MONTGOMERY & ASSOCIATES
Water Resource Consultants

April 22, 2021

Groundwater Management Plan Annual Report - Water Year 2020

Prepared for:

SCOTTS VALLEY WATER DISTRICT

1970 Broadway, Suite 225, Oakland, CA 94612
elmontgomery.com

Contents

1 EXECUTIVE SUMMARY 1
2 INTRODUCTION 3
2.1 District Overview 3
2.2 Groundwater Management Goals and Objectives 3
2.3 Annual Report Format 6
2.4 Santa Margarita Groundwater Basin 6
2.5 Groundwater Management Areas 11
2.6 Historical Groundwater Issues 13
3 WATER SUPPLY SUMMARY 14
3.1 Precipitation Summary 14
3.2 SVWD Water Supply 16
3.2.1 Groundwater Pumping 16
3.2.2 Recycled Water Deliveries 19
3.2.3 Seasonality of Groundwater Pumping 22
3.3 Regional Groundwater Pumping 24
3.4 SVWD Production Wells 28
3.4.1 Condition of Production Wells 28
3.4.2 Groundwater Pumping by Well 30
3.4.3 Groundwater Levels in Production Wells 30
4 GROUNDWATER QUALITY ASSESSMENT 32
4.1 SVWD Groundwater Quality and Treatment 32
4.1.1 Groundwater Quality 32
4.1.2 Groundwater Treatment 34
4.2 Environmental Compliance Sites 34
4.2.1 Watkins-Johnson Superfund Site 35
4.2.2 Scotts Valley Dry Cleaners 37
4.2.3 Kings Dry Cleaners 37
4.2.4 Inactive Sites 38
4.3 Recycled Water Program 38
5 GROUNDWATER CONDITIONS 40
5.1 Aquifer Conditions 40
5.1.1 Santa Margarita Aquifer 40
5.1.2 Monterey Formation 43
5.1.3 Lompico Aquifer 46

5.1.4 Butano Aquifer 50
5.2 Aquifer Storage Analysis 54
6 GROUNDWATER MANAGEMENT PROGRAMS 57
6.1 Groundwater Augmentation Projects 57
6.1.1 Water Use Efficiency Program 57
6.1.2 Recycled Water Program 58
6.1.3 Regional Intertie Project 59
6.1.4 Regional Water Supply MOA 59
6.1.5 Santa Margarita Groundwater Basin ASR Project 60
6.1.6 Low Impact Development Projects 60
6.1.7 Purified Recycled Water Recharge Project 63
6.2 Groundwater Management Activities 63
6.2.1 Sustainable Groundwater Management 63
6.2.2 Santa Margarita Basin Groundwater Model 63
6.3 Groundwater Management Monitoring Program 64
6.3.1 SVWD Data Collection 64
6.3.2 CASGEM Program 66
6.4 Stakeholder Outreach 66
7 REFERENCES CITED 68

Tables

Table 1. WY2010 to WY2020 SVWD Groundwater Pumping by Aquifer and Recycled Water Usage 18
Table 2. WY2011 to WY2020 SVWD Groundwater Pumping and Recycled Water Usage 22
Table 3. Summary of WY2020 Private Groundwater Pumping in the GWRA and SMGB 25
Table 4. WY2011 to WY2020 Groundwater Pumped in the GWRA by Aquifer 26
Table 5. Summary of Well Completion Data for Currently Active SVWD Production Wells 29
Table 6. WY2011 to WY2020 SVWD Groundwater Pumping by Well 30
Table 7. WY2020 Summary of Key Water Quality Constituents in Raw Groundwater 33
Table 8. Summary of Water Treatment Processes Applied by SVWD 34
Table 9. Model-Simulated Change in Aquifer Storage for the GWRA by Aquifer 56
Table 10. Unaccounted-for Water Estimates WY2017-WY2020 57
Table 11. Volume Infiltrated at LID Facilities in SVWD Service Areas 60
Table 12. Wells Used for the Groundwater Management Monitoring Program 65

Figures

Figure 1. Scotts Valley Water District Service Area Map 5
Figure 2. Santa Margarita Groundwater Basin 8
Figure 3. Geologic Cross-Section through the Scotts Valley Area 9
Figure 4. Cross-Section and Well Locations 10
Figure 5. Groundwater Reporting and Management Areas 12
Figure 6. Annual Precipitation for Scotts Valley by Water Year 15
Figure 7. Annual SVWD Groundwater Pumping and Service Connections 17
Figure 8. SVWD Groundwater Pumping by Month for WY2020 20
Figure 9. Annual and Cumulative Recycled Water Deliveries 21
Figure 10. SVWD Monthly Groundwater Pumping Comparison 23
Figure 11. Regional Groundwater Pumping by User Type in the GWRA 27
Figure 12. Locations of Environmental Compliance Sites 36
Figure 13. Recycled Water Management Plan (RWMP) Monitoring Locations 39
Figure 14. Groundwater Hydrographs for the Santa Margarita Aquifer 41
Figure 15. Santa Margarita Aquifer Groundwater Elevation Contour Map, September 2020 44
Figure 16. Groundwater Hydrographs for the Monterey Aquifer 45
Figure 17. Groundwater Hydrographs for the Lompico Aquifer 48
Figure 18. Lompico Aquifer Groundwater Elevation Contour Map, September 2020 49
Figure 19. Groundwater Hydrographs for the Butano Aquifer 52
Figure 20. Butano Aquifer Groundwater Elevation Contour Map, September 2020 53
Figure 21. Historical Change in Aquifer Storage for Groundwater Reporting Area 55
Figure 22. Location of Low Impact Development Projects 62

Appendices

Appendix A. Hydrographs of SVWD Production Wells
Appendix B. Hydrographs of Wells with Transducers

Acronyms & Abbreviations

AMI ....Automated Metering Infrastructure
amsl ....above mean sea level
ASR ....aquifer storage and recovery
bgs ....below ground surface
BMO.............Basin Management Objectives
BMP ....best management practice
CASGEM .....California Statewide Groundwater Elevation Monitoring
CDDW..........California Division of Drinking Water
DCE..............dichloroethylene
DWR ....California Department of Water Resources
GAC ....granular activated carbon
GPD..............gallons per day
gpm...............gallons per minute
GAC ....granulated activated carbon
GSA..............Groundwater Sustainability Agency
GSP ....Groundwater Sustainability Plan
GWMP ....Groundwater Management Plan
GWRA..........Groundwater Reporting Area
IRWMP ....Integrated Regional Watershed Management Plan
JPA ....Joint Powers Agreement
LID ....low impact development
LTCP ....Low-Threat Closure Policy
MCL ....maximum contaminant level
mg/L ....milligrams per liter
MHA ....Mount Hermon Association
MRP ....Monitoring and Reporting Program
MTBE...........methyl-tert-butyl ether
NPDES ....National Pollutant Discharge Elimination System
NPL ....National Priorities List
O&M ....operations and maintenance
PCE ....tetrachloroethene
RACR...........Groundwater Remedial Action Completion Report
RWQCB ....Central Coast Regional Water Quality Control Board
SCMGB ....Santa Cruz Mid-County Groundwater Basin
SGMA ....Sustainable Groundwater Management Act
SLVWD.........San Lorenzo Valley Water District
SMCL ....secondary maximum contaminant level

SMGB............Santa Margarita Groundwater Basin
SMGBAC .....Santa Margarita Groundwater Basin Advisory Committee
SMGWA........Santa Margarita Groundwater Agency
SVWD ....Scotts Valley Water District
SWRCB ....State Water Resources Control Board
TCE ....trichloroethylene
TDS ....total dissolved solids
µg/L ....micrograms per liter
USEPA ....United Stated Environmental Protection Agency
UWMP ....Urban Water Management Plan
VOC ....volatile organic compounds
WTP ....water treatment plant
WY ....Water Year

1 EXECUTIVE SUMMARY

The Scotts Valley Water District (SVWD or District), located in Santa Cruz County, serves water to residents and businesses within an area of approximately 5.5 square miles that includes most of the City of Scotts Valley as well as some unincorporated areas north of the City. Groundwater from the Santa Margarita Groundwater Basin (SMGB or Basin) is the sole source of potable water supply for the District.

SVWD formally adopted its Groundwater Management Plan in 1994 under Assembly Bill 3030 (AB3030). Annual reports describing the groundwater conditions in the Scotts Valley area and the District's management programs have been prepared since 1994. Since 2017, SVWD has actively participated as a member agency of the Santa Margarita Groundwater Agency (SMGWA) that was formed under a joint powers agreement per the Sustainable Groundwater Management Act (SGMA) of 2014. The SMGWA Board meets monthly overseeing groundwater management activities of the SMGWA under the requirements of SGMA and development of a Groundwater Sustainability Plan (GSP). The GSP is required to be submitted to DWR by January 31, 2022.

This is the last annual report that will be prepared by SVWD. Starting next year, SVWD's WY2021 annual report will be replaced by the first GSP Annual Report that will cover the entire Santa Margarita Groundwater Basin. The Water Year (WY) 2021 GSP Annual Report will be prepared by the SMGWA with input by all member agencies.

Water Year 2020 was a below average rainfall year with only 20.3 inches[1] of rainfall, which is 49% of average. Since the drought that ended in WY2015, rainfall has only been a cumulative 2.4 inches above normal. The cumulative rainfall deficit over the past 14-year period from October 2007 through September 2020 is 4.7 inches below average indicating that climate over that period is drier than historical climate.

Groundwater pumped by SVWD in WY2020 was 1,215 acre-feet, which is similar to the previous three years' pumping. Current pumping is 885 acre-feet less than the historical maximum pumping from 1997. In WY2020, approximately 64% of SVWD's groundwater production was from the Lompico aquifer and 36% was from the Butano aquifer. The District has no wells pumping from the Santa Margarita aquifer or Monterey formation.

[1] Rainfall measured at the El Pueblo weather station slightly underestimates total WY2020 precipitation due to a station malfunction in late fall 2019.

SVWD maintains a number of ongoing activities to support the sustainable management of the groundwater resource including water use efficiency, a recycled water program, and water audit and loss control program. In WY2020, recycled water deliveries were approximately 178 acre-feet. Since WY2002, approximately 2,670 acre-feet of recycled water has been delivered for use. Cumulative recycled water deliveries equate to banking more than twice the volume of groundwater that was pumped by SVWD in WY2020.

The quality of groundwater pumped from SVWD's wells is good. Iron and manganese treatment ensure that the concentrations of these constituents in delivered water is below the secondary maximum contaminant level. Volatile organic compounds (VOC) are below detectable levels in all production wells, except SVWD Wells #9 and #11A which continue to have VOCs detects below maximum contaminant levels.

SVWD is being kept informed about the remediation activities at regulated environmental compliance sites within the District boundaries. These sites have introduced primarily VOCs into the groundwater. The Watkins-Johnson Superfund site remediation is edging towards closure but still needs to complete the source control component of its remedial action to ensure protectiveness over the long-term. The site is currently designated as open-remediation for residential use due to existing soil gas plumes of benzene, TCE, PCE, arsenic and cadmium in soils. A draft Focused Feasibility Study proposing potential remediation alternatives including soil excavation was submitted by the site's owner to USEPA in January 2019.

Groundwater elevations in all aquifers in the GWRA have generally experienced recovery since 2010, with this trend continuing through WY2020. Groundwater levels in the Santa Margarita and Butano aquifers in WY2020 remain consistent with previous years, including the typical seasonal and climactic fluctuations. Groundwater levels in both the Monterey formation and Lompico aquifer increased slightly in WY2020, continuing a trend of recovery that began around WY2015. Specifically, Lompico aquifer groundwater levels have increased up to 40 feet over the past four years.

Despite increases in groundwater elevations shown in most hydrographs, there was a model-estimated loss of groundwater in storage during WY2020 of 890 acre-feet. This loss comes after last year's storage increase of 1,650 acre-feet. This results in a net increase in groundwater in storage of 760 acre-feet in the GWRA over the past two years.

2 INTRODUCTION

2.1 District Overview

The Scotts Valley Water District (SVWD or District) was formed under the County Water District Law, specifically California Water Code Section (CWC§) 30321 and received certification from the California Secretary of State in 1961. SVWD covers an area of about 5.5 square miles (Figure 1) in northern Santa Cruz County, and is located approximately five miles inland from the Monterey Bay. SVWD provides water to a majority of the residents and businesses in and around the City of Scotts Valley. Groundwater is the sole source of potable water supply for SVWD, so careful management is necessary to sustain the resource.

SVWD has been actively managing groundwater since the early 1980s; with the goal of increasing water supply reliability and protecting local water supply sources. In 1983, SVWD instituted a Water Resources Management Plan to monitor and manage water resources in the Scotts Valley area. In 1994, SVWD formally adopted a Groundwater Management Plan ([GWMP], Todd Engineers, 1994) in accordance with Assembly Bill 3030 (AB 3030), also known as the Groundwater Management Act (CWC §10750 *et seq.*).

2.2 Groundwater Management Goals and Objectives

The overall purpose of the GWMP is to provide a planning tool that helps guide the District in managing the quantity and quality of its groundwater supply, and to comply with the requirements of AB3030. The main goal of the GWMP is to better manage the sole source aquifers serving the community's drinking water. The goal of the SVWD GWMP is stated as follows:

> *"By implementation of a groundwater management plan for Scotts Valley, SVWD hopes to preserve and enhance the groundwater resource in terms of quality and quantity, and to minimize the cost of management by coordination of efforts among agencies."*

Development of Basin Management Objectives (BMOs) are required for the GWMP under CWC §10753.7(a)(1) as a systematic process to support groundwater basin management. The BMOs for SVWD are currently summarized as:

- Encouraging public participation through an annual report of groundwater management activities and its presentation at one or more public meetings.
- Coordinating with other local agencies.
- Continued monitoring and evaluation of groundwater conditions.

- Implementing groundwater augmentation projects.
- Investigating groundwater quality and preventing groundwater contamination.

These BMOs continue to guide the SVWD groundwater management program and serve as the major objectives of groundwater management for the District.

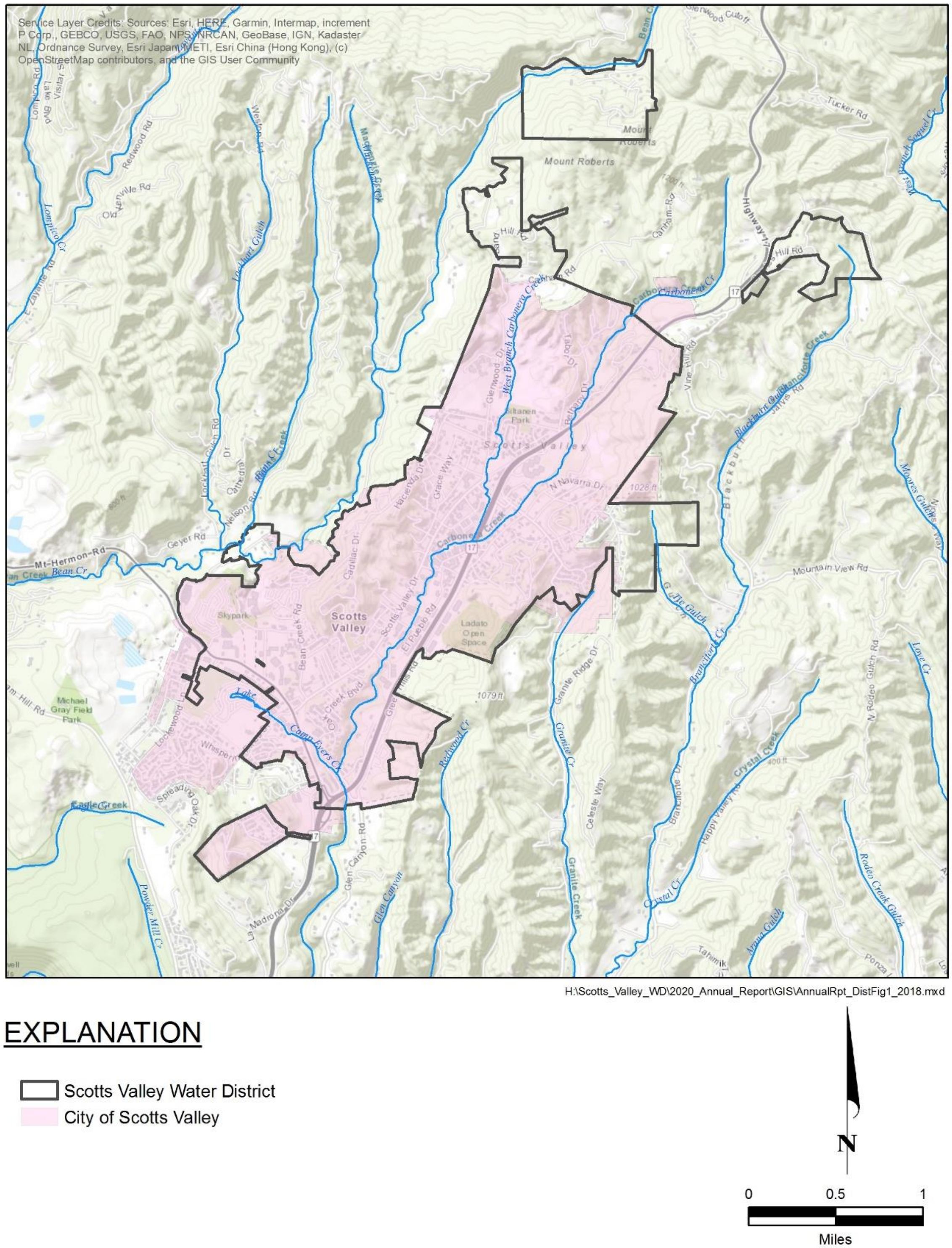


Figure 1. Scotts Valley Water District Service Area Map

2.3 Annual Report Format

An annual report is a key part of implementing the GWMP. The annual report evaluates and documents progress on meeting the GWMP goals and BMOs and identifies any concerns that should be monitored or addressed. This annual report is a management-level summary of groundwater conditions and groundwater management activities conducted by the District during Water Year (WY) 2020. The annual report is presented to the SVWD Board of Directors, distributed among local agencies and stakeholders, and made available to the public at the SVWD office and website.

The District has been producing annual reports since 1994. The format of the annual report has evolved over time to meet the needs of the District. Starting in 2013, the format of the annual reports began following a two-year cycle with a more comprehensive report provided in even years. Based on past experience, there are only incremental year-to-year changes in the basin; therefore, the two-year cycle provides a more cost- effective approach to accomplish the objectives of the annual report.

The odd year annual reports (2013, 2015, 2017 and 2019) are concise summaries focused on District operations whereas the even year annual reports (2014, 2016 and 2018) provide a more regional assessment that includes an evaluation of data from neighboring water districts and private suppliers, an assessment of water quality issues, an assessment of Basin conditions and the results from of the updated basin wide groundwater model.

In order to evaluate groundwater conditions within the context of California's climate cycle, data in the annual report are typically reported over a water year defined as the period from October 1 through September 30 of the following year. This period captures the cause-and-effect relationship on groundwater conditions of the typical rainy winter season followed by low rainfall and higher pumping during the summer.

2.4 Santa Margarita Groundwater Basin

The Santa Margarita Groundwater Basin (SMGB or Basin) covers approximately 33.2 square miles in the Santa Cruz Mountains. The SMGB forms a roughly triangular area that extends from Scotts Valley in the east, to Boulder Creek in the northwest, to Felton in the southwest (Figure 2). Groundwater is an important source of water supply for many residents living within the SMGB and is the primary water supply for SVWD.

California's groundwater basins and subbasins are defined in the Department of Water Resources' (DWR) 2016 Bulletin 118-Interim Update (DWR, 2016). The interim update includes the SMGB as shown on Figure 2. In 2016, a modified basin boundary was submitted by

SVWD and approved by DWR as part of a process established for local agencies under the Sustainable Groundwater Management Act (SGMA) to request that DWR revise the boundaries of a groundwater basin or subbasin, including the establishment of new subbasins. The revised basin expands the former Scotts Valley Groundwater Basin (Bulletin 118 basin number 3-27) to include parts of the former Felton Area basin (Bulletin 118 basin number 3-50) and the former Santa Cruz Purisima Formation basin (Bulletin 118 basin number 3-21). The SMGB's eastern boundary coincides with the also modified Santa Cruz Mid-County Groundwater Basin (SCMGB).

The SMGB consists of a sequence of sandstone, siltstone, and shale underlain by granite that lie within a geologic trough called the Scotts Valley Syncline. This sequence of sedimentary rocks is divided into several geologic formations. Formations are defined by the type of rock and their relative geologic age based on studies by the United States Geological Survey (Clark, 1996, 1981, Muir, 1981, Brabb *et al*., 1997, McLaughlin *et al*., 2001). In the SMGB, the sandstone units serve as the primary aquifers that supply the majority of groundwater production for the local water supply. The Basin's main aquifers are:

- Santa Margarita Sandstone (Santa Margarita aquifer),
- Monterey Formation,
- Lompico Sandstone (Lompico aquifer), and
- Butano Formation (Butano aquifer).

The SMGB is a geologically complex area that was formed by the same tectonic forces that created the Santa Cruz Mountains. The Basin is bounded by two regional faults, the Ben Lomond Fault to the west and the Zayante Fault to the north (Figure 2).Figure 3 presents a geologic cross-section illustrating the highly folded sedimentary layers in the SMGB. Figure 4 indicates where the cross-section runs through the Basin and shows the location of both production and monitoring wells. The deepest part of the Basin is located near SVWD Wells #3B and Orchard Well (replaced Well #7A in 2018) where the basin is over 1,500 feet thick. The Basin's geological complexity is reflected by variability of the geologic layers. For example, in some areas the Santa Margarita and Lompico aquifers are separated by the Monterey aquifer, whereas in other parts of the basin the Santa Margarita and Lompico aquifers are in contact with one another. This geological complexity exerts a strong influence on groundwater flow in the Basin.

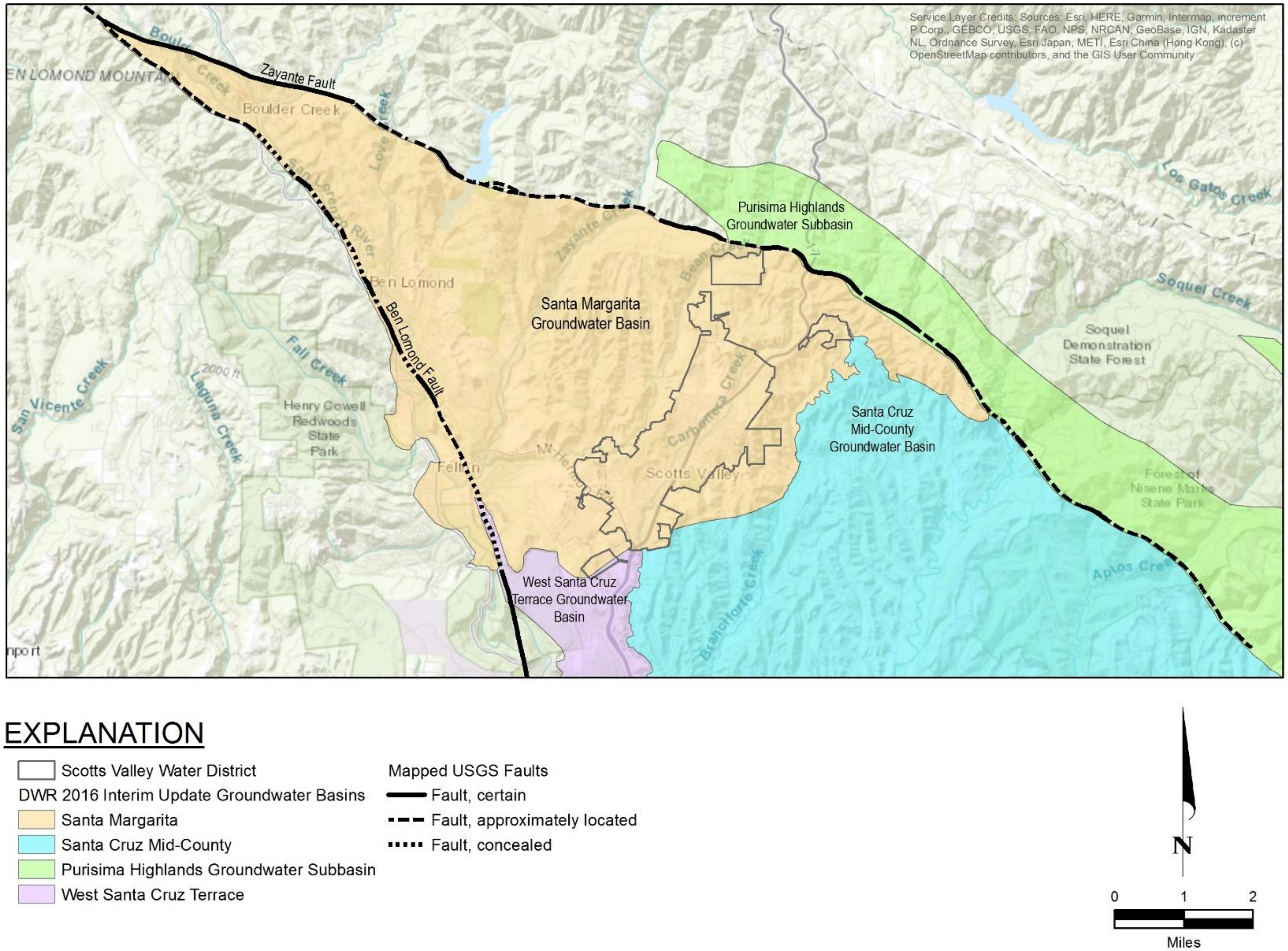


Figure 2. Santa Margarita Groundwater Basin

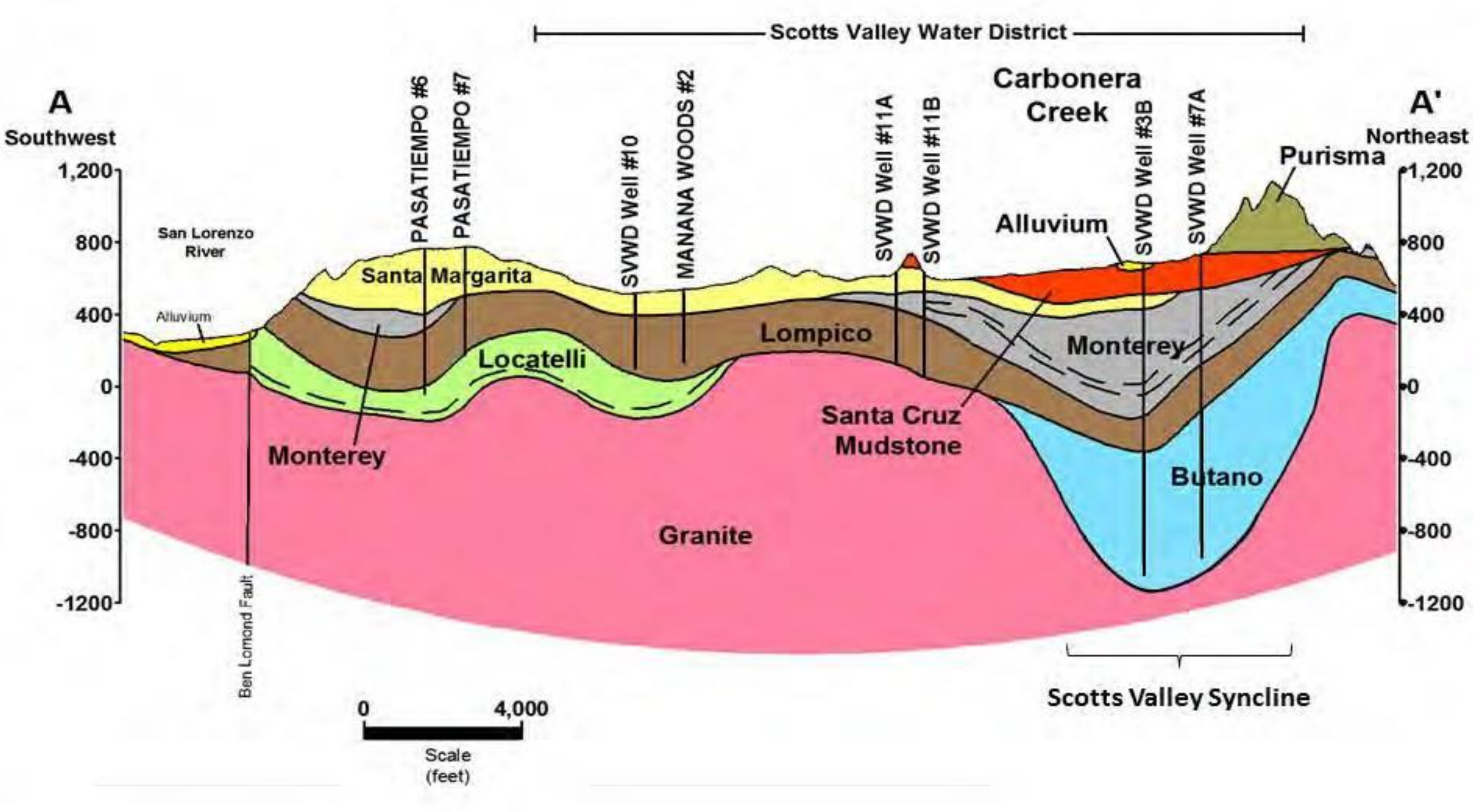
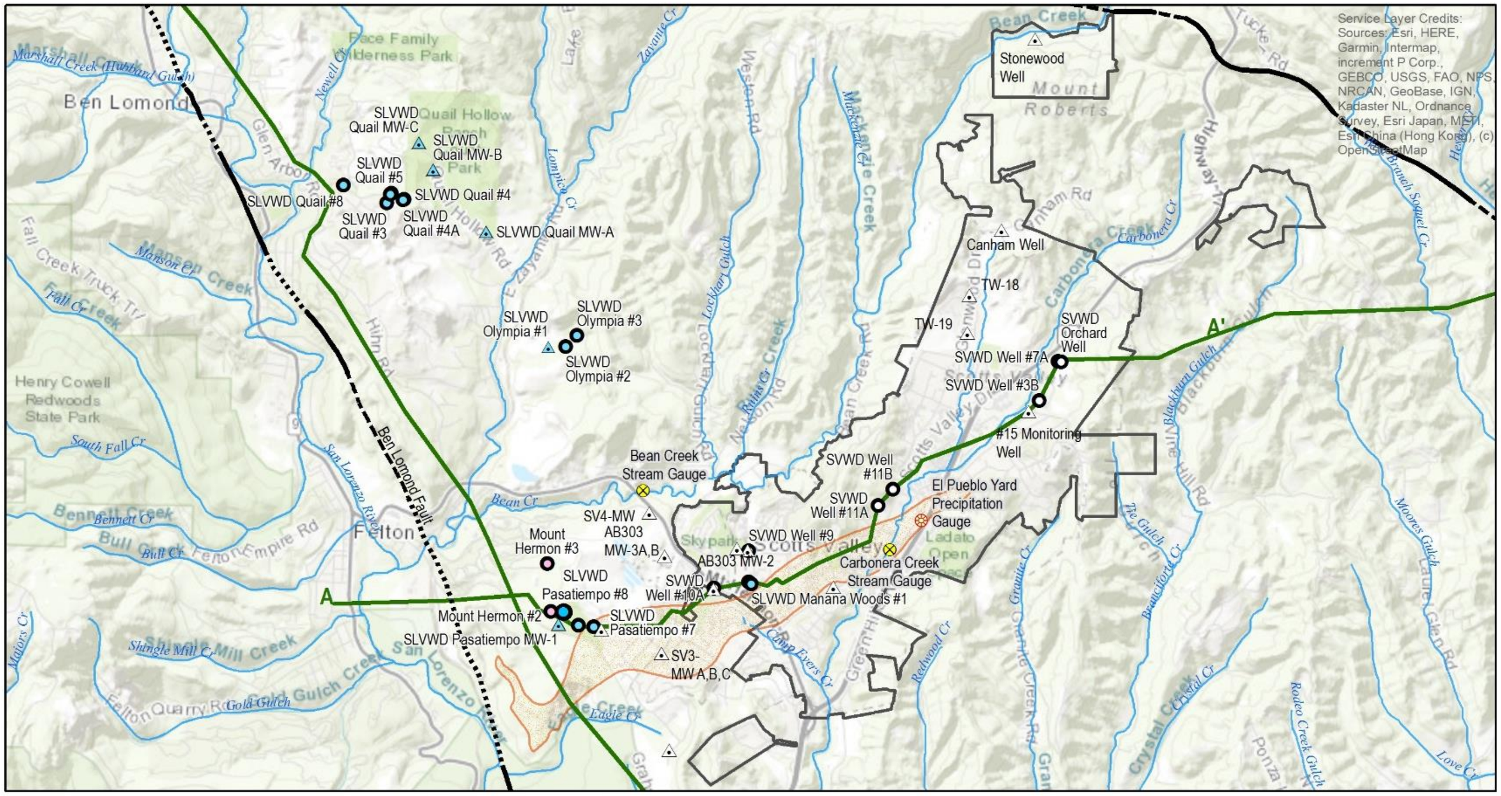


Figure 3. Geologic Cross-Section through the Scotts Valley Area



H:\Scotts_Valley_WD\2020_Annual_Report\GIS\AnnualRpt_CrossSection_Wells_2020.mxd

EXPLANATION

Scotts Valley Water District

Production Well Location
- SVWD
- SLVWD
- Mount Hermon

Monitoring Well Locations
- SLVWD
- SVWD

Gauge Locations
- GWMP Precipitation Gauge
- GWMP Stream Gauge
- Location of Direct Contact between the Santa Margarita Sandstone and the Lompico Sandstone
- Geologic Cross-Section Location

N

0 0.5 1
Miles

Figure 4. Cross-Section and Well Locations

2.5 Groundwater Management Areas

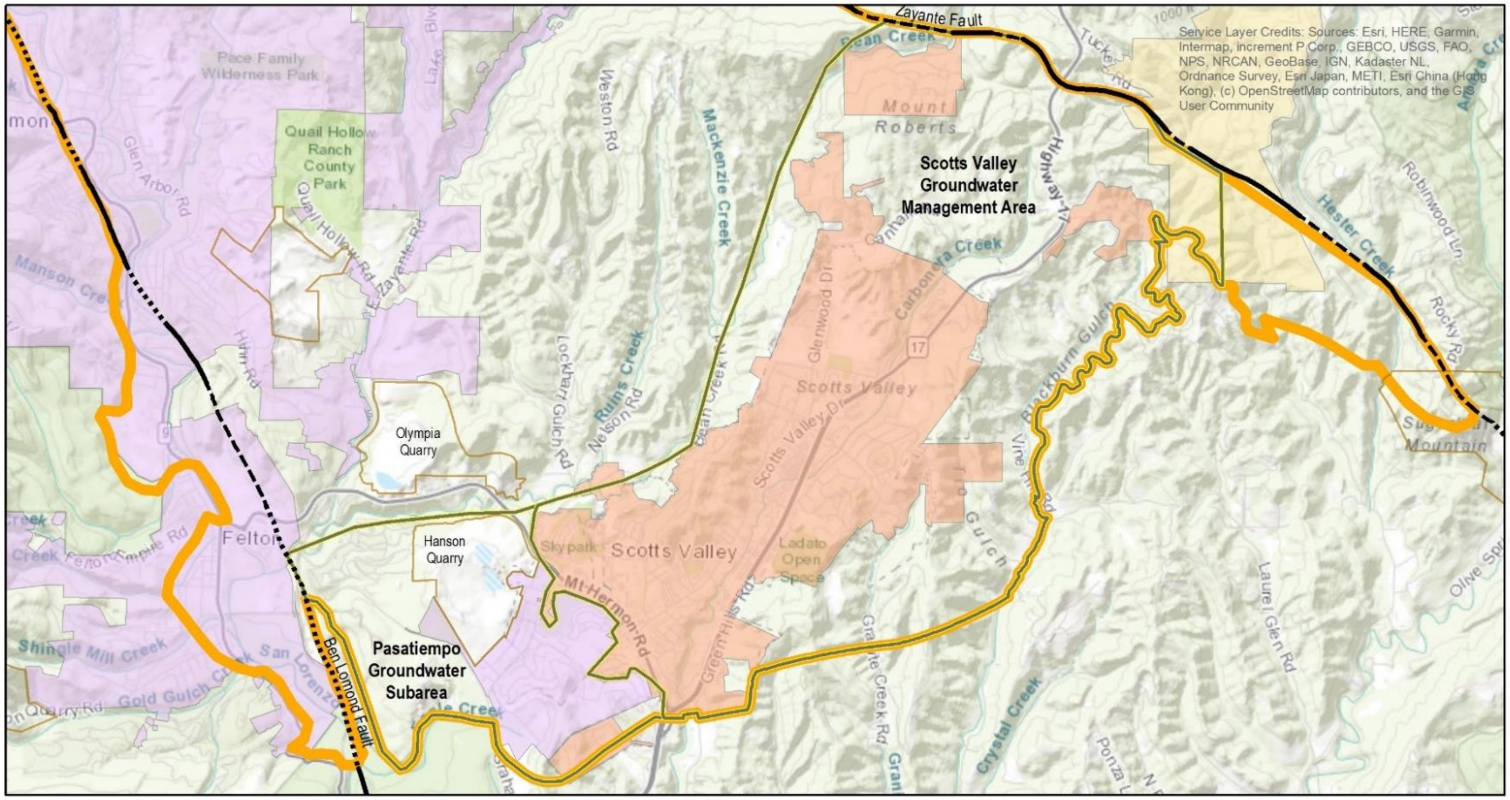
This annual report focuses on the portion of the SMGB that underlies the SVWD and adjacent areas; referred to as the Groundwater Reporting Area (GWRA). Two groundwater management areas are defined in this report for easy reference to key portions of the Basin. The management areas have been revised from annual reports prior to 2016 to match the modified boundary of the SMGB.

The groundwater management areas include:

- The SVWD Groundwater Management Area (SVWD GWMA) is the portion of the SMGB pumped primarily by the SVWD. The SVWD GWMA is bounded by Bean Creek on the north, Hanson Quarry on the west, and the SMGB boundary to the south and east (Figure 5).

- The Pasatiempo Groundwater Subarea includes the portion of the SMGB pumped by the SLVWD, the Mount Hermon Association, and one SVWD well and is bounded by the SVWD GWMA on the east, Bean Creek to the north, and the SMGB boundary to the south and the Ben Lomond Fault to the west (Figure 5).

The SVWD GWMA represents the portion of the SMGB where the District is actively involved in groundwater management. The GWRA adds adjacent areas to provide a broader context for a more regional approach to groundwater management. For the most part, the annual report collects and assesses data from the GWRA to support SVWD's groundwater management activities in the SVWD GWMA.



EXPLANATION

Water Districts
- Scotts Valley Water District
- San Lorenzo Valley Water District
- Soquel Creek Water District
- Groundwater Reporting Area with Management Subareas
- Quarry Location

DWR 2016 Interim Update Groundwater Basins
- Santa Margarita

Mapped USGS Faults
- Fault, certain
- Fault, approximately located
- Fault, concealed

N

0 0.5 1
Miles

Figure 5. Groundwater Reporting and Management Areas

2.6 Historical Groundwater Issues

Starting in the late 1960s, groundwater levels in many parts of the SMGB, especially in the Lompico aquifer, experienced significant declines with cumulative totals of up to 200 feet in some areas. Between the mid-1990s and mid-2000s, the rate of decline slowed as a balance between recharge and pumping was approached. The greatest declines occurred between the late 1960s and mid-1990s. A variety of factors are assumed to have contributed to these declines, including:

- Increased groundwater pumping due to residential and industrial growth in the area.
- Reduced recharge from the surface to groundwater due to an increase in impermeable land surface associated with urbanization.
- Reduced recharge during extended periods of below average rainfall.

Since the mid-2000s, groundwater levels in the GWRA have generally stabilized. While the stabilization of groundwater levels in recent years is promising, understanding the history and controlling factors that influence these groundwater level trends provides important context for making future sound groundwater management decisions.

3 WATER SUPPLY SUMMARY

3.1 Precipitation Summary

Precipitation is the primary source of groundwater recharge through both direct percolation of rainfall through the soil and infiltration of runoff through streambeds. Therefore, monitoring annual precipitation is a key component of understanding water supply trends and groundwater conditions in the SVWD GWMA. Average annual precipitation at El Pueblo weather station in Scotts Valley is 41.7 inches based on measurements collected since 1947 (Figure 6). In this period, the highest annual rainfall in Scotts Valley was 86.2 inches in WY1983, and the lowest annual rainfall was 19.9 inches in WY1976. Due to the mountainous nature of the Basin, precipitation across the District’s service area can vary up to 8 inches, with increasing precipitation in a westerly direction.

Precipitation in WY2020 of 20.3 inches[2] is the lowest since 2014. The year's precipitation amounts to about 49% of average and is only 0.4 inches more than the 1947 historical low of 19.9 inches (Figure 6). Water Year 2020 is one of nine years with below average precipitation over the past 14 years. The cumulative rainfall deficit over the 14-year period from October 2007 through September 2020 is 4.7 inches below average indicating that climate over that period is drier than historical climate. Since the end of the most recent drought (end of 2015), rainfall is only a cumulative 2.4 inches above average despite WY2017 being a very wet year. This small above average cumulative rainfall is only 4.5% of the cumulative 53.5-inch rainfall deficit that occurred over the 2012-2015 drought.

[2] Rainfall measured at the El Pueblo weather station slightly underestimates total WY2020 precipitation due to a station malfunction in late fall 2019

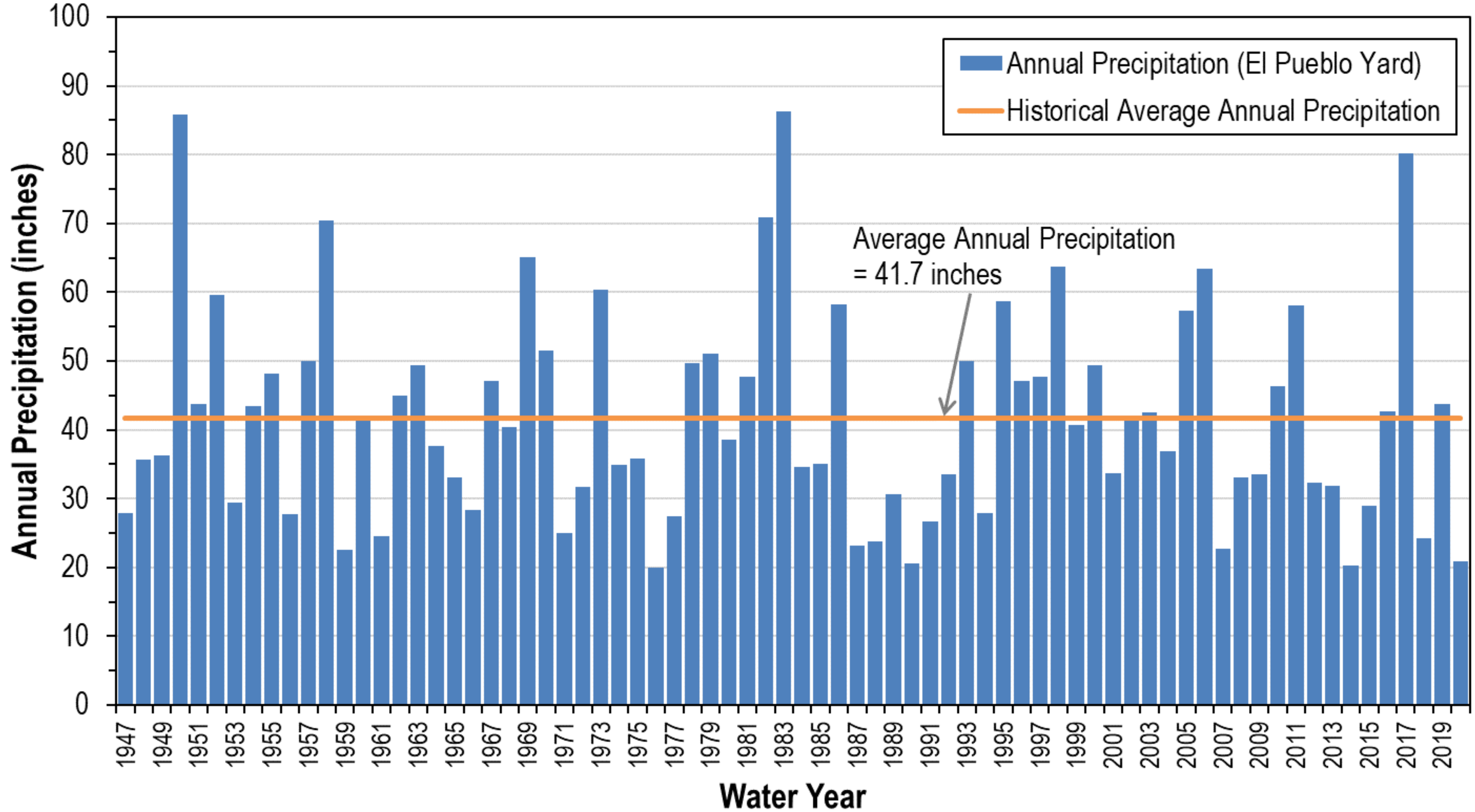


Figure 6. Annual Precipitation for Scotts Valley by Water Year

3.2 SVWD Water Supply

SVWD relies solely on groundwater from the SMGB for providing potable water to its customers. Recycled water is also available for non-potable uses such as landscape irrigation.

3.2.1 Groundwater Pumping

Annual SVWD pumping in WY2020 was 1,215 acre-feet, which is similar to the previous three years' pumping (Figure 7). Current pumping is 885 acre-feet less than the historical maximum pumping in 1997 (Table 1).

Note that this annual report presents actual groundwater pumped from the Basin, while SVWD frequently reports groundwater production and demand for other purposes. Production is the volume of groundwater pumped minus any process water that is not put into the distribution system. Demand is production plus/minus change in storage volumes. Production volumes are therefore less than the groundwater pumping volumes reported in this annual report. In comparison to groundwater pumped, in WY2020, production volumes that account for process water were 1,160 acre-feet, 47 acre-feet more than WY2019's production of 1,113 acre-feet.

SVWD currently operates five production wells: #3B, Orchard, #10A, #11A, and #11B. The locations of these wells are shown in Figure 4. Groundwater pumping by well varies seasonally and annually to meet changing local water demand and allow for well maintenance activities. More information on how much each of these wells pumps is included in Section 3.4.2

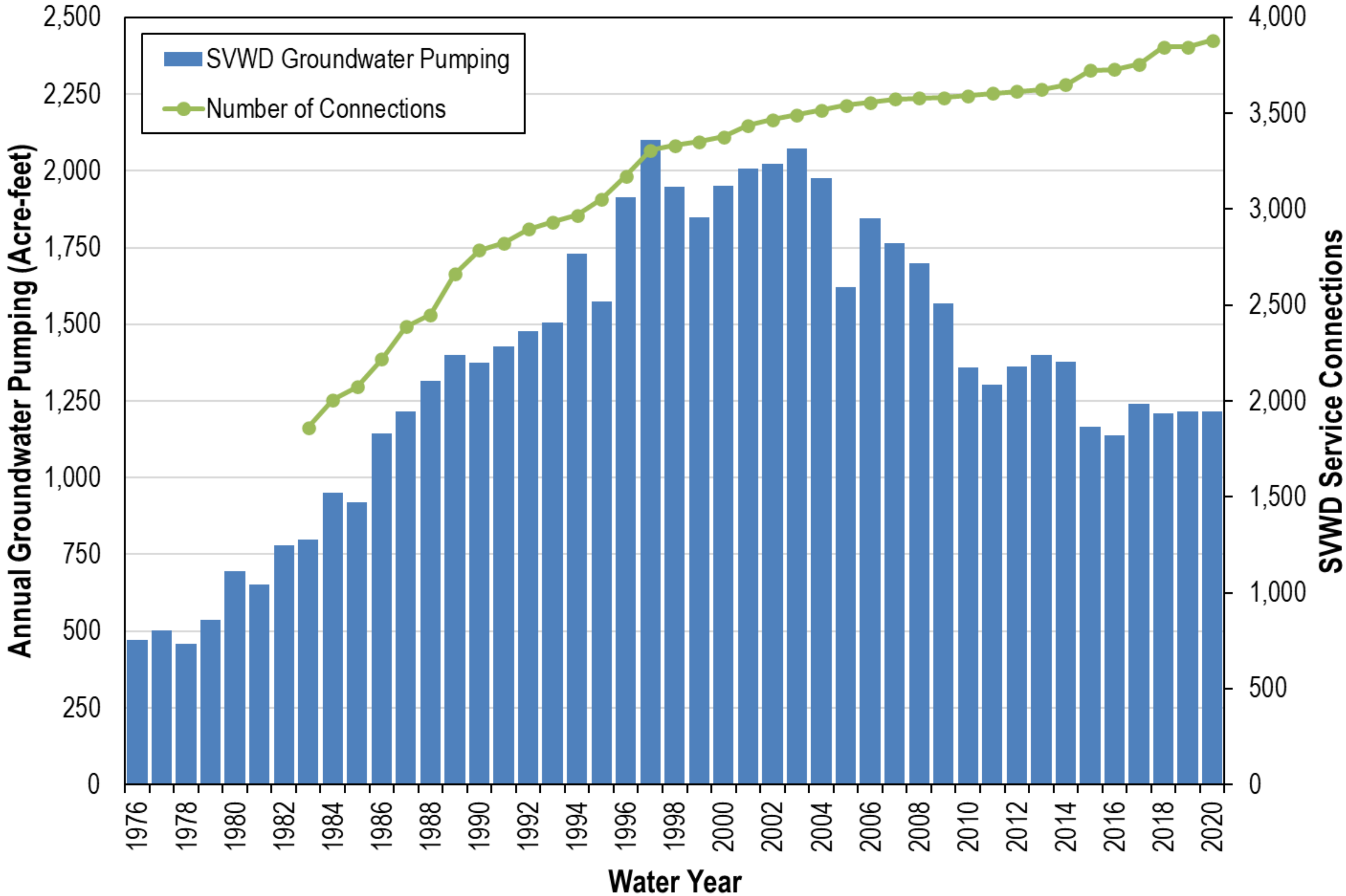


Figure 7. Annual SVWD Groundwater Pumping and Service Connections

In WY2020, 100% of SVWD groundwater pumping was derived from the Lompico and Butano aquifers (Table 1). Groundwater pumped from the Lompico and Butano aquifers accounts for 73% and 27% of WY2020 SVWD pumping, respectively. Annual groundwater pumping from the Lompico aquifer has declined noticeably since WY2014. WY2020 pumping from the Lompico aquifer is 52% of the pumping high of 1,483 acre-feet in WY2003. Similarly, WY2020 pumping in the Butano aquifer is 40% of the pumping high of 735 acre-feet in WY1997. The amount of Butano aquifer pumping decreased between WY2019 and WY2020 largely due to reduced pumping at the Orchard Well.

Table 1. WY2010 to WY2020 SVWD Groundwater Pumping by Aquifer and Recycled Water Usage

Aquifer	Historical Maximum	WY2011	WY2012	WY2013	WY2014	WY2015	WY2016	WY2017	WY2018	WY2019	WY2020
Monterey	426 (1984)	3	4	35	23	0	2	6	4	2	0
Lompico	1,483 (2003)	969	964	1,020	989	896	814	923	884	703	778
Butano	735 (1997)	320	383	345	365	237	323	312	322	510	437
Groundwater	2,100 (1997)	1,292	1,351	1,400	1,376	1,133	1,139	1,242	1,211	1,215	1,215
Recycled Water	200 (2013)	163	184	200	199	184	195	162	196	174	178
Total Water Supply	2,096 (2003)	**1,455**	**1,535**	**1,600**	**1,575**	**1,317**	**1,334**	**1,404**	**1,407**	**1,389**	**1,393**

Units in acre-feet

Thirty-five single family residence connections and one commercial/industrial connection were added in WY2020. The total non-fire related service connections is 3,882, as shown on Figure 7.

SVWD Wells, #10A, #11A and #11B produce exclusively from the Lompico aquifer, whereas SVWD Wells #3B and the Orchard Well (replacement for Well #7A) are screened across both the Lompico and Butano aquifers. Based on studies by Kennedy Jenks (2015), it is estimated that 60% of the groundwater pumped from SVWD Well #3B and the Orchard Well is from the Butano aquifer and 40% is from the Lompico aquifer. This pumping distribution has been applied to historical pumping (Table 1), so the values may differ from past annual reports.

A revised geologic interpretation has SVWD Well #9 screened completely within the Monterey Formation rather than the Santa Margarita aquifer (Kennedy Jenks, 2016a). This change is reflected on Table 1. The maximum estimated annual groundwater pumped from the Monterey Formation was 426 acre-feet in WY1984 when groundwater levels were about 200 feet higher. Due to lowered groundwater levels and low hydraulic conductivity in the Monterey Formation, SVWD Well #9 has been used sparingly over the past decade; SVWD did not produce groundwater from the Monterey Formation during WY2020.

Groundwater pumping is highest in the dry season months of May through October and lowest in the wetter months of December through March due primarily to seasonal changes in outdoor use (Figure 8). The timing of increased outdoor water use typically shifts with the amount of springtime precipitation. If March through May rainfall is above average, outdoor water usage tends to be below-average, whereas below-average spring rain tends to increase outdoor water use.

3.2.2 Recycled Water Deliveries

The Recycled Water Program has issued 56 permits in total, with four new connections issued in WY2020 (Figure 9). From WY2002 through WY2020, approximately 2,670 acre-feet of recycled water has been delivered to customers (Table 2). The cumulative use of recycled water since 2002 is equivalent to 220% of the District's groundwater pumping in WY2020. Since recycled water is used in-lieu of pumped groundwater, it is assumed that an equivalent volume of groundwater remains in the SMGB and is available to support future water supply needs.

Recycled water deliveries have increased annually from the program's inception through WY2013. Since 2013, deliveries have not increased much, but have fluctuated between 160 and 199 acre-feet per year. Deliveries in WY2020 increased slightly to approximately 178 acre-feet from 174 acre-feet in WY2019 (Figure 9 and Table 2).

There is a strong correlation between rainfall and recycled water deliveries, with wet years such as Water Years 2017 and 2019 having reduced recycled water demand (Figure 9 and Table 2). Other reasons for decreased demand could be due to recycled water customers replacing their landscapes or improving their irrigation practices as a consequence of the drought and associated efforts to use water more efficiently.

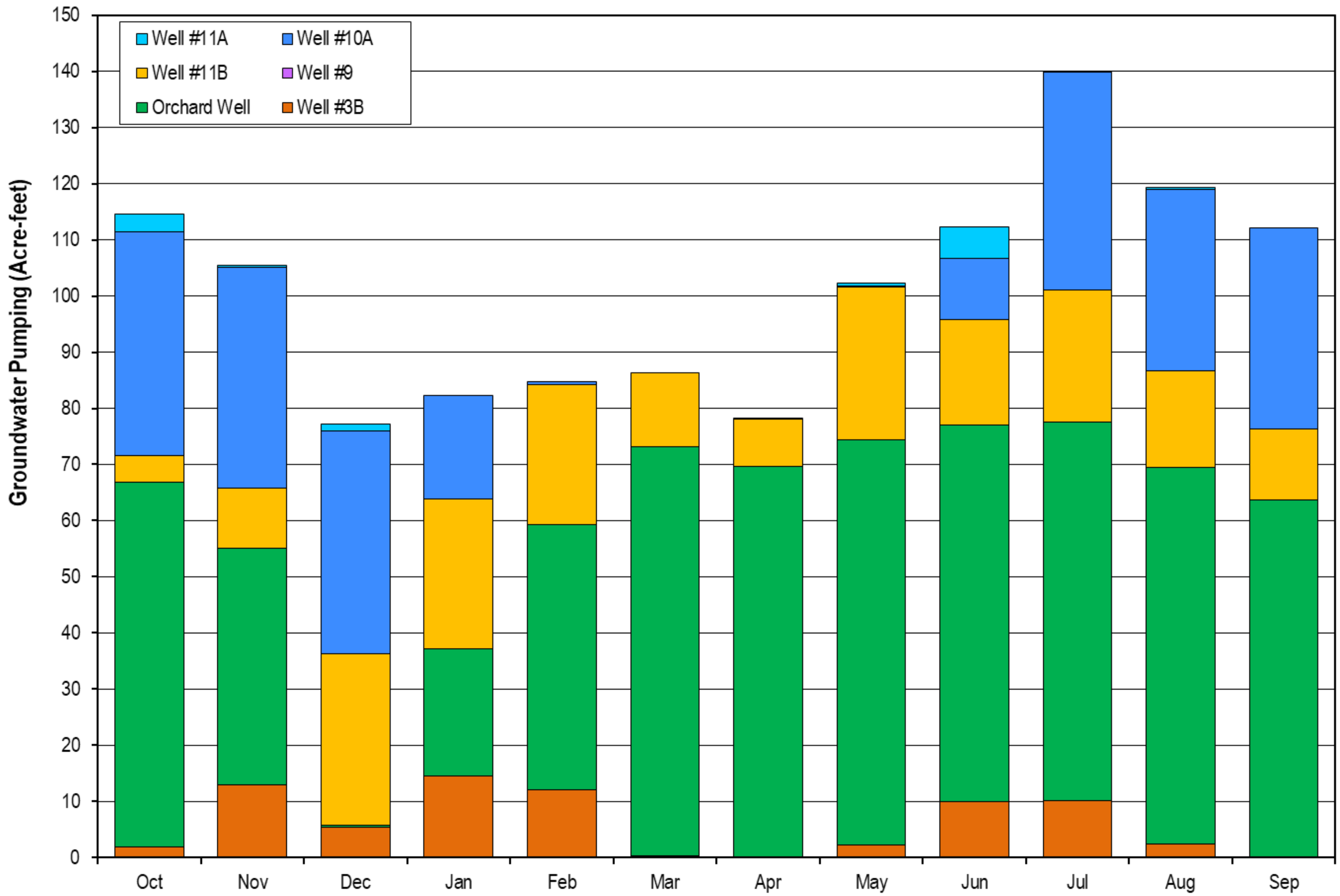


Figure 8. SVWD Groundwater Pumping by Month for WY2020

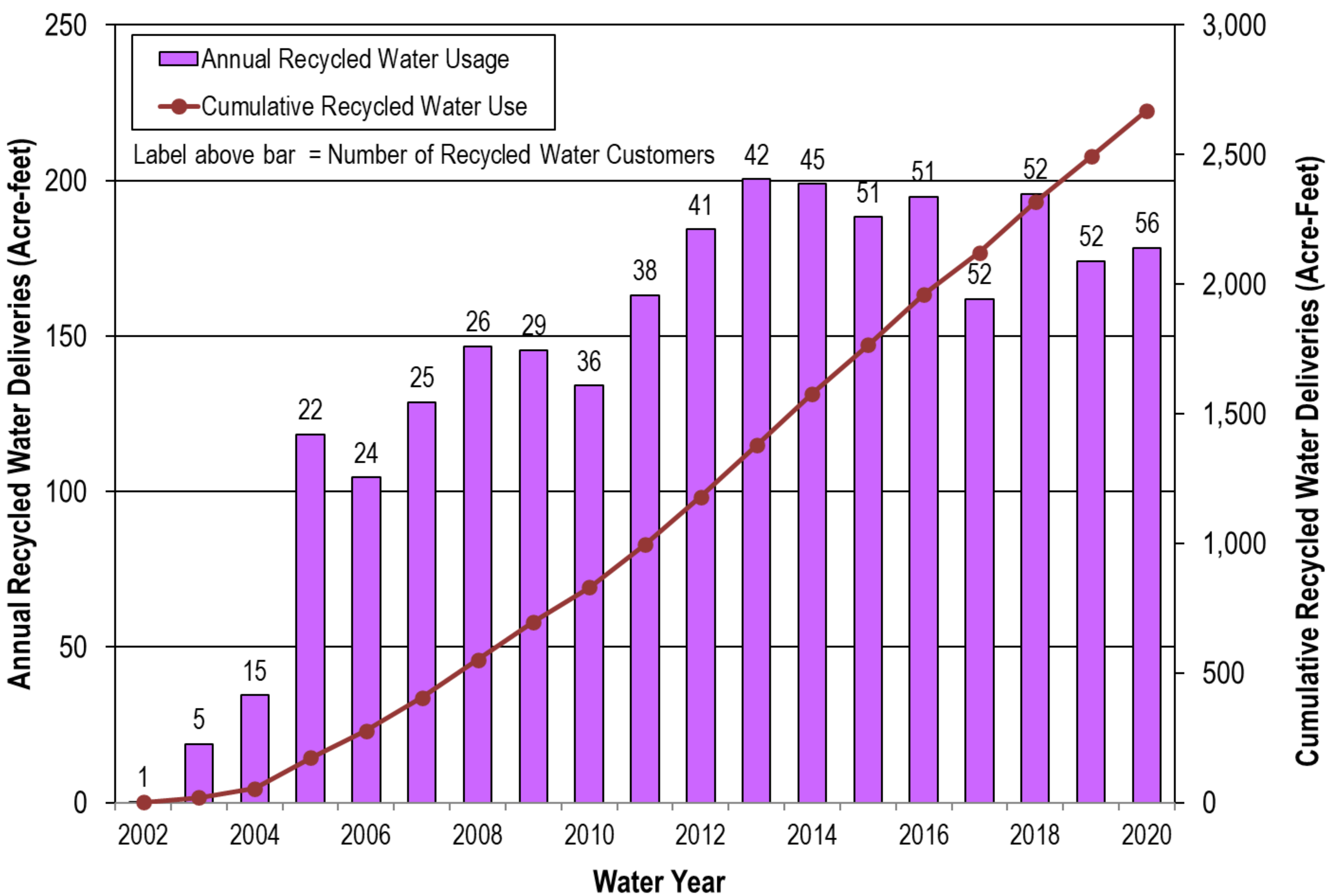


Figure 9. Annual and Cumulative Recycled Water Deliveries

Table 2. WY2011 to WY2020 SVWD Groundwater Pumping and Recycled Water Usage

Source	Historical Maximum	WY2011	WY2012	WY2013	WY2014	WY2015	WY2016	WY2017	WY2018	WY2019	WY2020
Groundwater	2,100 (1997)	1,292	1,351	1,400	1,376	1,133	1,139	1,242	1,211	1,215	1,215
Recycled Water	200 (2013)	163	184	200	199	184	195	162	196	174	178
Total Water Supply	2,096 (2003)	1,455	1,535	1,600	1,575	1,317	1,334	1,404	1,407	1,389	1,393

Units in acre-feet

3.2.3 Seasonality of Groundwater Pumping

Groundwater pumping by the District is greatest in the dry season months of May through October and lowest in the wetter months of December through March due to seasonal changes in outdoor use. The timing of increased outdoor water use typically shifts with the amount of springtime precipitation. If March through May rainfall is above average, outdoor water usage tends to be below-average, whereas below-average spring rain tends to increase outdoor water use.

To assess changes in SVWD water use trends, a comparison of the District's recent monthly groundwater pumped is compared to average groundwater pumped from historical periods when water use was higher. The results are shown on Figure 10.

Figure 10 shows four historical average monthly groundwater extraction rates. The first period represents the period of highest historical water use from WY1997 through WY2004, when the average annual groundwater pumped was about 1,980 acre-feet. The second period presents the period of declining groundwater extraction from WY2005 to WY2011, when the average annual groundwater pumped was about 1,630 acre-feet. The third period covers the recent drought from WY2012 through WY2015 when the average annual groundwater pumped was about 1,330 acre-feet. The fourth period includes the five years since the drought through to WY2020 where the average annual groundwater pumped has been about 1,204 acre-feet. Monthly pumping volumes for the four periods are included on Figure 10 as separate vertical bars of different colors.

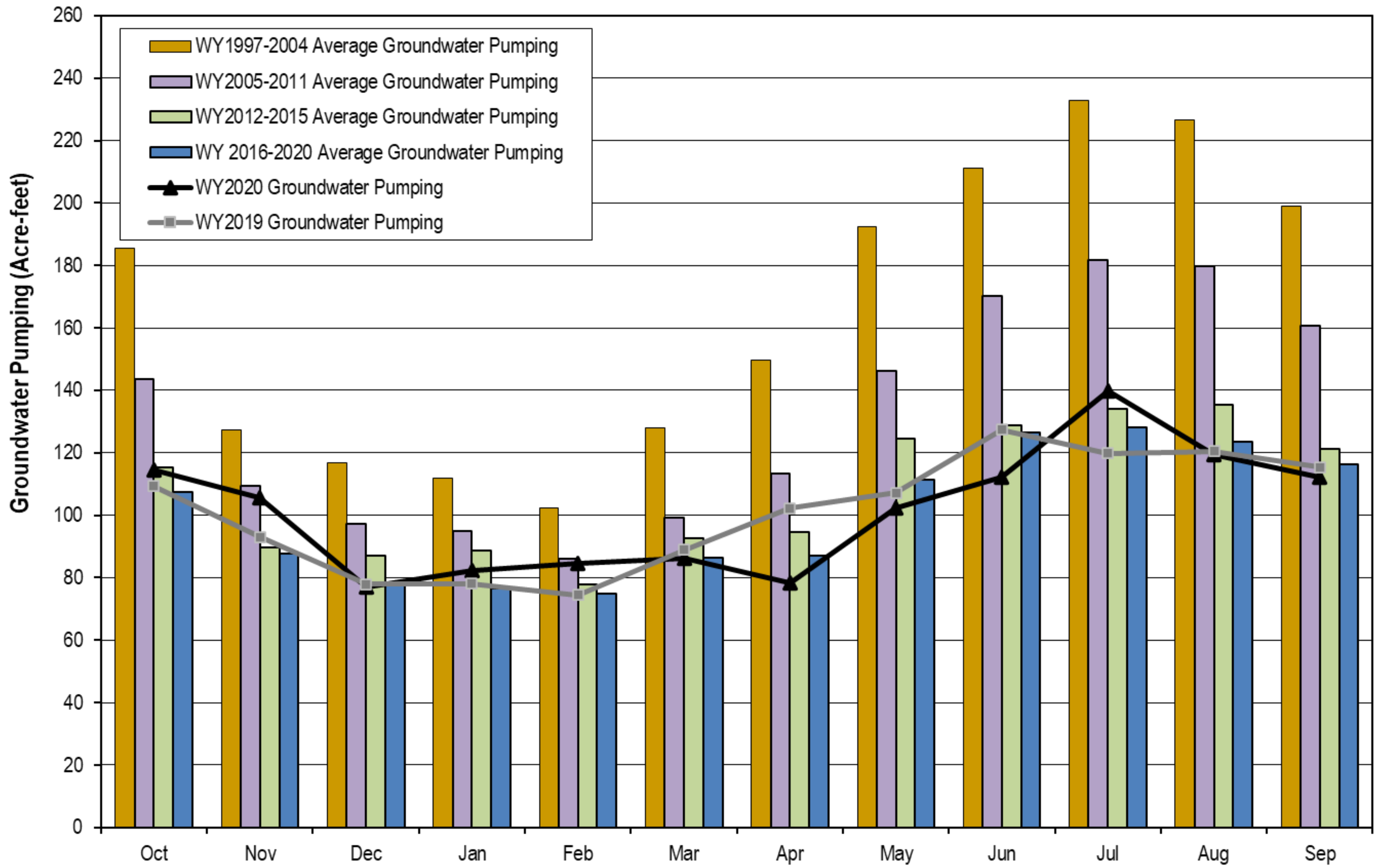


Figure 10. SVWD Monthly Groundwater Pumping Comparison

Comparing historical averages to average monthly groundwater pumping for WY2016 through WY2020, monthly groundwater pumped is below pre-drought historical averages, and even below monthly pumping during the recent drought. Monthly pumping differences are most pronounced during the summer months of May through October (Figure 10) when outdoor demand for irrigation is greatest. The difference between the maximum and minimum monthly pumping in WY2016 to WY2020 is 61 acre-feet, whereas for the WY1997 to WY2004 period it was 133 acre-feet.

The peak monthly difference in groundwater pumping indicates the District's ongoing programs to support sustainable management of its groundwater resources, including the use of recycled water, water use efficiency and water loss reduction programs, have contributed to reduced water demands that results in less groundwater pumping. Other factors that have influenced water demand include variations in the weather, economic conditions, plumbing code changes, water pricing, and the number and type of customers.

3.3 Regional Groundwater Pumping

In addition to SVWD, groundwater in the GWRA is pumped for water supply purposes by other water purveyors, small water systems, and private pumpers. Groundwater has also been pumped historically for purposes of environmental remediation and for industrial uses. Figure 11 provides a summary of annual groundwater pumped by user type in the GWRA. The users include:

- San Lorenzo Valley Water District (SLVWD) – SLVWD's Pasatiempo wellfield which extracts exclusively from the Lompico aquifer is within the GWRA. Groundwater pumped by SLVWD in the GWRA was 282 acre-feet in WY2019 and 362 acre-feet in WY2020. WY2020 pumping was the highest since WY2015. While pumping in the beginning of the water year was typical, pumping increased in September 2020 in response to the August CZU Complex fires that damaged SLVWD delivery infrastructure in the North System thereby placing increased demand on its groundwater sources. Groundwater pumping from SLVWD's wellfields outside the GWRA is not included in this report.

- Mount Hermon Association (MHA) – Pumping by MHA was 137 acre-feet in WY2019 and 177 acre-feet in WY2020. WY2015 had the lowest pumping on record at 114 acre-feet. The high was 232 acre-feet in WY2008. Groundwater is pumped from two wells screened in the Lompico aquifer.

- Industrial Wells – Historically, most industrial groundwater pumping was carried out by the Hanson Quarry before the quarry was closed in 2004. Currently, no large industrial wells are identified in the GWRA. The maximum industrial pumping was 485 acre-feet in

WY1987. Groundwater pumping was primarily from the Santa Margarita and Lompico aquifers.

- Environmental Remediation – no groundwater for environmental remediation has been pumped since WY2016. The Watkins-Johnson and Scotts Valley Dry Cleaners groundwater remediation systems have been shut down since 2016 and 2015, respectively. Historical pumping for remedial purposes was primarily from the Santa Margarita aquifer.

- Private Wells – Pumping from private wells for domestic use, landscape ponds, and irrigation is not metered, but is estimated at approximately 178 acre-feet in the GWRA for WY2020 (Table 3). Note that the Valley Gardens golf course was closed at the end of 2018 and its landscape ponds and turf have not been maintained. The maximum historical private pumping estimate was 381 acre-feet in WY1987 (Todd, 1998). We assume that private pumping has approximately remained the same from WY2015 to WY2020. As part of development of the GSP and the update of the Basin's groundwater model, an evaluation of the number of private wells pumping for domestic use was made based on residential parcels not served water by a small water system, MHA, or either water district. From that evaluation, it was estimated there are approximately 777 private wells pumping for domestic use within the Basin. Of those parcels identified, 268 parcels are within the GWRA. Private pumpers extract groundwater from the Santa Margarita, Monterey and Lompico aquifers. Based on the recent groundwater model update, the amount small water systems (SWS) were pumping in previous annual reports was underestimated and pumping of the Santa Margarita aquifer to replenish landscape ponds was not included. Table 3 summarizes WY2020 pumping in the GWRA and Basin based on groundwater model inputs developed for the update.

Table 3. Summary of WY2020 Private Groundwater Pumping in the GWRA and SMGB

Groundwater Use	Groundwater Reporting Area	Santa Margarita Groundwater Basin
Domestic (assume 0.3 acre-feet per connection)	80	233
Valley Gardens Golf Course	0	0
Small Water Systems	37	116
Landscape Ponds	123	123
Total Private Supply	**240**	**472**

Units in acre-feet

Annual groundwater pumping from the GWRA has remained similar over the past several years. Total groundwater pumping in the GWRA was estimated at 1,932 acre-feet in WY2020 (Table 4). This represents a 118 acre-foot increase in GWRA pumping from WY2019 but remains lower than pre-2015 pumping. Total GWRA pumping in WY2020 was 58% less than a high of 3,679 acre-feet in WY1997 (Figure 11). The long-term reduction is due to decreased pumping by water purveyors combined with the elimination of industrial groundwater use and environmental remediation pumping. Note that Figure 11 does not include Table 3 pumping from small water systems and landscape ponds, and therefore likely underestimates total groundwater pumping by about 160 acre-feet annually for all years.

Table 4 summarizes total groundwater pumping in the GWRA by aquifer. In the GWRA for WY2020, about 75% of the total pumping is from the Lompico aquifer, 22% is from the Butano aquifer, and the remaining 3% is from the Santa Margarita aquifer and Monterey Formation. Larger municipal and private wells typically pump from the Lompico and Butano aquifers which can sustain higher pumping rates. The Santa Margarita aquifer and Monterey Formation are generally pumped by lower-capacity private wells.

Table 4. WY2011 to WY2020 Groundwater Pumped in the GWRA by Aquifer

Aquifer	Historical Maximum	WY2011	WY2012	WY2013	WY2014	WY2015	WY2016	WY2017	WY2018	WY2019	WY2020
Santa Margarita	894 (1987)	63	56	74	71	74	57	14	14	14	14
Monterey	587 (1984)	49	50	82	66	37	39	43	41	39	37
Lompico	2,705 (2003)	1,743	1,739	1,537	1,425	1,449	1,322	1,421	1,462	1,252	1,445
Butano	738 (1997)	323	386	576	608	237	323	312	322	510	437
Total	3,665 (1997)	2,178	2,231	2,270	2,169	1,797	1,740	1,790	1,838	1,814	1,932

Units in acre-feet

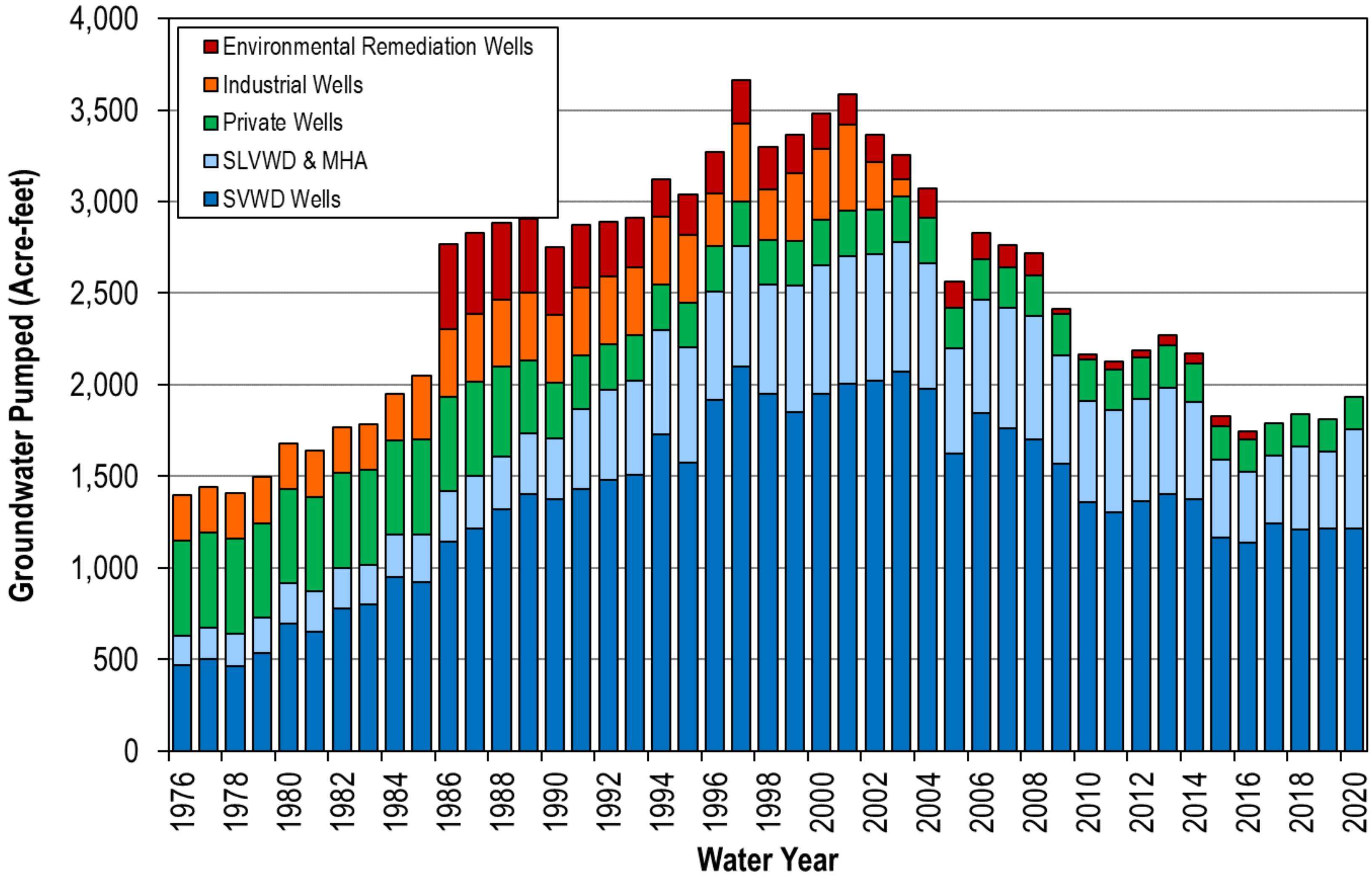


Figure 11. Regional Groundwater Pumping by User Type in the GWRA

3.4 SVWD Production Wells

SVWD currently operates six production wells: SVWD Wells #3B, Orchard, #9, #10A, #11A, and #11B. The locations of these wells are shown on Figure 4.

3.4.1 Condition of Production Wells

Understanding the condition of the currently active SVWD production wells is necessary to help ensure a reliable water supply for the District. Table 5 provides additional details regarding well completions. The service life of a well is difficult to predict and is dependent on several variables. Age of the well is one key indicator. The ages of SVWD's active wells range from 2 to 31 years old.

SVWD Wells #3B, #9, and #11A have limited capacity due to their inability to sustain pumping rates. SVWD Well #3B has structural well casing issues. It is believed that SVWD Well #9 is perforated entirely in the Monterey aquifer (Kennedy Jenks, 2016a), which is a poorer-quality and lower-yielding aquifer. SVWD Well #11A's capacity is limited because of a number of factors, including limited saturated aquifer thickness, its well design is likely not optimal, and because of local variations in aquifer properties (Feeney, 2015). The District is currently planning for both a new well to provide redundancy and to replace Well #3B with a new well on the same site.

Most wells show some corrosion over time. Corrosion of the metal in well screens and casing is typically the result of chemical processes related to the high content of dissolved gases (e.g., carbon dioxide, oxygen, or hydrogen sulfide) or high concentrations of certain constituents such as chloride. Wells constructed with dissimilar metals, such as stainless-steel screens and high-strength low-alloy (HSLA) or mild steel casings are known to suffer from galvanic corrosion where the metals are joined. SVWD Wells #10A, #11A, and #11B are all constructed with dissimilar metals. Conditions at the existing SVWD production wells are continued to be monitored for signs of corrosion.

Table 5. Summary of Well Completion Data for Currently Active SVWD Production Wells

SVWD Well Name	Year Installed	Screened Interval Depth (feet bgs)[1]	Casing Material	Last Video Log	Most Recent Rehabilitation
Well #3B	1995	700-730, 880-1050, 1180-1370, 1400-1670	16-inch diameter stainless-steel well casing, 0.040-inch slot well screen	2017	Mar-2007: Pump, motor & wire replacement. Late 2017: Well casing is corroded, and bottom of the well is filled with sand. Pump has been lifted and well is currently not sanding
Orchard Well (replaced Well #7A)	2018	705-784, 805-1063, 1084-1455	14-inch diameter stainless-steel well casing, 0.050-inch louver well screen	Feb-2018	None
Well #9	1980	155-195, 315-355	12-inch diameter mild steel casing, 0.080-inch slot well screen	Jan-2014	Jan-2014: Mechanical &/or chemical rehab; and pump, motor & wire replacement
Well #10A	2007	280-380, 400-450	12-inch diameter well casing, HLSA steel to 154 feet and stainless steel below; 0.040-inch stainless steel wire-wrap screen	Jun-2012	Jun-2012: Mechanical &/or chemical rehab; and pump, motor & wire replacement Full rehab planned for Mar-2017
Well #11A	1997	399-419, 459-469, 495-515	mild steel well casing, 12-inch diameter to 401 feet and 10-inch diameter below, 0.012-inch stainless steel wire-wrap screen	Sep-2007	Sep-2007: Pump, motor & wire replacement
Well #11B	1999	348-388, 423-468, 500-515	mild steel well casing, 14-inch diameter to 343 feet and 12-inch diameter below, 0.012-inch stainless steel wire-wrap screen	Jan-2019	Jun-2018: Airlift re-development which inadvertently removed natural filter pack and well is sanding. In 2019: A downhole sand separator was installed and three holes in the casing were swaged

Note: [1]feet bgs = feet below ground surface

3.4.2 Groundwater Pumping by Well

Groundwater pumping varies from year to year to meet the water demand. To meet changing operational conditions and seasonal demand fluctuations, pumping is shifted between production wells. Groundwater pumping is also shifted between wells to allow for maintenance. In WY2020, Orchard Well and Well #10A were the two highest producing wells (Table 6), pumping 75% of SVWD's potable groundwater supply. It should be noted that Well #3B and #11A are currently being operated substantially below their historical maximum annual pumping volumes as shown in Table 6.

Table 6. WY2011 to WY2020 SVWD Groundwater Pumping by Well

SVWD Well	Historical Maximum	WY2011	WY2012	WY2013	WY2014	WY2015	WY2016	WY2017	WY2018	WY2019	WY2020
#3B	409	226	143	208	273	160	257	167	337	7	72
#7A	991	312	501	368	335	236	281	354	destroyed & replaced by Orchard Well		
Orchard	-	-	-	-	-	-	-	-	200	843	657
#9	426	3	4	35	23	0	2	6	4	2	0
#10A	544	362	378	391	429	374	331	333	371	234	256
#11A	152	1	13	59	19	39	22	34	39	28	11
#11B	683	397	323	339	298	324	246	348	260	101	219
Total	**2,077 (2003)**	**1,292**	**1,351**	**1,400**	**1,376**	**1,133**	**1,139**	**1,242**	**1,211**	**1,215**	**1,215**
Screened in:	Lompico & Butano		Monterey		Lompico						

Units in acre-feet

3.4.3 Groundwater Levels in Production Wells

Historical groundwater levels collected and reported for the production wells include both pumping (dynamic) and non-pumping (static) conditions. Monitoring dynamic and static groundwater levels provides a means for evaluating well performance. If well efficiency declines over time, this may be indicated by increasing differences between static and dynamic groundwater levels, thereby demonstrating the well is in need of maintenance.

Furthermore, when groundwater levels decline below the top of the well screen, there is a potential to reduce well efficiency from air entrapment, mineral precipitation, biofouling, or corrosion resulting in lower pumping rates and higher operating costs. Analysis of dynamic and static groundwater levels in active production wells show the following for WY2020:

- SVWD Orchard Well: Both dynamic and static groundwater levels are above the uppermost screen. Since this is a new well, the groundwater level record is still developing.
- SVWD Well #3B: Both the dynamic and static groundwater levels are above the top of the upper well screen. The difference between dynamic and static groundwater levels has remained fairly consistent.
- SVWD Well #10A and 11A: Both the dynamic and static groundwater levels are above the top of the upper well screen and have continued a recent increasing trend. Prior to 2018, both wells' dynamic levels were below the top of the uppermost screened interval. The difference between dynamic and static groundwater levels in both wells has remained fairly consistent.
- SVWD #11B: Dynamic groundwater levels are for the most part below the bottom of the upper well screen for most of WY2020, though the elevations at the well generally appear to be increasing. Static groundwater levels remain above the top of the upper well screen. The difference between dynamic and static groundwater levels has remained fairly consistent.

Appendix A contains hydrographs for all SVWD production wells showing dynamic and static groundwater levels, and screen depths.

4 GROUNDWATER QUALITY ASSESSMENT

SVWD promotes water quality protection by monitoring groundwater quality, and by operating water treatment facilities to ensure that water delivered to customers meets all drinking water standards. SVWD also reviews activities at environmental remediation sites and provides feedback to the regulatory agencies responsible for these sites.

The District annually prepares and makes available the "*Scotts Valley Water District Water Quality Report*" to keep customers informed on water quality issues. This report follows the content and format required by law and provides the public with detailed results of water quality testing, a description of the water source, answers to common questions about water quality, and other useful water quality information. The District Water Quality Reports are available at http://svwd.org/your-water/water-quality.

4.1 SVWD Groundwater Quality and Treatment

SVWD monitors water quality at the groundwater production wells for the constituents required by the Safe Drinking Water Act and under Title 22 of the California Code of Regulations. Groundwater is sampled from the SVWD production wells for inorganic minerals, trace metals, total dissolved solids (TDS), pH, volatile organic compounds (VOCs), and methyl-tert-butyl ether (MTBE). Results of water quality analysis are reported to the California Department of Drinking Water (CDDW).

4.1.1 Groundwater Quality

Under the Safe Drinking Water Act, the USEPA and CDDW have set primary maximum contaminant levels (MCL) associated with public health risks as drinking water standards for various chemicals and constituents. These include industrial chemicals including VOCs and MTBE, and naturally occurring constituents such as arsenic. Secondary MCLs (SMCL) exist for constituents that are not defined as public health risks but require treatment for taste, odor, and other aesthetic issues. These include iron, manganese, sulfate, and TDS. MTBE has both an MCL and SMCL.

Table 7 provides a summary of the constituents of concern for untreated groundwater in the SVWD production wells. Historically, the VOCs tetrachloroethene (PCE), trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE) along with MTBE have been detected in low concentrations in SVWD Well #9. In WY2020, SVWD Well #9 groundwater contained low detections of cis-1,2-DCE, TCE and MTBE which are below their respective MCLs.

Table 7. WY2020 Summary of Key Water Quality Constituents in Raw Groundwater

SVWD Well	VOCs	MTBE	Arsenic	Chromium- 6	Iron & Manganese	Sulfate	TDS
#3B	ND	ND	ND	ND	Above SMCL	Below SMCL	Below SMCL
Orchard Well	ND	ND	ND	ND	Above SMCL	Below SMCL	Below SMCL
#9	Below MCL	Below MCL	ND	ND	Above SMCL	Above SMCL	Below SMCL
#10A	ND	ND	ND	ND	Above SMCL	Below SMCL	Below SMCL
#11A	Below MCL	ND	Below MCL	ND	Above SMCL	Below SMCL	Below SMCL
#11B	ND	ND	At MCL	ND	Above SMCL	Below SMCL	Below SMCL

Notes: ND – not detected in any samples collected in WY2020; NS – Not Sampled
Above MCL or SMCL – At least one sample in WY2017 exceeded respective primary MCL or secondary MCL
Below MCL or SMCL – Constituent detected in levels below respective primary MCL or secondary MCL

Chlorobenzene is a VOC that continues to be detected in SVWD Well #11A at concentrations up to 0.68 micrograms per liter (µg/L), consistent with historical levels, and well below the MCL of 70 µg/L. For both SVWD Well #9 and Well #11A, the source of contaminants has not been conclusively defined but is considered to be related to one of the known environmental compliance sites in the vicinity.

Chromium-6 and arsenic are naturally-occurring constituents that can be present in SVWD groundwater wells. These constituents result from the natural dissolution of minerals within the aquifers. Of those, arsenic is the only chemical constituent in SVWD production wells where concentrations can be close to its primary MCL of 10 µg/L. Arsenic levels in groundwater are coincidentally lowered to safe drinking water concentrations when the water is treated for iron and manganese. Arsenic concentrations in WY2020 that are above the laboratory detection limit of 1 µg/L (Table 7) are:

- SVWD Well #11A ranged from non-detect to 3.1 µg/L, and
- SVWD Well #11B ranged from 8.7 to 10 µg/L.

In addition to chromium-6 and arsenic, there are other naturally-occurring constituents that are typical in groundwater pumped by the District. These constituents (iron, manganese, sulfate, and TDS) have SMCLs for aesthetic issues such as a taste, odor, or staining (Table 5) that require treatment, but do not represent public health concerns. There were no major changes in the concentration or occurrence of these constituents in WY2020. One Well #3B sample during the water year had an iron spike up to 9.2 mg/l, however subsequent samples reverted to historical levels (around 0.5 mg/l). Temporary spikes in iron and manganese are common due to changing oxidation states during sampling.

4.1.2 Groundwater Treatment

SVWD treats groundwater extracted from wells to reduce concentrations of certain constituents that are above or approaching MCLs or SMCLs. In addition, the District treats groundwater for hydrogen sulfide for aesthetic reasons, even though it is not a regulated compound. SVWD treats groundwater at four water treatment plants (WTPs) prior to distribution. Table 8 summarizes the four groundwater treatment plants used by SVWD. By applying the appropriate treatment technology, the District is able to deliver potable water that meets regulatory standards and is safe to drink.

Table 8. Summary of Water Treatment Processes Applied by SVWD

Water Treatment Plant	SVWD Wells	Aquifer	Chemicals of Concern	Treatment Type
Orchard Run	#3B Orchard Well	Butano & Lompico	Iron, manganese, and hydrogen sulfide	Air stripper, chlorination, dual media filtration, and sequestering agent
SVWD Well #9	#9	Monterey	Sulfate, VOCs, and hydrogen sulfide	Chlorination and granular activated carbon (GAC) filtration
SVWD Well #10	#10 #10A	Lompico	Iron, manganese, VOCs, and hydrogen sulfide	Air stripper, chlorination, dual media filtration, sequestering agent, and standby GAC filtration
El Pueblo	#11A #11B	Lompico	Iron, manganese, and arsenic	pH adjustment, chlorination, dual media filtration, and sequestering agent

4.2 Environmental Compliance Sites

To protect its potable water supplies and more effectively manage its groundwater basin, SVWD stays informed about local environmental compliance sites in the SVWD GWMA where groundwater quality has been impacted by pollution or chemical spills.

Figure 12 shows the locations of environmental sites with known groundwater impacts, and their relationship to SVWD groundwater production wells. These include the following sites:

- Watkins-Johnson Superfund site at 440 Kings Village Road (Cleanup Status: Open - Eligible for Closure)

- Scotts Valley Dry Cleaners Site located at 272 Mount Hermon Road (Cleanup Status: Open - Site Assessment)

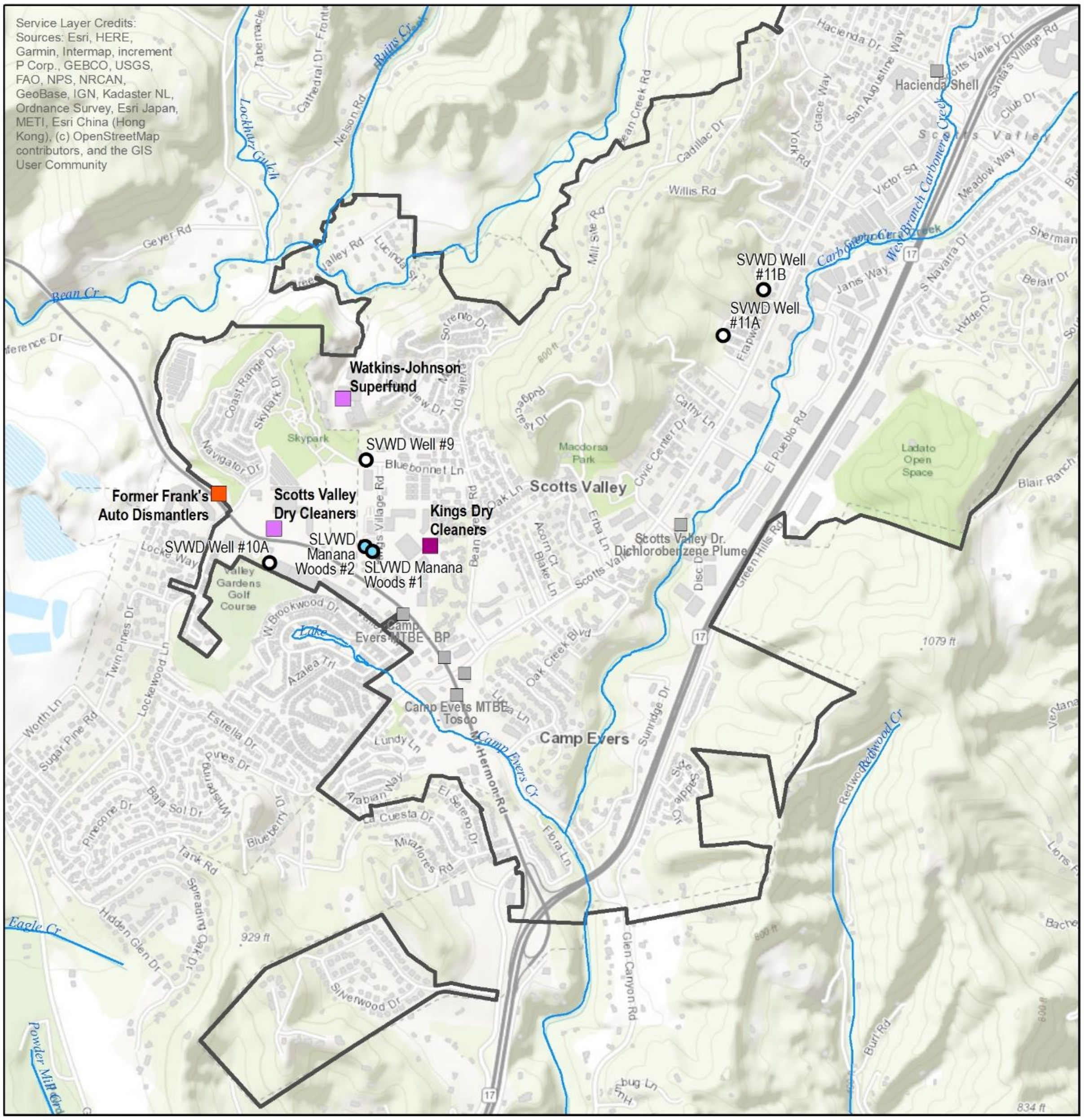
- Kings Dry Cleaners site at 222 Mount Hermon Road (Cleanup Status: Open - Verification Monitoring)

The following is an overview of the remaining active environmental compliance sites in the GWRA. More detailed information for these sites is available from the State Water Resources Control Board (SWRCB) GeoTracker website at https://geotracker.waterboards.ca.gov/ and the Department of Toxic Substances Control (DTSC) Envirostor website at www.envirostor.dtsc.ca.gov/public.

4.2.1 Watkins-Johnson Superfund Site

The Watkins-Johnson site is located at 440 Kings Village Road in Scotts Valley (Figure 12). Watkins-Johnson is a former semiconductor manufacturer. The site is a Federal Superfund Site, and remediation activities are under the jurisdiction of USEPA Region 9. The site's current owner is 400 Kings Village, LLC). The site is of interest to SVWD because of its proximity to SVWD Well #9, which is located approximately 400 feet south of the Superfund site. Two contaminants in particular are present at this site: PCE and TCE, both with a drinking water MCL of 5 micrograms per liter (µg/L). Groundwater quality sampling in 12 monitoring wells installed on site in August 2019 reported PCE concentrations ranging from non-detect to 78.8 µg/L and TCE concentrations ranging from non-detect to 2.67 µg/L (primary MCL for both these chemical constituents is 5 µg/L). Shallow groundwater extraction by the RA-2 remediation system was deactivated on July 5, 2016 and a draft Groundwater Remedial Action Completion Report (RACR) submitted to the USEPA on December 6, 2016.

The Watkins-Johnson Superfund site remediation is moving towards closure but still needs to complete the source control component of the remedial action to ensure protectiveness over the long-term. The site is currently designated as open-remediation for residential use due to existing soil gas plumes of benzene, TCE, PCE, arsenic and cadmium in soils. A draft Focused Feasibility Study proposing potential remediation alternatives including soil excavation was submitted to USEPA on behalf of the site's ownership in January 2019. There has been an ongoing request by SVWD to take over two Watkins Johnson monitoring wells located on City of Scotts Valley owned land. Due to the City's desire to sign off on these wells, it is looking unlikely these wells can be acquired by the District.



H:\Scotts_Valley_WD\2020_Annual_Report\GIS\AnnualRpt_EnvComplianceFig10_2018.mxd

EXPLANATION

Environmental Site Status
- Completed - Case Closed
- Open - Eligible for Closure
- Open - Remediation
- Open - Verification Monitoring
- Open - Site Assessment
- Scotts Valley Water District

N

0 2,000

Feet

Figure 12. Locations of Environmental Compliance Sites

4.2.2 Scotts Valley Dry Cleaners

The Scotts Valley Dry Cleaners site is located at 272 Mount Hermon Road (Figure 12). Site clean-up is overseen by the Central Coast Regional Water Quality Control Board (RWQCB). This site is of interest to SVWD because of its proximity to SVWD Well #10A and Well #9. SVWD has installed a granulated activated carbon (GAC) treatment system at SVWD Well #10 WTP as a precautionary measure.

In WY2020, the Scotts Valley Dry Cleaners site continued operation of soil vapor extraction and air sparging systems in their current configuration. These are remediation systems for the unsaturated soils above the groundwater table, so no groundwater is extracted, only soil vapor. Their consultant is also recommending researching environmental data and past use history of the former nearby airport to assess potential source(s) for the elevated PCE and TCE concentrations detected in their distal sampling location. Groundwater remediation systems at this site have been shut down since 2015. There is a request to transfer some of Watkins Johnson monitoring wells to Scotts Valley Dry Cleaners (Pratt Company) to assume access and responsibility, although no agreement has been finalized yet.

4.2.3 Kings Dry Cleaners

The Kings Dry Cleaners site is located at 222 Mount Hermon Road (Figure 12). Site clean-up is overseen by the County of Santa Cruz Environmental Health Division (EHD). The site of the former dry-cleaning facility is now a retail ice cream parlor. The site is 1,300 feet upgradient from the nearest SVWD production well (SVWD #9), and approximately 690 feet away from SLVWD inactive Mañana Woods production wells.

No remedial actions had occurred at the Kings Cleaners site over the past several years. The County of Santa Cruz EHD took over the oversight responsibilities for this site from the RWQCB in April 2017. EHD issued the responsible party, Ow Properties, with a Notice of Intent to Open Remedial Action Case under the Voluntary Cleanup Program. This Notice of Intent is based on documents on the GeoTracker website that show that PCE and related chemicals may be present in subsurface soils vapor, and possibly subsurface soil, at concentrations above applicable health-based screening levels. EHD has also requested that a work plan for further investigation to characterize the chemical concentrations in soil, soil gas, and indoor air be developed with conclusions and recommendations regarding the conditions, potential risks to human health and the environment, and the remedial actions needed. In November 2019, a request to perform an 8-hour indoor sampling event and a vapor intrusion investigation were submitted to EHD and approved. The results of this investigation are not yet available on GeoTracker as of this report’s writing.

4.2.4 Inactive Sites

Inactive sites, which have been approved for site closure or have been found to pose little threat to groundwater, are listed below and also included on Figure 12. See previous annual reports for site descriptions or visit SWRCB's GeoTracker website for comprehensive information on these sites (https://geotracker.waterboards.ca.gov/.

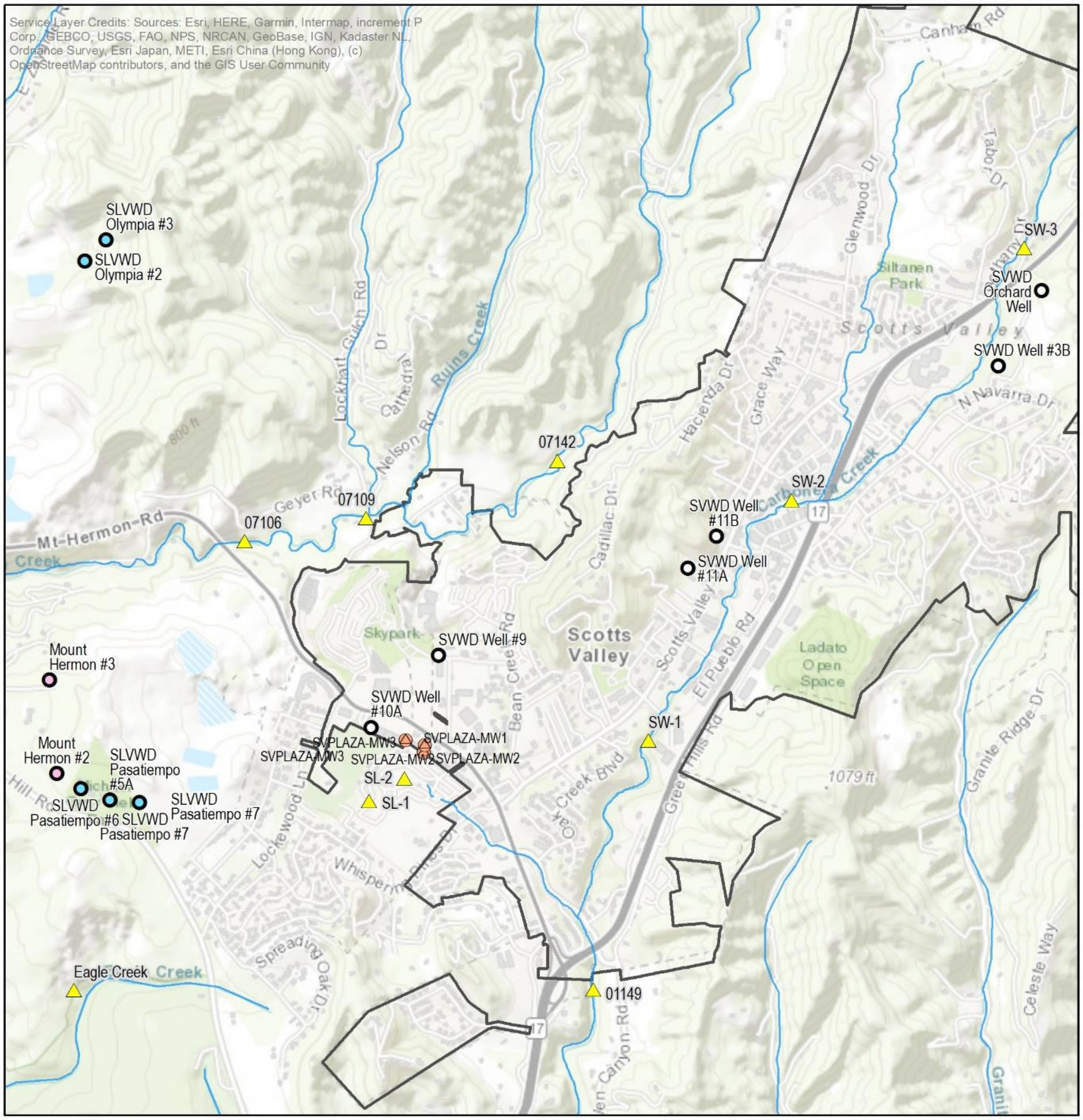
- Camp Evers combined site (remediation complete and case closed);
- Shaffer, Meisser & Rogers Property (Scotts Valley Drive Chlorobenzene Plume) [remediation complete and case closed];
- Hacienda Drive Shell Site (remediation complete and case closed); and
- Frank's Auto Dismantlers (case still open but not active).

4.3 Recycled Water Program

The Regional Water Quality Control Board permit for recycled water use includes a Monitoring and Reporting Program (MRP), which requires effluent monitoring and system performance monitoring. The MRP Order No. 01-067 details recycled water monitoring requirements, standard observations, distribution system inspections, and reporting requirements.

The presence of nitrate in recycled water has been noted in effluent samples, which is typical of treated wastewater. USEPA has established a primary drinking water MCL of 10 milligrams per liter (mg/L) for nitrate reported as nitrogen (nitrate as N). Nitrate in the City's recycled water during WY2020 ranged from 1.8 to 4.9 mg/L, with an average of 3.1 mg/L (City of Scotts Valley, 2020). Nitrogen removal efficiency at the plant ranged from 17% to 77%, with an average removal efficiency of 62%.

Although neither groundwater nor surface water monitoring is required by the permit, the District has performed this monitoring as part of meeting the basin management objective of monitoring changes in water quality in the past. Figure 13 shows the location of the monitoring features in relation to production wells. During WY2020, however, no samples were collected from surface water sites or groundwater wells. There has been no evidence of increases in nutrients or salts based on the sampling data conducted in previous years.



H:\Scotts_Valley_WD\2020_Annual_Report\GIS\AnnualRpt_RWMP_Monitoring_2020.mxd

EXPLANATION

- Scotts Valley Water District
- RWMP Shallow Groundwater Monitoring Well
- RWMP Surface Water Monitoring Locations

Production Well Location

- SVWD
- SLVWD
- Mount Hermon
- Streams

N

0 0.35 0.7

Miles

Figure 13. Recycled Water Management Plan (RWMP) Monitoring Locations

5 GROUNDWATER CONDITIONS

This section provides a summary of the data and analysis of groundwater conditions in the GWRA, including an assessment of changes in groundwater levels and aquifer storage.

5.1 Aquifer Conditions

5.1.1 Santa Margarita Aquifer

The Santa Margarita aquifer comprises porous sandstone with widespread surface exposure throughout the Scotts Valley area. As part of the revised geological interpretations in this area, the Santa Margarita aquifer is considered to be about 30 to 50 feet thick over much of the Scotts Valley area and thickens to the north and west towards the Bean Creek and Pasatiempo subareas (Kennedy Jenks, 2015). Figure 3 shows a geologic cross-section illustrating the variable thickness of the Santa Margarita aquifer. The Santa Margarita aquifer is the shallowest primary aquifer in the SMGB, so it was developed first by both municipal and private water users. Being the shallowest aquifer, it is readily recharged by direct percolation of rainfall where it is exposed at ground surface. Where there are impervious surfaces over the Santa Margarita aquifer, percolation potential may be retained if runoff is collected and infiltrated in a local percolation location, such as the low impact development (LID) projects described in Section 7.1.6,

Figure 14 provides groundwater elevation hydrographs for three representative Santa Margarita aquifer monitoring wells from different locations across the GWRA. The three well locations are shown on Figure 4. SVWD monitoring well TW-18 is measured continuously with an electronic data transducer. Overall, the groundwater elevations in the Santa Margarita aquifer vary by a range of 5 to 30 feet over the period of record, with fluctuations corresponding largely to climatic conditions. In general, groundwater levels in the Santa Margarita aquifer have remained relatively stable for the past 30 years. Note that Figure 14 and subsequent aquifer specific hydrographs have a vertical scale of 300 feet to show the groundwater elevation variations of all the aquifers at the same scale.

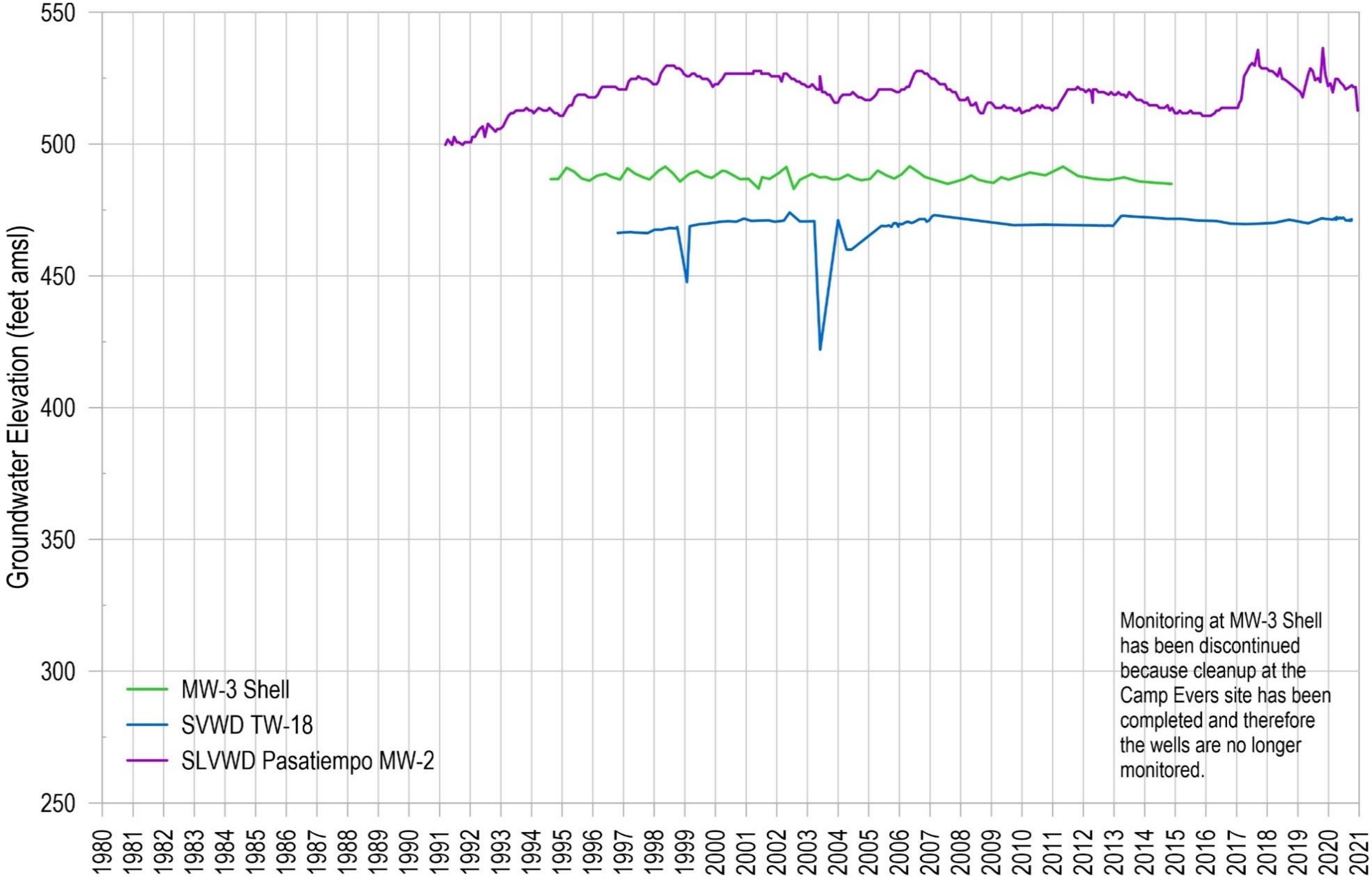


Figure 14. Groundwater Hydrographs for the Santa Margarita Aquifer

Groundwater levels for SLVWD's Pasatiempo MW-2 and SVWD's TW-18 monitoring well on Figure 14 show how different Santa Margarita aquifer locations respond differently to rainfall and pumping. SVWD's TW-18 monitoring well is located over two miles away from municipal wells that historically pumped from the Santa Margarita aquifer. Because of this distance, groundwater levels in the well do not show seasonal fluctuations related to pumping. The groundwater level trend over time has remained very stable. This suggests that the Santa Margarita aquifer in the northern portion of the District has not had much change in groundwater in storage for over ten years. Years when there has been above-average rainfall (1995-1998, 2005-2006, 2010-2011, 2017, 2019), there are no noticeable groundwater level increases in this well. This may indicate that groundwater levels in this part of the District are in equilibrium and that recharge from above-average rainfall results in increased natural discharge and not a change in storage with associated increase in groundwater levels.

The southern portion of the District, where SLVWD's Pasatiempo MW-2 monitoring well is located, is an area where there has historically been more Santa Margarita aquifer pumping by SVWD and SLVWD. Currently neither of these water districts pump from the Santa Margarita aquifer within the GWRA. The well's hydrograph on Figure 14 shows both smaller seasonal fluctuations, and larger fluctuations corresponding to periods of above-average rainfall (1995-1998, 2005-2006, 2010-2011, 2017, and 2019). Of note, groundwater elevations increased 16 feet in June of WY2017. This increase occurred primarily because of record rainfall in WY2017, but also coincides with the year SLVWD stopped pumping their wells screened in the Santa Margarita aquifer. While groundwater elevations in the southern portion of Scotts Valley fluctuate seasonally and in response to climactic changes, the reduction in Santa Margarita aquifer pumping appears to have increased groundwater elevations in this area. The peak groundwater levels in June indicate that it takes several months for direct rainfall to percolate down to the water table and recharge the Santa Margarita aquifer.

Figure 15 presents a groundwater elevation map of the Santa Margarita aquifer for September 2020. In general, groundwater in the Santa Margarita aquifer flows from higher elevations, where the Santa Margarita aquifer is exposed at the surface and direct recharge occurs, toward lower elevations where groundwater is discharged at springs or in creeks. The highest Santa Margarita aquifer groundwater elevations in the GWRA are found in the uplands south and northeast of Scotts Valley. The lowest groundwater elevations are found along Bean Creek, where groundwater discharges into the creek.

Portions of the Santa Margarita aquifer are unsaturated. As shown on Figure 3 and Figure 15, there are areas where the Lompico aquifer directly underlies the Santa Margarita aquifer. Declining groundwater levels in the Lompico aquifer have caused the Santa Margarita aquifer in these areas to become either unsaturated or to have lowered groundwater levels. Percolating rainfall and surface water in this area passes through the Santa Margarita aquifer as groundwater recharge to the underlying Lompico aquifer.

5.1.2 Monterey Formation

The Monterey formation is composed primarily of mudstone, shale, and siltstone, forming a regional aquitard that separates the Santa Margarita and Lompico aquifers. However, due to the gradational geologic transition from the underlying Lompico sandstone, the lower Monterey formation contains several sandstone interbeds that can locally produce groundwater for smaller municipal and private wells.

As shown on Figure 16**,** SVWD Well #9 experienced over 200 feet of groundwater level decline during the 1980's and early 1990's that diminished its water supply potential significantly. Following recovery in the later-1990's, a smaller groundwater level decline occurred over WY2013 and WY2014, likely in response to increased pumping and reduced recharge in the Monterey formation during this time of drought (Table 1). Groundwater levels in SVWD Well #9 have risen slowly through WY2020 but are still about 150 feet below elevations prior to 1980.

Similarities in the groundwater elevation trends of SVWD Well #9 and wells completed in the Lompico aquifer indicate hydrogeologic connectivity between the two formations (Figure 17). In the 1980's, when groundwater levels in the Lompico aquifer were higher, groundwater in the Lompico may have been recharging the sandier layers in the lower Monterey formation where SVWD Well #9 is completed. After the Lompico aquifer groundwater levels declined in the mid-1980s, this recharge was greatly diminished such that SVWD Well #9 was no longer able to sustain its earlier pumping rates. Groundwater elevations in the Monterey formation are currently stable to slightly increasing. Notably, elevations at SVWD #9 have been steadily increasing since 2014.

The Monterey formation in no longer used to produce water for SVWD. Because of limited wells completed within the Monterey formation with available groundwater level data, a groundwater elevation contour map cannot be constructed for the aquifer.

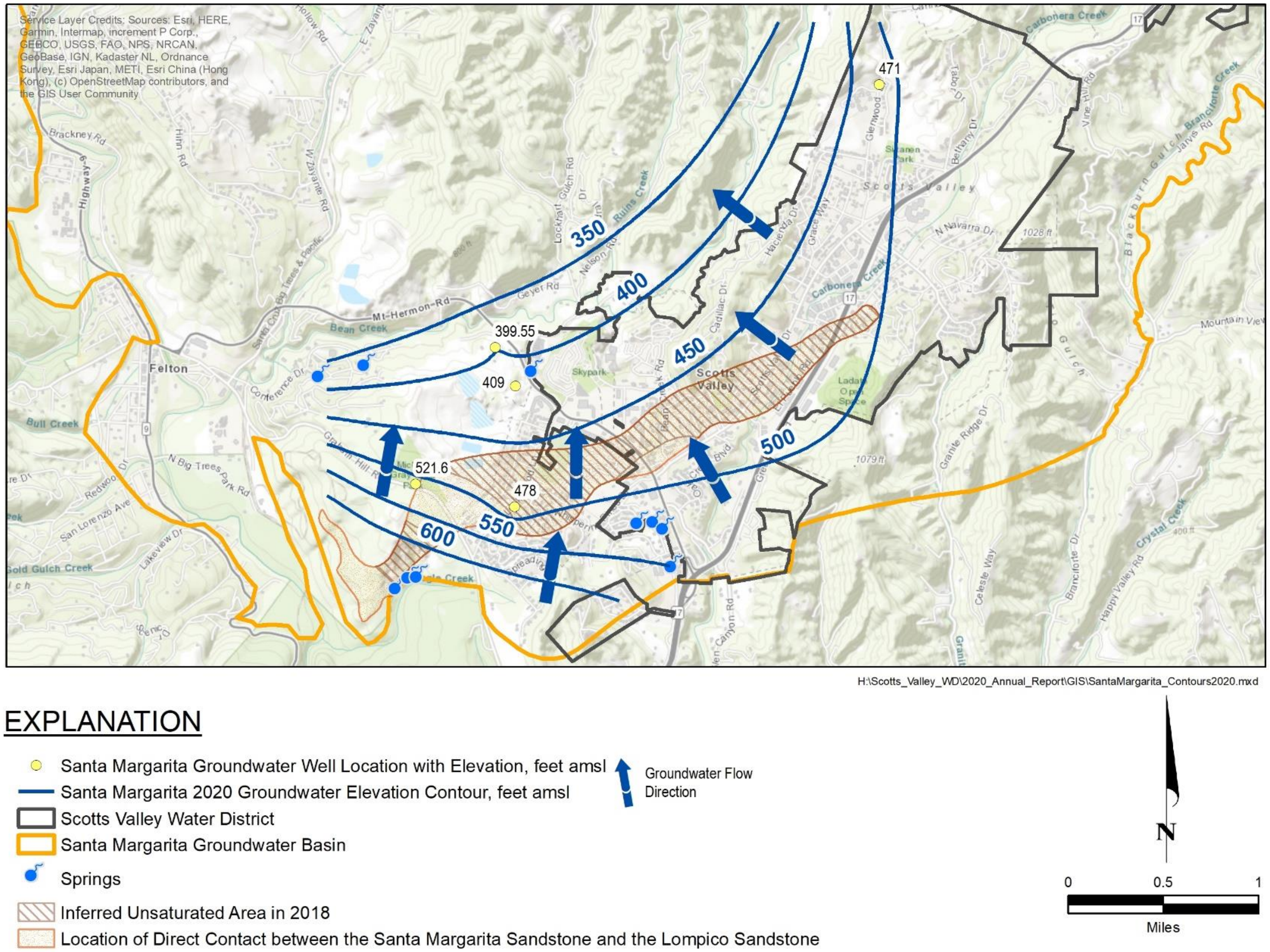


Figure 15. Santa Margarita Aquifer Groundwater Elevation Contour Map, September 2020

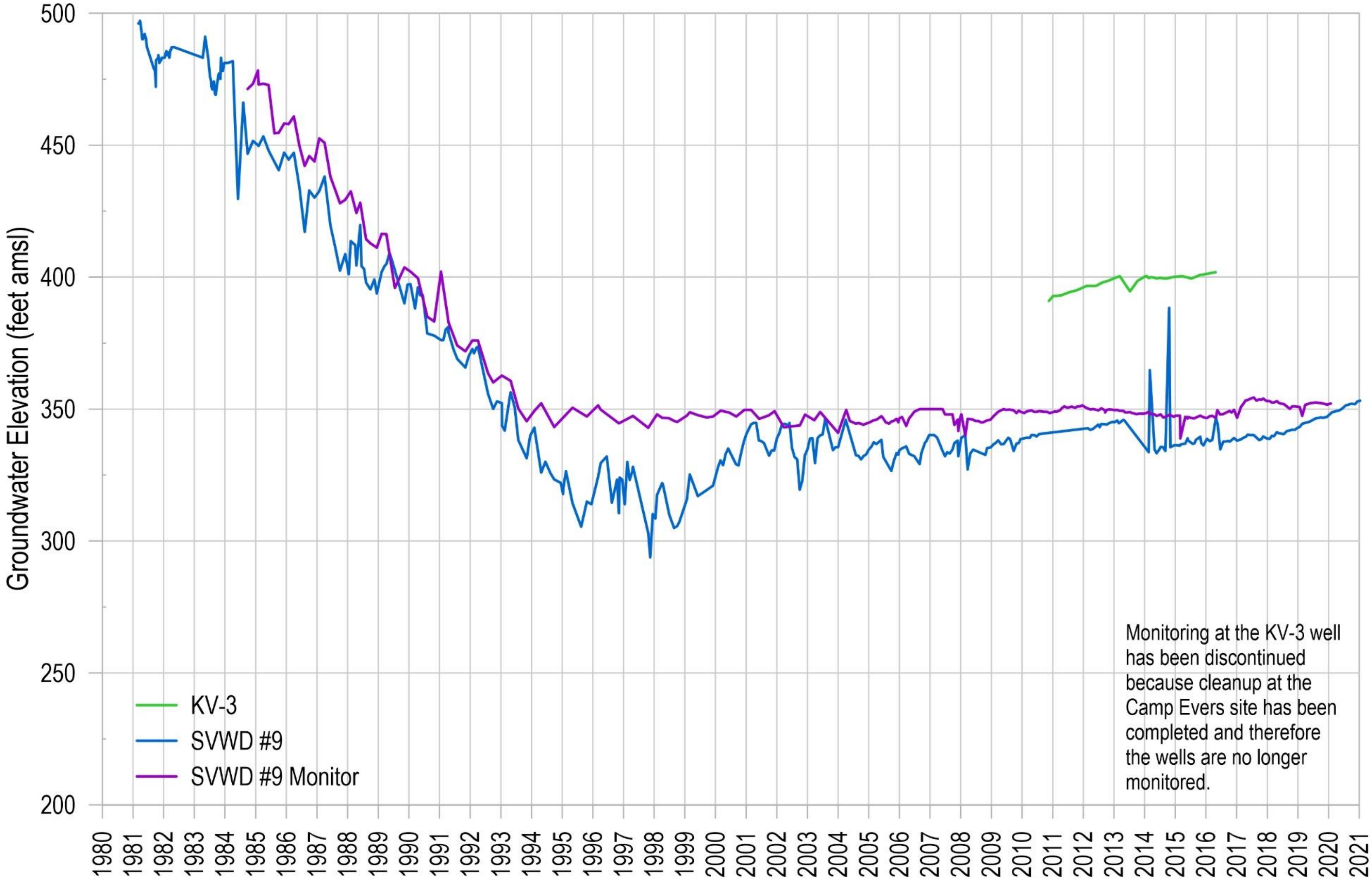


Figure 16. Groundwater Hydrographs for the Monterey Aquifer

5.1.3 Lompico Aquifer

The Lompico aquifer is typically a 300 to 400 feet thick medium-grained sandstone that becomes thinner and more fine-grained to the north and east across the SMGB (Clark, 1981, Brabb *et al.*, 1997). The Lompico sandstone is found throughout most of the Basin, though it only outcrops along the basin margins and in a few places within the San Lorenzo River valley. Figure 3 shows a geologic cross-section illustrating the complex character of the Lompico aquifer across the area.

The Lompico aquifer is the primary water producing aquifer in the SMGB and provides a large percentage of the municipal water supply, especially in the Scotts Valley area. In WY2020, 64% of GWRA groundwater pumped was from the Lompico aquifer (Table 4). Reliance on groundwater supply from the Lompico aquifer has contributed to historical Lompico aquifer groundwater level declines.

Figure 17 provides groundwater elevation hydrographs for six representative Lompico aquifer wells from different locations across the GWRA. The well locations are shown on Figure 4. SVWD monitoring wells TW-19 and SVWD AB303 MW-2 (Skate Park) are measured continuously with electronic data transducers (Appendix B includes more detailed hydrographs of these wells).

As evident on Figure 17, Lompico aquifer groundwater levels declined by 150 to 200 feet relative to pre-pumping levels across the GWRA. The greatest decline in groundwater levels occurred from 1984 to 1994. From 1995 to 1999, groundwater levels stabilized or increased in some areas. From 1999 to 2004, groundwater levels declined another 50 feet. Since 2005, groundwater levels have fluctuated within a more narrow range; although, groundwater levels in Pasatiempo MW-1 and SVWD #10 continued to decline up to 20 to 30 feet until 2010; thereafter groundwater levels have fluctuated within a narrow range like the other wells on the hydrograph. From around 2015 through 2020 several of the wells on Figure 17 show increasing groundwater levels, with up to roughly 40 feet of rise measured.

Figure 18 presents a groundwater elevation map of the Lompico aquifer for September 2020. Lompico aquifer wells are generally limited to the southern portion of the basin due to the great depth of the Lompico aquifer in the center of the Basin. The Lompico aquifer contours for this annual report are different to previous years' contours. A change has been made to not only rely on measured groundwater level data, but to also incorporate groundwater model simulated contours to provide more regional context on groundwater elevations and flow directions in those areas where there are no measured groundwater levels, e.g., the area just north of Bean Creek. The general pattern of contours on Figure 18 indicates flow from north Scotts Valley towards the south, and flow from the SLVWD Pasatiempo wellfield and Camp Evers flowing northwards under Bean Creek. There are also localized pumping depressions around the SVWD Well #3B and Orchard well, around SVWD Wells #11A and #11B, and around the SLVWD Pasatiempo and Mount Hermon Association wellfields (Figure 18).

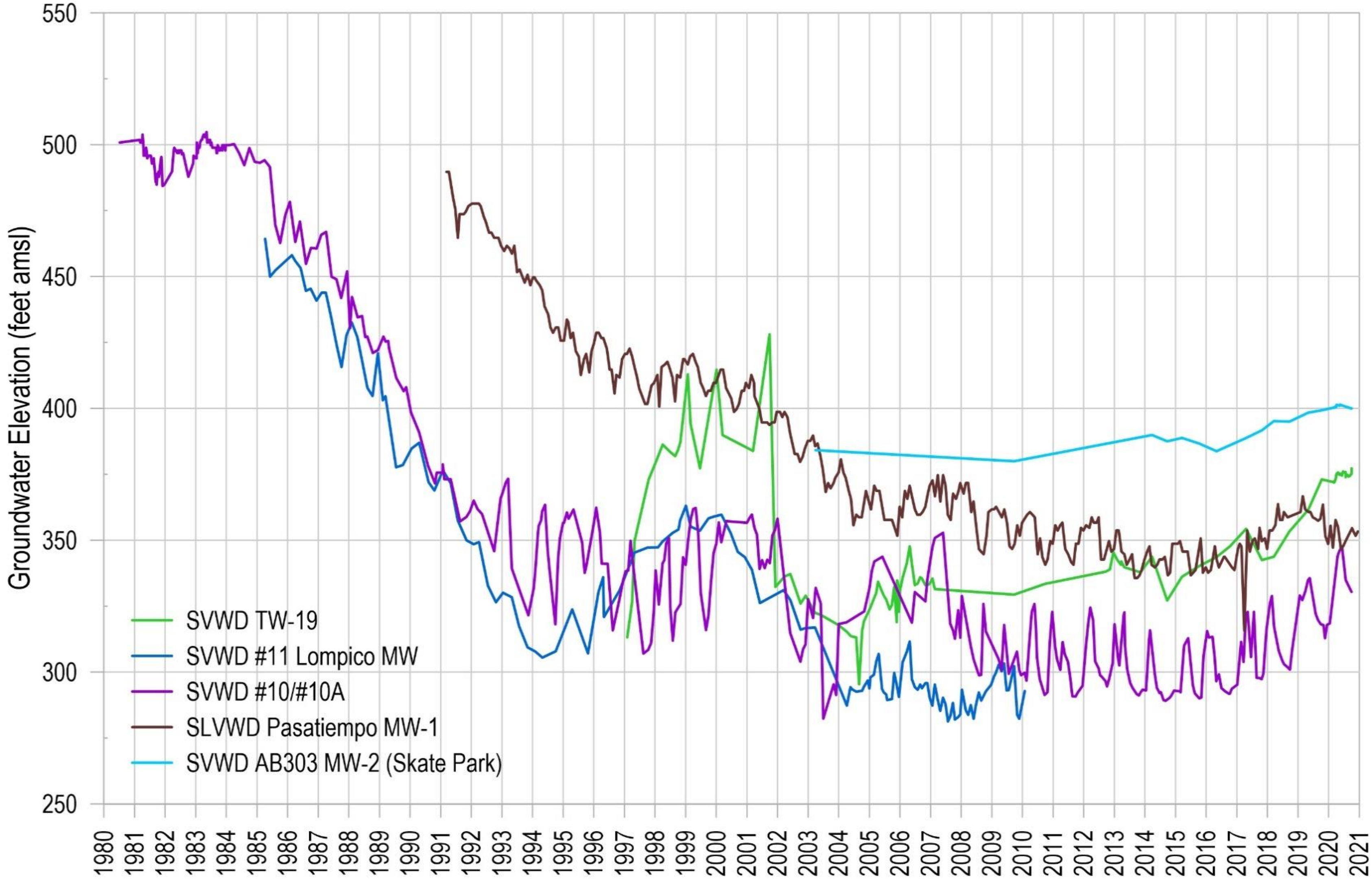
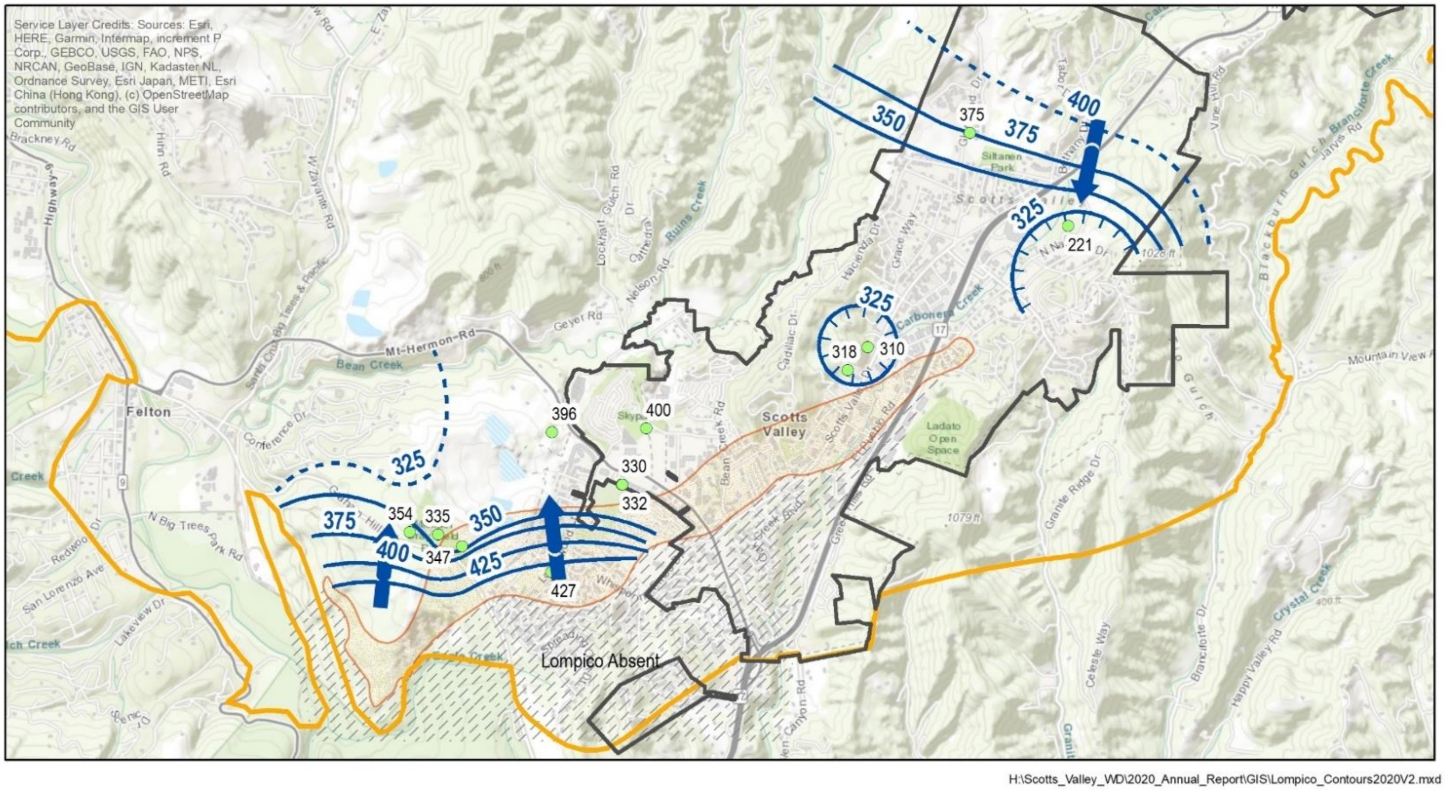


Figure 17. Groundwater Hydrographs for the Lompico Aquifer



EXPLANATION

- Santa Margarita Groundwater Basin
- Scotts Valley Water District
- Lompico Groundwater Well Location with Elevation, feet amsl

2020 Lompico Groundwater Elevation Contours, feet amsl

- Groundwater Elevation Contour
- Groundwater Depression Contour
- Uncertain Contour
- Lompico Absent
- Location of Direct Contact between the Santa Margarita Sandstone and the Lompico Sandstone

Groundwater Flow Direction

N

0 0.5 1
Miles

Figure 18. Lompico Aquifer Groundwater Elevation Contour Map, September 2020

5.1.4 Butano Aquifer

The Butano aquifer is a significant water-producing aquifer in the SMGB for SVWD, with approximately 40% of its potable supply pumped from this aquifer in WY2020. The Butano aquifer is a deep, thick sedimentary unit that consists largely of sandstone with interbeds of mudstone, shale, and siltstone. It is geologically complex and typically occurs at depths greater than 1,000 feet under much of the SMGB. The Butano aquifer forms a wedge along the northern portion of the SMGB (Figure 3). Its only surface outcrop in the Basin is along the northern SMGB boundary roughly parallel to the Zayante-Vergeles Fault.

During the first few years of SVWD pumping from this aquifer (WY1993 to WY1995), groundwater levels in SVWD Well #7A declined nearly 200 feet relative to pre-pumping levels (Figure 19). However, since SVWD Well #7A was completed in both the Lompico and Butano aquifers, it is unclear whether the decline reflects conditions in the Butano aquifer or the observed decreases in the Lompico aquifer (this well has since been destroyed and replaced with the Orchard Well). From 1996 to 2006, static groundwater levels at SVWD Well #3B and #7A fluctuated seasonally within an elevation range of 200 to 300 feet above mean sea level (amsl). With decreased pumping after 2006, groundwater levels have increased over 50 feet and have remained fairly stable since 2010. The seasonal range in groundwater levels is typically 50 feet but can be as much as 100 feet.

Due to it great depth, there are currently only two dedicated monitoring wells in the Butano aquifer. The Canham well is located 0.9-mile northeast of the nearest District wells, SVWD Wells #3B and Orchard Well and the SVWD Stonewood Well which is located in the very north of the District (Figure 3). Groundwater levels for the SVWD Canham monitoring well are plotted on Figure 19. Groundwater levels in both wells are measured continuously with electronic data transducers. Their groundwater levels are generally stable.

There is one other monitoring well, SVWD Well #15 Monitor Well located 500 feet from the SVWD's Well #3B. This monitoring well is partial screened the Butano aquifer and partially in the Lompico aquifer. It is equipped with an electronic data transducer that continuously measures groundwater levels. The hydrograph for this well is not included on Figure 19 because its levels fluctuate strongly in response to pumping at nearby SVWD Well #3B and Orchard Well, and adding it to the hydrograph would obscure the other data. Its hydrograph is included in Appendix B. The groundwater elevation data for SVWD Well #15 Monitor Well shows about a 100-foot decline when SVWD Well #3B is pumping, and about a 20-foot decline when SVWD Well #7A/Orchard Well is pumping. However, over its period of record, including during the WY2012 through WY2015 drought, groundwater level response to pumping remained consistent with no indication of a decline in groundwater levels over the drought or any other overall trend. Elevations in WY2020 have continued this trend, with minimal change from recent years.

Figure 20 presents a groundwater elevation map of the Butano aquifer for WY2020. Groundwater flow is mostly north to south, from the Butano aquifer's recharge area at the Basin's northern boundary towards the actively pumping SVWD Well #3B and Orchard Well.

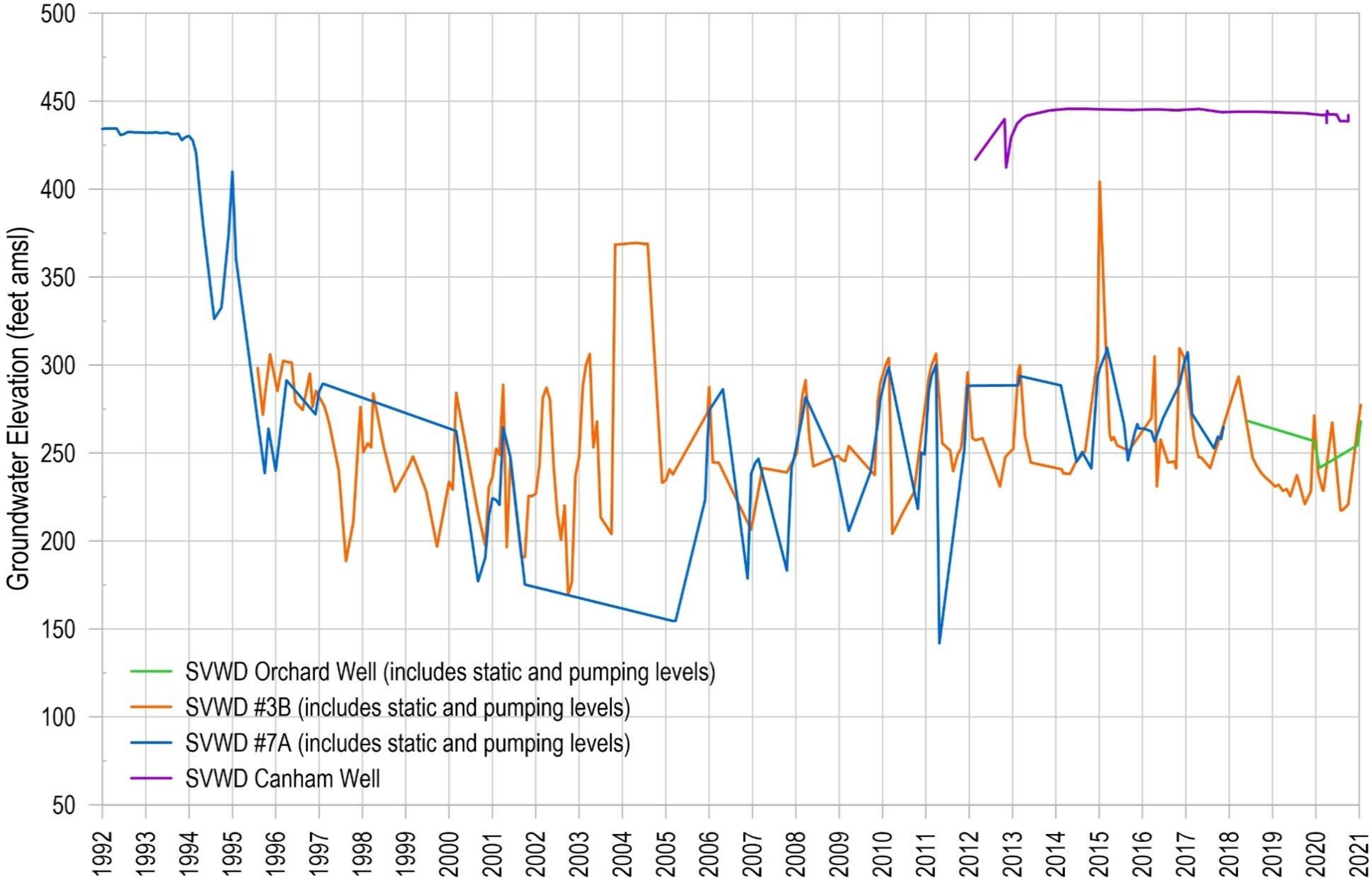
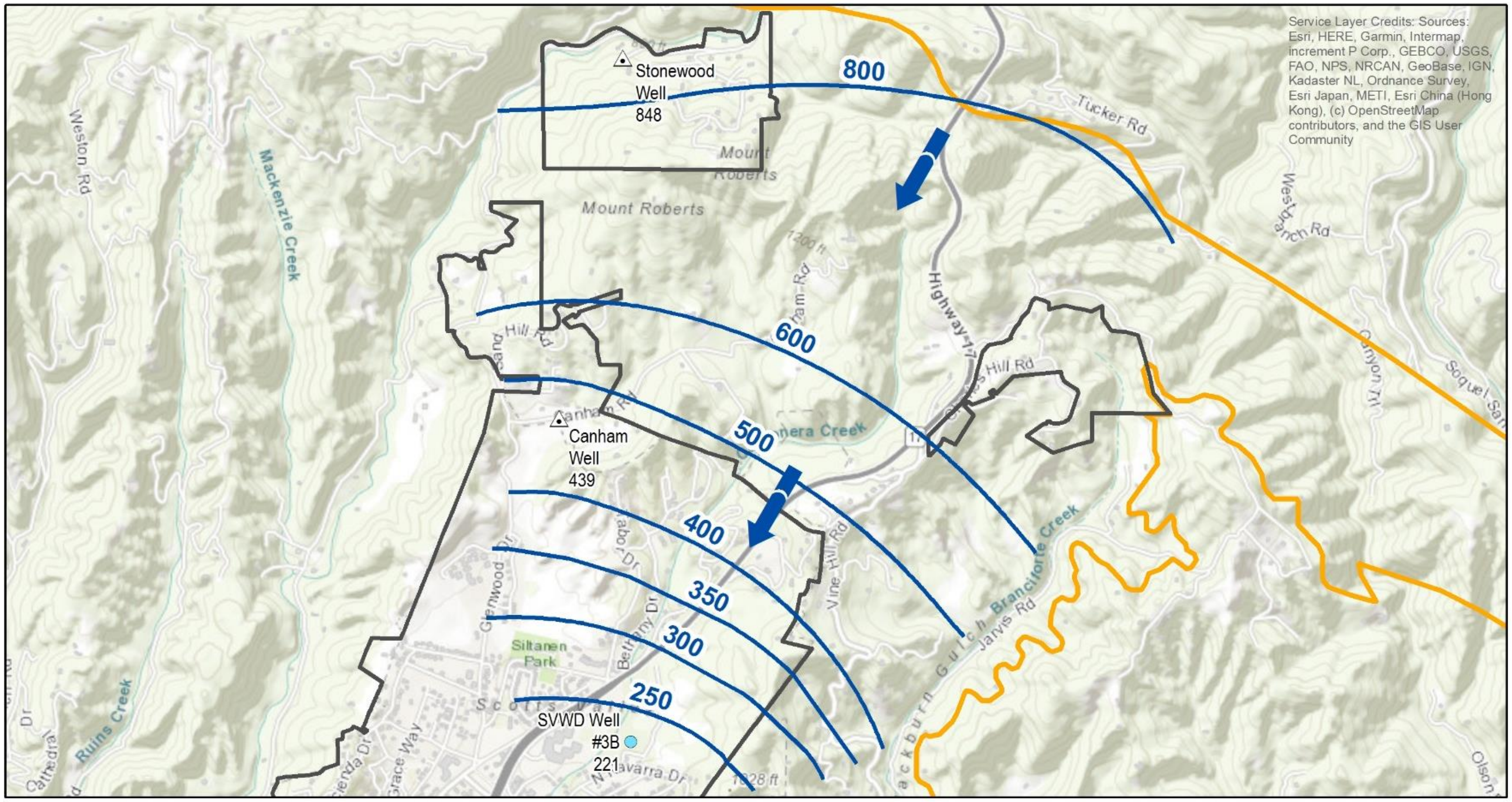


Figure 19. Groundwater Hydrographs for the Butano Aquifer



H:\Scotts_Valley_WD\2020_Annual_Report\GIS\Butano_Contours2020.mxd

EXPLANATION

- Butano 2020 Groundwater Elevation Contour, feet amsl
- Scotts Valley Water District
- Santa Margarita Groundwater Basin
- Butano Monitoring Well Location with Elevation, feet amsl
- Butano Production Well Location with Elevation, feet amsl
- Groundwater Flow Direction

N

0 0.25 0.5
Miles

Figure 20. Butano Aquifer Groundwater Elevation Contour Map, September 2020

5.2 Aquifer Storage Analysis

Aquifer storage is a measure of the volume of groundwater present in the aquifer. The change in aquifer storage measures the increase or decrease in the volume of groundwater in the aquifer resulting from changes in groundwater levels, primarily in response to variations in annual precipitation and groundwater pumping.

Because of the geologic complexity of the SMGB, the SMGB groundwater model provides a quantitative tool to evaluate the changes in groundwater conditions over time. The SMGB groundwater model has been updated in 2020 and 2021 as part of developing the SMGWA's GSP. The model is calibrated from WY1985 through WY2018 and now encompasses the entire Santa Margarita Basin. The area used for calculation of aquifer storage within the GWRA has also changed slightly and therefore aquifer storage results presented here are generally consistent from those presented in previous annual reports, but since the area of the updated model is slightly different to the older model, volumes are not exactly reproducible from one model to the next.

The results of the model-based calculations for change in aquifer storage since WY1985 are shown on Figure 21. Table 8 provides a summary of the long-term change in aquifer storage per aquifer as calculated by the updated SMGB GSP model. Since the last annual report did not include the change in storage estimates for WY2019, this report includes estimates for both WY2019 and WY2020. Groundwater in storage increased by 1,645 acre-feet in WY2019, driven by average precipitation following a critically dry year. This was one of the largest increases in the historical record, surpassed only by WY2017's record increase of groundwater in storage (Figure 21). Low rainfall in WY2020 resulted in a loss of groundwater in storage of 890 acre-feet. These storage losses are distributed across the Santa Margarita, Lompico, and Butano Aquifers, with the largest losses occurring the Santa Margarita aquifer (Table 9). Below average rainfall reduces recharge to all aquifer but most noticeably to the Santa Margarita aquifer.

Groundwater storage in the Basin is responsive to both changes in climate and groundwater use. Model results show that during the drought years of WY2012 through WY2015, the cumulative decline in aquifer storage was about 4,800 acre-feet. This drought-related storage decline was much less than the storage decline experienced during the WY1985 to WY1992 drought, which resulted in a reduction of groundwater in storage of about 14,600 acre-feet. The greater decline occurred, in part, because average pumping was 290 acre-feet per year more than it was during the WY2012-2015 drought, illustrating the Basin's sensitivity to changes in groundwater use.

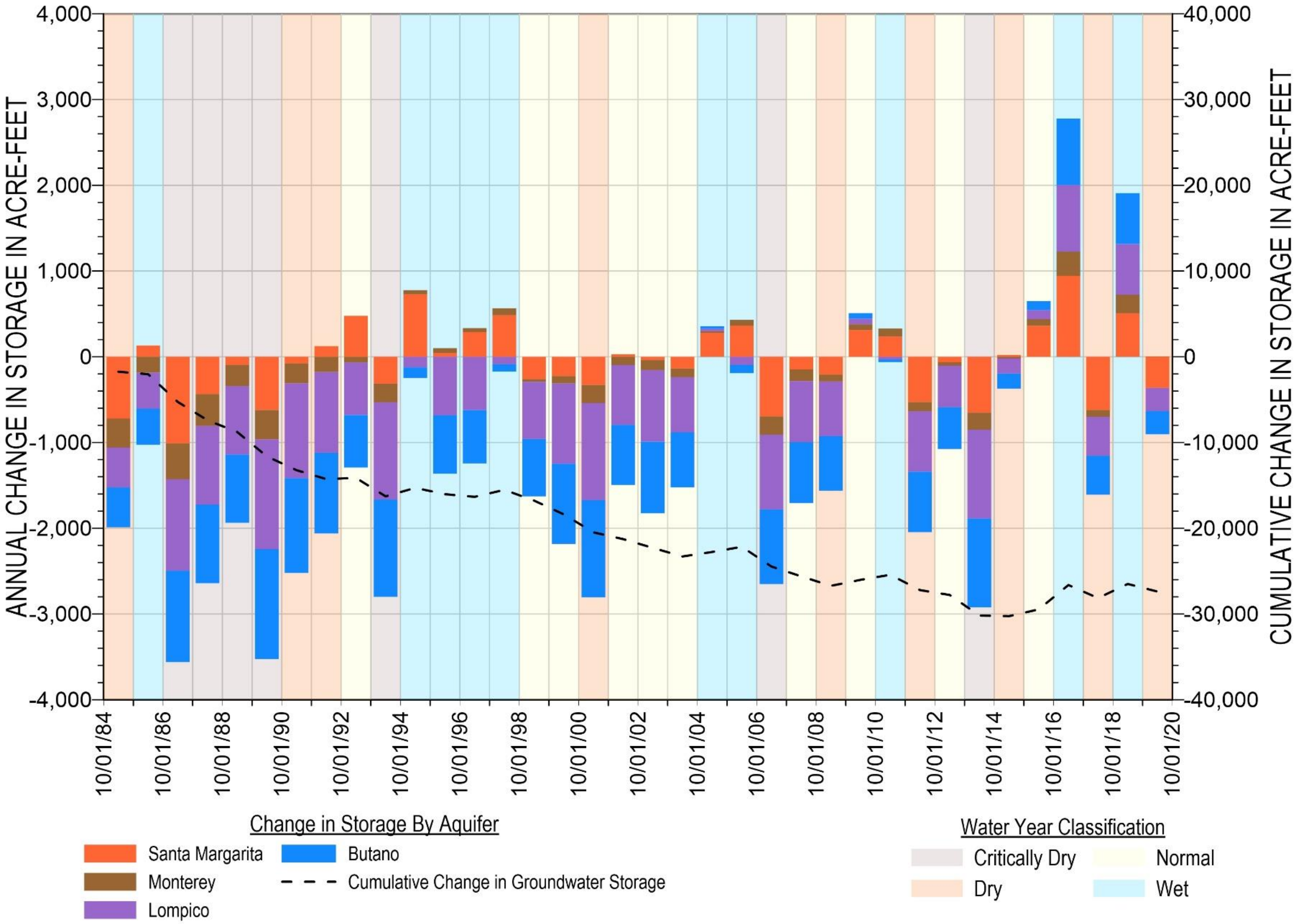


Figure 21. Historical Change in Aquifer Storage for Groundwater Reporting Area

The cumulative storage change line on Figure 21 falls steadily from WY1985 to around 2004, illustrating groundwater overuse and the effects of an eight-year drought. After 2004, cumulative loss of stored groundwater begins to reduce in response to improved groundwater management strategies. Since the end of the recent drought in in 2015/2016, cumulative change in storage in the GWRA has increased slightly. It is expected that projects and management actions planned as part of the upcoming GSP will help recover lowered groundwater levels in the south Scotts Valley area and increase stored groundwater in the GWRA.

Table 9. Model-Simulated Change in Aquifer Storage for the GWRA by Aquifer

Aquifer	WY1985 through WY1992	WY2005 through WY2011	WY2012 through WY2015	WY 2016	WY 2017	WY 2018	WY 2019	WY 2020
	Annual Average Change in Aquifer Storage (acre-feet)							
Santa Margarita	-340	20	-310	360	950	-620	510	-360
Monterey	-290	-30	-90	80	280	-80	210	0
Lompico	-870	-320	-600	110	780	-450	590	-270
Butano	-280	20	-210	250	780	-370	330	-260
Total	-1,780	-310	-1,210	790	2,780	-1,520	1,650	-890

Units in acre-feet

6 GROUNDWATER MANAGEMENT PROGRAMS

SVWD has actively managed groundwater in the SVWD GWMA since the early 1980s in an effort to increase water supply reliability and to protect local water supply sources. This section provides a summary of these programs conducted by the District to meet the BMOs.

6.1 Groundwater Augmentation Projects

One of the key BMOs is to implement groundwater augmentation projects. Current programs focus on water use efficiency, recycled water use and conjunctive use projects.

6.1.1 Water Use Efficiency Program

Water use efficiency reduces the overall demand for groundwater, and thus helps to sustain groundwater levels and long-term groundwater extraction. In recent years, SVWD has implemented numerous policies and programs to encourage water use efficiency among customers through coordinating public outreach activities, issuing monetary rebates to customers, and implementing best water use efficiency management practices. A more detailed description of SVWD's water use efficiency activities can be found on the water use efficiency section of the District's website at: http://www.svwd.org/water-use-efficiency.

Of particular note since the last annual report is the District's focus on water loss control. In 2016, District staff used AWWA M36 software to calculate an updated Water Audit Validity Score. The District received a validated score of 51 out of 100 in 2016, 50 out of 100 in 2017, and 60 out of 100 in 2018. Priority areas that are identified for attention included meter data from District sources, estimation of variable production cost, and customer metering accuracies. Table 10 provides a summary of estimated water loss from WY2010 through WY2015. It should be noted that the percentages of water loss in Table 10 are slightly overestimated because the groundwater production used in the calculation is groundwater pumped and not production. Further complicating a comparison of actual production with end use is that consumption is read on a sliding bi-monthly scale, The District defines production as groundwater pumped less water treatment process water, i.e., water produced for transmission to customers.

Table 10. Unaccounted-for Water Estimates WY2017-WY2020

	WY2017	WY2018	WY2019	WY2020
Groundwater Production*	**1,164**	**1,130**	**1,113**	**1,135**
Potable Water Delivered	994	1,046	1,000	1,017
Percent Water Loss (Unaccounted Water)	14.5%	7.4%	10.1%	10.4%

Units in acre-feet; * production = groundwater pumping less treatment process water

Full system leak detection survey was completed in 2015. The report from the consultant, M.E. Simpson, indicated only a few minor distribution system leaks that were repaired immediately. In addition to system leaks, the District has also operated a leak detection program for customers since 1996. Customers who have spikes in water consumption are sent a courtesy “leak letter” informing them of an increase in water usage and suggesting that there may be a leak at their property. Customers who encounter unusually high water use volumes may be eligible for an adjustment on their water bill. In February 2016, the Leak Adjustment Policy was changed to a Leak Adjustment Program, simplifying the process and increasing staff efficiency for implementation.

A significant percentage of District unaccounted water could potentially be the result of older meters that are under-reporting. The District began a multi-year meter change out program in 2016 coupled with an Automated Metering Infrastructure (AMI) system-wide deployment. The District retained Triton AMI to determine which automated metering system would work best and selected Badger Beacon coupled with WaterSmart customer engagement portal. The meter change out project is anticipated to be completed by Spring 2021AMI allows for every 15-minute recording of consumption data that is uploaded daily and stored in a cloud-based database. The information can be accessed by the District and customers to gain a better understanding of their water use patterns and to provide alerts about unusual fluctuations in water use.

6.1.2 Recycled Water Program

Recycled water is used in-lieu of groundwater for permitted non-potable uses, mainly for landscape irrigation. This augments the water supply and helps to meet water use efficiency goals. Since all of the recycled water use sites are located within the SMGB, the entire recycled water usage represents an equivalent reduction in groundwater pumping. Groundwater not pumped from the basin is assumed to be available for future beneficial use. Recycled water deliveries by SVWD historically and in WY2020 is reported in Section 4.2.2.

The Recycled Water Program is a cooperative effort between SVWD and the City of Scotts Valley. Recycled water is produced at the City of Scotts Valley Tertiary Treatment Plant, where it undergoes treatment including nitrate removal, ultra-violet disinfection, and chlorination. Recycled water is then distributed by SVWD to customers through a designated pipeline system. The City of Scotts Valley has passed an ordinance mandating use of recycled water for new construction where economically feasible.

From August 2015 through 2018, SVWD operated a Recycled Water Fill Station located on Kings Village Road from May to October. All District customers and City residents were eligible to receive up to 250 gallons of free recycled water per day for permitted uses.

In April 2016, the City of Scotts Valley and Pasatiempo Golf Club reached an agreement for the City to provide treated wastewater to the golf course for irrigation. This allows Pasatiempo Golf Club to reduce its reliance on potable water from the City of Santa Cruz during peak-use months when irrigation demand is high. In support of this regional effort, SVWD released 10% of its total recycled water allocation in exchange for compensation that can be applied toward funding future projects. The District did not have a current identified use for the amount of recycled water that it supplied to the golf course.

6.1.3 Regional Intertie Project

The District led a grant application effort to obtain Proposition 50 Water Security funding from the CDDW for constructing emergency intertie pipelines and pump stations between adjacent water systems for sharing water during a water emergency. The grant provided 44% funding for the project. Construction was completed in Spring 2016. For the GWRA, the interties of interest include the following connections:

- SVWD and the SLVWD's southern portion of its North System (previously called the South System),
- Northern and southern portions of the SLVWD North System, and
- SLVWD and the Mount Hermon Association.

The construction of the intertie linking the SLVWD's northern and southern portion of the North System provides a means for using surface water in place of pumping groundwater in the GWRA.

The intertie was activated in June 2020 due to a failure in SVWD Well #11B. The intertie provided 2.9 million gallons over eleven days.

6.1.4 Regional Water Supply MOA

The District is party to a Memorandum of Agreement (MOA) with SLVWD, City of Santa Cruz and County of Santa Cruz to explore and evaluate potential projects for the conjunctive use of surface and groundwater resources in the Santa Margarita basin and San Lorenzo River watershed.

6.1.5 Santa Margarita Groundwater Basin ASR Project

Over the past few years, the groundwater model has been used to evaluate a proposed City of Santa Cruz aquifer storage and recovery (ASR) project. Modeling was used to identify benefits or detriments to the basin resulting from the proposed ASR project. The City of Santa Cruz's evaluation into the feasibility of an ASR project in the basin is ongoing, and they are hoping that injection well testing can take place sometime in the next year. Work associated with the Santa Margarita Groundwater Agency (SMGWA) GSP is also considering and modeling slightly different forms of a City of Santa Cruz ASR project as a potential project that could help achieve basin sustainability over the long-term.

6.1.6 Low Impact Development Projects

Low impact development (LID) projects consist of applying stormwater best management practices (BMPs) – such as infiltration basins, vegetated swales, bio-retention and/or tree box filters – to retain and infiltrate stormwater that is currently being diverted into the storm drain system. The infiltrated stormwater recharges the shallow aquifers in a manner similar to natural processes. The infiltration helps augment groundwater levels and sustains groundwater contributions to stream baseflow that supports local fishery habitats. A complicating factor in implementing LID projects in the Scotts Valley area is that there is no centralized stormwater collection system, which limits the ability to do large scale projects to direct groundwater augmentation to the most beneficial areas.

The District installed monitoring equipment to assess the performance of the facilities in 2017. The total amount of stormwater infiltrated at the three LID facilities in the SVWD service area in WY2019 was 40.38 acre-feet and in WY2020 it was 19.42 acre-feet (Table 11).

Table 11. Volume Infiltrated at LID Facilities in SVWD Service Areas

Water Year	Volume Infiltrated, acre-feet			
	Transit Center	Woodside HOA	Scotts Valley Library	Total
2018	1.75	17.3	3.39	22.44
2019	3.08	31.17*	6.11*	40.38*
2020	1.5*	14.97*	2.94*	19.42*

*Volumes estimated using available data

Transit Center LID

The District obtained grant funding through a Santa Cruz County Prop 84 grant from the SWRCB for the planning, design, and construction of a LID retrofit at the Scotts Valley Transit Center site (Figure 22). The design included construction of a vegetated swale, a below-ground infiltration basin, and pervious pavement. Construction began in October 2016 and was completed in May 2017. In WY2020, a total of 1.5 acre-feet was infiltrated at this location.

Woodside HOA LID

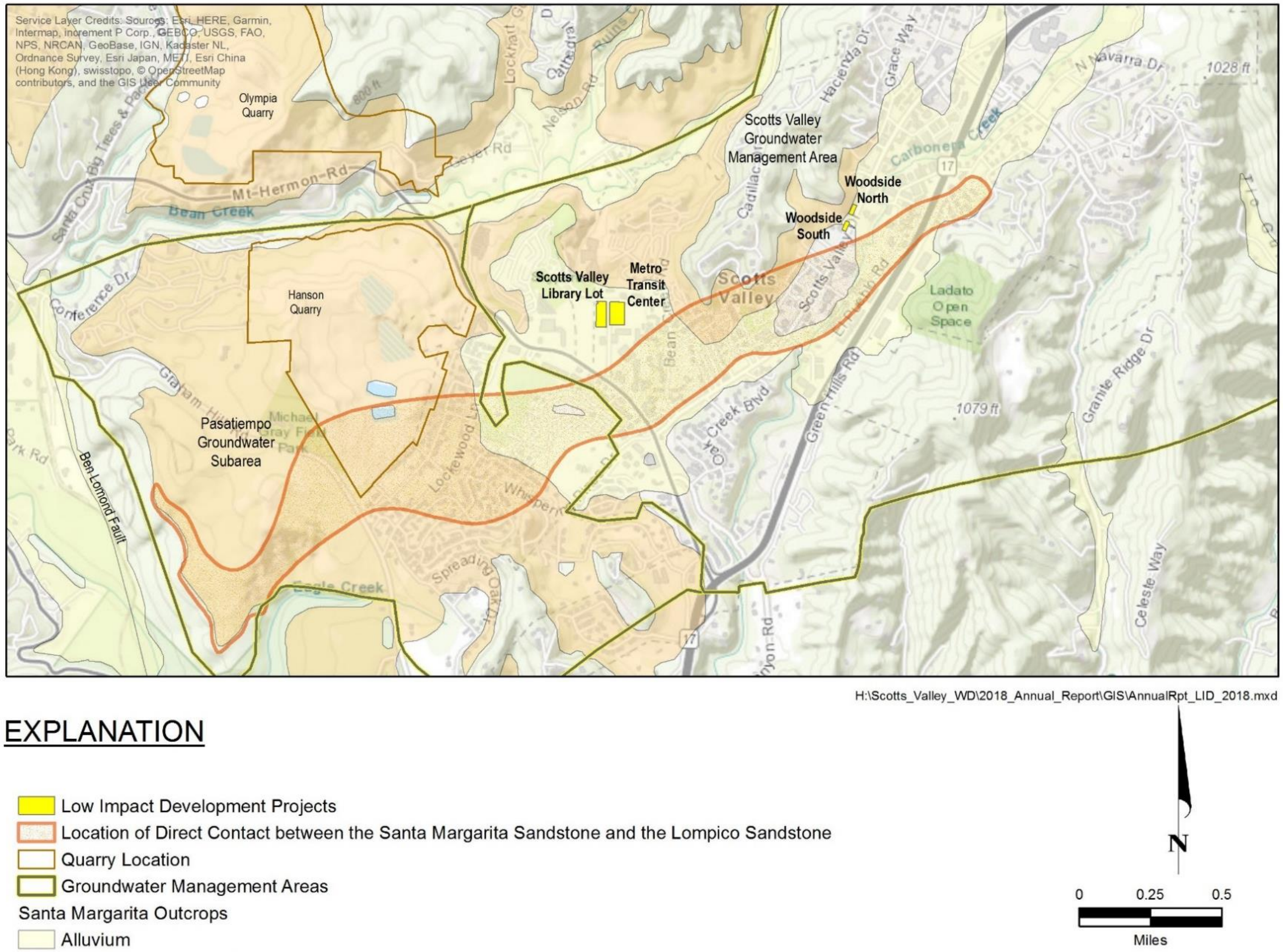
As part of the Prop 84 grant match, the District worked with a local developer to install a stormwater recharge facility at the Woodside HOA along Scotts Valley Drive (Figure 22). This facility includes a large below-ground infiltration basin. Stormwater is routed from the development to the basin where it can percolate down into the groundwater. Initial hydrology reports estimated recharge on the order of 20 to 40 acre-feet per year (Ruggeri, Jensen, and Azar, 2010). In WY2020, a total of 14.97 acre-feet was infiltrated at this location.

Scotts Valley Library LID

An earlier grant-funded project installed a below-ground infiltration basin at the Scotts Valley Library (Figure 22). In WY2020, a total of 2.94 acre-feet was infiltrated at this location.

All three LID facilities overlie Santa Margarita sandstone (Figure 22). Figure 22 shows the location of the LID facilities in relation to surface geology and the area where the Santa Margarita aquifer directly overlies the Lompico aquifer due to the absence of the less permeable Monterey formation. Because the LID facilities are not located in the area where the Monterey formation is missing, there is less potential of the LID facilities recharging the Lompico aquifer.

In addition to large LID projects as described above, the District is part of the Strategic and Technical Resources Advisory Groups for Ecology Action's regional sponsorship of the Prop 84 LID Incentives Grant. District staff provided input on rating criteria for the landscape certification program and the structure in the grant reporting. Through 2018, 32 SVWD customers were awarded grant incentives for making stormwater management improvements to their properties, with strategies such as rainwater harvesting, lawn and hardscape removal, and stormwater retention methods, such as swales and rain gardens. According to SVWD staff records, the program provided 31,733 square-feet of permeable recharge area.



EXPLANATION

- Low Impact Development Projects
- Location of Direct Contact between the Santa Margarita Sandstone and the Lompico Sandstone
- Quarry Location
- Groundwater Management Areas

Santa Margarita Outcrops

- Alluvium
- Santa Margarita Sandstone

Figure 22. Location of Low Impact Development Projects

6.1.7 Purified Recycled Water Recharge Project

The District is still assessing the feasibility and benefit to the Basin of a groundwater replenishment project using advanced treated purified wastewater. In 2020, Kennedy Jenks completed a new feasibility study comparing six potential alternatives that use different sources of recycled water. All alternatives assume three injection facilities near the District's El Pueblo Yard in central Scotts Valley, including reuse of wells SVWD #11A and #11B. Alternatives with more than 540 AFY to be injected require an additional two injection wells at locations to be determined. Direct injection of water provides a direct means of replenishing water to an aquifer and raising groundwater levels, without relying on the variable natural recharge process. Recent predictive modeling using the updated SMGWA groundwater model shows that the project could add 710 acre-feet per year into the Lompico aquifer, and groundwater levels could increase approximately 80 feet in the area of injection and up to 25 feet in the south Scotts Valley area.

6.2 Groundwater Management Activities

6.2.1 Sustainable Groundwater Management

SVWD actively participates in the Santa Margarita Groundwater Agency (SMGWA), the Basin's Groundwater Sustainability Agency (GSA), formed per the Sustainable Groundwater Management Act (SGMA) of 2014. The District is a member of the SMGWA, comprising the SVWD, San Lorenzo Valley Water District, and the County of Santa Cruz. The Board of Directors of the SMGWA includes two Board members from each of the member agencies, one from the City of Scotts Valley, one from the City of Santa Cruz, one from the Mount Hermon Association Community Water System, and two private well owner representatives. The SMGWA Board meets monthly overseeing development of the Basin's GSP. The GSP is required to be submitted to DWR by January 31, 2022.

6.2.2 Santa Margarita Basin Groundwater Model

SVWD received a Prop 84 Planning Grant in 2011 as part of the Santa Cruz IRWMP to update the existing SMGB Groundwater Model developed by ETIC (2006). The SMGB Groundwater Model provides a quantitative tool to assess regional groundwater conditions for the entire SMGB to support groundwater management and design of water augmentation projects. Kennedy Jenks Consultants updated, calibrated, and improved the model, especially with respect to its ability to accurately evaluate groundwater-surface water interactions and verified the model's applicability across the entire SMGB, not just the GWRA. The model was also updated with the most recent geological interpretations and incorporated improvements in modeling techniques and software. The technical report (Kennedy Jenks, 2015) is available on the District's website at http://svwd.org/resources/reports.

There have been minor updates to the model carried out by HydroMetrics WRI in 2016/2017. In WY2018, the SMGWA commissioned an evaluation of the model based on its ability to support GSP development. The evaluation included a series of recommended updates related to the model's hydrogeologic framework, recharge and evapotranspiration inputs, model calibration and uncertainty, and SGMA objectives. Extension updates to the model have been made as part of developing the Basin's GSP and it is being used to simulate Basin impacts from potential projects, such as in-lieu/conjunctive use, aquifer storage and recovery, and injection of highly treated recycled water. A report documenting the model updates and improvements will be included as an appendix to the GSP.

6.3 Groundwater Management Monitoring Program

The BMOs include provisions for ongoing monitoring of groundwater conditions, which is a requirement of Groundwater Management Act (CWC§ 10750 *et. seq*.) The following provides a brief overview of the monitoring program.

6.3.1 SVWD Data Collection

As part of the GWMP, the District has run a Groundwater Management Monitoring Plan for over 20 years to assess groundwater conditions in the GWRA. The SVWD Groundwater Management Monitoring Program provides a systematic procedure for data collection to support the District in assessing the hydrologic conditions of the SMGB in the GWRA. The primary components of this Monitoring Program are:

Groundwater Levels - Groundwater elevation data collected by SVWD, other local agencies, environmental remediation sites, private entities, and consultants.

Groundwater Pumping - Groundwater pumping compiled by SVWD and nearby groundwater users.

Precipitation - Precipitation data measured by SVWD and other nearby gauges.

Water Quality -Water quality data collected by SVWD, private entities, and environmental compliance sites.

The current Groundwater Management Monitoring Plan was included in the 2008 annual report. Monitoring locations are shown on Figure 4 and monitoring wells are listed in Table 12. The list has been amended to include newly constructed wells and remove inaccessible or destroyed wells.

Table 12. Wells Used for the Groundwater Management Monitoring Program

Well Name	Well Owner	Top of Casing Elevation (feet msl)	Primary Producing Formation	Screen Interval Depth (feet bgs)
SVWD Production Wells – Measurements taken monthly for both static and dynamic levels				
SVWD Well #3B	SVWD	672.47	Butano	700-730, 880-1050, 1180-1370, 1400-1670
SVWD Orchard Well	SVWD	723	Butano	705-784, 805-1063, 1084-1455
SVWD Well #9	SVWD	528.14	Monterey	155-195, 315-355
SVWD Well #10 (to be destroyed in FY2020)	SVWD	510.85	Lompico	190-220, 240-270, 325-355
SVWD Well #10A	SVWD	512.00	Lompico	280-380, 400-450
SVWD Well #11A	SVWD	602.60	Lompico	399-419, 459-469,495-515
SVWD Well #11B	SVWD	587.95	Lompico	348-388, 423-468, 500-515
SVWD Monitoring Wells - Key Indicator Wells – Measurements taken monthly				
#15 Monitoring Well[2]	SVWD	660	Lompico, Butano	700-1100
#9 Monitoring Well	SVWD	528	Monterey	N/A
SVWD Monitoring Wells - Measurements taken semi-annually				
SVWD AB303 MW-1[1]	SVWD	561.07	Santa Margarita	114-124
SVWD AB303 MW-2[2]	SVWD	524.22	Lompico	705-715, 810-850
SVWD AB303 MW-3A[1]	SVWD	522.69	Lompico	630-680
SVWD AB303 MW-3B[1]	SVWD	522.11	Santa Margarita	120-125
Canham Well	SVWD	782.78	Butano	1,281-1,381
Stonewood Well	SVWD	898.54	Butano	799-859
SV1-MW (filled with sand)	SVWD	704.3	Santa Margarita	60-80
SV3-MW A	SVWD	584.65	Santa Margarita	60-80
SV3-MW B	SVWD	584.65	Santa Margarita	100-110
SV3-MW C	SVWD	584.65	Lompico	150-160
SV4-MW	SVWD	447.79	Santa Margarita	50-60
TW-18[1,2]	SVWD	715.03	Santa Margarita	285-345
TW-19[1,2]	SVWD	659.49	Lompico	960-1060

Notes: [1]Groundwater level measurement data submitted to DWR CASGEM Program
[2]Equipped with electronic data transducer
feet msl = elevation in feet relative to mean sea level
feet bgs = depth in feet below ground surface

The results, analysis and interpretation of data collected for the Groundwater Management Monitoring Program are incorporated into and discussed throughout this annual report. The database that was set up as part of the Groundwater Management Monitoring Program is kept updated each year when this annual report is prepared. Although, this annual report does not contain a comprehensive listing of the District's database, the database can be made available by contacting the District.

To further supplement the Groundwater Management Monitoring Plan, the District has installed electronic data transducers for collecting continuous groundwater level data in most of its monitoring and production wells. Data collected by the transducers provide a key data set for evaluating long-term aquifer responses to pumping and recharge. Table 12 identifies the wells currently equipped with transducers.

6.3.2 CASGEM Program

In 2009, the California Statewide Groundwater Elevation Monitoring (CASGEM) program was established to develop a statewide monitoring program to track seasonal and long-term trends in groundwater elevation by establishing a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. Participation in CASGEM is typically a requirement for receiving DWR grants.

The Santa Cruz County Environmental Health Services is coordinating the DWR reporting responsibilities for all of Santa Cruz County. SVWD supports this effort by providing groundwater elevation data collected as part of the District's groundwater management activities. Table 12 indicates the wells that are reported to DWR for the CASGEM program. Reported data are available on the DWR website at: http://www.water.ca.gov/groundwater/casgem/.

Once the SMGWA's GSP is submitted to DWR, groundwater level data collected by the GSP's monitoring network are required to be uploaded semi-annually to the SGMA monitoring network portal. This effectively replaces the CASGEM program.

6.4 Stakeholder Outreach

Two BMOs address public participation in groundwater management activities and coordination with local agencies. The District uses several methods to accomplish this BMO. SVWD discusses groundwater management related activities in noticed regular public meetings of the SVWD Board of Directors. Notification of future meetings and agendas are made publicly available prior to the meeting. Copies of the agenda packages including staff reports are available for public review on the SVWD web site (www.svwd.org).

- SVWD builds public awareness through the development and publishing of its Groundwater Management Program annual reports. Copies of the annual report are publicly available on the District's website at http://svwd.org/resources/reports.
- SVWD actively participates in the SMGWA and the Santa Cruz Integrated Regional Water Management Group, both forums for developing collaborative solutions with local agencies.
- The District's 2015 Urban Water Management Plan (UWMP) filed with DWR is available at: http://svwd.org/resources/reports. The UWMP assesses the District's water supply, guides water use efficiency efforts, and provides a Water Shortage Contingency Plan to be implemented during times of water shortage. The UWMP is required to be updated every 5 years.

7 REFERENCES CITED

ARCADIS. 2015. Revised final remedy, former Watkins-Johnson Superfund Site. Prepared for TriQuint Semiconductor, Inc. June.

California Department of Water Resources (DWR). 2016. 2016 Bulletin 118 Interim Update. http://www.water.ca.gov/groundwater/bulletin118/docs/Bulletin_118_Interim_Update_2016.pdf. December 22.

City of Scotts Valley. 2021. City of Scotts Valley wastewater treatment facility 2020 annual report.

ETIC Engineering, Inc. 2006. Groundwater modeling study of the Santa Margarita groundwater basin final report: Prepared for Scotts Valley Water District. May.

Feeney, M. 2015. Technical memorandum: Well 11A replacement project – feasibility evaluation. Prepared for Scotts Valley Water District. August 28.

HydroMetrics WRI, 2011. Estimation of deep groundwater recharge using a precipitation-runoff watershed model, Soquel-Aptos, California. Prepared for Soquel Creek Water District, Central Water District, and City of Santa Cruz. August.

Kennedy Jenks Consultants. 2015. Santa Margarita Basin groundwater modeling technical study. Prepared for Scotts Valley Water District. June 24.

Kennedy Jenks Consultants. 2016a. Scotts Valley Water District 2015 annual report, groundwater management plan. Prepared for Scotts Valley Water District. February 26.

Kennedy Jenks Consultants. 2016b. 2015 urban water management plan. Prepared for Scotts Valley Water District. June.

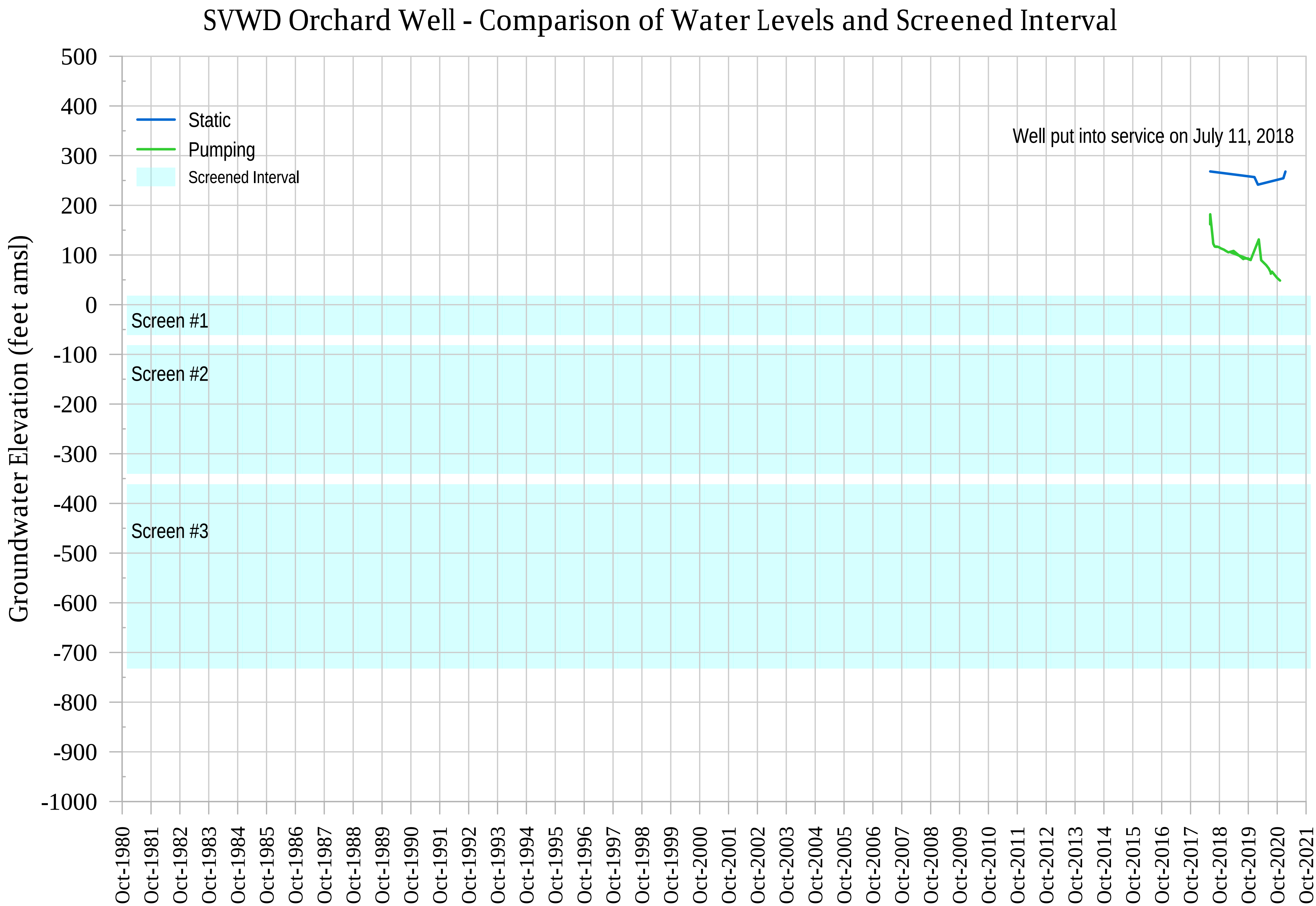
Kennedy Jenks Consultants. 2017. Santa Margarita Groundwater Basin recycled water groundwater replenishment programs, facilities planning report. Prepared for Scotts Valley Water District. February.

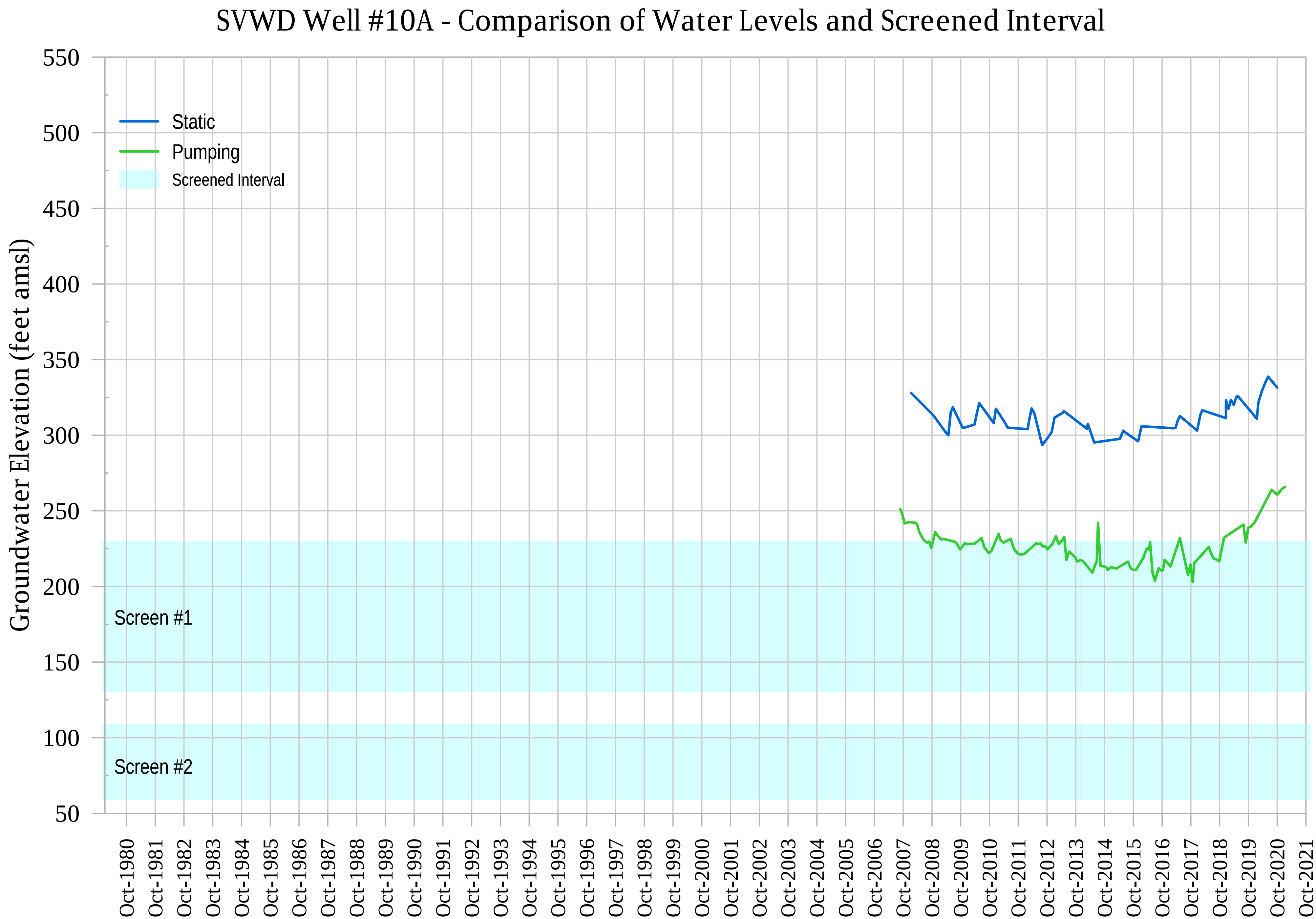
Ruggeri, Jensen, and Azar. 2010. Preliminary hydrology report for Woodside, City of Scotts Valley, Santa Cruz County, California, prepared for Sullivan Land Development, LLC. February 17.

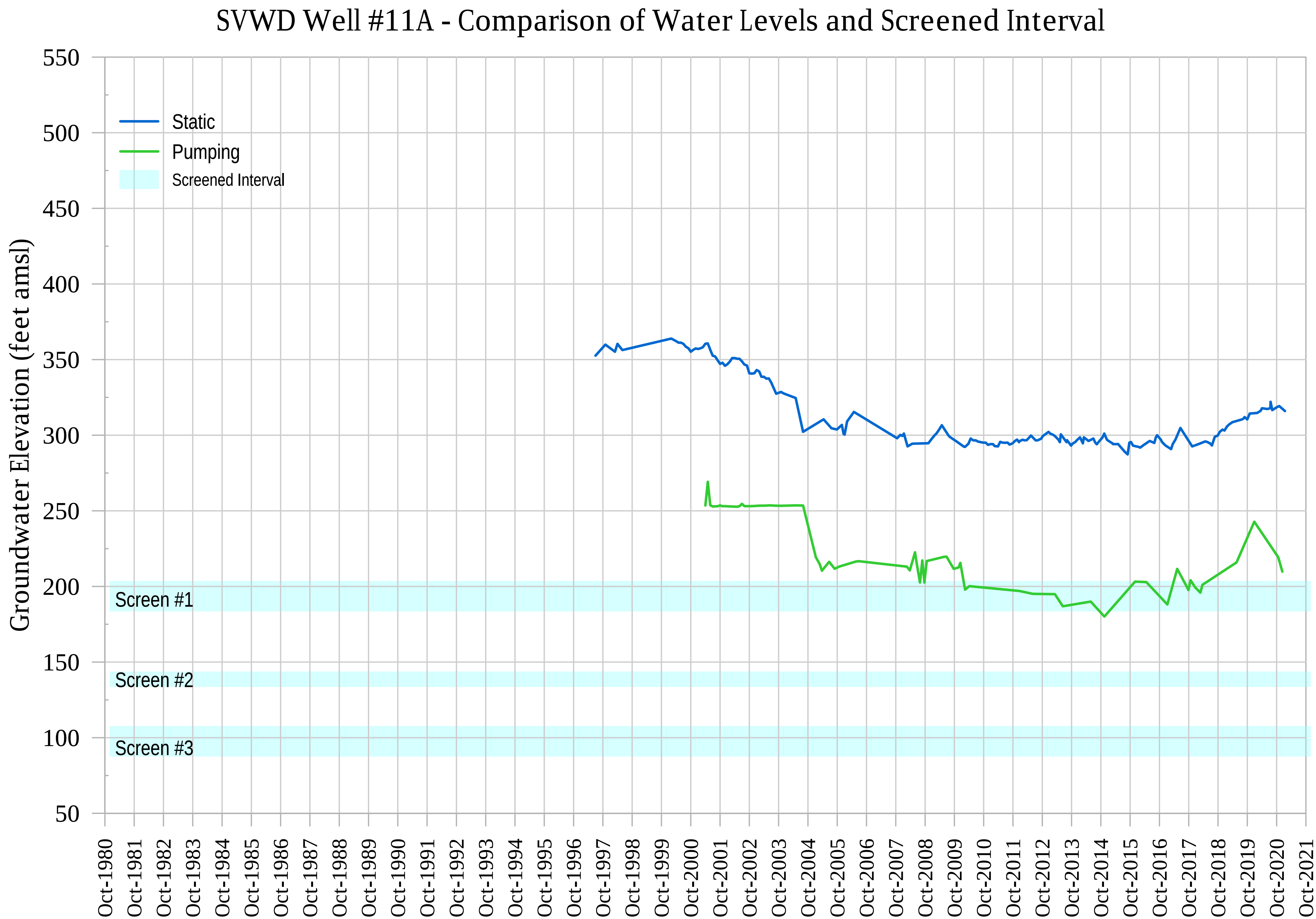
Todd Engineers. 1994. Scotts Valley groundwater management plan (AB 3030). Prepared for Scotts Valley Water District, 94 p.

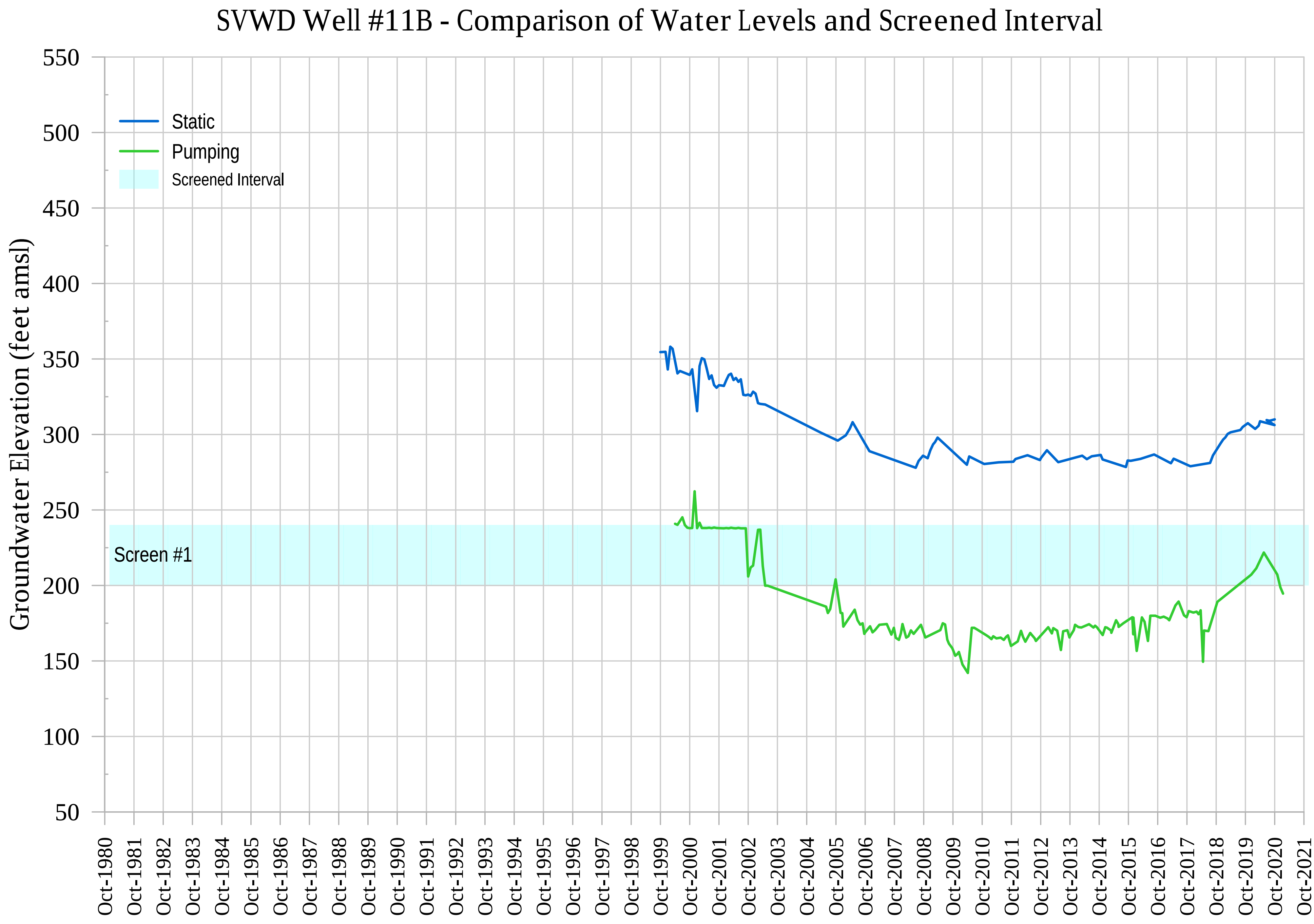
Appendix A

Hydrographs of SVWD Production Wells

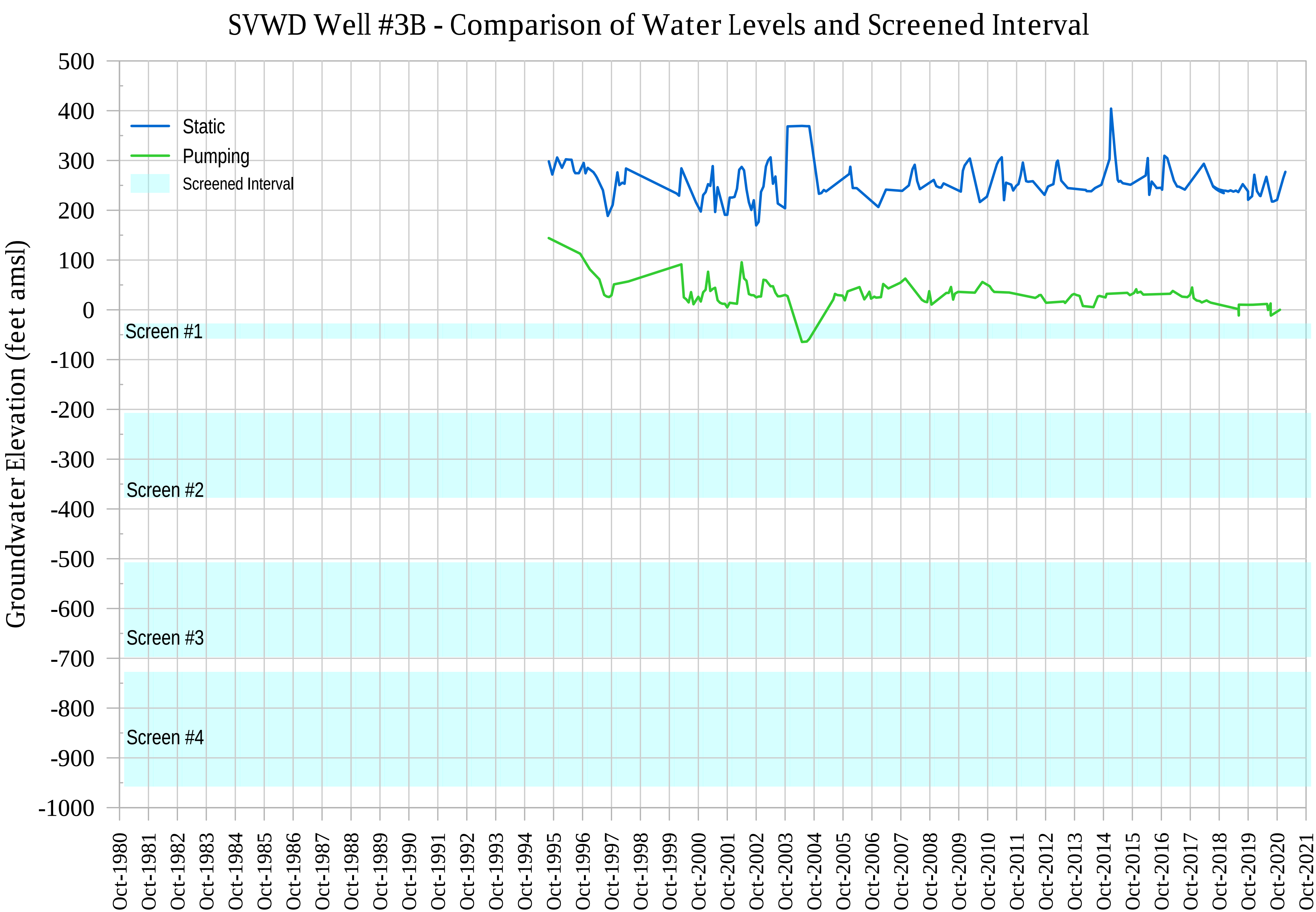

SVWD Orchard Well - Comparison of Water Levels and Screened Interval
Groundwater Elevation (feet amsl)
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
Static
Pumping
Screened Interval
Well put into service on July 11, 2018
Screen #1
Screen #2
Screen #3
Oct-1980
Oct-1981
Oct-1982
Oct-1983
Oct-1984
Oct-1985
Oct-1986
Oct-1987
Oct-1988
Oct-1989
Oct-1990
Oct-1991
Oct-1992
Oct-1993
Oct-1994
Oct-1995
Oct-1996
Oct-1997
Oct-1998
Oct-1999
Oct-2000
Oct-2001
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020
Oct-2021

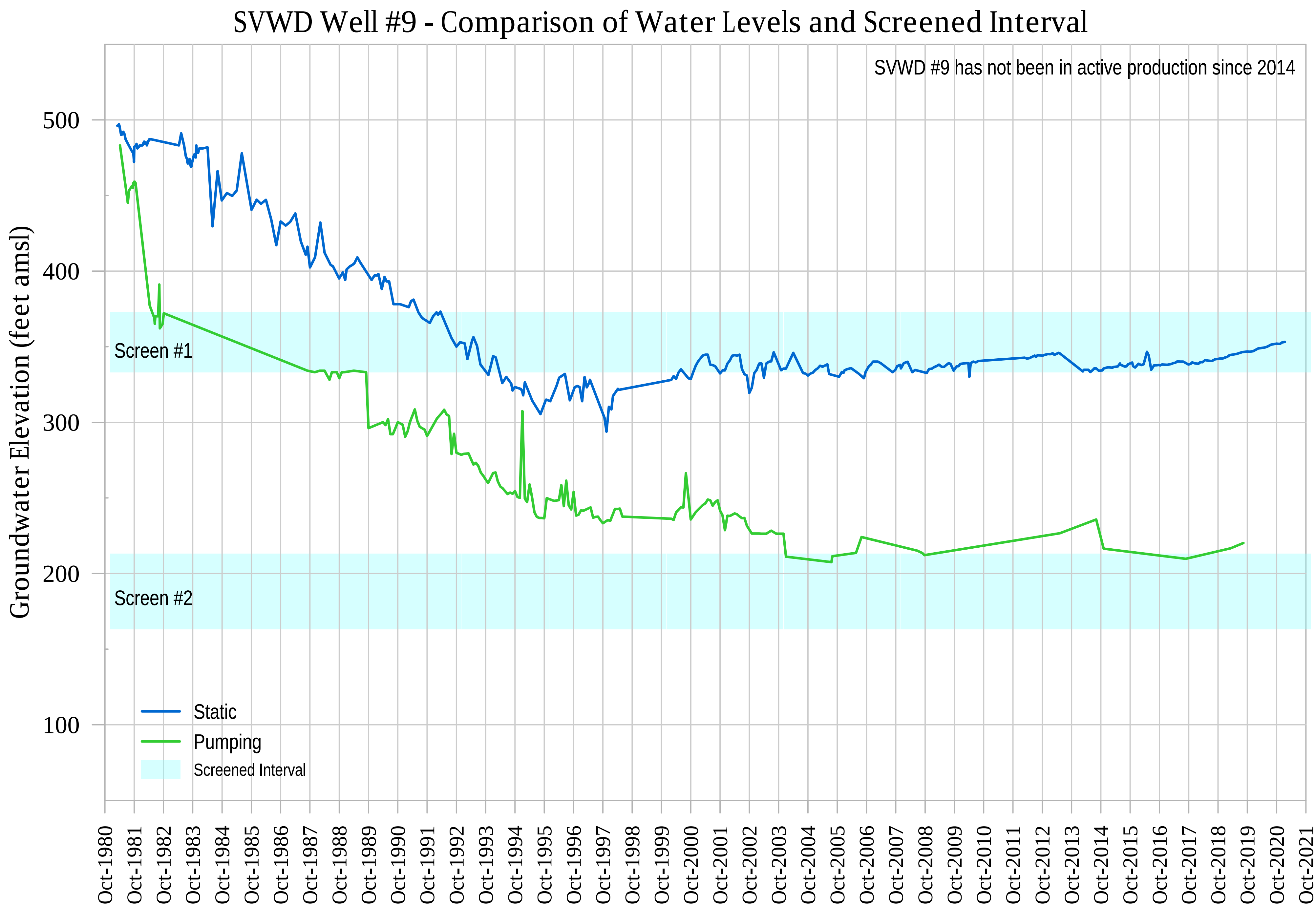

SVWD Well #10A - Comparison of Water Levels and Screened Interval
Groundwater Elevation (feet amsl)
550
500
450
400
350
300
250
200
150
100
50
Static
Pumping
Screened Interval
Screen #1
Screen #2
Oct-1980
Oct-1981
Oct-1982
Oct-1983
Oct-1984
Oct-1985
Oct-1986
Oct-1987
Oct-1988
Oct-1989
Oct-1990
Oct-1991
Oct-1992
Oct-1993
Oct-1994
Oct-1995
Oct-1996
Oct-1997
Oct-1998
Oct-1999
Oct-2000
Oct-2001
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020
Oct-2021


SVWD Well #11A - Comparison of Water Levels and Screened Interval
Groundwater Elevation (feet amsl)
550
500
450
400
350
300
250
200
150
100
50
Static
Pumping
Screened Interval
Screen #1
Screen #2
Screen #3
Oct-1980
Oct-1981
Oct-1982
Oct-1983
Oct-1984
Oct-1985
Oct-1986
Oct-1987
Oct-1988
Oct-1989
Oct-1990
Oct-1991
Oct-1992
Oct-1993
Oct-1994
Oct-1995
Oct-1996
Oct-1997
Oct-1998
Oct-1999
Oct-2000
Oct-2001
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020
Oct-2021



SVWD Well #11B - Comparison of Water Levels and Screened Interval
Groundwater Elevation (feet amsl)
550
500
450
400
350
300
250
200
150
100
50
Static
Pumping
Screened Interval
Screen #1
Oct-1980
Oct-1981
Oct-1982
Oct-1983
Oct-1984
Oct-1985
Oct-1986
Oct-1987
Oct-1988
Oct-1989
Oct-1990
Oct-1991
Oct-1992
Oct-1993
Oct-1994
Oct-1995
Oct-1996
Oct-1997
Oct-1998
Oct-1999
Oct-2000
Oct-2001
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020
Oct-2021


SVWD Well #3B - Comparison of Water Levels and Screened Interval
Groundwater Elevation (feet amsl)
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
Static
Pumping
Screened Interval
Screen #1
Screen #2
Screen #3
Screen #4
Oct-1980
Oct-1981
Oct-1982
Oct-1983
Oct-1984
Oct-1985
Oct-1986
Oct-1987
Oct-1988
Oct-1989
Oct-1990
Oct-1991
Oct-1992
Oct-1993
Oct-1994
Oct-1995
Oct-1996
Oct-1997
Oct-1998
Oct-1999
Oct-2000
Oct-2001
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020
Oct-2021



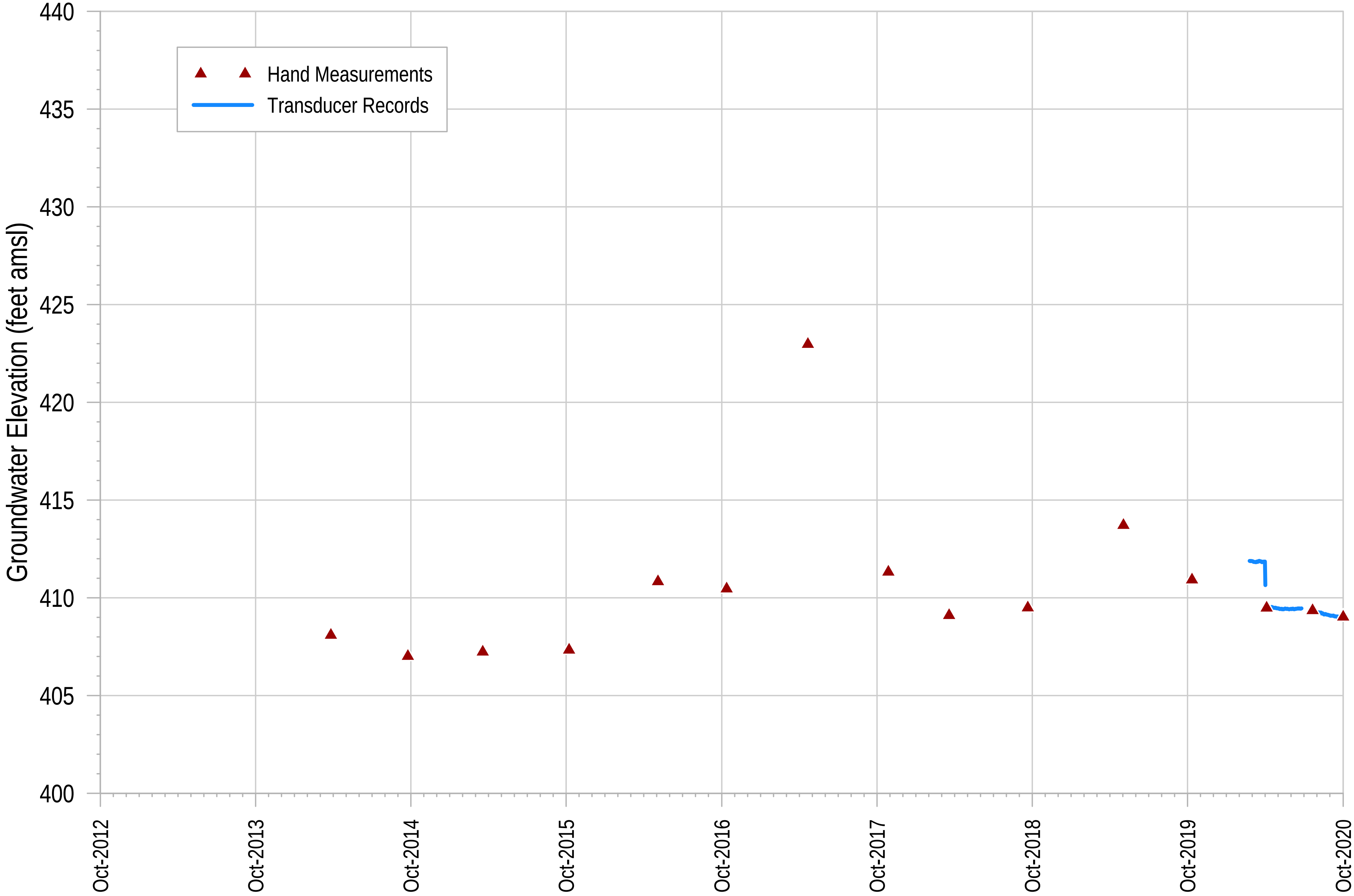
SVWD Well #9 - Comparison of Water Levels and Screened Interval
SVWD #9 has not been in active production since 2014
Groundwater Elevation (feet amsl)
500
400
300
200
100
Screen #1
Screen #2
Static
Pumping
Screened Interval
Oct-1980
Oct-1981
Oct-1982
Oct-1983
Oct-1984
Oct-1985
Oct-1986
Oct-1987
Oct-1988
Oct-1989
Oct-1990
Oct-1991
Oct-1992
Oct-1993
Oct-1994
Oct-1995
Oct-1996
Oct-1997
Oct-1998
Oct-1999
Oct-2000
Oct-2001
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020
Oct-2021

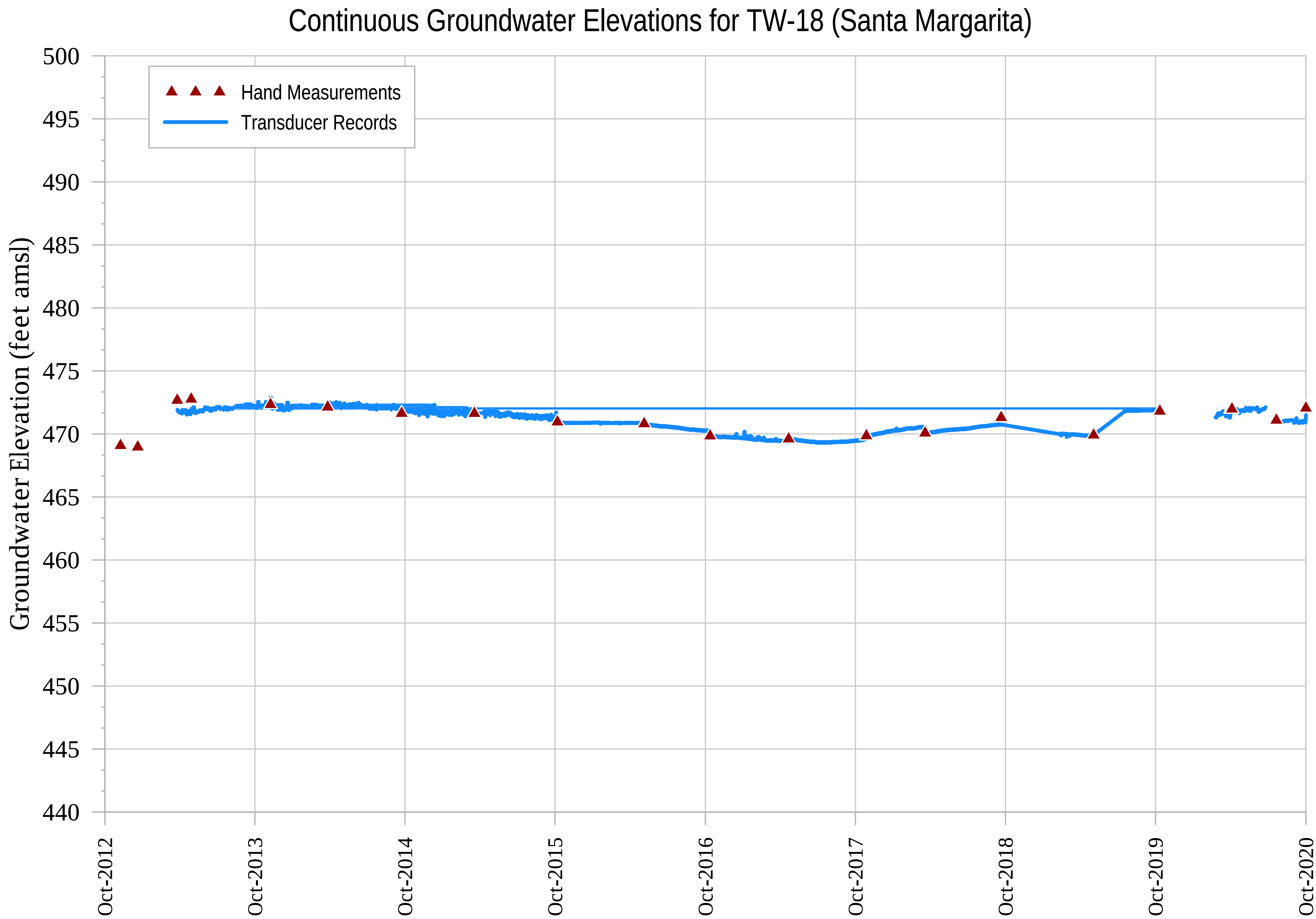
MONTGOMERY
& ASSOCIATES

Appendix B

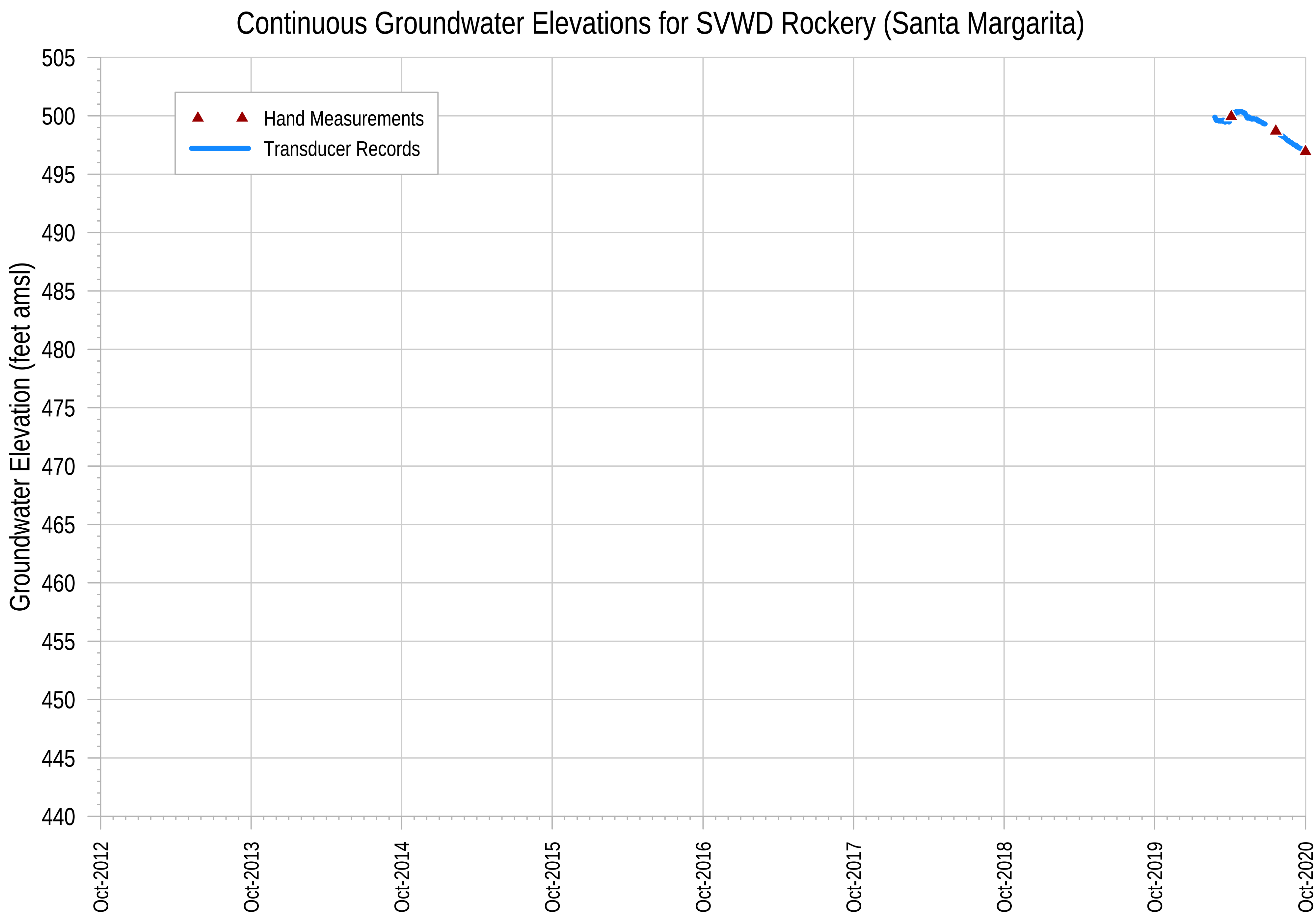
Hydrographs of Wells with Transducers

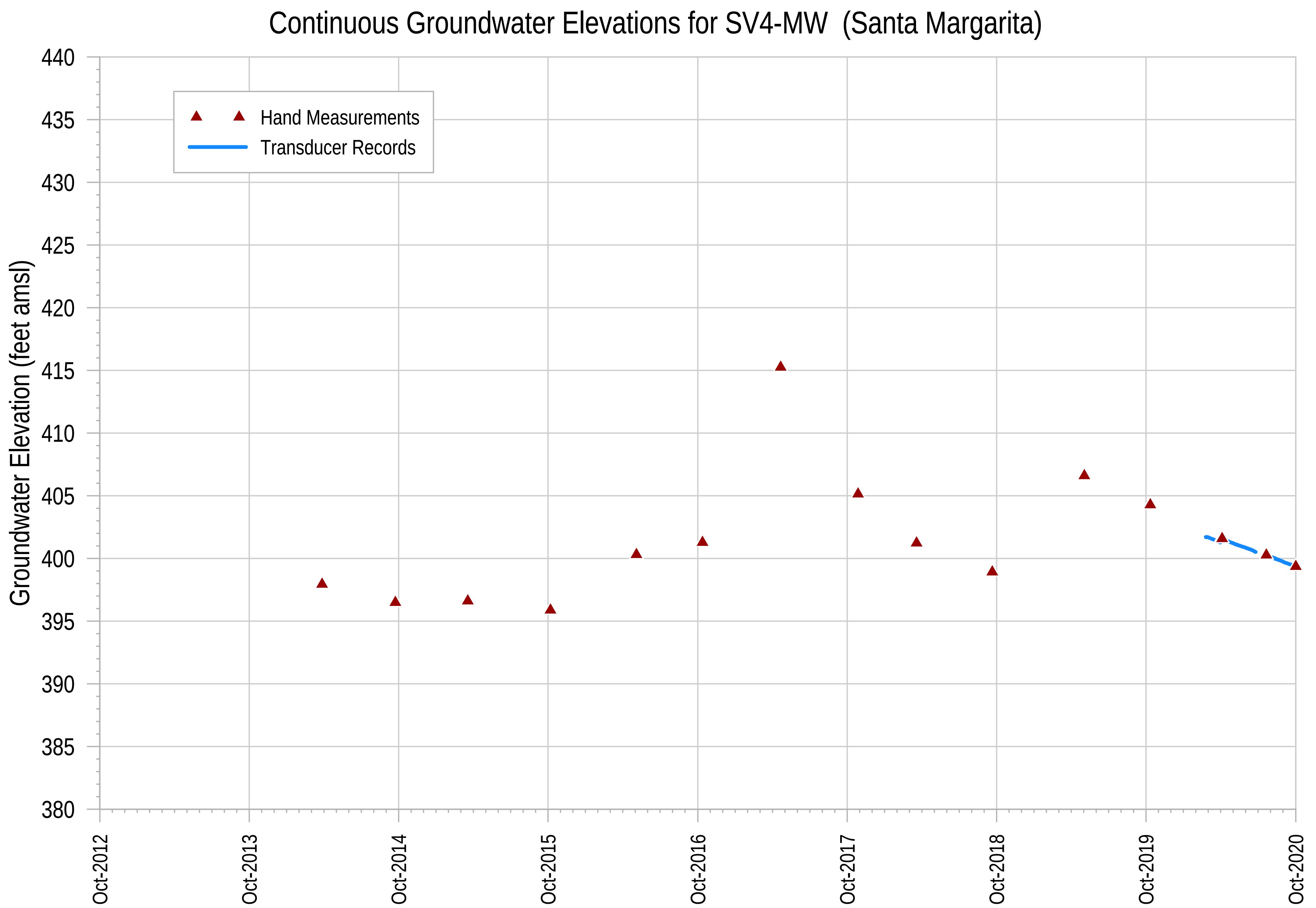
Continuous Groundwater Elevations for SVWD AB303 MW-3B (Santa Margarita)





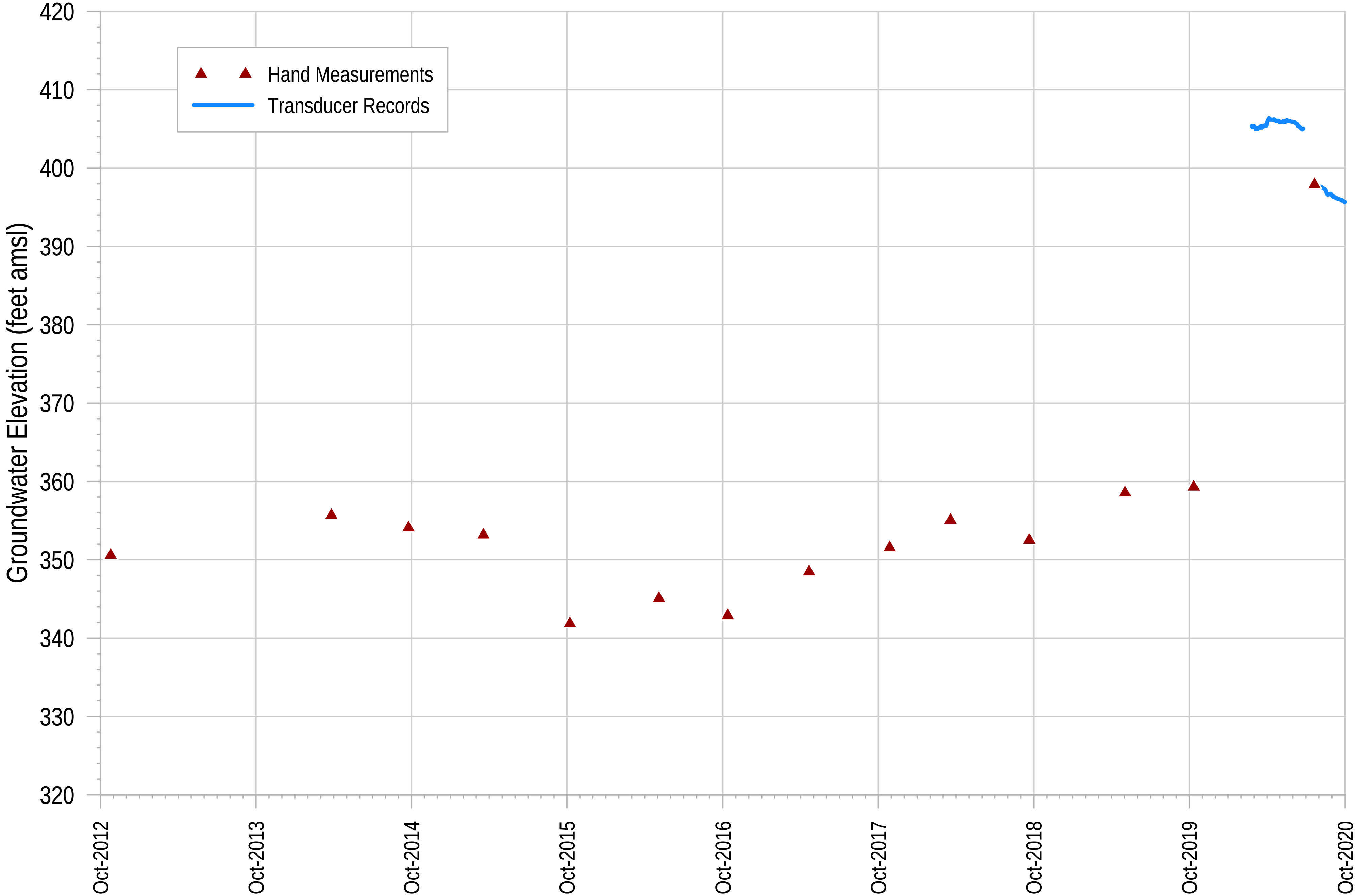
Continuous Groundwater Elevations for TW-18 (Santa Margarita)
Hand Measurements
Transducer Records
Groundwater Elevation (feet amsl)
500
495
490
485
480
475
470
465
460
455
450
445
440
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020

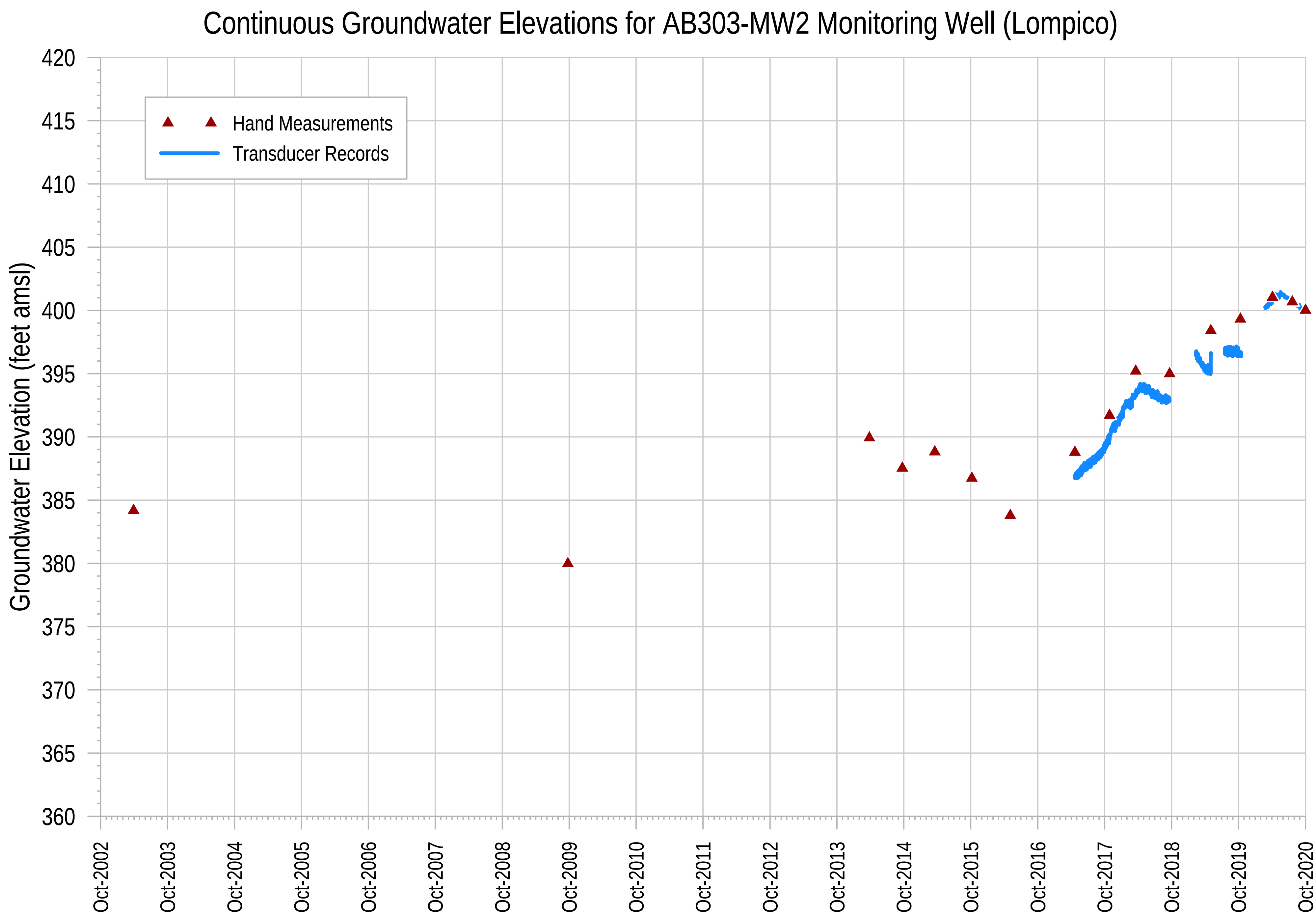

Continuous Groundwater Elevations for SVWD Rockery (Santa Margarita)
Groundwater Elevation (feet amsl)
505
500
495
490
485
480
475
470
465
460
455
450
445
440
Hand Measurements
Transducer Records
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020

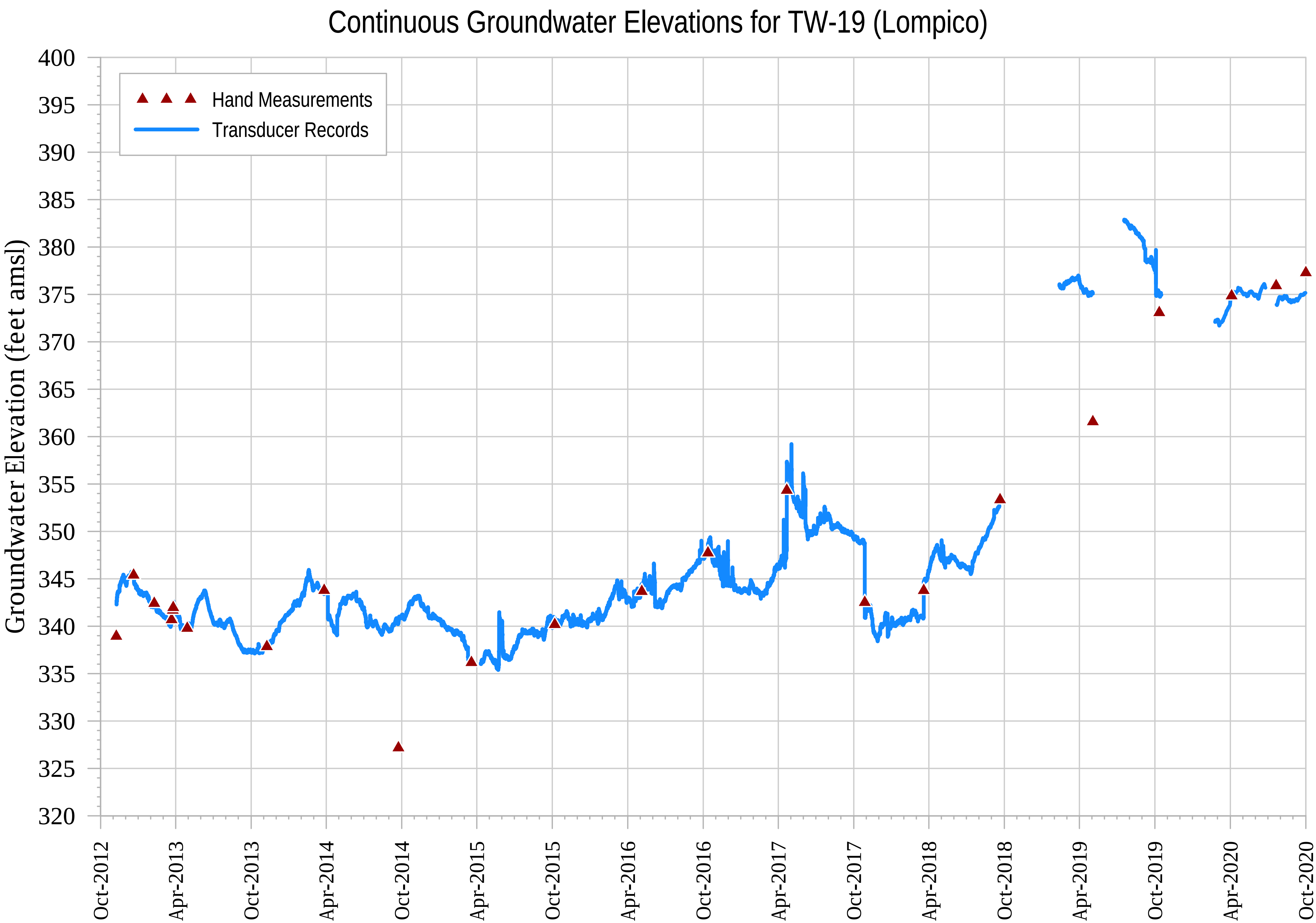


Continuous Groundwater Elevations for SV4-MW (Santa Margarita)
Groundwater Elevation (feet amsl)
Hand Measurements
Transducer Records
440
435
430
425
420
415
410
405
400
395
390
385
380
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020

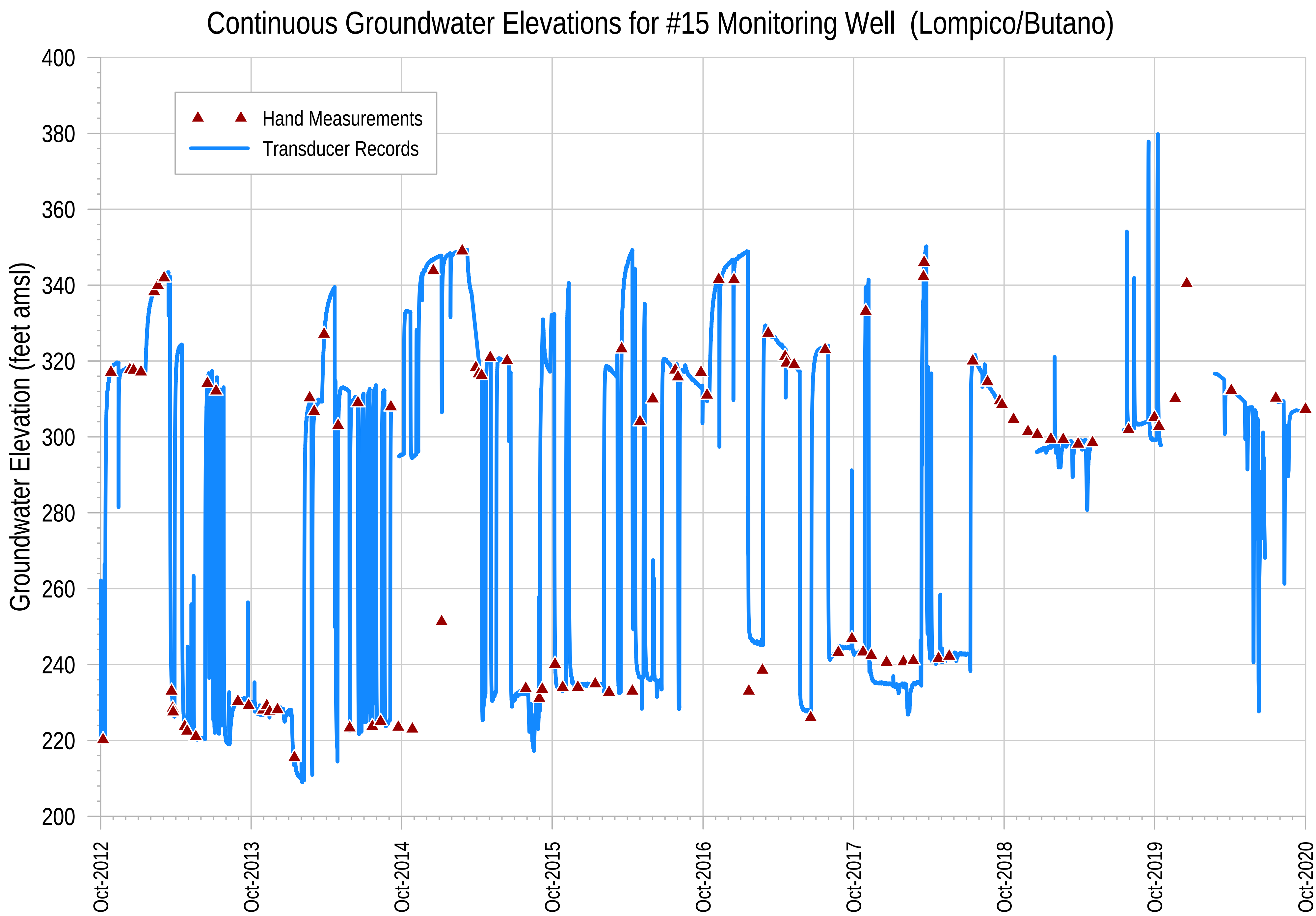
Continuous Groundwater Elevations for AB303 MW-3A (Lompico)



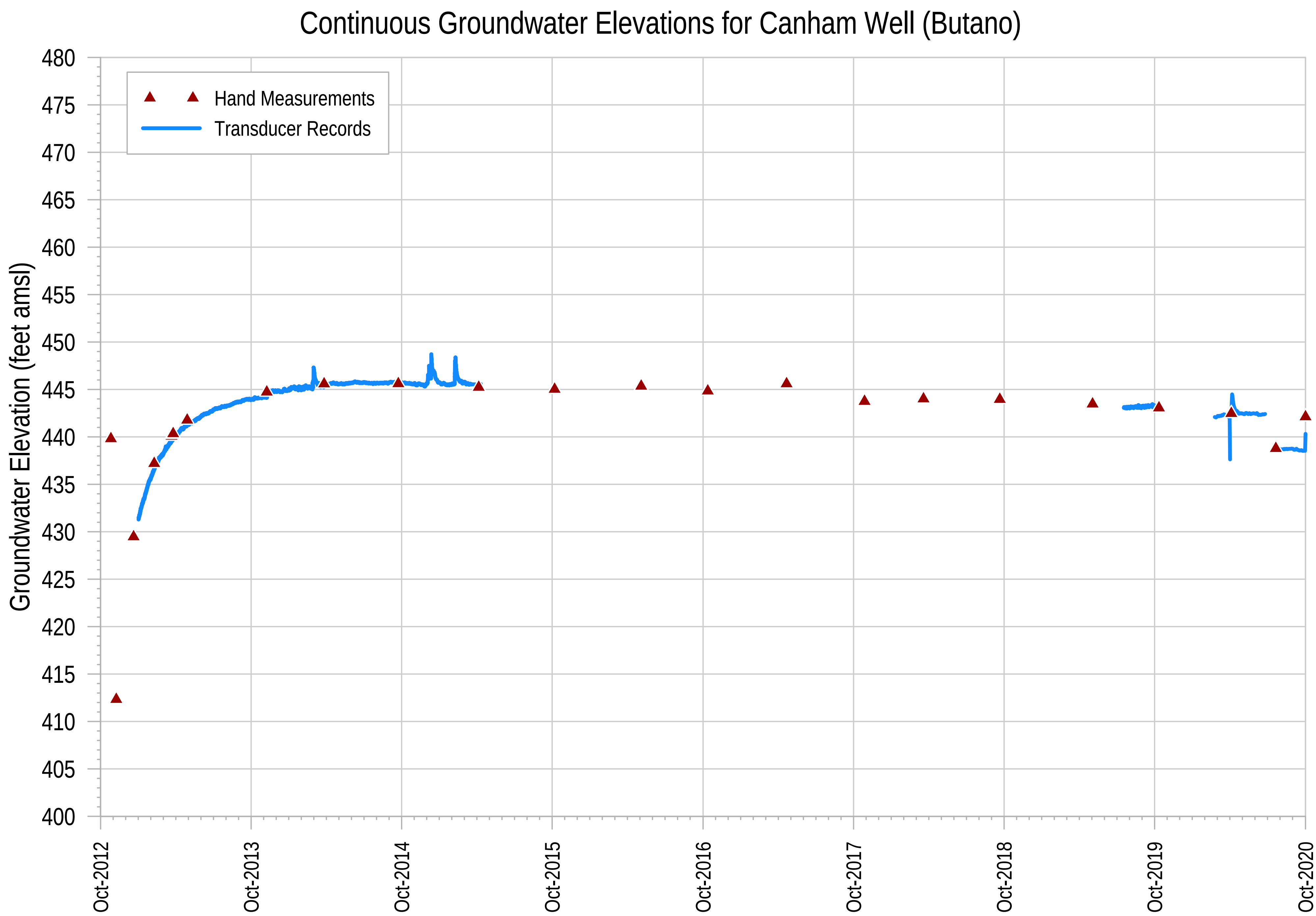

Continuous Groundwater Elevations for AB303-MW2 Monitoring Well (Lompico)
Groundwater Elevation (feet amsl)
420
415
410
405
400
395
390
385
380
375
370
365
360
Hand Measurements
Transducer Records
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020

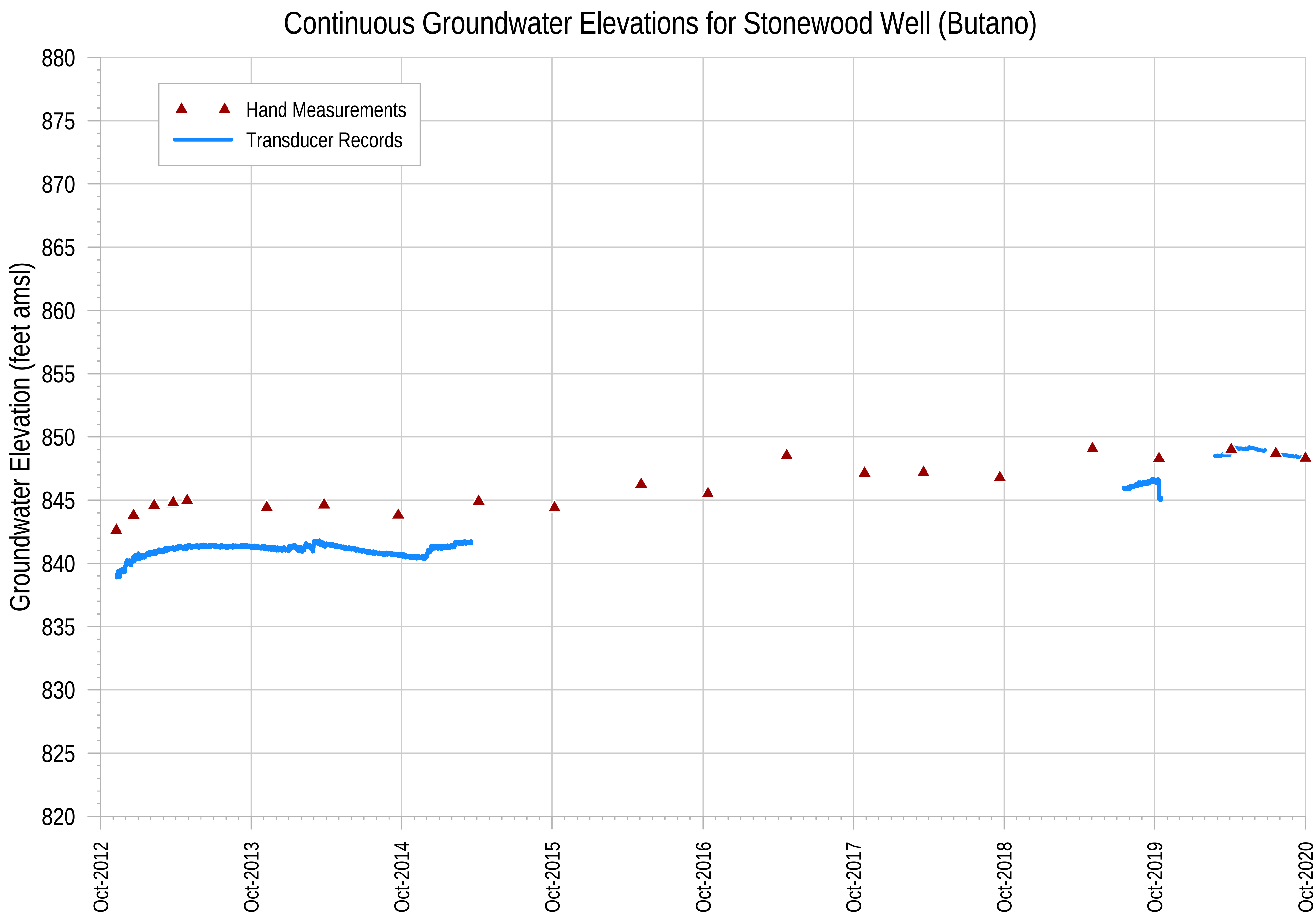


Continuous Groundwater Elevations for TW-19 (Lompico)
Hand Measurements
Transducer Records
Groundwater Elevation (feet amsl)
400
395
390
385
380
375
370
365
360
355
350
345
340
335
330
325
320
Oct-2012
Apr-2013
Oct-2013
Apr-2014
Oct-2014
Apr-2015
Oct-2015
Apr-2016
Oct-2016
Apr-2017
Oct-2017
Apr-2018
Oct-2018
Apr-2019
Oct-2019
Apr-2020
Oct-2020



Continuous Groundwater Elevations for #15 Monitoring Well (Lompico/Butano)
Groundwater Elevation (feet amsl)
400
380
360
340
320
300
280
260
240
220
200
Hand Measurements
Transducer Records
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020


Continuous Groundwater Elevations for Canham Well (Butano)
Groundwater Elevation (feet amsl)
480
475
470
465
460
455
450
445
440
435
430
425
420
415
410
405
400
Hand Measurements
Transducer Records
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020



Continuous Groundwater Elevations for Stonewood Well (Butano)
Hand Measurements
Transducer Records
Groundwater Elevation (feet amsl)
880
875
870
865
860
855
850
845
840
835
830
825
820
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
Oct-2020