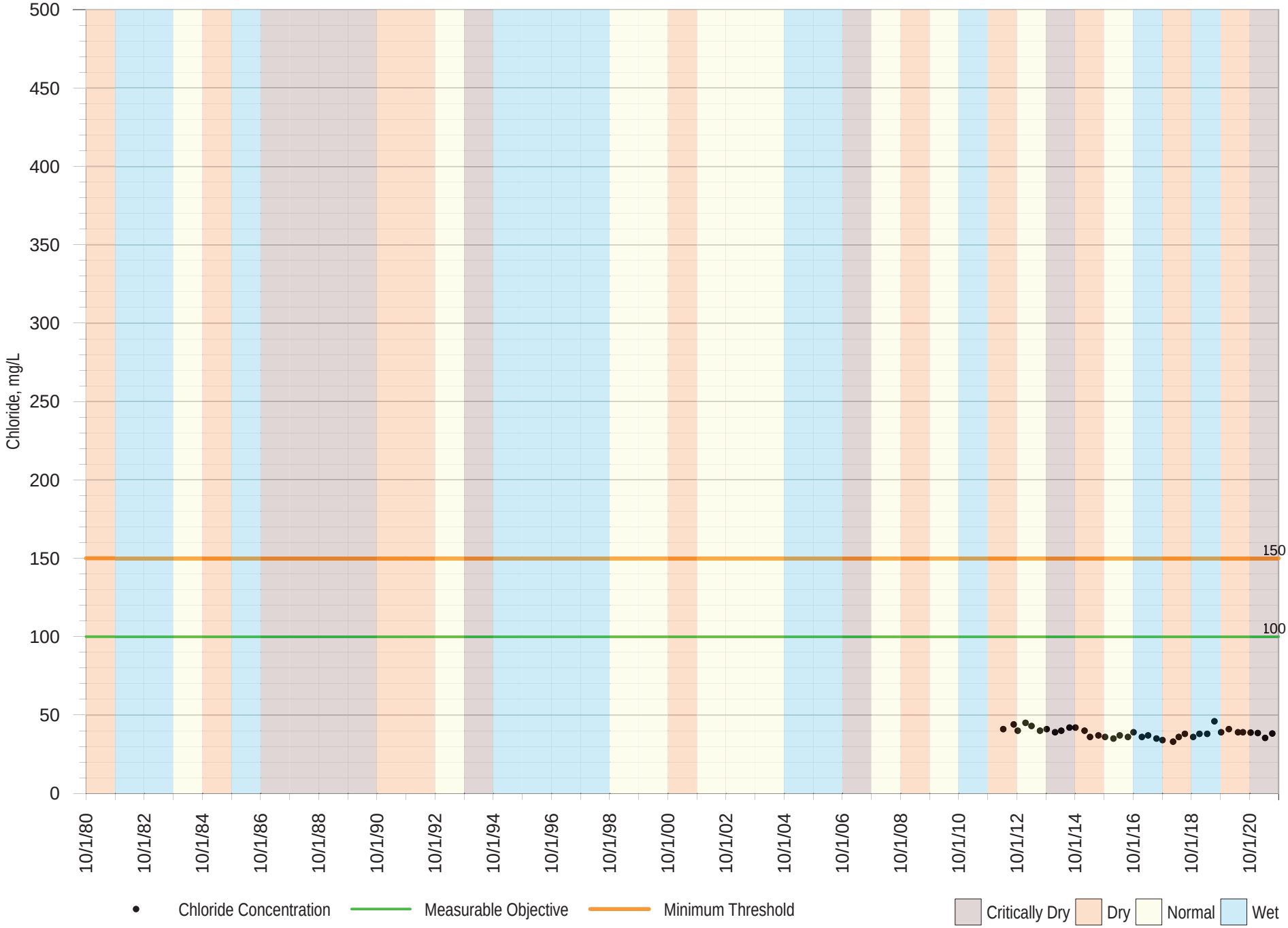
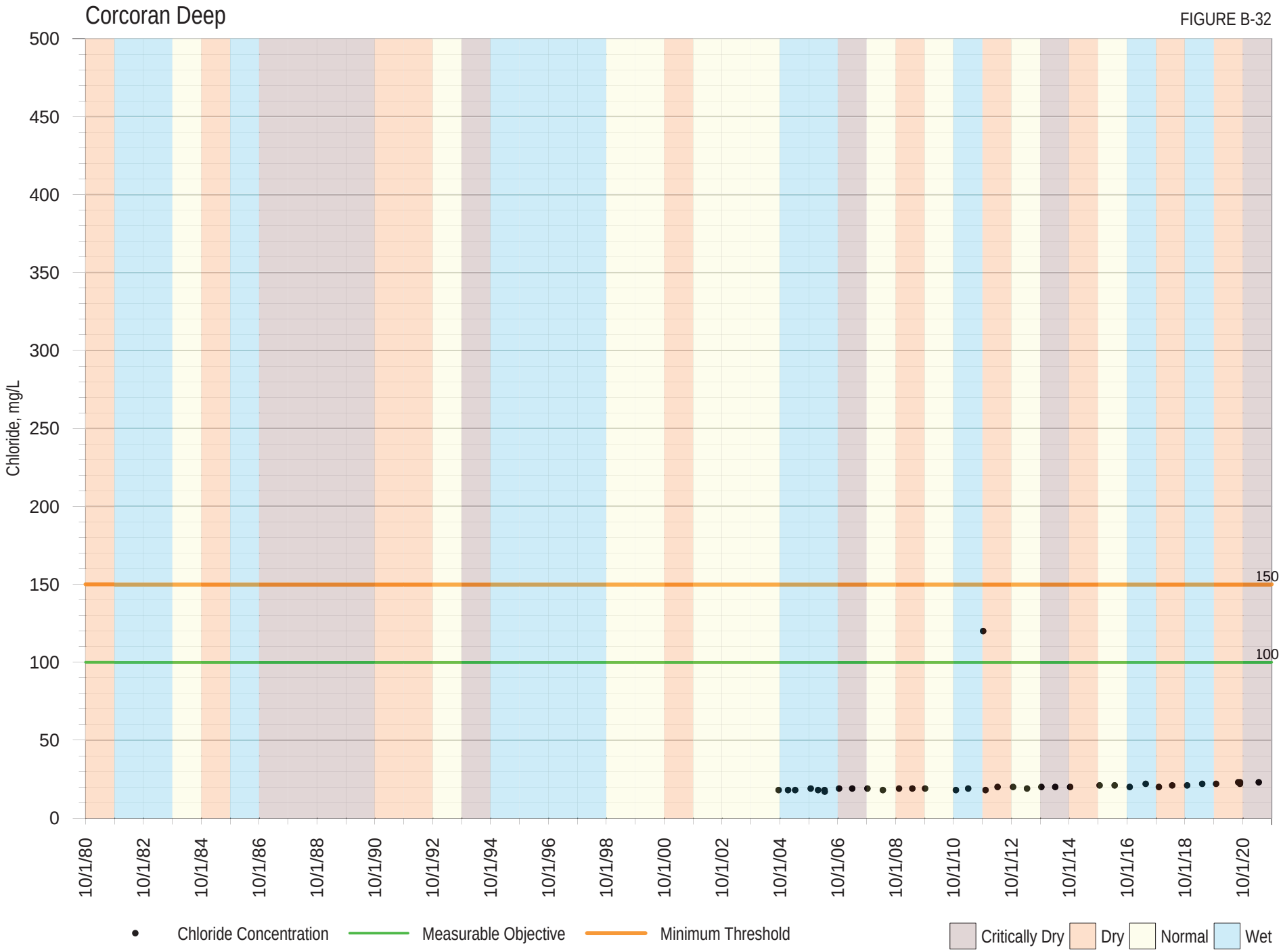
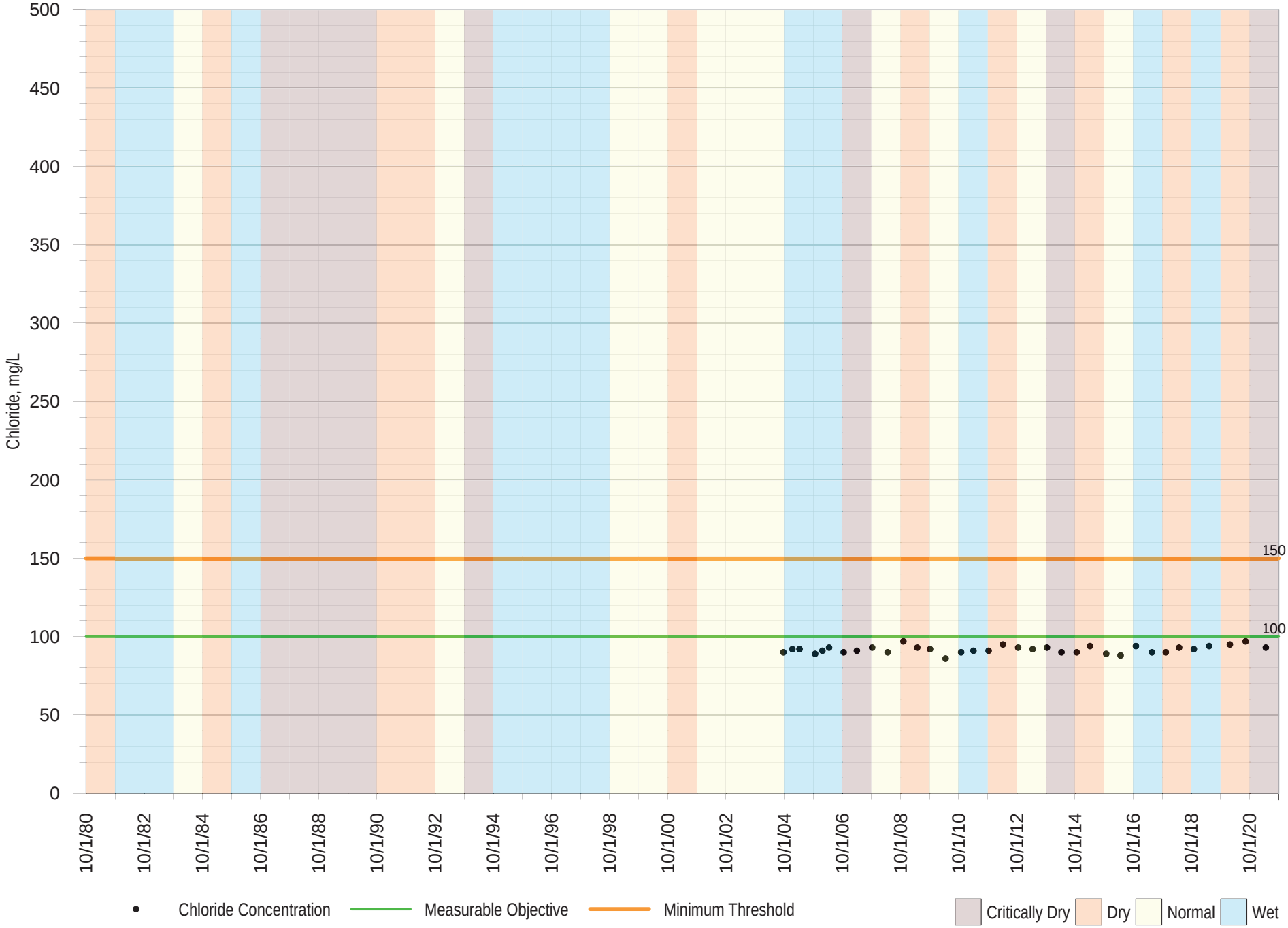


FIGURE B-32


Corcoran Deep
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
150
100
10/1/80
10/1/82
10/1/84
10/1/86
10/1/88
10/1/90
10/1/92
10/1/94
10/1/96
10/1/98
10/1/00
10/1/02
10/1/04
10/1/06
10/1/08
10/1/10
10/1/12
10/1/14
10/1/16
10/1/18
10/1/20
Chloride Concentration
Measurable Objective
Minimum Threshold
Critically Dry
Dry
Normal
Wet

Schwan

FIGURE B-33



SC-22AAA

FIGURE B-34