Tracy Subbasin
GSP Coordination Committee Meeting

Thursday March 23, 2023
1:00 PM to 3:00 PM

Teleconference Meeting Only
Teleconference Link: https://stantec.zoom.us/j/94618467229
Phone Number: +1-669-900-6833
Meeting ID: 946 1846 7229

The following options are available to members of the public to listen to these meetings and provide comments to the Committee Members before and during the meeting:

CALL-IN

Member of the public are encouraged to use the call-in number, which will allow them to fully participate in the meeting without having to be present in person. ***Once connected, we request you kindly mute your phone.***

PUBLIC COMMENT

If you wish to make a comment on a specific agenda item, please submit your comment via email by 5:00 p.m. on the Wednesday prior to the meeting. Please submit your comment via email to Matt Zidar, San Joaquin County, at mzidar@sjgov.org. Your comment will be shared with the Tracy Subbasin Groundwater Sustainability Agencies members and placed into the record at the meeting. Every effort will be made to read comments received during the meeting into the record, but some comments may not be read due to time limitations. Comments received after an agenda item will be made part of the record if received prior to the end of the meeting.

DISABILITY-RELATED MODIFICATIONS

If you need disability-related modification or accommodation in order to participate in this meeting, please call 1 (209) 468-3089 at least 48 hours prior to the start of the meeting.

AGENDA

I. Opening of Meeting/Roll Call

II. Scheduled Items

A. Approval of the February 16 GSP Coordination Committee Meeting Minutes – *Action Item*

B. GSA Status Updates - *Round Robin Discussion*

1. PMAs, Funding, and General Updates

C. GSP Implementation Updates

1. Spring Groundwater Level Measurements
2. Draft Annual Report

3. TSS Update
4. AEM Data – *Discussion Item*

D. Inter-basin Coordination – *Discussion Item*
   1. Adjacent Basin Updates
      1. Eastern San Joaquin: DMS System and Monitoring Field Data Collection
      2. Delta Mendota
      3. East Contra Costa
   2. DWR Engagement on Model

E. DWR Status Report – *Discussion Item*

III. Public Comments

IV. Agency Comments

V. Next GSP Coordination Committee Meeting Anticipated for April 20, 2023

VI. Adjournment

Tracy Subbasin
GSP Coordination Committee Meeting

Thursday February 16, 2023
1:00 PM to 3:00 PM

Teleconference Meeting Only
Teleconference Link: https://stantec.zoom.us/j/95890838080
Phone Number: +1-669-900-6833
Meeting ID: 958 9083 8080

AGENDA

I. Opening of Meeting/Roll Call

The meeting was called to order at 1:03 PM. Roll call found the following Sustainable Groundwater Management Act (SMGA) Groundwater Sustainability Agency (GSA) representatives for the Tracy Subbasin (Tsb) present via teleconference for the Quarterly Groundwater Sustainability Plan (GSP) Coordination Committee (Committee) meeting:

- Ryan Alameda, Stewart Tract GSA
- Lea Emmons, City of Tracy GSA
- Greg Gibson, City of Lathrop GSA
- Greg Young, Byron Bethany Irrigation District (BBID)
- David Weisenberger, Banta-Carbona Irrigation District (BCID)
- Matt Zidar, San Joaquin County

Other attendees:

- Emily Finnegan, Stantec
- Khandriale Clark, Stantec
- Richard Shatz, GEI
- Bill Brewster, California Department of Water Resources (DWR)
- Tim Gobler, Trinitas Farming
- Charlie Canarro, Kier and Wright

III. Scheduled Items

A. Approval of the January 19 GSP Coordination Committee Meeting Minutes – *Action Item*

RESULT: APPROVED

MOVER: Matt Zidar

SECONDER: Lea Emmons

AYES: All

NOES: None

ABSENT: David Weisenberger

ABSTAIN: None

B. GSA Status Updates - *Round Robin Discussion*

1. San Joaquin County – Mr. Zidar, along with several other GSAs, met with DWR and the State Water Resources Control Board (SWB) to discuss next steps for GSP incomplete determinations and answer questions. It was noted that DWR comments on GSP resubmittals were expected to be shared with GSAs by the end of March of this year. DWR and SWB staff set the expectation that some GSPs will still be found incomplete. DWR's determination of an incomplete initiates SWB involvement as the basin will be put in probationary status. Probationary status allows the SWB to declare deficiencies in the plan, quantify and report on groundwater extractions, register wells, and collect fees. Mr. Zidar noted that the SWB can do anything related to a physical solution with the fees that are collected, and the SWB is not subject to Proposition 218 requirements. The entire process from reporting on groundwater extractions to collecting fees is anticipated to take about a year. Mr. Zidar noted that the SWB can exclude certain users or a portion of a basin that is in compliance with the GSP sustainability goals, though it is unclear how exclusions would be defined. The determination of exclusions will be on a case-by-case basis. The process for putting basins on probation is also still developing.
2. City of Tracy – Nothing to report.

3. City of Lathrop – The Aquifer Storage and Recovery (ASR) well applied for under DWR's Urban Community Drought Grant funding was not approved. However, DWR Round 2 grant funding is anticipated to open in spring so the City is hoping that the ASR project could still be awarded funds. The feasibility study for the ASR well by Carollo Engineers is being finalized and may be of interest to Mr. Shatz for the Annual Report. Mr. Gibson also noted that there was an issue with measurements for one of Lathrop's monitoring wells but noted that the incorrect measurement is being addressed. Mr. Gibson mentioned that the language in the new Governor's Executive Order concerning well permitting was augmented and may change how the GSAs approach the topic. Mr. Shatz and Mr. Zidar confirmed that the new language only provides better definitions for "de minimus" and well types. It does not change any of the GSAs' roles or responsibilities related to well permitting. Mr. Gibson reminded the group that the City was included in a SWB list focused on drought reporting requirements for community water systems; on this list, the City is classified as an at-risk system. Entities on the list that are considered to have a high enough risk level may be required to conduct monthly and even weekly reporting. However, monthly or at least quarterly reporting is the requirement for most entities. He specified that the City was being included on that list due to improper reporting and is hoping that the new ASR well will help with that issue.
4. BBID – Mr. Young mentioned that BBID is working on capital improvement plans to build out conservation and water delivery projects and partnering with municipal customers on water security. Many of these projects are intended to help BBID manage its resources and customer needs, but they also support GSP implementation.
5. BCID – Mr. Weisenberger stated that BCID had a board meeting the previous day and noted that board is interested in pursuing flow gauges on local creeks to document recharge like the rain events in January 2023. He noted that if anyone else is interested in this topic they can discuss this offline. BCID's Board is also currently looking at options regarding groundwater recharge using gravel pits. Mr. Emmons from

the City of Tracy noted that the gravel pits near Corral Hollow Creek are likely not a good option but that they could consider gravel pits farther south. Mr. Emmons noted that he would be interested in having a conversation offline about this.

6. Stewart Tract – Nothing to report.

C. GSP Implementation Updates

1. Annual Report Updates

i. Mr. Shatz reported that BBID recently provided GEI with water supply data for surface water deliveries. GEI is processing this data to be included in the Annual Report. Mr. Shatz got in contact with Alameda County about two representative monitoring wells that were previously measured by the County. The County confirmed that those wells are no longer being measured, so Mr. Shatz is trying to find another entity to take them over. BBID, while understaffed at the moment, could try to take on monitoring those wells. Mr. Shatz will follow up with BBID's General Manager to discuss this further. Mr. Shatz also noted that it was important to maintain the same monitoring wells from year to year in order to compare groundwater contours annually and evaluate any changes in groundwater storage. Mr. Shatz noted that spring monitoring well reporting is coming up soon and he would like to see a higher success rate of capturing groundwater measurements. Mr. Zidar noted that if the Tracy Subbasin changes the representative monitoring well sites, this would initiate an amendment to the GSP, and therefore, the GSAs would need to readopt the revised GSP. Mr. Shatz noted that the GSAs should avoid changing the representative monitoring well sites if possible, to avoid readopting the GSP. Mr. Shatz also noted that the updated Department of Finance population data is anticipated to be released in May.

2. AEM Survey Data

i. DWR released AEM data two weeks ago. The file is very large and GEI is sifting through just the portions focused on the Tracy Subbasin and is paying attention to anywhere USGS called out the Corcoran Clay layer. With this new data, the group should be able to demonstrate that the Tracy Subbasin does not have surface water depletion occurring as a result of pumping below the Corcoran Clay layer. GEI should be able to make the data digestible for the Committee in time for the March meeting.

3. DWR Technical Support Services Update
   i. Mr. Shatz met with DWR to talk through the proposed monitoring well locations, and DWR noted that Tracy's TSS application was very detailed and that the well sites looked good. As a result, Tracy Subbasin's TSS application may get moved up line for funding. It could be as early as this summer that the new monitoring wells go in. DWR will be contacting applicable GSAs in the near future to set up agreements for the use of these lands and to drill the monitoring wells.
4. Update on DWR Sustainable Groundwater Management (SGM) Round 2 Grant Review Period
   i. Over half of the eligible subbasins applied for funding, and a total of 82 grant applications were received by DWR. The total funding requested was about $760 million and there is only $250 million currently available for awards. Preliminary awards are anticipated to be announced in June.
   ii. Separate from this specific topic, Ms. Finnegan noted that DWR is looking to finalize and distribute an Annual Report template for GSAs to use for consistency and accuracy. She also mentioned that a joint public workshop between the Eastern San Joaquin and Tracy Subbasins was being explored as an option. More details will be provided to the group as available.

D. Inter-basin Coordination – *Discussion Item*

1. Adjacent Basin Updates
   i. Please see Mr. Zidar's comments on behalf of San Joaquin County under GSA Status Updates for more information.
   ii. Additionally, Mr. Zidar brought up the need and benefits of having one shared data management system for the Eastern San Joaquin and Tracy Subbasins. The group considered questions

such as who is going to manage the system, how will the technology be integrated into everyone's current capabilities, and how to evaluate system functionalities. Ms. Finnegan reminded the group that Stantec is scoped to support Interbasin Coordination meetings through the DWR Facilitation Support Services program should the group wish to set up a meeting to discuss this topic further with the Eastern San Joaquin Subbasin.

iii. Mr. Emmons and Mr. Young had nothing to report regarding Delta Mendota and East Contra Costa, respectively.

2. DWR Engagement on Model
   i. Mike Cornelius from DWR met with Mr. Shatz, Mr. Young, and Mr. Brewster to discuss the issues that the Tracy Subbasin identified with the CIIVSIM model. DWR noted that the surface water deliveries are likely a component of the model that is incorrect and DWR staff were encouraging about feedback the Tracy Subbasin group had to share. It was decided that everyone would continue to work together to figure out how to improve upon the model. DWR is anticipated to release the next update of the CIIVSIM model in spring 2024. As part of the collaborative approach moving forward, Mr. Shatz will share the spreadsheet of data used to develop the Annual Reports with DWR.

E. DWR Status Report – *Discussion Item*

1. In his report, Mr. Brewster stated that news of Round 2 grants should be coming around May, and that he was unsure of when the Urban Drought Relief grant awards would be announced. He also noted that he would follow up with the DWR team developing the Annual Report template and see if there was any news he could share with the Tracy group. He confirmed, based on his observations, that GSP determinations are anticipated to come out on a quarterly basis.
2. In regard to concerns around changes to monitoring networks requiring an amendment to a GSP, Mr. Brewster encouraged the group to write a letter to the DWR Sustainable Groundwater Management Office about the process being problematic and starting a dialogue that might result in change. He additionally reminded the group of the importance of

monitoring wells and reporting out on a regular basis as it is a SGMA regulatory requirement, and it greatly supports DWR's understanding of each basin and its needs. DWR collects data and posts it regularly, so having regular up-to-date data only positively benefits everyone.

3. Mr. Brewster reminded the group about National Groundwater Awareness Week occurring March 5-11. He also stated that, in regard to the updated California Well Standards, he knew they were being routed internally but had no other updates at this time.

III. <u>Public Comments</u>

None.

IV. <u>Agency Comments</u>

Mr. Gibson noted that there was an article about Delta Tunnel projects and associated basin plan amendments that would require restoring 40% unimpaired flows to San Joaquin River and could potentially affect the GSP. He suggested the group track it as it could have major implications for the amount of groundwater Tracy Subbasin would use if it lost access to surface water. He also noted that he discovered a state website that tracks watershed data that this website and the DWR database seemed to be very out of date. DWR's website showed a significant number of wells that were no longer in use and he noted that it was in the group's best interests to have updated publicly available information. Mr. Shatz commented that there were likely more than 100 wells that were previously monitored in the Tracy Subbasin but that that the number is down to approximately 10-20 monitoring wells. Mr. Gibson will forward the link to the website to the group for everyone's reference. Mr. Brewster noted that he would be available to meet with GSAs if there are questions regarding DWR's datasets or if Mr. Gibson wanted to meet to discuss how to access some of DWR's datasets.

V. <u>Next GSP Coordination Committee Meeting Anticipated for March 23, 2023</u>

None.

VI. <u>Adjournment</u>

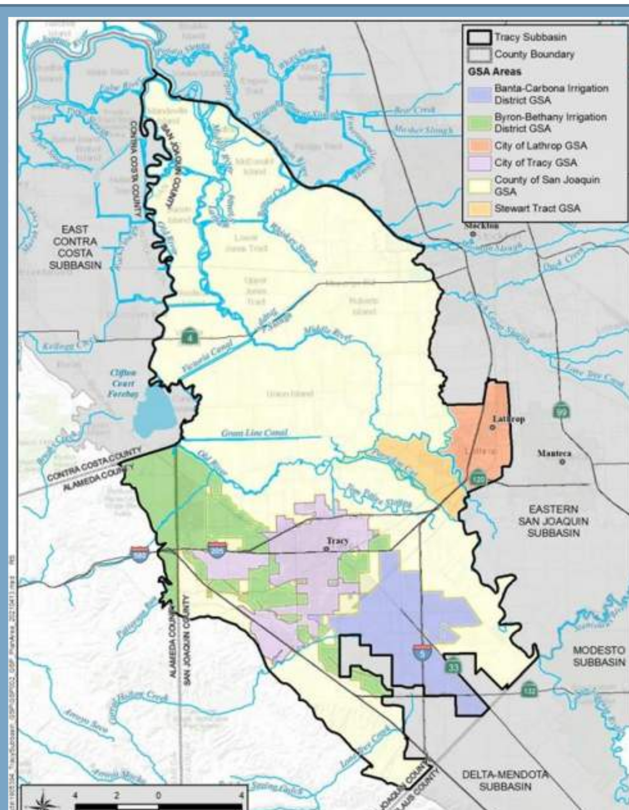
Ms. Finnegan adjourned the meeting at 2:41 PM.

GEI Consultants

Consulting
Engineers and
Scientists

Water Year 2022
Annual Report for the Tracy Subbasin

March 2023



Prepared for the Tracy Subbasin GSAs:

- Byron-Bethany Irrigation District
- Banta-Carbona Irrigation District
- City of Lathrop
- City of Tracy
- San Joaquin County
- Stewart Tract

Water Year 2022

Annual Report for the Tracy Subbasin

Prepared for:

Tracy Subbasin GSAs

Prepared by:

GEI Consultants
2868 Prospect Park Drive, Suite 400
Sacramento, CA 95670

March 2023

WATER YEAR 2022
ANNUAL REPORT FOR THE
GROUNDWATER SUSTAINABILITY PLAN FOR THE TRACY SUBBASIN

Certifications and Seals

This report and analysis were prepared by the following GEI Consultants Inc. professional geologists.

______________________Date: 3-30- 2023

Pauline Espinoza
Staff Geologist

_____________________Date: 3-30-2023

Richard W. Shatz
Principal Hydrogeologist
California Certified Hydrogeologist
C.H.G. No. 84

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Abbreviations and Acronyms

AF	acre-feet
AFY	acre-feet per year
amsl	above mean sea level
BBID	Byron-Bethany Irrigation District
BCID	Banta-Carbona Irrigation District
CVP	Central Valley Project
DWR	California State Department of Water Resources
GDE	Groundwater Dependent Ecosystem
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
InSAR	interferometric synthetic-aperture radar
msl	mean sea level
MTs	minimum thresholds
SJCEHD	San Joaquin County Environmental Health Department
SJR	San Joaquin River Index
SGMA	Sustainable Groundwater Management Act
SSJID	South San Joaquin Irrigation District
Subbasin	Tracy Subbasin
WY	water year

Executive Summary

This document provides annual monitoring data required by the California Department of Water Resources (DWR) for a groundwater sustainability plan (GSP) and consistent with the GSP dated November 2021 for the Tracy Subbasin (Subbasin). This report contains monitoring data for Water Year (WY) 2022 (October 1, 2021 – September 30, 2022) for the Non-Delta Management Area of the Subbasin. WY 2022 was preliminarily classified as a critically dry year by DWR for the San Joaquin Valley.

The Subbasin encompasses an area of about 370 square miles in San Joaquin and Alameda counties. The Subbasin was divided into two management areas during preparation of the GSP, the Delta Management Area and the Non-Delta Management Area. The Delta Management Area consists of numerous islands within an area of about 187 square miles. Waterways surrounding each island provide a constant source of recharge to the groundwater system. The Delta Management Area is being managed by the Delta Protection Commission and therefore the GSP did not attempt to manage groundwater in this area. The Non-Delta Management Area is about 183 square miles and generally consists of the upland areas south of the delta and includes the cities of Lathrop, Tracy, and the community of Mountain House along with agricultural areas serviced by Byron-Bethany Irrigation District (BBID), Banta-Carbona Irrigation District (BCID), and Naglee Burk Irrigation District. This report contains monitoring data and interpretations of only the Non-Delta Management Area.

Water levels, groundwater extractions, surface water diversions, total water usage measurements, and change in groundwater storage estimates are presented in this report. The measurements and information presented demonstrate the groundwater in the Subbasin is sustainable, consistent with the GSP findings, and no undesirable results were present, even though four wells exceeded their minimum thresholds due to this year being the third year of drought conditions.

Water supplies to the Subbasin consisted of groundwater, surface water, and recycled water. The volumes of water, quantified by meters and estimates are shown in **Table ES-1**. Managed groundwater recharge was also evaluated as this replenishes pumped groundwater. The city of Tracy provided direct recharge to the aquifers with surface water through its aquifer storage and recovery Well #8. The city of Lathrop recharged recycled water into a percolation basin and within the Lathrop GSA area the Occidental Chemical Corporation is injecting treated groundwater into the Lower Aquifer. Groundwater recharge from applied surface water in BBID and BCID areas also likely provided groundwater recharge, but this could not be quantified. Precipitation also provided water in the Subbasin but also was not quantified.

Table ES- 1. Tracy Subbasin Non-Delta Management Area Water Use

GSA Area	Groundwater Pumping	Managed Groundwater Recharge	Surface Water	Recycled Water	Total
	In Acre-Feet				
BBID	796	---	40,338	---	41,134
BCID	210	---	37,891	---	38,101
City of Lathrop	2,801	1,153	3,985	293	5,927
City of Tracy	1,315	250	18,178	---	19,243
San Joaquin County	21,945	---	23,661	---	45,606
Stewart Tract	---	---	1,688	26	1,715
Total	*27,067*	*1,402*	*125,742*	*319*	151,726
Percent	*18%*	*0.9%*	*83%*	*0.2%*	

Note: Groundwater recharge was subtracted from total water supplies

The Subbasin has sufficient surface water rights and uses surface water as its predominate source of water supply. Groundwater is used to supplement these supplies. Treated wastewater is recycled, although there is currently minimal reuse but it is expected to expand in the future.

The water supply to the Subbasin consisted of about 20 percent groundwater and 80 percent surface water. The accuracy of the total groundwater use in the Subbasin is about 20 percent metered and 80 percent is estimated. For surface water, about 85 percent is metered and 15 percent is estimated. Estimated groundwater pumping was derived by using satellite-based estimates of crop evapotranspiration minus surface water deliveries with the residual being groundwater pumping. The estimates were also adjusted based on local knowledge of irrigation practices relative to harvest times.

In general, the groundwater elevations observed in the Subbasin during WY 2022 show a decline across portions of the Subbasin, due to this being the third year of a drought. In the Upper Aquifer groundwater levels declined only by a small amount, an average Subbasin wide of about 1.5 feet. The Lower aquifer experience greater decline ranging from about 8 feet in the southeastern portion of the Subbasin to less than 4 feet at the eastern and western portions of the Subbasin, averaging about 2.8 feet across the Non-Delta Management Area. It is typical for positive and negative changes in groundwater elevations from year to year in various parts of the Subbasin. Seasonal trends of slightly higher spring groundwater elevations compared with fall levels are observed annually. Two wells in the Upper Aquifer and two wells in the Lower Aquifer had groundwater levels exceeded their minimum thresholds, but WY 2022 was the third consecutive year of dry/critical dry conditions.

The change in storage in the Non-Delta Management Area of the Subbasin was estimated using the difference of groundwater contours from fall 2021 to fall 2022. In WY 2022 the Subbasin lost about 8,800 acre-feet (AF) in the Upper Aquifer and about 6,500 AF in the Lower Aquifer, for a total of 15,300 AF.

A review of other sustainability indicators including subsidence and degraded water quality found that all remained above their minimum thresholds. Surface water depletion sustainability indicator had one well out of 10 that exceeded a minimum threshold by 0.4 feet indicating a slight increase in surface water depletion.

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1. Introduction

1.1 Purpose

The Tracy Subbasin Groundwater Sustainability Agencies (GSAs) each adopted the Tracy Subbasin Groundwater Sustainability Plan (GSP). The GSP was submitted to California Department of Water Resources (DWR) for approval on January 19, 2022. The GSP established minimum thresholds (MTs) and measurable objectives at representative monitoring wells for groundwater levels to guide the management of the Subbasin. This Annual Report provides annual monitoring data for Water Year (WY) 2022 (October 1, 2021 – September 30, 2022), consistent with the GSP.

1.2 Tracy Subbasin

The Tracy Subbasin (Subbasin) is identified by DWR in Bulletin 118 as Subbasin No. 5-022.15 (DWR 2016). The Subbasin is part of the greater San Joaquin Valley region of California. **Figure 1-1** shows the location of the Subbasin and surrounding subbasins. The Subbasin encompasses an area of about 238,429 acres (~370 square miles) in San Joaquin and Alameda counties, primarily between the eastern extent of the Coast Ranges on the south and the San Joaquin River on the north and east. The Subbasin is bounded on the southeast by the San Joaquin-Stanislaus counties border and the irregular northern boundary outline of the Del Puerto Water District (the Northern Delta-Mendota subbasin). The San Joaquin, Old, and Middle rivers are the principal rivers within or bordering the Subbasin. Within the Subbasin are the cities of Lathrop and Tracy. In 2018, DWR designated the Subbasin as a medium priority subbasin.

As described in the GSP, the Subbasin was subdivided into the Delta Management Area (managed by the Delta Protection Commission) and the Non-Delta Management Area as shown on **Figure 1-2**. The Delta Management Area consists of the Delta islands, which is a unique area in the state of California, where groundwater has to be drained or pumped away to maintain groundwater levels below ground surface. Most of the Delta islands ground surfaces are below sea level. The water is pumped back from the islands into the adjacent waterways. There is always a direct and constant connection between surface water and groundwater, requiring management of groundwater levels (dewatering) within the islands. There are hundreds of diversions that divert surface water from the adjacent waterways surrounding the islands for agricultural purposes. Because there have been no undesirable results for each of the sustainability indicators in the Delta Management Area and none are likely to occur in the future, groundwater monitoring is not necessary in this portion of the Subbasin for it to remain sustainable. As such, minimum thresholds and measurable objectives were not established for the Delta Management Area. The GSP identified the Non-Delta Management Area to be managed as the cities and agriculture in this area use some groundwater. This report documents the groundwater conditions and water supply for just the Non-Delta Management Area.

1.3 Tracy Subbasin GSAs

The Subbasin is managed by six GSAs which cover the entire Subbasin (**Figure 1-1**) and include:

- Byron-Bethany Irrigation District (BBID)
- Banta-Carbona Irrigation District (BCID)
- City of Lathrop
- City of Tracy
- San Joaquin County
- Stewart Tract

1.4 Organization of This Report

The required contents of an Annual Report are provided in the GSP Regulations. Organization of the report is meant to follow the regulations where possible to assist in the review of the document. Sections of the WY 2022 Annual Report include the following:

- **Section 1. Introduction:** a brief background of the Subbasin GSAs and a location map.
- **Section 2**. **Tracy Subbasin Setting and Monitoring Networks:** a summary of the Subbasin setting, Basin monitoring networks, and ways in which data are used for groundwater management.
- **Section 3. Groundwater Levels:** a description of recent monitoring data with groundwater elevation contour maps for spring and fall monitoring events and representative hydrographs.
- **Section 4. Groundwater Extraction:** a compilation of metered and estimated groundwater extractions by water use sector and location of extractions.
- **Section 5. Surface Water Use:** a summary of surface water by water use sector.
- **Section 6. Total Water Use:** a presentation of total water use by source and sector.
- **Section 7. Change in Groundwater in Storage:** a description of the methodology and presentation of changes in groundwater in storage.
- **Section 8. Annual Evaluation of Other Sustainability Criteria:** an evaluation of subsidence, interconnected surface water and groundwater quality.
- **Section 9. Progress towards Implementing the GSP:** a summary of progress toward filling data gaps and implementation of Projects and Management Actions.
- **Section 10. Summary of Progress toward Meeting Subbasin Sustainability:** a summary of sustainability of the Subbasin.

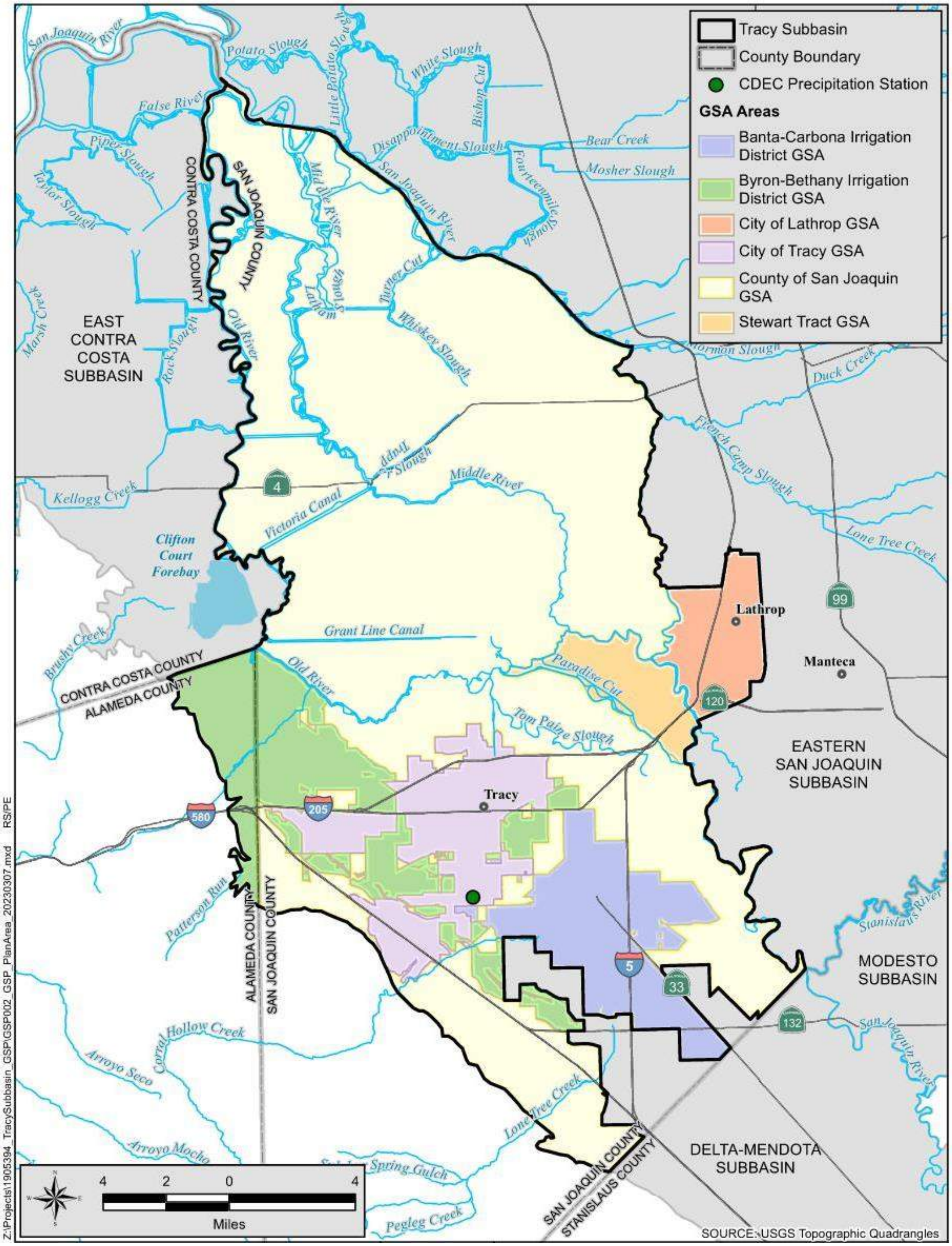

Figure 1-1. Tracy Subbasin

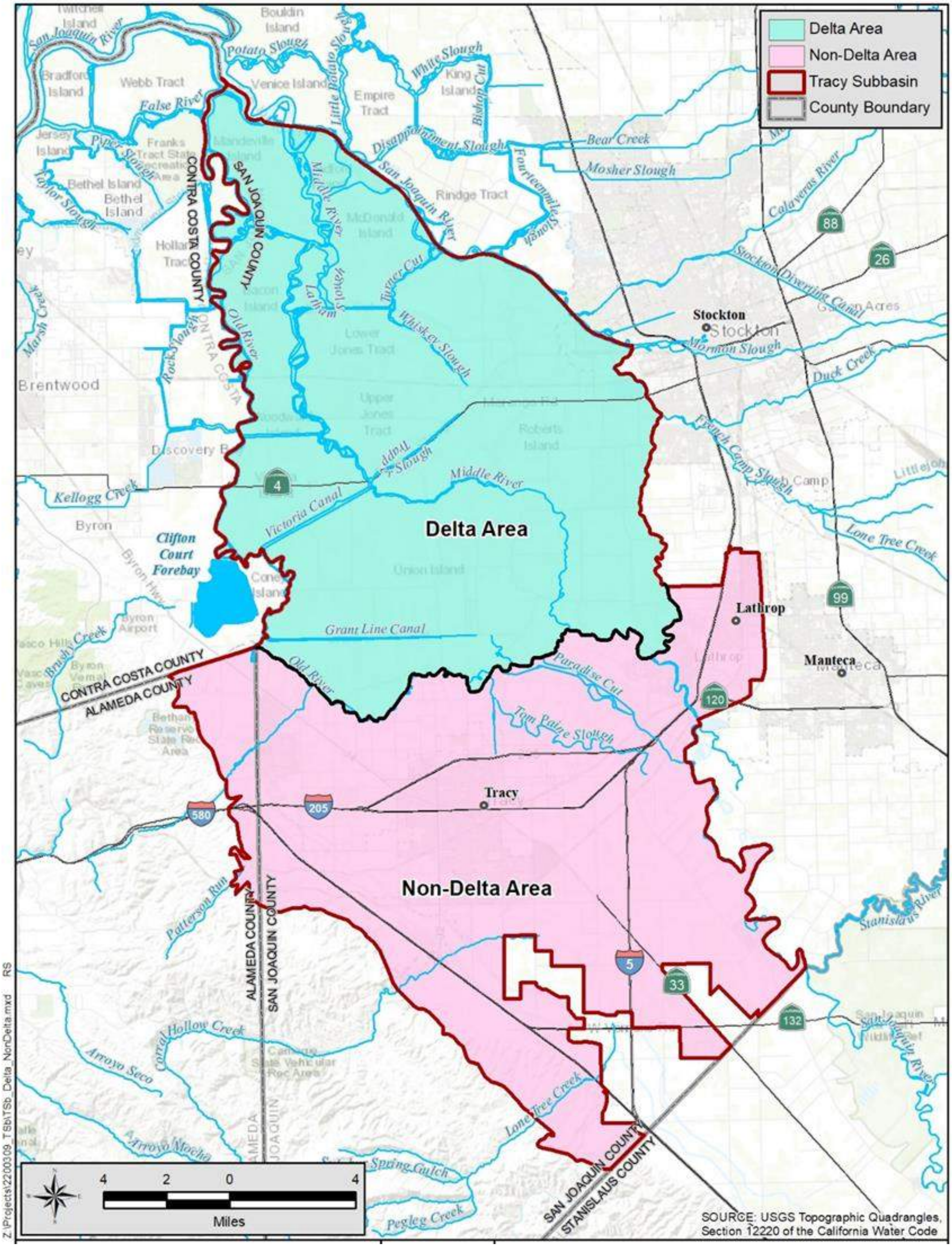

Figure 1-2. Tracy Subbasin Management Areas

2. Tracy Subbasin Setting and Monitoring Networks

This section provides a brief description of the subbasin setting and the groundwater management monitoring programs described in the GSP, as well as any notable events affecting monitoring activities or the quality of monitoring results WY 2022. Much of the background information reported in this WY 2022 Annual Report was taken from the GSP prepared by GEI Consultants Inc (GEI 2021).

2.1 Precipitation and Climatic Period

Like WY 2021, WY 2022 (October 1, 2021 – September 30, 2022) was an extreme year in terms of precipitation. WY 2021 was California's second driest year based on statewide runoff on record; WY 2022 is the fourth driest on record (DWR 2022).

WY 2022 was the third consecutive year of drought, and January and February 2022 were the driest California has seen in recorded history, resulting in a statewide drought emergency proclamation by Governor Gavin Newsom.

The precipitation data from the Tracy Carbona Rainfall station (Index Number 04-899-05) is the Subbasin's longest and most continuous record of precipitation, from 1935 through present, and is located near the center of the Non-Delta Management Area as shown on **Figure 1-1**. The average annual precipitation was 9.81 inches, (NOAA 2021); during WY 2022, precipitation was 10.39 inches but most of this rain fell in October and December with the remaining portions of the year with very little to no rain. **Figure 2-1** shows the long-term average and the WY 2022 precipitation.

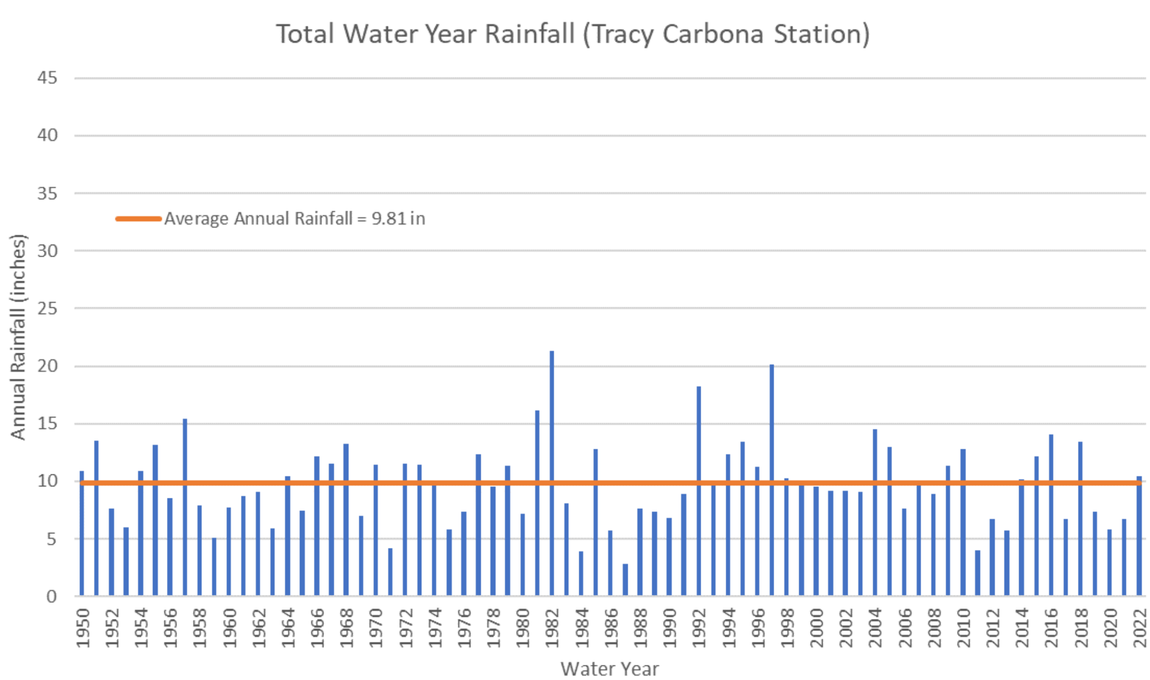

Figure 2-1. Tracy Carbona Precipitation Station Record

The San Joaquin River (SJR) Index is calculated by DWR on a water year basis. WY 2022 was preliminarily classified as a critically dry year by DWR. DWR has not yet released a final classification.

2.2 Principal Aquifers

Water-bearing sand and gravel beds are generally grouped together into zones that are referred to as aquifers. The aquifers can be vertically separated by fine-grained zones that can impede the movement of groundwater between aquifers. The Subbasin has two principal aquifers; an Upper unconfined to semi-confined aquifer and a Lower confined aquifer that are separated by the Corcoran Clay.

Groundwater level information in this report is provided by principal aquifer but groundwater extraction data could not be sorted by principal aquifer because of having to estimate the groundwater pumping by agriculture using land use methods.

2.3 Monitoring Networks

Monitoring networks were developed for each of the five sustainability indicators relevant to the Subbasin:

- Chronic lowering of groundwater levels
- Reduction of groundwater in storage
- Degraded water quality
- Land subsidence
- Depletion of interconnected surface water

Monitoring for the first two sustainability indicators (chronic lowering of water levels and reduction of groundwater in storage) is implemented by using representative monitoring sites. **Appendix A** includes a list and map of the locations of groundwater level monitoring wells and representative monitoring wells used for chronic lowering of water levels and reduction of groundwater in storage.

Monitoring for the remaining three sustainability indicators (degraded water quality, land subsidence, and depletion of interconnected surface water) use separate monitoring networks, as discussed below.

2.3.1 Additional Monitoring Networks

Evaluation of the water quality sustainability indicator is achieved through monitoring of an existing network of supply wells in the Subbasin. Constituents of concern identified in the GSP that have the potential to impact suitability of water for public supply or agricultural use include salinity (as indicated by total dissolved solids), nitrate, and boron. Eight representative wells with construction details were selected to monitor water quality and have minimum thresholds established. Six of the wells are public water supply wells and two wells were selected from the Irrigated Regulatory Lands Program water quality monitoring network.

Land subsidence in the Subbasin is monitored using interferometric synthetic-aperture radar (InSAR) data collected *via* microwave satellite imagery provided by DWR.

Surface water depletion was based on exceedances of groundwater level minimum thresholds established at representative wells.

Appendix A includes a list and map of the locations of monitoring wells and representative monitoring wells used for depletion of surface water and water quality.

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3. Groundwater Levels

This section provides groundwater level monitoring results displayed as hydrographs and groundwater contours. All of the data are presented as groundwater elevations. The groundwater levels were obtained by various entities including: DWR, city of Tracy, San Joaquin County and from various agencies with groundwater monitoring programs overseen by the Regional Water Quality Control Board. Ground levels for WY 2022 were uploaded to the Sustainable Groundwater Management Act (SGMA) Portal[1] and are contained in the Subbasin data management system.

3.1 Hydrographs

Positive and negative changes in groundwater elevations from year to year are observed in various parts of the Subbasin, has been observed historically. Seasonal trends of slightly higher spring groundwater elevations compared with fall levels are typically observed.

Appendix B contains hydrographs for representative monitoring wells with established minimum thresholds, showing water levels through the end of WY 2022 (October 2022). The threshold for most of the wells remained above their respective minimum threshold throughout WY 2022. Access continued to be a challenge at Well N and no measurements were made in WY 2022. Groundwater level measurements at wells 02S03E01D001M and 01S04E31P005M were measured by Alameda County in spring 2022 but were discontinued in fall without notification to the Tracy GSAs. BBID is in process to transfer the monitoring duties. Well ORL-1W is still in the process of being transferred to BBID by DWR but until the transaction is completed groundwater levels cannot be measured at this well.

In general, the groundwater elevations observed in the Subbasin during WY 2022 show a decline across portions of the Subbasin; due to this WY 2020 being classified as a dry year, WY 2021 being classified as a critical dry year, and WY 2022 preliminarily classified as critically dry year based on the SJR Index (DWR 2022).

Undesirable results for chronic lowering of groundwater levels is defined in the GSP as:

> When 25 percent or more of the representative monitoring wells (5 out of 21 wells) record groundwater levels that exceed the minimum thresholds for more than 2 consecutive years that are categorized as non-dry years (below-normal, above-normal, or wet), according to the San Joaquin Valley Water Year Hydrologic Classification. The lowering of groundwater levels during consecutive dry or critically-dry years is not considered to be unreasonable, and would therefore not be considered an undesirable result, unless the levels do not rebound to above the thresholds following those consecutive non-dry years.

In WY 2022, only 16 wells were monitored. Four representative wells Fall 2022 groundwater levels in the Upper and Lower Aquifer exceeded their minimum threshold, and only two wells reported consecutive

[1] https://sgma.water.ca.gov/portal/

dry measurements for 2 years, therefore undesirable results did not occur. One domestic dry well was reported in the Subbasin, in August, but further details about whether the issue was due to a pump failure, required lowering of the pump or drilling of a replacement well was not provided. There are 205 domestic wells within a 2-mile-radius that did not have any issues, suggesting the reported dry well was not due to chronic lowering of groundwater levels.

Table 3-1. Groundwater Elevations at Representative Monitoring Wells

Representative Wells		Groundwater Elevations		Selected MTs (ft msl)
CASGEM ID	Local Name	Groundwater Surface Elevation Fall 2022 (ft msl)	Groundwater Surface Elevation Fall 2021 (ft msl)	
Upper Aquifer Wells				
377341N1213039W001	Well N	NM	NM	**5**
377061N1214199W001	Well Q	47.11	NM	**55**
377951N1216011W001	02S03E01D001M	NM	77.1	**73**
377813N1214420W001	02S05E08B001M	-3.2	-1.2	**-7**
377976N1214560W001	01S05E31R002M	-1.4	0.6	**-1**
376388N1213233W001	03S06E28N001M	NM	61.04	**58**
377528N1215156W001	02S04E15R001M	51.41	NM	**43**
377979N1215800W001	01S04E31P005M	NM	41.54	**41**
378103N1215449W001	ORL-1W	NM	NM	**-3**
378165N1213145W001	MWM-24	11.38	13.97	**-1**
377823N1213330W001	MWR-25	6.75	4.99	**3**
378287N1212673W001	SAD MW-402D	22.85	0.3	**-2**
378116N1212841W001	PW11-031	1.5	3.59	**0**
378130N1212758W001	PW16-216	-3.34	-5.27	**-19**
Lower Aquifer Wells				
376713N1214581W001	Corral MW-6	-36.56	-28.08	**-60**
377402N1214508W002	MW-1B	-40.61	-39.81	**-69**
377031N1214485W002	MW-3B	-43.34	-46.78	**-40**
377427N1213943W002	MW-5B	-39.53	-37.61	**-60**
377656N1214199W002	MW-6B	-35.4	-34.85	**-67**
376974N1213258W001	03S06E05R001M	-36.46	-34.51	**-33**
378076N1212997W001	PW20-500	-6.18	-4.33	**-10**

Notes: Yellow highlight indicates Minimum Threshold exceeded

msl = mean sea level

3.2 Groundwater Contours

Spring (seasonal high) and fall (seasonal low) water-level elevation contours were prepared by GEI for each of the principal aquifers for WY 2022 to illustrate groundwater conditions in the Subbasin. The seasonal low groundwater contours were developed using October 2022 groundwater level measurements, even though they are outside of the defined water year but represent groundwater conditions based on pumping during WY 2022. Groundwater elevation measurements to develop the contours WY 2022 for each principal aquifer are provided in **Appendix C**.

Groundwater level data from 23 wells within the Subbasin were used to create the Upper Aquifer groundwater elevation contour maps with another 10 wells from surrounding subbasins. Groundwater level data from 18 wells within the Subbasin were used to create the Lower Aquifer groundwater elevation contour maps with another 7 wells from surrounding subbasins.

3.2.1 Upper Aquifer Groundwater Contours

Groundwater contours for the Upper Aquifer in the Non-Delta Management Area for spring and fall WY 2022 show very little difference as shown on **Figures 3-1 and 3-2**. The groundwater is at a higher elevation, about 190 feet above mean sea level (amsl) near the foothills and lower elevations (about 0-10 feet amsl) near the rivers, suggesting the groundwater in the Upper Aquifer is discharging into the rivers and waterways. Groundwater levels remained at about the same elevation between spring and fall. Recharge to Upper Aquifer appears to be near Corral Hollow Creek, as a groundwater mound is present. Near the city of Lathrop, the groundwater contours are higher near the San Joaquin River and are lower to the east, into the Eastern San Joaquin Subbasin, suggesting groundwater is being recharged by the river in this area.

3.2.2 Lower Aquifer Groundwater Elevation Contours

Groundwater contours were developed for the Lower Aquifer for spring and fall 2022 as shown on **Figures 3-3 and 3-4**. Overall, groundwater conditions in the Subbasin in the spring were higher than in the fall, a typical seasonal trend for the Subbasin.

Groundwater flow direction is generally to the northwest over most of the Subbasin during the spring. In the fall, a pumping depression was present near the center of the Subbasin, likely due to the city of Tracy having five municipal supply wells in this area and agricultural. This pumping depression has been present since at least 2007 (GEI 2007). The regional groundwater flow direction is from the southeast to the northwest, but due to the pumping depression radial flow into the depression is from the east, west and north. Groundwater elevations are higher near the city of Lathrop and decrease to the east.

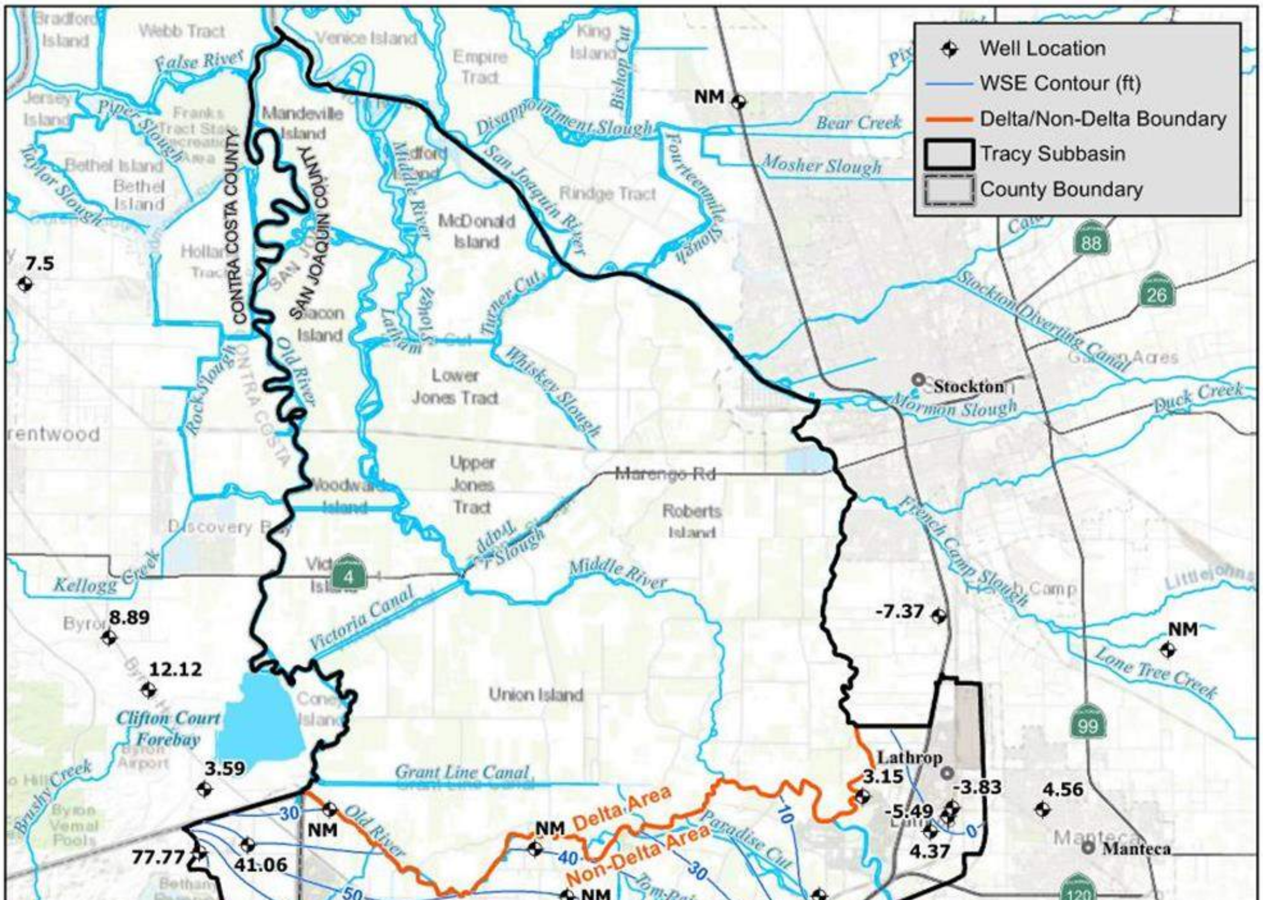

Figure 3-1. Upper Aquifer Spring 2022

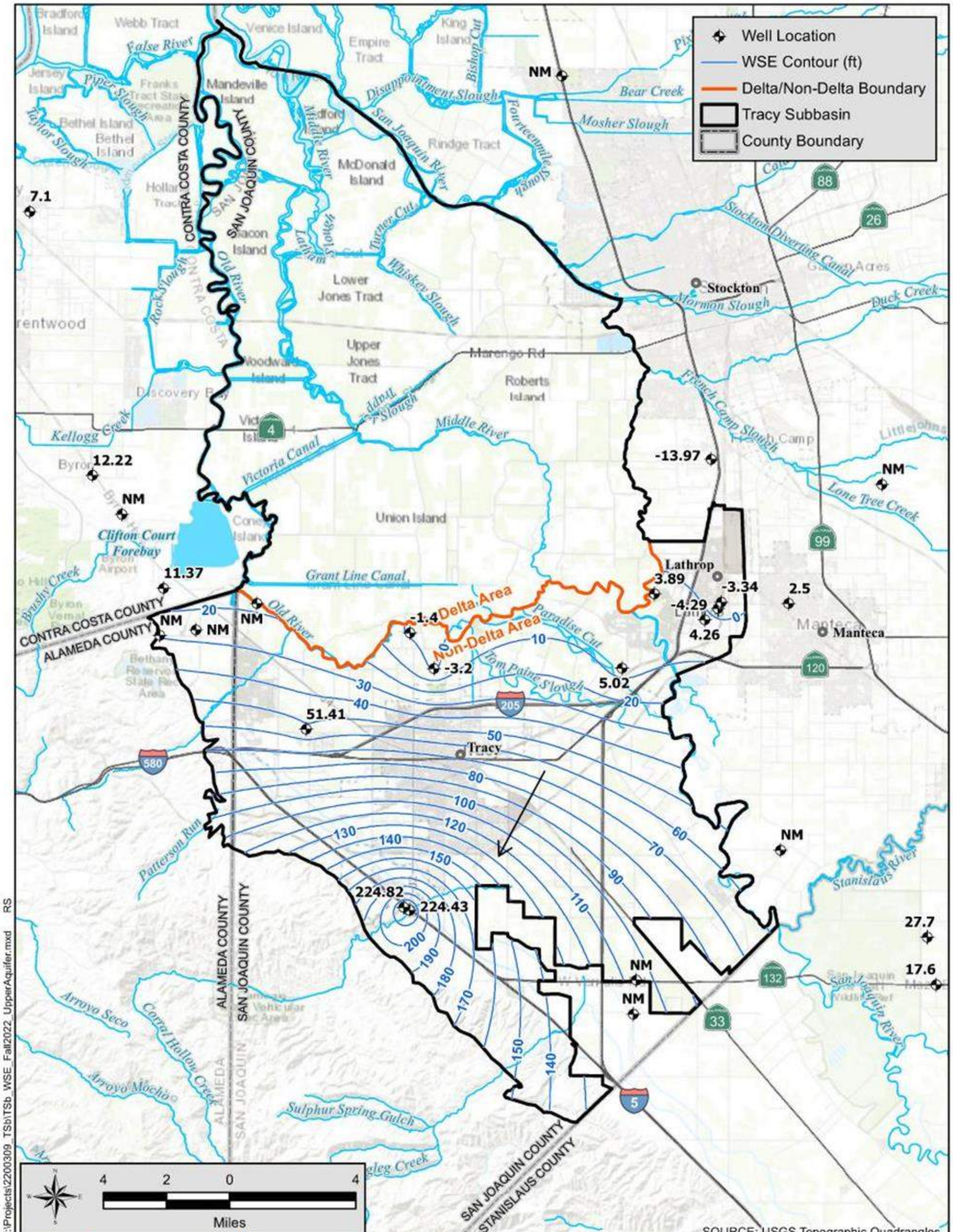

Figure 3-2. Upper Aquifer Fall 2022

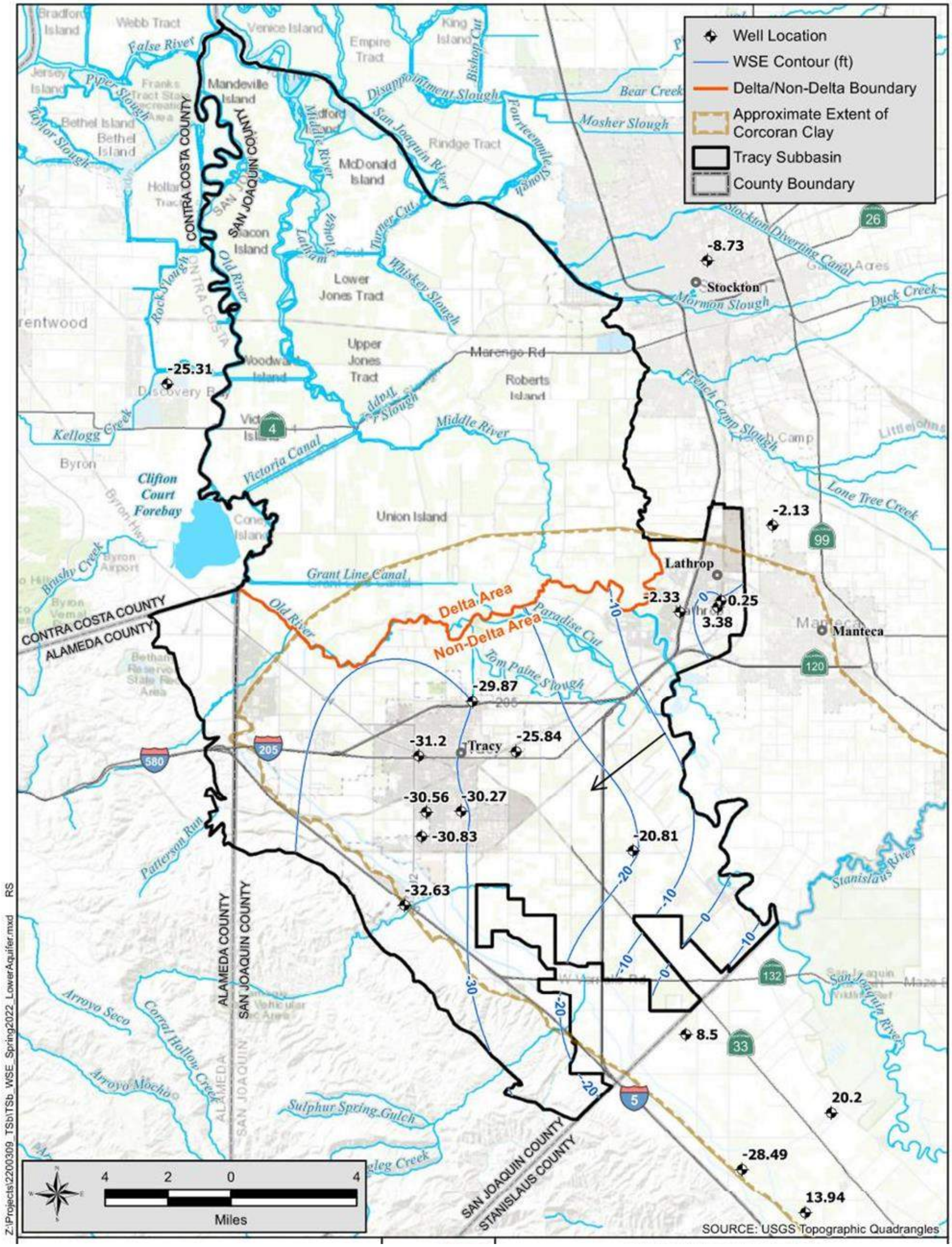

Figure 3-3. Lower Aquifer Spring 2022

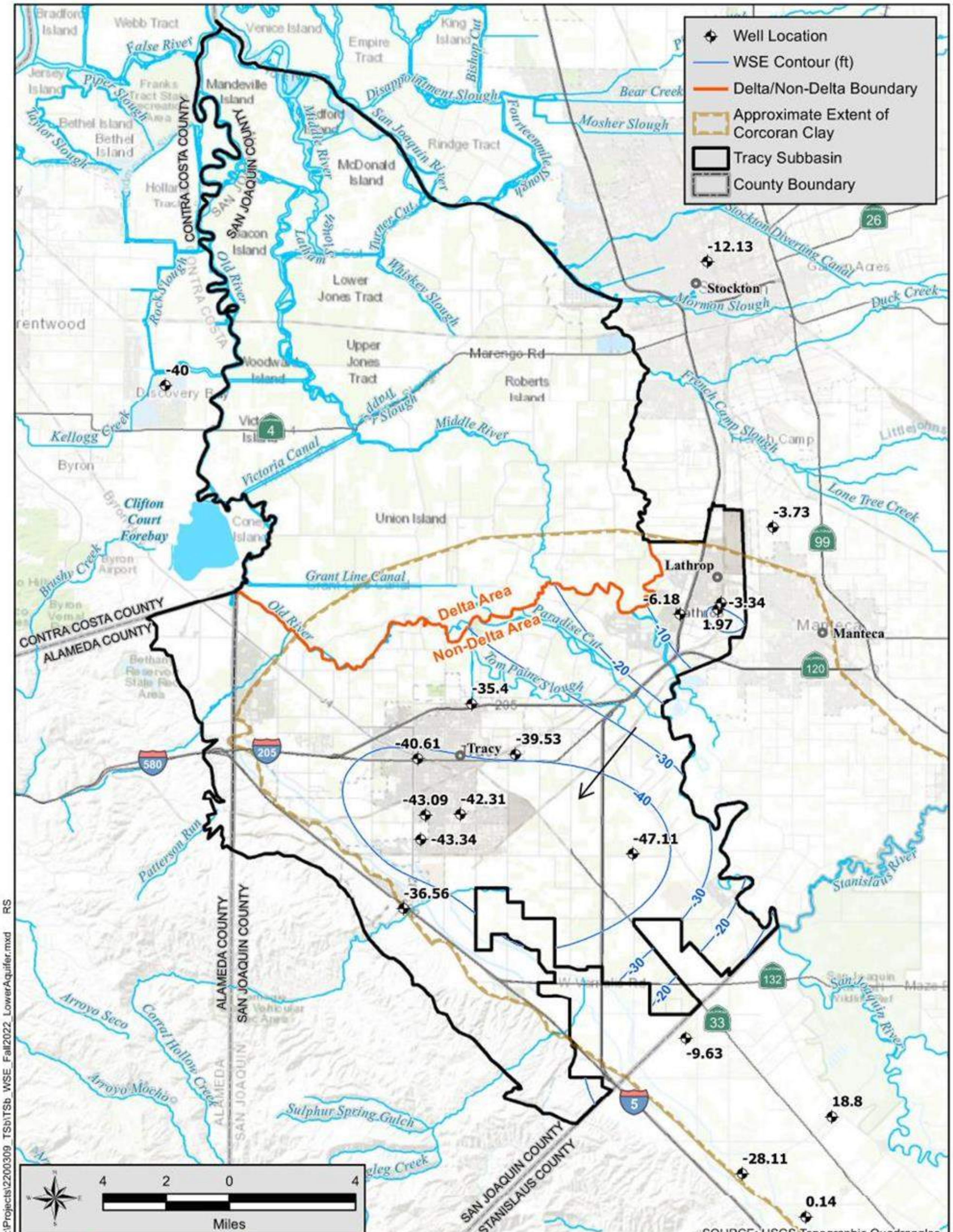

Figure 3-4. Lower Aquifer Fall 2021

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4. Groundwater Extraction

This section presents the metered and estimated groundwater extractions from the Subbasin for WY 2022. The types of groundwater extraction by water use sector including agricultural, urban (municipal and small public water systems), industrial, managed wetlands and native vegetation. All groundwater extractions are provided in acre-feet (AF).

Groundwater extractions from the Subbasin are metered in urban areas by community water agencies and at a few agricultural wells. **Table 4-1** provides the metered groundwater extraction data. Managed groundwater recharge through the city of Tracy's aquifer storage and recovery Well #8 is included in this table as the recharge reduces the total amount of extracted groundwater and is metered. Groundwater was also recharged by city of Lathrop's recycled water percolation ponds and by Occidental Chemical Corporation injection of treated groundwater. This recharge would reduce metered groundwater pumping from about 5,300 AFY to 3,900 AFY.

Table 4-2 provides an estimate of groundwater extractions. Groundwater extractions for most agricultural well owners are not metered and had to be estimated. Direct evapotranspiration was estimated by using ITRC-METRIC[2] based on satellite data. **Appendix D** provides a summary of the approach used to estimate groundwater extractions for agricultural areas. In general, to estimate the groundwater pumping in agricultural areas, water supplies (precipitation, metered groundwater pumping, meter surface water diversions, and reported riparian diversions) were subtracted from the total crop evapotranspiration with the residual being estimated groundwater pumping for agriculture.

Groundwater extractions for domestic well owners were not included in the estimated groundwater pumping as these are de-minimus users, typically using less than 2 AF of water per year.

The annual groundwater extraction volumes for each category plus a total for all water use sectors are summed in **Table 4-3**. For the 2021 WY, total groundwater pumping was about 25,665 AF. Agricultural pumping was the largest component of total groundwater pumping and accounts for about 88 percent of total pumping during WY 2022. Urban (community and small community water districts) account for about 14 percent of the groundwater use. Industrial pumping account for 2 percent of groundwater use. Groundwater pumping for remedial activities was 2 percent of the total.

For reporting purposes, information from **Tables 4-1 and 4-2** were compiled into DWR's Annual Report submittal tables. Groundwater extraction measurements (Part A) from wells within the Subbasin are presented in **Table 4-4**. Groundwater extraction measurement methods (Part B) are presented in **Table 4-5**. All values in these two tables have been rounded.

[2] The ITRC-METRIC process is based on a **surface energy balance** and includes corrections for aerodynamic resistance. It depends upon both accurate and frequent LandSAT satellite thermal images and understanding of the cropping systems within a region. Source: *http://www.itrc.org/projects/metric.htm*

Figure 4-1 illustrates the general location and volume of extractions, from **Tables 4-1** and **4-2**, in each GSA to correlate the pumping presented with the locations shown within the Subbasin. The precise locations of the urban groundwater extractions are known but the estimated groundwater extractions by agriculture are not known; therefore, only the total amounts within each GSA are shown. Also, the aquifer that the wells extract water from is unknown.

Table 4-1. Water Year 2022 Metered Groundwater Extraction by Water Use Sector (Acre-Feet)

	2021			2022									
Water Use Sector/Agency	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Agricultural													
BBID	105	47	0	0	0	0	213	0	0	0	0	0	365
BCID [1]	0	0	0	0	0	0	0	0	39	106	65	0	210
SJ County	---	---	---	---	---	---	---	---	---	---	---	---	0
Stewart Tract	---	---	---	---	---	---	---	---	---	---	---	---	0
Subtotal Agricultural Extractions													**575**
Urban/Municipal/Rural													
Lathrop	0	0	0	82	162	183	209	114	84	93	107	87	1,120
Tracy	63	8	25	99	20	273	199	305	122	140	34	25	1,315
San Joaquin County GSA small community systems	98	42	33	31	57	83	91	137	155	169	160	79	1,134
Subtotal Urban Extractions													**3,569**
Industrial													
BBID (Musco Olive)	48	21	0	0	0	0	0	0	0	0	0	0	69
Deuel Vocational Institution	---	---	---	---	---	---	---	---	---	---	---	---	0
Sharpe Army Defense Distribution Depots (U.S Army)	---	---	---	---	---	---	---	---	---	---	---	---	0
Tracy Army Defense Distribution Depots (U.S Army)	---	---	---	---	---	---	---	---	---	---	---	---	0
Subtotal Industrial Extractions													**69**
Managed Wetlands													
	--	--	--	--	--	--	--	--	--	--	--	--	0
Subtotal Wetlands Extractions													**0**
Native Vegetation													
	--	--	--	--	--	--	--	--	--	--	--	--	0
Subtotal Native Vegetation Extractions													**0**
Other Water Use Sector - Groundwater Remediation													
Occidental Chemical Cooproration (lower aquifer)	64	53	54	44	38	43	62	68	69	80	70	65	710
Occidental Chemical Cooproration (upper aquifer)	4	11	28	24	24	28	27	25	26	20	15	16	248
Sharpe Army Defense Distribution Depots (U.S Army)	0	0	0	0	0	0	0	0	0	0	0	81	81
Subtotal Remediation Extractions													**1,038**
Total Metered Groundwater Extractions													**5,252**
Managed Recharge [2]													
Tracy (Well 8)	0	78	172	0	0	0	0	0	0	0	0	0	250
City of Lathrop CTF (percolation ponds)	1	0	7	16	17	28	28	34	27	24	12	0	195
Occidental Chemical Cooporation (recharge)	68	64	82	68	62	71	89	93	95	100	85	81	958
Subtotal Recharge Extractions													**1,402**
Total Metered Groundwater Extractions (extractions minus managed recharge)													**3,849**

Notes: --- = information not available
[1] Groundwater pumping exported to the North and Central Delta-Mendota subbasin
The total volumes of water extracted should only be considered accurate to the nearest 100 AF
The accuracy of meters is typically plus or minus 50 percent

Table 4-2. Water Year 2022 Estimated Groundwater Extraction by Water Use Sector (Acre-Feet)

Estimated Groundwater Extractions for Water Year 2022 (acre-feet)													
		2021						2022					
Water Use Sector/Agency	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Agricultural [1]													
BBID Area	0	0	0	0	362	0	0	0	0	0	0	0	362
BCID Area	0	0	0	0	0	0	0	0	0	0	0	0	0
City of Lathrop Area	0	0	0	0	0	69	96	77	113	163	0	0	517
City of Tracy Area	0	0	0	0	0	0	0	0	0	0	0	0	0
SJ County Area	0	0	0	0	1,443	2,726	3,362	3,370	4,271	5,065	0	0	20,236
Stewart Track	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Agricultural Extractions													**21,116**
Urban/Municipal/Rural													
Lathrop	0	0	0	0	0	0	0	0	0	0	0	0	0
Tracy	0	0	0	0	0	0	0	0	0	0	0	0	0
CSA 50 Patterson Irrigation Park	---	---	---	---	---	---	---	---	---	---	---	---	100
San Joaquin River Club	---	---	---	---	---	---	---	---	---	---	---	---	150
Subtotal Urban Extractions													**250**
Industrial													
Sharpe Army Defense Distribution Depots (U.S Army)	---	---	---	---	---	---	---	---	---	---	---	---	125
Tracy Army Defense Distribution Depots (U.S Army)	---	---	---	---	---	---	---	---	---	---	---	---	325
Subtotal Industrial Extractions													**450**
Managed Wetlands													
	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Wetlands Extractions													**0**
Managed Recharge													
	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Recharge Extractions													**0**
Native Vegetation													
	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Native Vegetation Extractions													**0**
Other Water Use Sector - Groundwater Remediation													
	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Remediation Extractions													**0**
Total Estimated Groundwater Extractions													**21,816**

Notes: [1]Estimated Groundwater Pumping for Agriculture based on Estimated Evapotranspiration minus Actual Surface Water Deliveries less fallowed and native lands
--- = information not available
Urban/Municipal/Rural and Industrial estimates develop by using = number of people served *0.25 acre-feet (AF) per person
Industrial water use is only based on public water system number of people served and may not include industrial uses
Other water use estimates are from average annual pumping as documented in the GSP
The total volumes of water extracted should only be considered accurate to the nearest 1,000 AF
Estimated agriculture groundwater pumping accuracy is plus or minus 50 percent

Table 4-3. Water Year 2022 Total Groundwater Extraction by Water Use Sector (Acre-Feet)

Total Groundwater Use	2022 WY	Percent
Groundwater Use Direct/Metered (Table 4-1)	5,252	19%
Groundwater Use Estimated (Table 4-2)	21,816	81%
Total Water Use	***27,067***	

Note: The total volumes of water extracted (metered and estimated) should only be considered accurate to the nearest 1,000 AF

Table 4-4. PART A: Groundwater Extractions, Water Year 2022

Basin Number	5-022.15
Water Year	2022
Total Groundwater Extractions (AF)	27,067
Water Use Sector Urban (AF)	3,819
Water Use Sector Industrial (AF)	519
Water Use Sector Agricultural (AF)	21,691
Water Use Sector Managed Wetlands (AF)	0
Water Use Sector Managed Recharge (AF)	1,402
Water Use Sector Native Vegetation (AF)	0
Water Use Sector Other (AF)	1,038
Water Use Sector Other Description	Remedial Cleanup

Notes: --- = information not available; AF = acre feet
The total volumes of metered extracted water should only be considered accurate to the nearest 100 AF
The total volumes of estimated water extracted should only be considered accurate to the nearest 1,000 AF

Table 4-5. PART B: Groundwater Extraction Methods, Water Year 2022

Basin Number	5-022.15
Water Year	2022
Meters Volume (AF)	5,252
Meters Description	Monthly readings
Meters Type	Direct
Meters Accuracy (%)	95%
Meters Accuracy Description	Based on meter manufacturer information
Electrical Records Volume (AF)	0
Electrical Records Description	
Electrical Records Type	
Electrical Records Accuracy (%)	
Electrical Records Accuracy Description	
Land Use Volume (AF)	21,116
Land Use Description	For agricultural lands, if crop evapotranspiration - SW diversions or recycled water by each GSA area was >0, value reported
Land Use Type	Estimated
Land Use Accuracy (%)	70%
Land Use Accuracy Description	Land Sat ETc Calculations
Groundwater Model Volume (AF)	0
Groundwater Model Description	
Groundwater Model Type	
Groundwater Model Accuracy (%)	
Groundwater Model Accuracy Description	
Other Method(s) Volume (AF)	700
Other Method(s) Description	Estimated from previous water year (remediation) or per person served from Drinking Water Watch website
Other Method(s) Type	Estimated
Other Method(s) Accuracy (%)	50%
Other Method(s) Accuracy Description	Reported values from previous water year

Notes: > = less than; % = percent; AF = acre feet; SW = surface water
The total volumes of estimated water extracted should only be considered accurate to the nearest 1,000 AF

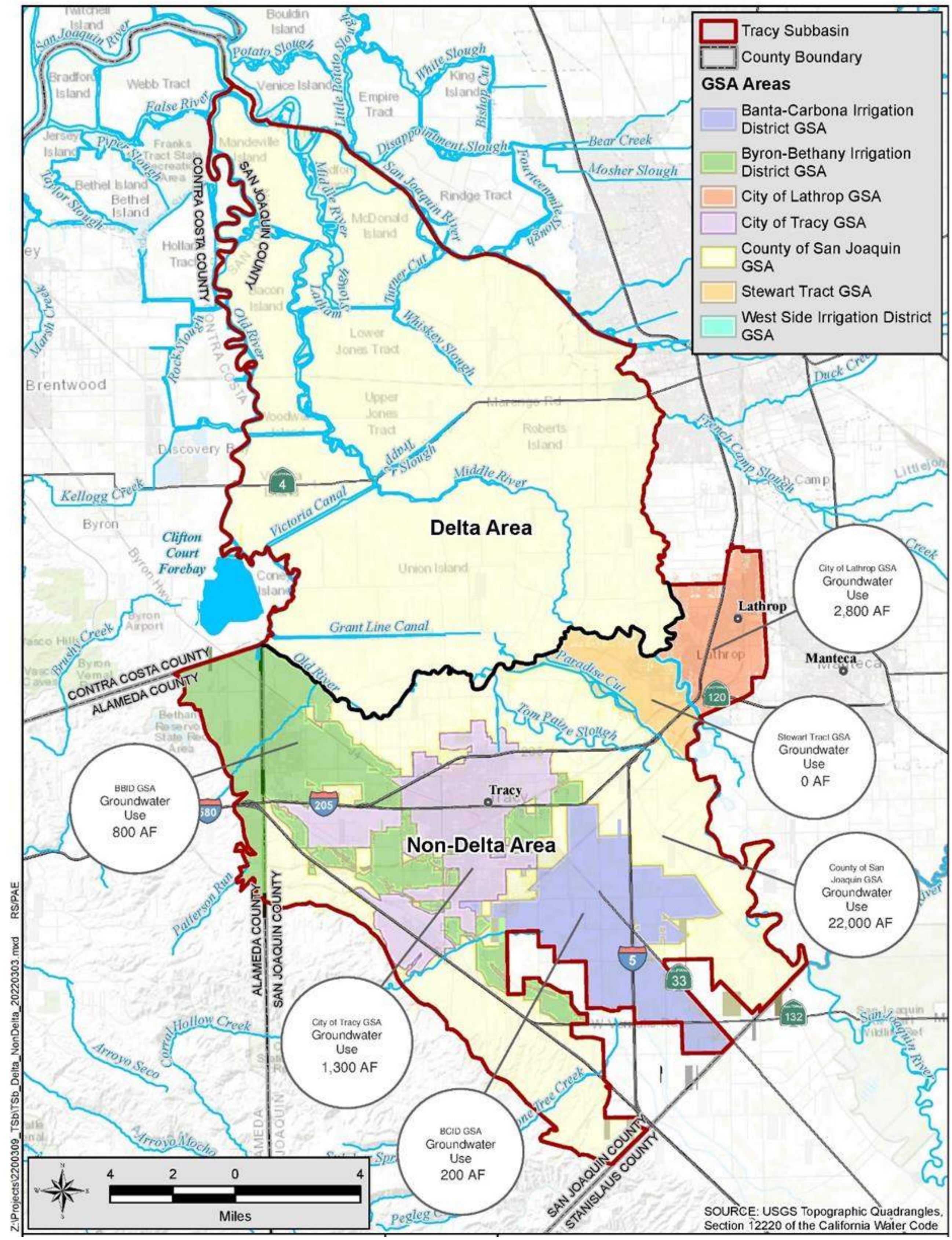

Figure 4-1. Location and Volume of Groundwater Extractions

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5. Surface Water Use

The Non-Delta Management Area relies on three surface water source types: imported supplies (South San Joaquin Irrigation District [SSJID]), Central Valley Project (CVP) supplies, and local supplies (from the San Joaquin and Old River). Brief descriptions of each are provided below. Total direct (metered) surface water supplies are summarized in **Table 5-1**. Estimated surface water used in the Subbasin are summarized in **Table 5-2.**

5.1 Imported Supplies

The cities of Tracy and Lathrop import treated surface water from the SSJID. During WY 2022, the cities imported and used 14,601 AF.

5.2 Central Valley Project Supplies

The city of Tracy, the Community of Mountain House, and BBID use water supplied from the Delta-Mendota Canal which is part of the CVP. The water is collected from the Old River into the Clifton Forebay, located just west of the Subbasin (*refer to* **Figure 5-1**). The amount of imported water used during WY 2022 from the CVP was about 14,164 AF.

5.3 Local Supplies

Local surface water supplies include surface water from the San Joaquin River, Old River and other adjacent waterways. The BBID and BCID divert water from the rivers. Riparian landowners also diverted water from the waterways. During WY 2022, the total Local Supply was 78,529 AF.

5.4 Metered Surface Water Supplies

Surface water supplies entering the Subbasin are metered (direct). During WY 2022, the total surface water used from all water sources was about 107,294 AF.

Table 5-1. Water Year 2022 Metered Surface Water Supplies by Water Use Sector (Acre-Feet)

	2021			2022									
Water Use Sector/Agency	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Agricultural Use - CVP													
BBID Area	253	3	2	2	110	285	438	439	570	305	245	224	2,876
BCID Area (inside District)	--	--	--	--	--	--	--	--	--	--	--	--	0
Subtotal Agricultural Diversions Reported													**2,876**
Agricultural Use - Local - San Joaquin River/Old River													
BBID Area	1,305	267	0	11	459	3,752	4,479	5,537	6,494	4,620	3,632	2,220	32,776
BCID Area (inside District)	1,342	0	0	0	1,273	2,886	3,568	5,924	6,927	7,226	5,234	3,511	37,891
City of Tracy (Sugar Cut)	--	--	--	--	--	--	--	--	--	--	--	--	--
SJ County Area (BCID Kasson area)	218	0	0	0	593	587	662	1,195	1,410	1,448	1,089	660	7,862
Subtotal Local Agricultural Diversions Reported													**78,529**
Urban/Municipal - CVP													
Mountain House (CVP)	390	225	207	192	258	353	365	447	522	515	559	485	4,518
Tracy (CVP)	989	66	0	540	725	427	435	514	743	786	797	749	6,770
Subtotal Urban CVP Diversions Reported													**11,288**
Urban/Municipal - Imported													
Lathrop (SSJID)	258	167	72	200	102	216	244	365	519	536	507	455	3,640
3910015-015													
Tracy (SSJID)	577	1,134	1,175	433	381	660	740	1025	1104	1249	1329	1154	10,960
Subtotal Urban Imported Reported													**14,601**
Total Diversions Reported													**107,294**

Note: --- = information not available

The total volumes of water should only be considered accurate to the nearest 100 AF

[1] = 377 AF of Tracy SSJID used for recharge

5.5 Estimated Surface Water Supplies

The Non-Delta Management Area portion of the Subbasin is bounded by the San Joaquin River, Middle River, Old River, Tom Paine Slough and various other canals and water ways. About 70 diversions have been documented (DWR 1995). To attempt to quantify these surface water supplies a search of riparian diversion reporting's was performed through the State Water Resources Control Board); however, only three filings were present and are listed in **Table 5-1**. Irrigation diversions may be present under other diversion types of reporting's (appropriative or statement of diversions) but due to the limited time and funding an alternative approach was used. Parcels immediately adjacent to the rivers and waterways were identified as potential users of surface water and the evapotranspiration estimates (*see* **Appendix D**) were used to estimate the amount of surface water used by these parcels. During WY 2022, the total estimated surface water used from all water sources was 18,448 AF, as shown on **Table 5-2**.

Table 5-2. Water Year 2022 Estimated Surface Water Use by Sector (Acre-Feet)

		2021						2022					
Water Use Sector/Agency	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Agricultural Use													
BBID Area	0	0	0	0	0	0	0	0	0	0	0	0	0
BCID Area	0	0	0	0	0	0	0	0	0	0	0	0	0
City of Lathrop Area	0	0	0	0	0	0	0	0	0	0	0	0	0
City of Tracy Area	0	0	0	0	0	0	0	0	0	0	0	0	0
SJ County Area	133	18	11	53	91	244	395	587	632	668	460	302	3,595
Stewart Tract Area	---	---	---	---	---	---	---	---	---	---	---	---	0
												Subtotal Agricultural Diversions	**3,595**
Agricultural Use Riparian [1] - Local													
BBID Area	10	6	4	20	46	29	6	2	4	10	15	16	168
BCID Area	0	0	0	0	0	0	0	0	0	0	0	0	0
City of Lathrop Area	34	16	10	12	22	22	20	25	25	33	60	66	345
City of Tracy Area	38	14	8	28	56	46	27	48	50	56	46	31	448
SJ County Area	940	310	106	202	522	909	1,144	1,218	1,415	1,842	2,039	1,556	12,204
Stewart Tract Area	92	70	53	94	183	219	156	162	135	213	194	117	1,688
												Subtotal Riparian Agricultural Diversions	**14,854**
Urban/Municipal/Rural													
	0	0	0	0	0	0	0	0	0	0	0	0	0
												Subtotal Urban Diversions	**0**
Managed Wetlands													
	0	0	0	0	0	0	0	0	0	0	0	0	0
												Subtotal Wetlands	**0**
Managed Recharge													
BBID Area	0	0	0	0	0	0	0	0	0	0	0	0	0
BCID Area	0	0	0	0	0	0	0	0	0	0	0	0	0
SJ County Area	0	0	0	0	0	0	0	0	0	0	0	0	0
												Subtotal Fallowed Land	**0**
Native Vegetation													
BBID Area	0	0	0	0	0	0	0	0	0	0	0	0	0
BCID Area	0	0	0	0	0	0	0	0	0	0	0	0	0
SJ County Area	0	0	0	0	0	0	0	0	0	0	0	0	0
												Subtotal Native Vegetation	**0**
												Total Estimated Diversions	**18,448**

Notes: --- = information not available

Estimated based on land parcels immediately adjacent to rivers or waterways

The total volumes of water extracted should only be considered accurate to the nearest 1,000 AF

5.6 Total Surface Water Supplies

Local surface water supplies include surface water flows that entered the Subbasin from San Joaquin, Old River, and other adjacent waterways. Although, water was supplied from the CVP aqueduct (Delta-Mendota Canal) the water was diverted from the Old River through the Clifton forebay, so this water could be considered to be from a local source. Water was also imported into the Subbasin from SSJID. **Table 5-3** provides a summary of the total surface water use. **Table 5-4** provides the information required to be uploaded to DWR with this annual report. All values in this table have been rounded.

Table 5-3. Water Year 2022 Total Surface Water Use (Acre-Feet)

	2022 WY	Percent
Surface Water Use Direct/Metered (Table 5-1)	107,294	85%
Surface Water Use Estimated (Table 5-2)	18,448	15%
Total Surface Water Used	***125,742***	

Note: The total volumes of water extracted should only be considered accurate to the nearest 1,000 AF

5.7 Surface Water Used for Groundwater Recharge

During WY 2022, 250 AF of water from SSJID was injected into the city of Tracy aquifer storage and recovery Well #8, as listed in **Table 4-1**. The city of Lathrop used some recycled water (derived from both SSJID and its groundwater wells) for groundwater recharge by placing the water into a percolation basin. The volumes of water are both metered.

5.8 Recycled Water Supplies

Treated wastewater was used by the city of Lathrop for irrigation of some lands/agricultural fields within the Lathrop GSA area and in the Stewart Tract GSA area. California Natural Products, located within the city of Lathrop, treats their own wastewater. **Table 5-4** lists the recycled water use. It is expected in future years that this recycled water use will expand significantly as both the cities of Lathrop and Tracy have constructed an extensive framework of pipes to use more treated wastewater.

Table 5-4. Water Year 2022 Metered Recycled Water Use by Sector (Acre-Feet)

	2021			2022									
Water Use Sector/Agency	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Agricultural Use - Recycled													
City of Lathrop Area	35	34	27	32	31	37	1	32	0	0	33	31	293
City of Tracy Area	--	--	--	--	--	--	--	--	--	--	--	--	
SJ County Area	--	--	--	--	--	--	--	--	--	--	--	--	
Stewart Tract (CTF)	13	0	13	0	0	0	0	0	0	0	0	0	26
Subtotal Recycled Agriculture													**319**
Urban/Municipal - Recycled													
	--	--	--	--	--	--	--	--	--	--	--	--	--
Subtotal Urban Recycled													--
Urban/Municipal - Imported													
	--	--	--	--	--	--	--	--	--	--	--	--	--
Subtotal Urban Imported													--
Total Recycled													**319**
Notes:													
--- Information not available													

Note: --- = information not available
The total volumes of water extracted should only be considered accurate to the nearest 100 AF

Table 5-5. PART C: Surface Water Supply, Water Year 2022

Basin Number	5-022.15
Water Year	2022
Methods Used to Determine	Metered, Estimated
Water Source Type Central Valley Project (AF)	14,164
Water Source Type State Water Project (AF)	0
Water Source Type Colorado River Project (AF)	0
Water Source Type Local Supplies (AF)	93,383
Water Source Type Local Imported Supplies (AF)	14,601
Water Source Type Recycled Water (AF)	319
Water Source Type Desalination (AF)	0
Water Source Type Other (AF)	0
Water Source Type Other Description	N/A

Note: AF = acre feet, N/A = not applicable
The total volumes of water metered should only be considered accurate to the nearest 100 AF
The total volumes of water estimated should only be considered accurate to the nearest 1,000 AF

6. Total Water Use

This section summarizes the total annual groundwater and surface water used to meet agricultural, urban and rural, industrial demands and remedial cleanup activities in the Non-Delta Management Area. **Table 6-1** provides a summary of these water sources and water sectors for WY 2022.

Total water use (Part D submittal to DWR) in the Subbasin for WY 2022 to be submitted to DWR is provided in **Table 6-2**.

For WY 2022, the quantification of total water use was completed from reported metered municipal water production and metered surface water delivery, and from models used to estimate agricultural and rural water demand. **Table 6-1** summarizes the total water use in the Subbasin by source and water use sector for WY 2022. The method of measurement and a qualitative level of accuracy for each estimate is rated on a qualitative scale of low, medium, and high.

Table 6-1. Total Water Use by Source and Water Use Sector, Water Year 2022 (Acre-Feet)

	Water Source										
	Groundwater		Surface Water CVP		Surface Water Local		Surface Water Imported		Recycled		
Water Sector	Metered (Table 4-1)	Estimated (Table 4-2)	Metered (Table 5-1)	Estimated (Table 5-2)	Metered (Table 5-1)	Estimated (Table 5-2)	Metered (Table 5-1)	Estimated (Table 5-2)	Metered (Table 5-4)	Managed Groundwater Recharge	Total
Agricultural	575	21,116	2,876	0	78,529	18,448	0	0	319	0	**121,863**
Urban/Municipal/Rural	3,569	250	11,288	0	0	0	14,601	0	0	0	**29,708**
Industrial	69	450	0	0	0	0	0	0	0	0	**519**
Managed Wetlands	0	0	0	0	0	0	0	0	0	0	**0**
Managed Recharge	0	0	0	0	0	0	0	0	0	1,402	**1,402**
Native Vegetation	0	0	0	0	0	0	0	0	0	0	**0**
Other (Remediation)	1,038	0	0	0	0	0	0	0	0	0	**1,038**
Total Water Use	***5,252***	***21,816***	***14,164***	***0***	***78,529***	***18,448***	***14,601***	***0***	***319***	***1,402***	***151,726***
Total Water Use (Metered)	***5,252***	***---***	***14,164***	***---***	***78,529***	***---***	***14,601***	***---***	***319***	***1,402***	***111,462***
Total Water Use (Estimated)	***---***	***21,816***	***---***	***0***	***---***	***18,448***	***---***	***0***	***---***	***--***	***40,264***

Notes: The total volumes of water extracted should only be considered accurate to the nearest 1,000 AF
Total groundwater metered and estimated was reduced by managed groundwater recharge

Table 6-2. PART D: Total Water Use, Water Year 2022

Basin Number	5-022.15
Water Year	2022
Total Water Use (AF)	151,726
Methods Used to Determine	metered & estimated
Water Source Type Groundwater (AF)	27,068
Water Source Type Surface Water (AF)	125,742
Water Source Type Recycled Water (AF)	319
Water Source Type Reused Water (AF)	0
Water Source Type Other (AF)	0
Water Source Type Other Description	
Water Use Sector Urban (AF)	29,708
Water Use Sector Industrial (AF)	519
Water Use Sector Agricultural (AF)	121,863
Water Use Sector Managed Wetlands (AF)	0
Water Use Sector Managed Recharge (AF)	1,402
Water Use Sector Native Vegetation (AF)	0
Water Use Sector Other (AF)	1,038
Water Use Sector Other Description	Remediation

Notes: The total volumes of water rounded to nearest 1,000 AF where combination of metered and estimated, or just estimated
The total volumes of water rounded to nearest 100 AF where only metered

7. Change in Groundwater Storage

Groundwater change in storage were estimated from the California Central Valley Groundwater-Surface Water Simulation Model (C2VSim-FG_v1.0) groundwater flow model for the period of WY 1974 through WY 2015. Changes in storage for WY 2016 through WY 2022 were estimated using fall groundwater contours to coincide with previous water year estimates made using the groundwater model. However, fall measurements are often affected by late season pumping and are not as consistent as spring measurements, made typically before pumping starts. For consistency purposes, the same wells each year were used for contouring and to estimate the change in groundwater elevations. As previously discussed in **Section 3-1**, some wells had missing measurements during WY 2022, so a similar set of wells used for WY 2016 through WY 2021 could not be used to calculate change in storage in WY 2022.

Raster files of the change in groundwater elevation maps were then used to calculate an average change in groundwater levels in each principal aquifer. The average change in groundwater levels were then multiplied by the average specific yield or storage coefficient for each aquifer. The volume change depicted represents a total volume, including the volume displaced by the aquifer material and the volume of groundwater stored within the void space of the aquifer. The portion of void space in the aquifer that can be utilized for groundwater storage is represented by the aquifer storage coefficient (S), a unitless factor, which is multiplied by the total volume change to derive the change in groundwater in storage. The average storativity, or specific yield, is about 0.05 for the Upper Aquifer and was used to estimate the change in storage for the Upper Aquifer (Hotchkiss and Balding 1971). The storage coefficient, obtained through aquifer testing at a Well #8 and nearby observation wells in the city of Tracy, was measured as 0.0001 (Padre and Associates 2004). The specific storage (storativity times the average aquifer thickness of 200 feet) or 0.02 was used to estimate the change in storage for the Lower Aquifer (Fetter 1988).

The total change in storge in the for WY 2022 was about -15,300 AF. The groundwater elevation change maps for fall 2022, **Figures 7-1 and 7-2**, corresponds to the areas where changes in storage occurred. Groundwater levels/elevations changed very little (subbasin wide average -1.50 feet) in the Upper Aquifer and resulted in reduction of about -8,800 AF. The change in groundwater elevations in the Lower Aquifer was the greatest in the southeastern portion of the Non-Delta Management Area where the levels dropped by about 20 feet but was less than 5 feet along the western and eastern sides of the Subbasin. The average change in groundwater elevation was (-2.77 feet) resulting in a change in storage of about -6,500 AF in the Lower Aquifer.

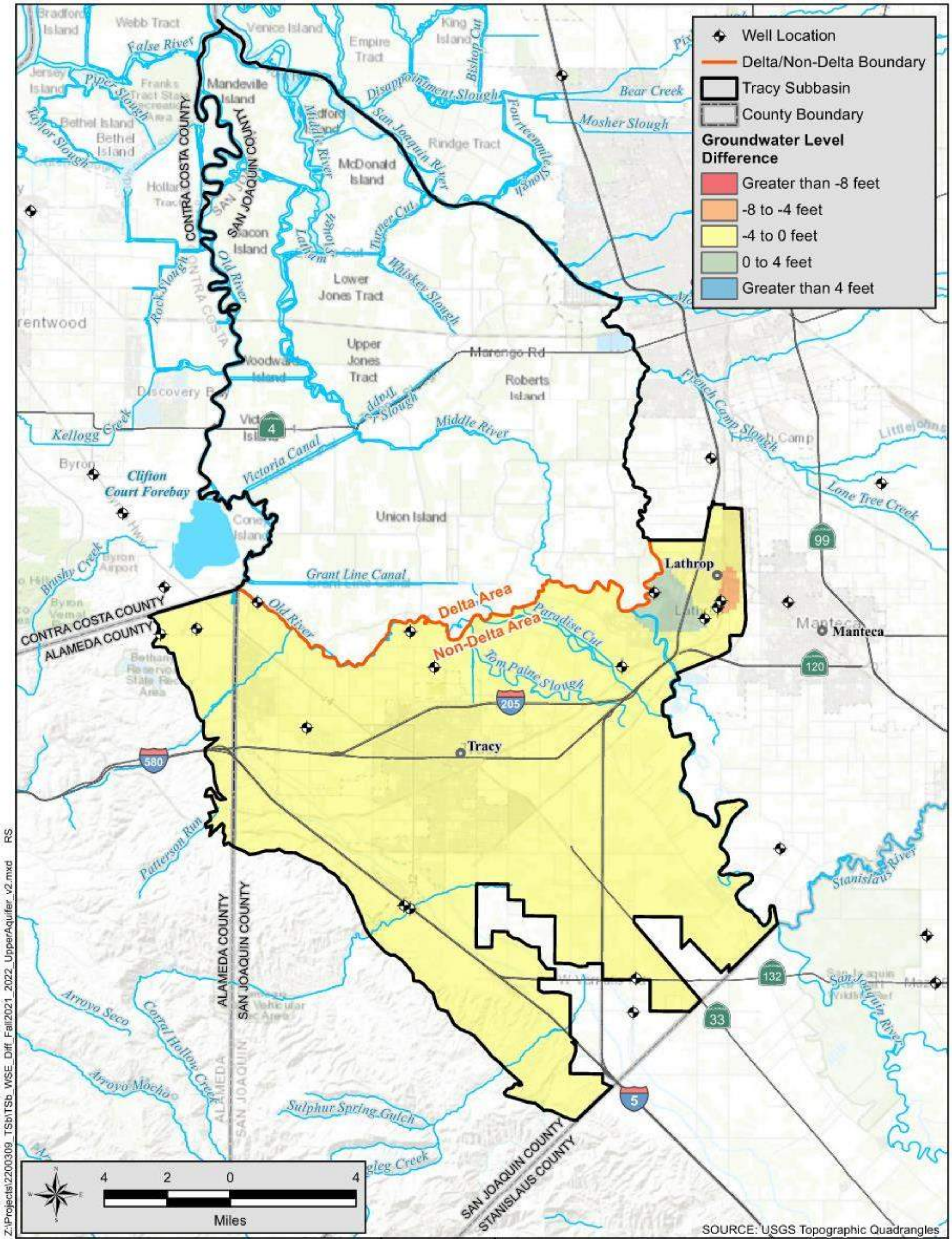

Figure 7-1. Upper Aquifer Change in Groundwater Levels for WY 2022

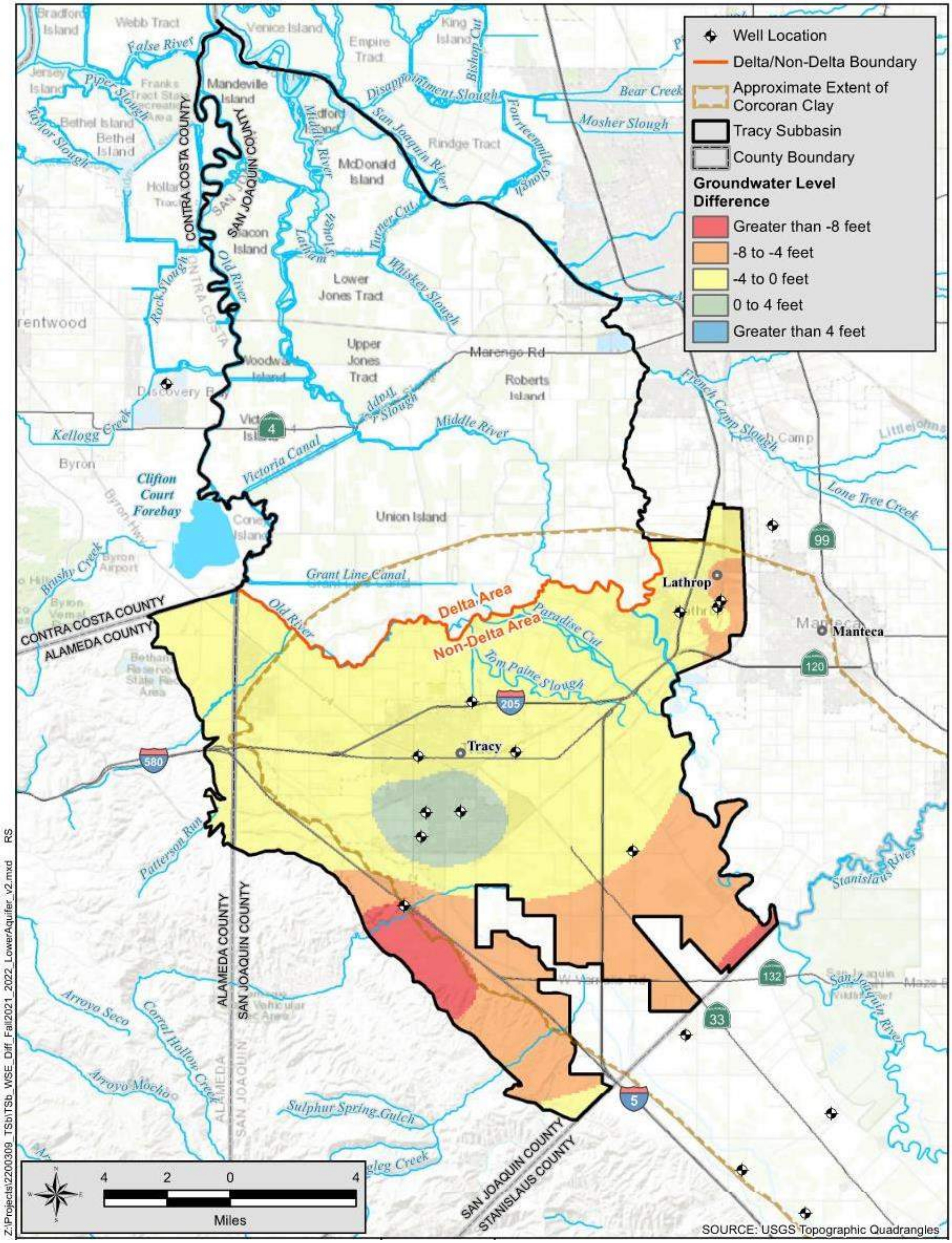

Figure 7-2. Lower Aquifer Change in Groundwater Levels for WY 2022

Table 7-1 provides fall change in storage (fall–fall) measurements for comparison along with the water year classification. Groundwater elevations and change in storage in the Upper Aquifer have remained similar with the slight differences due to the water year type (amount of recharge). As shown the fall change in storage correlate well with the water year classifications and that aquifers generally refill to the seasonal high during wet years, indicating the Subbasin is within its sustainable yield.

Overall, the Upper and Lower Aquifers from 2016, the end of the last drought refilled during the 2017 through 2019 wetter years and but declined through WY 2020 through WY 2022 drought years. Overall, during the last seven water years the Subbasin has lost about 30,000 AF of storage, but this includes 5 years of precipitation with below normal to critical dry years.

Table 7-1. Annual Change in Groundwater in Storage

Water Year	SJR Water Year Classification	Upper Aquifer Annual Fall Change (AF)	Lower Aquifer Annual Fall Change (AF)
2016	dry	-2,200	-7,800
2017	wet	600	23,800
2018	below normal	-2,300	5,400
2019	wet	3,000	0
2020	dry	-6,100	-3,000
2021	critical	-2,500	-23,500
2022	critical	-8,800	-6,500

The 15,000 AF decrease (combined fall total of Upper and Lower aquifers) of groundwater in storage in WY 2022 shown in **Table 7-1** is coincident with 3 years of below average precipitation in 2020, 2021, and 2022. There was considerably less of a decrease in WY 2022 compared to WY 2021.

Figure 7-3 is a graph demonstrating the cumulative change in storage for the Upper Aquifer from both the C2VSim groundwater model and the calculated change in storage using the groundwater contour differences. **Figure 7-4** is a graph demonstrating the cumulative change in storage for the Lower Aquifer. The change in storage for the Upper Aquifer has a much smaller magnitude of change in storage using the calculated change in storage from groundwater contours in comparison to the groundwater model predications. This is possibly related to the groundwater model having an average pumping of 250,000 AF per year (AFY) rather than the groundwater pumping of about 27,000 AF. The Lower Aquifer has about the same magnitude of change in storage between CV2Sim and those made using groundwater contours.

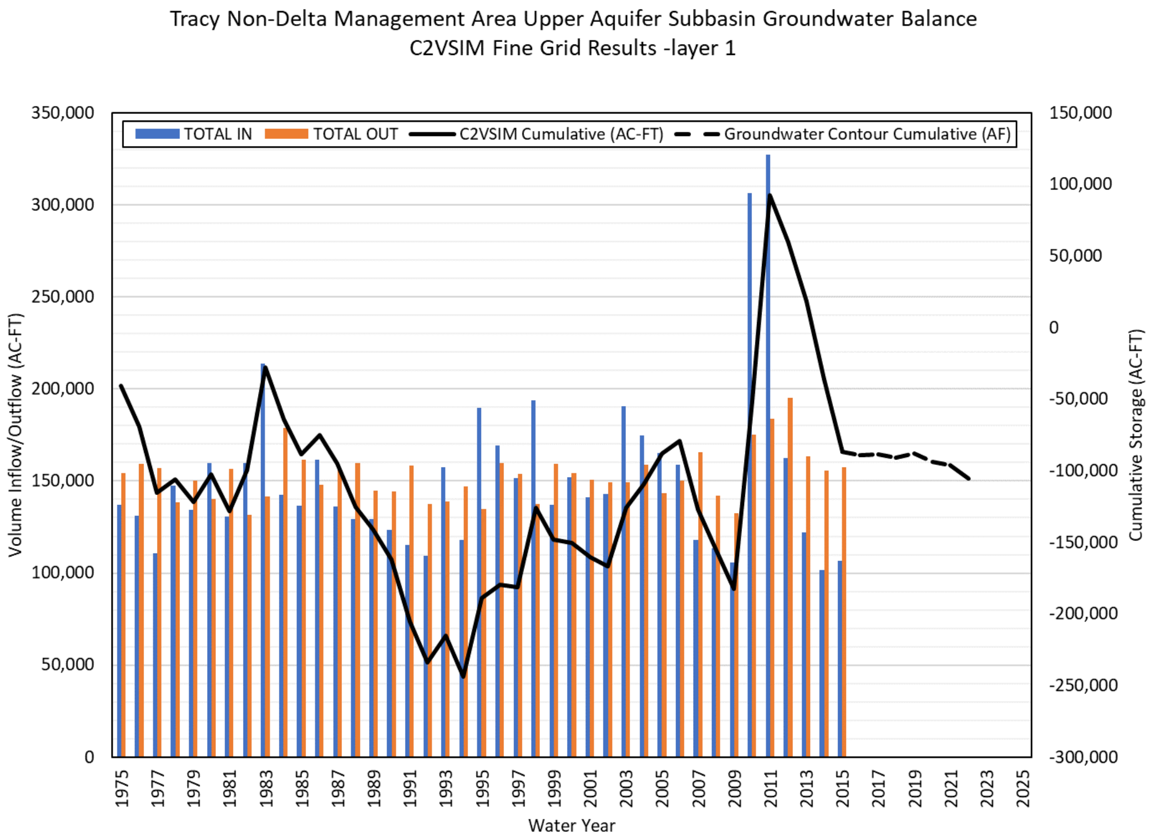

Figure 7-3. Upper Aquifer - Cumulative Change in Storage

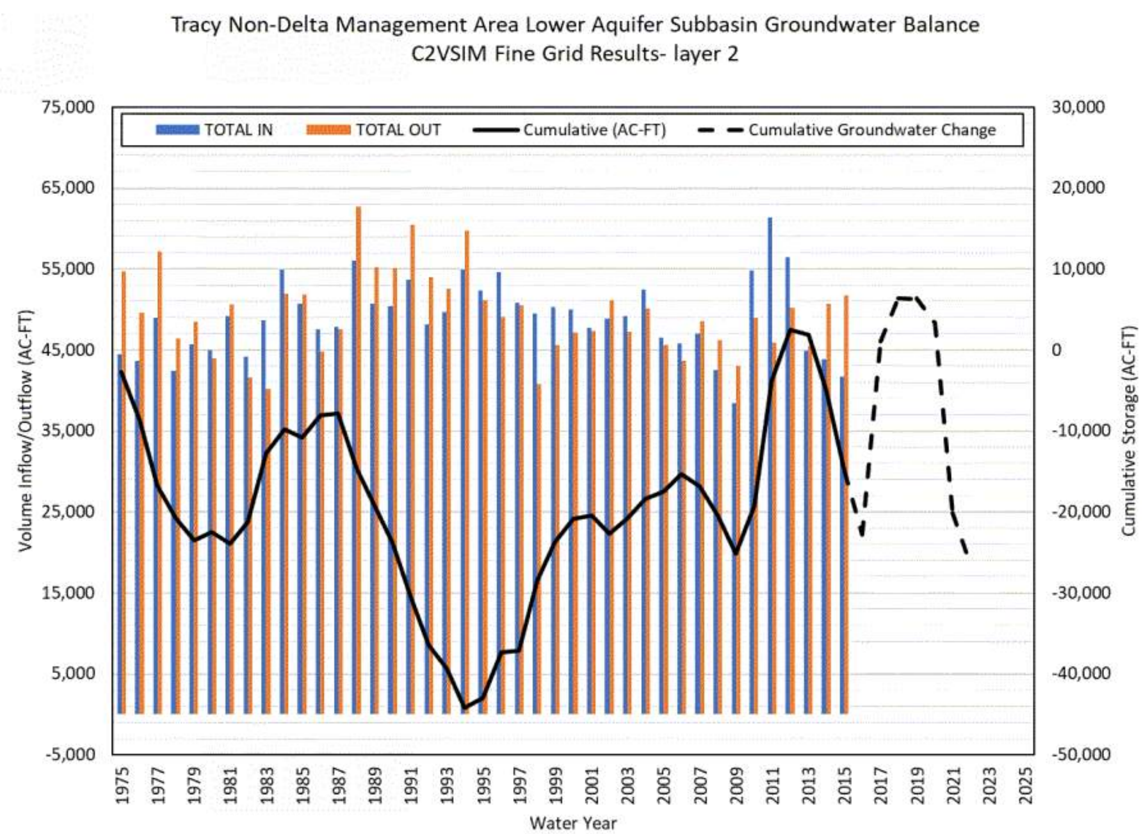

Figure 7-4. Lower Aquifer - Cumulative Change in Storage

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8. Annual Evaluation of Other Sustainability Criteria

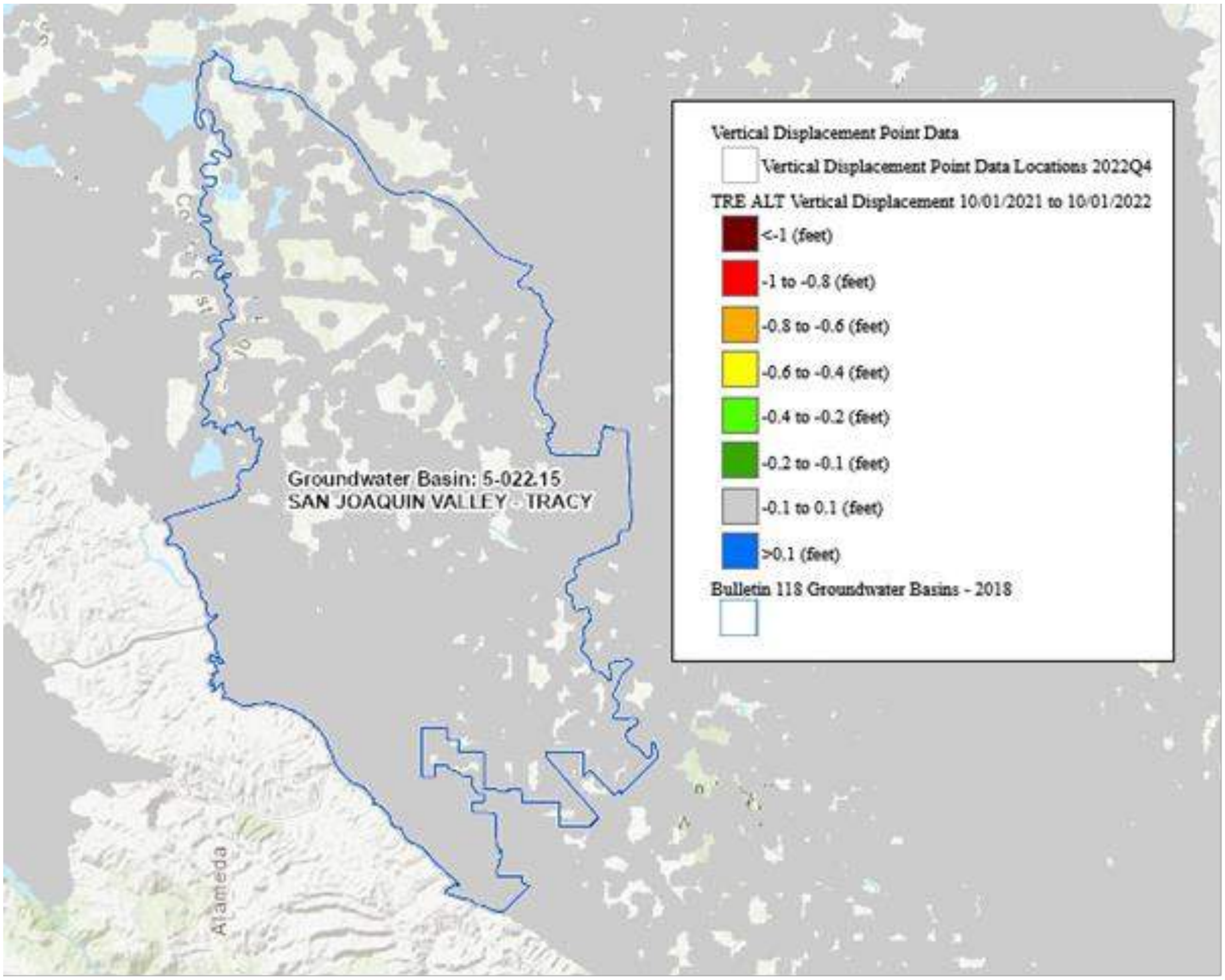
The previous sections of this report evaluated groundwater chronic lowering of groundwater levels and reduction of groundwater storage sustainability criteria. The GSAs furthered the assessment by evaluation of subsidence, groundwater quality and surface water depletion sustainability criteria as described in the following sections.

8.1 Subsidence

Land subsidence is the lowering of the land surface. As described in the GSP, several human-induced and natural causes of subsidence exist, but the only process applicable to the SGMA are those due to lowered ground surface elevations caused by groundwater pumping. Historical subsidence was estimated using InSAR data provided by DWR. InSAR measures ground elevation using microwave satellite imagery data. The GSP documents minor subsidence in the Subbasin using data provided by DWR depicting the difference in InSAR measured ground surface elevations between October 1, 2021 through October 1, 2022 as processed by DWR.[3] These data show that subsidence of -0.1 to +0.1 feet occurred in the Subbasin. The estimation error of the InSAR data is 0.1 foot.

The minimum threshold for land subsidence in the Subbasin is set at nor more than 0.03 feet in any single year (October 1 – October 1 to match the water year) and a cumulative -0.13 feet in any 5-year period, similar to historic subsidence levels. The cumulative amount would exceed the estimation error in the InSAR data of 0.1 foot and would therefore be valid. Subsidence is less than the detectable limits and the minimum threshold has not been exceeded, therefore undesirable results have not occurred during WY 2022.

3 https://storymaps.arcgis.com/stories/41574a6d980b4e5d8d4ed7b90f9698d2?utm_medium=email&utm_source=govdelivery



8.2 Interconnected Surface Water

Minimum thresholds were established at 10 representative monitoring wells in both the Upper and Lower Aquifers for surface water depletion. Representative monitoring wells were established in the Lower Aquifer due to the unknown extent of the Corcoran Clay beneath the Delta Management Area. Three wells were not monitored in 2022, wells ORL-1W, Well N, and 01S04E31P005M. **Table 8-1** shows a comparison of minimum thresholds and fall 2022 groundwater elevations. One well, 01S05E31R002M, exceeded the minimum thresholds.

Table 8-1. Summary of Surface Water Depletion

Representative Wells for Surface Water Depletion				
CASGEM ID	Local Name	Minimum Thresholds (ft amsl)	2022 Fall Groundwater Elevation (ft msl)	MT Exceedance
Upper Aquifer Wells				
377341N1213039W001	Well N	5	NM	--
377813N1214420W001	02S05E08B001	-7	-3.2	No
377976N1214560W001	01S05E31R002	-1	-1.40	Yes
378165N1213145W001	MWM-24	-1	10.38	No
377823N1213330W001	MWR-25	3	7	No
378103N1215449W001	ORL-1W	-3	NM	--
377979N1215800W001	01S04E31P005M	41	41.06	No
Lower Aquifer Wells				
377402N1214508W002	MW-1B	-69	-40.41	No
377427N1213943W002	MW-5B	-60	-39.53	No
377656N1214199W002	MW-6B	-67	-35.4	No

Notes: Yellow highlight indicates MT Exceedance
ORL-1W not measured in WY 2022 by DWR or GSAs due to transfer of well

8.3 Groundwater Quality

Although groundwater quality is not a primary focus of SGMA, actions or projects undertaken by GSAs to achieve sustainability cannot degrade water quality to the extent that they would cause undesirable results. As stated in the GSP, groundwater quality in the Subbasin is generally poor, with few areas of good water quality. Total dissolved solids, nitrate, and boron were identified as constituents of concern and measurable threshold were established. Eight wells were identified as representative monitoring wells. **Table 8-2** provides a list of the wells and any water quality data that was obtained during WY 2022. None of the water quality constituents exceeded the measurable thresholds in WY 2022.

Table 8-2. Summary of Groundwater Quality

PWS Code	Local Name	Measurable Thresholds			WY 2022		
		TDS (mg/L)	Nitrate (mg/L)	Boron (mg/L)	TDS (mg/L)	Nitrate (mg/L)	Boron (mg/L)
Upper Aquifer							
	SJCDW00032	0	10	4.2	NA	NA	NA
	SJCDW00034	0	14	1.0	NA	NA	NA
3910015-005	WELL 06	500	10	0.7	NA	4.1	NA
Lower Aquifer							
3910702-006	WSW009	1000	10	1.7	502	<0.4	0.8
3910011-003	PRODUCTION WELL 01	1000	10	2.9	NA	2.2	NA
3910011-018	WELL 04R -NEW LINCOLN	1000	10	1.4	NA	1.3	NA
3910011-032	PRODUCTION WELL 06	1000	10	1.5	NA	0.78	NA
3910011-034	PRODUCTION WELL 07	1000	10	2.0	NA	1.5	NA

Note: NA = Not analyzed, no sample taken; TDS = total dissolved solids.

9. Progress Towards Implementing the GSP

The GSA agencies in the Subbasin have agreed to work together to protect the groundwater resources of the Subbasin to meet the current and future beneficial uses in the Subbasin by developing a GSP during WY 2022 that conforms with the requirements of SGMA.

This section describes the project and management actions from the GSP that are in progress, recently implemented, or anticipated in the Subbasin to maintain sustainability. It also includes public outreach activities.

9.1 Public Involvement

The GSAs held 11 monthly to quarterly Technical Committee meetings during WY 2022 which were open to attended by the public. During the April meeting WY 2021 Annual Report was presented and discussed.

In accordance with the GSP, an update to the Subbasin's Communication and Engagement Plan was initiated which include interviews with the public. The plan will be completed in WY2023.

9.2 Progress Toward Filling Data Gaps

The GSAs identified in the GSP data gaps in their monitoring network, hydrogeologic conceptual model, and uncertainties in the groundwater model.

9.2.1 Expanded Groundwater Monitoring Network

Five new monitoring well locations have been selected and applications were submitted to DWR's Technical Support Services in September 2022. In WY 2023, further progress is anticipated with the landowners entering into agreements to allow DWR to being construction of the wells. Land could not be located to drill a sixth well but an existing well is being explored to potentially include in the monitoring network. One of the five monitoring wells is located near the well that was reported dry in WY 2022.

9.2.2 Purchase and Install Transducers

Purchase of transducers for three wells to improve the correlation of groundwater to surface water. The transducers have not been purchased or installed.

9.2.3 Groundwater Dependent Ecosystems

The Natural Communities Commonly Associated with Groundwater (commonly known as NCCAG) identified potential Groundwater Dependent Ecosystems (GDEs). The potential GDE areas have not been validated. Evaluation of potential GDEs with the depth to groundwater are scheduled to begin in WY 2023.

9.2.4 Improve Groundwater Quality Monitoring Network

The GSAs, in their GSP, identified 125 community and small community water supply wells in the Subbasin with water quality data but only 50 of the wells had well construction details to identify which aquifer they extract water from. The GSP indicated that within the next 5 years, construction details will be located so that water quality results can be sorted by principal aquifers to improve the distribution of representative monitoring wells for water quality and trend assessment in the Subbasin. No progress has been made to locating these well construction details.

9.2.5 C2VSim Improvements

The GSAs, in their GSP, identified multiple items that could potentially improve C2VSim-FG_v1.0 and make the model more useful for the Subbasin. No progress was made during WY 2022 but in January 2023, the GSAs met with DWR to discuss the updates to the C2VSim-FG_v1.0 and provided them with water supply information to use in the model update.

9.3 Projects and Management Actions

The hydrologic conditions and hydrogeologic setting of the Subbasin and ongoing proactive water management have demonstrated the resilient nature of the Subbasin and avoidance of groundwater overdraft conditions. As a result, the DWR has designated the Subbasin as medium priority. The groundwater modeling with climate change and projections over the next 50 years showed that the Upper Aquifer has a deficit of 800 AFY, while the Lower Aquifer has a surplus of about 1,000 AFY (GEI 2021).

One project was identified to expand BCID service area to maintain sustainability of the Upper Aquifer. One management action was included in the GSP to evaluate and consider revising the San Joaquin County well ordinance to provide more protection for domestic wells, GDEs and surface water.

The status of each project and management action is described below.

9.3.1 Project #1: Reduction of Groundwater Pumping

This project will consist of expansion of the BCID distribution facilities to provide surface water to up to 2,000 acres of agricultural land that is currently solely reliant on groundwater. The project requires construction of new lateral pipelines, establishment of new turnouts to deliver water to the agricultural properties, and enlargement of a pump station tied to an existing main lift canal. The expansion of the distribution facilities project is currently under review by BCID Board of Directors. Construction is expected to begin in 2023 and be completed by 2030.

In WY 2022, BCID sought to improve groundwater levels by construction of Phase 1 of the Conjunctive Use Project, which included about 6,800 linear feet of 36-inch diameter pipeline to serve 340 acres of farmland with surface water and begin providing water in July 2022. This portion of the conjunctive use project will reduce groundwater pumping by an average annual volume of about 600 AFY, meeting a portion of the forecasted overdraft deficit.

BCID in WY 2022 identified a potential grant proposal solicitation package to help to fund the remaining project buildout. BCID decided to pursue the grant and completed the grant application in December 2022.

9.3.2 Management Action #1: Modify Well Ordinance

This management action may consist of revising San Joaquin County Well Ordinance to create surface water protection zones near rivers, canals, and sloughs in the Non-Delta Management Area. Minimum sanitary seal and screen depth requirements will be developed to limit wells from using shallow aquifers directly connected to surface water. The project will require development of technical information to support the development of protection zones and modification of the Well Ordinance. Exemptions may be allowed for replacement of existing wells. The well ordinance may also be modified to include special study requirements for high-capacity wells to assess their potential effects on nearby domestic wells.

San Joaquin County Environmental Health Department (SJCEHD) well permitting agency developed an approach to the Governor's Executive Order N-7-22, Action 9.a and 9.b, which required implementation of temporary requirements for approval of well permits. To address Action 9.b requirements, SJCEHD developed a simple distance-drawdown curve with various pumping rates to assess whether nearby wells could be affected by pumping of a new well. Additional meetings with SJCEHD are planned for WY 2023 to continue to explore long-term potential improvements, potentially keeping the develop approach after the EO is rescinded and using it for new wells near surface water.

The new California Well Standards are expected to be released in Spring 2023 with the final in Fall 2023 which will be sent to the State Water Resources Control Board who will require revisions and adoption of local well ordinances to meet the minimum standards. SJCEHD could potentially include a permanent version of Action 9.b along with proposed surface water protection zones and special studies into their well ordinance at that time. The GSAs do not have authority to permit wells or ordinances pertaining to them.

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10. Summary of Progress toward Meeting Subbasin Sustainability

The GSAs have begun to resolve data gaps by submitting five applications for groundwater level monitoring wells to Technical Support Services. No other progress towards filling other gaps were made in WY 2022. The GSAs are adjusting their monitoring of groundwater levels to improve upon the regularity to obtain groundwater level measurements.

Groundwater minimum thresholds for chronic lowering of groundwater levels were exceeded at four wells in the Non-Delta Management Area in fall 2022, but because of having three consecutive drought years this did not produce undesirable results as defined in the GSP. There was an associated decrease in groundwater in storage. However, this does not indicate that the Subbasin is not sustainable. The evaluation of other sustainability indicators did not result in any exceedances of minimum thresholds. Relative to the Subbasin conditions at the end of this water year indicate lower groundwater levels in comparison to previous years due to ongoing drought conditions that started in WY 2020.

Partial implementation to provide surface water to areas that were solely reliant on groundwater was completed in WY 2022. This will reduce groundwater pumping is the Upper Aquifer by about 600 AFY, almost fully resolving the projected deficit of 800 AFY.

Actions are underway to collect data, improve the monitoring and data collection networks, and coordinate coordination with adjacent GSAs. Progress has been made toward implementing Project #1: Reduction of Groundwater Pumping (*refer to* **Section 9.2.1**).

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Appendix A Monitoring Network Inventory

Table A-1. Groundwater Level Monitoring Well Network

CASGEM ID	Local Name	Latitude	Longitude	Reference Point Elevation (ft)	Screened Interval (ft bgs)	Total Depth (ft bgs)	Period of Record	Well Type	Monitoring Frequesncy
Upper Aquifer Wells									
377341N1213039W001	Well N	37.7341	-121.3039	23.36	Unknown	40	1960-2019	R	Semi-Ann
377061N1214199W001	Well Q	37.7061	-121.4199	121.41	120-140	140	1972-2020	R	Semi-Ann
377951N1216011W001	02S03E01D001M	37.795122	-121.601114	90	40-80	80	2014-2020	I	Semi-Ann
377813N1214420W001	02S05E08B001M	37.7813	-121.442	4.3	50-80	80	1960-2019	R	Semi-Ann
377976N1214560W001	01S05E31R002M	37.7976	-121.456	4.6	Unknown	92	1960-2019	R	Semi-Ann
376388N1213233W001	03S06E28N001M	37.6388	-121.3233	148.24	107-128	128	2012-2020	O	Semi-Ann
377528N1215156W001	02S04E15R001M	37.7528	-121.5156	63.41	0.1-45	45	2011-2019	U	Semi-Ann
378103N1215449W001	ORL-1W	37.810306	-121.544889	16.6	86-106	106	2005-2018	O	Cont.
377979N1215800W001	01S04E31P005M	37.797914	-121.580028	60	8-23	24	2014-2020	O	Semi-Ann
376713N1214580W001	Corral MW-5	37.671344	-121.457985	297.89	71-81	87	2015-2019	O	Active
376700N1214547W001	Corral MW-4	37.669968	-121.454661	243.74	16.5-26.5	27	2015-2019	O	Active
--	Glori MW-2	37.680557	-121.343939		20-35	35	2020-future	O	Quarterly/Cont.
--	DV MW-16-BP	37.749268	-121.327641	18	60-85	85	1995-2020	O	Unknown
378165N1213145W001	MWM-24	37.816573	-121.314586		10-20	21	2005-2020	O	Quarterly
377823N1213330W001	MWR-25	37.782319	-121.333029		10.5-20.5	21.5	2005-2020	O	Quarterly
378130N1212758W001	PW16-216	37.813046	-121.275824		208-213	216	1980-2019	In	Quarterly
376891N1213607W001	SJCDW00034	37.6891	-121.3607		Unknown	180	2018-2020	O	Annual
377660N1215308W001	SJCDW00032	37.766	-121.5308		Unknown	125	2018-2020	O	Annual
Lower Aquifer Wells									
376713N1214581W001	Corral MW-6	37.67127	-121.458089	303.33	455-475	477	2015-2018	O	Quarterly
376664N1214612W001	Corral MW-7	37.666448	-121.46123	304.97	310-330, 360-380, 410-430	430	2015-2019	O	Quarterly
377402N1214508W001	MW-1A	37.740187	-121.450762	49.25	428-468	480	2012-2019	O	Semi-Ann
377402N1214508W003	MW-1C	37.740187	-121.450762	51.2	748-788	800	2012-2019	O	Semi-Ann
377402N1214508W002	MW-1B	37.740187	-121.450762	50.09	618-658	670	2012-2019	O	Semi-Ann
377143N1214459W001	MW-2A	37.714305	-121.445905	92.58	426-466	480	2012-2019	O	Semi-Ann
377143N1214459W002	MW-2B	37.714305	-121.445905	92.53	634-674	690	2012-2019	O	Semi-Ann
377143N1214459W003	MW-2C	37.714305	-121.445905	92.53	770-810	820	2012-2019	O	Semi-Ann
377031N1214485W001	MW-3A	37.703055	-121.448544	137.86	382-402	415	2012-2019	O	Semi-Ann
377031N1214485W002	MW-3B	37.703055	-121.448544	138.08	540-580	595	2012-2019	O	Semi-Ann
377031N1214485W003	MW-3C	37.703055	-121.448544	138.22	770-810	820	2012-2019	O	Semi-Ann
377149N1214257W001	MW-4A	37.714872	-121.425674	104.08	450-490	505	2012-2019	O	Semi-Ann
377149N1214257W002	MW-4B	37.714872	-121.425674	102.75	680-700	715	2012-2019	O	Semi-Ann
377149N1214257W003	MW-4C	37.714872	-121.425674	103.11	770-810	820	2012-2019	O	Semi-Ann
377427N1213943W001	MW-5A	37.742656	-121.394318	48.39	406-446	460	2012-2019	O	Semi-Ann
377427N1213943W002	MW-5B	37.742656	-121.394318	47.82	576-616	640	2012-2019	O	Semi-Ann
377427N1213943W003	MW-5C	37.742656	-121.394318	48.06	770-810	820	2012-2019	O	Semi-Ann
377656N1214199W001	MW-6A	37.765631	-121.41992	26.52	410-450	465	2012-2019	O	Semi-Ann
377656N1214199W002	MW-6B	37.765631	-121.41992	26.65	590-630	645	2012-2019	O	Semi-Ann
377656N1214199W003	MW-6C	37.765631	-121.41992	26.8	755-795	810	2012-2019	O	Semi-Ann
376444N1213980W001	03S05E26M001M	37.6444	-121.398	234.09	Unknown	782	2012-2020	I	Semi-Ann
376974N1213258W001	03S06E05R001M	37.6974	-121.3258	59.69	252-275, 295-340, 395-436, 487-537, 589-597, 623-698, 724-749	775	1959-2020	U	Semi-Ann
376470N1213162W001	03S06E28F003M	37.647	-121.3162	119.82	331-715, 726-745	745	1999-2020	I	Semi-Ann
--	SAD MW-438D	37.852531	-121.273705	16	260-280	280	Unknown	O	Quarterly
--	SAD MW-401D	37.82681	-121.263461		230.25-240	240	Unknown	O	Quarterly
378287N1212673W001	SAD MW-402D	37.828719	-121.267374		260-270	270.5	Unknown	O	Quarterly

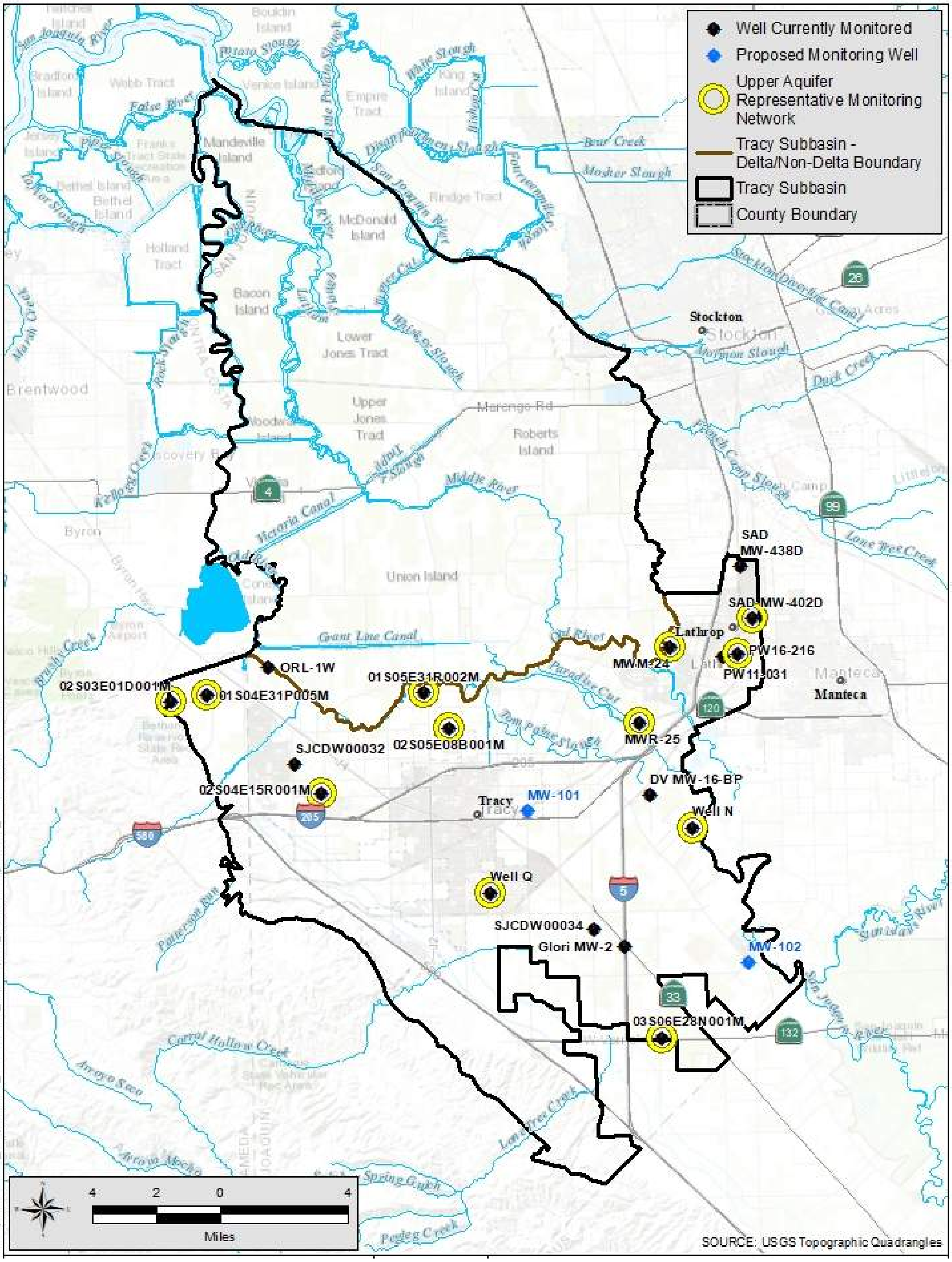

Figure A-1. Upper Aquifer Groundwater Level Monitoring Wells

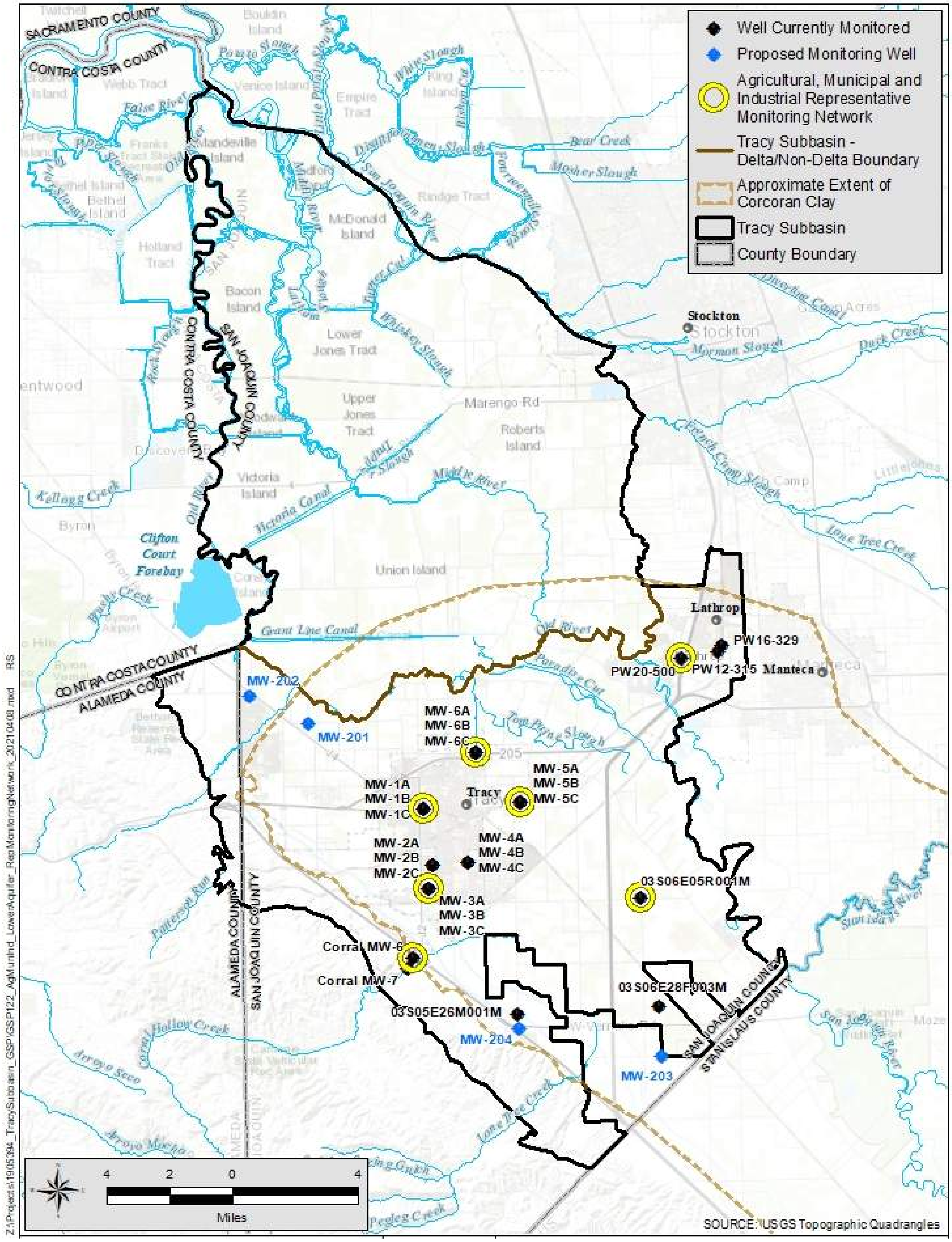

Figure A-2. Lower Aquifer Groundwater Level Monitoring Wells

Table A-2. Representative Monitoring Wells for Chronic Lowering of Groundwater

Representative Wells for Chronic Lowering of Groundwater Levels						Purpose for Monitoring				
CASGEM ID	Local Name	Latitude	Longitude	Screened Interval (ft bgs)	Total Depth (ft bgs)	Domestic Wells	GDE	Areas Soley Dependent On GW	Agricultural, Municipal, and Industral Wells	Frequency of Monitoring
Upper Aquifer Wells										
377341N1213039W001	Well N	37.7341	-121.3039	Unknown	40	X	X	X	X	Monthly
377061N1214199W001	Well Q	37.7061	-121.4199	120-140	140	X		X	X	Semi-Annual
377951N1216011W001	02S03E01D001M	37.79512	-121.6011	40-80	80	X		X	X	Semi-Annual
377813N1214420W001	02S05E08B001M	37.7813	-121.442	50-80	80	X	X		X	Monthly
377976N1214560W001	01S05E31R002M	37.7976	-121.456	Unknown	92	X			X	Semi-Annual
376388N1213233W001	03S06E28N001M	37.6388	-121.3233	107-128	128	X			X	Semi-Annual
377528N1215156W001	02S04E15R001M	37.7528	-121.5156	0.1-45	45	X		X	X	Semi-Annual
377979N1215800W001	01S04E31P005M	37.79791	-121.58	8-23	24		X		X	Monthly
378165N1213145W001	MWM-24	37.81657	-121.3146	10-20	21		X			Monthly
377823N1213330W001	MWR-25	37.78232	-121.333	11-21	22		X			Monthly
378130N1212758W001	PW16-216	37.81305	-121.2758	208-213	216	X			X	Semi-Annual
378287N1212673W001	SAD MW-402D	37.82872	-121.2674	260-270	270.5	X		X	X	Semi-Annual
Lower Aquifer Wells										
376713N1214581W001	Corral MW-6	37.67127	-121.4581	455-475	477	X		X	X	Semi-Annual
377402N1214508W002	MW-1B	37.74019	-121.4508	618-658	670				X	Semi-Annual
377031N1214485W002	MW-3B	37.70306	-121.4485	540-580	595				X	Semi-Annual
377427N1213943W002	MW-5B	37.74266	-121.3943	576-616	640				X	Semi-Annual
377656N1214199W002	MW-6B	37.76563	-121.4199	590-630	645				X	Semi-Annual
378076N1212997W001	PW20-500	37.8076	-121.2997	300-500	498				X	Quarterly
376974N1213258W001	03S06E05R001M	37.6974	-121.3258	252-749	775				X	Semi-Annual

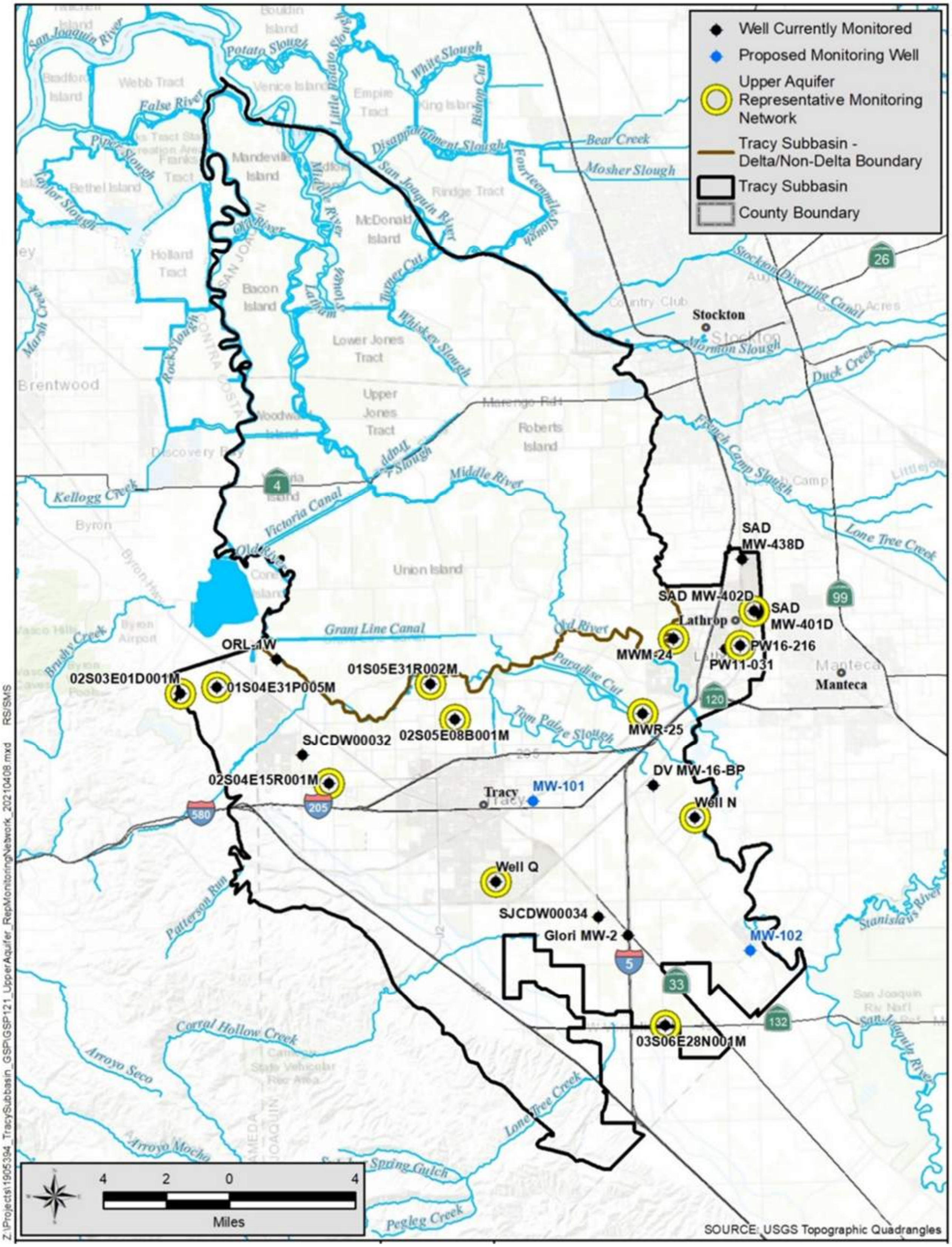

Figure A-3. Upper Aquifer Groundwater Level Representative Monitoring Wells

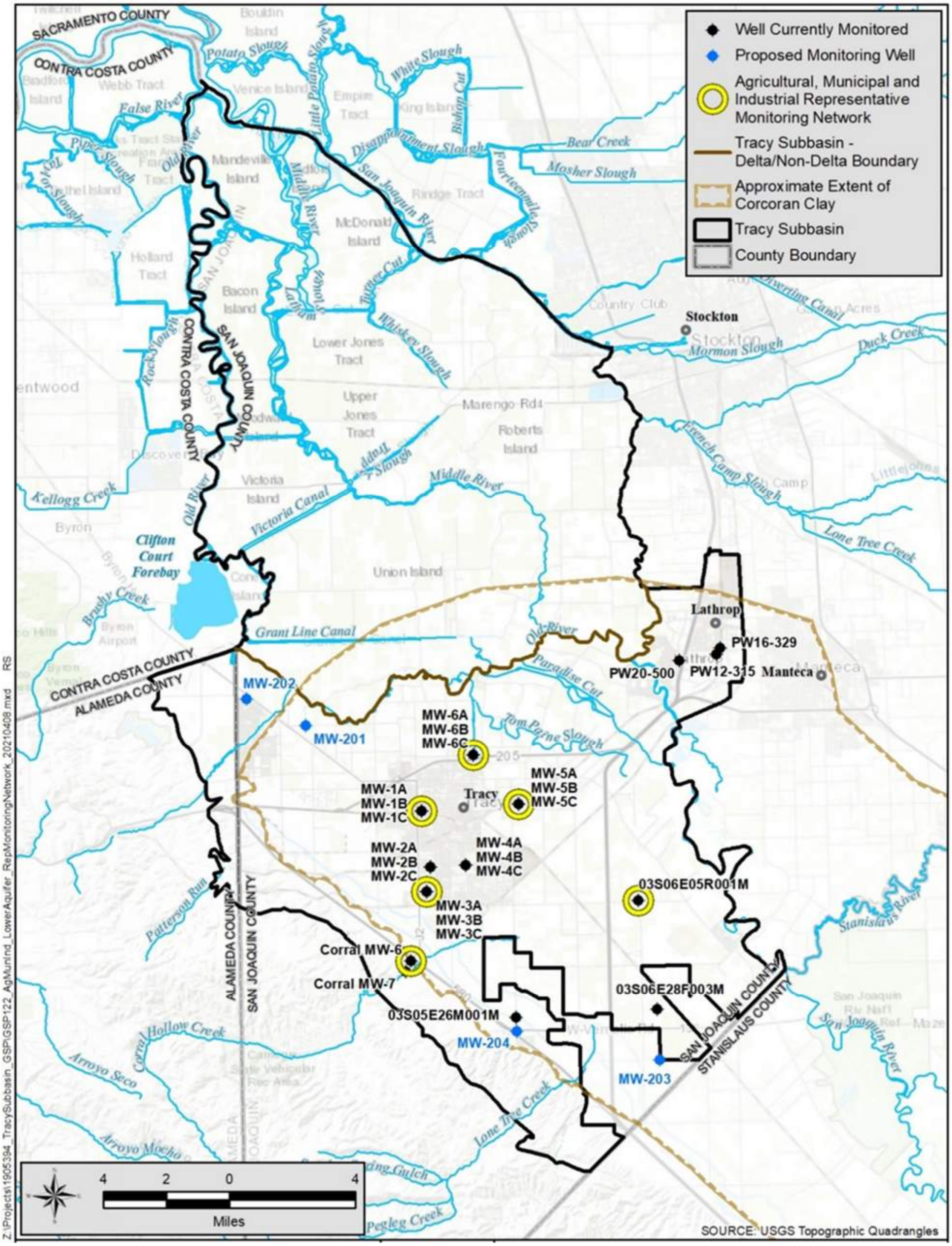

Figure A-4. Lower Aquifer Groundwater Level Representative Monitoring Wells

Table A-3. Surface Water Depletion Representative Monitoring Wells

CASGEM ID	Local Name	Latitude	Longitude	Screened Interval (ft bgs)	Total Depth (ft bgs)	Frequency of Monitoring
Upper Aquifer Wells						
377341N1213039W001	Well N	37.7341	-121.3039	Unknown	40	Monthly
377813N1214420W001	02S05E08B001M	37.7813	-121.442	50-80	80	Monthly
377976N1214560W001	01S05E31R002M	37.7976	-121.456	Unknown	92	Monthly
377979N1215800W001	01S04E31P005M	37.79791	-121.58	8-23	24	Monthly
378103N1215449W001	ORL-1W	37.81031	-121.5449	86-106	106	Monthly
377979N1215800W001	01S04E31P005M	37.79791	-121.58	8-23	24	Monthly
378165N1213145W001	MWM-24	37.81657	-121.3146	10-20	21	Monthly
377823N1213330W001	MWR-25	37.78232	-121.333	11-21	22	Monthly
378116N1212841W001	PW11-031	37.81163	-121.2842	23-28	31	Quarterly
Lower Aquifer Wells						
377402N1214508W002	MW-1B	37.74019	-121.4508	618-658	670	Monthly
377427N1213943W002	MW-5B	37.74266	-121.3943	576-616	640	Monthly
377656N1214199W002	MW-6B	37.76563	-121.4199	590-630	645	Monthly

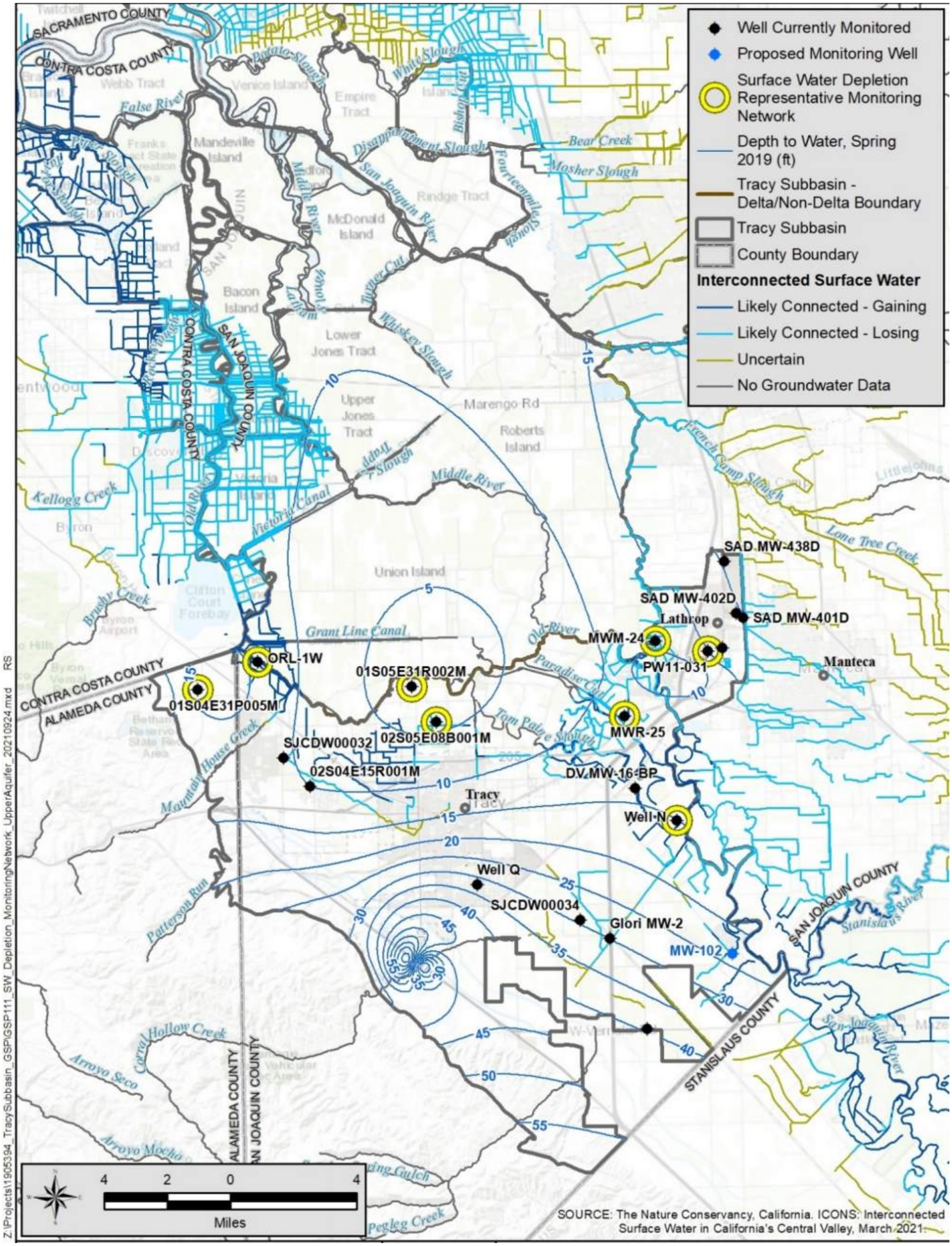

Figure A-5. Upper Aquifer Surface Water Depletion Representative Monitoring Wells

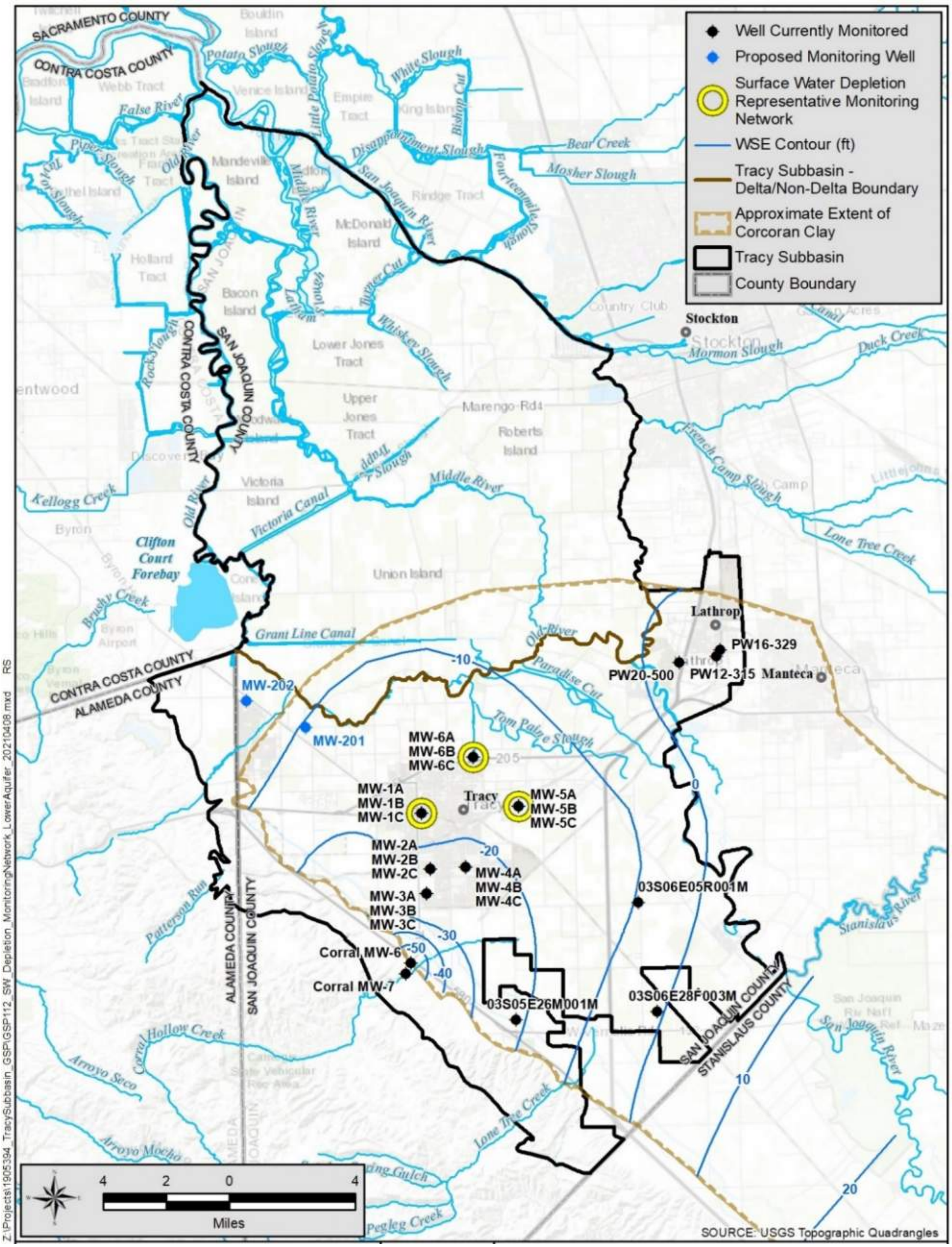

Figure A-6. Lower Aquifer Surface Water Depletion Representative Monitoring Wells

Table A-4. Degraded Water Quality Representative Monitoring Wells

PWS Code	Local Name	Total Depth (ft bgs)	Frequency of Monitoring
Upper Aquifer Wells			
	SJCDW00032	125	Annual
	SJCDW00034	180	Annual
3910015-005	WELL 06	270	3-years
Lower Aquifer Wells			
3910702-006	WSW009	930	3-years
3910011-003	PRODUCTION WELL 01	980	3-years
3910011-018	WELL 04R - NEW LINCOLN	980	3-years
3910011-032	PRODUCTION WELL 06	1196	3-years
3910011-034	PRODUCTION WELL 07	874	3-years

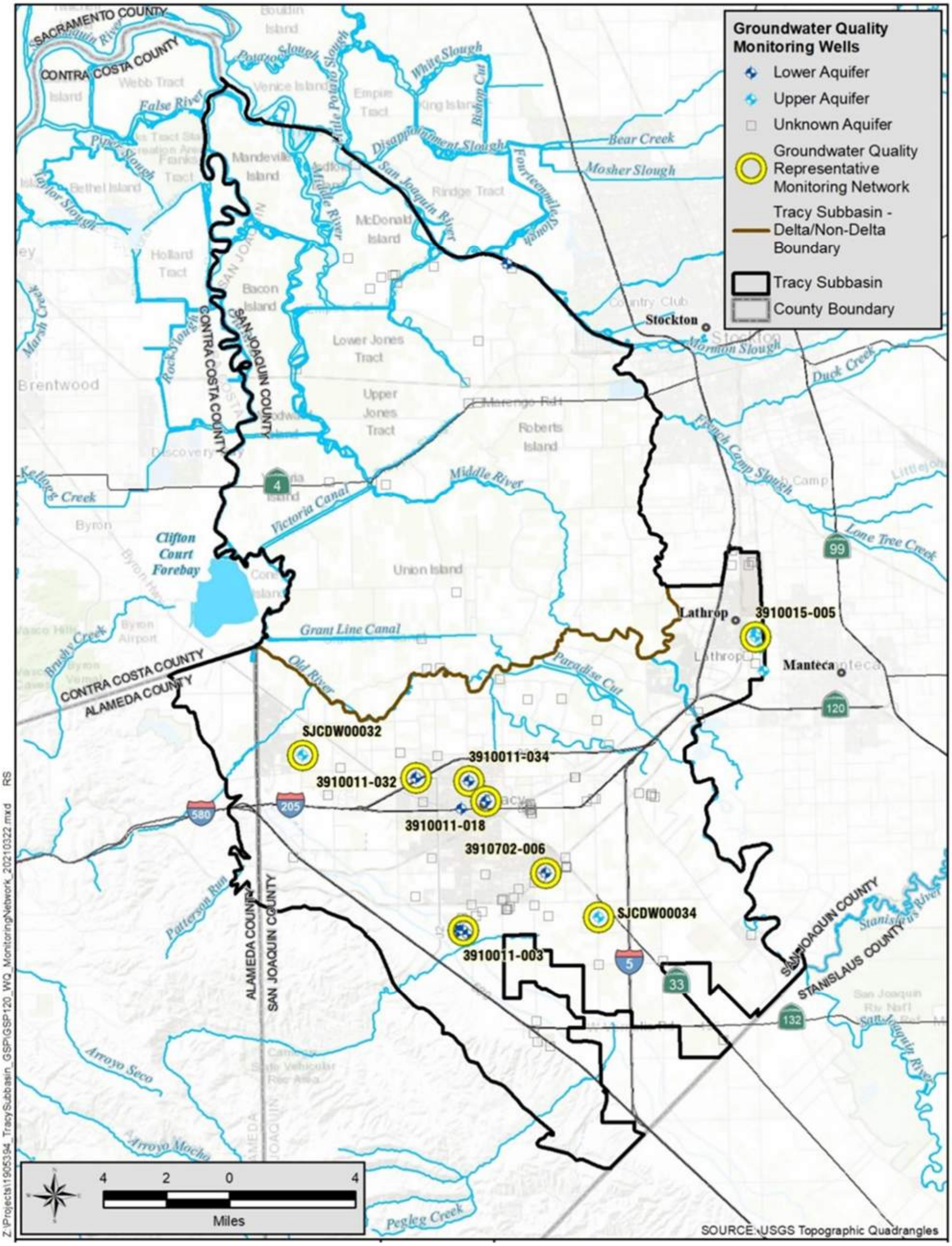

Figure A-7. Water Quality Monitoring Network and Representative Monitoring Network

Appendix B Monitoring Well Hydrographs

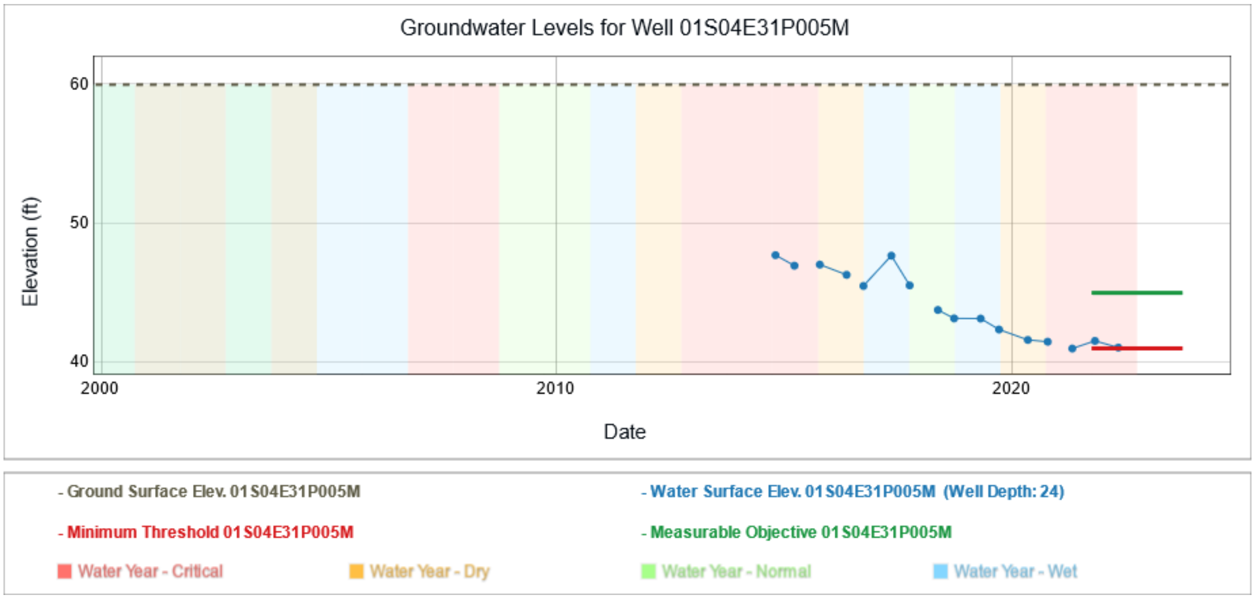

Figure B-1. 01S04E31P005M

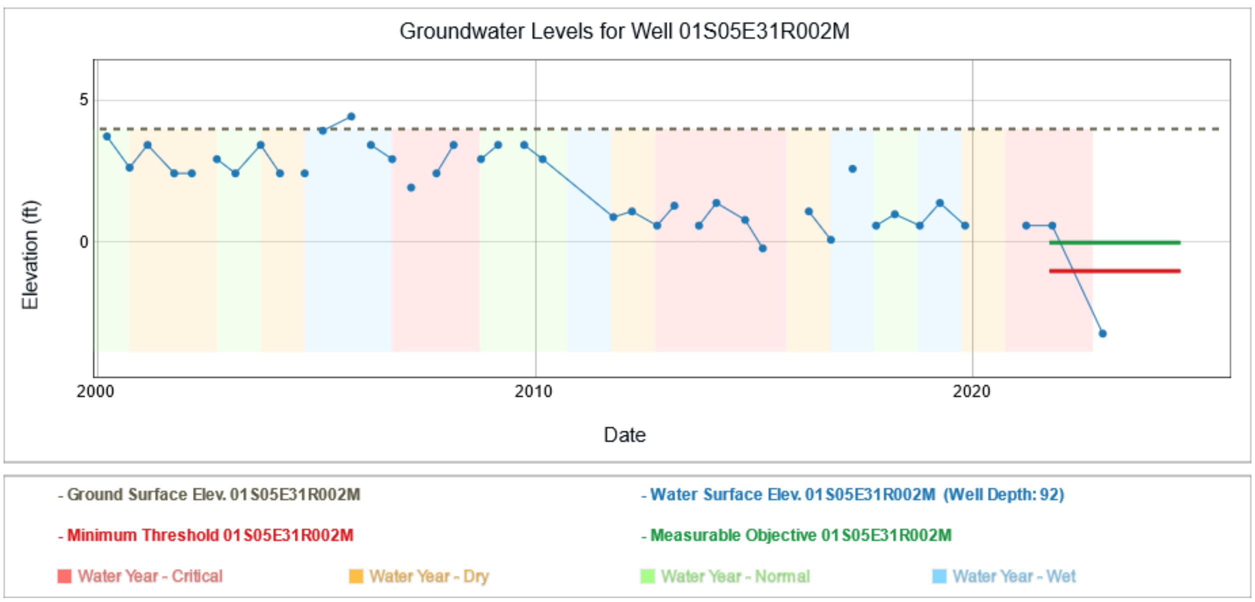

Figure B-2. 01S05E31R002M

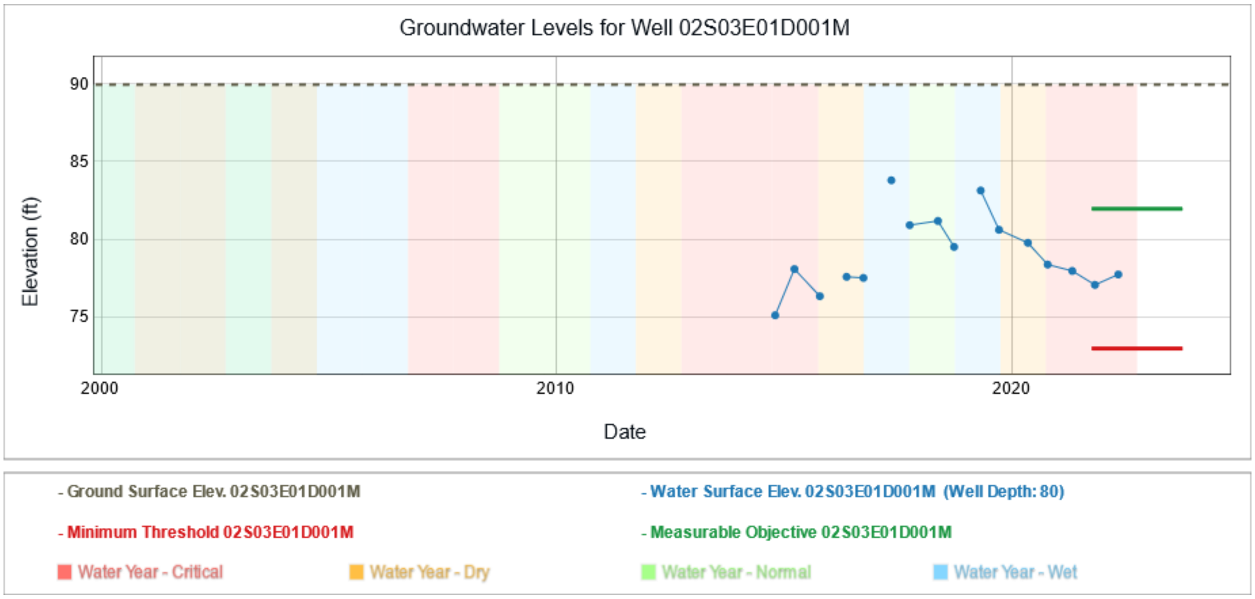

Figure B-3. 02S03E01D001M

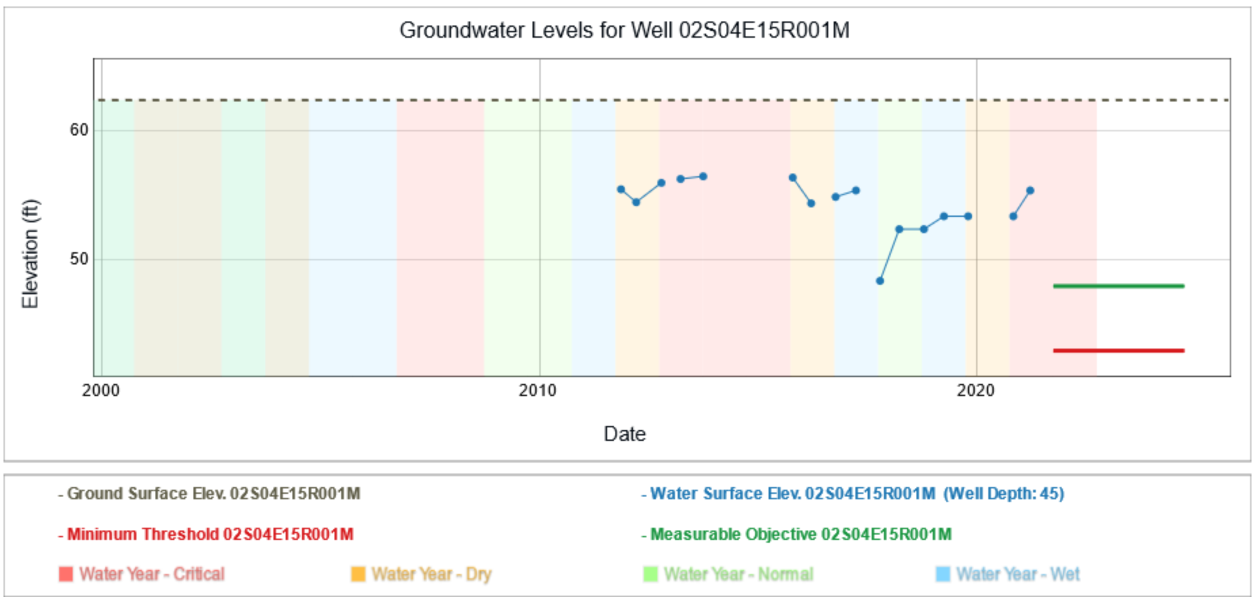

Figure B-4. 02S04E15R001M

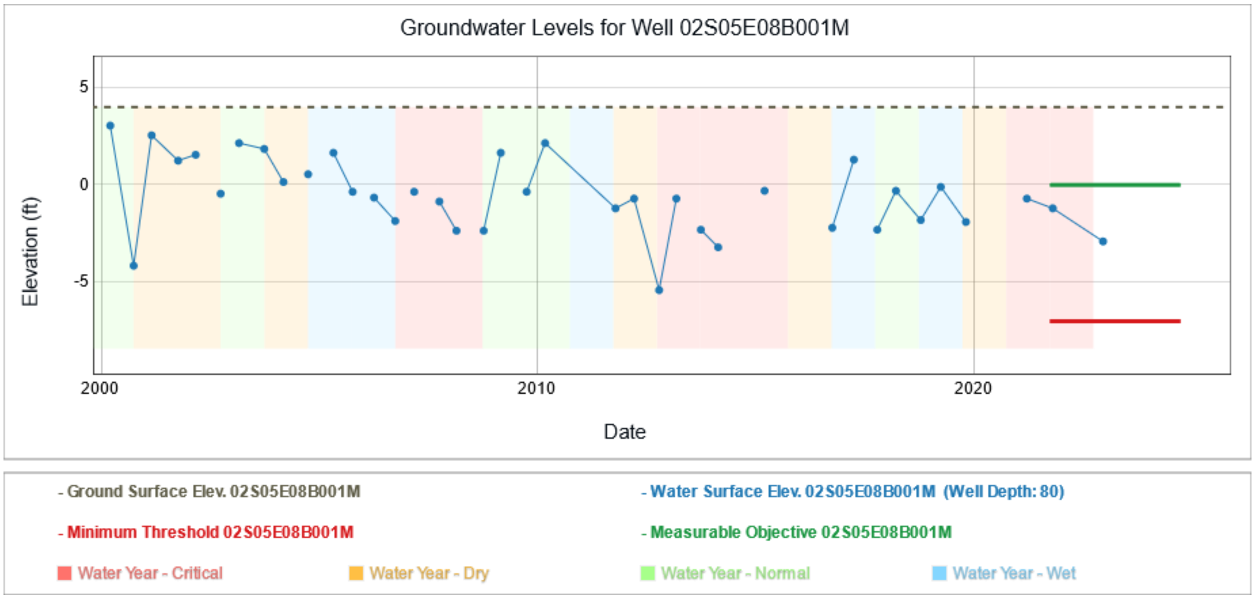

Figure B-5. 02S05E08B001M

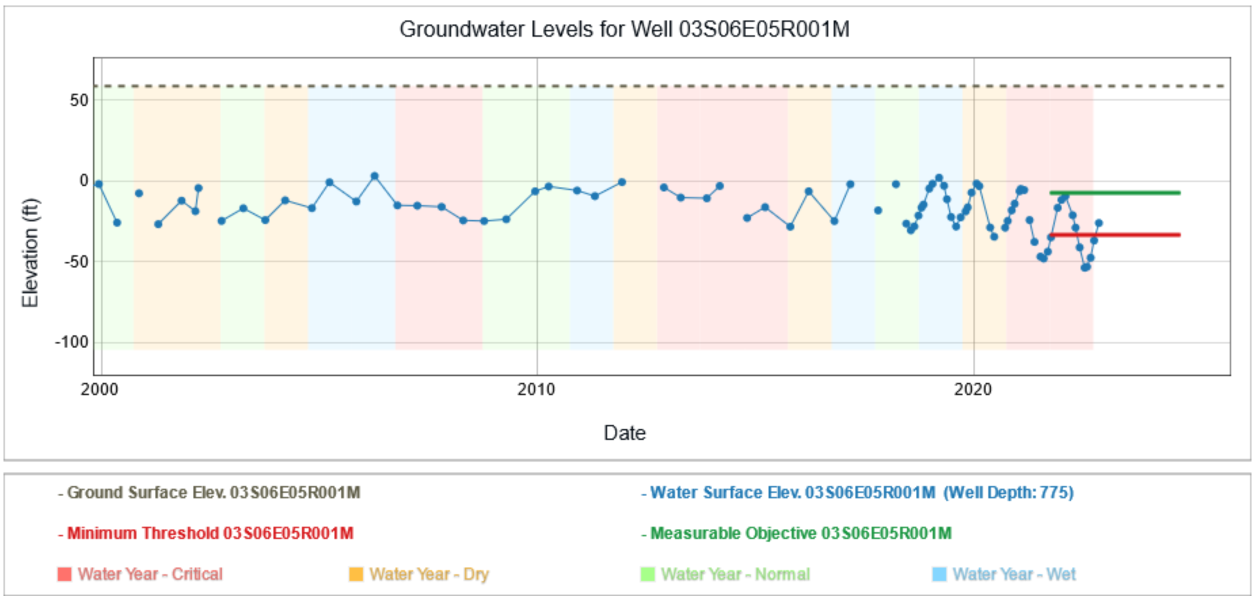

Figure B-6. 03S06E05R001M

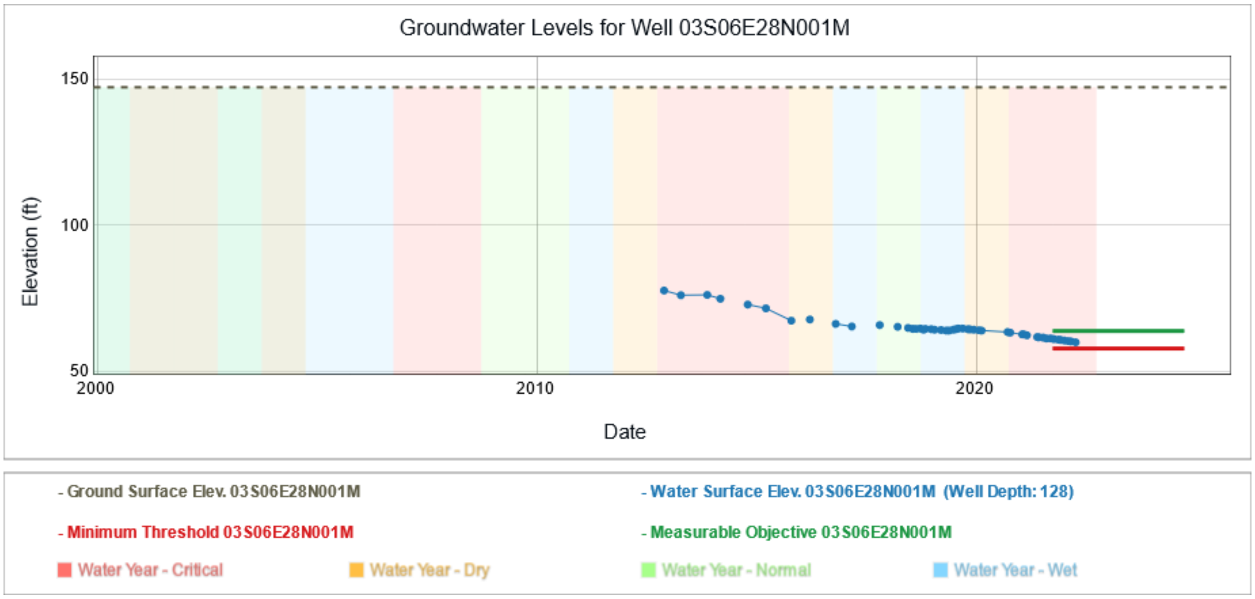

Figure B-7. 03S06E28N001

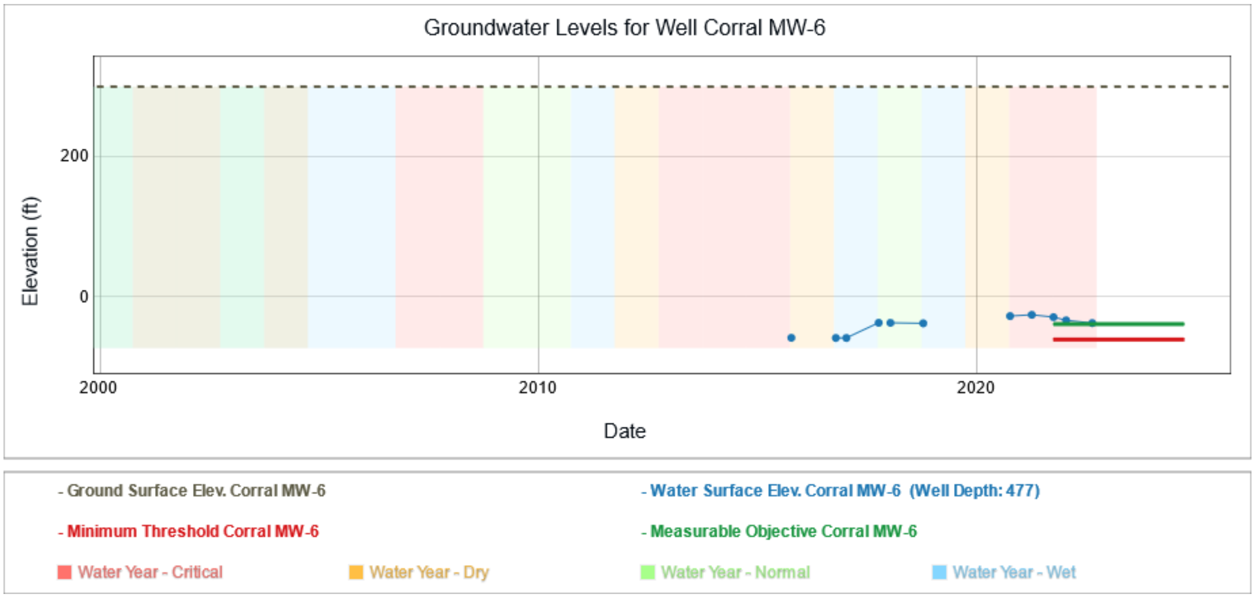

Figure B-8. Corral MW-6

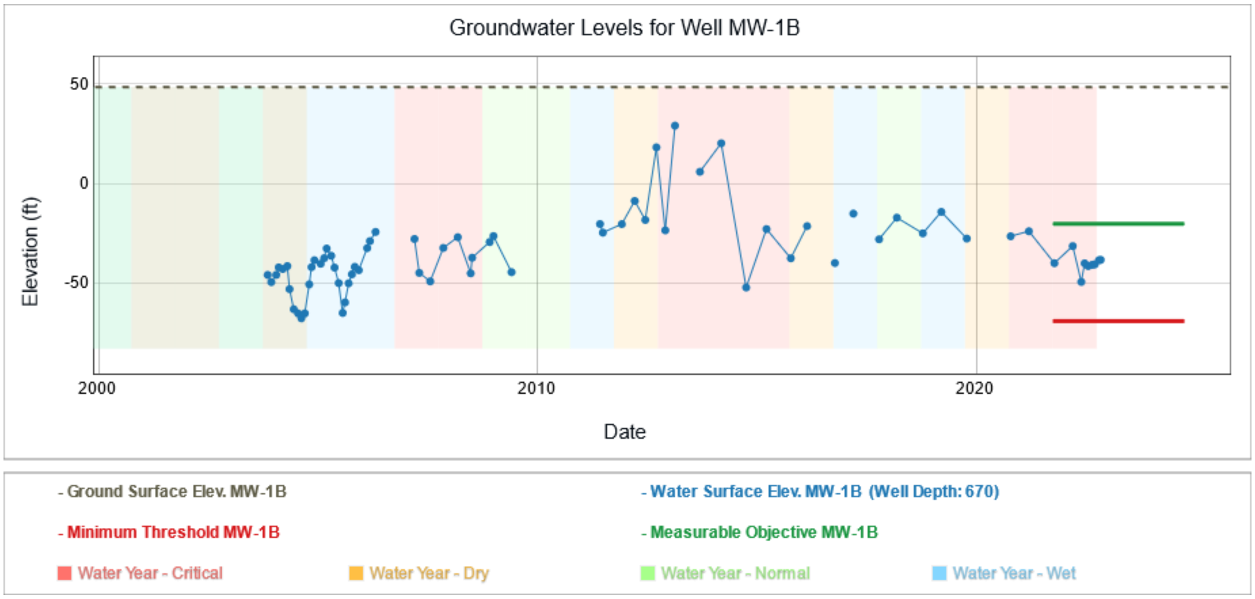

Figure B-9. MW-1B

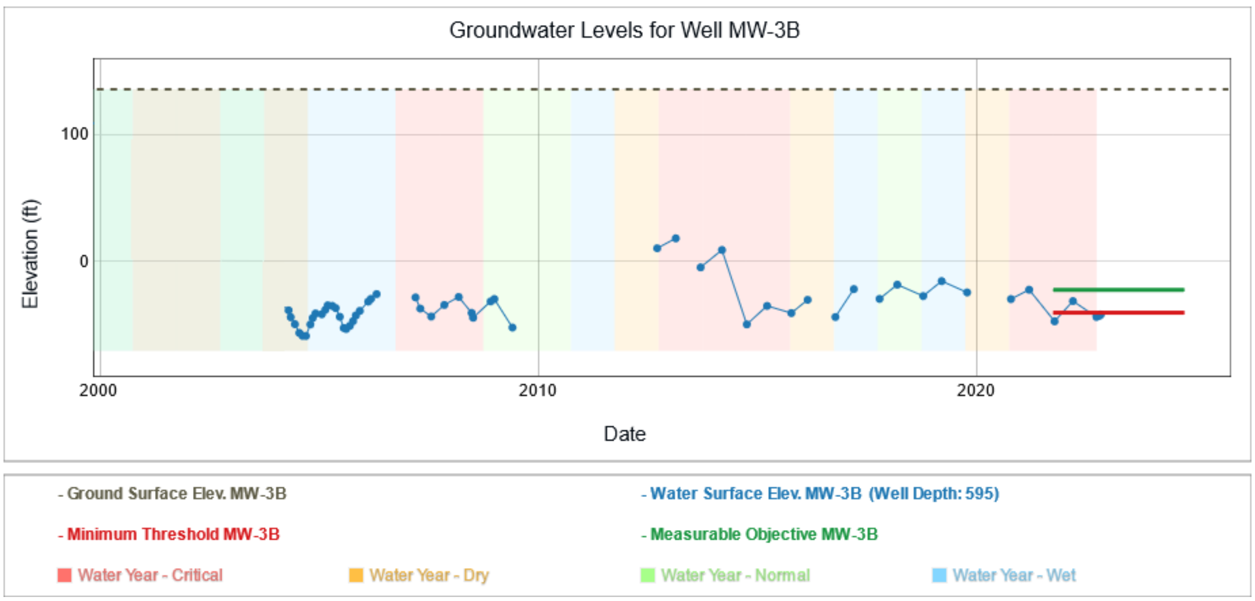

Figure B-10. MW-3B

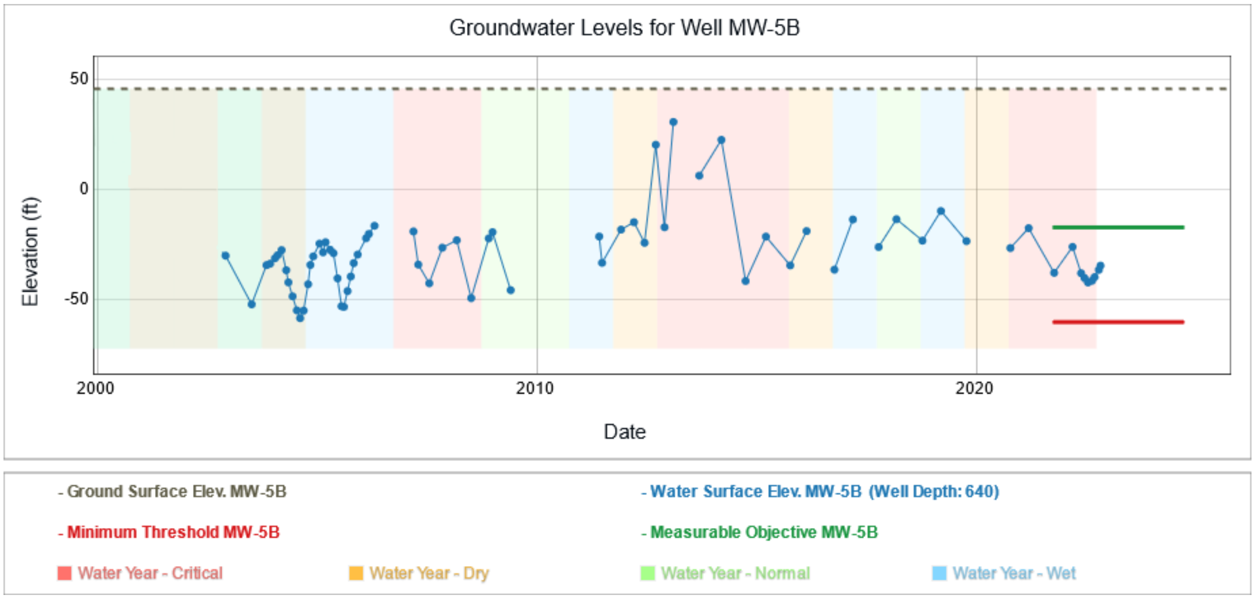

Figure B-11. MW-5B

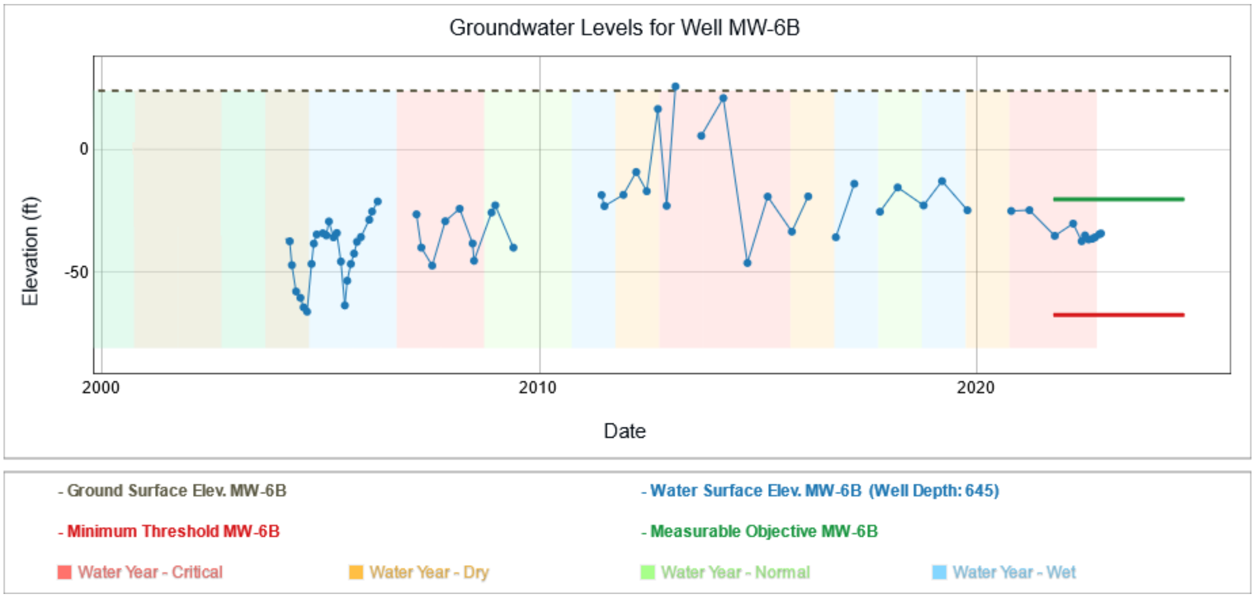

Figure B-12. MW-6B

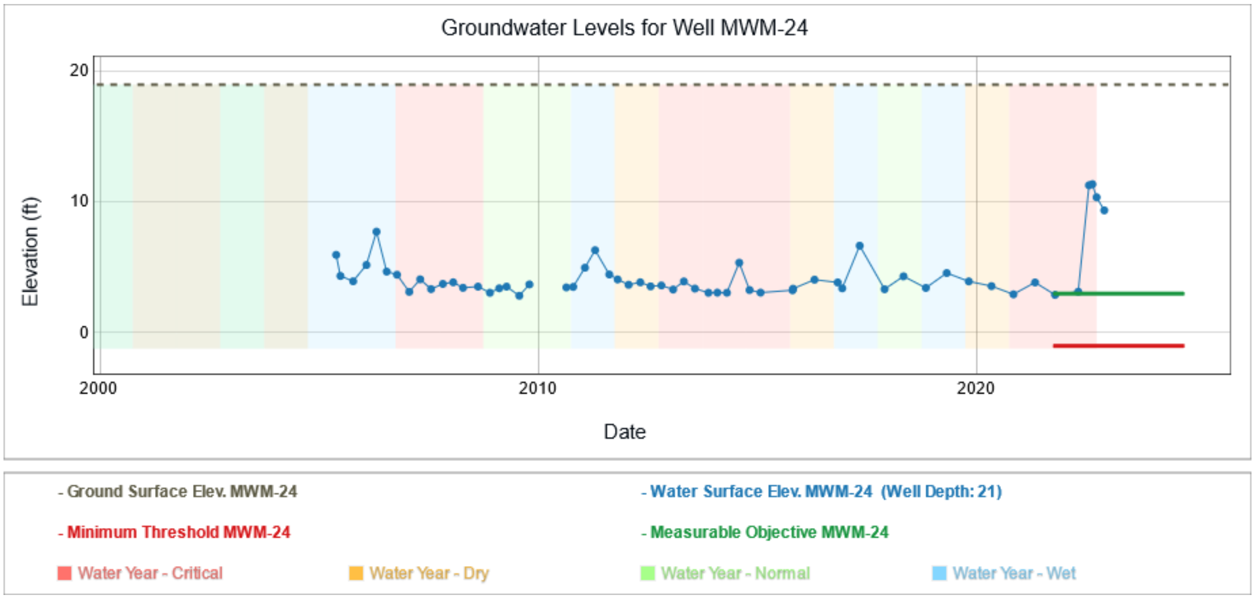

Figure B-13. MWM-24

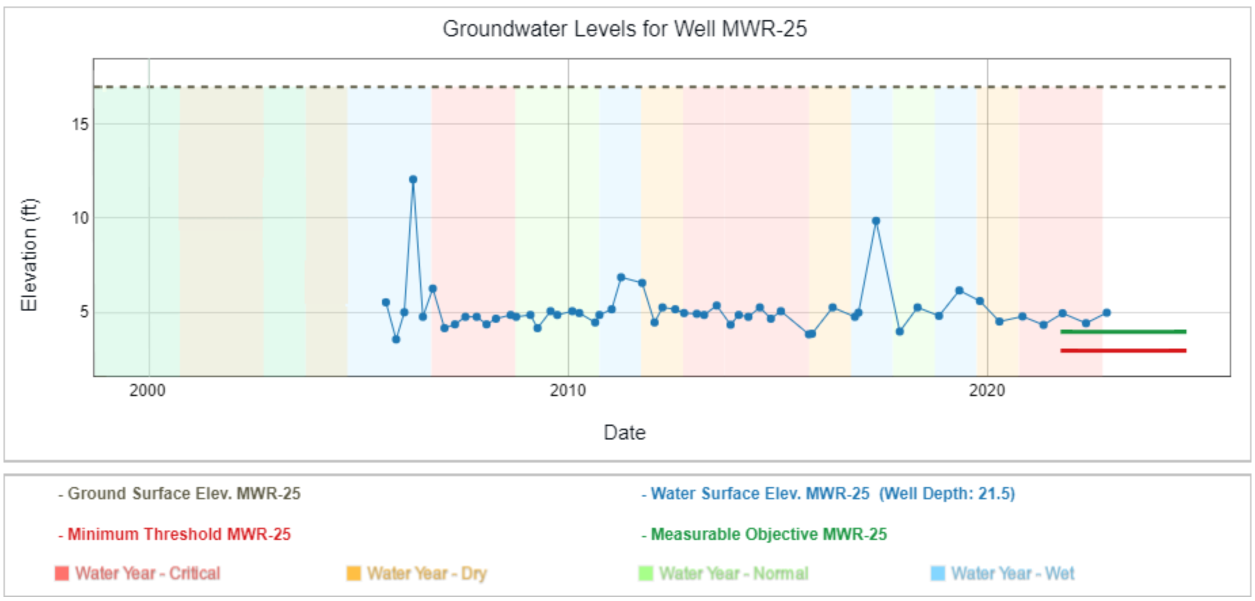

Figure B-14. MWR-25

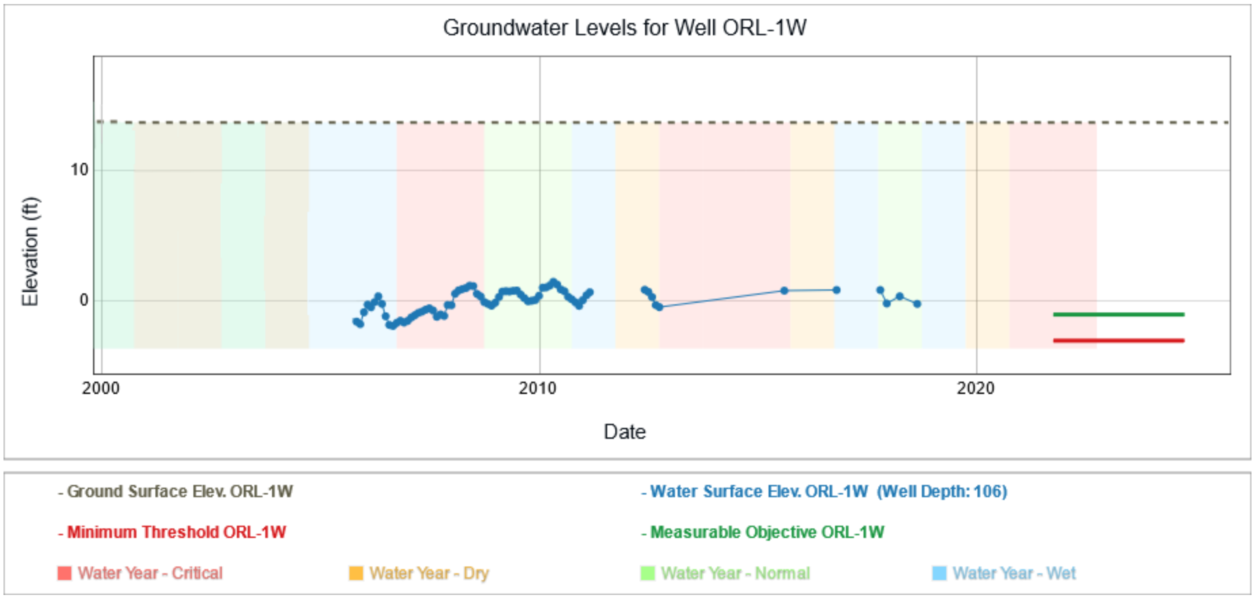

Figure B-15. ORL-1W

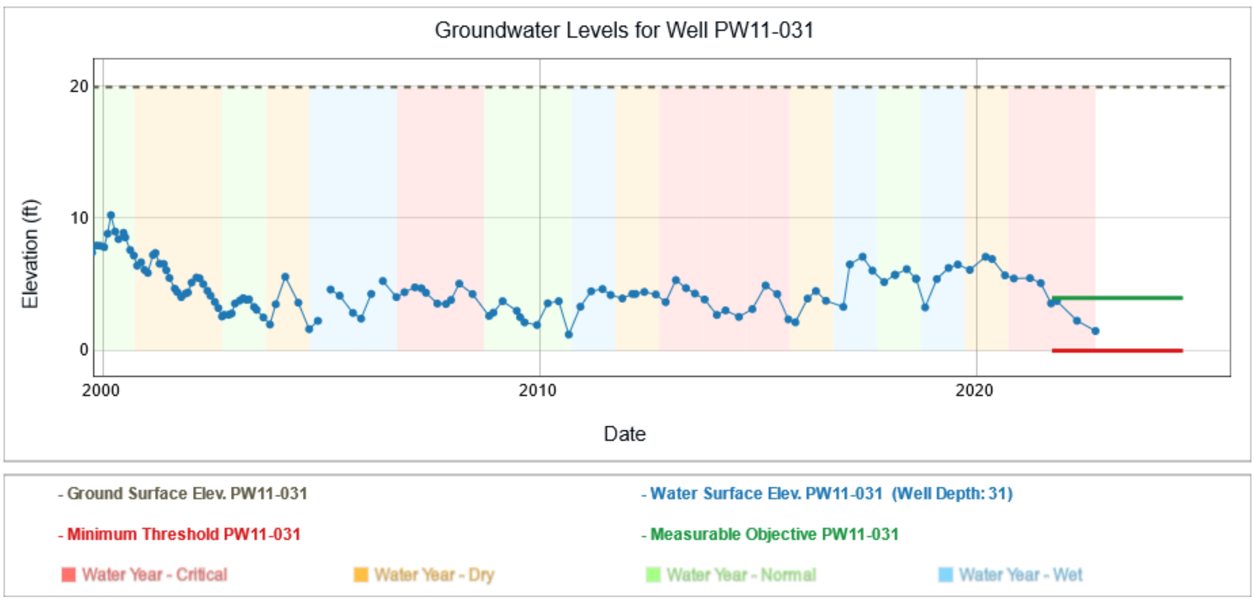

Figure B-16. PW11-031

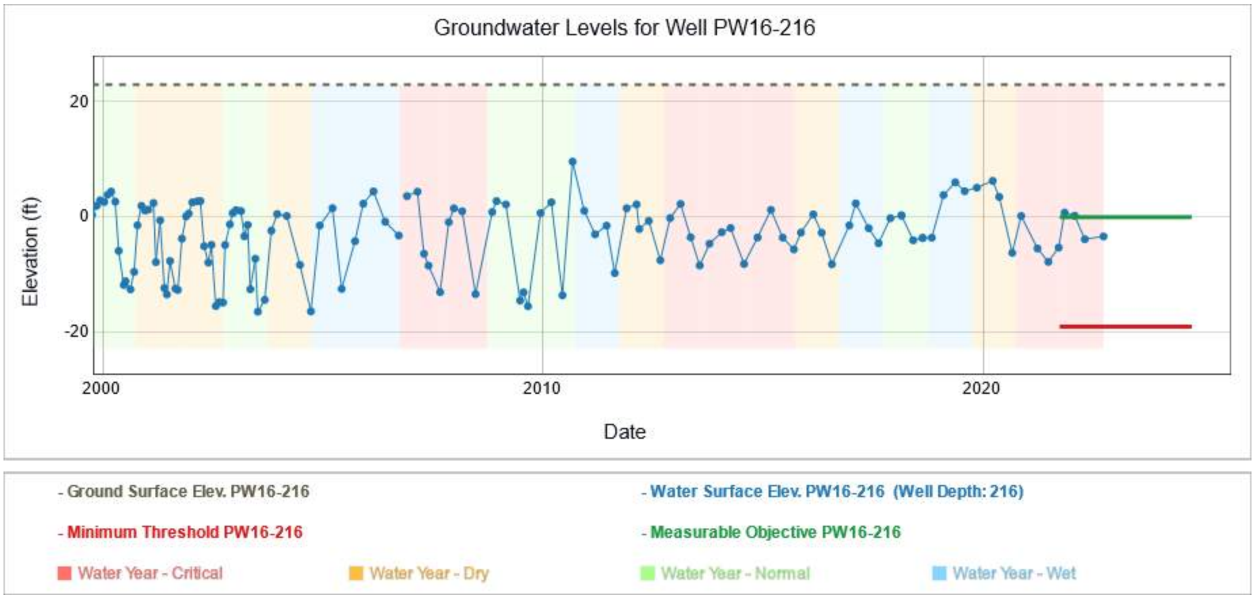

Figure B-17. PW16-216

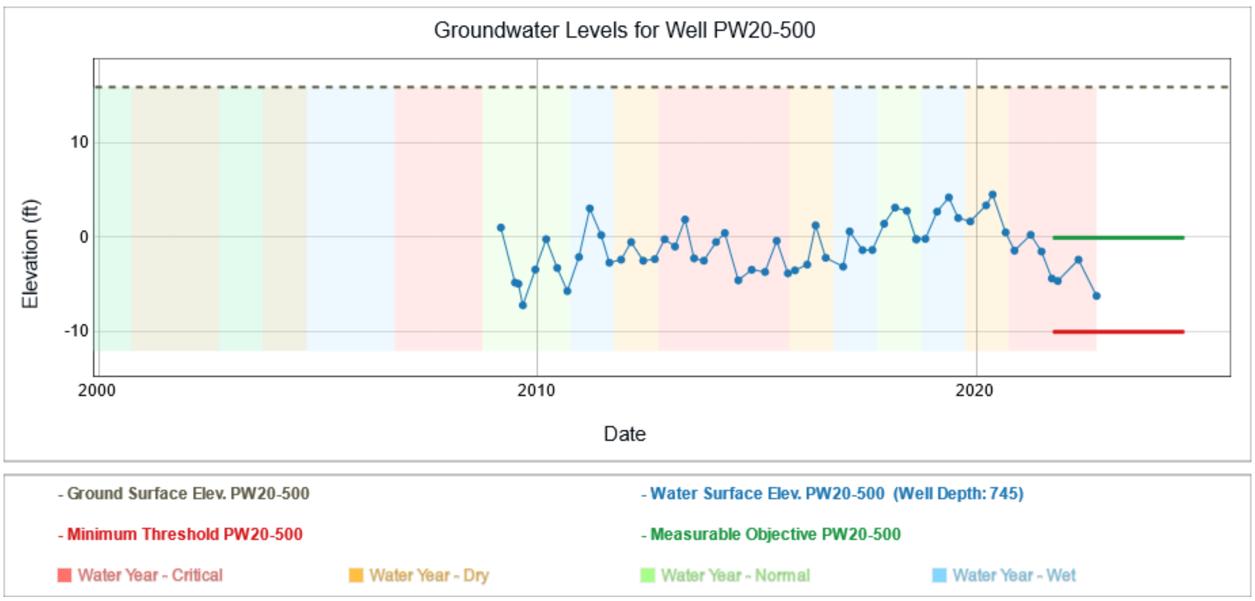

Figure B-18. PW20-500

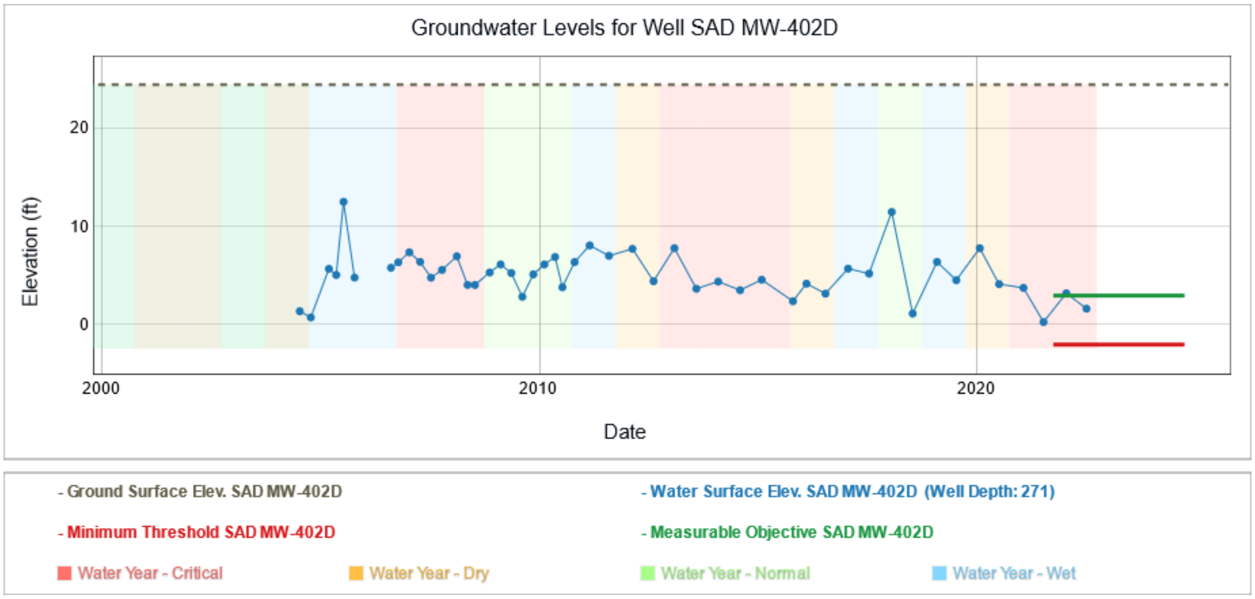

Figure B-19. SAD MW-402D

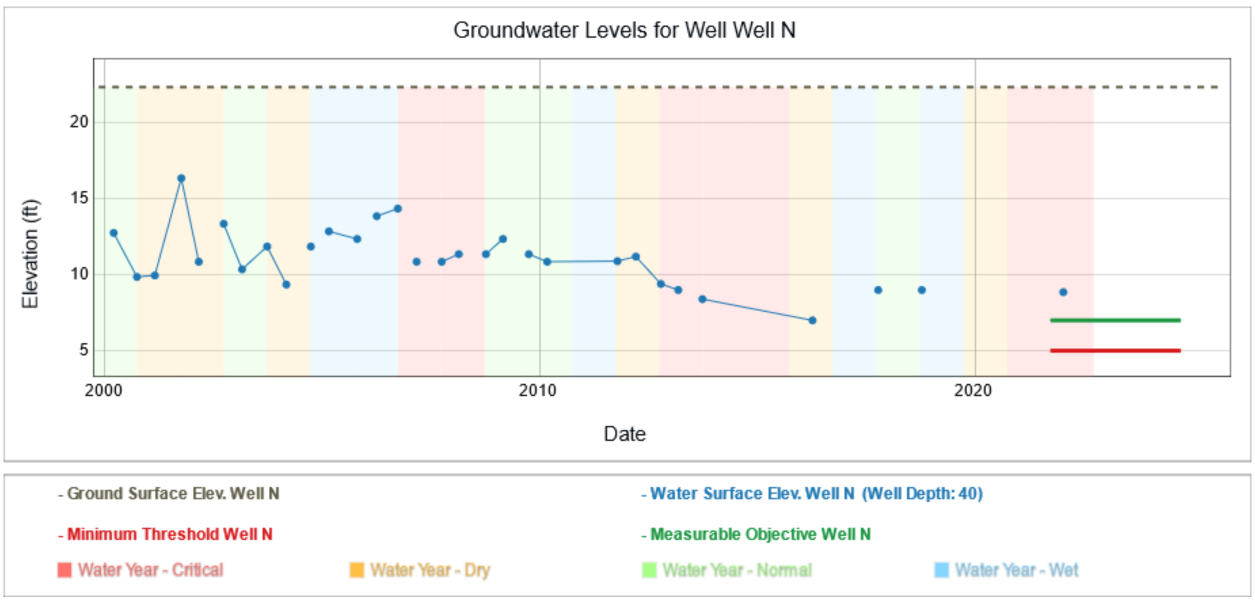

Figure B-20. Well N

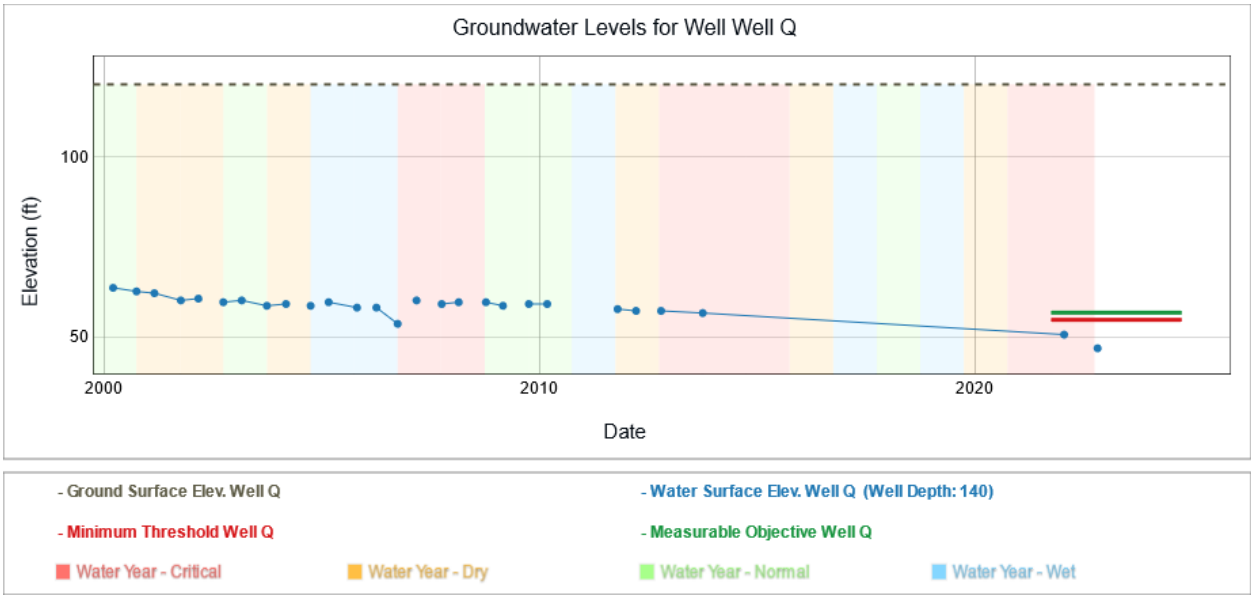

Figure B-21. Well Q

Appendix C Groundwater Contours

Table C-2: Lower Aquifer Contouring Data

CASGEM_ID	Latitude	Longitude	Local_ID	Aquifer	WSE Spring 2015	WSE Fall 2015	WSE Spring 2016	WSE Fall 2016	WSE Spring 2017	WSE Fall 2017	WSE Spring 2018	WSE Fall 2018	WSE Spring 2019	WSE Fall 2019	WSE Spring 2020	WSE Fall 2020	WSE Spring 2021	WSE Fall 2021	WSE Spring 2022
Inside Non-Delta Management Area																			
376713N1214581W001	37.67127	-121.45809	Corral MW-6	Lower	-57	-58	-58 [2]	-58	-58	-36	-36	-37	-35	-37	-33 [4]	-27	-25	-28	-32.63
377402N1214508W002	37.74019	-121.45076	MW-1B	Lower	-23	-37	-21	-40	-15	-28	-17	-25	-14	-27	-21 [3]	-26	-24	-40	-31.2
377143N1214459W002	37.7143	-121.4459	MW-2B	Lower	-31	-40	-27	-43	-20	-29	-18	-26	-15	-25	-19 [3]	-29	-22	-45	-30.56
377031N1214485W002	37.70306	-121.44854	MW-3B	Lower	-35	-40	-30	-43	-21	-29	-18	-27	-15	-24	-18 [3]	-29	-22	-47	-30.83
377149N1214257W002	37.71487	-121.42567	MW-4B	Lower	-29	-40	-26	-42	-18	-29	-17	-26	-14	-25	-19 [3]	-29	-22	-44	-30.27
377427N1213943W002	37.74266	-121.39432	MW-5B	Lower	-21	-34	-19	-36	-13	-26	-13	-23	-10	-23	-17 [3]	-26	-17	-38	-25.84
377656N1214199W002	37.76563	-121.41992	MW-6B	Lower	-19	-33	-19	-35	-14	-25	-15	-22	-13	-24	-18 [3]	-25	-24	-35	-29.87
	37.81006	-121.27790	PW12-315	Lower	2	7	3	7	10.47	12.99	12.20	9.83	13.24	12.21	12.89	10.84	5.90	3.60	3.38
378130N1212758W001	37.81305	-121.27582	PW16-329	Lower	2	7	4	6	9.65	12.09	11.41	8.89	12.24	11.27	12.27	9.73	5.88	3.33	0.25
378076N1212997W001	37.80760	-121.29970	PW20-500	Lower	-3.63	-3.78	1.31	-2.13	0.67	-1.30	3.20	-0.16	2.77	2.10	3.44	0.57	0.31	-4.33	-2.33
376974N1213258W001	37.69740	-121.32580	03S06E05R001M	Lower	-15.81	-27.91	-6.01	-24.41	-1.61	-17.81	-1.61	-21.01	-2.61	-22.11	-2.81	-28.51	-5.21	-43.31	-20.81
Outside of Non-Delta Management Area, In Adjacent Subbasins																			
378480N1212464W001	37.84800	-121.24640	01S07E18L001M	Lower	1	0	0	0	7	5	3	2	2	3	2	0	0	-2	-2.13
379103N1215994W002	37.91033	-121.59938	1BMW-343	Lower	-17	-36	-14	-51	-17	-65	-40	-37	-16	-39	-22	-43	-19	-39	-25.31
379697N1212856W001	37.96970	-121.28560	01N06E02C001M	Lower	-19	-29	-21	-21	-17	-13	-9	-10	-6	-6	-4	-35	-11	-10	-8.73
375509N1212609W001	37.55090	-121.26100	MP030.43R	Lower	14	15	-9	15 [1]	16	44	24	39	43	37	52	-5	2	-35	-28.49
376129N1212942W001	37.61290	-121.29420	121	Lower	21	22	-3	-6	9	12	18	20 [2]	22	22	25	20	26	-3	8.5
375313N1212242W001	37.53130	-121.22420	MP033.71L	Lower	23	-35	-19	-8	12	15	13	-9	23	16	36	21	14	9	13.94
375774N1212096W001	37.57740	-121.20960	WSID 3	Lower	19	-9	26	17	32	31	31	32	33	36	34	33	32	23	20.2

Notes:

[1] = No measurment available. Value based off of previous years trend.

[2] = No measurement available; reason: special/other. Value based off of previous years trend.

[3] = MW-1B, MW-2B, MW-3B, MW-4B, MW-5B, and MW-6B estimated groundwater surface elevations for Spring 2020 MW-3A where a groundwater level measurement was taken. No measurements taken from "B" level MWs.

[4] = Corral Hollow estimated using previous values or from nearby MW-3A

[5] = PW09-338 estimated by using differences from nearby PW-12-315

Table C-1: Upper Aquifer Contouring Data

CASGEM ID	Latitude	Longitude	Local ID	Aquifer	WSE Spring 2015	WSE Fall 2015	WSE Spring 2016	WSE Fall 2016	WSE Spring 2017	WSE Fall 2017	WSE Spring 2018	WSE Fall 2018	WSE Spring 2019	WSE Fall 2019	WSE Spring 2020	WSE Fall 2020	WSE Spring 2021	WSE Fall 2021	WSE Spring 2022	WSE Fall 2022
Within Non-Delta Management Area																				
376713N1214580W001	37.67134	-121.45799	Corral MW-5	Upper	230.27	226.67	227.00 [4]	226.28	226.28	229.35	229.00	228.09	227.51	227.64	227.1 [1]	226.55	225.95	225.59	224.99	224.82
376700N1214547W001	37.66997	-121.45466	Corral MW-4	Upper	227.66	221.42	NM	223.53	223.53	228.12	227.04	224.79	230.02	227.66	NM	225.42	226.77	224.44	226.59	224.43
377528N1215156W001	37.75280	-121.51560	02S04E15R001	Upper	53.41	56.41	54.41	54.91	55.41	48.41	52.41	52.41	53.41	53.41	52.00 [1]	53.41	55.41	55.00 [2]	59.41	51.41
377813N1214420W001	37.78130	-121.44200	02S05E08B001	Upper	-0.30	-2.00	-0.10 [1]	-2.20	1.30	-2.30	-0.30	-1.80	-0.10	-1.90	-1.00 [1]	-2.40 [1]	-0.70	-1.20	NM	-3.2
377976N1214560W001	37.79760	-121.45600	01S05E31R002	Upper	-0.20	0.67	1.10	1.00	2.60	0.60	1.00	0.60	1.40	0.60	-0.20 [1]	0.40 [3]	0.20	0.60	NM	-1.4
377979N1215800W001	37.79791	-121.58003	01S04E31P005M	Upper	46.96	47.04	46.30	45.50	47.68	45.54	43.77	43.16	43.15	42.36	41.61	41.48	40.99	41.54	41.06	NM
377951N1216011W001	37.79512	-121.60111	02S03E01D001M	Upper	78.12	76.37	77.62	77.55	83.84	80.95	81.22	79.55	83.18	80.65	79.81	78.41	78.00	77.10	77.77	NM
378103N1215449W001	37.81031	-121.54489	ORL-1W	Upper	0.80 [1]	0.83	0.80 [1]	0.88	0.90 [4]	0.88	0.40	-0.18	0.40 [5]	-0.20	0.40	-0.20	0.40	-0.20	NM	NM
378165N1213145W001	37.81657	-121.31459	MWM-24	Upper	3.00 [1]	3.26	4.07	3.86	6.67	3.34	4.33	3.44	4.58	3.94	3.58	2.95	3.86	2.91	3.15	3.89
377823N1213330W001	37.78232	-121.33303	MWR-25	Upper	4.00 [1]	3.87	5.30	4.80	9.90	4.02	5.30	4.85	6.20	5.64	4.55	4.82	4.37	4.99	4.46	5.02
	37.80492	-121.28526	PW09-198	Upper	4.43	1.93	4.40	1.18	5.61	4.07	6.00 [6]	4.00 [1]	7.50	7.96	6.45	4.96	4.29	3.77	4.37	4.26
	37.81006	-121.27790	PW12-193	Upper	3.42	-3.03	3.31	-5.69	2.75	-1.30	0.74	-1.63	3.59	4.37	4.91	1.67	-1.92	-0.35	-5.49	-4.29
378130N1212758W001	37.81305	-121.27582	PW16-216	Upper	3.13	-0.80	2.36	-6.30	4.24	1.69	2.16	-1.70	5.70	6.98	6.31	0.21	-5.43	0.79	-3.83	-3.34
Outside of Non-Delta Management Area, In Adjacent Subbasins																				
378126N1212368W001	37.81260	-121.23680	01S07E30R001M	Upper	9.56	4.56	7.96	4.96	11.46	7.00 [2]	10.46	7.06	11.66	9.16	8.50 [2]	4.56	6.26	2.96	4.56	2.5
378787N1212825W001	37.87870	-121.28250	01S06E02G002M	Upper	-4.67	-10.17	-7.00 [1]	-9.47	1.73	-3.47	-2.17	-8.57	-1.87	-6.77	-5.37	-10.27	-10.67	-11.57	-7.37	-13.97
376377N1211496W001	37.63793	-121.14989	Katen69	Upper	32.10	27.10	30.10	32.10	33.60	33.10	34.10	32.60	33.60	34.60	31.60	33.10	33.10	33.00 [4]	30.1	17.6
376596N1211549W001	37.65970	-121.15522	03S07E24M001M	Upper	24.70	24.70	26.20	24.20	27.70	27.70	28.20	28.70	30.70	27.70	28.20	28.20	29.20	25.20	26.7	27.7
378678N1211832W001	37.86780	-121.18320	01S07E10A001M	Upper	-15.70	-26.50	-16.40	-30.30	-13.60	-22.70	-15.20	-22.90	-14.50	-23.00	-16.60	-26.10	-16.40	-30.30	NM	NM
379894N1216794W001	37.98935	-121.67944	02N03E30J999M	Upper	7.40	7.00	8.90	7.10	10.20	7.40	8.00	7.10	8.90	7.50	6.50	6.50	7.60	6.20	7.5	7.1
378703N1216407W001	37.86841	-121.64122	01S03E03M999M	Upper	19.68	16.38	15.58	14.68	19.88	21.98	17.58	15.78	19.08	17.28	18.48	19.08	18.50 [3]	9.98	8.89	12.22
378507N1216238W001	37.85070	-121.62380	01S03E15A001M	Upper	13.52	11.82	13.72	10.42	16.52	14.32	12.02	11.00 [7]	13.52	14.62	16.02	16.02	15.50 [3]	13.72	12.12	NM
378690N1216484W001	37.81689	-121.59916	01S03E25M999M	Upper	24.47	21.17	22.17	22.47	27.37	21.07	12.47	24.77	25.27	24.77	25.77	27.17	21.00 [3]	11.17	3.59	11.37
376388N1213233W001	37.63880	-121.32330	DMGSP 77.6	Upper	71.74	67.54	67.94	66.44	65.54	66.04	65.44	64.44	64.34	64.64	64.14	63.44	62.54	61.24	60.14	NM

Notes:

[1] = No measurment available. Value based off of previous years trend.

[2] = No measurement available; reason: temporarily inaccessible. Value based off of previous years trend.

[3] = No measurement available; reason: can't get tape in casing. Value based off of previous years trend.

[4] = No measurement available; reason: special/other. Value based off of previous years trend.

[5] = ORL -1W is being transferred to BBID and will in the future be monitored. Well is adjacent to Old River. Used 2018 measurements to populate missing data 2019, 2020 and 2021.

[6] = Used trends from nearby wells

[7] = Value based off of historic low

NM = no measurement

Appendix D Estimated Groundwater Pumping

APPENDIX D

ESTIMATING AGRICULTURAL GROUNDWATER PUMPING

Groundwater is used for agricultural purposes, in some areas as their sole source of supply and in others to augment surface water supplies. Most agricultural wells are not metered so alternative methods were employed to estimate groundwater pumping in agricultural areas. The water use by agriculture was estimated for the Non-Delta Management Area portion of the Tracy Subbasin (Subbasin) (*see* **Figure D-1, Non-Delta Management Area)**. **Figure D-2, Irrigated Agricultural Fields,** shows the agricultural fields in the Non-Delta Management Area by Groundwater Sustainability Agency (GSA) area.

Evapotranspiration

Actual crop evapotranspiration (ETc) in the Non-Delta of the Subbasin was calculated for Water Year (WY) 2022 between October 1, 2021 through September 30, 2022 by the Irrigation Training and Research Center (ITRC). The ITRC- METRIC process was used which depends upon both accurate and frequent LandSAT satellite thermal images. Evapotranspiration was estimated using satellite LandSAT 7, LandSAT 8 and LandSAT 9, available from the United States Geological Survey, on 16-day-intervals were used for the METRIC process for WY 2022.

A critical benefit of using ITRC-METRIC process to determine actual evapotranspiration (ETc) is that land use/crop type information is not needed. Therefore, inaccuracies of determining land use are not part of the uncertainty in ETc output.

The ITRC used the METRIC process to calculate ETc by each GSA area in the Non-Delta portions of the Subbasin. **Table D-1** provides these estimates.

The overall boundary ETc was then reduced to remove non-irrigated areas (native vegetation and fallowed fields) to obtain just irrigated agricultural fields. The total ETc was processed to remove urban areas where water is supplied by municipal entities and is metered. GEI further this assessment of the city of Tracy area, because of rapid development and changing land use conditions. Identified fields shown on **Figure D-2** were individually evaluated using Goggle Earth imagery (April 6, 2022) as whether the fields were irrigated, fallow, or are being converted to developments . **Table D-2** was adjusted based on these survey results. The amount of non-irrigated fields and ETc for all agricultural fields by GSA are provided in **Table D-3**.

The Non-Delta Management Area portion of the Subbasin is bounded by the San Joaquin River, Middle River, Old River, Tom Paine Slough, and various other canals and water ways. About 70 diversions have been documented as shown on **Figure D-4** (DWR 1995). To attempt to quantify these surface water supplies a search of riparian diversion reporting's was performed through the State Water Resources Control Board Water (Water Board), however, only three filings were present, and one reported no diversions. Irrigation diversions may be present under other diversion types of reporting's (appropriative or statement of diversions) but due to the limited time and funding an alternative approach was used. Parcels immediately adjacent to the rivers and waterways were identified as potential users of surface water and the ETc estimates were removed. **Figure D-3** shows the parcels assumed to have riparian water rights. **Table D-4** provides a summary of the ETc for the riparian areas/fields and assumed water diversions. **Table D-5** provides an estimate for irrigated agricultural lands without riparian water supplies.

Water Supplies

Water supplies to the Non-Delta Management Area consists of surface water deliveries by Byron-Bethany Irrigation District, Banta-Carbona Irrigation District, and Naglee Burk Irrigation District and metered agricultural wells, other reported diversions and precipitation.

All of the surface water supplied for agricultural purposes by Byron-Bethany Irrigation District, Banta-Carbona Irrigation District, and Naglee Burk Irrigation District is metered at the diversion point(s). **Table D-6** contains the metered surface water diversions to non-riparian fields (Naglee Burk Irrigation District supplies listed under the San Joaquin County GSA area).

Byron-Bethany Irrigation District and Banta-Carbona Irrigation District both have a few wells that are used to supplement water supplies. These wells are metered. **Table D** contains the metered groundwater pumping to non-riparian agricultural fields.

Riparian surface water diversions in Non-Delta Management Area were not reported to the Water Board in WY 2022 in time to prepare this report. Filings are not required to be reported for 2022 until April 1, 2023, after this Annual Report is due. In WY 2021 diversions were reported at only three locations. Therefore, to approximate the diversions for WY 2022 WY 2021 data was used. Of the three diversions reported, one reported with zero diversions, the second diversion was not located within the assumed riparian areas previously subtracted from the ETc processed data, and the third diversion was for the Naglee Burk Irrigation District that was reported in **Table D-6**. **Table D-8** contains other metered reported riparian diversions to non-riparian agricultural fields.

Total precipitation was measured at the Tracy Carbona precipitation station and reported as inches and converted to feet. The total Non-Riparian Field ETc acres were then multiplied to obtain an estimate of the amount of precipitation that helped to meet ETc estimates. An effective precipitation of 80 percent was assumed to more accurately estimate of the water supplied by precipitation. **Table D-9** contains the estimated contribution of precipitation to the Non-Riparian fields.

Estimated Groundwater Pumping

The Non-Riparian Field ETc monthly data was then processed by subtracting water supplies (meter surface water, metered groundwater pumping diversions, reported riparian diversions and precipitation) with the residual being estimated groundwater pumping for agriculture. **Table D-10** provides the estimated groundwater pumping, with negative values indicating the lack of adequate water to meet ETc demands and therefore groundwater may have been used make up the residual. The estimated groundwater pumping is about 37,000 acre-feet (AF) in WY 2022.

The estimated groundwater pumping was reviewed by the GSAs and with local knowledge of agricultural practices modified the estimated groundwater pumping estimates. **Table D-11**, provides these modified estimates of groundwater pumping based on the following considerations:

Although there are ETc during August, September, and October irrigation stops during this timeframe as this is harvest time for trees, almonds and walnuts, and many other crops as well. So even though plants continue to transpire it doesn't mean the plant needs water as it dries down for harvest in those months, essentially obtaining/depleting water in the soil pores. Also, the tree roots may extend down to the groundwater surface and use groundwater during this period. Lima beans are grown in the area. Irrigation stops in mid-August and the plants rely on water in the soil to finish the development of the seed and then in September spend most of the month drying down (to wilting point) to be ready for cutting them off at the ground. All of this time they are transpiring and are intentionally in water deficit to prep for harvest. Alfalfa is a crop that doesn't normally get irrigated in October but is continually transpiring all of October. Therefore, even though there was estimated groundwater pumping during these 3 months, no groundwater pumping likely occurred during these months.

The estimated groundwater pumping between November and January were also removed as crops are not grown or irrigated during these months.

The Stewart Tract GSA area is surrounded entirely by surface water, (*see* **Figure D-4**) and has numerous diversions points suggesting any ETc would be met with surface water. Therefore, groundwater pumping in this area was removed.

As a result of these modifications, the estimated groundwater pumping in the Non-Delta Management Area of the Subbasin was about 21,000 AF during WY 2022.

Conclusions and Recommendations

This is the second year of estimating groundwater pumping using the METRIC method and quantifying the amount of water supplies. Some assumptions were made that could affect the results and may be improved upon in future reports. For purposes of estimating the groundwater pumping, the modified estimate of groundwater pumping (is about 21,000 AF) should be used for reporting groundwater pumping, because it includes local agricultural practice knowledge.

The information contained in this report can be used to reduce uncertainties in the C2VSim groundwater model used to develop the water budgets for the Groundwater Sustainability Plan. Water supply information used in this report and historic information were provided to DWR's C2VSim modeling group in January 2023.

In future water years, the following improvements may help to better quantify the estimated groundwater pumping:

- Attempt to refine the assigned riparian areas by obtaining appropriative and statements of diversions reporting's to locate these fields.
- Perform an irrigation well canvas in the Byron-Bethany Irrigation District and Banta-Carbona Irrigation District areas to document location of wells. An inventory of wells using DWR's well logs database was insufficient to locate wells in these areas requiring field well canvases.

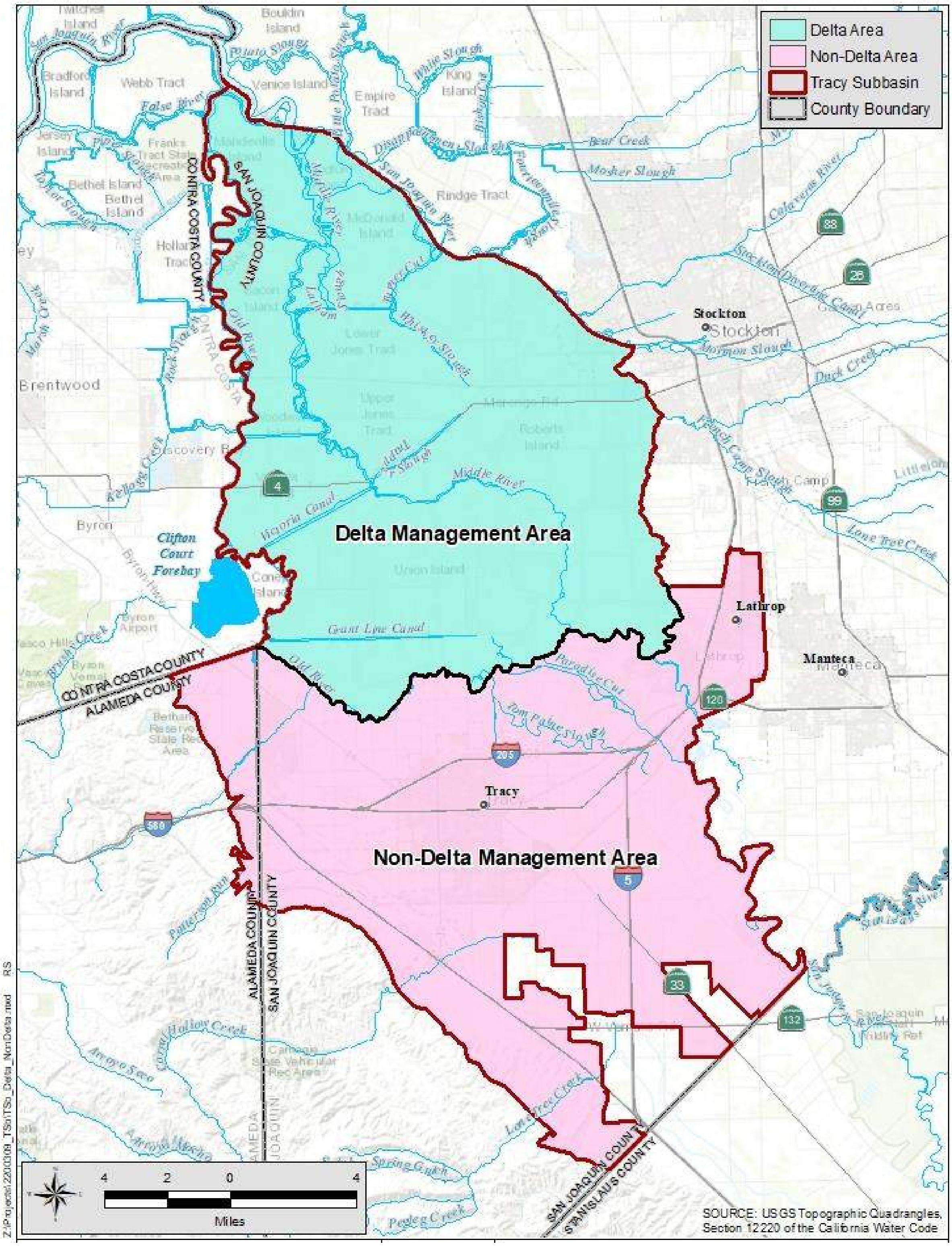

Figure D-1 Non-Delta Management Area

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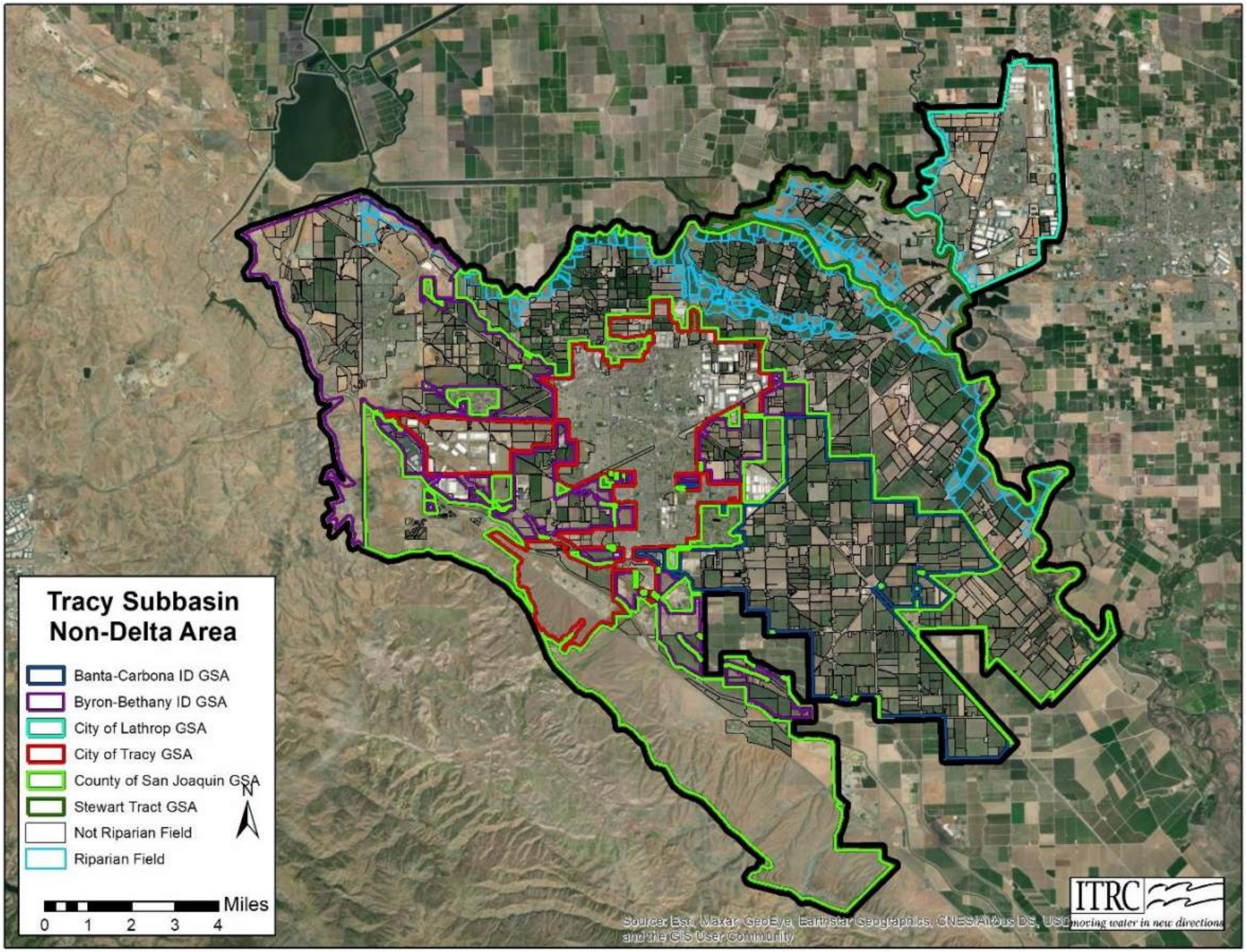


Figure D-2 Identified Agricultural Fields

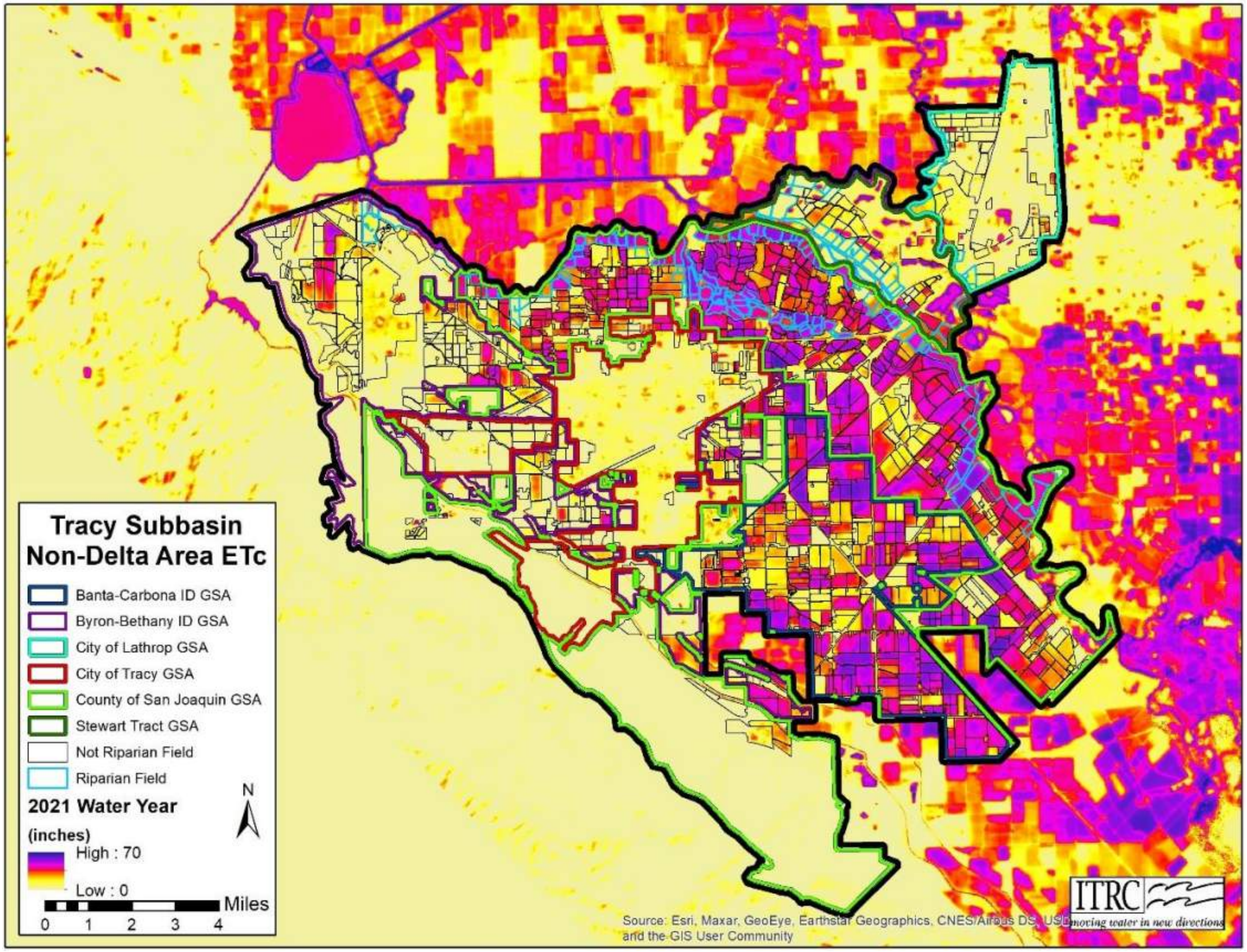
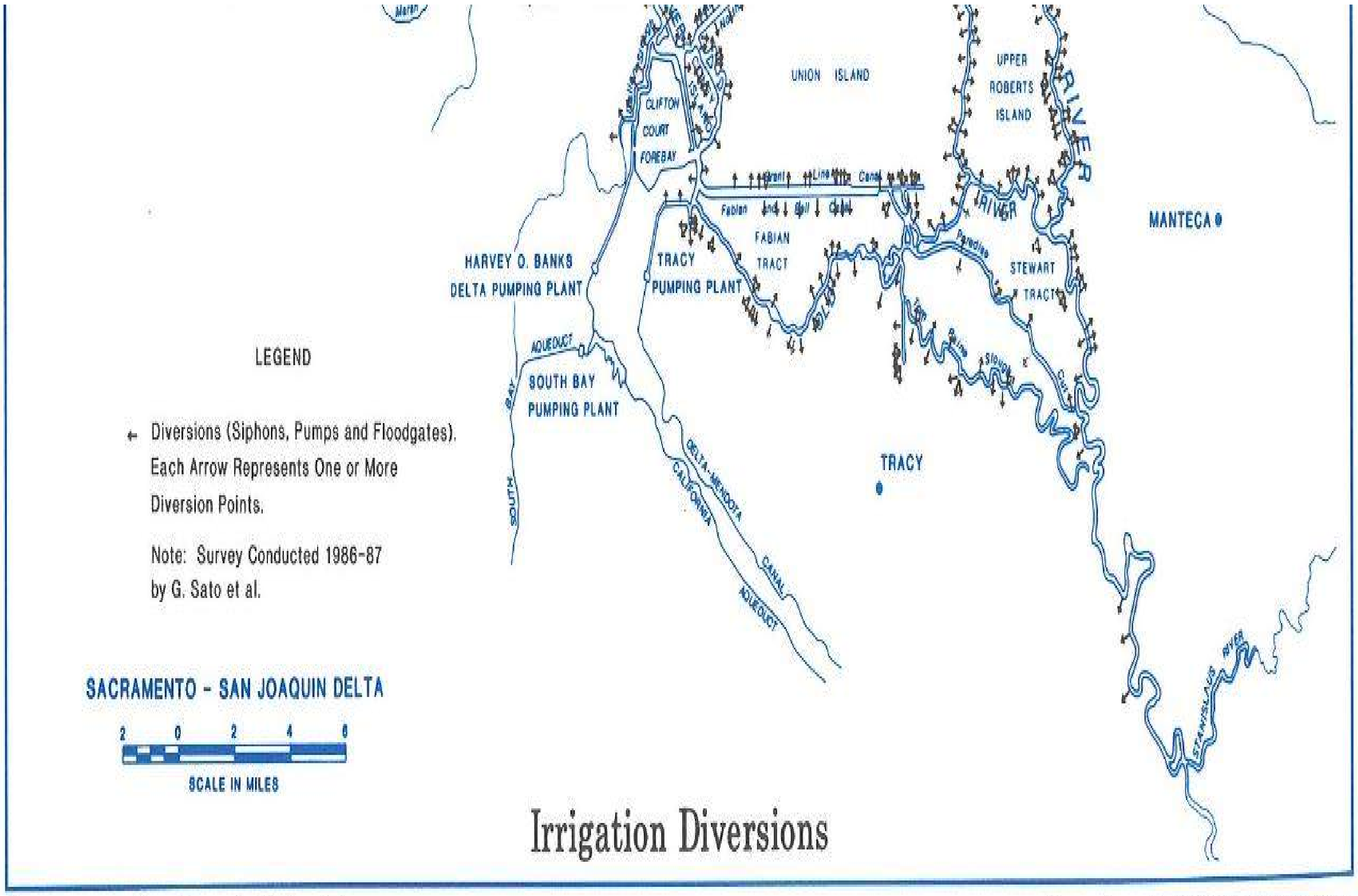


Figure D-3 ETc by Field and Estimated Riparian Parcels



Sacramento–San Joaquin Delta Atlas *Department of Water Resources*

Figure D-4 Surface Water Diversion

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Table D-1. Overall Boundary ETc

OVERALL BOUNDARY ETc (INCHES)													
GSA	ACRES	2021-2022											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Banta-Carbona ID GSA	16,653	2.38	0.43	0.04	0.15	0.92	1.66	2.61	3.67	5.03	5.51	4.46	3.69
Byron-Bethany ID GSA - TSb	22,314	1.04	0.34	0.08	0.33	0.97	1.03	0.82	0.86	1.24	1.68	1.47	1.03
City of Lathrop GSA	7,653	1.05	0.64	0.29	0.32	0.68	0.71	0.62	0.76	0.82	0.97	0.89	1.00
City of Tracy GSA	16,535	1.08	0.25	0.08	0.20	0.63	0.50	0.27	0.71	0.69	0.83	0.56	0.61
County of San Joaquin GSA - TSb	49,157	1.51	0.45	0.16	0.37	1.06	1.55	1.75	2.04	2.47	2.85	2.81	2.31
Stewart Tract GSA	6,070	1.45	0.58	0.33	0.60	1.36	1.72	1.71	2.22	2.04	2.35	2.19	1.84

OVERALL BOUNDARY ETc (AF)														
GSA	ACRES	2021-2022												
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA	16,653	3,308	595	62	214	1,273	2,298	3,621	5,099	6,979	7,651	6,195	5,124	**42,418**
Byron-Bethany ID GSA - TSb	22,314	1,933	623	152	621	1,802	1,912	1,518	1,594	2,311	3,120	2,743	1,914	**20,241**
City of Lathrop GSA	7,653	668	409	182	202	433	454	395	483	521	622	571	638	**5,578**
City of Tracy GSA	16,535	1,495	344	113	271	870	686	373	972	955	1,145	774	847	**8,844**
County of San Joaquin GSA - TSb	49,157	6,201	1,851	673	1,534	4,325	6,341	7,176	8,341	10,103	11,679	11,524	9,445	**79,194**
Stewart Tract GSA	6,070	734	296	169	304	689	871	865	1,125	1,030	1,187	1,107	929	**9,305**
Total	**118,382**	**14,338**	**4,119**	**1,351**	**3,146**	**9,392**	**12,561**	**13,947**	**17,613**	**21,899**	**25,403**	**22,913**	**18,897**	**165,580**

Notes: The tables above include ETc within the urban areas including cities of Lathrop, Tracy and Mountain House

Table D-2. Non-Irrigated Areas ETc

Non-Irrigated Areas ETc (AF)														
GSA	ACRES	2021-2022												
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA	2,553	328	58	10	24	152	200	249	353	555	616	452	397	3,393
Byron-Bethany ID GSA - TSb	10,984	595	164	65	315	824	600	279	230	419	929	844	480	5,744
City of Lathrop GSA	5,923	518	304	129	134	312	313	274	350	383	426	344	407	3,893
City of Tracy GSA	15,937	1,456	330	106	243	814	639	346	924	905	1,089	728	816	8,396
County of San Joaquin GSA - TSb	27,023	1,774	543	236	652	1,670	1,708	1,558	1,971	2,375	2,656	2,442	2,119	19,704
Stewart Tract GSA	3,393	543	173	77	148	381	493	554	771	752	796	724	645	6,056
Total	**65,814**	**5,214**	**1,572**	**622**	**1,516**	**4,152**	**3,954**	**3,259**	**4,599**	**5,389**	**6,512**	**5,535**	**4,864**	**47,187**

Table D-3. All Agricultural Field ETc

ALL AGRICULTURAL FIELD ETc (INCHES)													
GSA	ACRES	2021-2022											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Banta-Carbona ID GSA	14,100	2.54	0.46	0.04	0.16	0.95	1.79	2.87	4.04	5.47	5.99	4.89	4.02
Byron-Bethany ID GSA - TSb	11,330	1.42	0.49	0.09	0.32	1.04	1.39	1.31	1.44	2.00	2.32	2.01	1.52
City of Lathrop GSA	1,730	1.04	0.73	0.37	0.48	0.84	0.98	0.84	0.93	0.96	1.36	1.57	1.60
City of Tracy GSA	598	0.77	0.28	0.16	0.56	1.12	0.93	0.54	0.96	1.00	1.12	0.92	0.63
County of San Joaquin GSA - TSb	22,133	2.40	0.71	0.24	0.48	1.44	2.51	3.05	3.45	4.19	4.89	4.92	3.97
Stewart Tract GSA	2,678	0.85	0.55	0.41	0.70	1.38	1.70	1.40	1.58	1.25	1.75	1.72	1.27

ALL AGRICULTURAL FIELD ETc (AF)														
GSA	ACRES	2021-2022												
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA	14,100	2,980	537	52	190	1,121	2,098	3,372	4,746	6,424	7,035	5,743	4,727	**39,025**
Byron-Bethany ID GSA - TSb	11,330	1,338	460	87	306	978	1,311	1,239	1,364	1,892	2,191	1,898	1,434	**14,497**
City of Lathrop GSA	1,730	150	105	53	69	122	141	121	134	138	196	227	231	**1,685**
City of Tracy GSA	598	38	14	8	28	56	46	27	48	50	56	46	31	**448**
County of San Joaquin GSA - TSb	22,133	4,427	1,308	437	883	2,656	4,633	5,618	6,370	7,728	9,023	9,082	7,326	**59,490**
Stewart Tract GSA	2,678	191	123	92	156	308	378	311	353	278	391	383	284	**3,249**
Total	**52,568**	**9,124**	**2,547**	**729**	**1,630**	**5,240**	**8,607**	**10,688**	**13,014**	**16,510**	**18,891**	**17,379**	**14,033**	**118,394**

Notes: The tables have the monthly ETc for fields summarized for each GSA - ETc for areas classified as Urban have been removed as these are supplies are metered

Table D-4. Riparian Areas ETc

Riparian Areas ETc (AF)														
		2021-2022												
GSA	ACRES	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA	0													0
Byron-Bethany ID GSA - TSb	357	10	6	4	20	46	29	6	2	4	10	15	16	168
City of Lathrop GSA	288	34	16	10	12	22	22	20	25	25	33	60	66	345
City of Tracy GSA	0													0
County of San Joaquin GSA - TSb	3,958	940	310	106	202	522	909	1,144	1,218	1,415	1,842	2,039	1,556	12,204
Stewart Tract GSA	1,512	92	70	53	94	183	219	156	162	135	213	194	117	1,688
Total	**6,115**	**1,077**	**402**	**171**	**328**	**774**	**1,178**	**1,327**	**1,407**	**1,579**	**2,098**	**2,308**	**1,756**	**14,406**

Table D-5. Non- Riparian Field ETc

NON-RIPARIAN FIELD ETc (INCHES)													
		2021-2022											
GSA	ACRES	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Banta-Carbona ID GSA	14,100	2.54	0.46	0.04	0.16	0.95	1.79	2.87	4.04	5.47	5.99	4.89	4.02
Byron-Bethany ID GSA - TSb	10,973	1.45	0.50	0.09	0.31	1.02	1.40	1.35	1.49	2.07	2.39	2.06	1.55
City of Lathrop GSA	1,442	0.96	0.74	0.36	0.47	0.83	0.99	0.84	0.91	0.94	1.35	1.39	1.37
City of Tracy GSA	598	0.77	0.28	0.16	0.56	1.12	0.93	0.54	0.96	1.00	1.12	0.92	0.63
County of San Joaquin GSA - TSb	18,175	2.30	0.66	0.22	0.45	1.41	2.46	2.95	3.40	4.17	4.74	4.65	3.81
Stewart Tract GSA	1,166	1.02	0.55	0.41	0.65	1.28	1.64	1.59	1.96	1.47	1.83	1.94	1.72

NON-RIPARIAN FIELD ETc (AF)														
		2021-2022												
GSA	ACRES	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA	14,100	2,980	537	52	190	1,121	2,098	3,372	4,746	6,424	7,035	5,743	4,727	**39,025**
Byron-Bethany ID GSA - TSb	10,973	1,327	454	83	286	931	1,283	1,233	1,362	1,889	2,181	1,883	1,417	**14,329**
City of Lathrop GSA	1,442	115	89	44	57	100	119	101	109	113	163	167	164	**1,339**
City of Tracy GSA	598	38	14	8	28	56	46	27	48	50	56	46	31	**448**
County of San Joaquin GSA - TSb	18,175	3,487	998	331	680	2,133	3,724	4,474	5,152	6,313	7,180	7,043	5,770	**47,286**
Stewart Tract GSA	1,166	99	53	40	63	125	160	155	191	143	178	189	167	**1,561**
Total	**46,453**	**8,046**	**2,145**	**557**	**1,303**	**4,466**	**7,429**	**9,360**	**11,607**	**14,931**	**16,793**	**15,071**	**12,277**	**103,987**

Table D-6. Surface Water Supplies to Fields (AF)

Surface Water Supplies to Agricultural Fields (AF)														
		2021-2022												
GSA		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA		1342	0	0	0	1273	2886	3568	5924	6927	7313	5482	3575	38,290
Byron-Bethany ID GSA - TSb		1558	270	2	13	569	4037	4917	5976	7064	4925	3877	2444	35,652
City of Lathrop GSA		35	34	27	32	31	37	1	32	0	0	33	31	293
City of Tracy GSA		38	14	8	28	56	46	27	48	50	56	46	31	448
County of San Joaquin GSA - (BCID+NBID)		336	18	11	53	684	807	1025	1739	1997	2071	1513	931	11,185
Stewart Tract GSA (recycled)		13	0	13	0	0	0	0	0	0	0	0	0	26
Total		**3,322**	**337**	**62**	**126**	**2,613**	**7,813**	**9,538**	**13,718**	**16,038**	**14,366**	**10,951**	**7,012**	**85,894**

Note: City of Lathrop surface water deliveries are from treated wastewater.

Table D-7. Metered Groundwater Pumping to Fields (AF)

Metered Groundwater Pumping to Fields (AF)														
		2021-2022												
GSA		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Byron-Bethany ID GSA - TSb		0	0	0	0	0	0	0	0	0	0	0	0	0
City of Lathrop GSA		0	0	0	0	0	0	0	0	0	0	0	0	0
City of Tracy GSA		0	0	0	0	0	0	0	0	0	0	0	0	0
County of San Joaquin - TSb		0	0	0	0	0	0	0	0	0	0	0	0	0
Stewart Tract GSA (recycled)		0	0	0	0	0	0	0	0	0	0	0	0	0
Total		0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table D-8. Other Reported Diversions (AF)

Other Reported Riparian Diversions - (AF)														
		2021-2022												
GSA		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA														
Byron-Bethany ID GSA - TSb														
City of Lathrop GSA														
City of Tracy GSA														
County of San Joaquin GSA - TSb		15	0	0	0	0	25	32	43	45	44	36	31	272
Stewart Tract GSA														
Total		15	0	0	0	0	25	32	43	45	44	36	31	272

Riparian surface water diversions in WY2022 not required to be report to the SWRCB until April 2022. Therefore, WY2021 values were used to estimate the diverions in 2022.
Other appropative and Statement of Diversions for irrigation where not retrieved or included.

Table D-9. Total Precipitation

Total Precipitation - (inches)														
		2021-2022												
GSA		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Total (inches)		2.65	0.05	3.08	0.03	0.02	0.55	0.18	0	0	0	0	0.15	6.71
Total (feet)		0.22	0.00	0.26	0.00	0.00	0.05	0.02	0.00	0.00	0.00	0.00	0.01	0.56

Total Effective Precipitation at 80% - (AF)														
		2021-2022												
GSA	Field Acres	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA	14,100	623	12	724	7	5	129	42	0	0	0	0	35	681
Byron-Bethany ID GSA - TSb	10,973	485	0	0	0	0	0	0	0	0	0	0	0	485
City of Lathrop GSA	1,442	64	1	74	1	0	13	4	0	0	0	0	4	148
City of Tracy GSA	598	26	0	31	0	0	5	2	0	0	0	0	1	61
County of San Joaquin GSA - TSb	18,175	803	15	933	9	6	167	55	0	0	0	0	45	1,866
Stewart Tract GSA	1,166	51	1	60	1	0	11	3	0	0	0	0	3	120
Total	**46,453**	**2,052**	**30**	**1,821**	**18**	**12**	**325**	**106**	**-**	**-**	**-**	**-**	**89**	**3,361**

Table D-10. Estimated Groundwater Pumping (AF)

Estimated Agricultural Groundwater Pumping (AF)														
		2021-2022												
GSA	Acres	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA	14,100	(1,015)	(526)	672	(183)	156	917	239	1,178	503	191	(509)	(1,181)	(2,398)
Byron-Bethany ID GSA - TSb	10,973	715	(184)	(81)	(273)	(362)	2,754	3,684	4,614	5,175	2,744	1,994	1,027	(819)
City of Lathrop GSA	1,442	(17)	(54)	58	(24)	(68)	(69)	(96)	(77)	(113)	(163)	(134)	(130)	(926)
City of Tracy GSA	598	26	0	31	0	0	5	2	-	-	-	-	1	-
County of San Joaquin GSA - TSb	18,175	(2,333)	(964)	613	(619)	(1,443)	(2,726)	(3,362)	(3,370)	(4,271)	(5,065)	(5,494)	(4,763)	(32,076)
Stewart Tract GSA	1,166	(34)	(52)	33	(62)	(124)	(149)	(151)	(191)	(143)	(178)	(189)	(164)	(1,403)
Total														**(37,623)**

Notes:

Negative values indicate groundwater pumping because deficient surface water suplies.

Estimated Groundwater Pumping (AF) = diversions + precip + surface water supply + metered groundwater pumping - Non-Riparian Fields ETc

Table D-11. Modified Estimated Groundwater Pumping (AF)

Modified Estimated Agricultural Groundwater Pumping (AF)														
		2021-2022												
GSA	Acres	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
Banta-Carbona ID GSA	14,100	-	-	-	-	156	917	239	1,178	503	191	-	-	-
Byron-Bethany ID GSA - TSb	10,973	-	-	-	-	(362)	2,754	3,684	4,614	5,175	2,744	-	-	(362)
City of Lathrop GSA	1,442	-	-	-	-	33	(69)	(96)	(77)	(113)	(163)	-	-	(517)
City of Tracy GSA	598	-	-	-	-	0	5	2	-	-	-	-	-	-
County of San Joaquin GSA - TSb	18,175	-	-	-	-	(1,443)	(2,726)	(3,362)	(3,370)	(4,271)	(5,065)	-	-	(20,236)
Stewart Tract GSA	1,166	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		-	-	-	-	(1,616)	882	467	2,346	1,295	(2,292)	-	-	**(21,116)**

Negative values indicate groundwater pumping because deficient of surface water suplies. Water year total only summing negative values, no carry over from previous

Notes and Assumptions:

In Modified Estimate ETc for August, September and October are not valid as this is harvest time for trees, Almonds and Walnuts, and many other crops as well. So even though plants have evaportranspiration it doesn't mean the plant needs water as it dries down for harvest in those months. The tree roots may extend down to the groundwater surface and use groundwater during this period. Another example, are lima beans, grown in the area. Irrigation stops in mid August and the plants rely on water in the soil to finish the development of the seed and then in September spend most of the month drying down to be ready for cutting them off at the ground. All of this time they are transpiring and are intentionally in water deficit to prep for harvest. Alfalfa is a crop that doesn't normally get irrigated in October but is continually transpiring all of October. Therefore, although groundwater pumping was calculated for these months, no groundwater pumping occurred during these months.

The calculations do not include any carry over from previous month irrigation.

In Modified Estimate: November, December and January = Etc removed as crops have been harvested and irrigation shut off for the season.

Appendix E Change in Storage

Fall to Fall

Change in Storage Using Water Level Difference Contour Surfaces

	Basin Area (acres)	Average Water level change (ft)	Storativity [1,2] (unitless)	Change in Storage (AF)[3]	Totals
WY 2016 - Fall 2015 - Fall 2016					
Upper Aquifer	117,120	-0.38	0.05	-2,225	
Lower Aquifer	117,120	-3.32	0.02	-7,777	
				Total WY 2016	**-10,002**
WY 2017 - Fall 2016 - Fall 2017					
Upper Aquifer	117,120	0.11	0.05	644	
Lower Aquifer	117,120	10.16	0.02	23,799	
				Total WY 2017	**24,443**
WY 2018 - Fall 2017 - Fall 2018					
Upper Aquifer	117,120	-0.4	0.05	-2,342	
Lower Aquifer	117,120	2.29	0.02	5,364	
				Total WY 2018	**3,022**
WY 2019 - Fall 2018 - Fall 2019					
Upper Aquifer	117,120	0.51	0.05	2,987	
Lower Aquifer	117,120	-0.01	0.02	-23	
				Total WY 2019	**2,963**
WY 2020 - Fall 2019 - Fall 2020					
Upper Aquifer	117,120	-1.05	0.05	-6,149	
Lower Aquifer	117,120	-1.3	0.02	-3,045	
				Total WY 2020	**-9,194**
WY 2021 - Fall 2020 - Fall 2021					
Upper Aquifer	117,120	-0.43	0.05	-2,518	
Lower Aquifer	117,120	-10.02	0.02	-23,471	
				Total WY 2021	**-25,989**
WY 2022 - Fall 2021 - Fall 2022					
Upper Aquifer	117,120	-1.5	0.05	-8,784	
Lower Aquifer	117,120	-2.77	0.02	-6,488	
				Total WY 2022	**-15,272**

Notes:

[1]Hotchkiss and Balding, 1971. Open File Report, for Geology, Hydrology and Water Quality of the Tracy-Dos Palos Area, San Joaquin Valley, California. Cites an average of 0.05 % for specific yield , storativity = specific yield.

[2]Padre, 2004. Storativity based on Well 8 aquifer testing with observation wells.

[3]Calculated as Area x Water level change x Specific Yield or Storativity

Values in Table7-1 have been rounded