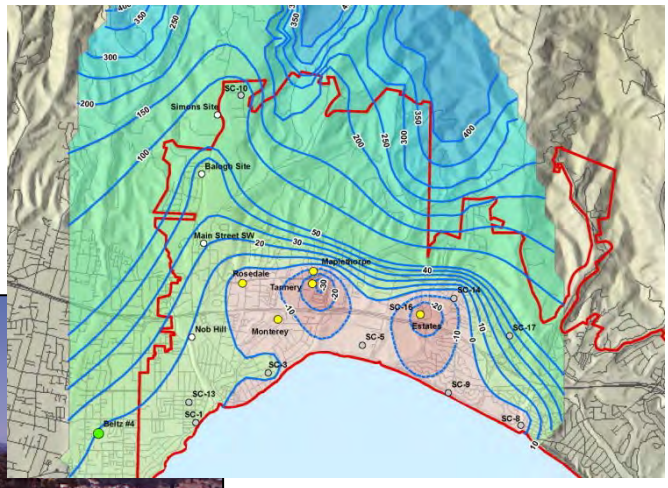
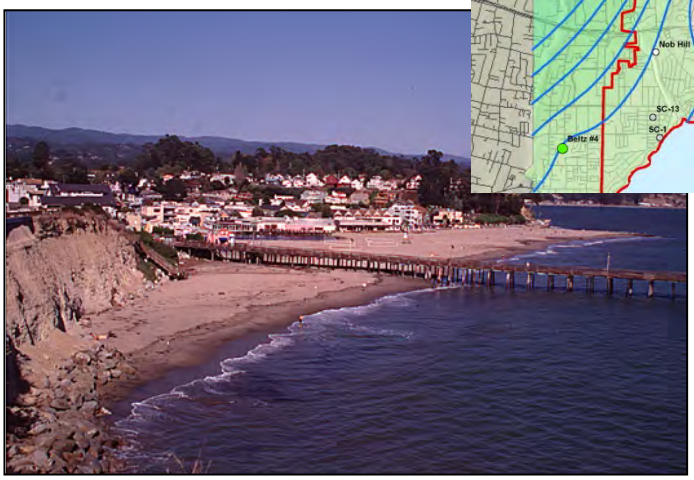
Soquel-Aptos Area Groundwater Management Annual Review and Report Water Year 2013

Prepared for:
Soquel Creek Water District
Central Water District

June 2014





Prepared by:

HydroMetrics WRI

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ABBREVIATIONS

AF ..... acre-feet
ARR .....Annual Review and Report
ASR.....aquifer storage and recovery
BAG.....Groundwater Management Plan Basin Advisory Group
BIG.....Basin Implementation Group
BMO .....basin management objective
CASGEM .....California Statewide Groundwater Elevation Monitoring
CDS .....Coastal Distribution System
CWD.....Central Water District
DWSAP.....Drinking Water Source Assessment and Protection
EIR .....environmental impact report
FTP .....file transfer protocol
GAMA .....Groundwater Ambient Monitoring and Assessment Program
GMP .....Groundwater Management Plan
gpd .....gallons per day
IRWMP .....Integrated Regional Water Management Plan
JPA.....Joint Exercise of Powers Agreement
LAFCO.....Local Agency Formation Commission
MCL .....maximum contaminant level
mg/L .....milligrams per Liter
msl .....mean sea level (this report considers equivalent to NGVD29)
NGVD29 .....National Geodetic Vertical Datum of 1929
OEHHA .....California Office of Environmental Health Hazard Assessment
PDF.....portable document format
PHG.....public health goal
PRMS.....Precipitation-Runoff Modeling System
PVWMA .....Pajaro Valley Water Management Agency
RCD.....Resource Conservation District of Santa Cruz County
RPE.....reference point elevation
RWQCB .....Central Coast Regional Water Quality Control Board
SAGMA .....Soquel Aptos Groundwater Management Alliance
SCWD2 .....Santa Cruz Water Department/Soquel Creek Water District desalination project
SqCWD .....Soquel Creek Water District

SRP .....satellite reclamation plant
TMDL.....total maximum daily load
TDS.....total dissolved solids

EXECUTIVE SUMMARY – WATER YEAR 2013

INTRODUCTION

This Annual Review and Report (ARR) is part of the implementation of the Groundwater Management Plan (GMP) for the Soquel-Aptos basin approved by Soquel Creek Water District (SqCWD) and Central Water District (CWD) in 2007 (SqCWD and CWD, 2007). The ARR summarizes groundwater conditions in the Soquel-Aptos basin, documents the status of groundwater management activities, and recommends any amendments to the GMP. The report will serve as a living document that has been updated annually starting with the Water Year 2009 report.

GROUNDWATER CONDITIONS

Long-term overdraft of the basin has led to ongoing risk of seawater intrusion and pumping must be reduced to recover the basin. In Water Year 2013, coastal groundwater levels in seven out of thirteen SqCWD and City of Santa Cruz monitoring wells screened in productive units remained below elevations that protect the aquifers from seawater intrusion (Figure ES- *1*). Recovery of the basin and overdraft will be eliminated when coastal groundwater levels rise to protective elevations at all coastal wells.

In Water Year 2013, rainfall in the Soquel-Aptos basin was below average for the second straight year. Although SqCWD declared a Stage 2 water shortage alert with a drought curtailment target of 15%, municipal production was higher than the previous three years with no or lower drought curtailment targets possibly due to improving economic conditions that reduced vacancies. Municipal production in the Soquel-Aptos basin was still lower for Water Year 2013 than all water years from 1985-2009.

Recent estimates for SqCWD's share of long-term pumping yield (HydroMetrics WRI, 2012) are a combined 800 acre-feet below pumping goals stated in the GMP. Municipal production in Water Years 2009-2013 has been below the combined long-term pumping yield of 3,375 acre-feet per year by SqCWD and the City of Santa Cruz in the Purisima area. Municipal production remains above the combined long-term pumping yield of 1,822 acre-feet per year by SqCWD and CWD in the Aromas area. However, pumping at long term pumping yields will not protect the basin from seawater intrusion until after groundwater levels

recover to protective elevations. Hence, the long term pumping yields are referred to as post recovery pumping yields. SqCWD pumping remains above the revised pumping goals proposed for the GMP of 2,300 acre-feet per year in the Purisima area and 600 acre-feet per in the Aromas area to recover the basin within 20 years

In general, the groundwater level trends in these coastal wells in the western and central Purisima areas have been increasing over the last five years, but some wells showed declines in Water Year 2013. The groundwater level trend in coastal wells in the Aromas area has generally been stable over the last five years with some wells showing an increase over the last two years (Figure ES- 2).

There is ongoing risk of seawater intrusion into the productive units of the Soquel-Aptos basin due to coastal groundwater levels being below protective elevations. Observed Total Dissolved Solids (TDS) and chloride concentrations are used to assess seawater intrusion. The occurrence of seawater intrusion varies by area in the Soquel-Aptos basin:

- TDS and chloride concentrations do not suggest seawater intrusion at SqCWD's production wells or monitoring wells in the western Purisima area (A, AA, and Tu-units).
- TDS and chloride concentrations in one of the City of Santa Cruz's monitoring wells suggest seawater intrusion in the westernmost Purisima area (A-unit).
- TDS and chloride concentrations do not suggest seawater intrusion at SqCWD's production wells or monitoring wells in the central Purisima area (BC and DEF-units).
- TDS and chloride concentrations continue to be elevated in deep monitoring wells installed below the freshwater-saltwater interface in the Aromas area (Purisima F-unit and Aromas Red Sands).
- There is a long-term increasing trend in TDS and chloride concentrations at one well installed above the freshwater-saltwater interface in the Aromas area.

Naturally occurring constituents such as iron and manganese in the Purisima Formation and chromium VI in the Aromas Red Sands continue to have high concentrations in groundwater. High nitrate concentrations were detected at the Sells well which caused its removal from service in Water Year 2009. All delivered water met drinking water standards for constituents found in groundwater.

STATUS OF GROUNDWATER MANAGEMENT

The status of basin management objectives (BMO) is updated through Water Year 2013. The main basin management objectives of concern are BMO 1-1 to pump within the sustainable yield and BMO 2-2 to maintain groundwater levels to prevent seawater intrusion. Overall municipal production exceeds the combined long-term pumping yield, even though annual municipal production amounts for Water Years 2010 through 2013 were the lowest since 1985. Coastal groundwater levels remain below protective elevations at over half the coastal wells. Therefore, achieving BMOs 1-1 and 2-2 may require fulfilling BMO 1-2 to develop alternative water supplies for achieving a long-term balance between recharge and withdrawals in meeting current and future demand. However, plans for a regional desalination plant that would fulfill BMO 1-2 was put on hold in 2013 and other alternatives are currently being evaluated.

Basin management elements are specific projects, programs, and policies for meeting basin management objectives. The status of elements is also updated in this report.

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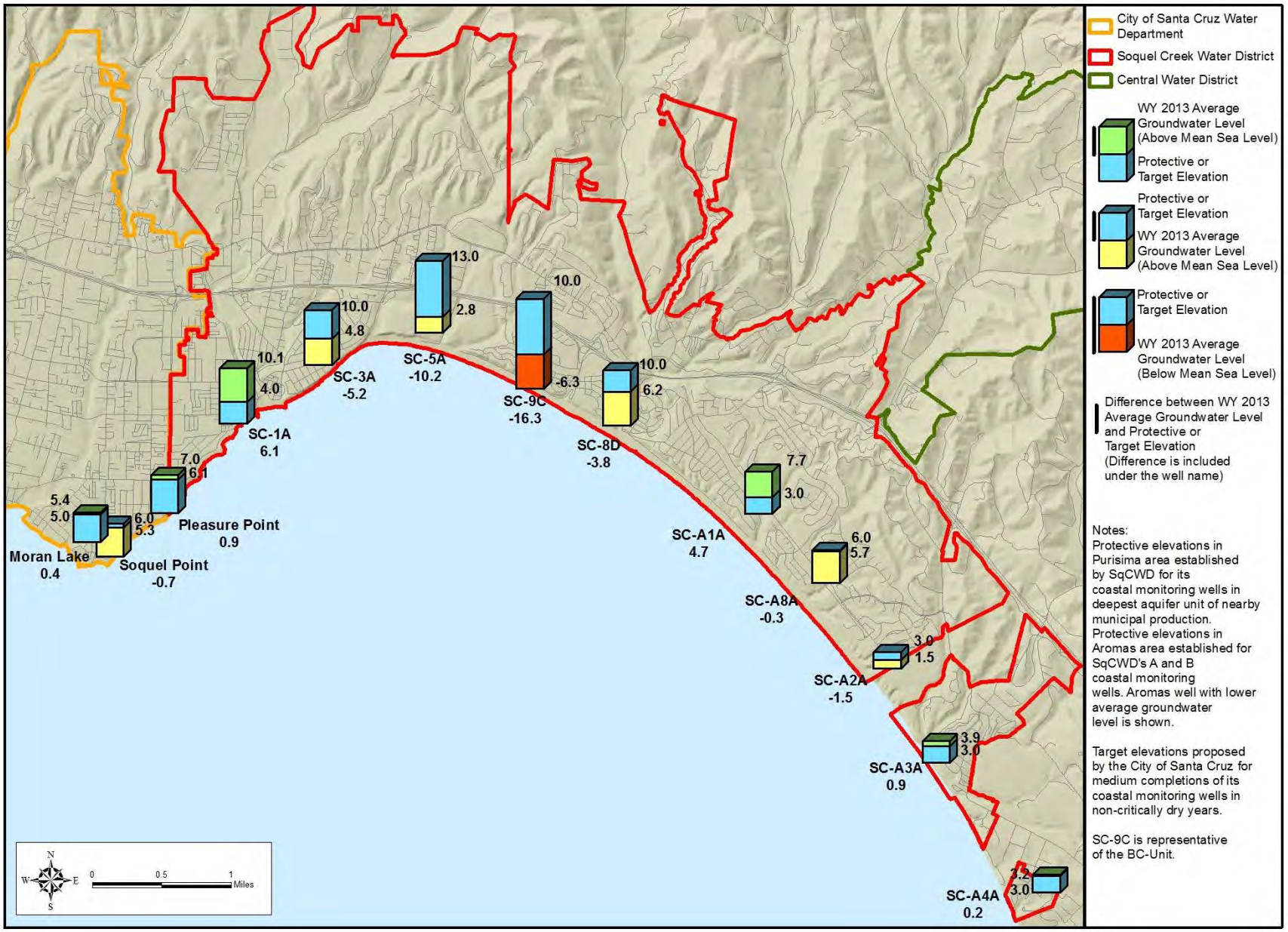

Figure ES- 1 (2013): Average Water Year 2013 Groundwater Levels at Coastal Monitoring Wells Relative to Protective Elevations

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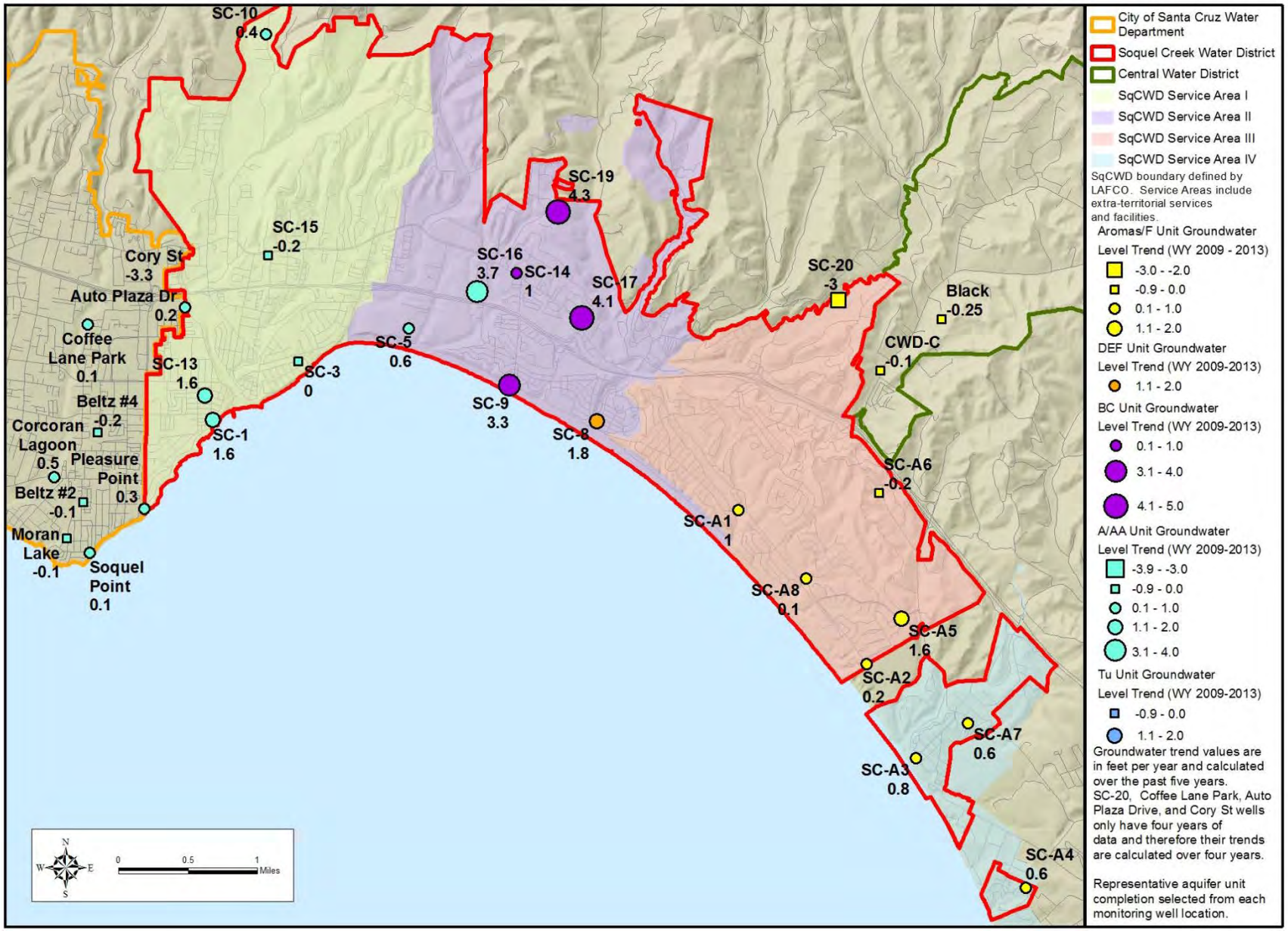

Figure ES- 2 (2013): Groundwater Level Trends Water Years 2009-2013 at Representative Monitoring Wells

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SECTION 1
BACKGROUND AND SCOPE

Soquel Creek Water District (SqCWD) and Central Water District (CWD) approved a Groundwater Management Plan (GMP) in 2007 (SqCWD and CWD, 2007). Part of the GMP implementation requires preparation of an Annual Review and Report (ARR) following each water year. The ARR summarizes groundwater conditions in the Soquel-Aptos area, documents the status of groundwater management activities, and recommends amendments to the GMP. Under direction of the Soquel-Aptos area Basin Implementation Group (BIG), a new format for the report has been prepared starting with the Water Year 2009 ARR. The report will serve as a living document and be updated annually. This is the third annual update using the new format, covering Water Year 2013 (October 2012-September 2013).

1.1 GROUNDWATER MANAGEMENT PLAN REVIEW

Last year's ARR included a review of the GMP itself. Proposed revisions to the Existing Groundwater Conditions and Basin Management Objectives were approved by the Basin Implementation Group in 2013. An official update of the GMP requires approval of the SqCWD and CWD Boards of Directors. However, ongoing groundwater management is based on the proposed revisions so the revisions are referenced in this report.

1.2 LIVING DOCUMENT CONCEPT

The living document is contained in a three-ring binder and portable document format (PDF) electronic file that will be updated with new information on basin conditions each year. Summaries and maps of previous water years will remain in the binder and PDF file, with summaries and maps for the most recent water year successively added. The section reviewing the status of GMP implementation is similar to Section 3 of the Water Year 2008 report, but will be updated through the most recent water year. An executive summary of the entire water year will also be added to the front of the binder and PDF file each year. New map figures for the executive summary were added for Water Year 2011 and map figures for this and subsequent years will be added each year.

1.3 DOCUMENT ORGANIZATION

Sections 2-5 update basin conditions for the water year. Since each year new Sections 2-5 discussing the latest water year are inserted to the binder and PDF, the sections are labeled with the subject water year. Some figures and tables illustrating basin conditions or current basin understanding, such as multi-year graphs, are replaced when they are updated. Other figures and tables, such as snapshot contour maps, are added when updated and their figure and table numbers labeled with the subject water year.

Section 2 describes conditions for the subject water year such as precipitation and overall pumping that affect the entire basin. The updated Section 2 is inserted in front of the previous Section 2. Multi-year graphs of precipitation and pumping are replaced each year.

Sections 3-5 describe conditions for three different portions of the Soquel-Aptos area. Section 3 discusses the western portion of the Soquel-Aptos area, where the productive aquifer units are the Purisima A and AA-units and the sub-Purisima Tu-unit. Section 4 discusses the central portion of the Soquel-Aptos area, where the productive aquifer units are the Purisima BC and DEF-units. Section 5 discusses the eastern portion of the Soquel-Aptos area, where the productive aquifer units are the Purisima F-unit and Aromas Red Sands aquifer. The above productive aquifer units are defined by the basin hydrostratigraphy outlined in Johnson et al. (2004) (Figure 1-1). The deep to shallow sequence of productive aquifer units in the Purisima Formation is AA, A, BC, DEF, to F. The Aromas Red Sands overlies the Purisima F-unit.

Each of Sections 3-5 is organized as follows:

- A description of pumping for the relevant SqCWD service areas and CWD or City of Santa Cruz is summarized and inserted.
- A multi-year graph of the water agencies' pumping for the area is replaced. The estimates of non-agency pumping will also be replaced if there is new information.
- A summary of the overall groundwater condition and groundwater level trends for the water year is inserted.
- SqCWD has established and updated protective groundwater elevations in coastal monitoring wells to protect the basin from seawater intrusion over the long term (HydroMetrics LLC, 2009b and HydroMetrics WRI,

2012). The City of Santa Cruz has also proposed protective groundwater elevations for its coastal monitoring wells. A table comparing coastal groundwater levels in the water year versus protective elevations for the aquifer group is inserted.

- A map showing representative groundwater elevation contours for the spring and fall of the reported water year is inserted. The groundwater elevation contour maps from the water year 2007 report are also included as a baseline.
- A summary of the overall condition and trends of water quality for the water year is inserted.
- The section will include a discussion of any specific issues that arise for the reported water year.
- Hydrographs and chemographs will be replaced.

The current procedure is to update all items (summaries, tables, multi-year graphs, and contour maps) in Sections 2-5 each year except for review of information in the GMP. However, the BIG may decide that not all items require an update every year. The BIG may also decide that additional items should be added in subsequent years.

Section 6 discusses the updated status of GMP Basin Management Objectives and Basin Management Elements (projects, programs, or policies). This section will be replaced each year, but completion of any objectives or elements in previous years will remain in the description in order to keep an ongoing record of activities. This year, this section will include recommended revisions to the descriptions of Basin Management Objectives to include updated information.

Section 7 discusses current GMP action priorities, and data gaps. The current GMP action priorities should be considered the current guide for groundwater management programs, projects, and policies (GMP Elements) to implement. Section 7 includes recommended plans for addressing high priority data
Table 1-1 provides a summary of whether updated items in each report will be inserted or replaced in the binder and PDF.

Table 1-1: Summary of Items to Add or Replace for Each Annual Report

Report Item	**Insert or Replace in Report**
Executive Summary	
Text	Insert

Summary Maps	Insert
Section 1 - Background and Scope	Replace
Section 2 - Basinwide Conditions	
Text	Insert
Precipitation and pumping charts	Replace
Pumping tables	Replace
GMP Information Review	2012 Only
Section 3 - 5 - Aquifer Conditions	
Text	Insert
Summary tables	Insert
Pumping charts	Replace
Contour maps	Insert
Hydrographs	Replace
Chemographs	Replace
Section 6 - GMP Implementation Status	Replace
Recommendations for BMO Revisions	2012 Only
Section 7 - Recommendations	Insert

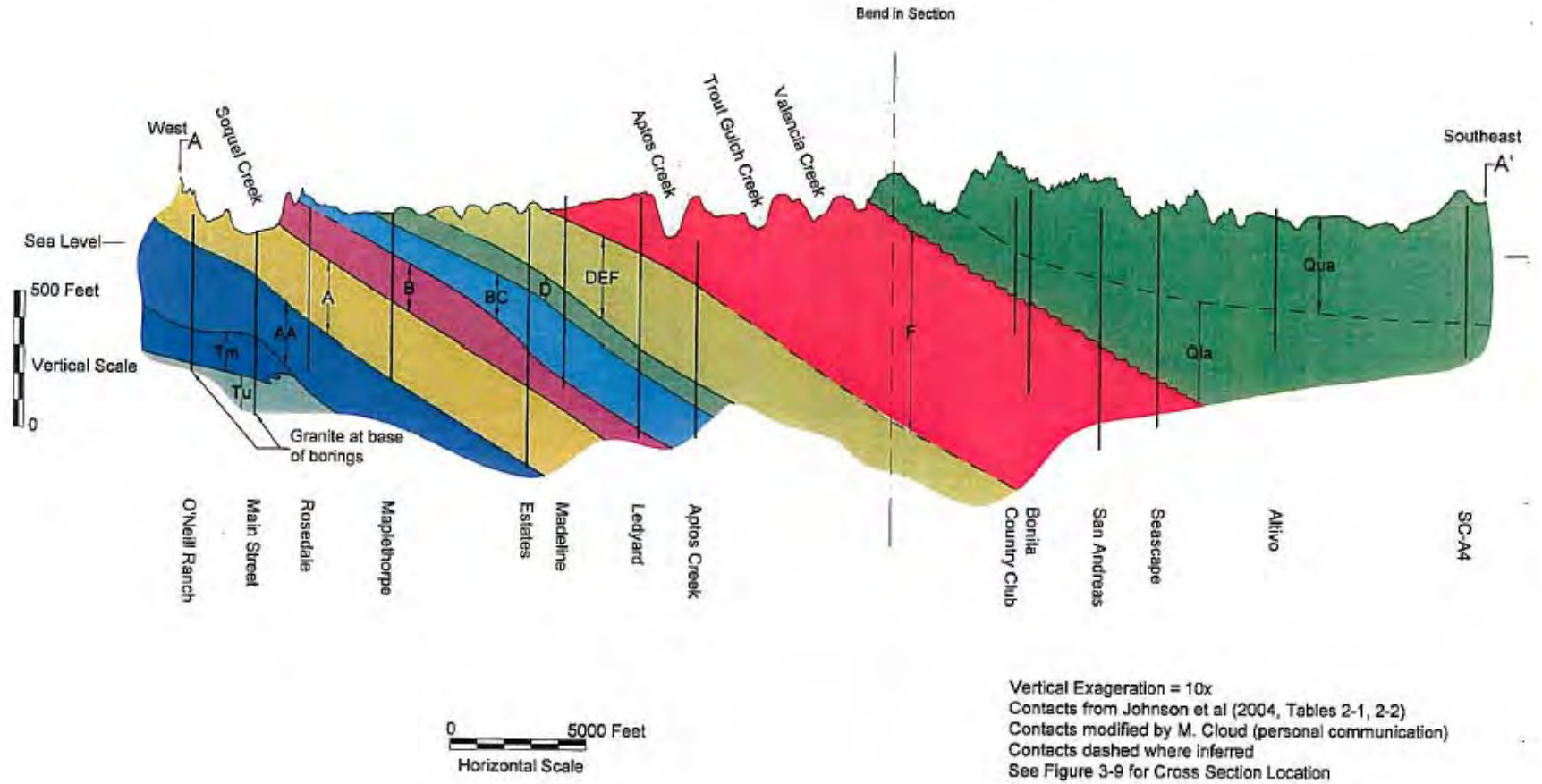

Figure 1-1: Cross-section of Basin Hydrostratigraphy (reproduced from GMP Figure 3-10)

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SECTION 2 – WATER YEAR 2013
BASINWIDE CONDITIONS IN THE SOQUEL-APTOS GROUNDWATER MANAGEMENT AREA

This section presents conditions in the Soquel-Aptos area for Water Year 2013 that affect the entire groundwater basin. This section also includes a review of information in GMP Section 3 (Existing Groundwater Conditions).

2.1 ANNUAL RAINFALL AND RECHARGE

SqCWD collects rainfall data from three gauges in the Soquel-Aptos area: the Mancarti gauge on Laurel Road, the Kraeger gauge on Longridge Road, and the weather station at the Main Street well site. Data loggers record rainfall at these gauges at 15-minute intervals. Precipitation at the Mancarti and Kraeger gauges during Water Year 2013 was 28.9 and 30.4 inches respectively. These rainfall totals were below the average (mean) values of 36.5 inches at the Mancarti gauge and 37.2 inches at the Kraeger gauge measured between Water Year 1984 and Water Year 2013. Water Year 2013 was the first full water year with data from the Main Street weather station and rainfall totaled 17.4 inches.

Annual rainfall totals by Water Year for both gauges are presented on Figure 2-1. Water Year 2013 ranks as the 10th and 13th driest year in the 30 year record for the Mancarti and Kraeger gauges, respectively.

Figure 2-1 also shows rainfall totals for the NOAA Cooperative station in Santa Cruz (station number 047916). Rainfall in Water Year 2013 at the Santa Cruz station was 18.0 inches, which was below the average value of 29.5 inches observed from Water Year 1984 through Water Year 2013. Water Year 2013 ranks as the 7h driest year in the 72 year record for this station. The two year rainfall for Water Years 2012-2013 estimated for the Santa Cruz station was 41.6 inches, which is below the trigger condition of 50 inches that led SqCWD to declare a Stage 2 water shortage warning in 2013. Figure 2-2 shows the locations of the stations and estimated distribution of rainfall.

Four of the last thirteen water years have had above average rainfall. Water Year 1998 was the last year with rainfall above 60 inches per year. Results from the Soquel-Aptos Precipitation-Runoff Modeling System (PRMS) study (HydroMetrics WRI, 2011a) show that from 2001 through 2009 (which was the end of the modeled period), the average groundwater recharge was approximately 8,200 acre-feet per year, while the overall

average for the calibrated period (1984 through 2009) was 10,800 acre-feet per year. The two years (2005-2006) of above average precipitation was when the majority of the basin's recharge occurred, and those years were not wet enough to bring the average for the period up to the overall annual average recharge.

A relationship between rainfall and deep recharge has been derived from the calibrated PRMS simulation of Water Years 1984-2009 based on a best fit of rainfall and simulated deep recharge. The best fit quadratic equation for deep recharge based on rainfall at the Santa Cruz Cooperative station over the full water year is Deep Recharge = 15.855 x Rainfall^2 – 171.51 x Rainfall (HydroMetrics WRI, 2013a). Based on this relationship, the estimate for deep recharge in Water Year 2013 is 2,100 acre-feet, or 80% lower than the average simulated for the calibration period of Water Years 1984-2009 (HydroMetrics WRI, 2011a).

2.2 ANNUAL PRODUCTION

Total municipal production for the Soquel-Aptos area in Water Year 2013 was 5,292 acre-feet (AF), the fifth lowest annual total since Water Year 1984. However, this was the highest total since Water Year 2009. Annual production by water year for SqCWD, CWD, and the City of Santa Cruz is shown on Figure 2-3.

CWD pumping in Water Year 2013 was the highest since Water Year 2009. CWD production of 558 acre-feet in Water Year 2013 was the 8th highest annual total since records are available starting in Water Year 1974 (Johnson et al, 2004). The relatively high amount of pumping is likely related to below average rainfall in Water Year 2013. Five of the seven water years (2002, 2004, 2007-9) with greater CWD pumping occurred when rainfall was below average.

SqCWD pumping of 4,219 acre-feet in Water Year 2013 was the highest since Water Year 2009. However, SqCWD pumping in Water Years 2010-2013 have been the four lowest annual totals since 1979. It appears that economic conditions, weather, and conservation were likely factors in the reduced demand sustained over the four year period as SqCWD has only declared drought curtailment in the last two years. The economic conditions resulted in both residential and commercial vacancies. Secondly, reduced demand within the SqCWD service area may have resulted from completed water demand offsets for which the corresponding development had not been completed. Thirdly, public awareness about the importance of sustained water conservation has been heightened in recent years due in part to ongoing outreach and education programs by local water agencies.

After declaring a Stage 1 water shortage alert with a drought curtailment target of 5%, SqCWD declared a Stage 2 water shortage warning in 2013 with a drought curtailment target of 15% with requests for voluntary conservation. The increased demand in 2013 relative to the previous three years despite the higher drought curtailment target was likely due to improved economic conditions.

City of Santa Cruz Water Year 2013 production of 515 acre-feet was similar to the average water year pumping from Water Year 1984-2013 of 518 acre-feet. The City's pumping over its pumping season is better represented by the calendar year total production. The City's pumping during calendar year 2013 was 524 acre-feet, which is similar to the City's planned future maximum groundwater production during non-critically dry years of 525 acre-feet per year (Chambers Group, 2011).

In early 2012, SqCWD updated its estimates for its post-recovery pumping yields, which are meant to protect the Aromas and Purisima areas from seawater intrusion after groundwater levels recover to protective elevations. The post-recovery pumping yields are based on modeled offshore flows required to protect against seawater intrusion; along with estimated recharge, non-District consumptive use, and District consumptive use factors (HydroMetrics WRI, 2012). SqCWD pumping for the Purisima area has ranged from 2,582 to 2,651 acre-feet per year the last five years, which is less than the estimated post-recovery pumping yield of 2,800 acre-feet per year for the Purisima area. Although SqCWD pumping in the Aromas area in Water Year 2013 of 1,609 acre-feet per year was the fourth year in a row with lower amounts than recorded from Water Years 1984-2009, this amount is still above the post-recovery pumping yield of 1,200 acre-feet per year for the Aromas area. Total SqCWD production in Water Year 2013 was 219 acre-feet above the combined post-recovery pumping yield of 4,000 acre-feet per year. However, to recover groundwater levels to protective elevations, pumping must be reduced below post-recovery pumping yields. SqCWD's current planning goal for allowing groundwater elevations to recover is to limit pumping to 2,900 acre-feet per year with an estimated recovery time frame of 20 years (HydroMetrics WRI, 2012). SqCWD's pumping goal of 2,900 acre-feet per year has been proposed as a revised numerical target for the GMP's Basin Management Objective 1-1: Pump within the Sustainable Yield. Both the post-recovery pumping yields and estimated recovery time frame assume average annual recharge and non-District consumptive use does not change from what has been estimated from current and historical data.

Available records starting in Water Year 1974 show that CWD has never pumped more than 1% above its sustainable yield share of 622 acre-feet per year that is implied in the

GMP. From calendar year 1993 through 2012, City of Santa Cruz has not pumped more than 1% above its sustainable yield share of 575 acre-feet per year that is assumed in the GMP.

Estimated production by private wells and small water systems, including residential, commercial, and agricultural supply, are also shown on Figure 2-3. Estimated private well production of approximately 1,711 acre-feet per year in the Purisima area has not been updated since Johnson et al. (2004) expanded on estimates developed by Wolcott (1999). The estimate forprivate well production in the Aromas area was updated to 974 acre-feet per year based on a land use study to estimate water use for the CWD groundwater model (HydroMetrics WRI and Kennedy/Jenks, 2014). Figure 2-4 shows the study areas for the Purisima and Aromas used for the estimates presented in Johnson et al. (2004) and how they relate to the Soquel-Aptos groundwater management area. The estimated private well pumping is based on water use factors estimated by Wolcott (1999). Water use factors for annual residential use include 0.39 acre-feet per parcel for suburban residences and 1.0 acre-feet per parcel for rural and mountain residences. The non-agricultural land use for the Aromas area is almost all rural and mountain residences.

Santa Cruz County also compiled estimates for consumption and/or number of service connections for small water systems a few years ago (Ricker, 2012). Small water production is updated based on this information and an annual water use factor of 0.442 acre-feet per connection estimated by Wolcott (1999). A survey conducted by Pajaro Valley Water Management Agency in 2009 showed annual water use factors ranging from 0.47 to 0.73 acre-feet per parcel for Aromas Water District, Central Water District, and San Andreas Mutual (Carollo, 2010)Figure 2-4 shows the location of small water systems and several other known groundwater users. Additional updates are based on pumping information provided by the Santa Cruz County Parks Department and Cabrillo College. The Parks Department provided estimates of Polo Grounds park irrigation well pumping (Branham, 2007) but the irrigation system was off the well by the end of September 2011 as SqCWD converted the well to municipal use. Cabrillo College provided pumping records for calendar year 2009 (Cabrillo College, 2010). Cabrillo College pumping for that year was one-third of the estimate provided by Wolcott (285 acre-feet per year). Table 2-1 summarizes water use estimates for the Purisima area in the Soquel-Aptos groundwater management area. Table 2-2 summarizes water use estimates for the Aromas area in the Soquel-Aptos groundwater management area.

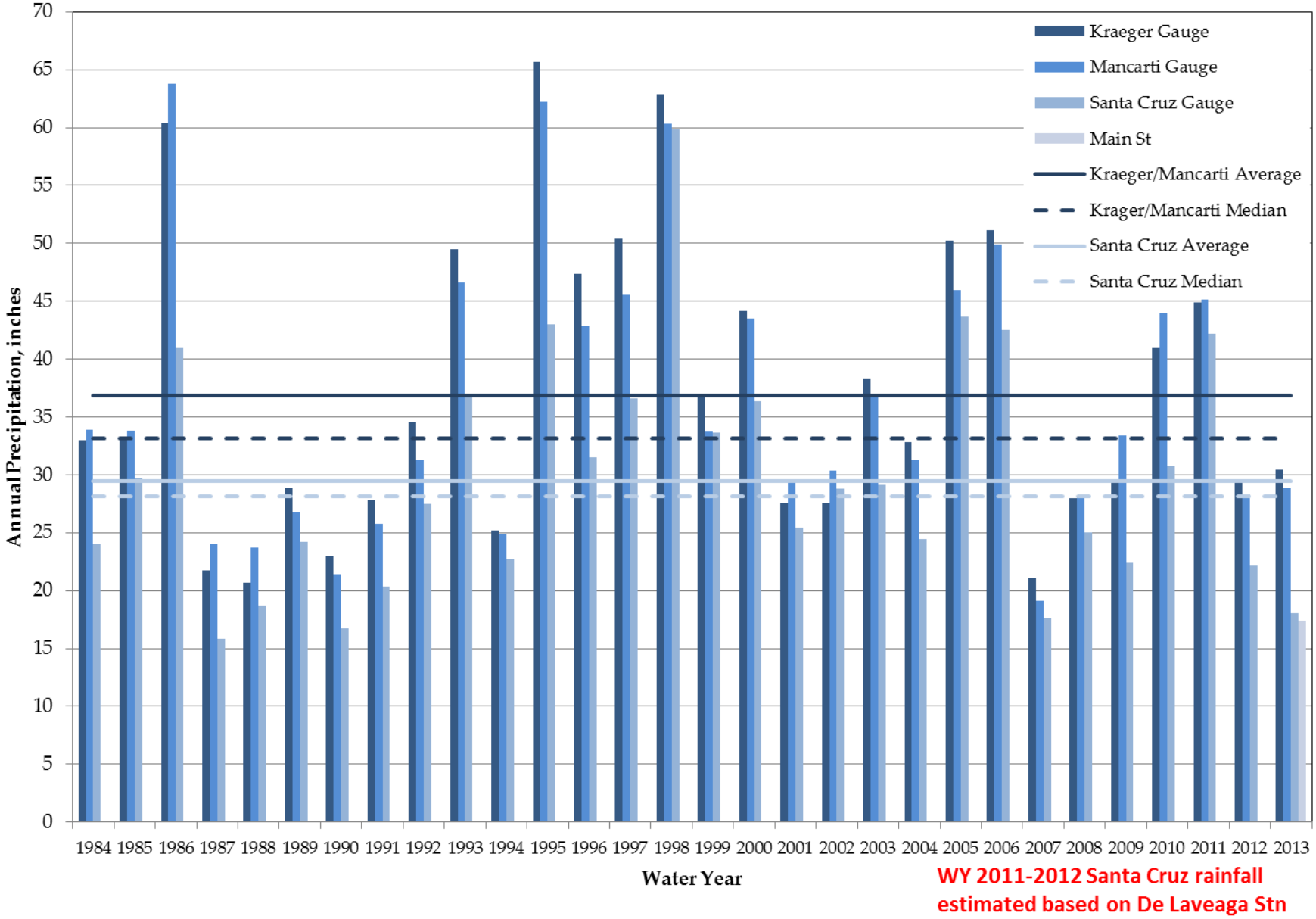

Figure 2-1: Precipitation at Kraeger, Mancarti, Santa Cruz Co-op, and Main Street Gauges

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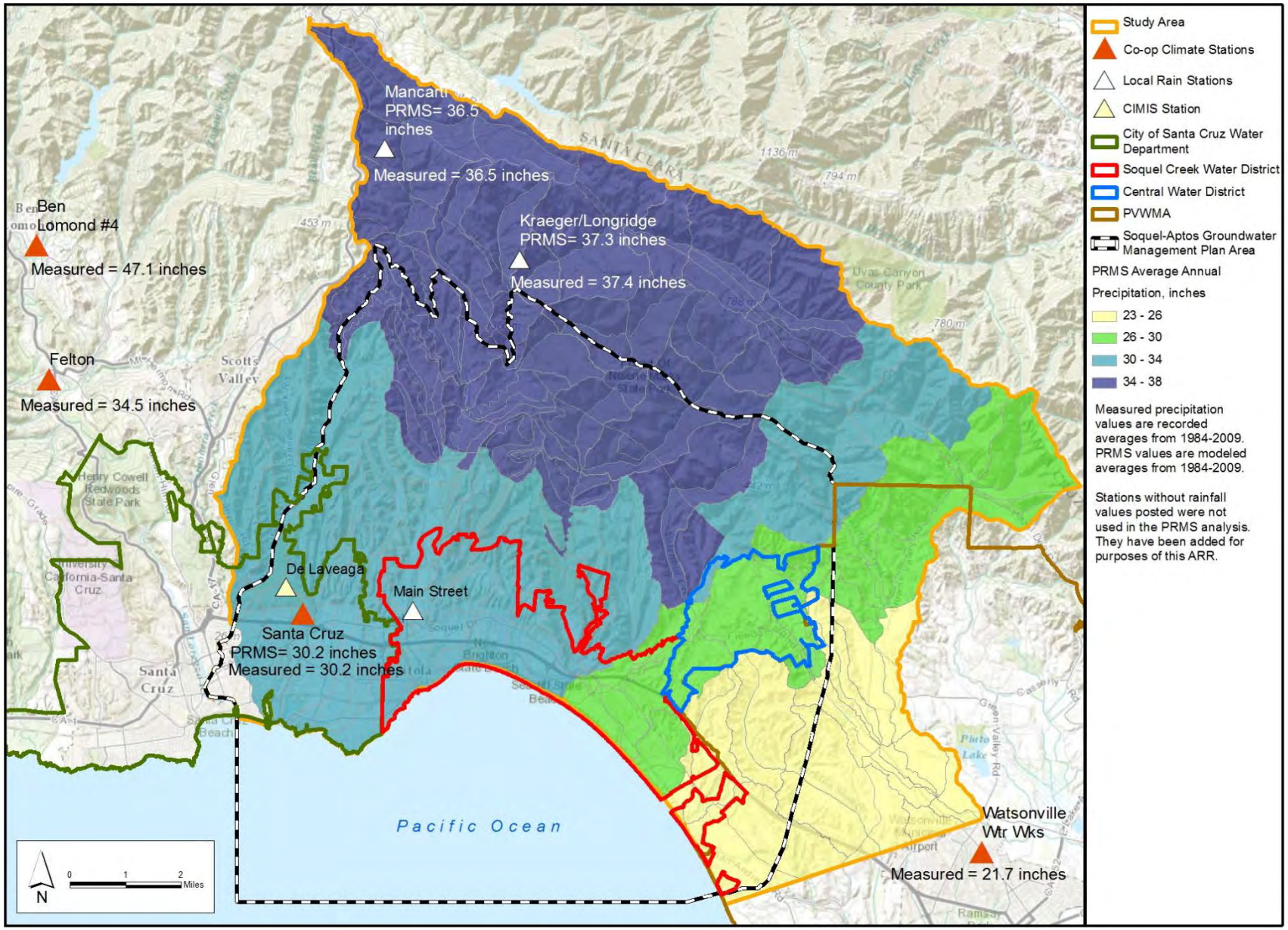

Figure 2-2: Rainfall Station Locations

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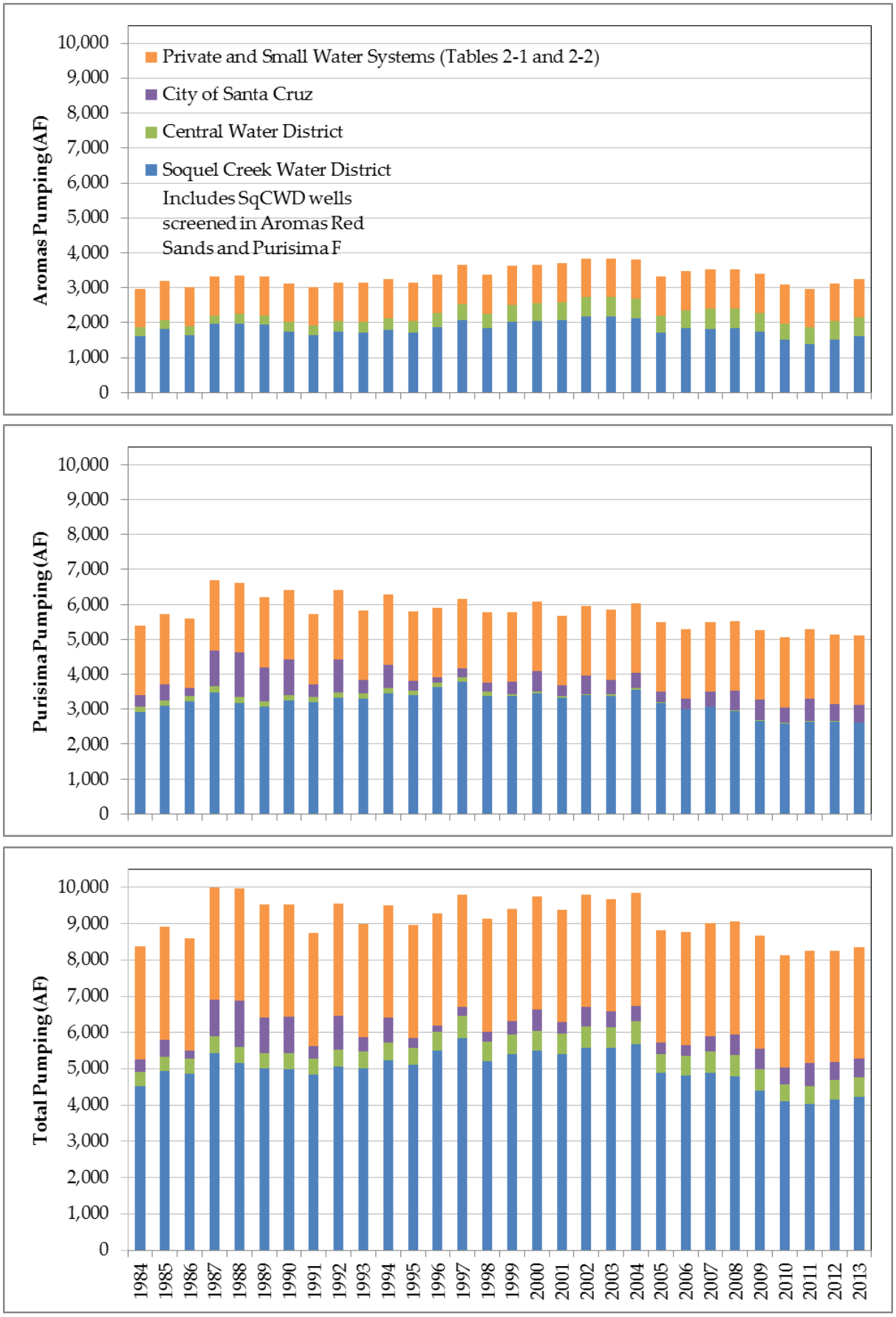

Figure 2-3: Pumping by Water Year in Acre-Feet

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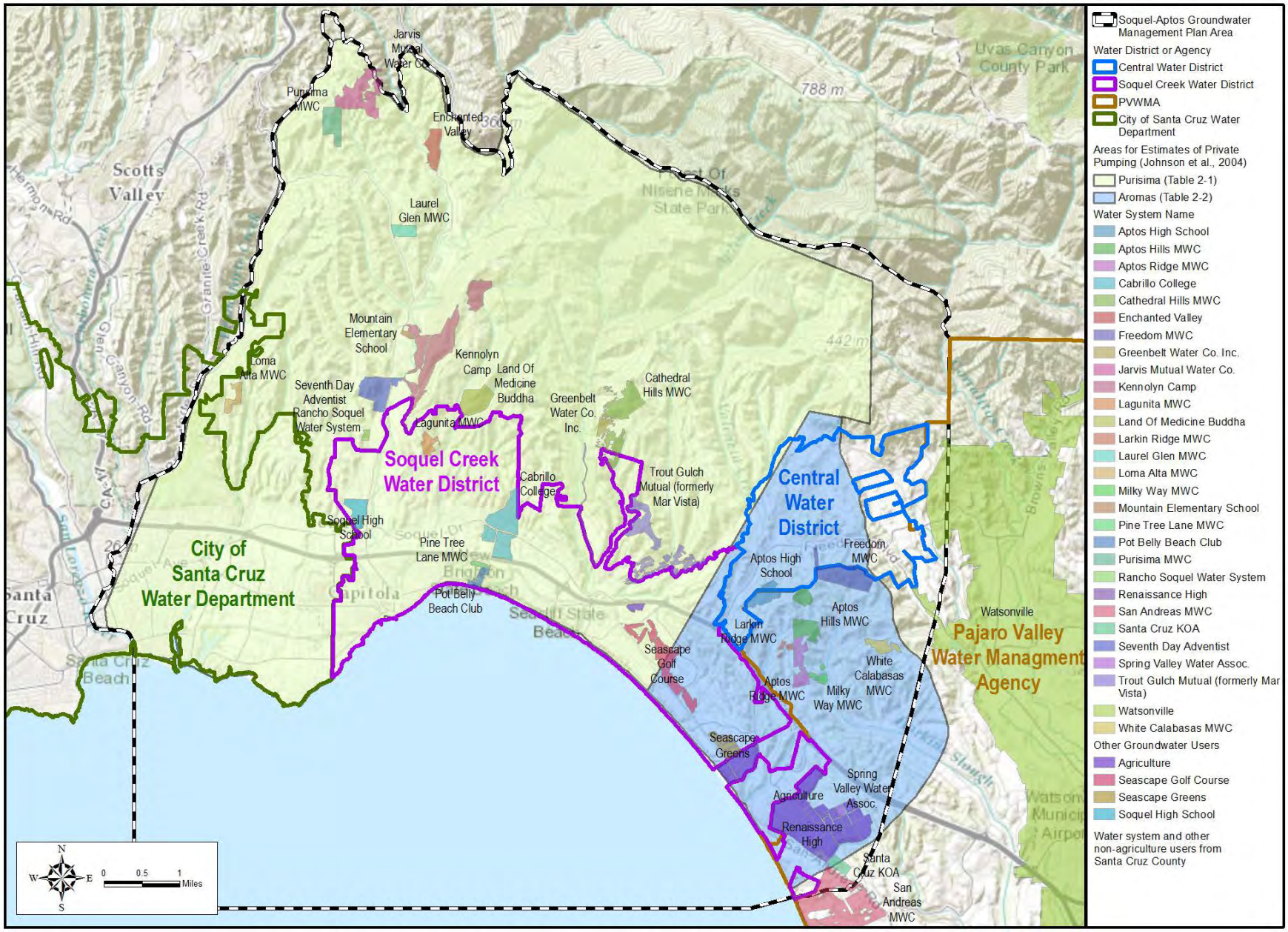

Figure 2-4: Study Areas for Estimating Private Pumping and Locations of Small Water Systems

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Table 2-1: Estimates of Non-Water Agency Pumping in the Purisima Area

User		Estimated Water Use (AF/year)	Source	Comments
Private Urban	Residential and Commercial	124	Wolcott, 1999	may include stream diversions
	Agriculture	93		
	Seascape Golf Course	232		
Private Rural	Residential and Commercial	1,099	Wolcott, 1999	
	Agriculture	163		
Small Water Systems	Cabrillo College	95	Cabrillo College, 2010	Calendar Year 2009
	Other Urban	21	Ricker, 2012, Wolcott 1999	Total connections from County and water use factor from Wolcott. 19 of 24 Pot Belly Beach Club connections removed from coastal wells in 2011 estimated to reduce pumping 8 AFY
	Rural	161		Annual consumption from County OR Total connections from County and water use factor from Wolcott
Total Purisima Area		**1,988**		

Table 2-2: Estimates of Non-Water Agency Pumping in the Aromas Area

User		Estimated Water Use (AF/year)	Source	Comments
	Polo Grounds Park	0	Branham, 2007	30 AFY to irrigate Park through 2011 prior to conversion to municipal well
Private Rural	Residential and, Commercial	601	HydroMetrics WRI and Kennedy/Jenks 2014	Calculated from GIS study of land use by parcel and water use factors from Wolcott
	Agriculture	373		
Small Water Systems	Rural	108	Ricker, 2012, Wolcott 1999, Faler 1992	Annual consumption from County OR Annual consumption from Faler OR Total connections compiled by County and water use factor from Wolcott
Total Aromas Area		**1,082**		

Water use factor from Wolcott is 0.442 AFY/connection.

SECTION 3 - WATER YEAR 2013 AQUIFER CONDITIONS FOR WESTERN PURISIMA AREA (A/AA/TU-UNITS)

This section presents groundwater level and water quality conditions for Water Year 2013 in the western portion of the Soquel-Aptos area where the primary production aquifers are the Purisima A-unit, the Purisima AA-unit, and the sub-Purisima Tu-unit.

3.1 SqCWD Service Area I and City of Santa Cruz Annual Production

In the western portion of the Soquel-Aptos area, groundwater is produced for municipal purposes by SqCWD in its Service Area I and the City of Santa Cruz from its Live Oak well field. SqCWD's Estates well in Service Area II to the east is also partially completed in the A-unit.

SqCWD's Service Area I production was 2,013 acre-feet in Water Year 2013, the seventh lowest annual amount since service area data have been recorded starting in 1984, but the highest in the last seven years. Production in Service Area I over the last nine years has been below the historical average. Water Year 2013 pumping in Service Area I was approximately 72% of the SqCWD's revised estimate of its post-recovery pumping yield for the Purisima area (HydroMetrics WRI, 2012). Water Year 2013 production at the Estates well in Service Area II was 221 acre-feet, the lowest amount since the well was brought online in 1986. Production at the Estates well in each of the last five years was lower than all years since 1991.

The City of Santa Cruz's production from the Live Oak well field was 515 acre-feet in Water Year 2013. However, the City's pumping season spans two water years as the pumping season typically extends from April-May to November-December so the City manages pumping based on calendar year totals. The City's pumping in calendar year 2013 was 524 acre-feet, which is similar to the City's planned maximum groundwater production during non-critically dry years such as 2013 of 525 acre-feet per year (Chambers Group, 2011). The planned pumping of 525 acre-feet per year is based on average annual production by the City since 1984.

The City of Santa Cruz's groundwater production depends on availability of its surface water supply resulting in larger annual variation in groundwater production than SqCWD. For calendar years 2008 to 2013, City production ranged from 473 to 548 acre-feet per year with an average of 517 acre-feet per year.

Figure 3-1 shows production at SqCWD wells in Service Area I, the Estates well, and the City's Live Oak well field by water year.

3.2 GROUNDWATER LEVEL CONDITIONS AND TRENDS

SqCWD has established protective groundwater elevations in coastal monitoring wells to protect the Purisima A-unit in the western portion of the Soquel-Aptos area from seawater intrusion. Cross-sectional models were used to estimate groundwater elevations that result in the long term freshwater-salt water interface in the Purisima A-unit being seaward of the coast (HydroMetrics LLC, 2009b).

In Water Year 2013, average coastal groundwater levels in two of the three SqCWD A-unit monitoring wells remained below protective elevations, as shown in Table 3-1. Due to a revision in surveyed reference elevations, average groundwater levels at SC-1A have been above the protective elevation in more years than previously thought, although they had been below the protective elevation in eight of nine water years from 2001 to 2009. Average groundwater levels have been above protective elevations starting in Water Year 2010. These groundwater levels coincide with lower pumping at the Garnet well; Annual pumping ranged from 132 to 325 acre-feet in Water Years 2010 to 2013, the lowest four years since Water Year 1997. Water Year 2013 pumping of 132 acre-feet was the lowest annual amount and the average groundwater level at SC-1A was the highest level since the Garnet well came online in 1996.

Groundwater levels at SC-3A and SC-5A did not meet protective elevations to protect against seawater intrusion in Water Year 2013. The hydrographs at the end of the section show that average groundwater levels have been below protective elevations for the entire period of record at SC-3A and SC-5A.

Table 3-1 (2013): Comparison of Water Year 2013 Coastal Groundwater Levels with Protective Levels in Western Purisima Area

Unit A Well	Location	Minimum Groundwater Elevation[1] (feet msl)[2]	Maximum Groundwater Elevation (feet msl)	Average Groundwater Elevation (feet msl)	Protective or Target Elevation (feet msl)
SC-1A	Prospect	3.7	14.9	10.1	4
SC-3A[4]	Escalona	1.8	6.710.2	4.8	10
SC-5A[5]	New Brighton	-1.0	7.8	2.8	13
Moran Lake Medium		4.8	6.3	5.5	5.0[3]
Soquel Point Medium		4.2	6.8	5.3	6.0[3]
Pleasure Point Medium		4.6	9.2	7.0	6.1[3]

[1] Based on monthly data except where noted

[2] msl = mean sea level

[3] Target elevations proposed by City of Santa Cruz (Almond, 2012)

[4] Based on seven months of data: October, December, February, and April-July.

[5] Based on six months of data: October, December, February, and April, June, and July

The City of Santa Cruz has proposed annual averages of 5.0-6.1 feet msl as target groundwater elevations for its coastal monitoring wells at Pleasure Point, Soquel Point, and Moran Lake during non-critically dry years. For critically dry years, the City has proposed minimum quarterly averages of 2 feet msl as target groundwater elevations for its three coastal monitoring wells (Almond, 2012). The City defines critically dry years as years with less than 29,000 acre-feet runoff at the Felton gauge on the San Lorenzo River (City of Santa Cruz, 2009). The hydrographs for these wells identify when water years were classified as critically dry and the target groundwater elevation would have been the minimum quarterly average of 2 feet msl.

Water Year 2013 was not critically dry; and the target elevations for the City of Santa Cruz coastal monitoring wells were 5.0-6.1 feet msl. As shown on Table 3-1, the average groundwater level in the Soquel Point well was below the City's target elevation, while the average groundwater levels in the Moran Lake and Pleasure Point wells were above the City's target elevation in Water Year 2013. Due to a revision in surveyed reference elevations, groundwater levels in the Soquel Point well have been higher than previously thought, but average groundwater levels have still been below target elevations since Water Year 2008. Average groundwater levels in the Moran Lake well have been above the target

elevation since the well was installed in 2004. Average groundwater levels in the Pleasure Point well have been above the target elevation the last four years after falling below the target elevation in Water Year 2009. Combined Beltz #7/#10 and #8 well pumping has been between 211 and 316 acre-feet per year for the last four years after being between 383 and 411 acre-feet per year for the previous three years. Groundwater levels from the Medium completion of these well clusters are used because it is the deepest completion in the A unit, which is the primary aquifer supplying the Live Oak well field, and it has lower groundwater levels than the Deep completion in the AA unit.

Table 3-2 summarizes the important groundwater level trends by monitoring well. Changes to trends in WY 2013 include:

- Decline in groundwater levels at SC-3A and SC-5A in WY 2013 though the long term trend is rising. SqCWD service area I pumping was increased in WY 2013.
- A decline of groundwater levels at inland monitoring wells. Groundwater levels at City of Santa Cruz Coffee Lane Park, Auto Plaza Drive, and Cory Street declined over WY 2013 with Cory Street groundwater levels dropping approximately 10 feet from WY 2012. Although the City's 30th Avenue and SqCWD's SC-22 wells were only installed in 2012 and there is not much of a previous record for comparison, there were declines in groundwater levels at those wells over WY 2013 also. There were several pumping tests at the City's newly constructed Beltz 12 well near Cory Street during October-November 2012 and August 2013 but this may not fully explain the decline that is consistent from month to month. Monitoring of the O'Neill well during the August 2013 test showed slow recovery. The recently constructed O'Neill well and Beltz 12 well are expected to extract mostly from the sub-Purisima Tu unit. The long-term recharge rate of the Tu unit may be limited.

Hydrographs for multiple completions of these wells follow at the end of this section. Hydrographs for multiple completions of monitoring wells adjacent to production wells are also included following this section.

Hydrographs for single wells including production wells are included with chemographs. These hydrographs show trend lines and rates of change for Water Years 2009-2013 when municipal production for the Western Purisima has been below historical averages.

Contour maps of groundwater elevations in Spring and Fall 2012 for the Purisima A-unit and AA-unit are shown in Figure 3-2 and Figure 3-3. Figure 3-2 shows that spring coastal groundwater levels in the A-unit were higher than SqCWD's protective elevation and the City's target elevations in the western half of the western Purisima area, but Figure 3-3 shows that fall coastal groundwater levels in the A-unit were lower than protective or target elevations in much of the area. Figure 3-3 shows Fall 2013 pumping depressions below sea level extending from the Maplethorpe well to the Estates well in the eastern portion of the A-unit, and included a portion of the coast. The area of pumping depressions below sea level was similar to Fall 2012.

As inferred from the contour maps, groundwater flows towards a large pumping depression around SqCWD's production wells and a smaller pumping depression around the City of Santa Cruz's production wells. The contour maps indicate significant flow from the northwest consistent with outcrop areas for the A and AA- units being towards the north and west (Johnson et al., 2004).

Table 3-2 (2013): Summary of Groundwater Level Trends in Western Purisima Area

Category	Well	Groundwater Level Trend Description	Notes
SqCWD Coastal Monitoring A-unit Wells	SC-1A	Rise of 6 feet from WY 2009 to WY 2013.	Reduced pumping at Garnet
	SC-3A	Decline of ~4 feet from WY 2010-2013	Increased pumping at Rosedale in WY 2011-2013 vs. WY 2009-2010
	SC-5A	Long-term increasing trend, but decline of 3 feet in WY 2013 from Wy 2012	No substantial change in Estates and Tannery II pumping in WY 2013, but Service Area I pumping increased
City of Santa Cruz Coastal A and AA-unit Wells	Moran Lake	Decline since WY 2006	Increased pumping at Beltz #9 WY 2008-2013 compared to WY 1999-2007
	Soquel Point	Steady since WY 2009	
	Pleasure Point	Rise WY 2010-2013	Reduced pumping at Beltz #8 and #10 WY 2010-2013 compared to WY 2007-2009
SqCWD Coastal Monitoring B and BC-unit Wells	SC-1B SC-3C	Decline of 5-10 feet in overlying unit since WY 1998	Decreased rainfall since WY 1998
		Decline since WY 2011 after slight rise WY 2010-2011	Lower precipitation in WY 2012-2013 compared to WY 2010-2011
Inland A and AA unit wells	Coffee Lane Park	Decline since WY 2011 after rise WY 2010-2011	None
	Auto Plaza Drive	Decline over WY 2013	None
	Cory Street	Decline ~10 ft in WY 2013	Testing of Beltz 12 well Oct-Nov 2012 and Aug 2013
Inland AA and Tu-unit Wells	SC-10AA	Decline of 5-10 feet in inland AA-unit since WY 2002; Steady in WY 2012-2013	None
	Thurber Lane Deep	Decline of 50 feet in inland Tu-unit since WY 2005; Slight decline WY 2009-2013	None

3.3 WATER QUALITY CONDITIONS AND TRENDS

The most significant groundwater quality threat in the Soquel-Aptos basin is seawater intrusion. As discussed above, average groundwater levels generally remain below protective elevations in the A-unit. As a result, there is ongoing risk of seawater intrusion into the productive units of the western Purisima area.

Observed Total Dissolved Solids (TDS) and chloride concentrations in production wells do not suggest any seawater intrusion impacting SqCWD's production wells in the Purisima A and AA-units and sub-Purisima Tu-unit. Observed TDS and chloride concentrations in SqCWD's monitoring wells also do not indicate incipient seawater intrusion. The maximum contaminant limit (MCL) for chlorides is 250 mg/L and recent chloride concentrations in both production and monitoring wells have been below 100 mg/L or less except for a one-time measurement at SC-3RC in April 2010 (wells replacing SC-3 wells at Escalona in 2009 were labeled SC-3R). Chemographs for SqCWD wells in the area are included at the end of this section.

Higher chlorides and TDS concentrations were observed in Water Year 2013 at SC-1A than previous years. However, an evaluation of the general mineral composition concluded that there was no consistent indication of seawater intrusion (HydroMetrics WRI, 2014). Another indication that seawater intrusion is not occurring is the higher salt concentrations coincided with higher groundwater levels at SC-1A. At wells where chloride concentrations are less than 100 mg/L, there is generally no correlation between changes in salt concentrations and groundwater levels.

TDS and chloride concentrations at two City of Santa Cruz monitoring wells near the coast have suggested seawater intrusion. Chloride concentrations in the Medium completion (A-unit) of the Moran Lake well cluster have steadily decreased from a maximum of 700 mg/L in 2005 to below 250 mg/L in 2012 for the first time since measurements began in 2004. Chloride concentrations in the Medium completion (A-unit) of the Soquel Point well cluster have remained relatively stable above 1,100 mg/L starting in 2005. Chloride concentrations in the Deep completion (AA-unit) of the Soquel Point well cluster have shown an increasing trend from 67 mg/L to 130 mg/L since 2004. The City replaced the Deep Soquel Point well in 2012 due to concerns about whether water quality data

from the well were representative, but samples from the replacement well in 2013 confirm the increasing trend in chloride concentrations

Groundwater pumped from the Purisima formation continues to be treated for iron and manganese to meet drinking water standards. In Water Year 2013, color and turbidity were also reduced during treatment to meet drinking water standards.

3.4 STATE OF THE AQUIFER SUMMARY

Seawater intrusion has not been detected in most of the Western Purisima area. However, the productive Purisima A and AA-units remain at risk for seawater intrusion as coastal groundwater levels remain below SqCWD's protective elevations or the City's target elevations in three of the six coastal monitoring well locations. There has been lower overall production in the last seven years versus the historical average. However, increased production in WY 2013 compared to the previous six years resulted in some groundwater level declines at wells in the Purisima A and AA-units. A longer period of low production with adaptive management of the pumping distribution will be required to recover the basin to protect against the risk of seawater intrusion.

SqCWD and City have installed inland production wells (O'Neill Ranch and Beltz #12) that will extract primarily from the Tu unit. Groundwater levels measured during testing of these wells indicate recharge rate of the Tu unit may be limited so active management of pumping these wells based on groundwater levels in the Tu unit will be needed when these wells come online.

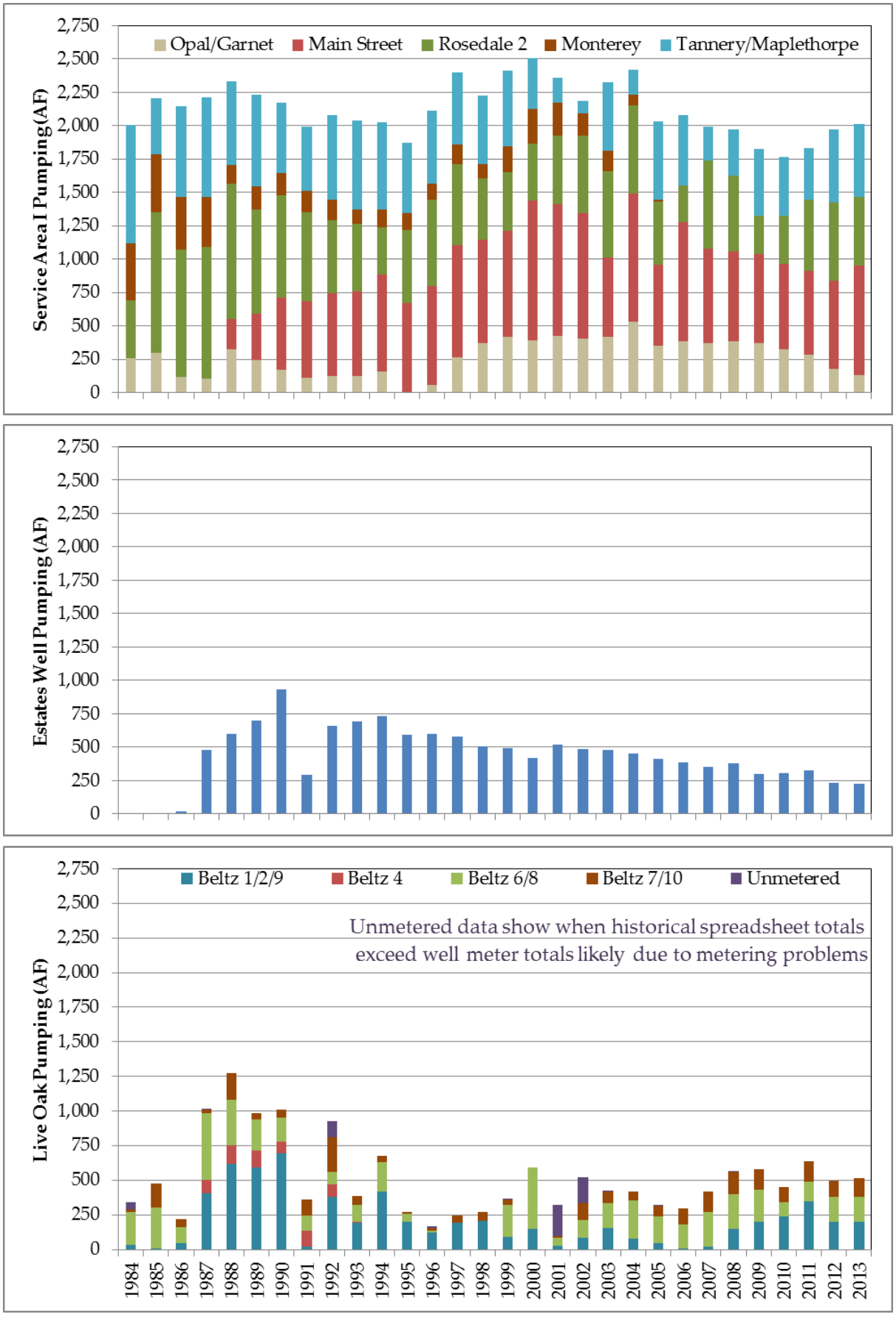

Figure 3-1: Pumping by Water Year in Western Purisima Area

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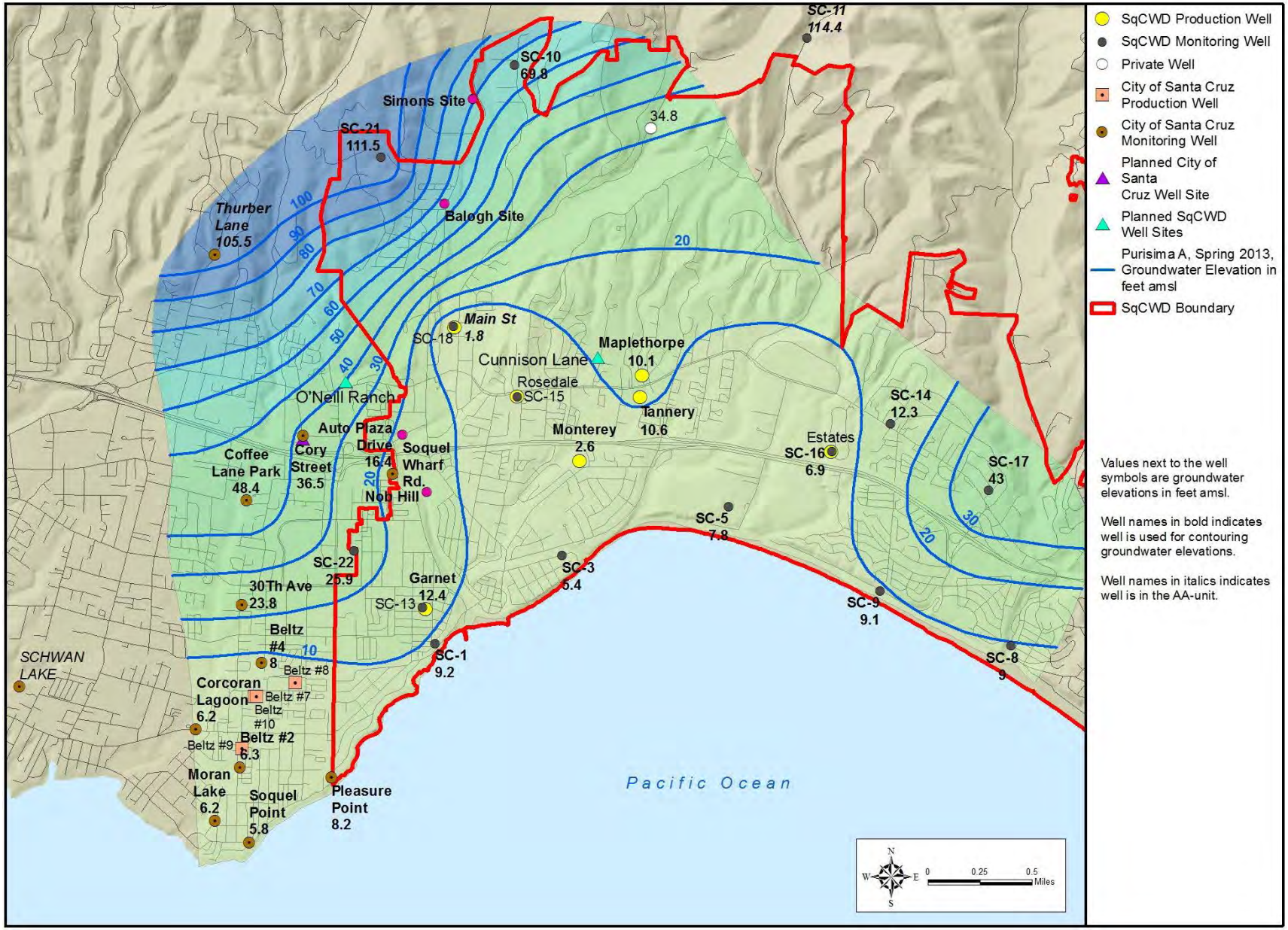

Figure 3-2 (2013): Groundwater Elevation Contours, Purisima A-Unit, Spring 2013

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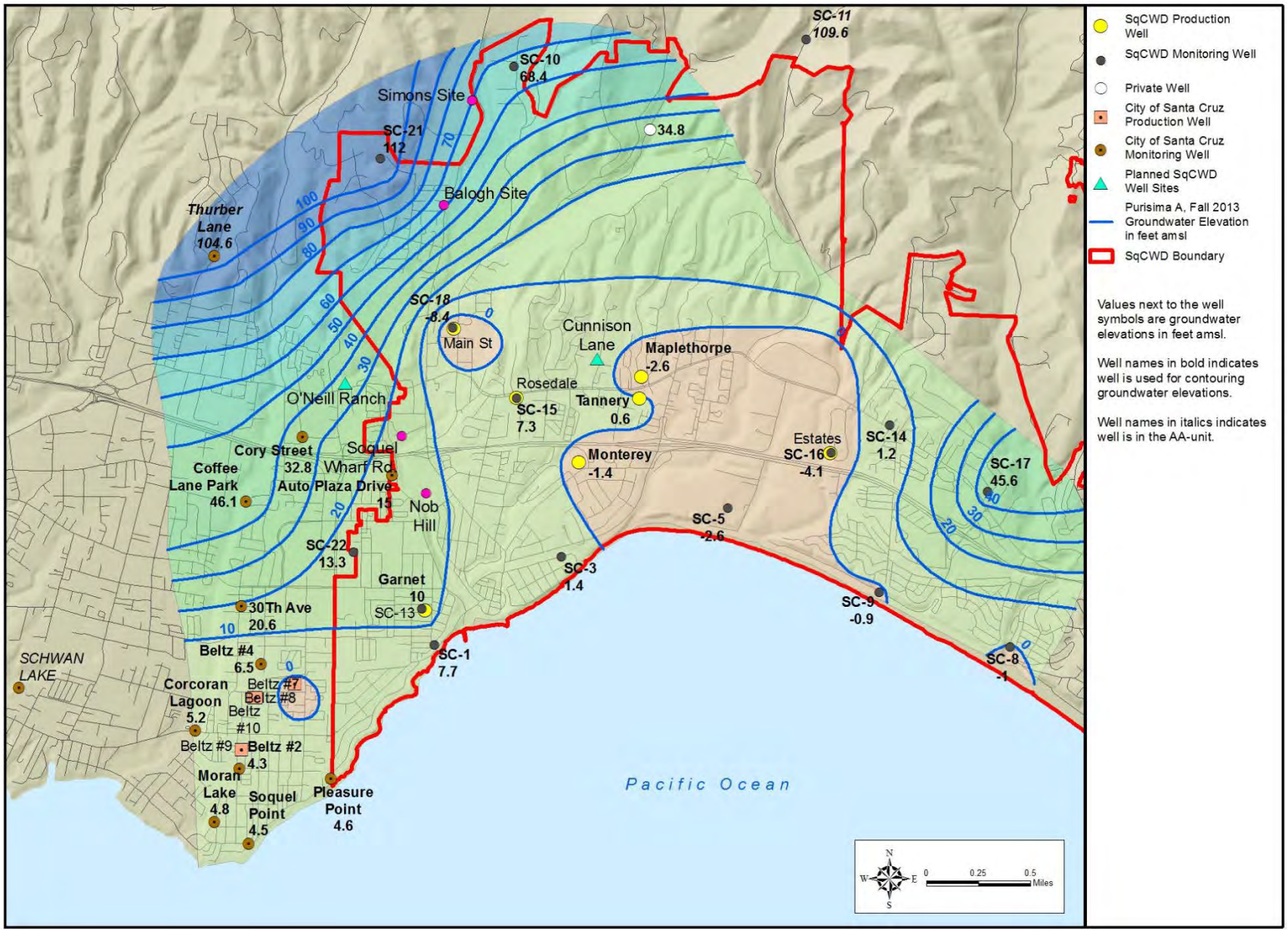

Figure 3-3 (2013): Groundwater Elevation Contours, Purisima A-Unit, Fall 2013

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Monitoring Well Hydrographs for Western Purisima Area

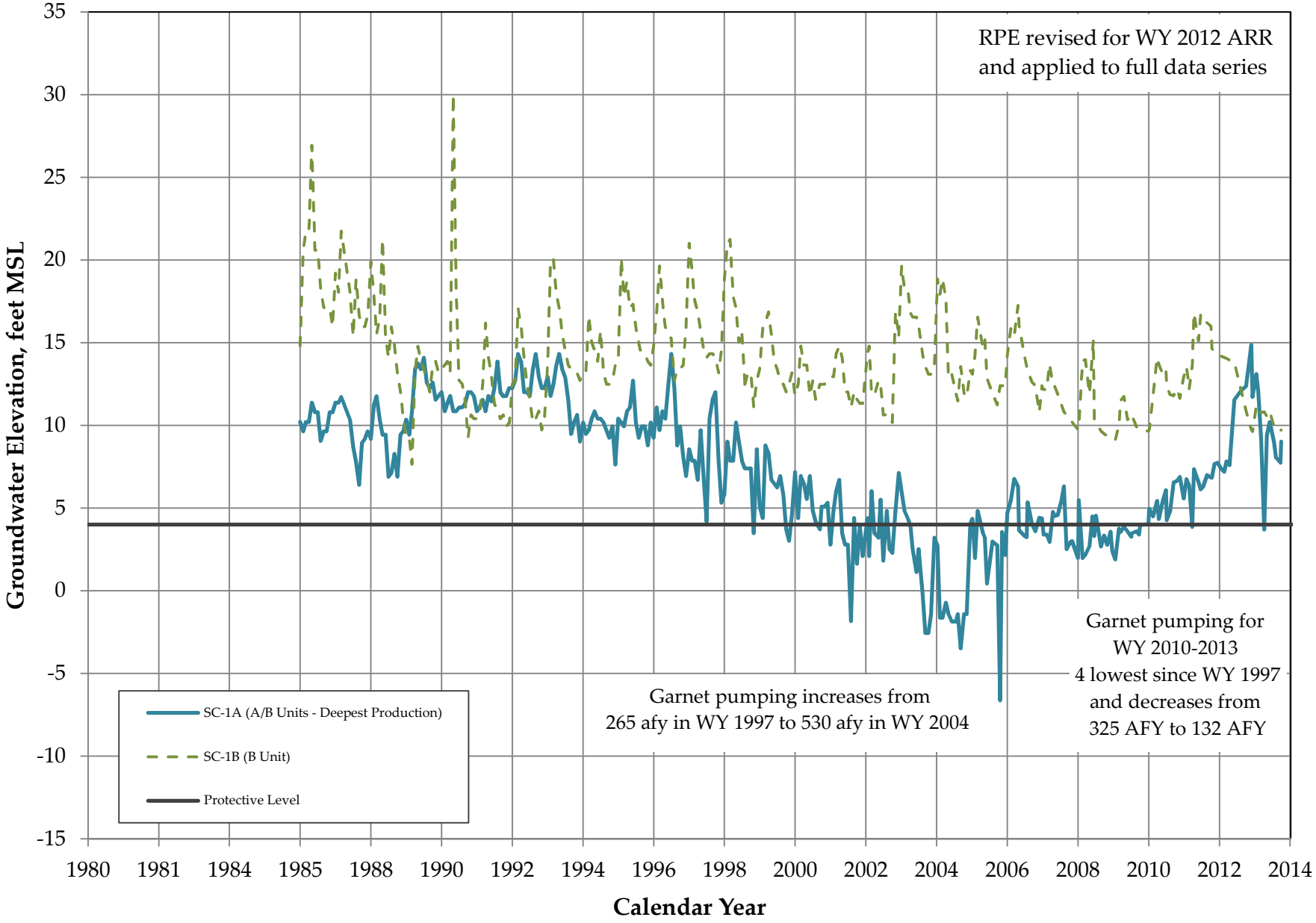
Hydrographs of SqCWD Coastal Monitoring Well Clusters

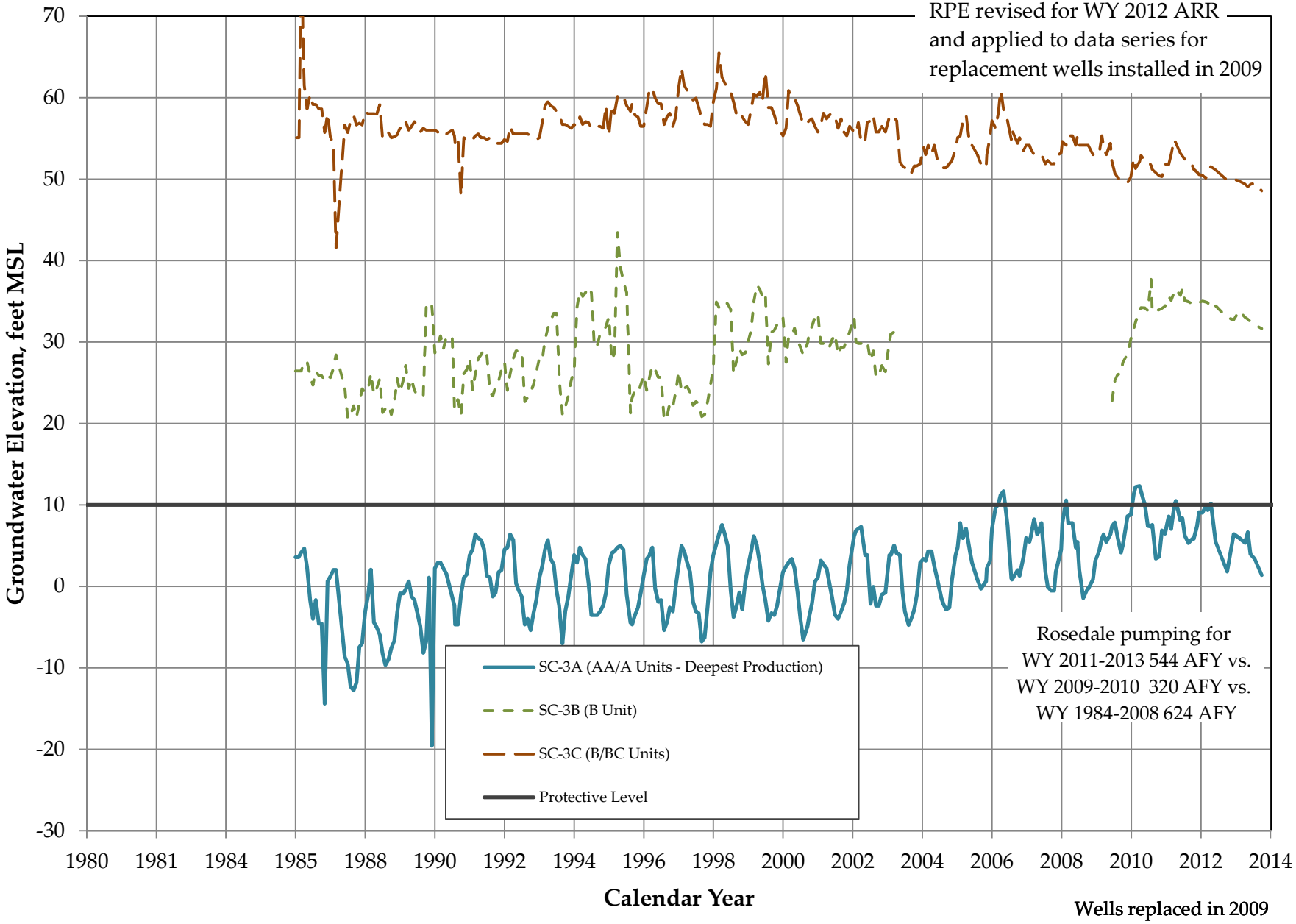
Hydrographs of City of Santa Cruz Coastal Monitoring Well Clusters

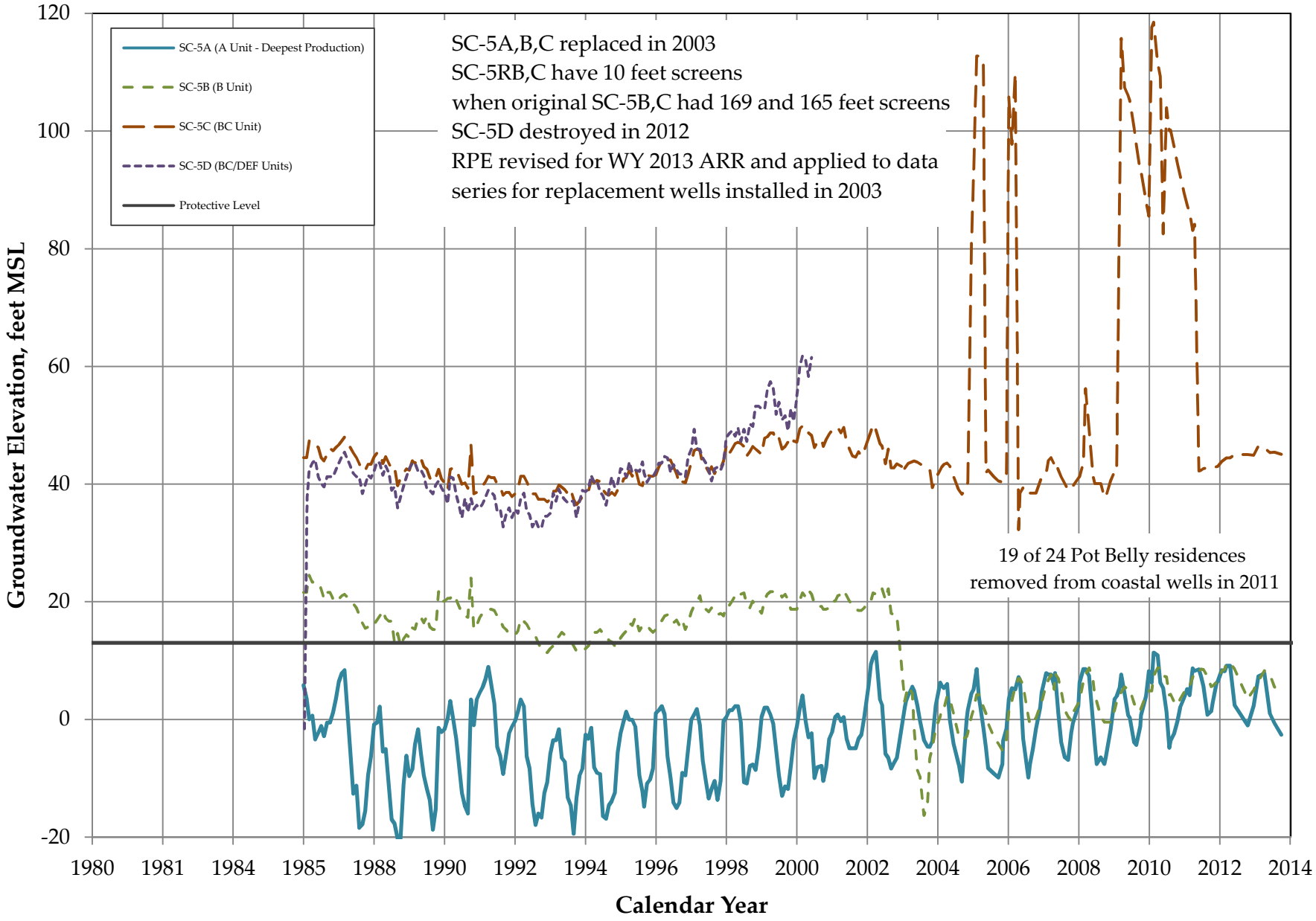
Hydrographs of SqCWD Inland Monitoring Well Clusters

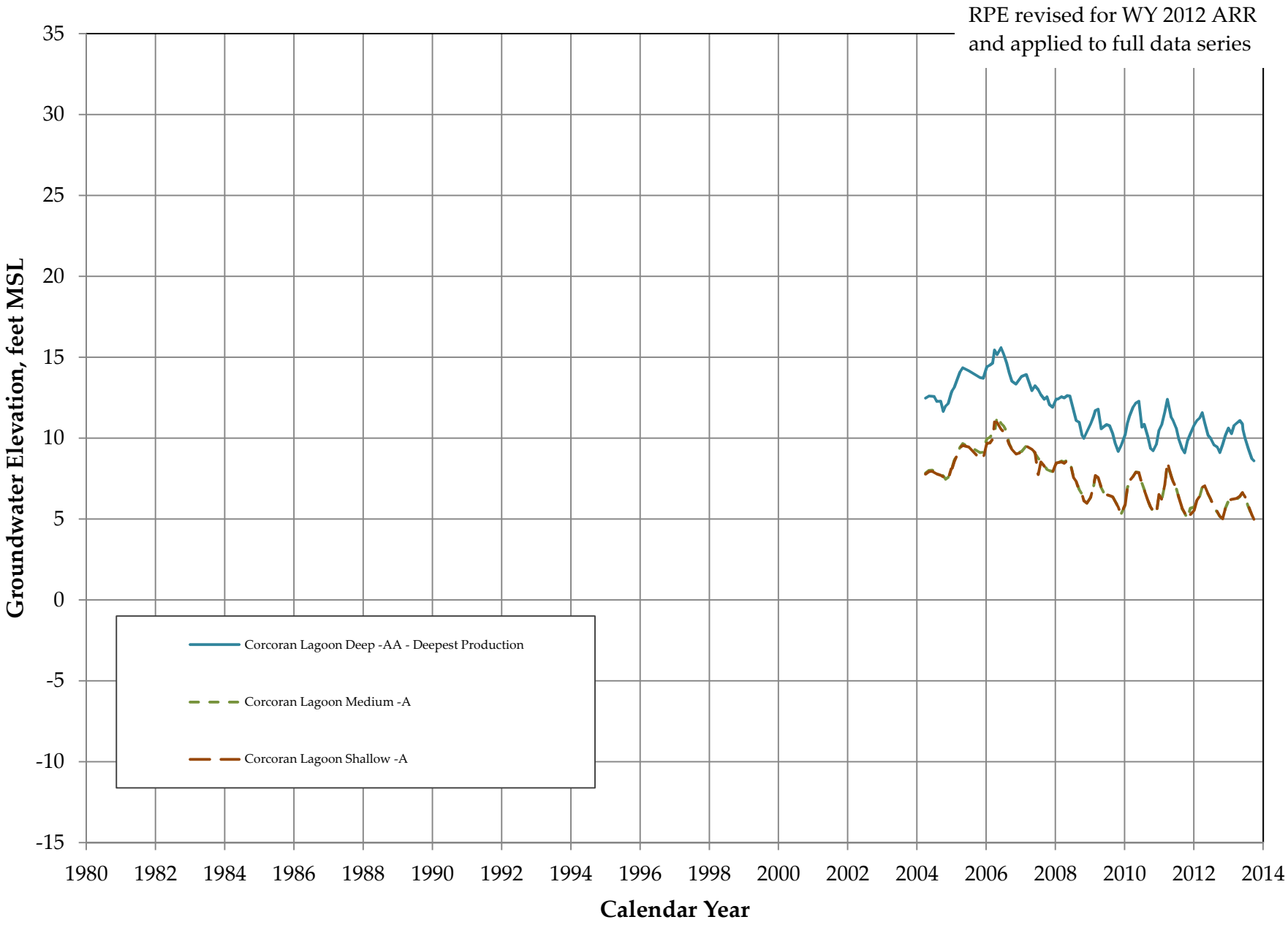
Hydrographs of City of Santa Cruz Inland Monitoring Well Clusters

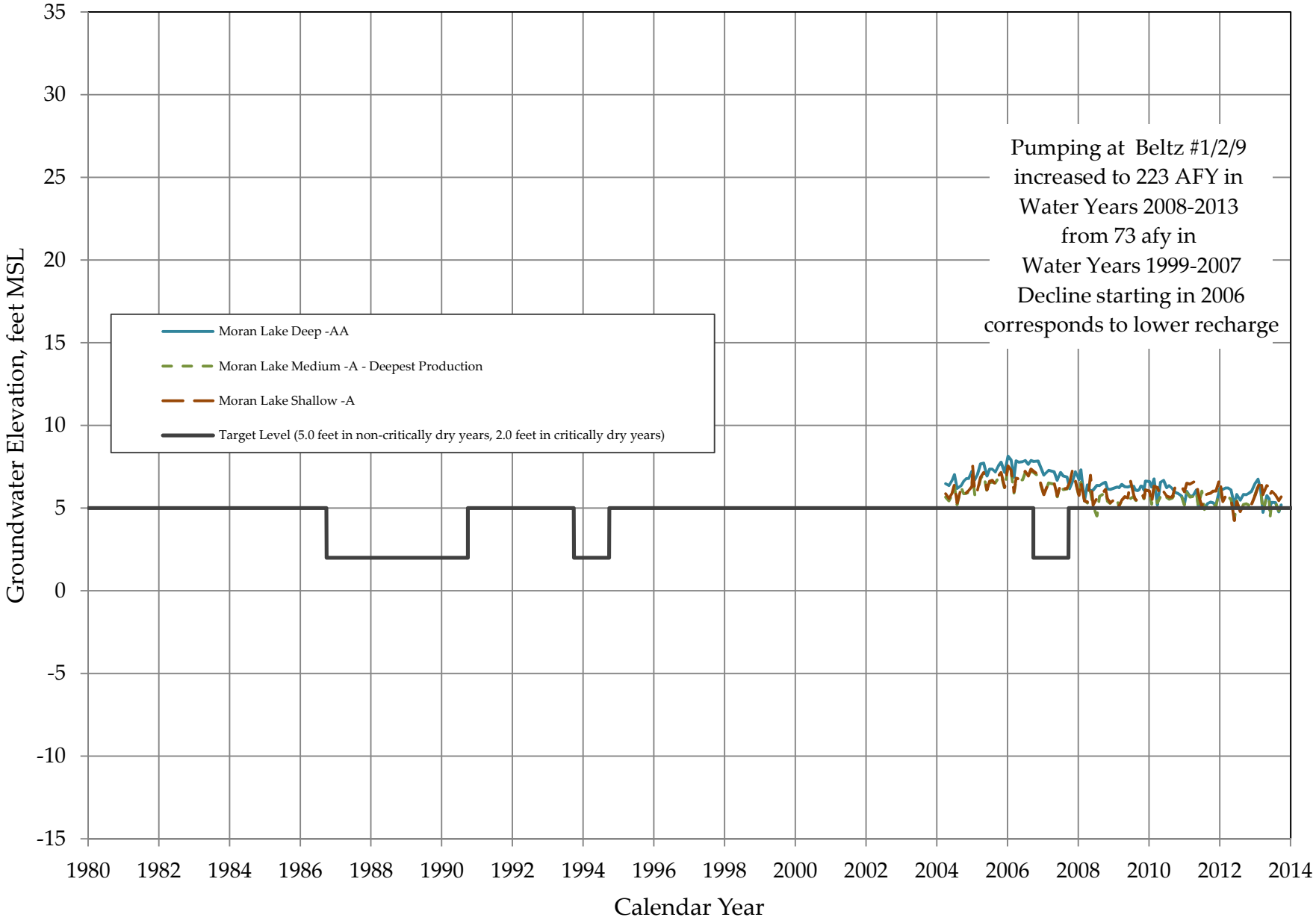
Hydrographs of SqCWD Monitoring Wells Adjacent to Production Wells

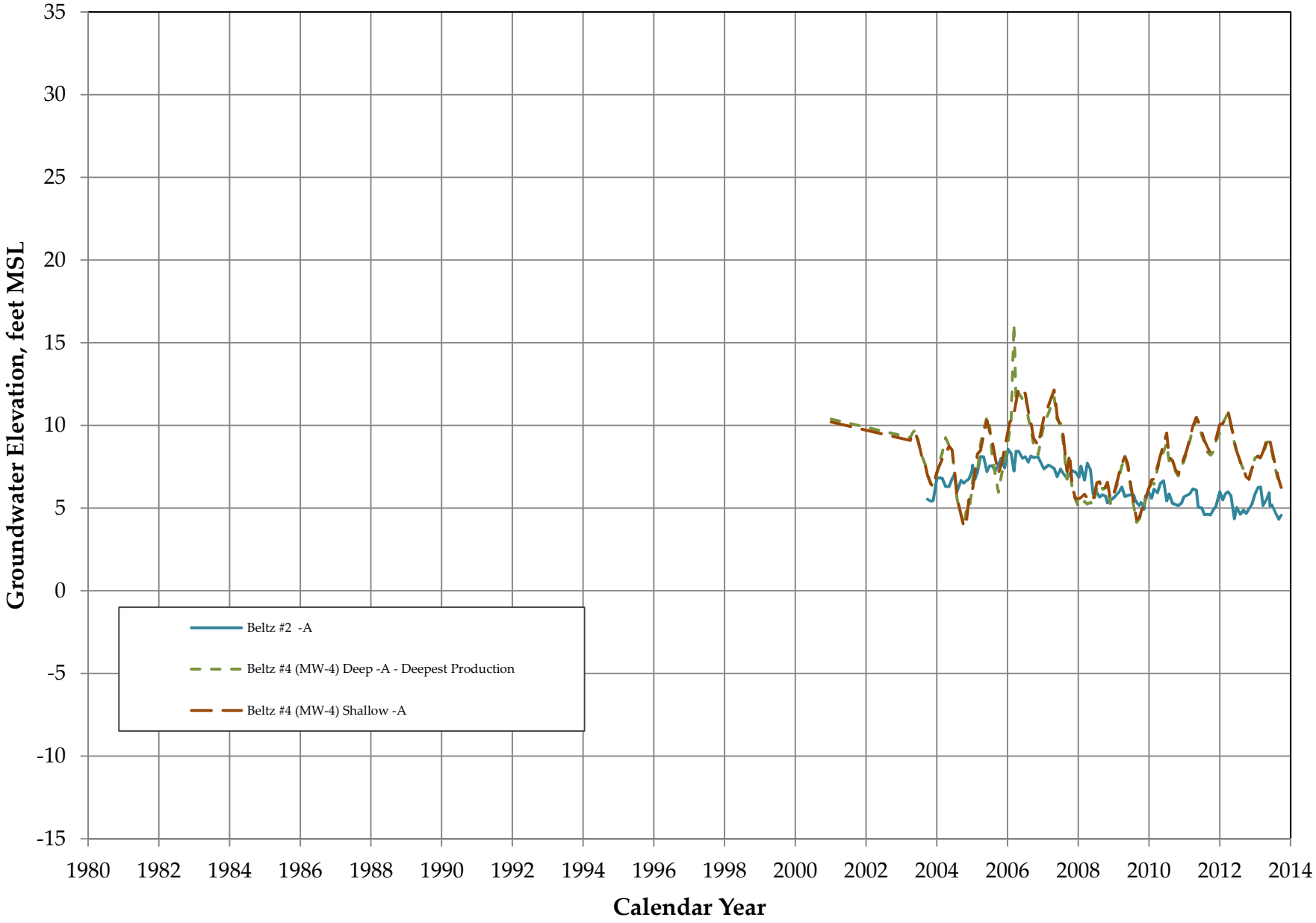

RPE revised for WY 2012 ARR
and applied to full data series
Garnet pumping increases from
265 afy in WY 1997 to 530 afy in WY 2004
Garnet pumping for
WY 2010-2013
4 lowest since WY 1997
and decreases from
325 AFY to 132 AFY
SC-1A (A/B Units - Deepest Production)
SC-1B (B Unit)
Protective Level
Groundwater Elevation, feet MSL
Calendar Year
35
30
25
20
15
10
5
0
-5
-10
-15
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

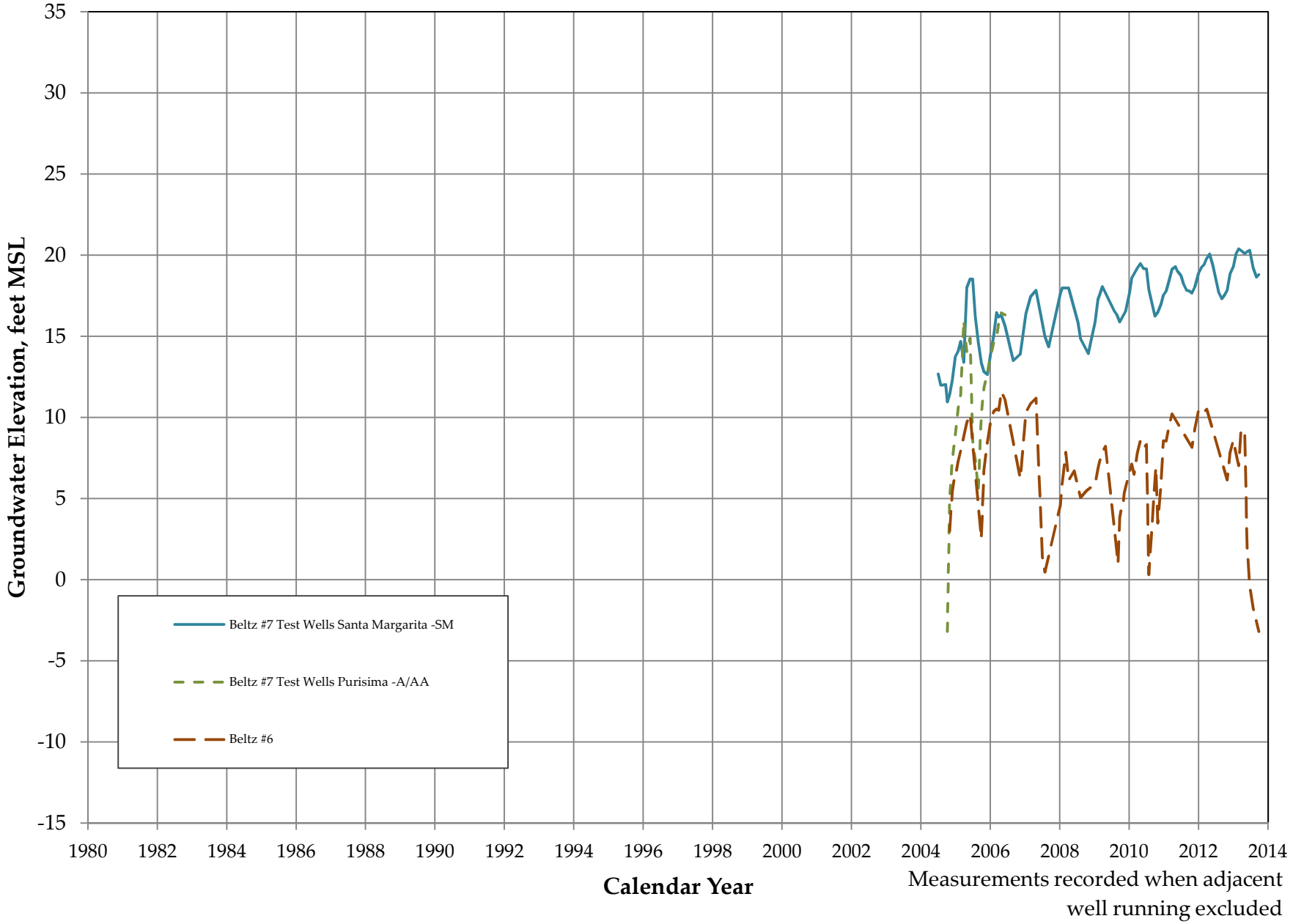

RPE revised for WY 2012 ARR and applied to data series for replacement wells installed in 2009
Groundwater Elevation, feet MSL
70
60
50
40
30
20
10
0
-10
-20
-30
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-3A (AA/A Units - Deepest Production)
SC-3B (B Unit)
SC-3C (B/BC Units)
Protective Level
Rosedale pumping for
WY 2011-2013 544 AFY vs.
WY 2009-2010 320 AFY vs.
WY 1984-2008 624 AFY
Wells replaced in 2009

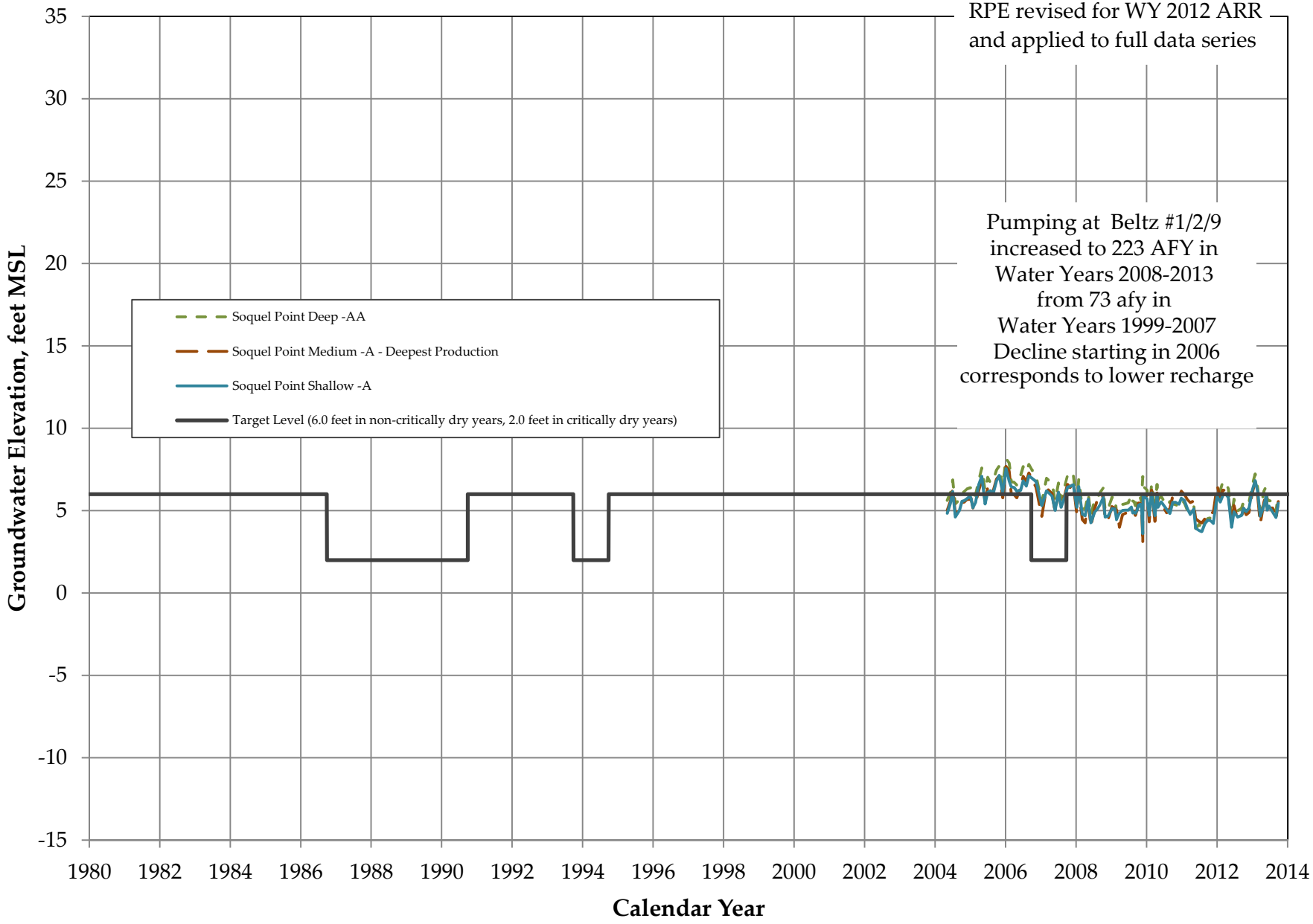

SC-5A (A Unit - Deepest Production)
SC-5B (B Unit)
SC-5C (BC Unit)
SC-5D (BC/DEF Units)
Protective Level
SC-5A,B,C replaced in 2003
SC-5RB,C have 10 feet screens
when original SC-5B,C had 169 and 165 feet screens
SC-5D destroyed in 2012
RPE revised for WY 2013 ARR and applied to data
series for replacement wells installed in 2003
19 of 24 Pot Belly residences
removed from coastal wells in 2011
Groundwater Elevation, feet MSL
120
100
80
60
40
20
0
-20
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year

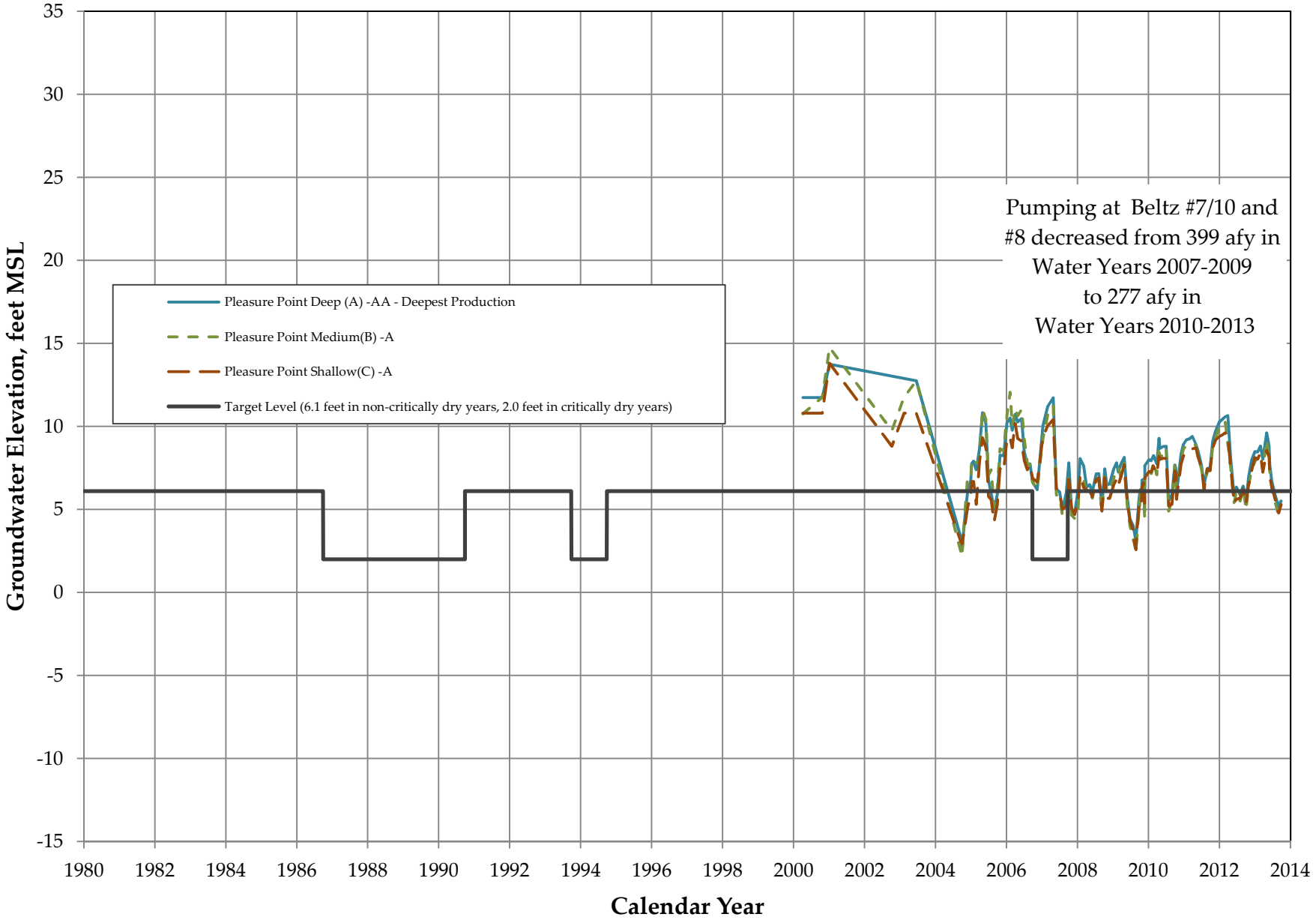

RPE revised for WY 2012 ARR and applied to full data series
Groundwater Elevation, feet MSL
35
30
25
20
15
10
5
0
-5
-10
-15
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Corcoran Lagoon Deep -AA - Deepest Production
Corcoran Lagoon Medium -A
Corcoran Lagoon Shallow -A

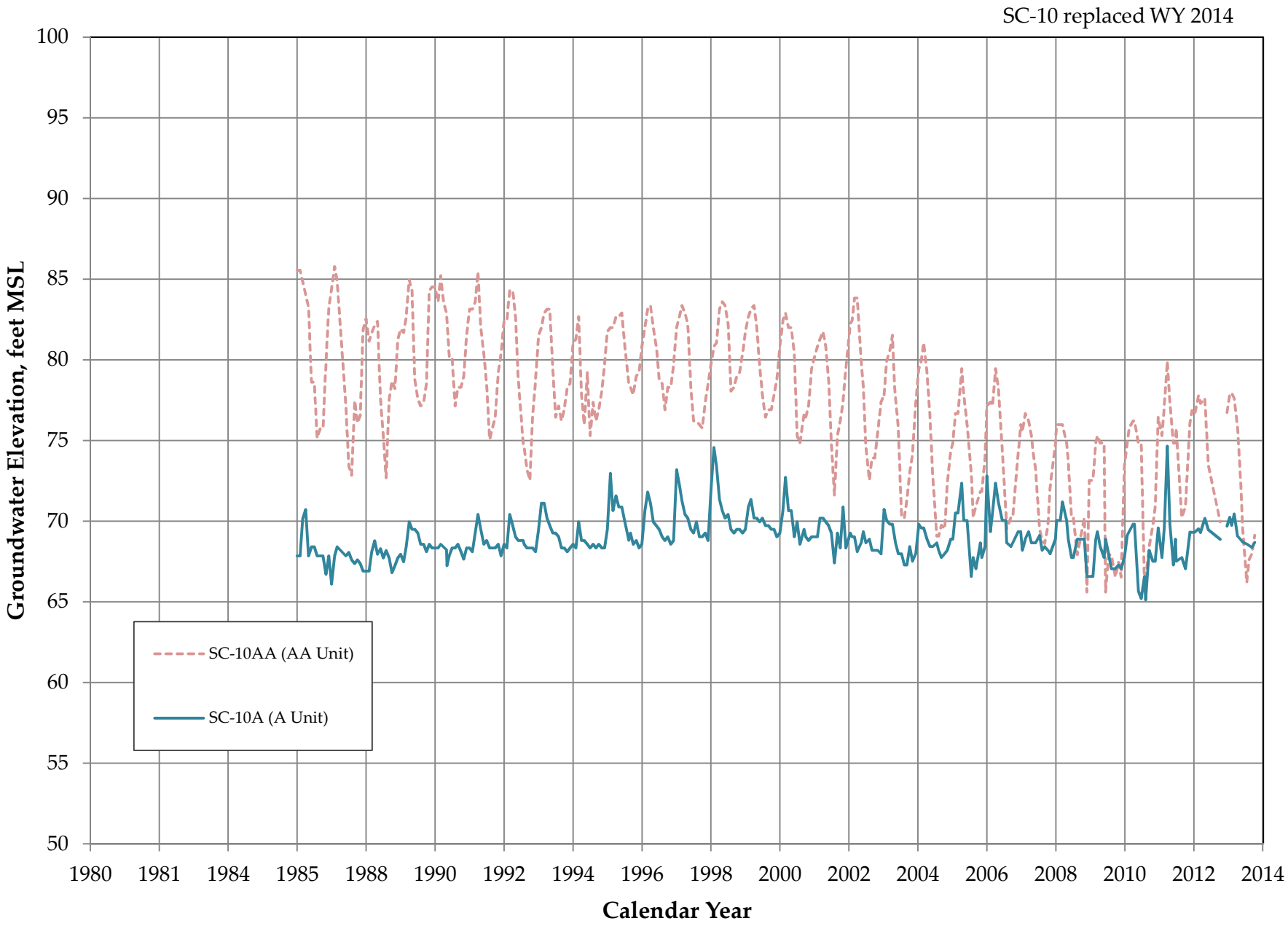

Groundwater Elevation, feet MSL
35
30
25
20
15
10
5
0
-5
-10
-15
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Moran Lake Deep -AA
Moran Lake Medium -A - Deepest Production
Moran Lake Shallow -A
Target Level (5.0 feet in non-critically dry years, 2.0 feet in critically dry years)
Pumping at Beltz #1/2/9 increased to 223 AFY in Water Years 2008-2013 from 73 afy in Water Years 1999-2007 Decline starting in 2006 corresponds to lower recharge

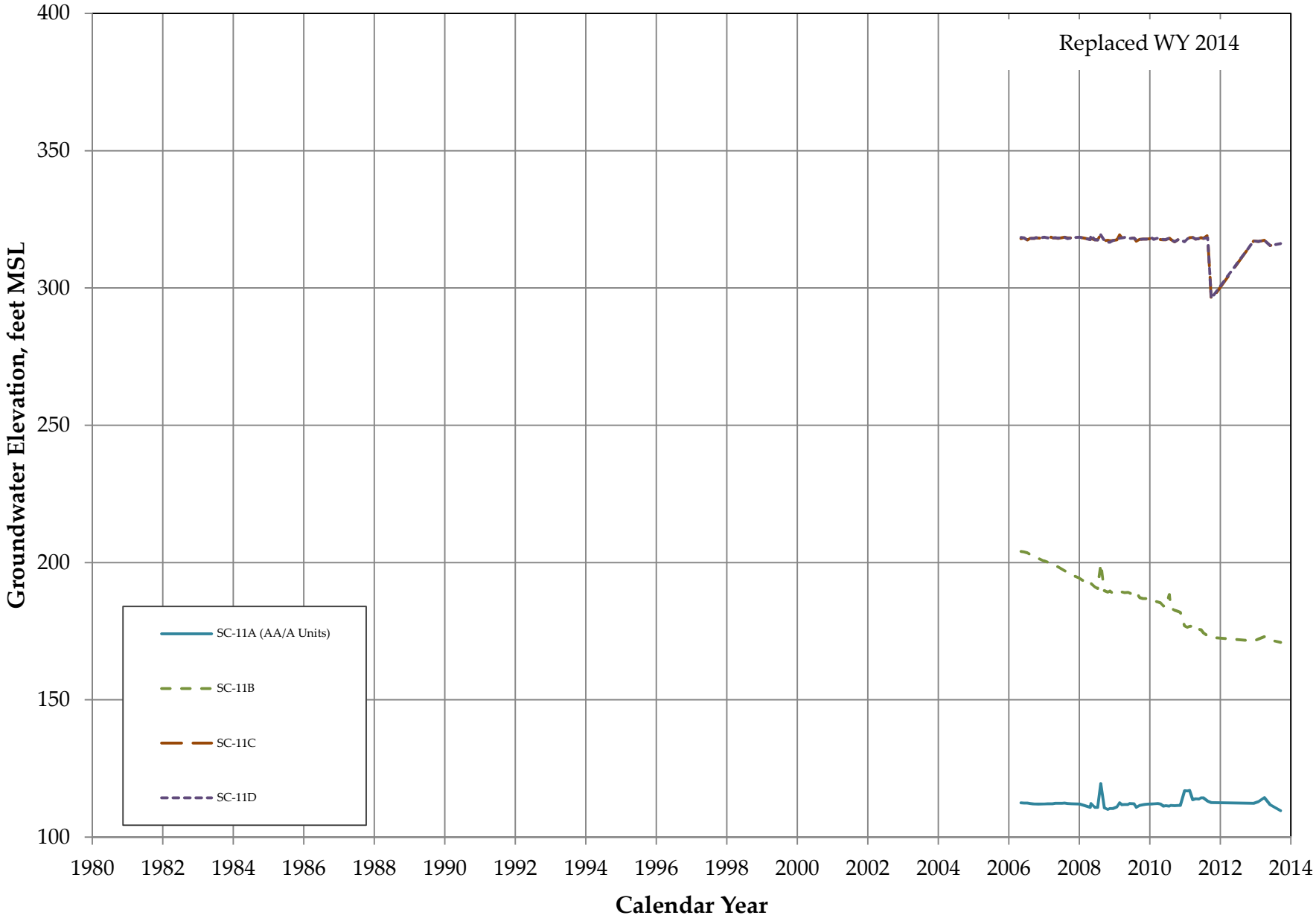

Groundwater Elevation, feet MSL
35
30
25
20
15
10
5
0
-5
-10
-15
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Beltz #2 -A
Beltz #4 (MW-4) Deep -A - Deepest Production
Beltz #4 (MW-4) Shallow -A

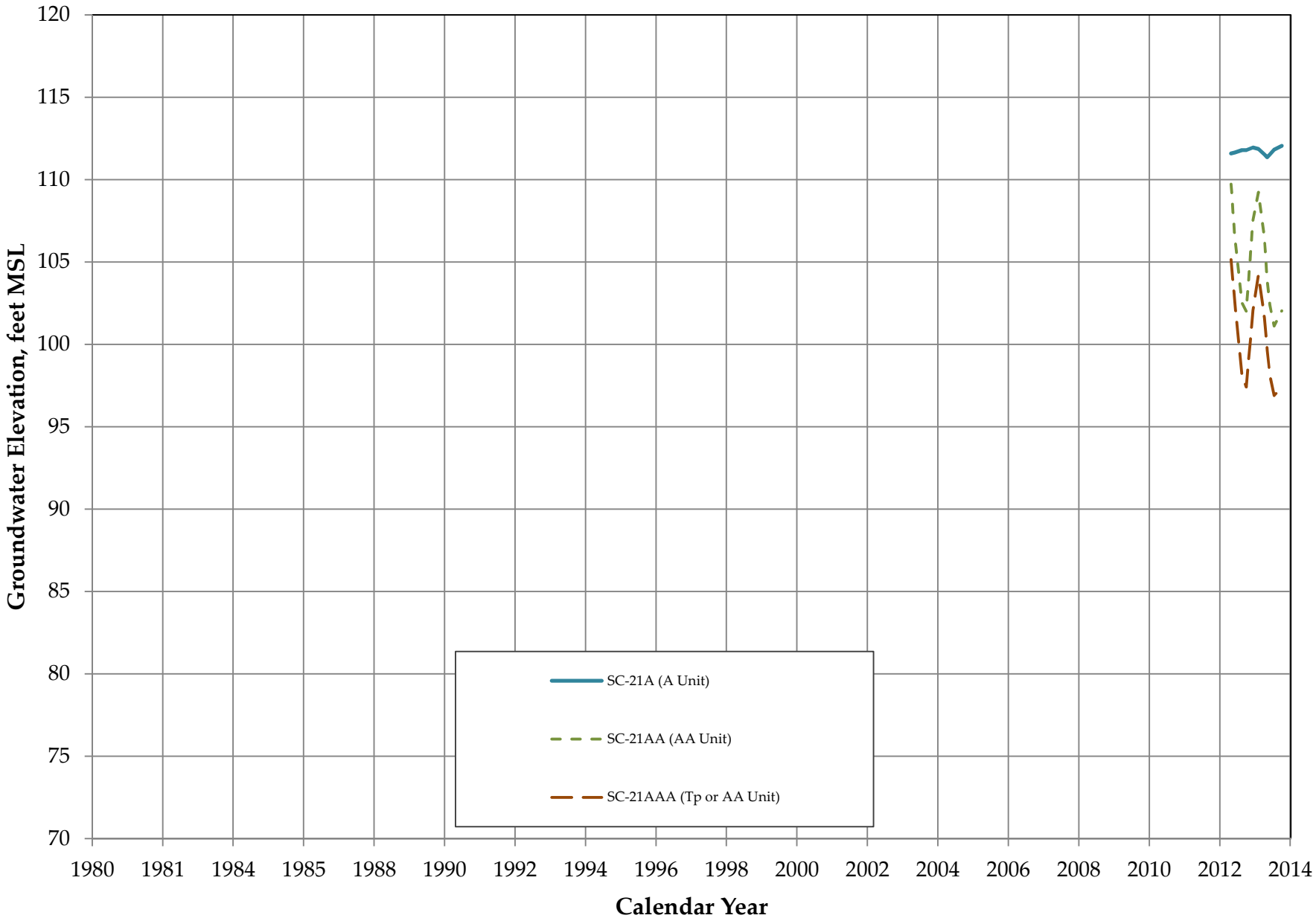

Groundwater Elevation, feet MSL
35
30
25
20
15
10
5
0
-5
-10
-15
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Beltz #7 Test Wells Santa Margarita -SM
Beltz #7 Test Wells Purisima -A/AA
Beltz #6
Measurements recorded when adjacent well running excluded

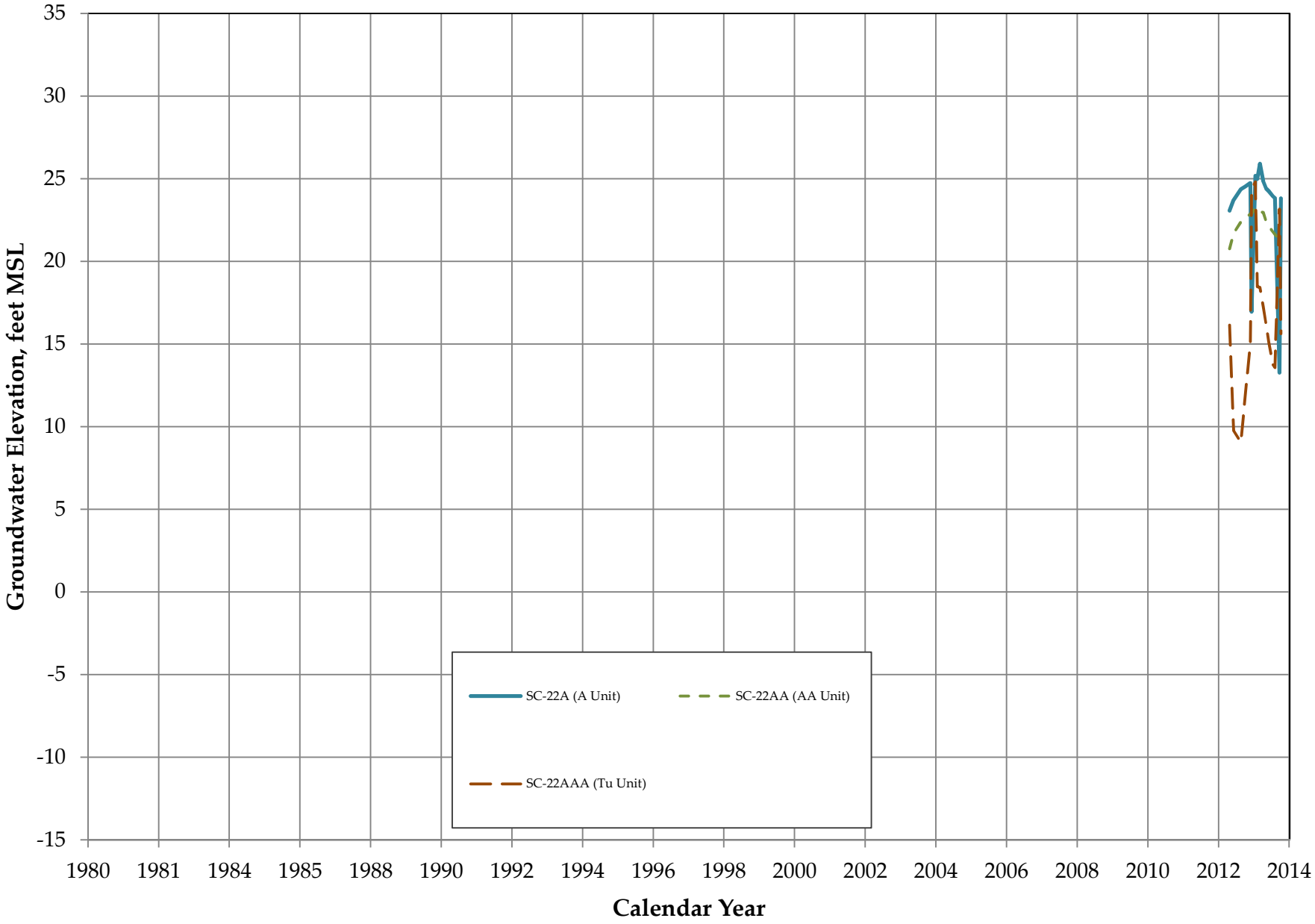

RPE revised for WY 2012 ARR
and applied to full data series
Pumping at Beltz #1/2/9
increased to 223 AFY in
Water Years 2008-2013
from 73 afy in
Water Years 1999-2007
Decline starting in 2006
corresponds to lower recharge
Soquel Point Deep -AA
Soquel Point Medium -A - Deepest Production
Soquel Point Shallow -A
Target Level (6.0 feet in non-critically dry years, 2.0 feet in critically dry years)
Groundwater Elevation, feet MSL
35
30
25
20
15
10
5
0
-5
-10
-15
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year

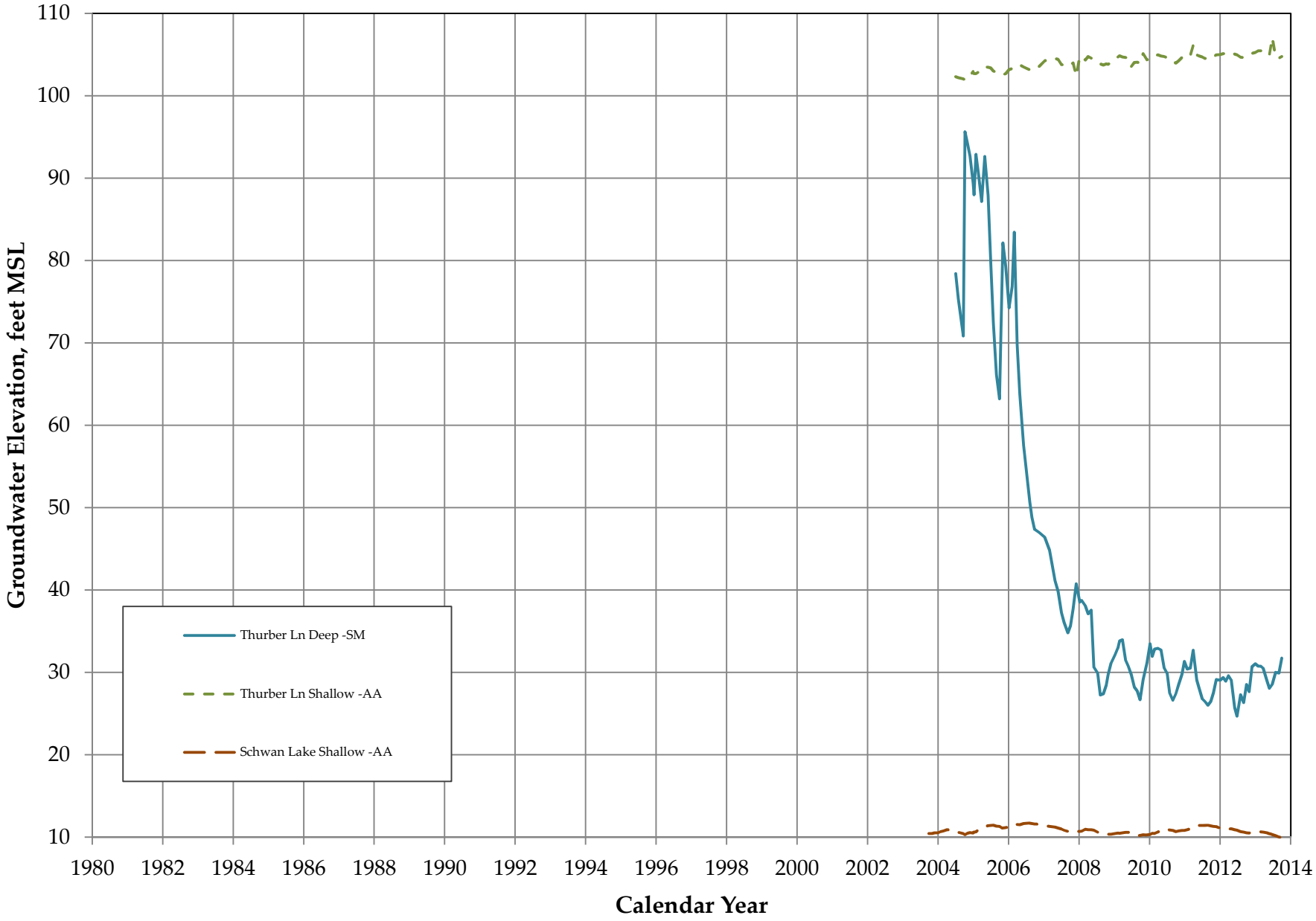

Groundwater Elevation, feet MSL
35
30
25
20
15
10
5
0
-5
-10
-15
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Pleasure Point Deep (A) -AA - Deepest Production
Pleasure Point Medium(B) -A
Pleasure Point Shallow(C) -A
Target Level (6.1 feet in non-critically dry years, 2.0 feet in critically dry years)
Pumping at Beltz #7/10 and #8 decreased from 399 afy in Water Years 2007-2009 to 277 afy in Water Years 2010-2013

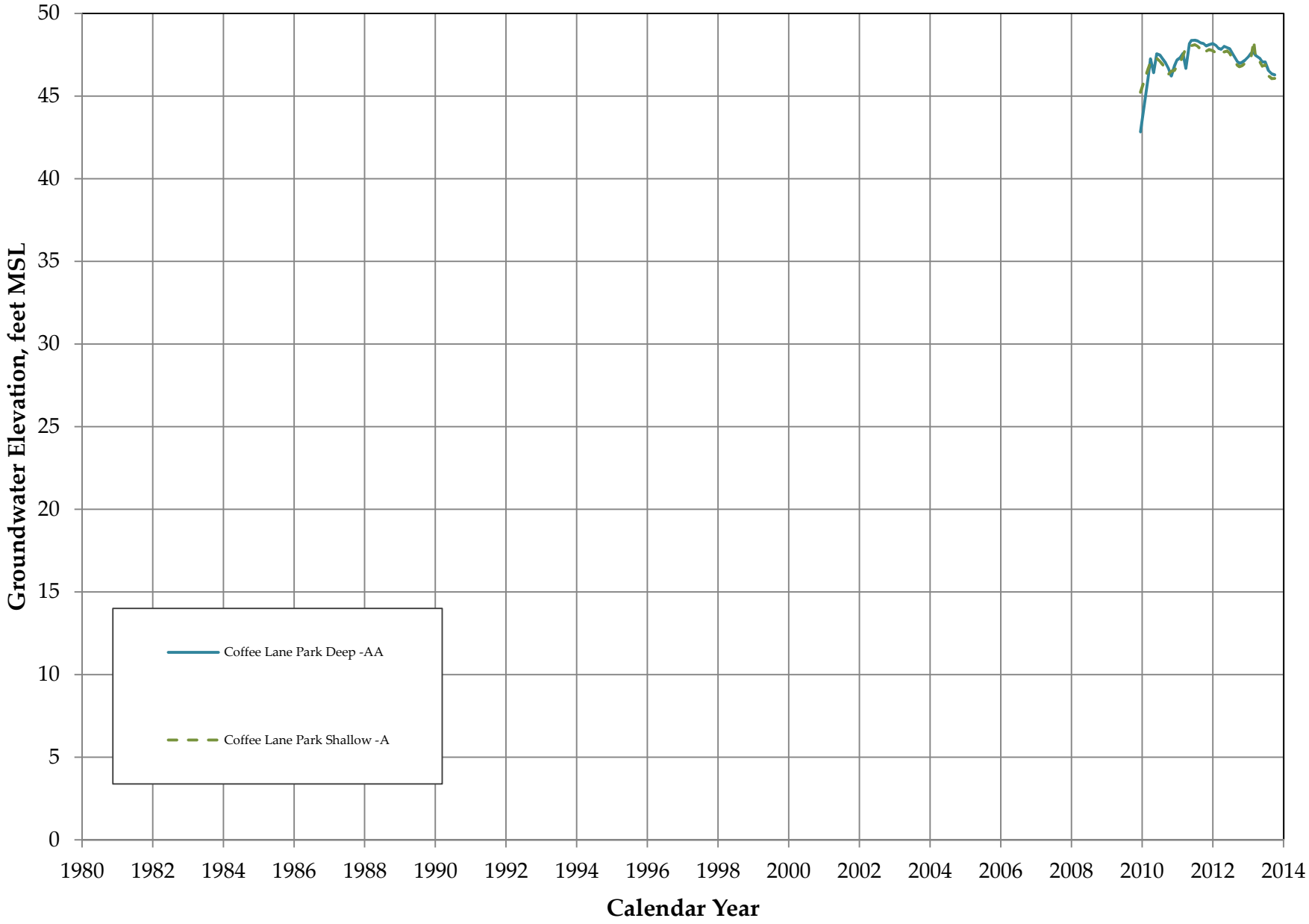

SC-10 replaced WY 2014
Groundwater Elevation, feet MSL
100
95
90
85
80
75
70
65
60
55
50
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-10AA (AA Unit)
SC-10A (A Unit)

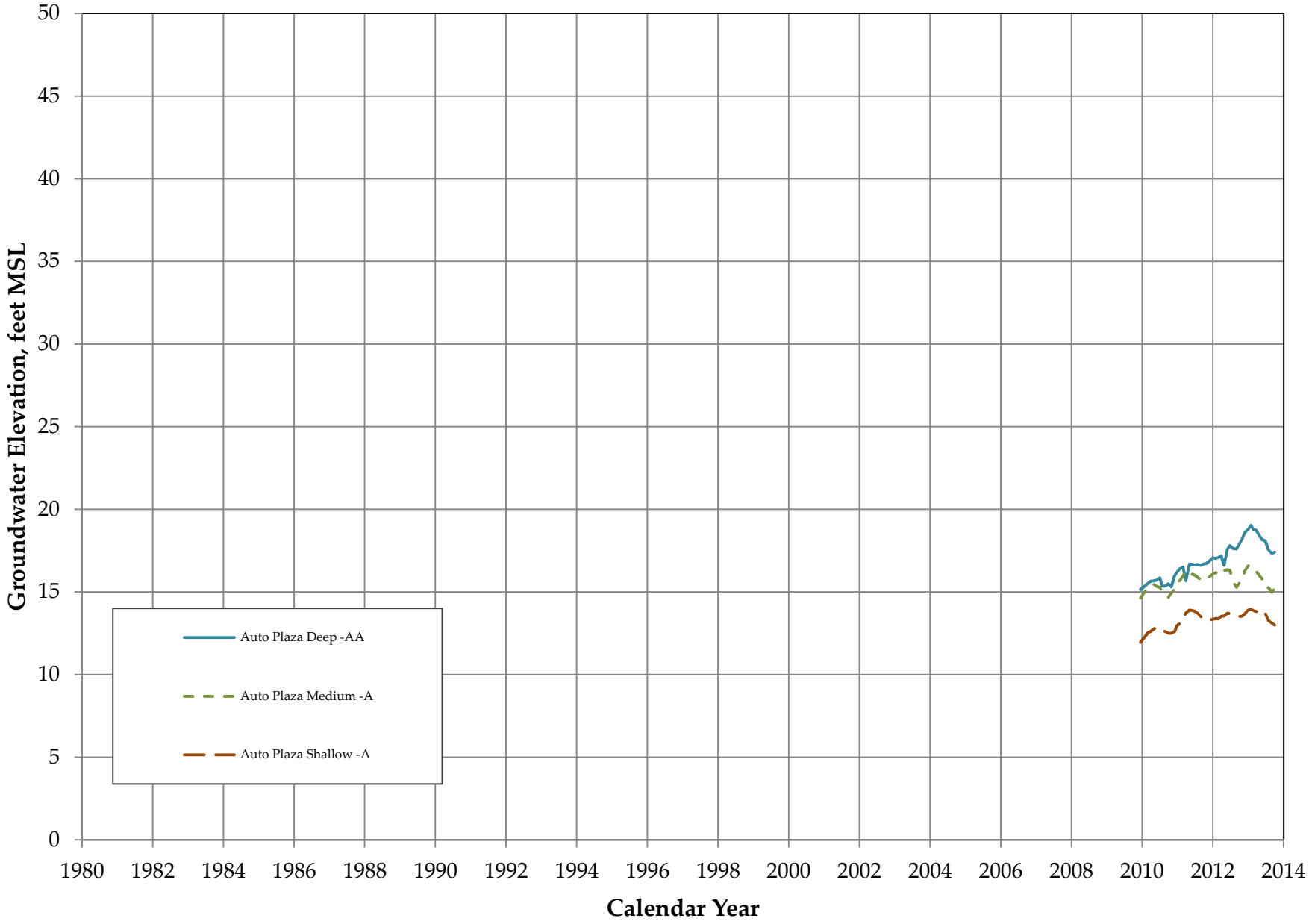

Replaced WY 2014
Groundwater Elevation, feet MSL
400
350
300
250
200
150
100
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-11A (AA/A Units)
SC-11B
SC-11C
SC-11D

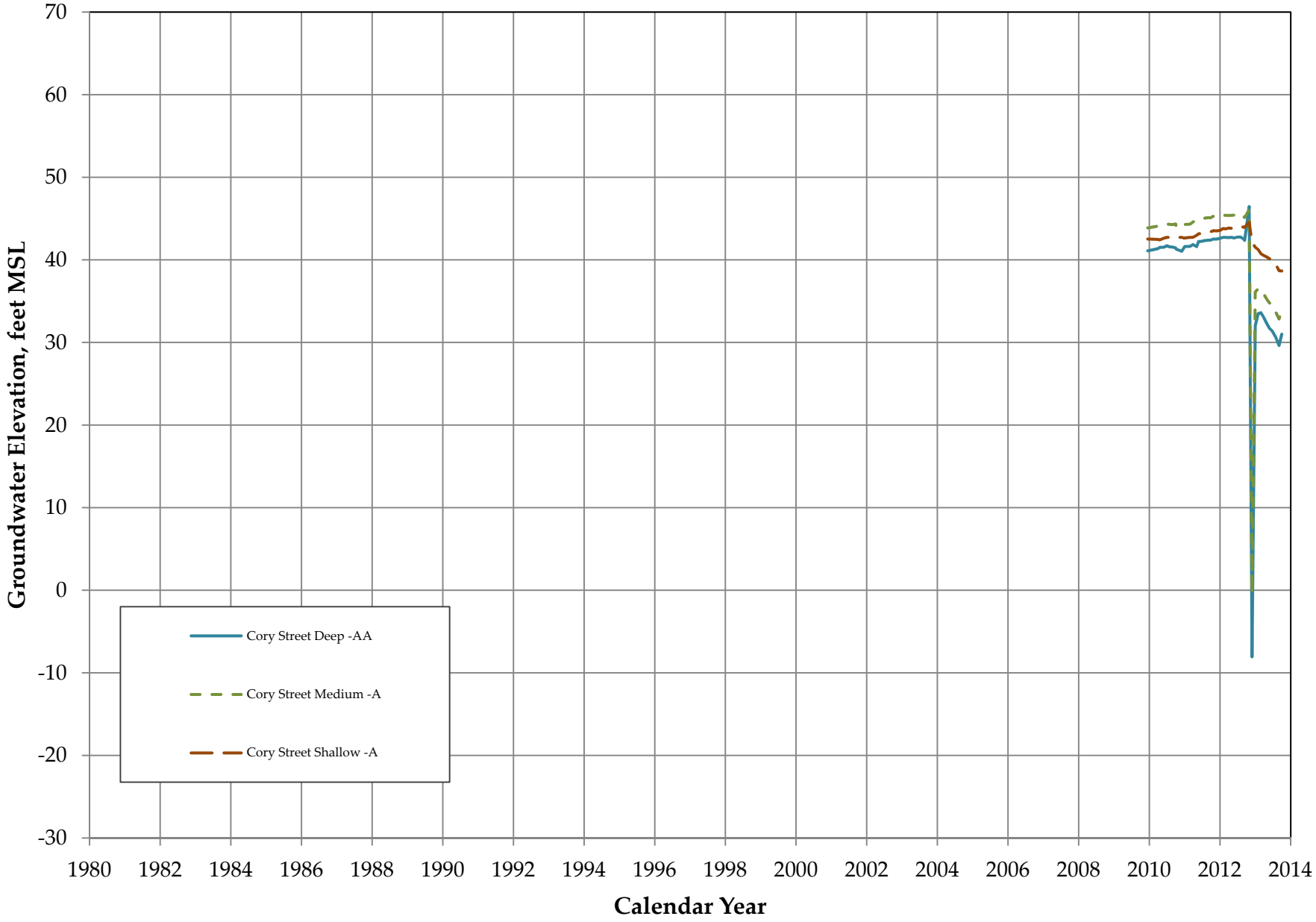

120
115
110
105
100
95
90
85
80
75
70
Groundwater Elevation, feet MSL
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-21A (A Unit)
SC-21AA (AA Unit)
SC-21AAA (Tp or AA Unit)

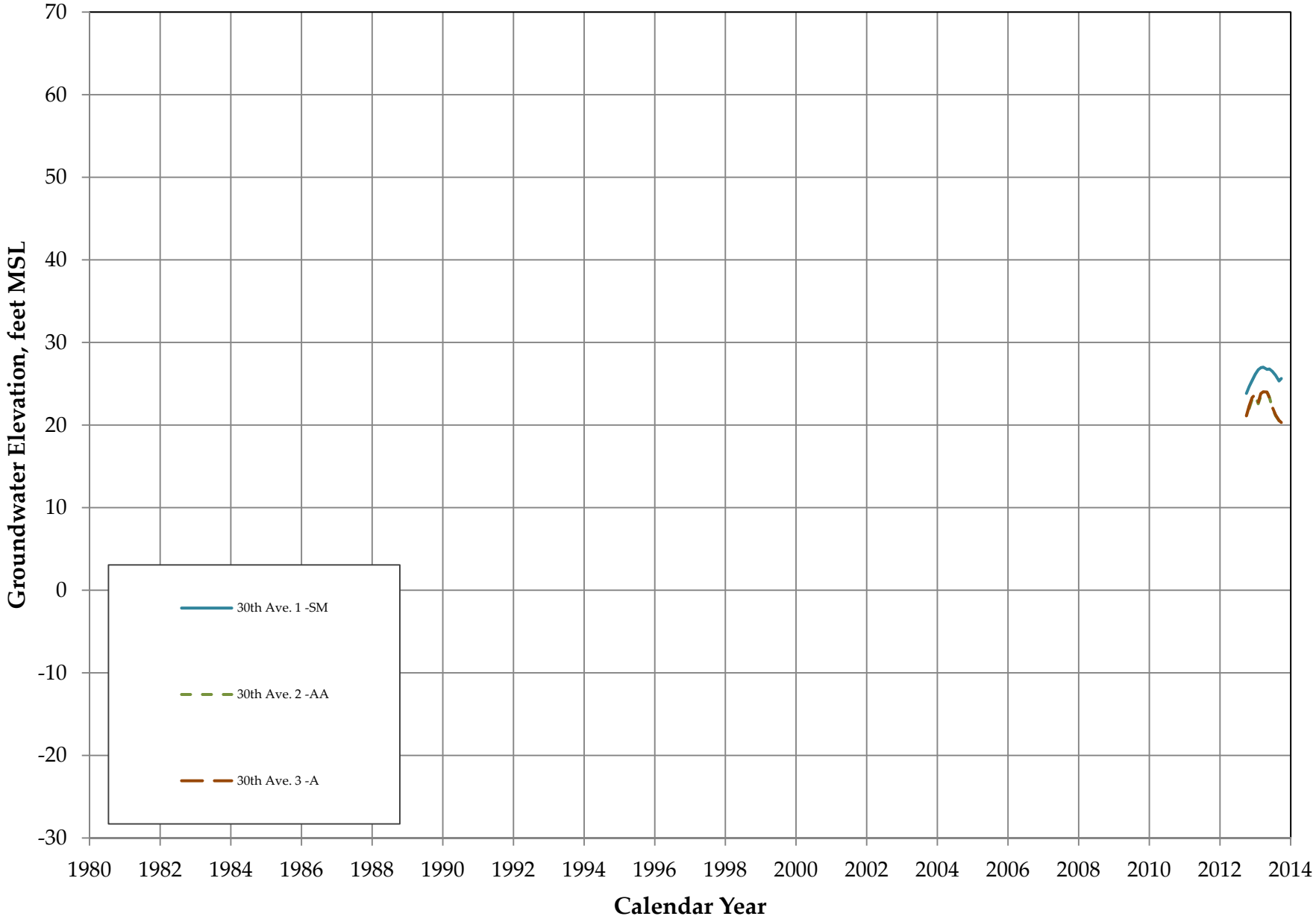

Groundwater Elevation, feet MSL
35
30
25
20
15
10
5
0
-5
-10
-15
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-22A (A Unit)
SC-22AA (AA Unit)
SC-22AAA (Tu Unit)

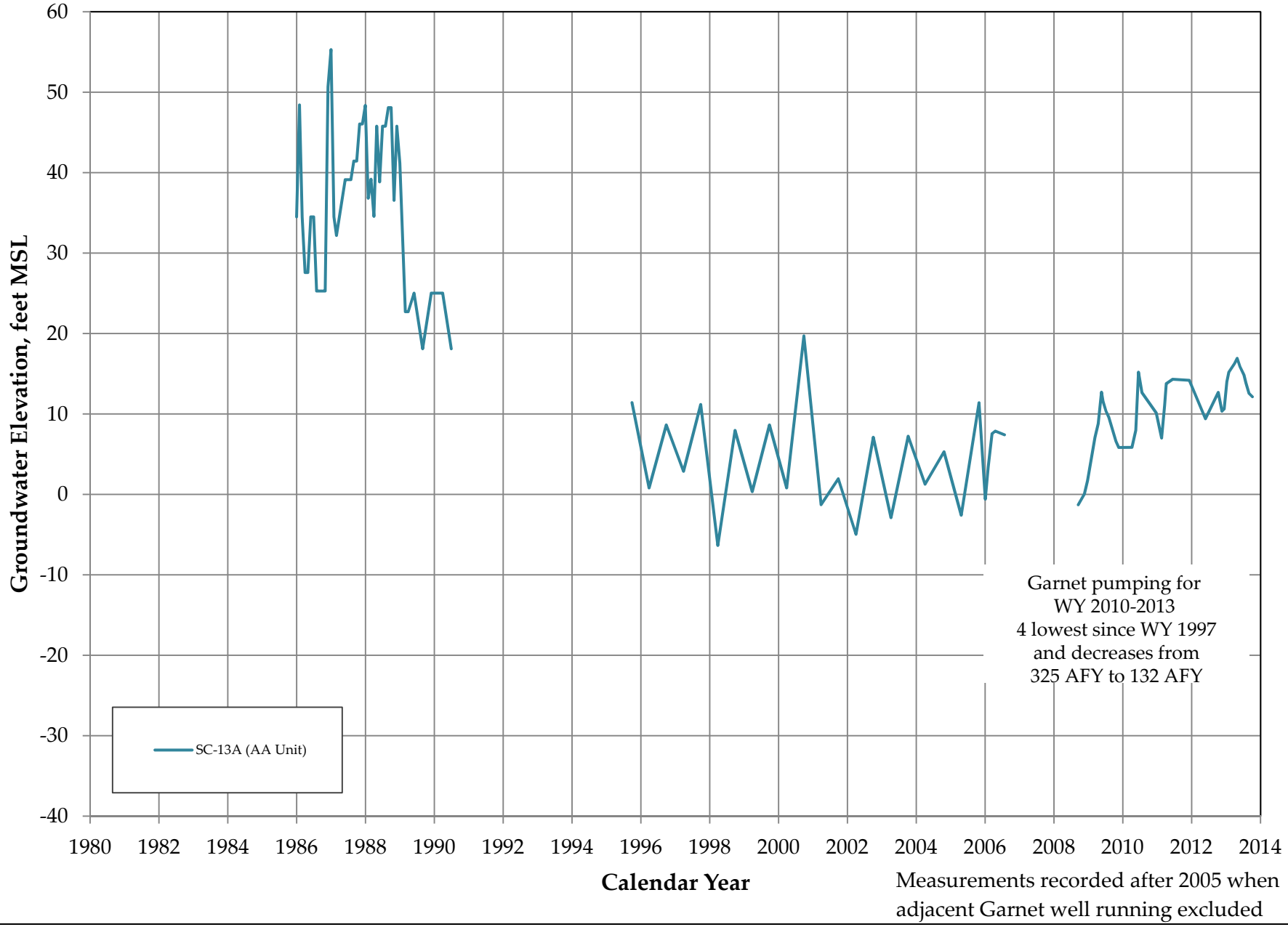

Groundwater Elevation, feet MSL
110
100
90
80
70
60
50
40
30
20
10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Thurber Ln Deep -SM
Thurber Ln Shallow -AA
Schwan Lake Shallow -AA

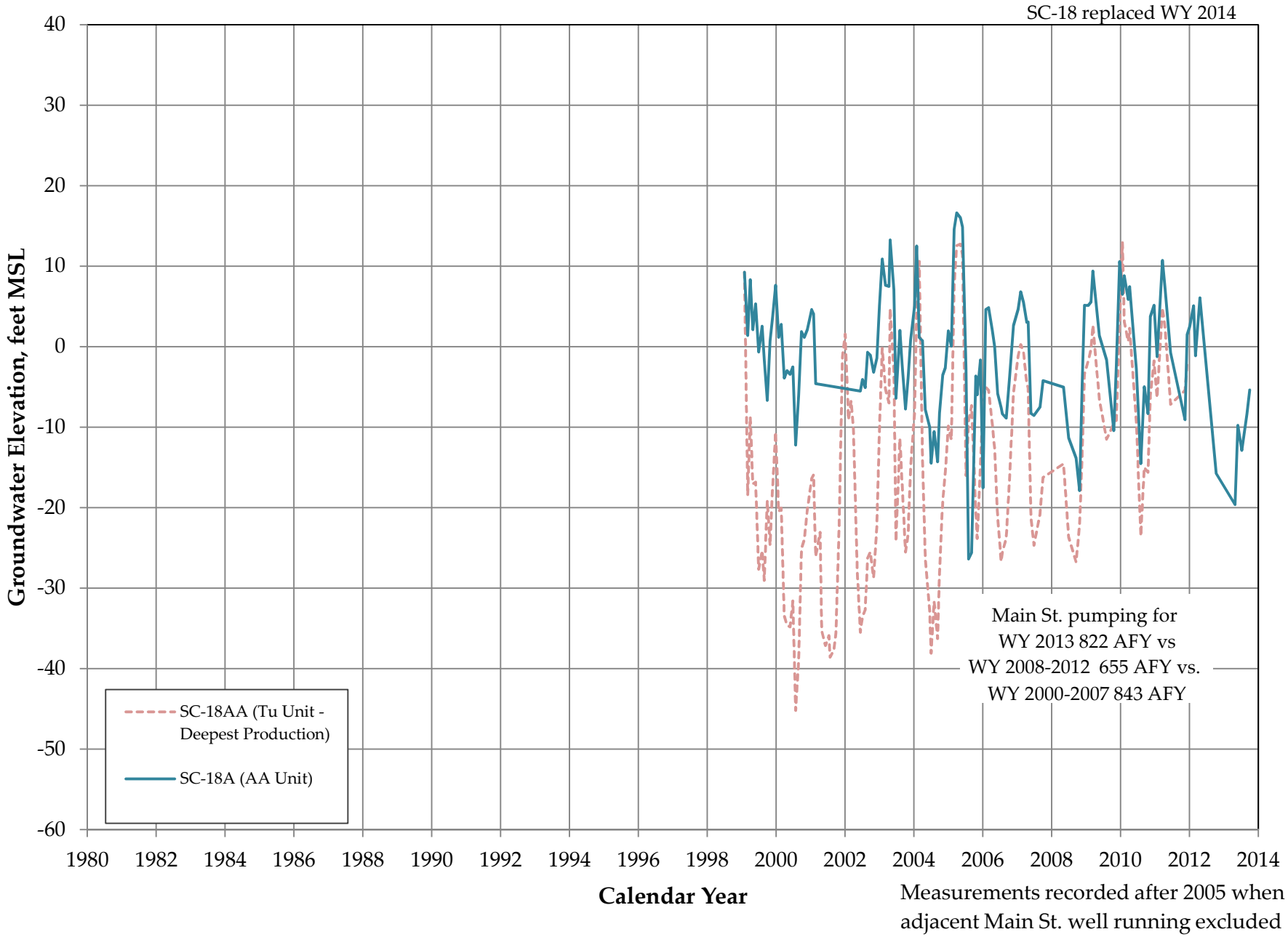

Groundwater Elevation, feet MSL
50
45
40
35
30
25
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Coffee Lane Park Deep -AA
Coffee Lane Park Shallow -A

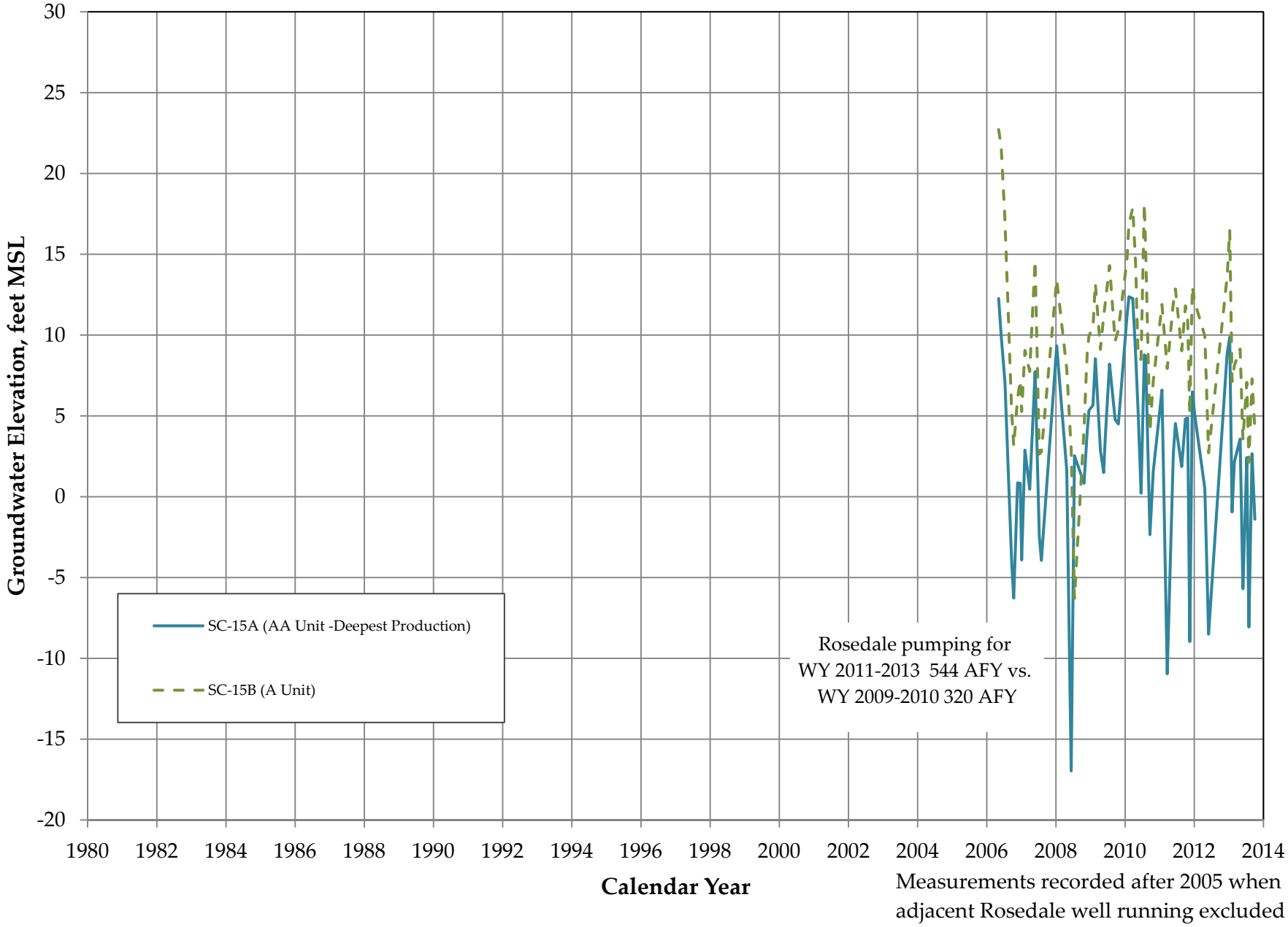

Groundwater Elevation, feet MSL
50
45
40
35
30
25
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Auto Plaza Deep -AA
Auto Plaza Medium -A
Auto Plaza Shallow -A


Groundwater Elevation, feet MSL
70
60
50
40
30
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Cory Street Deep -AA
Cory Street Medium -A
Cory Street Shallow -A


Groundwater Elevation, feet MSL
70
60
50
40
30
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
30th Ave. 1 -SM
30th Ave. 2 -AA
30th Ave. 3 -A


Groundwater Elevation, feet MSL
60
50
40
30
20
10
0
-10
-20
-30
-40
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-13A (AA Unit)
Garnet pumping for
WY 2010-2013
4 lowest since WY 1997
and decreases from
325 AFY to 132 AFY
Measurements recorded after 2005 when
adjacent Garnet well running excluded


SC-18 replaced WY 2014
Groundwater Elevation, feet MSL
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-18AA (Tu Unit - Deepest Production)
SC-18A (AA Unit)
Main St. pumping for
WY 2013 822 AFY vs
WY 2008-2012 655 AFY vs.
WY 2000-2007 843 AFY
Measurements recorded after 2005 when adjacent Main St. well running excluded


Groundwater Elevation, feet MSL
30
25
20
15
10
5
0
-5
-10
-15
-20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-15A (AA Unit -Deepest Production)
SC-15B (A Unit)
Rosedale pumping for
WY 2011-2013 544 AFY vs.
WY 2009-2010 320 AFY
Measurements recorded after 2005 when
adjacent Rosedale well running excluded

Chemographs and Single Well Hydrographs for Western Purisima Area

Graphs of SqCWD Coastal Monitoring Well Clusters

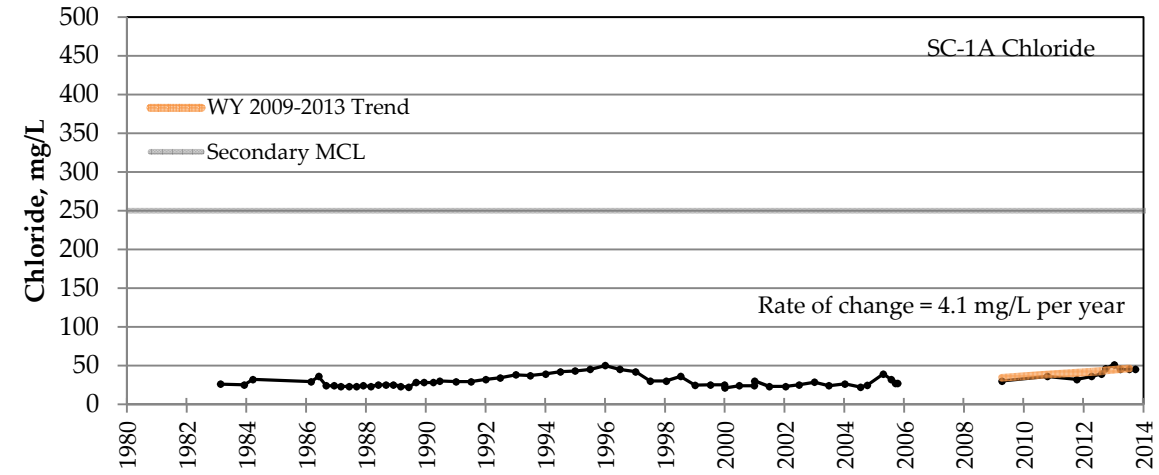
Graphs of City of Santa Cruz Coastal Monitoring Well Clusters

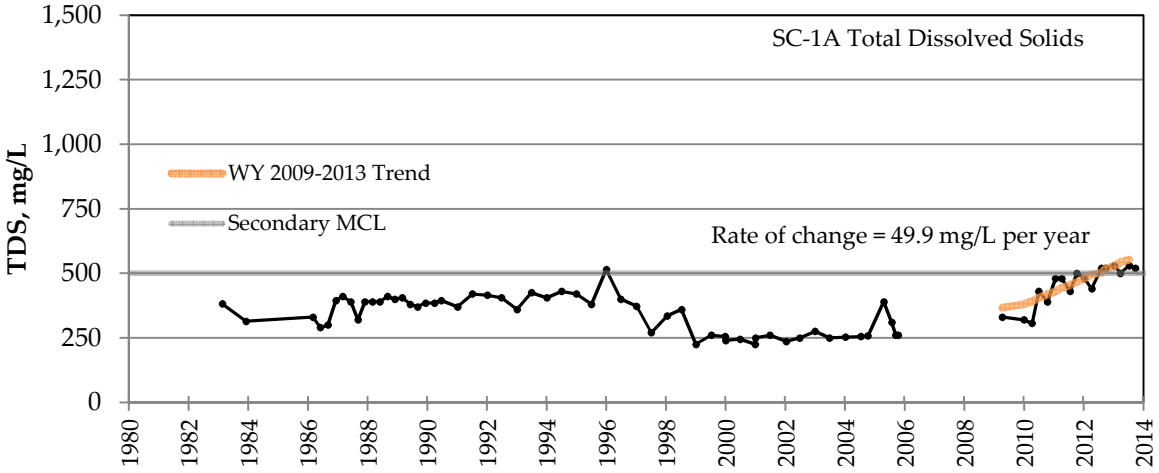
Graphs of SqCWD Inland Monitoring Well Clusters

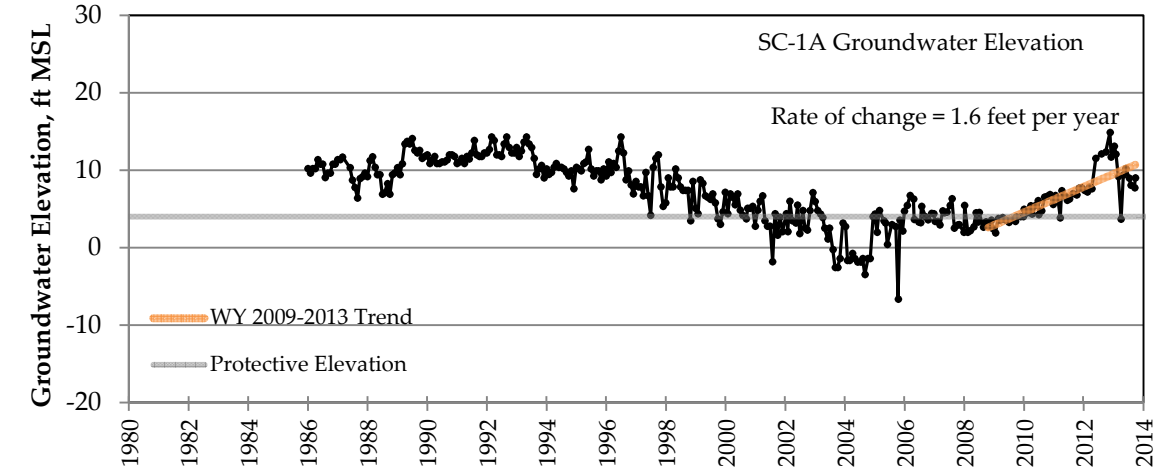
Graphs of City of Santa Cruz Inland Monitoring Well Clusters

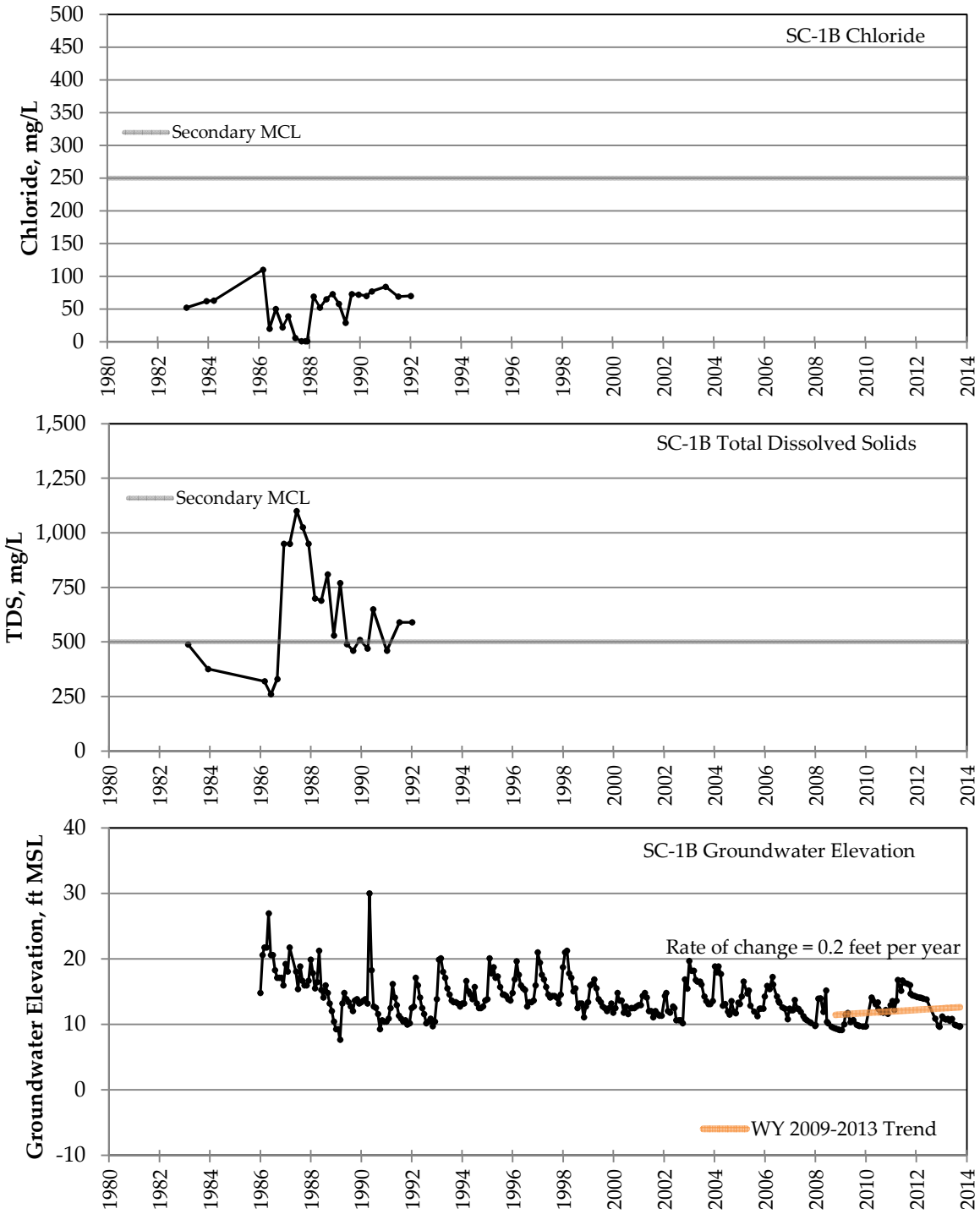
Graphs of SqCWD Production Wells and Monitoring Wells Adjacent to Production Wells

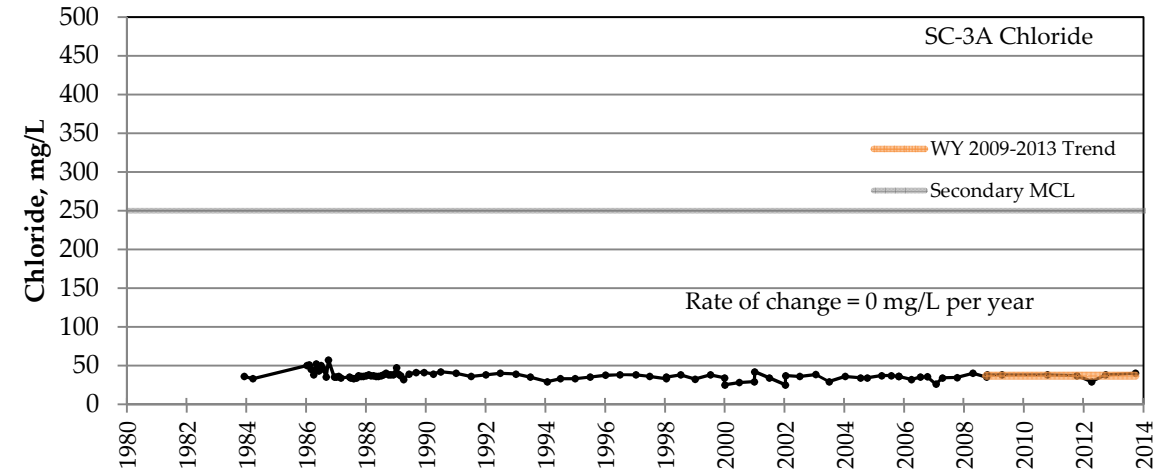
Trends shown on the hydrographs and chemographs are based on a linear fit to data in the specified time period.

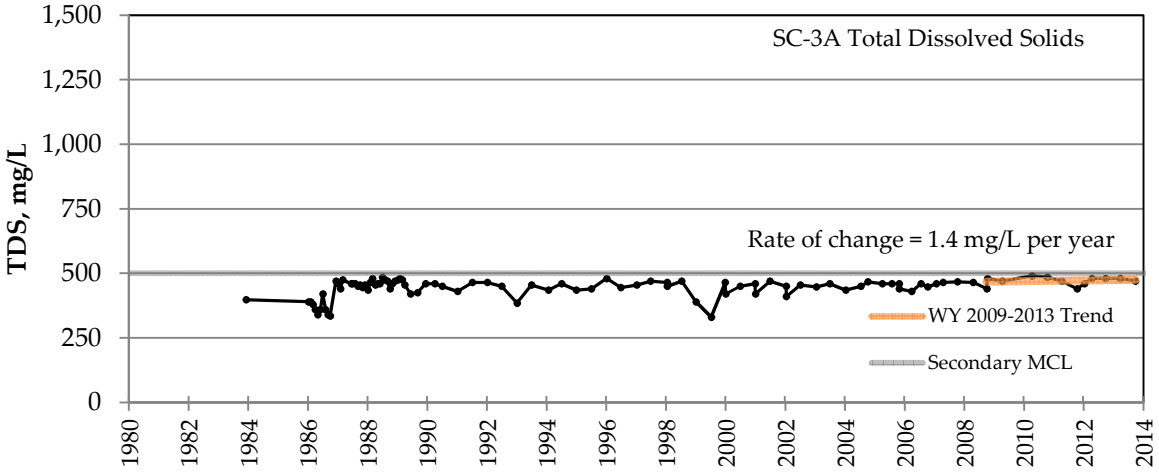

SC-1A Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 4.1 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

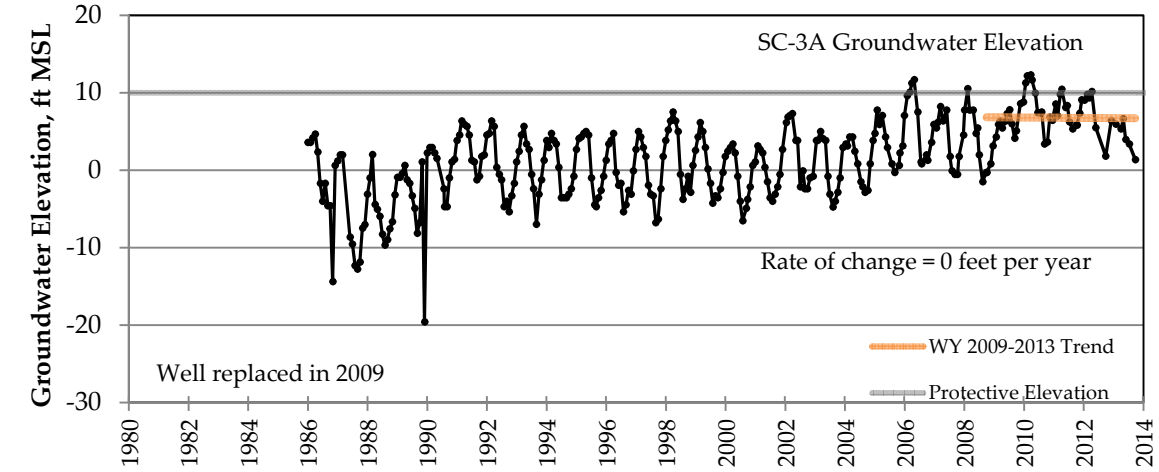

SC-1A Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 49.9 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

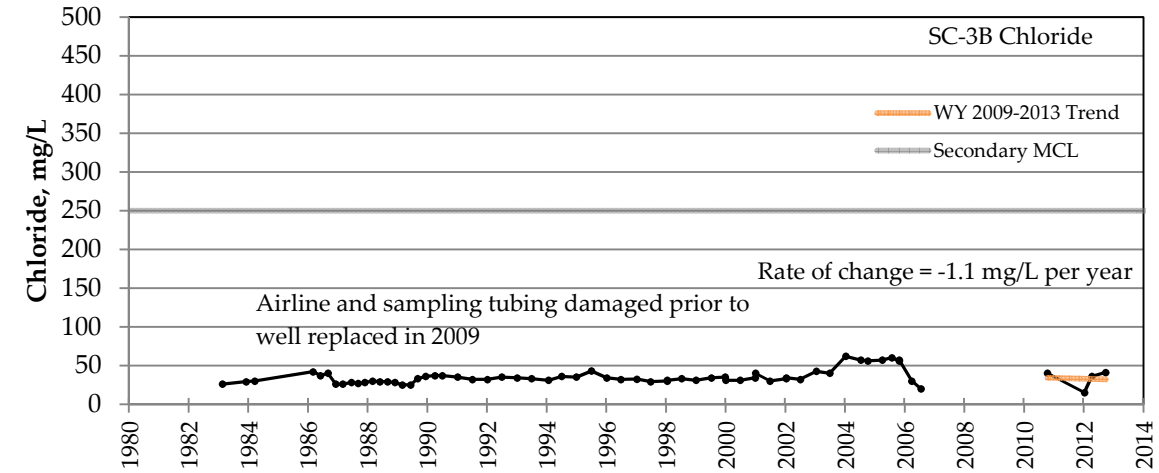

SC-1A Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 1.6 feet per year
WY 2009-2013 Trend
Protective Elevation
30
20
10
0
-10
-20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

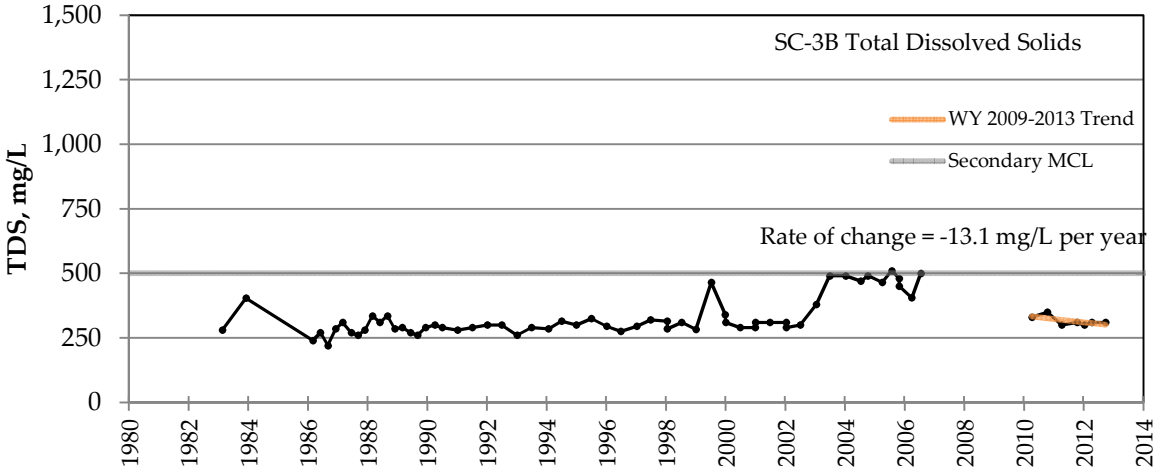

SC-1B Chloride
Chloride, mg/L
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
SC-1B Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
SC-1B Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.2 feet per year
WY 2009-2013 Trend
40
30
20
10
0
-10

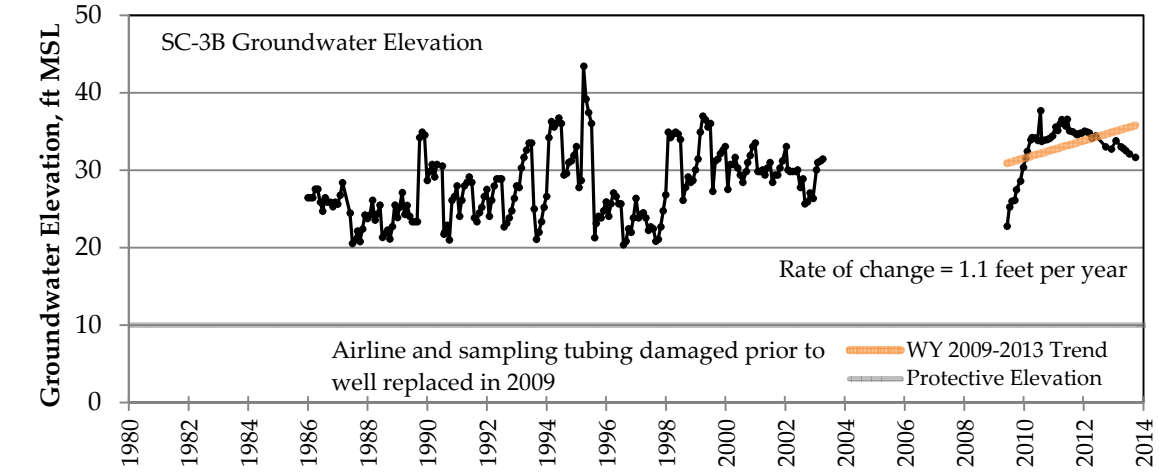

SC-3A Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

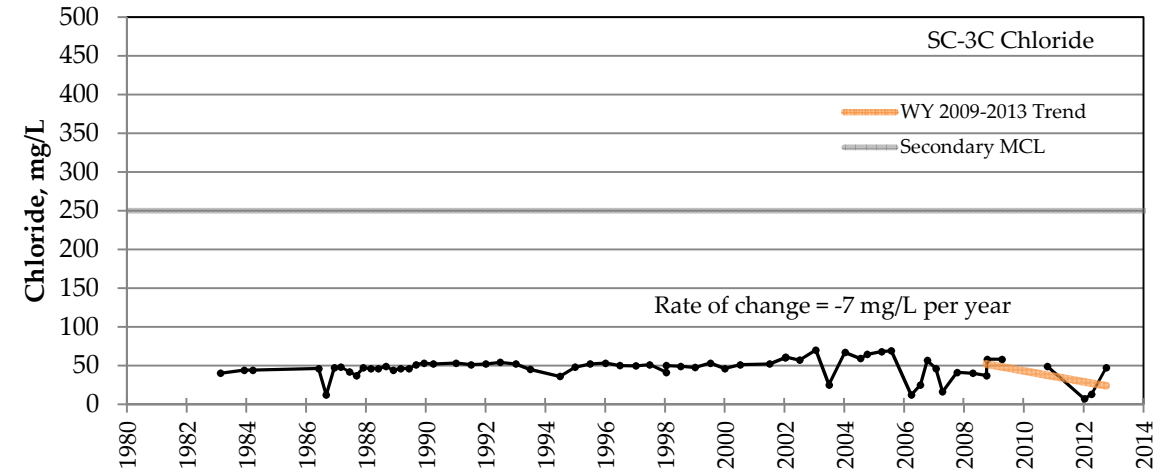

SC-3A Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Rate of change = 1.4 mg/L per year
WY 2009-2013 Trend
Secondary MCL
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

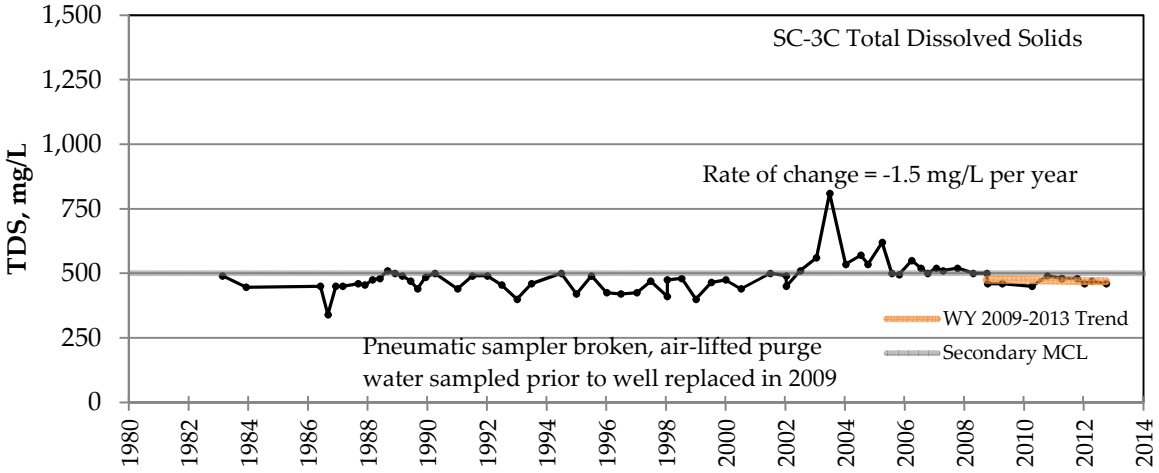

SC-3A Groundwater Elevation
Groundwater Elevation, ft MSL
20
10
0
-10
-20
-30
Rate of change = 0 feet per year
Well replaced in 2009
WY 2009-2013 Trend
Protective Elevation
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

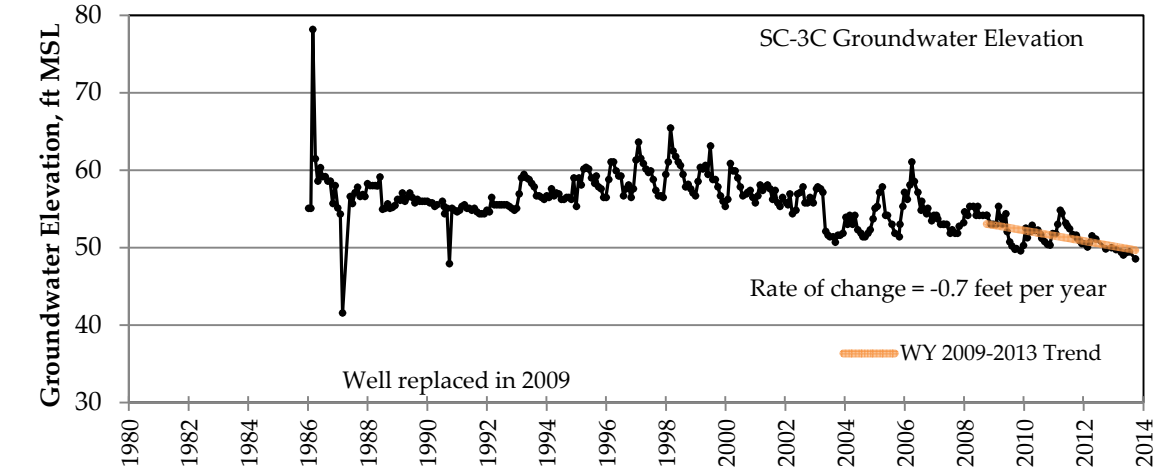

SC-3B Chloride
WY 2009-2013 Trend
Secondary MCL
Chloride, mg/L
Rate of change = -1.1 mg/L per year
Airline and sampling tubing damaged prior to well replaced in 2009
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

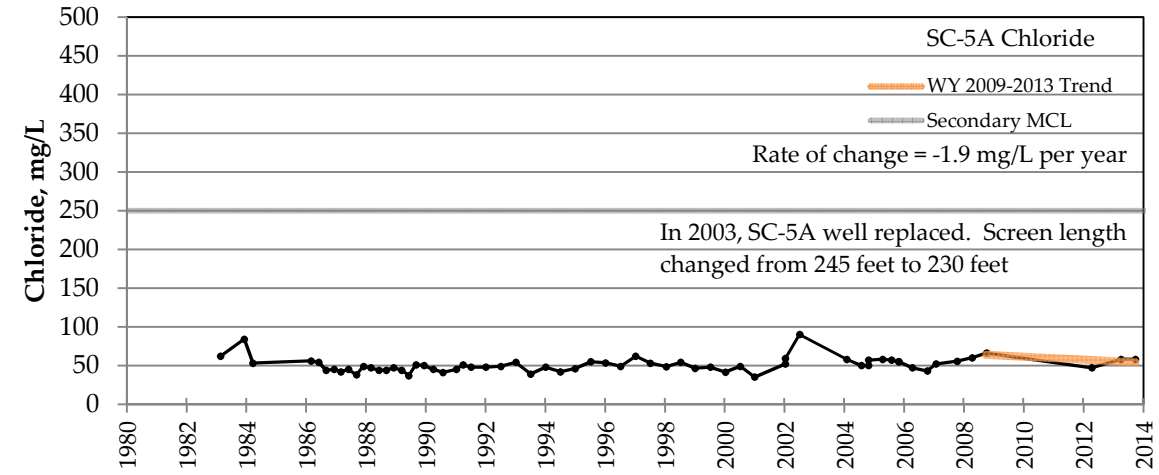

SC-3B Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
TDS, mg/L
Rate of change = -13.1 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

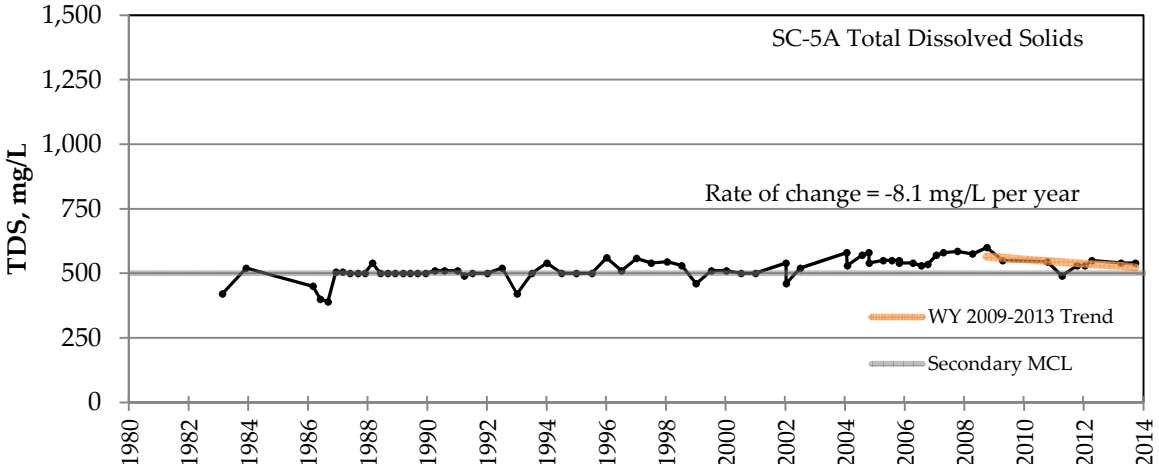

SC-3B Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 1.1 feet per year
Airline and sampling tubing damaged prior to well replaced in 2009
WY 2009-2013 Trend
Protective Elevation
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

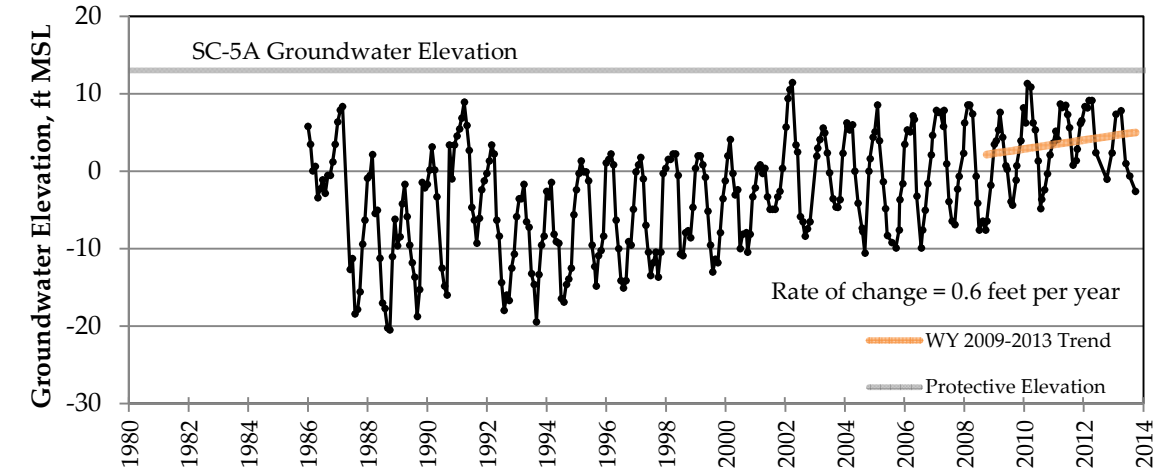

SC-3C Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -7 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

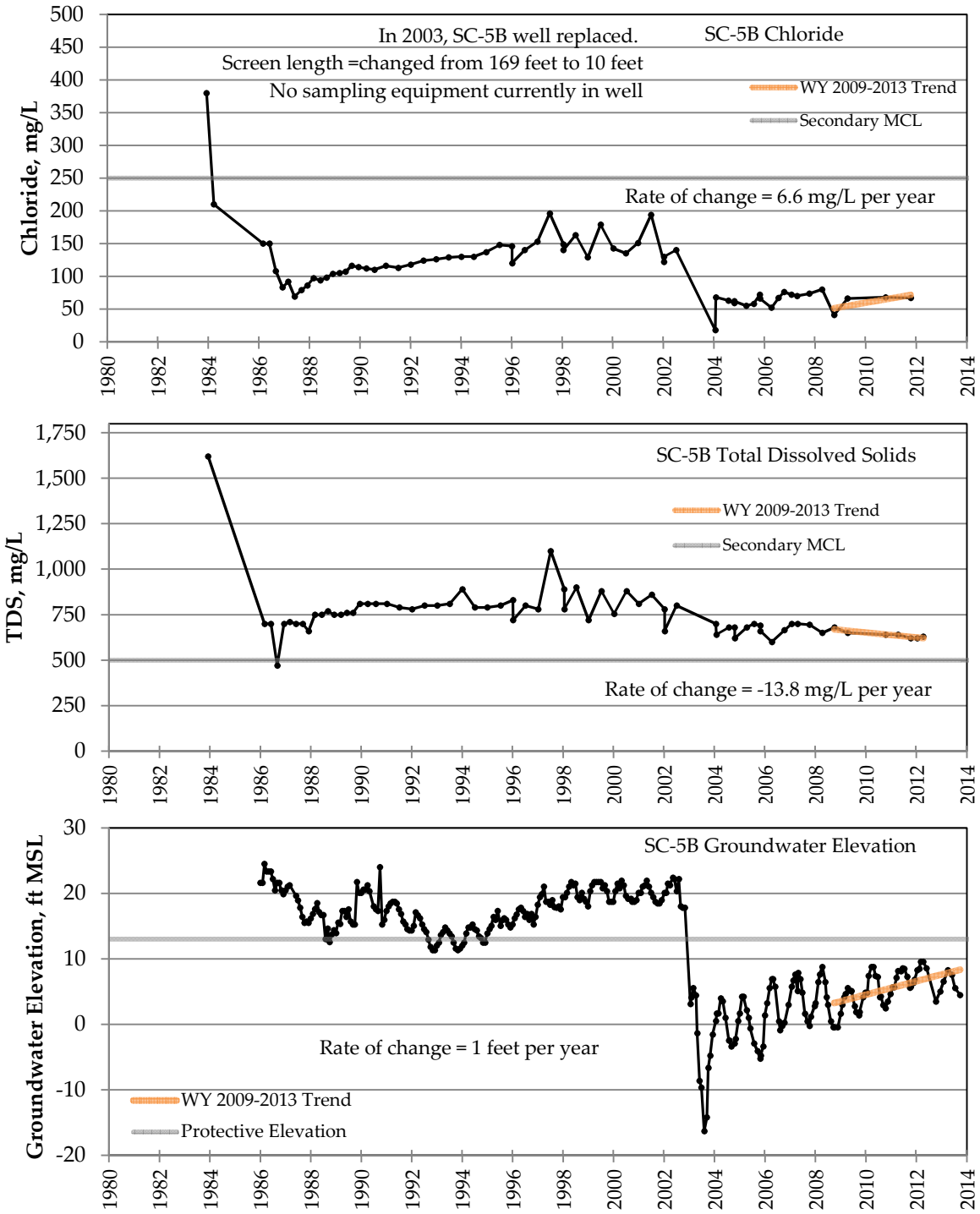

SC-3C Total Dissolved Solids
TDS, mg/L
Rate of change = -1.5 mg/L per year
WY 2009-2013 Trend
Secondary MCL
Pneumatic sampler broken, air-lifted purge water sampled prior to well replaced in 2009
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

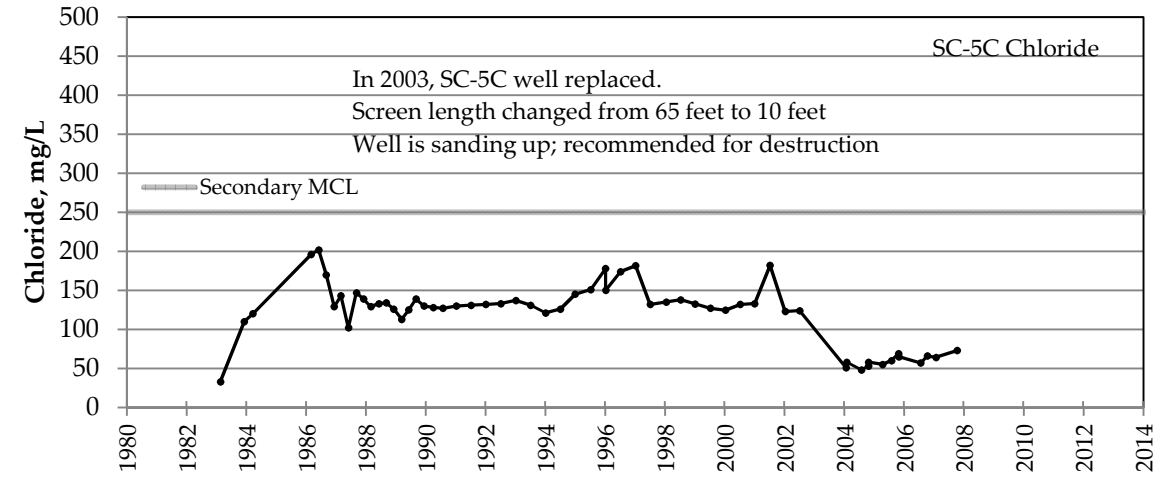

SC-3C Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.7 feet per year
WY 2009-2013 Trend
Well replaced in 2009
80
70
60
50
40
30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

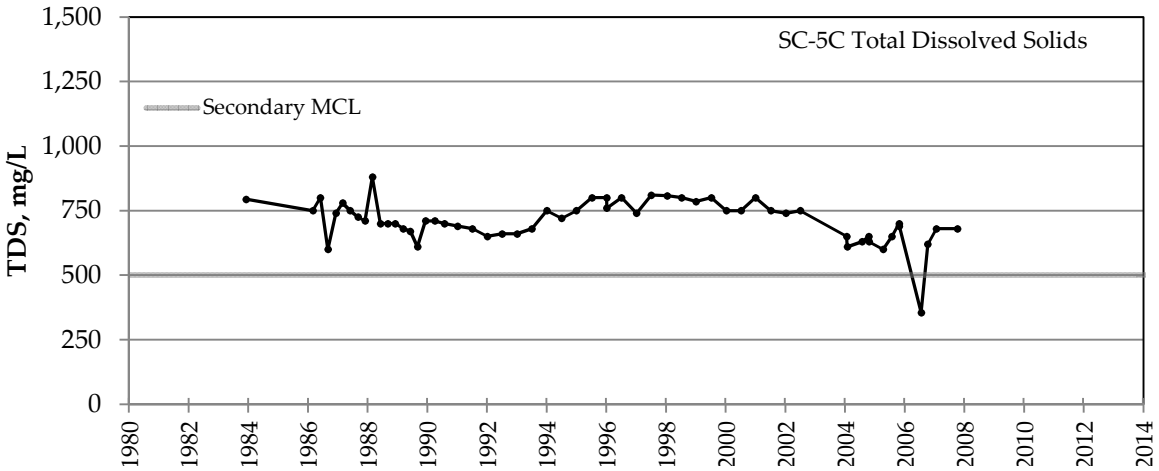

SC-5A Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -1.9 mg/L per year
In 2003, SC-5A well replaced. Screen length changed from 245 feet to 230 feet
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

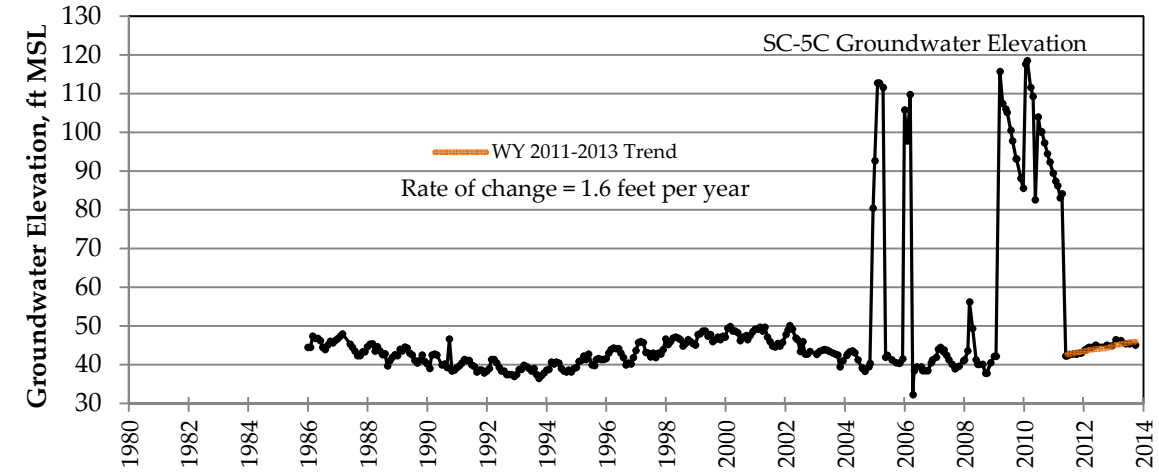

SC-5A Total Dissolved Solids
Rate of change = -8.1 mg/L per year
WY 2009-2013 Trend
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

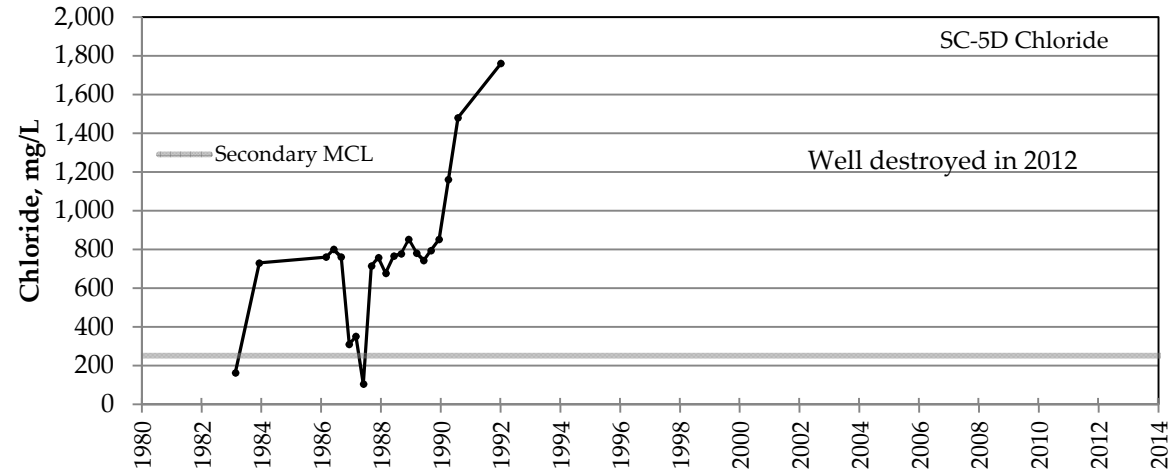

SC-5A Groundwater Elevation
Rate of change = 0.6 feet per year
WY 2009-2013 Trend
Protective Elevation
Groundwater Elevation, ft MSL
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

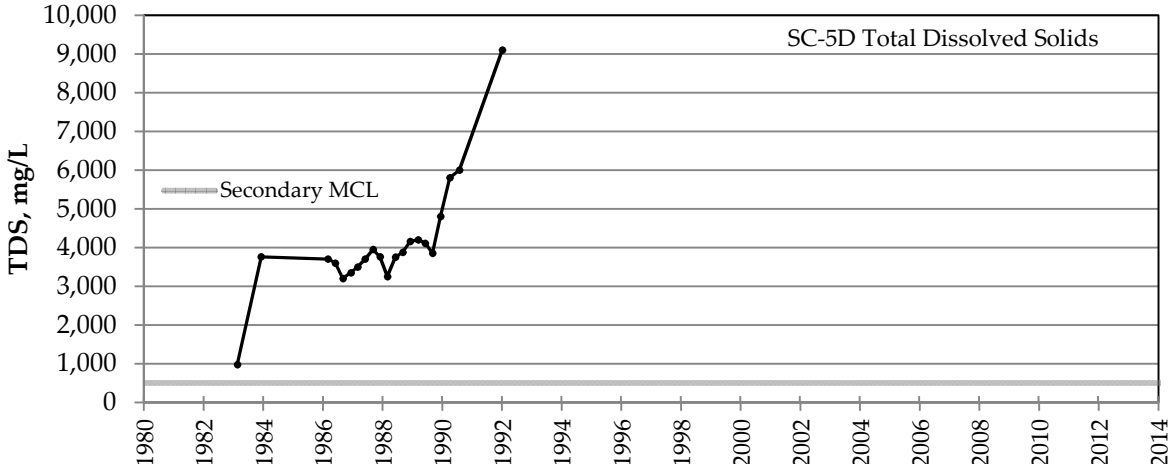

In 2003, SC-5B well replaced.
Screen length =changed from 169 feet to 10 feet
No sampling equipment currently in well
SC-5B Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 6.6 mg/L per year
Chloride, mg/L
SC-5B Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -13.8 mg/L per year
TDS, mg/L
SC-5B Groundwater Elevation
Rate of change = 1 feet per year
WY 2009-2013 Trend
Protective Elevation
Groundwater Elevation, ft MSL

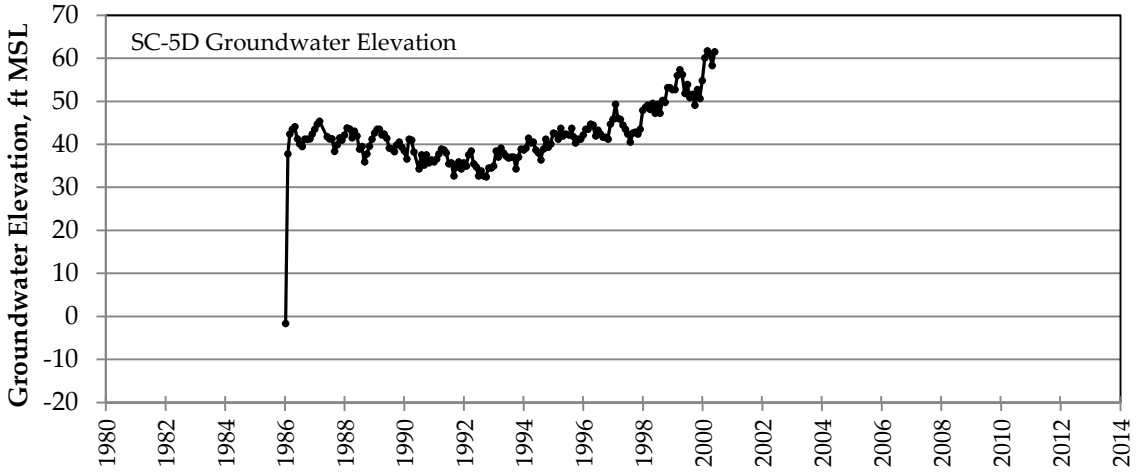

SC-5C Chloride
In 2003, SC-5C well replaced.
Screen length changed from 65 feet to 10 feet
Well is sanding up; recommended for destruction
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

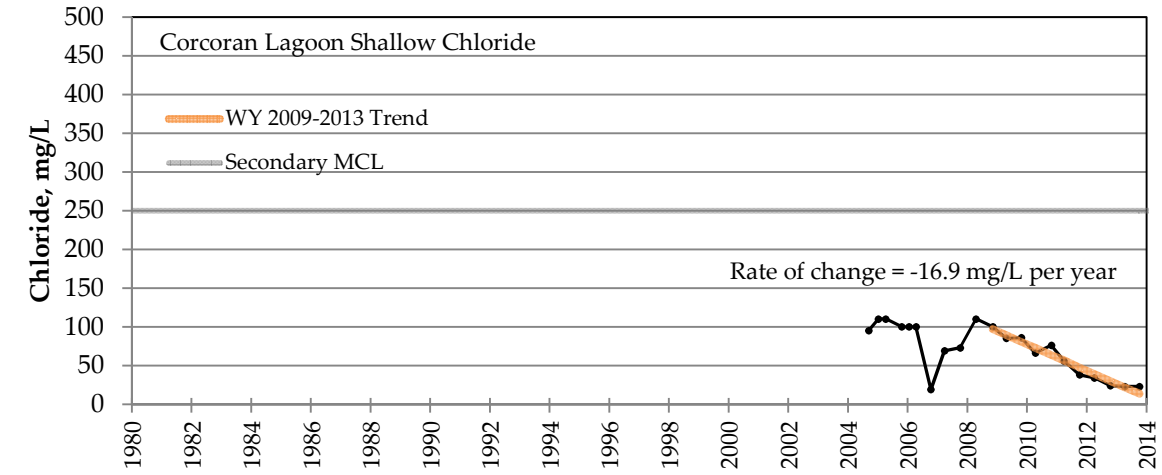

SC-5C Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

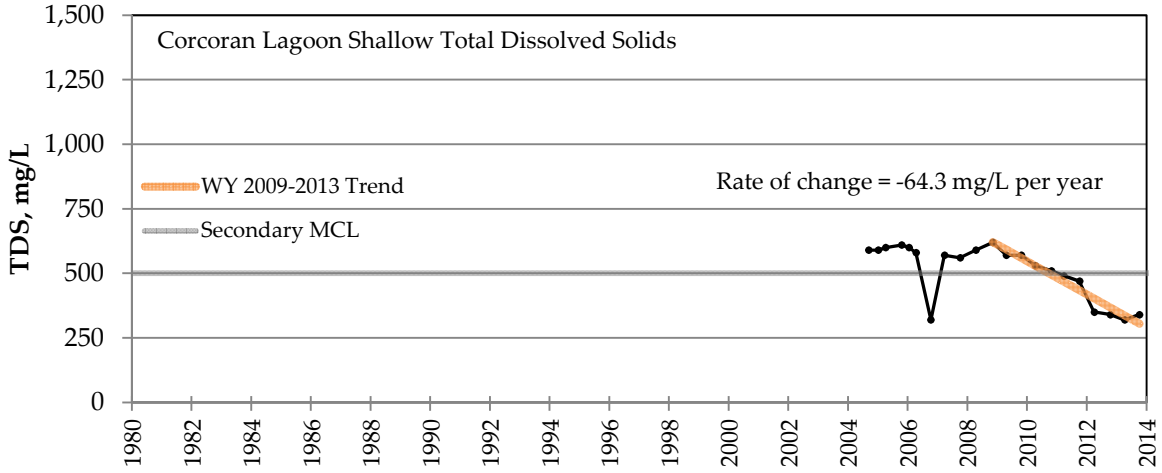

SC-5C Groundwater Elevation
WY 2011-2013 Trend
Rate of change = 1.6 feet per year
Groundwater Elevation, ft MSL
130
120
110
100
90
80
70
60
50
40
30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

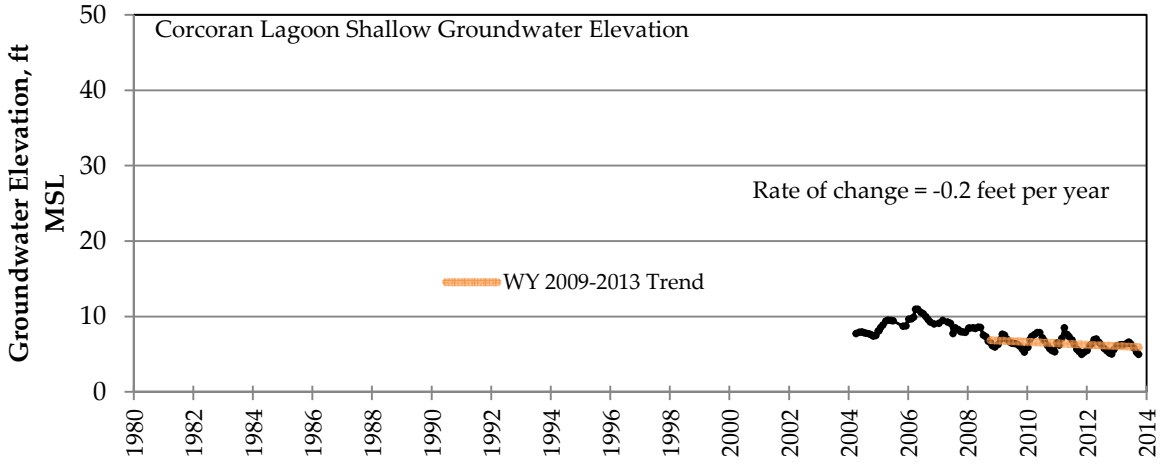

SC-5D Chloride
Chloride, mg/L
Secondary MCL
Well destroyed in 2012
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

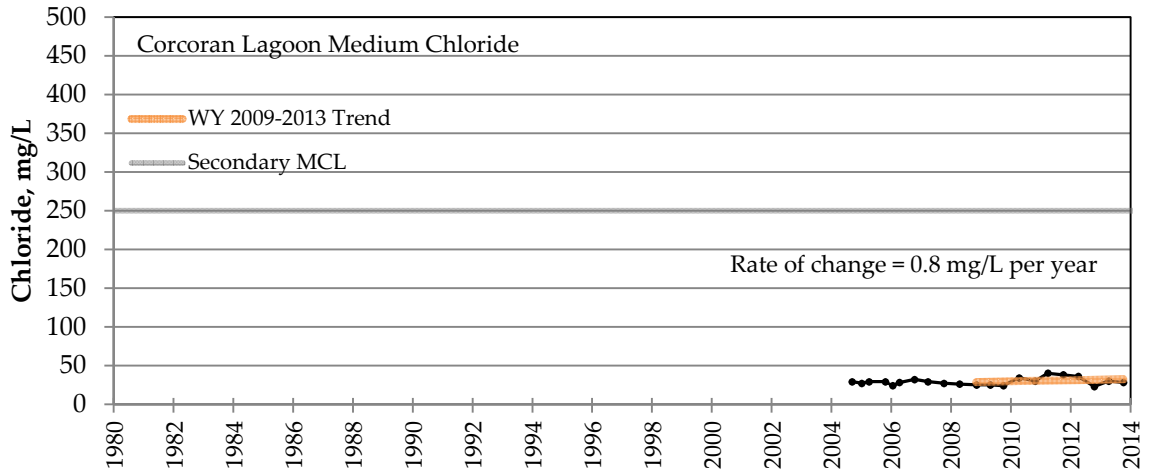

SC-5D Total Dissolved Solids
TDS, mg/L
Secondary MCL
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

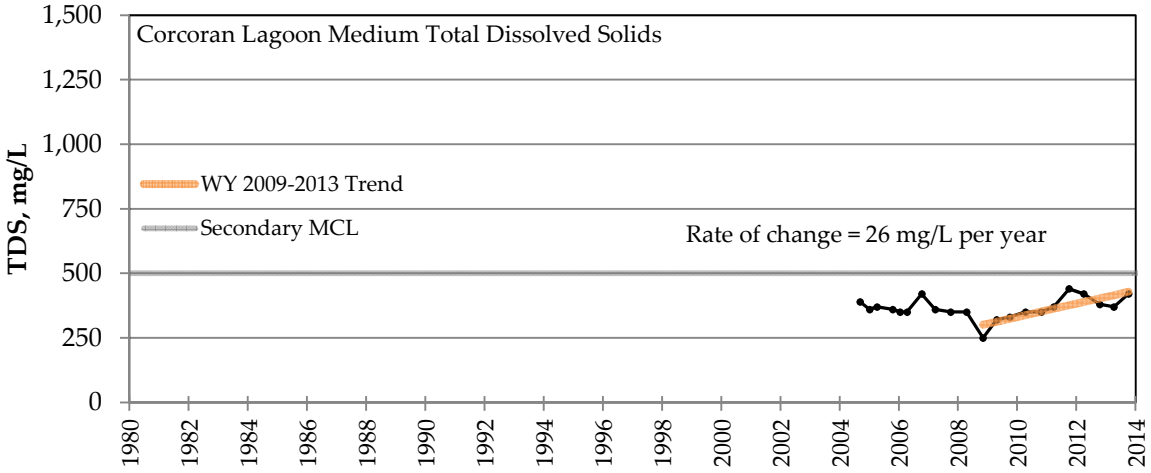

SC-5D Groundwater Elevation
Groundwater Elevation, ft MSL
70
60
50
40
30
20
10
0
-10
-20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

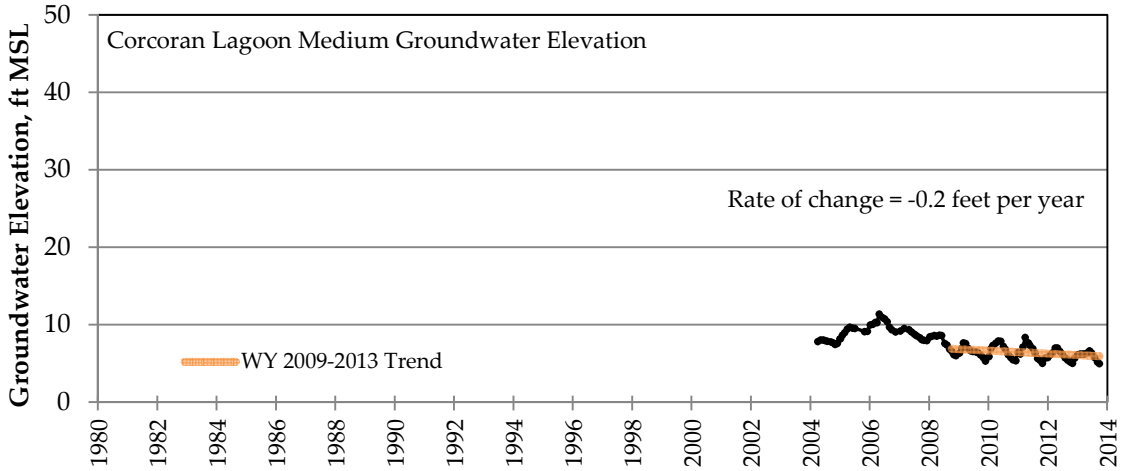

Corcoran Lagoon Shallow Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -16.9 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

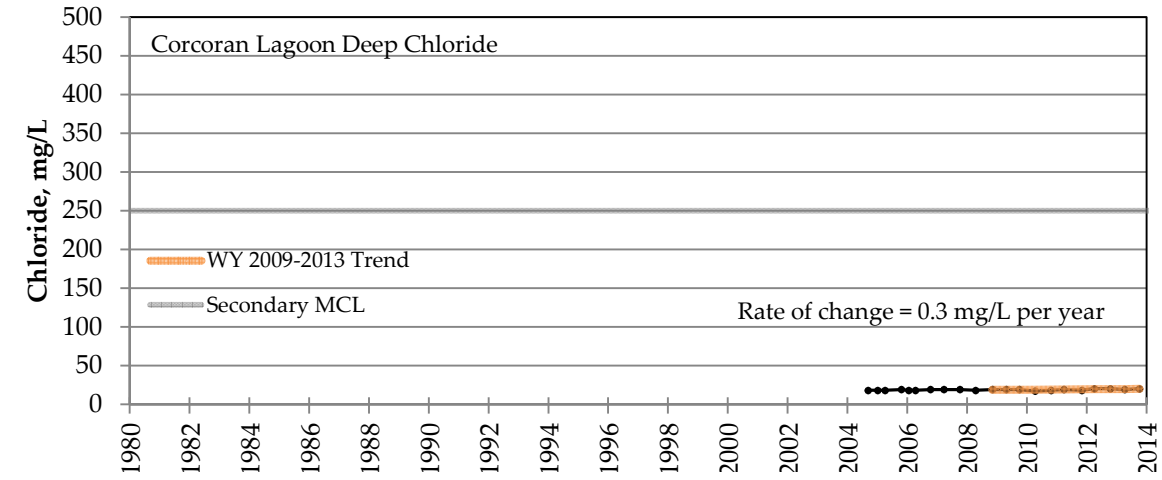

Corcoran Lagoon Shallow Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -64.3 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

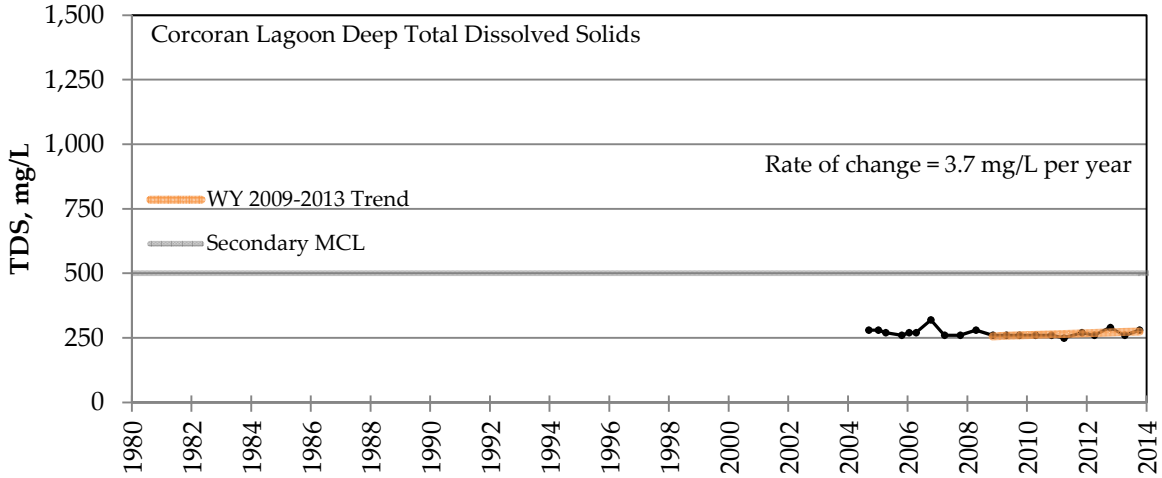

Corcoran Lagoon Shallow Groundwater Elevation
WY 2009-2013 Trend
Rate of change = -0.2 feet per year
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

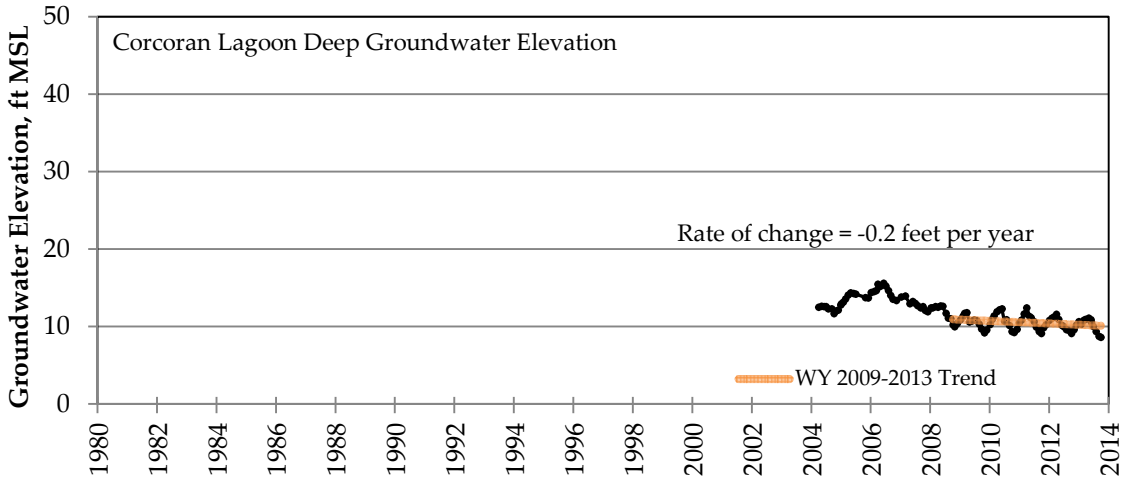

Corcoran Lagoon Medium Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.8 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

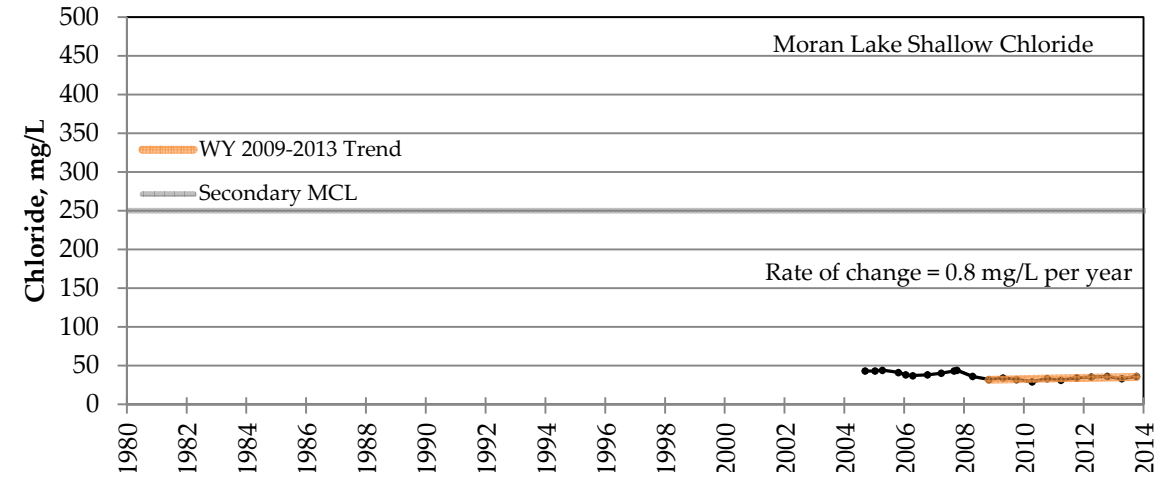

Corcoran Lagoon Medium Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 26 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

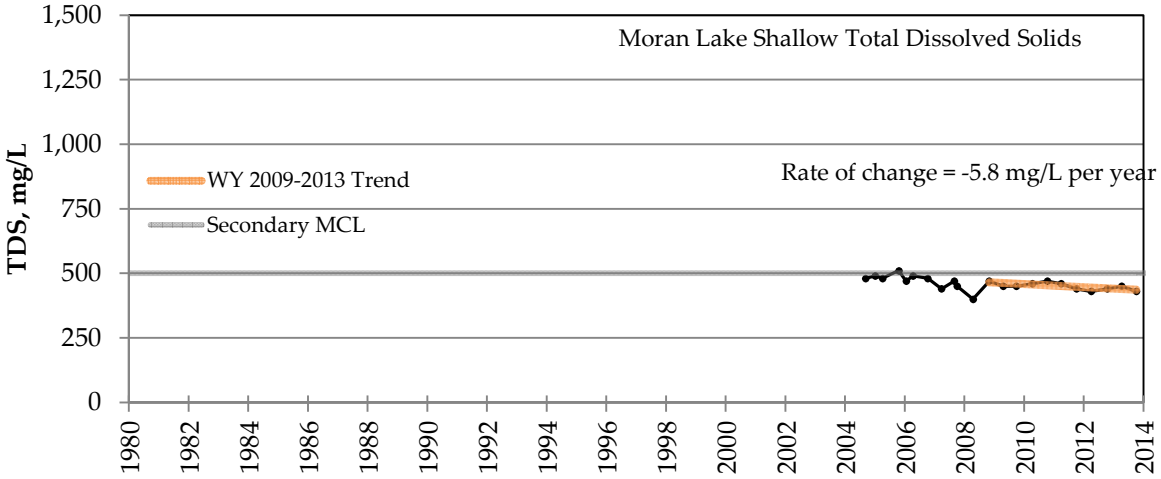

Corcoran Lagoon Medium Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Rate of change = -0.2 feet per year
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

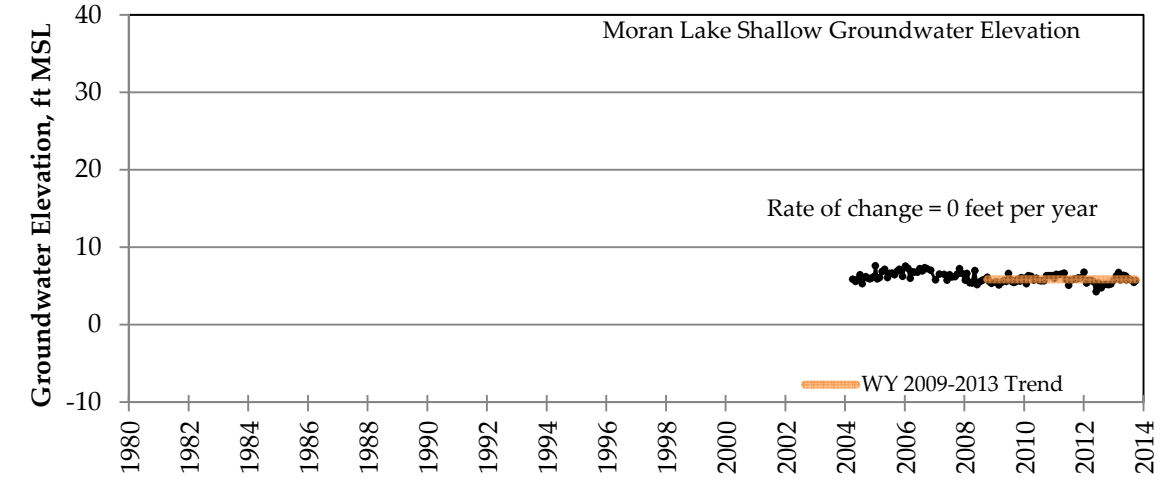

Corcoran Lagoon Deep Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.3 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

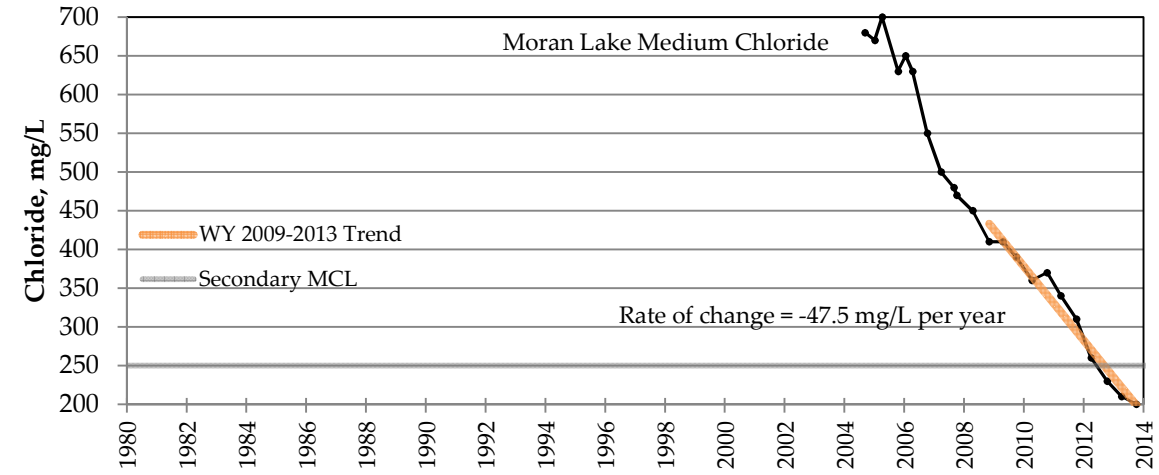

Corcoran Lagoon Deep Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Rate of change = 3.7 mg/L per year
WY 2009-2013 Trend
Secondary MCL
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

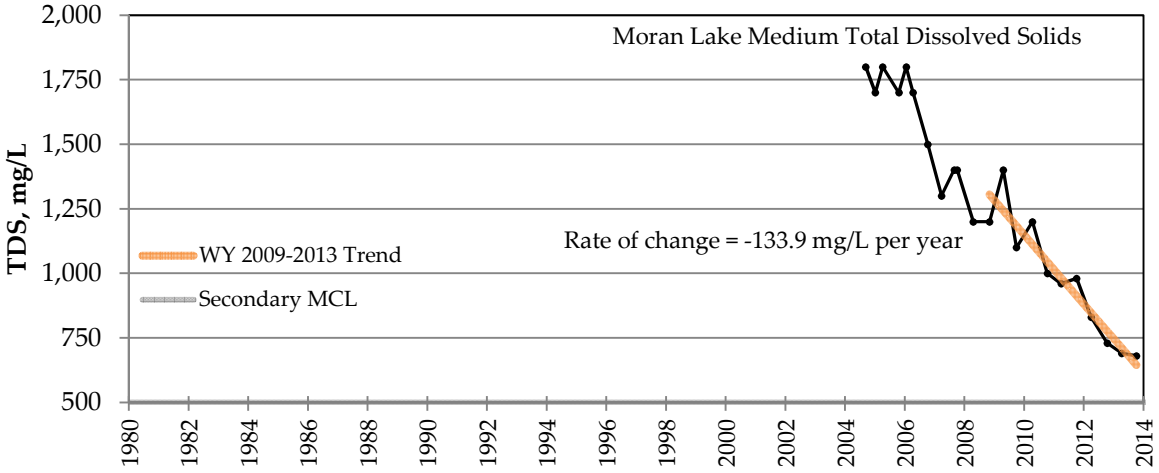

Corcoran Lagoon Deep Groundwater Elevation
Groundwater Elevation, ft MSL
50
40
30
20
10
0
Rate of change = -0.2 feet per year
WY 2009-2013 Trend
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

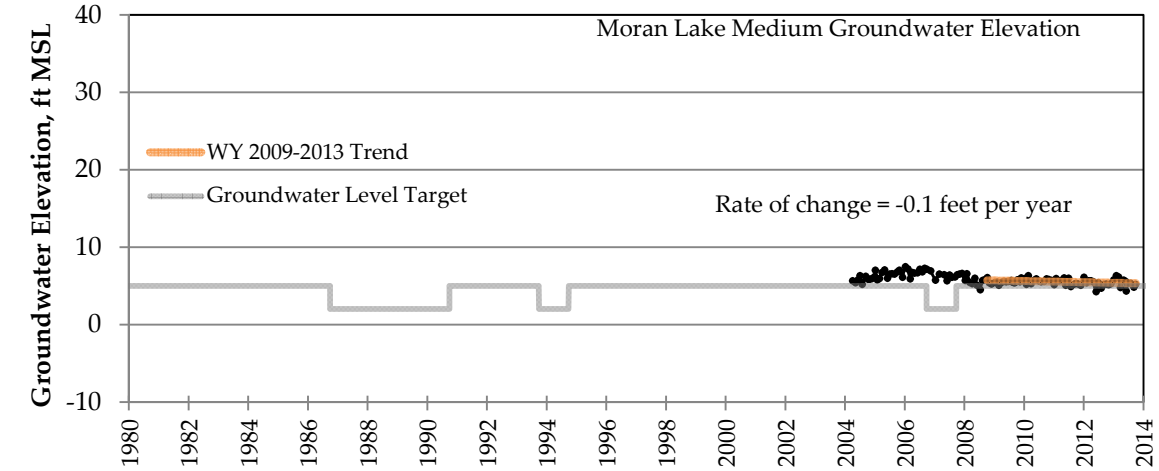

Moran Lake Shallow Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.8 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

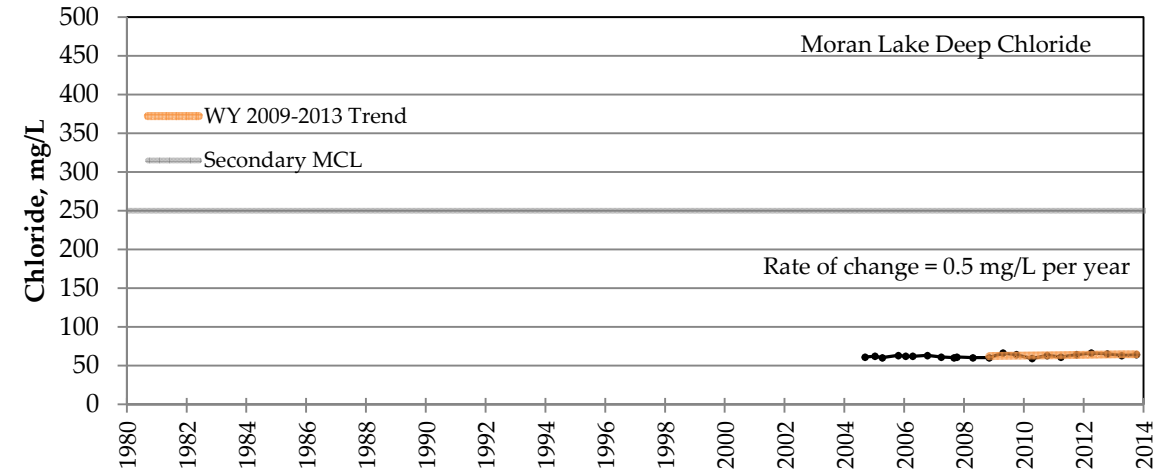

Moran Lake Shallow Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -5.8 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

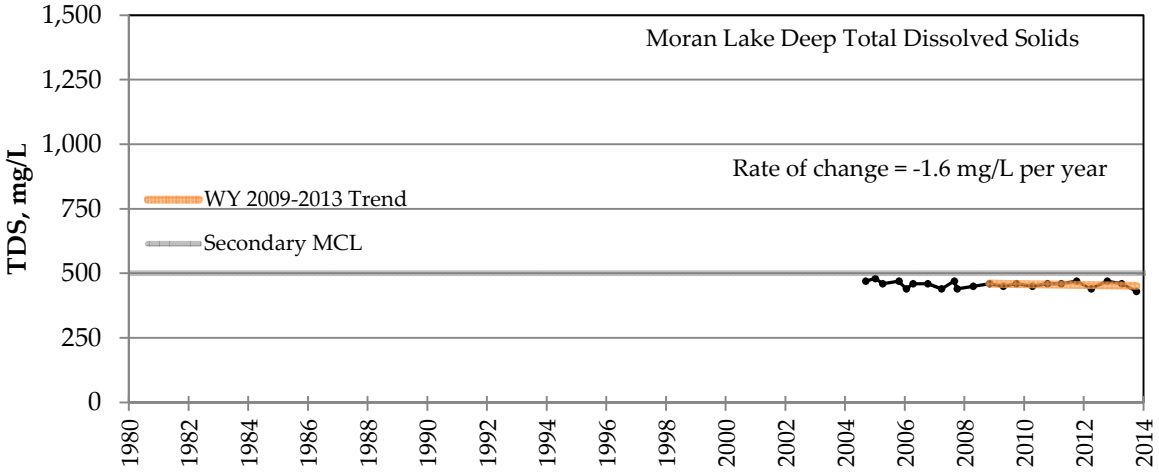

Moran Lake Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0 feet per year
WY 2009-2013 Trend
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

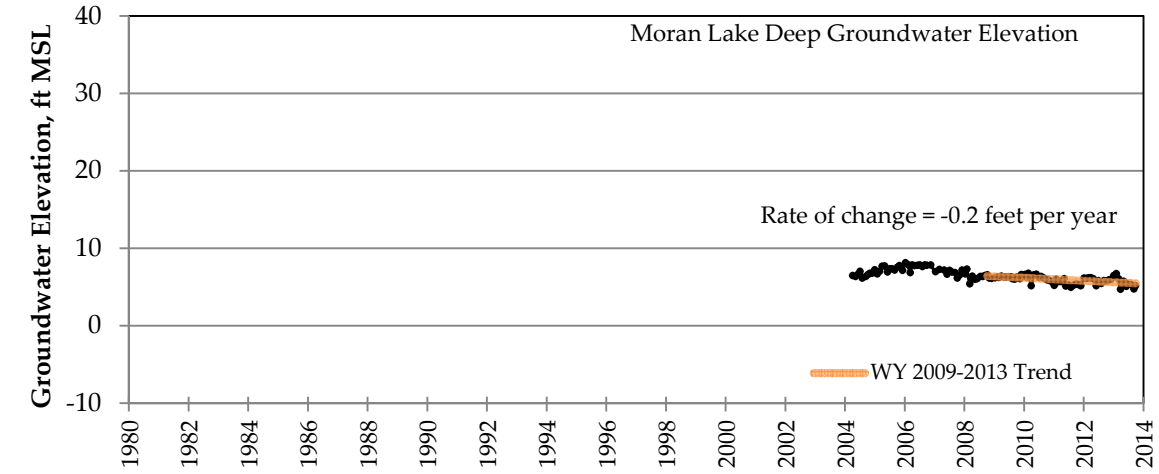

Moran Lake Medium Chloride
Chloride, mg/L
700
650
600
550
500
450
400
350
300
250
200
WY 2009-2013 Trend
Secondary MCL
Rate of change = -47.5 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

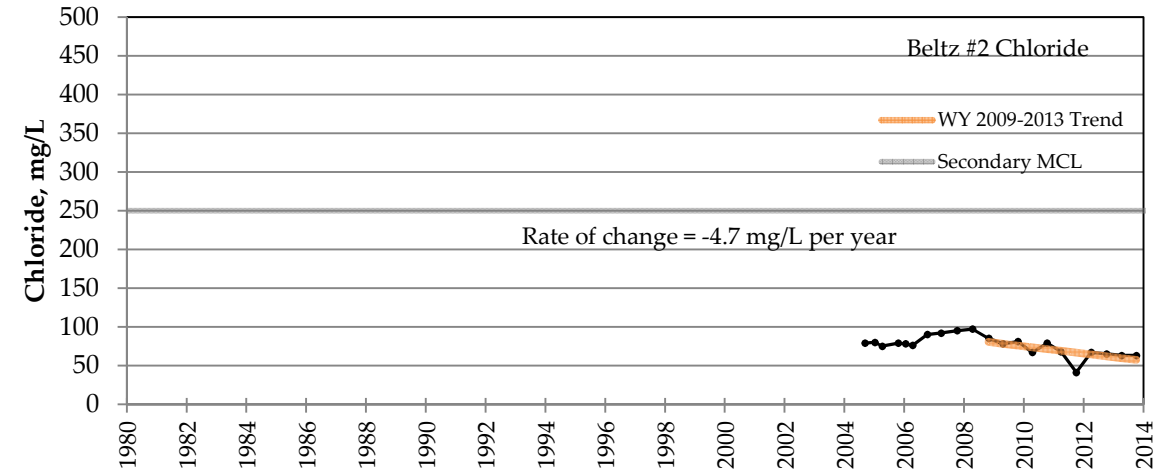

Moran Lake Medium Total Dissolved Solids
TDS, mg/L
2,000
1,750
1,500
1,250
1,000
750
500
WY 2009-2013 Trend
Secondary MCL
Rate of change = -133.9 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

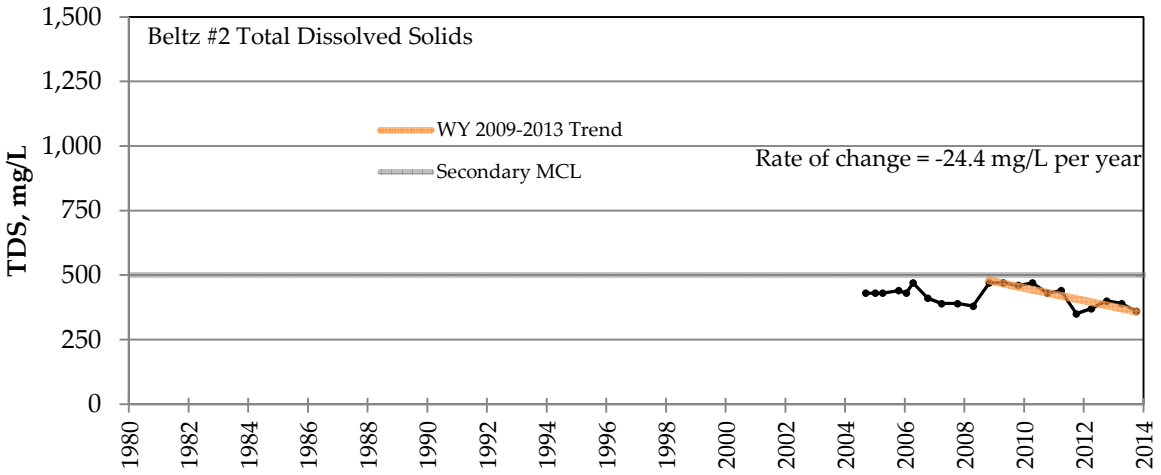

Moran Lake Medium Groundwater Elevation
Groundwater Elevation, ft MSL
40
30
20
10
0
-10
WY 2009-2013 Trend
Groundwater Level Target
Rate of change = -0.1 feet per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

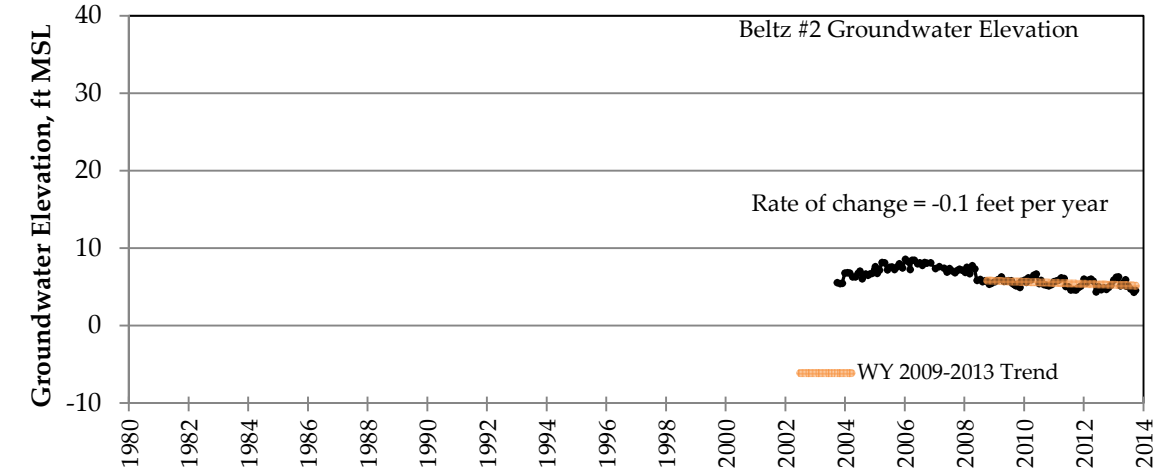

Moran Lake Deep Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.5 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

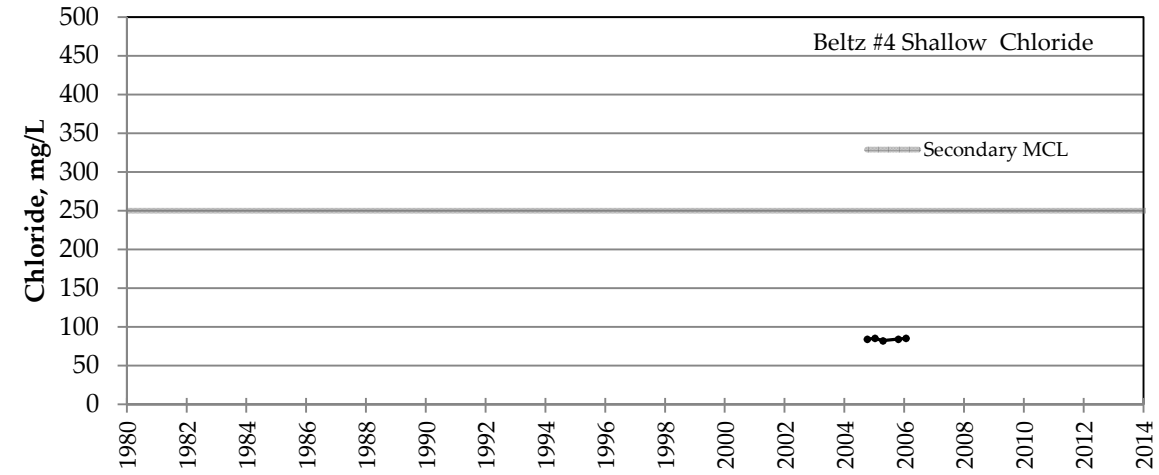

Moran Lake Deep Total Dissolved Solids
TDS, mg/L
Rate of change = -1.6 mg/L per year
WY 2009-2013 Trend
Secondary MCL
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

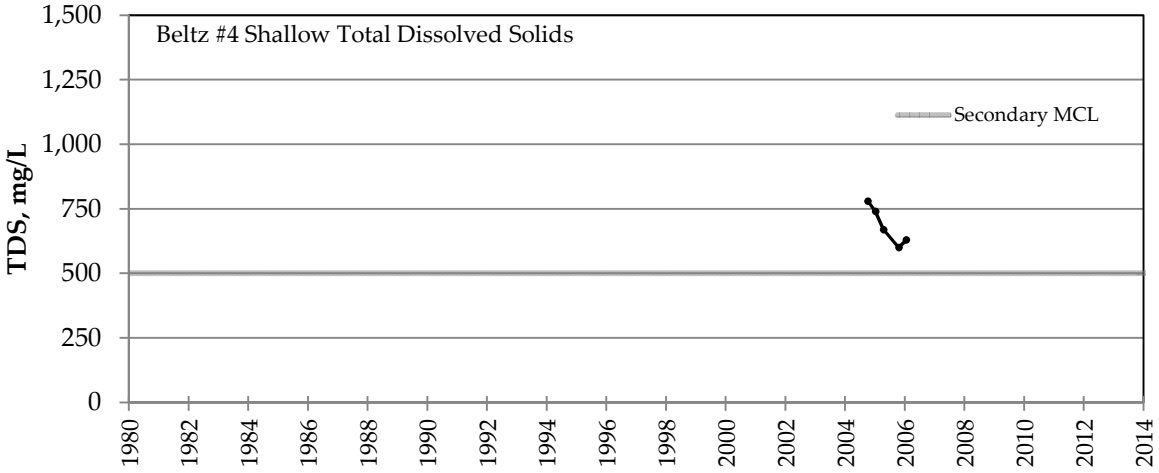

Moran Lake Deep Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.2 feet per year
WY 2009-2013 Trend
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

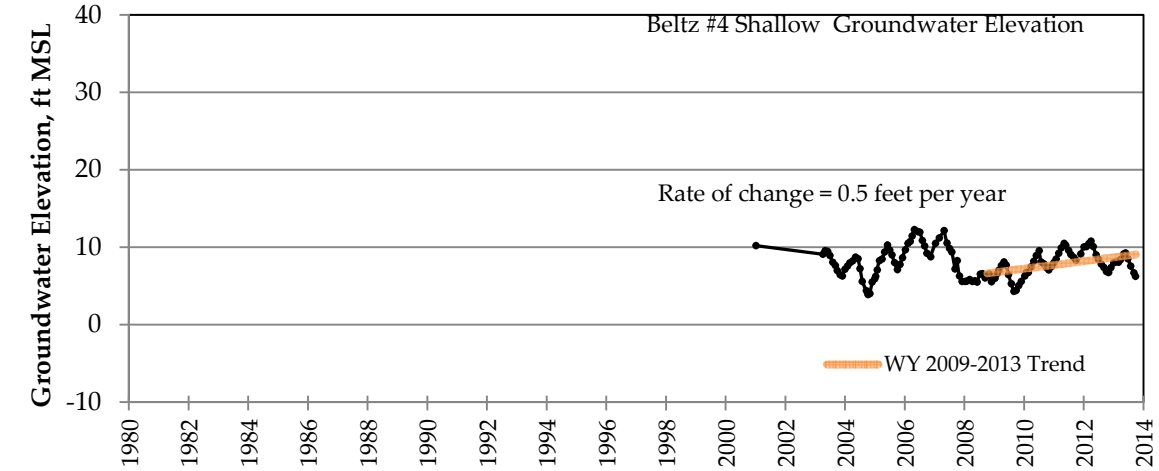

Beltz #2 Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -4.7 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

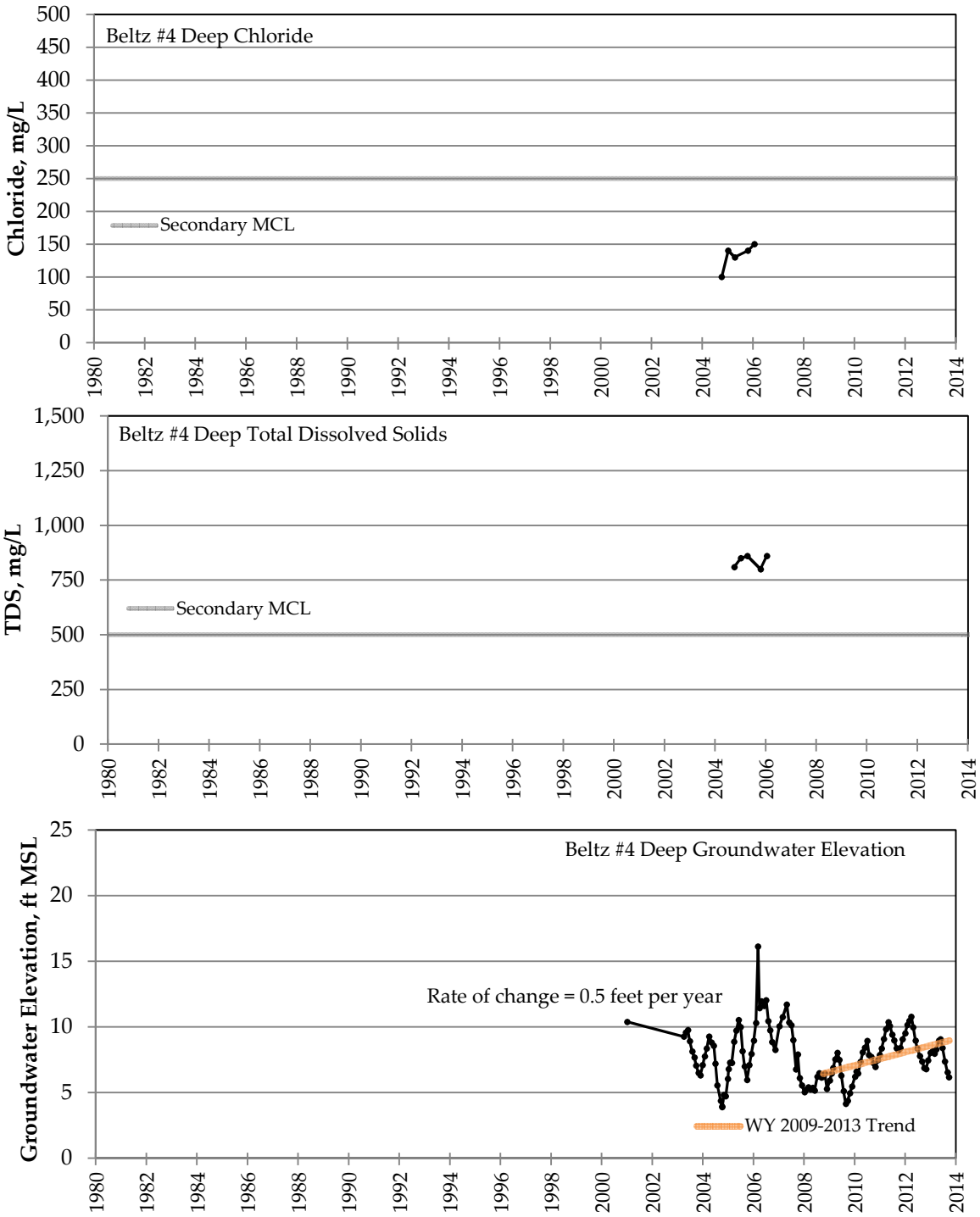

Beltz #2 Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -24.4 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

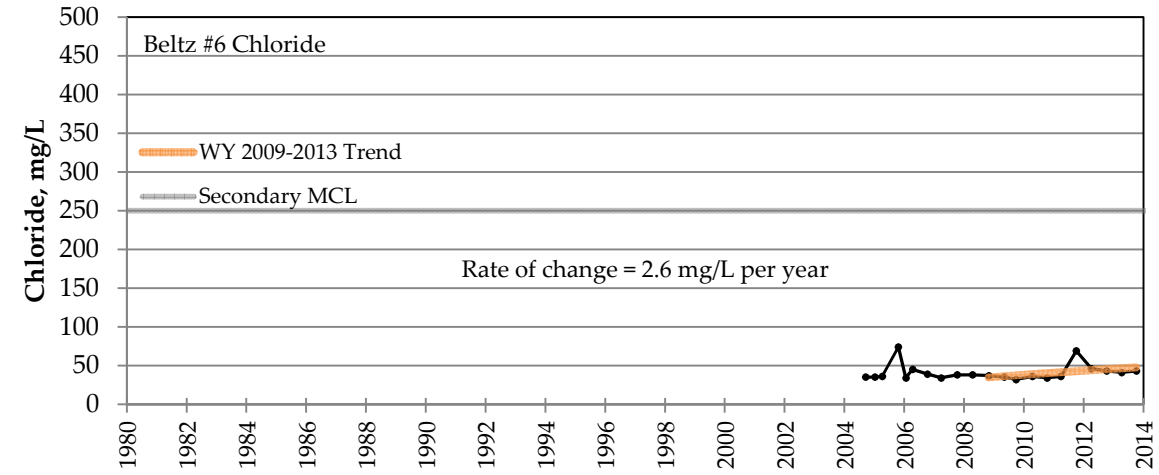

Beltz #2 Groundwater Elevation
Rate of change = -0.1 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

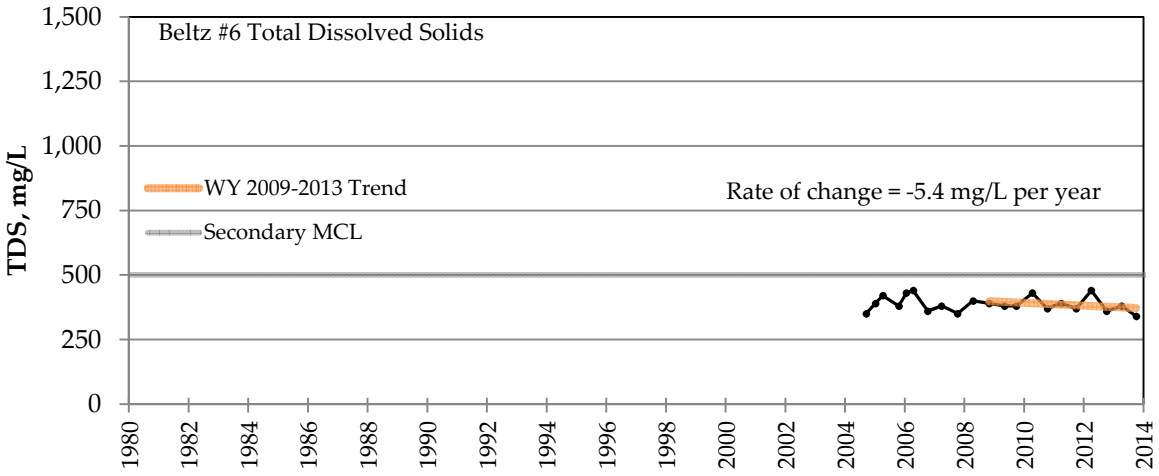

Beltz #4 Shallow Chloride
Chloride, mg/L
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

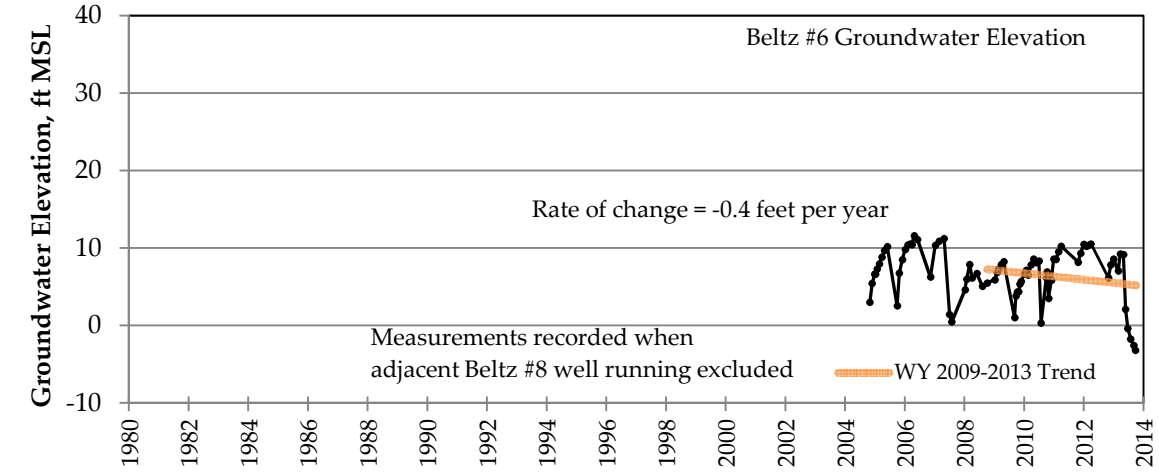

Beltz #4 Shallow Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

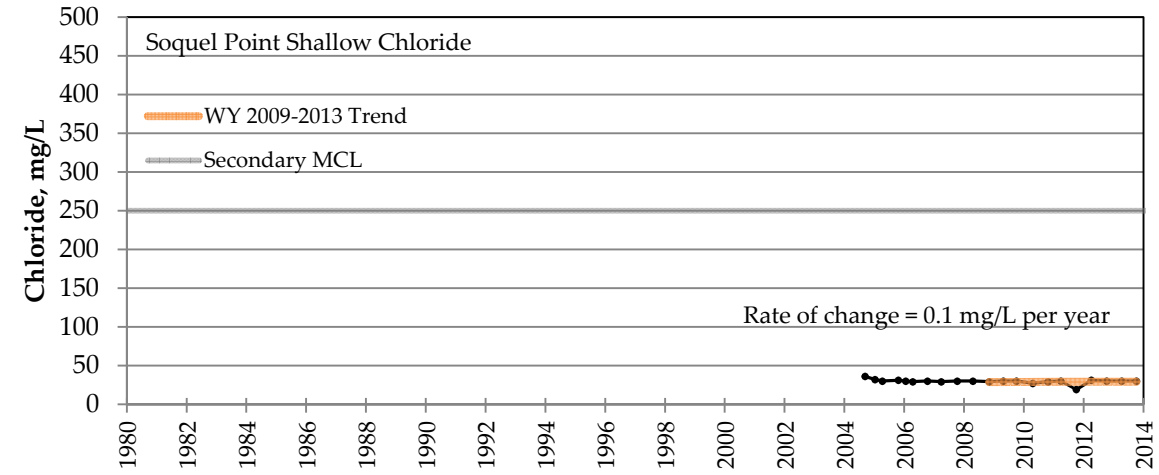

Beltz #4 Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.5 feet per year
WY 2009-2013 Trend
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

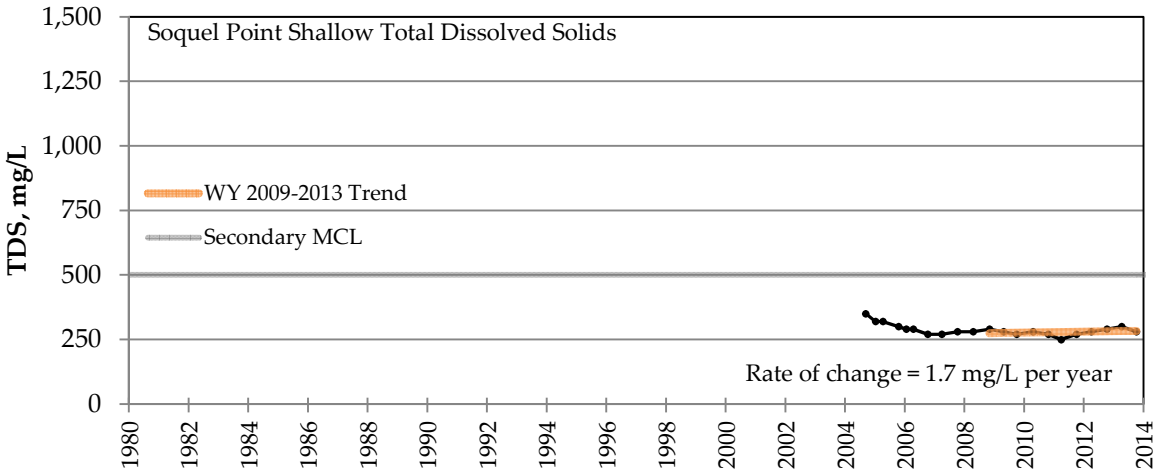

Beltz #4 Deep Chloride
Chloride, mg/L
Secondary MCL
Beltz #4 Deep Total Dissolved Solids
TDS, mg/L
Secondary MCL
Beltz #4 Deep Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.5 feet per year
WY 2009-2013 Trend

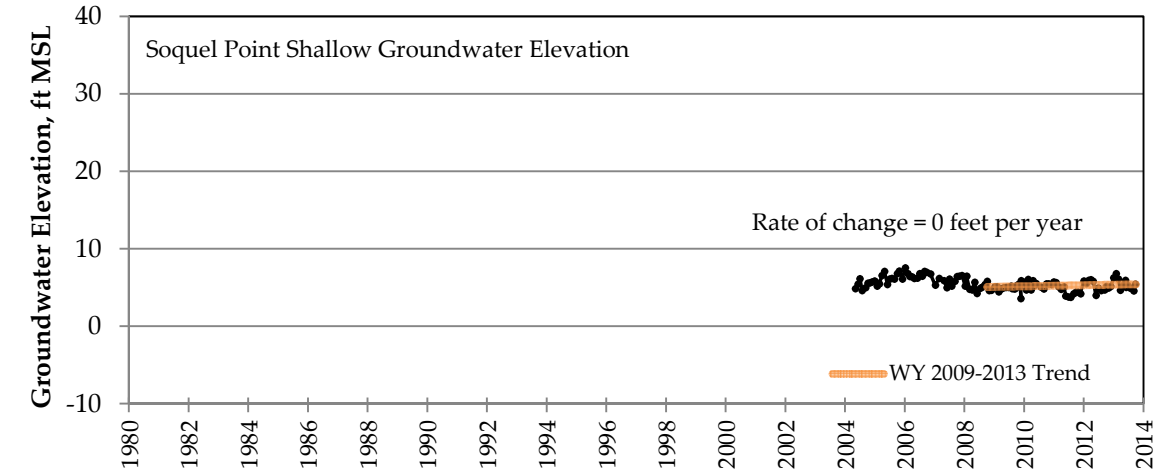

Beltz #6 Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 2.6 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

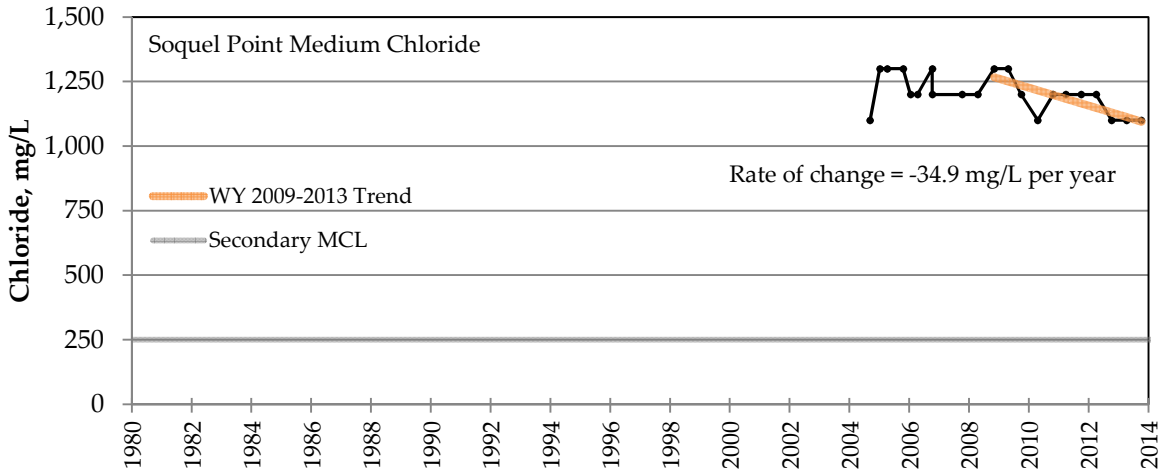

Beltz #6 Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -5.4 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

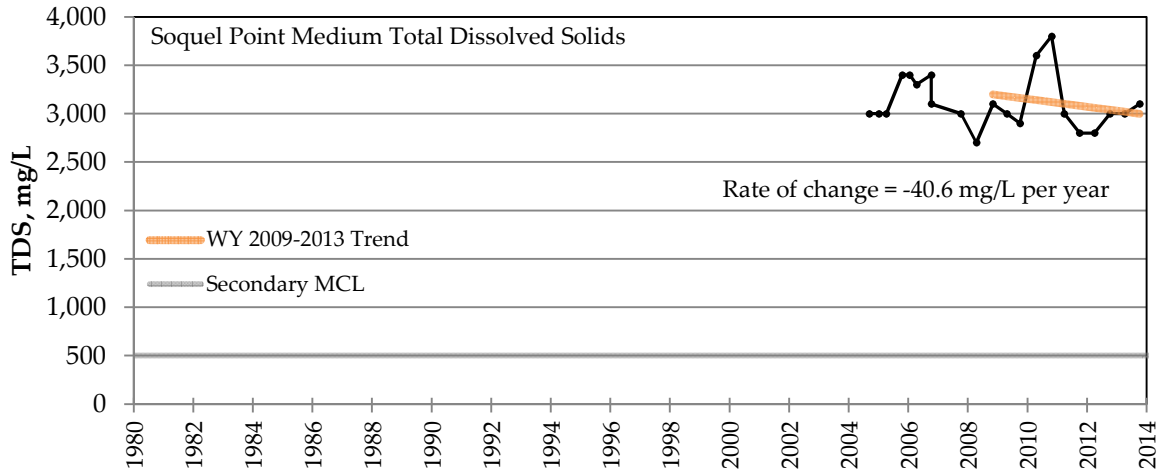

Beltz #6 Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.4 feet per year
Measurements recorded when
adjacent Beltz #8 well running excluded
WY 2009-2013 Trend
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

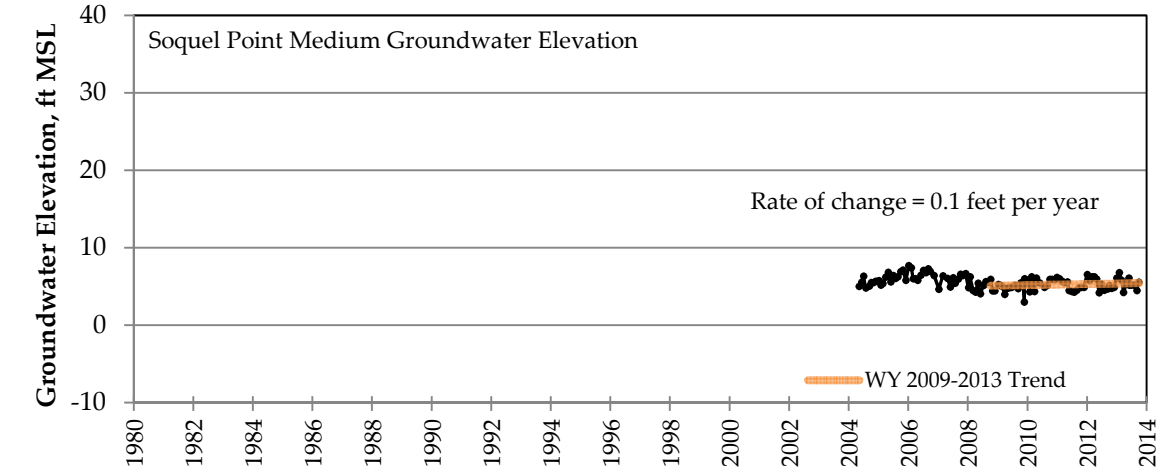

Soquel Point Shallow Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.1 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

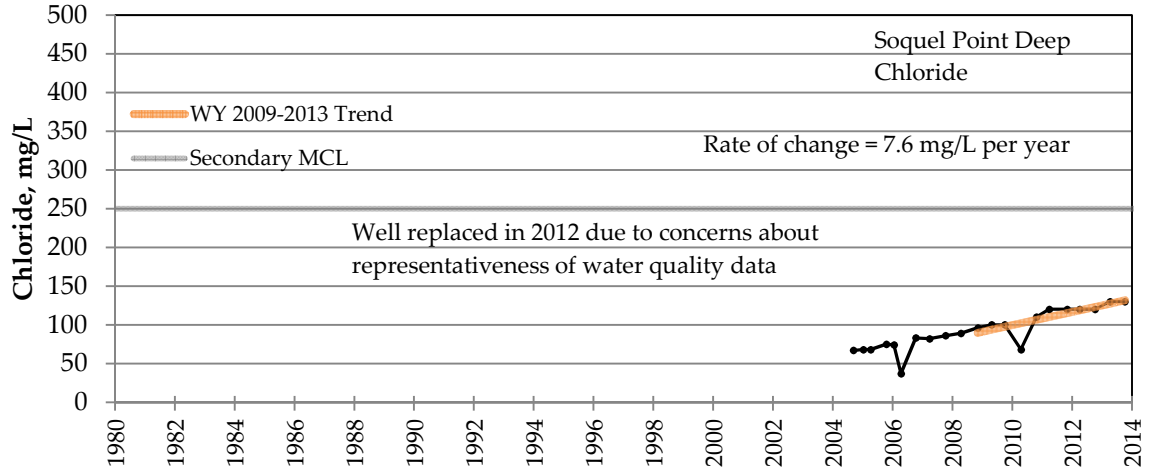

Soquel Point Shallow Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 1.7 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

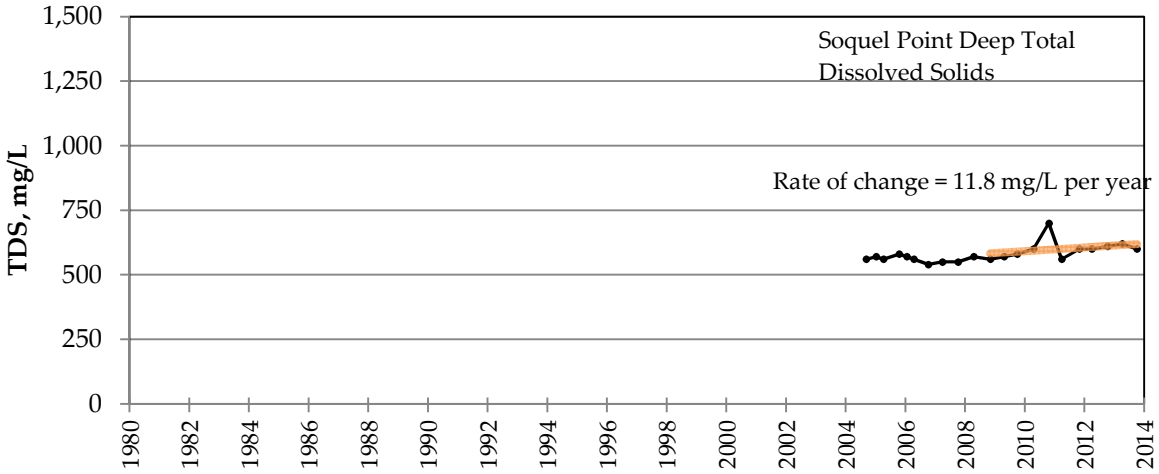

Soquel Point Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0 feet per year
WY 2009-2013 Trend
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

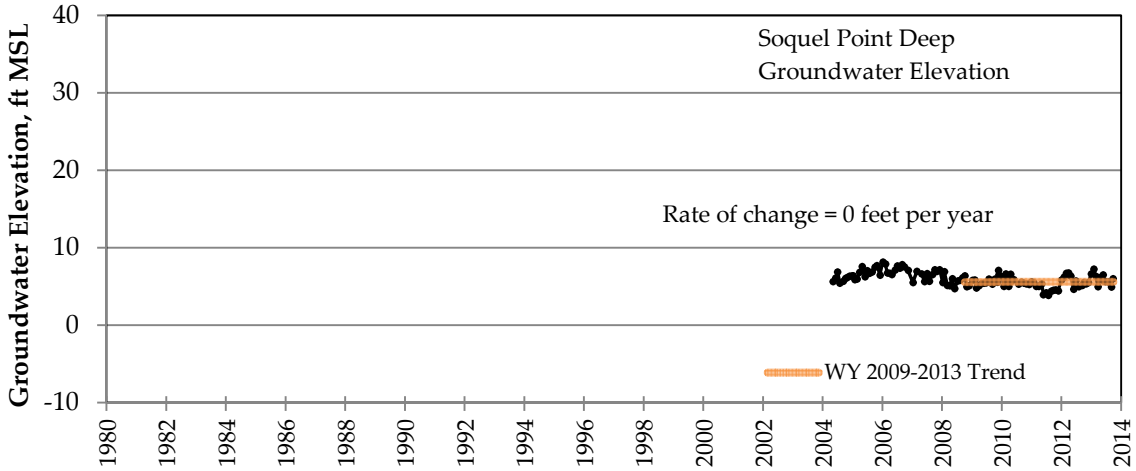

Soquel Point Medium Chloride
Chloride, mg/L
1,500
1,250
1,000
750
500
250
0
Rate of change = -34.9 mg/L per year
WY 2009-2013 Trend
Secondary MCL
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

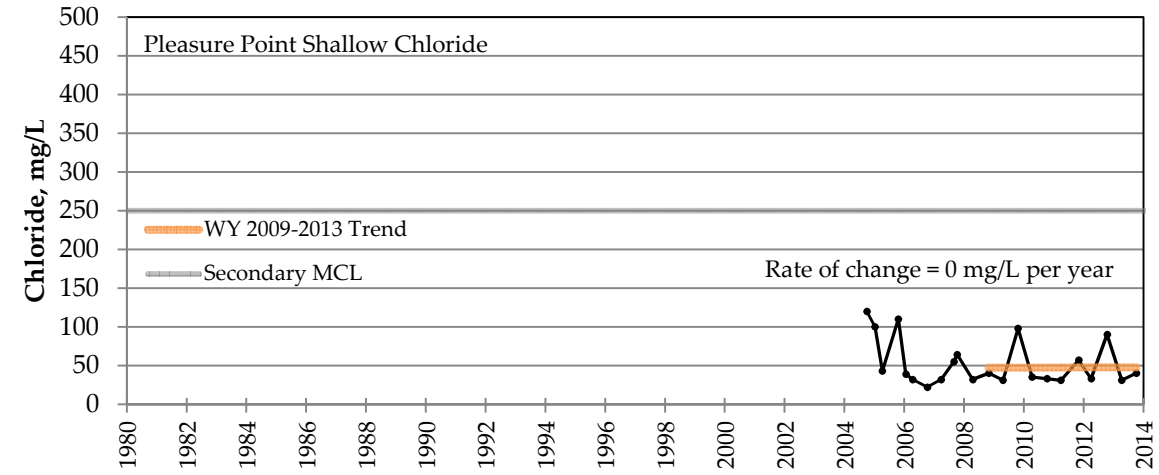

Soquel Point Medium Total Dissolved Solids
TDS, mg/L
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Rate of change = -40.6 mg/L per year
WY 2009-2013 Trend
Secondary MCL
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

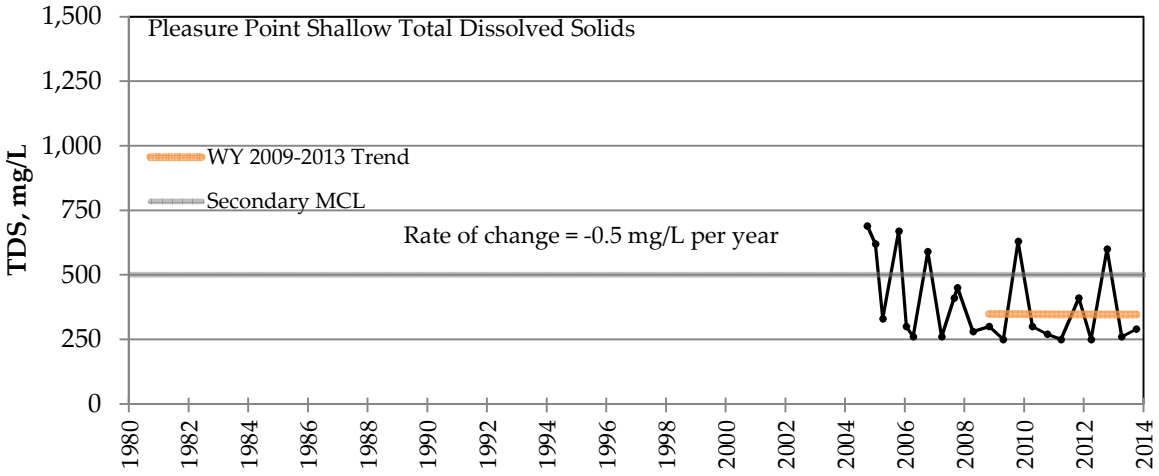

Soquel Point Medium Groundwater Elevation
Groundwater Elevation, ft MSL
40
30
20
10
0
-10
Rate of change = 0.1 feet per year
WY 2009-2013 Trend
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

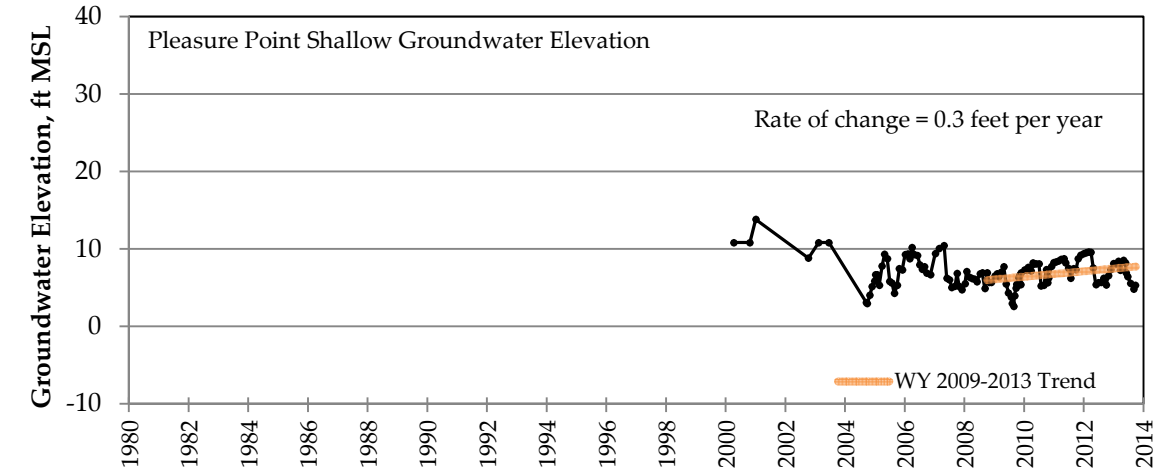

Soquel Point Deep
Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 7.6 mg/L per year
Well replaced in 2012 due to concerns about
representativeness of water quality data
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

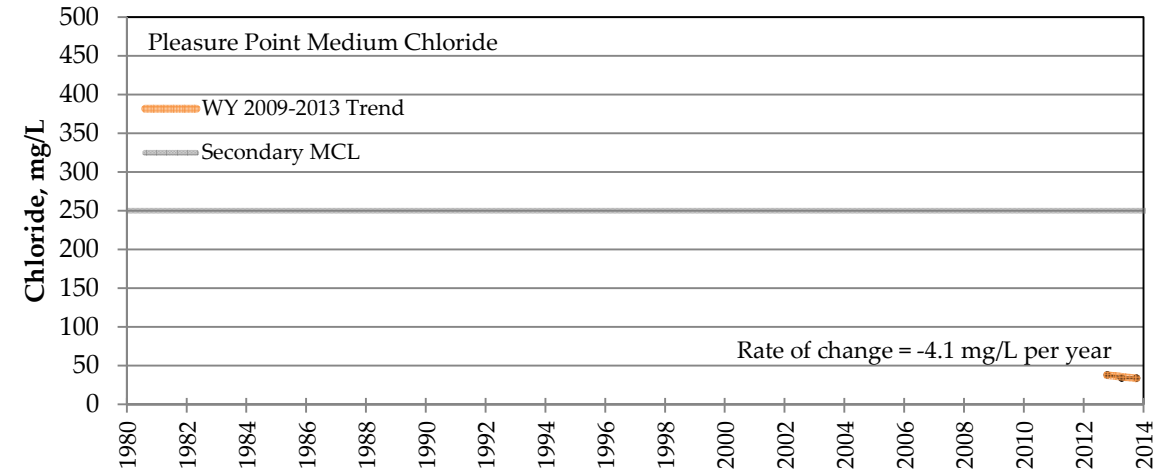

Soquel Point Deep Total
Dissolved Solids
Rate of change = 11.8 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

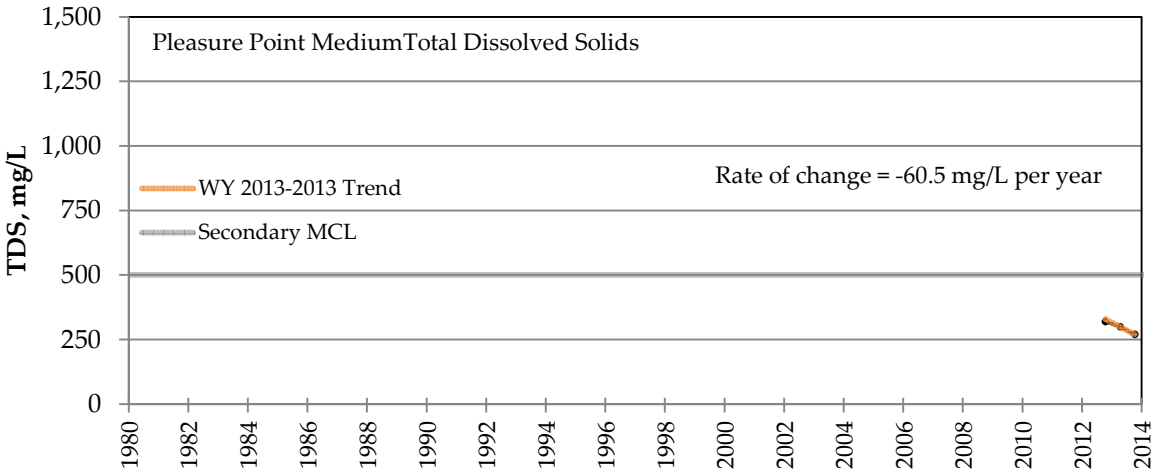

Soquel Point Deep
Groundwater Elevation
Rate of change = 0 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

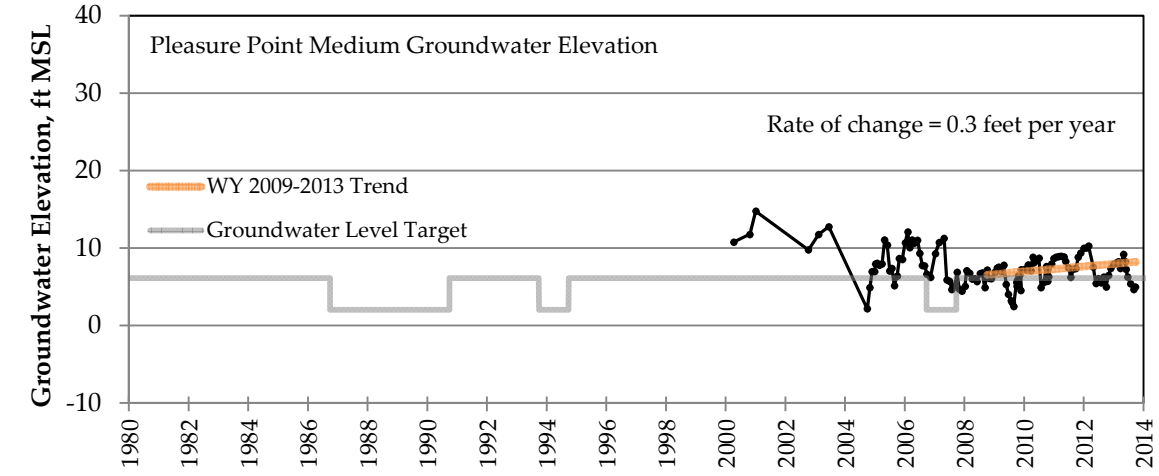

Pleasure Point Shallow Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

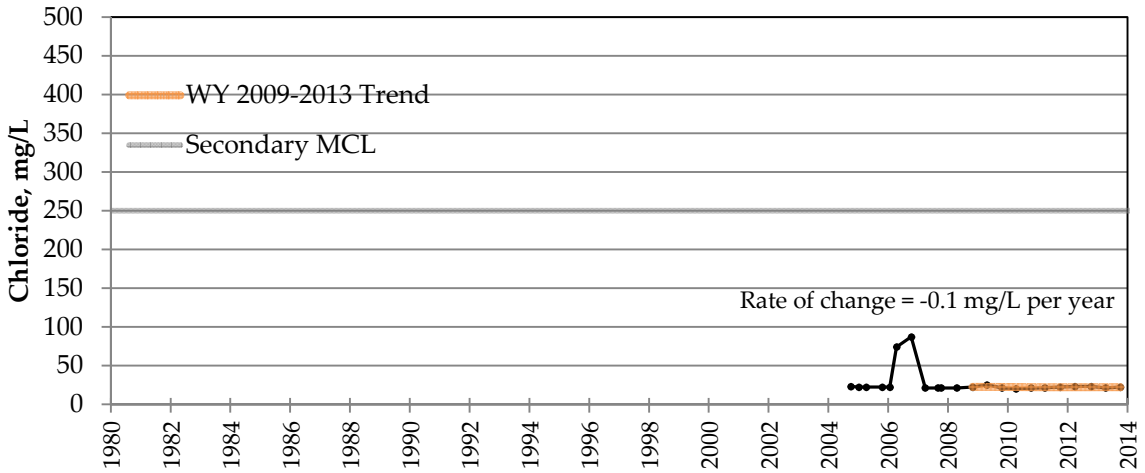

Pleasure Point Shallow Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.5 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

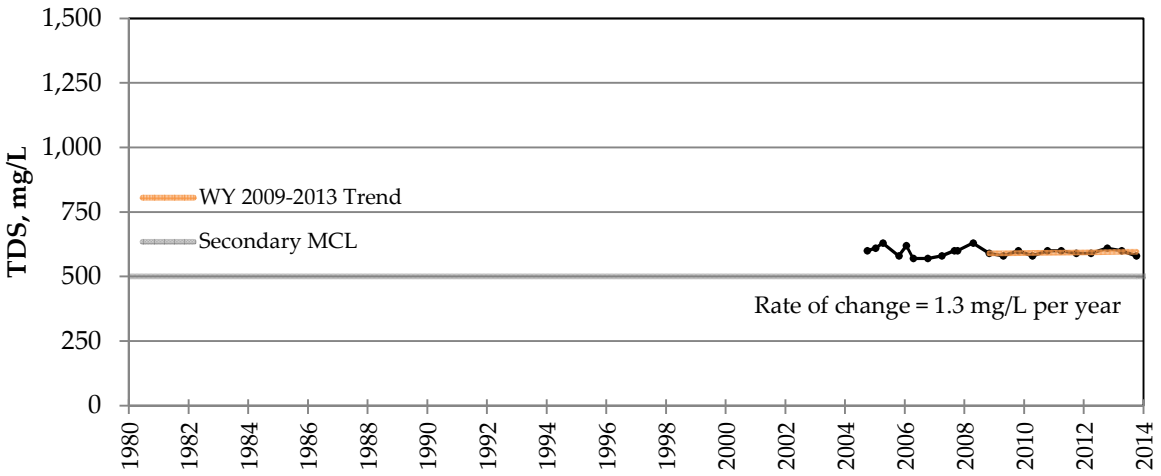

Pleasure Point Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.3 feet per year
WY 2009-2013 Trend
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

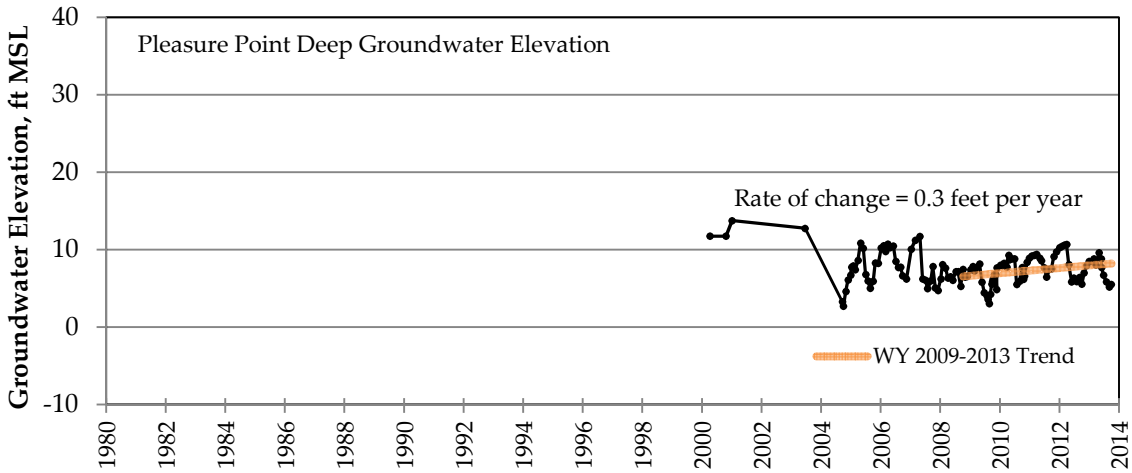

Pleasure Point Medium Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -4.1 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

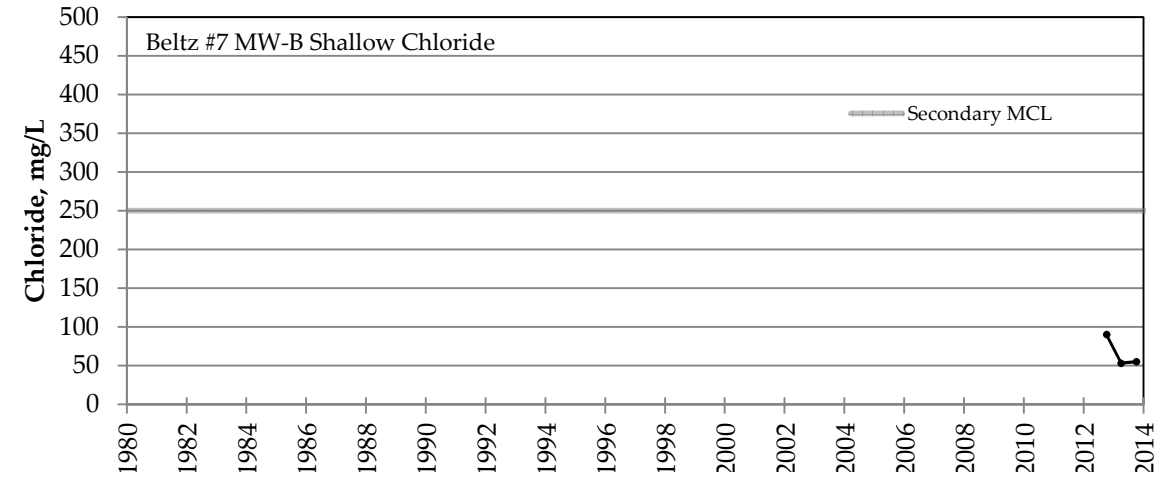

Pleasure Point MediumTotal Dissolved Solids
TDS, mg/L
WY 2013-2013 Trend
Secondary MCL
Rate of change = -60.5 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

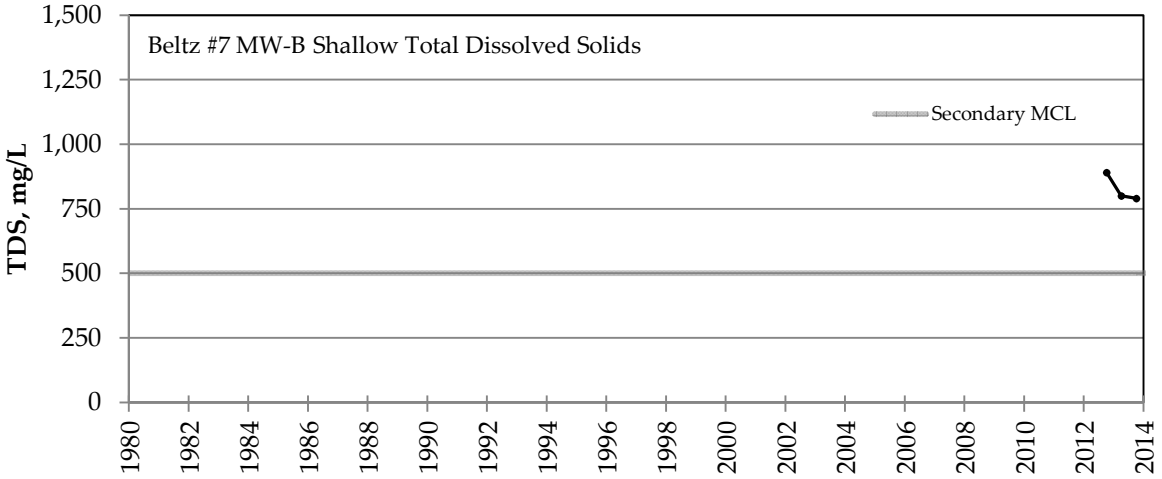

Pleasure Point Medium Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.3 feet per year
WY 2009-2013 Trend
Groundwater Level Target
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

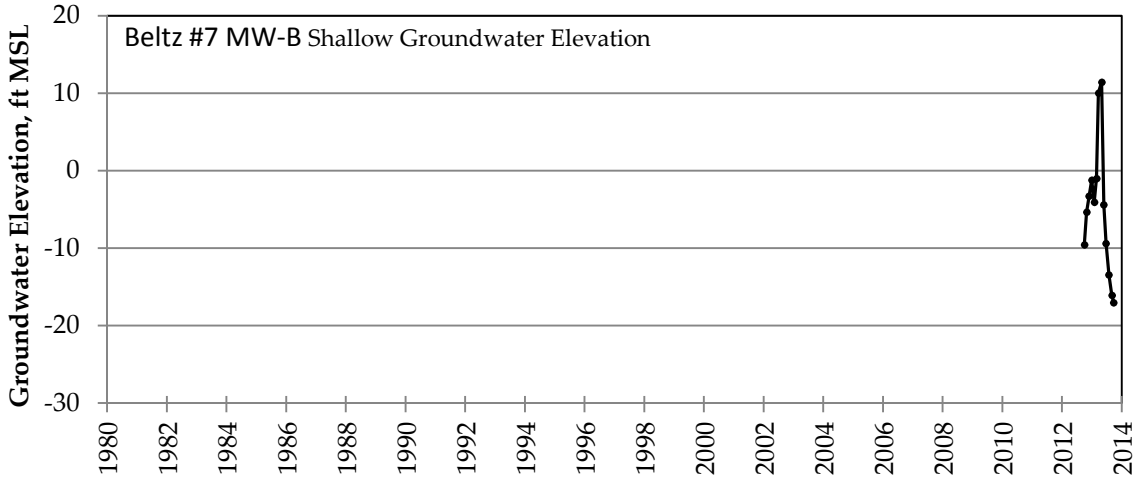

Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.1 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

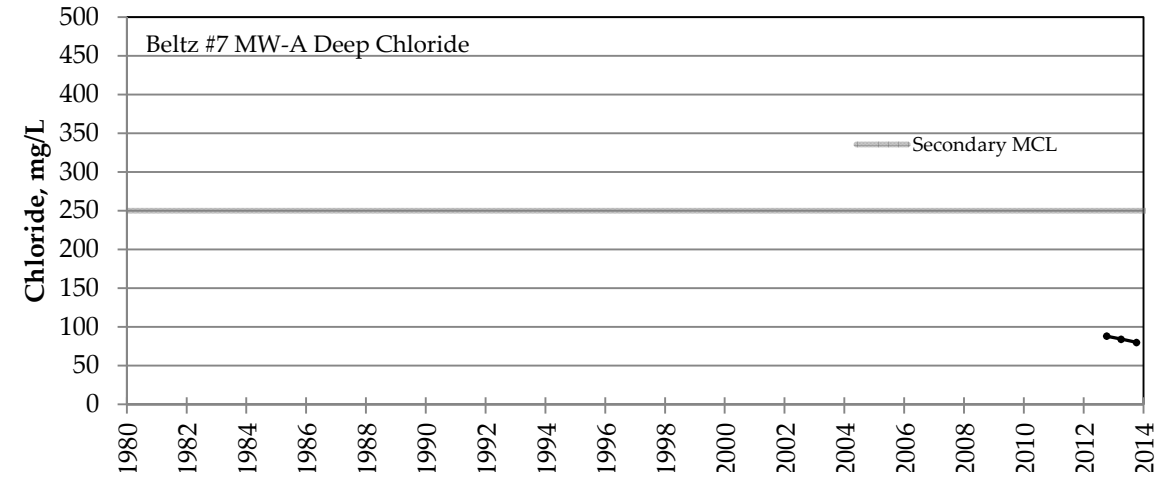

TDS, mg/L
1,500
1,250
1,000
750
500
250
0
WY 2009-2013 Trend
Secondary MCL
Rate of change = 1.3 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

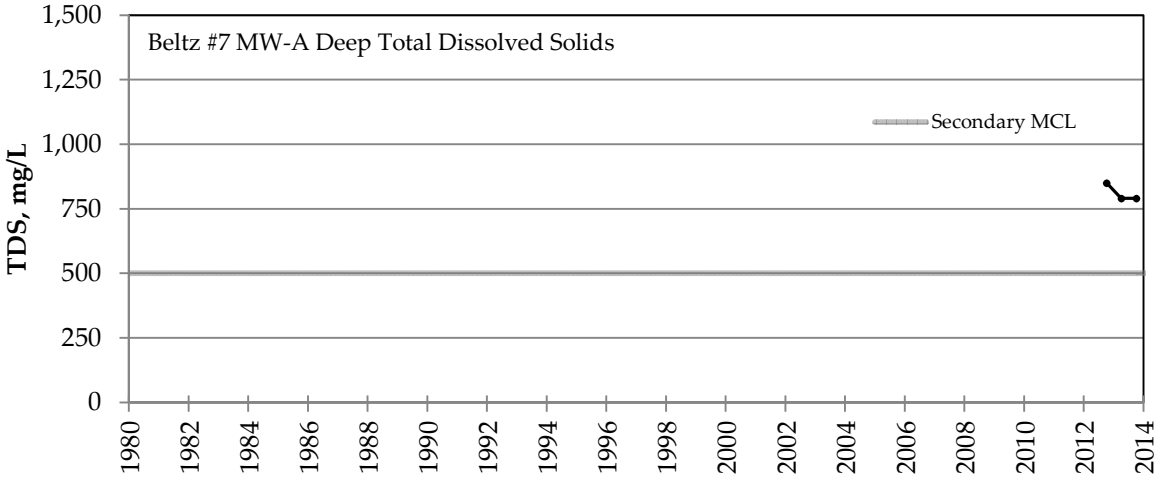

Groundwater Elevation, ft MSL
40
30
20
10
0
-10
Pleasure Point Deep Groundwater Elevation
Rate of change = 0.3 feet per year
WY 2009-2013 Trend
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

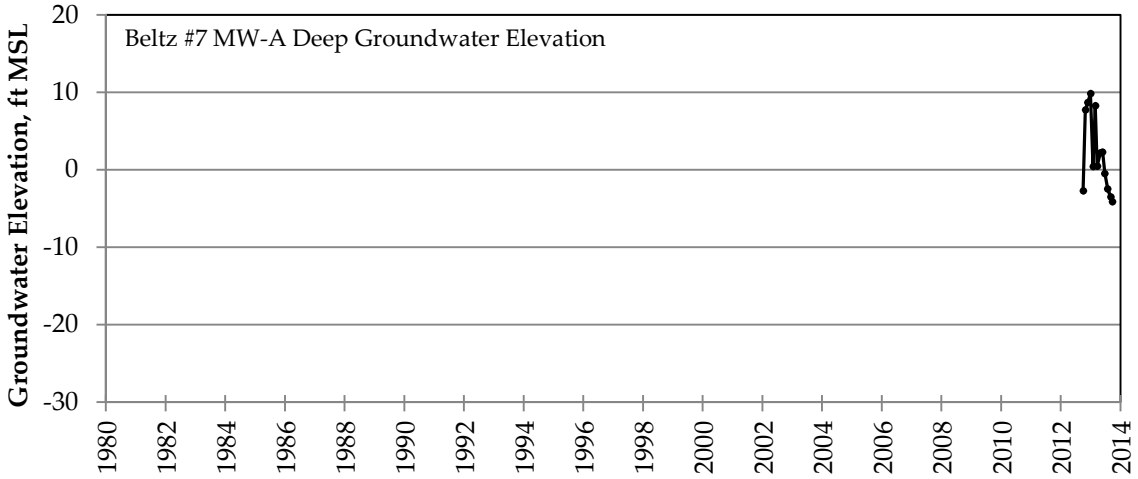

Beltz #7 MW-B Shallow Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

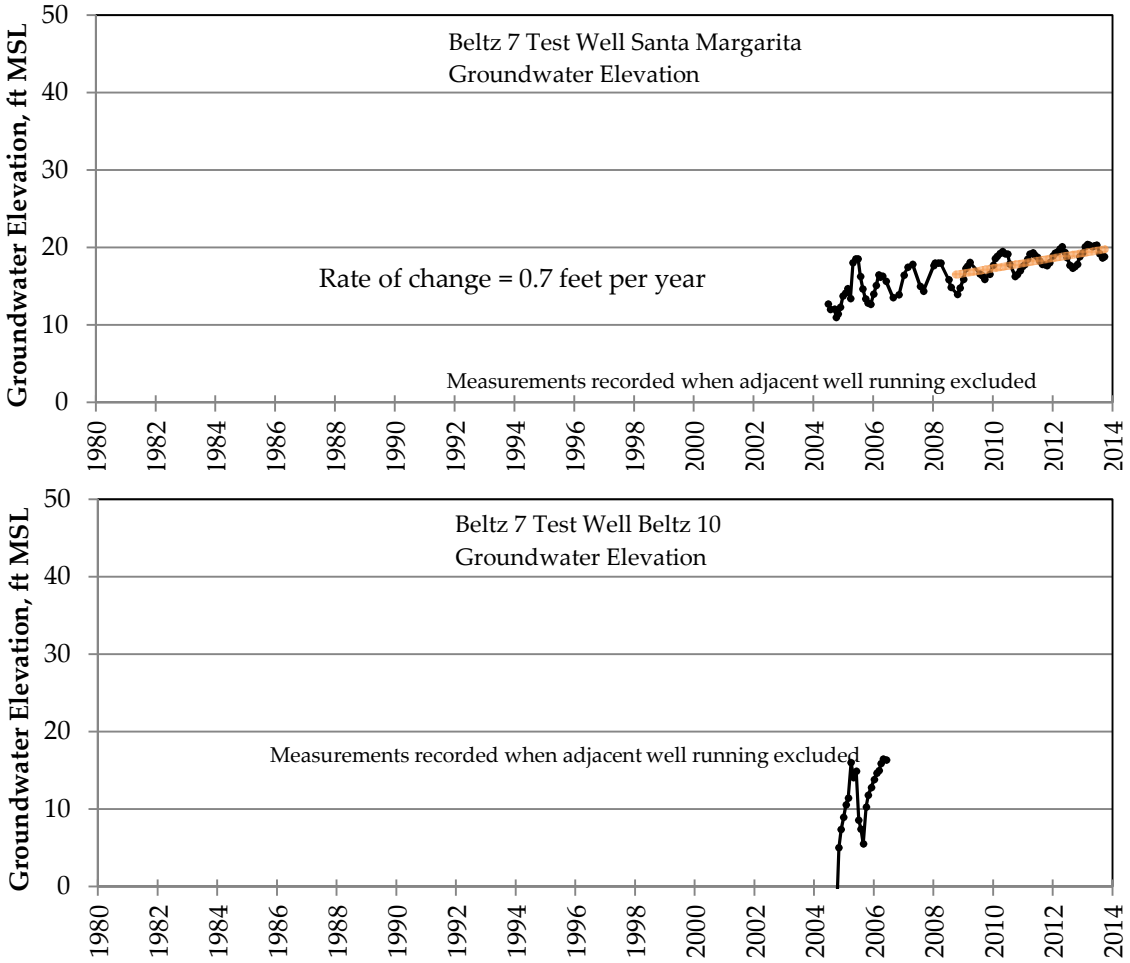

Beltz #7 MW-B Shallow Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

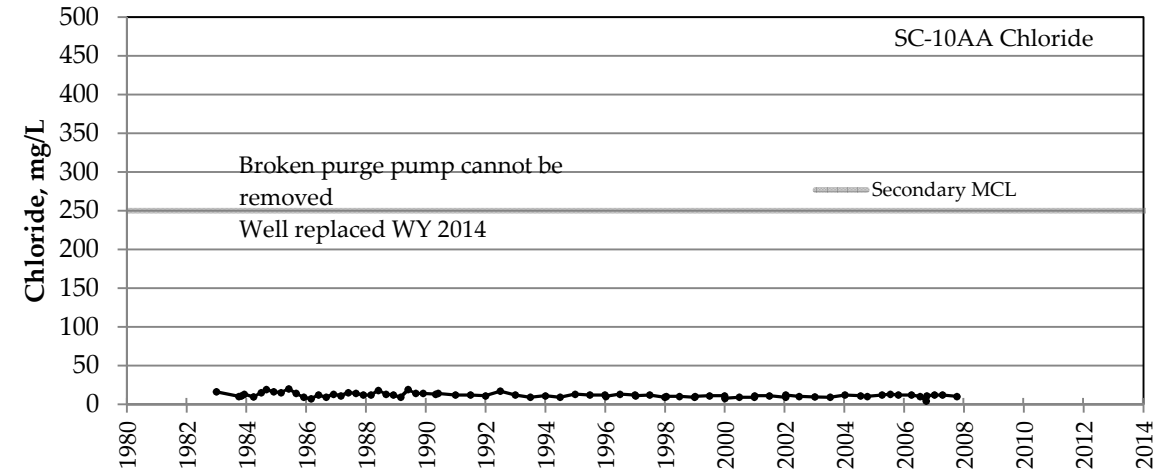

Beltz #7 MW-B Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

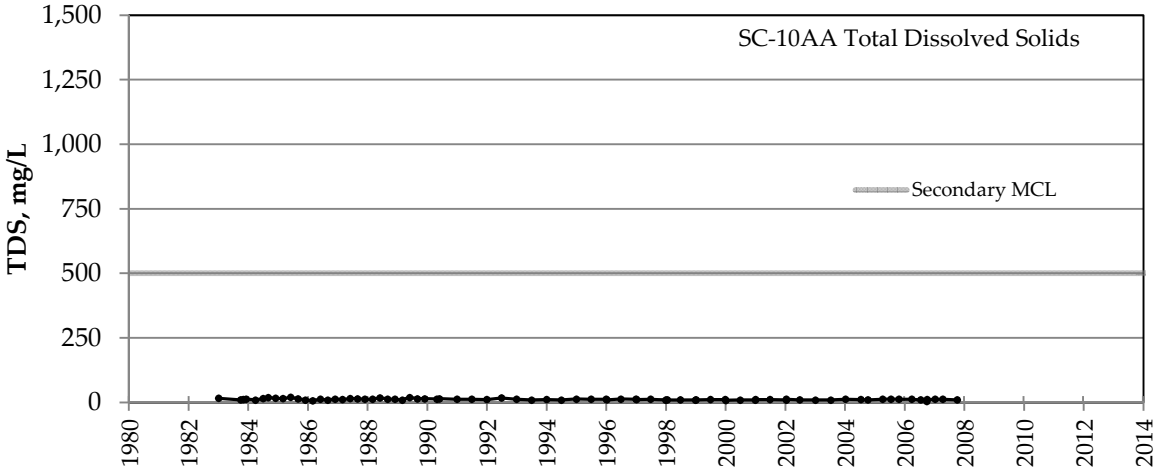

Beltz #7 MW-A Deep Chloride
Chloride, mg/L
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

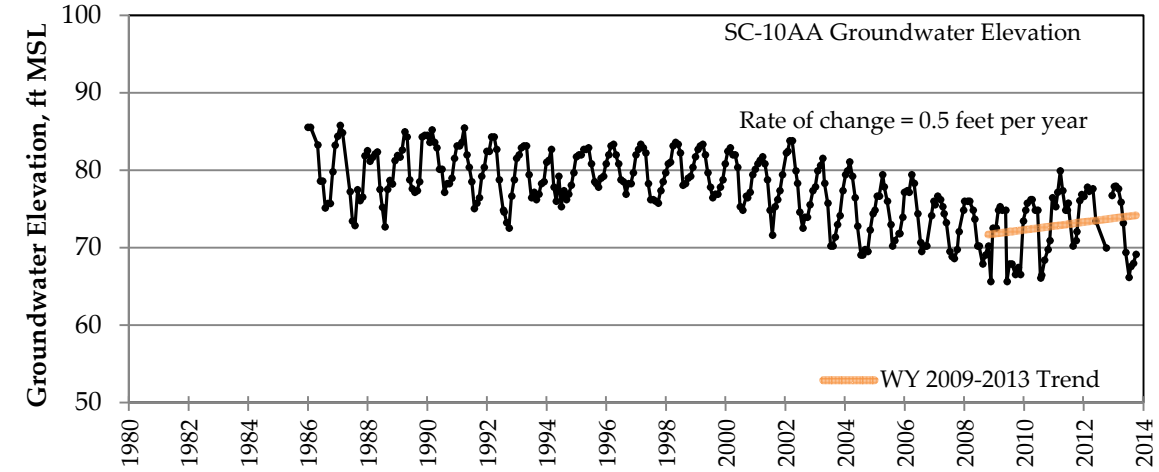

Beltz #7 MW-A Deep Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

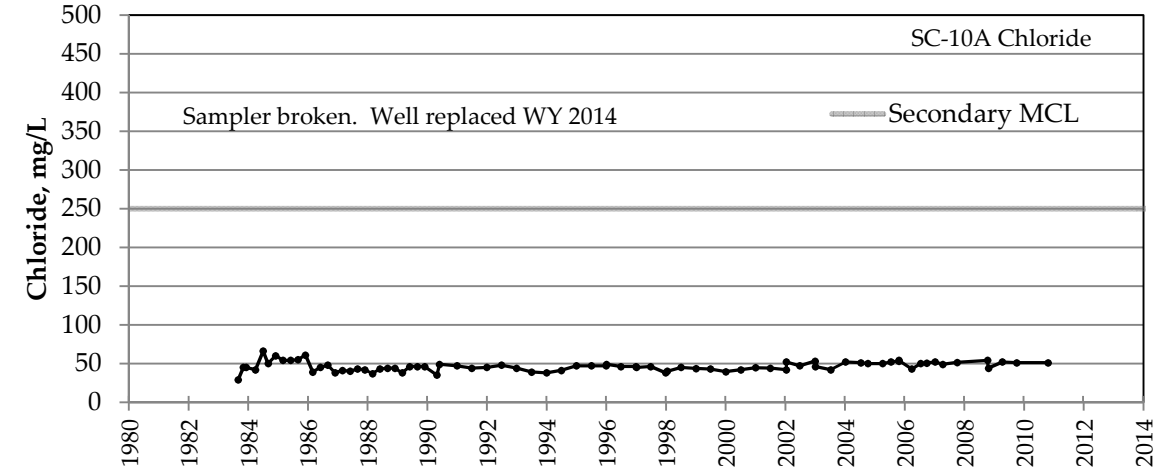

Beltz #7 MW-A Deep Groundwater Elevation
Groundwater Elevation, ft MSL
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

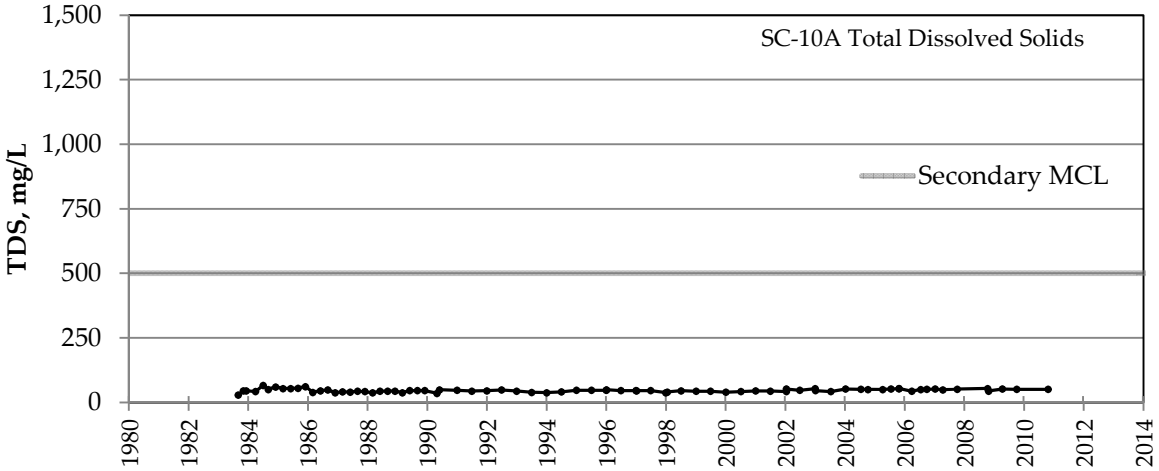

Beltz 7 Test Well Santa Margarita
Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.7 feet per year
Measurements recorded when adjacent well running excluded
Beltz 7 Test Well Beltz 10
Groundwater Elevation
Groundwater Elevation, ft MSL
Measurements recorded when adjacent well running excluded
0
10
20
30
40
50
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

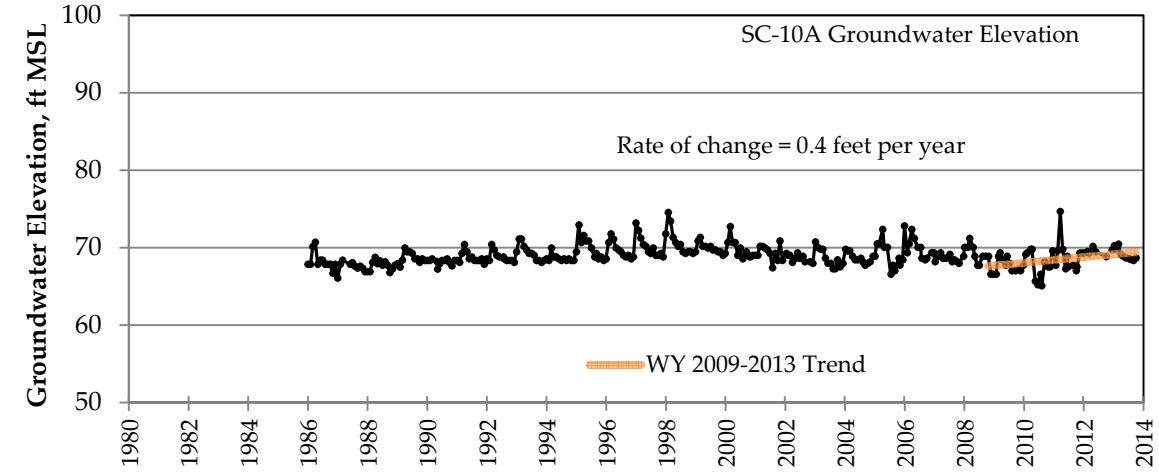

SC-10AA Chloride
Chloride, mg/L
Broken purge pump cannot be removed
Well replaced WY 2014
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

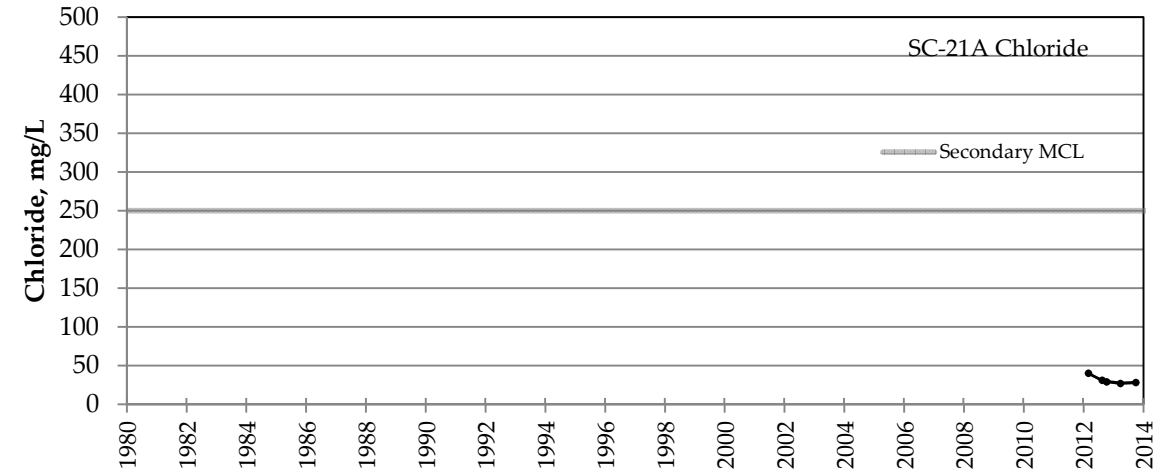

SC-10AA Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

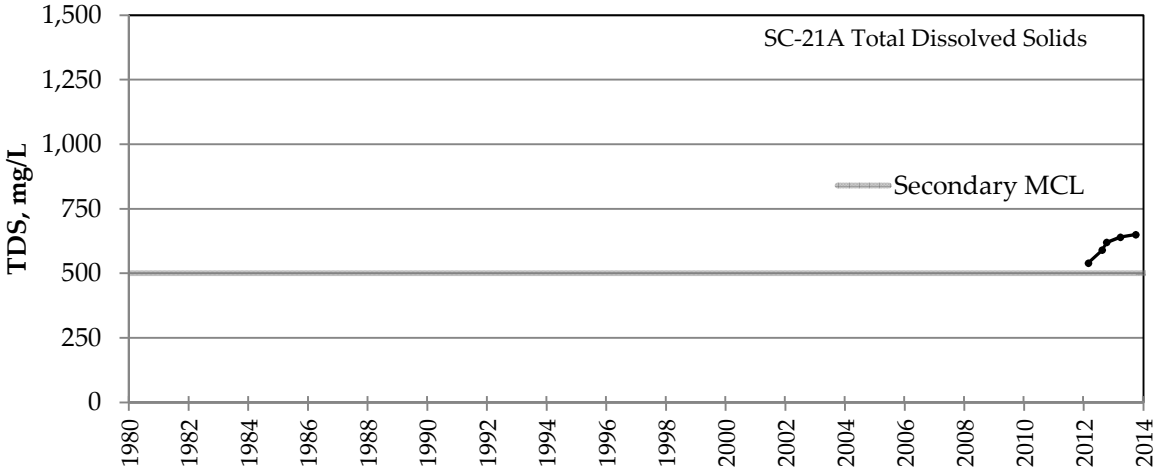

SC-10AA Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.5 feet per year
WY 2009-2013 Trend
100
90
80
70
60
50
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

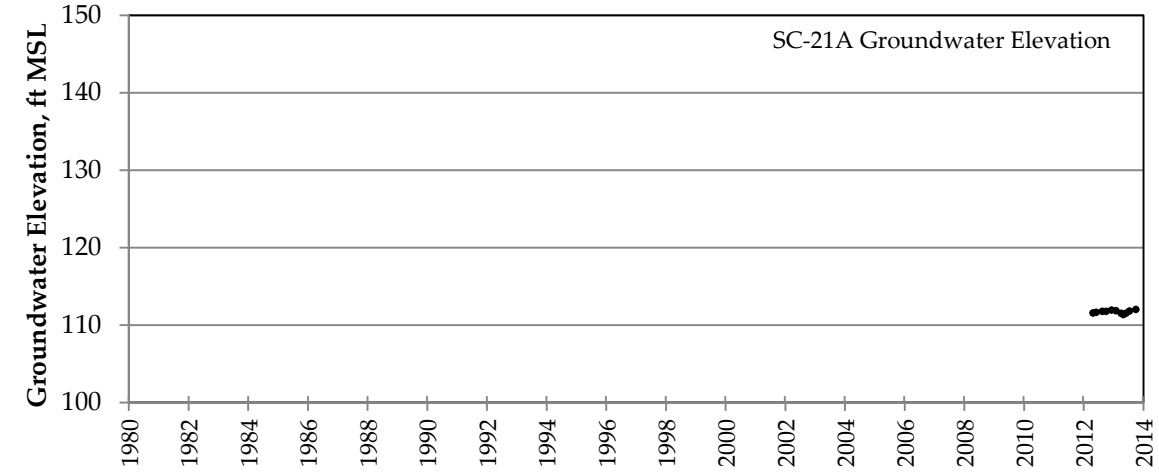

SC-10A Chloride
Sampler broken. Well replaced WY 2014
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

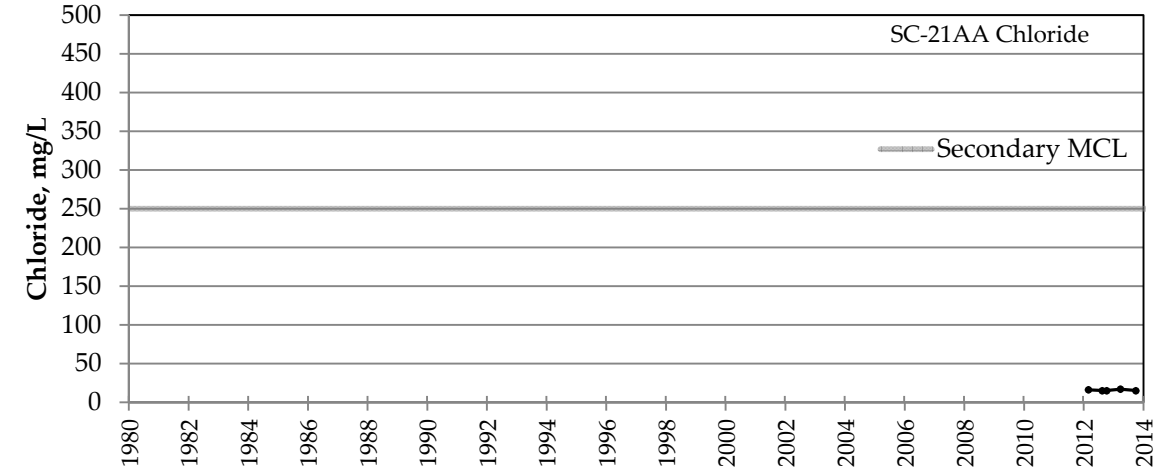

SC-10A Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

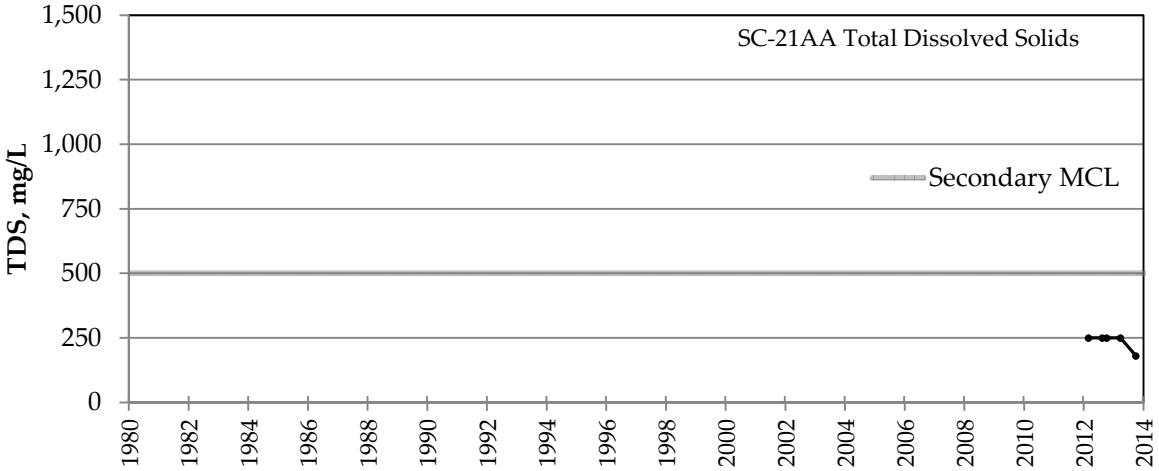

SC-10A Groundwater Elevation
Rate of change = 0.4 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
100
90
80
70
60
50
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

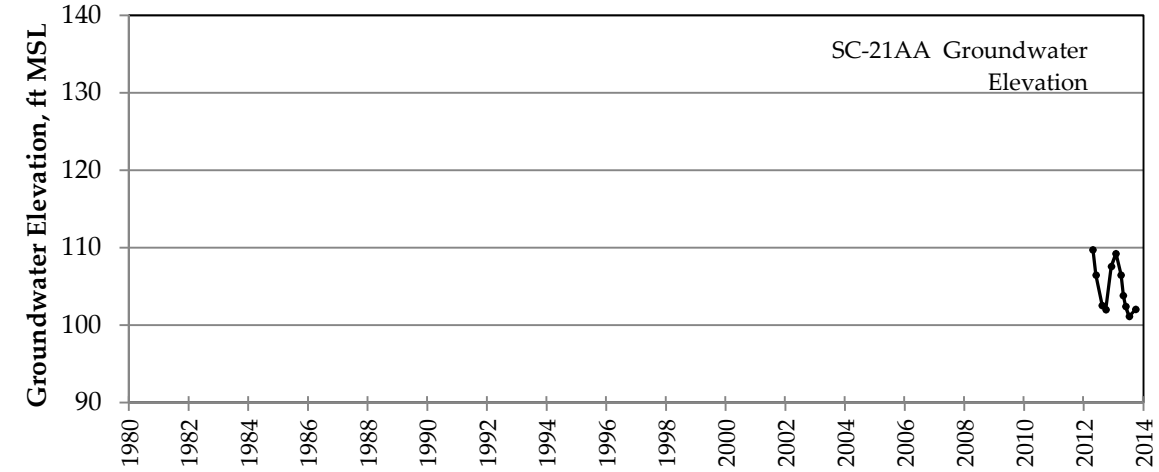

SC-21A Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

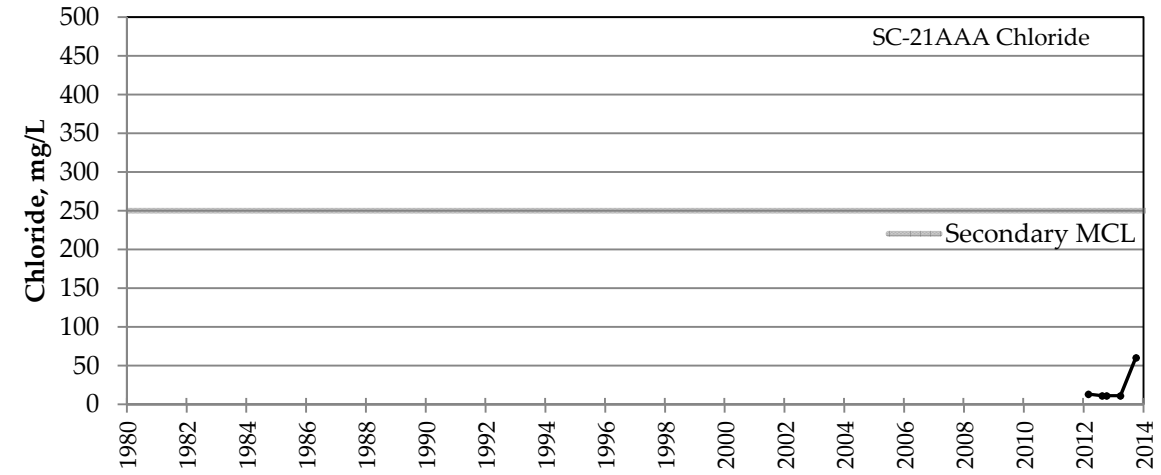

SC-21A Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

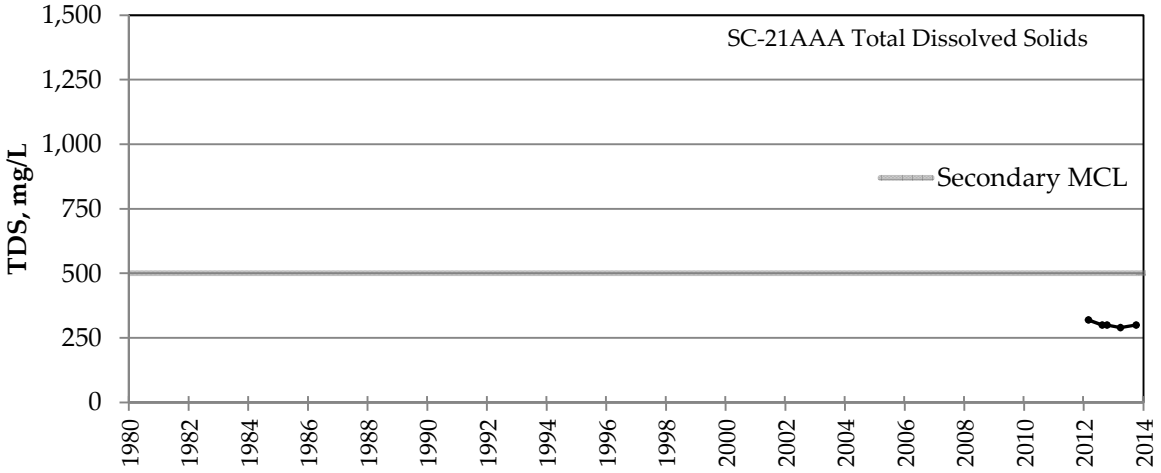

SC-21A Groundwater Elevation
Groundwater Elevation, ft MSL
150
140
130
120
110
100
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

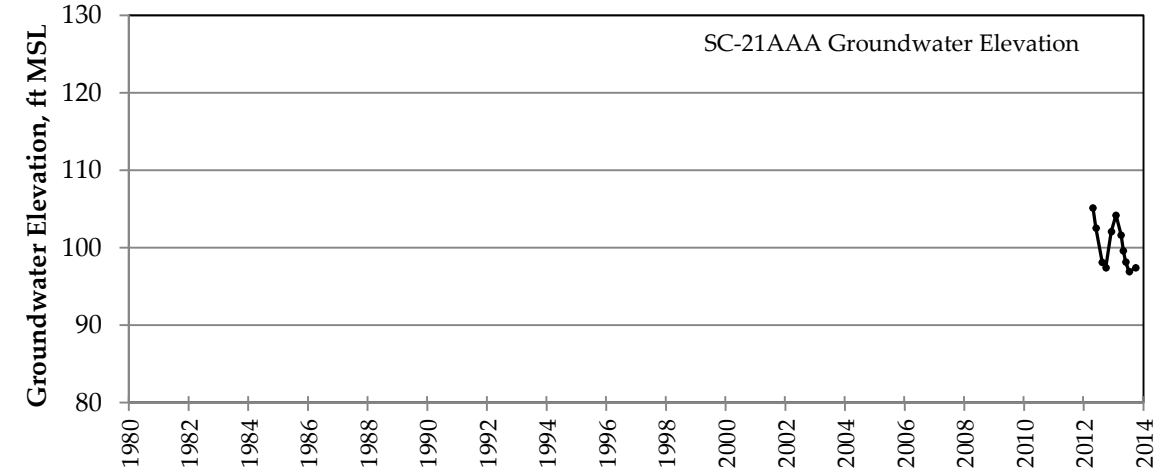

SC-21AA Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

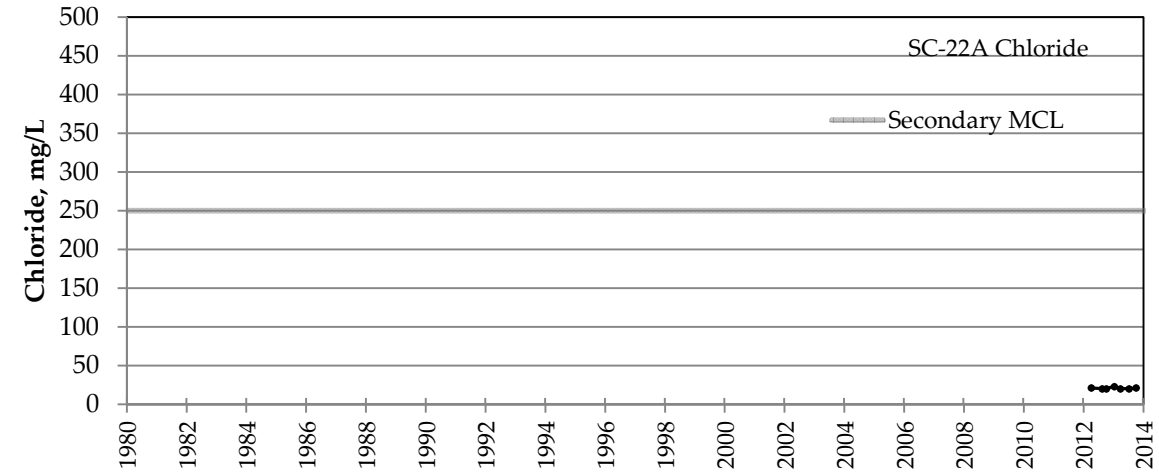

SC-21AA Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

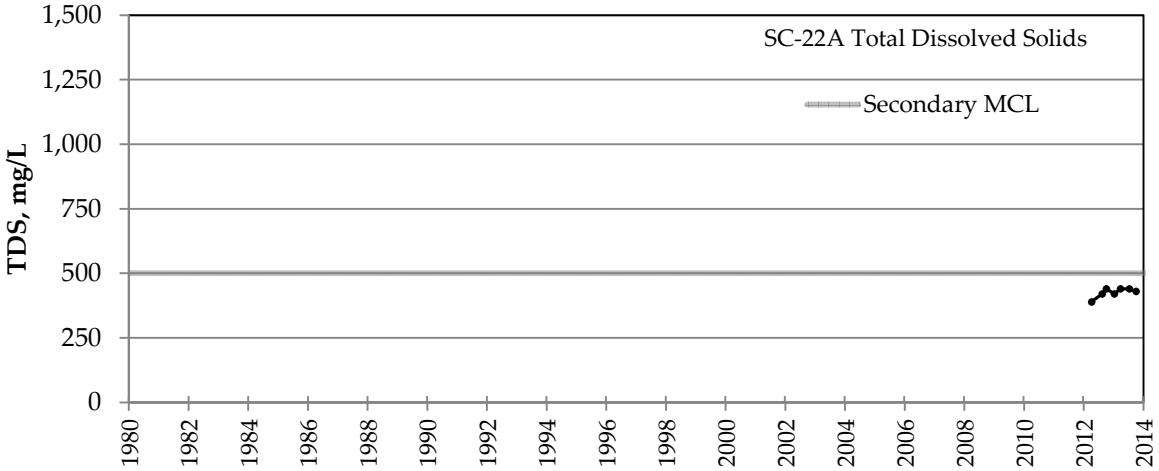

SC-21AA Groundwater Elevation
Groundwater Elevation, ft MSL
140
130
120
110
100
90
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

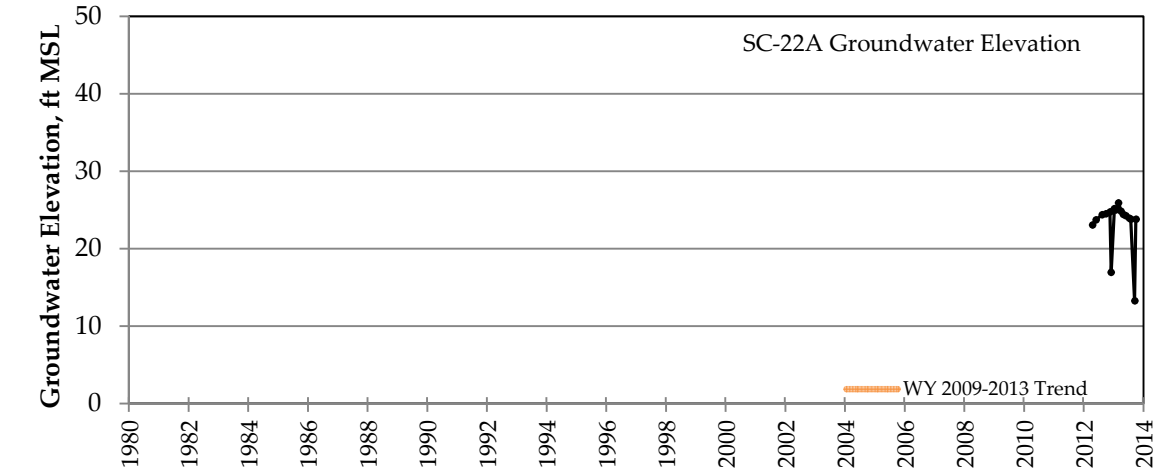

SC-21AAA Chloride
Chloride, mg/L
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

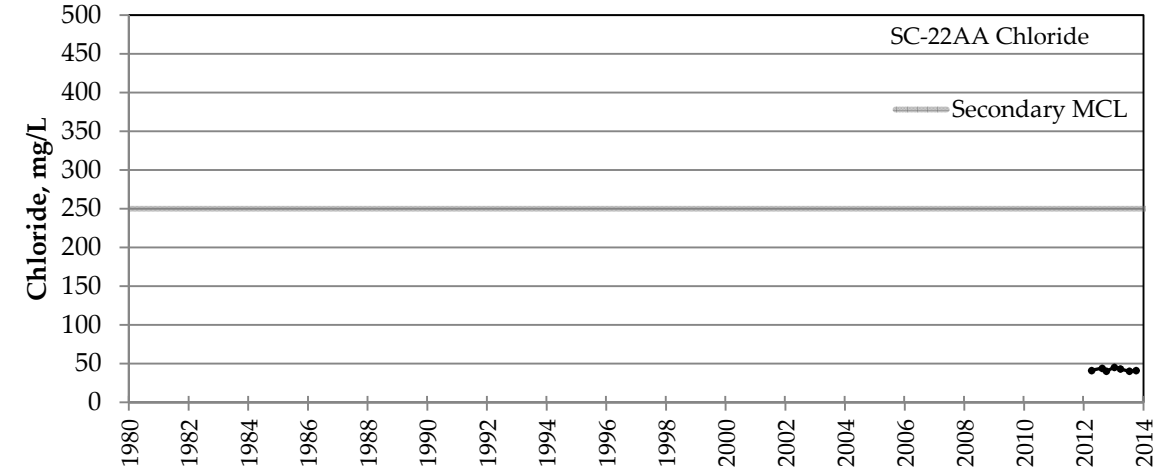

SC-21AAA Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

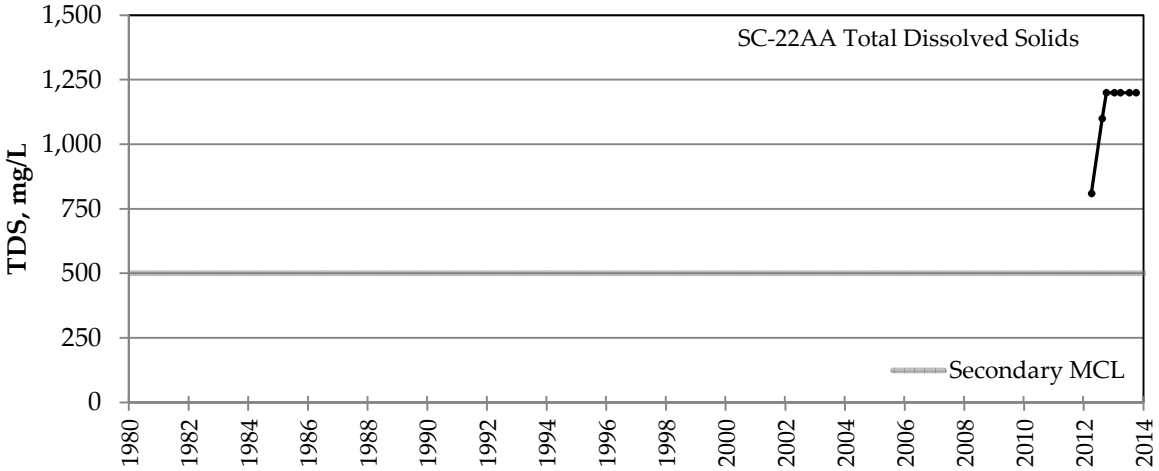

SC-21AAA Groundwater Elevation
Groundwater Elevation, ft MSL
130
120
110
100
90
80
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

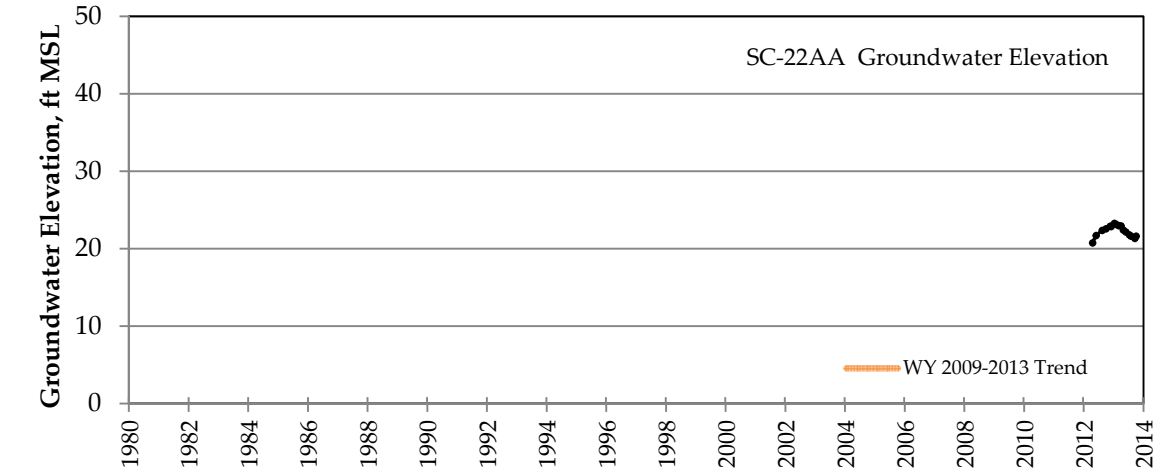

SC-22A Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

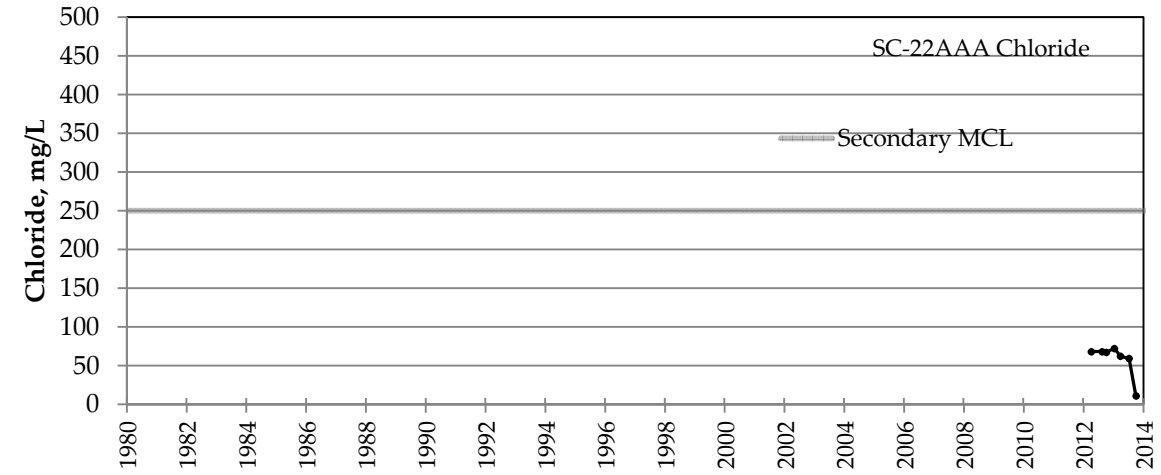

SC-22A Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

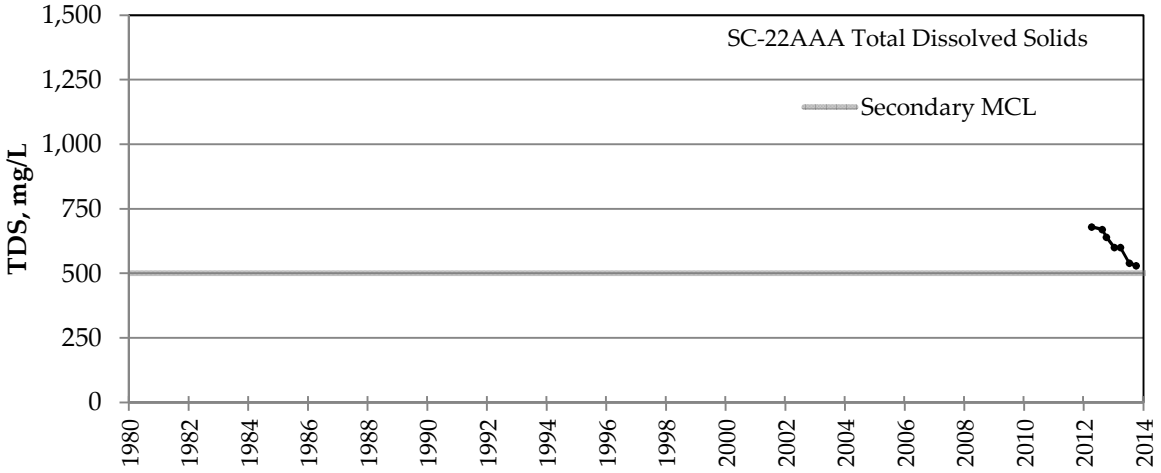

SC-22A Groundwater Elevation
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

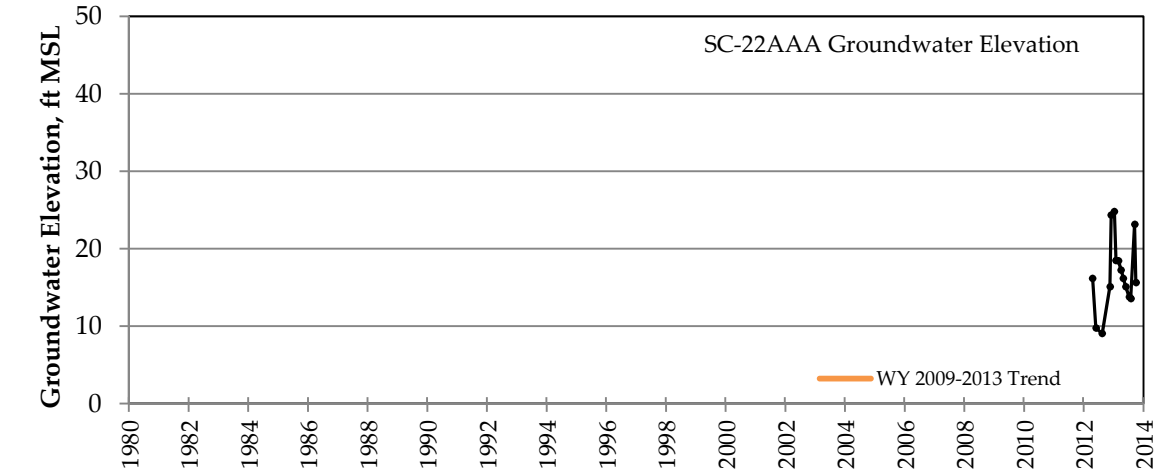

SC-22AA Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

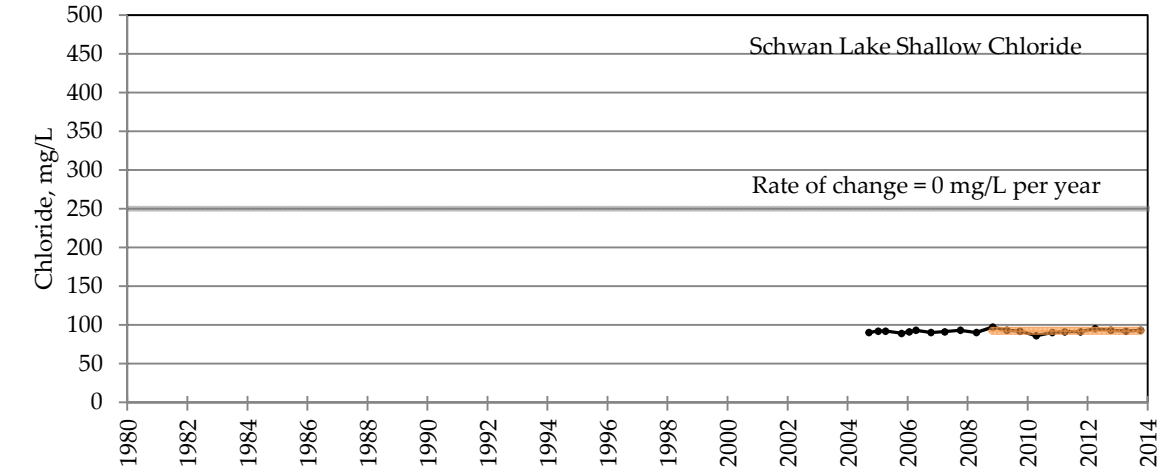

SC-22AA Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

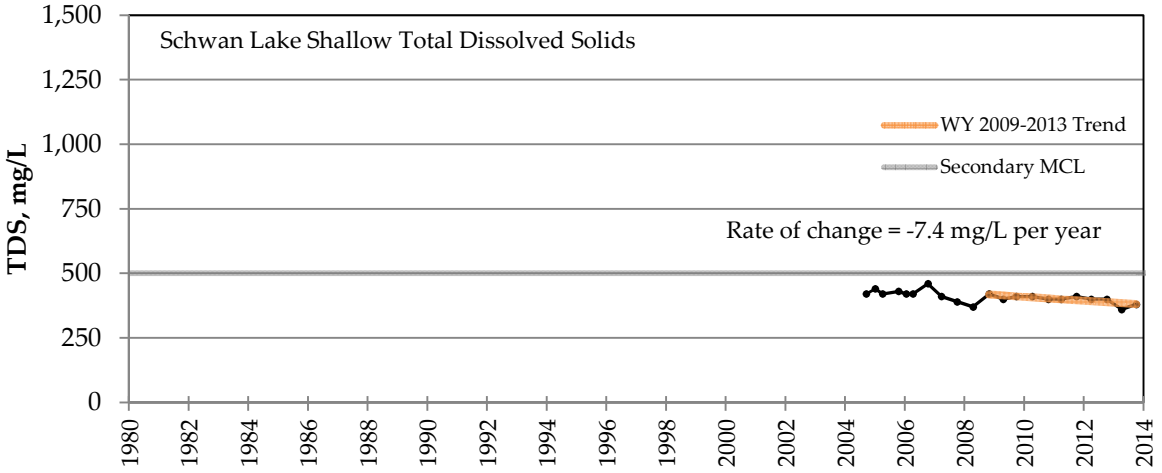

SC-22AA Groundwater Elevation
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

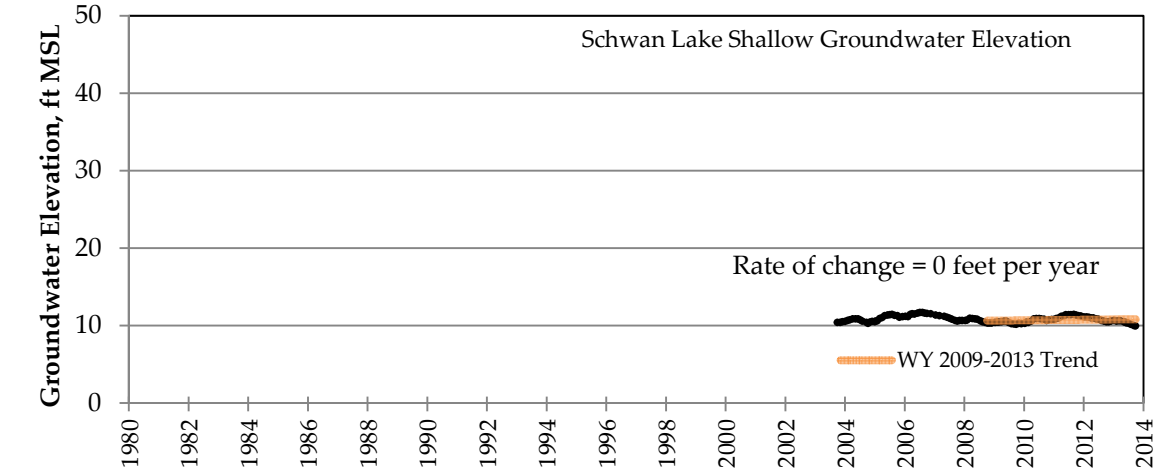

SC-22AAA Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

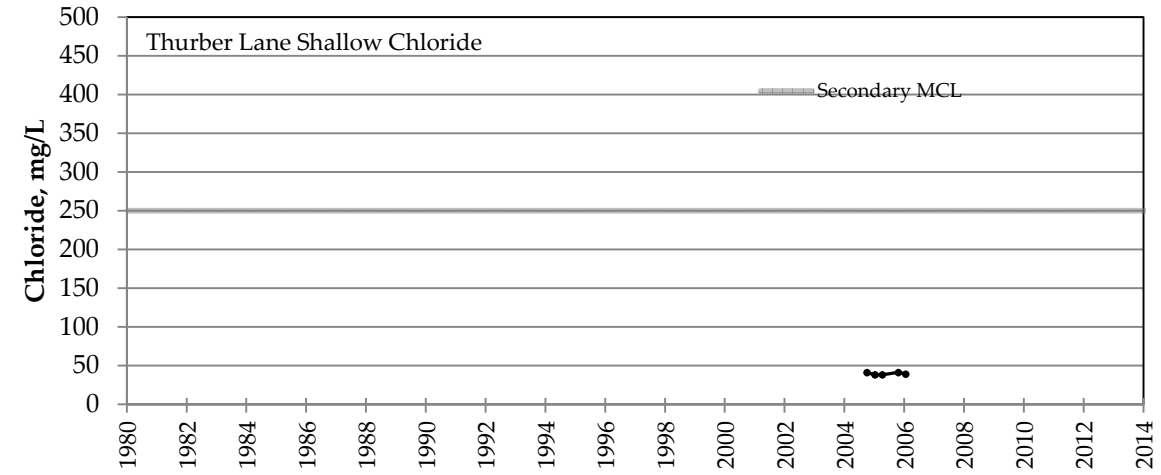

SC-22AAA Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

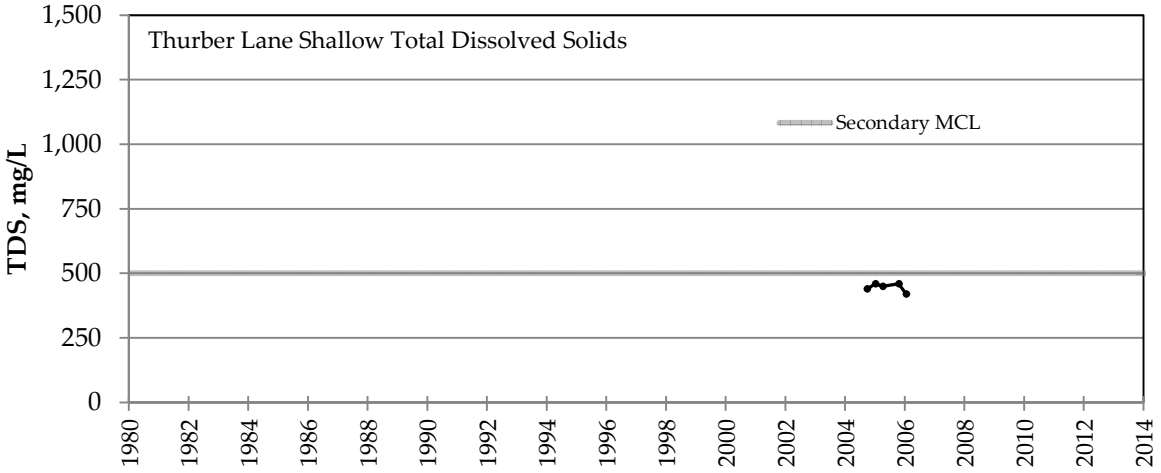

SC-22AAA Groundwater Elevation
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

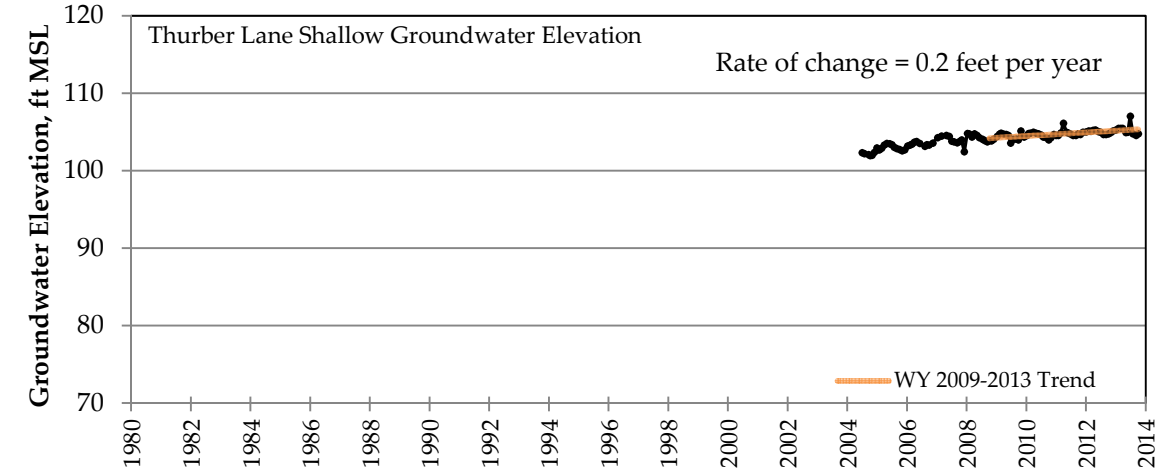

Schwan Lake Shallow Chloride
Chloride, mg/L
Rate of change = 0 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

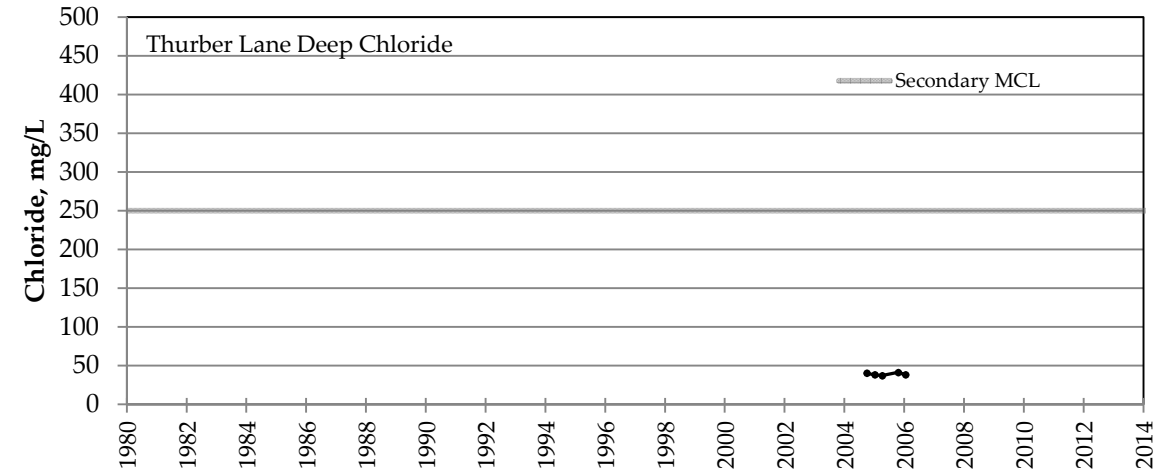

Schwan Lake Shallow Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -7.4 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

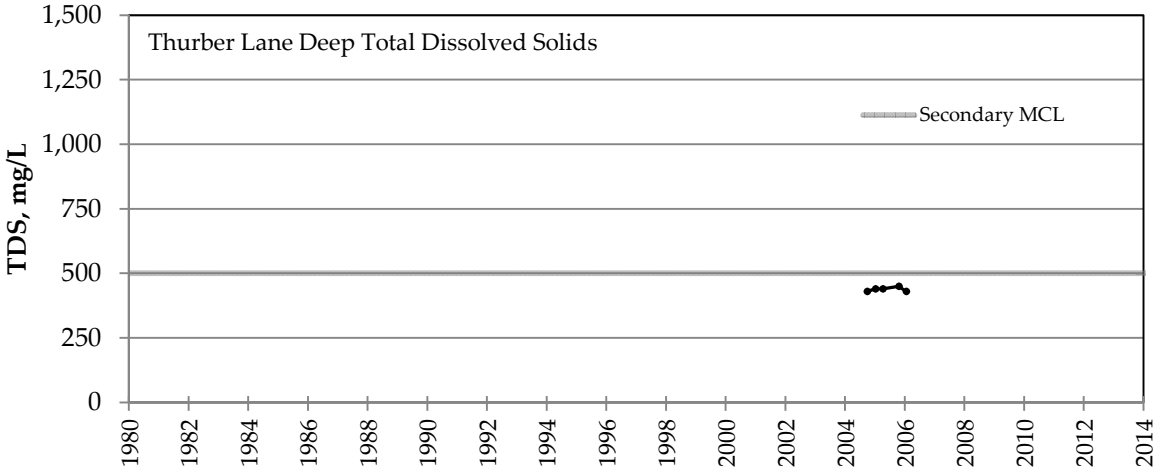

Schwan Lake Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0 feet per year
WY 2009-2013 Trend
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

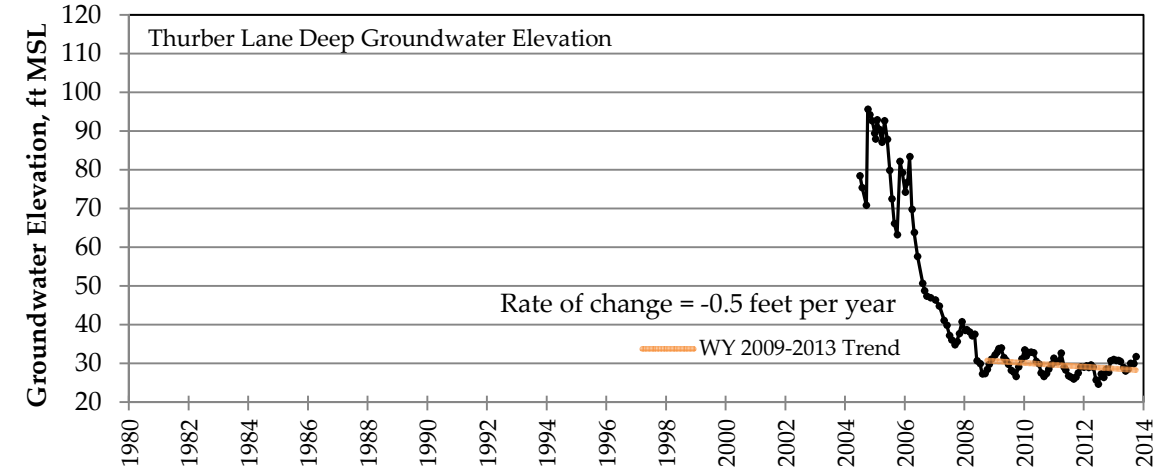

Thurber Lane Shallow Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

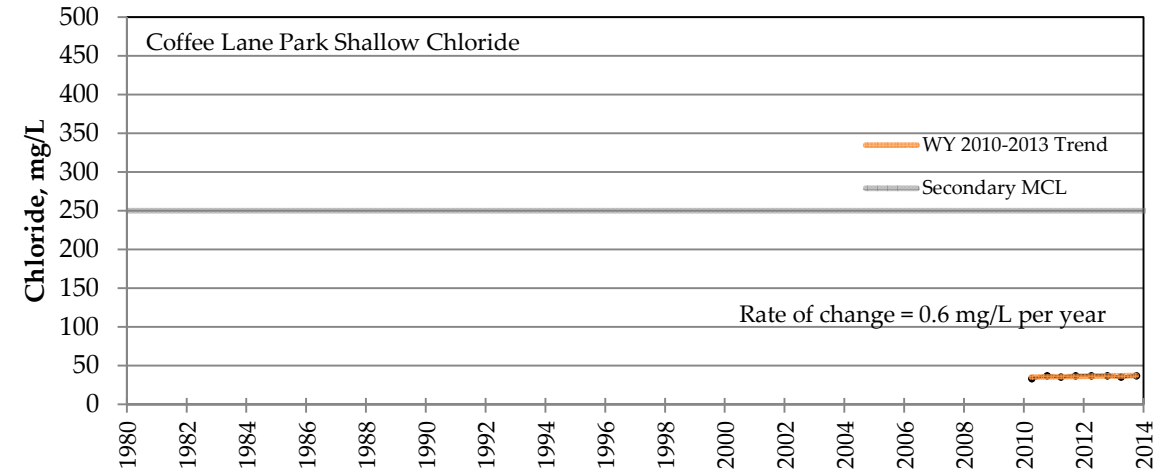

Thurber Lane Shallow Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

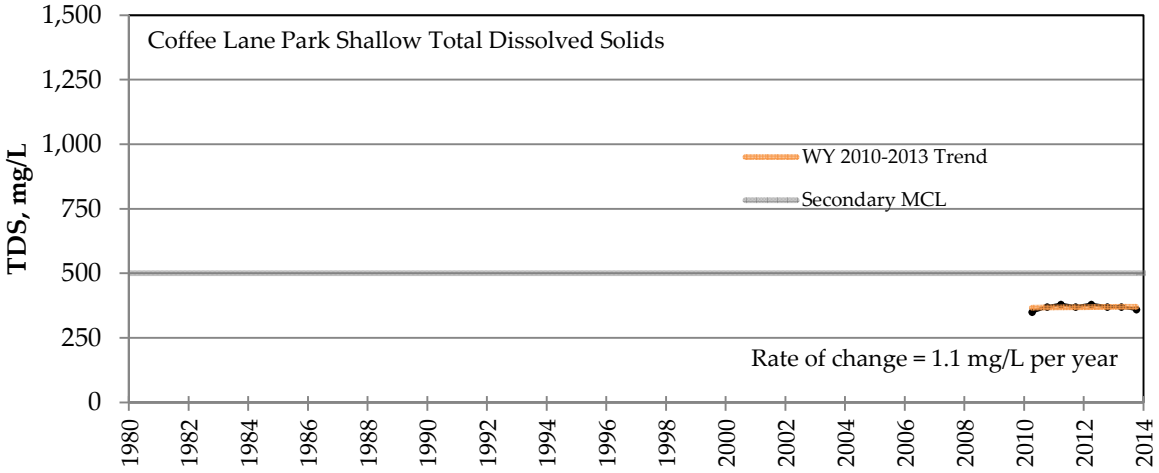

Thurber Lane Shallow Groundwater Elevation
Rate of change = 0.2 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
120
110
100
90
80
70
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

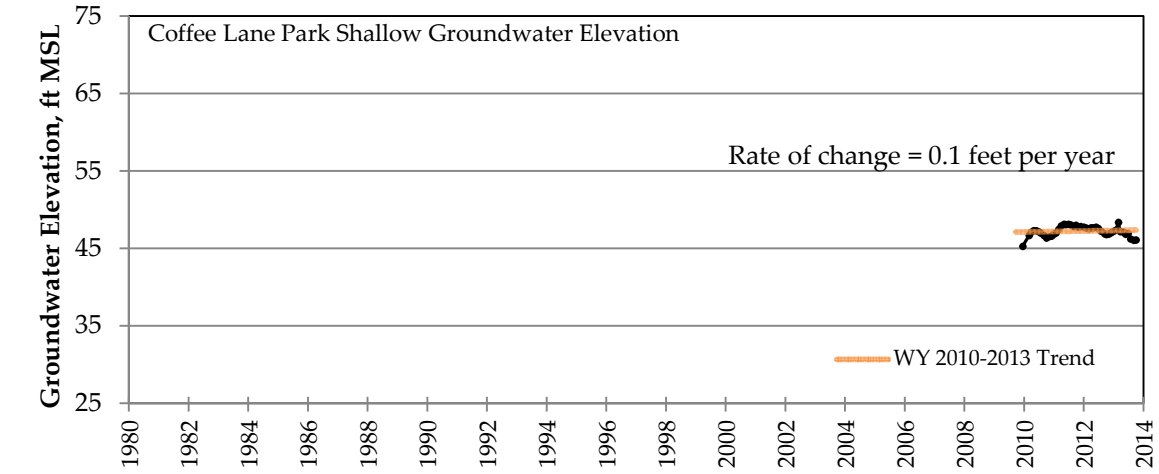

Thurber Lane Deep Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

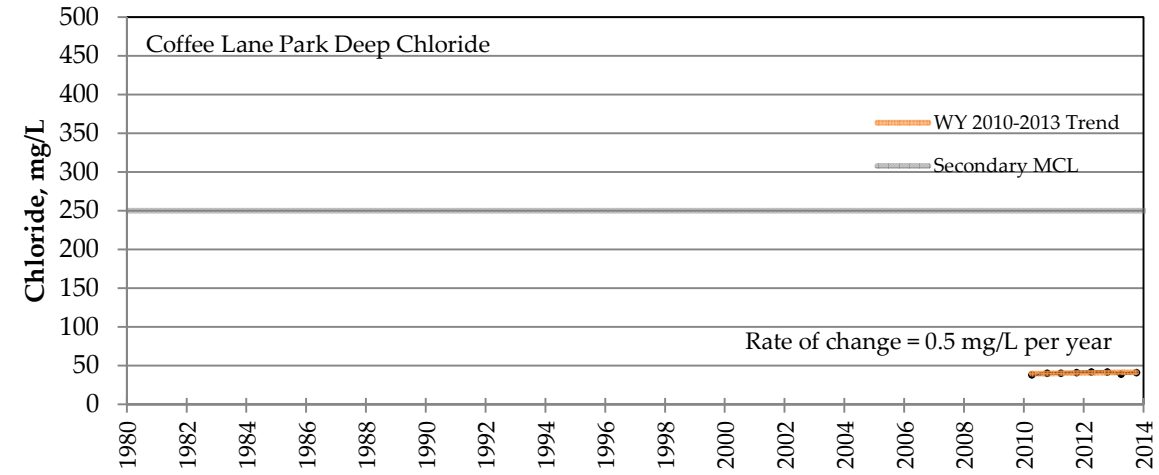

Thurber Lane Deep Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

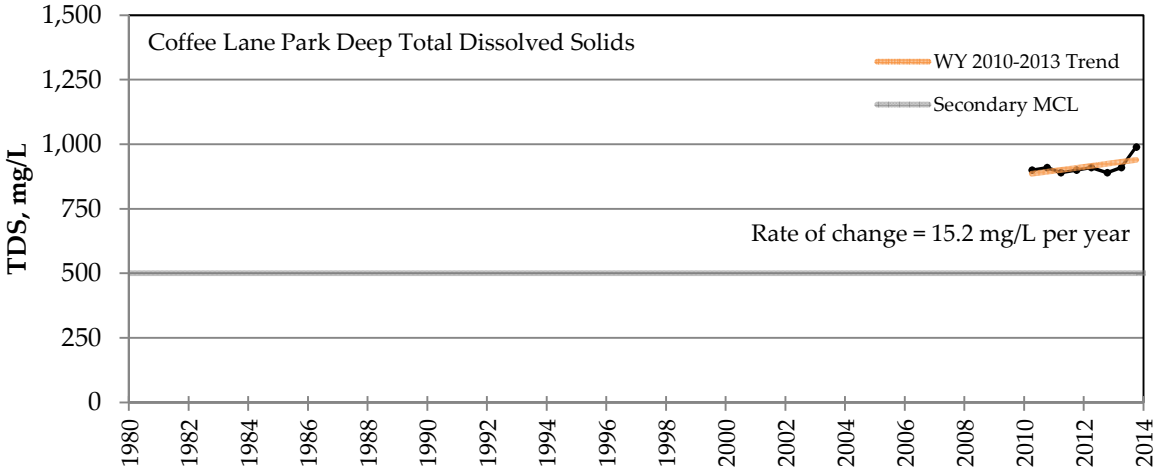

Thurber Lane Deep Groundwater Elevation
Rate of change = -0.5 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
120
110
100
90
80
70
60
50
40
30
20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

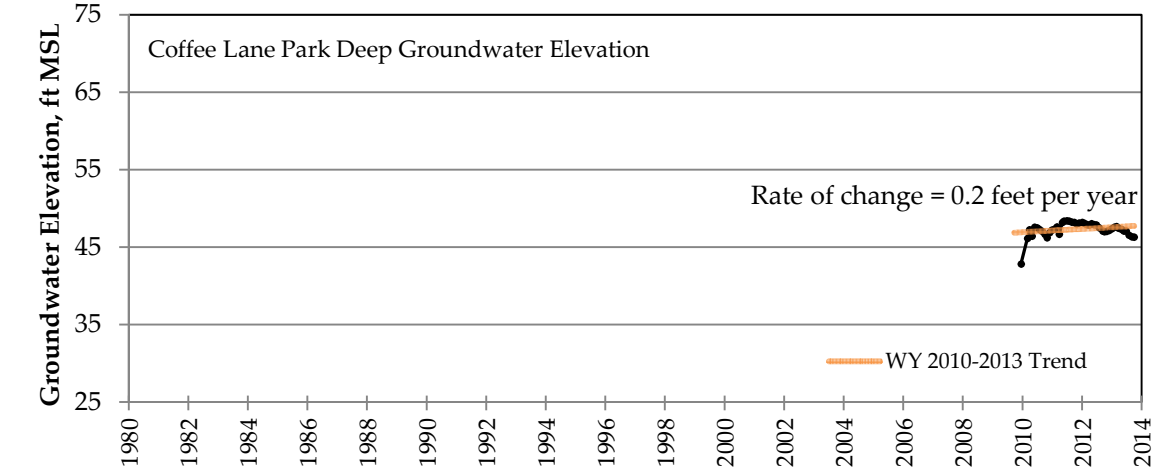

Coffee Lane Park Shallow Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 0.6 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

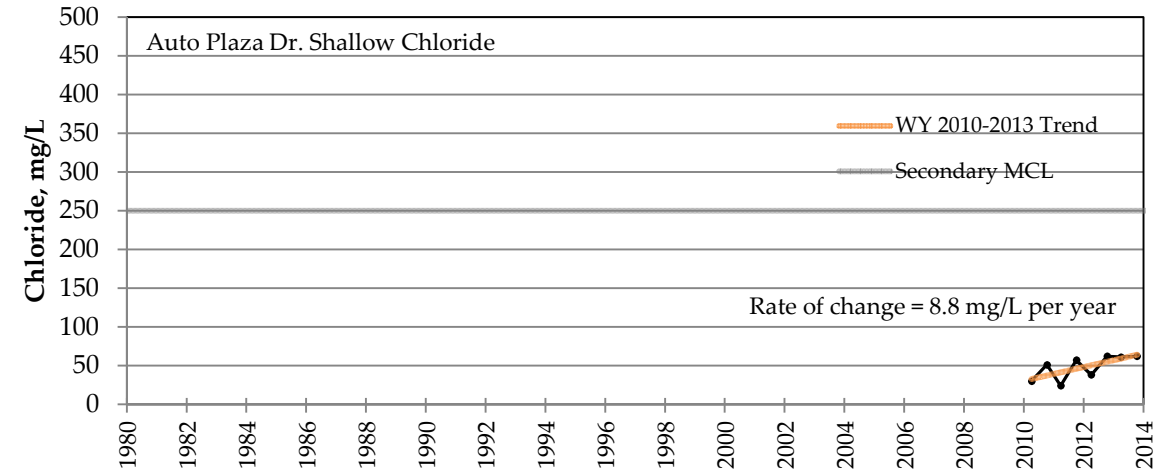

Coffee Lane Park Shallow Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 1.1 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

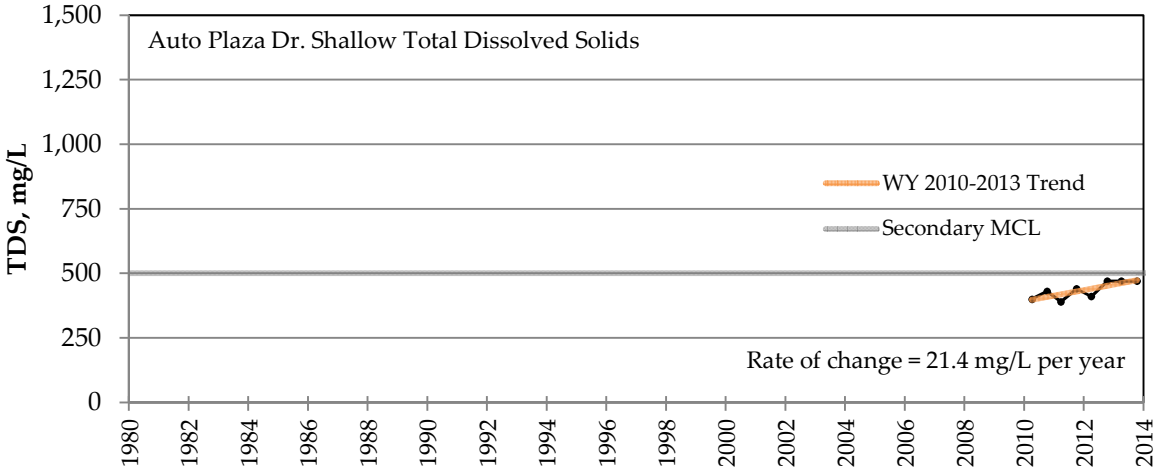

Coffee Lane Park Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
75
65
55
45
35
25
Rate of change = 0.1 feet per year
WY 2010-2013 Trend
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

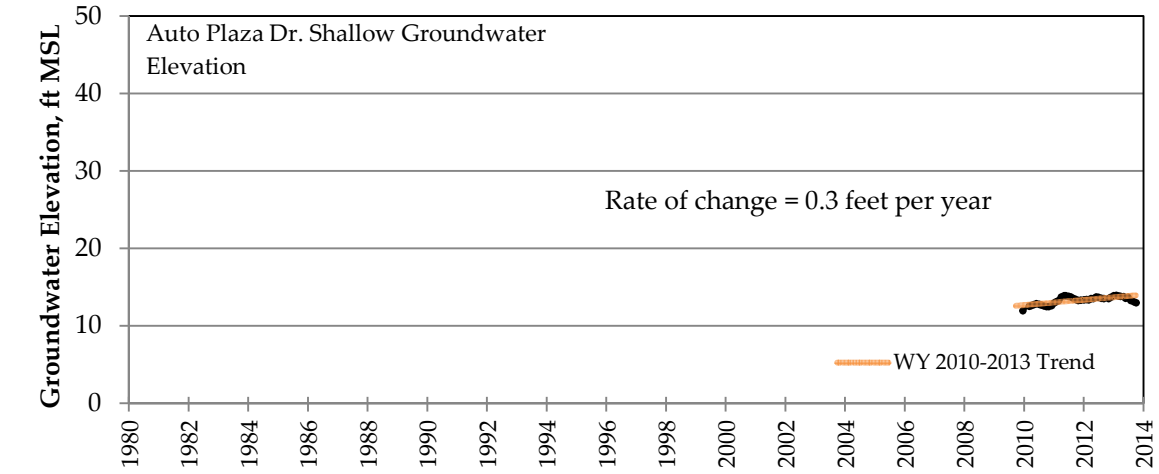

Coffee Lane Park Deep Chloride
Chloride, mg/L
WY 2010-2013 Trend
Secondary MCL
Rate of change = 0.5 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

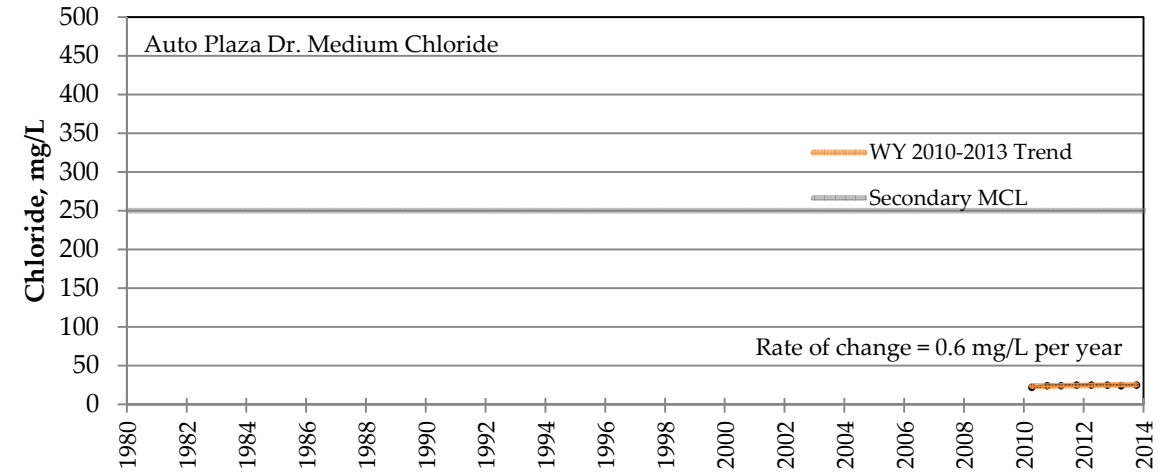

Coffee Lane Park Deep Total Dissolved Solids
TDS, mg/L
WY 2010-2013 Trend
Secondary MCL
Rate of change = 15.2 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

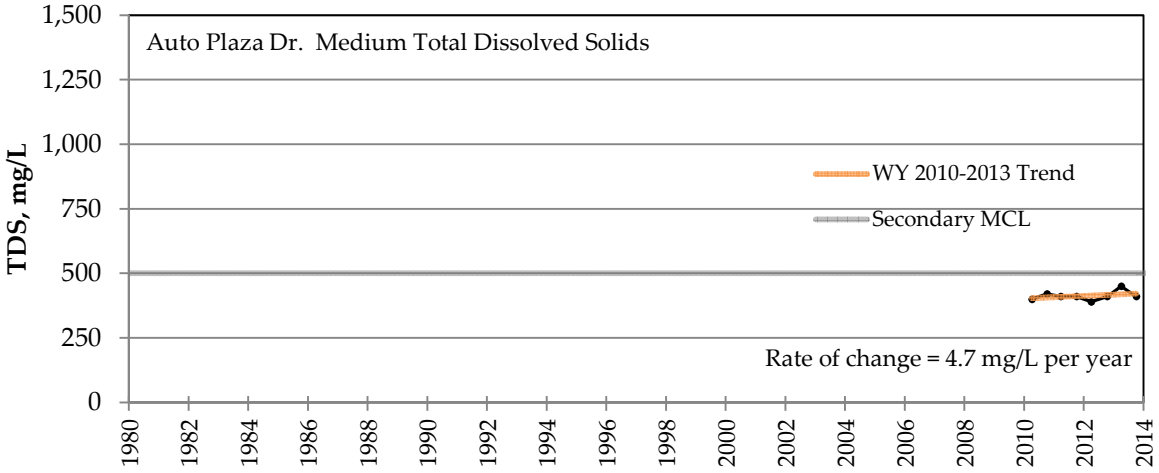

Coffee Lane Park Deep Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.2 feet per year
WY 2010-2013 Trend
75
65
55
45
35
25
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

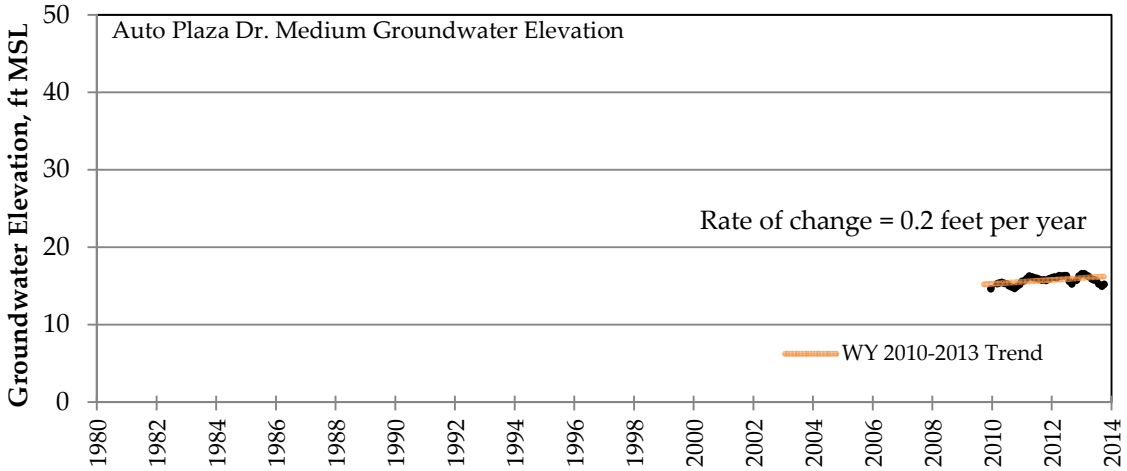

Auto Plaza Dr. Shallow Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 8.8 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

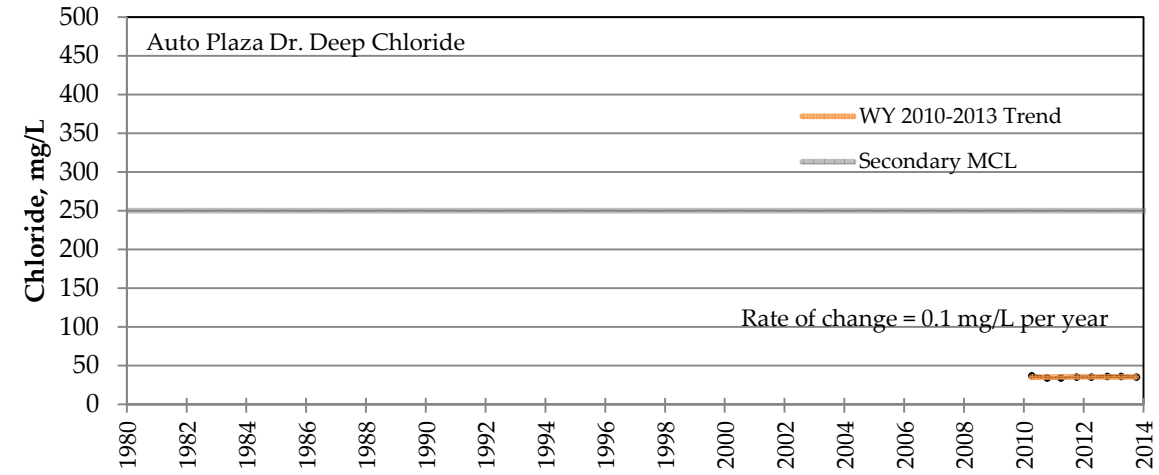

Auto Plaza Dr. Shallow Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 21.4 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

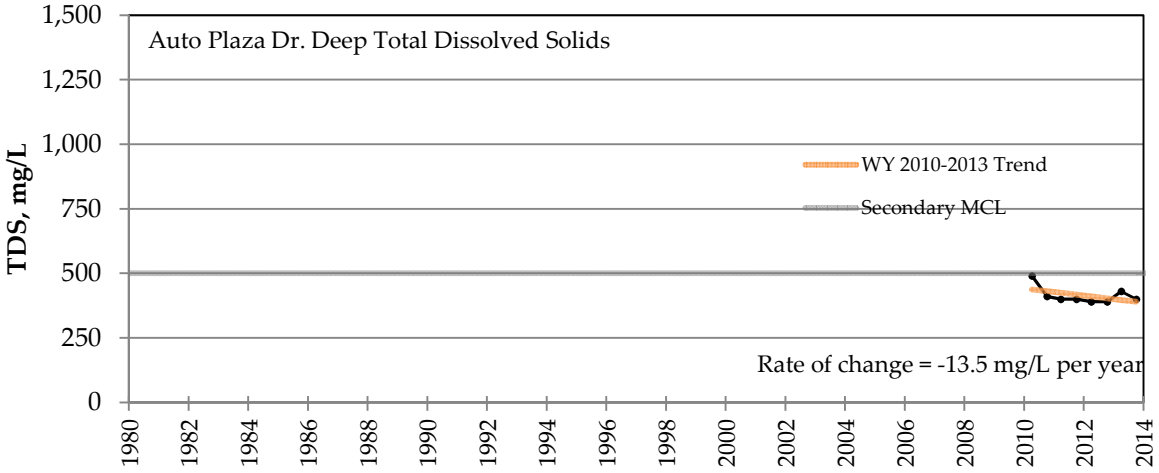

Auto Plaza Dr. Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
50
40
30
20
10
0
Rate of change = 0.3 feet per year
WY 2010-2013 Trend
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

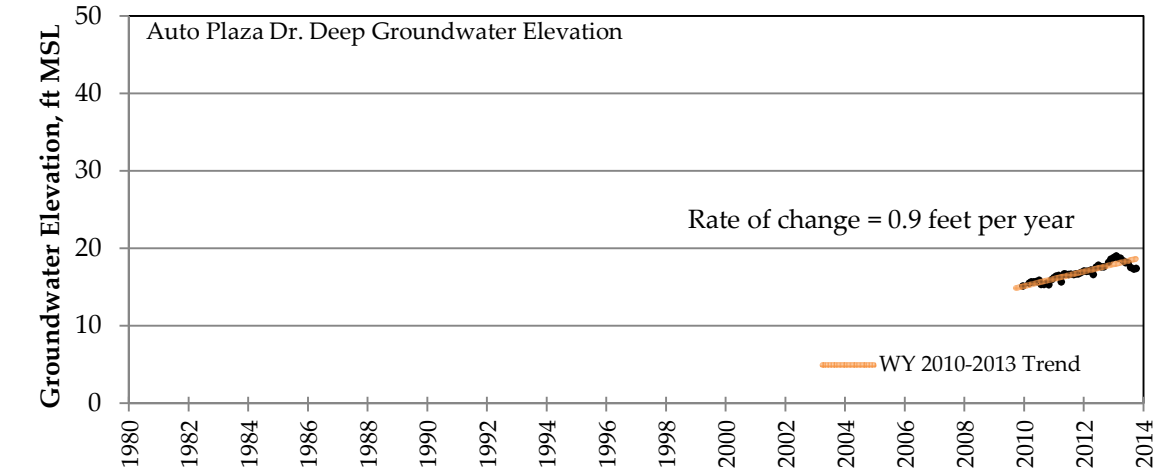

Auto Plaza Dr. Medium Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 0.6 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

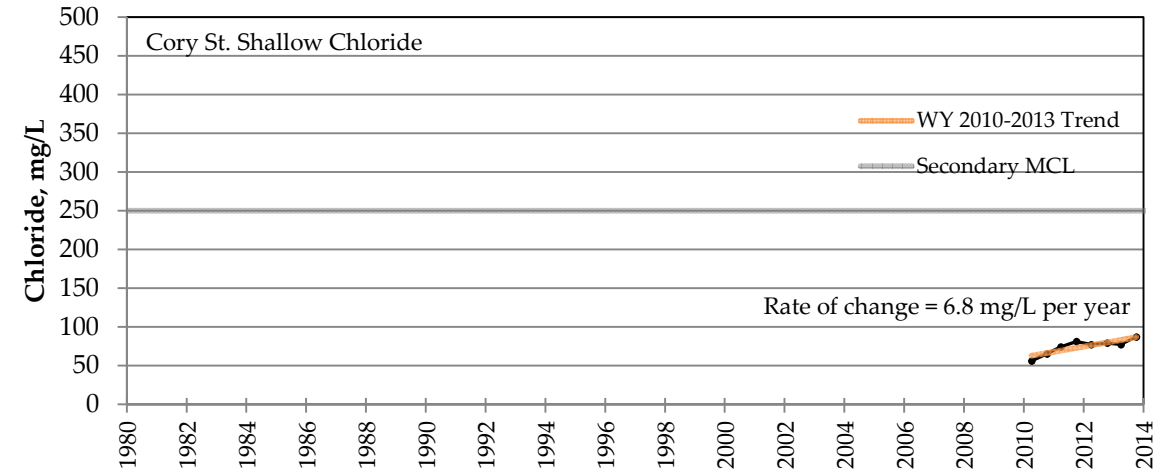

Auto Plaza Dr. Medium Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 4.7 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

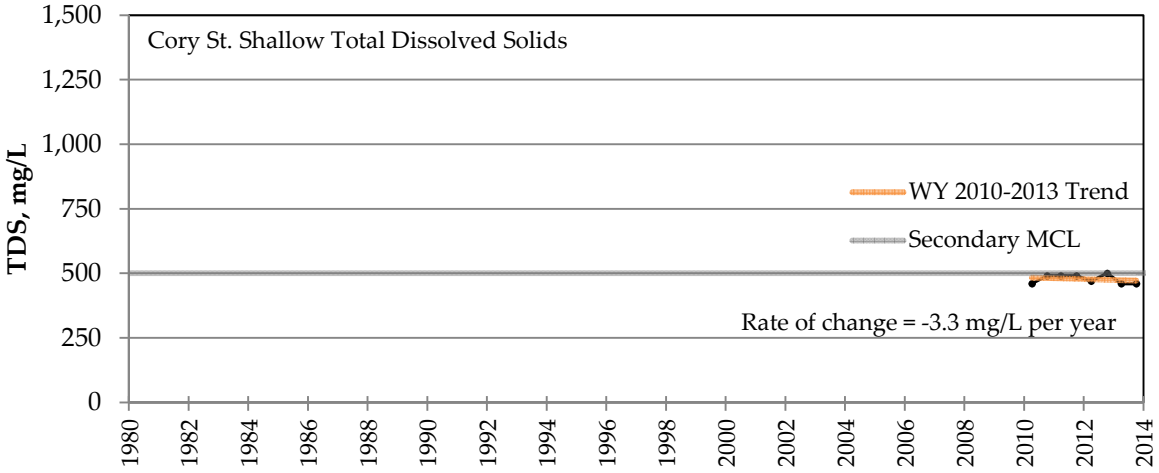

Auto Plaza Dr. Medium Groundwater Elevation
Groundwater Elevation, ft MSL
50
40
30
20
10
0
Rate of change = 0.2 feet per year
WY 2010-2013 Trend
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

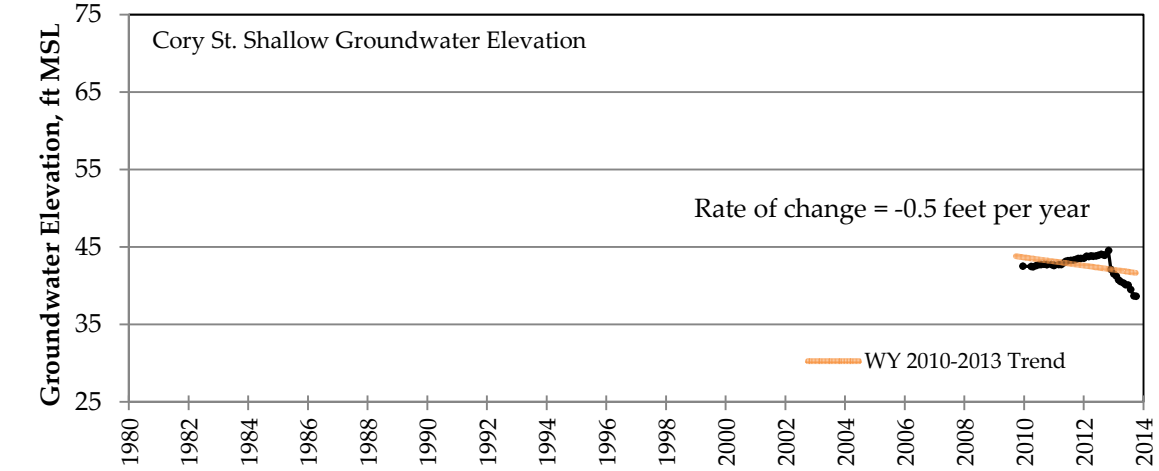

Auto Plaza Dr. Deep Chloride
Chloride, mg/L
WY 2010-2013 Trend
Secondary MCL
Rate of change = 0.1 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

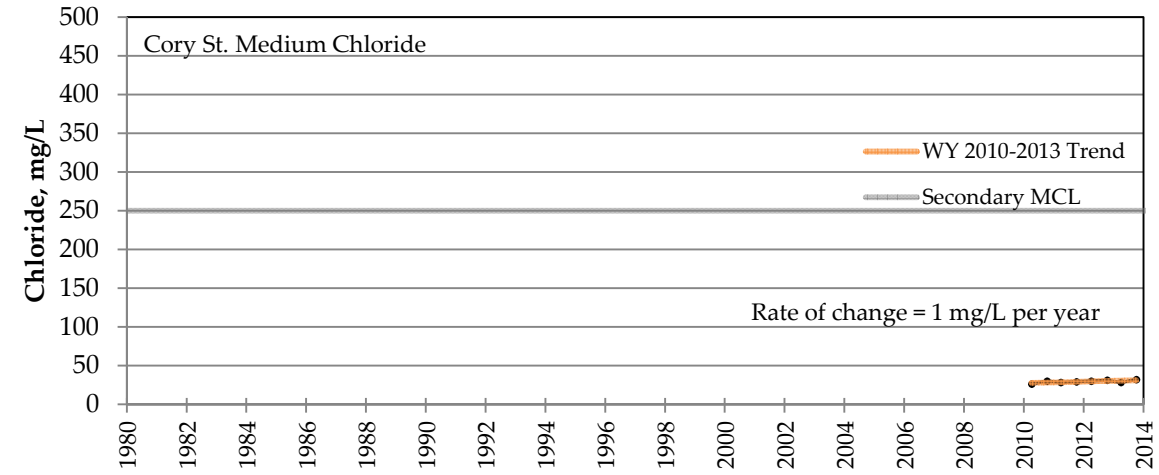

Auto Plaza Dr. Deep Total Dissolved Solids
TDS, mg/L
WY 2010-2013 Trend
Secondary MCL
Rate of change = -13.5 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

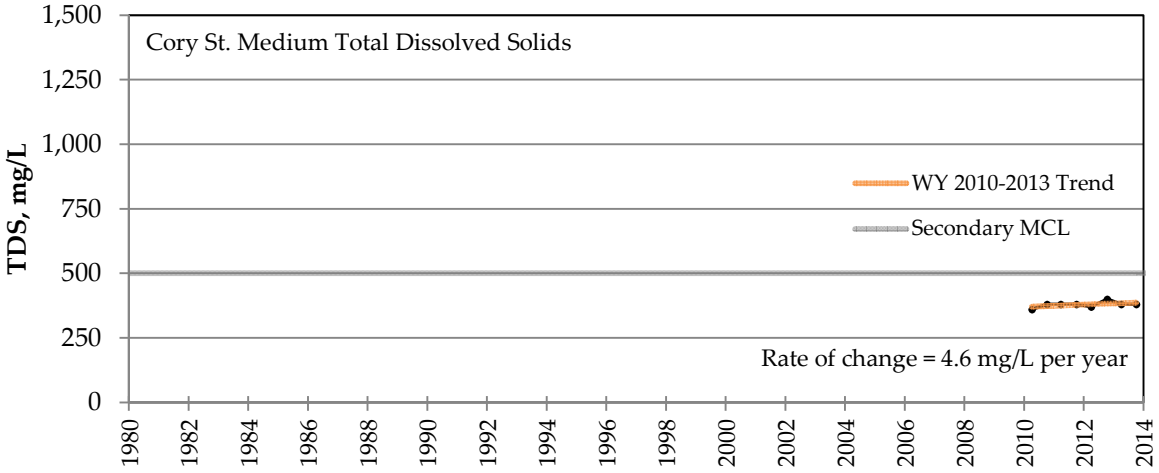

Auto Plaza Dr. Deep Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.9 feet per year
WY 2010-2013 Trend
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

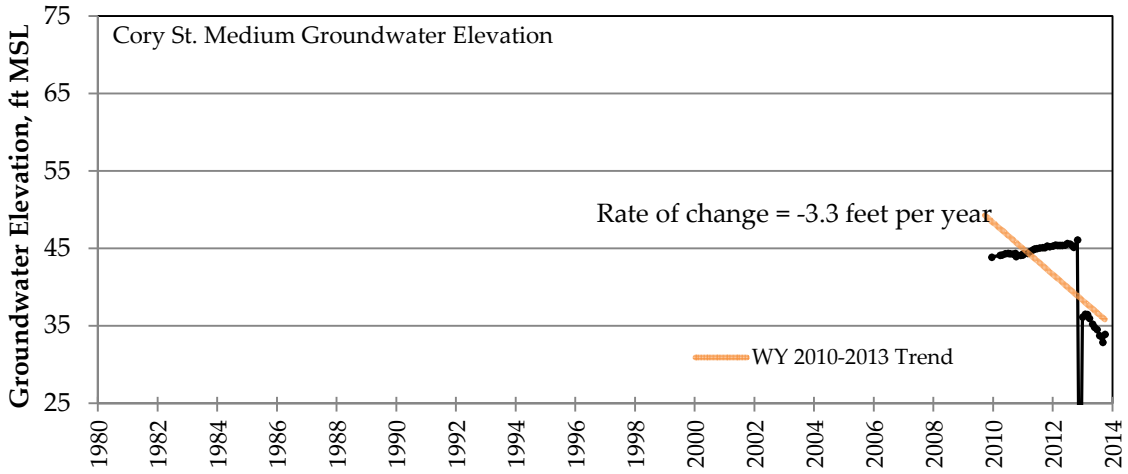

Cory St. Shallow Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 6.8 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

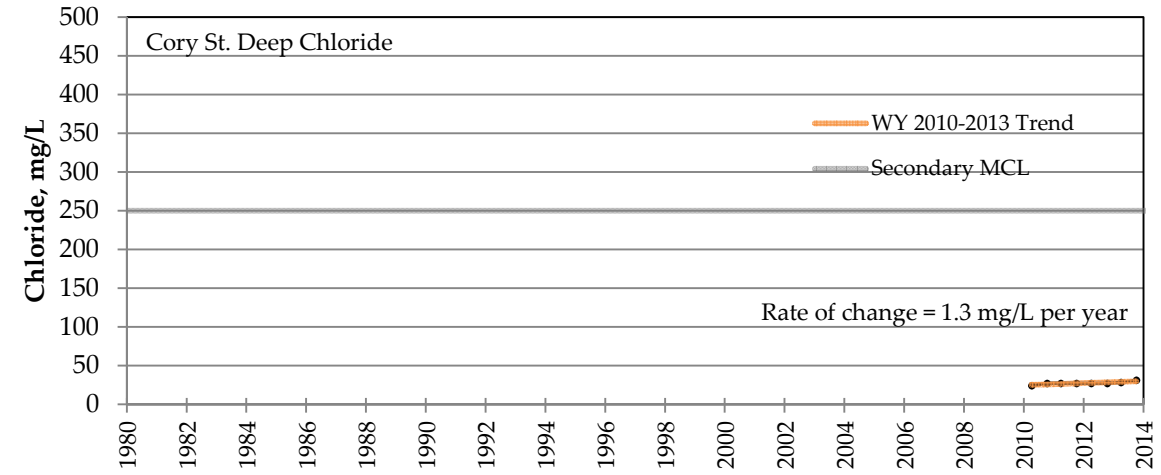

Cory St. Shallow Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = -3.3 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

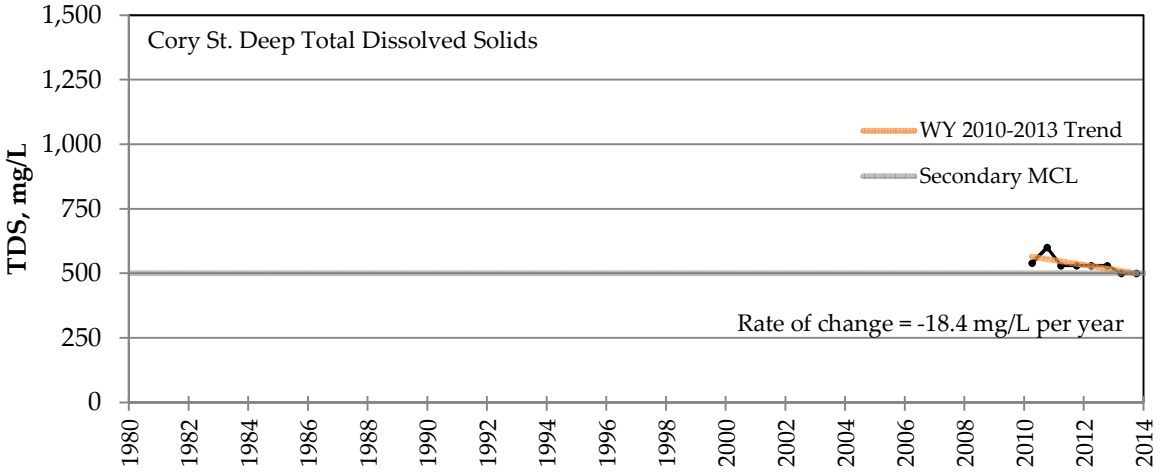

Cory St. Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
75
65
55
45
35
25
Rate of change = -0.5 feet per year
WY 2010-2013 Trend
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

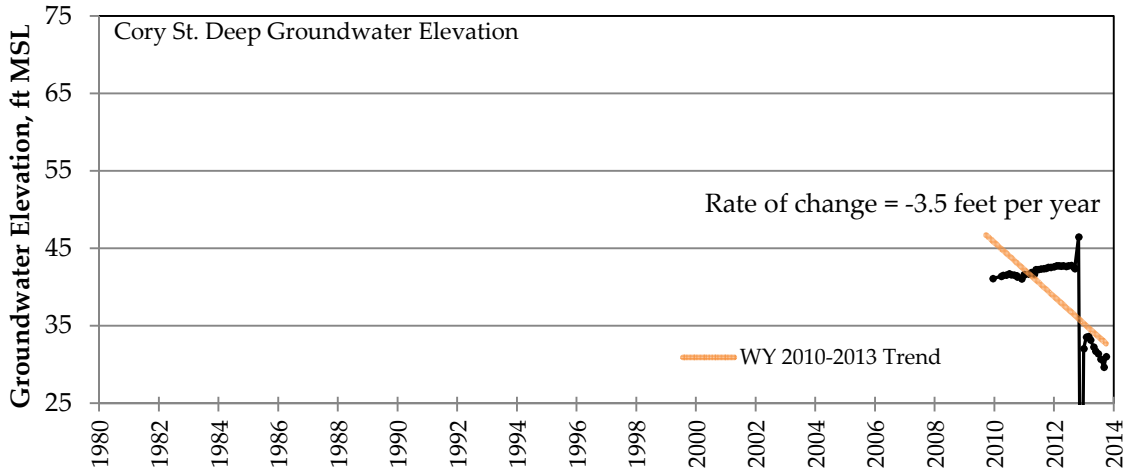

Cory St. Medium Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 1 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

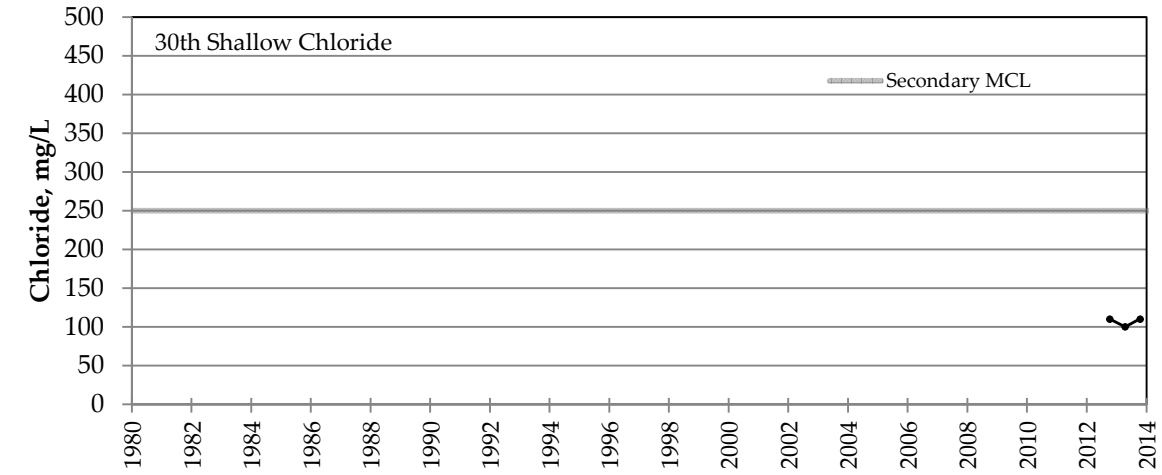

Cory St. Medium Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
WY 2010-2013 Trend
Secondary MCL
Rate of change = 4.6 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

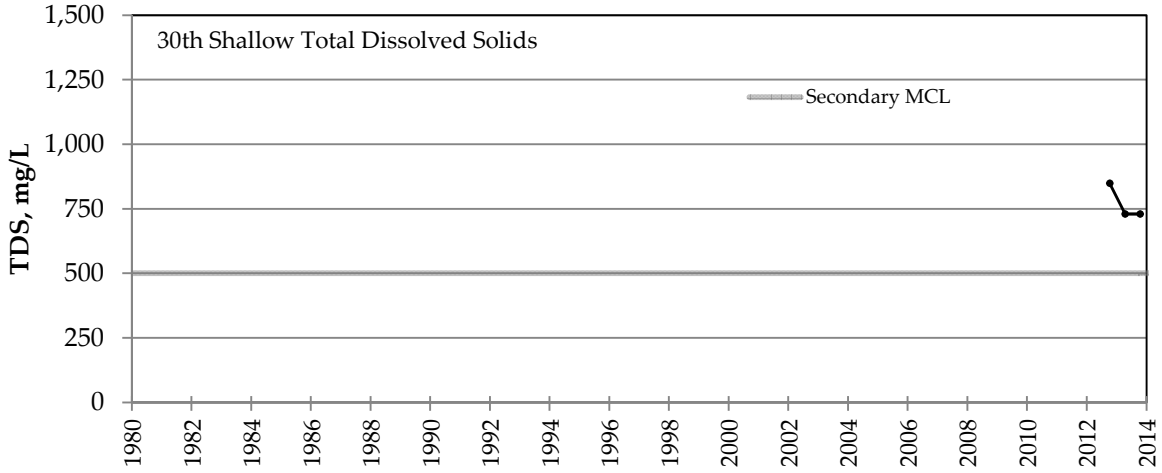

Cory St. Medium Groundwater Elevation
Groundwater Elevation, ft MSL
75
65
55
45
35
25
Rate of change = -3.3 feet per year
WY 2010-2013 Trend
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

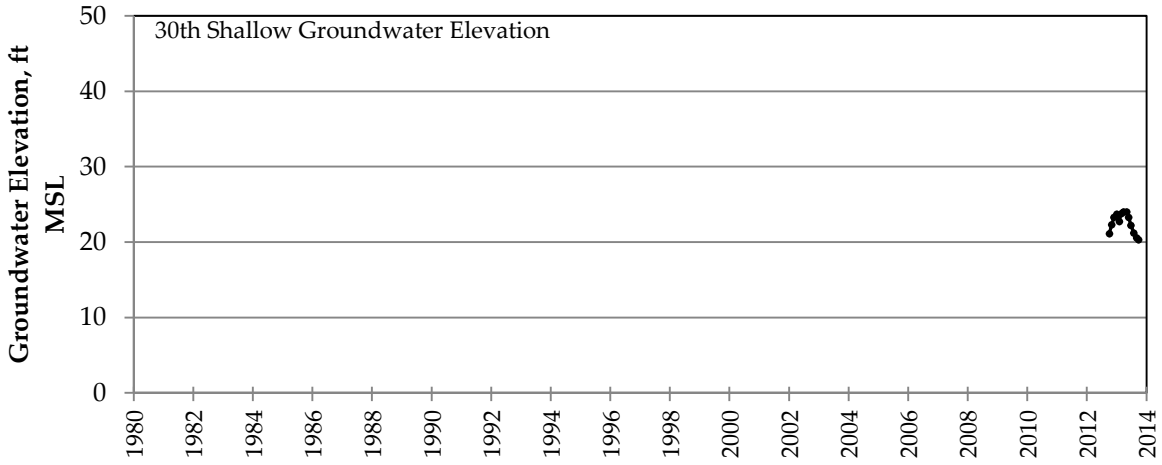

Cory St. Deep Chloride
Chloride, mg/L
WY 2010-2013 Trend
Secondary MCL
Rate of change = 1.3 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

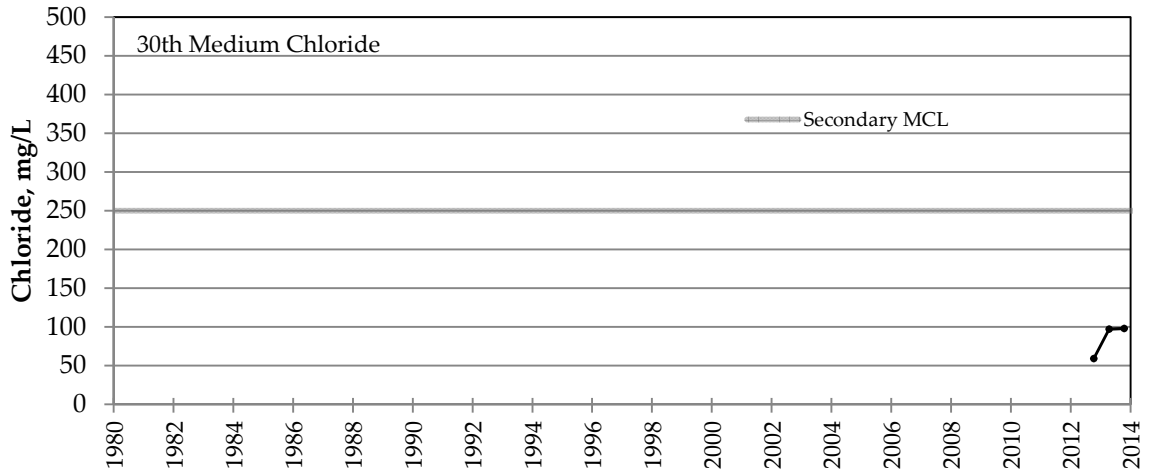

Cory St. Deep Total Dissolved Solids
TDS, mg/L
WY 2010-2013 Trend
Secondary MCL
Rate of change = -18.4 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

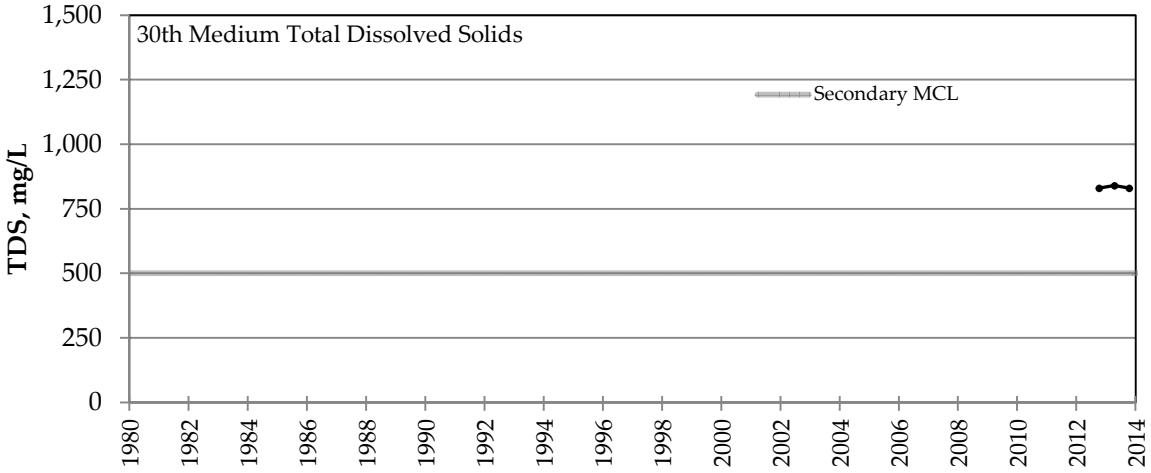

Cory St. Deep Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -3.5 feet per year
WY 2010-2013 Trend
75
65
55
45
35
25
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

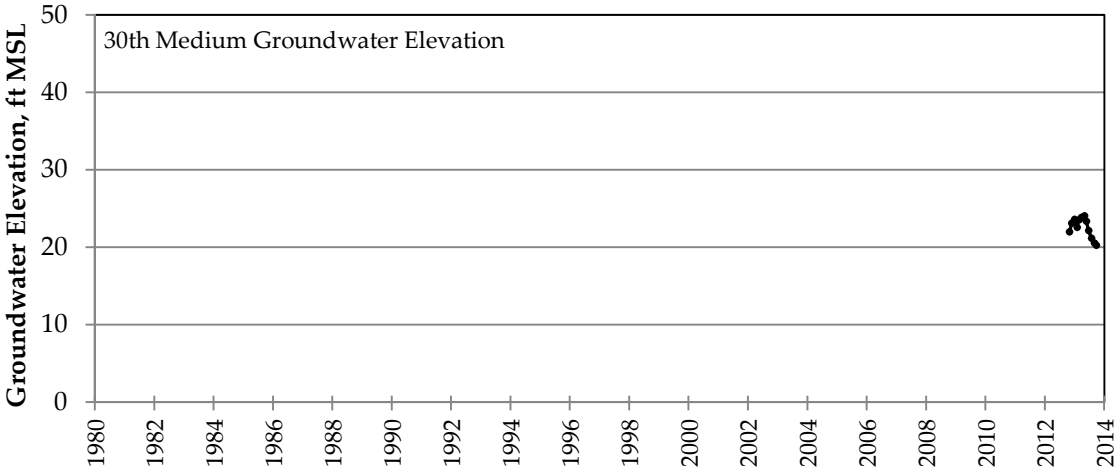

30th Shallow Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

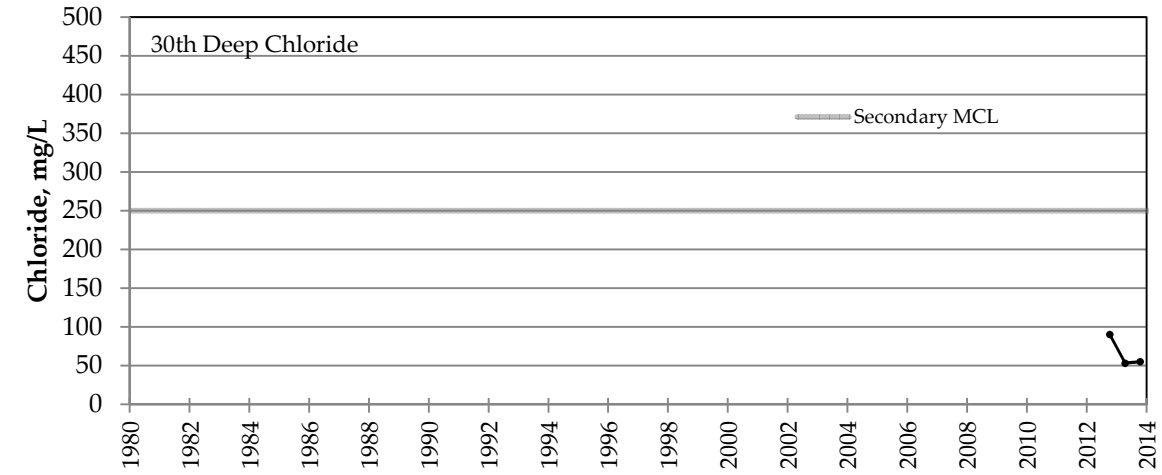

30th Shallow Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

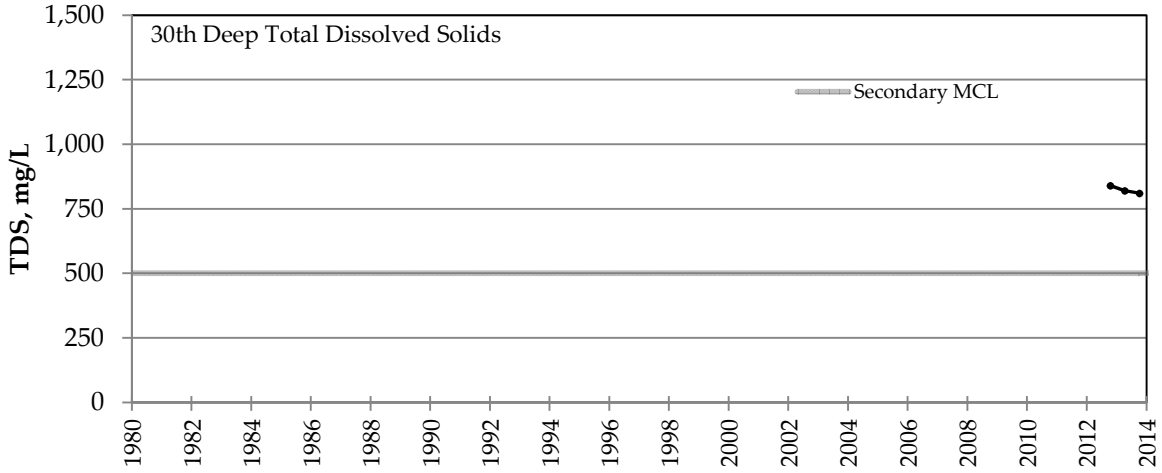

30th Shallow Groundwater Elevation
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

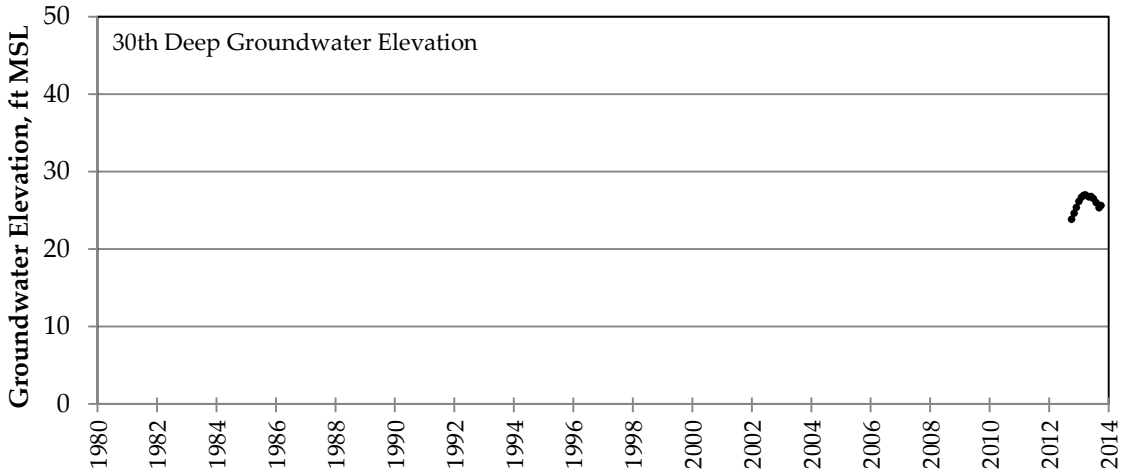

30th Medium Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

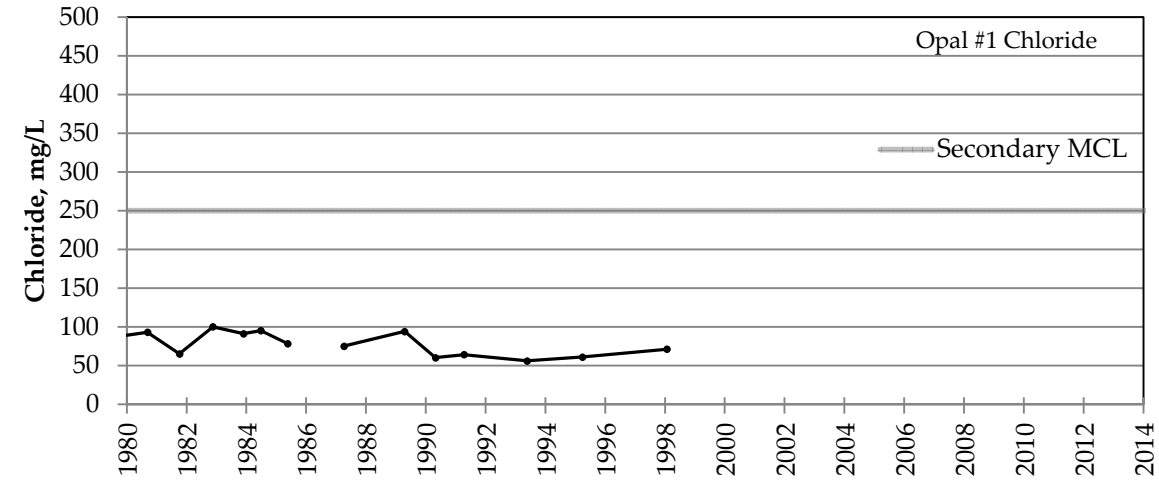

30th Medium Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

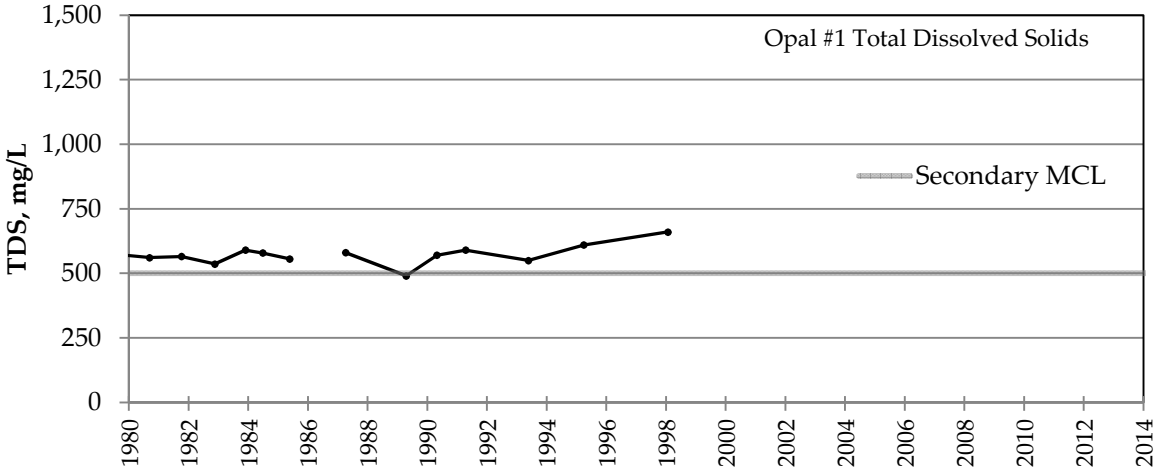

30th Medium Groundwater Elevation
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

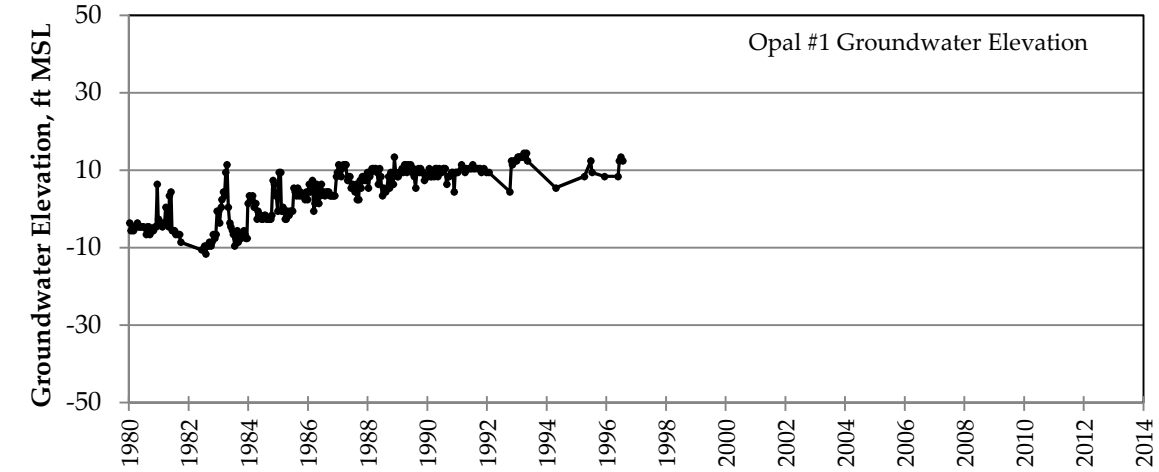

30th Deep Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

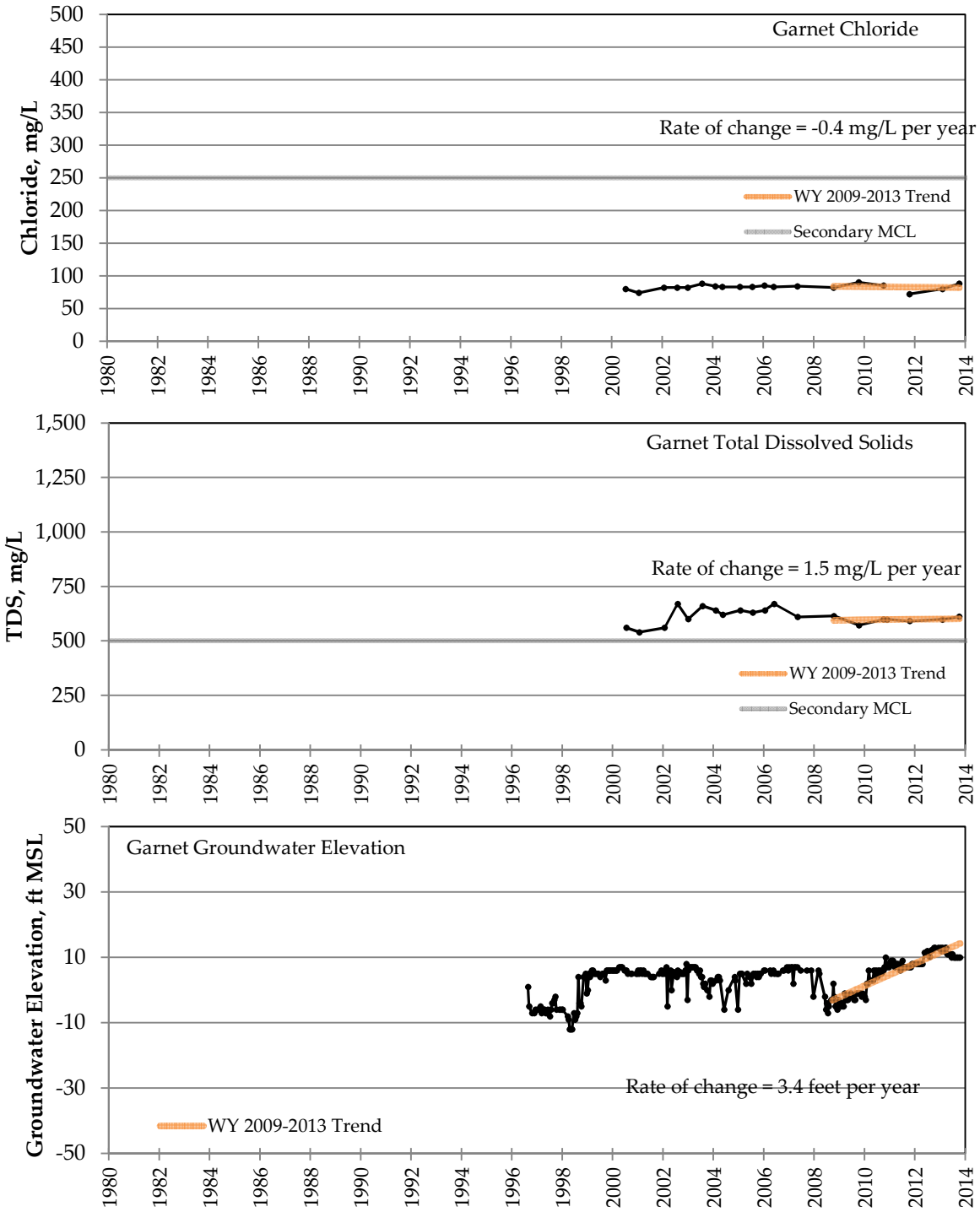

30th Deep Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

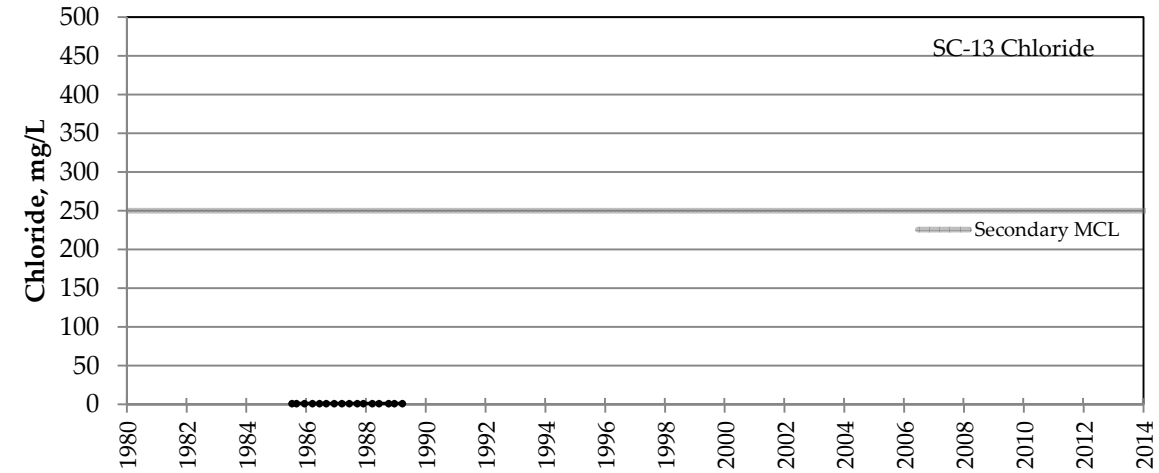

30th Deep Groundwater Elevation
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

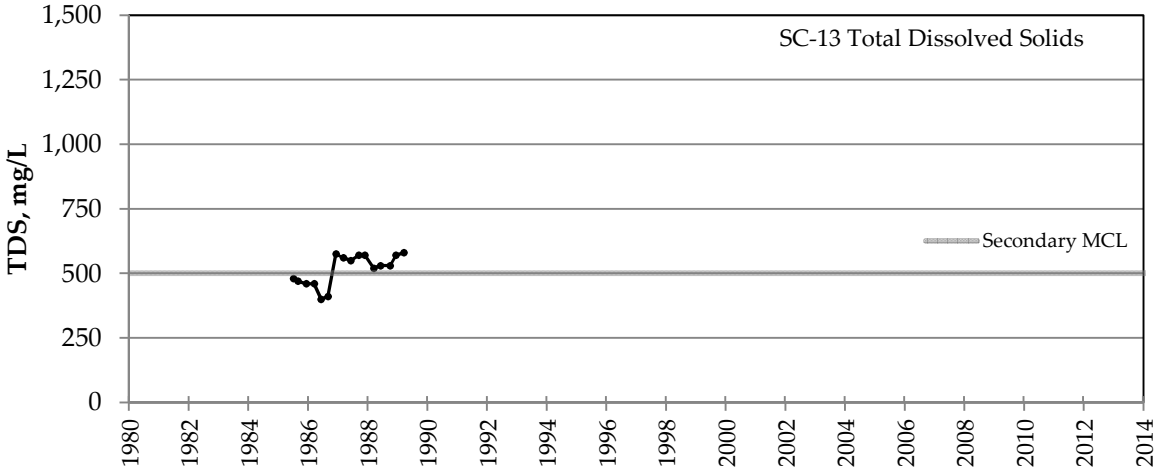

Opal #1 Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

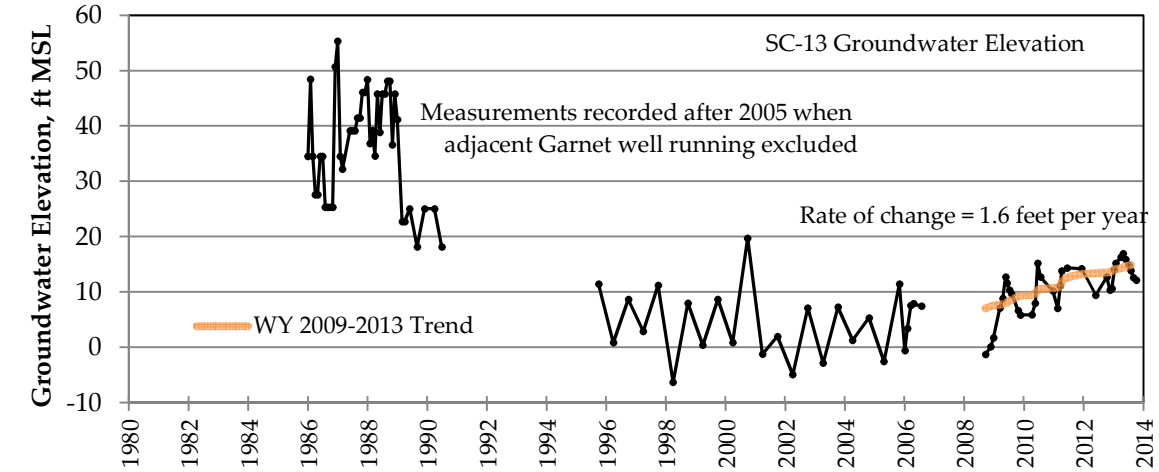

Opal #1 Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

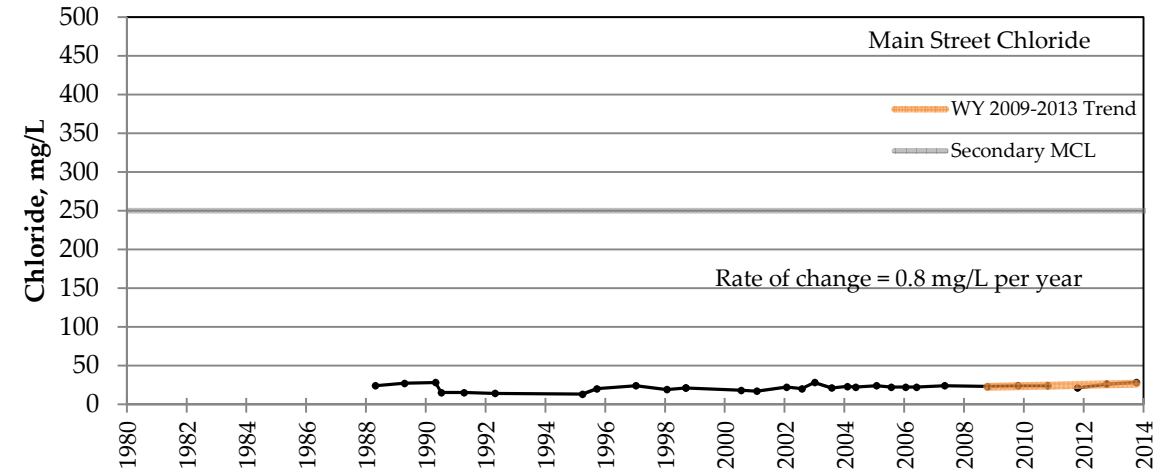

Opal #1 Groundwater Elevation
Groundwater Elevation, ft MSL
50
30
10
-10
-30
-50
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

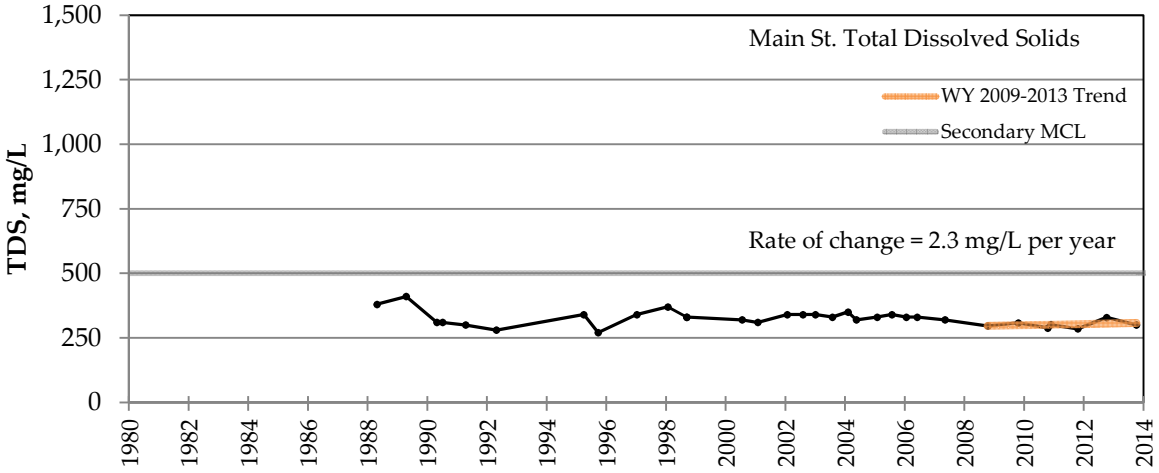

Garnet Chloride
Chloride, mg/L
Rate of change = -0.4 mg/L per year
WY 2009-2013 Trend
Secondary MCL
Garnet Total Dissolved Solids
TDS, mg/L
Rate of change = 1.5 mg/L per year
WY 2009-2013 Trend
Secondary MCL
Garnet Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 3.4 feet per year
WY 2009-2013 Trend

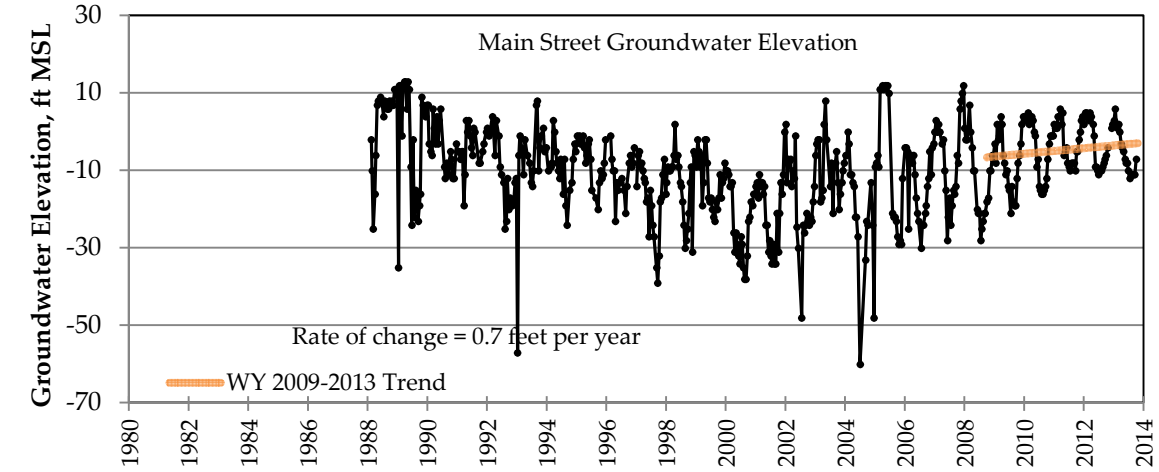

SC-13 Chloride
Chloride, mg/L
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

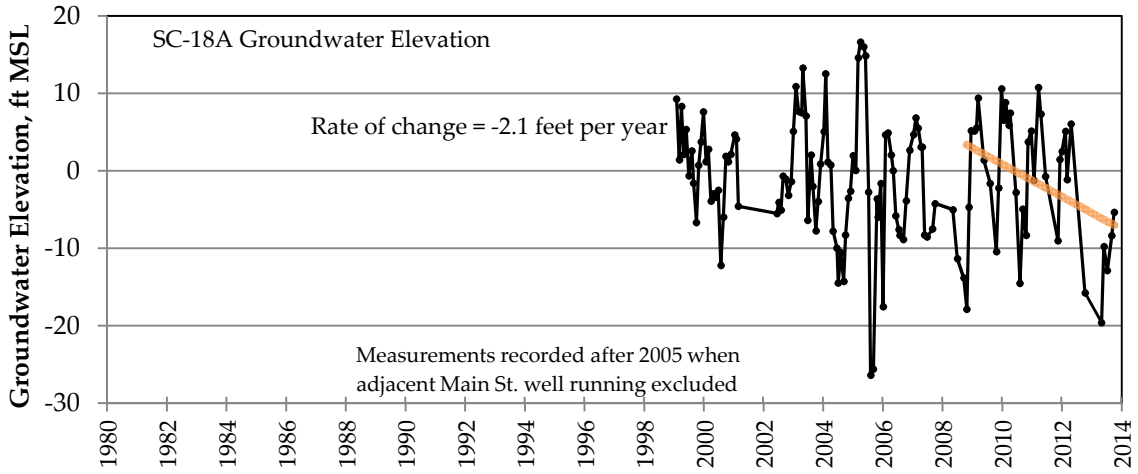

SC-13 Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

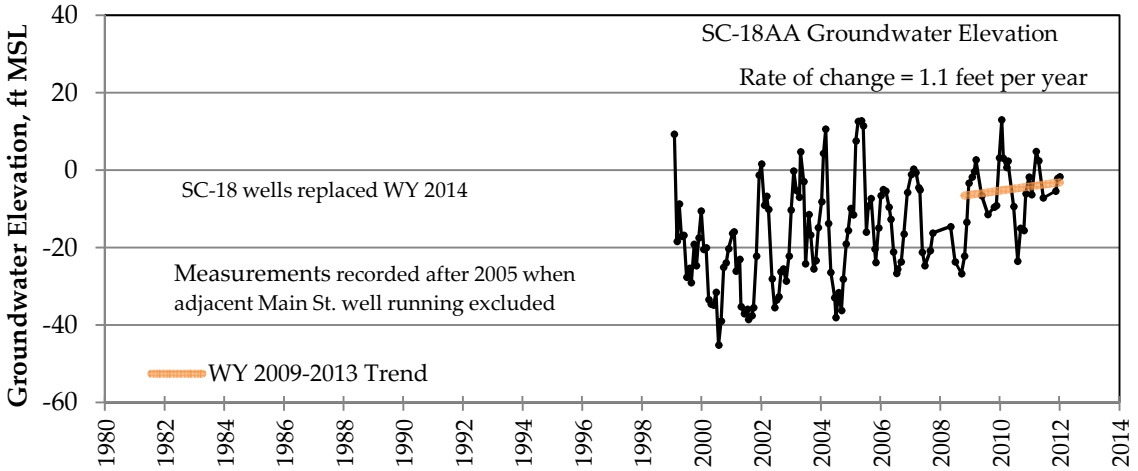

SC-13 Groundwater Elevation
Groundwater Elevation, ft MSL
Measurements recorded after 2005 when
adjacent Garnet well running excluded
Rate of change = 1.6 feet per year
WY 2009-2013 Trend
60
50
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

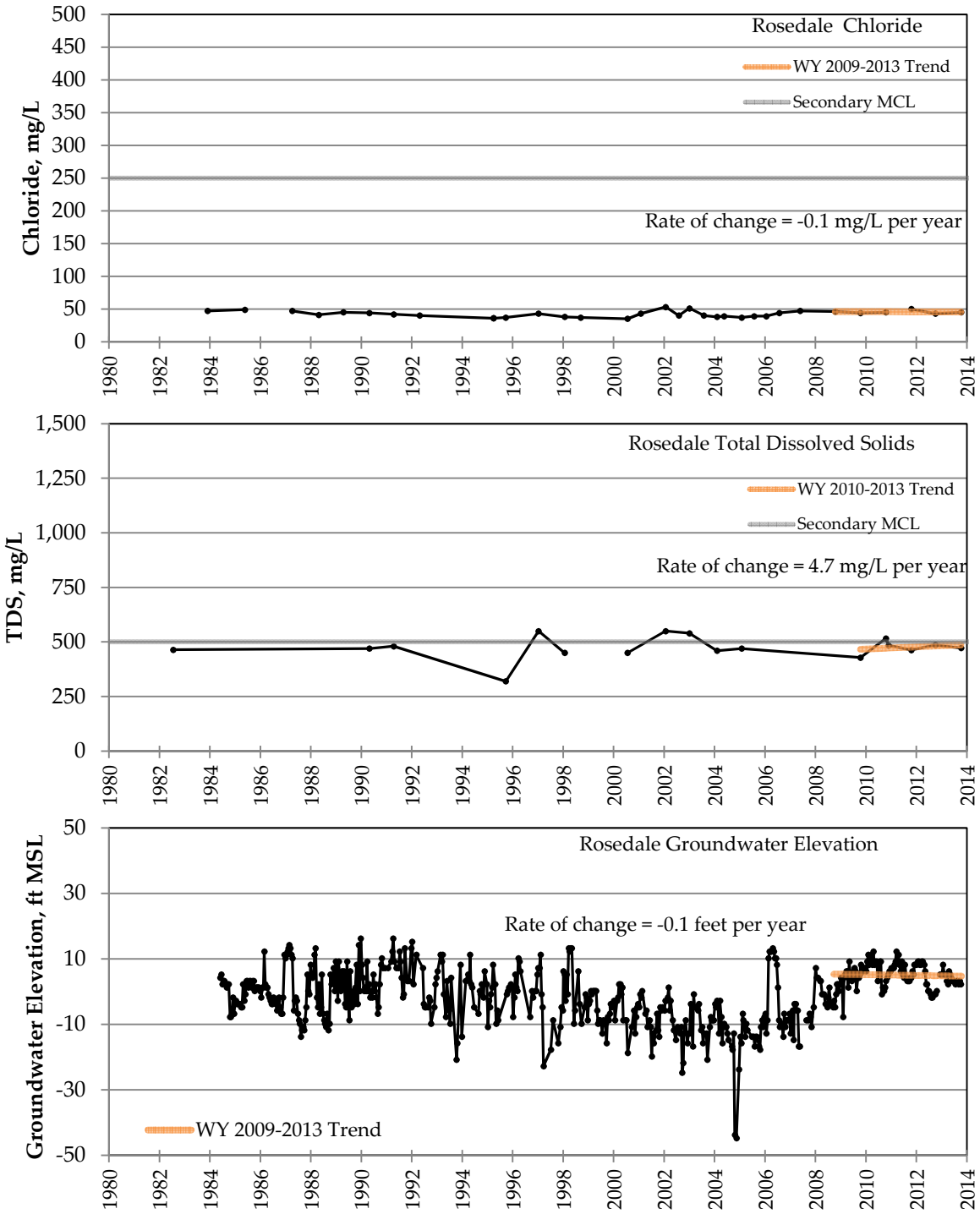

Main Street Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.8 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

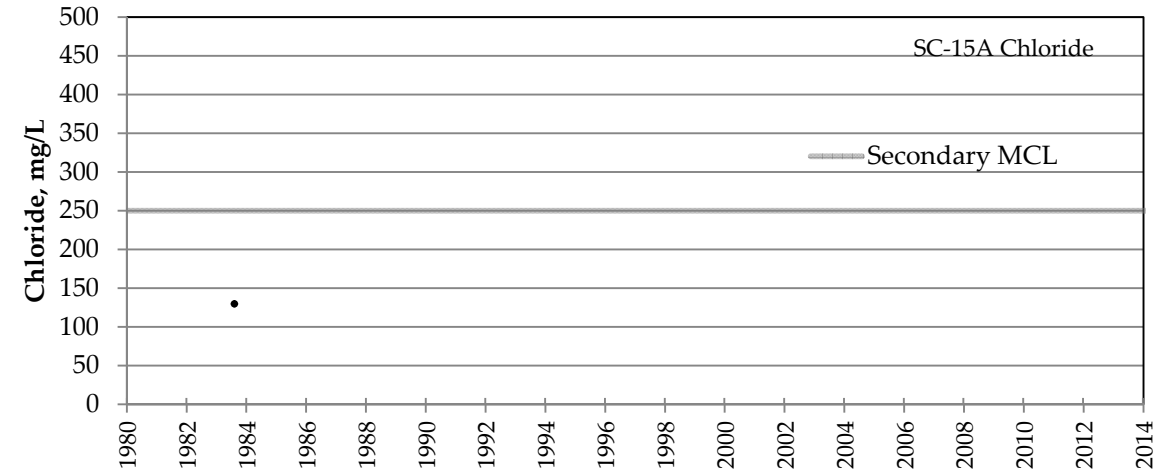

Main St. Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 2.3 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

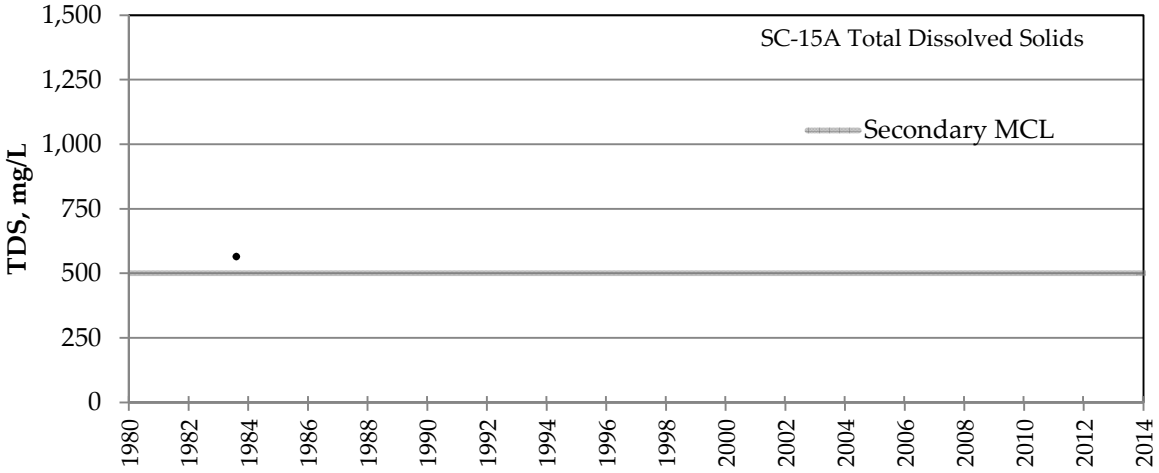

Main Street Groundwater Elevation
Rate of change = 0.7 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
30
10
-10
-30
-50
-70
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

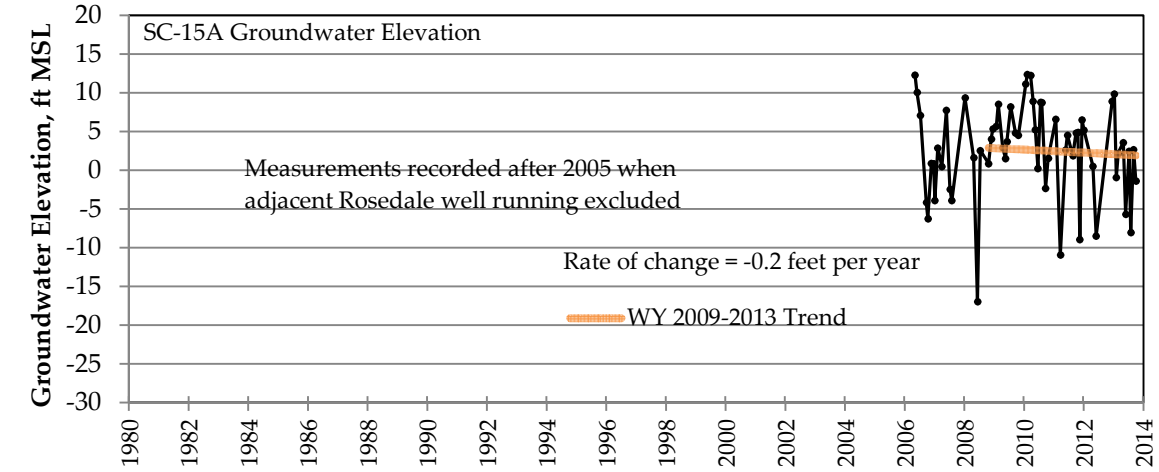

SC-18A Groundwater Elevation
Rate of change = -2.1 feet per year
Measurements recorded after 2005 when adjacent Main St. well running excluded
Groundwater Elevation, ft MSL
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

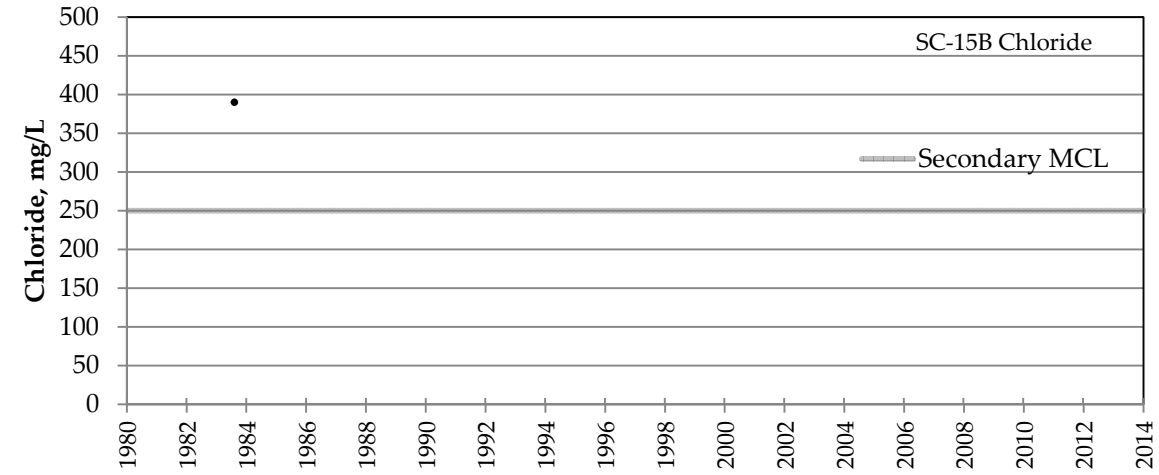

SC-18AA Groundwater Elevation
Rate of change = 1.1 feet per year
SC-18 wells replaced WY 2014
Measurements recorded after 2005 when adjacent Main St. well running excluded
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
40
20
0
-20
-40
-60
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

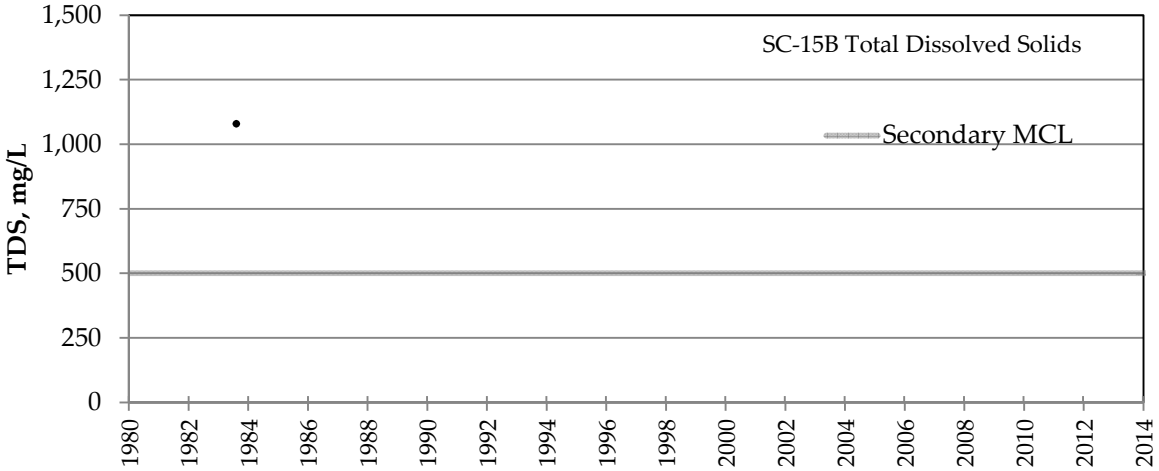

Rosedale Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.1 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Rosedale Total Dissolved Solids
WY 2010-2013 Trend
Secondary MCL
Rate of change = 4.7 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Rosedale Groundwater Elevation
Rate of change = -0.1 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
30
10
-10
-30
-50

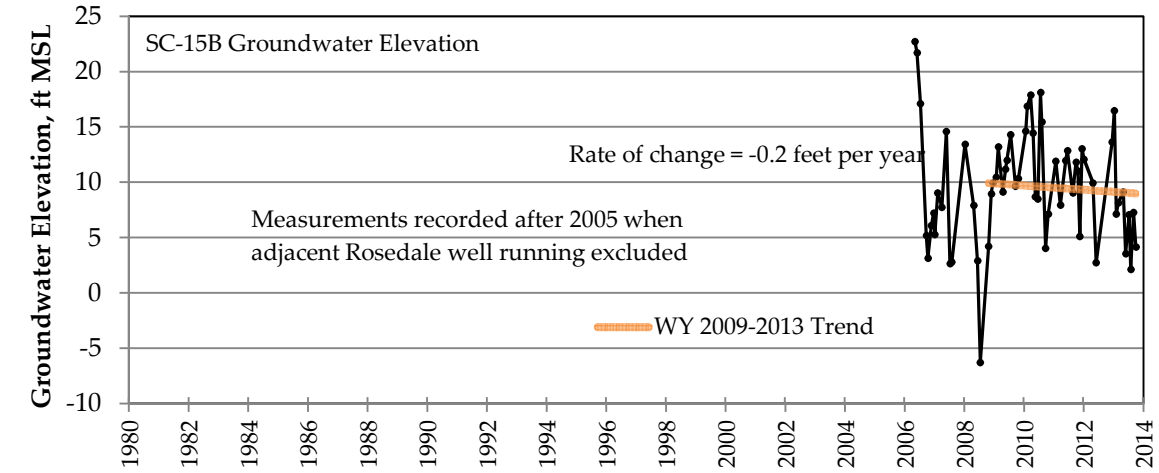

SC-15A Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

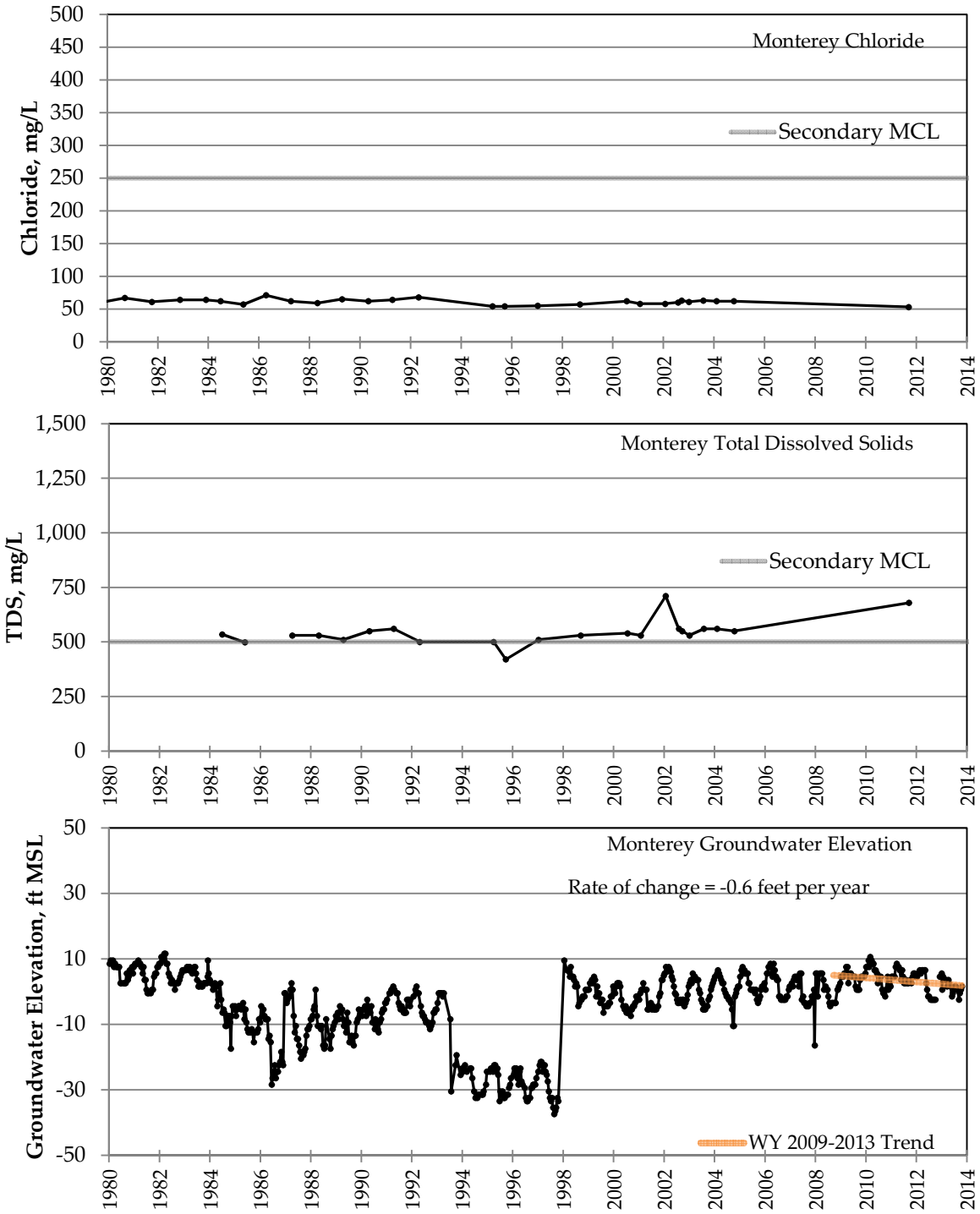

SC-15A Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

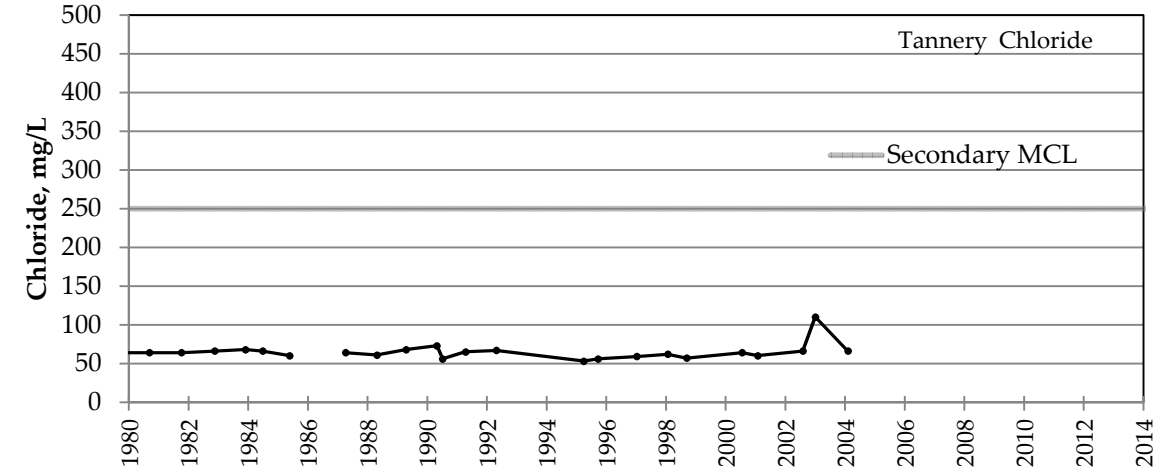

SC-15A Groundwater Elevation
Measurements recorded after 2005 when adjacent Rosedale well running excluded
Rate of change = -0.2 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
20
15
10
5
0
-5
-10
-15
-20
-25
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

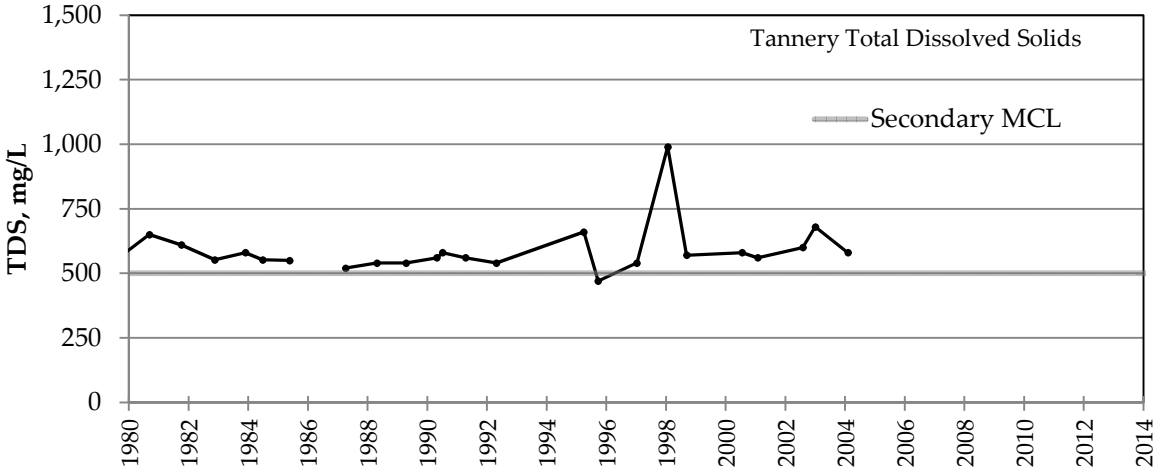

SC-15B Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

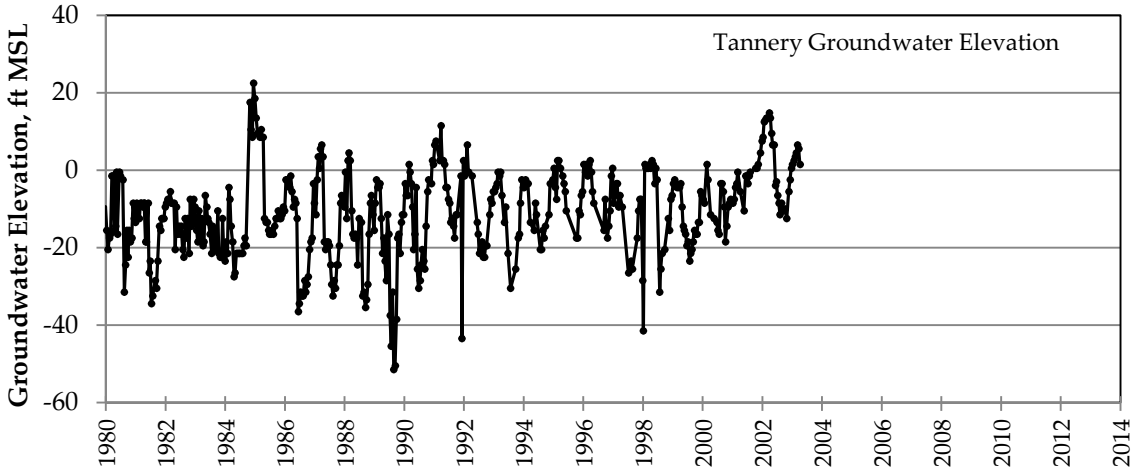

SC-15B Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

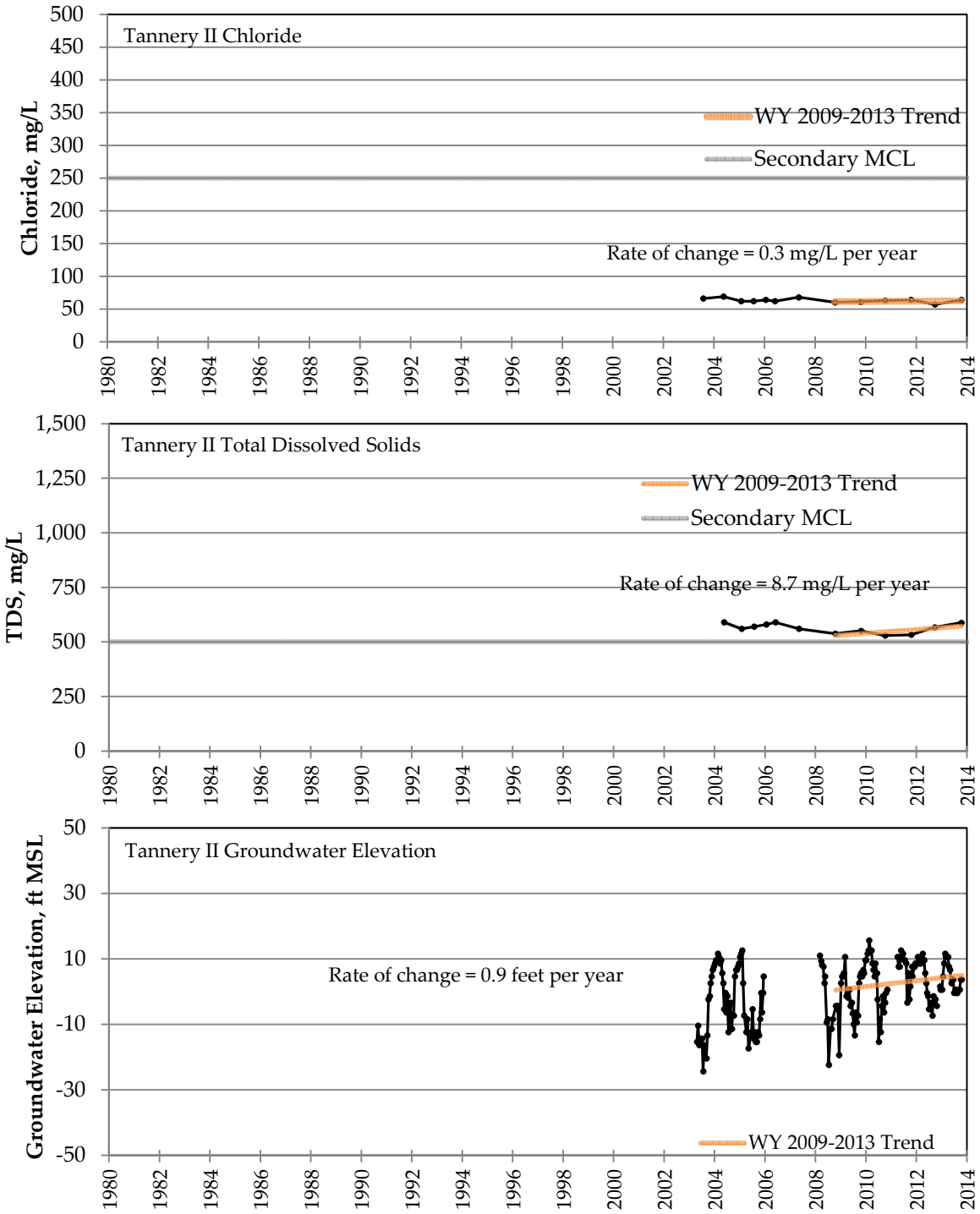

SC-15B Groundwater Elevation
Rate of change = -0.2 feet per year
Measurements recorded after 2005 when
adjacent Rosedale well running excluded
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
25
20
15
10
5
0
-5
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

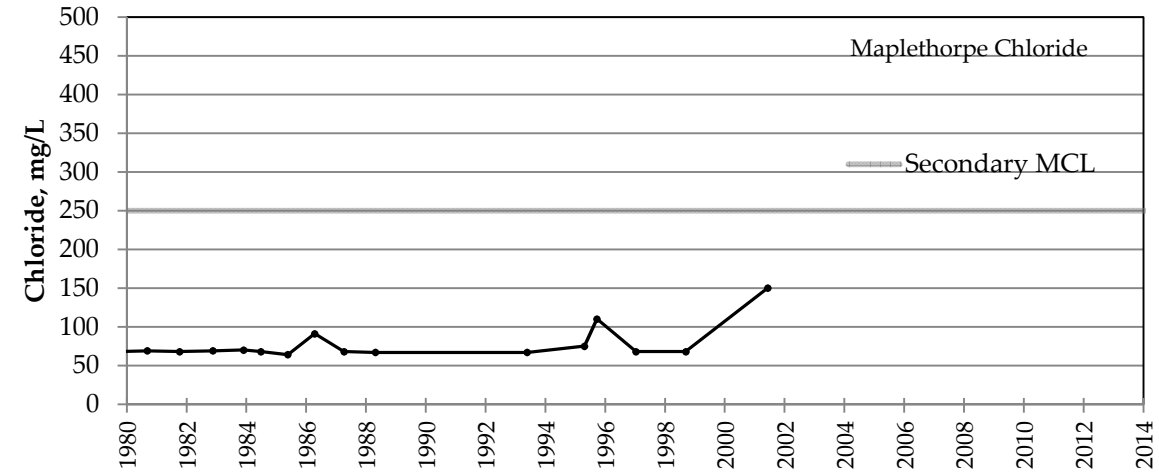

Monterey Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Monterey Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Monterey Groundwater Elevation
Rate of change = -0.6 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
30
10
-10
-30
-50

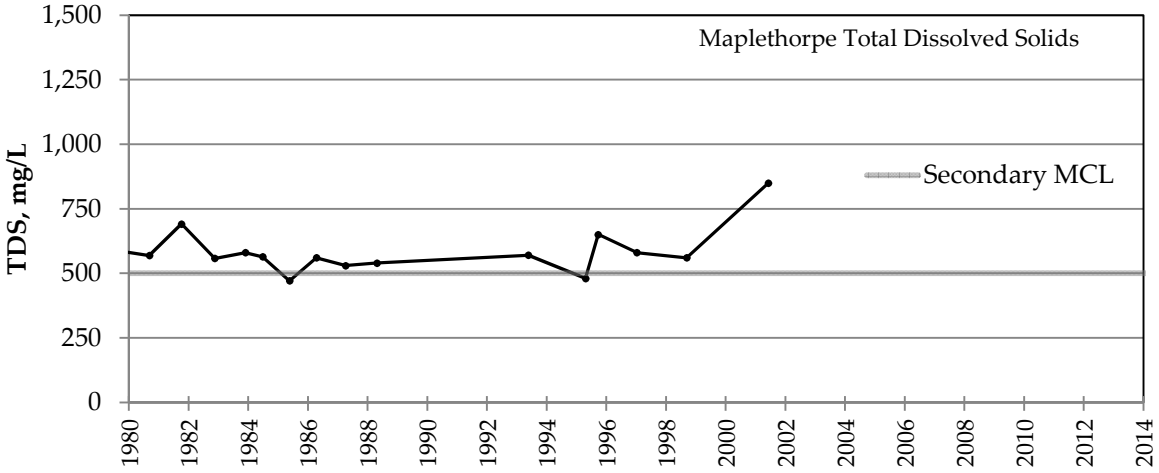

Tannery Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

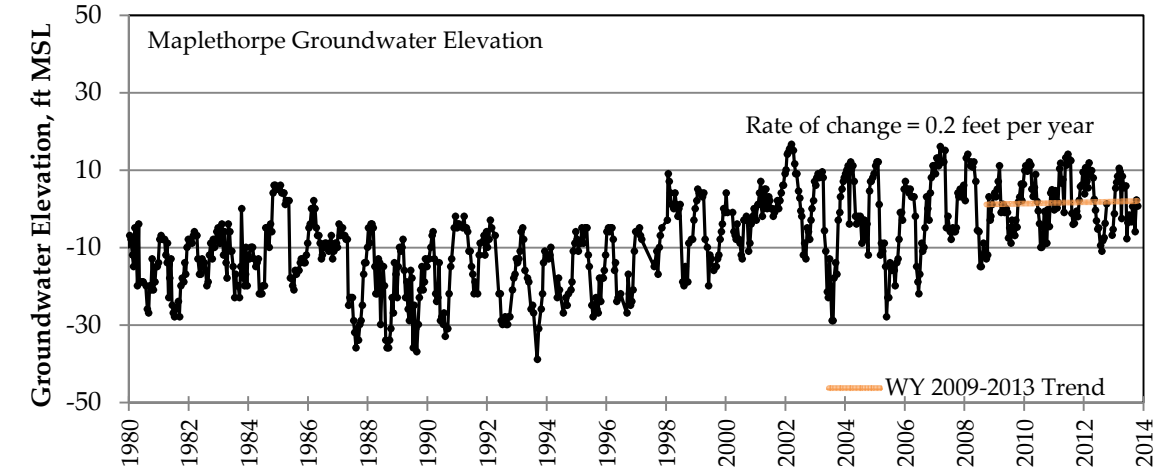

Tannery Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Tannery Groundwater Elevation
Groundwater Elevation, ft MSL
40
20
0
-20
-40
-60
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Tannery II Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.3 mg/L per year
Tannery II Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 8.7 mg/L per year
Tannery II Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.9 feet per year
WY 2009-2013 Trend


Maplethorpe Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Maplethorpe Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Maplethorpe Groundwater Elevation
Rate of change = 0.2 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
30
10
-10
-30
-50
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

SECTION 4 – WATER YEAR 2013 AQUIFER CONDITIONS FOR CENTRAL PURISIMA AREA (BC/DEF-UNITS)

This section presents groundwater level and water quality conditions for Water Year 2013 in the central portion of the Soquel-Aptos area where the primary production aquifers are the Purisima BC-unit and the Purisima DEF-unit.

4.1 SqCWD Service Area II Production

In the central portion of the Soquel-Aptos area, groundwater is produced for municipal purposes by SqCWD in Service Area II. SqCWD's Service Area II production was 597 acre-feet in Water Year 2012, the lowest annual total since service area totals have been recorded from Water Year 1984, and the sixth consecutive year of production decreases. Production in Service Area II in seven of the last eight years has been below the historical average. Figure 4-1 shows the production in Service Area II by water year. Figure 4-1 also shows the production by well in Service Area II grouped by aquifer unit. Combined pumping at the wells grouped as BC-unit wells (Estates, Ledyard, and Madeline) was 354 acre-feet, the lowest annual amount since Water Year 1986. Combined pumping at the wells grouped as DEF-unit wells (Aptos Creek and T. Hopkins) was 243 acre-feet, the second lowest amount since Water Year 1990. Water Year 2013 pumping in Service Area II was approximately 21% of SqCWD's revised estimate of the post-recovery pumping yield in the Purisima area (HydroMetrics WRI, 2012).

4.2 Groundwater Level Conditions and Trends

SqCWD has established protective groundwater elevations in coastal monitoring wells to protect the Purisima BC-unit and DEF-unit in the central portion of the Soquel-Aptos area from seawater intrusion. Cross-sectional models were used to estimate groundwater elevations that result in the freshwater-salt water interface in the productive aquifer unit being seaward of the coast over the long term (HydroMetrics LLC, 2009b).

Average coastal groundwater levels in the SqCWD's BC-unit and DEF-unit monitoring wells remained below protective elevations in Water Year 2013, as shown in Table 4-1. Although the maximum groundwater level at SC-8D was above the protective elevation in Water Year 2013, average groundwater levels

must be at or above the protective elevation to protect the productive aquifer against seawater intrusion. Hydrographs for wells in the SC-9 and SC-8 clusters follow at the end of this section. The hydrographs show that groundwater levels at wells SC-9C and SC-8D have been below protective elevations for most of the data record, and remained below protective elevations in Water Year 2013.

Table 4-1 (2013): Comparison of Water Year 2013 Coastal Groundwater Levels with Protective Elevations

Well	Location	Unit	Minimum Groundwater Elevation[1] (feet msl)[2]	Maximum Groundwater Elevation (feet msl)	Average Groundwater Elevation (feet msl)	Protective Elevation (feet msl)
SC-9C	Seacliff	BC	-13.8	-0.1	-6.3	10
SC-8D	Aptos Creek	DEF	0.4	10.6	6.2	10

[1] Bi-monthly data from October, December, February, April, June, and July.

[2] msl = mean sea level

Table 4-2 summarizes the important groundwater level trends by monitoring well. There were no substantial changes to trends in Water Year 2013.

Hydrographs for multiple completions of these wells follow at the end of this section. Hydrographs for multiple completions of monitoring wells adjacent to production wells, and static groundwater levels in groups of production wells are also included following this section.

Hydrographs for single wells including production wells are included with chemographs. These hydrographs show trend lines for Water Years 2009-2013, a period when production in the Central Purisima area was decreasing and below historical averages.

Contour maps of groundwater elevations in Spring and Fall 2013 for the Purisima BC-unit are shown in Figure 4-2 and Figure 4-3. Figure 4-2 shows that the Spring 2013 pumping depression in the BC-unit was below sea level, with below sea level groundwater levels extending to the coast. Figure 4-3 shows the below sea level pumping depression deepened in the fall at some locations, and extended to more of the coast than in the spring. The figures show groundwater flows from all directions including from the Bay towards the pumping

depression in the BC-unit. The pumping depressions were less extensive than the previous year.

Table 4-2 (2013): Summary of Groundwater Level Trends in Central Purisima Area

Category	Well	Groundwater Level Trend Description	Notes
SqCWD Coastal Monitoring BC and DEF-unit Wells	SC-9C	Rise WY 2008-2013	Reduced pumping at Estates, Ledyard, and Madeline WY 2009-2013
	SC-8D	Rise WY 2008-2013	Reduced pumping at Aptos Creek and T. Hopkins WY 2008-2013
	SC-8B	Rise WY 2008-2013 in BC-unit and ~ 10 feet below SC-8D	Deeper drawdown from BC-unit pumping even though more nearby DEF pumping
SqCWD Shallow Monitoring Coastal Wells	SC-9E	Rise of 2 feet WY 2010 in overlying interval of DEF-unit then stable	Increasing rainfall WY 2008-2011, but lower rainfall in WY 2012-2013
	SC-8F	Rise of ~4 feet since Water Year 2006	Well replaced in 2012, data consistent with previous data
SqCWD Inland BC Unit Monitoring Well	SC-19	30+ feet rise since installation in WY 2007,	Increasing rainfall since WY 2007 with lower rainfall in WY 2012-2013

4.3 WATER QUALITY CONDITIONS AND TRENDS

The most significant groundwater quality threat in the Soquel-Aptos basin is seawater intrusion. As discussed above, groundwater levels remain below protective elevations in the BC and DEF-units. As a result, there is ongoing risk of seawater intrusion into the productive units of the central Purisima area.

Observed Total Dissolved Solids (TDS) and chloride concentrations do not suggest any seawater intrusion impacting SqCWD's production wells in the Purisima BC and DEF-units. Observed TDS and chloride concentrations in SqCWD's monitoring wells in the BC and DEF-units also do not indicate incipient seawater intrusion. Recent chloride concentrations in both production and monitoring wells are at 100 mg/L or less, while the maximum contaminant

limit (MCL) for chlorides is 250 mg/L. Chemographs for SqCWD wells in the area are included following this section.

Well SC-8F, completed in the shallow F-unit, was sanded up to 100 feet and was replaced in 2012. Water quality data prior to the replacement from 2007 are not reliable. The chloride concentration from the replacement well was 38 mg/L in Water Year 2013.

Water pumped from the Purisima formation continues to be treated for iron and manganese to meet drinking water standards. In Water Year 2013, color and turbidity were also reduced during treatment to meet drinking water standards.

In 2013, the Aptos Creek and T. Hopkins wells had detections of arsenic that ranged from 1.6-3.1 µg/L, below the MCL of 10 µg/L for arsenic. Water from these wells is treated to reduce arsenic concentrations below 0.7-3.1 µg/L, with an average of 2.1 µg/L.

4.4 STATE OF THE AQUIFER SUMMARY

Seawater intrusion has not been detected in most of the Central Purisima area. However, the productive Purisima BC and DEF-units remain at risk for seawater intrusion as coastal groundwater levels remain well below protective elevations. Due to historically low production in Water Years 2009 through 2013, groundwater levels in the Purisima BC and DEF-units showed recovery over the last four years. A longer period of low production will be required to recover the basin to be protected against the risk for seawater intrusion.

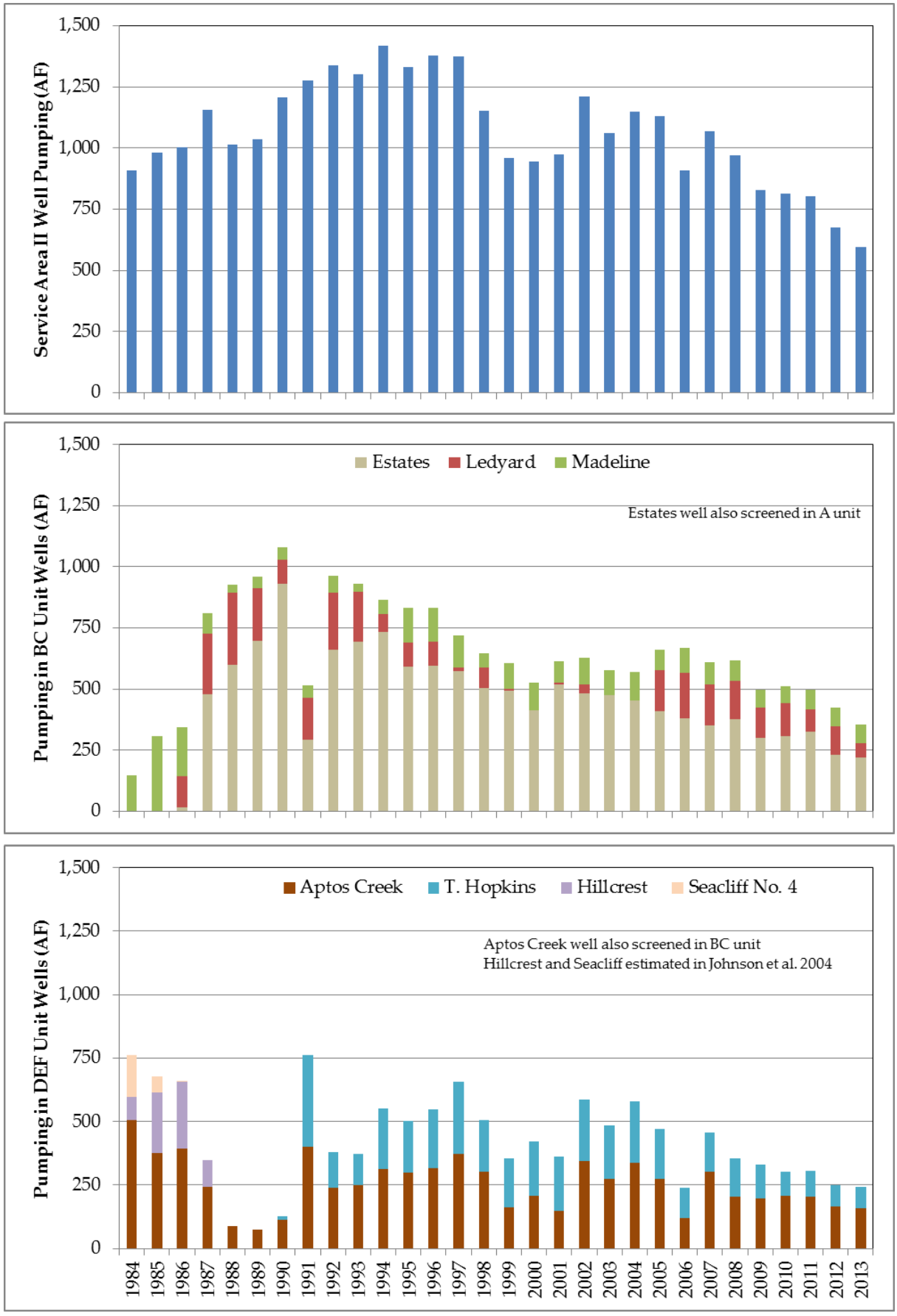


Figure 4-1: Pumping by Water Year in Central Purisima Area

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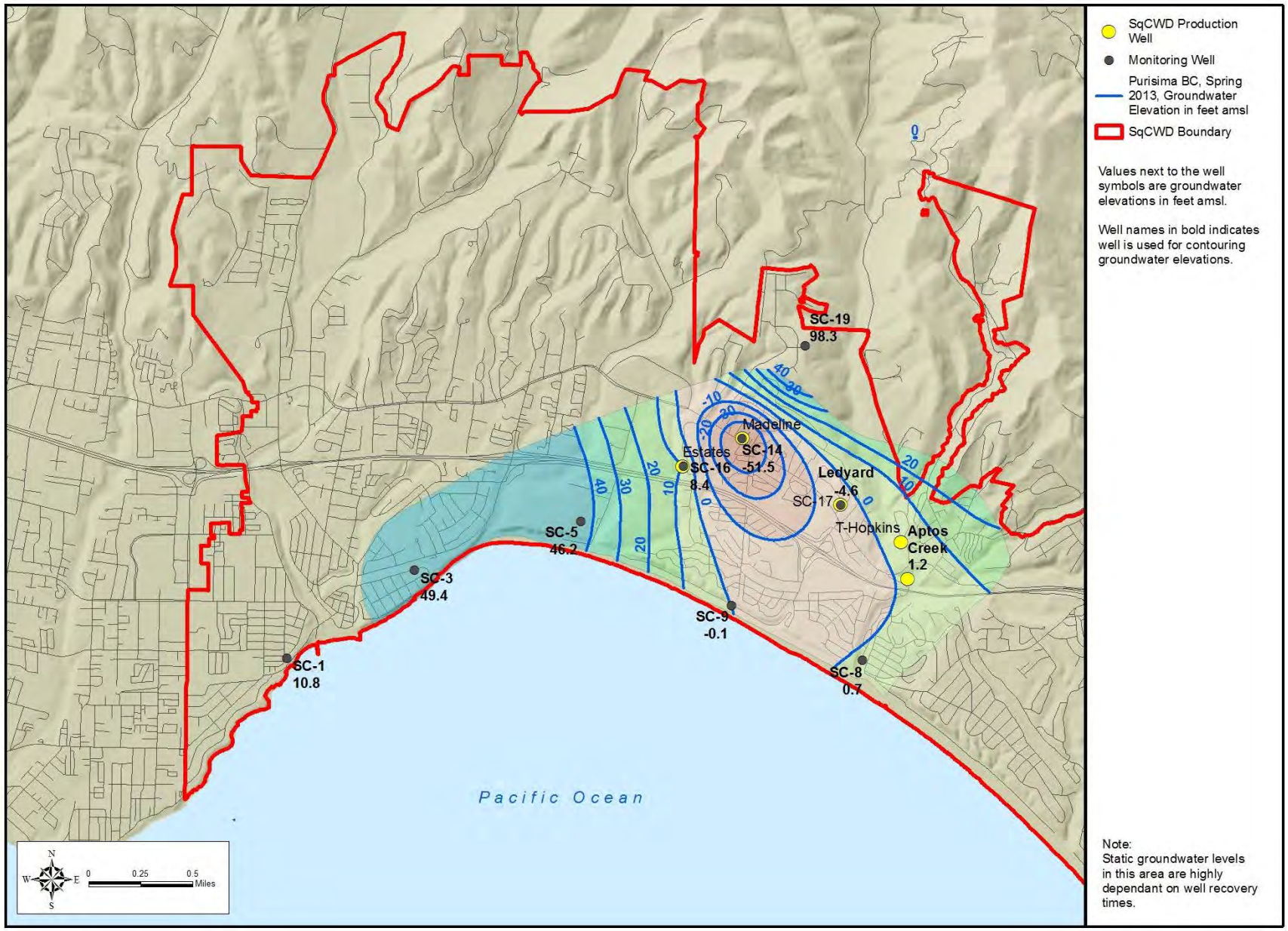

Figure 4-2 (2013): Groundwater Elevation Contours, Purisima BC-Unit, Spring 2013

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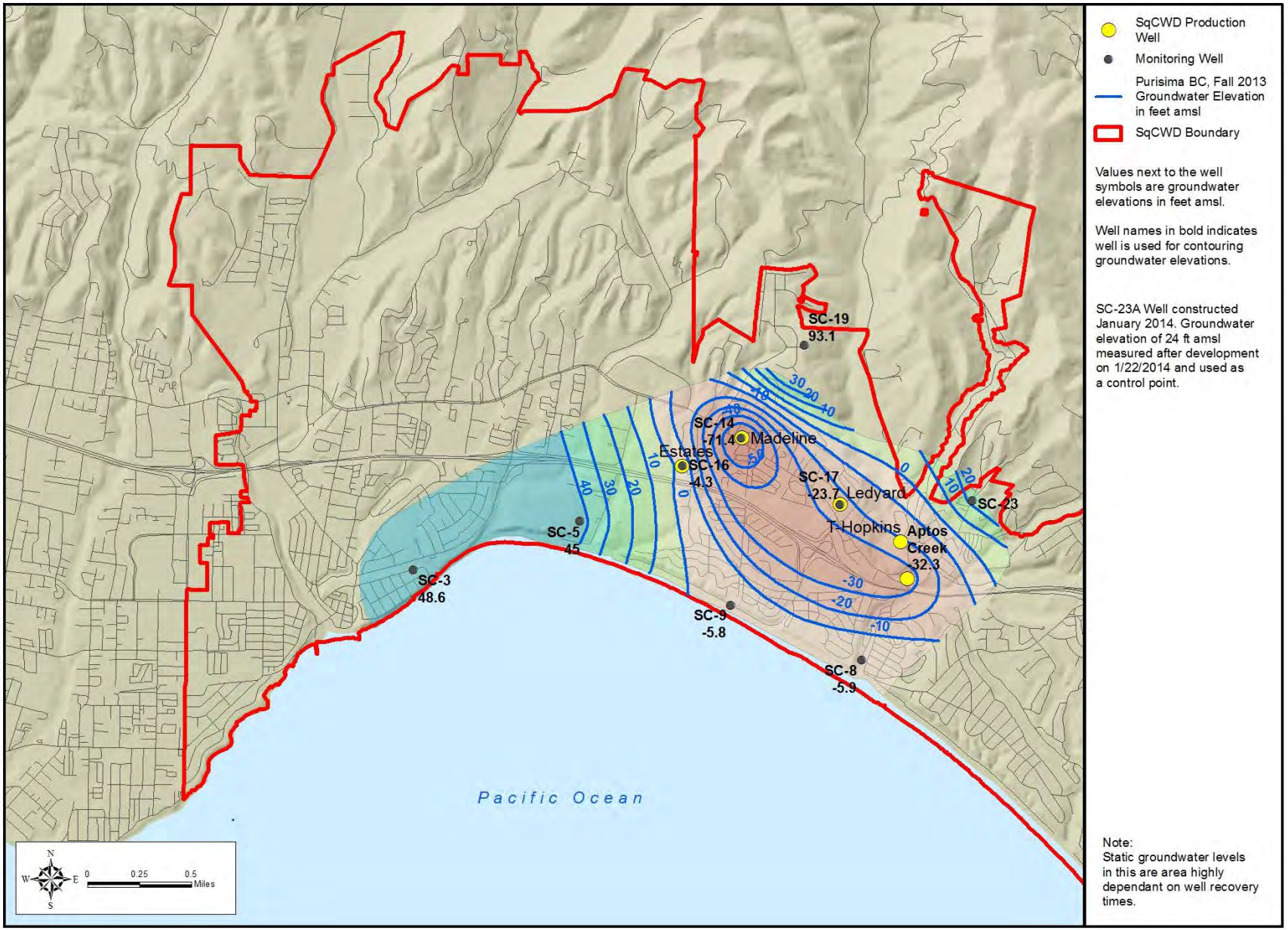

Figure 4-3 (2013): Groundwater Elevation Contours, Purisima BC-Unit, Fall 2013

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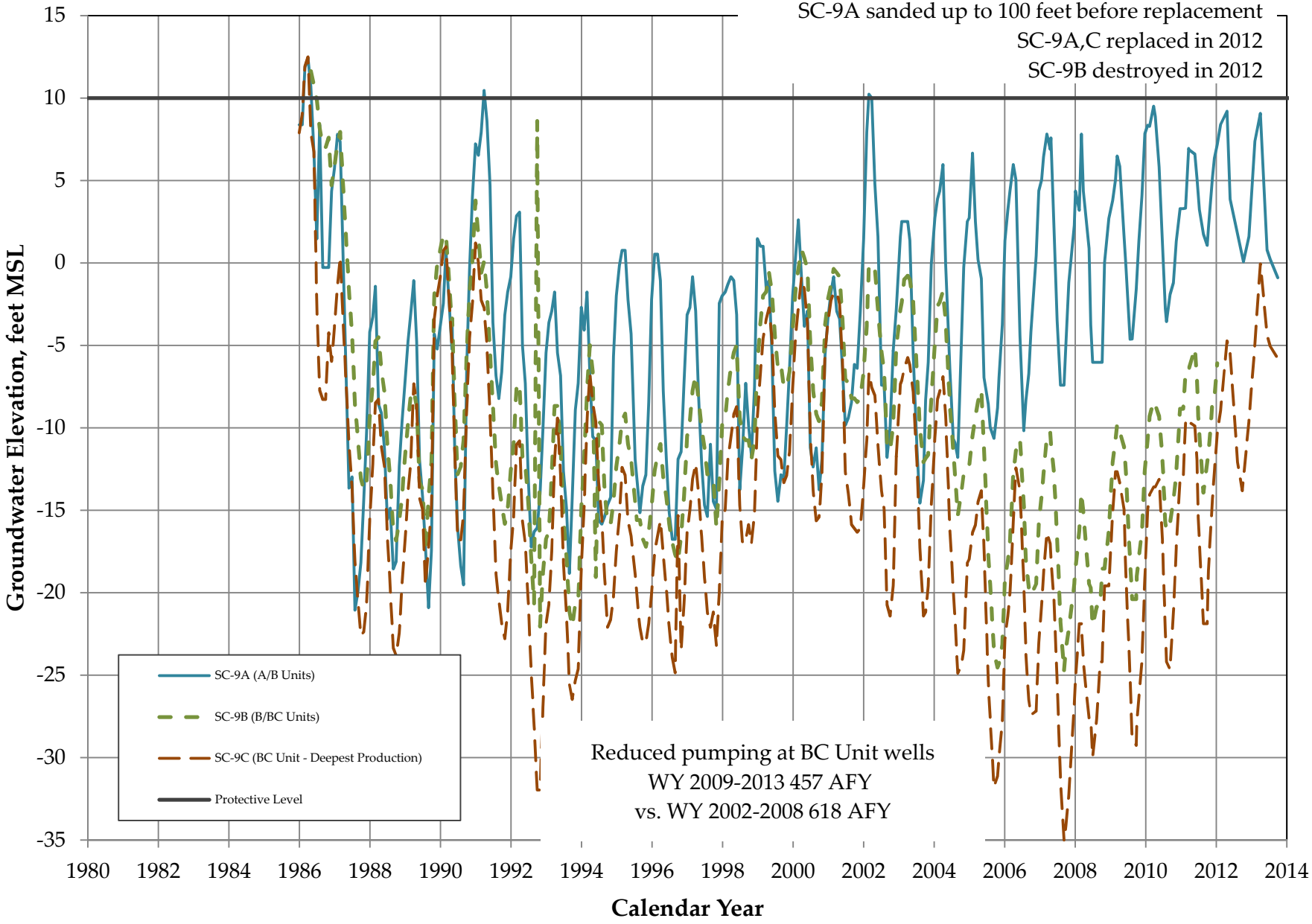
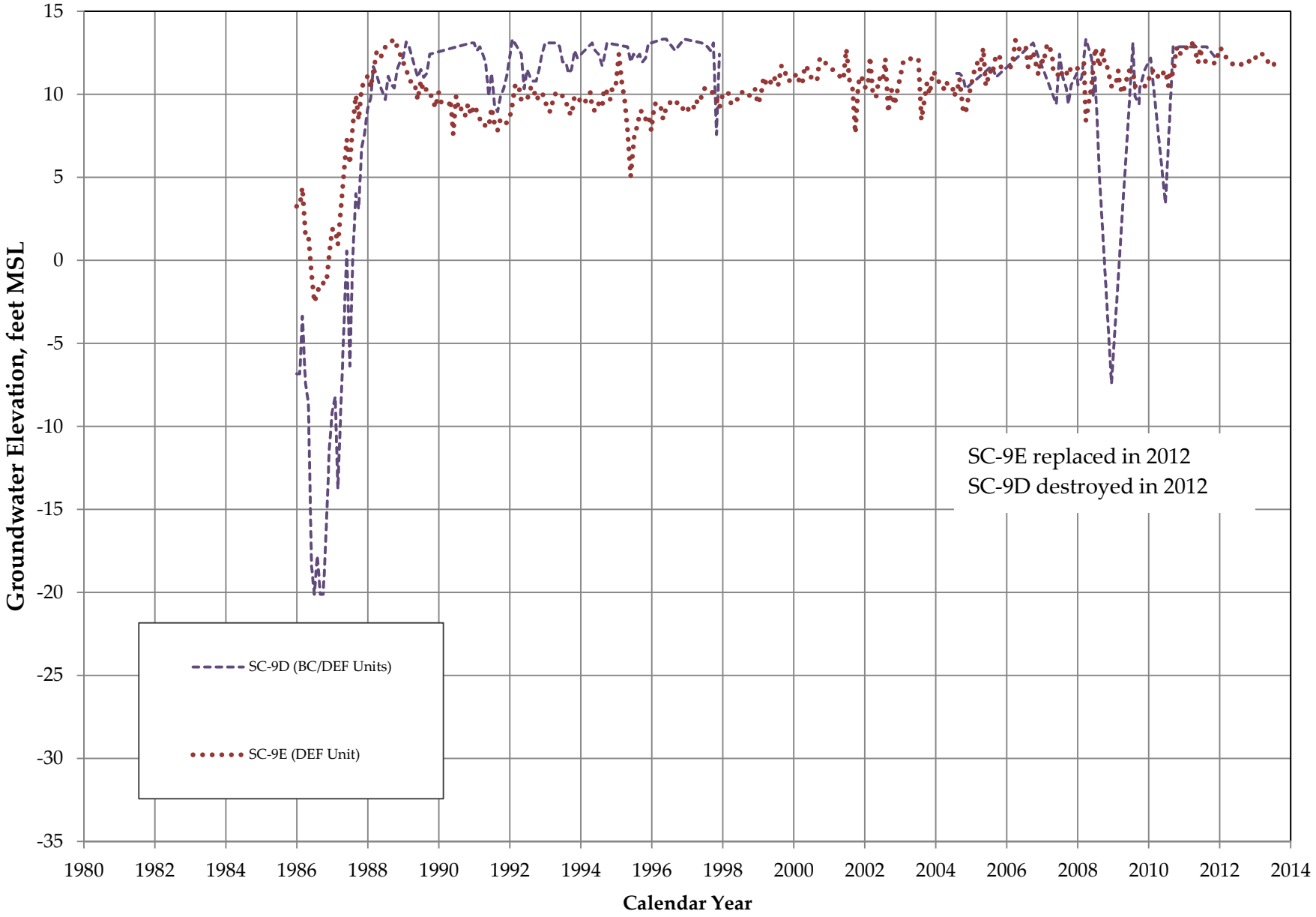
Monitoring Well Hydrographs for Central Purisima Area

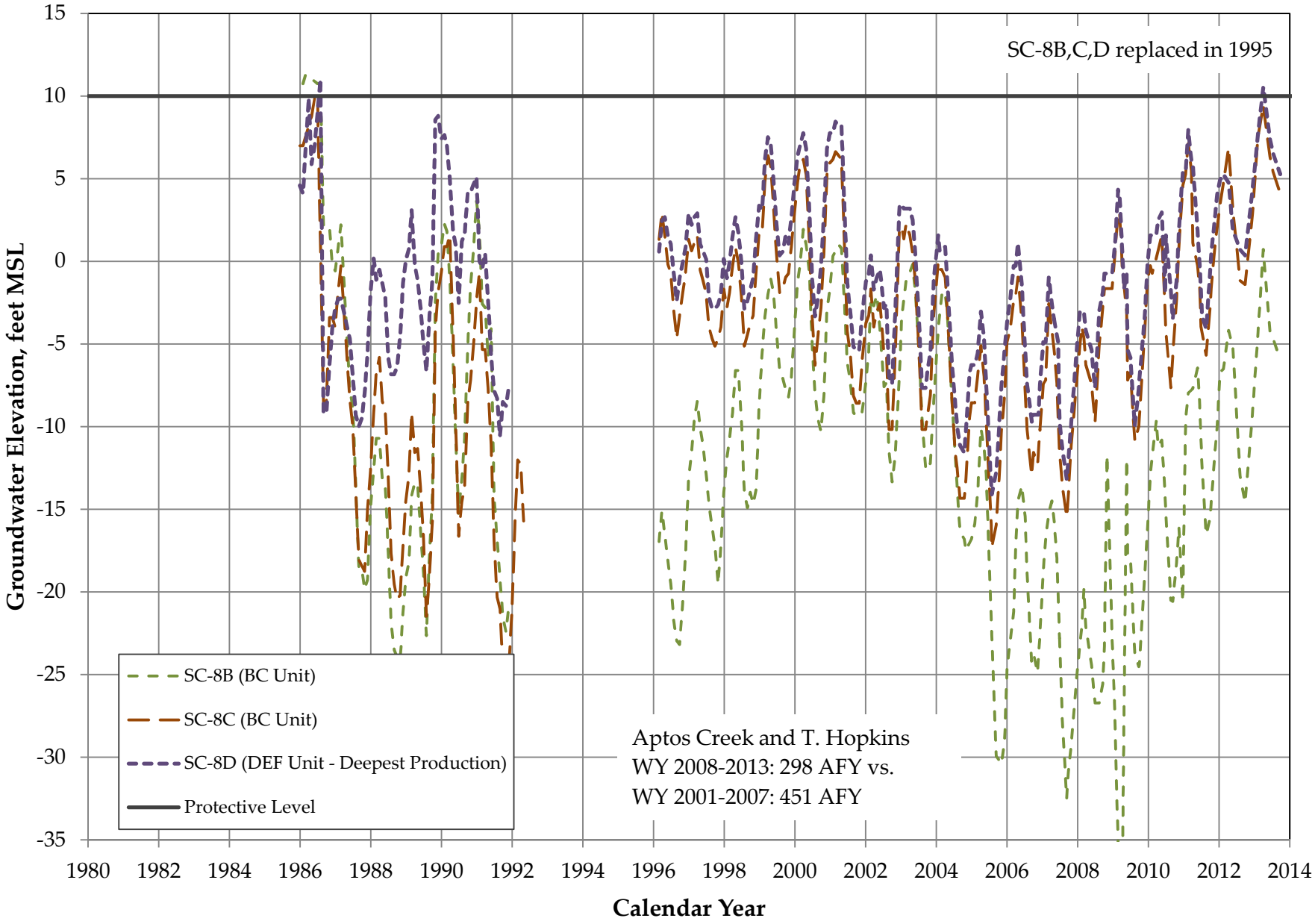
Hydrographs of SqCWD Coastal Monitoring Well Clusters

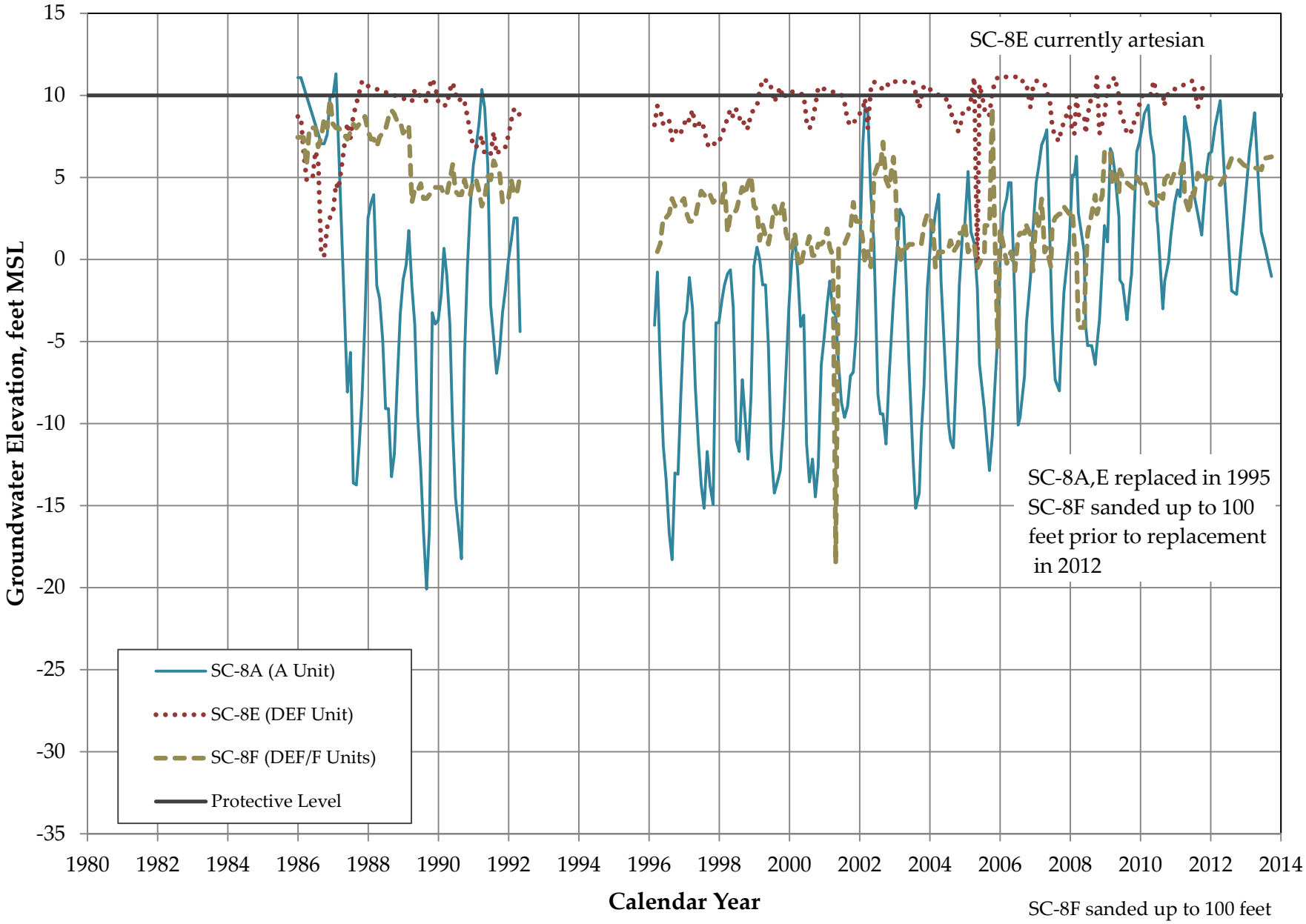
Hydrographs of SqCWD Inland Monitoring Well Clusters

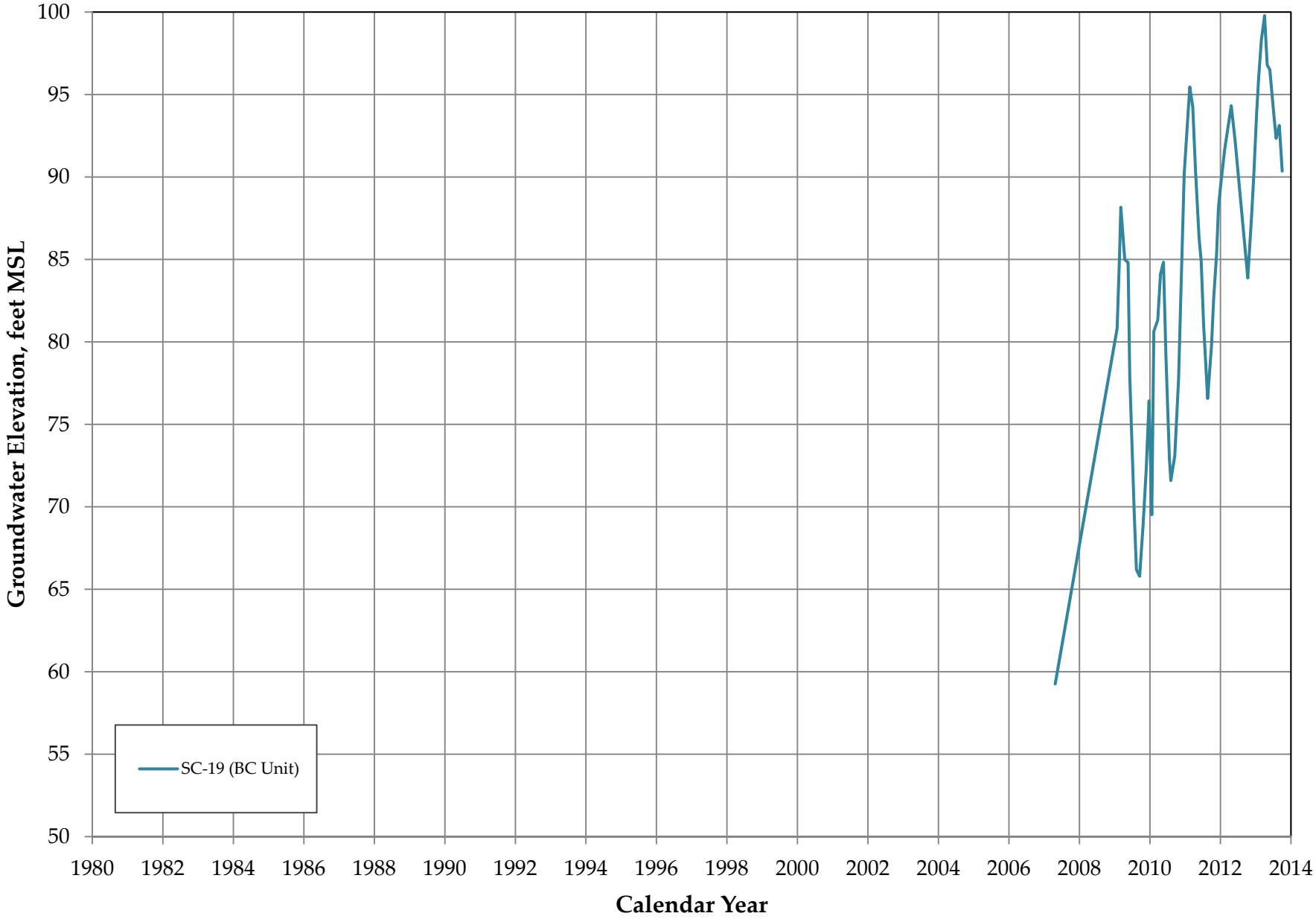
Hydrographs of SqCWD Monitoring Wells Adjacent to Production Wells

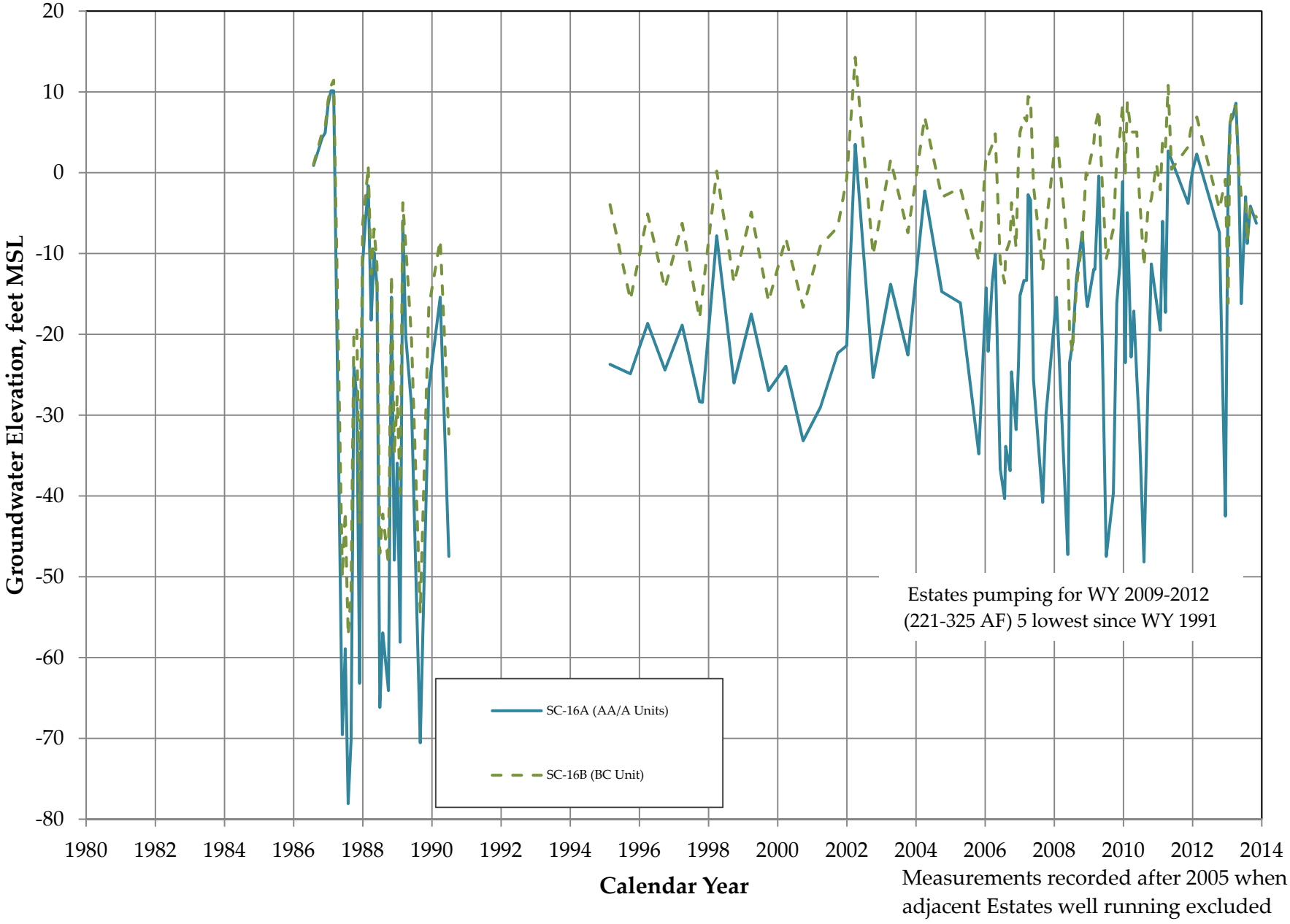

SC-9A sanded up to 100 feet before replacement
SC-9A,C replaced in 2012
SC-9B destroyed in 2012
Groundwater Elevation, feet MSL
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-9A (A/B Units)
SC-9B (B/BC Units)
SC-9C (BC Unit - Deepest Production)
Protective Level
Reduced pumping at BC Unit wells
WY 2009-2013 457 AFY
vs. WY 2002-2008 618 AFY

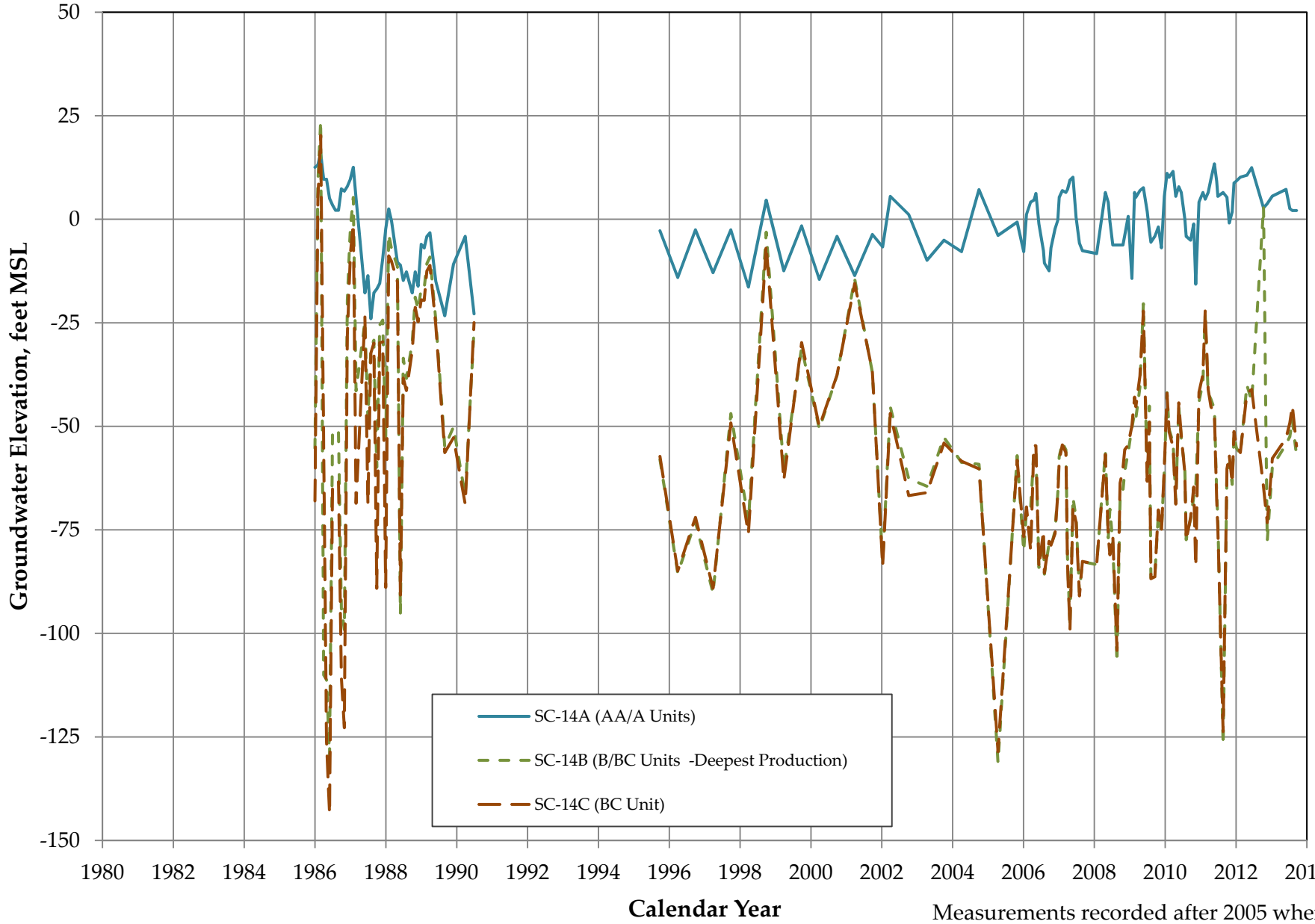

Groundwater Elevation, feet MSL
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-9E replaced in 2012
SC-9D destroyed in 2012
SC-9D (BC/DEF Units)
SC-9E (DEF Unit)

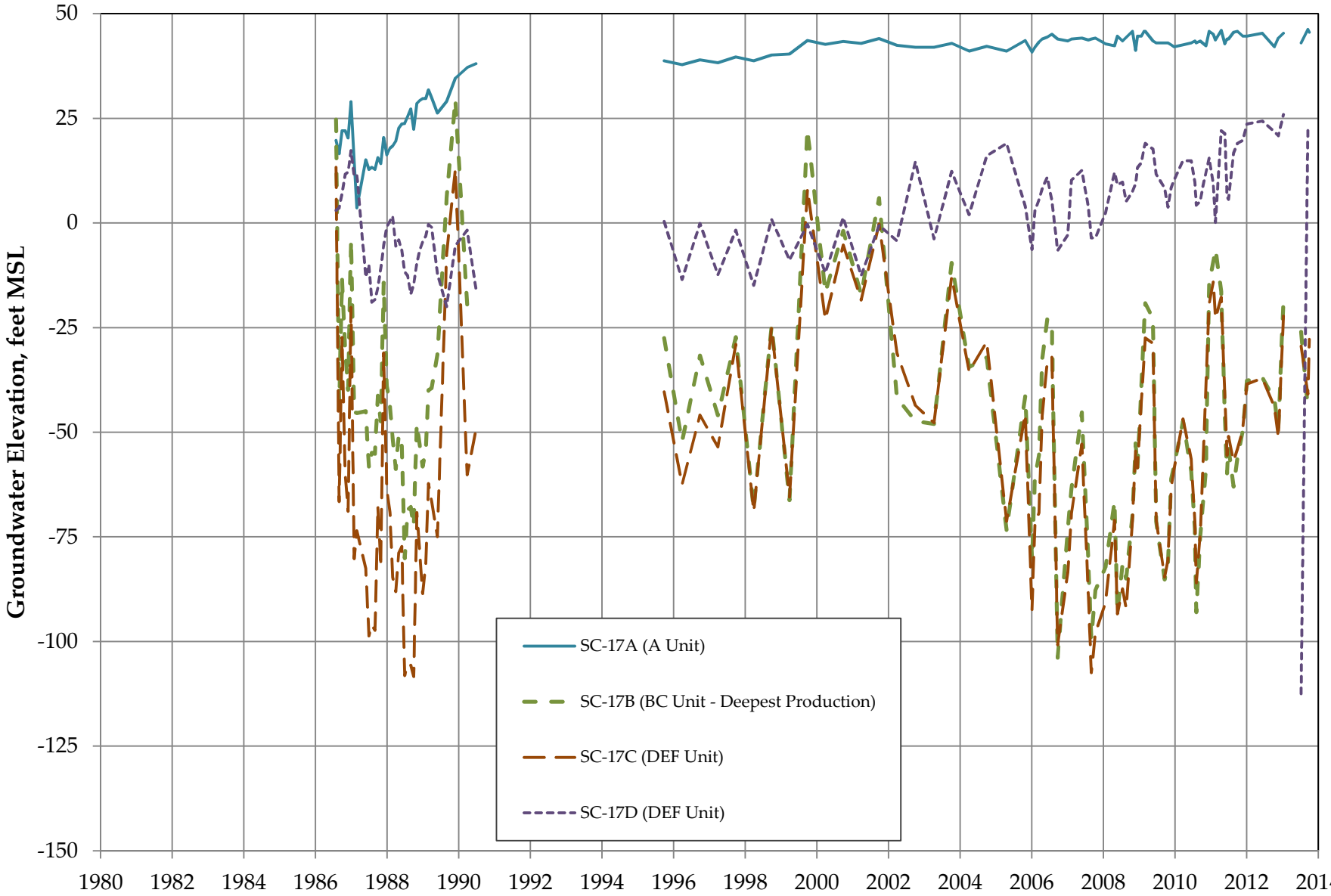

SC-8B,C,D replaced in 1995
Groundwater Elevation, feet MSL
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-8B (BC Unit)
SC-8C (BC Unit)
SC-8D (DEF Unit - Deepest Production)
Protective Level
Aptos Creek and T. Hopkins
WY 2008-2013: 298 AFY vs.
WY 2001-2007: 451 AFY


SC-8E currently artesian
SC-8A,E replaced in 1995
SC-8F sanded up to 100 feet prior to replacement in 2012
SC-8F sanded up to 100 feet
SC-8A (A Unit)
SC-8E (DEF Unit)
SC-8F (DEF/F Units)
Protective Level
Groundwater Elevation, feet MSL
Calendar Year
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Groundwater Elevation, feet MSL
100
95
90
85
80
75
70
65
60
55
50
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-19 (BC Unit)


Groundwater Elevation, feet MSL
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-16A (AA/A Units)
SC-16B (BC Unit)
Estates pumping for WY 2009-2012
(221-325 AF) 5 lowest since WY 1991
Measurements recorded after 2005 when
adjacent Estates well running excluded


50
25
0
-25
-50
-75
-100
-125
-150
Groundwater Elevation, feet MSL
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-14A (AA/A Units)
SC-14B (B/BC Units -Deepest Production)
SC-14C (BC Unit)
Measurements recorded after 2005 when adjacent Madeline well running excluded



Measurements recorded after 2005 when adjacent Ledyard well running excluded

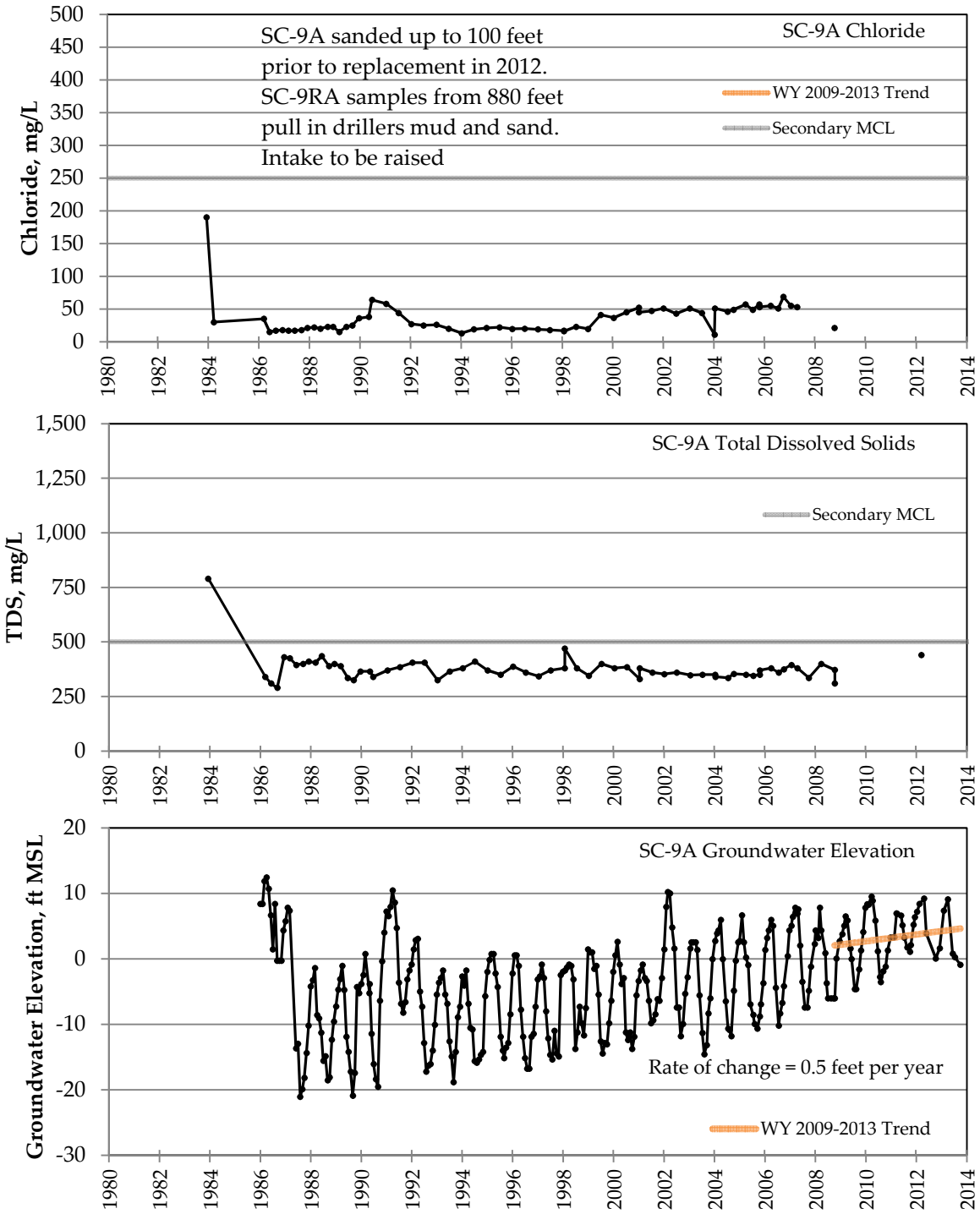
Chemographs and Single Well Hydrographs for Central Purisima Area

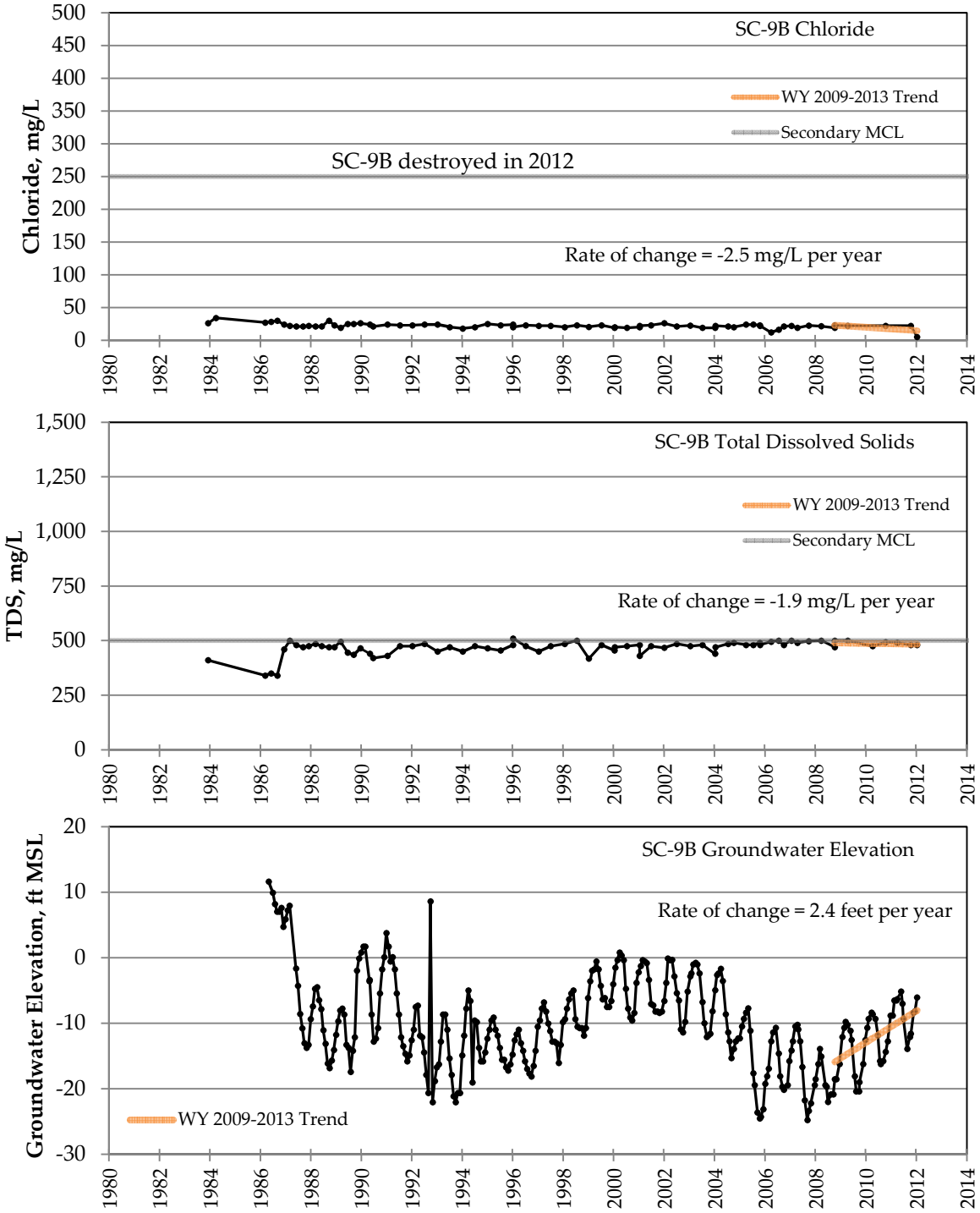
Graphs of SqCWD Coastal Monitoring Well Clusters

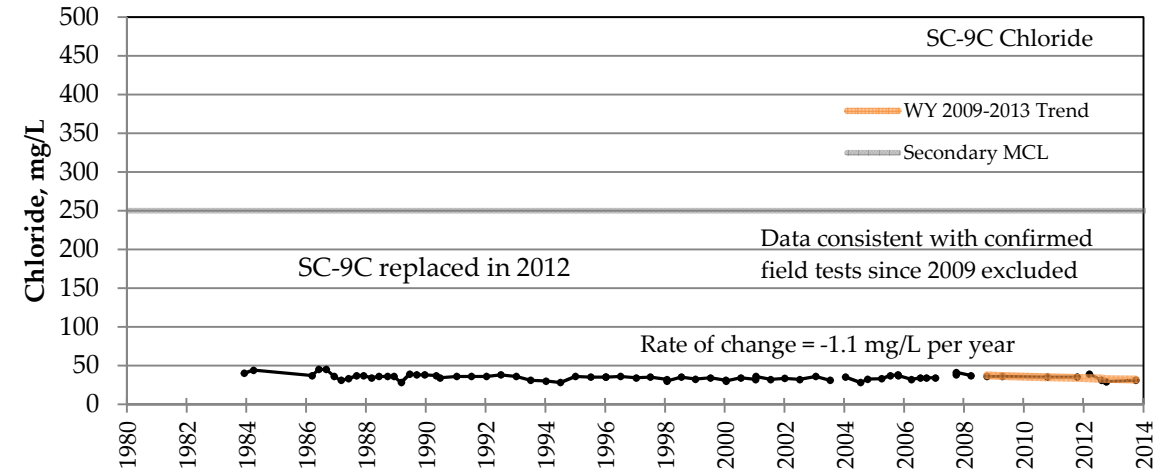
Graphs of SqCWD Inland Monitoring Well Clusters

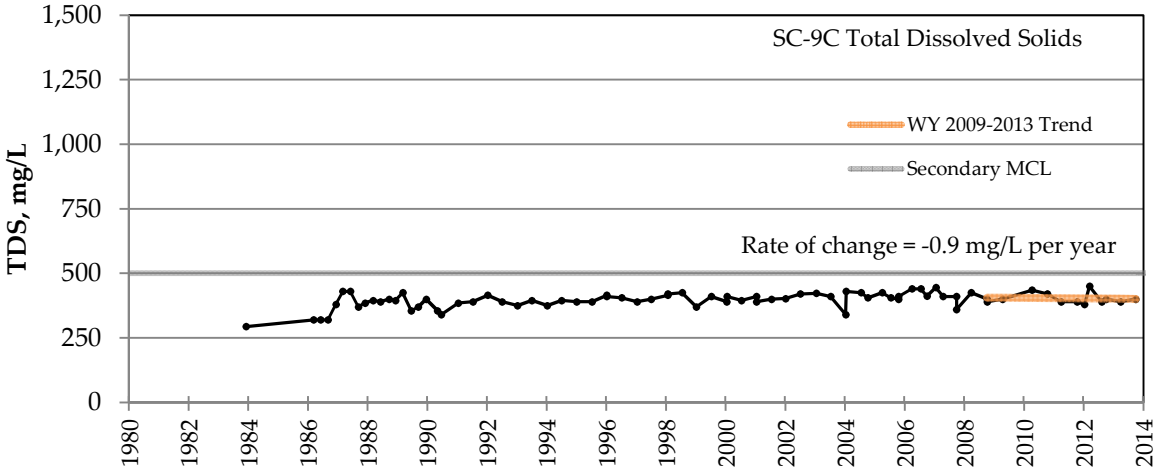
Graphs of SqCWD Production Wells and Monitoring Wells Adjacent to Production Wells

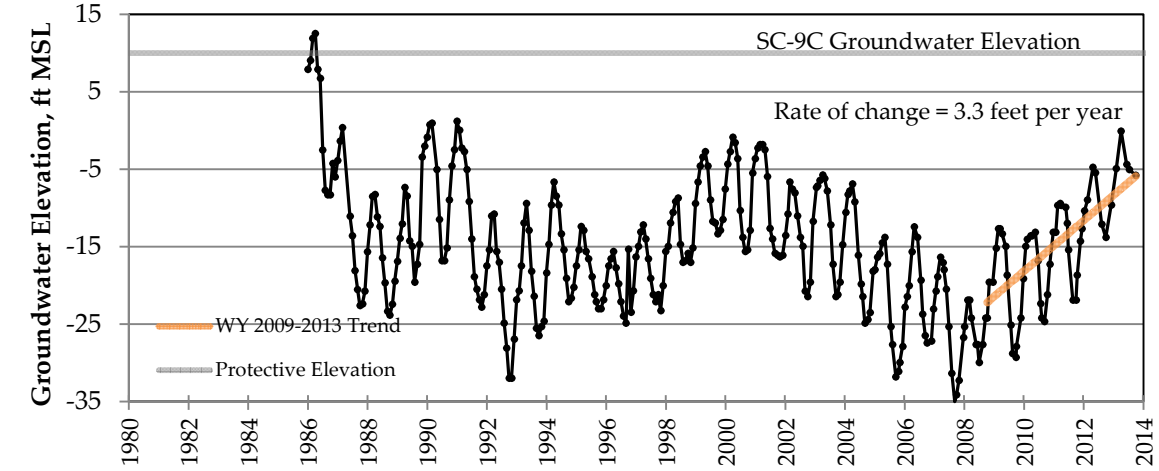
Trends shown on the hydrographs and chemographs are based on a linear fit to data in the specified time period.

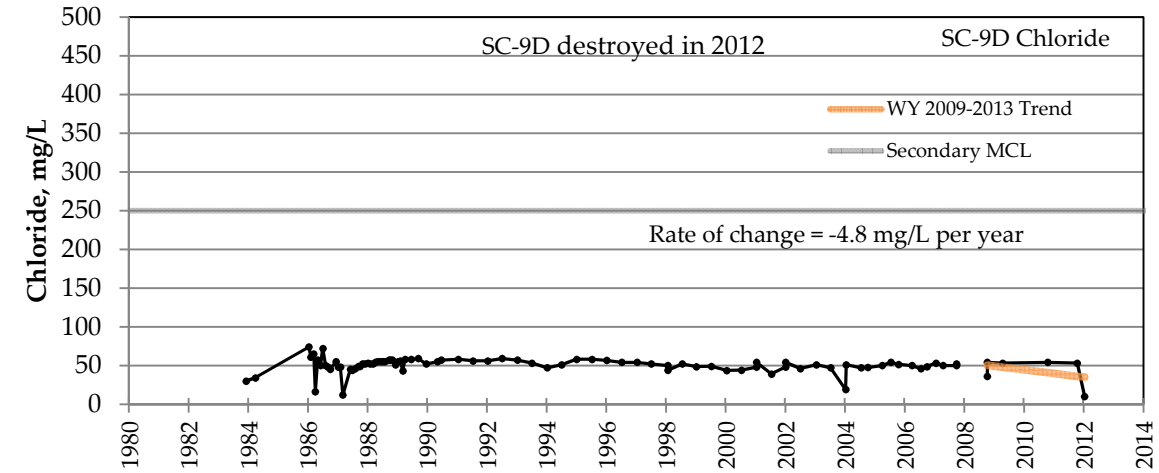

SC-9A sanded up to 100 feet
prior to replacement in 2012.
SC-9RA samples from 880 feet
pull in drillers mud and sand.
Intake to be raised
SC-9A Chloride
WY 2009-2013 Trend
Secondary MCL
Chloride, mg/L
SC-9A Total Dissolved Solids
Secondary MCL
TDS, mg/L
SC-9A Groundwater Elevation
Rate of change = 0.5 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL

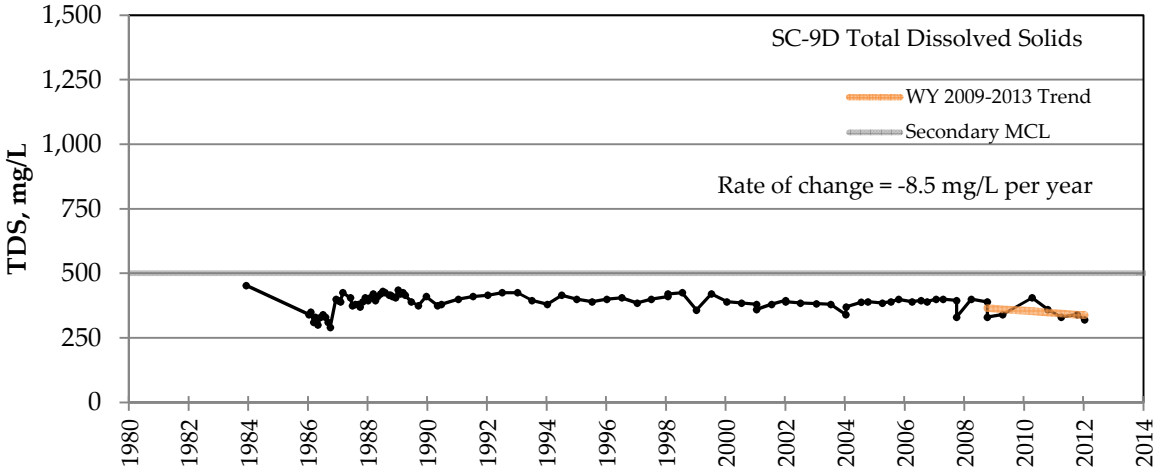

SC-9B Chloride
WY 2009-2013 Trend
Secondary MCL
SC-9B destroyed in 2012
Rate of change = -2.5 mg/L per year
Chloride, mg/L
SC-9B Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -1.9 mg/L per year
TDS, mg/L
SC-9B Groundwater Elevation
Rate of change = 2.4 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL

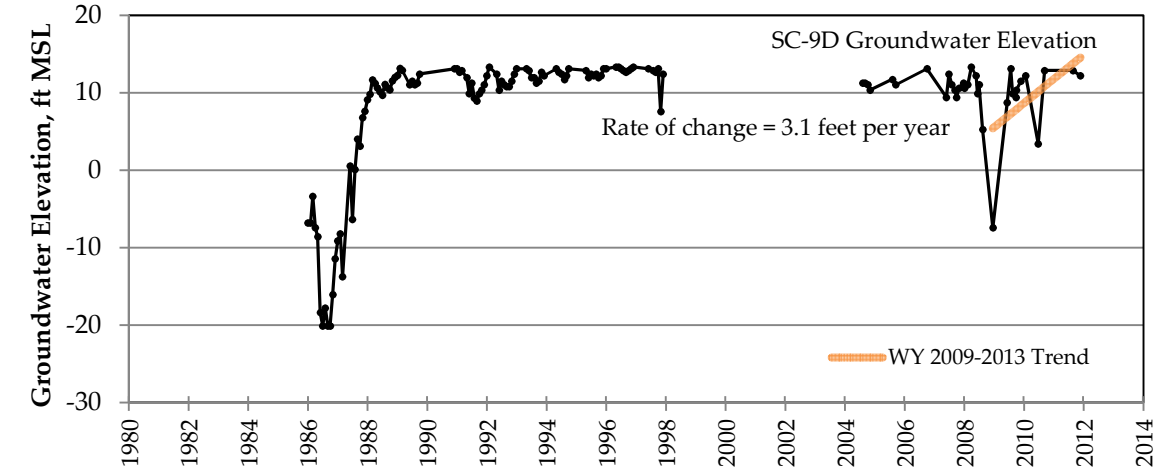

SC-9C Chloride
WY 2009-2013 Trend
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
SC-9C replaced in 2012
Data consistent with confirmed field tests since 2009 excluded
Rate of change = -1.1 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

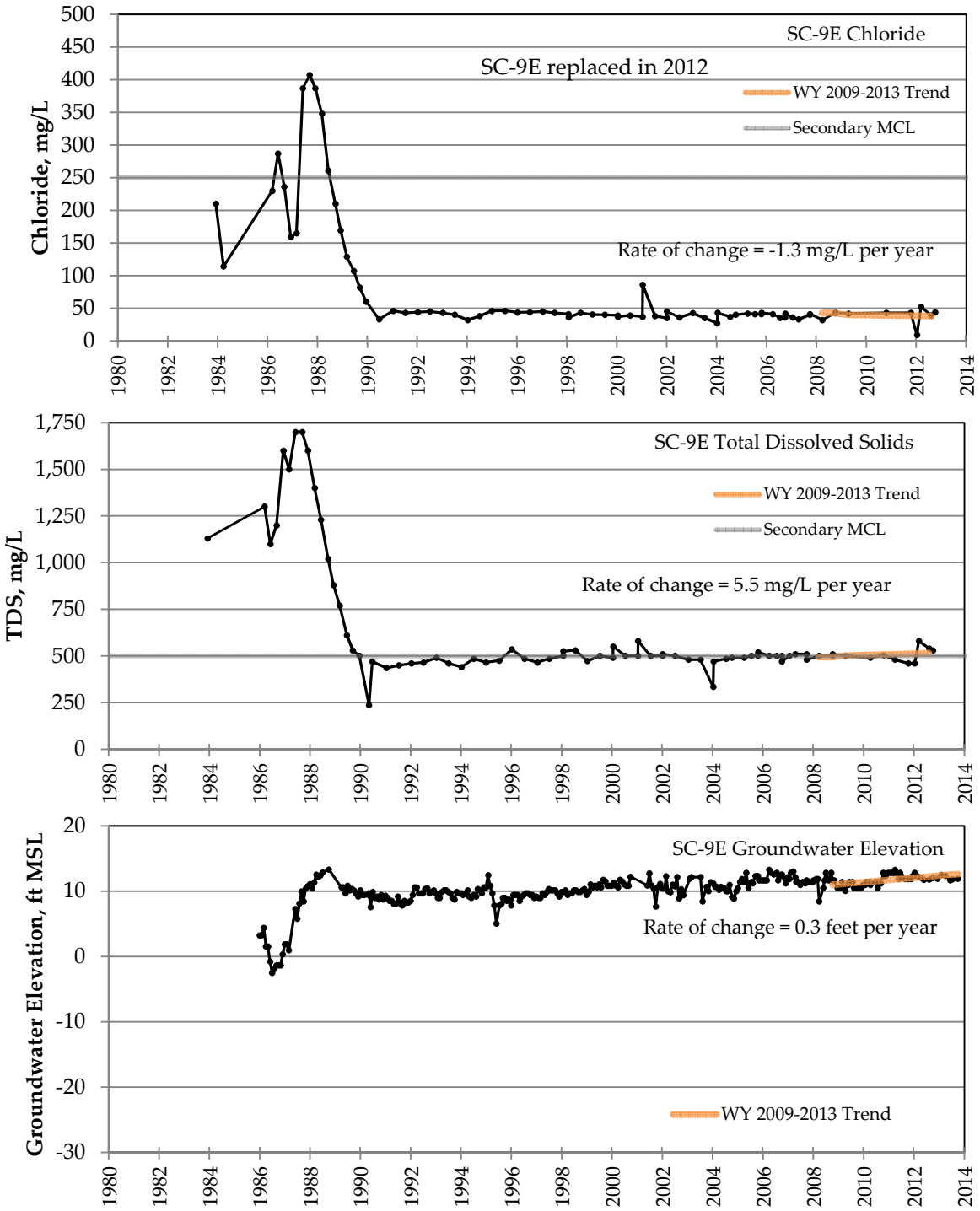

SC-9C Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Rate of change = -0.9 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

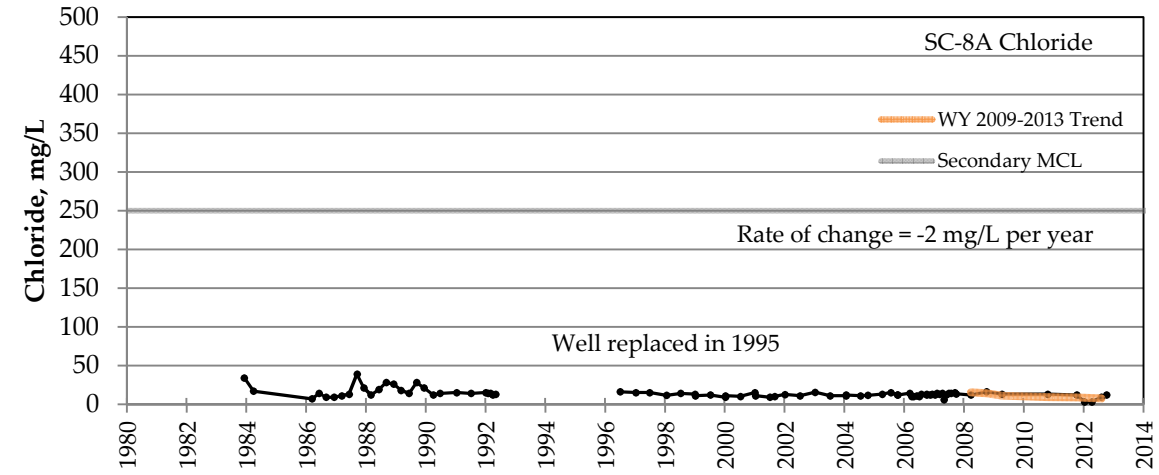

SC-9C Groundwater Elevation
Rate of change = 3.3 feet per year
WY 2009-2013 Trend
Protective Elevation
Groundwater Elevation, ft MSL
15
5
-5
-15
-25
-35
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

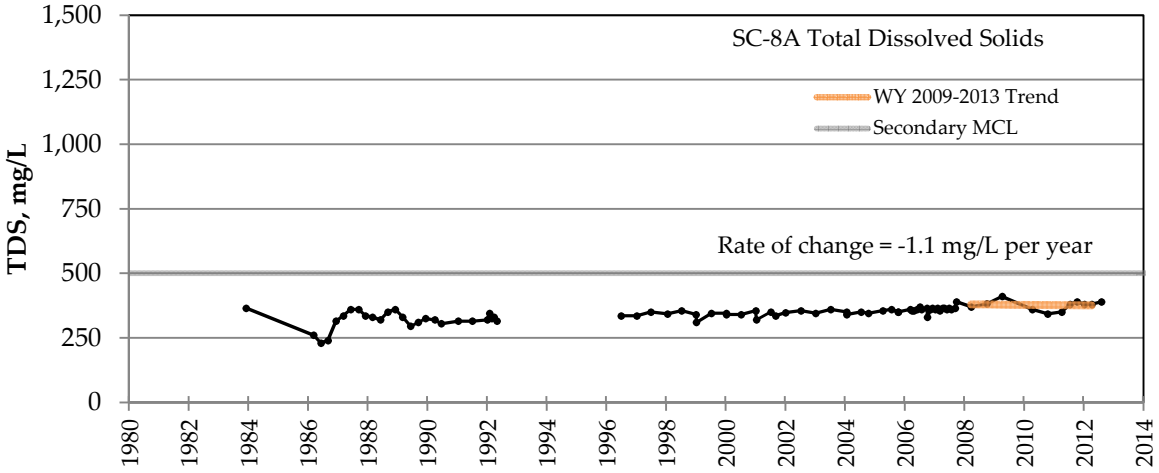

SC-9D destroyed in 2012
SC-9D Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -4.8 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

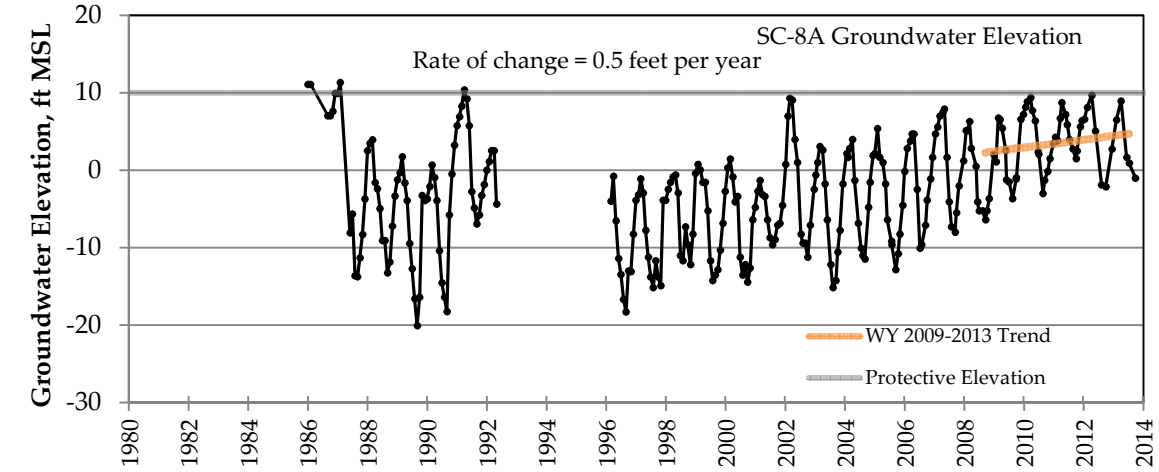

SC-9D Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -8.5 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

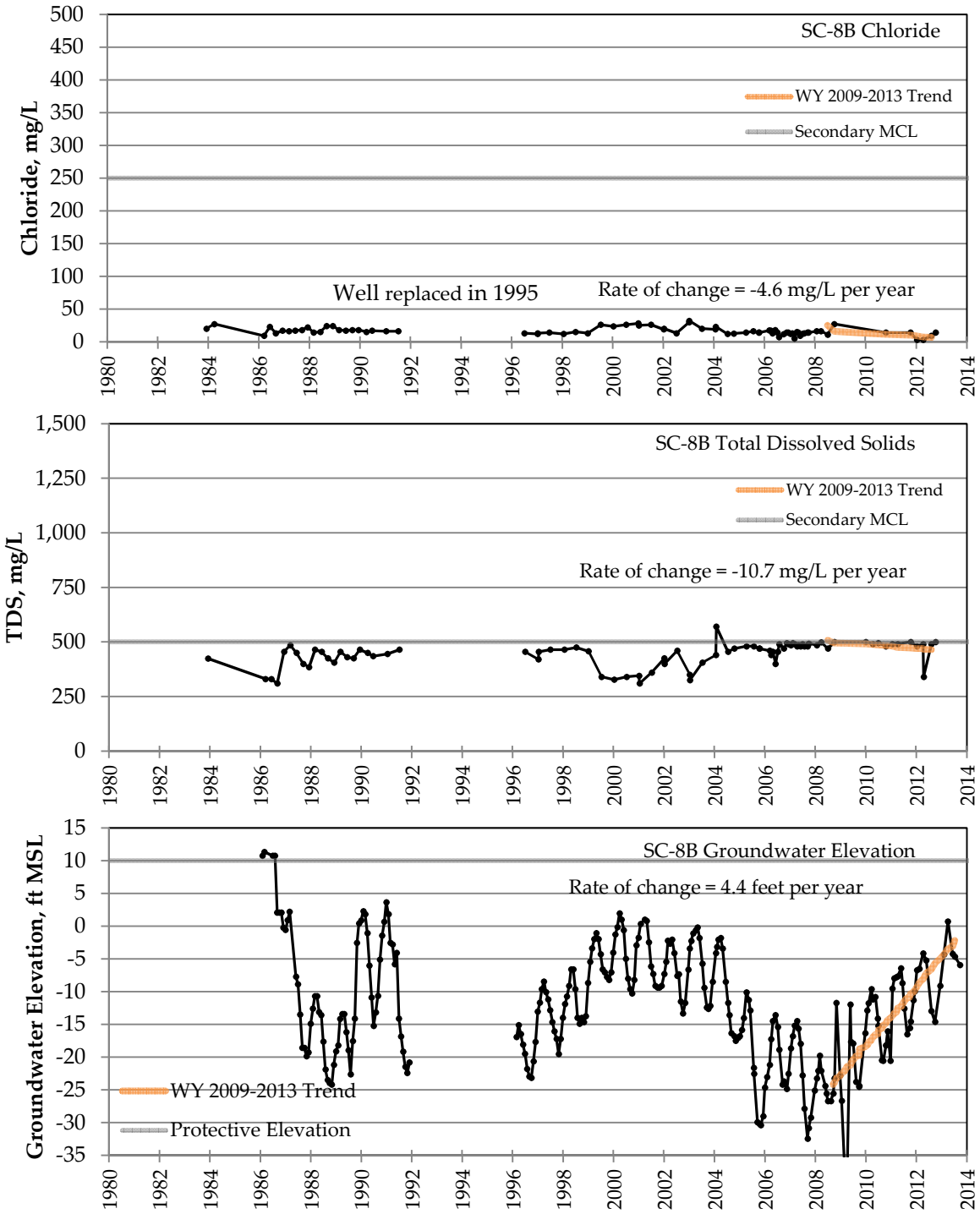

SC-9D Groundwater Elevation
Rate of change = 3.1 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

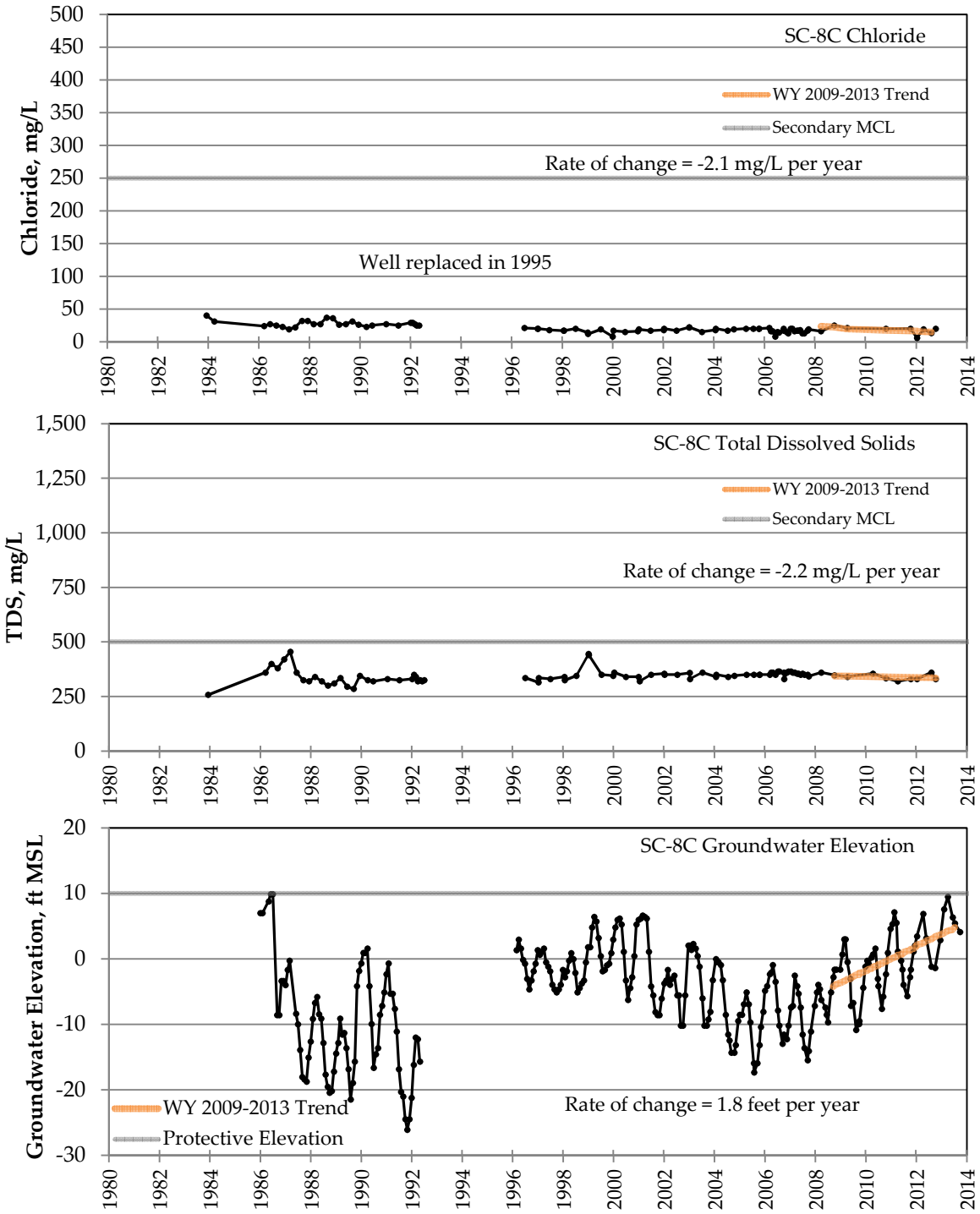

SC-9E Chloride
SC-9E replaced in 2012
WY 2009-2013 Trend
Secondary MCL
Rate of change = -1.3 mg/L per year
Chloride, mg/L
SC-9E Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 5.5 mg/L per year
TDS, mg/L
SC-9E Groundwater Elevation
Rate of change = 0.3 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL

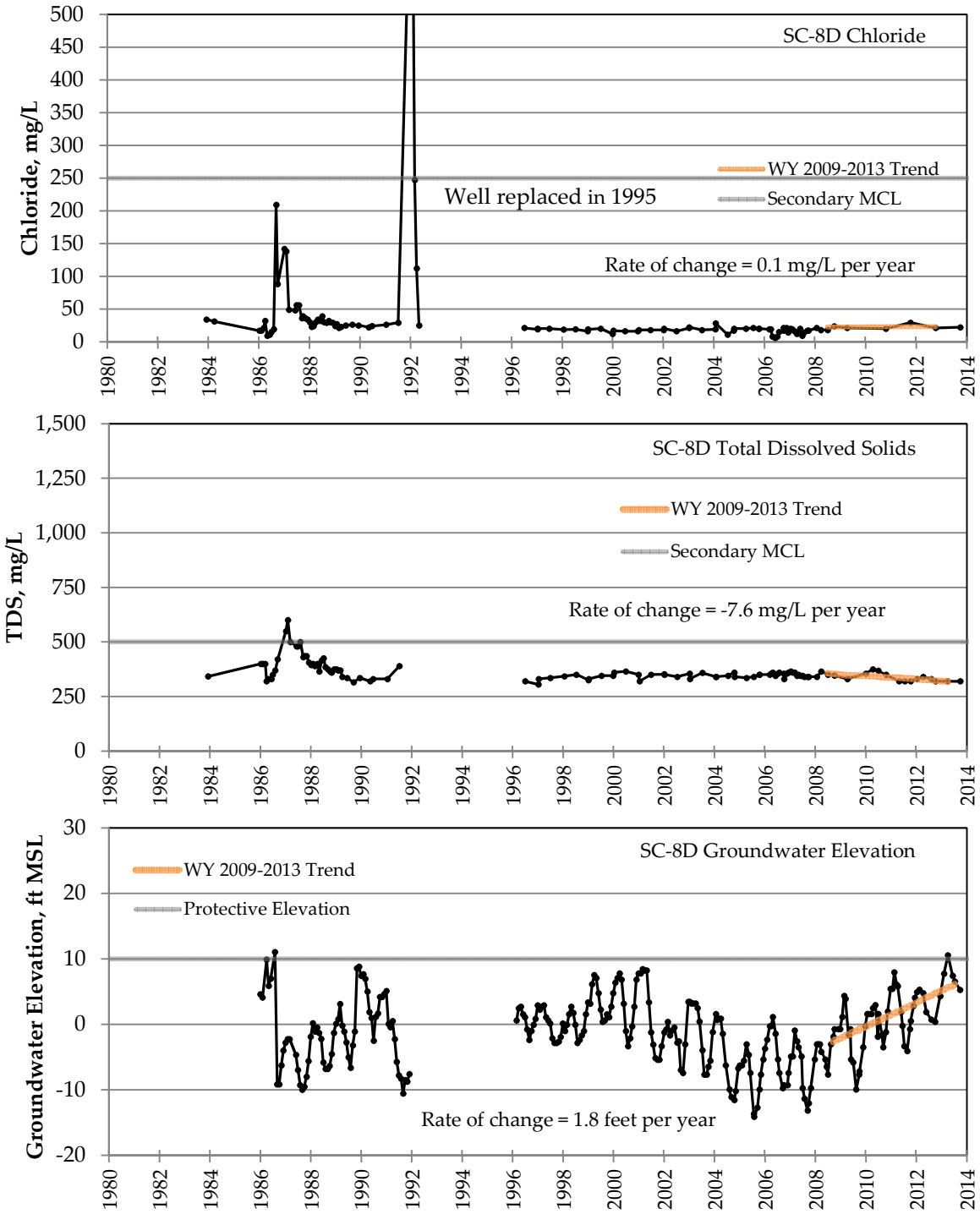

SC-8A Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -2 mg/L per year
Well replaced in 1995
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

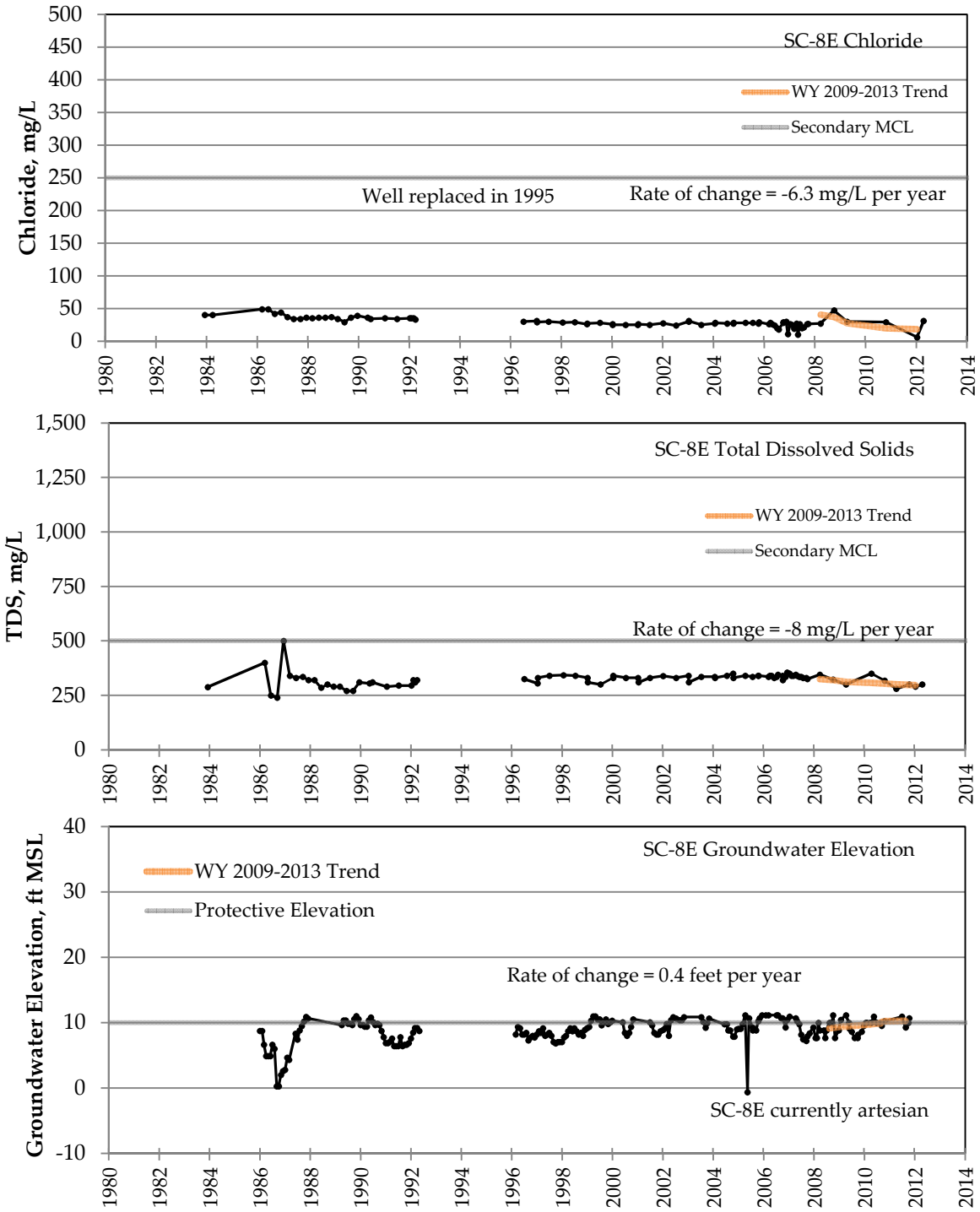

SC-8A Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -1.1 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

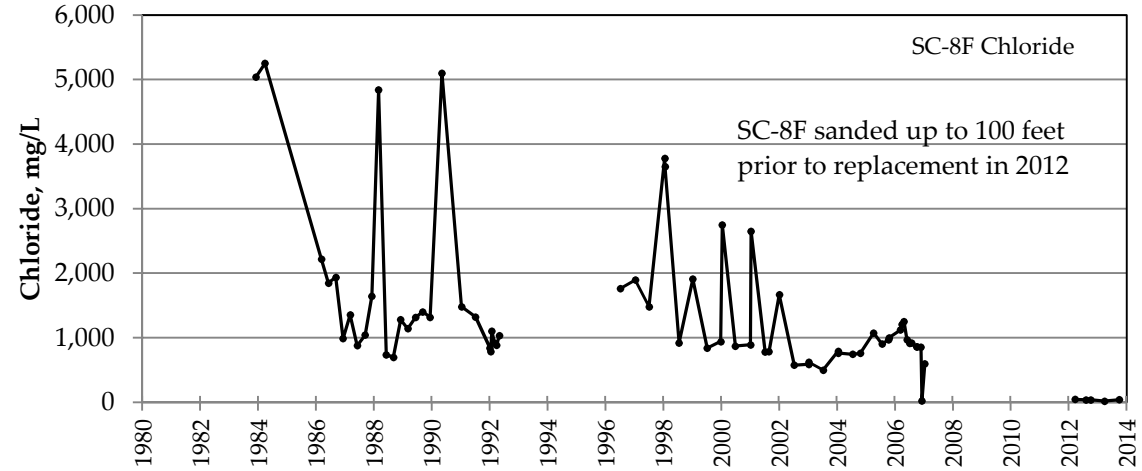

SC-8A Groundwater Elevation
Rate of change = 0.5 feet per year
WY 2009-2013 Trend
Protective Elevation
Groundwater Elevation, ft MSL
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

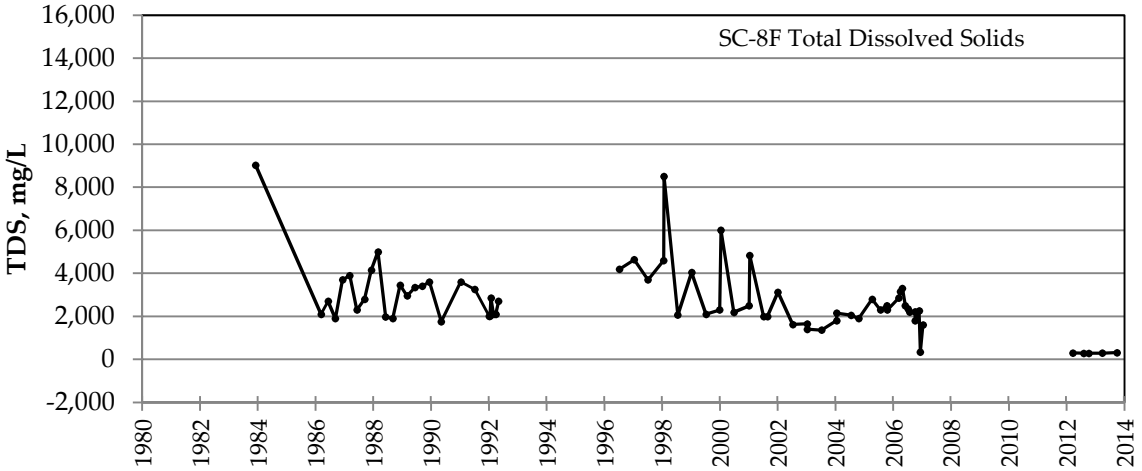

SC-8B Chloride
WY 2009-2013 Trend
Secondary MCL
Chloride, mg/L
Well replaced in 1995
Rate of change = -4.6 mg/L per year
SC-8B Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
TDS, mg/L
Rate of change = -10.7 mg/L per year
SC-8B Groundwater Elevation
Rate of change = 4.4 feet per year
WY 2009-2013 Trend
Protective Elevation
Groundwater Elevation, ft MSL

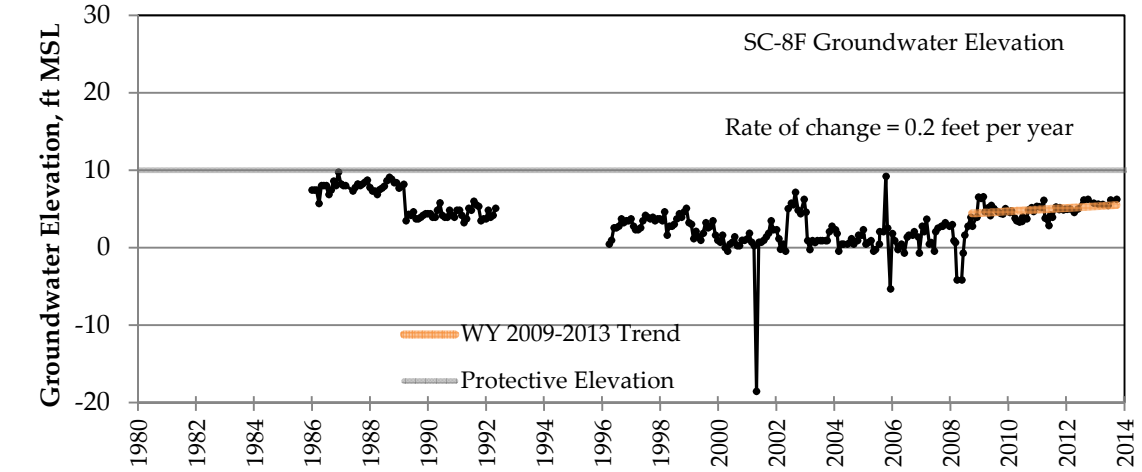

SC-8C Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -2.1 mg/L per year
Well replaced in 1995
Chloride, mg/L
SC-8C Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -2.2 mg/L per year
TDS, mg/L
SC-8C Groundwater Elevation
WY 2009-2013 Trend
Protective Elevation
Rate of change = 1.8 feet per year
Groundwater Elevation, ft MSL

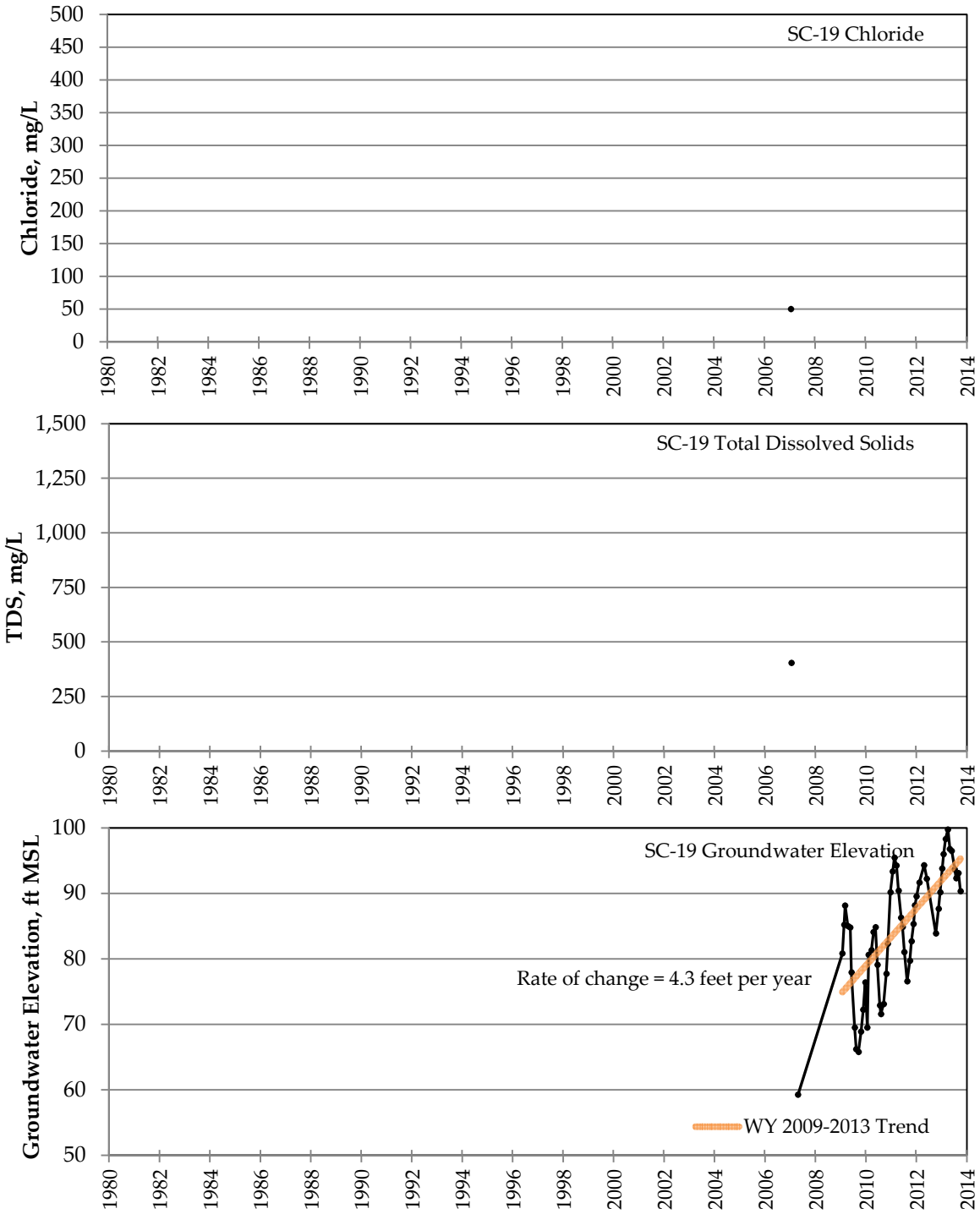

SC-8D Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Well replaced in 1995
Rate of change = 0.1 mg/L per year
SC-8D Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -7.6 mg/L per year
SC-8D Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Protective Elevation
Rate of change = 1.8 feet per year

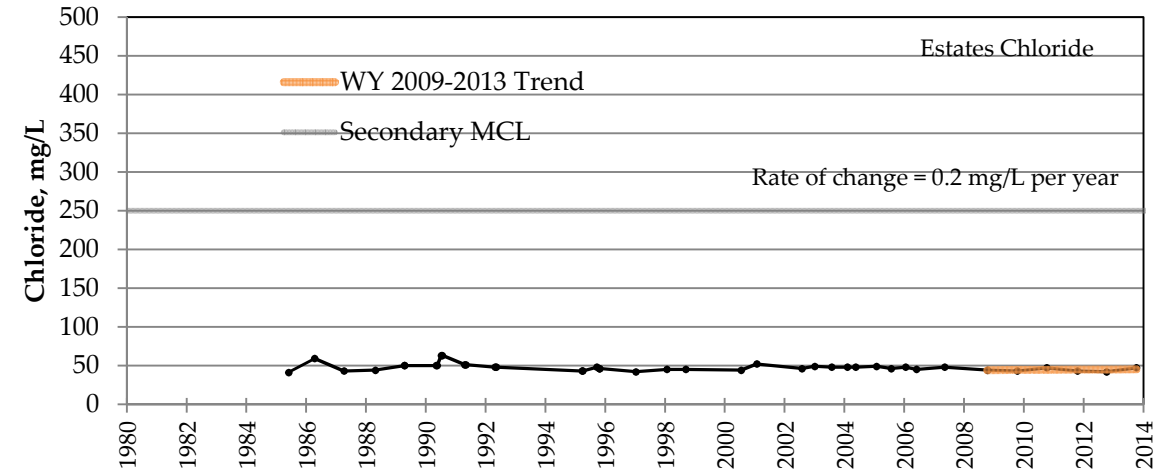

SC-8E Chloride
WY 2009-2013 Trend
Secondary MCL
Well replaced in 1995
Rate of change = -6.3 mg/L per year
Chloride, mg/L
SC-8E Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -8 mg/L per year
TDS, mg/L
SC-8E Groundwater Elevation
WY 2009-2013 Trend
Protective Elevation
Rate of change = 0.4 feet per year
SC-8E currently artesian
Groundwater Elevation, ft MSL

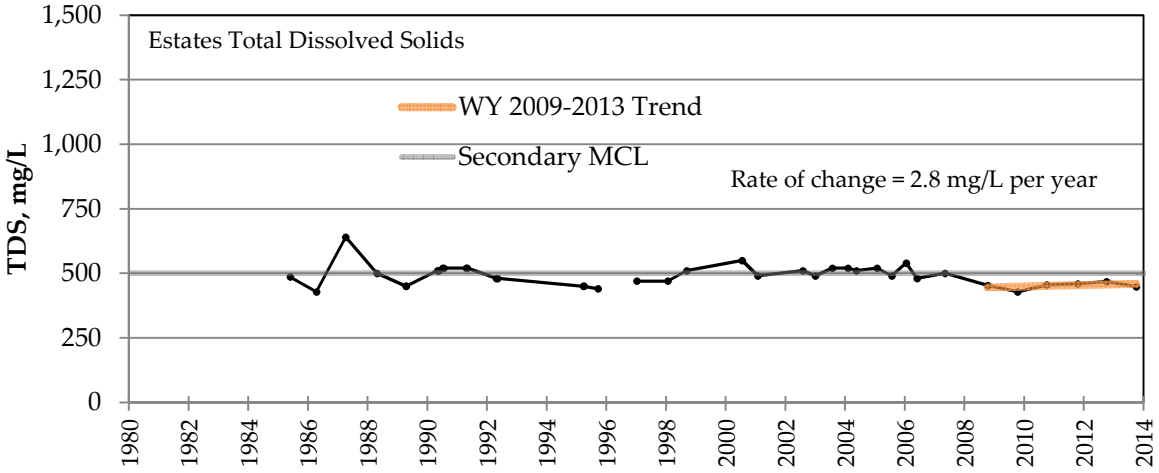

SC-8F Chloride
SC-8F sanded up to 100 feet
prior to replacement in 2012
Chloride, mg/L
6,000
5,000
4,000
3,000
2,000
1,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

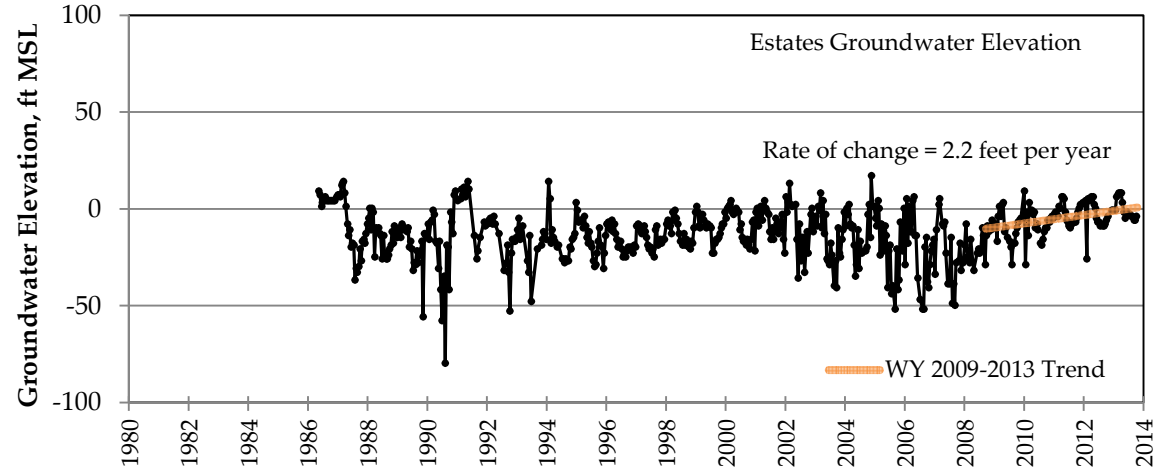

SC-8F Total Dissolved Solids
TDS, mg/L
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
-2,000
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

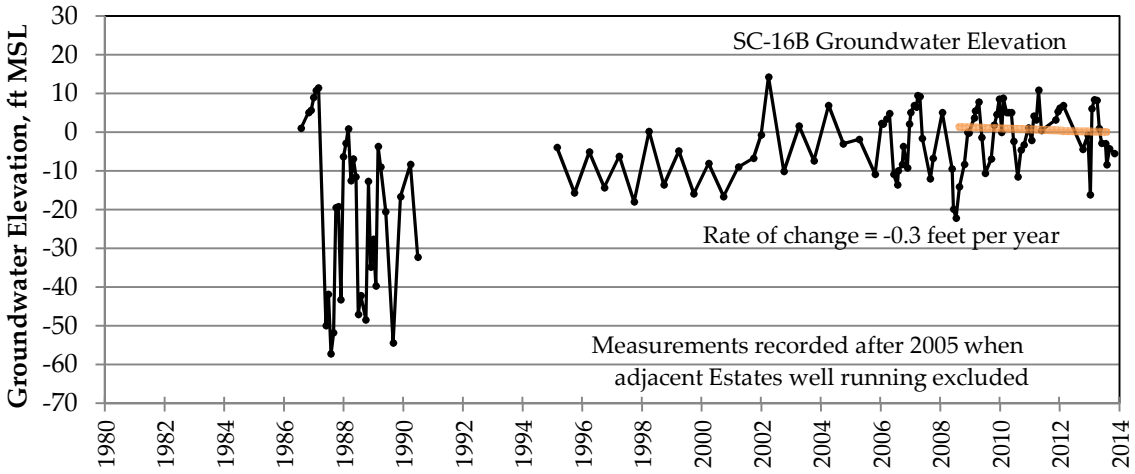

SC-8F Groundwater Elevation
Rate of change = 0.2 feet per year
WY 2009-2013 Trend
Protective Elevation
Groundwater Elevation, ft MSL
30
20
10
0
-10
-20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

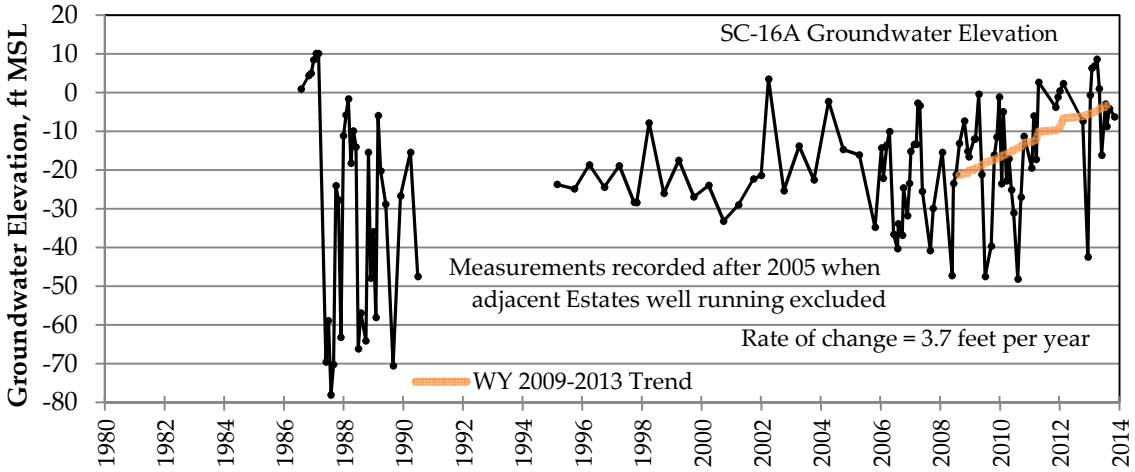

SC-19 Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
SC-19 Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
SC-19 Groundwater Elevation
Groundwater Elevation, ft MSL
100
90
80
70
60
50
Rate of change = 4.3 feet per year
WY 2009-2013 Trend

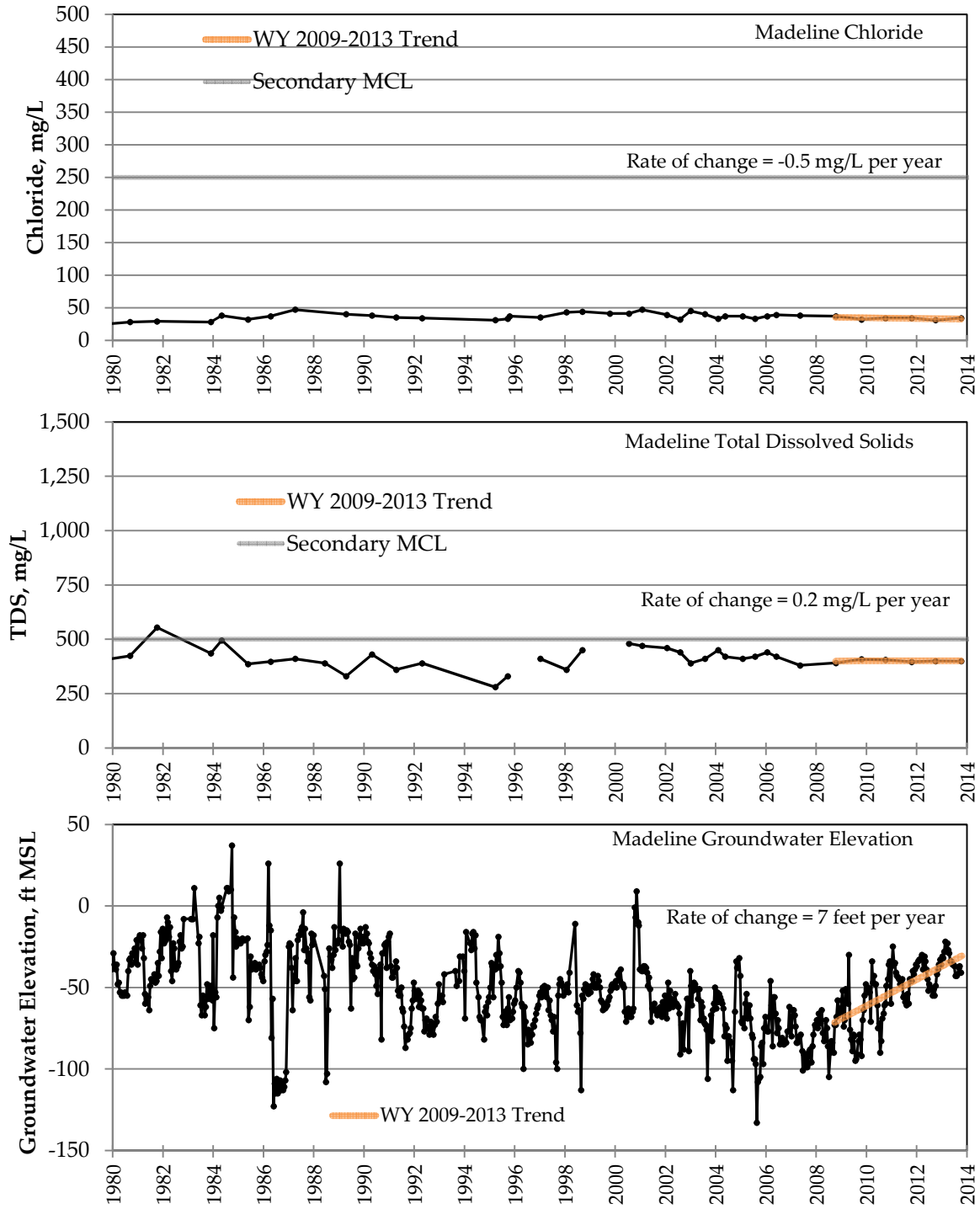

Estates Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.2 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

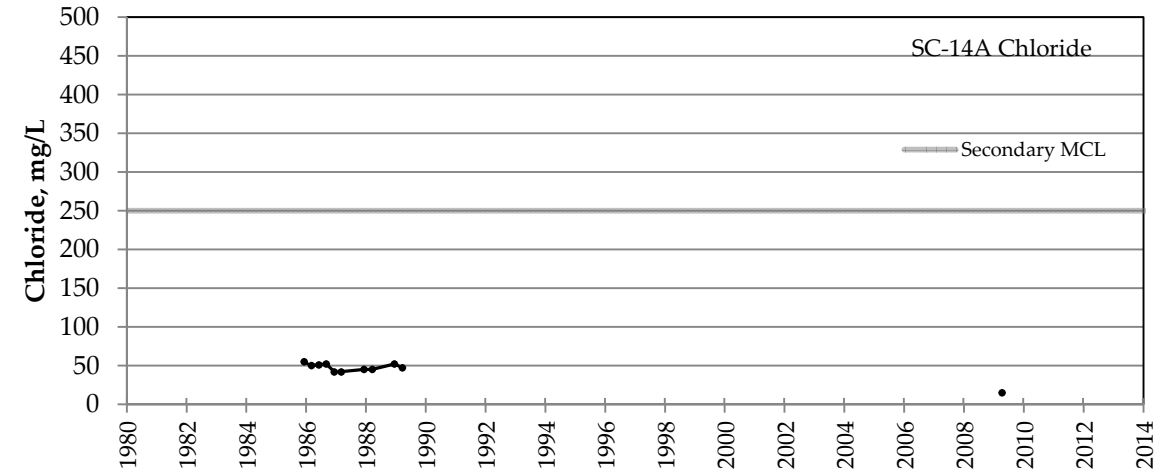

Estates Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 2.8 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

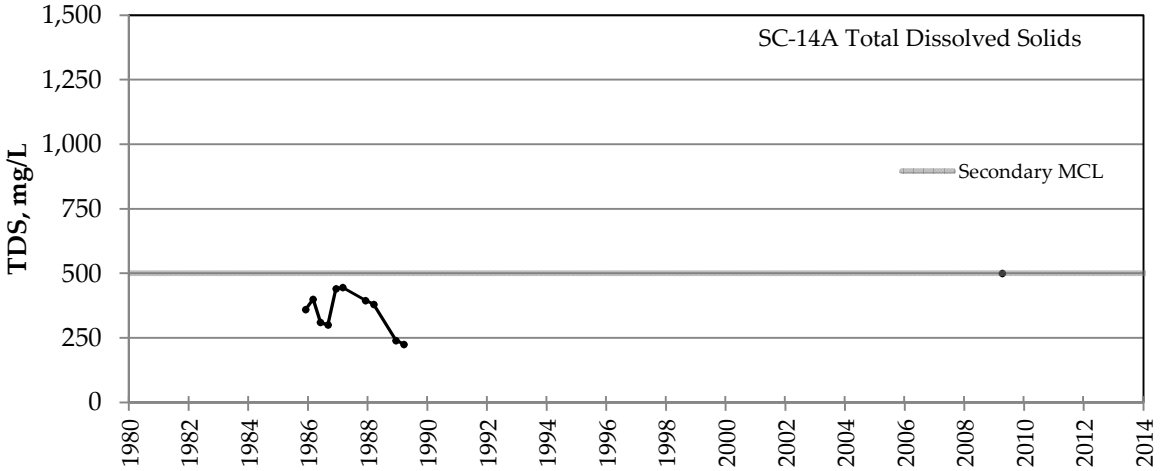

Estates Groundwater Elevation
Rate of change = 2.2 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
100
50
0
-50
-100
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

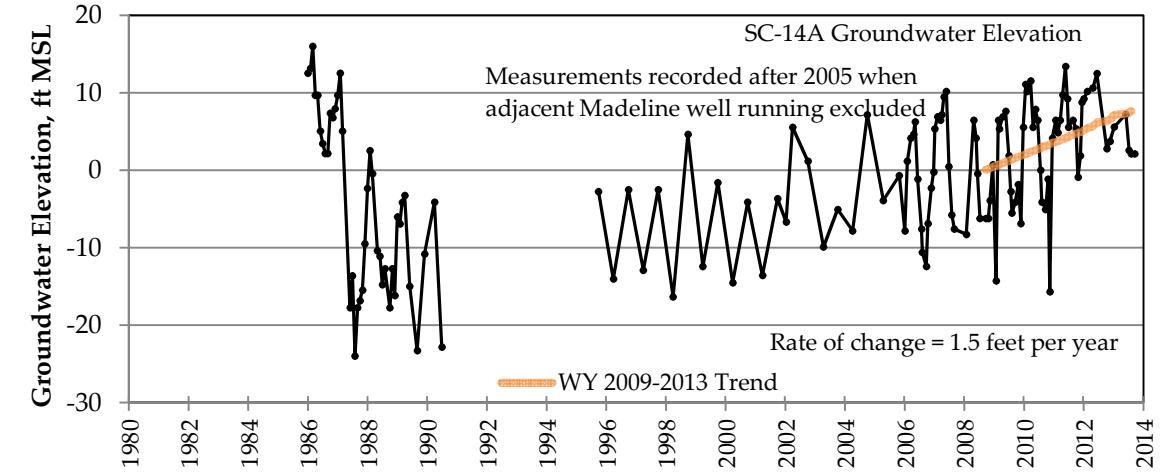

SC-16B Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.3 feet per year
Measurements recorded after 2005 when
adjacent Estates well running excluded
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

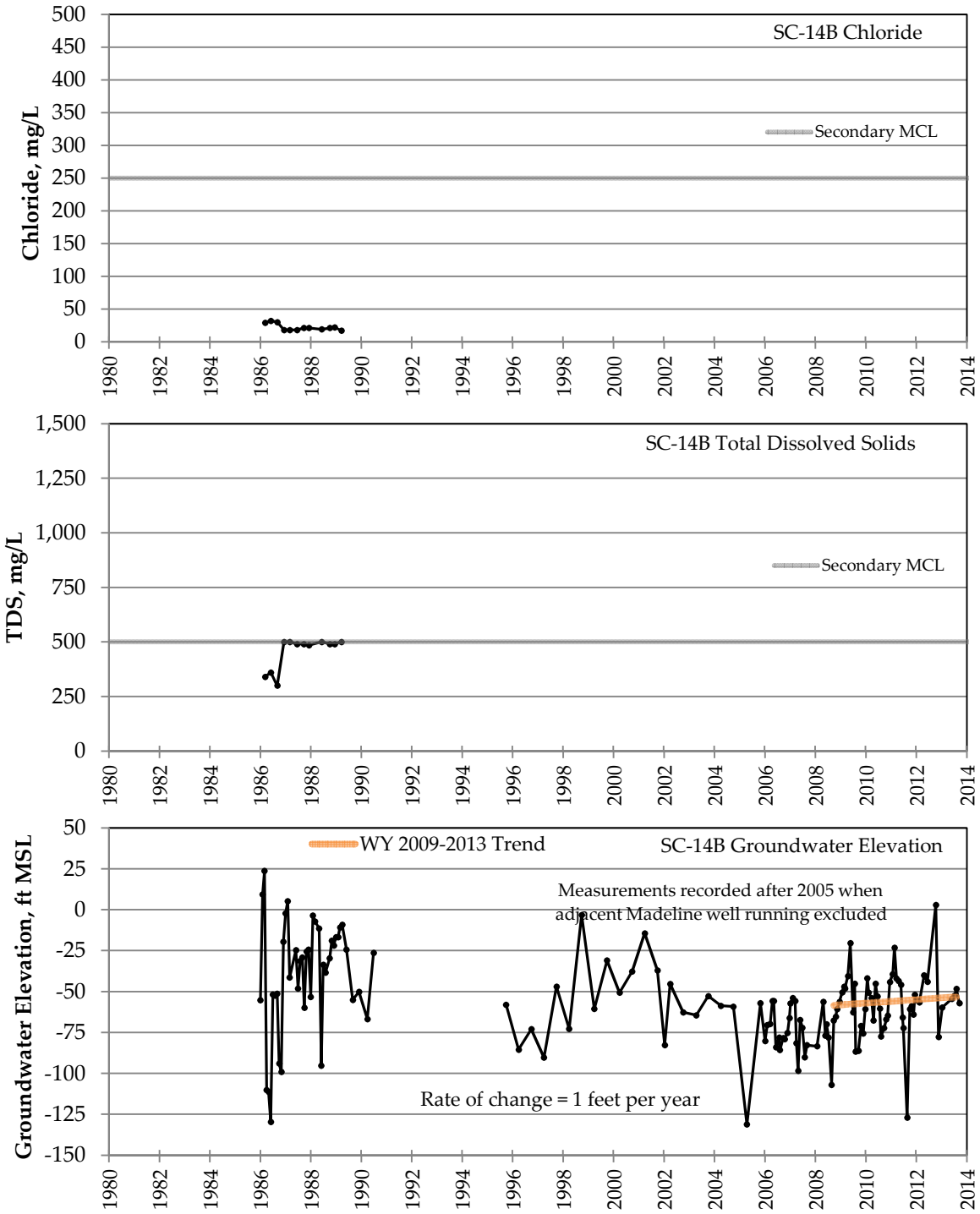

SC-16A Groundwater Elevation
Groundwater Elevation, ft MSL
Measurements recorded after 2005 when
adjacent Estates well running excluded
Rate of change = 3.7 feet per year
WY 2009-2013 Trend
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

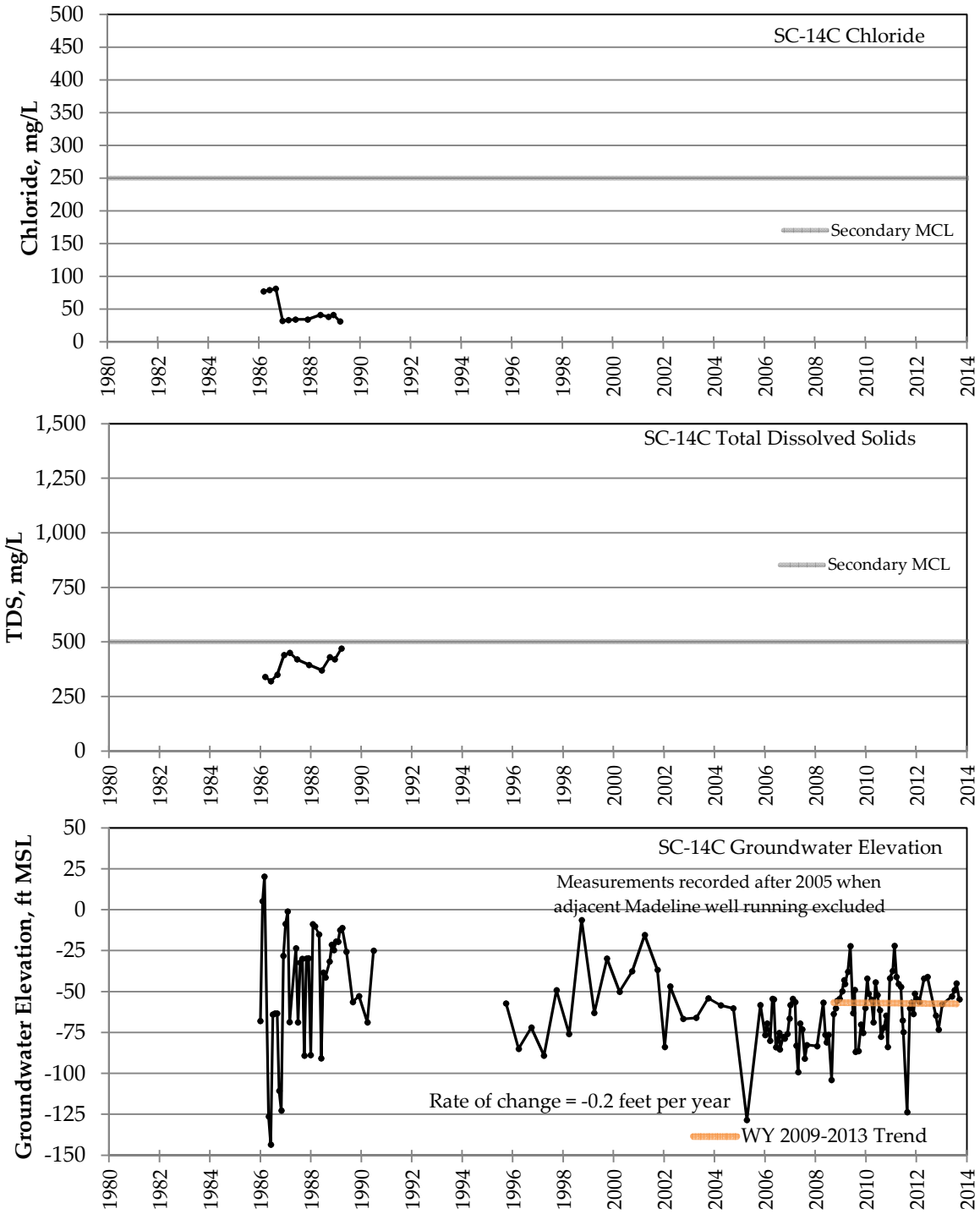

Madeline Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.5 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Madeline Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.2 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Madeline Groundwater Elevation
Rate of change = 7 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
0
-50
-100
-150

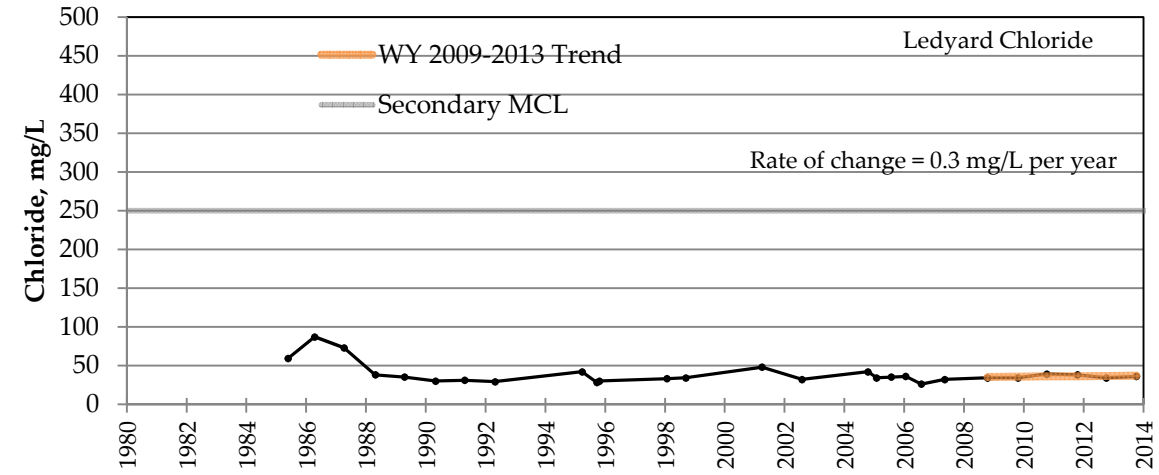

SC-14A Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

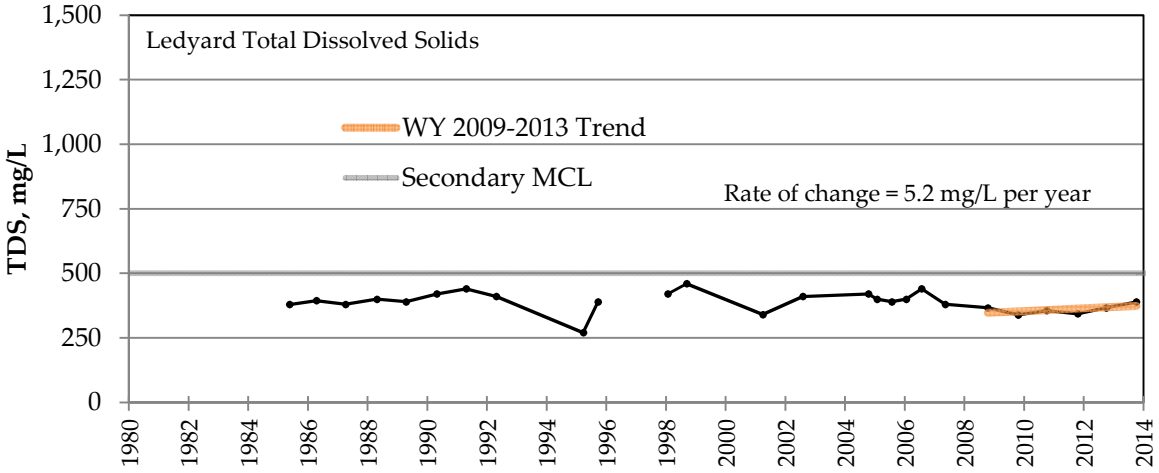

SC-14A Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

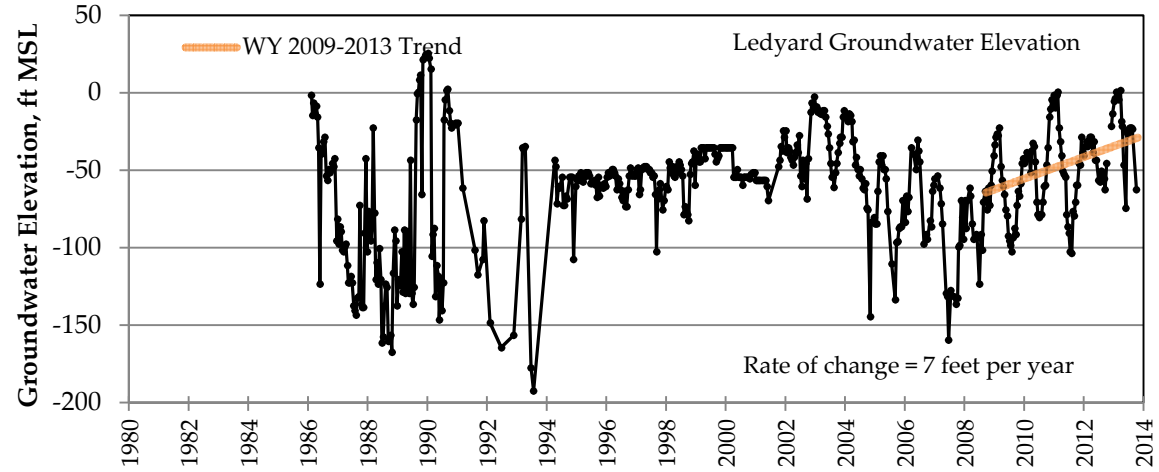

SC-14A Groundwater Elevation
Measurements recorded after 2005 when
adjacent Madeline well running excluded
Rate of change = 1.5 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
20
10
0
-10
-20
-30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

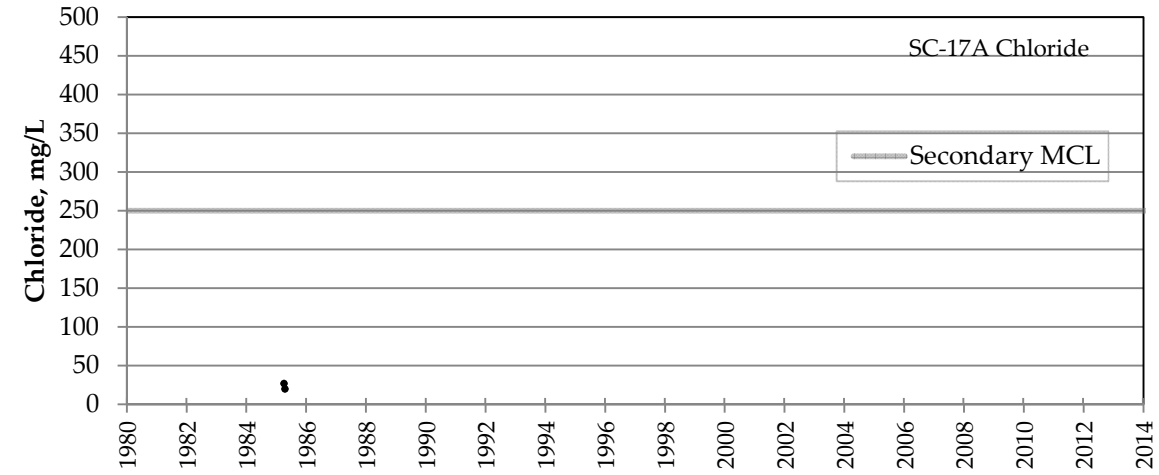

SC-14B Chloride
Chloride, mg/L
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
SC-14B Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
SC-14B Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Measurements recorded after 2005 when adjacent Madeline well running excluded
Rate of change = 1 feet per year
50
25
0
-25
-50
-75
-100
-125
-150

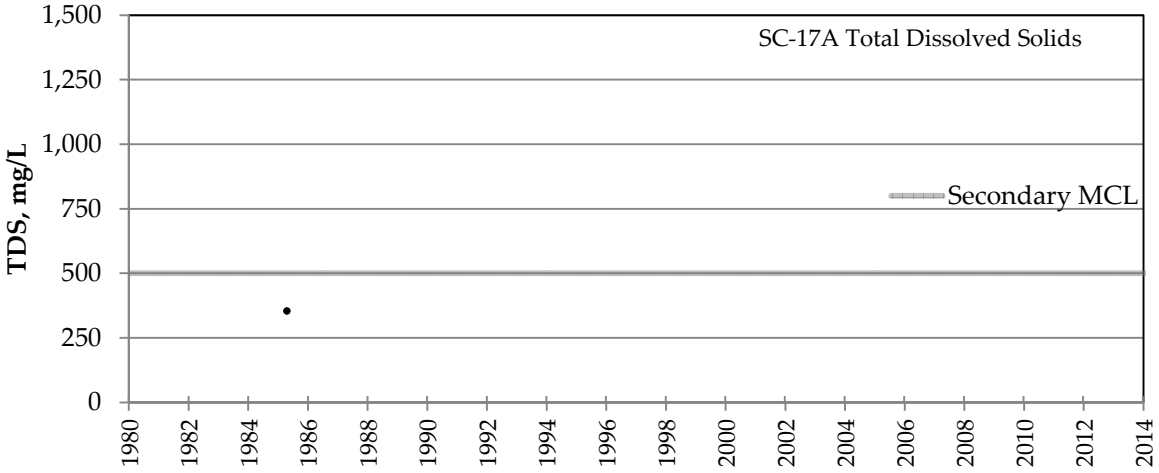

SC-14C Chloride
Chloride, mg/L
Secondary MCL
SC-14C Total Dissolved Solids
TDS, mg/L
Secondary MCL
SC-14C Groundwater Elevation
Groundwater Elevation, ft MSL
Measurements recorded after 2005 when adjacent Madeline well running excluded
Rate of change = -0.2 feet per year
WY 2009-2013 Trend

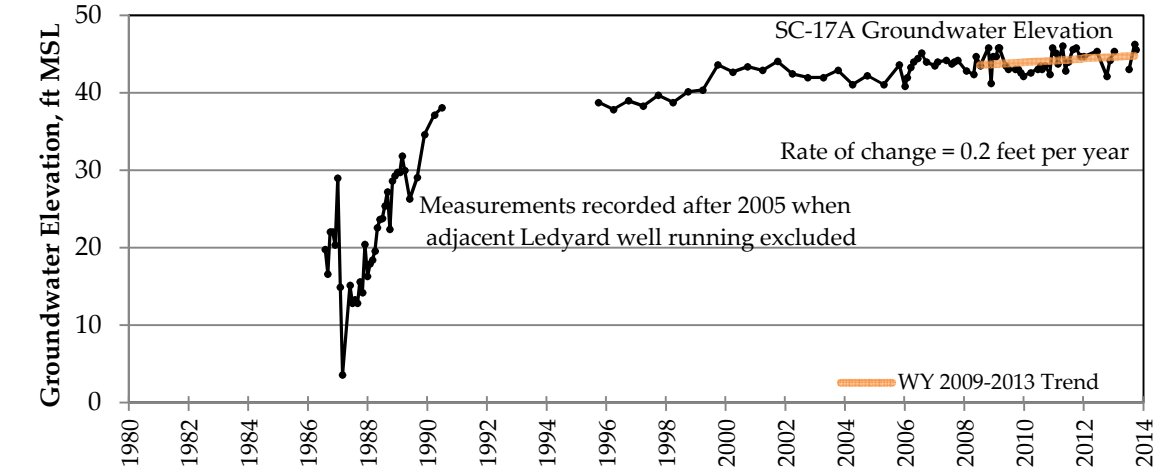

Ledyard Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.3 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

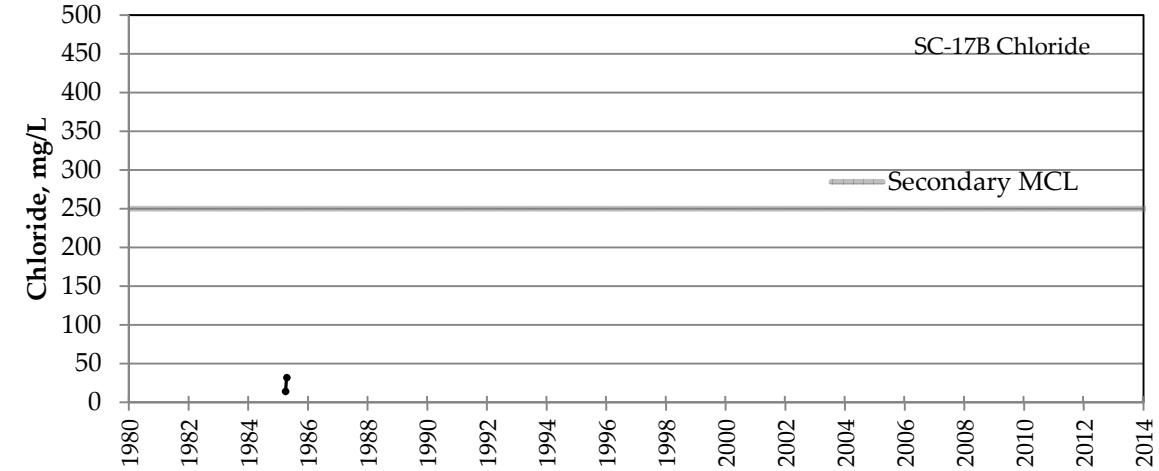

Ledyard Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 5.2 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

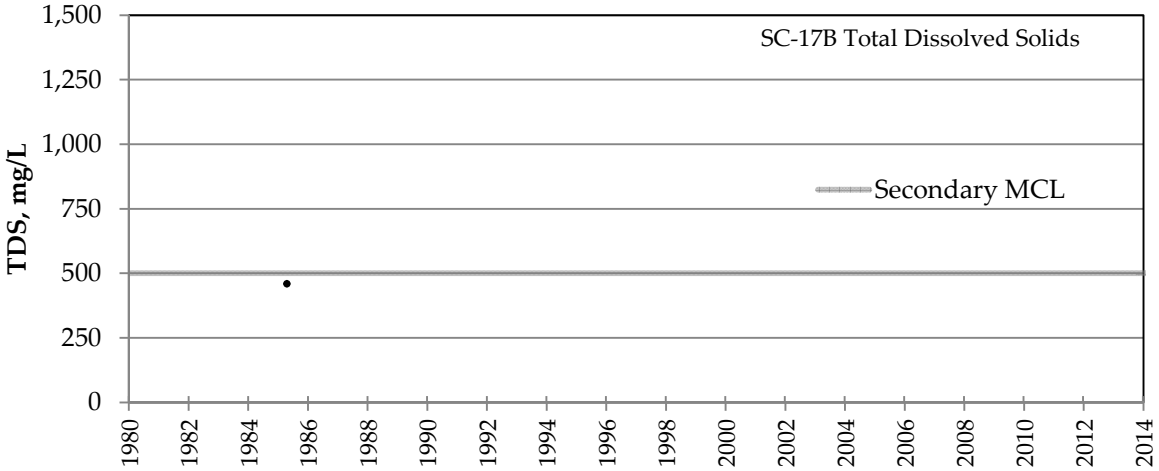

WY 2009-2013 Trend
Ledyard Groundwater Elevation
Rate of change = 7 feet per year
Groundwater Elevation, ft MSL
50
0
-50
-100
-150
-200
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

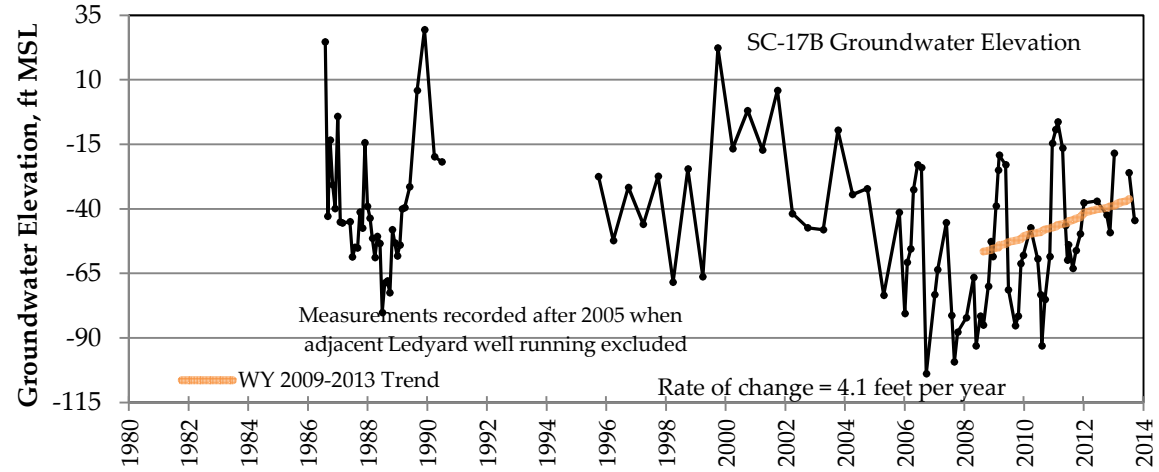

SC-17A Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

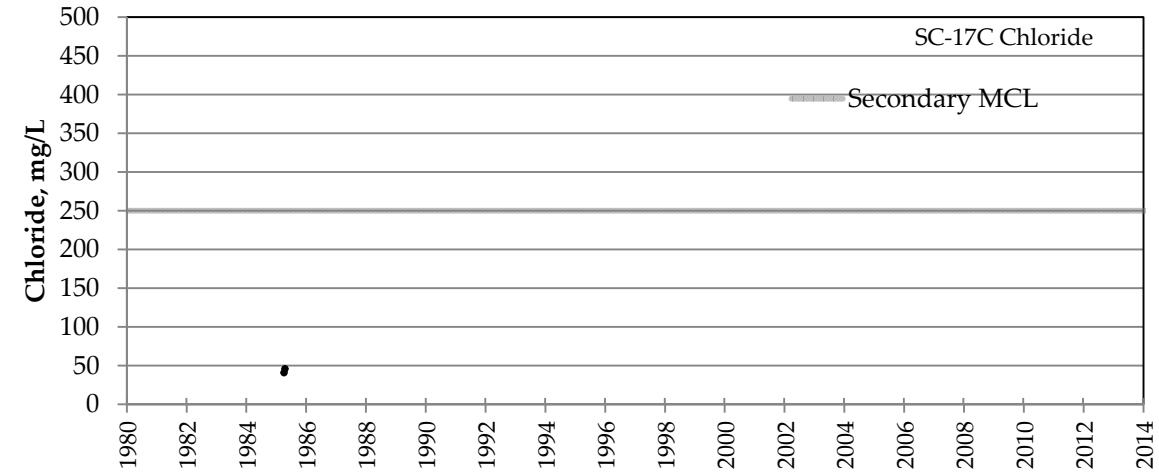

SC-17A Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

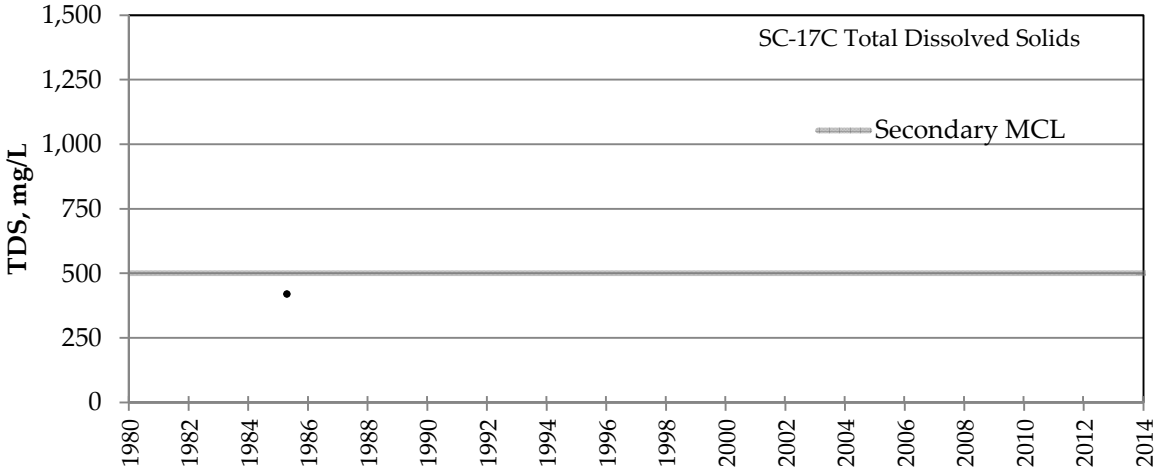

SC-17A Groundwater Elevation
Rate of change = 0.2 feet per year
Measurements recorded after 2005 when
adjacent Ledyard well running excluded
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

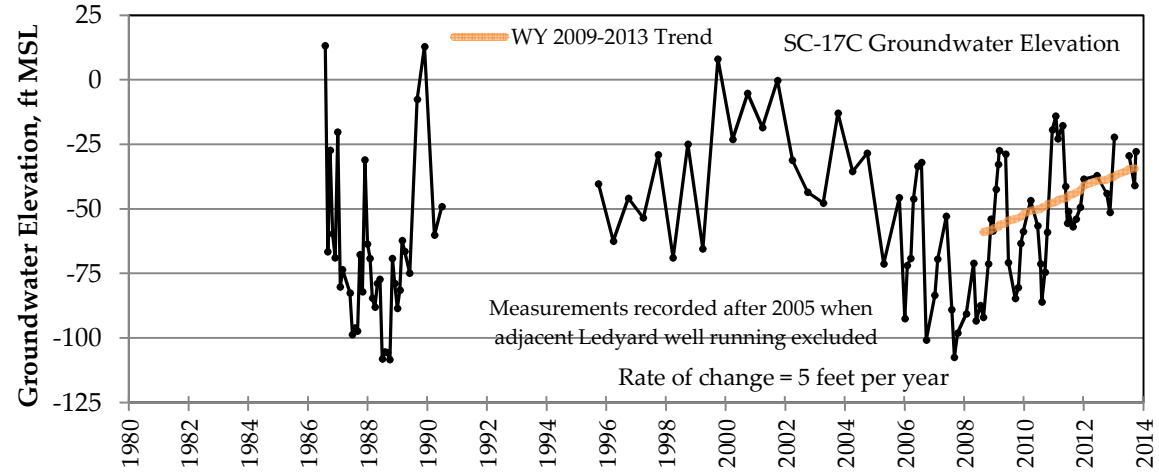

SC-17B Chloride
Chloride, mg/L
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

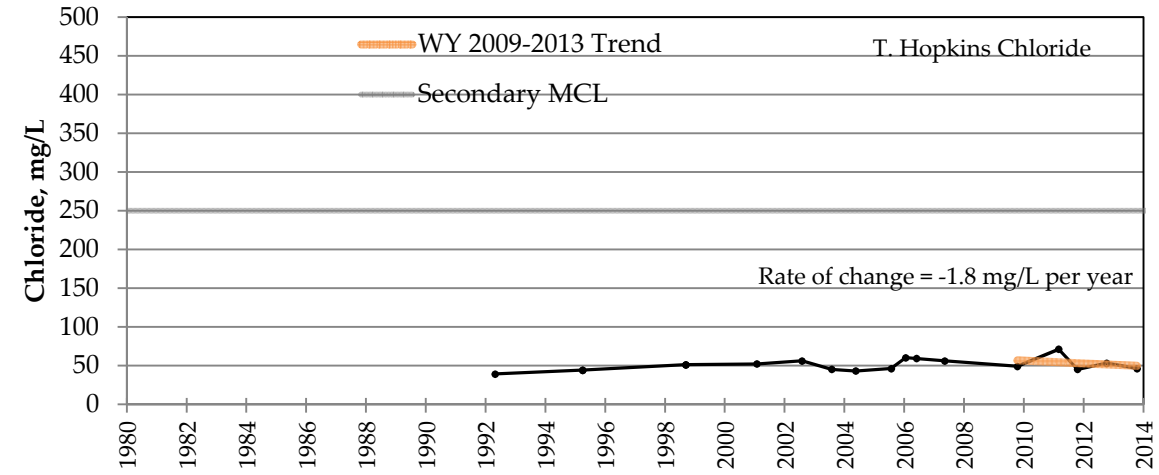

SC-17B Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

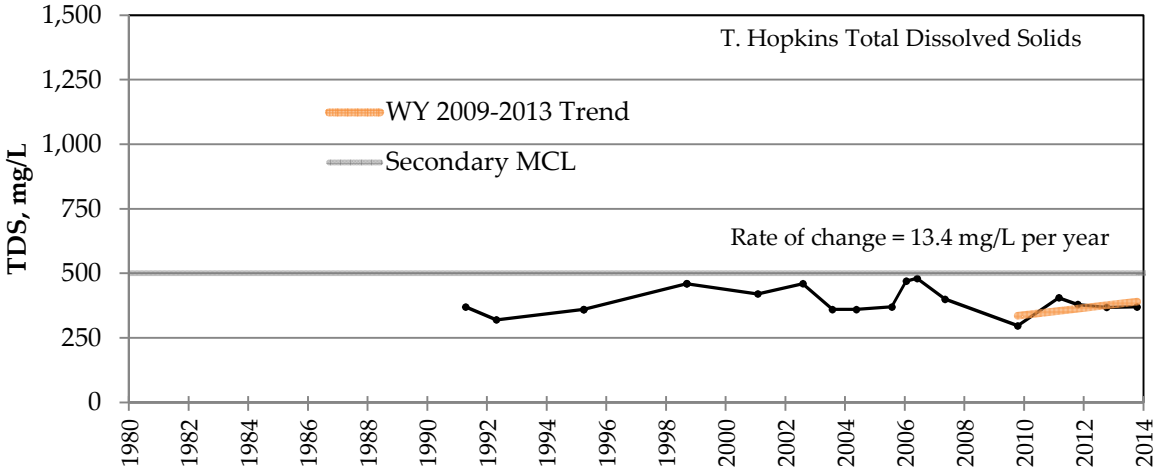

SC-17B Groundwater Elevation
Groundwater Elevation, ft MSL
Measurements recorded after 2005 when
adjacent Ledyard well running excluded
WY 2009-2013 Trend
Rate of change = 4.1 feet per year
35
10
-15
-40
-65
-90
-115
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

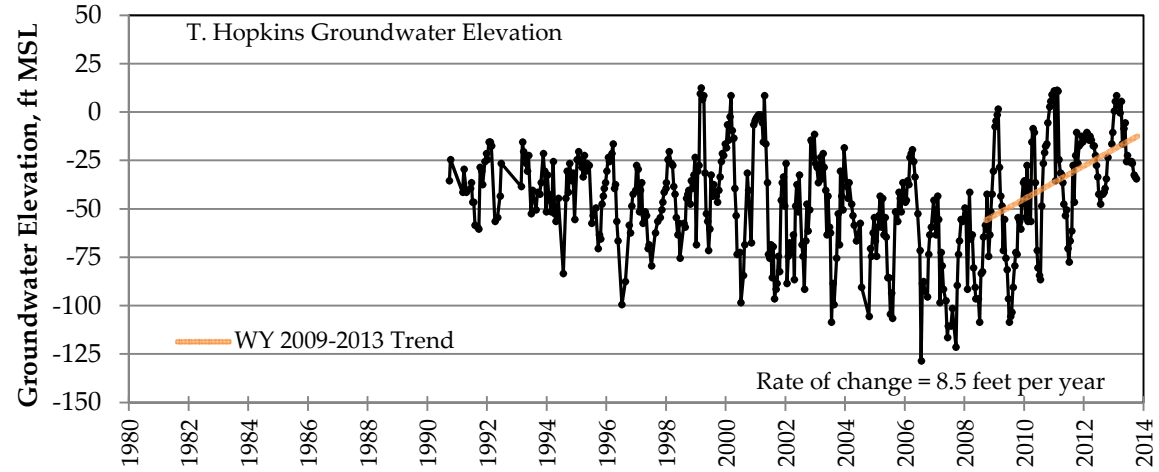

SC-17C Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

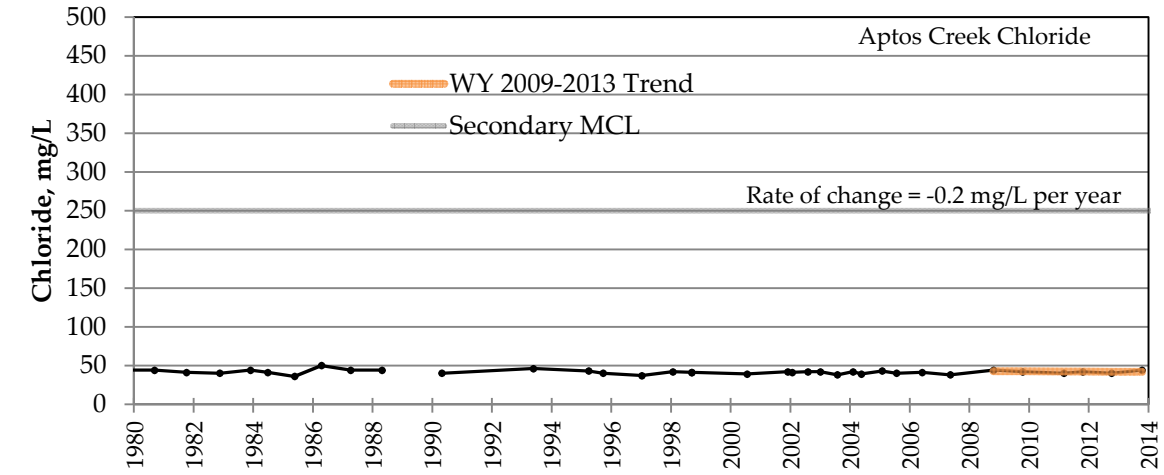

SC-17C Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

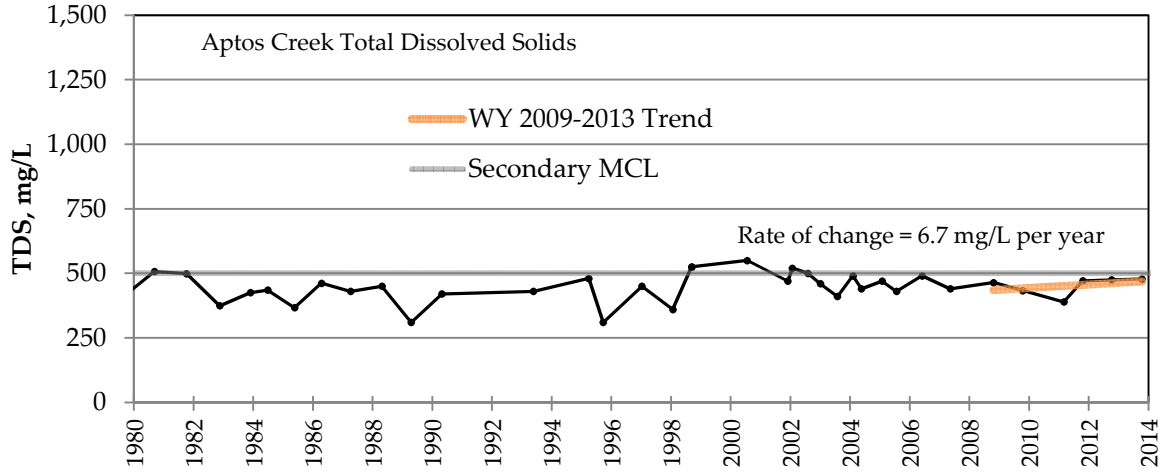

WY 2009-2013 Trend
SC-17C Groundwater Elevation
Measurements recorded after 2005 when adjacent Ledyard well running excluded
Rate of change = 5 feet per year
Groundwater Elevation, ft MSL
25
0
-25
-50
-75
-100
-125
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

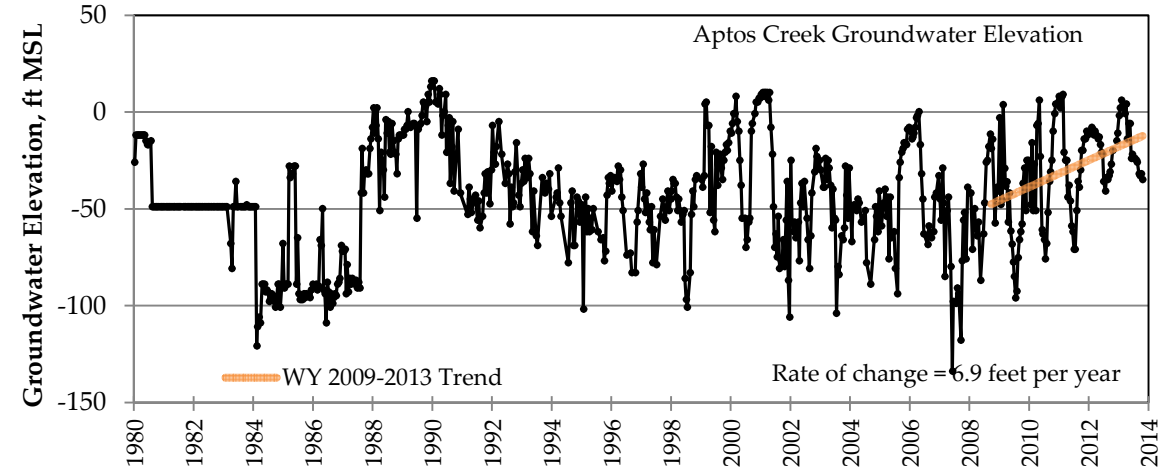

T. Hopkins Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -1.8 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


T. Hopkins Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 13.4 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


T. Hopkins Groundwater Elevation
WY 2009-2013 Trend
Rate of change = 8.5 feet per year
Groundwater Elevation, ft MSL
50
25
0
-25
-50
-75
-100
-125
-150
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Aptos Creek Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.2 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Aptos Creek Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 6.7 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Aptos Creek Groundwater Elevation
WY 2009-2013 Trend
Rate of change = 6.9 feet per year
Groundwater Elevation, ft MSL
50
0
-50
-100
-150
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

SECTION 5 – WATER YEAR 2013
AQUIFER CONDITIONS FOR AROMAS AREA
(PURISIMA F-UNIT/AROMAS RED SANDS)

This section presents groundwater level and water quality conditions for Water Year 2013 in the eastern portion of the Soquel-Aptos area where the primary production aquifers are the Purisima F-unit and the Aromas Red Sands.

5.1 SqCWD Service Areas III and IV and CWD Production

In the eastern portion of the Soquel-Aptos area, groundwater is produced for municipal purposes by SqCWD in Service Areas III and IV, and by CWD at its Cox and Rob Roy well fields. SqCWD's Service Area III production was 1,545 acre-feet in Water Year 2013, an increase from the three previous years which had the three lowest annual total since Water Year 1995. Water Year 2013 was the first full water year with the Polo Grounds well as part of the Service Area III system as it was added in September 2012. Service Area IV production in the La Selva Beach area was 65 acre-feet in Water Year 2013, the fourth lowest annual total going back to Water Year 1984 but the highest of the last four years. The Sells well was taken out of service in April 2009 due to high nitrate concentrations. CWD production at its Cox well field, completed in the Purisima F-unit, was 2 acre-feet in Water Year 2013. Over the previous fifteen years, only a small proportion of CWD's pumping has been from the Cox well field, but the well field was virtually shut down in Water Year 2013. Production at its Rob Roy well field completed in the Aromas Red Sands was 556 acre-feet. Rob Roy production was the fifth highest annual total on record.

Figure 5-1 shows production in the Aromas area by water year, grouped into three geographical areas. The Valencia watershed area includes the SqCWD's Aptos Jr. High and Polo Grounds wells and CWD's Cox wells, which are screened in the Purisima F-unit. With pumping at the Aptos Jr. High and Polo Grounds wells totaling 349 acre-feet in Water Year 2013, annual municipal pumping in this area exceeded 300 acre-feet for the third straight year when 300 acre-feet had not been exceeded since Water Year 1986. The Aptos Jr. High well was out of service for Water Years 1987-2006. The Valencia watershed area south and east of Valencia Creek is now included in pumping totals for the Aromas

area for comparisons to the post-recovery yield because geologic maps include this sub-area in the Aromas outcrop (HydroMetrics WRI, 2012). Water Year 2013 pumping at the Aptos Jr. High and Polo Grounds wells was approximately 29% of SqCWD's revised estimate of its post-recovery pumping yield in the Aromas area.

The wells in the other two areas are screened in both the Purisima F-unit and the Aromas Red Sands. The Seascape and Rob Roy area includes most of SqCWD's Service Area III wells and CWD's Rob Roy wells. This area has the largest portion of municipal production in the Aromas area. Production has declined since Water Year 2004, but production has increased in each of the last two water years. SqCWD production in the Seascape area was 1,183 acre-feet in Water Year 2013, the second lowest total since Water Year 1984. SqCWD production of 1,195 acre-feet in Water Year 2013 is over 99% of SqCWD's post-recovery yield for the Aromas yield (HydroMetrics WRI, 2012). Seascape and Rob Roy combined total pumping in Water Year 2013 was 1,751 acre-feet, an increase over the previous year. CWD production at Rob Roy has been relatively steady over the last fifteen years and Well #12 has been used as the lead well starting in 2003.

The La Selva Beach area consists of SqCWD's Service Area IV wells, where pumping has declined since Water Year 2008 after the Sells well was taken out of service. Water Year 2012 pumping of 65 acre-feet in Service Area IV was the fourth lowest total going back to Water Year 1984 when records for service area totals begin but the highest of the last four years.

SqCWD's post-recovery pumping yield for the Aromas area has been updated to 1,200 acre-feet per year, including pumping from the Aptos Jr. High well and the Polo Grounds well (HydroMetrics WRI, 2012). Therefore, SqCWD's pumping of 1,609 acre-feet in Water Year 2013 from SqCWD wells in the Aromas area still exceeds the post-recovery pumping yield. In addition, pumping will have to be reduced below the pumping yield to recover the basin to protective levels.

5.2 GROUNDWATER LEVEL CONDITIONS AND TRENDS

SqCWD has revised protective groundwater elevations in coastal monitoring wells to protect the Purisima F-unit and Aromas Red Sands in the eastern portion of the Soquel-Aptos area from seawater intrusion. Cross-sectional models were used to estimate groundwater elevations that result in the freshwater-salt water

interface being maintained at the current location at the coastal monitoring wells in the long term (HydroMetrics WRI, 2012).

Coastal groundwater levels in SqCWD's F-unit and Aromas Red Sands monitoring wells compared to protective elevations are shown in Table 5-1. In the Aromas area, the revised protective elevations are selected to maintain the interface in both the A and B screens. Therefore, observed groundwater levels in both screens should be compared to protective elevations. Hydrographs for multiple completions of monitoring wells in the Aromas area follow at the end of this section Observed groundwater levels must also be adjusted to account for salinity before they are compared to protective elevations. The protective groundwater elevation estimated by SEAWAT-2000 is the equivalent freshwater head (Langevin and others, 2003). The equivalent freshwater head for groundwater with a substantial amount of salinity is higher than the observed groundwater levels due to the higher density of saline water. Equivalent freshwater heads are calculated where chloride concentrations in coastal monitoring wells are greater than 250 mg/L as described in Attachment A of HydroMetrics WRI (2012). The hydrographs for single monitoring wells grouped with chemographs for chlorides and total dissolved solids show the equivalent freshwater heads.

Average groundwater levels are above protective elevations in the northwest part of the Aromas area coastline at SC-A1, where the hydrographs show groundwater levels at these wells have been above protective elevations for most of the monitoring record. In the Seascape area, average equivalent freshwater heads remain below protective elevations at SC-A8A and SC-A2A. . In Service Area IV to the southeast, average equivalent freshwater heads at SC-A3 and SC-A4 were above protective elevations in Water Year 2013. Groundwater levels at SC-A3A rising above the protective elevation the last two years have occurred during a four year period with reduced Service Area IV pumping with the Sells well offline. Maintaining groundwater levels above protective elevation at SC-A4 will likely depend on pumping by nearby small water systems and private pumping that are closer to SC-A4 than any municipal well.

Table 5-1 (2013): Comparison of Water Year 2013 Coastal Groundwater Levels with Protective Elevations

Well	Location	A Screen Unit/ B Screen Unit	Average Equivalent Freshwater Head A screen[1] (feet msl)[2]	Average Equivalent Freshwater Head B screen (feet msl)[1]	Protective Elevation (feet msl)[1]
SC-A1	Cliff	DEF/F	7.7	7.6	3
SC-A8	Dolphin & Sumner	F/ Aromas	5.6	7.0	6
SC-A2	Sumner	F/F	1.5	5.2	3
SC-A3	Playa & Vista	Aromas/Aromas	3.9	4.6	3
SC-A4	Canon del Sol	F/F	3.2	5.2	3

[1] Bi-monthly data from October, December, February, April, June, and September.
[2] msl = mean sea level

In general, groundwater levels at SqCWD's coastal monitoring wells in the area have stabilized or show a slight increasing trend over the last four years, after showing a declining trend over previous years. The stabilized or rising groundwater levels correspond with historically low production by SqCWD in the area. However, the previous declines occurred despite reductions in pumping at some nearby municipal production wells. The lack of correlation between groundwater levels and local pumping may indicate that non-municipal pumping had a more immediate effect on groundwater levels in the Aromas area than the Purisima area. Johnson et al. (2004) had previously concluded that groundwater levels in the area did not reflect year to year changes in climatic conditions.

Table 5-2 summarizes the important groundwater level trends by well. Changes to trends in WY 2013 include:

- Decline of 2 feet in SC-A2A over Water Years 2012-2013. Combined pumping at Seascape and San Andreas varied from low pumping in WY 2011 to high pumping in Water Year 2012 to average pumping in Water Year 2013.
- Decline of 2 feet in CWD-C in Water Year 2013. CWD's Rob Roy 12 well had its highest annual production since coming online in 1999.
- Decline of 20 feet in SC-20A over Water Years 2012-2013. The Polo Grounds well came online in August 2012.

- Decline of 10 feet in Black monitoring well over Water Years 2012-2013. This decline may be related to lower rainfall over the two years and/or increased pumping at CWD's Rob Roy 12 well and SqCWD's Polo Grounds well.

Hydrographs for multiple completions of monitoring wells near the SqCWD and CWD production wells are included at the end of this section. Hydrographs for single wells including production wells are included with chemographs. These hydrographs show trend lines for Water Years 2008-2012 when there have been decreases of municipal production for the Aromas area.

Contour maps of groundwater elevations in Spring and Fall 2013 for the Purisima F-unit and Aromas Red Sands are shown in Figure 5-2 and Figure 5-3, respectively. Both Spring and Fall 2013 contour maps show that groundwater levels were above sea level, although coastal groundwater levels are below protective elevations along a good portion of the coast. Slightly higher coastal groundwater levels in the spring than the fall are evidenced by the location of the 5 foot contour. The main difference from the previous year is the greater pumping depression that has developed at the Polo Grounds and Rob Roy #12 wells.

The contour maps show that groundwater generally flows from the hills to Monterey Bay with some of the flow pattern altered by pumping. There also appears to be a groundwater flow divide south and east of SqCWD and CWD. South and east of this divide, groundwater flows to Pajaro Valley. There is also a surface watershed divide in this area.

Table 5-2 (2013): Summary of Groundwater Level Trends in Aromas Area

Category	Well	Groundwater Level Trend Description	Notes
SqCWD Coastal Monitoring Wells	SC-A1	Rise of ~2 feet WY 2010-2013. Rise of ~4 feet in B screen since WY 2009.	Lower pumping at Country Club WY 2010-2013 vs. previous years; Seascape Golf Course also pumping nearby
	SC-A8	Slight rise since installation in WY 2007	Lower combined pumping at Seascape and San Andreas WY 2009-2013 vs. previous nine years
	SC-A2	Rise of 1.5-2 feet WY 2009-2012. Decline of 2 feet WY 2012-2013	Combined pumping at San Andreas and Seascape WY 2013 similar to long-term average after high pumping in WY 2012
	SC-A3	. Stable WY 2013 after rise in WY 2012	Historical low SA IV pumping in WY 2010-2013 after Sells went offline
	SC-A4	Rise of 2+ feet WY 2009-2013	Nearest SqCWD wells are in SA IV
CWD Monitoring Wells in Rob Roy Field	CWD-A	Stable trend wince WY 2006	None
	CWD-B	Stable trend since WY 2006	None
	CWD-C	Decline of 2+ feet in WY 2013	Rob Roy 12 WY 2013 highest annual pumping since well came online in WY 1999
Inland Wells	SC-20	Decline of ~20 feet WY 2012-2013	WY 2013 first full year Polo Grounds online
	Black Monitoring Well	~10 foot decline in WY 2012-2013	Lower rainfall in WY 2012-2013. Also, Polo Grounds online and increased pumping at Rob Roy 12.

5.3 WATER QUALITY CONDITIONS AND TRENDS

Seawater intrusion has been consistently detected at deep monitoring wells along the coast of the Aromas area. At all coastal monitoring clusters in the Aromas area except SC-A1, the deepest completion was installed to be below the freshwater-saltwater interface. As discussed above, groundwater levels are below protective elevations in the part of the Aromas area nearest most of SqCWD's pumping in the Aromas area As a result, there is risk of seawater intrusion continuing to advance toward production wells in the Aromas area.

Observed Total Dissolved Solids (TDS) and chloride concentrations continue to be elevated at the deep coastal monitoring wells installed below the freshwater-saltwater interface. Chloride concentrations are above 6,000 mg/L in these wells.

In the northwest part of the Aromas area coast, the freshwater-salt water interface has not been observed at SC-A1 and salt concentrations at SC-A8A below the interface have remained relatively stable since well installation in 2007. The hydrographs show groundwater levels at these wells have been above protective elevations for most of the monitoring record at SC-A1 and just below protective elevations at SC-A8A.

At SC-A2 in the central part of the Aromas area coast, the freshwater-saltwater interface has continued to move shallower and landward over the long term as the SC-A2A hydrograph continues to show equivalent freshwater heads below protective elevation in Water Year 2013. There is a long-term increasing trend in TDS and chloride concentrations at both SC-A2A and SC-A2B. The interface has moved up into the SC-A2B screen with TDS and chloride concentrations rising over the secondary MCLs over time. This apparent landward movement of seawater has put the nearby Seascape well at the highest risk to be impacted by seawater intrusion

The interface is most shallow at SC-A3 in the southeast part of the Aromas area coast near SqCWD's Service Area 4 production wells. Although TDS and chloride concentrations have been relatively stable in SC-3A, TDS and chloride concentrations in SC-A3B did rise over secondary MCLs in the past indicating the interface had moved up into the SC-A3B screen. Concentrations in SC-A3B did stabilize or decline after the Sells well was taken offline in 2009. The drop in

concentrations observed at SC-A3B occurred after installation of new sampling equipment in March 2012 and the hypothesis that the new equipment only represents the upper screen of SC-A3B and not the lower screen where the freshwater-salt water interface is more likely to occur will be tested.

In the most southeast part of the Aromas area where the closest pumping is by small water systems and private pumping, TDS and chloride concentrations continue to rise in SC-A4A as the protective elevation was only achieved in the last year. The freshwater-saltwater interface has not been observed to have risen up to SC-A4B.

In addition, concentrations at the SC-A5 wells screened below the Seascape well are rising and continue to indicate that seawater has advanced to below that production well. The rise should be monitored closely as a potential risk to the Seascape well.

Chemographs of TDS and chloride for SqCWD monitoring wells in the Aromas area are included at the end of this section. Table 5-3 summarizes the important water quality trends by well.

Observed Total Dissolved Solids (TDS) and chloride concentrations in SqCWD's production wells do not suggest any seawater intrusion impact on municipal production in the Purisima F-unit and Aromas Red Sands. Recent chloride concentrations in the production wells are at 60 mg/L or less, while the maximum contaminant level(MCL) for chlorides is 250 mg/L. Chemographs for SqCWD production wells in the area are included at the end of this section.

Nitrate at SqCWD's Sells well showed concentrations at or just under the maximum contaminant limit of 45 mg/L in 2009 and 2010. The well was removed from service in April 2009. The well was not sampled for nitrate in 2011 and 2012.

The California Department of Public Health is scheduled to implement a new drinking water standard (MCL) for Chromium VI of 10 µg/L beginning July 1, 2014. Chromium VI concentrations in SqCWD production wells screened in the Aromas Red Sands ranged from 6,3 to 22 µg/L in 2013. Chromium VI concentrations in CWD production wells screened in the Aromas Red Sands ranged from 4 to 11 µg/L in 2009 and 2013. Concentrations for total chromium met current drinking water standards for all wells. A report on depth discrete testing of flows and Chromium VI concentrations at the Bonita, San Andreas,

and Altivo wells was issued in 2009 (HydroMetrics LLC, 2009d). Similar tests were conducted at the Rob Roy 12 well in 2012 (HydroMetrics WRI, 2014a).

OEHHA established a PHG for 1,2,3-trichloropropane of 0.0007 µg/L in August 2009, but an enforceable drinking water standard has not yet been set by the California Department of Public Health. The compound 1,2,3-trichloropropane ranged from <0.005 µg/L to 0.015 µg/L in the Country Club well in 2011. The well was not sampled for TCP in 2012 or 2013. This constituent has not been detected at other wells.

Screen elevations listed for most shallow well in the cluster with current chloride concentrations above 250 mg/L.

In 2013, arsenic was measured at 0.6 µg/L in groundwater from the Aptos Jr. High well but treatment plant effluent samples at other times were measured up to 1.4 ug/L, which is below the MCL of 10 µg/L for arsenic.

5.4 STATE OF THE AQUIFER SUMMARY

Seawater intrusion has been detected along the coast of the Aromas area. Coastal groundwater levels have been below protective elevations in the southeast part of the Aromas area indicating risk for continued seawater intrusion into the productive Purisima F unit and the Aromas aquifer. The long-term water quality trend indicates that seawater intrusion has advanced over the last 25 years. Overall, historically low municipal production in the Aromas area has resulted in some recovery of groundwater levels, but not enough to protect the production aquifers over the entire Aromas area. Reducing the risk of seawater intrusion by raising groundwater levels may not be achieved by maintaining recent low municipal production in the Aromas area.

Table 5-3 (2013): Summary of TDS and Chloride Concentration Trends in Aromas Area

Category	Well	Concentration Trend Description	Notes
SqCWD Coastal Monitoring Wells	SC-A1	Chloride consistently <40 mg/L	No completions (deepest to -455 ft msl[1]) installed below freshwater/seawater interface
	SC-A8A	Relatively stable since 2007 installation; chloride=7,000 mg/L	Installed (-391 to -411 ft msl[1]) below interface
	SC-A2A	Long-term increasing trend; chloride = 14,500 mg/L in WY 2013	Installed below interface; near Seascape
	SC-A2B	Long-term increasing trend, chloride ~ 400 mg/L in WY 2013	Installed (-293 to -313 ft msl[1]) above interface when chloride ~ 30 mg/L in WY 1987
	SC-A3A	Stable long-term trend, although slight decline in WY 2012; chloride > 17,000 mg/L (near full strength seawater)	Installed below interface; near Sells and Bonita, rise in groundwater levels WY 2012
	SC-A3B	Long-term increasing trend, but sudden drop in WY 2012 and stable since	Installed (-127 to -167 ft msl[1]) above interface when chloride < 10 mg/L in WY 1987. Concentrations drop after bladder pumps installed.
	SC-A4A	Increasing trend; chloride > 10,000 mg/L in WY 2013	Installed (-334 to -354 ft msl[1]) below interface
	SC-A4B	Increasing trend; chloride 20-70 mg/L in WY 2012	Installed above interface
SqCWD Monitoring Wells near Production Wells	SC-A5A	Increasing trend; chloride > 8,000 mg/L in WY 2012	Installed (-475 to -495 ft msl[1]) below interface; screened 100 feet below Seascape well
	SC-A5B	Increasing trend; Chloride 50-100 mg/L in WY 2012.	Installed above interface; screened 30 feet below Seascape well

[1] msl = mean sea level

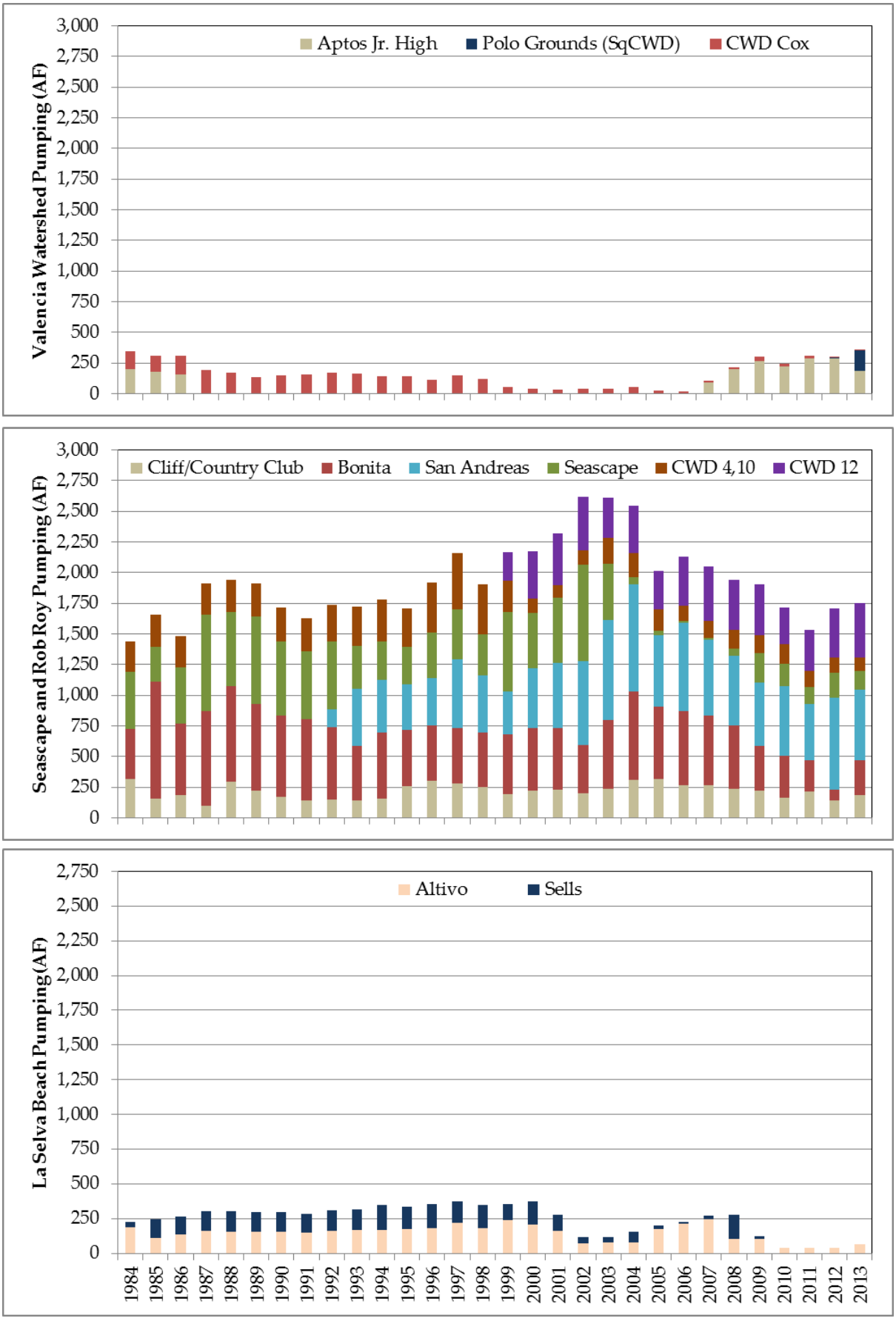


Figure 5-1: Pumping By Water Year in the Aromas Area

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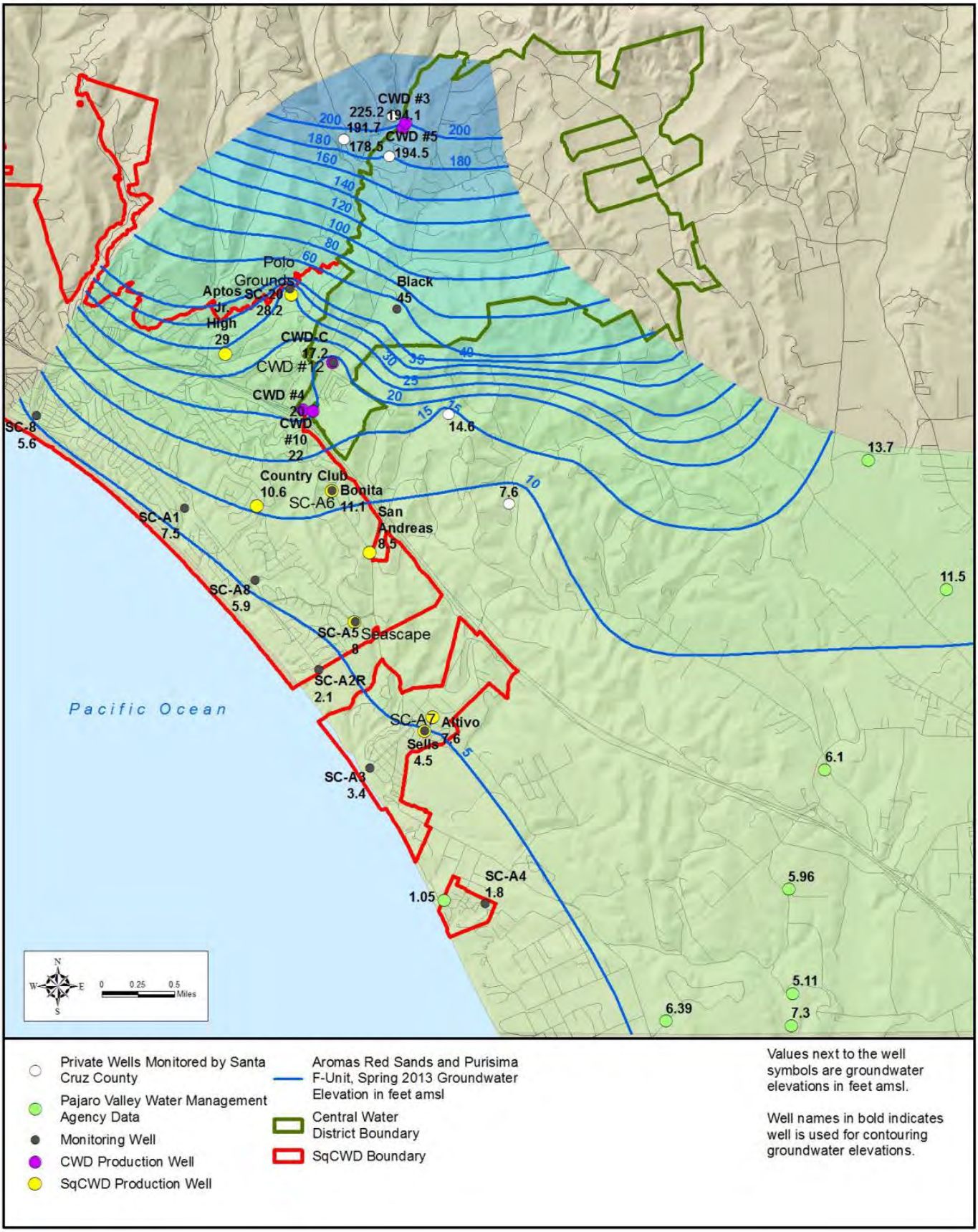

Figure 5-2 (2013): Groundwater Elevation Contours, Aromas Area, Spring 2013

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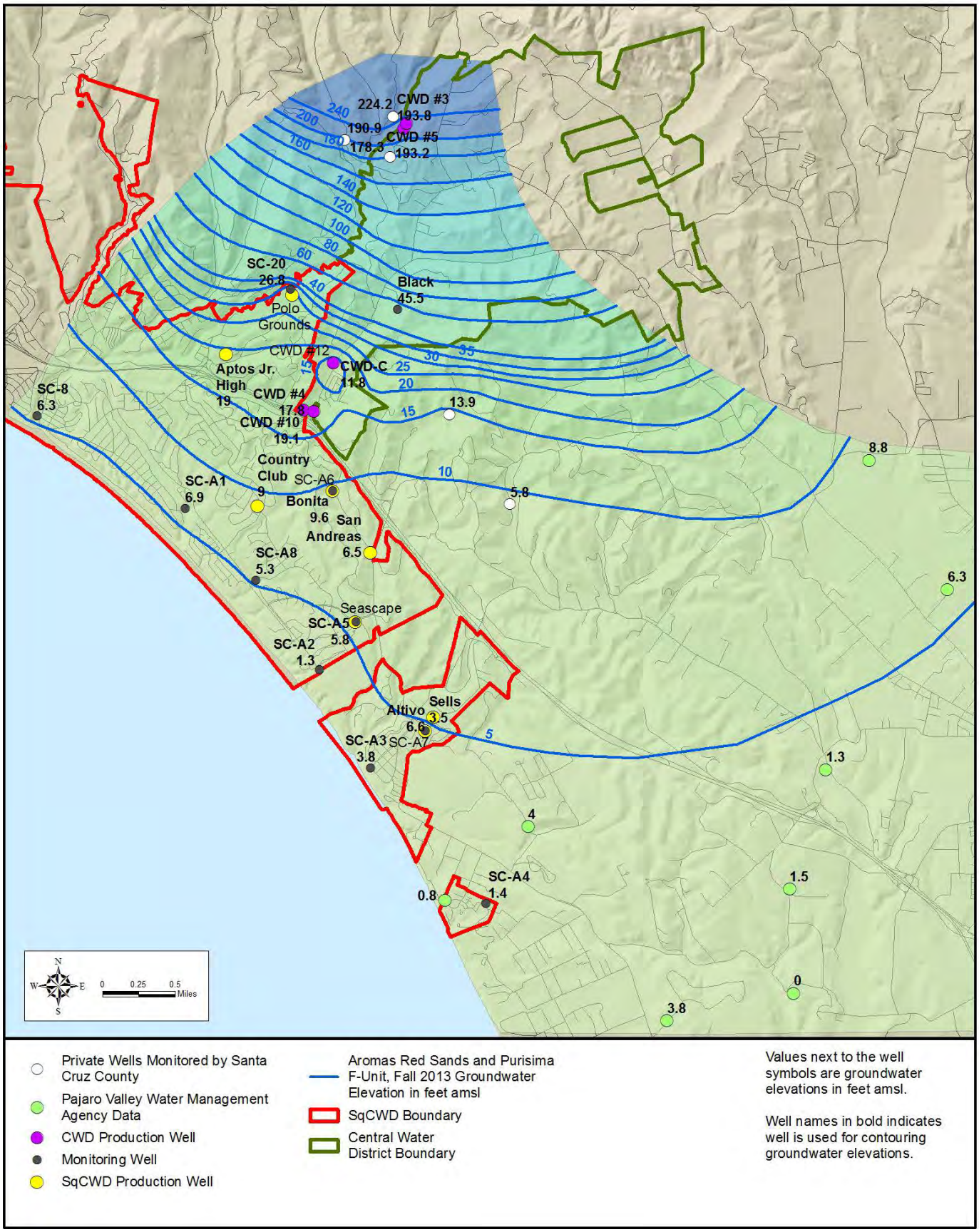

Figure 5-3 (2013): Groundwater Elevation Contours, Aromas Area, Fall 2013

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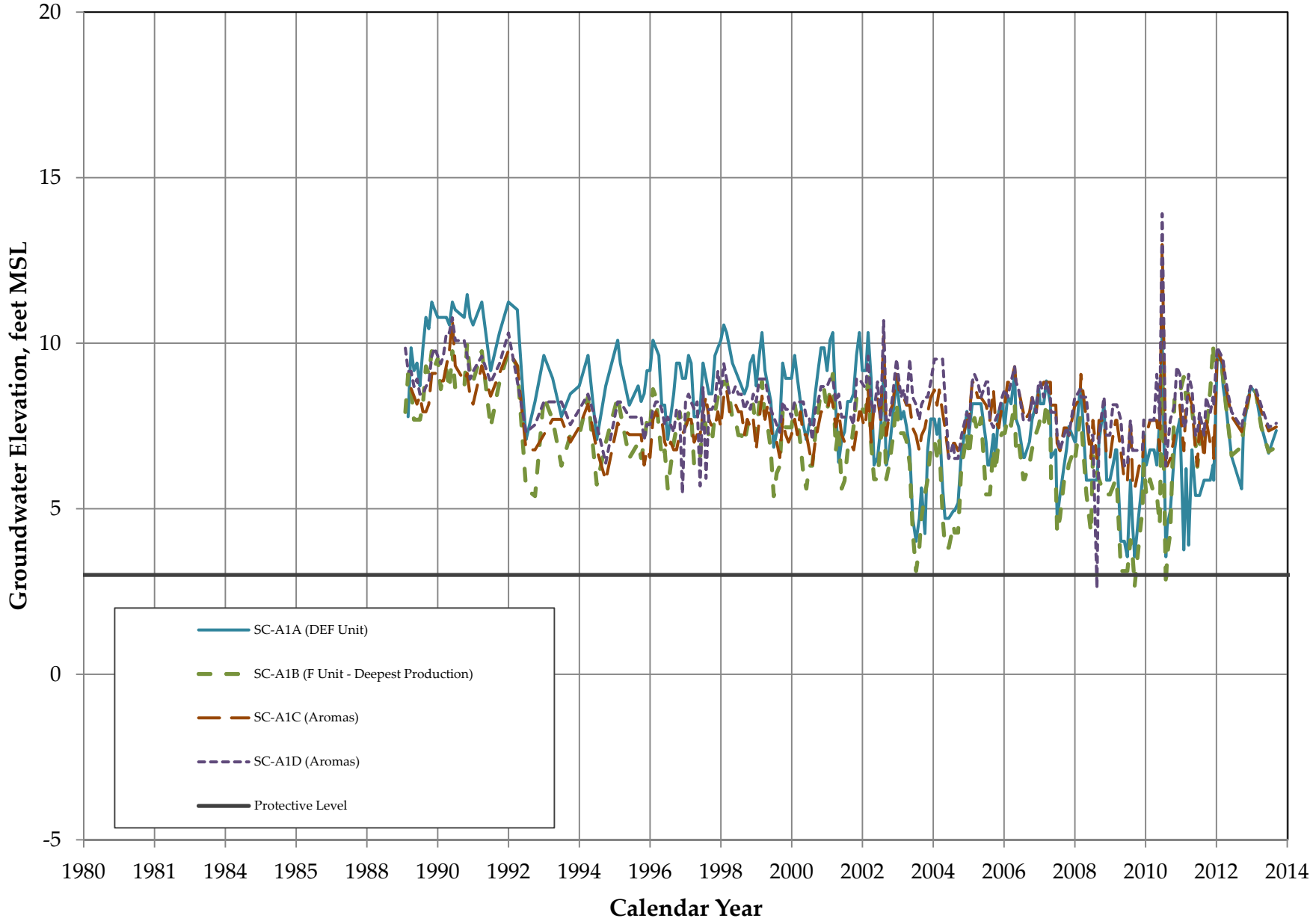
Hydrographs for Aromas Area

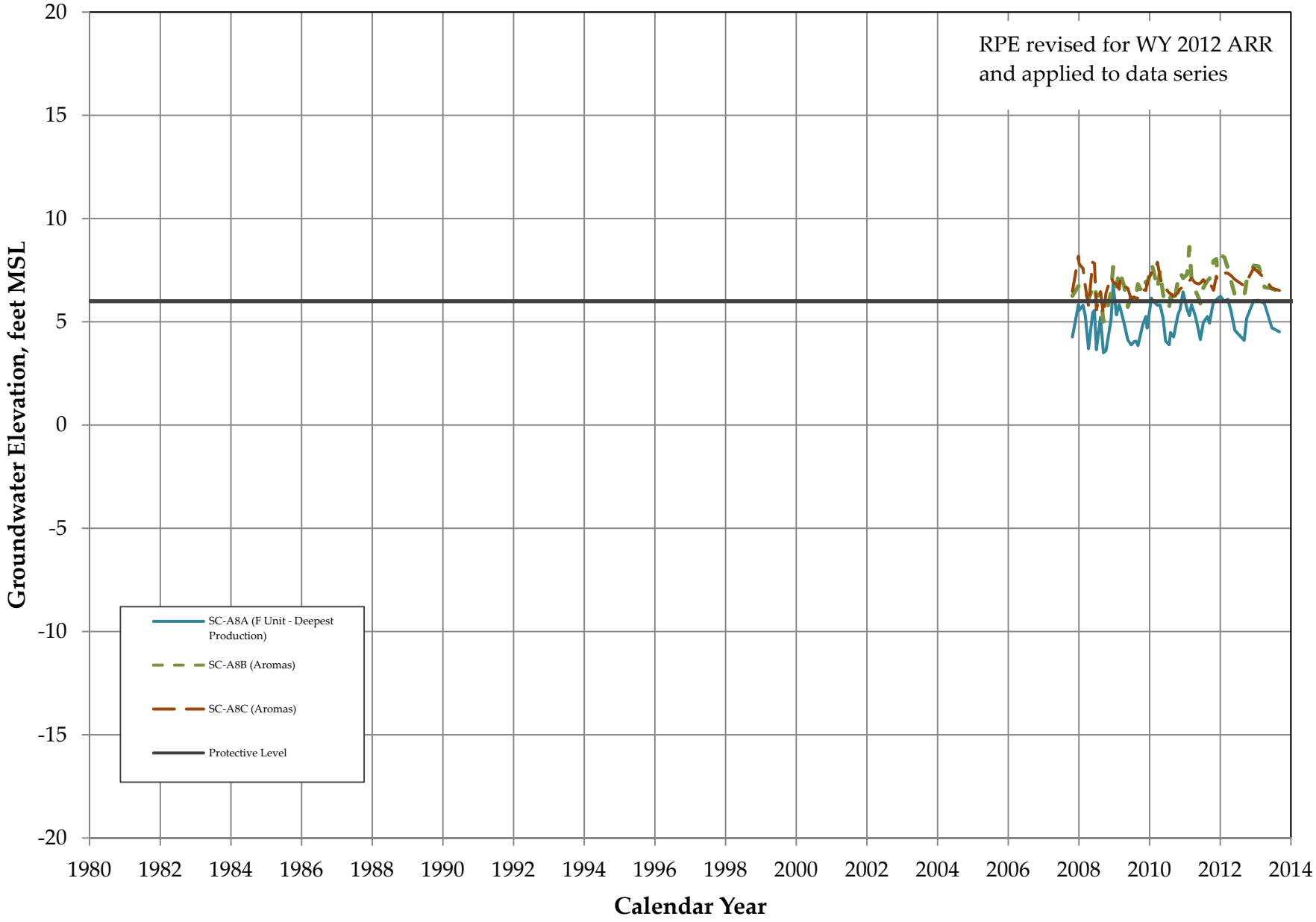
Hydrographs of SqCWD Coastal Monitoring Well Clusters

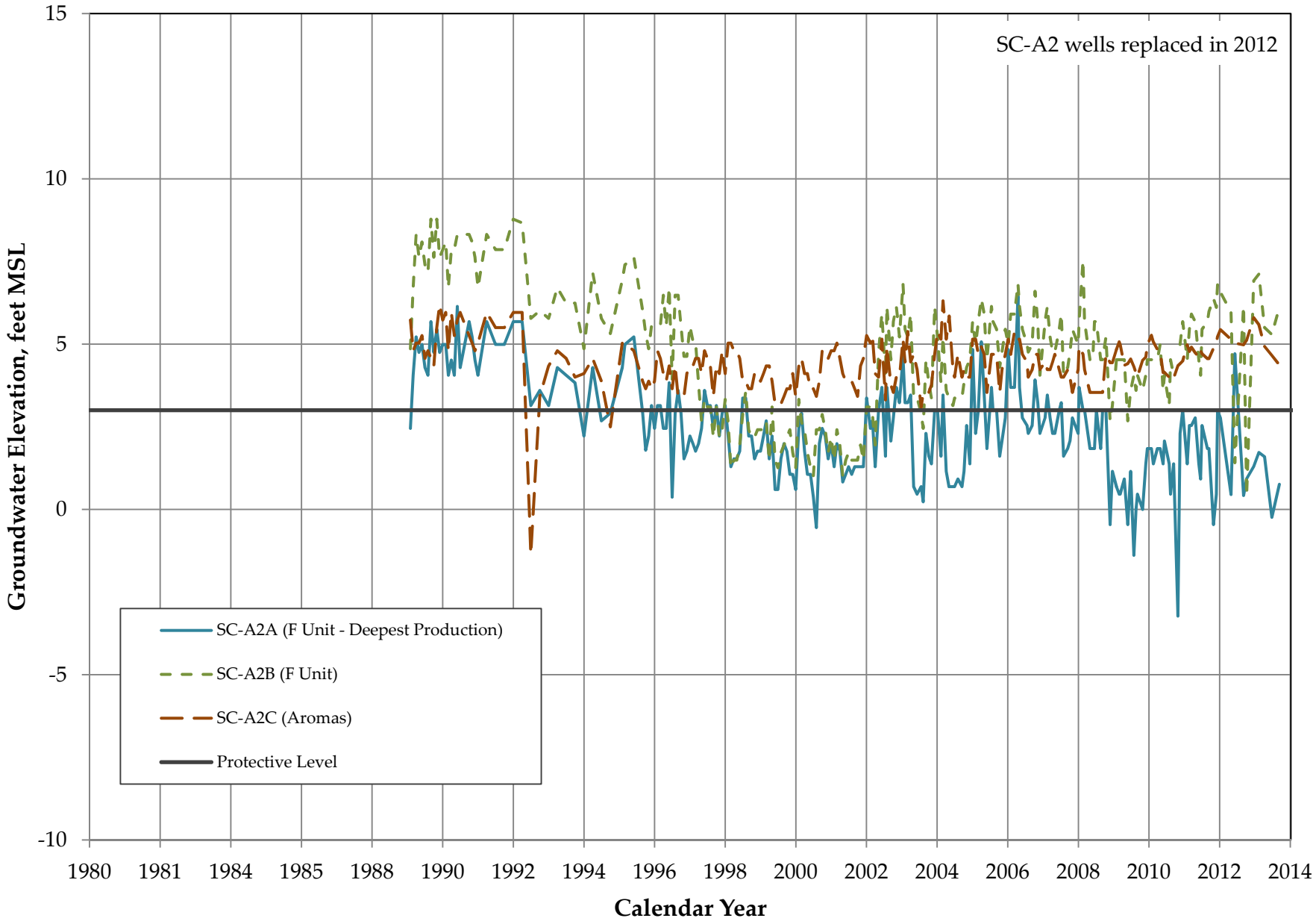
Hydrographs of SqCWD Monitoring Wells Adjacent to Production Wells

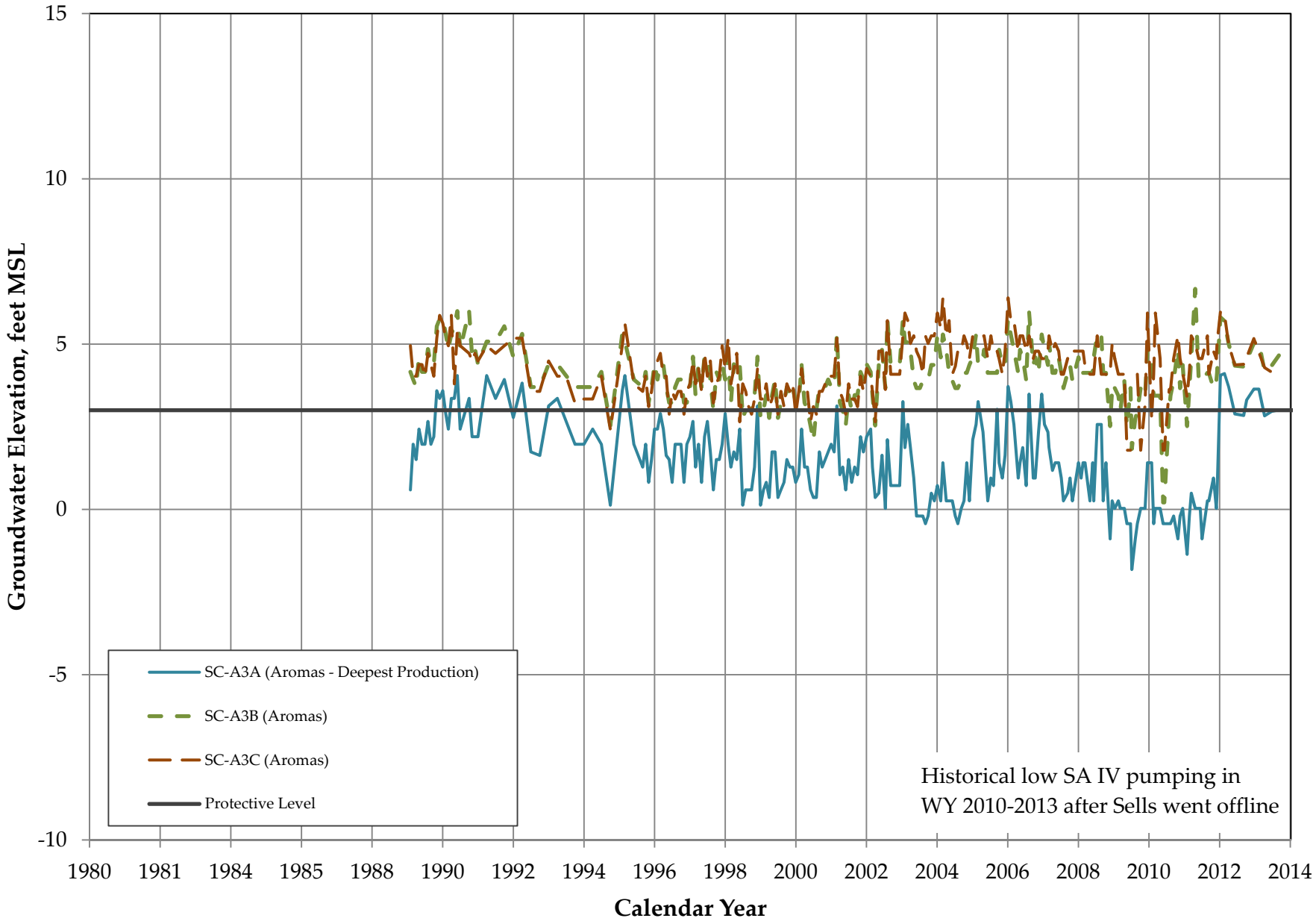
Hydrographs of CWD Monitoring Wells Adjacent to Production Wells

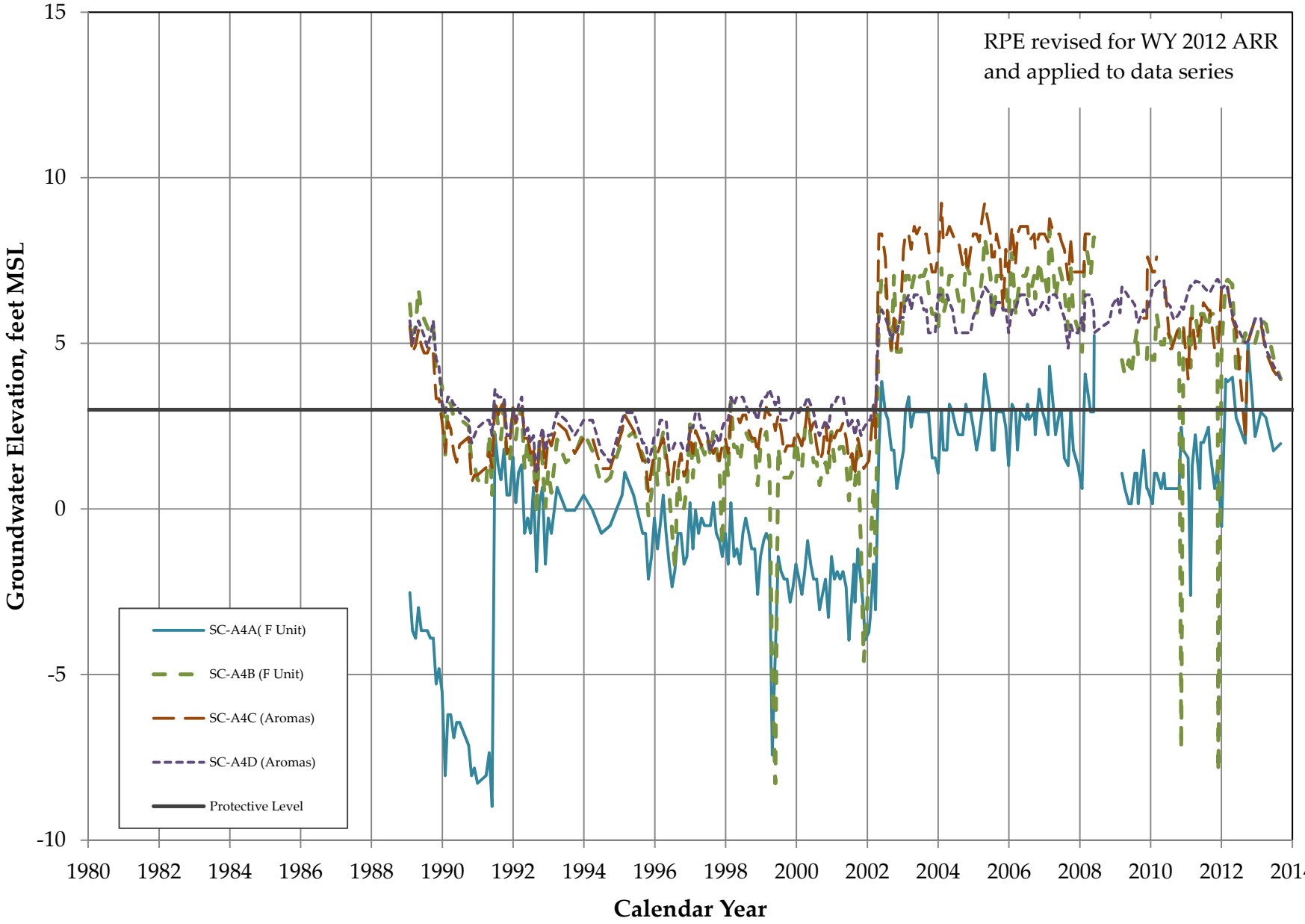
Hydrograph of Inland Monitoring Wells

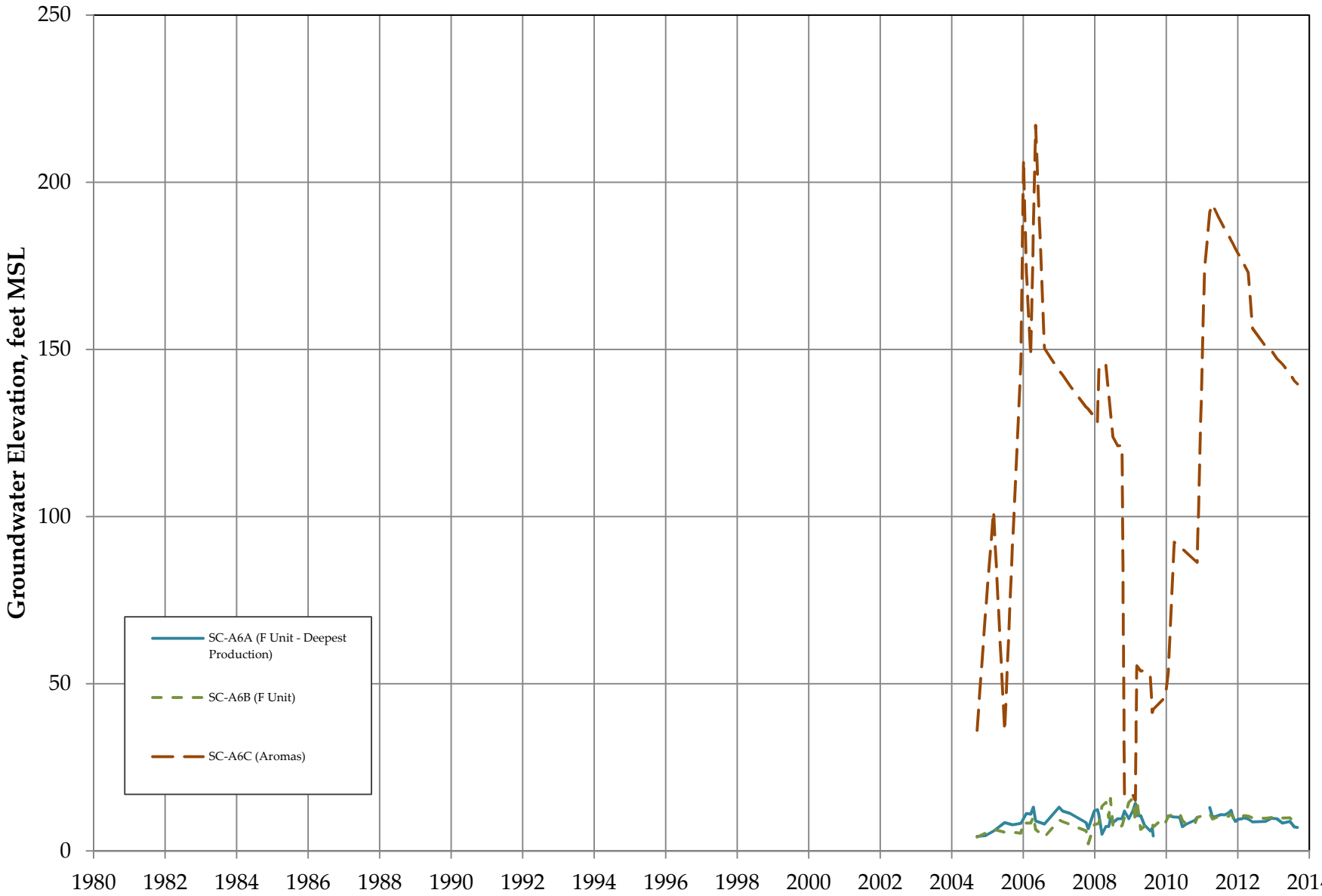

20
15
10
5
0
-5
Groundwater Elevation, feet MSL
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-A1A (DEF Unit)
SC-A1B (F Unit - Deepest Production)
SC-A1C (Aromas)
SC-A1D (Aromas)
Protective Level

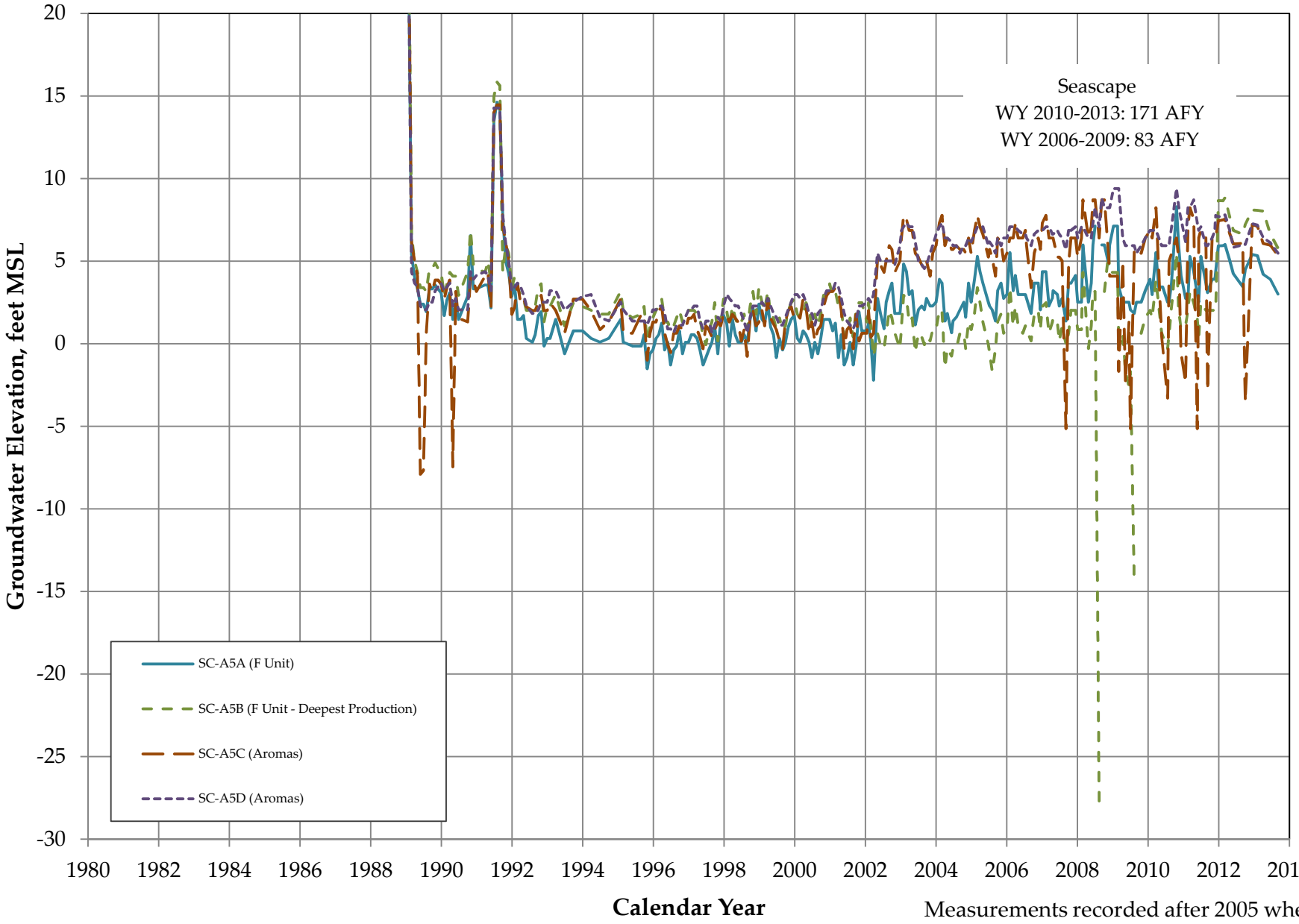

RPE revised for WY 2012 ARR and applied to data series
Groundwater Elevation, feet MSL
Calendar Year
20
15
10
5
0
-5
-10
-15
-20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
SC-A8A (F Unit - Deepest Production)
SC-A8B (Aromas)
SC-A8C (Aromas)
Protective Level


SC-A2 wells replaced in 2012
Groundwater Elevation, feet MSL
15
10
5
0
-5
-10
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-A2A (F Unit - Deepest Production)
SC-A2B (F Unit)
SC-A2C (Aromas)
Protective Level

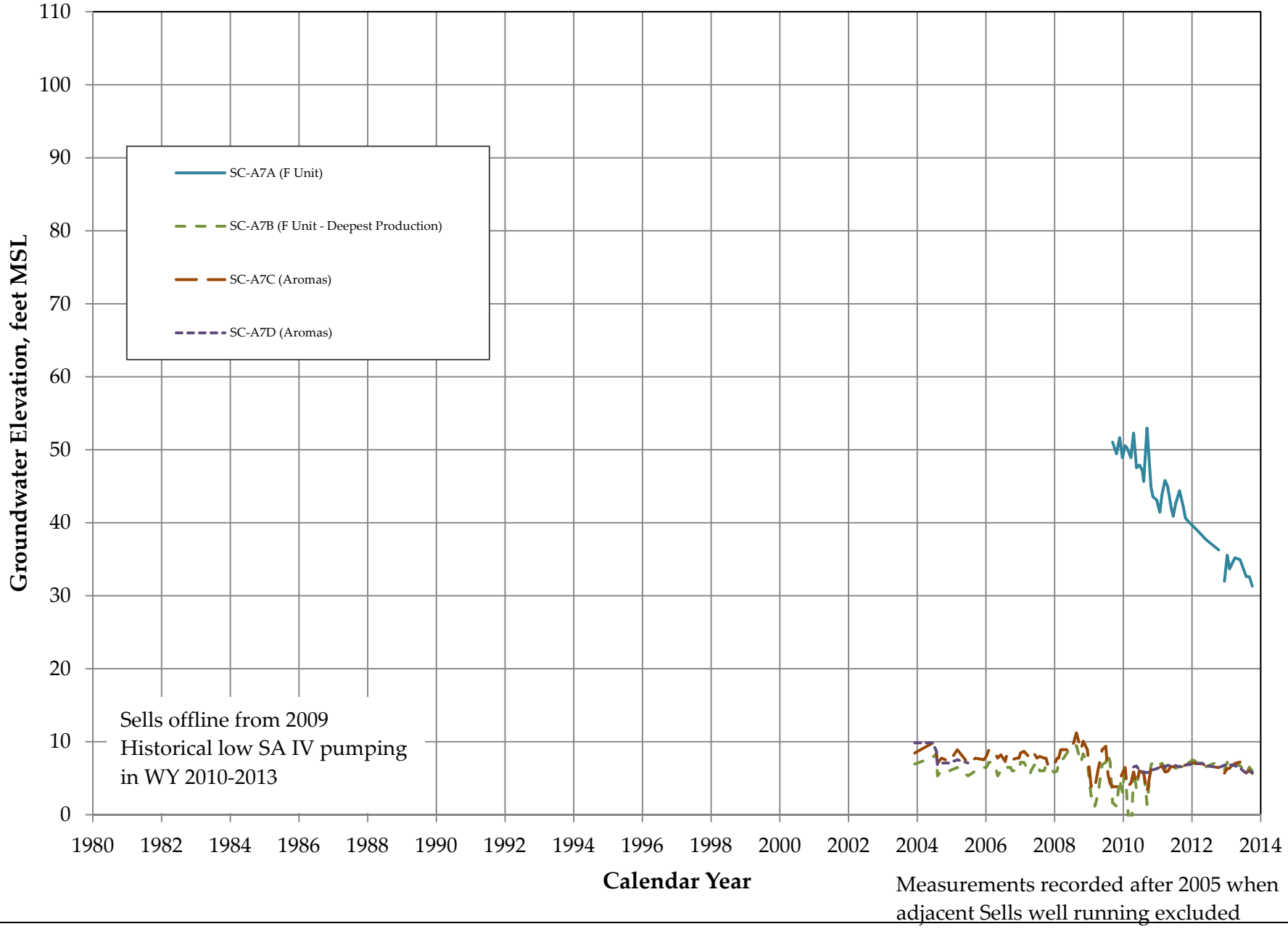

15
10
5
0
-5
-10
Groundwater Elevation, feet MSL
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-A3A (Aromas - Deepest Production)
SC-A3B (Aromas)
SC-A3C (Aromas)
Protective Level
Historical low SA IV pumping in
WY 2010-2013 after Sells went offline

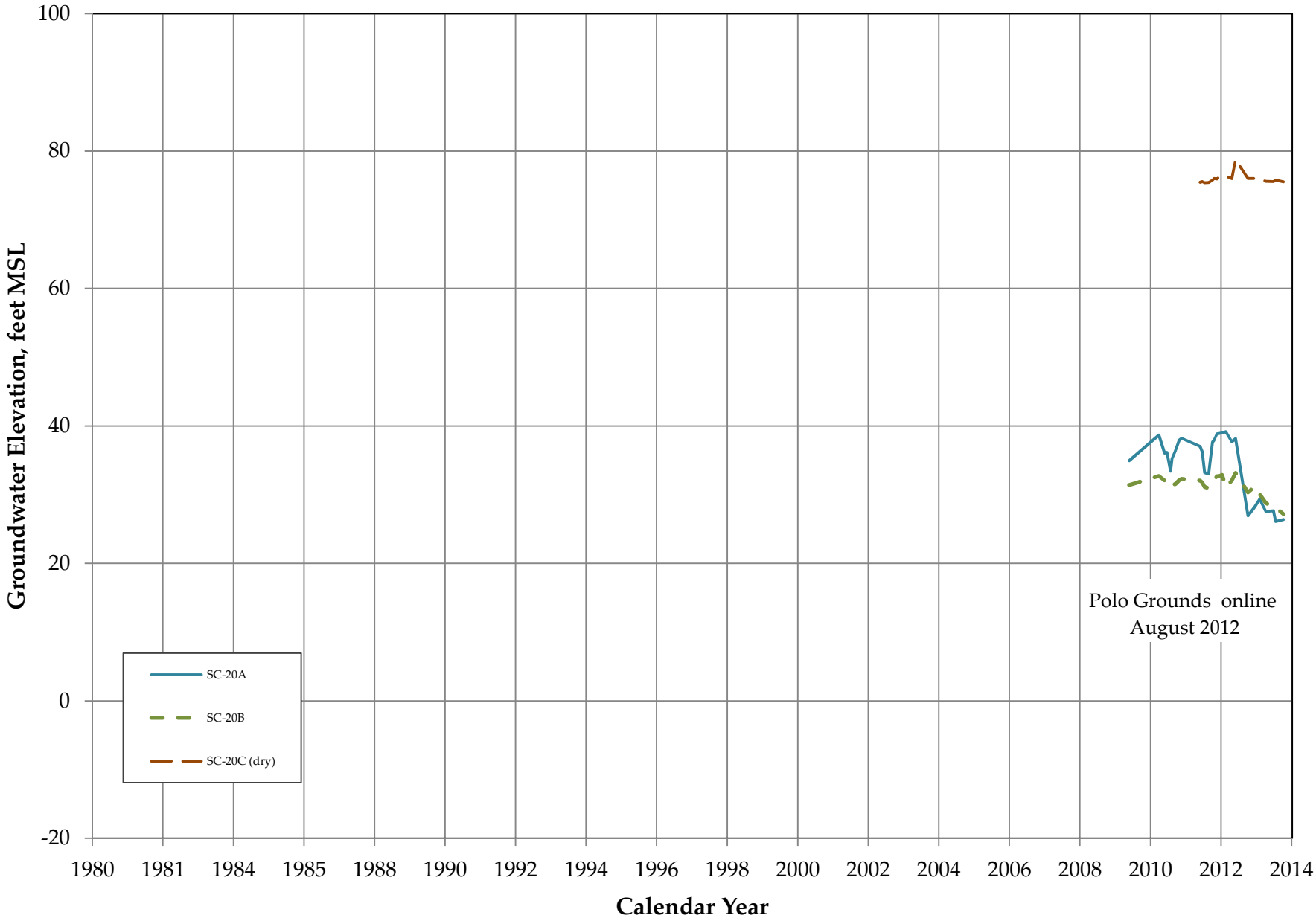

RPE revised for WY 2012 ARR
and applied to data series
Groundwater Elevation, feet MSL
Calendar Year
15
10
5
0
-5
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
SC-A4A(F Unit)
SC-A4B (F Unit)
SC-A4C (Aromas)
SC-A4D (Aromas)
Protective Level

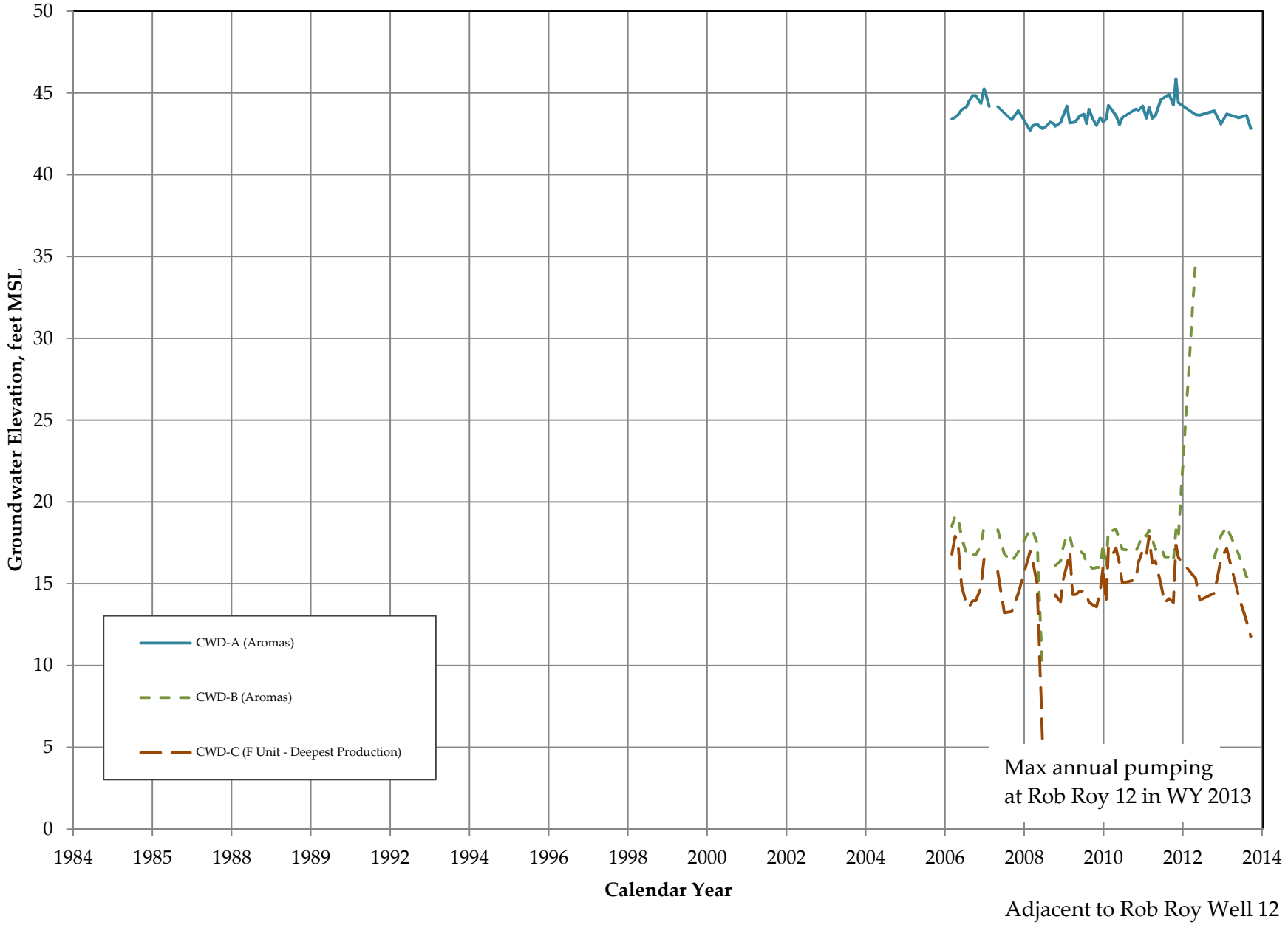

250
200
150
100
50
0
Groundwater Elevation, feet MSL
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-A6A (F Unit - Deepest Production)
SC-A6B (F Unit)
SC-A6C (Aromas)
Measurements recorded after 2005 when adjacent Bonita well running excluded

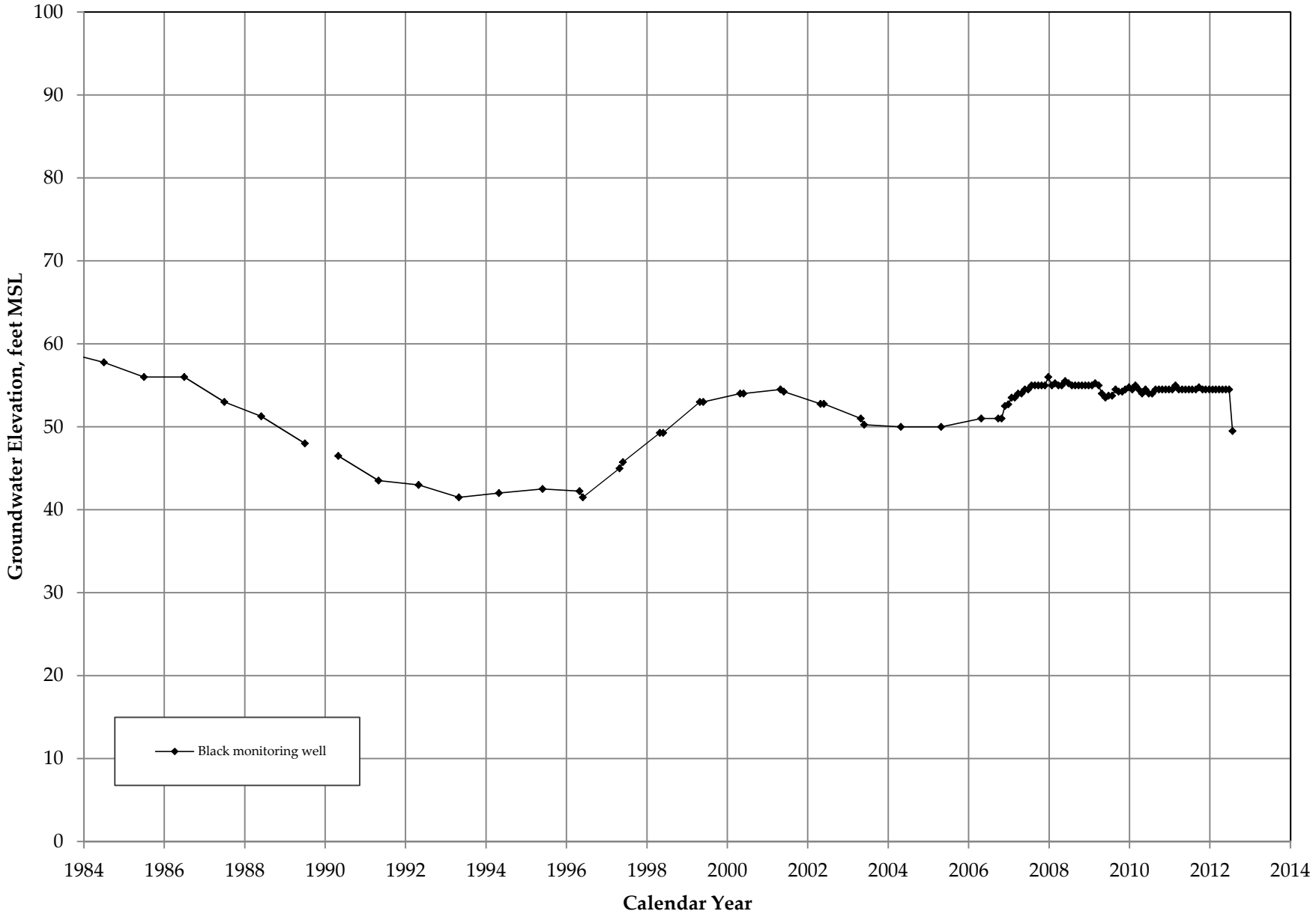


Measurements recorded after 2005 when adjacent Seascape well running excluded


Groundwater Elevation, feet MSL
110
100
90
80
70
60
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-A7A (F Unit)
SC-A7B (F Unit - Deepest Production)
SC-A7C (Aromas)
SC-A7D (Aromas)
Sells offline from 2009
Historical low SA IV pumping
in WY 2010-2013
Measurements recorded after 2005 when
adjacent Sells well running excluded


Groundwater Elevation, feet MSL
100
80
60
40
20
0
-20
1980
1981
1984
1985
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
SC-20A
SC-20B
SC-20C (dry)
Polo Grounds online
August 2012


Groundwater Elevation, feet MSL
50
45
40
35
30
25
20
15
10
5
0
1984
1985
1988
1989
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
CWD-A (Aromas)
CWD-B (Aromas)
CWD-C (F Unit - Deepest Production)
Max annual pumping
at Rob Roy 12 in WY 2013
Adjacent to Rob Roy Well 12


Groundwater Elevation, feet MSL
100
90
80
70
60
50
40
30
20
10
0
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Calendar Year
Black monitoring well

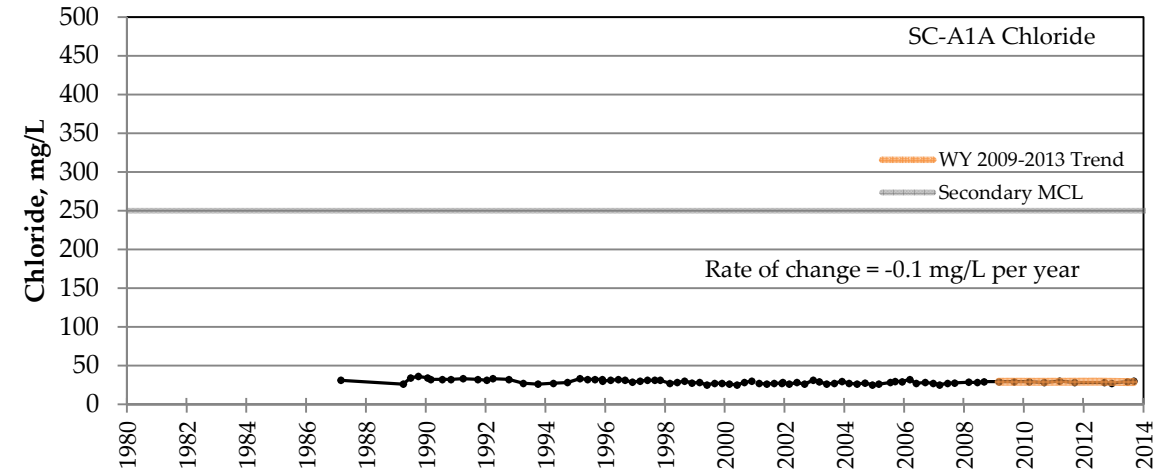
Chemographs and Single Well Hydrographs for Aromas Area

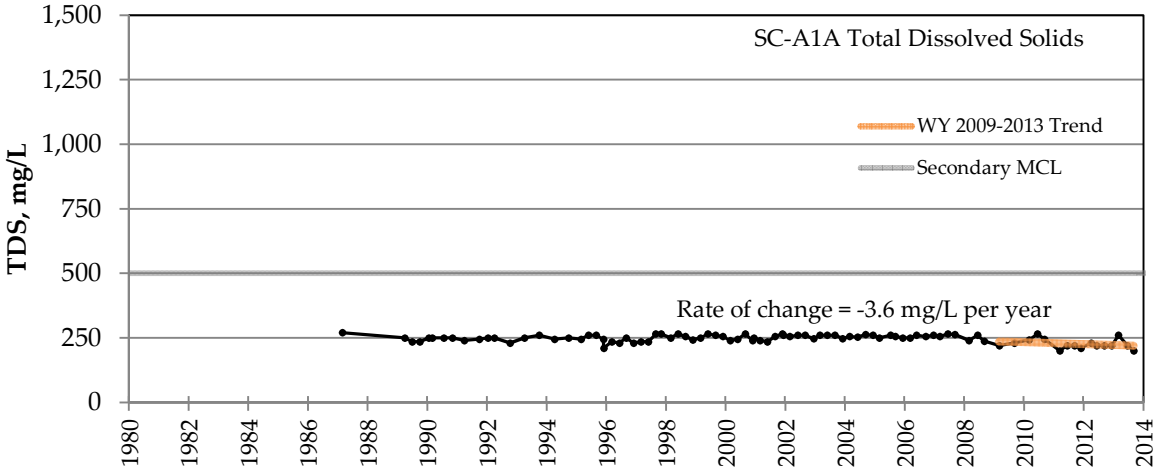
Graphs of SqCWD Coastal Monitoring Well Clusters

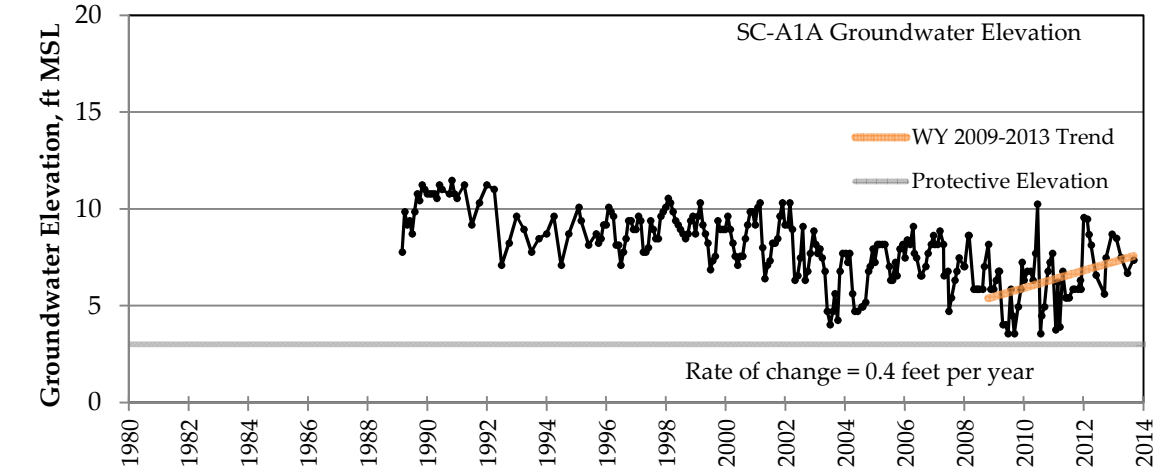
Graphs of SqCWD Production Wells and Adjacent Monitoring Wells

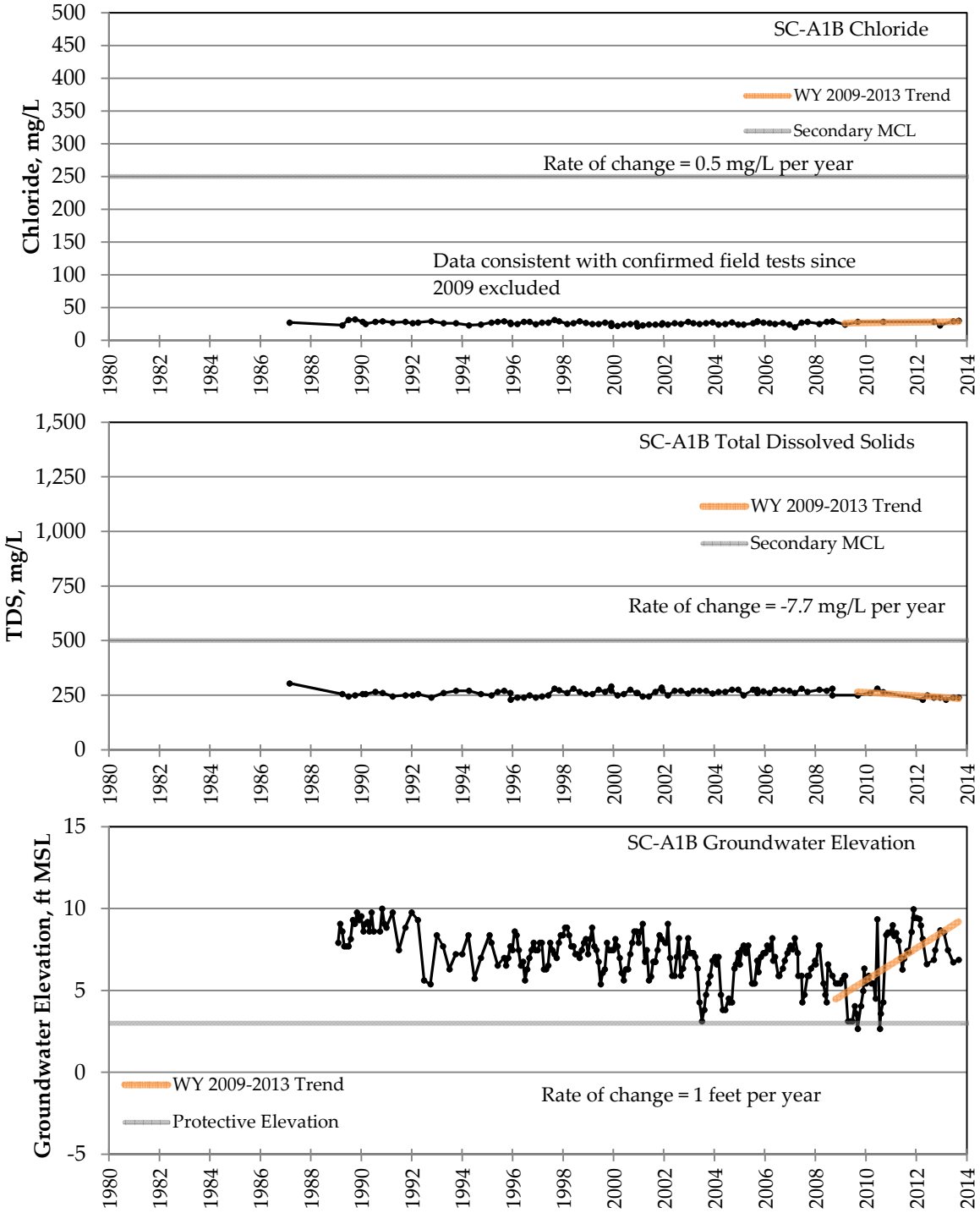
Graphs of CWD Production Wells and Monitoring Wells

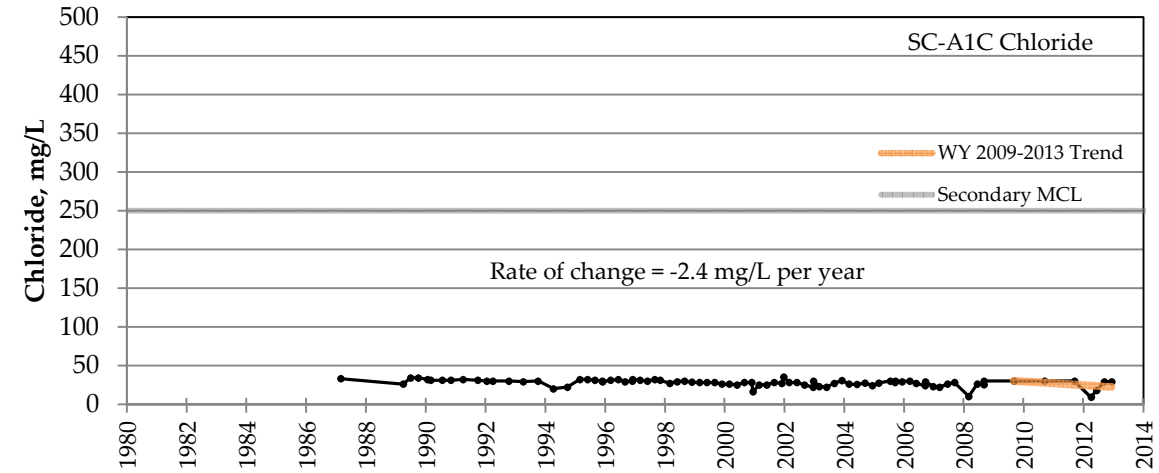
Trends shown on the hydrographs and chemographs are based on a linear fit to data in the specified time period.

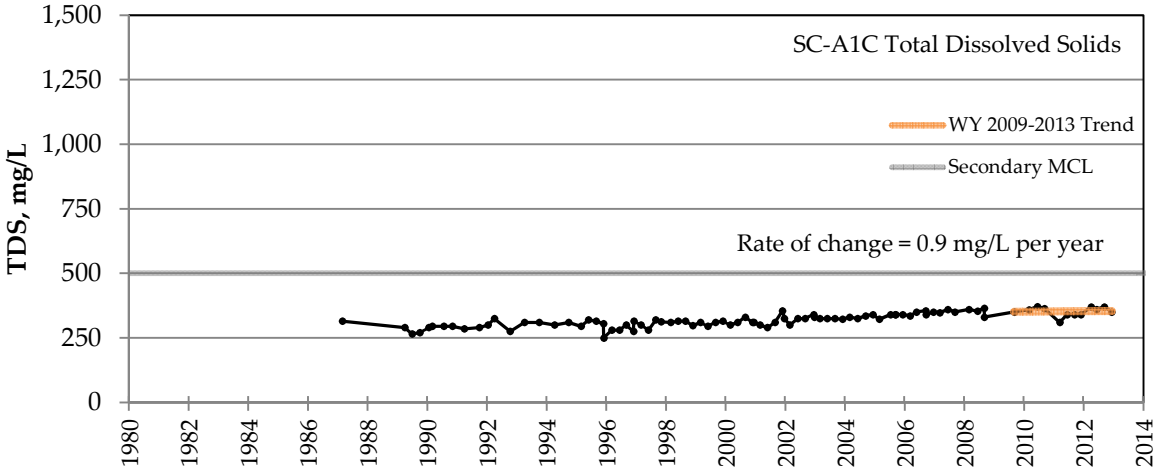

SC-A1A Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.1 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

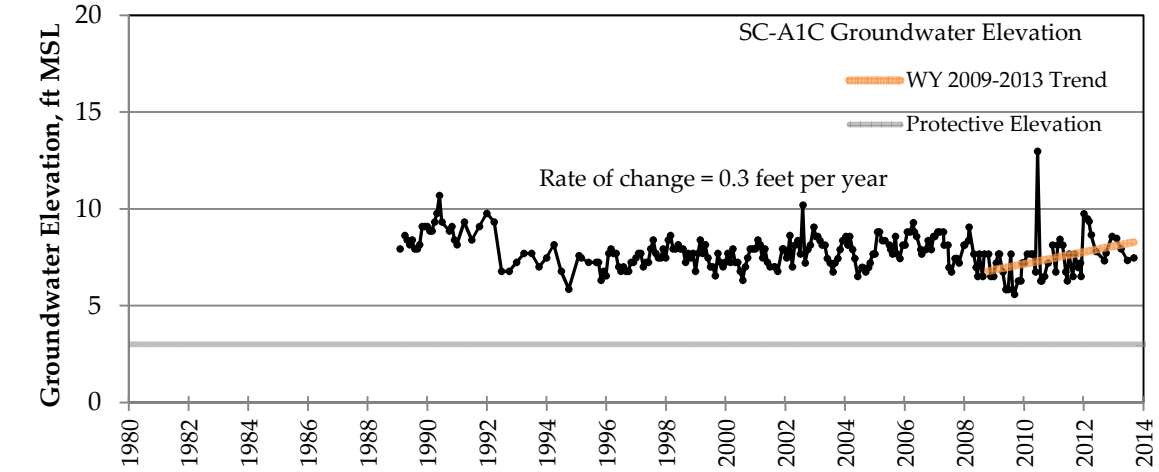

SC-A1A Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -3.6 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

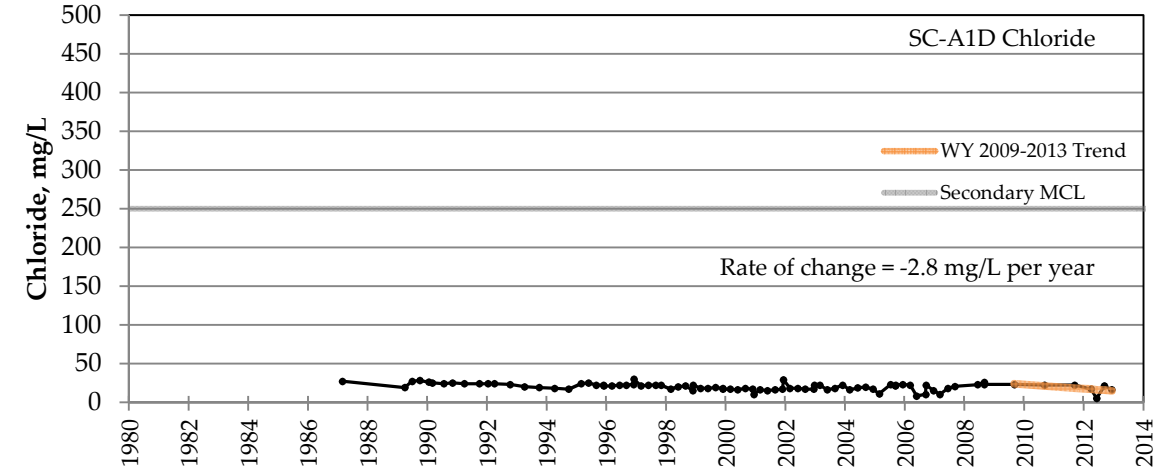

SC-A1A Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Protective Elevation
Rate of change = 0.4 feet per year
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

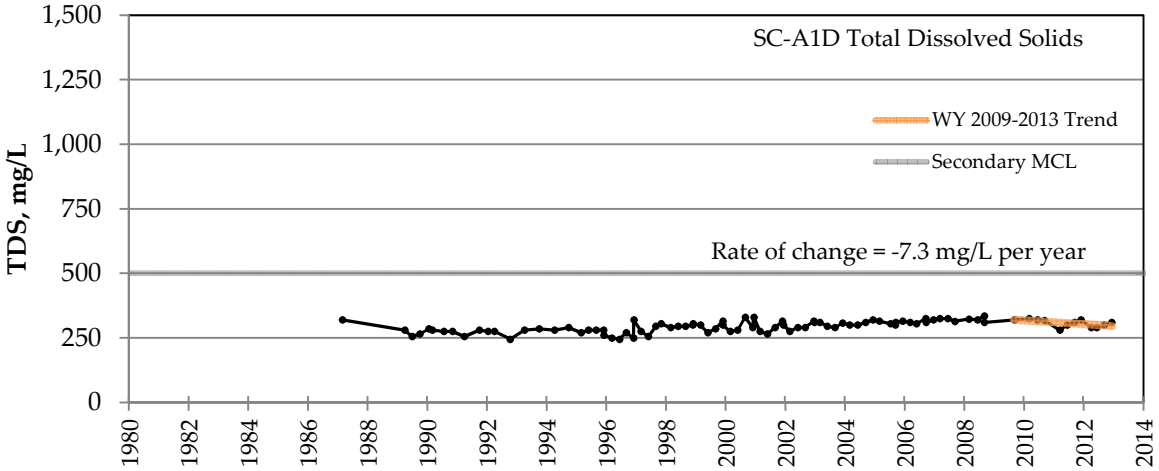

SC-A1B Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.5 mg/L per year
Data consistent with confirmed field tests since 2009 excluded
SC-A1B Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -7.7 mg/L per year
SC-A1B Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Protective Elevation
Rate of change = 1 feet per year

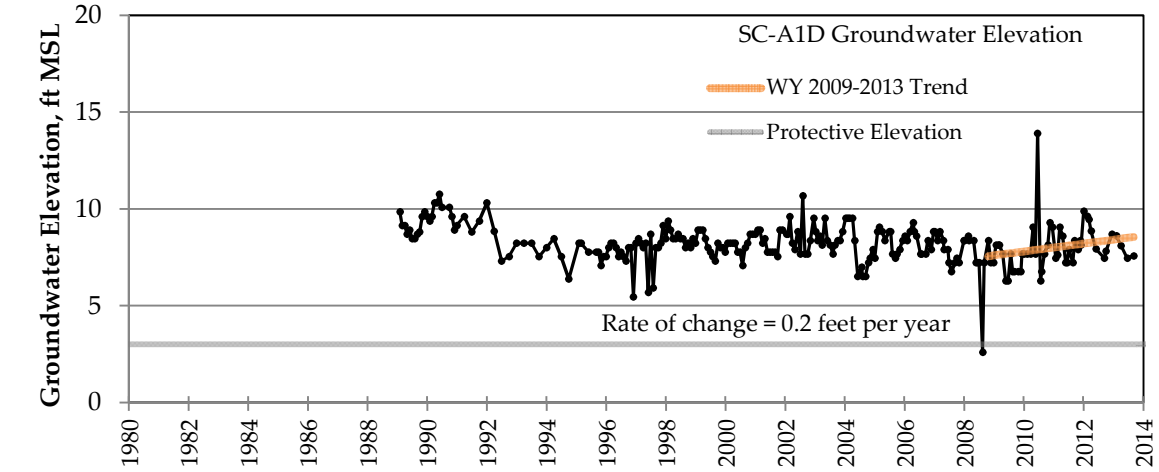

SC-A1C Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -2.4 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

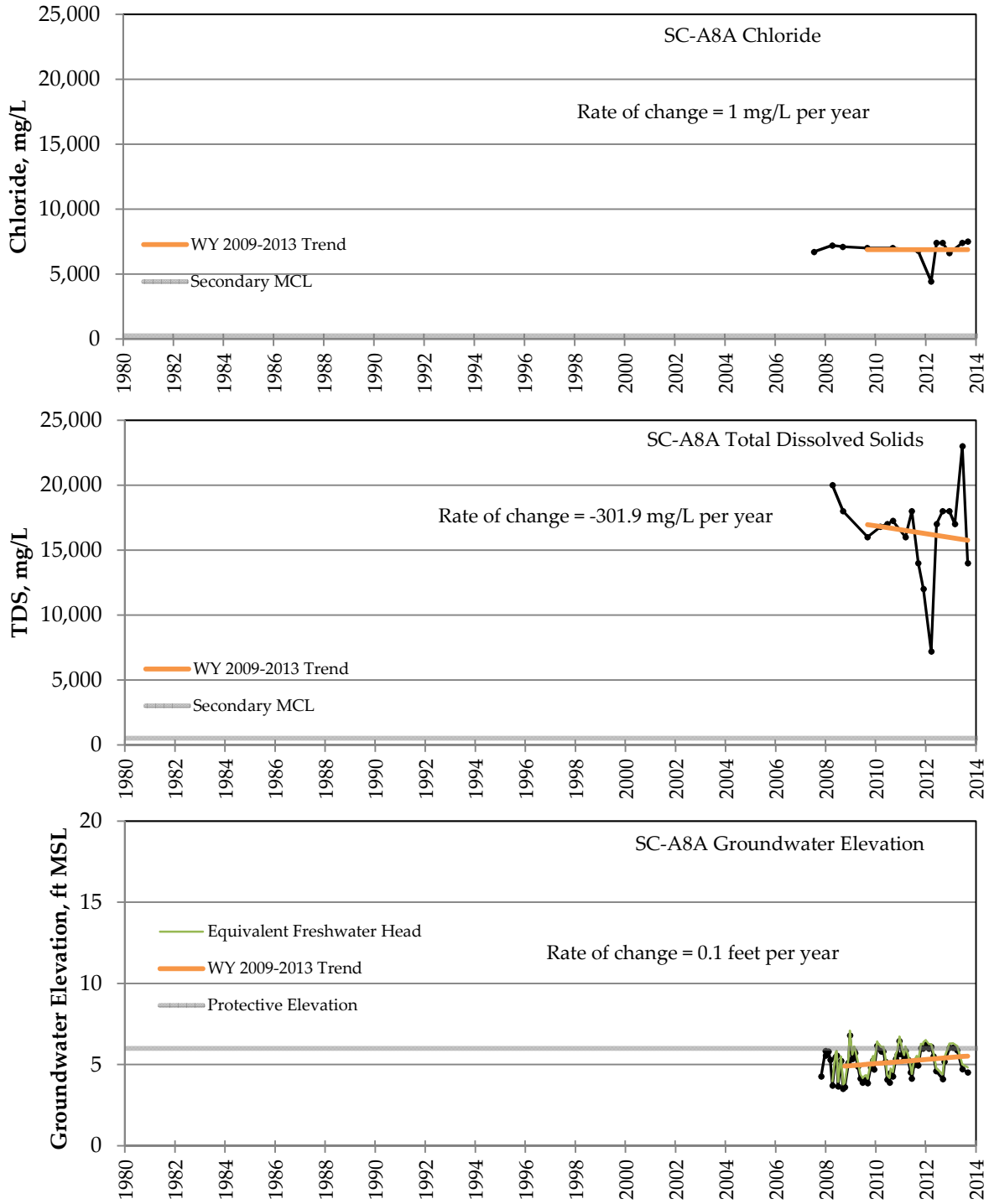

SC-A1C Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.9 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

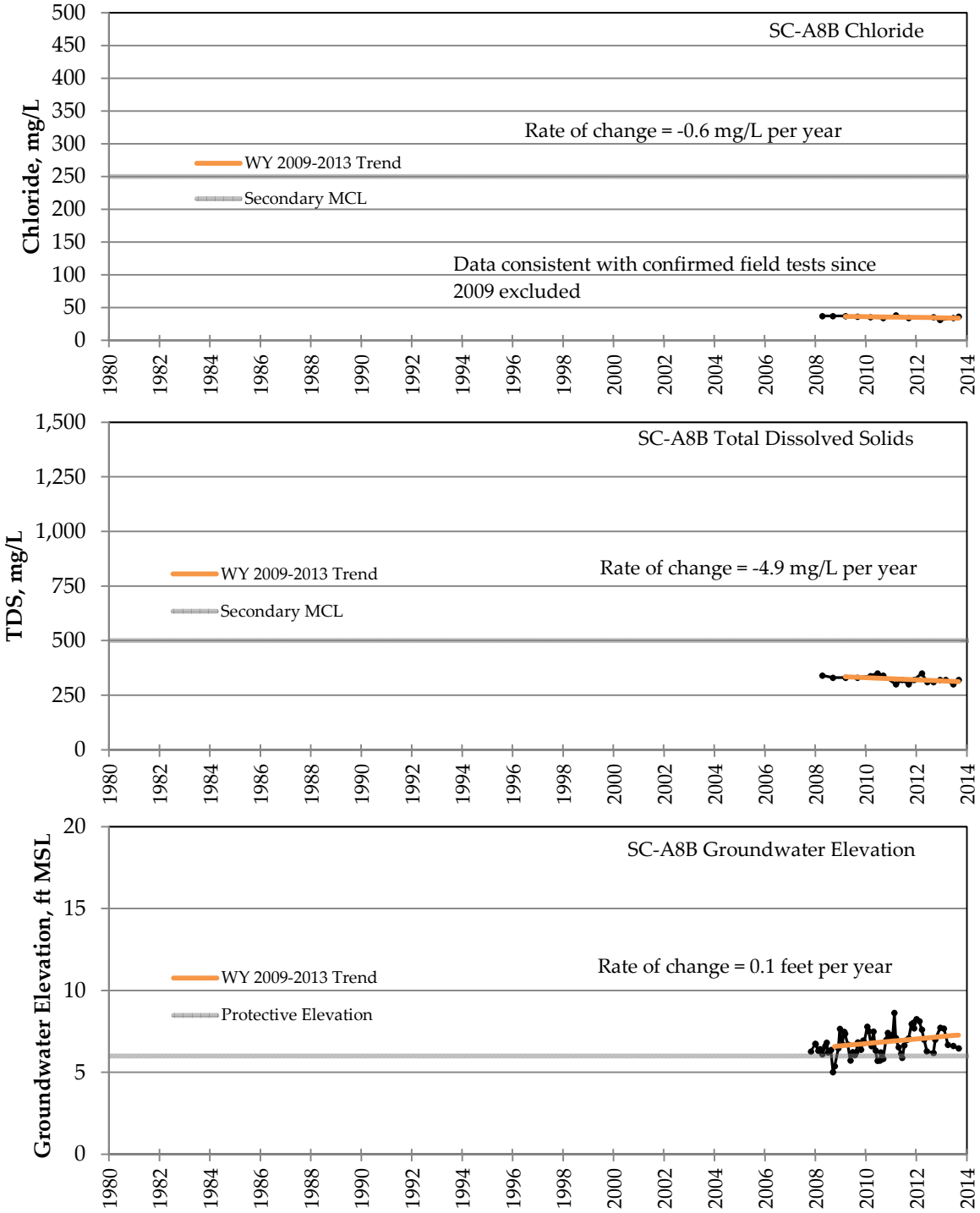

SC-A1C Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Protective Elevation
Rate of change = 0.3 feet per year
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

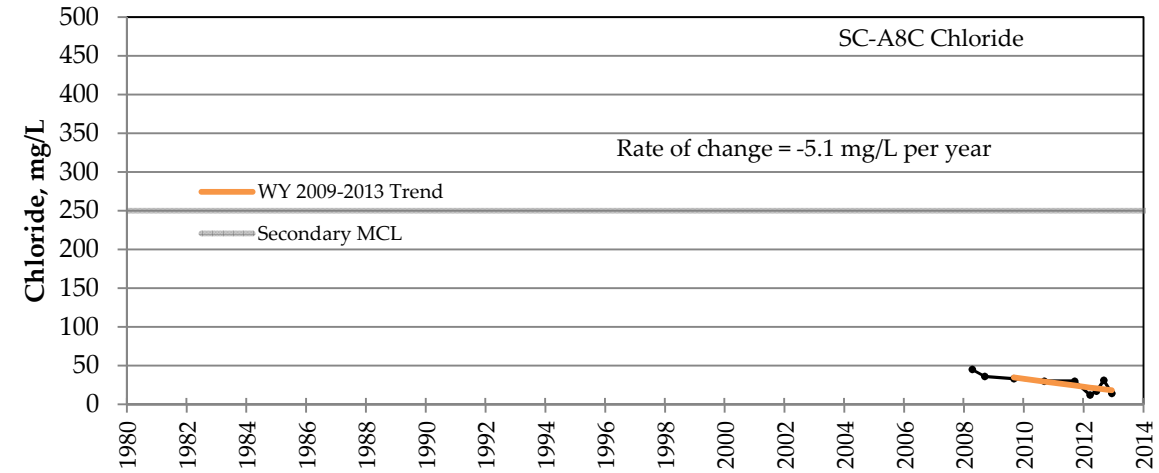

SC-A1D Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -2.8 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

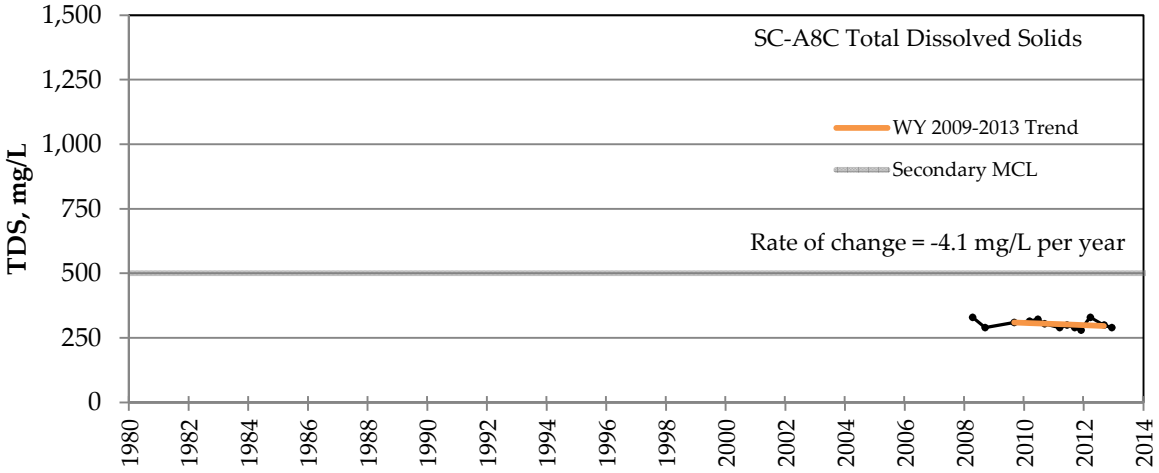

SC-A1D Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -7.3 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

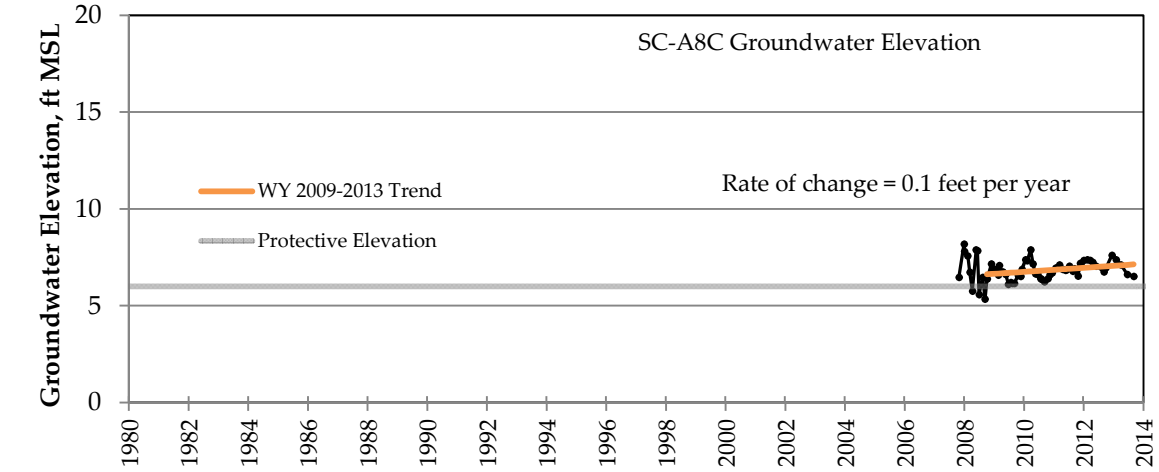

SC-A1D Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Protective Elevation
Rate of change = 0.2 feet per year
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

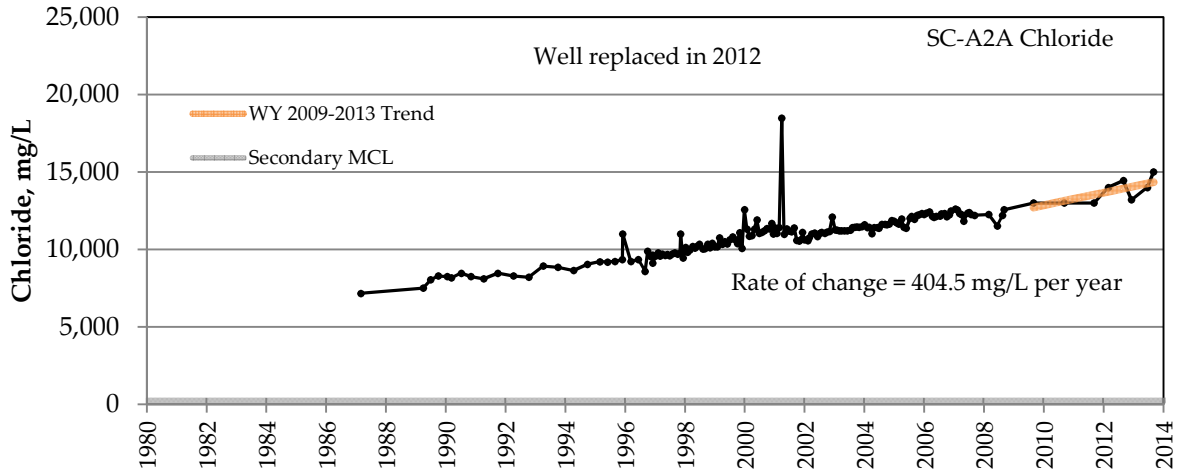

SC-A8A Chloride
Rate of change = 1 mg/L per year
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
SC-A8A Total Dissolved Solids
Rate of change = -301.9 mg/L per year
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
SC-A8A Groundwater Elevation
Rate of change = 0.1 feet per year
Groundwater Elevation, ft MSL
Equivalent Freshwater Head
WY 2009-2013 Trend
Protective Elevation

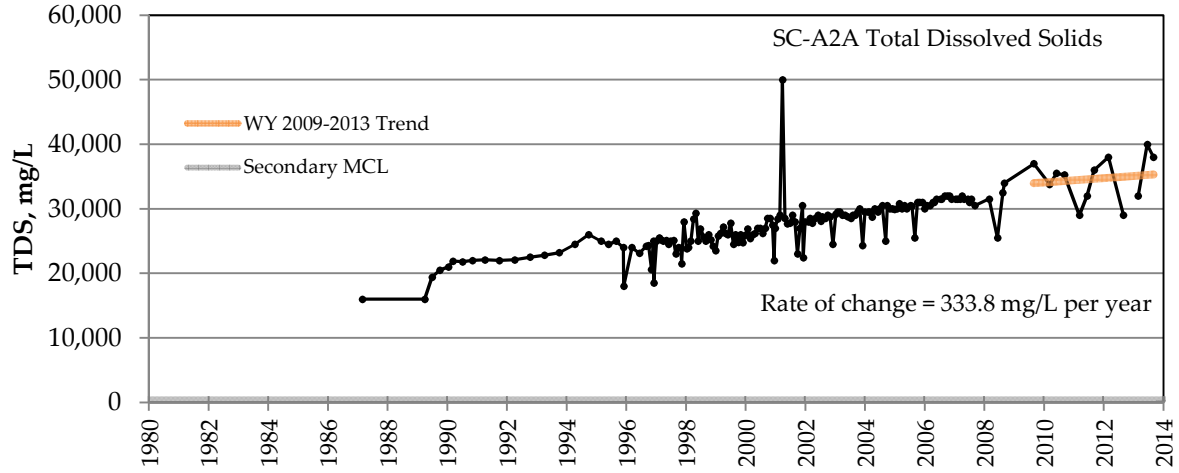

SC-A8B Chloride
Chloride, mg/L
Rate of change = -0.6 mg/L per year
WY 2009-2013 Trend
Secondary MCL
Data consistent with confirmed field tests since 2009 excluded
SC-A8B Total Dissolved Solids
TDS, mg/L
Rate of change = -4.9 mg/L per year
WY 2009-2013 Trend
Secondary MCL
SC-A8B Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.1 feet per year
WY 2009-2013 Trend
Protective Elevation

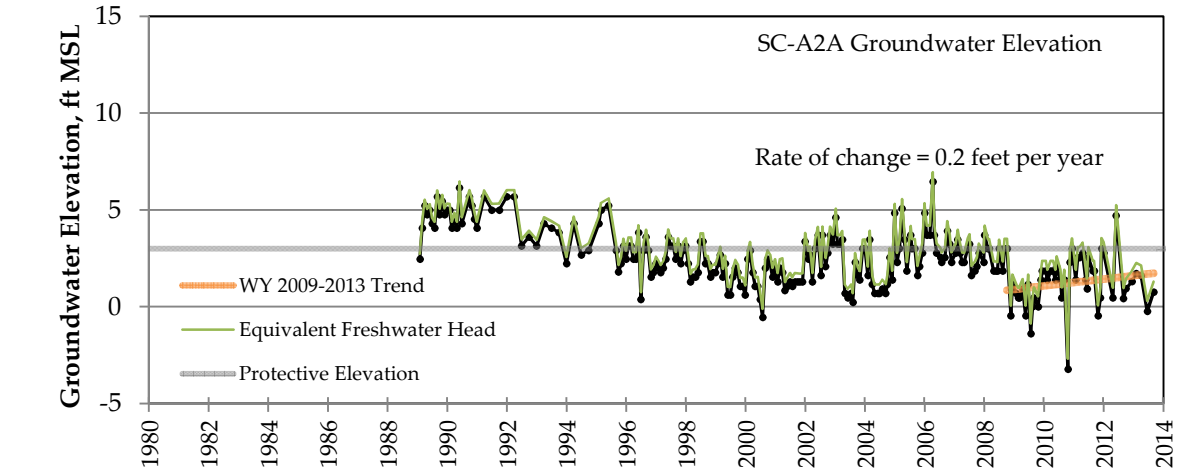

SC-A8C Chloride
Chloride, mg/L
Rate of change = -5.1 mg/L per year
WY 2009-2013 Trend
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

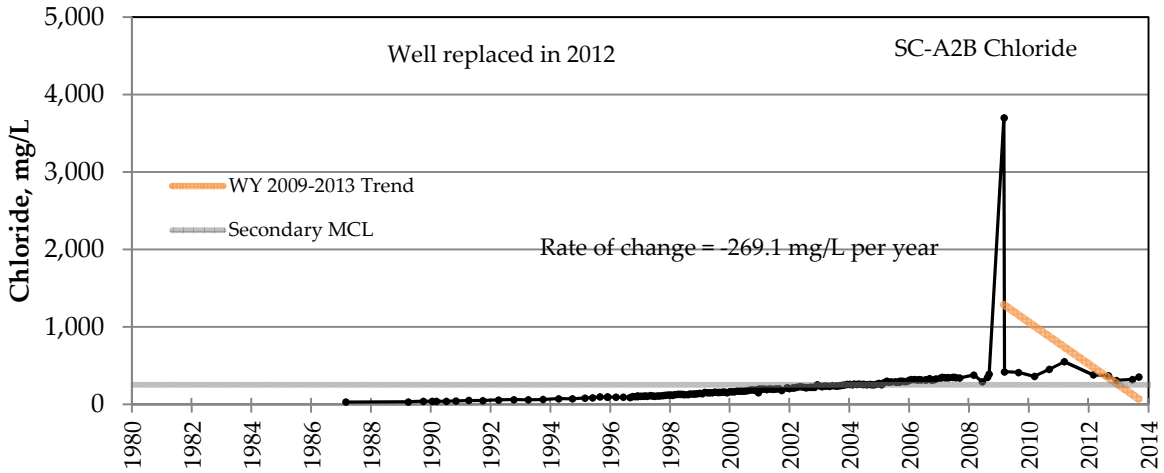

SC-A8C Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -4.1 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

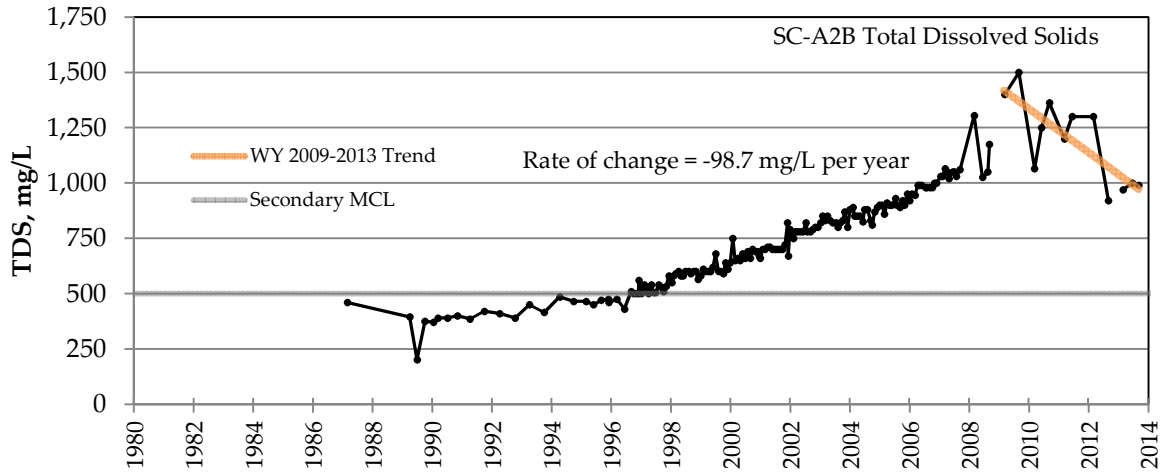

SC-A8C Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Protective Elevation
Rate of change = 0.1 feet per year
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

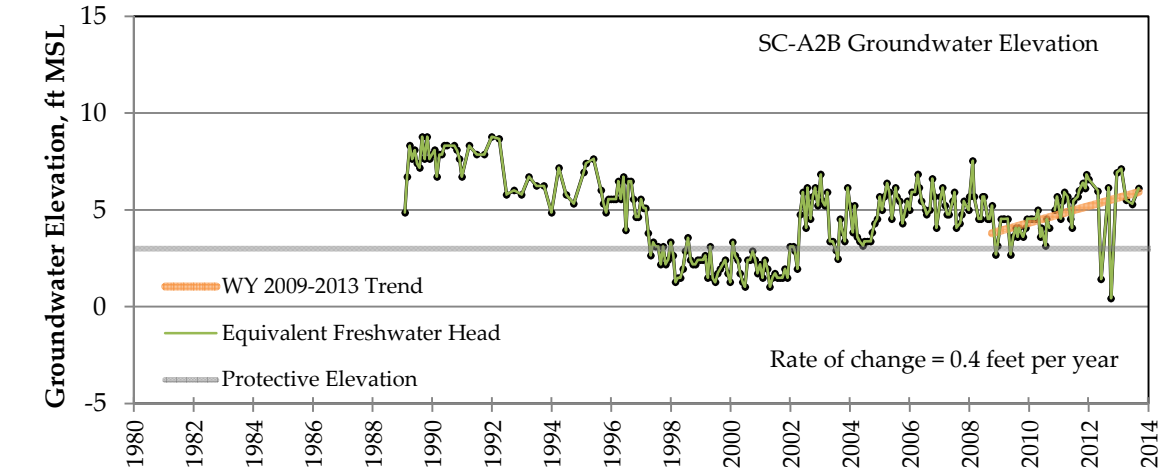

SC-A2A Chloride
Well replaced in 2012
WY 2009-2013 Trend
Secondary MCL
Rate of change = 404.5 mg/L per year
Chloride, mg/L
25,000
20,000
15,000
10,000
5,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

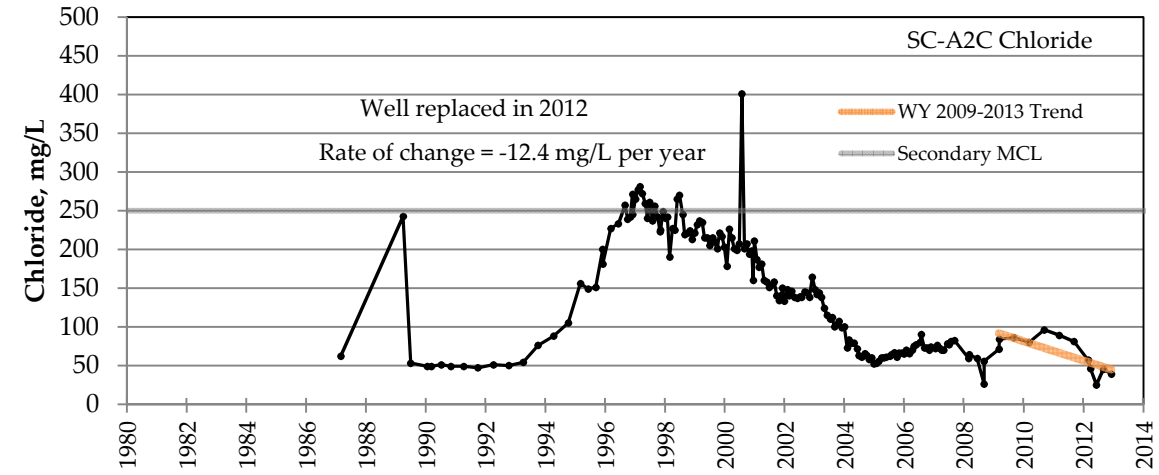

SC-A2A Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 333.8 mg/L per year
TDS, mg/L
60,000
50,000
40,000
30,000
20,000
10,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

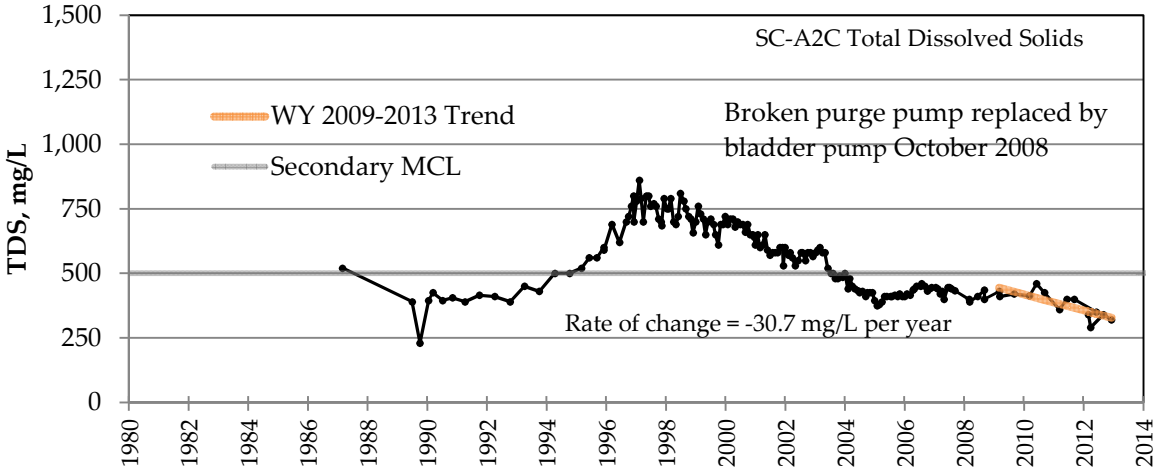

SC-A2A Groundwater Elevation
Rate of change = 0.2 feet per year
WY 2009-2013 Trend
Equivalent Freshwater Head
Protective Elevation
Groundwater Elevation, ft MSL
15
10
5
0
-5
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

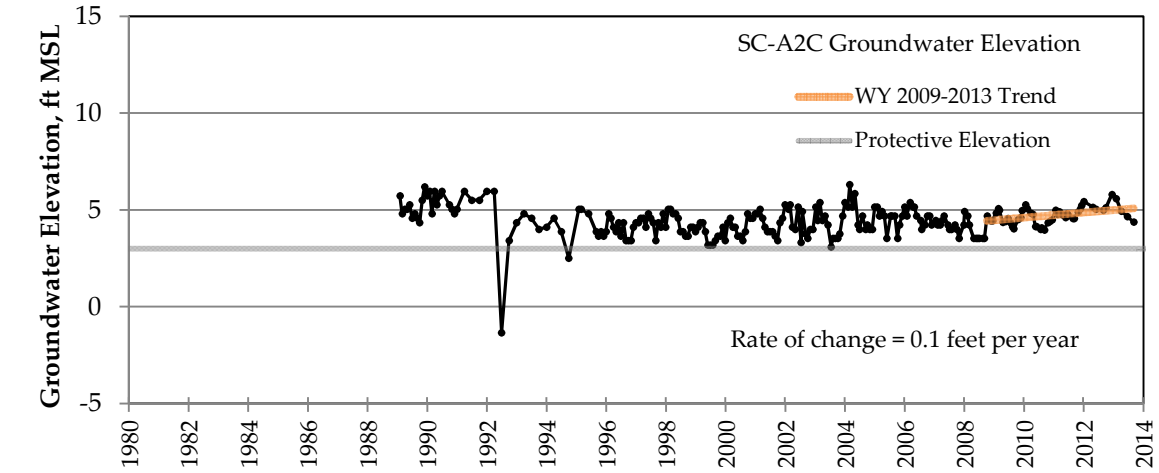

Well replaced in 2012
SC-A2B Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -269.1 mg/L per year
5,000
4,000
3,000
2,000
1,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

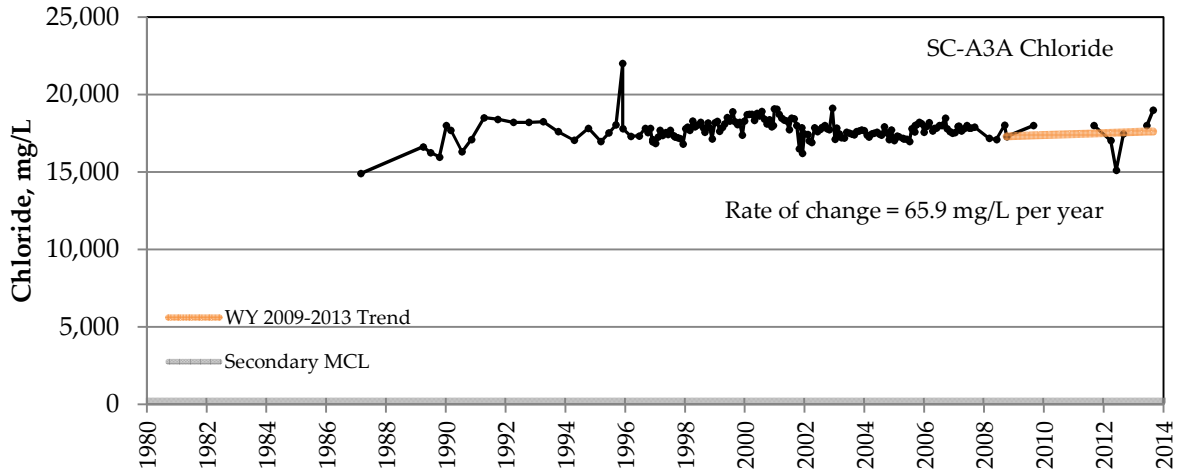

SC-A2B Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -98.7 mg/L per year
1,750
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

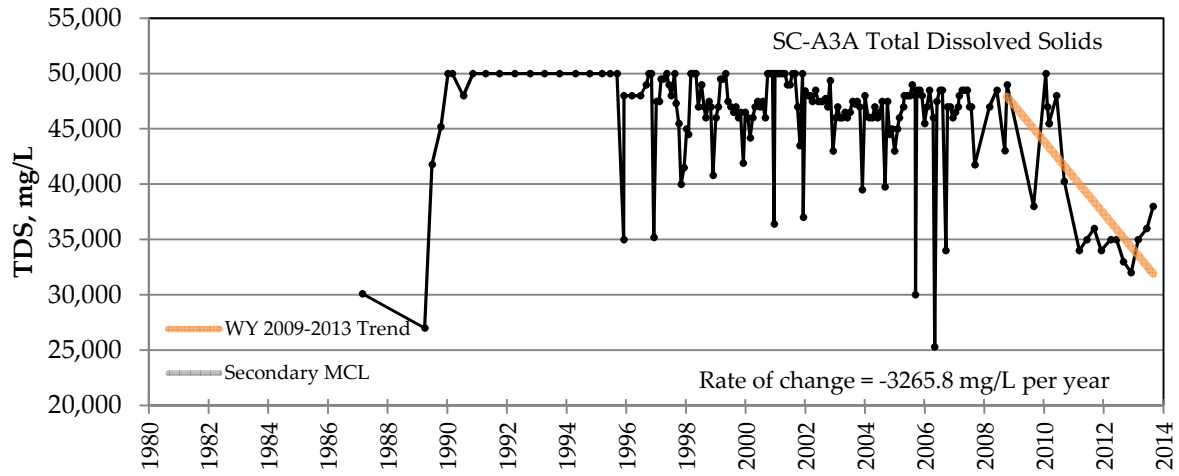

SC-A2B Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Equivalent Freshwater Head
Protective Elevation
Rate of change = 0.4 feet per year
15
10
5
0
-5
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

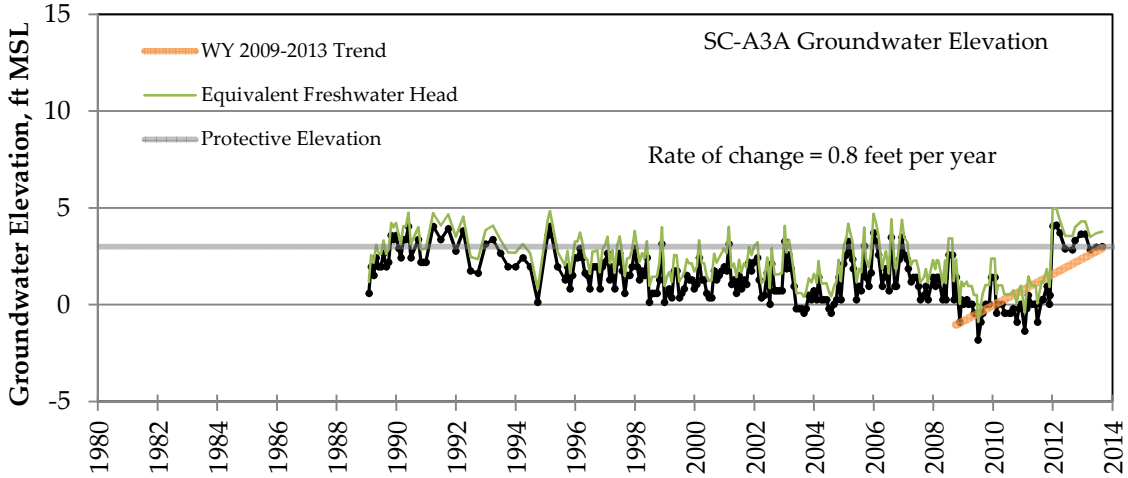

SC-A2C Chloride
Well replaced in 2012
Rate of change = -12.4 mg/L per year
WY 2009-2013 Trend
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

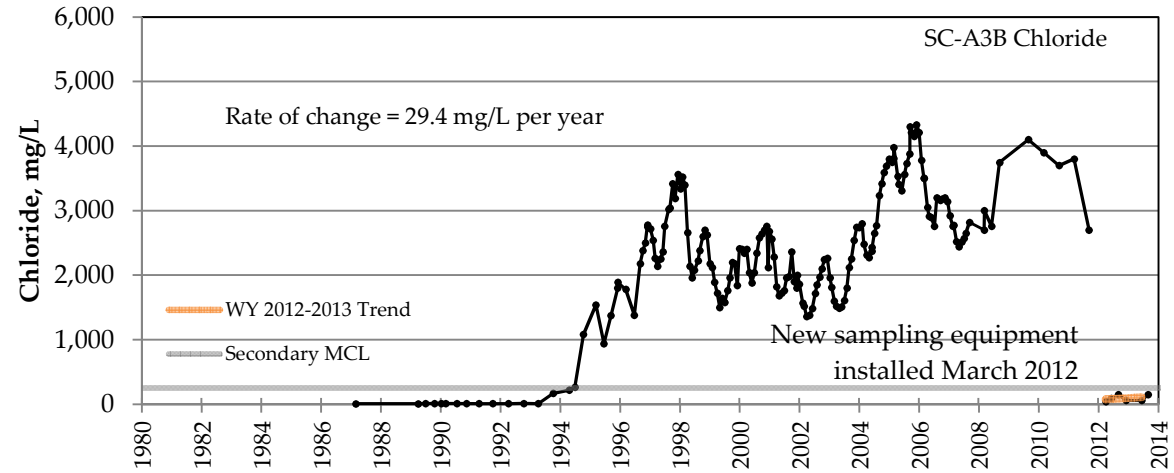

SC-A2C Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Broken purge pump replaced by bladder pump October 2008
Rate of change = -30.7 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

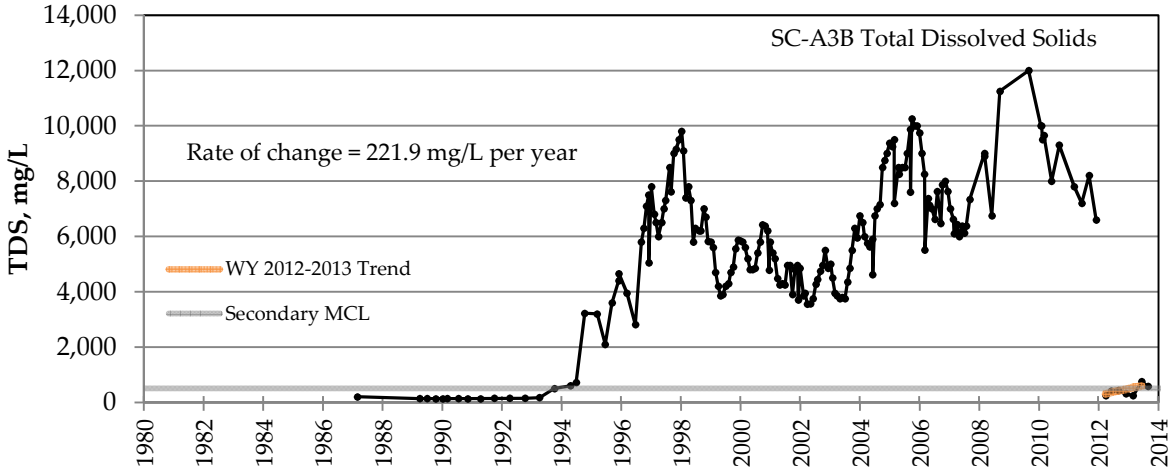

SC-A2C Groundwater Elevation
WY 2009-2013 Trend
Protective Elevation
Rate of change = 0.1 feet per year
Groundwater Elevation, ft MSL
15
10
5
0
-5
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

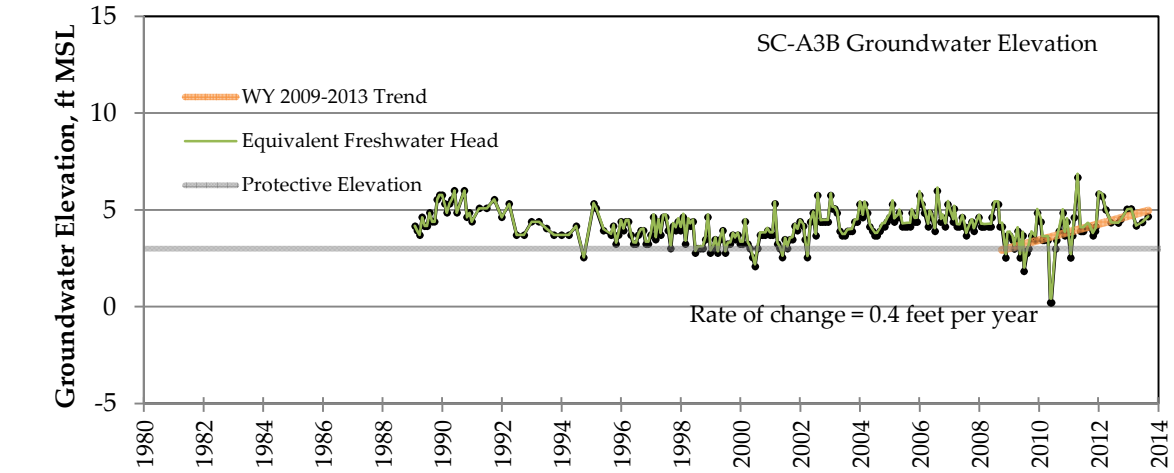

SC-A3A Chloride
Chloride, mg/L
25,000
20,000
15,000
10,000
5,000
0
Rate of change = 65.9 mg/L per year
WY 2009-2013 Trend
Secondary MCL
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

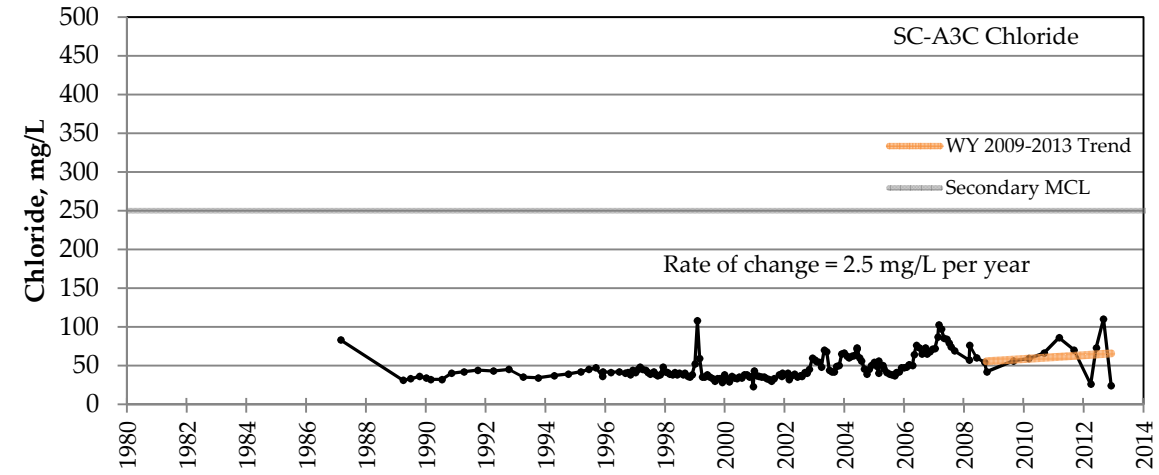

SC-A3A Total Dissolved Solids
TDS, mg/L
55,000
50,000
45,000
40,000
35,000
30,000
25,000
20,000
WY 2009-2013 Trend
Secondary MCL
Rate of change = -3265.8 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

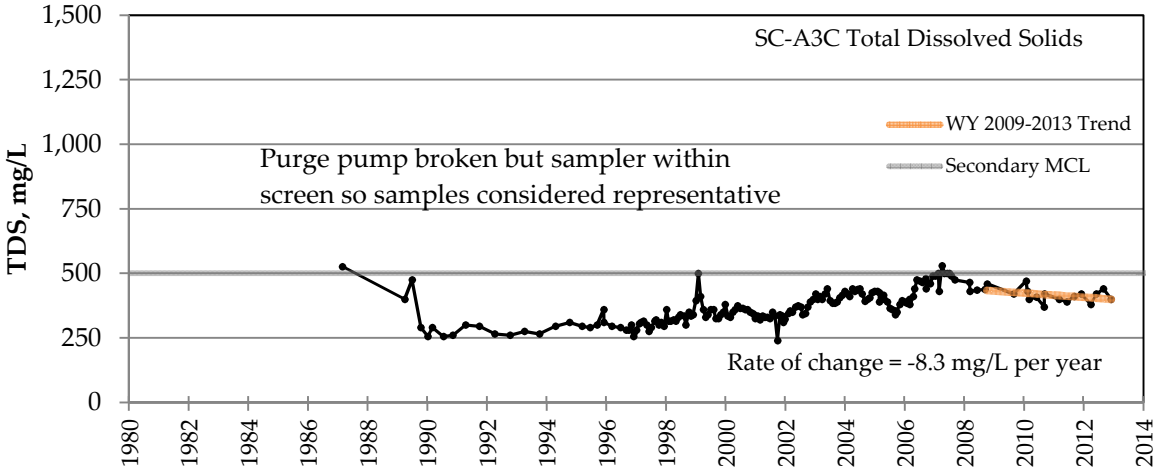

SC-A3A Groundwater Elevation
Groundwater Elevation, ft MSL
15
10
5
0
-5
WY 2009-2013 Trend
Equivalent Freshwater Head
Protective Elevation
Rate of change = 0.8 feet per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

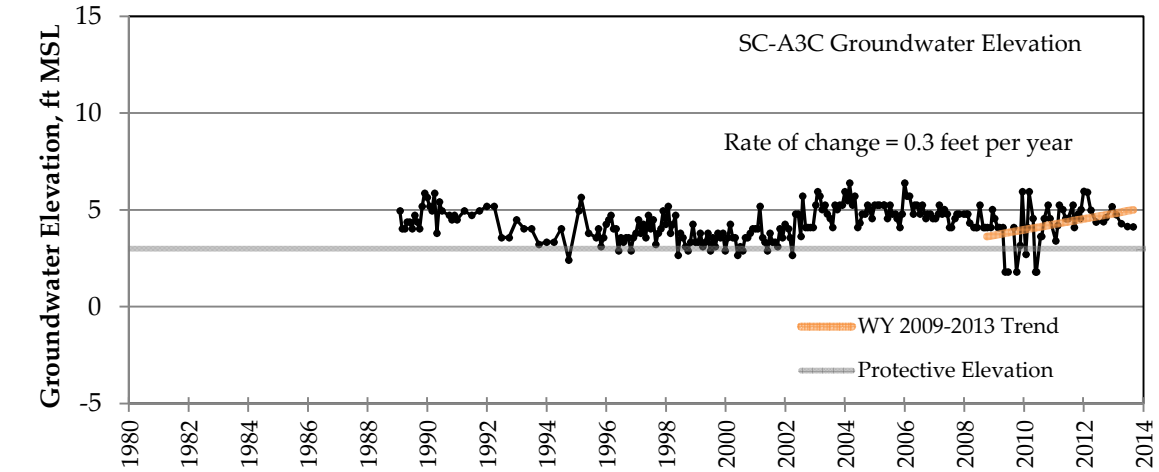

SC-A3B Chloride
Rate of change = 29.4 mg/L per year
WY 2012-2013 Trend
Secondary MCL
New sampling equipment
installed March 2012
Chloride, mg/L
6,000
5,000
4,000
3,000
2,000
1,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

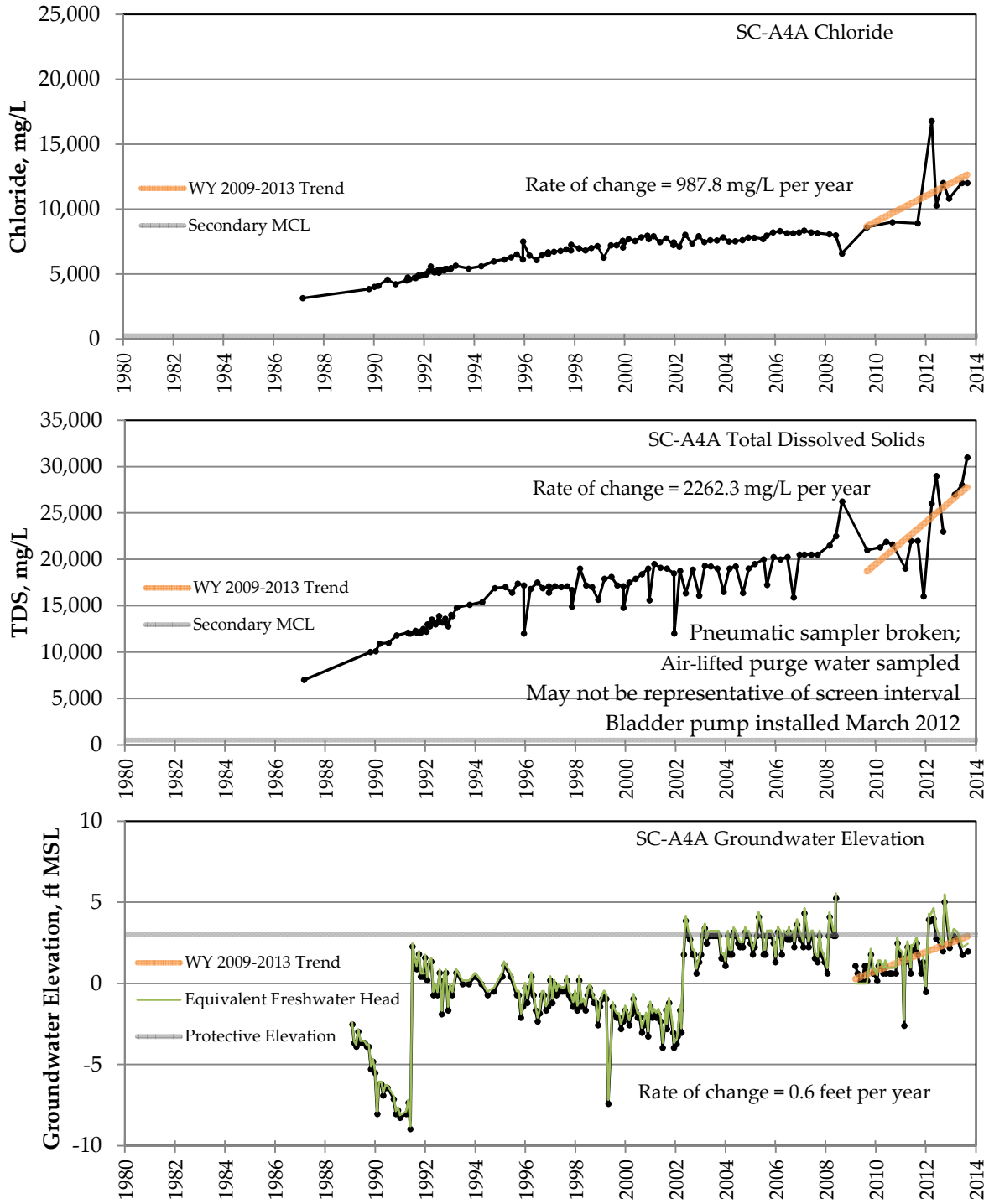

SC-A3B Total Dissolved Solids
Rate of change = 221.9 mg/L per year
WY 2012-2013 Trend
Secondary MCL
TDS, mg/L
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

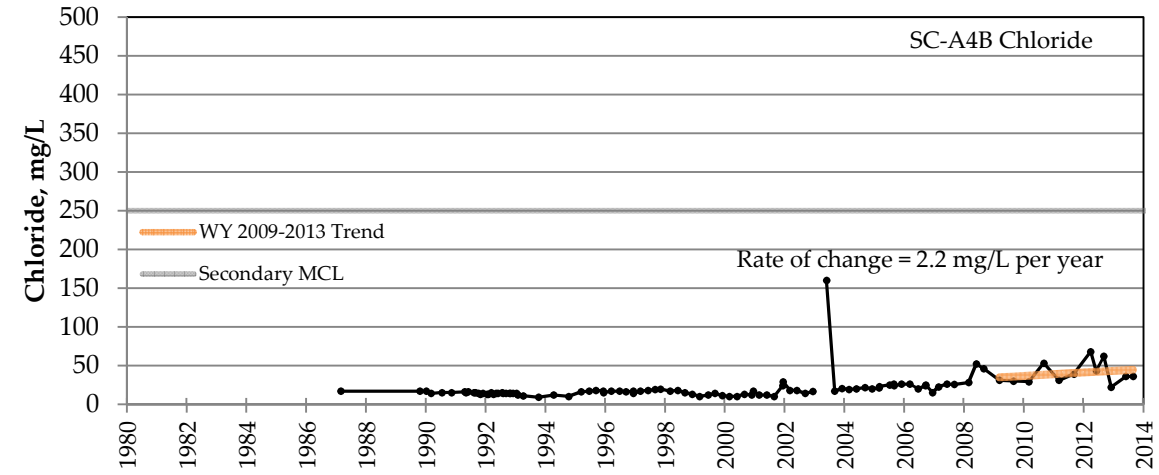

SC-A3B Groundwater Elevation
WY 2009-2013 Trend
Equivalent Freshwater Head
Protective Elevation
Rate of change = 0.4 feet per year
Groundwater Elevation, ft MSL
15
10
5
0
-5
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

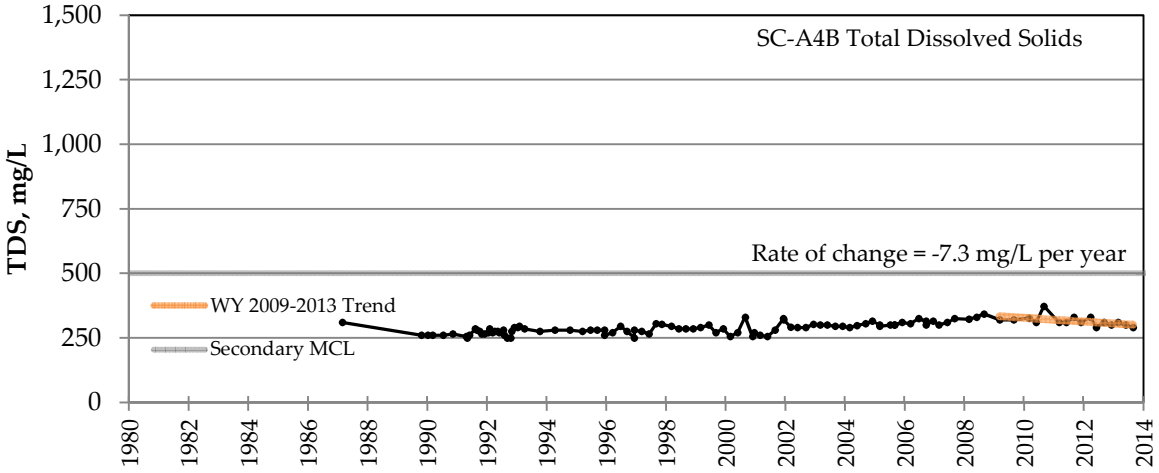

SC-A3C Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 2.5 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

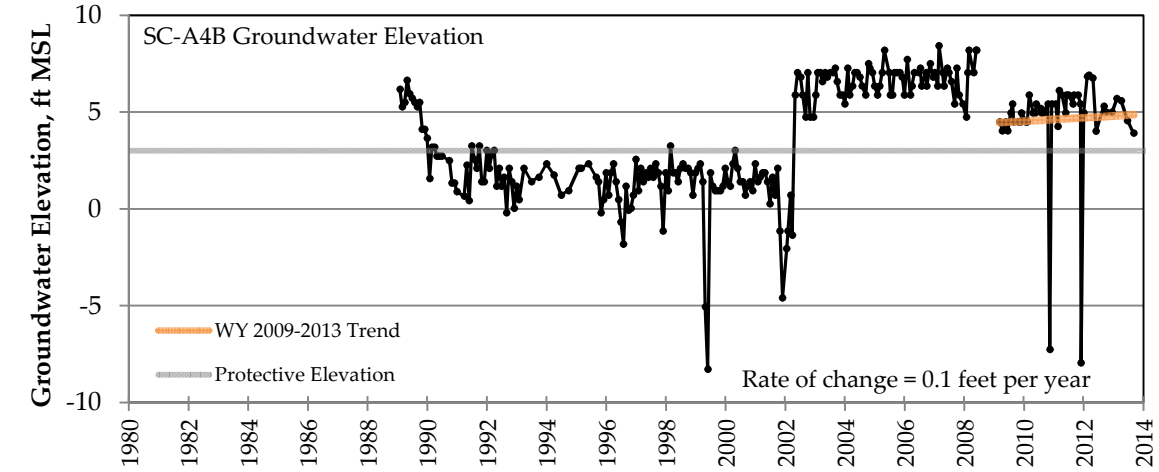

SC-A3C Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Purge pump broken but sampler within screen so samples considered representative
Rate of change = -8.3 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

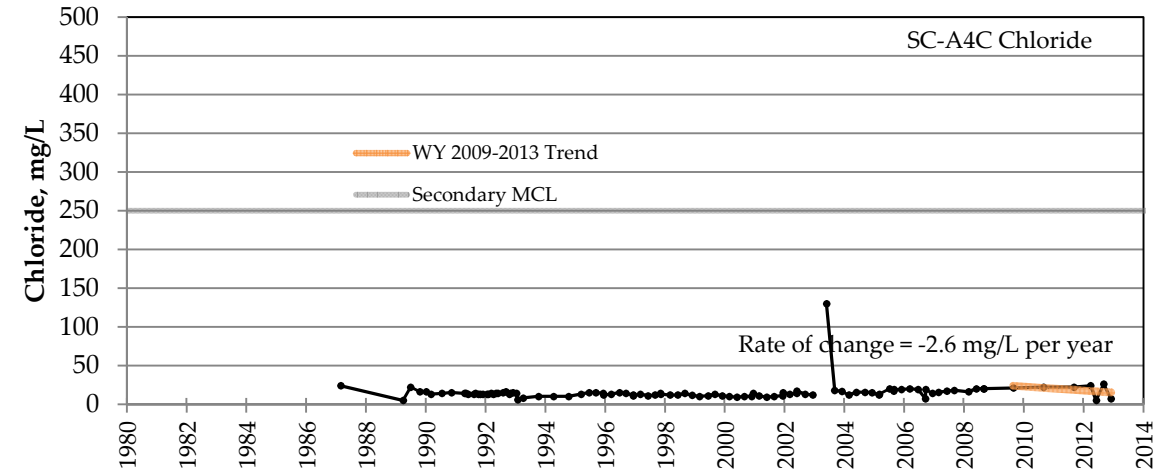

SC-A3C Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.3 feet per year
WY 2009-2013 Trend
Protective Elevation
15
10
5
0
-5
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

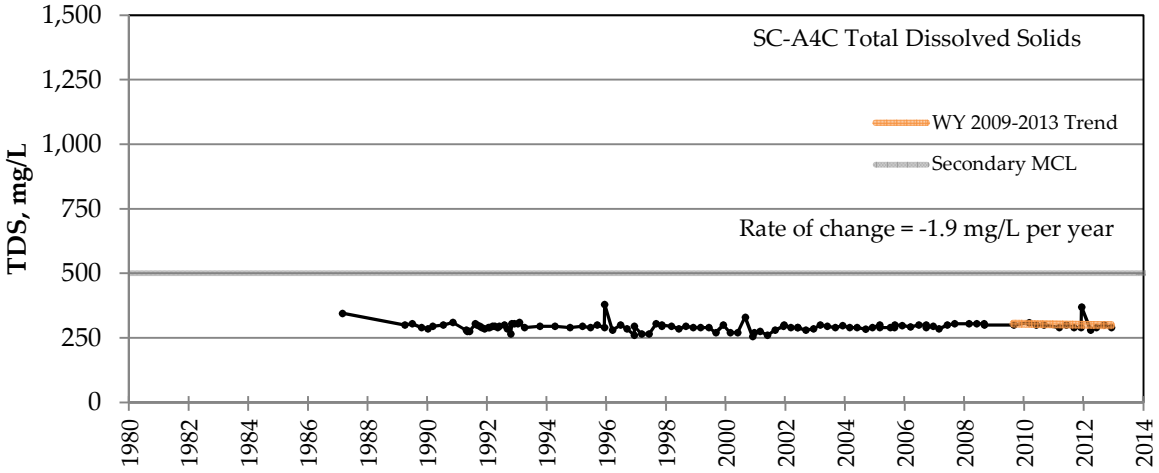

SC-A4A Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 987.8 mg/L per year
SC-A4A Total Dissolved Solids
TDS, mg/L
Rate of change = 2262.3 mg/L per year
Pneumatic sampler broken;
Air-lifted purge water sampled
May not be representative of screen interval
Bladder pump installed March 2012
SC-A4A Groundwater Elevation
Groundwater Elevation, ft MSL
Equivalent Freshwater Head
Protective Elevation
Rate of change = 0.6 feet per year

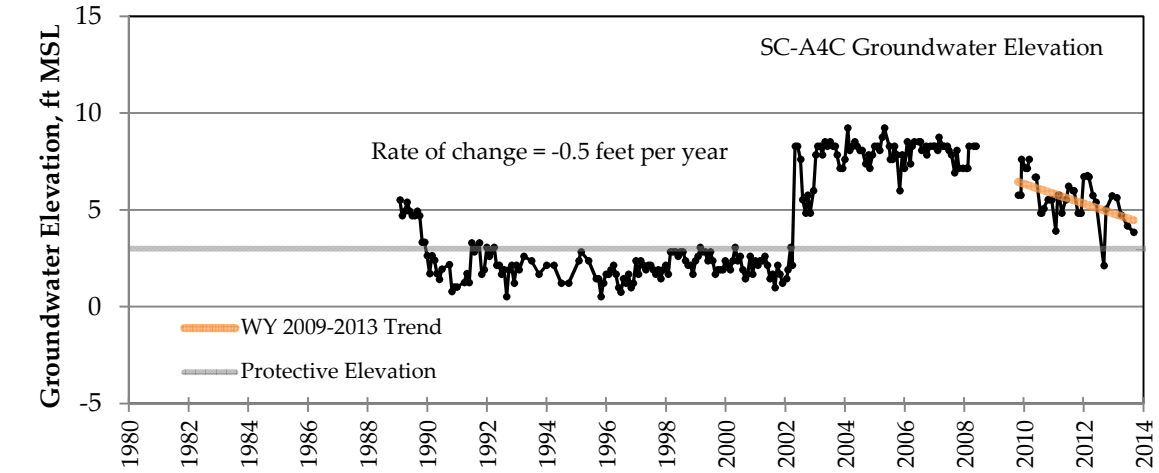

SC-A4B Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
WY 2009-2013 Trend
Secondary MCL
Rate of change = 2.2 mg/L per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

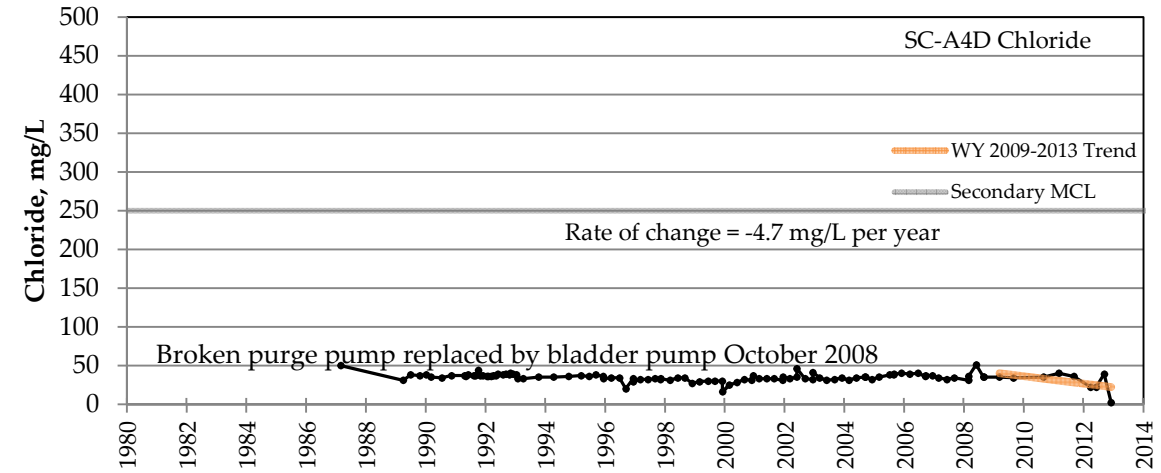

SC-A4B Total Dissolved Solids
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Rate of change = -7.3 mg/L per year
WY 2009-2013 Trend
Secondary MCL
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

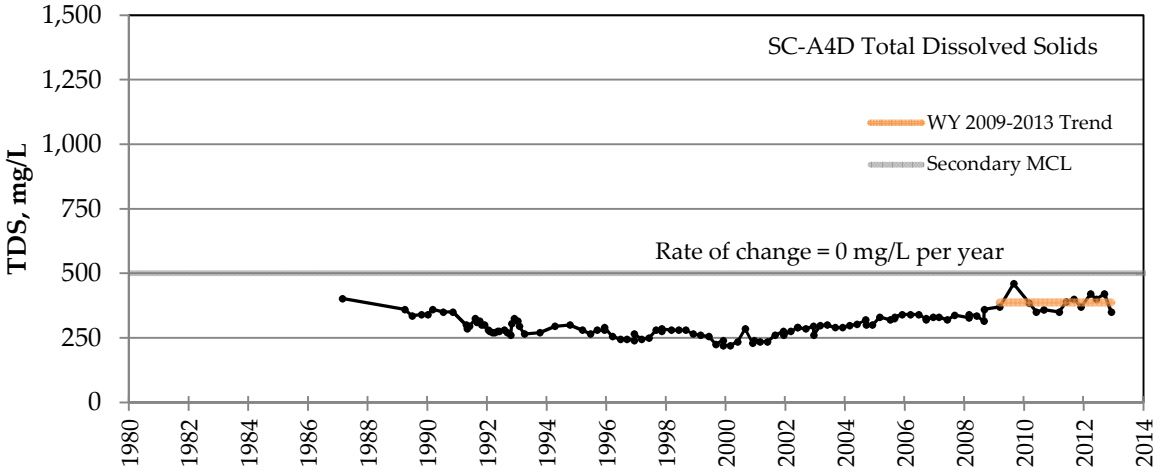

SC-A4B Groundwater Elevation
Groundwater Elevation, ft MSL
10
5
0
-5
-10
WY 2009-2013 Trend
Protective Elevation
Rate of change = 0.1 feet per year
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

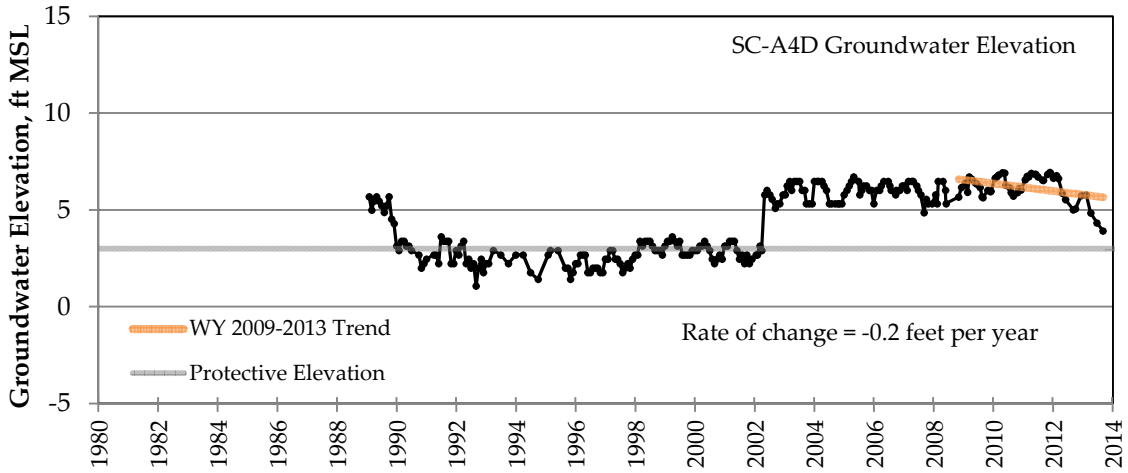

SC-A4C Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -2.6 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

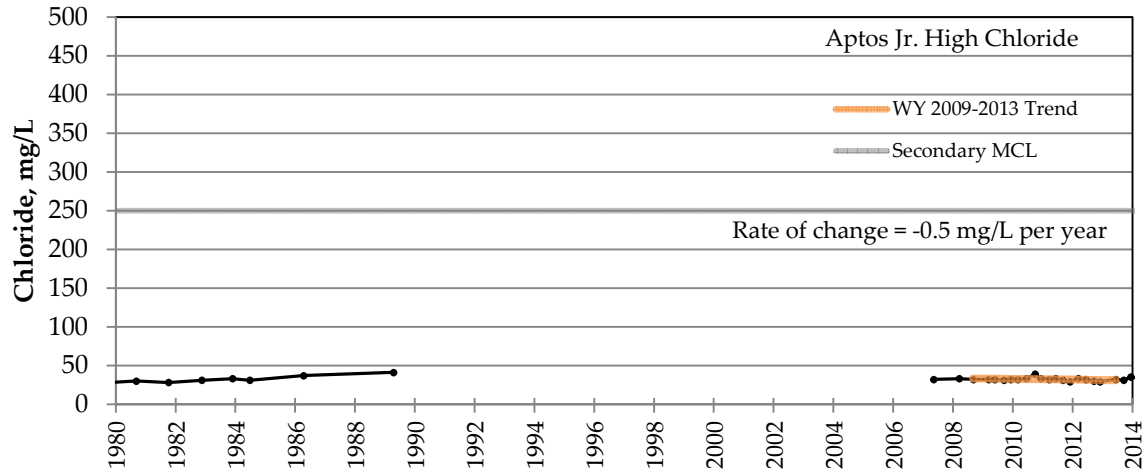

SC-A4C Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -1.9 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

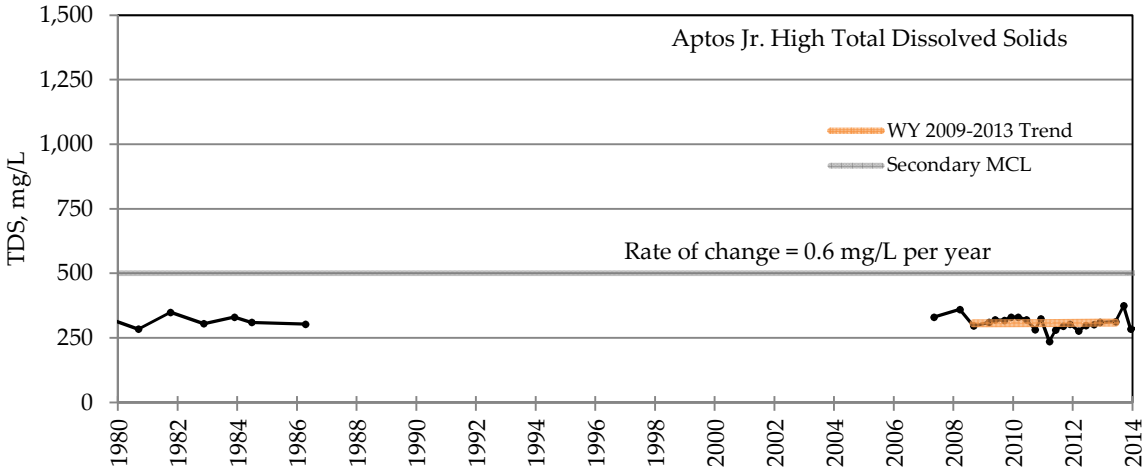

SC-A4C Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.5 feet per year
WY 2009-2013 Trend
Protective Elevation
15
10
5
0
-5
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

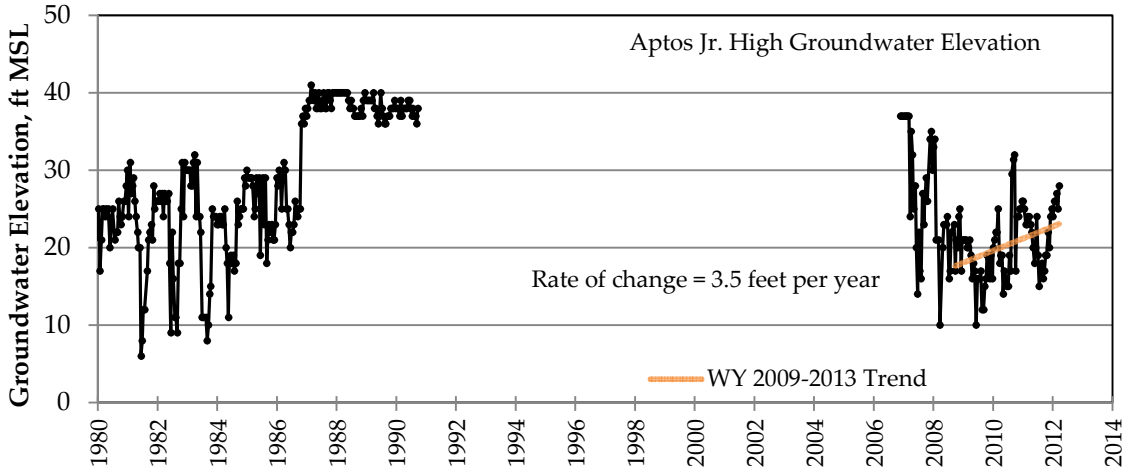

SC-A4D Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -4.7 mg/L per year
Broken purge pump replaced by bladder pump October 2008
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

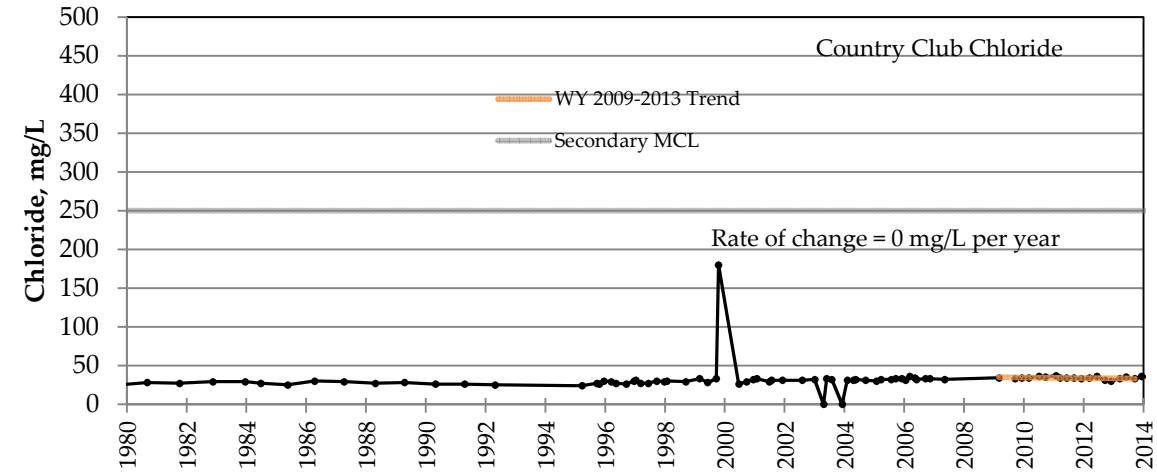

SC-A4D Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

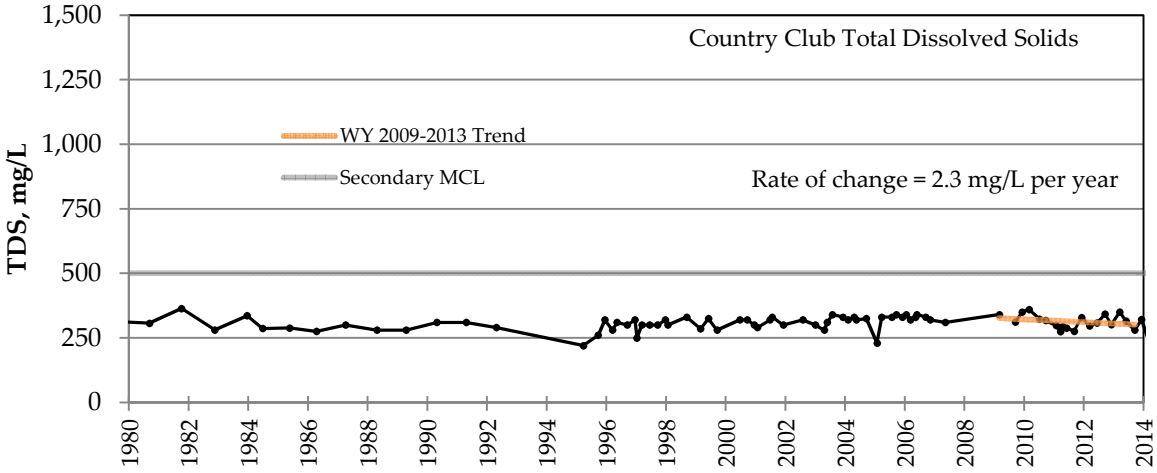

SC-A4D Groundwater Elevation
Groundwater Elevation, ft MSL
WY 2009-2013 Trend
Protective Elevation
Rate of change = -0.2 feet per year
15
10
5
0
-5
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

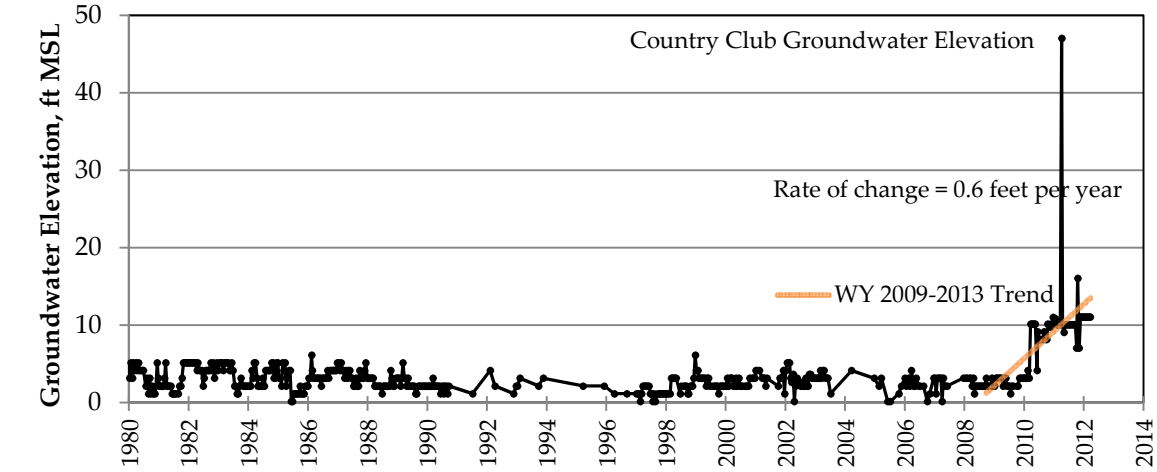

Aptos Jr. High Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.5 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

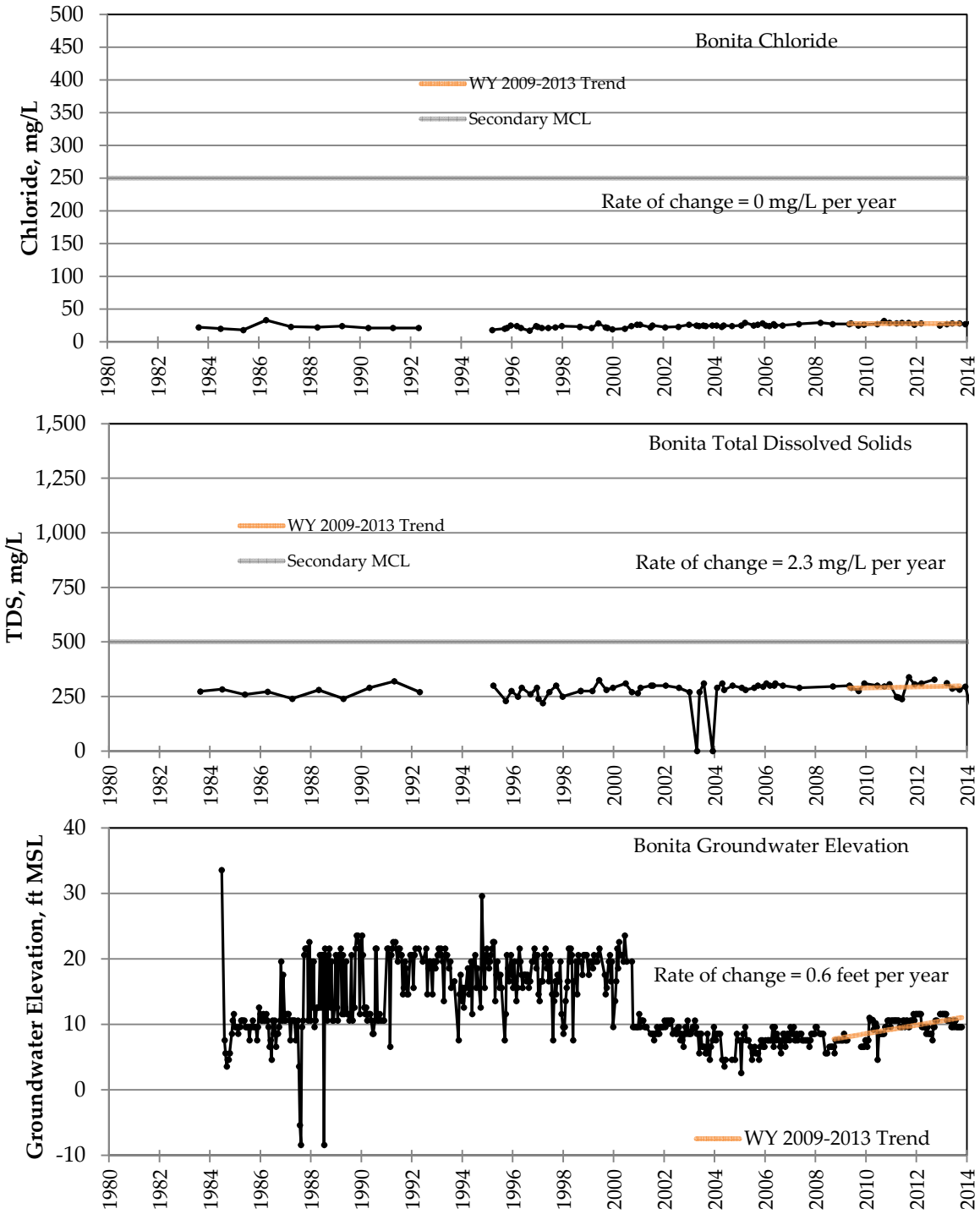

Aptos Jr. High Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.6 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

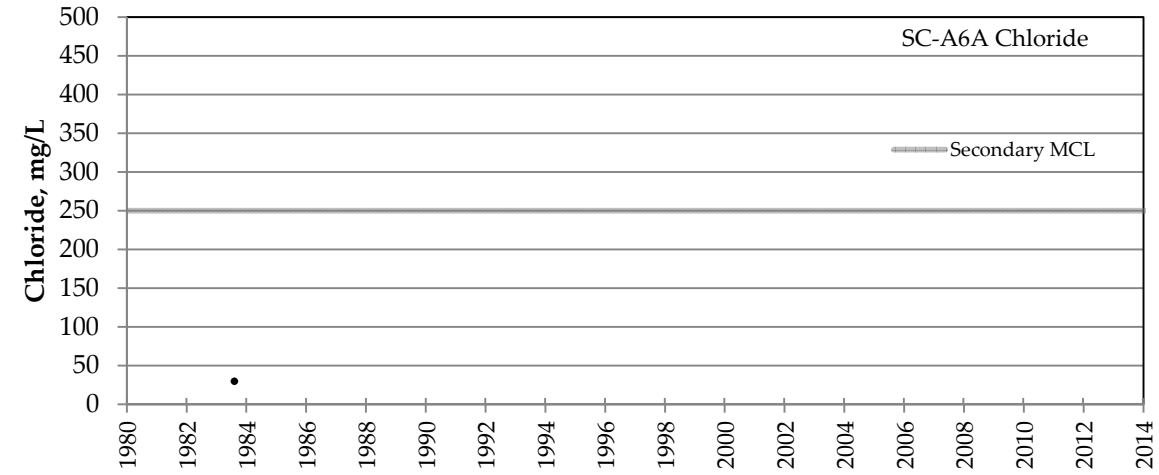

Aptos Jr. High Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 3.5 feet per year
WY 2009-2013 Trend
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

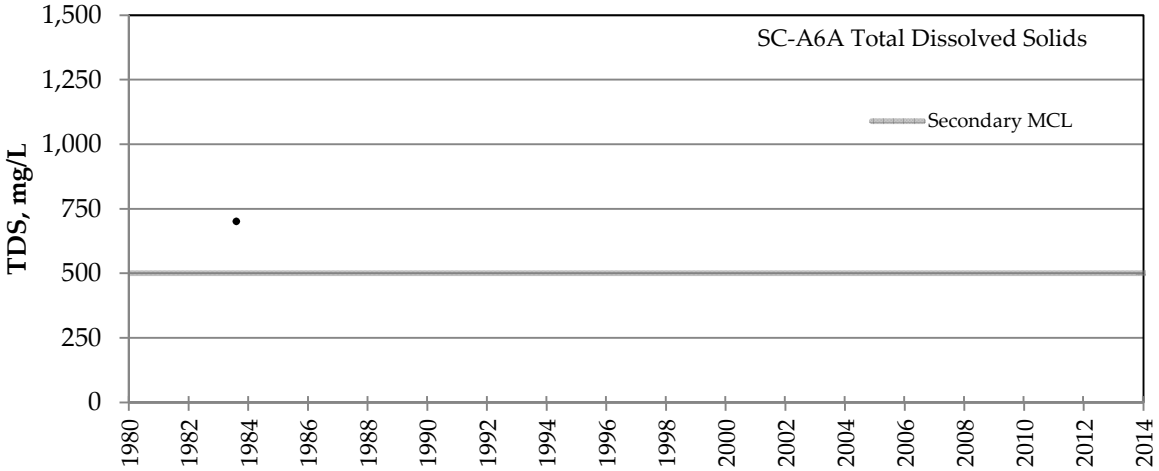

Country Club Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

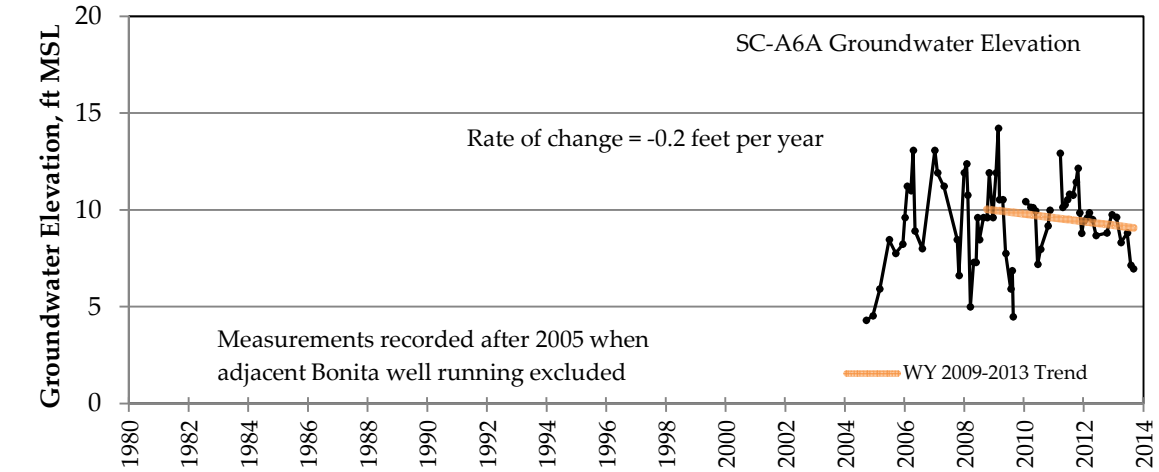

Country Club Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 2.3 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

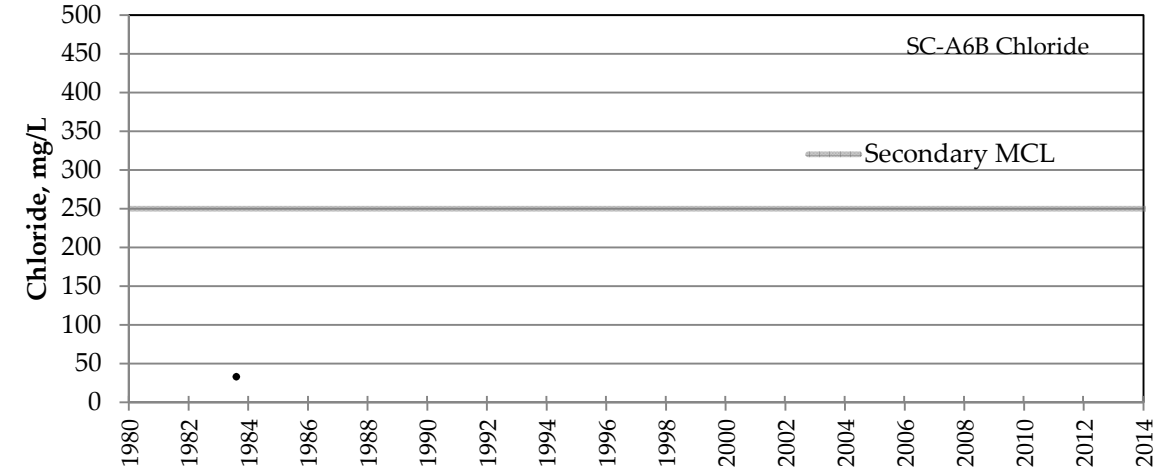

Country Club Groundwater Elevation
Rate of change = 0.6 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

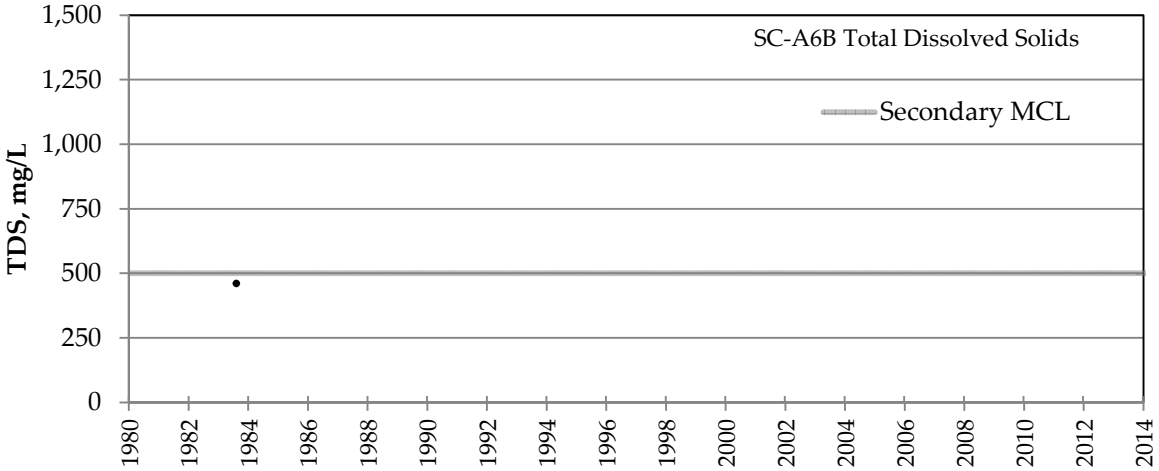

Bonita Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Bonita Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 2.3 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Bonita Groundwater Elevation
Rate of change = 0.6 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
40
30
20
10
0
-10

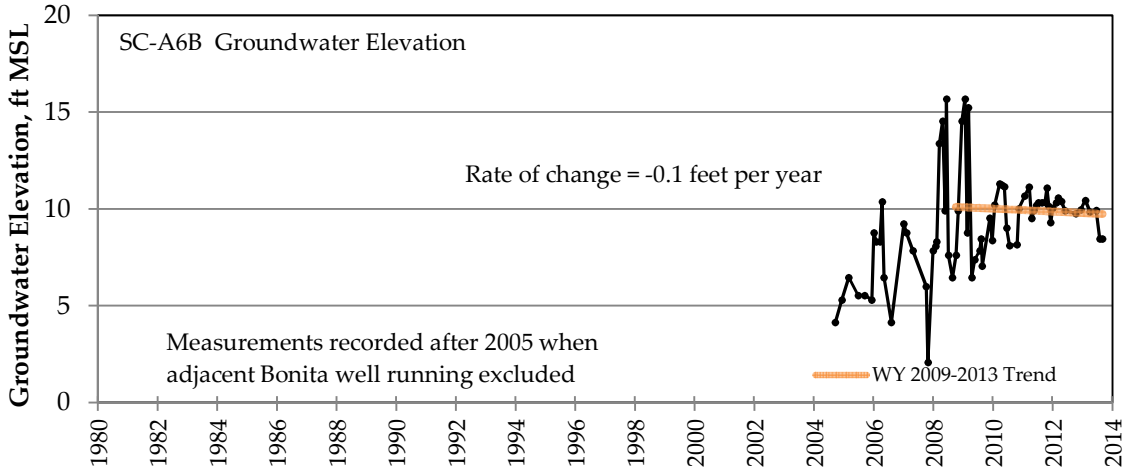

SC-A6A Chloride
Chloride, mg/L
Secondary MCL
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

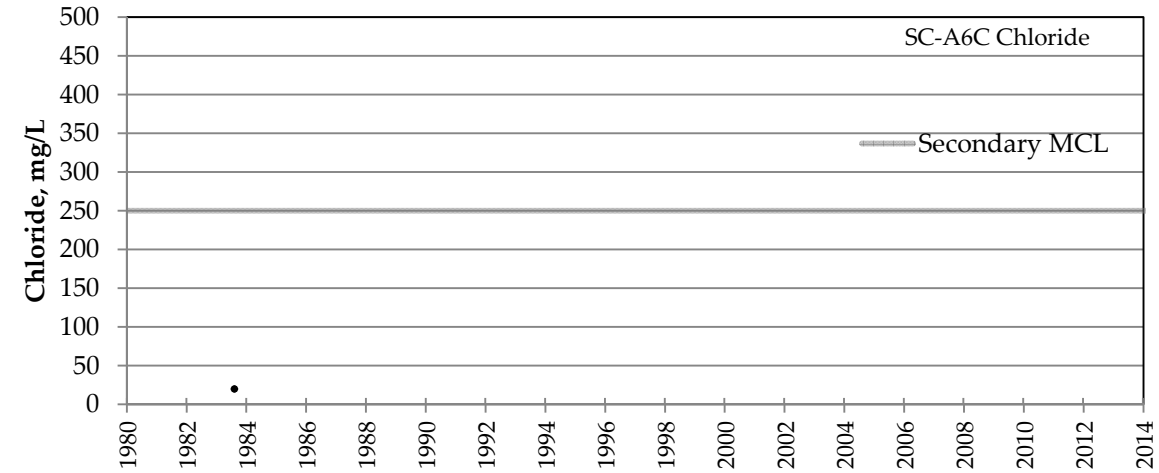

SC-A6A Total Dissolved Solids
TDS, mg/L
Secondary MCL
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

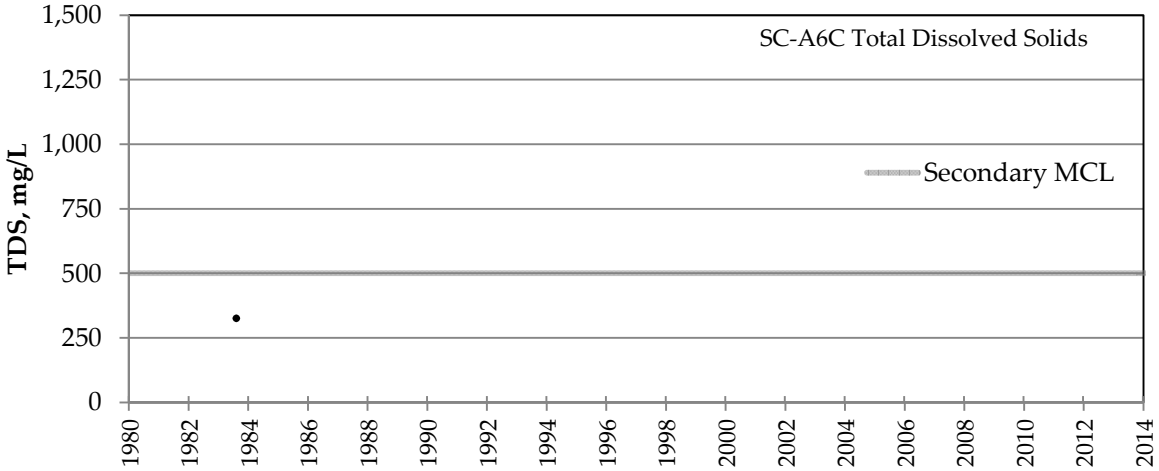

SC-A6A Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.2 feet per year
Measurements recorded after 2005 when adjacent Bonita well running excluded
WY 2009-2013 Trend
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

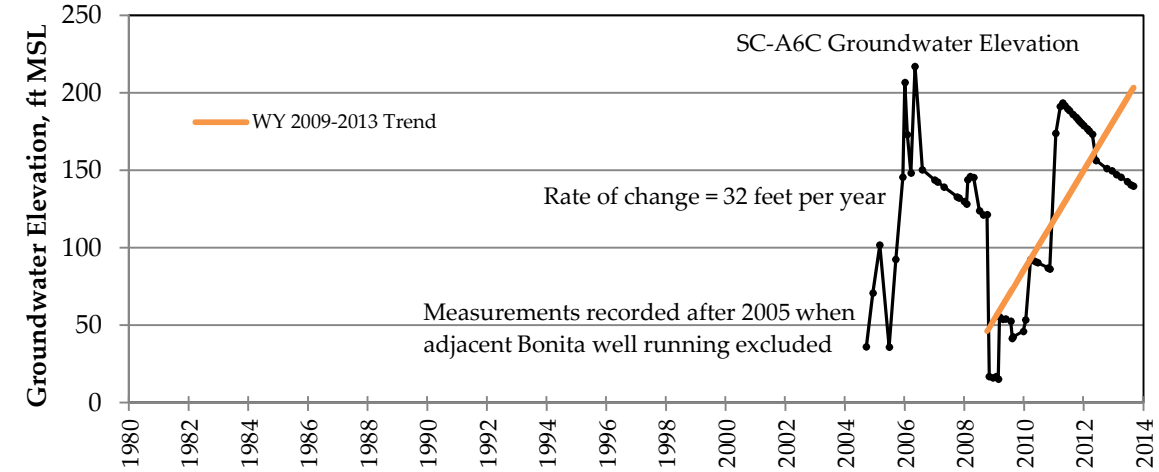

SC-A6B Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

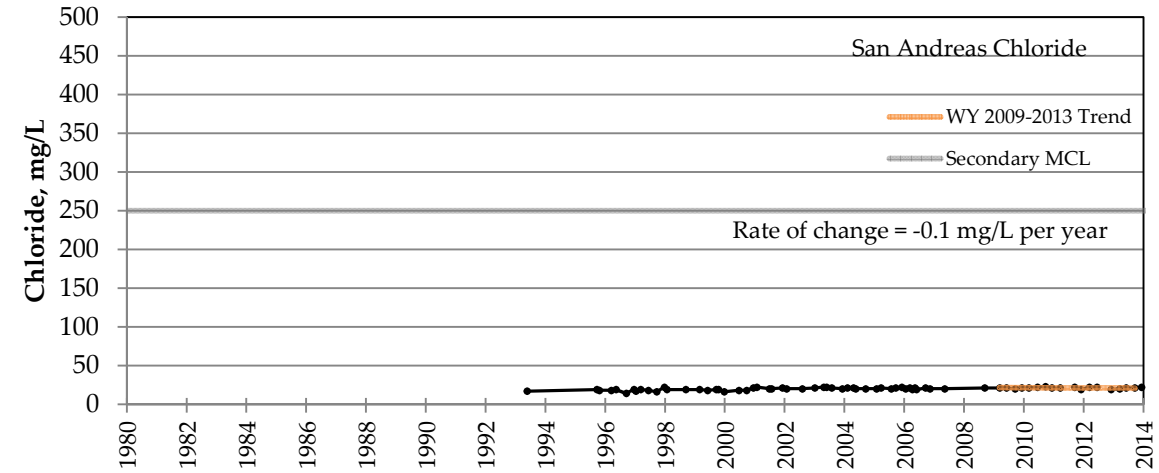

SC-A6B Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

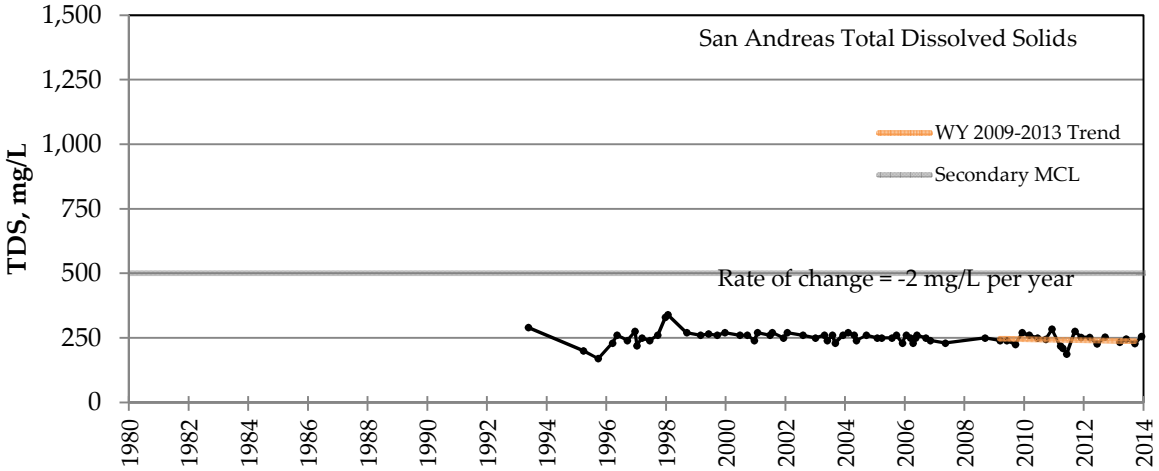

SC-A6B Groundwater Elevation
Rate of change = -0.1 feet per year
Measurements recorded after 2005 when adjacent Bonita well running excluded
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

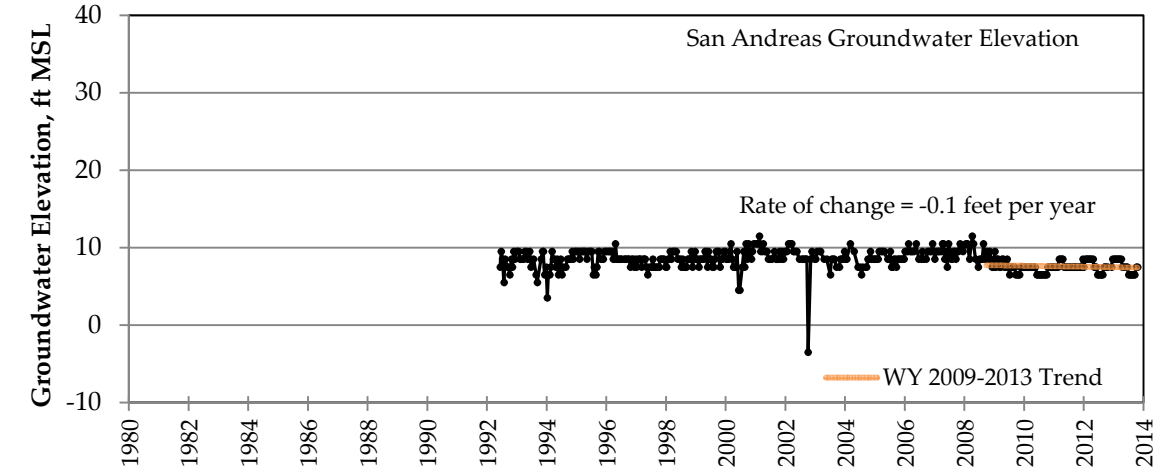

SC-A6C Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

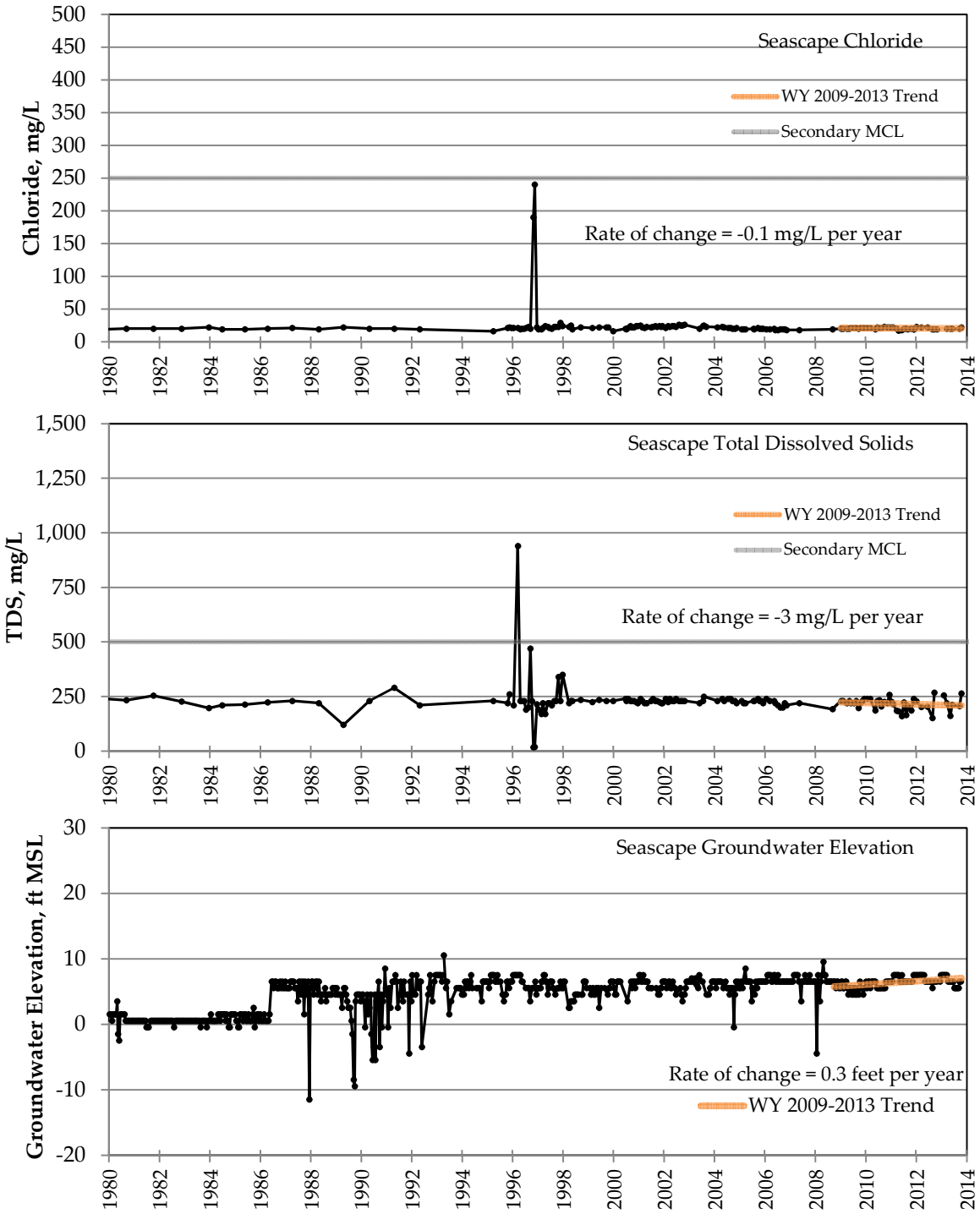

SC-A6C Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

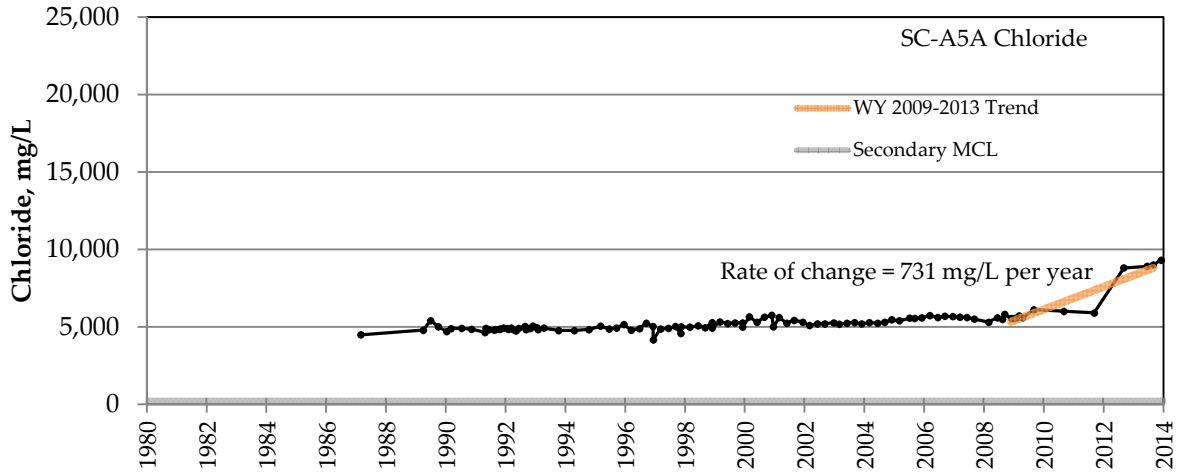

SC-A6C Groundwater Elevation
WY 2009-2013 Trend
Rate of change = 32 feet per year
Measurements recorded after 2005 when
adjacent Bonita well running excluded
Groundwater Elevation, ft MSL
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

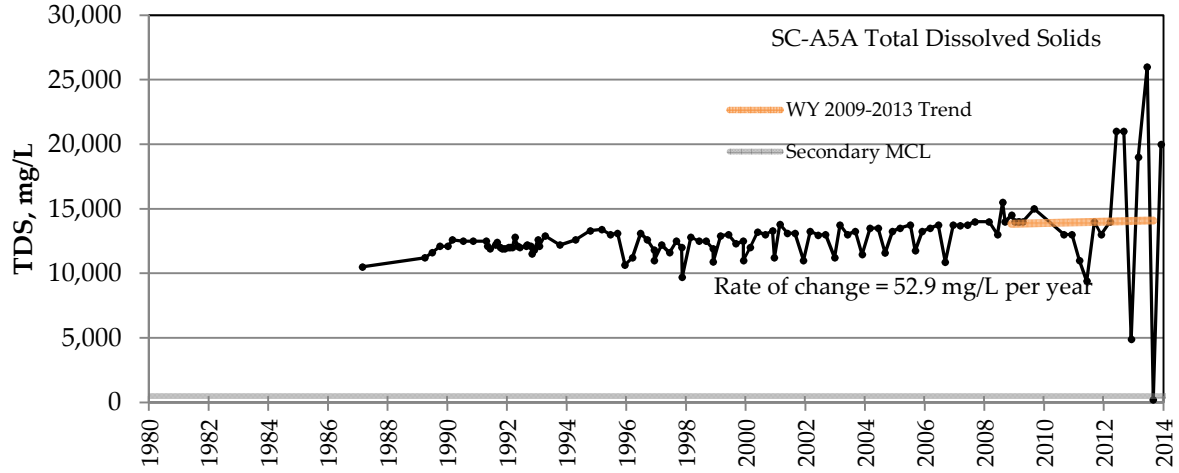

San Andreas Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.1 mg/L per year
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

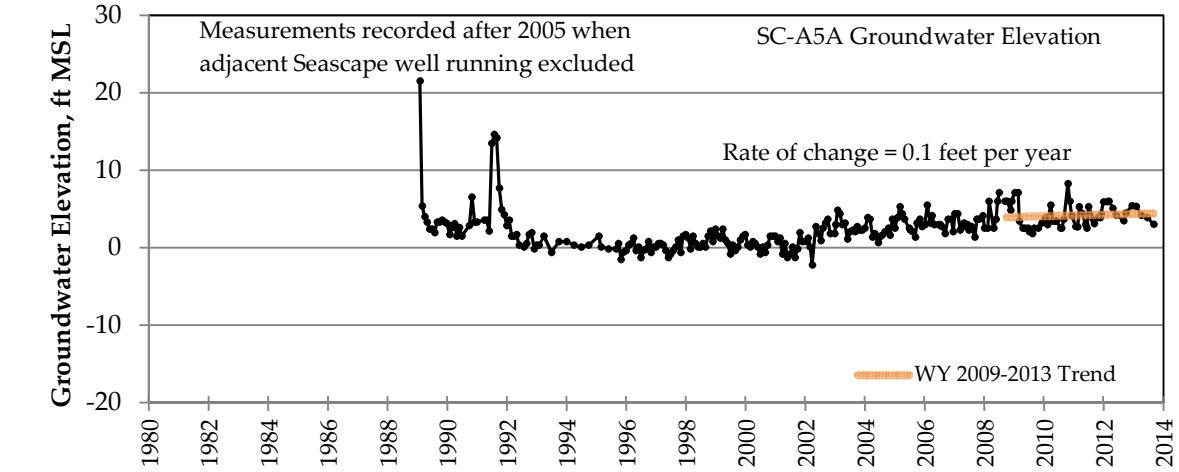

San Andreas Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = -2 mg/L per year
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

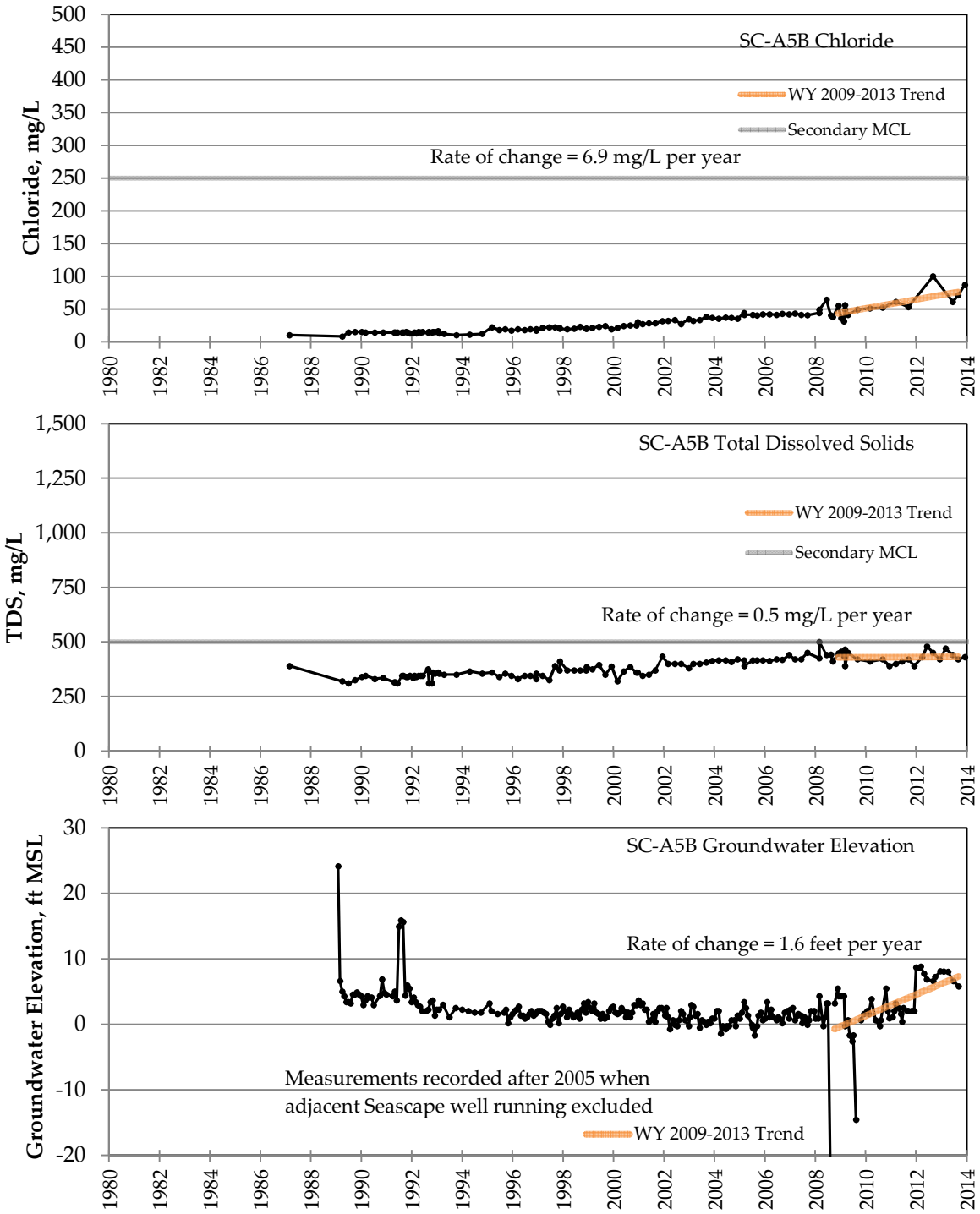

San Andreas Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.1 feet per year
WY 2009-2013 Trend
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

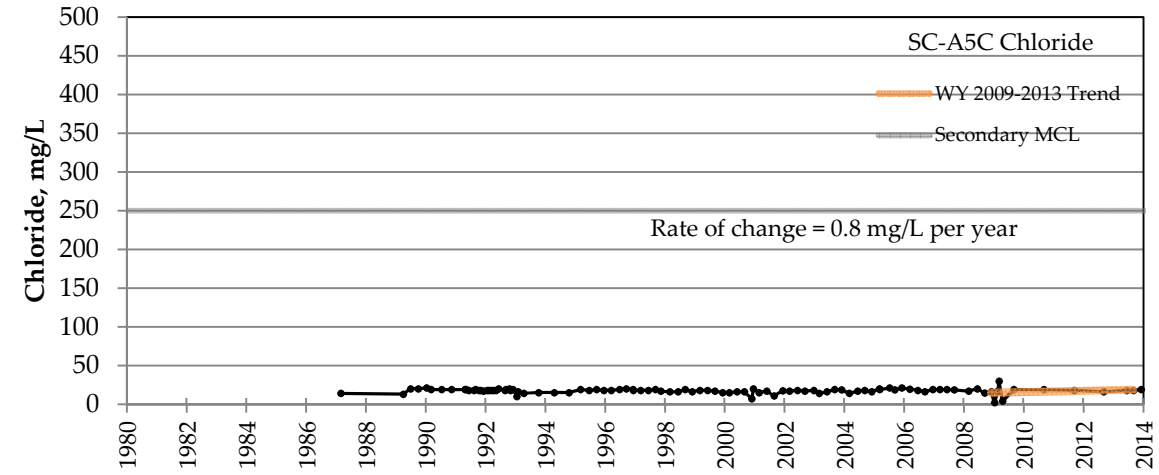

Seascape Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.1 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Seascape Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -3 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
Seascape Groundwater Elevation
Rate of change = 0.3 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
30
20
10
0
-10
-20

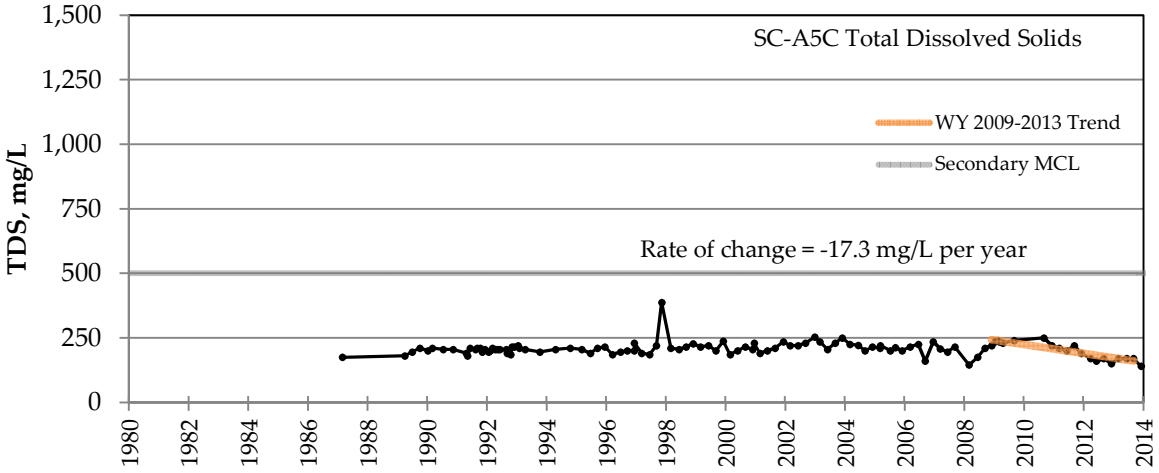

SC-A5A Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 731 mg/L per year
Chloride, mg/L
25,000
20,000
15,000
10,000
5,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

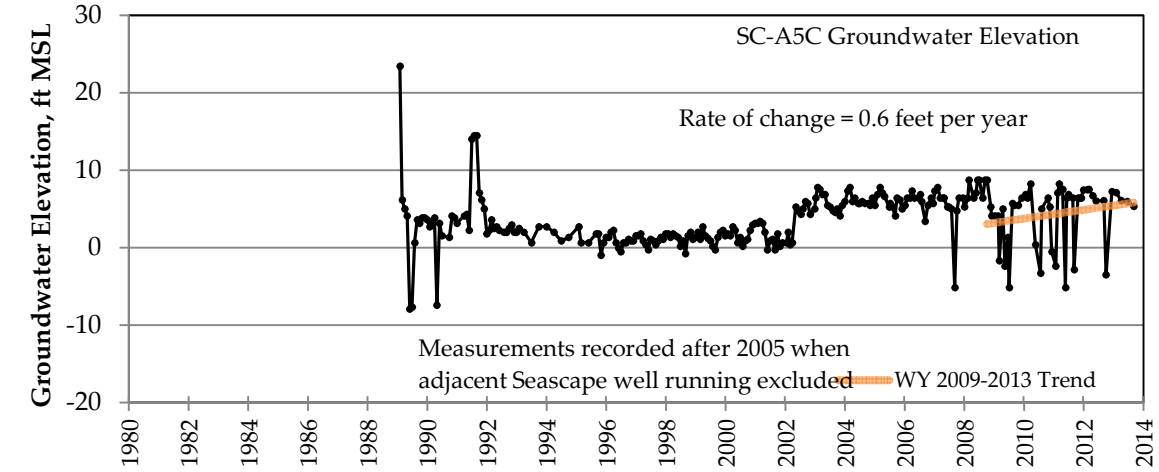

SC-A5A Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 52.9 mg/L per year
TDS, mg/L
30,000
25,000
20,000
15,000
10,000
5,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

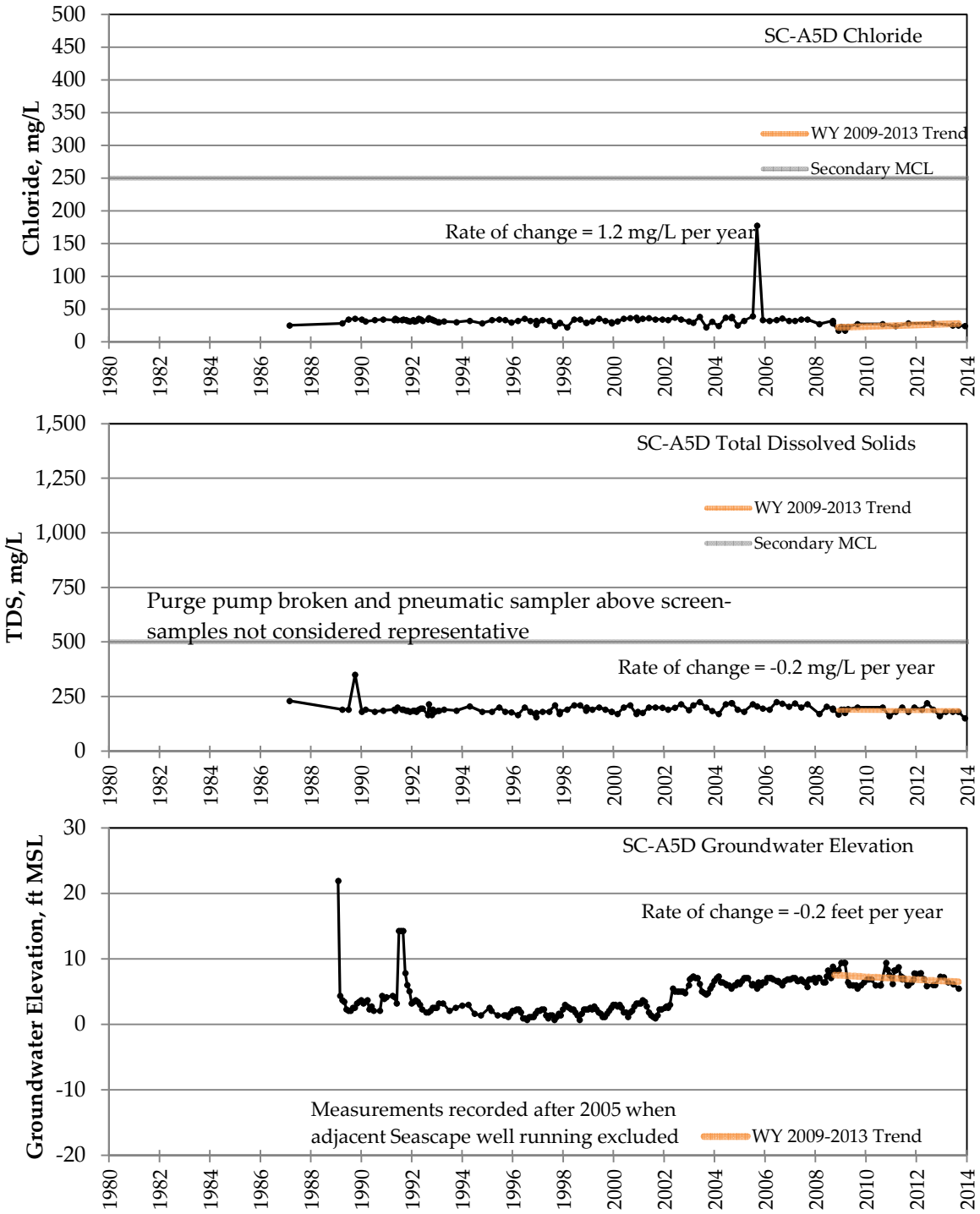

Measurements recorded after 2005 when adjacent Seascape well running excluded
SC-A5A Groundwater Elevation
Rate of change = 0.1 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
30
20
10
0
-10
-20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

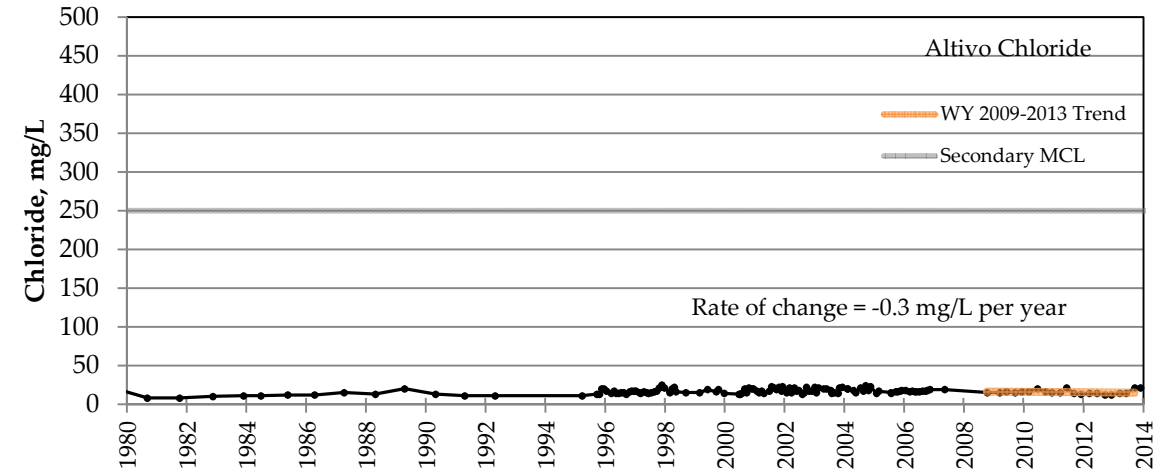

SC-A5B Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 6.9 mg/L per year
Chloride, mg/L
SC-A5B Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.5 mg/L per year
TDS, mg/L
SC-A5B Groundwater Elevation
Rate of change = 1.6 feet per year
Measurements recorded after 2005 when
adjacent Seascape well running excluded
WY 2009-2013 Trend
Groundwater Elevation, ft MSL

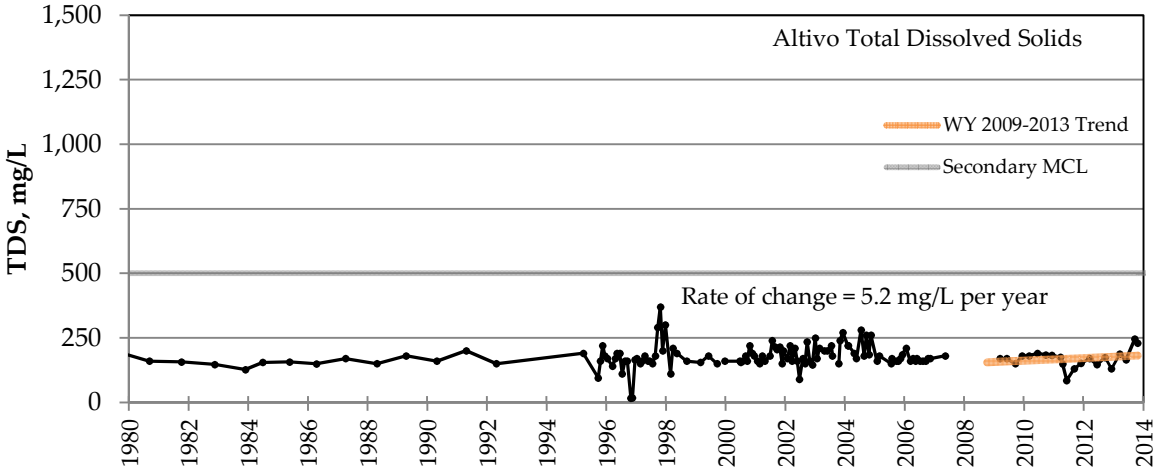

SC-A5C Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = 0.8 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

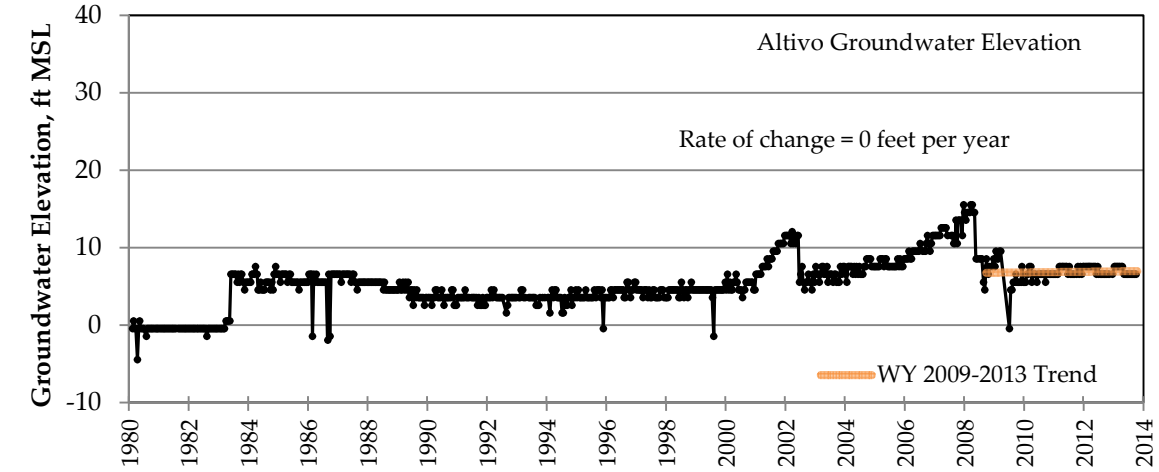

SC-A5C Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = -17.3 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

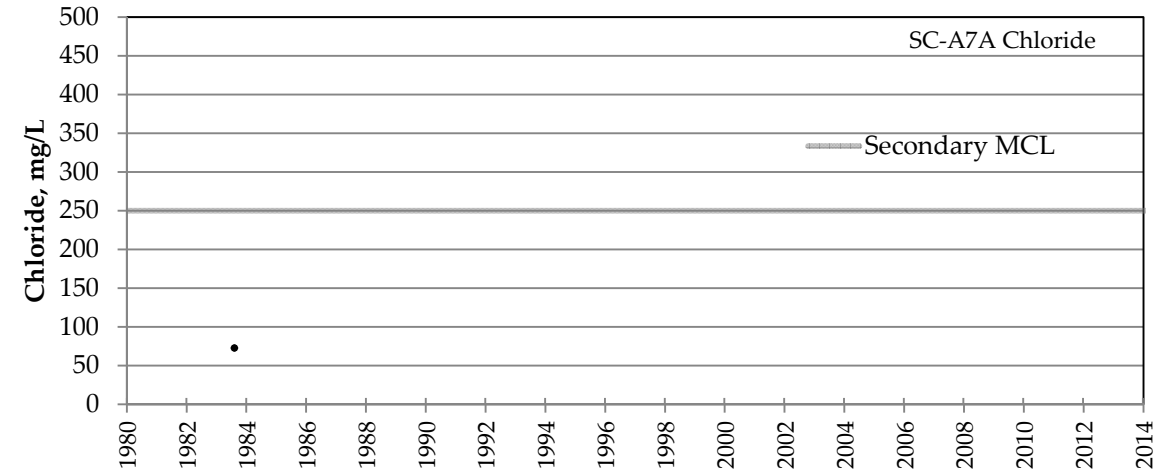

SC-A5C Groundwater Elevation
Rate of change = 0.6 feet per year
Measurements recorded after 2005 when
adjacent Seascape well running excluded
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
30
20
10
0
-10
-20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

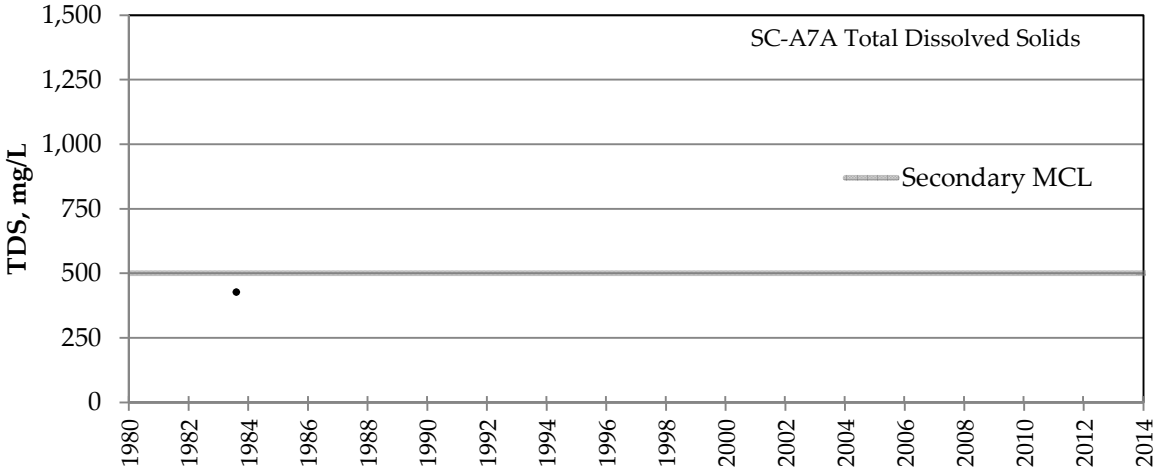

SC-A5D Chloride
Chloride, mg/L
WY 2009-2013 Trend
Secondary MCL
Rate of change = 1.2 mg/L per year
SC-A5D Total Dissolved Solids
TDS, mg/L
WY 2009-2013 Trend
Secondary MCL
Purge pump broken and pneumatic sampler above screen-
samples not considered representative
Rate of change = -0.2 mg/L per year
SC-A5D Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.2 feet per year
Measurements recorded after 2005 when
adjacent Seascape well running excluded
WY 2009-2013 Trend

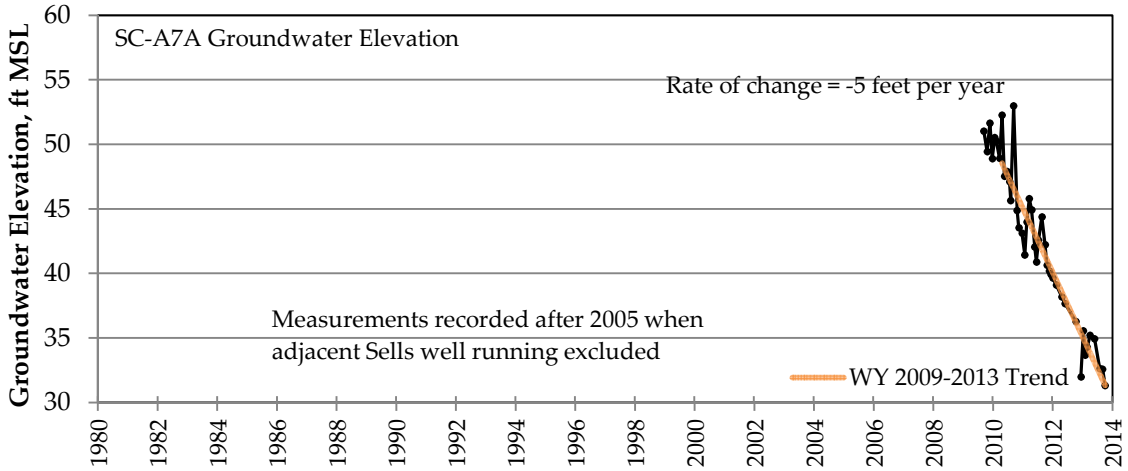

Altivo Chloride
WY 2009-2013 Trend
Secondary MCL
Rate of change = -0.3 mg/L per year
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

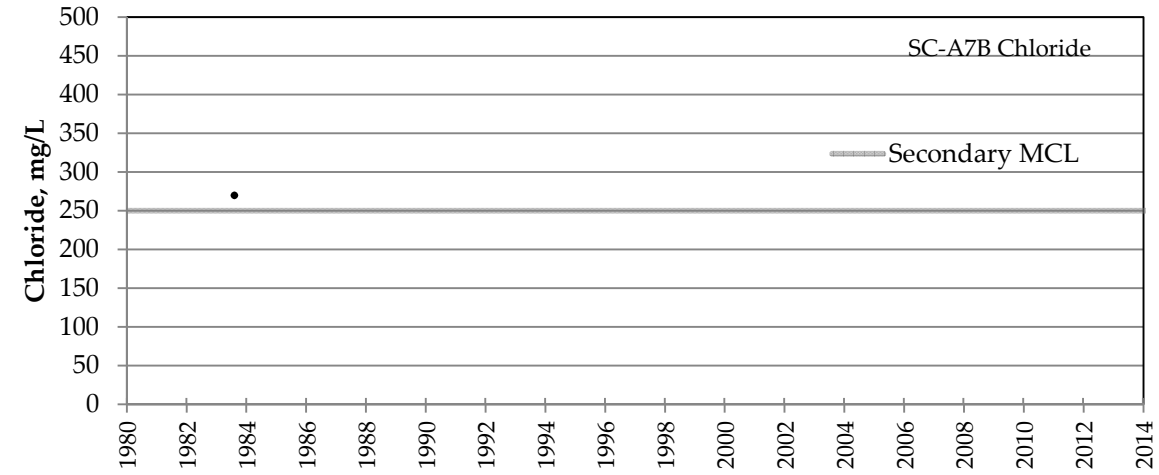

Altivo Total Dissolved Solids
WY 2009-2013 Trend
Secondary MCL
Rate of change = 5.2 mg/L per year
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

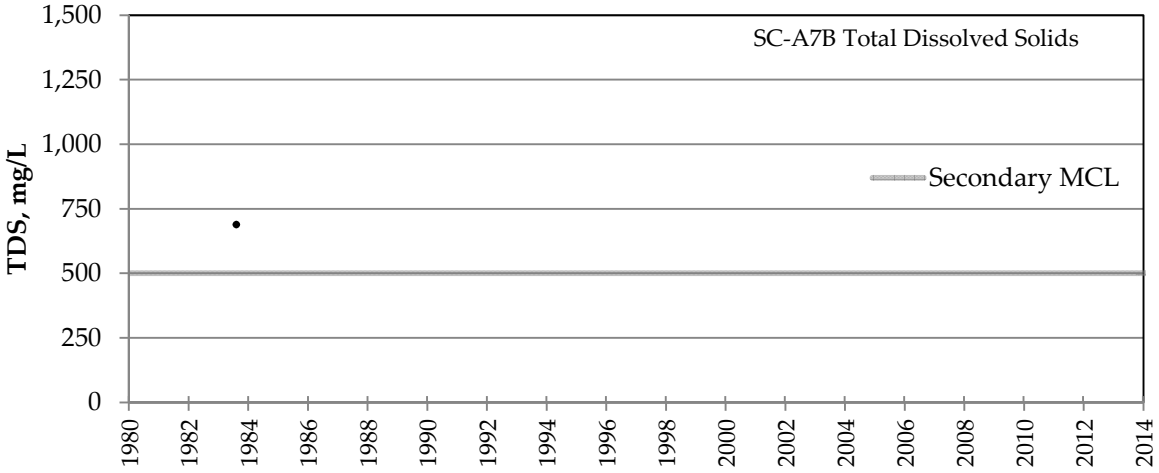

Altivo Groundwater Elevation
Rate of change = 0 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

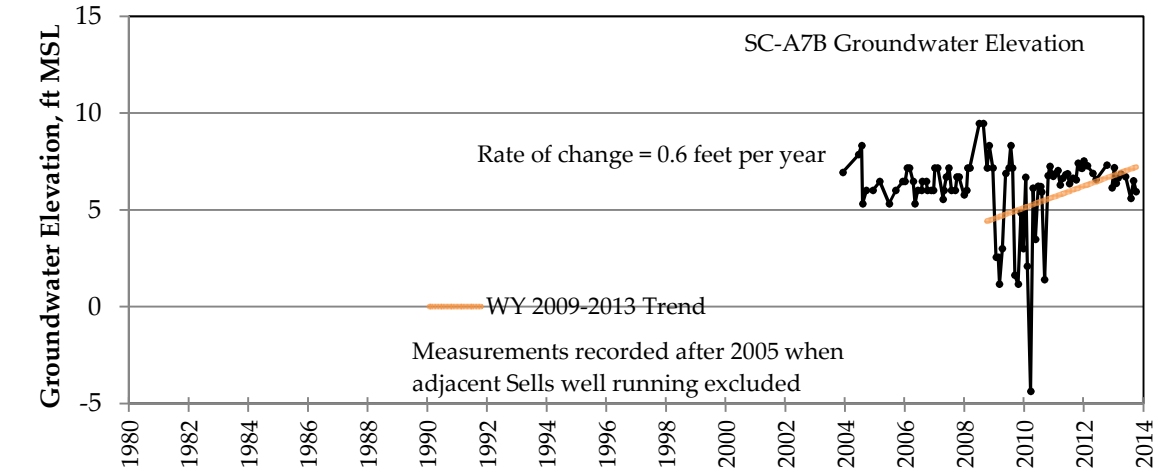

SC-A7A Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

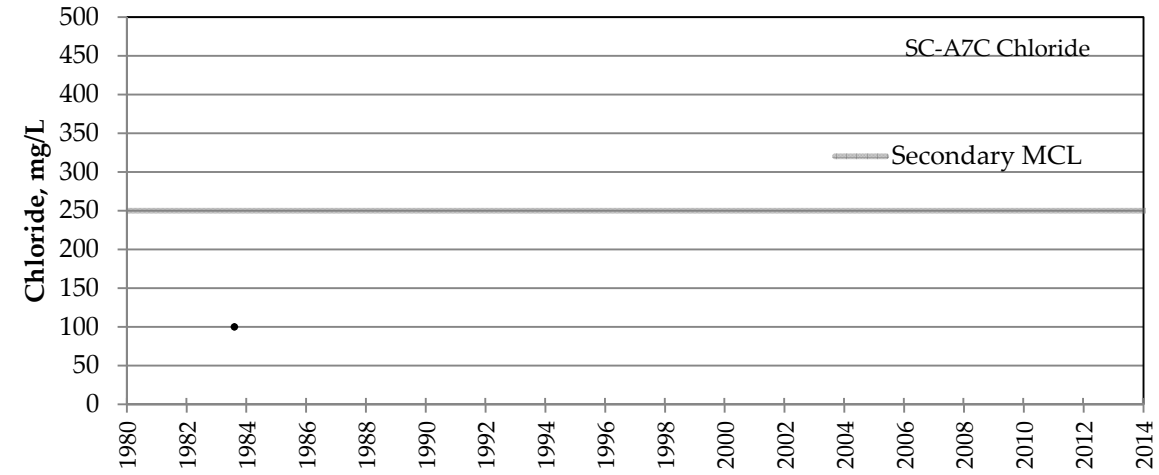

SC-A7A Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

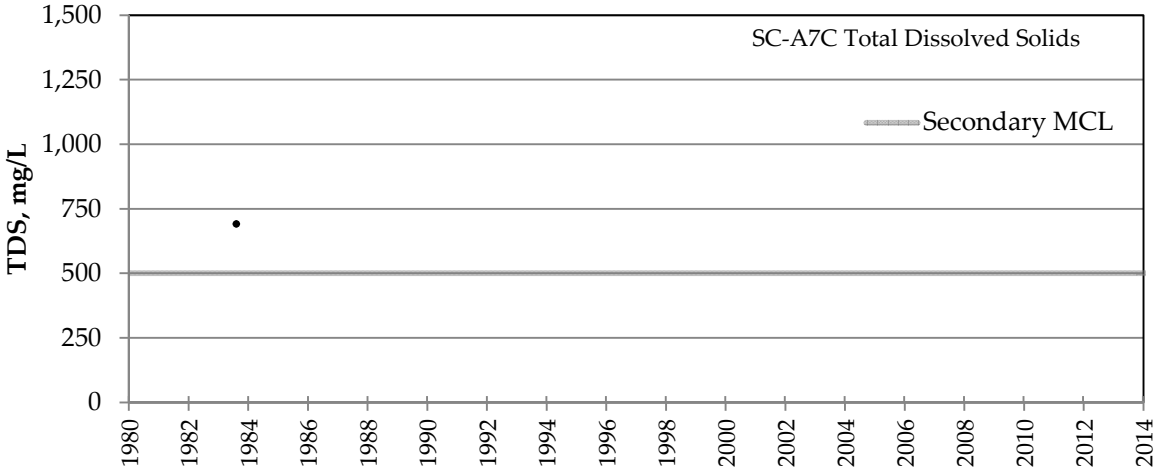

SC-A7A Groundwater Elevation
Rate of change = -5 feet per year
Measurements recorded after 2005 when adjacent Sells well running excluded
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
60
55
50
45
40
35
30
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

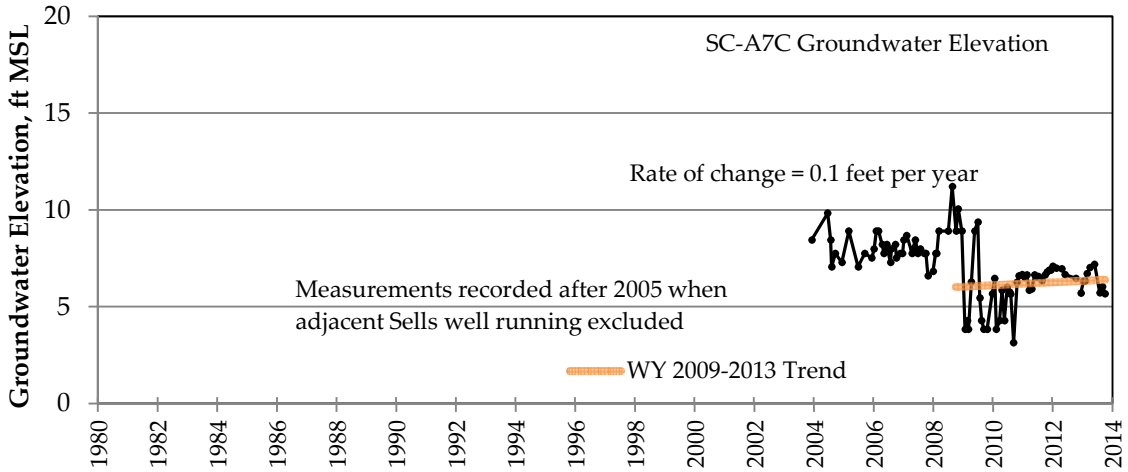

SC-A7B Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

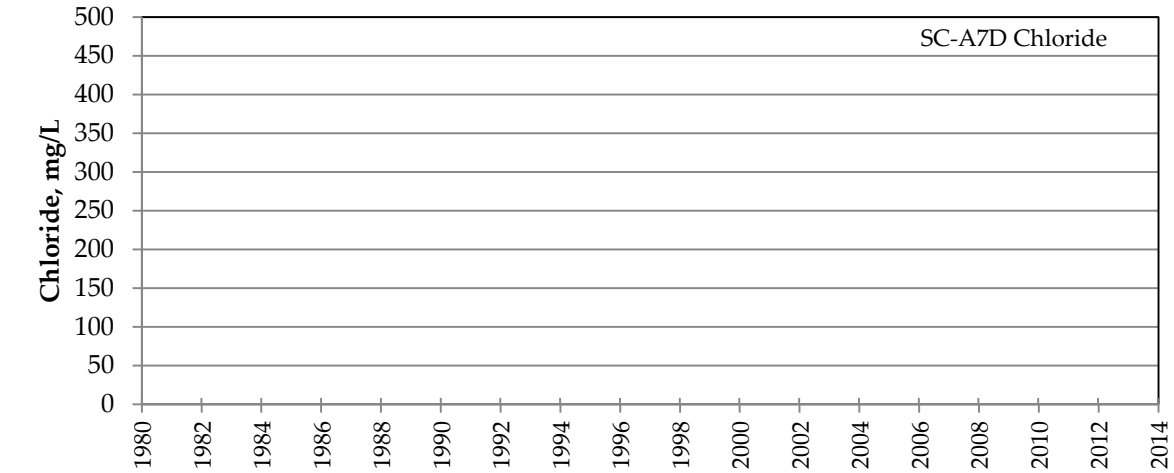

SC-A7B Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

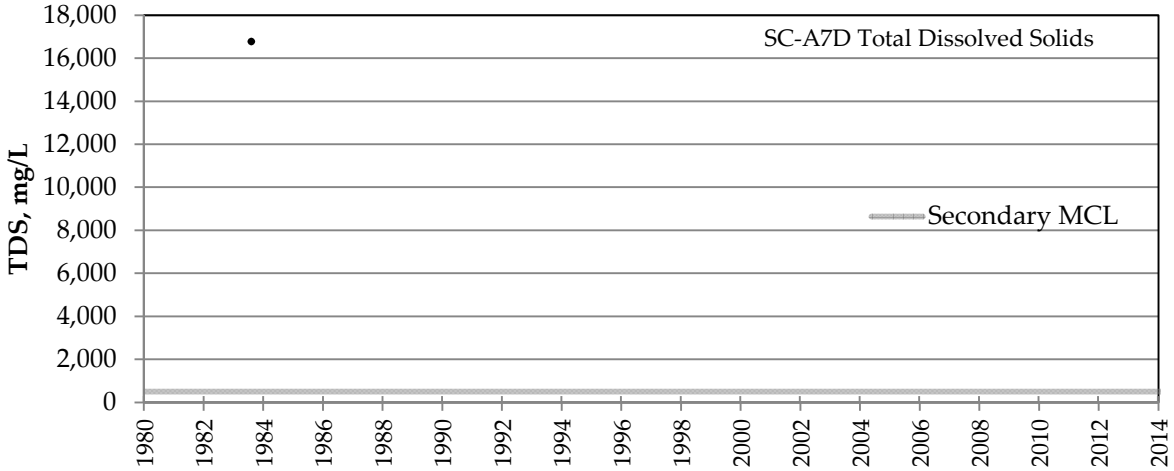

SC-A7B Groundwater Elevation
Rate of change = 0.6 feet per year
WY 2009-2013 Trend
Measurements recorded after 2005 when
adjacent Sells well running excluded
Groundwater Elevation, ft MSL
15
10
5
0
-5
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

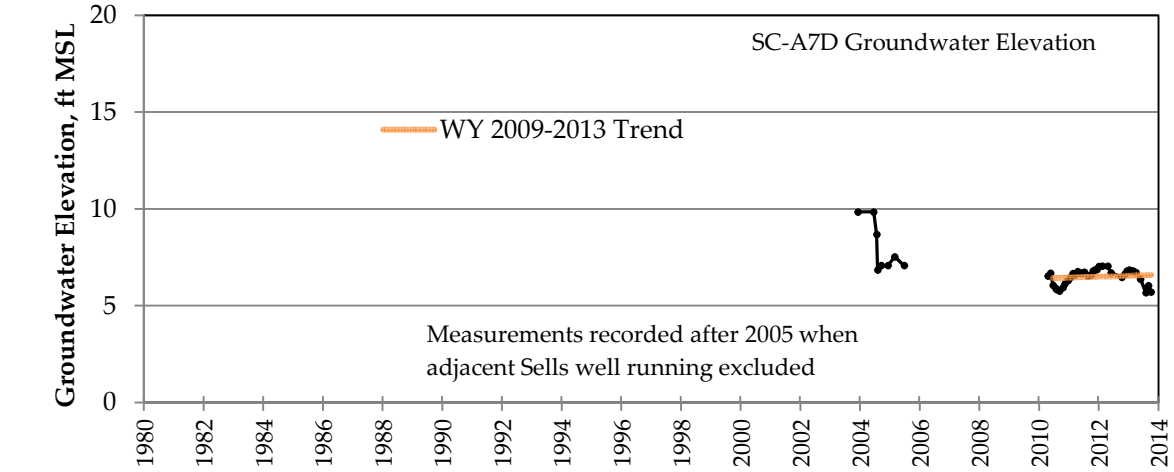

SC-A7C Chloride
Secondary MCL
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

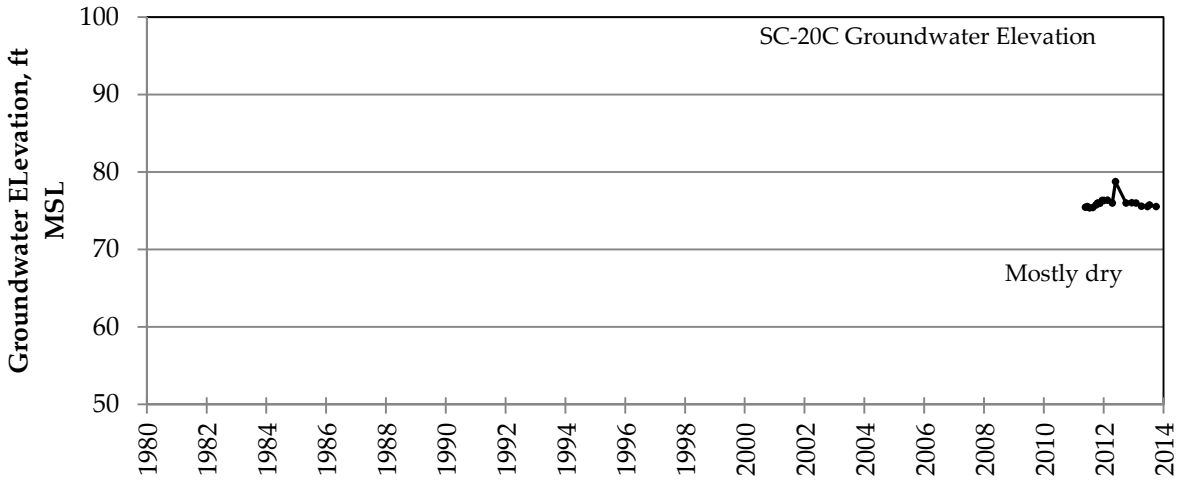

SC-A7C Total Dissolved Solids
Secondary MCL
TDS, mg/L
1,500
1,250
1,000
750
500
250
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

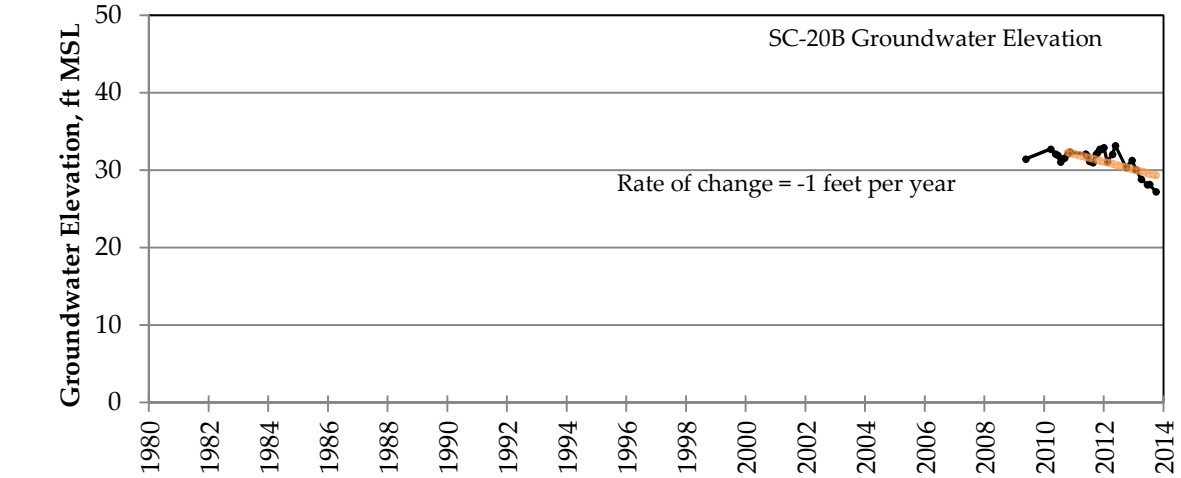

SC-A7C Groundwater Elevation
Rate of change = 0.1 feet per year
Measurements recorded after 2005 when
adjacent Sells well running excluded
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

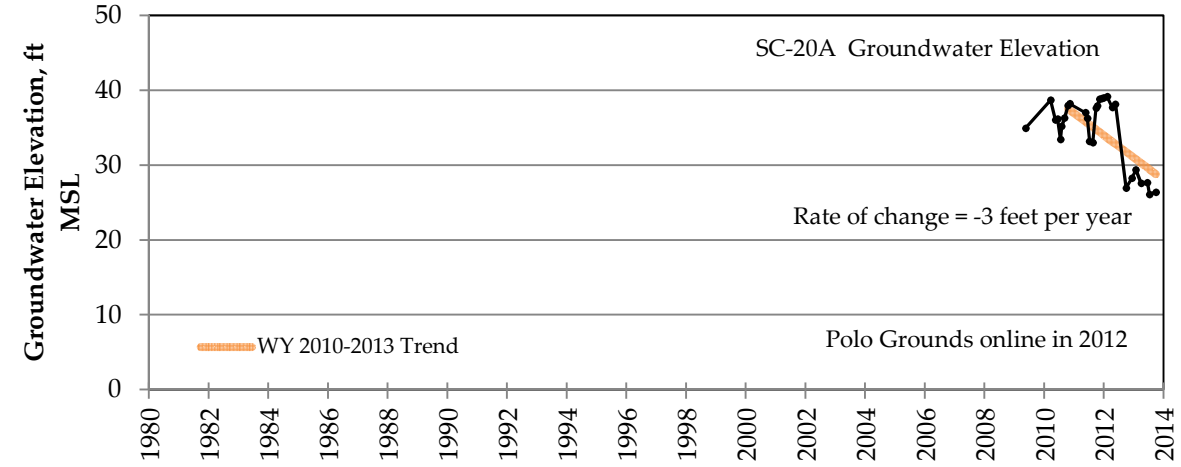

SC-A7D Chloride
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

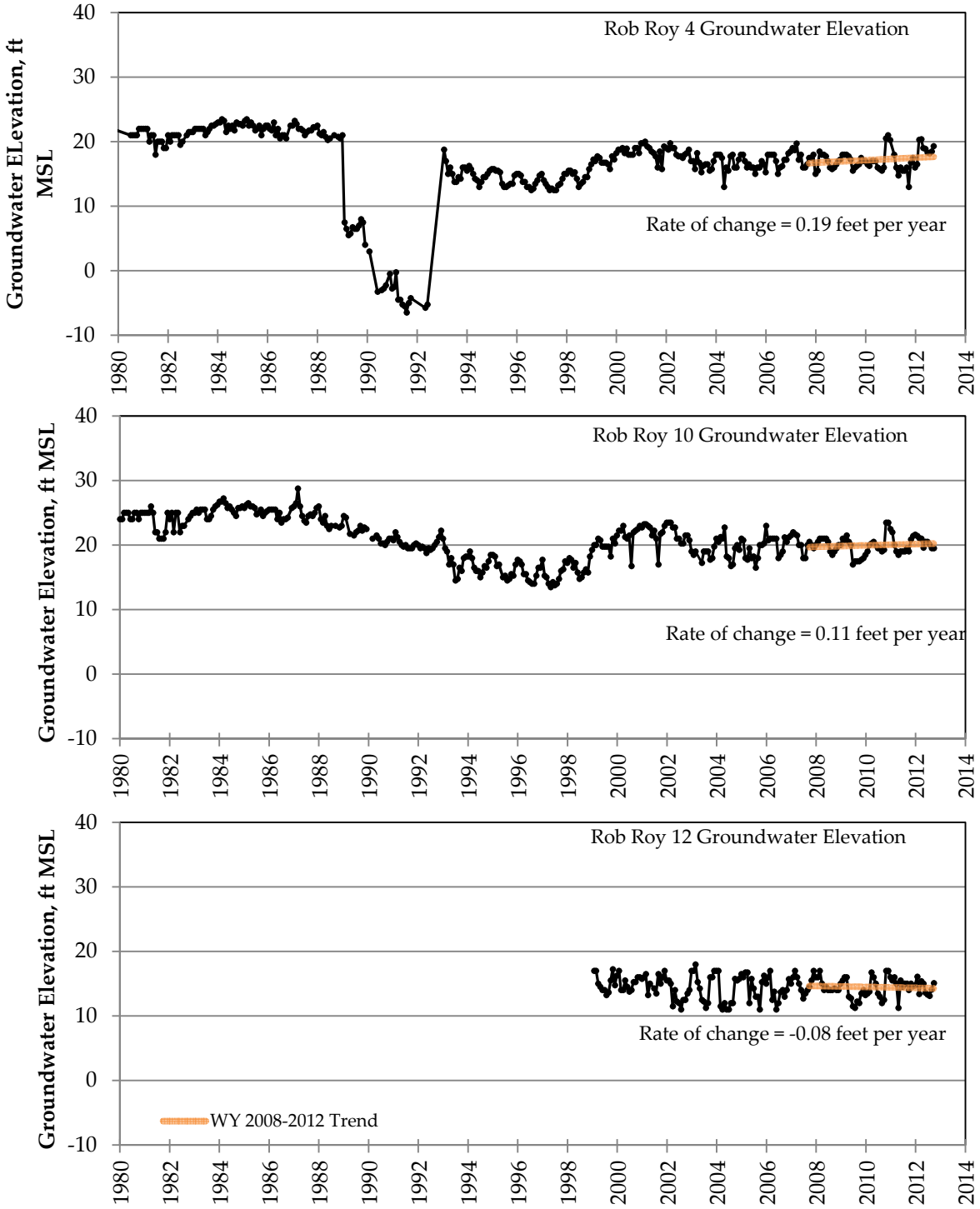

SC-A7D Total Dissolved Solids
Secondary MCL
TDS, mg/L
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

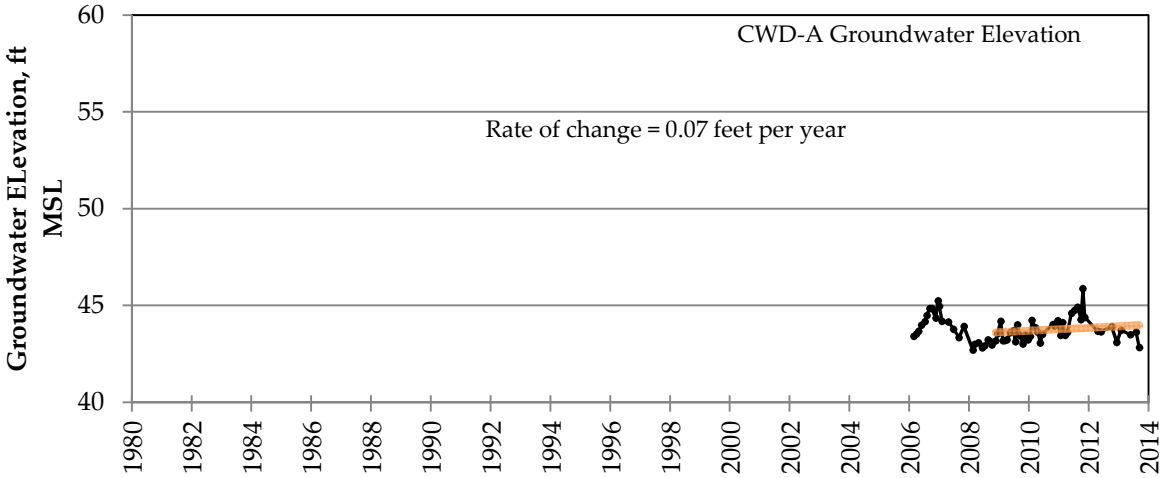

SC-A7D Groundwater Elevation
WY 2009-2013 Trend
Measurements recorded after 2005 when
adjacent Sells well running excluded
Groundwater Elevation, ft MSL
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

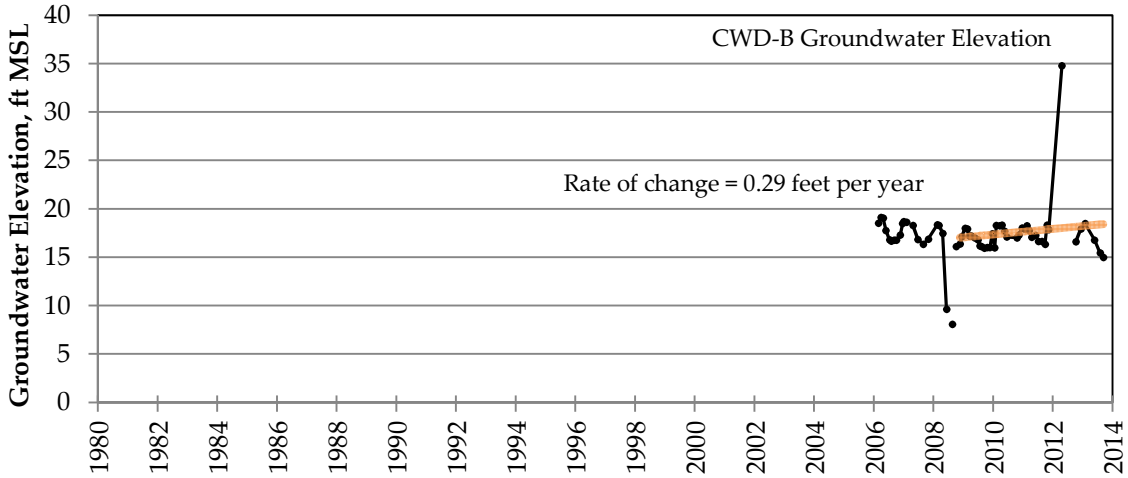

SC-20C Groundwater Elevation
Groundwater ELevation, ft MSL
Mostly dry
100
90
80
70
60
50
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

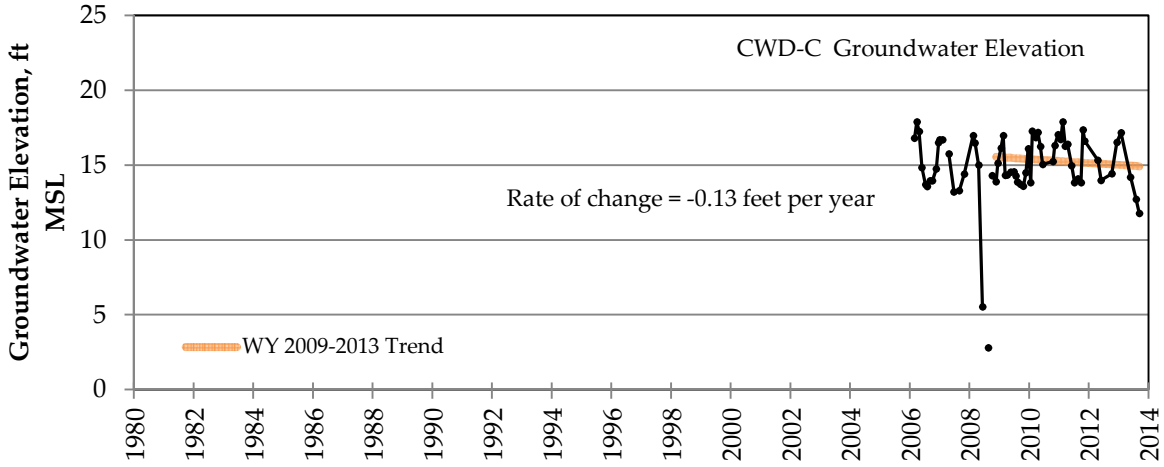

SC-20B Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -1 feet per year
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

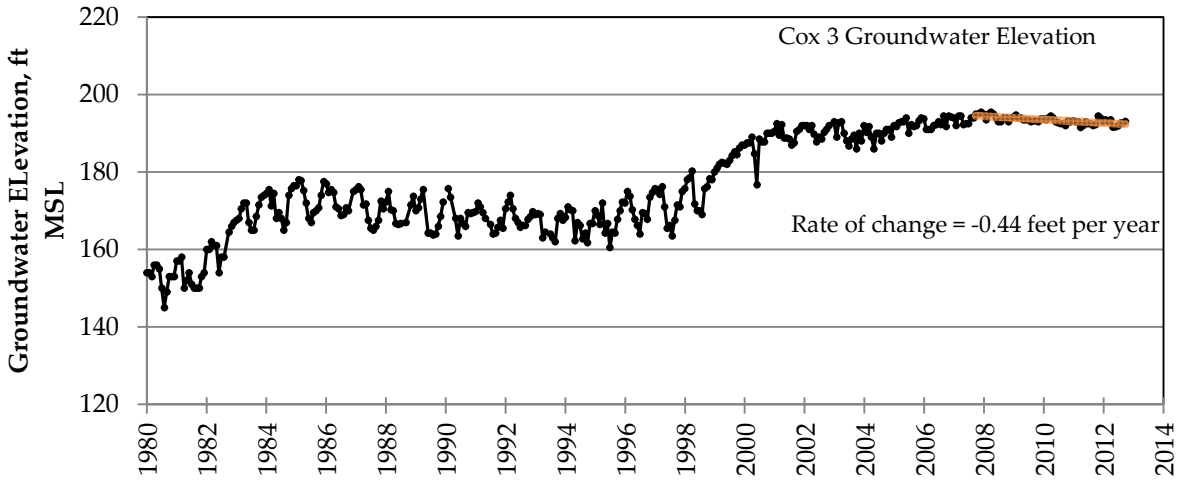

SC-20A Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -3 feet per year
WY 2010-2013 Trend
Polo Grounds online in 2012
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

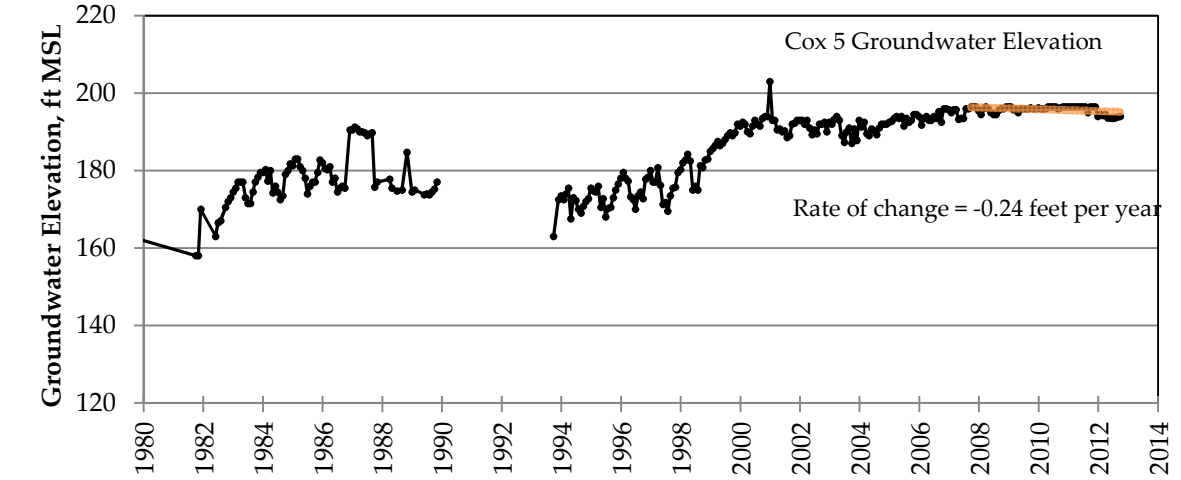

Rob Roy 4 Groundwater Elevation
Groundwater ELevation, ft MSL
Rate of change = 0.19 feet per year
Rob Roy 10 Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = 0.11 feet per year
Rob Roy 12 Groundwater Elevation
Groundwater Elevation, ft MSL
Rate of change = -0.08 feet per year
WY 2008-2012 Trend
40
30
20
10
0
-10
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

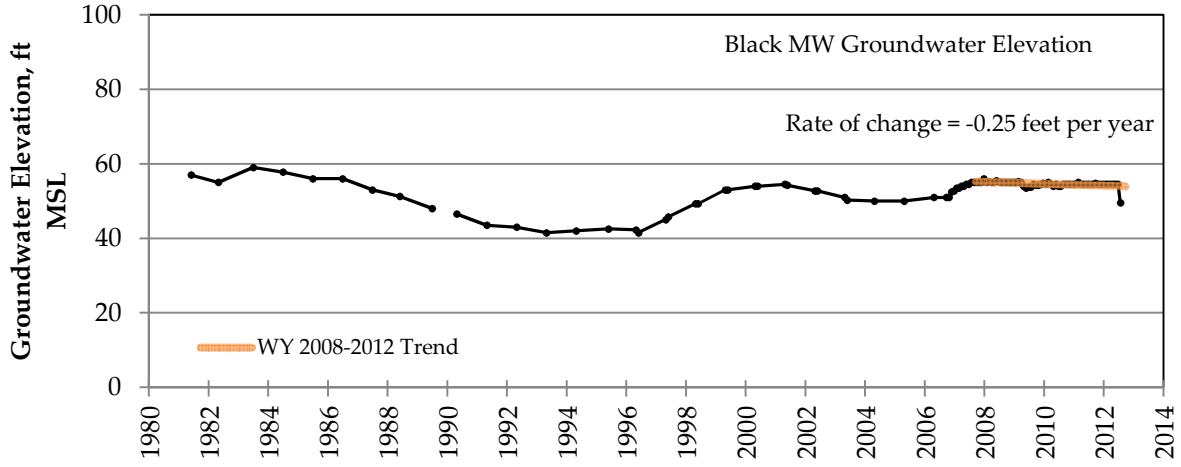

CWD-A Groundwater Elevation
Rate of change = 0.07 feet per year
Groundwater ELevation, ft MSL
60
55
50
45
40
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


CWD-B Groundwater Elevation
Rate of change = 0.29 feet per year
Groundwater Elevation, ft MSL
40
35
30
25
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


CWD-C Groundwater Elevation
Rate of change = -0.13 feet per year
WY 2009-2013 Trend
Groundwater Elevation, ft MSL
25
20
15
10
5
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Cox 3 Groundwater Elevation
Rate of change = -0.44 feet per year
Groundwater ELevation, ft MSL
220
200
180
160
140
120
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Cox 5 Groundwater Elevation
Rate of change = -0.24 feet per year
Groundwater Elevation, ft MSL
220
200
180
160
140
120
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Black MW Groundwater Elevation
Rate of change = -0.25 feet per year
WY 2008-2012 Trend
Groundwater Elevation, ft MSL
100
80
60
40
20
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

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SECTION 6
GROUNDWATER MANAGEMENT PLAN IMPLEMENTATION STATUS

6.1 STATUS OF BASIN MANAGEMENT OBJECTIVES

The 2007 Groundwater Management Plan (SqCWD and CWD, 2007) listed nine Basin Management Objectives (BMOs) for meeting three basin management goals. The BMOs are specific criteria defining the desired state of the basin. The status of each of the BMOs during Water Year 2013 is summarized in Table and expanded upon below. Each BMO in the Groundwater Management Plan (GMP) is listed, along with an assessment of how well the objective was met in Water Year 2013. Revisions to the BMOs were proposed and approved by the Basin Implementation Group (BIG) in 2013. The official update of the GMP requires approval of SqCWD and CWD Board of Directors, but the assessment is based on the revised objective to reflect current groundwater management. Specific basin management activities, or elements, are discussed in Section 6.2.

Table 6-1: Status of Basin Management Objectives

Number	Basin Management Objective	Status
	Goal 1:Ensure water supply reliability for current and future beneficial uses	
1-1	Pump Within the Sustainable Yield	Pumping exceeds recovery goals.
1-2	Develop alternative water supplies to achieve a long-term balance between recharge and withdrawals to meet current and future demand	Regional desalination on hold. Other alternatives being evaluated.
1-3	Manage groundwater storage for future beneficial uses and drought reserve	Depends on achieving BMOs 1-1, 1-2, and 2-2.
	Goal 2: Maintain water quality to meet current and future beneficial uses	
2-1	Meet existing water quality standards for beneficial uses, such as drinking water standards.	Drinking water standards met.
2-2	Maintain groundwater levels to prevent seawater intrusion	Achieved at 6 of 14 coastal well locations.
2-3	Prevent and monitor contaminant pathways	Activities ongoing.
	Goal 3: Prevent adverse environmental impacts	
3-1	Maintain or Enhance the Quantity and Quality of Groundwater Recharge by participating in land use planning process	Activities ongoing.
3-2	Avoid alteration of stream flows that would adversely impact the survival of populations of aquatic and riparian organisms	Soquel Creek monitoring ongoing.
3-3	Protect the structure and hydraulic characteristics of the groundwater basin by avoiding withdrawals that cause subsidence	No subsidence reported.

BMO 1-1: PUMP WITHIN THE SUSTAINABLE YIELD

- In early 2012, SqCWD updated its estimates for its post-recovery pumping yields, which are meant to protect the Aromas and Purisima areas against seawater intrusion after groundwater levels recover to protective elevations. These long term pumping yields are referred to as post-recovery pumping yields to clarify that the basin needs to be recover before the yields can be used as an annual pumping target. Post-recovery pumping yields are based on modeled offshore flows required to protect against seawater intrusion, along with estimated recharge, non-District consumptive use, and District consumptive use factors (HydroMetrics WRI, 2012). The post-recovery pumping yield estimated for the Purisima area is 2,800 acre-feet per year as opposed to the pumping goal of 3,000 acre-feet per year in the GMP. The post-recovery pumping yield estimated for the Aromas area is 1,200 acre-feet per year; compared to the pumping goal of 1,800 acre-feet per year in the GMP.

- To recover groundwater levels to protective elevations, pumping must be reduced below the estimated post-recovery pumping yields. The SqCWD pumping goal proposed for the GMP is to limit pumping to 2,900 acre-feet per year, 2,300 acre-feet per year from the Purisima area and 600 acre-feet per year from the Aromas area, in order to recover the basin within 20 years (HydroMetrics WRI, 2012). The estimated recovery time frame assumes average annual recharge and non-District consumptive use does not change from what has been estimated based on current and historical data.

- SqCWD's total groundwater pumping for Water Year 2013 was 4,219 acre-feet. SqCWD pumped 2,610 acre-feet from the Purisima area (Service Areas I and II). Pumping was less than the post-recovery pumping yield estimate of 2,800 acre-feet per year for the Purisima area for the fifth straight year but remains above the pumping goal to recover the basin within 20 years. SqCWD pumped 1,609 acre-feet from the Aromas area (Service Areas III and IV including Aptos Jr. High and the Polo Grounds well). Although the last four years have had been the four lowest totals for SqCWD production from the Aromas area since water year totals have been recorded starting in Water Year 1984, annual production remains above the post-recovery pumping yield estimate of 1,200 acre-feet per year and the recovery pumping goal of 600 acre-feet per year.

- CWD's groundwater pumping for Water Year 2013 was 2 acre-feet in the Purisima Formation and 572 acre-feet in the Aromas Red Sands, which meets CWD's target objectives for pumping within the sustainable yield.

- CWD has been within its pumping targets consistently over the last 39 years.

- SqCWD and CWD's target pumping are within the context of a total estimated pumping in the basin. Other pumpers in the Soquel-Aptos Area include the City of Santa Cruz, small water systems, and private domestic and agricultural wells.

- The City of Santa Cruz pumped 524 acre-feet from the Purisima area in calendar year 2013. This amount is similar to the 525 acre-feet per year future production planned by the City in non-critically dry years (Chambers Group, 2011).

- The City of Santa Cruz pumped 514 acre-feet in Water Year 2013, which is below the 575 acre-feet per year estimate (Johnson et al., 2004) that was assumed for estimating SqCWD's post-recovery pumping yield.

- There have been no updates on pumping estimates for private well pumping for the Purisima area since the GMP was enacted. Estimates for the Aromas area have been extracted from a land use study developed for CWD's groundwater model and totaled 108 acre-feet per year greater than was estimated at the time of the GMP (HydroMetrics WRI and Kennedy/Jenks, 2014).

- The County has compiled more recent information on small water system consumption and connections and pumping estimates have been provided for Polo Grounds Park in 2007 and Cabrillo College in 2009. Irrigation pumping at Polo Grounds Park ceased before 2012 as the well was converted to SqCWD use. Changes in estimates for non-water agency pumping are not great or certain enough to warrant changing water agency pumping goals at this time.

- Measured pumping amounts do not meet numerical targets proposed as revision for this BMO in the GMP as the basin remains in overdraft and pumping will need to be reduced yields to recover groundwater levels in the basin to protective elevations (BMO 2-2).

BMO 1-2: DEVELOP ALTERNATIVE WATER SUPPLIES TO ACHIEVE A LONG-TERM BALANCE BETWEEN RECHARGE AND WITHDRAWALS TO MEET CURRENT AND FUTURE DEMAND

- The pilot plant for the Santa Cruz Water Department/Soquel Creek Water District (SCWD²) Regional Seawater Desalination Project completed testing in April 2009. The pilot study report was issued in 2010. A report on technology innovations and system optimization was issued in 2011.

- Environmental review and design were initiated for the Regional Seawater Desalination Project. The draft EIR was published in 2013 and public comments were published in a Public Review Summary Report. A schedule for response to comments has not been set.

  The Regional Seawater Desalination Project is on hold. The City of Santa Cruz is increasing the involvement of the community in water supply issues before making critical decisions involving future water supplies. SqCWD is also currently undergoing additional evaluation of alternatives for supplemental supply.

- SqCWD approved its 2012 Integrated Resources Plan Update (SqCWD, 2012), which evaluated other alternative water supplies such as off-stream diversion of Soquel Creek, satellite reclamation plants for providing recycled water, desalination by SqCWD only, the Glenwood Reservoir and transfer of surplus water from the San Lorenzo River by the City of Santa Cruz. The Plan Update concluded that desalination by SqCWD only and the Soquel Creek off-stream reservoirs have potential for future consideration if SCWD² does not materialize.

- The 2012 Integrated Resources Plan Update also evaluated using mandatory water restrictions to reduce consumption for typical residential customers by 35% in order to meet pumping goals. The Plan

Update concluded that this alternative has potential for future consideration if SCWD[2] does not materialize.

- The County continues to evaluate the feasibility and benefits of interties and water transfers among water agencies in northern Santa Cruz County. Information about using excess winter flows in the San Lorenzo River to potentially meet 30% of SqCWD's winter demand was presented in 2011 (Khalsa, 2011). The evaluation includes a legal assessment of various water rights options for the water transfers (Nguyen, 2013). A final project is expected to be issued in 2014. SqCWD supports this continued evaluation but recognizes that any transfer will not provide enough water by itself to meet this BMO.

- SqCWD, CWD, and the City of Santa Cruz continue to maintain and update their conservation programs to reduce current and future demand.

BMO 1-3: MANAGE GROUNDWATER STORAGE FOR FUTURE BENEFICIAL USES AND DROUGHT RESERVE

- Groundwater levels remain below protective elevations (BMO 2-2) in much of the basin therefore water was not stored for future beneficial uses and drought reserve.

- The GMP states that "achieving this objective is likely to depend on first achieving BMO 1-1 and BMO 1-2 since storing surplus water will not be possible without first eliminating overdraft conditions and developing alternative supplies." BMO 1-1 has not been met because pumping is above goals to achieve recovery and eliminate overdraft. Options to develop alternative water supplies under BMO 1-2 are being re-evaluated with the regional desalination project on hold.

BMO 2-1: MEET EXISTING WATER QUALITY STANDARDS FOR BENEFICIAL USES, SUCH AS DRINKING WATER STANDARDS

- Drinking water from SqCWD and CWD municipal wells was tested according to Title 22 requirements. In Water Year 2013, raw groundwater pumped by SqCWD from the Purisima Formation met all water quality standards except for iron, manganese, color and turbidity. Raw groundwater from the Purisima Formation was treated to meet water

quality standards for these constituents; all delivered water met drinking water standards. In Water Year 2013, groundwater pumped by SqCWD from the Aromas Red Sands met all drinking water standards, thereby meeting the basin management objective for the Aromas Red Sands aquifer. Water delivered by CWD from its Purisima Formation and Aromas Red Sands sources met all drinking water standards.

- Groundwater from SqCWD monitoring wells was tested regularly for indications of seawater intrusion. TDS and chloride concentrations in Aromas monitoring wells show long term seawater intrusion. No new intrusion was detected in monitoring wells that were previously un-impacted.

- Groundwater in two City of Santa Cruz monitoring wells has had TDS and chloride concentrations that suggest seawater intrusion since the wells were installed in 2004. Only the Soquel Point Medium monitoring well currently has chloride concentrations above the secondary MCL.

- Groundwater from SqCWD's Sells well showed concentrations at or just under the maximum contaminant limit for nitrates starting in 2009. The Sells well was taken out of service in April 2009.

BMO 2-2: MAINTAIN GROUNDWATER LEVELS TO PREVENT SEAWATER INTRUSION

- Water Year 2013 groundwater levels at one of the five SqCWD coastal monitoring well clusters in the Purisima area met protective elevations as outlined in *Groundwater Levels to Protect against Seawater Intrusion and Store Freshwater Offshore* (HydroMetrics LLC, 2009b) and proposed as revisions to this BMO. Average groundwater levels at well SC-1A have been above protective elevations since Water Year 2010.

- Water Year 2013 groundwater levels at three of the five SqCWD coastal monitoring well clusters in the Aromas area met protective elevations as revised in *Revised Protective Elevations and Outflows for the Aromas Area and Updated Water Balance for the Soquel-Aptos Groundwater Basin* (HydroMetrics WRI, 2012) and proposed as revisions to this BMO. Average groundwater levels at the northwestern SC-A1 well cluster have been above revised protective elevations for most of the monitoring

record. Average groundwater levels at the southeastern SC-A3 and SC-A4 well clusters rose above protective elevations in Water Years 2012 and 2013, respectively.

- Water Year 2013 groundwater levels at City of Santa Cruz coastal monitoring wells met protective elevations as proposed by the City (Almond, 2010) at two of the City's three coastal well clusters. Average groundwater levels at the Moran Lake well have been above protective elevations since the well was installed in 2004. Average groundwater levels at the Pleasure Point well have been above protective elevations in Water Years 2010 through 2013.

- Groundwater levels will not meet all protective elevations until BMO 1-2 is achieved, and pumping in the basin is maintained below post-recovery pumping yields.

BMO 2-3: PREVENT AND MONITOR CONTAMINANT PATHWAYS

- SqCWD and CWD continue to implement the well abandonment requirements in Santa Cruz County's well ordinance.

- Santa Cruz County used Proposition 50 bond funding to implement a well destruction program in 2012.

- SqCWD has not updated its Drinking Water Source Assessment and Protection (DWSAP) reports (Todd Engineers, 2002 and LSCE, 2002) since the GMP has been enacted. California DHS recommends review and update of DWSAP reports every five years (California DHS, 1999), and an update of the potentially contaminating activities near SqCWD's wells is planned for 2014.

- SqCWD submitted a DWSAP reports for the Aptos Jr. High and Polo Grounds wells to State Department of Public Health in 2011 (HydroMetrics WRI, 2011b and 2011c).

- CWD submitted updated DWSAP reports (Johnson, 2009) to State Department of Public Health in Water Year 2009.

- SqCWD will submit a DWSAP report for the O'Neill Ranch well in 2014.

BMO 3-1: MAINTAIN OR ENHANCE THE QUANTITY AND QUALITY OF GROUNDWATER RECHARGE BY PARTICIPATING IN LAND USE PLANNING PROCESSES

- SqCWD and CWD continue to support Santa Cruz County efforts to review land use proposals in Primary Recharge Areas and identify projects to enhance groundwater recharge. SqCWD has a representative on the Technical Advisory Committee for these efforts.

- CWD continued to maintain much of its area as a primary recharge area.

BMO 3-2: AVOID ALTERATION OF STREAMFLOWS THAT WOULD ADVERSELY IMPACT THE SURVIVAL OF POPULATIONS OF AQUATIC AND RIPARIAN ORGANISMS

- SqCWD continued to monitor streamflow and shallow groundwater levels near Soquel Creek.

- SqCWD's finalized its Well Master Plan EIR in 2011 (ESA, 2011). The EIR includes measures for monitoring streamflow at Soquel Creek and Aptos Creek, and pumping modifications if baseflow depletion related to future pumping from the proposed O'Neill Ranch Well and Austrian Way Well are detected.

- SqCWD submitted a stream monitoring and adaptive management plan for Soquel Creek to Santa Cruz County and National Marine Fisheries Service and began implementation of the plan in partnership with the City of Santa Cruz. The first reports evaluating baseline conditions before the O'Neill Ranch and Beltz #12 wells come online will be available in 2014.

BMO 3-3: PROTECT THE STRUCTURE AND HYDRAULIC CHARACTERISTICS OF THE GROUNDWATER BASIN BY AVOIDING WITHDRAWALS THAT CAUSE SUBSIDENCE

- No subsidence has been reported since the GMP was enacted

6.2 STATUS OF BASIN MANAGEMENT ELEMENTS

The Soquel-Aptos Basin Groundwater Management Plan Update includes 14 elements. Elements are the specific projects, programs, and policies that are planned for management of the Basin. Action items were identified for each element. This section provides a summary and status of the action items included in each element. Status descriptions were provided by SqCWD, CWD, City of Santa Cruz, Santa Cruz County, and Pajaro Valley Water Management Agency.

Action items that have been identified since the Groundwater Management Plan Update are added. The Water Year report where the action item is first identified is included in parantheses.

ELEMENT 1: GROUNDWATER MONITORING

1. Continue and expand existing regional groundwater monitoring programs

SqCWD and CWD continued measuring groundwater levels and sampling groundwater quality from their network of monitoring and production wells as described in the GMP.

SqCWD has expanded its network by adding monitoring wells:

- In Water Year 2008, quarterly groundwater level measurements were initiated at the SC-19 well at Austrian Way and monthly groundwater level measurements and quarterly water quality measurements were initiated at the three SC-A8 wells located at Dolphin Drive and Sumner Avenue.
- In Water Year 2009, SqCWD installed three SC-20 monitoring wells at Polo Grounds Park using Proposition 50 bond funding. Data loggers were installed in these new wells to continuously record groundwater levels.
- In Water Year 2012, SqCWD installed new monitoring wells at the Cornwell Road Tank Site (SC-21) and on 41st Ave in the Western Purisima (SC-22). SqCWD also began monitoring the newly installed O'Neill Ranch production well in 2012.
- This past year, SqCWD installed new monitoring wells at the Larkin Valley Tank Site (SC-A9) and on Quail Run Road in the Eastern Purisima (SC-23).

The City of Santa Cruz continued measuring groundwater levels and sampling groundwater quality at its network of monitoring wells. In early 2010, the City of Santa Cruz expanded its network when it installed monitoring wells at three new locations: Coffee Lane Park, Cory Street, and Auto Plaza Drive. In 2012, the City installed monitoring wells at 30th Avenue and Elda Lane, converted the former Beltz 7 production well to two monitoring wells, and replaced the deep monitoring well at Soquel Point. Groundwater levels are measured monthly and groundwater quality is sampled semi-annually at all City of Santa Cruz's monitoring wells. In 2013, the City installed a deeper monitoring well at Cory Street to monitor the Tu unit that supplies the City's Beltz #12 well and SqCWD's O'Neill Ranch well.

Santa Cruz County Environmental Health Services monitors groundwater levels in approximately 35 private and small water system wells constructed in the Purisima and Aromas aquifers. Most wells are measured semi-annually (spring and fall), but a smaller group of wells in the Valencia Creek area are measured monthly.

2. Continue shallow Groundwater Monitoring Program

SqCWD continued to monitor groundwater levels in shallow wells along Soquel Creek. In 2012, SqCWD installed a new shallow well on Soquel Wharf Road, the first shallow well on the west side of the Creek. Monitoring of the Simon shallow well was suspended in 2011 but an agreement to recommence monitoring was obtained in 2012. Equipment for monitoring groundwater levels in shallow wells was installed and tested in 2012 at the Main Street, Soquel Wharf Road, and Nob Hill shallow wells.

3. Share and consolidate monitoring data among all agencies overlying the Soquel-Aptos Area Basin

In 2009, the state enacted legislation (SBX7-6) implementing the California Statewide Groundwater Elevation Monitoring (CASGEM) program, requiring submittal of groundwater level data for all groundwater basins in the state. Groundwater elevation data from the Soquel-Aptos basin are being submitted to the State as part of the County-wide data submittals. With the support of the Basin Advisory Group, Santa Cruz County is the reporting entity for all groundwater basins in the County. PVWMA staff has developed a framework for the database that will be used to submit the data to the state.

County staff prepared and submitted the coordinated monitoring plan to the state in 2011 (Khalsa, 2011). County staff continues to coordinate submission of CASGEM data (Nguyen, 2014).

Additional data are shared by SqCWD, CWD, Pajaro Valley Water Management Agency, the City of Santa Cruz, and Santa Cruz County in an ad-hoc manner. SqCWD's file transfer protocol (FTP) site is used for the agencies to upload and download data.

4. Analyze data and assess the adequacy of the monitoring well network annually

Analyses of groundwater data are discussed in Sections 3-5.

In Water Year 2008, SqCWD began implementing recommendations in the *Evaluation of Water Quality Monitoring Network and Recommendations for Improvement* (HydroMetrics LLC, 2007) by installing new bladder pump equipment for sampling and identifying monitoring wells that need to be replaced.

In Water Year 2009, SqCWD replaced the three SC-3 monitoring wells at Escalona Drive because they were providing unreliable data. Monitoring wells SC-8F, SC-9A, and SC-A2 were replaced in 2012, along with wells SC-9C and SC-9E. Wells SC-9B and SC-9D were destroyed and not replaced, as SC-9C and SC-9E provide more representative data of the aquifer units.
Monitoring wells at Cherryvale (SC-10), Porter Gulch (SC-11), and Main Street (SC-18) were replaced in the past year with a new deeper well installed at Cherryvale (SC-10AAA).

Based on an Assessment and Informational Update of the Groundwater Management Program, SqCWD's board approved a plan in 2009 for retrofitting existing monitoring wells with groundwater level data loggers and bladder pumps. Groundwater level loggers and bladder pumps are currently installed in the SC-1, SC-3R, SC-5RA, SC-8R (except SC-8RE which is artesian), SC-9R, SC-20, SC-21, SC-22 SC-A1, SC-A2R, SC-A3, SC-A4, SC-A5, and SC-A8 wells. SC-5RB only has a bladder pump installed.

5. ***Coordinate with other groundwater resource agencies to develop uniform data collection procedures and data sharing protocols***

   Minimum standards for monitoring protocols have not yet been set for all agencies in the Soquel-Aptos Area Basin.

   SqCWD continued to support Santa Cruz County efforts to create a GIS well layer for information about private wells in Santa Cruz County. The database has information on about 6,000 private wells throughout the County. The County provided a GIS layer of monitored private wells for use in this annual report.

   The County has begun development of a coordinated database for water resources data through the Integrated Regional Water Management Plan using Proposition 50 funds.

6. ***Develop an outreach program to obtain groundwater level data from private pumpers within the Soquel-Aptos area***

   In 2008, Santa Cruz County established a voluntary groundwater monitoring program with private well owners in the Soquel-Aptos basin and provided the data for use in this annual report.

   As part of the Well Master Plan EIR, SqCWD is including a voluntary monitoring and mitigation program for private wells within 1,000 meters of new SqCWD production wells (ESA, 2010). The program includes collection of production and groundwater level data at private wells to monitor for restrictive effects related to pumping of a new SqCWD well. Thirteen private wells near the Polo Grounds well enrolled in the program and monitoring at these wells commenced in 2012. Eight private wells near the O'Neill Ranch well enrolled in the program and monitoring at these wells commenced in 2013.

ELEMENT 2: SURFACE WATER MONITORING

1. ***Monitor stream gauges on Soquel Creek to identify and track changes in baseflow conditions***

   SqCWD continued to monitor streamflow and temperature at the Upper Soquel Creek and West Branch stream gauges. Data loggers record stream

elevations every 15 minutes, and the data are downloaded and converted to daily values once a month. SqCWD continued to contribute toward the cost to operate and maintain the Soquel Creek Stream Gauging Station at Bridge Street along with Santa Cruz County and the U.S. Geological Survey.

The County also continued a sediment monitoring program on Soquel Creek and the West Branch.

SqCWD's Well Master Plan EIR contains plans for monitoring streamflow on Soquel Creek (ESA, 2011). A stream monitoring and adaptive management plan was submitted to the resource agencies in 2012. The Soquel Wharf Road shallow well and Nob Hill stream water level gauge were installed downstream of the O'Neill Ranch and City of Santa Cruz Beltz #12 wells. In its response to comments on Beltz #12 EIR, the City committed to partner with SqCWD in developing and implementing the plan (Almond, 2011). The first report on baseline data will be submitted to the resource agencies in summer 2014 prior to the two new production wells coming online.

2. ***Monitor rainfall in the Soquel-Aptos Area Basin to establish rainfall-runoff relationship***

SqCWD continued to collect rainfall data at the Mancarti and Kraeger/Longridge Rain Gauges within the Soquel Creek Watershed. Data loggers record values every 15 minutes, and the data are downloaded and converted to daily values once a month.

SqCWD, CWD, and the City of Santa Cruz cooperatively funded a study to estimate the spatial and temporal variation in deep groundwater recharge. The study used daily rainfall data at four coop climate stations in and around the Soquel-Aptos Basin in addition to the Mancarti and Kraeger/Longridge gauges (Figure 2-1) to estimate deep recharge.

SqCWD has installed a weather station at its Main Street wells site as part of the Soquel Creek monitoring and adaptive management plan. The station monitors rainfall data.

3. ***Monitor selected shallow wells adjacent to creeks to identify and quantify stream aquifer interactions. Coordinate a meeting with SqCWD and the County of Santa Cruz to discuss future analysis of the shallow well monitoring data from 2003 – 2006***

SqCWD continued to measure shallow groundwater levels at the four monitoring sites along the eastern side of Soquel Creek: Simons, Balogh, Main Street, and Nob Hill. A new shallow well on the western side of Soquel Creek was installed at Soquel Wharf Road in 2012.

Analysis of these shallow groundwater levels was provided in the *Water Year 2007 Annual Review and Report* (HydroMetrics LLC, 2009a). Santa Cruz County is on the Basin Advisory Group that reviewed the analysis. Shallow well water levels will also be presented in the Soquel Creek monitoring and adaptive management reports.

4. ***Analyze stream gauge data, rainfall data, and shallow monitoring data annually***

Data from the above three monitoring programs were analyzed in the *Water Year 2007 Annual Review and Report* (HydroMetrics LLC, 2009a). Additional analysis is not included in this report, but further analysis will be included in reports for the Soquel Creek monitoring and adaptive management plan. Additional reporting may be necessary in the future as the surface water monitoring program is expanded to other creeks such as Aptos Creek.

5. ***Support stream monitoring and management activities along Aptos Creek and Valencia Creek***

The County has maintained a program of streamflow and sediment monitoring on Valencia Creek since September 2008.

SqCWD's Well Master Plan EIR contains measures for monitoring streamflow on Aptos Creek, including installation of a new streamflow gauge downstream of the proposed Austrian Way well (ESA, 2011).

The Aptos Creek pathogen TMDL has been adopted by the Regional Water Quality Control Board. The sediment TMDL for the Aptos watershed is on hold because management measures are being implemented through the Santa Cruz County Stormwater Management Program (Briggs, 2007). Stormwater management plans for the County were approved by the State Regional Water Quality Control Board in 2009 and implementation activities are ongoing.

The County, City of Santa Cruz and Scotts Valley Water District recently received Proposition 84 stormwater grant to implement projects to reduce stormwater runoff and increase groundwater recharge by infiltrating runoff from impervious surfaces. These projects will be implemented in 2014 (Nguyen, 2014).

SqCWD continued its ongoing funding and review of stream habitat and juvenile salmonid (steelhead and coho salmon) monitoring in the Soquel and Aptos Creek watersheds as part of the Santa Cruz County Stream Habitat and Juvenile Salmonid Sampling Program.

ELEMENT 3: SUBSIDENCE MONITORING

1. Develop and implement a GPS based subsidence monitoring program

SqCWD and CWD have not initiated work to develop and implement a subsidence monitoring program.

2. Analyze data and assess the frequency of the subsidence monitoring

This action item cannot be performed until a subsidence monitoring program is implemented.

3. Review other means of subsidence measuring and monitoring

SqCWD and CWD have not reviewed alternate means of measuring and monitoring subsidence.

ELEMENT 4: INTERAGENCY COORDINATION

1. Develop and secure a supplemental source of supply with the City of Santa Cruz

The pilot plant for the Santa Cruz Water Department/Soquel Creek Water District (SCWD^2) Regional Seawater Desalination Project completed testing in 2009. Environmental review and design were initiated for the Regional Seawater Desalination Project in 2010. A Notice of Preparation and Initial Study for Environmental Impact Report of the Regional Seawater Desalination Project was issued in November 2010. A scoping report was issued in February 2011 that summarizes public comment on the proposed

scope and content of the Environmental Impact Report. The Draft EIR is scheduled was published in 2013 and public comments were published in a Public Review Summary Report. However, the project is on hold while the City of Santa Cruz is increasing the involvement of the community in water supply issues.

2. ***Continue to cooperatively manage groundwater under the provisions of the Soquel Aptos Groundwater Management Alliance (SAGMA)***

   SAGMA continues to meet annually to discuss management of the groundwater basin. SAGMA makes up most of the Basin Advisory Group that reviews this annual report.

3. ***Expand the Soquel-Aptos Groundwater Management Authority to include other water resource agencies that have jurisdiction within the Soquel-Aptos area***

   The Soquel-Aptos Groundwater Management Authority has not been expanded and the area subject to the GMP remains the areas of SqCWD and CWD. However, there have been recent discussions to include the City of Santa Cruz and Santa Cruz County in the Soquel-Aptos Groundwater Management Authority.

4. ***Continue to support the USGS GAMA project and work cooperatively with USGS, State, and regional agencies to improve statewide monitoring***

   The Groundwater Ambient Monitoring and Assessment Program (GAMA) last tested private and public wells in the Soquel-Aptos area in 2005 (Kulongoski and Belitz, 2007). The GAMA program intends to sample a subset of these wells every three years to establish groundwater quality trends. SqCWD and CWD will support the USGS as it conducts new sampling at wells in the Soquel-Aptos area.

5. ***Continue to support the USGS Soquel Creek Stream Gauging Station***

   SqCWD continues to contribute toward the cost to operate and maintain the Soquel Creek Stream Gauging Station at Bridge Street in Soquel.

6. ***Continue to participate and support the Northern Santa Cruz County Integrated Regional Water Management Plan (IRWMP)***

Proposition 50 funding for projects identified in the IRWMP has reimbursed the 2009 construction of monitoring wells at the Polo Grounds Park. SqCWD used Proposition 50 funding to convert the Polo Grounds irrigation well to a municipal well. Santa Cruz County used funding for abandoned well destruction and projects to enhance groundwater recharge.

A Proposition 84 planning grant for IRWMP studies was approved by the State in 2011. Included in the approved studies was the Aromas and Purisima Groundwater Basin Management Study. This study was conducted by CWD and evaluated maximizing the developable yield in CWD's Cox Well Field; addressed concerns about Chromium VI in the CWD service area; and addressed regional Aromas water quality and overdraft concerns. This study was completed in early 2014. This grant is also supporting the next phase of developing opportunities for transfer of surplus water from the San Lorenzo River by the City of Santa Cruz to allow reduction in groundwater pumping.

An update of the IRWM Plan will also be completed using Proposition 84 funding.

7. ***Support implementation of Pajaro Valley Water Management Agency's (PVWMA) Basin Management Plan and PVWMA/City of Watsonville efforts to develop the Watsonville Area Water Recycling Project***

SqCWD and CWD continue to support implementation of PVWMA's Basin Management Plan (BMP) and the Watsonville Area Water Recycling Project, which began operation in April 2009. From 2009-2013, approximately 10,351 acre-feet of recycled water was produced and 15,779 acre-feet of blended water was delivered by the Coastal Distribution System. The update of the BMP commenced in 2011 and the Conservation and Customer Service Field Manager of SqCWD serves on the ad-hoc BMP Advisory Committee. The draft BMP has been released for public review. The BMP is scheduled to be finalized in 2014 when the EIR is certified by PVWMA's Board of Directors. Implementation of the updated BMP is expected to reduce current groundwater extraction by 12,000 acre-feet per year to halt further seawater intrusion.

8. ***Support PVWMA efforts to develop a numerical model of the Pajaro Valley groundwater basin***

PVWMA has developed the Pajaro Valley Hydrologic Model, a numerical model of the Pajaro Valley basin. SqCWD had a representative on the model's Technical Advisory Committee, which approved the final model in 2010. SqCWD and CWD also provided data for the model. The model is being used in the update to PVWMA's Basin Management Plan.

9. Support the Central Coast Regional Water Quality Control Board's (RWQCB) Implementation Strategy for the Aptos Watershed Sediment Total Maximum Daily Load (TMDL) Report

RWQCB decided in 2007 to implement management measurements for sediment impairment of the Aptos watershed through the Santa Cruz County Stormwater Management Program (Briggs, 2007). The State Water Resources Control Board approved the County's Storm Water Management Plan in Water Year 2009. The County completed a draft runoff and pollution control ordinance, draft stormwater construction best management practices manual, and updates to design criteria for stormwater management in 2011. SqCWD and CWD continue to support the County's implementation of stormwater management.

10 (2012). Develop and implement cooperative management agreements to monitor and mitigate impacts from operating new municipal wells.

In 2011, SqCWD and CWD agreed on cooperative groundwater management to monitor and mitigate any impacts on CWD's wells from operating the Polo Grounds well, which is being converted from park irrigation to municipal use. Implementation of the agreement has commenced and the baseline report for conditions prior to operation of the Polo Grounds well was issued in 2013.

SqCWD and the City of Santa Cruz have developed plans to monitor and mitigate impacts from operating the O'Neill Ranch and Beltz #12 wells as part of the EIRs for those wells. Those plans will serve as a basis for a cooperative groundwater agreement between the agencies.

11 (2010). Coordinate on water resource data and technical studies.

SqCWD and CWD staff participated with County staff in a 2009 joint meeting of the County Water Advisory Commission and the Commission on the

Environment to discuss local issues related to water supply and climate change. The County sponsored a U.S. Geological Survey study of climate change effects on County hydrology, which was completed in 2012.

SqCWD, CWD, and the City of Santa Cruz cooperatively funded a study to estimate the spatial and temporal variation in deep groundwater recharge that was completed in 2011 (HydroMetrics WRI, 2011a).

SqCWD, CWD, the City of Santa Cruz, and PVWMA are working with the County to provide groundwater level data for submission to the state under the new California Statewide Groundwater Elevation Program (CASGEM).

Representatives from the County, SqCWD, and PVWMA served on the Technical Advisory Committee for CWD's Aromas and Purisima Groundwater Basin Management Study.

11 (2013). Support County efforts to engage non-municipal groundwater users

The County is forming a stakeholder advisory group to improve small water systems and private well owners participation in groundwater management of the basin. SqCWD and CWD will provide technical support to the County in this effort.

ELEMENT 5: DEVELOP A SUPPLEMENTAL SOURCE OF SUPPLY

1. Develop and secure a supplemental water supply suitable for implementing a conjunctive use program

The pilot plant for the Santa Cruz Water Department/Soquel Creek Water District (SCWD^2) Regional Seawater Desalination Project completed testing in April 2009. A Notice of Preparation and Initial Study for Environmental Impact Report of the Regional Seawater Desalination Project was issued in November 2010. The Draft EIR was published in 2013 and public comments were published in a Public Review Summary Report. However, the project is on hold due to concerns about the level of community support for the project.

2. Explore and pursue funding opportunities for supplemental supply projects

SqCWD and CWD supported the IRWMP that was awarded Proposition 50 funding for intake study costs related to the desalination plant. SqCWD also

received grant funding in 2008 to study the feasibility and cost-effectiveness of constructing satellite reclamation plants to provide recycled water. The recommendation from this study concluded that construction of satellite reclamation plants to provide recycled water is not cost-effective and SqCWD would need to obtain additional funding to pursue the project (Black and Veatch, 2009).

SqCWD participated with the County and City of Santa Cruz in the evaluation and feasibility of the potential to utilize the City of Santa Cruz facilities to divert and treat excess winter streamflow from the San Lorenzo River to SqCWD during the months of November through April to allow reduction in groundwater pumping and in lieu recharge. The County's work on the project was funded by a Prop 84 IRWM Planning grant.

ELEMENT 6: PROTECT EXISTING RECHARGE ZONES

1. ***Support existing Santa Cruz County efforts to update Groundwater Recharge Maps that identify primary groundwater recharge zones***

   SqCWD and CWD continue to support Santa Cruz County efforts to update these maps. The County has updated primary groundwater recharge maps using electronic GIS data on soils and geology. The County also has soil information to assist with identifying secondary recharge areas as needed.

   SqCWD, CWD, and the City of Santa Cruz cooperatively funded a study to estimate the spatial and temporal variation in deep groundwater recharge. The study used daily rainfall data at four coop climate stations in and around the Soquel-Aptos Basin in addition to the Mancarti and Kraeger/Longridge gauges to estimate deep recharge. This study identifies where most of the basin recharge takes place.

2. ***Support PVWMA's efforts to optimize recharge and recovery, and develop an ASR (Aquifer Storage and Retrieval) Project in the Aromas Red Sands***

   PVWMA has developed, and is operating, its Harkins Slough Aquifer Storage and Retrieval (ASR) Project. This ASR project involves seasonal percolation of diverted Harkins Slough water into the Harkins Slough recharge basin for storage until the irrigation season, when it is extracted and delivered to the Coastal Distribution System (CDS) for distribution. The construction of the Harkins Slough diversion structure and recharge basin was completed in Fall

2001. The project has operated every year since 2002. Between 2002 and 2013, 7,004 acre feet of water have been diverted from Harkins Slough and pumped to the percolation pond. Recovery wells have extracted nearly 2,099 acre feet of diverted water for distribution in the CDS. The remaining water is in storage and left to recharge the Aromas Red Sands aquifers. Due to a dry weather brackish water flood in January 2012, water quality in the slough was too poor to operate the project during from January to May 2012. In 2013 due to lack of rainfall during this historic drought, diversions to the recharge basin have been limited. Ongoing studies being performed by the University of California, Santa Cruz (hydrogeology), and Stanford University (geophysics) are meant to provide data to help understand the hydrologic structure that controls recharge and recovery. SqCWD and CWD wrote letters of support for PVWMA's successful Local Grant Assistance (AB303) grant application to study the recharge processes beneath the pond with the goal of gaining better understanding of the fate of percolated water. The study, called the Harkins Slough Project Re-Operation Feasibility Study began in 2010 with the installation of three new monitoring wells and was completed in 2012. PVWMA continues to work on optimizing and looking for opportunities to re-operate the Harkins Slough project.

3. ***Support future efforts to characterize recharge areas within the Soquel-Aptos area***

   The data from the GAMA project (Kulongoski and Belitz, 2007) are expected to include chemical analyses that will help characterize recharge areas. A full review of these data to perform this characterization has not taken place.

   SqCWD, CWD, and the City of Santa Cruz cooperatively funded a study to estimate the spatial and temporal variation in deep groundwater recharge (HydroMetrics WRI, 2011a). The study used daily rainfall data at four coop climate stations in and around the Soquel-Aptos Basin in addition to the Mancarti and Kraeger/Longridge gauges to estimate deep recharge. This study identifies where most of the basin recharge takes place.

4. ***Coordinate and expand efforts between groundwater management agencies and the County of Santa Cruz to establish regulations for land use within Primary Recharge Areas***

   SqCWD and CWD continue to support County efforts to review land use proposals within Primary Recharge Areas.

ELEMENT 7: ENHANCE GROUNDWATER RECHARGE

1. Enhance groundwater recharge with stormwater runoff

SqCWD and CWD continue to support Santa Cruz County efforts to identify projects to enhance groundwater recharge. The County led a Proposition 50 funded effort to implement demonstration projects to restore groundwater infiltration from developed areas at Polo Grounds Park and Brommer Street Park within the Groundwater Management Area. Installation of two separate facilities at Polo Grounds Park was completed in 2011 and 2012. The County received a Prop 84 stormwater grant to construct the Brommer Street project and provide additional infiltration measures as a part of a new park development at the Heart of Soquel Park to be implemented in 2014. The Resource Conservation District of Santa Cruz County is also implementing a separate grant funded project to promote recharge through home drainage improvements, including outreach and technical assistance.

CWD supported Aptos High School with its recharge pond project in 2008.

2. Develop and implement standards that require discretionary projects in primary recharge zones to maintain or increase a site's pre-development absorption of runoff

SqCWD and CWD continue to support County efforts to develop a program that will include standards regulating impervious surfaces and provide measures to increase groundwater recharge. The County is working with RWQCB to develop requirements for Low Impact Development to address hydromodification impacts as required in the County's stormwater plan. The County adopted a runoff and pollution control ordinance, stormwater construction best practices manual, and updates to design criteria for stormwater runoff in 2012. The RWQCB has approved the County's program as meeting the state requirements, with some enhancements.

3. Support County of Santa Cruz efforts to prioritize potential sites for drainage facilities, and implement construction

SqCWD and CWD continue to support County efforts to identify drainage facilities with potential for groundwater recharge.

4. ***Participate in public outreach and awareness for groundwater recharge***

   SqCWD and CWD supported the County and Resource Conservation District (RCD)'s implementation of the grant funded projects to promote recharge.

5. ***Investigate the water storage potential of the Aromas Red Sands***

   Potential projects for enhanced recharge in the Pleasant Valley/Freedom Blvd. area may be considered by SqCWD and CWD.

ELEMENT 8: MANAGE PUMPING

1. ***Locate, design, and install additional and replacement production wells to improve pumping distribution, disperse the basin's overall drawdown and improve operational flexibility***

   SqCWD published its draft EIR for the Well Master Plan in 2010. After responding to comments, SqCWD certified the EIR in 2011 and approved the Polo Grounds well, Cunnison Lane well, Granite Way well, O'Neill Ranch well, and Austrian Way well projects. SqCWD constructed a treatment plant for the Polo Grounds well and brought the well online in 2012. Construction of the O'Neill Ranch well was completed in 2012 and construction of a treatment plant for the well is scheduled for 2014.

2. ***Continue to encourage private well users located within critical groundwater areas of the Soquel-Aptos basin to discontinue pumping and connect to the local municipal water supply systems***

   SqCWD continued to use its Private Well Incentive Policy to encourage private well users located in critical groundwater areas to properly abandon their wells and connect to the District's distribution system.

   SqCWD has coordinated with the Pot Belly Beach Club to remove 19 residences from coastal wells and connect to the District's distribution system. This project was completed in 2011, although there are five additional homes that remain on existing wells and may be connected in the future.

3. ***Cooperatively work with City of Santa Cruz to develop a coordinated pumping plan for the City's Live Oak wells and SqCWD's Purisima wells***

SqCWD and the City of Santa Cruz met in 2010 to develop a cooperative groundwater management agreement. SqCWD revised its monitoring and mitigation plan in the Well Master Plan EIR (ESA, 2011) in response to comments from the City. The City sought and received feedback from SqCWD on its CEQA documentation for its proposed new inland well, Beltz #12. The Beltz #12 EIR was certified by the City in 2011 (Chambers Group, 2011). SqCWD's and the City's EIRs are consistent in the amount of planned future maximum pumping by the City from its existing coastal production wells and Beltz #12 will be 525 acre-feet per calendar year during non-critically dry years and 645 acre-feet per calendar year during critically dry years. Proposed revisions to the draft agreement were exchanged in 2012.

4. ***Analyze groundwater level/quality data and groundwater pumping data at least annually, and recommend changes to the groundwater pumping distribution as necessary***

   This analysis is completed in Sections 2-5. SqCWD's consulting hydrologist has provided recommendations for pumping distribution to meet different pumping goals (HydroMetrics WRI, 2013).

   SqCWD completed installing groundwater level transducers in all of its production wells in Water Year 2010. The transducers are connected to SqCWD's SCADA system, allowing SqCWD to adjust pumping based on current pumping groundwater levels.

ELEMENT 9: IDENTIFY AND MANAGE CUMULATIVE IMPACTS

1. ***Encourage sustainable pumping from non-agency groundwater users***

   SqCWD worked with Cabrillo College, Trout Gulch Mutual, PureSource Mutual, Seascape Greens and Seascape Golf Course to improve water use efficiency and implement conservation opportunities.

2. ***Identify and manage well interference and manage groundwater storage for beneficial uses and drought reserve***

   Groundwater levels in production wells are monitored to assess whether cones of depression from other wells have caused lowered groundwater levels that result in an appreciable diminution in the quantity or quality of

water pumped by that well. Based on monitoring data, well interference between the three agencies that operate municipal production wells in the Soquel-Aptos Area Basin has not been identified as an issue at this time. Well interference has been identified as an issue within the SqCWD system. Well production has been affected at the Estates and T. Hopkins wells due to cumulative drawdown.

The Well Master Plan EIR includes monitoring and mitigation plans to address restrictive effects on nearby production wells after the Well Master Plan is implemented. The plans address private wells, the City of Santa Cruz's Live Oak well field, and CWD's Cox and Rob Roy well fields. Monitoring of private wells near the Polo Grounds well commenced in 2011. SqCWD installed monitoring wells on 41st Ave to monitor well interference between the City of Santa Cruz and SqCWD's production wells in 2012.

The potential for well interference between the newly installed SqCWD O'Neill Ranch well and City of Santa Cruz Beltz #12 well has been identified and the EIRs for the two wells outline a monitoring plan.

3. ***Install new wells in locations that reduce cumulative impacts***

Cumulative effects of pumping the new wells in the Well Master Plan have been analyzed. Based on planned redistribution of pumping, the net cumulative effects of the Well Master Plan should be beneficial.

Two of the new wells in the Well Master Plan, the Austrian Way and Granite Way wells, are intended to alleviate the identified cumulative impacts that affect the production of the Estates and T. Hopkins wells.

The City of Santa Cruz certified its Environmental Impact Report (Chambers Group, 2011) for the Beltz #12 well at Research Park Drive and Cory Street to redistribute a portion of the City's projected drought year pumping to an inland location.

4. ***Continue to improve and quantify projected future demands from all groundwater users***

SqCWD updated projections of future demands in Water Year 2009 to support analyses for the Well Master Plan EIR. Future projected demand was reduced 410 acre-feet per year from projections in SqCWD's *Integrated Resources Plan* (ESA, 2006) based on recent demand reductions. Updated demand projections were documented in the updated Urban Water Management Plan (SqCWD, 2011).

ELEMENT 10: WATER CONSERVATION

1. Continue and update the existing water conservation programs for SqCWD.

SqCWD continued a broad and multi-faceted water conservation program and added rebates for greywater, turf replacement and hot water recirculation devices. SqCWD adopted water use efficiency ordinances for indoor and outdoor use by new development and remodels, updated the water waste ordinance and began enforcement to prevent haulers from taking water from SqCWD bulk water stations outside the District. SqCWD also installed the first phase of a grant funded landscape demonstration project at its headquarters in 2010. SqCWD will implement a long-term, year-round Water Use Reduction Program beginning in 2014 that includes a residential water budget of 75 gallons per person per day.

2. Continue and update the existing water conservation programs for CWD.

CWD continued its existing water conservation programs and opened a drought tolerant demonstration garden in Water Year 2009.

3. Annually report estimated savings from the ongoing water conservation program.

Water production by SqCWD in Water Year 2013 was the ninth straight year when production was at least 500 acre-feet less than the previous ten-year period average (1995-2004). Much of this continuing reduction is attributed to SqCWD's on-going conservation programs.

4 (2010). Support County wide ordinances promoting conservation.

The County has developed a water efficient landscape ordinance while implementing the state's water efficient landscape ordinance. The ordinance

will be presented to the County Planning Commission and Board of Supervisors in 2013. The County is developing a package of measures to update and expand the County's water conservation measures that may include the creation of a water use impact fee. In 2009, amendments to the County well ordinance went into effect that resulted in increased water conservation by agricultural users and small water systems. New water use efficiency ordinances have been adopted for the SqCWD and City of Santa Cruz service areas. The County, SqCWD, the City of Santa Cruz, and the City of Capitola also worked with the local Greywater Alliance to establish procedures for use of greywater irrigation systems. SqCWD and CWD support these County efforts.

5 (2011). Develop Drought Curtailment Criteria.

SqCWD's Urban Water Management Plan 2010 (SqCWD, 2011) includes criteria for declaring drought curtailments. The criteria are multi-year rainfall totals through March of the current year and are based on results from the Soquel-Aptos Area Recharge Model (HydroMetrics WRI, 2011a), a PRMS model that estimates the spatial and temporal variation in deep groundwater recharge. Drought curtailments were declared in 2012 (Stage 1) and 2013 (Stage 2).

ELEMENT 11: SUPPORT THE DEVELOPMENT AND UPDATE OF POLICIES AND ORDINANCES FOR WELL CONSTRUCTION, ABANDONMENT, AND DESTRUCTION

1. Support existing well construction and well destruction standards, including the recent revisions to the County of Santa Cruz Well Ordinance

SqCWD and CWD worked closely with Santa Cruz County to implement revisions to the water well ordinance that went into effect March 23, 2009. SqCWD followed the revised ordinance with its recent monitoring well replacement projects.

2. Support County of Santa Cruz's well destruction program

SqCWD and CWD support Santa Cruz County's abandoned well destruction program. With the support of the agencies through the IRWMP, the County used Proposition 50 water bond funding to destroy abandoned wells, an

effort that was completed in 2012, and included destruction of 4 wells. One of the destroyed wells was at the County's Polo Grounds park near the well recently added to SqCWD's municipal supply.

Monitoring wells such as the SC-9 cluster and SC-8F were properly destroyed when they were replaced in 2012. SqCWD also destroyed SC-9, SC-8F, SC-5D, and SC-5E in 2012. In 2012, the monitoring well SC-5C was identified as needing to be sealed; the well cannot be fully destroyed since it shares a borehole with wells SC-5A and 5B. The former production well at Madeline has also been identified for destruction. In 2013-2014 monitoring wells such as the SC-10, SC-11 and SC-18 well clusters were properly destroyed after they were replaced.

3. ***Continue to implement SqCWD well destruction policy***

SqCWD continues to require property owners to properly destroy abandoned private wells before connecting to the SqCWD system.

4. ***Request Santa Cruz County Environmental Health Services establish a voluntary monitoring program of private wells, particularly in inland areas of the Soquel-Aptos groundwater management area***

The County has implemented this voluntary monitoring program of groundwater levels. Groundwater levels are being monitored semi-annually at wells in the inland areas of the groundwater management area and monthly at wells along Valencia Creek.

ELEMENT 12: WELLHEAD PROTECTION MEASURES

1. ***Periodically update and review the SqCWD and CWD Drinking Water Source Assessment and Protection (DWSAP) analysis and submittals.***

SqCWD has not updated DWSAP analysis and submittals (LSCE, 2002; Todd Engineers, 2002) since the GMP has been enacted. SqCWD submitted DWSAPs for the Aptos Jr. High and Polo Grounds wells (HydroMetrics WRI, 2011b and 2011c). CWD submitted updated DWSAP reports (Johnson, 2009) to State Department of Public Health in Water Year 2009. SqCWD will submit a DWSAP for the O'Neill Ranch well in 2014 and plans to update the catalog potentially contaminating activities for wells included in the 2002 DWSAPs in 2014.

2. ***Continue to assist with and endorse Santa Cruz County's expanded wellhead protection programs.***

   SqCWD and CWD continue to support Santa Cruz County's programs for wellhead protection. Related programs not listed in the Groundwater Management Plan are the County's septic system management program and the RCD and Ecology Action's Livestock and Land program.

3. ***Support groundwater remediation activities.***

   SqCWD and CWD continue to support the State and Santa Cruz County's programs such as regulation of the cleanup and monitoring of sites with known or potential contamination by the Central Coast Regional Water Quality Control Board (RWQCB) and Santa Cruz County Department of Environmental Health, submittal of the MTBE Report to Public Water System Operators, and use of the State's Underground Storage Tank Cleanup Fund.

ELEMENT 13: PUBLIC EDUCATION

1. ***Maintain SqCWD's Public Information Program***

   In addition to its ongoing public information program, in 2010, SqCWD sponsored a demonstration garden on Wharf Rd. in Soquel, collaborated with other agencies and private non-profit organizations on the Green Gardner Program.

2. ***Maintain SqCWD School Education Program***

   SqCWD continued to conduct its robust school education program including assemblies, classroom teaching and teacher training.

3. ***Maintain CWD Public Education Programs***

   CWD continued to conduct its public education programs and completed development of a drought tolerant demonstration garden in Water Year 2009.

4. ***Support and participate in regional programs***

SqCWD continued to support and participate in regional programs, such as outreach for the Integrated Regional Water Management Plan.

ELEMENT 14: IMPROVE GROUNDWATER BASIN MANAGEMENT TOOLS

1. Continue to improve and quantify sustainable yield estimates

SqCWD and CWD have continued to improve and update their sustainable yield estimates. Post-recovery pumping yields based on modeled offshore flows required to achieve groundwater elevations protective against seawater intrusion have been developed (HydroMetrics WRI, 2012). The post-recovery pumping yields are based on recently developed estimates for recharge (HydroMetrics WRI, 2011a), modifications of prior estimates for consumptive use (Johnson et al., 2004), and outflows to Pajaro Valley. The estimated post-recovery pumping yield for the Purisima area is 2,800 acre-feet per year. The estimated post-recovery pumping yield for the Aromas area is 1,200 acre-feet per year. SqCWD commissioned a peer review in 2014 to evaluate these estimates.

2. Establish water levels that protect the groundwater basin against seawater intrusion

SqCWD has established protective groundwater elevations at its coastal monitoring wells that protect against seawater intrusion. The protective groundwater elevations are documented in *Groundwater Levels to Protect against Seawater Intrusion and Store Freshwater Offshore* (HydroMetrics LLC, 2009b). Protective groundwater elevations for the Aromas area were revised to maintain the freshwater-salt water interface at its current location in the monitoring wells (HydroMetrics WRI, 2012).

3. Assist state, federal, or local wildlife and fisheries agencies as they develop water flow or water quality requirements for riparian and aquatic organisms

SqCWD continued its ongoing funding and review of stream habitat and juvenile salmonid (steelhead and coho salmon) monitoring in the Soquel and Aptos Creek watersheds as part of the Santa Cruz County Stream Habitat and Juvenile Salmonid Sampling Program. SqCWD and CWD also support the County's new policy for management of large woody material in county streams.

4. ***Maintain and enhance data collection and management.***

Data collection has been enhanced by installing new sampling equipment in several of SqCWD's wells. SqCWD and CWD have also installed groundwater level transducers in production wells to facilitate real-time management of pumping.

SqCWD and CWD continue to update the agencies' databases and Geographical Information Systems. Calendar year 2009 and future data for all water quality constituents analyzed by SqCWD are now stored in a new WaterTrax database.

5. ***Ensure data sharing among regional water agencies***

A formal process for data sharing among regional water agencies has been developed for the California Statewide Groundwater Elevation Monitoring (CASGEM) program. Data were also provided for this report by SqCWD, CWD, the City of Santa Cruz, and Santa Cruz County. SqCWD's file transfer protocol (FTP) site is used for the agencies to upload and download data.

6. ***Explore methods to collect data from non-agency groundwater users***

The County has implemented a voluntary monitoring program of groundwater levels at private wells. SqCWD's Well Master Plan EIR includes a voluntary monitoring and mitigation program for private wells within 1,000 meters of new SqCWD production wells (ESA, 2010) that will collect production and groundwater level data at private wells. Monitoring of private wells near the Polo Grounds well commenced in 2011.

7. ***Prepare a subregional groundwater model for CWD's Rob Roy Well Field***

A subregional model for the Aromas area was prepared for CWD as a tool to delineate well capture zones in the updated DWSAP reports (Johnson, 2009). This model was adapted for CWD's Proposition 84 funded basin management study in 2013

8. ***Provide data and technical assistance to Pajaro Valley Water Management Agency (PVWMA) Groundwater Basin Model***

PVWMA is finalizing the Pajaro Valley Hydrologic Model, a numerical model of the Pajaro Valley basin. SqCWD had a representative on the Technical Advisory Committee, which met in 2010 to approve the final model. The model is being used for the Basin Management Plan.

9. Explore opportunities to expand existing groundwater models to cover the Soquel-Aptos area

Two models were finalized in 2011 that may provide opportunities to develop a groundwater model that covers the Soquel-Aptos area: the Soquel-Aptos Area Recharge Model, a PRMS model that estimates the spatial and temporal variation in deep groundwater recharge, and the Pajaro Valley Hydrologic Model, a MODFLOW model of the Pajaro Valley basin. Results from the PRMS model was used in the adaptation of CWD's DWSAPs model for its Proposition 84 funded basin management study, which was completed in 2013.

SqCWD has budgeted for development of a groundwater model in 2014-2015 that will use the PRMS model and CWD's model

10. Explore methods to measure and locate the seawater/freshwater interface

Methods to locate the seawater/freshwater interface have not been explored. Estimated travel times for the interface were presented to SqCWD in 2012. SqCWD has budgeted for geophysics work to locate the seawater/freshwater interface in 2014-2015.

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SECTION 7
BASIN MANAGEMENT ACTION PRIORITIES AND RECOMMENDATIONS

7.1 BASIN MANAGEMENT ACTION PRIORITIES

This section lists the top priorities for projects and programs to achieve BMOs. BMO 2-2, maintain groundwater levels to prevent seawater intrusion, is the best indicator of the status of basin management. This objective has not been met, so the highest priorities are given to projects that will help raise coastal groundwater levels to prevent seawater intrusion. The priority list is focused on projects and programs that have not yet begun implementation. The list does not include a number of ongoing projects that support basin management objectives. The exclusion of ongoing projects from this list should not be considered a recommendation to change any of those ongoing projects.

1. Secure Supplemental Supply (Element 5, BMO 1-2). BMO 2-2 and other BMOs rely on successfully securing a supplemental supply and achieving BMO 1-2. The regional desalination plant is currently on hold and alternate supply options are being evaluated. Conservation can be viewed as a new water supply, and the updated Integrated Resources Plan (SqCWD, 2012) emphasizes continued implementation of existing and new conservation and drought management programs. It also identifies local supplemental supply alternatives for consideration instead of, or in addition to, the regional desalination project. These alternatives include a Soquel Creek diversion project, local-only desalination, site specific recycled water projects for non-potable irrigation use, and mandatory restrictions. A transfer of San Lorenzo River winter surplus flows from City of Santa Cruz to SqCWD is being evaluated but is unlikely to meet SqCWD's full supplemental supply for recovering the basin and achieving BMO 2-2. SqCWD is also evaluating injection of recycled water.

2. Monitor Tu Unit (Unit Below Purisima Formation) as SqCWD O'Neill Ranch well and City of Santa Cruz Beltz 12 well come online. (Element 8). Groundwater level data collected during pump testing of these wells indicate that recharge of the Tu unit supplying these wells may be limited. Groundwater levels in the Tu unit should be closely monitored as these wells come online and pumping managed to prevent well interference. In addition, groundwater levels at wells screened in the Tu unit should be mapped to evaluate flow directions in the Tu unit

3. Use Groundwater Level Logger Data in Groundwater Management (Element 1). SqCWD, CWD, and the City of Santa Cruz have implemented equipment to continuously collect groundwater level data. The use of the data in groundwater management should be expanded, starting with using the data to calculate average groundwater levels at the coast for comparison with protective elevations.

4. Monitor Effects of 3rd Consecutive Dry Year (Element 1). Water Year 2014 will likely be the third consecutive below average rainfall year. Monitoring effects of the drought will include assessing basin storage response to reduced recharge and evaluating groundwater level response in the Western Purisima to planned increases in pumping by the City of Santa Cruz due to lower surface water availability.

5. Initiate Groundwater Stakeholder Advisory Committee (Elements 4 and 13). With support from SqCWD and CWD, Santa Cruz County is leading an effort to form a Mid-County groundwater stakeholder advisory committeeto improve small water systems and private well owners' participation in groundwater management of the basin. Committee meetings will also provide a forum to share information about groundwater hydrology, protection against seawater intrusion, groundwater rights, data collection and monitoring, water use efficiency and basin sustainability.**6. Expand Groundwater Management Authority to Include Santa Cruz County and City of Santa Cruz (Element 4).** The County has important groundwater management responsibilities for the basin, particularly in oversight of non-municipal pumpers. The City is the largest pumper from the basin besides SqCWD and CWD.

7. Develop Groundwater Model (Element 14). Planning future management of the basin such as pumping reductions to recover the basin would be greatly enhanced with the predictive capabilities of a numerical groundwater model. Development of a groundwater model should be undertaken over 2014-2015.

8. Undertake Geophysics Study to Locate Seawater Interface (Element 14). Identifying the location of the seawater interface will assist with planning to prevent seawater intrusion in the Purisima and further advancement of seawater intrusion in the Aromas. Undertaking onshore geophysics studies should be undertaken over 2014-2015 with feasible offshore studies evaluated for possible implementation in 2015-2016.

7.2 CURRENT DATA INADEQUACIES

The following is a list of the main data inadequacies that could be addressed to enhance basin understanding and management.

- Non-agency pumping. As shown in Table 2-1 and Table 2-2, estimates of private pumpers are based on data from 1999 or earlier, more recent data is needed for a more complete analysis of basin pumping. The County has provided data on small water system consumption and estimates for private pumping in the Aromas area were developed as part of the Prop 84 planning grant funded CWD study.
- Verify pumping requirements for basin recovery. In 2012, SqCWD developed estimates of pumping rates and time frames necessary for achieving basin recovery. Uncertainties in these estimates may influence SqCWD's supplemental supply and basin management plans. Reducing the uncertainty may require better tools, such as a groundwater model, or verifying the effects of reduced pumping after SqCWD obtains a supplemental supply.

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SECTION 8
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