TULE SUBBASIN PROBATIONARY HEARING DRAFT STAFF REPORT

March 2024

Table of Contents

Appendix B – Figures

Definitions and Abbreviations

2020 GSP(s) – The version of the Tule Subbasin Groundwater Sustainability Plans (Six GSPs) adopted by seven Groundwater Sustainability Agencies on January 30, 2020, and submitted to the Department of Water Resources on January 30, 2020.

2020 GSP(s) Incomplete Determination – The Department of Water Resources' January 28, 2022, determination that the 2020 GSPs were "incomplete" pursuant to California Code of Regulations, title 23, section 355.2, subdivision (e)(2).

2022 GSP(s) – The version of the Tule Subbasin Groundwater Sustainability Plans (Six GSPs) resubmitted to the Department of Water Resources on July 27, 2022.

2022 GSP(s) Inadequate Determination – The Department of Water Resources' March 02, 2023, determination that the 2022 GSPs were "inadequate" pursuant to California Code of Regulations, title 23, section 355.2, subdivision (e)(3).

ACS – American Community Survey, an annual survey conducted by the U.S. Census

AF – Acre-feet

AFY – Acre-feet per year

AGSA – Alpaugh Groundwater Sustainability Agency

AMSL – Above Mean Sea Level

Annual Report – The report Groundwater Sustainability Agencies must submit annually to the Department of Water Resources (Wat. Code, § 10728).

Aquifer – Water within a body of porous sediment or rock beneath the Earth's surface. The water in an aquifer is referred to as groundwater.

Aquifer, confined – An aquifer beneath a body or layer of less porous sediment or rock. The confining layer of less porous sediment or rock "traps" the underlying aquifer, which can allow water pressure in the confined aquifer to increase. In the California Central Valley, confined aquifers are often located below unconfined aquifers, so confined aquifers are commonly referred to as "lower" aquifers. Confined aquifers typically provide more water for agricultural use, because confined aquifers often hold more groundwater.

Aquifer, semi-confined – An aquifer that is only partially confined by bodies or layers of less porous rock.

Aquifer, unconfined – An aquifer that is not confined by a layer of less porous sediment or rock. In the California Central Valley, unconfined aquifers are commonly located above confined aquifers, so unconfined aquifers are commonly referred to as "upper" aquifers. Unconfined aquifers typically provide

more water for household use, because domestic wells are usually not drilled very deep.

B118 or Bulletin 118 – The Department's report entitled "California's Groundwater: Bulletin 118."

Basin – Groundwater basin or subbasin

bgs – Below Ground Surface

Board or State Water Board – State Water Resources Control Board

CalGEM – California Geologic Energy Management Division

Caltrans – California Department of Transportation

CASGEM – The California Statewide Groundwater Elevation Monitoring Program

Central Valley Water Board – Central Valley Regional Water Quality Control Board

CEQA – California Environmental Quality Act

CDFA – California Department of Food and Agriculture

CDFW – California Department of Fish and Wildlife

CDP – Census Designated Place

CGPS – Continuous Global Positioning System

CNRA – California Natural Resources Agency

Constituents - Chemical elements and compounds

Coordination Agreement – A legal agreement adopted between two or more groundwater sustainability agencies that provides the basis for coordinating multiple agencies or groundwater sustainability plans within a basin pursuant Part 2.74 of the California Water Code (Wat. Code, § 10721, subd. (d)).

CV-SALTS - Central Valley Salinity Alternatives for Long-Term Sustainability

CWS – Community Water System

DAC – Disadvantaged Community, meaning a community with an annual median household income less than 80 percent of the statewide annual median household income (Wat. Code, § 79505.5).

Data Gap – Refers to a lack of information that significantly affects the understanding of the basin setting or evaluation of the efficacy of Plan implementation and could limit the ability to assess whether a basin is being sustainably managed (Cal. Code Regs., tit. 23, § 351, subd. (*l*)).

DDW – State Water Board's Division of Drinking Water

De-designated area – The portion of the Tule Subbasin containing groundwater that the Central Valley Regional Water Quality Control Board de-designated for municipal and agricultural supply beneficial uses, as described in the Regional Board's 2017 Tulare Lake Basin Plan Amendment.

DEID – Delano Earlimart Irrigation District

De minimis extractor – A person who extracts, for domestic purposes, two acre-feet or less per year (Wat. Code, § 10721, subd. (e)).

DBCP – 1,2-Dibromo-3-chloropropane

Domestic Purposes – The use of water in homes, resorts, motels, organization camps, camp grounds, etc., including the incidental watering of domestic stock for family sustenance or enjoyment and the irrigation of not to exceed one-half acre in lawn, ornamental shrubbery, or gardens at any single establishments. The use of water at a camp ground or resort for human consumption, cooking or sanitary purposes is a domestic use (Cal. Code Regs., tit. 23, § 660).

DPR – Department of Pesticide Regulation

DWR or Department – Department of Water Resources

E-clay – Corcoran clay

EPA – Environmental Protection Agency

ET – Evapotranspiration

ETGSA – Eastern Tule Groundwater Sustainability Agency

FKC – Friant-Kern Canal

Ft – US feet

FWA – Friant Water Authority

GAMA Program – Groundwater Ambient Monitoring and Assessment Program

GDEs – Groundwater Dependent Ecosystems

GEARS – Groundwater Extraction Annual Reporting System

GL- Groundwater Level

Groundwater – Water beneath the surface of the earth within the zone below the water table in which the soil is completely saturated with water but does not include water that flows in known and definite channels unless included pursuant to Section 10722.5 (Wat. Code, §10721, subd. (g)).

Groundwater Dependent Ecosystems – Ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface (Cal. Code Regs., tit. 23, § 351, subd. (m)).

Groundwater Flow –The volume and direction of groundwater movement into, out of, or throughout a basin.

Groundwater Recharge – The augmentation of groundwater, by natural or artificial means (Wat. Code, § 10721, subd. (i)).

Groundwater Sustainability Program – Coordinated and ongoing activity undertaken to benefit a basin, pursuant to a groundwater sustainability plan.

GSA or Groundwater Sustainability Agency –One or more local agencies that implement the provisions of SGMA (i.e., Part 2.74 of Division 6 of the California Water Code) (Wat. Code, § 10721, subd. (j)).

GSP, Groundwater Sustainability Plan, or Plan – A plan of a groundwater sustainability agency proposed or adopted pursuant to SGMA (i.e., Part 2.74 of Division 6 of the California Water Code) (Wat. Code, § 10721, subd. (k)).

GSP Regulations – California Code of Regulations, title 23, section 350 et seq.

GWQ – Groundwater Quality

ibid – The reference is the same as above. It's an abbreviation of the Latin word "ibīdem," which means "in the same place."

ILRP – Irrigated Lands Regulatory Program

IM – Interim Milestone

InSAR – Interferometric Synthetic Aperture Radar

ISW – Interconnected Surface Water

KRWQC – Kings River Water Quality Coalition

Long-term Overdraft –The condition of a groundwater basin where the average annual amount of water extracted for a long-term period, generally 10 years or more, exceeds the long-term average annual supply of water to the basin, plus any temporary surplus. Overdraft during a period of drought is not sufficient to establish a condition of long-term overdraft if extractions and recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.

LTRID – Lower Tule River Irrigation District

LS – Land Subsidence

Management Area – An area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors (Cal. Code Regs., tit. 23, § 351, subd. (r)).

MCL – Maximum Contaminant Level

Meter – A device that measures groundwater extractions and that meets the requirements of California Code of Regulations, title 23, section 1042.

Mg/L – Milligrams per liter

MO – Measurable Objective – refers to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.

MT – Minimum Threshold – refers to a numeric value for each sustainability indicator used to define undesirable results.

OpenET – Online tool to estimate evapotranspiration via satellite-driven models.

OSWCR – Online System of Well Completion Reports

Overdraft – occurs where the average annual amount of groundwater extraction exceeds the average annual supply of water to the basin.

pCi/L – Picocuries per liter

PID – Pixley Irrigation District

Plan – See “Groundwater Sustainability Plan.”

Person – Any person, firm, association, organization, partnership, business, trust, corporation, limited liability company, or public agency, including any city, county, city and county, district, joint powers authority, state, or any agency or department of those entities. “Person” includes, to the extent authorized by federal or tribal law and subject to the limitations described in Water Code section 10720.3, the United States, a department, agency or instrumentality of the federal government, an Indian tribe, an authorized Indian tribal organization, or interstate body.

PMA – Project and Management Action

Principal Aquifers – Aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems (Cal. Code Regs., tit. 23, § 351, subd. (aa)).

Probationary Basin – Basin for which the State Water Board has issued a determination under California Water Code Section 10735.2.

Recharge - See “Groundwater Recharge” above.

Recharge Area – The area that supplies water to an aquifer in a groundwater basin (Wat. Code, § 10721, subd. (t)).

Report – A report of groundwater extraction as required by Section 5202 of the Water Code that includes the information required by Section 5203 of the Water Code.

RMS or Representative Monitoring Site - A monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin.

RWQCB – Regional Water Quality Control Board

SAFER – Safe and Affordable Funding for Equity and Resilience

SDFR – Socially Disadvantaged Farmer or Rancher

Secondary MCL – Also known as a secondary drinking water standard. Defined in the California Code of Health and Safety, section 116275, subdivision (d), as a standard that specify maximum contaminant level that, in the judgment of the State Water Board, is necessary to protect the public welfare. Secondary drinking water standards may apply to any contaminant in drinking water that may adversely affect the odor or appearance of the water and may cause a substantial number of persons served by the public water system to discontinue its use, or that may otherwise adversely affect the public welfare.

SGMA – Sustainable Groundwater Management Act

SMC – Sustainable Management Criteria - includes the sustainability goals, undesirable results, minimum thresholds, and measurable objectives outlined within a given GSP.

Statutory Deadline – The date by which an Agency must be managing a basin pursuant to an adopted Plan, as described in Water Code sections 10720.7 or 10722.4.

Sustainability Goal – The existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield (Wat. Code, § 10721, subd. (u)).

Sustainable Groundwater Management – The management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results. (Wat. Code, § 10721, subd. (v)).

Sustainability Indicator – Any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code section 10721, subd. (x) (Cal. Code Regs., tit. 23, § 351, subd. (ah)).

Sustainable Yield – The maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result (Wat. Code, § 10721, subd. (w)).

1,2,3 - TCP – 1,2,3-Trichloropropane

TCWA – Tri-County Water Authority

TDS – Total Dissolved Solids

µg/L – Micrograms per liter

UR or Undesirable Result – one or more of the following effects caused by groundwater conditions occurring throughout a basin as described in Water Code section 10721, subd. (x):

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.
2. Significant and unreasonable reduction of groundwater storage.
3. Significant and unreasonable seawater intrusion.
4. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
5. Significant and unreasonable land subsidence that substantially interferes with surface land uses.
6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

USBR – United States Bureau of Reclamation

USGS – United States Geological Survey

Water Budget – An accounting of the total groundwater and surface water entering and leaving a basin including the changes in the amount of water stored.

Water Year or WY – October 1 to September 30 of the succeeding year.

Executive Summary

This Executive Summary briefly summarizes key sections of the Draft Tule Subbasin GSP Assessment Staff Report (Draft Staff Report). A full discussion of these sections is provided in the Draft Staff Report. Where appropriate, the section titles in this Executive Summary refer to the corresponding section in the Draft Staff Report. For example, the "SGMA and State Intervention (Section 2)" section of this Executive Summary covers Section 2 of the Draft Staff Report.

Introduction

The mission of the State Water Resources Control Board (State Water Board) is to preserve, enhance, and restore the quality of California's water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations. The State Water Board is committed to racial equity and working towards a California where race no longer predicts a person's access to, or quality of, water resources.

In 2014, the state Legislature passed the historic Sustainable Groundwater Management Act (SGMA) that established a new framework for how groundwater would be managed locally at the basin scale to achieve long-term sustainability. Under SGMA, local agencies are responsible for the sustainable management of their groundwater basins; however, state agencies are responsible for ensuring local groundwater management achieves SGMA's goals. SGMA provides the State Water Board and the California Department of Water Resources (DWR) with oversight of groundwater resources to protect them for use by the communities, farms, and environmental resources that depend upon them. The Tule Subbasin (subbasin) is critically overdrafted: on average, water is being pumped out of the basin faster than it is recharged by rain and other sources. Overdraft can cause the land surface to sink, potentially damaging infrastructure and reducing aquifer storage.

In addition, overdraft threatens groundwater levels and drinking water quality and could have disparate impacts on communities that rely on shallow wells. Due to historic and political factors, many of these are economically disadvantaged and communities of color.

The State Water Board recognizes that local public agencies in the Tule Subbasin significant efforts since the passage of SGMA to form groundwater sustainability agencies (GSAs) and then develop detailed technical and other information supporting the adoption and implementation of six groundwater sustainability plans (GSPs) for the subbasin. Despite those efforts, in January of 2022, DWR reviewed GSPs to determine if the GSPs met SGMA's requirements and found it to be incomplete. Following revisions made by the GSAs in the subbasin, DWR reevaluated the GSPs in March of 2023, determined the GSPs to be inadequate, and referred the subbasin to the State Water Board, as required by SGMA. Consistent with SGMA, the State Water Board may

now consider whether to designate the Tule Subbasin as a "probationary basin," a term that is used in SGMA to describe a basin in the first stage of state intervention.

The goals of this executive summary are to:

- Describe SGMA and the State Water Board's state intervention process to provide context for the State Water Board's upcoming Tule Subbasin Probationary Hearing (Probationary Hearing);
- Briefly describe the demographics, geology, and hydrology of the Tule Subbasin;
- Summarize the actions State Water Board staff (Board staff) recommend the State Water Board could take at the subbasin Probationary Hearing. These recommended actions are to:
    - Designate the entire subbasin probationary. In the short-term, this would mean most groundwater pumpers in the basin would need to start: 1) measuring their groundwater extractions, 2) reporting extractions to the State Water Board, 3) and paying groundwater extraction fees to the State Water Board. Board staff recommends that most domestic household users (people who use less than two acre-feet per year for domestic purposes only) be exempt from reporting extractions and paying fees.
    - Identify certain deficiencies (issues with the subbasin's current groundwater sustainability plan) and potential actions that the GSAs could take to address them.
    - Require people who extract more than 500 acre-feet per year of groundwater from the subbasin to install and use meters to measure groundwater extractions.
    - Require people extracting groundwater from the wells located in the Friant Kern Canal subsidence management areas to install and use meters to measure their groundwater extractions.
    - Shift the reporting deadline for groundwater extractors from February 1 of each year to December 1.

SGMA and State Intervention (Section 2)

SGMA established a framework for groundwater management in California. SGMA requires local agencies to form GSAs in high-priority and medium-priority basins and to develop and implement GSPs. GSAs are responsible for achieving long-term sustainable management of their groundwater basins that avoids certain undesirable results within 20 years of implementing their GSPs.

When DWR, in consultation with the State Water Board, deems the GSP or GSPs in a high-priority or medium-priority basin inadequate[1], DWR refers the basin to the State Water Board for a determination as to whether to begin the state intervention process[2]. State intervention is additional to local management and intended to be temporary, and is a two-step process:

- The first step of state intervention under SGMA is for the State Water Board to determine, through a public process, whether to place the basin on probation.
- In the second step, through a public process, the State Water Board may implement an interim plan for the basin. This can only happen if deficiencies are not fixed after at least one year of the basin being on probation.

In determining whether to put a basin on probation, the State Water Board analyzes whether deficiencies identified by DWR were sufficiently addressed prior to the probationary hearing. As part of its analysis, and as reflected in State Water Board Resolution 2021-0050, *Condemning Racism, Xenophobia, Bigotry, and Racial Injustice and Strengthening Commitment to Racial Equity, Diversity, Inclusion, Access and Anti-Racism,* the State Water Board considers the impacts of basin non-compliance on vulnerable communities, including communities of color.

During a probationary period, GSAs would have time to resolve deficiencies identified in their GSPs and the State Water Board would collect data on groundwater extractions, collect fees from certain groundwater users, and may conduct additional investigations. Importantly, the GSA retains its authorities and responsibilities and must continue to implement its GSP regardless of if the basin is in probation.

Basin Description (Section 3)

Located in California's Central Valley in the southern portion of the San Joaquin Valley, the Tule Subbasin (**Figure ES-1**) is bounded to the north by the Kaweah Subbasin, the west by the Tulare Lake Subbasin, the south by the Kern Subbasin, and the east by the Sierra Nevada Mountains. The Subbasin covers approximately 475,895 acres or about 744 square miles[3].

The subbasin contains 13 localized urban areas, including the city of Porterville, and the communities of Allensworth, Alpaugh, Ducor, Earlimart, East Porterville, Pixley, Poplar-Cotton Center, Richgrove, Terra Bella, Teviston, Tipton, and Woodville. According to the Census Block Group Data 2022, the Tule Subbasin has an estimated population of 152,577 people. Most of the land within the subbasin and surrounding areas is used for

[1] Wat. Code, § 10735.2, subd. (a)(3).
[2] Wat. Code, § 10735, et seq.
[3] DWR, 2016.

growing crops and raising livestock. The primary land use designations for urban land are residential, commercial, and industrial. The Tule Subbasin is currently managed by seven GSAs, and the full list of member agencies can be found in Section 3. On June 28, 2023, the Delano-Earlimart Irrigation District GSA terminated its oversight of the Western Management Area. The Tulare County GSA has since expanded its boundaries to include the Western Management Area, and Tri-County Water Authority GSP will cover the area (Communication with GSAs).

Groundwater in the subbasin is used for drinking water, agriculture, wildlife habitat, and oil and gas extraction. The subbasin contains several aquifers, which are bodies of rock and/or sand and soil that hold groundwater. These aquifers are separated by layers of clay, which slow the movement of water between aquifers and can act as a barrier. In 2022, the Tule Subbasin GSAs executed a Coordination Agreement that divides the subbasin into three different aquifer zones relevant to groundwater management:

- The upper aquifer is the shallow unconfined to semi-confined portion of the aquifer. An unconfined aquifer is an aquifer that is not confined, or “trapped,” by a layer of less porous sediment or rock. The upper aquifer occurs in the upper 100 feet of sediment in the east side of the basin and deepens to the west of the subbasin where it occurs at a maximum depth of 450 feet below the surface.
- The lower aquifer occurs below the Corcoran Clay (E-clay). It is confined within the entirety of the western portion of the subbasin, meaning that a layer of less porous sediment or rock “traps” the aquifer. The lower aquifer is semiconfined within the northeastern portion of the subbasin. This aquifer is approximately 400 feet deep in the east and 2,000 feet deep in the west.
- The third aquifer zone, the Santa Margarita Formation and the Olcese sand, which exist only within the southeastern portion of the Tule Subbasin, below the Pliocene sediments. This aquifer is considered to be completely separated (hydraulically disconnected) from the deep aquifer.

Groundwater is the main source of water for agricultural and urban land uses, but surface water is also available. Surface water sources include Lake Success, Tulare Lake, the Tule River, Deer Creek, and the White River (2022 Coordination Agreement, Attachment 2, p.7). Of the three rivers within the subbasin, the Tule River is the largest and most consistent source of surface water to the subbasin, averaging 118,000 acre-feet of inflow from 1986 to 2017.

For more information on the history, demographics, economy, governance context, groundwater levels, groundwater quality, and subsidence in the subbasin, please refer to Section 3 of the Draft Staff Report.

Recommendations for State Water Board Action (Section 4)

SGMA states, “in those circumstances where a local groundwater management agency is not managing its groundwater sustainably, the State needs to protect the resource until it is determined that a local groundwater management agency can sustainably manage the groundwater basin or subbasin.” In March 2023, DWR determined the Tule Subbasin 2022 GSPs to be inadequate. Board staff agree with this determination. Now, the State Water Board may determine whether a probationary designation is warranted. Board staff have reviewed the GSPs, Coordination Agreements, and the DWR staff reports documenting DWR’s review of the GSPs.

Staff recommends the State Water Board designate the subbasin as probationary, and find the following:

The GSPs will allow substantial impacts to people who rely on domestic wells for drinking, bathing, food preparation, and cleaning, as well as impacts to critical infrastructure such as canals (e.g., Friant-Kern Canal), levees, and the aquifer itself within the subbasin. These undesirable results are likely to occur to an extent in the subbasin that will prevent the subbasin from reaching sustainability by 2040, as required by SGMA. Designating the subbasin probationary is needed to ensure the subbasin gets back on track to achieve sustainability by 2040.

Section 4 of the Draft Staff Report explains Board staff recommendations for a potential probationary designation of the subbasin. These recommendations are summarized below.

GSP Deficiencies and Potential Actions to Address Deficiencies (Section 4.1)

Board staff have identified specific deficiencies in the Tule Subbasin 2022 GSPs and have outlined potential corrective actions to address those specific deficiencies. The Draft Staff Report also incorporates deficiencies identified by DWR’s determination. Deficiencies that have been identified within the GSPs relate to:

- Chronic lowering of groundwater levels with insufficient management criteria.
- Continued land subsidence (sinking).
- Further degradation of groundwater quality.
- Depletions of interconnected surface water.

A summary of the GSPs deficiencies and corrective actions are described in further detail below.

To end State Water Board intervention in a groundwater basin, GSAs in that basin must demonstrate their ability and willingness to manage groundwater sustainably and address the issues that caused state intervention to occur. The State Water Board will evaluate any updated and adopted GSPs and determine whether the GSAs have

addressed the deficiencies, whether the GSPs are consistent with SGMA, and whether the GSAs are implementing the GSPs in a manner that will likely achieve sustainability in the subbasin.

Defining and Avoiding Undesirable Results Related to Chronic Lowering of Groundwater Levels (Deficiency GL – Section 4.1.1)

Under SGMA, one piece of achieving the sustainability objective for a basin is avoiding "chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon."[4] Declining groundwater levels can cause shallow wells to go dry or reduce their productivity, increase the energy costs of pumping, bring polluted water closer to well screens (the area where groundwater enters a well), or reduce water available for deep-rooted plants. Declining groundwater levels also makes it more difficult to avoid other related undesirable results caused by groundwater conditions, including land subsidence and depletions of interconnected surface water.

DWR identified deficiencies in the 2022 GSPs related to Chronic Lowering of Groundwater Levels. Key deficiencies included: 1) the GSPs' goals appear to allow significant and unreasonable impacts to domestic wells and the people that rely on them 2) the GSP's goals do not achieve sustainability, and 3) GSPs plan to measure progress against modeled projections rather than goals that achieve sustainability and avoid harm caused by declining groundwater levels.

Board staff agree with DWR's analysis and further identify deficiencies with: 1) the way the GSPs plan to address wells that they would allow to dry (well mitigation plan) and 2) the way that GSPs plan to reduce groundwater pumping (demand management).

The Staff Report identifies deficiencies and potential actions based on DWR and Board staff analysis. Key deficiencies and potential actions are summarized below:

- **Deficiency**: The GSPs' goals appear to allow significant and unreasonable impacts to domestic wells and the people that rely on them. For example, GSPs would allow hundreds of wells to go dry.
  Potential Action: Revise goals so that they do not allow significant and unreasonable impacts.
- **Deficiency**: The GSP's goals do not achieve sustainability.
  Potential Action: Revise goals to prevent overdraft. Evaluate feasibility of projects that GSPs rely on to increase water supply.
- **Deficiency**: GSPs plan to measure progress against modeled projections rather than goals that avoid harm caused by declining groundwater levels.
  Potential Action: Revise how progress toward sustainability is measured.

[4] Wat. Code, § 10721, subd. (x)(1).

- **Deficiency**: Well mitigation plans lack crucial detail.
  Potential Action: Add detail to well mitigation plans.
- **Deficiency**: Demand management plans lack crucial detail.
  Potential Action: Add detail to demand management plans.

Defining and Avoiding Undesirable Results Related to Land Subsidence (Deficiency LS – Section 4.1.2)

Another consideration under SGMA is avoiding "significant and unreasonable land subsidence that substantially interferes with surface land uses."[5] Subsidence is the sinking of land caused by groundwater removal. Land subsidence from excessive groundwater extraction can cause irreversible damage to infrastructure (bridges, roads, pipelines, canals, levees, and buildings) and aqueduct operations. Land subsidence can also diminish the storage capacity of an aquifer, which reduces the amount of available groundwater storage for the future. Importantly, subsidence and the resulting reduction of groundwater storage are often irreversible.

In the Tule Subbasin, subsidence is primarily caused by the removal of water from the clay layers by groundwater extraction, which causes irreversible compaction and sinking of the land surface. In the subbasin, pumping from the lower aquifer is likely the primary cause of subsidence.

DWR identified deficiencies in the 2022 GSPs related to Subsidence. Key deficiencies included: 1) the GSPs claim without justification that their goals would prevent significant and unreasonable impacts, 2) GSPs plan to measure progress against modeled projections rather than goals that achieve sustainability while avoiding harm caused by declining groundwater levels, 3) the GSPs allow more subsidence along the Friant-Kern Canal than the maximum subsidence allowed in an agreement between GSAs and the Friant Water Authority, 4) the GSPs lack crucial detail about how they plan to meet their goals, and 5) the GSPs allow subsidence to continue beyond 2040.

Board staff agree with DWR's analysis and further identify deficiencies with: 1) inconsistencies in the GSPs' goals and 2) efforts to prevent significant and unreasonable impacts along the Friant-Kern Canal, which delivers drinking water to over 250,000 people and irrigation water to over 1 million acres of farmland. The 1.5 feet of subsidence since 2020 already threatens the ongoing efforts to repair canal damage that was caused from earlier subsidence.

The Staff Report identifies deficiencies and potential actions based DWR's and Board staff's analysis. Key deficiencies and potential actions are summarized below:

- **Deficiency**: The GSPs claim without justification that their goals would prevent significant and unreasonable impacts.
  Potential Action: Revise goals so that they demonstrably prevent significant and unreasonable impacts.

[5] Wat. Code, § 10721, subd. (x)(5).

- **Deficiency**: GSPs plan to measure progress against modeled projections rather than goals that achieve sustainability while avoiding harm caused by declining groundwater levels.
  Potential Action: Revise how progress toward sustainability is measured.
- **Deficiency**: The GSPs allow more subsidence along the Friant-Kern Canal than the maximum subsidence allowed in an agreement between GSAs and the Friant Water Authority.
  Potential Action: Limit subsidence to, at most, the limits in other agreements.
- **Deficiency**: GSPs lack crucial detail about how they plan to meet their goals and subsidence since 2020 indicates that GSAs are not on track to meet their goals.
  Potential Action: Develop and implement plans to limit pumping near critical infrastructure. Do not allow new wells near critical infrastructure. Develop plans to repair damage caused by subsidence.
- **Deficiency**: GSPs allow subsidence to continue beyond 2040.
  Potential Action: Do not allow subsidence beyond 2040.

Degraded Groundwater Quality (Deficiency GWQ – Section 4.1.3)

Another consideration under SGMA is avoiding "significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies."[6] Degradation of water quality can limit local water supplies and beneficial uses, and SGMA requires GSAs to consider the interests of all beneficial uses and users of groundwater, including municipal well operators and public water systems.[7] Water quality degradation that significantly and unreasonably affects the supply or suitability of groundwater for use in drinking water systems is an undesirable result.

DWR concluded the GSAs took sufficient actions to correct the deficiencies by redefining groundwater quality conditions suitable for agricultural and domestic use based on existing regulatory agency standards.

Board staff acknowledge the effort the subbasin made in resolving the DWR deficiency. However, Board staff also reviewed the 2022 GSPs and identified multiple deficiencies. Key deficiencies and associated potential actions are summarized below:

- **Deficiency**: The GSPs goals are not well described, so it is unclear if the goals would prevent significant and unreasonable impacts.
  Potential Action: Clearly describe the impacts that would be considered significant and unreasonable.
- **Deficiency**: The GSPs would allow continued and unmanaged degradation of groundwater quality in areas where groundwater quality degraded below drinking

[6] Wat. Code, § 10721, subd. (x)(4).
[7] Wat. Code, § 10723.2.

water standards before SGMA was passed.
Potential Action: Identify representative monitoring wells in areas where groundwater quality has already degraded below drinking water standards and develop goals that prevent it from further degradation.

- **Deficiency**: The GSPs do not address some constituents (pollutants) that can be impacted by basin management and that are detected throughout the basin.
Potential Action: Address uranium and nitrite in addition to the constituents already addressed. Also consider addressing PFAS and PFOA.

- **Deficiency**: The GSPs would allow drinking water in some domestic drinking water wells to degrade below drinking water standards because the GSPs apply agricultural water standards to drinking water wells in agricultural areas.
Potential Action: Revise plans so that drinking water in domestic wells does not degrade below drinking water standards.

- **Deficiency**: The GPSs are not consistent on how they will monitor groundwater quality. They also do not monitor frequently enough.
Potential Action: Clearly describe how groundwater quality will be monitored. Monitor frequently enough to detect short-term and seasonal trends.

- **Deficiency**: The GSPs do not include plans to help people whose well water is allowed to degrade below drinking water standards. The GSPs do not:1) plan the additional sampling necessary to understand the extent of degraded water or 2) include the well mitigation planning necessary to restore well water to drinking water standards.
Potential Action: Collect and analyze more water samples when drinking water degrades below drinking water standards. Develop clear plans to restore access to clean drinking water when it degrades below drinking water standards.

Interconnected Surface Water (Deficiency ISW – Section 4.1.4)

Another consideration under SGMA is avoiding "[d]epletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water."[10] Depletions of interconnected surface water within the basin may have adverse impacts on surface water uses, such as degradation or loss of groundwater dependent ecosystems (GDEs) and reduced downstream surface water flow to users.

The GSP regulations allow GSPs to not develop plans to protect interconnected surface water if GSPs demonstrate that significant and unreasonable impacts to interconnected surface water are unlikely to occur. The Tule GSPs claim that there is no interconnected surface water in the basin and therefore did not establish sustainable management criteria, and DWR did not identify a deficiency associated with interconnected surface water. However, Board staff also reviewed the GSPs and identified multiple deficiencies. These deficiencies and associated potential actions are summarized below:

- **Deficiency**: The GSPs do not demonstrate that there is no interconnected surface water in the Tule basin. Instead, the GSPs rely on inadequate analyses that do not consider the best available data.
  Potential Action: Use the best available data to evaluate whether interconnected surface water exists in the basin. Explain the monitoring data used in the analysis.

- **Deficiency**: The GSPs use an incorrect definition of interconnected surface water when evaluating whether there is interconnected surface water in the basin.
  Potential Action: Use the correct definition of interconnect surface water when evaluating whether it is in the basin.

- **Conditional Deficiency**: The GSP currently does not include plans to avoid significant and unreasonable impacts related to interconnected surface water. If GSAs identify interconnected surface water, using the best available data and correct definition of interconnected surface water, then the lack of plan is a deficiency.
  Conditional Potential Action: If the basin identifies interconnected surface water, then the GSP should be revised to avoid significant and unreasonable impacts related to interconnected surface water.

Additional Staff Recommendations for State Water Board Action (Sections 4.2-4.4)

Exclusions from Probationary Status

SGMA directs the State Water Board to exclude from probationary status any portions of the basin for which a GSA demonstrates compliance with the sustainability goal.[8] Staff believe no GSAs in the Tule Subbasin have demonstrated compliance with the sustainability goal. All seven GSAs have adopted and are implementing six GSPs, which DWR has determined to be inadequate. Board staff do not recommend excluding any portions of the subbasin from the probationary designation.

Modification to Water Year and Reporting Dates

Board staff do not recommend modifying the water year for reporting of extractions but do recommend modifying the extraction reporting deadline for groundwater extraction reports required pursuant to Water Code Section 5202 by changing it from February 1 to December 1.

[8] Wat. Code, § 10735.2, subd. (e).

Requirements for Installation and Use of Measuring Devices

As part of a probationary designation, the State Water Board may require groundwater extraction reporters to install and use measuring devices, such as flow meters, for measuring their groundwater extractions.

Board staff recommend the State Water Board:

- Require any person extracting more than two acre-feet per year for any reason or extracting groundwater for any reason other than domestic purposes to report their groundwater extractions and pay fees.
- Require any person extracting more than 500 acre-feet per year to install and use meters that meet the requirements of Cal. Code Regs., tit. 23, § 1042 on all their production wells within the subbasin.
- Require any person extracting groundwater from the wells located in the Friant-Kern Canal subsidence management areas to install and use meters that meet the requirements of Cal. Code Regs., tit. 23, § 1042 on all their production wells within the basin.
- Exclude any person who extracts two acre-feet or less per year for domestic uses only (de minimis users) from reporting requirements and paying fees. This exception includes most household users, including those extracting from wells located in the Friant-Kern Canal subsidence management areas.

Conclusion

Despite significant efforts by GSAs in the Tule Subbasin, Board staff's analysis supports DWR's determination that the Tule Subbasin 2022 GSPs are inadequate. The current plans do not achieve sustainability and allow substantial impacts to critical infrastructure and communities who rely on domestic wells. The Tule Subbasin is therefore unlikely to achieve sustainability by 2040 while avoiding undesirable results, as required by SGMA.

Addressing deficiencies related to lowering groundwater levels and groundwater quality degradation is also consistent with the State Water Board's goal to ensure every Californian has safe and affordable drinking water as reflected in its commitment to the Human Right to Water and administration of the Safe and Affordable Drinking Water Fund.

Board staff recommend probationary status as a next step for getting the subbasin back on track to achieve sustainability and protect groundwater resources for the communities, farms, and environmental resources that depend on them.

1.0 Purpose and Organization of Staff Report

The purpose of the Staff Report is to inform the State Water Resources Control Board (State Water Board) as it considers whether to designate the Tule Subbasin as a probationary basin consistent with the requirements of the Sustainable Groundwater Management Act (SGMA). The Department of Water Resources (DWR) deemed the groundwater sustainability plans (GSPs) for the Tule Subbasin to be inadequate. The Staff Report provides the Board staff's characterization of the specific deficiencies in the GSPs, outlines an approach to state intervention for the Tule Subbasin, and more generally explains the State intervention process.

The Staff Report consists of five sections of subbasin specific content regarding state intervention and a final section of references.

- **Section 1.0. Purpose and Organization.** Discusses the purpose of the report and provides an outline of the content.
- **Section 2.0**. **SGMA Background, State Intervention Process, and Equity Considerations.** Details what it means for a subbasin to be deemed inadequate by DWR, provides a history of SGMA and discusses what it means for a groundwater subbasin to go into the state intervention process. This section also includes a discussion of probation, a potential first step in state intervention; the reporting and fee requirements; and an interim plan, the potential second step in state intervention, as well as describing Board consideration of groundwater challenges for disadvantaged communities (DACs).
- **Section 3.0. Historical, Physical, and Demographical Description of the Basin.** Describes the Tule Subbasin and contains the geographic, demographic, economic, and governance context within the subbasin, including a history of human use and development. This section also details the Groundwater Sustainable Agencies (GSAs) and their members, beneficial uses of groundwater, geologic history of the basin, and basin hydrology.
- **Section 4.0. Board staff Recommendations.** Details DWR's inadequate determination and its purpose, and the deficiencies and potential actions to address those deficiencies that have been identified by DWR and Board staff. Also included in this section is a discussion of exclusions from probationary status (Wat. Code, § 10735.2, subd. (e)), modification to water year (WY) reporting dates, and requirements for installation and use of measuring devices (Wat. Code, § 10735.2, subd. (c)(3)).
- **Section 5.0. Additional Considerations.** Presents other considerations that Board staff have addressed related to the California Environmental Quality Act (CEQA), the human right to water, and the public trust doctrine.

The State Water Board will consider public comments, this Staff Report, and other relevant information that is presented during its public process as it evaluates whether to designate the Tule Subbasin as a probationary basin.

2.0 The Sustainable Groundwater Management Act and State Intervention

Section 0 provides general background on SGMA, including its goals and the role it defines for local and state agencies. Section 0 then describes the State Water Board's role as a backstop, to protect groundwater and those who depend on it when local efforts alone are inadequate.

2.1 The Sustainable Groundwater Management Act Background

2.1.1 Legislative Enactment of the Sustainable Groundwater Management Act

Groundwater, one of California's greatest natural resources, makes up a significant portion of the state's water supply. Approximately 80 percent of Californians use groundwater for drinking or other household uses. Rain replenishes groundwater each year, but the amount of replenishment (or recharge) varies and depends on local conditions. Overdraft occurs when groundwater pumping removes water faster than precipitation can recharge the groundwater in a basin. Some groundwater basins in California are in a state of critical overdraft causing significant adverse environmental, economic, and social impacts. In some cases, groundwater levels have dropped so low that many existing wells are no longer able to pump water, including domestic supply wells in rural, largely economically disadvantaged communities (DACs). Wildlife and ecosystems that rely on shallow groundwater or rivers and streams connected to groundwater can also be adversely affected by low groundwater levels (CDFW, 2019). Excessive pumping has led to land subsidence in some areas, in turn causing damage to critical infrastructure such as levees and canals.

To protect California's groundwater resources, former California Governor Jerry Brown signed a three-bill legislative package in 2014, composed of Assembly Bill 1739 (Dickinson), Senate Bill (SB) 1168 (Pavley), and SB 1319 (Pavley). These bills created SGMA, the first legislative act in California to establish a statewide framework for sustainable groundwater management.

SGMA applies to California's alluvial groundwater basins that are designated as high and medium priority by DWR. SGMA requires local public agencies in those basins to form GSAs and develop and implement GSPs. GSAs are responsible for achieving a long-term management of their groundwater basins that avoids "undesirable results" (as defined under SGMA) within 20 years of implementing their GSPs.

SGMA's framework to sustainably manage groundwater at the local level is implemented through a division of governance between GSAs, DWR, and the State Water Board. Under SGMA, governance of groundwater sustainability in a subbasin begins with GSAs. SGMA provides the GSAs with authorities to implement rules and regulations for GSPs, monitor and enforce compliance with plans, and oversee or control groundwater extractions. DWR is the primary state technical assistance and oversight agency in SGMA and is tasked with assessing and evaluating GSPs for compliance with SGMA's requirements. The State Water Board acts when necessary to ensure SGMA is implemented successfully and may temporarily intervene in groundwater management when the proposed management of a groundwater basin is deemed inadequate due to deficiencies in the GSP. The State Water Board's role is discussed further in Section 0.

The federal government and federally recognized California Native American Tribes are subject to SGMA only to the extent authorized under federal or tribal law; however, they may voluntarily participate in development or administration of GSPs and in Board SGMA processes (Wat. Code, § 10720.3).

2.1.2 Path to Sustainability

As noted above, SGMA required the formation of GSAs in high-priority or medium-priority groundwater basins and subbasins (basins) by June 30, 2017. Any local public agency with water supply, water management, or land use responsibilities within a groundwater basin was eligible to be a GSA. The current set of GSAs and the set of local public agencies that compose those GSAs reflect local decision-making. GSAs have authority to create new rules and ordinances to manage groundwater users located within the GSA boundary.

GSAs operating within a given basin are collectively required to ensure groundwater is managed sustainably. To this end, SGMA provides GSAs with authorities to develop and implement GSPs, conduct investigations, register groundwater wells or require installation of meters, require pumpers to report extractions or recharge activities, build and operate projects, gather data, regulate or restrict extractions, and charge fees (Wat. Code, § 10725 et seq.). In developing and updating a GSP, GSAs must create opportunities for public engagement, encourage active involvement of diverse social, cultural, and economic elements of the population within the basin, and inform the public about their progress implementing the GSP (Cal. Code Regs., tit. 23, § 354.10, subd. (d)). A GSA may also "appoint and consult with an advisory committee consisting of interested parties" as it develops and implements a GSP (Wat. Code, § 10727.8).

GSPs outline how groundwater is to be used and managed without causing the following six undesirable results in the basins: significant and unreasonable declines in groundwater levels, reductions in groundwater storage, intrusion of seawater, degradation of water quality, subsidence of land, and depletions of interconnected

surface waters. These are often referred to as the sustainability indicators. GSPs are not required to address undesirable results that occurred before and were not corrected by January 1, 2015 (Wat. Code, § 10727.2, subd. (b)(4)).

SGMA requires that GSAs develop a sustainability goal description for each basin. According to SGMA, the sustainability goal is the implementation of measures identified to ensure the basin is operated without causing undesirable results (Wat. Code, § 10721, subds. (u), (w)).

2.1.2.1 Define Undesirable Results

GSAs are required to develop a definition of when effects caused by groundwater conditions occurring throughout a basin are considered to be significant and unreasonable for their basin (Cal. Code Regs., tit. 23, § 354.26). The definition of undesirable results includes both a narrative definition and a quantitative definition for each sustainability indicator. The definitions are based on sustainable management criteria (SMC) developed by the GSAs.

2.1.2.2 Define Quantitative Thresholds to Avoid Undesirable Results

To avoid undesirable results and to achieve the basin's long-term sustainability goals, GSPs must set quantitative minimum thresholds (MTs) and measurable objectives (MOs) for each of the sustainability indicators, as well as interim milestones. MTs quantify groundwater conditions for each applicable sustainability indicator at representative monitoring sites (RMSs) within the basin (Cal. Code Regs., tit. 23, § 354.28). MOs define quantifiable goals for sustainability indicators that maintain or improve sustainable groundwater conditions within the subbasin. Interim milestones define measurable target values for groundwater conditions over increments of five years (Wat. Code, § 10727.2, subd. (b)(1); Cal Code Regs., tit. 23, § 354.30).

2.1.2.3 Achieve Sustainability through Project and Management Actions

GSPs are required to describe project and management actions that the GSA has determined will achieve the sustainability goal for the subbasin (Cal. Code Regs., tit. 23, § 354.44). The project descriptions must include the criteria that would trigger implementation, a timetable for implementation, an explanation of the source and reliability of the water on which the projects rely, and a funding plan (Cal. Code Regs., tit. 23, § 355.44). GSPs must provide descriptions of current or future projects to achieve balanced levels of groundwater to reach long-term sustainable conditions. For those groundwater basins experiencing the most severe (critical) overdraft, GSPs were due by 2020 and must achieve groundwater sustainability within 20 years (by 2040). For the remaining high-priority and medium-priority basins, GSPs were due by 2022, thus requiring them to achieve groundwater sustainability by 2042 unless submitted earlier (Wat. Code, § 10720.7, subd. (a)) (Wat. Code, § 10727.2, subd. (b)).

2.2 State Intervention

When DWR, in consultation with the State Water Board, deems the GSP or GSPs in a basin inadequate (Wat. Code, § 10735.2, subd. (a)(3)), DWR refers the basin to the State Water Board for potential state intervention pursuant to the provisions of Chapter 11 of SGMA (Wat. Code, § 10735 et seq.). State intervention under the SGMA statute is a two-step process. The Board may decide not to take the first step if basins address deficiencies before the Board is ready to take the first step.

- The first step is for the Board to consider and potentially designate a basin as probationary (described in Section 0). During probation, GSAs have at least one year to resolve deficiencies while the State Water Board collects data on groundwater extractions, collects fees from certain groundwater users, and, optionally, conducts additional investigations. If deficiencies have not been resolved after at least one year of probation, the Board may decide to move to the second step.
- The second step is for the Board to consider and potentially impose an interim plan for the basin (described in Section 0). An interim plan is intended to be a temporary measure to protect groundwater until the State Water Board determines that locally led management complies with SGMA and will be effective. Under an interim plan, the State Water Board can manage groundwater use in a basin, including enacting restrictions on groundwater extractions (Wat. Code, § 10735.8).

Importantly, throughout the state intervention process, and even before the Board potentially takes the first step in state intervention:

- The state intervention process may end after deficiencies are addressed. If the Board determines deficiencies have been resolved and the basin is likely to achieve sustainability, the Board will end state intervention. The Board may also decide not to designate a basin as probationary if deficiencies are addressed before the Board considers probation.
- GSAs retain authorities and responsibilities and must continue to implement their plans. Basins may be held in intervention after deficiencies are addressed if plans are not being adequately implemented.

2.2.1 Probation – First Potential Step

If DWR determines a GSP for a medium-priority or high-priority basin in critical overdraft to be inadequate, the State Water Board may, after notice and a public hearing, designate the basin as a probationary basin (Wat. Code, § 10735.2, subd. (a)(3)). Other situations can also trigger the State Water Board's state intervention authorities (Wat. Code, § 10735.2, subds. (a)(1)-(5)).

The State Water Board can only designate a basin probationary at a public hearing after ample public notice (see Section 0). Following a probationary designation, certain groundwater pumpers in the basin must report information about their groundwater use to the State Water Board (Section 0) and pay associated fees (Section 0). As part of the probationary designation, the State Water Board has discretion to require certain groundwater pumpers to use meters or other specific methods to measure groundwater extractions (Section 0) or to exempt certain categories of pumpers from reporting and fees (Section 0). SGMA directs the State Water Board to exclude from probationary status any portion of a basin for which a GSA demonstrates compliance with the sustainability goal (Section 0; Wat. Code, § 10735.2, subd. (e)).

2.2.1.1 Probationary Hearing Process

The State Water Board must provide notice of the hearing at least 90 days before it occurs by publishing the hearing dates on its website and notifying DWR and each city and county overlapping with the basin (Wat. Code, § 10736, subds. (a), (b)(1)-(2)).

In addition, at least 60 days before the hearing, the Board must mail or send by electronic mail notice to all persons known to the Board who extract or who propose to extract water from the basin, or who have made written or electronic mail requests to the Board for special notice of hearing pursuant to SGMA (Wat. Code, § 10736, subd. (b)(3)(B)).

Although not required by the statute, the Board staff are providing these draft recommendations for action in the basin, in the form of a draft staff report, to the public for a minimum 60-day public comment period prior to the probationary hearing. Staff also expect to host one or more in-person or virtual public engagement meetings during the public comment period to explain state intervention and receive public comments on staff's recommendations.

2.2.1.2 Reporting

Any person who extracts or pumps groundwater from a probationary basin must file a groundwater extraction report (report) with the State Water Board each year (Wat. Code, § 5202; see possible exceptions below). Reports must be submitted electronically (Cal. Code Regs., tit. 23, § 1032). On May 16, 2017, the State Water Board adopted a resolution for an emergency regulation to help implement SGMA that included electronic filing requirements. The emergency regulation was authorized under Water Code § 348, which allows DWR or the Board to adopt emergency regulations for the electronic filing of reports required under Water Code § 5200 et seq. The Office of Administrative Law approved the final regulation on June 29, 2017.

These reports must include:

- the name and address of the person who extracted groundwater

- the name of the basin from which the water was extracted
- the place of groundwater extraction
- the capacity of the groundwater extraction facilities
- monthly records of the groundwater extractions
- the purpose of use
- a general description of the area in which the water was used, and
- the year groundwater extraction commenced (Wat. Code, § 5203).

Persons extracting groundwater within a basin will be required to begin reporting their extractions to the Board 90 days after any probationary designation (Wat. Code, § 5202, subd. (a)(1)). Groundwater extraction reports, by default, are due by February 1 of each year for groundwater extractions made during the previous water year (Wat. Code, § 5202, subd. (b)). However, the Board may modify the water year or reporting date for a report of groundwater extractions (also see Section 0) (Wat. Code, § 10735.2, subd. (c)(4)).

Data collected by the State Water Board can be used by GSAs and stakeholders in remedying deficiencies and achieving sustainable groundwater management. If the State Water Board eventually develops an interim plan for a basin, the State Water Board may rely on the data to ensure the interim plan is consistent with water rights priorities, as required by SGMA (Wat. Code, § 10735.8, subd. (d)).

2.2.1.3 Fees

The Water State Water Board will notify well-owners and landowners of their extraction reporting requirements and associated filing fees. Any person that is required to file a groundwater extraction report to the State Water Board is also required to pay a report filing fee. Fees are required because Water Code section 1529.5 directs the State Water Board to recover the costs of state intervention activities via a schedule of fees. These fees were adopted under the 2017 emergency regulation described above.

The current annual fee for groundwater extractions (excluding de minimis extractions) in a probationary groundwater basin is a base filing fee of $300 per well and $40 per acre-foot (AF) of water extracted in the probationary basin. The State Water Board may amend fees as needed by subsequent emergency regulation (Wat. Code, § 348).

2.2.1.4 Measurement Requirements

All groundwater extractors subject to reporting requirements must submit annual reports that tabulate monthly records of groundwater extractions. The measurements of the extractions must be made by a methodology, water-measuring device, or combination

thereof satisfactory to the Board (Wat. Code, § 5203, subd. (e)). The State Water Board's *Options for Measuring Extraction Volumes* guidance document identifies acceptable ways to measure extractions (State Water Board, 2022). Options include a totalizing flowmeter, the run time method, or other methods as evaluated and approved in advance by staff on a case-by-case basis.

For basins in probation or subject to an interim plan, the State Water Board can require extractors to install meters to measure and report their groundwater extractions accurately, or the State Water Board can specify other means for measuring and reporting groundwater extractions (Wat. Code, § 10735.2, subd. (c)(3)).

Default Exemption for De Minimis Users

A well owner who extracts two acre-feet (AF) or less of groundwater per year from a parcel of land for domestic purposes only is defined as a "de minimis user" under the SGMA statute. De minimis users in probationary basins are exempt from reporting and fees unless the State Water Board determines reporting information from those users is necessary to sustainably manage the basin (Wat. Code, §§ 5202, subd. (c)(1), 10735.2, subd. (c)(2)).

Optional Exemption from Reporting for Certain Classes or Categories of Users

The State Water Board may choose to exclude certain classes or categories of groundwater extractions from extraction reporting and associated fees (Wat. Code, § 10735.2, subd. (c)). Specifically, the State Water Board could exempt classes or categories of extractors subject to a local plan or program that adequately manages groundwater within a portion of the basin if extractors are likely to have a minimal impact on basin withdrawals.

2.2.2 Interim Plan – Second Potential Step

The potential second step of state intervention involves the development and implementation of an interim plan for the basin by the State Water Board. The Board may develop an interim plan for the probationary basin one year after the probationary designation of the basin if the Board, in consultation with DWR, determines that a GSA(s) has not remedied the deficiencies that resulted in designating the basin as probationary (Wat. Code, § 10735.4, subd. (c)).

If the State Water Board adopts an interim plan, it would temporarily manage groundwater in the basin pursuant to the interim plan until the local agencies could demonstrate their ability to resume sustainable management of the basin. An interim plan is intended to be a temporary measure to protect groundwater until the State Water Board determines that locally led management complies with SGMA's requirements. An interim plan will include corrective actions, a schedule for those actions, monitoring, and

enforcement (Wat. Code, § 10735.8, subd. (b)). An interim plan will likely focus on reducing groundwater use in the basin to sustainable levels as soon as practical. An interim plan may include elements of an existing plan or adjudication that the Board finds would help meet the basin's sustainability goal.

2.2.3 Equity Considerations in State Water Board Decisions

The State Water Board mission—to preserve, enhance, and restore the quality of California's water resources and drinking water—is strengthened by the Board's commitment to racial equity and environmental justice[9] (State Water Board, 2021a). The State Water Board acknowledges and condemns inequities, past and present, in water access, affordability, and quality. The Board seeks to proactively use existing processes and authorities to help address structures and practices that may perpetuate these inequities. These considerations have informed the analyses employed in this report, as well as the determination of deficiencies, and proposed corrective actions identified herein. Some of these proposed actions, if implemented, would both help address past and present inequities and resolve GSP deficiencies by addressing groundwater supply and quality impacts related to management actions. Proposed actions would ensure, where appropriate, that sufficient mitigation measures are in place to protect communities from chronic lowering of groundwater levels and other undesirable results that are significant and unreasonable. The State Water Board will continue to engage with and consider the needs of potentially affected DACs and Black, Indigenous, and people of color (BIPOC) communities in the Tule Subbasin as it implements its responsibilities under SGMA.

It is estimated that in California 9.4 million people, 25% of the state's population, live in DACs. In the San Joaquin Valley approximately 2.2 million people, 55% of the state's population, live in DACs (Fernandez-Bou et al., 2021a). The geography of DACs is a product of urban segregation, redlining, and the racialized exclusion from public benefits that occurred as people of color were pushed outside of city limits, into industrial and

[9] For the State Water Board, racial equity is achieved when race can no longer be used to predict life outcomes (that is, when racial information does not help explain patterns of outcomes) and when outcomes for all groups are improved. For the State Water Board, environmental justice means the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. One way that inequities can relate to outcomes for water users is through the likelihood of success of policies and efforts. Theory and numerous case studies of local organizations with roles in the management of groundwater or other natural resources with common-pool properties, for example, suggest those organizations may be more likely to succeed where more resource users perceive the organizations and outcomes as fair (Ostrom, 2012).

service worker areas, or relegated to far flung farmworker camps where they often experienced degraded and exploitative conditions (London et al., 2021).

DACs often are served by small public water systems and rely on groundwater either in whole or in part for their water supply. Their groundwater wells often are shallow and thus are more susceptible to water quality issues or the risk of going dry if the groundwater level is lowered. While the public water systems serving DACs still are required to maintain essential resources and meet public health requirements, these systems are less likely to have the resources (e.g., infrastructure and financing) of more affluent communities to respond adequately to water supply or water quality emergencies. Systems serving DACs may be unable to treat their water source, find alternative supplies for a contaminated drinking water source, deepen their wells, or build new wells. As a result, DACs may be more vulnerable than other municipalities and cities to impacts on surface water and groundwater supplies. Section 3.3 includes information regarding the history of human occupation and development of the San Joaquin Valley and Tule subbasin and existing inequalities in water access, affordability, and quality.

3.0 Basin Description

The basin is the default physical scale at which SGMA responsibilities and authorities, at the state and local levels, apply.

3.1 Geographic Context

Located in California's Central Valley in the southern portion of the San Joaquin Valley, the Tule Subbasin (subbasin) (**Figure 3-1**) is bounded:

- to the north by the Kaweah Subbasin,
- to the west by the Tulare Lake Subbasin and Kings County,
- to the south by the Kern Subbasin and Kern County, and
- to the east by the Sierra Nevada Mountains.

The subbasin covers approximately 475,895 acres or about 744 square miles (2022 Coordination Agreement, p.16).

The land of the subbasin slopes from slightly higher elevations along the eastern margins of the subbasin toward the western boundary (USGS Topo **Figure 3-2**). The highest elevations within the subbasin are approximately 850 feet (ft) Above Mean Sea Level (AMSL) and occur along the eastern boundary of the subbasin (2022 Coordination Agreement, Attachment 2, p. 4). Drainage within the subbasin flows in a westerly direction. Drainage from Tule River, the largest natural drainage feature in the

subbasin, ultimately discharges onto the Tulare lakebed during periods of above-normal precipitation (ibid, p. 7). The Tulare lakebed is located on the southern half of the Tulare Lake Subbasin in Kings County. Drainage from Deer Creek rarely reaches the Tulare lakebed and drainage from White River extends as far as State Highway 99 and does not reach the Tulare lakebed (ibid, p. 8).

3.2 Geologic Context

The Tule Subbasin sits in the south-central segment of the San Joaquin Valley. The San Joaquin Valley is a linear sediment filled depression, typically known as a structural trough. The sediments overlay crystalline basement rocks (Bartow, 1991). The structural trough is 200 miles long and 70 miles wide and is filled with 32,000 ft of marine and continental sediments at its greatest depth (DWR, 2006). Sediments were deposited during inundation of the Pacific Ocean and by erosion of the surrounding Sierra Nevada and Coastal Range mountains, respectively. These sediments of loose clay, silt, sand, or gravel deposited by flowing water are known as alluvial deposits. When deposited away from direct connection to the ocean, they are known as continental deposits. Continental deposits form an alluvial wedge that thickens from the eastern edge of the valley toward the structural trough. The axis, or center line, of sediment deposition is beneath and slightly west of the rivers, lakes, sloughs, and marshes, and marks the current and historic artery of surface water drainage in the San Joaquin Valley.

See **Figure 3-3** for a map of the geology of the subbasin.

3.2.1 Geologic History

The subbasin within the San Joaquin Valley is geologically complex, has evolved on a geologic time scale, and was dominated by a pattern of movement of the earth's crust – a tectonic regime, with a presence of one crustal plate descending below the edge of another, known as a subduction zone, along the western continental margin (Bartow, 1991). During the Late Mesozoic and early Cenozoic (145 to 65.5 million years ago) a structural process of lateral crustal compression and deformation, a mountain building phase known as the Cordilleran Orogeny, took place, and the Farallon Plate subducted under the North American Plate **(Figure 3-4).** This tectonic geological process began to develop:

- an accretionary prism (marine sediments scraped off from the Farallon Plate), now known as the Costal Range Mountains.
- a continental volcanic arc, creating the batholith that would become the Sierra Nevada Mountains.
- a forearc basin (region between a subduction zone and the mountain belt), which was beginning to develop the Central Valley where the subbasin is located.

The Tule Subbasin was originally connected to the Pacific Ocean. Its connection to marine water periodically flooded the forearc basin, allowing deep marine sediment deposition (Bartow, 1991). As the rising mountains from the Coastal Ranges blocked the flow between the forearc basin and the Pacific Ocean and the Sierra Nevada Mountains continued to uplift, erosion and deposition of the surrounding mountains filled the valley for millions of years.

The sediment depositional history of the San Joaquin Valley, from deepest to relatively shallow sediments, can be divided into several periods:

- Late Mesozoic and early Cenozoic: The San Joaquin Valley was part of a forearc basin that was open to the Pacific Ocean as deep marine sediment was deposited in the basin.
- Late Miocene: The San Andreas Fault to the west of the forearc basin shifted movement and began to close off the area that now forms the San Joaquin Valley from the ocean, creating an extensive inland sea where marine sediments of the Etchegion Formation and San Joaquin Formation were deposited.
- Pliocene: The San Joaquin Basin west of the San Andreas Fault continued to close off, causing the extensive inland sea to shallow. Marine sediments were deposited in the shallowing sea bottom.
- Late-Pliocene and early-Pleistocene: The San Joaquin Valley began to evolve into its current form. Tulare Formation sediments were eroded from the uplifting mountains and deposited into the subsiding valley.
- Pleistocene: Quaternary sediments filled the basin and were deposited on alluvial fans and along the San Joaquin Basin axis by the rivers and streams emanating from the adjoining mountains.
- Pleistocene: Aggrading alluvial fans cut off the flow of the San Joaquin Rivers to the sea due to glacial and wet climate events (Atwater et al., 1986). Large-scale lacustrine deposits (formed at lake bottoms) accumulated in the shallow lakes that developed as a result of the internal drainage. This is also when the Corcoran Clay (E-Clay of Croft 1972) accumulated in the Tulare Lakebed.

3.2.2 Stratigraphy

Sediments comprising the Tule Subbasin include younger and older alluvium, flood-basin deposits, lacustrine and marsh deposits, and continental deposits (**Figure 3-5**). Older alluvium consists of poorly sorted lenticular (lentil or lens shaped) deposits of clay, silt, sand, and gravel, which may range from loosely consolidated to cemented. Younger alluvium consists of a heterogeneous complex of interstratified discontinuous beds of unsorted to fairly-well sorted clay, silt, sand, and gravel.

3.3 Human Use and Development

Humans have occupied the southern Central Valley for tens of thousands of years (Smith and Secrest, 2004). Until the last hundred or so of these years, the Tule Subbasin was covered by the Tulare Lake, the largest freshwater body west of the Mississippi and a shallow, highly biologically productive water system fed by the Kings, Kaweah, and Tule Rivers, among other streams (**Figure 3-6**).

Prior to European contact, the southern Central Valley held one of the densest populations of peoples north of Mexico (Cook, 1955). Native California Indians hunted and managed a wide variety of game on the lakeshore and on the lake itself, fished and managed fisheries in the lake and streams, and cultivated a variety of pines, oaks, and grasses. Tules, many of which were located on islands that dotted the Lake, also provided material for building boats, baskets, and dwellings.

What Europeans were seeing when they encountered the rich diversity of people, plants, animals, and landscapes (more than 2,000 native plant species are endemics and grow nowhere else on earth) and when they "admired the grand vistas of Yosemite and the gold and purple flowers carpeting the Central Valley were the fertile gardens of the Sierra Miwok and Valley Yokuts Indians, modified and made productive by centuries of harvesting, tilling, sowing, pruning, and burning" (Anderson, 2006, p.3, 13-14).

Indigenous Californian land and water management

During the 1970s and 1980s a new appreciation developed in academic circles for the "complex and diverse economies of Native Californians prior to European contact, including a deeper understanding of the sophisticated systems of traditional knowledge employed by Native Californians (Anderson, 1993, p.16)."

As part of land, plant, and animal management, Native Californians managed water resources, and practiced flood control and erosion control (Anderson, 1993, p.21). Over several thousand years and to adapt to variable climate conditions, people managed water to keep ground waters close to valley surfaces, to keep springs and streams usable, and to benefit plant and animal species. Kumeyaay elders describe a process:

> in which rocks were aligned in parallel rows on alluvial fans along the desert mountain edge and in the mountain valleys east of Laguna Crest. These rock ridges were also aligned across small drainage channels to slow the downward flow of rain water and to allow more to enter the ground… for the purpose of spreading the summer storm water and catching the fine silt carried by it… on all steep slopes (Shipek 1991, p.384).

People placed plants along streams, rivers, and new cuts in banks created by storms to maintain good drainage and prevent erosion; and they placed boulders and brush along narrows to keep water in upstream portions for longer periods and maintain groundwater close to the surface (ibid., p.385-386).

Irrigation "was an indigenous technique, practiced long before the Spanish and other Europeans introduced their agricultural knowledge." Written accounts of at least two communities – the Owens Valley Paiute and the Eureka Valley Indians – describe the irrigation techniques they used (Anderson 2006, pp.42,137; Anderson, 1993, pp.19,33,45,239-330). Native Californians used groundwater to supplement surface water. For example, the Cahuilla people developed natural springs and groundwater wells, including digging walk-in wells as a water source during times of scarcity for personal consumption, food processing and preparation, personal hygiene, medicinal uses, spiritual and ceremonial uses, production of household items, the construction of dwellings, and spiritual practices.[10]

When Europeans arrived, they were witnessing the culmination of centuries, or perhaps millennia, of the use of sophisticated practices and traditional knowledge that allowed plants, animals, and ecosystems to thrive (Blackburn, p.151 citing Heizer and Elsasser, 1980). Although Native Californians faced many challenges to practicing traditional land and water management after European contact,[11] expertise persists, traditional techniques endure and have been revived in many places, and in some cases are integrated with state and local agencies land management practices.[12]

European Contact

The Spanish did not build any missions in the interior of California, but they did visit the Central Valley. Francisco Tomás Hermenegildo Garcés may have been one of the first Spaniards to visit and write about the Southern San Joaquin Valley. He saw expanses of grassland, forested banks along the rivers and waterways, and observed the ephemeral nature of some of the tributaries to the larger rivers. He engaged socially with people along his journey including sharing meals that included the highly valued Chia, participating in a sweat, and consoling a dying boy and his family (Garcés 1775-1776, p.270-286).

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[10] Trial Motion, Memorandum and Affidavit (October 21, 2014), *Agua Caliente Band of Cahuilla Indians v. Coachella Valley Water District*, et al. (C.D. Cal., Case No. 5:13-cv-00883-JGB-SP) (2014 WL 11152398).

[11] Governor's Exec. Order No. N-15-19 (June 18, 2019).

[12] For examples of Tribal, public and private funding efforts, e.g. "Partnering and Learning from Tribes to Integrate Traditional Ecological Knowledge" article, Yurok Condor Restoration Program website, California Department of Fish and Wildlife Tribal Affairs website). California's Fourth Climate Assessment, Summary Report of Tribal and Indigenous Communities within California)

Later immigrants saw the grasslands of the Central Valley, the interior of the coastal range, and the Sierra foothills as prime ranching land, moving into the valley from 1836 to 1848, with at least one Mexican land grant made in the area north of Tulare Lake: Laguna de Tache ranch, located on approximately 48,800 acres between present-day Kingsburg and present-day Laton (Smith and Secrest, 2004). During the Mexican era (1822-1848), Mexico sent governors and some soldiers, but otherwise did not institute significant changes. The Plan of Iguala guaranteed citizenship to Indians, protected property, and some rights, but in practice Indians continued to be forced to labor for the missions and major epidemics spread through the Indian population (Cook, 1978, p.91-98). From the 1820s to the 1840s, hunters and trappers came overland, followed by the gold rush of 1849, which brought a rapid influx of tens of thousands of people to California and major physical change to water and the environment.

Ranchers, herders, and speculators jockeyed for land and rights up and down the San Joaquin Valley (Smith and Secrest, 2004). In 1853, hydraulic mining eclipsed other mining activities when it was discovered that forceful jets of water at hillsides would reveal gold-bearing alluvium. As extensive networks of reservoirs, flumes, ditches, and iron pipes were built to carry billions of gallons of Sierran water to hydraulic mining operations, waste mud and gravel washed downstream forcing rivers out of their banks, causing major flooding, sweeping away farm structures, drowning cattle, and wiping out orchards (Anderson, 2006 p.99). Prior to contact with Europeans, the valley landscape consisted of large swaths of brackish and freshwater marshes, which are “among the most productive ecosystems on earth” (Barbour et al., 1993). In 1850, Congress passed the Swamp Land Act, which encouraged the reclamation of swampy “overflow” lands. Landowners and speculators began forming canal and ditch companies that corralled previously freely flowing streams, sloughs, and marshes into new channels, drying the land and making it more suitable for ranching and farming. The remaining marsh land in the Central Valley is now a fraction of what once existed (Mason, 1957, p.55).

Groundwater Development

Reclamation efforts resulted in more acreage being available for crop farming, which drove agricultural innovation, which in turn drove further interest in developing land for agriculture. Diversion and channelization of regional surface waters resulted in significantly less water flowing through the Tule Subbasin to Tulare Lake. By 1899, Tulare Lake had lost nearly 60,000 acres and was largely dry (U.S. Bureau of Reclamation, 1970; Smith and Secrest, 2004). Modification of the surface water systems would continue through the 20th century with the completion of several large dams in the region, including Pine Flat Dam on the Kings River in 1954, Success Dam on the Tule River in 1961, and Terminus Dam on the Kaweah River in 1962. Nevertheless, as surface supplies dwindled, people in the region turned to groundwater supplies. The end of the 19th century saw the first development of pump-driven irrigation wells, driven by steam and gasoline engines, in the San Joaquin Valley. However, by the 1940’s the region’s water consumption had grown to the point that the

federal government constructed the Friant-Kern Canal and used it to deliver an average of 750,000 acre-feet per year (AFY) of surface water from the San Joaquin River to supplement groundwater resources. Still, the combination of water imported from the San Joaquin River and existing groundwater pumps could not meet demand and so groundwater pumping continued to increase (U.S. Environmental Protection Agency, 1984). As of water year (WY) 2022 groundwater extraction represents approximately 77% of the Tule Subbasin Total Water use (excluding precipitation) (Annual Report, WY 2022, Tables 8 and 9).

Even in the early days of the rapid development of groundwater use there was recognition that groundwater pumping lowered the water table, resulting in the need to sink deeper and deeper wells to keep up production (Smith and Secrest, 2004; Anderson, 2006 p.97). People who came from East, Southeast, and South Asia, south of the border with Mexico, from states affected by the Dust Bowl, and from the Great Migration (of Black farmers from the South) were employed as farm laborers (Pannu 2012 p.231-232). Historically exclusionary policies meant that they were not able to incorporate into towns and cities, often increasing dependance on shallow groundwater wells for domestic and farm use. Depletion of the aquifers has posed increasing threats to the ability of these communities to access needed water for health, sanitation, and farming, which is often exacerbated by a lack of representation, investment, and exclusion from infrastructure services (ibid). In 1980, DWR Bulletin 118-80 identified the Tule Basin as being subject to conditions of critical overdraft. Groundwater levels in the Tule Subbasin generally correlate with water year type. Since 1988 groundwater levels have trended downwards with some wells declining by 20 ft from 2010 to 2014 (California State Water Resources Control Board, 2014). Recharge occurs in more than 25 recharge basins and along the Tule River and Deer Creek channels (U.S. Bureau of Reclamation, 2015).

3.4 Demographics, Economy, and Governance Context

The subbasin contains 13 localized urban areas, including the city of Porterville, and the communities of Allensworth, Alpaugh, Ducor, Earlimart, East Porterville, Pixley, Poplar-Cotton Center, Richgrove, Terra Bella, Teviston, Tipton, and Woodville. The city of Porterville, Tulare County, and the Poplar and Alpaugh Community Service Districts are members of GSAs that manage the basin.

According to the Census Block Group Data 2022, the Tule Subbasin has an estimated population of 152,577 people. Approximately 71.3% of the population is Hispanic or Latino, 18.5% white, 4.7% Asian, 2.7% Black, 1.9% identified as other, and approximately 0.9% Native American.

According to the California Native American Heritage Commission, Native American tribes which may have knowledge of cultural resources in the subbasin include the Big Pine Paiute Tribe of the Owens Valley, Big Sandy Rancheria of Western Mono Indians,

Chumash Council of Bakersfield, Kern Valley Indian Community, Kitanemuk & Yowlumne Tejon Indians, Santa Rosa Rancheria Tachi Yokut Tribe, Tejon Indian Tribe, and the Tubatulabals of Kern Valley (NAHC 2023, personal communication, 11 May).

According to the United States Census Bureau, the average annual household income within the Tule subbasin in 2022 is $58,957 (U.S. Census Bureau 2022). This is less than the California median household income of $91,905 (U.S. Census Bureau, 2022). The area is rural with approximately 150,652 housing units (U.S. Census Bureau, 2020).

Agriculture (growing crops and raising livestock), is the primary industry within the Tule Subbasin. 2021 provisional crop mapping data indicates the primary crop types as pistachios, almonds, corn, sorghum, grapes, and citrus which when combined account for nearly 60% of all crop production.

As Public Policy Institute of California has noted:

> Like many agriculturally dependent regions, the [San Joaquin] valley faces significant socioeconomic challenges, including a high rate of unemployment and pockets of extreme rural poverty that worsen when the farm economy suffers. The region also faces difficult public health challenges in which farming plays a role, including unsafe drinking water in many small rural communities and some of the nation's worst air quality (Public Policy Institute of California, 2017; see also Hang et al., 2021).

3.4.1 Groundwater Sustainability Agencies

Seven GSAs manage groundwater in the Tule Subbasin, with each GSA comprising multiple member agencies (**Figure 3-7**). A list of the GSAs and their member agencies is in **Table 3-1**. The GSAs developed six GSPs under a coordination agreement: each of the GSAs, other than County of Tulare GSA, developed its own GSP. The County of Tulare GSA covers a small number of parcels, all of which are adjacent to land managed by Pixley GSA or Tri-County Water Authority (TCWA) GSA. Consequently, the County of Tulare GSA has an agreement with Pixley GSA and TCWA GSA to manage lands covered by the County of Tulare GSA (2022 Coordination Agreement, Attachment 3, p. 1, p. 8, Figure 1-2).

On June 28, 2023, the Delano Earlimart Irrigation District (DEID) GSA terminated its oversight of Western Management Area, about 7,554 acres west of DEID boundaries. The Western Management Area is considered "white lands" with no surface water and historically dependent on groundwater for a water supply (2022 DEID GSP, Section 1, p. 7). The Tulare County GSA has since expanded its boundaries to include the Western Management Area, and Tri-County Water Authority GSP will cover the area

(Communication with GSAs). SGMA requires each basin to have one or more GSAs that collectively will implement one or more plans for the entire basin.[13]

[13] Wat. Code, § 10735.2, subd. (a)(2); Wat. Code, § 10735.2, subd. (a)(4)

Table 3-1 – Tule Subbasin Groundwater Sustainability Agencies

GSA	Member Agencies	Date GSA Formed	GSP
Alpaugh GSA	• Alpaugh Irrigation District • Alpaugh Community Services District • Atwell Island Water District	05/31/2016	Alpaugh GSA GSP
Delano-Earlimart Irrigation District GSA	• Delano-Earlimart Irrigation District • Earlimart Public Utilities District	09/06/2016	DEID GSA GSP
Eastern Tule GSA	• County of Tulare • City of Porterville • Saucelito Irrigation District • Tea Pot Dome Water District • Vandalia Water District • Terra Bella Irrigation District • Kern-Tulare Water District • Porterville Irrigation District	02/23/2017	Eastern Tule GSA GSP
Lower Tule River Irrigation District GSA	• Lower Tule River Irrigation District • Poplar Community Services District	07/12/2016	LTRID GSA GSP
Pixley Irrigation District GSA	• Pixley Irrigation District • Pixley Public Utility District	08/09/2016	Pixley GSA GSP
Tri-County Water Authority GSA	• Angiola Water District • Deer Creek Storm Water District	03/07/2016	Tri-County GSA GSP
County of Tulare GSA	• County of Tulare	06/06/2017	N/A

3.5 Basin Hydrology - Groundwater

The Tule Subbasin is hydraulically bound by the surface contact between alluvial sediment and crystalline rock of the Sierra Nevada only on the eastside of the subbasin (**Figure 3-8**). The remaining subbasin boundaries are defined by DWR and water management areas, but the actual physical water-bearing formations extend into adjacent areas of the Tulare Basin hydrologic area.

Groundwater flows into the Tule subbasin from natural recharge areas along major streams including the Tule River, Deer Creek, and White River (DWR, 2003). Groundwater generally flows toward a groundwater pumping depression in the west-central portion of the subbasin (2022 Coordination Agreement, Attachment 2, p. 16). Based on current and historical groundwater elevation maps, horizontal groundwater barriers do not appear to exist in the subbasin (ibid, p**.** 5). The average annual precipitation entering the subbasin from WY 1986 - 2016 is 306,000 AFY (ibid, p. 23).

3.5.1 Groundwater Use

DWR surveyed land uses within the subbasin area in 2020 (**Figure 3-9**). The subbasin area contains approximately 95% agricultural or native, undeveloped land use and 4.6% urban land use designations. According to the six Tule Subbasin 2022 GSPs, agricultural land across the GSAs is predominantly used for dairy, dairy support crops, row crops, cotton, corn, hay, grain, grapes, almonds, pistachios, citrus, and subtropical fruits. The primary land use designations for urban land are residential, commercial, and industrial. Groundwater is the main source of water for agricultural and urban land uses (Annual Report, WY 2022, Table 5-1). According to data reported by the GSAs in their WY 2019 - 2022 Annual Reports, the average annual total groundwater extraction volume was approximately 715,849 AF, or 66% of the average annual total water use (excluding precipitation) in the subbasin, which was 1,077,040 AF (Annual Report, WYs 2021 and 2022).

3.5.1.1 Drinking Water

The subbasin contains one incorporated city, the City of Porterville, which uses groundwater from the subbasin, and meets the criteria of a severely disadvantaged community (SDAC). The water system for the City of Porterville is failing per the State Water Board's 2023 Drinking Water Needs Assessment (California State Water Resources Control Board, 2023a), meaning the system is out of compliance or consistently fails to meet primary drinking water standards. The City of Porterville is classed as failing in part for water exceeding Maximum Contaminant Levels (MCLs) of

agricultural byproducts such as nitrate and is also noted as failing due to treatment system violations for uranium, which has been detected in groundwater used by the city.

The State Water Board's Division of Drinking Water (DDW) evaluated the drinking water systems for nine Census Designated Places (CDPs)[14] within the subbasin: Tipton, Pixley, Terra Bella, Alpaugh, Allensworth, Earlimart, Ducor, Woodville, and Richgrove. The estimated population of the nine CDPs is 22,992 (U.S. Census Bureau, 2020). All nine of the CDPs that are evaluated by DDW fit the criteria of SDACs. Six of these communities (Allensworth, Pixley, Woodville, Tipton, Earlimart, and Richgrove) are served by failing drinking water systems (**Figure 3-10**) (California State Water Resources Control Board, 2023a). The systems serving these six CDPs are failing, in part, because the water the systems deliver has exceeded MCLs for total trihalomethanes, arsenic, or nitrate.

The Tule River Tribe of California (Tule River Tribe) is located just east of the Tule Subbasin in the foothills of the Sierra Nevada Mountain Range and maintains land holdings and facilities within the subbasin (2022 ETGSA GSP, Section 3, p. 6).

Domestic wells and community water systems in DACs and communities of color are typically disproportionately impacted by poor drinking water quality (Pace et al., 2022). These are significant issues: there are now around 450 "disadvantaged unincorporated communities" in the eight counties of the San Joaquin Valley[15] and "over 30% of the population [of the San Joaquin Valley] lives in unincorporated areas with little infrastructure to support clean drinking water, sewage treatment, and other services" (Hang et al. 2021, footnotes omitted).

Regarding water quality, "the region is a hot spot for unsafe drinking water" a problem that is most acute for small, poor, rural communities (Public Policy Institute of California, 2019). A "pervasive problem is the accumulation of nitrate in groundwater, due to decades of intensive use of nitrogen fertilizer and dairy manure on fields. The nitrate problem is most acute for small communities and domestic wells that are relatively shallow, where nitrate concentration is often higher" (Public Policy Institute of California, 2017). High salinity can also make water unsuitable for drinking: studies have noted that TDS in shallow groundwater in drainage problem areas can be higher than 40,000 milligrams per liter (mg/L) (Beard et al., 1994; Fujii and Swain, 1995).

One indicator of water quality issues for drinking water users is dependency on a community water system that is out of compliance with standards or requirements. As mentioned above, six of the nine CDPs in the Tule Subbasin are listed as failing for

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[14] CDPs are concentrations of population that are not incorporated as cities, towns, or villages.

[15] San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern counties.

reasons related to water quality, treatment, and supply shortage or drought risk (California State Water Resources Control Board, 2023a). In both disadvantaged unincorporated communities and economically disadvantaged cities in the San Joaquin Valley, “people of color are 84% and 83%, respectively, of those served by out-of-compliance [community water systems]… These levels are roughly 10 percentage points higher than the overall representation of this group in the population” (London et al., 2021). Domestic wells in the subbasin could also be experiencing water quality impacts, but specific monitoring data is not available.

3.5.1.2 Agriculture

Approximately 320,000 acres of crops in the subbasin were irrigated between 1990 and 2010 based on an aggregate of land use data (2022 Tri-County GSP, Appendix I, p. 63, Figure 7). Between 1990 and 2010, cotton acreage experienced the greatest decrease, while acreage dedicated to growing nuts and dairy-support crops (alfalfa, corn, and wheat) substantially increased (2022 Tri-County GSP, Appendix I, p. 9). These shifts are largely due to the increase in dairy farm acreage from 5,000 acres in 1990 to 11,000 acres in 2010 (ibid., p. 9). Dairy-support crops can have multiple growing cycles within a given year, which may result in higher water demand than an area in which only one crop is grown within a given year (ibid., p.9). Irrigated agriculture in the Tule subbasin is estimated to directly support about 14.5 thousand jobs and generate about two billion dollars in gross value (McCullough, 2020).

The GSAs’ estimate that, from 2018 to 2022, agricultural groundwater extractions increased approximately 44% from 464,800 AFY (2018) to 668,300 AFY (2022) and averaged 673,925 AFY in the subbasin (Annual Reports, WY 2019 – WY 2022, p. iv and i).

3.5.1.3 Environment

Potential environmental beneficial uses of groundwater include providing water for natural habitat found along portions of public navigable waterways located in the subbasin. The Tule River south of Lake Success, near Highway 190 in Porterville, for example is a public navigable waterway with natural habitat. Natural habitat is also present within the Pixley National Wildlife Refuge that is located within the southwest portion of the subbasin, and within the eastern reaches of Deer Creek (Lawrence Berkeley National Laboratory, 2018). Pixley National Wildlife Refuge’s wetlands are supplied by pumped groundwater.

The Natural Communities Commonly Associated with Groundwater (Natural Communities) dataset describes potential groundwater-dependent ecosystems (GDEs) based on aerial imagery and field surveys **(Figure 3-11)**. In the Tule Subbasin, the NCCAG dataset identifies 410 potential GDE polygons, many of which have been

ground-truthed during expert-lead field surveys. Of those, 232 were vegetative and 178 were wetlands. Vegetative GDEs constituted 94.6% (5,199.2 acres) of total GDE area compared to 5.4% (284.8 acres) for wetland GDEs. Vegetative GDEs constituted one percent of the subbasin's total area. Furthermore, there were 24 types of vegetative GDEs and eight types of wetlands GDEs.

The *Suaeda nigra* (Yerba Mansa) alliance was the dominant vegetation type (55.6%, 2,890.6 acres). Importantly, according to the California Native Plant Society, *S. nigra* alliance is particularly rare, as much of the preferred alkaline habitats has been converted to agriculture, and *S. nigra* is defined by the National Wetland Inventory as an obligate wetland species (Barbour et al. 2016, Jones and Stokes 2006, U.S. Army Corps of Engineers 2020, National Wetland Plant List, version 3.5, 12/14/2023). There were eight identified *Prosopis glandulosa* alliance GDEs (0.7% of vegetative GDEs at 34.1 acres). This alliance is not common and is highly threatened especially due to groundwater pumping and invasion of *Tamarix* stands (Becker. 1982, Stromberg et al. 1992).

Palustrine, emergent, persistent, seasonally flooded wetlands constituted 76.0% of potential wetland GDEs (216.6 acres). Seeps and springs only constituted 0.1% (0.4 acres) of all wetland GDE area.

The Lower Tule River Irrigation District (LTRID) GSA area had the greatest number of potential vegetative GDE polygons (70), but the TCWA GSA area had the greatest total area of vegetative GDEs (69.2%, 2,987.9 acres). As with the subbasin in general, the *S. nigra* alliance was most dominant in the TCWA GSA area, representing 72.6% (2,609.8 acres) of all potential vegetative GDEs within the GSA area. The *Prosopis glandulosa* alliance GDEs were only found within the Eastern Tule (ETGSA) and LTRID GSA areas.

Similarly, the ETGSA area had the greatest number of wetland GDE polygons (99) and the greatest total area of wetland GDEs (42.9%, 122.1 acres). As with the subbasin overall, the palustrine, emergent, persistent, seasonally flooded wetlands were most dominant in the ETGSA area (81.6%, 99.7 acres).

3.5.1.4 Oil and Gas Production

Oil production is the leading non-agricultural industry in the Tulare Lake Basin (Geologic Energy Management Division, 2023). Production in the Tule Subbasin is constrained to specific areas, primarily within the Deer Creek Oil Field. Board staff reviewed the California Geologic Energy Management Division's Well Finder web mapping application and found 70 active oil and gas production wells in the Tule Subbasin, of which one is new. Four active water disposal wells also exist within the subbasin. There are also about 19 idle oil and gas wells, three idle water disposal wells, and almost 587 now-inactive oil-related and gas-related wells in the subbasin (Geologic Energy Management Division, 2023).

3.5.2 Aquifer Framework

The complex subbasin aquifer setting includes unconfined and semi-confined aquifers above the Corcoran Clay, where it exists in the subbasin, and a confined aquifer below the Corcoran Clay (**Figure 3-12**). The unconfined and semi-confined units are distributed throughout the upper portions above the Corcoran Clay and are comprised of course-grained to medium-grained sediments with abundant lenses of fine-grained deposits (clay, sandy clay, sandy silt, and silt) (USGS, 1998). A study conducted in the 1960s subdivided the coarser grained deposits into three units: older alluvium, younger alluvium, and undifferentiated continental deposits (Croft and Gordon, 1968).

The principal groundwater aquifers within the subbasin occur primarily in the unconsolidated continental sediment deposits that form alluvial fans along the Tule River and streams that drain from the Sierra Nevada Mountains into the western-central portion of the subbasin. These unconsolidated sediment deposits that form the upper and lower aquifers range in thickness from 0 feet below ground surface (ft-bgs) at the eastern contact with crystalline rocks at the base of the Sierra Nevada Mountain Range, to approximately 3,000 ft-bgs in the western portion of the subbasin near Tulare Lake (2022 Coordination Agreement, Attachment 2, p. 4).

Physiography (geography that deals with physical features of the earth), weathering characteristics, and soils have typically been used to map formations in the subbasins within the Central Valley. However, classifying stratigraphic units (layers of sedimentary rock) in the subsurface has been challenging since lithology (type of rock formation) variations are not distinct (Bertoldi et al., 1991). As a result, most groundwater studies of the Central Valley define hydrogeologic units—aquifers and confining units—rather than stratigraphic units (U.S. Geological Survey, 2009). In the Tule Subbasin 2022 Coordination Agreement Attachment 2, the hydrogeologic setting was simplified for the Hydrogeologic Conceptual Model. For groundwater level monitoring, the subbasin is divided into five different aquifer/aquitard zones:

- The upper aquifer is the shallow unconfined to semiconfined portion of the aquifer which occurs in the upper 100 ft of sediment in the east side of the basin. The upper aquifer deepens to the west of the subbasin where it occurs at a maximum depth of 450 ft-bgs (2022 Coordination Agreement, Attachment 2, p 11).
- The Corcoran Clay (E-clay) of the Tulare Formation is the confining unit beneath the Upper Aquifer. It occurs within the western portion of the subbasin and pinches out approximately two to three miles east of Highway 99 (*Ibid*, p 11).
- The lower aquifer occurs below the E-clay and is confined within the entirety of the western portion of the subbasin and semi confined within the northeastern

portion of the subbasin. The depth to the lower aquifer is approximately 400 ft-bgs in the east and 2,000 ft-bgs towards the west (*ibid*, p. 11).

- Another confining unit consisting of Pliocene siltstone and interbedded sandstone exists below the lower aquifer in the southeastern portion of the subbasin. The thickness of this confining unit is about 500 – 1600 ft and separates the lower aquifer from the Santa Margarita Formation and the Olcese Sand (*ibid*, p. 11).
- The Santa Margarita Formation and the Olcese sand exist exclusively within the southeastern portion of the Tule Subbasin below the Pliocene sediments and are considered hydraulically disconnected from the deep aquifer. The Olcese Sand and Santa Margarita Formation are relatively permeable units and are important for agriculture in the southeastern reaches of the subbasin (*ibid*, p. 11).

3.5.3 Groundwater Levels

The Public Policy Institute of California (PPIC) states that "Long-term depletion of the [San Joaquin Valley] region's aquifers" can be traced back to the 1930s (Public Policy Institute of California, 2017). Board staff confirmed ongoing groundwater level declines specifically in the Tule Subbasin by evaluating groundwater level data from the past 75 years, although the declines appear to have become substantially more significant since 2000.

Board staff analyzed groundwater level data from the California Statewide Groundwater Elevation Monitoring (CASGEM, California Department of Water Resources, 2009) Program to determine both long-term and more recent groundwater level trends.

3.5.3.1 Long Term Groundwater Trends

CASGEM data are often spatially and temporally inconsistent, as CASGEM wells are not all systemically monitored at the same time. To reduce the impact of disproportionate spatial and temporal monitoring, staff only analyzed data from wells with both:

- groundwater level data from at least 40 percent of the years in the study period of 1948 to 2023
- at least one groundwater measurement after 2000

Of the 1,034 total CASGEM wells in the subbasin, 319 met these criteria to analyze trends in spring groundwater levels and 215 met these criteria to analyze trends in fall groundwater levels. These wells were then analyzed for trends at the 90% confidence level using a Mann Kendall test, which is a common statistical test for detecting trends.

- For spring, 42% (135) of the wells had a negative trend, 26% (83) had a positive trend, and the remaining 32% (101) had no trend at the 90% confidence level.
- For fall, 26% (55) of the wells had a negative trend, 33% (70) had a positive trend, and the remaining 42% (90) had no trend at the 90% confidence level.

3.5.3.2 Recent Groundwater Trends

Staff's long-term trend analysis revealed more significant declines in groundwater levels after 2000. To better understand the recent changes in groundwater level, staff analyzed the trend in groundwater elevation data from 2000 to 2023 using wells with:

- groundwater level data from at least 10 of the years (42% of the years) between the study period of 2000 to 2023

Of the 1034 wells available in CASGEM, 174 met the criterion to analyze trends in spring groundwater levels and only 77 met the criterion to analyze trends in fall groundwater levels.

- For spring, 79% (137) of the wells had a negative trend, 3% (5) had a positive trend, and the remaining 18% (32) had no trend at the 90% confidence level.
- For fall, 68% (52) of the wells had a negative trend, 4% (3) had a positive trend, and the remaining 28% (21) had no trend at the 90% confidence level.

Further, these analyses indicate that: (1) groundwater levels had a relatively stable trend before 2000, and (2) groundwater has declined significantly since around the year 2000. A significant number of wells in the subbasin are missing the groundwater level measurements from 2012 to 2023, which may influence the results of trend analysis for 1948 to 2023 by not capturing the decline after 2012.

3.5.4 Groundwater Recharge

Groundwater recharge in the subbasin occurs primarily by two methods: (1) infiltration of surface water from the Tule River, Deer Creek, and the White River, as well as from unlined water conveyances (canals), and (2) deep percolation of applied irrigation water (Croft and Gordon, 1968; DWR, 1995).

The GSAs propose a variety of groundwater recharge projects whose successful implementation is assumed and included in the subbasin's groundwater flow model. This includes eight projects in the ETGSA and one project in the TCWA GSA (2022 Coordination Agreement, Attachment 3, Table 6, pdf p. 650). The ETGSA (ETGSA Annual Report, WY 2022) lists recharge projects as "under development, on-going action" and its Annual Report documents that 13,470 AF of native Tule River and Deer Creek water was diverted for "in-lieu pumping of groundwater to recharge basins". The

TCWA GSA Annual Report (TCWA Annual Report, WY 2022) details three projects with groundwater recharge elements to them: the White Ranch Project, the Prosperity Farms Project, and the Allensworth Project. The GSAs are actively seeking funding and recently contracted with Geosyntec Consultants for a preliminary design for the White Ranch Project. The Prosperity Farms Project has already been constructed, is in use by the landowner, and is expected to reduce lower aquifer pumping by 1,500 AFY. The Allensworth Project entered the design phase in the spring 2023 and is expected to be constructed by 2024.

3.5.5 Groundwater Storage

DWR estimated the total potential and actual storage capacity of the Tule Subbasin based on an estimated specific yield of 9.5%, water level data collected by DWR, and data from well owners who shared information voluntarily. According to the calculations, the basin has the *potential* to store up to about 14.6 million AF to a depth of 300 ft and 94.1 million AF to the base of fresh groundwater, often treated as the “bottom” of a basin (California Department of Water Resources, 2003). But, due to declining groundwater levels, the basin stored only about 9.1 million AF of groundwater to a depth of 300 ft as of 1995 (California Department of Water Resources, 2003). Williamson et al. (1989) estimated the amount of stored groundwater in the subbasin as of 1961 was 33 million AF to a depth of less than 1000 ft.

A numerical model was developed and calibrated to inform the Tule subbasin GSPs. It was used to validate surface and groundwater budgets, evaluate sustainable yield, develop water budgets, and evaluate historical land subsidence. In the model, the subbasin was separated into five layers: an Upper Aquifer representing an unconfined aquifer above the Corcoran Clay, the confining layer Corcoran Clay which separates the Upper from Lower Aquifer in the western portion of the subbasin, a Lower Aquifer representing a semi-confined to confined aquifer below the Corcoran Clay, Pliocene marine deposits below the Lower Aquifer, and the Santa Margarita Formation Aquifer in the eastern portion of the subbasin.

From the results of the groundwater flow model simulations, the GSAs estimated the sustainable yield to be approximately 130,000 AFY and to range from 108,000 to 162,000 AFY.

The GSA’s groundwater flow model projects groundwater elevations in the Upper Aquifer over the duration of the transitional pumping period (2020 to 2040) to decline by around 100 to 120 ft in the central portion of the subbasin and by about 40 to 80 ft in the western portion of the subbasin. For the Lower Aquifer, the model projects groundwater elevations to decline by about 20 to 40 ft over the transitional pumping period.

3.5.6 Groundwater Quality

Groundwater quality in the subbasin varies spatially (including depth) and is impacted by both natural and anthropogenic (human caused) water quality constituents. Generally, groundwater quality increases with depth, with the poorest quality groundwater within the unconfined and semi-confined aquifers (see Section 3.5.2, above, for more information on the aquifers). These shallow zones are primarily degraded by anthropogenic constituents such as total dissolved solids (TDS), nitrate, measured as N (nitrogen), and other anthropogenic constituents from agricultural land use. The highest quality groundwater is typically in the deeper confined aquifer, below the E-clay in the western portion of the subbasin. The confined aquifer is generally unimpacted by anthropogenic constituents unless improperly constructed wells or other conduits allow for mixing of the higher and lower quality waters, such as wells screened between multiple aquifers. However, significant pumping in the confined aquifer may increase concentrations of naturally occurring constituents such as arsenic. Arsenic and other constituents can be released from reduced pore waters within clays through dewatering and compaction related to subsidence.

Several existing water quality programs have either conducted sampling programs or required regulated entities (such as public water systems or state small water systems) to sample groundwater in the subbasin for title 22 constituents (Cal. Code Regs., tit. 22, § 64431 et seq.; Cal. Code Regs., tit. 22, § 64441 et seq.). Agencies that regulate or monitor groundwater quality in the subbasin include:

- State Water Board
    - Division of Drinking Water (regulatory)
    - Groundwater Ambient Monitoring and Assessment (GAMA) (monitoring)
- Central Valley Regional Water Quality Control Board (Central Valley Water Board)
    - Irrigated Lands Regulatory Program (ILRP) (regulatory)
    - Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) (regulatory)
- U.S. Geological Survey (monitoring)
- Department of Water Resources (DWR) (monitoring)
- Department of Pesticide Regulation (DPR) (regulatory)

These agencies have collected groundwater quality samples from wells within the unconfined, semi-confined, and confined aquifers within the subbasin. Groundwater quality data from these agencies' programs and others can be accessed through the

GAMA Program's groundwater information system tool (California State Water Resources Control Board, 2023c).

3.5.6.1 Key Constituents

Board staff developed the SGMA Groundwater Quality Visualization Tool (California State Water Resources Control Board, 2023b) to help GSAs and other interested parties identify the groundwater quality constituents that each GSP should address. The tool uses data from the GAMA dataset to summarize, by basin, constituents that: 1) may be influenced by basin-wide groundwater management and 2) have exceeded regulatory thresholds since 2015 in 3 or more wells.

As of March 28, 2023, the tool identifies eight such constituents for Tule, as listed in Table 3-2, below. Of 541 wells sampled in the subbasin, 213 (21%) of the wells sampled had concentrations exceeding one or more regulatory standards for these eight constituents in Water Supply Wells (**Figure 3-13**). An additional two constituents have been detected in 23% of monitoring wells sampled, post-2015, in the subbasin, as listed in Table 3-2. The actual extent and impact of all detected constituents is likely much greater since most wells are not part of a monitoring network or regularly monitored for water quality impacts. Moreover, this tool does not address whether all constituents are consistently monitored in the subbasin. Thus, there may be other water quality issues in the subbasin that are not identified by the tool.

Table 3-2 - Summary of Water Supply Wells in the Tule Subbasin Exceeding Regulatory Water Quality Thresholds for selected Constituents

Constituent	Regulatory Threshold	Wells above Regulatory Threshold	Risk
Nitrate as Nitrogen	10 mg/L	25%	Decreases the ability for blood to carry oxygen to tissues (California Environmental Protection Agency, 2006)
1,2,3-Trichloropropane (1,2,3-TCP)	0.005 µg/L	19%	Risk of cancer (California Environmental Protection Agency, 2009)
Total Dissolved Solids***	500 – 1000 mg/L *	3%	No health risk at SMCL (California Environmental Protection Agency, 2017)

Arsenic	10 µg/L	14%	Digestive health, motor health, may cause cancer, and more (Agency for Toxic Substances and Disease Registry, 2007)
Gross Alpha radioactivity	15 pCi/L	8%	Risk of cancer (Office of Water, 2001)
1,2-Dibromo-3-chloropropane (DBCP)	0.2 µg/L	5%	Depression of central nervous system, digestive issues, and reproduction issues in men, and more (California Environmental Protection Agency, 2000)
Uranium	20 pCi/L	5%	Kidney damage and risk of cancer (Office of Water, 2001)
Nitrite as Nitrogen****	1 mg/L	2%	Decreases the ability for blood to carry oxygen to tissues (California Environmental Protection Agency, 2006)
Perfluorooctanoic acid (PFOA)**	5.1 ng/L**	23%	Risk of cancer (California Environmental Protection Agency, 2017)
Perfluorooctanoic Sulfonate (PFOS)**	1.5 ng/L**	23%	Risk of cancer (California Environmental Protection Agency, 2017)

* Secondary MCL (SMCL)

** Only present in monitoring wells sampled post- 2015 and regulatory threshold is notification level (NL).

*** Has also exceeded regulatory standards, but it was not identified in the tool or listed in Table 3-3, as there has only been a single exceedance post-2015.

**** Should be considered where active nitrification and denitrification are occurring.

3.5.6.2 Driving Mechanisms

Constituent concentrations in groundwater are dependent on physical and chemical influences. Examples of physical influences include changes in groundwater levels, gradients, source water recharge volumes, and quality of recharge water. Examples of chemical influences include reduction/oxidation (redox) conditions of groundwater (which can cause mobilization, mineralization, or adsorption of constituents) and radioactive decay of elements (U.S. Geological Survey, 2009).

As the need for new, deeper wells increases, users may encounter new constituents at deeper depths where there may be higher concentrations of new constituents, such as arsenic, uranium, and TDS. Also, many studies suggest that groundwater level decline and subsidence may increase constituent concentrations by changing the physical and chemical influences on constituent concentrations (Levy et al., 2021; Haugen et al., 2021; Smith et al., 2018).

For example:

- Shallow constituents, which typically exist in the top of the unconfined aquifer, may migrate downward with the water table resulting in those constituents being pulled into well screens at deeper depths.
- Continued groundwater level decline at different rates may alter groundwater elevation gradients which may cause constituents to migrate along new flow paths.
- Artificial recharge or changes in groundwater levels that alter redox conditions may cause the mobilization of constituents (e.g., Haugen et. al., 2021).
- Groundwater overdraft and resulting subsidence may expel pore water from compacted clay layers, increasing arsenic concentrations (Smith et. al., 2018; Underhill, 2023; Erban et. al., 2013). Arsenic can pose a significant threat to human health for people who depend on groundwater for drinking purposes (U.S. Environmental Protection Agency, n.d.).
- Improperly constructed or sealed wells may act as conduits for constituents of concern into confined and unconfined aquifers (DWR, 1991).

3.5.6.3 Impacts to Drinking Water Users

Nine of the ten constituents listed in Table 3-2 may pose health risks to drinking water users. As shown in Table 3-2, these constituents pose health risks by causing digestive issues (arsenic and DBCP), mobility and vision issues (arsenic and DBCP), kidney disease (uranium), respiratory issues (nitrate and nitrite), cancer (arsenic, gross alpha, uranium, 1,2,3-TCP, PFOA, and PFOS), and reproductive issues (DBCP) (California Environmental Protection Agency, 2001; Agency for Toxic Substances and Disease

Registry, 2007). The remaining constituent in Table 3-2, TDS, does not pose a significant health risk but is assigned a Secondary Maximum Contaminant Level (SMCL) of 500 mg/L for taste, staining, hardness, and other non-health risk factors.

3.5.6.4 De-designated Area

A portion of the upper aquifer in the Tule Subbasin does not legally provide beneficial use for municipal or agricultural supply purposes within two of the Subbasin's GSA management areas, LTRID GSA and Tri-County Water Authority GSA (**Figure 3-14**). In 2017, the Central Valley Water Board adopted Resolution R5-2017-0032, which amended the Tulare Lake Basin Water Quality Control Plan (Central Valley Regional Control Board, 2018) to de-designate (remove uses from specified areas where those uses are not suitable) beneficial use in this area for municipal or agricultural supply purposes (Central Valley Regional Control Board, 2017). The Central Valley Water Board noted that groundwater salinity concentrations in this area already exceeded the maximum salinity concentration of 3,000 mg/L TDS for municipal beneficial use, which is also the maximum salinity concentration identified to support agricultural beneficial uses (Resolution No. 88-63).

3.5.7 Subsidence

Land subsidence impacts in the subbasin have been attributed to groundwater management processes, predominantly over-pumping in areas where fine-grained sediments overlie coarser grained sediments (U.S. Geological Survey, 2018). As water is pumped and removed from sediment pore space, the sediment structure collapses, land surface elevations decline, and groundwater storage capacity is lost. Land subsidence in the basin can impact infrastructure, increase flooding due to sinking of levees, and permanently reduce aquifer storage. Many areas within the Tule Subbasin have experienced subsidence due to groundwater extractions. Interferometric Synthetic Aperture Radar (InSAR) uses radar images to remotely sense surface elevation changes over time. Recent InSAR data spanning June 2015 to October 2023 indicate the maximum subsidence in that time period in the Tule Subbasin is approximately 7 ft on the northwestern side of the subbasin in the LTRID GSA (**Figure 3-15**). The maximum measured subsidence in the same time period in areas adjacent to the Friant-Kern Canal is approximately 3.4 ft near Terra Bella. Recent land subsidence has caused reduced flow capacity in the Friant-Kern Canal (2022 Coordination Agreement, Attachment 1, p. 15).

3.6 Basin Hydrology - Surface Water

Human activities over the last few centuries have substantially altered surface water hydrology in the area (see Section 0).

The Central Valley Water Board's Tulare Lake Basin Plan (2018) summarizes surface water systems in the Tulare Lake hydrological region, which includes the Tule groundwater subbasin:

> The Kings, Kaweah, Tule, and Kern Rivers, which drain the west face of the Sierra Nevada Mountains, are of excellent quality and provide the bulk of the surface water supply native to the basin. Imported surface supplies, which are also of good quality, enter the basin through the San Luis Canal/California Aqueduct System, Friant-Kern Canal, and the Delta-Mendota Canal. Adequate control to protect the quality of these resources is essential, as imported surface water supplies contribute nearly half the increase of salts occurring within the basin.
>
> Buena Vista Lake and Tulare Lake, natural depressions on the valley floor, receive flood water from the major rivers during times of heavy runoff. During extremely heavy runoff, flood flows in the Kings River reach the San Joaquin River as surface outflow through the Fresno Slough. These flood flows represent the only significant outflows from the basin.

In addition to the Kings, Kaweah, Tule, and Kern rivers, the Tulare Lake hydrological region contains numerous mountain streams. These streams have been administratively divided into eastside streams and westside streams using Highway 58 from Bakersfield to Tehachapi. Streams from the Tehachapi and San Emigdio Mountains are grouped with westside streams. In contrast to eastside streams, which are fed by Sierra snowmelt and springs from granitic bedrock, westside streams derive from marine sediments and are highly mineralized, and intermittent, with sustained flows only after extended wet periods (Central Valley Water Board, 2018).

The Kings, Kaweah, St. Johns, and Tule Rivers are all fully appropriated year-round, meaning those sources have insufficient supply for new surface water right applications for diversions at any time of the year. Poso Creek is fully appropriated from June 15 through October 31 of each year, meaning no water is available for new water rights applications for diversions during those months (State Water Resources Control Board, 1998).

The reaches of the Tule River that overlie the Tulare Lake Basin Hydrologic Region, and are below Lake Success support the following beneficial uses:

- Agricultural Supply (AGR)
- Water Contact Recreation (REC-1)
- Non-Contact Water Recreation (REC-2)
- Warm Freshwater Habitat (WARM)
- Wildlife Habitat (WILD)

- Ground Water Recharge (GWR)
- Municipal and Domestic Supply (MUN)
- Industrial Service Supply (IND)
- Industrial Process Supply (PRO)

According to the 2022 Coordination Agreement Basin Setting, native surface water features specific to the management of the Tule Subbasin include Lake Success, Tulare Lake, the Tule River, Deer Creek, and the White River (2022 Coordination Agreement, Attachment 2, p.7). Of the three rivers within the subbasin, the Tule River is the largest and most consistent source of surface water to the subbasin, averaging 118,300 AF of inflow from 1986 – 2017 (ibid., p.7). Surface water delivery volumes from the White River and Deer Creek are minor in comparison, averaging just 5,800 and 17,800 AF from 1986 - 2017, respectively (2022 Coordination Agreement, Attachment 2, p. 8).

Imported water is another critical source of surface water for the subbasin, accounting for an average of 345,600 AF of surface water supply in between 1986 – 2017 (2022 Coordination Agreement, Attachment 2, p. 24). A major component of imported water to the subbasin is the Friant-Kern Canal, which delivers water from the Central Valley Project and runs along the eastern border of the subbasin. Smaller distribution systems also move water within the subbasin, such as unlined canals and the pipeline distribution systems of PID, LTRID, Terra Bella Irrigation District, Teapot Dome Water District, DEID, and Saucelito Irrigation District.

4.0 Recommendations for Board Action

SGMA states, “in those circumstances where a local groundwater management agency is not managing its groundwater sustainably, the State needs to protect the resource until it is determined that a local groundwater management agency can sustainably manage the groundwater basin or subbasin.” To ensure SGMA is implemented successfully, the State Water Board may temporarily intervene in groundwater management after DWR determines that proposed management of a groundwater basin is inadequate due to deficiencies in the GSP(s) for the basin (Wat. Code § 10735 et. seq).

GSPs for critically over-drafted high- and medium-priority basins had to be adopted and submitted to DWR for their assessment by January 31, 2020 (Wat. Code § 10735.2, subd. (a)(2)). The Tule Subbasin 2020 GSPs were submitted to DWR in January 2020, and DWR posted the GSPs to their website and established a 60-day comment period on February 19, 2020. DWR had two years within the GSPs’ submittal date to issue a written assessment and a determination of the status of the GSPs. On January 28, 2022, DWR gave the Tule Subbasin 2020 GSPs an incomplete determination and the Tule GSAs had 180 days to address the GSPs’ deficiencies identified in DWR’s Incomplete Determination of the 2020 Tule Subbasin GSPs. The Tule GSAs then adopted revised GSPs (Tule Subbasin 2022 GSPs), which were submitted to DWR on July 27, 2022, and posted to DWR’s website on August 1, 2022. DWR evaluated the 2022 GSPs and determined that the GSPs did not sufficiently correct the deficiencies identified in DWR’s incomplete determination except for one. DWR officially determined the Tule Subbasin 2022 GSPs “inadequate” on March 2, 2023.

The State Water Board now may determine whether a probationary designation is warranted (See Section 0). Board staff have reviewed the GSPs and the DWR staff reports documenting DWR’s review of the GSPs. Staff concur with DWR’s determination that the Tule GSPs are inadequate, and staff analyses indicate the Tule GSAs are not managing their groundwater sustainably. Staff note:

- The GSP’s SMC will allow substantial impacts to people who rely on domestic wells for human consumption, cooking, and sanitary purposes and on infrastructure such as canals (e.g., Friant-Kern Canal), levees, as well as impacts to the aquifer itself within the subbasin.
- Based on the above, the Tule subbasin GSAs are not on track to achieve sustainability by 2040. Designating the subbasin probationary is critical for getting the basin back on track to achieve sustainability by 2040.

Staff therefore recommends the State Water Board designate the subbasin as a probationary basin.

The State Water Board may designate a basin probationary if state intervention authorities are triggered and after providing notice and holding a public hearing (Wat. Code, § 10735.2, subd. (a)). The overall goal of probation is to gather information to help local GSAs address deficiencies in their plans, so they can sustainably manage their groundwater resources as soon as possible. During a probationary designation, the State Water Board will require many groundwater extractors to report their extractions, which will help resolve data gaps related to groundwater use, and Board staff will provide guidance to GSAs working to develop an adequate sustainability plan (or plans). Concurrently, GSA efforts to fix deficiencies should continue.

After GSAs have adopted a revised plan (or plans) that resolve the deficiencies, they can seek to exit probationary status by submitting the plan (or plans) to the State Water Board. If the State Water Board determines that deficiencies were addressed, the Board may resolve to have the GSA (or GSAs) exit probation; however, if the Board does not believe that the plan (or plans) are being adequately implemented, it may decide to continue probation. If deficiencies are not addressed after a year, the State Water Board can take steps to manage groundwater more directly by developing and adopting, after noticing and a hearing, an interim plan for the basin. An interim plan is intended to temporarily manage the basin until GSAs can develop and implement an adequate plan or plans. A probationary determination is a first step to addressing continuing overdraft while also resolving plan deficiencies and is required before the State Water Board can move to the step of developing an interim plan.

The following sections explain staff recommendations for a probationary determination:

- Section 0 recommends the specific GSP deficiencies that should be addressed and potential actions to address deficiencies.
- Section 0 recommends that no areas in the subbasin be excluded from probationary status.
- Section 0 recommends that the groundwater extraction annual reporting deadline be altered such that:
    - Users who are required to report their extractions do so by December 1 of each year for the previous water year instead of the default date of February 1 for the previous water year.
- Section 0 recommends that:
    - Users extracting 2 AFY or less for domestic purposes only be excluded from reporting groundwater extractions and paying fees.
    - Users extracting more than 2 AFY for any reason be required to report groundwater extractions and pay fees.

- Users extracting more than 500 AFY for any reason be required to install flow meters.
- Users extracting from the wells adjacent to Friant-Kern Canal be required to install flow meters, except for users extracting 2 AFY per year for domestic purposes only.

4.1 Groundwater Sustainability Plan Deficiencies and Potential Actions to Address Deficiencies

If the State Water Board designates a basin as probationary, the Board must identify the specific deficiencies and potential actions to address the deficiencies (Wat. Code, § 10735.6, subd. (a)). This Staff Report incorporates deficiencies identified in DWR's determination. For the Tule Subbasin 2022 GSPs, Board staff reviewed the GSPs and identified additional key issues generally within the scope of DWR deficiencies. These additional deficiencies are similar to the recommended corrective actions that DWR identified for basins with approved plans. Board staff are also considering the time it would take for basins to address deficiencies and exit probation. While other basins began implementing plans in 2020 that are now approved, the Tule subbasin does not yet have a plan that will achieve sustainable groundwater management by 2040. In order to meet the 20-year timeline, plan deficiencies should be addressed now, including the additional Board-identified issues that are similar to the DWR-identified recommended corrective actions that other basins with approved plans are already working to address.

Below, Board staff have identified specific deficiencies within the Tule Subbasin 2022 GSPs and Coordination Agreement and have outlined potential actions to address those specific deficiencies. Deficiencies that have been identified within the GSP(s) generally include but are not limited to: (1) chronic lowering of groundwater levels with insufficient SMC; (2) continued land subsidence; (3) further degradation of groundwater quality, and (4) depletions of interconnected surface water.

DWR's 2022 GSPs Inadequate Determination evaluates the subbasin's 2022 GSPs against the deficiencies DWR identified for the 2020 GSPs in DWR's 2020 GSP Incomplete Determination. Consequently, for each of the four overarching deficiencies, Board staff describe relevant portions of the 2020 GSPs, DWR's 2020 Incomplete Determination, and the 2022 GSPs. Staff then break down the deficiency into components. Finally, staff identify potential actions to address the deficiency components. Some actions contribute to addressing more than one deficiency, and staff identified more than one potential action for some deficiencies.

The potential actions to address the deficiencies provide the GSAs with a possible path out of state intervention and State Water Board oversight. Ultimately, the State Water

Board will evaluate any updated and adopted GSPs as a whole and will determine whether the GSAs have addressed the deficiencies, whether the GSPs are consistent with SGMA, and whether the GSAs are implementing the GSPs in a manner that the Board finds will likely achieve the sustainability goal.

In some cases, a GSP revision may resolve a deficiency identified by the Board, but the Board may find the revision adversely affects other management criteria. For example, if the plain-language definition of an undesirable result is revised, then the quantitative undesirable result and minimum thresholds may no longer adequately represent the significant and unreasonable conditions that the basin is trying to avoid, and the measurable objectives may no longer provide operational flexibility above the minimum thresholds.

Additionally, the Board may consider how GSPs that do not meet SGMA's mandate to sustainably manage groundwater by avoiding undesirable results affect other Board programs and policies. For example:

- Chronic lowering of groundwater levels can impact shallow domestic wells, many of which are located in communities of color. Failure to avoid this undesirable result (Wat. Code, § 10721, subd. (x)(1)) may also be inconsistent with or impact:
    - The Human Right to Water Resolution (California State Water Resources Control Board, 2016)
    - Racial Equity Resolution (California State Water Resources Control Board, 2021a)
    - Policy implementing the Safe and Affordable Funding for Equity and Resilience (SAFER) Program Fund Expenditure Plan (Division of Financial Assistance, 2020)
    - Groundwater Management Principles & Strategies to Monitor, Analyze & Minimize Impacts to Drinking Water Wells (California State Water Resources Control Board, 2021b)
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies (Wat. Code, § 10721, subd. (x)(4)) may also be inconsistent with or impact:
    - Antidegradation policy (California State Water Resources Control Board, 1968)
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water (Wat. Code, § 10721, subd. (x)(6)) may also be inconsistent with or impact:
    - Tribal beneficial uses of water (California State Water Resources Control Board, 2017)

- The Board's public trust obligations (see section 5.3)

The Board may amend or rescind a probationary designation decision after providing appropriate public notice of the proceeding (Wat. Code, § 10736, subd. (c)).

Roadmap to Proposed Deficiencies

Table 4-1, below, summarizes the deficiencies described in sections 4.1.1 through 4.1.4. See the following sections for additional detail on each deficiency including potential actions to address the deficiencies. Appendix A summarizes the text in sections 4.1.1 through 4.1.4, including the sub deficiencies, what SGMA requires, a summary of deficiencies, and potential actions to correct the deficiencies.

Table 4-1 – Summary of Proposed State Water Board Deficiencies

Deficiency Groundwater Levels (GL)-1 – The 2022 GSPs plain-language undesirable results do not clearly describe the impacts from groundwater level decline that would constitute a "lack of access to water supplies."
Deficiency GL-2 – The Tri-County Water Authority GSP quantitative undesirable result definition is unclear and inconsistent with the Coordination Agreement.
Deficiency GL-3 – The GSPs use modeled rather than observed 2015 groundwater levels to identify wells that were already impacted before SGMA.
Deficiency GL-4 – GSPs do not provide a reasonable path to achieve the sustainability goal by 2040.
Deficiency GL-5 – The 2022 GSPs Minimum Thresholds do not clearly represent undesirable results.
Deficiency GL-6 – The number of impacted wells differs between the Coordination Agreement and the Delano-Earlimart Irrigation District GSP.
Deficiency GL-7 – The Tri-County Water Authority GSP does not explain how it chose the 90th percentile threshold for well completion elevations as the Minimum Threshold for upper aquifer wells.
Deficiency GL-8 – The well mitigation framework provided in the GSPs lacks necessary detail.

Deficiency GL-9 – There are inconsistencies in the description of the proposed groundwater level monitoring network between the text, tables, and maps of the 2022 Coordination Agreement.
Deficiency Land Subsidence (LS)-1 – The 2022 GSPs do not clearly describe subsidence conditions that would reasonably be expected to cause undesirable results.
Deficiency LS-2 – The GSAs did not set Minimum Thresholds in accordance with DWR Regulations.
Deficiency LS-3 – The GSPs do not provide adequate implementation details and are not on track to avoid serious impacts to the Friant-Kern Canal.
Deficiency LS-4 – The Tri-County Water Authority GSP does not define Undesirable Results and Sustainable Management Criteria consistent with the Subbasin Coordination Agreement.
Deficiency LS-5 – The GSPs do not address undesirable results caused by land subsidence after 2040, and instead allow for residual subsidence to continue after 2040.
Deficiency Groundwater Quality (GWQ)-1 – The 2022 GSPs do not clearly define the conditions that would be considered an undesirable result.
Deficiency GWQ-2 – Minimum thresholds set by the 2022 GSPs are not consistent with GSP Regulations.
Deficiency GWQ-3 – The Tri-County Water Authority GSP does not define Undesirable Results and Sustainable Management Criteria consistent with the Subbasin Coordination Agreement.
Deficiency GWQ-4 – The water quality monitoring plan in the 2022 GSPs is not consistent with GSP regulations.
Deficiency GWQ-5 – Management actions are not responsive to water quality degradation.

Deficiency Interconnected Surface Water (ISW)-1 – The 2022 GSPs claim that there is no ISW in the Tule basin, but the analysis is limited and relies on incomplete data.
Deficiency ISW-2 – The 2022 GSPs do not correctly define Interconnected Surface Water.
Conditional Deficiency ISW-3 – If depletions of Interconnected Surface Water occur in the subbasin, the GSAs must set Sustainable Management Criteria for depletions of Interconnected Surface Water and establish a shallow water monitoring network.

4.1.1 Deficiency GL – Defining and Avoiding Undesirable Results Related to Chronic Lowering of Groundwater Levels

Under SGMA, one requirement of achieving the sustainability objective for a basin is avoiding "chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon." (Wat. Code, § 10721, subd. (x)(1).) Lowering groundwater levels can cause shallow wells to go dry or reduce their productivity, increase the energy costs of pumping, bring polluted water closer to well screens (the area where groundwater enters a well), or reduce water available for deep-rooted plants (see definition of groundwater-dependent ecosystems in the Definitions and Abbreviations section). Lowering groundwater levels also makes it more difficult to avoid other, related undesirable results caused by groundwater conditions, including subsidence and depletions of interconnected surface water.

DWR concluded that the Tule Subbasin 2022 GSPs do not adequately justify the approach for developing SMC for chronic lowering of groundwater levels, the criteria that the GSAs will use to evaluate success in the subbasin. DWR notes, moreover, that the SMC would likely result in significant and unreasonable impacts to people who rely on shallow wells (See sections below Table 4-2 below). Board staff concur and further note that the 2022 GSPs do not: 1) clearly address the proposed fate of the shallow part of the basin (the Upper Aquifer) or 2) identify the wells that could be impacted by the GSP's current approach. Staff also describe gaps in the GSAs' well impact mitigation proposal and the feasibility of avoiding chronic lowering of groundwater levels with the projects and management actions proposed in the 2022 GSPs. Finally, staff also identify discrepancies in the description of the groundwater level monitoring network.

Table 4-2 – Summary of DWR's Chronic Lowering of Groundwater Levels Deficiency and Relevant Components of the 2020 and 2022 Tule Subbasin GSPs

2020 GSPs	DWR's 2020 GSP Incomplete Determination	2022 GSPs	DWR's 2022 GSP Inadequate Determination
The GSPs define undesirable results as occurrences of groundwater elevations below MTs in 50% of wells for 2 consecutive years.	The GSPs did not define the groundwater level undesirable results or establish MOs/MTs in accordance with GSP regulations.	The revised GSPs no longer require 2 years of groundwater levels below MTs at 50% of the wells, but rather describe unreasonable results occurring when groundwater levels are below MT.	The revisions to the GSPs did not change the way MTs were established, nor did they explain how the MTs would avoid groundwater level undesirable results.

4.1.1.1 Tule Subbasin 2020 Groundwater Sustainability Plans

This subsection and following subsections describe the portions of the Coordination Agreement, individual GSPs, or DWR's determination relevant to the proposed Board deficiencies.

Plain-language Definition of an Undesirable Result

The 2020 Coordination Agreement for the Tule subbasin described undesirable results for groundwater levels "to be significant and unreasonable if there is basin-wide loss of well pumping capacity, which cannot be remedied" (2020 Coordination Agreement, p. 48).

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

MTs are the numeric values used to define undesirable results. MOs are specific, quantifiable goals for the maintenance or improvement of groundwater conditions to achieve the sustainability goal for the basin.

The 2020 Coordination Agreement quantified undesirable groundwater level results as unreasonable lowering of groundwater levels "below the MTs for two consecutive years at greater than 50% of GSA Management Area RMS Sites, which results in significant

impacts to groundwater supply" (2020 Coordination Agreement, p. 49). Interim milestones were established using groundwater flow model-projected groundwater elevations. The lowest interim milestone typically corresponded to the 2030 interim milestone. Then, MTs were established as the difference between the lowest interim milestone and the change in groundwater elevation during the recent drought of 2007-2016.

The 2020 GSPs did not describe how groundwater conditions at the MTs would impact beneficial uses of groundwater, e.g., estimating how many wells in the subbasin would be dry if groundwater levels were to drop to the MTs.

Representative Monitoring Sites and Monitoring Network

The groundwater level monitoring network as described in the 2020 Coordination Agreement includes monitoring wells completed in both the Upper and Lower Aquifers. The network consists of 66 Upper and 65 Lower Aquifer monitoring wells (2020 Coordination Agreement, Attachment 1, p. 5 and 7), including 21 and 17 RMS sites in the Upper and Lower Aquifers respectively (2020 Coordination Agreement, Attachment 1, Figures A1-2 and A1-5). Note that the numbers of monitoring wells listed in Tables A1-1 and A1-3, 71 upper and 68 lower aquifer wells, do not agree with the summary of monitoring wells in the text. The tables also list 19 composite wells with perforations across multiple aquifers. There is at least one groundwater level RMS for each of the subbasin's management areas. No monitoring wells were identified to monitor the groundwater level in the Santa Margarita Formation in the southeastern portion of the subbasin.

Well Impact Mitigation

The 2020 Coordination Agreement did not mention plans for any well impact mitigation that would lessen the significance of impacts to wells from groundwater level declines allowed in the GSPs.

Projects and Management Actions

Projects and Management Actions are proposed for each GSA within the subbasin to address groundwater level decline and loss of storage (as well as land subsidence and groundwater quality).

The GSAs summarized projects and management actions in their Groundwater Flow Model of the Tule Subbasin (2020 Coordination Agreement, Attachment 2, Table 2-6) as a Summary of Projects Exclusive of Transitional Pumping. This includes 17 projects in the Eastern Tule GSA (ETGSA), three projects in the Lower Tule River Irrigation District (LTRID) GSA, one project in the Pixley GSA, no projects in the Delano-Earlimart

Irrigation District (DEID) GSA, four projects in the Tri-County Water Authority (TCWA) GSA, and two projects in the Alpaugh GSA. Most of the projects included supply augmentation including increased basin recharge and recycled water recharge, changes in water deliveries, capture of flood water, and water banking operations (2020 Coordination Agreement, Attachment 2, Table 2-6). These projects and their associated water volumes were included in the groundwater flow model simulations to account for assumed successful implementation of the projects in their water budget determinations.

Potential Effects of Minimum Thresholds on Other Sustainability Indicators

Although the 2020 Coordination Agreement states that MTs were developed to prevent undesirable results in adjacent areas, the agreement did not explain how MTs had been selected to avoid causing those undesirable results.

The 2020 Coordination Agreement also did not explicitly discuss how groundwater level MTs relate to the MTs for other sustainability indicators; nor did the 2020 Coordination Agreement explain how the GSAs had determined that basin conditions at groundwater level MTs will avoid undesirable results for each of the sustainability indicators.

4.1.1.2 Department of Water Resources' 2020 Groundwater Sustainability Plan Incomplete Determination

In the January 28, 2022, DWR determination letter, DWR identified a deficiency in the 2020 GSPs related to groundwater level SMC:

> Deficiency 1. The [2020] GSPs do not define undesirable results or set MTs and measurable objectives for groundwater levels in a manner consistent with the GSP regulations (2020 GSPs Incomplete Determination, p. 9).

DWR only identified the most fundamental issues with MTs, noting that "The GSPs do not demonstrate that the established sustainable management criteria are based on a commensurate level of understanding of the basin setting or whether the interests of beneficial uses and users have been considered." (ibid., Statement of Findings, p. 2).

Plain-Language Definition of an Undesirable Result

DWR noted that the GSP defined an undesirable result related to chronic lowering of groundwater levels as a "basin-wide loss of well pumping capacity, which cannot be remedied", but found that:

> Neither the Coordination Agreement nor the GSPs describe the groundwater conditions that would lead to impacts to well pumping capacities or under what

conditions the ability to pump groundwater could no longer be remedied… (ibid., p.10).

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

The 2020 GSPs quantitatively defined undesirable results as groundwater elevations below MTs for two consecutive years at more than 50 percent of the RMSs. DWR determined that the GSPs did not describe the selection criteria for the 50 percent threshold and how it relates to basin-wide well capacity losses.

The 2020 GSPs defined groundwater level SMCs by using groundwater flow model-projected groundwater elevations to describe interim milestones and subtracted the observed "recent drought" (2007-2016) reduction in groundwater elevation from the lowest interim milestone (usually the 2030 interim milestone) to determine the MT. Further, measurable objectives and interim milestones would be updated based on observed groundwater elevations between 2020 and 2040. DWR determined that "GSAs must establish what groundwater level conditions throughout the subbasin would be considered significant and unreasonable that the GSAs intend to avoid and are based on their commensurate understanding of the basin setting" (2020 GSPs Incomplete Determination, p. 11).

DWR's 2020 GSP Corrective Actions

DWR determined that the GSAs needed to take two corrective actions to address groundwater level deficiencies:

> 1) To revise the GSP with subbasin-specific information to describe groundwater level conditions that would be significant and unreasonable, lead to undesirable results, and comply with the GSP regulations. DWR further stated that "The GSAs should define the conditions, including specific water level depth and well construction information, anticipated to cause well failures, result in additional operational costs for groundwater extraction from deeper pumping levels, and result in additional costs to lower pumps, deepen wells, or drill new wells." (2020 GSPs Incomplete Determination, p. 12). The GSAs also needed to explain how defining an undesirable result as 50 percent MT exceedances over two years would avoid "the effects the GSAs have determined are undesirable results."
>
> 2) To revise the GSPs by explaining their selected MTs, how they were indicative of supply depletion at the well location, how they are protective of domestic wells (and if not revise them), and how they may indicate supply depletion for municipal or agricultural wells (2020 GSPs Incomplete Determination, p. 13).

4.1.1.3 Tule Subbasin 2022 Groundwater Sustainability Plan Submission and Water Year 2022 Annual Report

The GSAs each submitted a revised GSP to DWR on August 1, 2022, in compliance with the 180-day resubmittal deadline. While not considered in DWR's assessment of the 2022 GSPs, the GSAs also each filed a WY 2022 Annual Report for their portion of the subbasin on March 31, 2023.

Plain-Language Definition of an Undesirable Result

The GSAs revised their groundwater level undesirable result in the 2022 GSPs to be defined as "continued chronic lowering of groundwater levels below those needed to accommodate continued pumping during the transitional period" and "lack of access to water supplies for all beneficial uses and users due to lowered groundwater levels" (2022 Coordination Agreement, p. 49).

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

The GSAs revised their groundwater level undesirable result in the 2022 GSPs to be defined as "the lowering of groundwater elevation below the MT at an RMS in any given GSA for the area and beneficial uses and users associated with that RMS" (2022 Coordination Agreement, p. 50). The DEID and TCWA 2022 GSP MTs were revised to consider domestic well depths. The other 2022 GSP MTs were not revised.

Representative Monitoring Sites and Monitoring Network

The groundwater level monitoring network as described in the 2020 Coordination Agreement includes monitoring wells completed in both the Upper and Lower Aquifers. The network consists of 78 Upper and 66 Lower Aquifer monitoring wells (2022 Coordination Agreement, p. 5 and 7), including 27 and 20 RMS sites in the Upper and Lower Aquifers respectively (2022 Coordination Agreement, Attachment 1, Tables A1-1 and A1-2). Note that the 2022 Coordination Agreement confusingly states both that there are 78 Upper Aquifer monitoring wells and 82 Upper Aquifer monitoring wells. The network also consists of 6 composite monitoring wells with perforations across multiple aquifers and three wells completed in the Santa Margarita Formation Aquifer. There is at least one groundwater level RMS for each of the subbasin's 17 management areas (2022 Coordination Agreement, Attachment 2, p. 46).

Well Impact Mitigation

The GSAs presented a Mitigation Program Framework with the 2022 Coordination Agreement outlining their mitigation programs to address groundwater levels as well as

land subsidence and groundwater quality impacts. The framework states that each GSA will adopt a Mitigation Program consistent with the Mitigation Program Framework in order assist with wells that may be impacted by declining groundwater levels. Each GSA's Mitigation Program will consist of eight common elements:

(a) identification of impacts
(b) a process for making claims of impact
(c) investigation of claims by the GSAs
(d) qualifications for mitigation
(e) mitigation
(f) outreach to educate public about the Program
(g) an adoption schedule for the Program
(h) funding sources for the Programs

The process for making claims of impact (element b) from declining groundwater levels includes an application process, data collection by the GSA, identification of appropriate mitigation, and a response to the user (2022 Coordination Agreement, Attachment 7, p. 2). For mitigation of wells impacted by declining groundwater levels (element e), suitable mitigations may include deepening wells, constructing new wells, modifying pump equipment, providing replacement water, coordination of consolidation of the well owner with existing water systems, or other means of mitigation (2022 Coordination Agreement, Attachment 7, p. 3). Both the Pixley Irrigation District and the LTRID developed an Impact Mitigation Plan, wherein they state that claims will only be accepted both for wells younger than 25 years and for impacts that occurred after January 1, 2023.

Projects and Management Actions

The GSAs summarized projects and management actions in their Groundwater Flow Model of the Tule Subbasin (2022 Coordination Agreement, Attachment 3, Table 6) as a Summary of Projects Exclusive of Transitional Pumping. This includes 17 projects in ETGSA, three projects in the LTRID GSA, two projects in the Pixley GSA, no projects in the DEID GSA, four projects in the Tri-County GSA, and two projects in the Alpaugh GSA. Most of the projects included supply augmentation via increased basin recharge and recycled water recharge, changes in water deliveries, capture of flood water, and water banking operations (2022 Coordination Agreement, Attachment 3, p. 29). These projects and their associated water volumes were included in the groundwater flow model simulations to account for assumed successful implementation of the projects in their water budget determinations.

Groundwater Allocations and Demand Management

The ETGSA is implementing its Groundwater Accounting Action (2022 ETGSA GSP, Section 7, p. 1-5), which includes using the BasinSafe groundwater accounting system in combination with ETGSA's Fifth Amended Rules and Regulations (2022 ETGSA GSP, Section 7, p. 2). Landowners are given the option to use a meter to measure groundwater extraction or to use Land IQ to estimate consumptive water use per parcel. Staff appreciates that the "ETGSA has engaged in extensive outreach to implement BasinSafe and to adopt the initial Rules and Regulations and subsequent versions" (2022 ETGSA GSP, Section 7, p. 3). The Groundwater Accounting Action includes an extraction rampdown schedule to reduce pumping down to the "sustainable limit" by 2035, noting that adjustments may be made as other PMAs are implemented (2022 ETGSA GSP, Section 7, p. 3, Table 7-1).

ETGSA allocates "Native Sustainable Yield" groundwater credits, calculated as the long-term average channel losses from the Tule River, Porter Slough, Deer Creek, and White River plus the "calculated underflow from the Sierra Nevada mountains," and 'Precipitation' groundwater credits, calculated as the long-term average precipitation in the ETGSA area (2022 ETGSA GSP, Attachment 7-1, p. 13).

The action allows for transitional pumping in two tiers, ramping down to the sustainable yield in 2035. ETGSA applies groundwater extraction fees and Tier 1 and 2 penalty fees (2022 ETGSA GSP, Attachment 7-1, p. 20). The WY 2022 Annual Report states that the ETGSA is already implementing its Groundwater Accounting Action in order to "track groundwater use, determine groundwater allocations, and develop individual water budgets for landowners and management areas within the GSA" (ETGSA Annual Report, WY 2022, p. 34).

The DEID 2022 GSP describes a transitional pumping management action (Action 1) for the Western Management Area that is similar to that of the ETGSA's Greater Tule Management Area. Transitional pumping is based on sustainable yield and precipitation credits. Transitional pumping over the sustainable yield is ramped down until 2035 when "groundwater credits would be limited to the sustainable yield plus precipitation accruals to groundwater and any supplemental groundwater credits" (2022 DEID GSP, Section 5, p. 36). Additionally, "DEID GSA anticipates implementing a program establishing and providing for transfer of groundwater credits within the [Western Management Area]", and a groundwater accounting program will be developed (2022 DEID GSA, Section 5, p. 36). The DEID 2022 GSP also proposes demand reduction programs (Action 7), including land retirement, cropping changes, water conservation, and wildlife habitat conversion (2022 DEID GSA, Section 5, p. 59).

Potential Effects of Minimum Thresholds on Other Sustainability Indicators

The 2022 Coordination Agreement acknowledges that the lowering of groundwater levels is directly related to sustainability indicators for changes in groundwater storage and land subsidence. The GSAs maintain that keeping groundwater levels above MTs will minimize undesirable results for groundwater storage and land subsidence (2022 Coordination Agreement, p. 58). The GSAs state that keeping groundwater levels above the MTs "is not anticipated to produce undesirable results for the majority of beneficial uses and users of groundwater" (ibid) and that Mitigation Programs, to be created per GSA, will address impacts to shallow domestic wells.

4.1.1.4 Proposed State Water Board Deficiencies and Potential Actions

In DWR's 2022 GSP Inadequate Determination dated March 2, 2023, DWR staff determined that the GSAs had not corrected the chronic lowering of groundwater levels deficiency in the 2022 GSPs. DWR's 2022 GSP Inadequate Determination states:

> Department staff expected GSAs to establish what groundwater level conditions would be considered significant and unreasonable, which would be groundwater level conditions that the GSAs intended to avoid and should be based on their commensurate understanding of the basin setting. Because the GSPs did not establish minimum thresholds in a manner consistent with the requirements of the GSP Regulations, Department staff are not able to assess whether the GSAs have established sustainable management criteria based on a commensurate level of understanding of the basin setting or whether the interests of beneficial uses and users have been considered (2022 Coordination Agreement, p. 13).

Board staff concurs with DWR's findings in their 2022 GSP Inadequate Determination and hereby incorporate it by reference. In addition, Board staff have identified additional issues with continuity in monitoring well data, the role of well impact mitigation in avoiding undesirable results, and the GSAs' reliance on uncertain new water supplies to achieve sustainability.

Below, Board staff break down deficiencies for the subbasin related to lowering of groundwater levels. Deficiencies from DWR's inadequate determination are incorporated into the deficiencies identified below. Deficiencies include:

- GL-1 through GL-3, GL-6, and GL-7: Identified by DWR
- GL-4, GL-5, and GL-8: Identified by DWR. Additional concerns noted by Board staff.
- GL-9: Identified by Board staff.

Deficiency Groundwater Levels (GL)-1 – The 2022 GSPs plain-language undesirable results do not clearly describe the impacts from groundwater level decline that would constitute a "lack of access to water supplies."

What SGMA Requires: The GSP Regulations require a GSA to describe the "Potential impacts on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(3)).

Deficiency: DWR noted in its 2020 GSPs Incomplete Determination that the 2020 GSPs did not explain "the conditions [of chronic lowering of groundwater levels] that would cause undesirable results." The revised plain-language undesirable result was defined as the "continued chronic lowering of groundwater levels below those needed to accommodate continued pumping during the transitional period of temporary overdraft**..."** or "…lack of access to water supplies for all beneficial uses and users due to lowered groundwater levels**..."** (2022 Coordination Agreement, p. 49). The quantitative undesirable result was defined as the "lowering of the groundwater elevation below the MT at an RMS in any given GSA for the area and beneficial uses and users associated with the RMS."[16] As DWR notes in their 2022 GSPs Inadequate Determination, the GSPs indicate that 776 wells would be impacted if groundwater levels declined to MTs, so it is not clear how the GSP quantifies "lack of access to water supplies."

Without a clear description of the water supply impacts that are "significant and unreasonable," GSAs and the State cannot evaluate whether MTs or broader quantitative definitions of an undesirable result that will guide day-to-day basin management are appropriate for avoiding undesirable results. Moreover, the groundwater levels required to accommodate transitional pumping must also avoid undesirable results, so without a clear understanding of the water supply impacts that are considered significant and unreasonable, it is not possible to evaluate whether the groundwater levels associated with transitional pumping would cause undesirable results.

Board staff propose the below Potential Action GL-1 to address the deficiency:

[16] This undesirable result is described in the Coordination Agreement and five out of the six Tule GSPs.

Potential Action GL-1 – Clearly describe the impacts from groundwater level decline that would constitute a "lack of access to water supplies" in the definition of undesirable results.

GSAs should prioritize engaging with representatives from the range of users in the subbasin, including domestic well owners, small farmers, infrastructure managers, state and federal fish and wildlife agencies, advocates, and others, to clearly define what impacts would constitute a "lack of access to water supplies." The plain-language undesirable results should be specific enough that GSAs and others can evaluate, over time, whether an undesirable result has occurred and whether the quantitative definition is sufficient to detect undesirable results. For example, GSPs may define "lack of access to water supplies" as a given percentage of drinking water wells that require immediate action to restore supply due to declining groundwater levels. Feedback from users in the subbasin can help identify a definition of an undesirable result for chronic lowering of groundwater levels that is specific to the uses in the subbasin.

GSAs should also establish MTs based on groundwater elevations that maintain access to water supplies and establish MOs that provide operational flexibility above MTs. In establishing MTs, GSAs should use existing well construction information and interpolated MT groundwater surfaces to clearly describe the impacts of MTs on groundwater wells. After establishing MTs, GSAs should evaluate the impacts of transitional pumping to ensure that they do not cause undesirable results.

Deficiency GL-2 – The Tri-County Water Authority GSP quantitative undesirable result definition is unclear and inconsistent with the Coordination Agreement.

What SGMA Requires: The GSP Regulations require the criteria for undesirable results to be "based on a quantitative description of the combination of MT exceedances that cause significant and unreasonable effects in the basin" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(2)). Moreover, GSAs choosing to develop multiple GSPs "shall enter into a coordination agreement to ensure that the Plans are developed and implemented utilizing the same data and methodologies and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting" (Cal. Code Regs., tit. 23, § 357.4, subd. (a)).

Deficiency: The 2022 TCWA GSP Addendum does not include a quantitative undesirable result definition. It is not clear that the 2022 TCWA Addendum adopts the Coordination Agreement quantitative undesirable result definition, because the plain-language undesirable result defined in the Addendum differs from the plain-language undesirable result in the Coordination Agreement. As DWR notes in its 2022 GSPs Inadequate Determination, it is unclear "if the GSA is defining it as undesirable if there is one minimum threshold exceedance."

Board staff propose the below Potential Action GL-2 to address the deficiency.

Potential Action GL-2 – The Tri-County Water Authority GSP should include a quantitative undesirable result. The Tule portion of the GSA should be managed by a GSP consistent with the Tule subbasin.

The TCWA GSP should include a quantitative undesirable result that:

- is consistent with the Coordination Agreement and,
- defines the number and nature of MT exceedances that would be used to identify an undesirable result.

Deficiency GL-3 – The GSPs use modeled rather than observed 2015 groundwater levels to identify wells that were already impacted before SGMA.

What SGMA Requires: The GSP Regulations require that description of undesirable results include discussion of the "potential effects on the beneficial uses and users of groundwater" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(1)), "based on information described in the basin setting, and other data or models as appropriate" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(1)).

Deficiency: The GSPs use a calibrated basin-wide flow model, rather than observations, to estimate 2015 groundwater elevations across the basin. They use these modeled 2015 groundwater elevations to estimate which wells would have already been impacted before SGMA. Then the GSPs remove these wells from their analysis of the impacts of undesirable results on beneficial uses and users of groundwater. However, the relationship between the modeled water levels and observed water levels is unclear. As noted by DWR, "The Plan does not demonstrate the correlation between the modeled values and the actual measured values; therefore, the Department is unable to determine if the model outputs are reasonable predictions of actual conditions and potentially skews the impact analysis" (2022 GSPs Inadequate Determination, p. 10).

Board staff propose the below Potential Action GL-3 to address the deficiency:

Potential Action GL-3 – Use observed 2015 groundwater levels to identify wells impacted before SGMA.

GSPs should use observed 2015 groundwater elevations when identifying which wells may have been impacted before SGMA.

Deficiency GL-4 – GSPs do not provide a reasonable path to achieve the sustainability goal by 2040.

What SGMA Requires: The GSP Regulations require "an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is

likely to be maintained through the planning and implementation horizon" (Cal. Code Regs., tit. 23, § 354.24). The sustainability goal is "the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield." (Wat. Code, § 10721 subd. (u)).

Deficiency: DWR finds that the 2022 Coordination Agreement projects expected groundwater pumping to exceed 400,000 acre-feet per year after the 20-year implementation period for SGMA (2020-2040; 2022 Coordination Agreement, Attachment 3, Table 9). This exceeds the subbasin's 130,000 acre-feet per year sustainable yield (2022 Coordination Agreement, p. 46), which means that the current water budgets are inadequate and the GSPs do not provide a reasonable path to achieve the sustainability goal by 2040. Board staff agree and note additional deficiencies concerning the subbasin's ability to achieve sustainability by 2040.

While Board staff acknowledge and appreciate the substantial efforts of the Tule subbasin GSAs to establish groundwater allocations, Board staff note concerns with the subbasin's allocation plans:

- It does not appear to Board staff that allocation plans rely on adaptative management. Allocations appear to be scheduled over time based on modeled transitional pumping, which might cause the allocation program to reduce pumping too slowly if modeled scenarios prove too optimistic or too quickly if modeled scenarios prove too negative.

- Board staff note concern that groundwater credits and trading may undermine the Tule subbasin's sustainability goal if not carefully designed and managed. Groundwater allocation plans sometimes work by allocating groundwater extractors a number of "credits" that represent a total amount of groundwater that can be extracted without penalty. For example, an extractor may be allocated credits that represent the amount of groundwater that can be sustainably extracted every year. Some plans might also provide additional credits for precipitation, surface water, or recharge. For example, plans that estimate groundwater use from total consumptive use (as estimated by satellites) may provide extractors additional credits for the precipitation and surface water deliveries that contributed to the total consumptive use. Plans may also allocate extractors credits for surface water that extractors used to recharge aquifers. Some plans may then allow these credits to be sold or traded between extractors, which is referred to as "groundwater trading."

  Staff note that the California Water Commission finds that, "If done well, groundwater trading can provide a voluntary, flexible tool to help alleviate the

economic burden of using less groundwater" (California Water Commission, 2022, p. 4). But the California Water Commission also cautions that, "If groundwater trading programs are not thoughtfully designed and well-managed, they could negatively impact vulnerable users at a very localized scale and in a short timeframe" (ibid, p. 8). Moreover, the California Water Commission warns that, without careful oversight, groundwater trading programs could create additional challenges. For instance, market power could be concentrated, certain parties may attempt "to escalate prices or to create user blocs that dictate where water goes" (ibid, p. 22), or landowners with multiple wells could attempt to move allocations between their own wells (called well aggregation). In light of the above, and in addition to other concerns regarding budgets and allocations, Board staff note:

- ETGSA's Groundwater Accounting Action includes a Precipitation Credit based on a running long-term average of precipitation in the ETGSA area (2022 ETGSA GSP, Attachment 7-1, p. 13). Staff note that using a long-term average for precipitation credits may overestimate precipitation as climate change increases the frequency, duration, and intensity of drought. Staff also note that the Precipitation Credit appears to assume total infiltration and recharge to aquifers from precipitation falling on the subbasin, which is not accurate.
- The Groundwater Accounting Action applies to the Greater Tule Management Area, and the ETGSA 2022 GSP states that a groundwater accounting management action is "to be determined" for the Kern Tulare Water District Management Area (2022 ETGSA GSP, p. 405). Staff note that the Tule Subbasin 2021/22 Annual Report states that 7,000 AF were pumped for agricultural use in the Kern Tulare Water District Management Area while 125,000 AF were pumped for agricultural use in the Greater Tule Management Area (ETGSA Annual Report, WY 2022, Appendix B, Table 1), so it is concerning that the accounting management action has not yet been determined for this area of greater pumping.
- The pumping reductions planned for the DEID GSA area apply to the Western Management Area only, which consists of 7,554 acres of "white lands" (DEID GSP, Section 1, p.7). The DEID 2022 GSP does not propose transitional pumping or demand reduction actions in the DEID Management Area. Staff note that the Tule Subbasin 2021/22 Annual Report states that 15,000 AF were pumped for agricultural use in the Western Management Area while 76,000 AF were pumped for agricultural use in the DEID Management Area (DEID Annual Report, WY 2022, Appendix 3, Table 3).

Board staff propose the below Potential Actions GL-4a through GL-4d to address the deficiency:

Potential Action GL-4a – Further investigate the water budget and update the GSPs accordingly.

The GSPs should be updated with a future water budget that does not continue to overdraft the basin after 2040. This water budget should inform projects and management actions. GSAs should revise GSPs with additional projects and management actions that will prevent overdraft by 2040.

To ensure GSAs have an adequate understanding of the scope of projects and management actions that will be required to prevent overdraft, the following groundwater fluxes should be further investigated and quantified to refine the subbasin water budget as necessary:

- Inflows to the Lower Aquifer and Santa Margarita Formation Aquifer, to define whether the Santa Margarita Formation Aquifer is separate from or a part of the Lower Aquifer.
- Vertical gradients in the Upper Aquifer, Lower Aquifer, and Santa Margarita Formation Aquifer.
- Inter-basin subsurface flows at the subbasin boundaries.

The GSP should be updated as subbasin sustainable yield better estimated from data collected by GSAs. Under SGMA, the sustainable yield is defined as, “the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result” (Wat Code, § 10721, subd. (w)).

The sustainable yield is not the same as an annual extraction volume for the subbasin; however, it can provide a guideline for balancing subbasin inflows and outflows.

Potential Action GL-4b – Update GSPs with detail necessary to evaluate feasibility of proposed supply augmentation projects.

In order to ensure the sustainable yield can be reached, the GSAs should consider whether projects and management actions are feasible, including projects and management actions related to recharge projects. Implementing some of the recharge projects identified in the 2022 GSPs may require new or amended water rights. If a project would rely on existing water rights, the GSPs should identify the water right identification numbers and other relevant details. It may be unreasonable for the GSP to assume that projects that currently lack adequate water rights for implementation can obtain either new water rights or modifications to existing water rights within a timeframe

that will allow the project to contribute to the GSP achieving sustainability. For the GSP to demonstrate a likelihood of attaining the sustainability goal, the GSP should discuss the timing for obtaining approvals and describe any uncertainties, such as water availability in source streams (e.g., Will less surface water be available with projected Bay-Delta Plan implementation? Is the source on the inventory of fully appropriated streams (SWRCB Order WR 98-08, Ex. A)? Can potential protests be anticipated from downstream water users?).

Potential Action GL-4c – GSPs should identify groundwater levels at key indicator wells in each aquifer that will trigger specific demand management actions, ensuring sufficient spatial coverage to represent beneficial uses and users in each aquifer.

GSPs should use groundwater elevations as the preferred subbasin management metric. Groundwater levels in key representative monitoring wells are the clearest and simplest empirical data that reflect groundwater conditions in the subbasin. Groundwater elevation is simple to measure and can be monitored continuously and remotely using pressure transducers.

GSPs should identify key indicator wells in each of the three subbasin aquifers (Upper Aquifer, Lower Aquifer and Santa Margarita Formation Aquifer) that will serve as index wells that trigger pumping cutbacks when groundwater levels decline to critical groundwater elevations. Indicator wells should have sufficient spatial coverage to be representative of beneficial uses and users; drinking water uses in particular should be represented by indicator well(s) that reflect shallow groundwater conditions.

GSPs should determine pumping cutbacks that will be triggered at specific groundwater elevations in a tiered trigger scheme based on the groundwater conditions on September 1 of each year (or as close to annual low measurements as is possible). Determining cutbacks on or shortly after September 1 for the subsequent year should provide irrigators with time to make crop planting and other business decisions. GSAs could re-evaluate the cutbacks and adjust as needed if a wet winter occurs. If GSPs establish management zones around each indicator well, extraction wells within an indicator well's management zone could follow pumping cutbacks according to the triggers for that indicator well and the aquifer in which they are completed. For example, when groundwater levels drop to the Trigger 1 level at an index well, all non-exempt pumpers within the index well's management zone must reduce their extractions by 15%; if water elevations drop to the Trigger 2 level, then all non-exempt pumpers must reduce pumping by 30%. Trigger elevations and the pumping cutback amounts could be set based on the groundwater level SMC. Pumping reduction amounts may be best determined through an iterative process and observations of the aquifers' responses.

This management approach is responsive to real-time conditions in the subbasin, and thus potentially an improvement over an approach based strictly on groundwater

models, but cutback metrics should be informed by a revised water budget and groundwater model. The impacts of recharge projects should be accounted for under this approach as groundwater levels respond to recharge, incorporating the time delay of infiltration to the aquifer(s).

Sustainable management under SGMA requires planning for the range of likely hydrologic conditions. In developing allocation and demand management programs, GSAs should therefore account for a future scenario in which extended droughts occur within the SGMA timeframe (Cal. Code Regs., tit. 23, § 354.44, subd. (b)(9)). The 2013-2015 period of the 2012-2016 drought in California was the hottest and driest period on record at the time of the passage of SGMA. Allocation and demand management programs should anticipate a recurrence of such conditions, as well as conditions that occur in extreme wet years.

When developing allocation and demand management programs, GSAs should plan for the impacts from pumping cutbacks that will be necessary during various water year types, including multi-year severe drought periods. GSAs can hold stakeholder meetings to educate irrigators on crop conversions, water efficiency practices, fallowing schemes, land transition options (particularly multi-benefit land repurposing), and other adaptation methods. Multi-benefit land repurposing options include dryland crops, grazing, recharge basins, parks/recreational spaces for communities, solar (renewable energy), and wildlife habitat. GSAs could encourage farmers to work together to strategically locate repurposed lands to maximize benefits (e.g., use lands adjacent to existing habitat, recreation areas, or communities). Planning ahead for potential fallowing and land conversion can reduce possible land conversion impacts related to dust, pests, and/or invasive plants.

Potential Action GL-4d – Track how allocations and trading may be affecting achievement of the sustainability goal or beneficial uses or users.

While the State Water Board does not regulate groundwater trading under SGMA (other than as may be provided in an interim plan), staff note the California Water Commission (California Water Commission, 2022, p. 17) describes “precursors” for “designing a well-managed groundwater trading program,” which include:

1) A sound GSP, without critical data gaps that are relevant to starting a groundwater trading program, that includes:

a) A water budget that accounts for water needs for human health and safety, the environment, and all other users in the basin.

b) Clearly defined sustainable groundwater management conditions and a limit on the amount of groundwater that can be pumped to achieve sustainable conditions.

c) A means of monitoring how much water is coming into and going out of the system.

d) A means of measuring water use that provides verifiable, accurate data.

e) A groundwater accounting system that tracks how much water is being used and by whom.

2) Groundwater allocations that limit the amount of groundwater that an individual pumper can use and provide a consistent unit of trade.

3) The flexibility to design a locally relevant program with rules that respond to the local context and that accommodate local needs.

4) A sound governance system with transparent and robust decision-making mechanisms and leadership, and with program oversight and enforcement experience.

The California Water Commission also finds that a well-designed groundwater trading program should have, at a minimum: clear trading rules; clearly articulated roles and responsibilities for trading participants; sufficient funding and expertise to run the program and enforce rules; transparent, accurate, and timely trading data; clearly identified triggers for adapting or pausing the program as needed; and consistent enforcement of trading rules (California Water Commission, 2022, p. 18). The California Water Commission states that “consistent, active enforcement is a critical function of the GSA, that it is essential to running a well-managed groundwater trading program, that those participating in trading programs should agree to enforcement mechanisms, and that penalties must be sufficient to deter non-compliance" (ibid, p. 22).

GSPs should provide a detailed description of the groundwater credits system and the groundwater credits that have been allocated to date. GSPs should also clarify the safeguards that are in place to ensure that the trading programs do not undermine total allowable groundwater extractions, as specified in the GSPs. Groundwater credits may need to be revised based on measured extractions, and precipitation credits should be tied to recent measurements rather than long-term averages.

Deficiency GL-5 – The 2022 GSPs Minimum Thresholds do not clearly represent undesirable results.

What SGMA Requires: The GSP Regulations require that MTs “for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results” (Cal. Code Regs., tit. 23, § 354.28, subd. (c)(1)).

Deficiency: The MTs in the GSPs do not clearly represent undesirable results, as the 2022 GSPs do not clearly define undesirable results. Instead, MTs often represent

projected, future groundwater elevations. DWR's Incomplete Determination required that GSAs revise their approach to MTs. DWR noted that MTs were based on groundwater modeling results rather than elevations that indicated "depletion of supply... that may lead to undesirable results" (Cal. Code Regs., tit. 23, § 354.28, subd. (c)(1)). DWR's Inadequate Determination noted that GSPs still often established MTs based on groundwater projections. Board Staff concur and further clarify that model results or other projections can be used to establish MTs that represent realistic water surfaces provided that the MTs clearly represent the depletion of supply that may cause undesirable results.

Board staff propose the below Potential Action GL-5 to address the deficiency:

Potential Action GL-5 – Set Minimum Thresholds that represent undesirable results rather than projected groundwater elevations.

Establish MTs that represent undesirable results. Describe the effects of MTs on beneficial uses and users relative to groundwater level conditions on January 1, 2015. If groundwater levels under the subbasin GSPs would be worse (significantly lower) in 2040 as compared to prior to January 1, 2015, explain how the decline is not significant and unreasonable. Establishing new MTs may require establishing new MOs in order for the MOs to provide the necessary operational flexibility above MTs.

Deficiency GL-6 – The number of impacted wells differs between the Coordination Agreement and the Delano-Earlimart Irrigation District GSP.

What SGMA Requires: The GSP Regulations require multiple agencies producing GSPs for a subbasin to enter into a coordination agreement "to ensure that the plans are developed and implemented utilizing the same data and methodologies, and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting" (Cal. Code Regs., tit. 23, § 357.4, subd. (a)). The GSP Regulations also require that MTs "for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results" (Cal. Code Regs., tit. 23, § 354.28, subd. (c)(1)) and that description of undesirable results include "potential effects on the beneficial uses and users of groundwater" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(1)).

Deficiency: The revised 2022 DEID GSP indicates that MTs would impact 28 wells, the revised Coordination Agreement indicates the MTs would impact only 8 wells. Furthermore, while the DEID GSP distinguishes between upper and lower aquifer wells, there is no such distinction in the Coordination Agreement, exacerbating the discrepancy. GSPs and the Coordination Agreement should present consistent estimates of wells that may be dewatered at MTs.

Board staff propose Potential Action GL-6 to address the deficiency:

Potential Action GL-6 – Resolve the discrepancy between the Coordination Agreement and the Delano-Earlimart Irrigation District GSP.

Ensure that the correct number of impacted wells at MTs is included in the Coordination Agreement and the DEID GSP. Distinguish between impacted wells in upper and lower aquifers in the Coordination Agreement and the DEID GSP.

Deficiency GL-7 – The Tri-County Water Authority GSP does not explain how it chose the 90th percentile threshold for well completion elevations as the Minimum Thresholds for upper aquifer wells.

What SGMA Requires: The GSP Regulations require that the description of MTs include "the information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator" (Cal. Code Regs., tit. 23, § 354.28, subd. (b)(1)). Furthermore, there should be description of "how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators" (Cal. Code Regs., tit. 23, § 354.28, subd. (b)(2)).

Deficiency: The TCWA GSP does not explain why it uses a 90th percentile threshold to establish MTs. The 90th percentile threshold means that MTs would protect at least 90 percent of wells completed in the upper aquifer but would potentially not protect the remaining 10 percent of wells. Because the GSP does not clarify the plain-language undesirable result, it is unclear that use of the 90th percentile threshold will avoid undesirable results.

Board staff propose that Potential Actions GL-1 and GL-5, which are detailed under Deficiencies GL-1 and GL-5, should address this deficiency.

Deficiency GL-8 – The well mitigation framework provided in the GSPs lacks necessary detail.

What SGMA Requires: Although SGMA and the GSP Regulations do not require development of a well impact mitigation plan, many GSAs have proposed to couple such plans with MTs to allow for greater groundwater level declines while avoiding undesirable results. The 2022 Coordination Agreement states that "during the transition period between 2020 and 2040, each GSA will adopt a Mitigation Program or Programs" (2022 Coordination Agreement, p. 49).

Deficiency: The mitigation framework included in the 2022 GSPs and Coordination Agreement does not provide enough detail about how and when impacted wells would be mitigated. DWR notes in the 2022 GSPs Inadequate Determination that "…the framework does not provide specific details regarding under what conditions or

circumstances the GSAs would take action…" given that "…the mitigation framework appears to be reliant on impacted well owners applying for assistance." DWR also expresses concern that the mitigation framework may rely on modeled rather than observed pre-2015 groundwater elevations to potentially exclude wells. Board staff concur with DWR and further note that wells should not be excluded from mitigation unless they have been continuously dry since before SGMA. Board staff clarify, however, that it may be reasonable for GSAs to use imperfect estimations of wells impacted before SGMA to inform cost or impact analyses, so long as these estimations are not used as a basis to deny mitigation.

Board staff propose the below Potential Action GL-8 to address the deficiency.

Potential Action GL-8 – Establish accessible, comprehensive, and appropriately funded well impact mitigation programs that mitigate impacts to wells affected by lowering of groundwater levels and/or degradation of water quality. Develop well mitigation programs with clear triggers, eligibility requirements, and funding sources.

As appropriate depending on the GSAs revised SMC and other projects and management actions, the GSAs should develop mitigation plans that include mitigation for both declining groundwater levels and water quality impacts. The mitigation plans should:

- Identify clear triggers for well mitigation that avoid undesirable results (e.g., employ mitigation prior to a well losing supply).
- Identify adequate and highly reliable funding sources for mitigation efforts commensurate with the magnitude of impacts allowed under the GSAs' MTs; demonstrating adequate funding may involve projecting out fee revenues to demonstrate financial capacity that matches expected need. Board staff notes that fee revenues levied by the GSAs on groundwater extractions are a more reliable funding source than grants and subsidies.
- Prioritize program accessibility by defining broad eligibility requirements, avoiding reimbursement-based mitigation that may not be accessible to low-income well users, offering translated program materials, and partnering with trusted community leaders and organizations in program development and roll-out.
- Identify approaches for preventing even the temporary loss of safe and reliable drinking water supplies, due to basin management, for people reliant on wells. For example, GSAs may proactively contact the owners of wells that are at risk of impacts from groundwater level declines or water quality degradation. Coordinating proactively with well owners may also reduce the overall financial costs of mitigation by reducing or eliminating the need for interim water supplies.

Mitigation options may include:

- Replacing or deepening wells.

- Support for expansion of public water system boundaries to private well communities or consolidation of smaller drinking water systems dependent on at-risk wells with larger public water systems. This would involve identifying vulnerable areas where consolidation or extension of service is feasible. Consolidation efforts may include: (1) providing financial assistance, particularly for low-cost intertie projects that are adjacent to larger systems, (2) working with County Planning agencies to ensure that communities served by at-risk wells are annexed into the service areas of larger water systems to limit barriers to future interties, and (3) facilitating outreach and introductions between small water systems and owners of domestic wells and larger water systems to assist in developing future partnerships.
- (For water quality degradation) Well water treatment (point-of-entry (POE)) for wells impacted by arsenic, nitrate, 1,2,3-Trichloropropane (1,2,3-TCP), and 1,2-Dibromo-3-chloropropane (DBCP) (State Water Board et. al., 2022), drilling new wells completed in aquifers with better water quality, consolidation of existing water systems, or expanding service areas for existing public water systems not facing water quality impacts.

GSAs should not plan to fund well mitigation via the Safe and Affordable Drinking Water Fund administered through the State Water Board. This funding program was designed for addressing legacy impacts that are not within the scope of SGMA and not for addressing impacts caused by groundwater management actions or inactions by GSAs.

Where GSAs' mitigation plans rely on cooperation with the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) program, the GSAs should explain the relationship between the mitigation programs, including timelines, mitigation strategies, and funding sources.

Deficiency GL-9 – There are inconsistencies in the description of the proposed groundwater level monitoring network between the text, tables, and maps of the 2022 Coordination Agreement.

What SGMA Requires: The GSP Regulations require that all GSPs include descriptions of the "location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used" (Cal. Code Regs., tit. 23, § 354.34, subd. (h)).

Deficiency: There are discrepancies between the text, tables, and maps in the description of the groundwater level monitoring network in the 2022 Coordination Agreement (2022 Coordination Agreement, Attachment 1, p. 5-7, Figure A1-2, and Tables A1-1 and A1-2). The text on page five states both that there are 78 Upper Aquifer monitoring wells and 82 Upper Aquifer monitoring wells. Figure A1-2, which depicts

monitoring well locations, does not resolve the discrepancy. The text and tables identify 27 Upper and 29 Lower Aquifer RMSs for groundwater levels, but Figure A1-2 does not appear to depict all 27 Upper and 29 Lower Aquifer RMSs. There is also no legend description describing the half-circle symbols, for example, wells TSMW-5L/TSMW-5U in the southwest corner of the map. There are four wells listed as RMSs for the Upper Aquifer and one well listed as an RMS for the Lower Aquifer in Tables A1-1 and A1-2 that have no vertical information available for either screen perforation or casing depth. Therefore, it is not clear in which aquifer these wells are completed, yet they are assigned to an aquifer in the monitoring network. Finally, composite wells that contain screen perforation intervals across multiple aquifers are not ideal groundwater level RMSs and may degrade groundwater quality by providing conduits for constituents to travel between aquifers.

Board staff propose the below Potential Action GL-9 and Groundwater Quality Potential Action GWQ-4f to address the deficiency.

Potential Action GL-9 – Resolve monitoring network discrepancies int the Coordination Agreement text, figures, and tables.

Determine and report the correct number of total wells being monitored. Clearly show and label all groundwater level monitoring wells and RMSs in map-view, and ensure the maps are consistent with the text and tables. Determine and report vertical depth and perforated intervals for the four Upper Aquifer and one Lower Aquifer wells that lack this information in the 2022 Coordination Agreement, (2022 Coordination Agreement, Attachment 1, Tables A1-1, A1-2). Then, determine and report which aquifer these wells are monitoring.

4.1.2 Deficiency LS – Defining and Avoiding Undesirable Results Related to Land Subsidence

Another consideration under SGMA is avoiding “significant and unreasonable land subsidence that substantially interferes with surface land uses.” (Wat. Code, § 10721, subd. (x)(5).) Land subsidence from excessive groundwater extraction can cause irreversible damage to infrastructure and aqueduct operations. Land subsidence can also diminish the storage capacity of an aquifer, which reduces the amount of available water for the future.

DWR concluded that the Tule Subbasin 2022 GSPs do not adequately justify the approach for developing SMC for subsidence (See Table 4-3 below). DWR also noted that the GSPs do not clearly define how they avoid “significant and unreasonable effects on critical infrastructure.” (2022 GSPs Inadequate Determination of Tule Subbasin GSP, p. 17) Board staff have built on DWR’s analysis, noting that subsidence may substantially impact the Friant-Kern Canal, and have concluded that the 2022 GSPs

lack a detailed analysis of the effects of subsidence on all beneficial uses and users within the subbasin. Board staff therefore conclude that significant and unreasonable subsidence may occur under the Tule Subbasin 2022 GSPs.

Table 4-3 – Summary of DWR Land Subsidence Deficiency and Relevant Components of the 2020 and 2022 Tule Subbasin GSPs

2020 GSPs	DWR's 2020 GSP Incomplete Determination	2022 GSPs	DWR's 2022 GSP Inadequate Determination
Defined undesirable results for land subsidence in the Subbasin as "a loss of functionality of a structure or a facility to the point that, due to subsidence, the structure or facility, such as the Friant-Kern Canal (Canal), cannot reasonably operate to meet contracted for [sic] water supply deliveries without either significant repair or replacement."	The Coordination Agreement and six GSPs in the Tule Subbasin do not define sustainable management criteria for land subsidence in a manner required by SGMA and the GSP Regulations or provide sufficient explanations of how the undesirable results and minimum thresholds were selected.	Land subsidence that occurs during the transition period from 2020 to 2040 will be considered significant and unreasonable if damage and/or loss of functionality of a structure or a facility occurs to the extent that the structure or facility cannot reasonably operate without either repair or replacement, as determined by the GSA where the structure and facility are located or where beneficial use is impacted due to the damage and/or loss of functionality of the structure or facility.	For areas not adjacent to the Friant-Kern Canal, the plans have not quantified the amount of subsidence that would result in undesirable results, defined the criteria for undesirable results consistent with avoiding significant and undesirable impacts, nor established minimum thresholds and measurable objectives consistent with the intent of SGMA.
Identified only the Friant-Kern Canal as critical infrastructure that could be impacted by land subsidence.	Neither the Coordination Agreement nor the individual GSPs support the definition of an undesirable result with a quantitative	The Coordination Agreement identifies high priority land uses: Gravity-driven water conveyance (canals, turnouts, stream channels, water delivery	The plans do not quantify the amount of subsidence that would result in undesirable results for areas not

	description of the groundwater conditions that would lead to functional impacts to structures and facilities, when and where the effects of land subsidence would cause undesirable results to the Canal, or what loss of functionality to structures or facilities other than the Canal would have that effect.	pipelines, and basins), wells, and flood control infrastructure, and low priority land uses: highways and bridges, railroads, other pipelines, wastewater collection, utilities, and buildings.	adjacent to the Friant-Kern Canal

4.1.2.1 Tule Subbasin 2020 GSP

Plain-language Definition of an Undesirable Result

The 2020 Coordination Agreement defined an undesirable result for land subsidence as "a loss of functionality of a structure or a facility to the point that, due to subsidence, the structure or facility, such as the Friant-Kern Canal (Canal), cannot reasonably operate to meet contracted for [sic] water supply deliveries without either significant repair or replacement." (2020 Coordination Agreement, p. 51). The Friant-Kern Canal was the only critical infrastructure or facility identified by the GSP (ibid).

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

The 2020 Coordination Agreement described an undesirable result as "the unreasonable subsidence below minimum thresholds at greater than 50% of GSA Management Area RMS resulting in significant impacts to critical infrastructure" (2020 Coordination Agreement, p. 51). MOs and MTs were established using subsidence projections based on the Tule Subbasin Groundwater Flow Model at various RMS in the basin (2020 LTRID GSP, Section 3, p.15). Due to the presence of the Friant-Kern Canal, ETGSA adopted a stricter definition of an undesirable result, determining that an exceedance at any single RMS would indicate an undesirable result for the GSA.

Representative Monitoring Sites and Monitoring Network

The 2020 Coordination Agreement describes the use of global positioning surveys (GPS), extensometers, and satellite data using interferometric synthetic aperture radar (InSAR). The GSAs will utilize eight United States Bureau of Reclamation (USBR) GPS stations located along the Friant-Kern Canal, with an additional 102 GPS stations proposed across the subbasin (2020 Coordination Agreement, Attachment 1, p. 16). Currently there is one extensometer located near Porterville, and the Coordination Agreement mentions the possibility of adding additional locations but does not offer any further information on these additions (ibid). Lastly, InSAR data will be used to monitor regional land surface changes (ibid).

Infrastructure Mitigation

The 2020 GSPs did not include specific plans to mitigate the impacts of subsidence even though its SMC allowed continued subsidence. The Coordination Agreement noted that “the Parties to this Agreement agree to work diligently to develop an initial localized mitigation program based on the best available information related to the projected cause of post 2020 subsidence, with the intent to have said mitigation program effective upon or before the occurrence of any localized or basin wide subsidence undesirable result.” but did not provide further details (2020 Coordination Agreement, p. 57). Further, “the Parties have begun to work with Friant Water Authority on the development of a Friant-Kern Canal mitigation program, potentially to include targeted pumping reductions and mitigation fees, to be imposed by GSAs within specific areas, based on an analysis of each GSA’s likely proportional impact on post 2020 subsidence" (ibid).

Projects and Management Actions

The 2020 Coordination Agreement states that “Projects and management actions will be implemented by each GSA in order to decelerate and eventually arrest land subsidence within the Tule Subbasin by 2040, including measures necessary to reduce or eliminate land subsidence significantly and unreasonably affecting the functionality or a structure or facility, such as the FKC.” (2020 Coordination Agreement, p. 51). The projects and management actions identified in the 2020 Coordination Agreement and GSPs generally included supply augmentation (recharge projects, expanding distribution system, developing water banks, improving surface water storage, and capturing of flood water) (2020 Coordination Agreement, Table 2-6).

The discussion of projects and management actions was general and did not specify the criteria that would trigger implementation, a timetable for implementation, a description of how the GSAs would meet costs, or an explanation of the source and reliability of the water necessary for the supply augmentation projects. Instead, the 2020

Coordination Agreement stated that “the GSAs will need to develop and implement projects and management actions to either prevent or mitigate for the undesirable results from post 2020 subsidence that is likely to occur as the subbasin works towards sustainability.” (ibid., p. 57).

4.1.2.2 DWR’s 2020 GSP Incomplete Determination

In the January 28, 2022, DWR Incomplete Determination Letter, DWR identified a deficiency in the 2020 GSPs related to land subsidence SMC:

> Deficiency 2. The [2020] GSPs do not define undesirable results or set minimum thresholds and measurable objectives for land subsidence in a manner consistent with the GSP regulations (2020 GSPs Incomplete Determination, p. 13).

Plain-language Definition of an Undesirable Result

The DWR 2020 GSP Incomplete Determination indicated that the GSAs should “revise their minimum thresholds and measurable objectives for land subsidence to be consistent with the intent of SGMA that subsidence be avoided or minimized once sustainability is achieved” (2020 GSPs Incomplete Determination, p. 17).

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

DWR staff noted issues with the way the GSAs defined an undesirable result, noting that:

> Neither the Coordination Agreement nor the individual GSPs support [the definition of an undesirable result] with a quantitative description of the groundwater conditions that would lead to functional impacts to structures and facilities, when and where the effects of land subsidence would cause undesirable results to the Canal, or what loss of functionality to structures or facilities other than the Canal would have that effect (ibid., p. 14).

Further, DWR staff concluded that:

> the lack of clearly defined undesirable results… mean that it would be impossible to understand and monitor whether the GSPs are managing the Subbasin in a manner that would achieve the sustainability goal and avoid impacts to land uses and property interests (ibid., p. 14)

The 2020 GSPs and the 2020 Coordination Agreement describe land uses and property interests susceptible to land subsidence but fail to describe how the determined SMC would protect said land uses and property interests.

DWR's 2020 GSP Corrective Actions

DWR staff proposed a four-part corrective action to address the subsidence deficiency in the 2020 GSPs. DWR staff recommended that:

a) For areas defined as adjacent to the Canal in the Eastern Tule GSP, DEID GSP, and LTRID GSP areas, the GSAs should identify, through analysis, the total amount of subsidence that can be tolerated by the Canal during implementation of the GSPs to maintain the ability to reasonably operate to meet contracted water supply deliveries. Eastern Tule GSA, DEID GSA, and LTRID GSA should explain how implementation of the projects and management actions is consistent with both achieving the long-term avoidance or minimization of subsidence and not exceeding the tolerable amount of cumulative subsidence adjacent to the Canal.

i. GSPs adjacent to the Canal should provide an updated description of the Land Subsidence Management and Monitoring Plan and the associated subsidence management in the vicinity of the Canal. The GSPs should include details of any projects, management actions, or mitigation programs associated with the management of land subsidence in the Subbasin.

b) For areas not adjacent to the Canal, the GSAs should identify facilities and/or structures, land uses and property interests that may be susceptible to impacts from land subsidence and should quantify the amount of land subsidence that would result in undesirable results. The GSAs should describe the rationale and any analysis performed to inform the quantification of undesirable results in these areas.

c) Tule Subbasin GSAs should define the criteria for when undesirable results occur in the Subbasin based on the results of analyses completed in response to Corrective Actions 1 and 2, the rationale behind the approach, and why it is consistent with avoiding the significant and unreasonable effects identified by the GSAs.

d) The GSAs should revise their minimum thresholds and measurable objectives for land subsidence to be consistent with the intent of SGMA that subsidence be avoided or minimized once sustainability is achieved. In doing that, the GSAs should identify a cumulative amount of tolerable subsidence that, if exceeded, would substantially interfere with groundwater and land surface beneficial uses and users in the Subbasin. The GSPs should explain how the extent of any future subsidence permitted by the GSPs would not substantially interfere with surface land uses. The GSAs should explain how implementation of the projects and management actions is consistent both with achieving the long-term avoidance or minimization of subsidence and with not exceeding the tolerable amount of cumulative subsidence (ibid p. 17-18).

4.1.2.3 Tule Subbasin 2022 GSP Submission

The GSAs submitted six revised GSPs to DWR on July 27, 2022, in compliance with the 180-day resubmittal deadline.

Plain-language Definition of an Undesirable Result

The 2022 Coordination Agreement defines an undesirable result for land subsidence as "if damage and/or loss of functionality of a structure or a facility occurs to the extent that the structure or facility cannot reasonably operate without either repair or replacement, as determined by the GSA where the structure and facility are located or where beneficial use is impacted due to the damage and/or loss of functionality of the structure or facility."

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

The 2022 Coordination Agreement states that "the quantitative definition of undesirable results for land subsidence is ongoing land subsidence below the minimum threshold at any given RMS Site that cannot be attributable to recoverable land subsidence" (2022 Coordination Agreement p. 56). The methods for establishing MTs and MOs remain the same as the 2020 Coordination Agreement and GSPs.

Representative Monitoring Sites and Monitoring Network

The 2022 Coordination Agreement proposes the same methods of monitoring as the 2020 Coordination Agreement and mentions the addition of 34 benchmark stations established by the Friant Water Authority (FWA).

Infrastructure Mitigation

To address the potential impacts of land subsidence to infrastructure and other land uses in the Tule Subbasin, the GSAs plan to adopt a Mitigation Program Framework by each GSA individually to mitigate the land subsidence impacts of GSA-related activities on different land uses (2022 Coordination Agreement, Attachment 7). For claims of impacts to land uses from land subsidence, the process may include an application by the affected party and well owner, data collection and investigation by the GSA to verify the claim, identification of suitable mitigation, and coordination, as necessary, with said affected parties to implement the mitigation (ibid).

Projects and Management Actions

The GSAs did not update projects and management actions in the 2022 Coordination Agreement (2022 Coordination Agreement, Table 2-6). To address land subsidence along the Friant-Kern Canal, the ETGSA developed a Land Subsidence Monitoring Plan and Management Plan to implement groundwater management measures to minimize future non-recoverable land subsidence along the canal in the 20-year transition period and to arrest nonrecoverable land subsidence after 2040. Management Zones have been identified to implement management actions. The Monitoring Plan includes an enhanced benchmark and groundwater level monitoring network, the establishment of a monitoring and management committee, and annual reporting. The Management Plan establishes management action criteria for implementing enhanced management actions according to four certain thresholds called Tiers (2022 Coordination Agreement, Attachment 6).

4.1.2.4 Proposed State Water Board Deficiencies and Potential Actions

DWR's 2022 GSPs Inadequate Determination dated March 2, 2023, found that the subsidence deficiency was not corrected in the 2022 GSPs submitted on July 27, 2022. DWR's 2022 GSPs Inadequate Determination states:

> …the Plan has not quantified the amount of subsidence that would result in undesirable results, defined the criteria for undesirable results consistent with avoiding significant and undesirable effects, nor established minimum thresholds and measurable objectives consistent with the intent of SGMA (2022 GSPs Inadequate Determination, p. 23).

Board staff concur with DWR's findings in the 2022 GSPs Inadequate Determination and hereby incorporate them by reference. Board staff have also identified additional, related issues. Below, Board staff describe Tule basin subsidence deficiencies, incorporating DWR's inadequate determination as appropriate. Deficiencies include:

- LS-1: Identified by DWR.
- LS-2 through LS-4: Identified by DWR. Additional concerns noted by Board staff.

Deficiency Land Subsidence (LS)-1 - The 2022 GSPs do not clearly describe subsidence conditions that would reasonably be expected to cause undesirable results.

What SGMA Requires: The GSP Regulations require a GSA to "describe...the processes and criteria relied upon to define undesirable results applicable to the basin." This description must include the cause of past or potential undesirable results, "the criteria used to define when and where the effects of the groundwater conditions cause

undesirable results," and the potential effects of undesirable results on groundwater uses and users, land uses, and property interests (Cal. Code Regs., tit. 23, § 354.26).

Deficiency: The 2022 Coordination Agreement claims without adequate justification that ongoing subsidence at current rates would not cause undesirable results for "low priority land uses" and therefore fails to establish reasonable subsidence SMC. DWR notes in its 2022 GSP Inadequate Determination that the GSAs "determined that the forecasted land subsidence during the transition period, which was of a similar magnitude to what had been historically measured, was not anticipated to result in undesirable results to land uses or critical infrastructure because no undesirable results had previously been reported as a result of historical land subsidence in those areas." (2022 GSPs Inadequate Determination, p. 17-18). GSAs used this determination to establish quantitative undesirable result definitions and associated MTs that allowed continued subsidence at near-current rates. DWR, however, notes that "GSAs have not demonstrated subsidence undesirable results are not present and are not likely to occur." (2022 GSPs Inadequate Determination, p. 18). DWR therefore finds that the "[2022 Coordination Agreement] does not quantify the amount of land subsidence that would result in undesirable results for areas not adjacent to the Canal" (2022 GSPs Inadequate Determination, p. 17). DWR also finds that "in addition to not quantifying the amount of subsidence that would be considered undesirable for areas of the Subbasin not adjacent to the Friant-Kern Canal, the GSAs have also not defined the criteria for when undesirable results occur in the Subbasin" (2022 GSPs Inadequate Determination, p. 17).

The GSPs do not clearly quantify the degree of impacts related to subsidence that are "significant and unreasonable." GSAs and the State Water Board therefore cannot evaluate whether the proposed MTs are adequate or if the broader quantitative definition of an undesirable result would guide day-to-day basin management as appropriate for avoiding plain-language undesirable results.

Board staff propose the below Potential Action LS-1 to address the deficiency.

Potential Action LS-1 – Clearly define the subsidence conditions that would result in an undesirable result for the basin and provide enough detail that associated Minimum Thresholds can be determined (Cal. Code Regs., tit. 23, § 354.28).

The current plain-language definition of an undesirable result for subsidence is "if damage and/or loss of functionality of a structure or a facility occurs to the extent that the structure or facility cannot reasonably operate without either repair or replacement, as determined by the GSA where the structure and facility are located or where beneficial use is impacted due to the damage and/or loss of functionality of the structure or facility." The GSPs should therefore define the amount of subsidence that would require repairs to infrastructure or the GSPs should develop a new plain-language

undesirable result that is more easily quantified. After the GSPs define the amount of subsidence that would cause an undesirable result, the GSPs should develop 1) associated MTs that directly correlate to a quantitative undesirable result and 2) associated MOs that provide operational flexibility above MTs.

Deficiency LS-2 – The GSAs did not set Minimum Thresholds in accordance with DWR Regulations.

What SGMA Requires: The GSP Regulations state that MTs for land subsidence should identify the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. These quantitative values should be supported by:

- The identification of land use or property interests potentially affected by land subsidence
- An explanation of how impacts to those land use or property interests were considered when establishing minimum thresholds
- Maps or graphs showing the rates and extent of land subsidence defined by the minimum thresholds (Cal. Code Regs., tit. 23, § 354.28, subd. (c)(5)).

MOs for land subsidence must be based on the same metrics and monitoring sites used for MTs. MOs must "provide a reasonable margin of operational flexibility under adverse conditions" (Cal. Code Regs., tit. 23, § 354.30, subd. (c) & (d)).

GSAs must also establish interim milestones (IMs) for each sustainability indicator, "using the same metric as the measurable objective, in increments of five years." These IMs support the GSP's description of "a reasonable path to achieve the sustainability goal for the basin within 20 years of implementation" (Cal Code Regs., tit. 23, § 354.30, subd. (e)).

Deficiency: The DWR 2022 GSP Inadequate Determination noted that "the Plan does not quantify the amount of land subsidence that would result in undesirable results for areas not adjacent to the [Friant-Kern] Canal" (ibid., p. 17). This deficiency includes two sub-deficiencies: LS-2a and LS-2b.

Deficiency LS-2a – Minimum Thresholds were not established based on avoiding undesirable results.

The DWR 2022 GSP Inadequate Determination found that "the GSAs have not identified a cumulative amount of tolerable subsidence that, if exceeded, would substantially interfere with groundwater and land surface beneficial uses and users in the Subbasin" (ibid. p. 18). Instead, the 2022 GSPs established MTs for areas not

adjacent to the Friant-Kern Canal based on the unsupported claim that the current rate of subsidence could continue through 2040 without causing undesirable results.

Moreover, the GSPs MTs for “low priority land uses,” which they define as “highways and bridges, railroads, other pipelines, wastewater collection, utilities, and buildings,” are based on the unsupported claim that “low priority land uses” would not be impacted by ongoing subsidence at current rates. These “low priority land use” MTs are therefore based on projections of anticipated subsidence through 2040 at near-current rates rather than on avoiding significant and unreasonable impacts. GSPs identify “high priority land uses” as gravity-driven water conveyance systems (canals, turnouts, stream channels, water delivery pipelines, and basins), wells, and flood control infrastructure. The only MTs, however, that are based on potential significant and unreasonable impacts are MTs along the Friant-Kern Canal.

Board staff proposes the below Potential Action LS-2a to address the deficiency.

Potential Action LS-2a – Define and clearly list Minimum Thresholds based on the level of subsidence at each RMS that would cause the undesirable results conditions that the GSAs are trying to avoid.

The 2022 Coordination Agreement established MTs based on projected subsidence using a groundwater flow model. This approach does not provide MTs that would avoid undesirable results. It instead provides MTs based on subsidence the GSAs expect to experience given implementation of current projects and management actions. MTs should be used to assess the adequacy of projects and management actions in avoiding undesirable results, not the other way around. The 2022 GSPs effectively reverses this relationship.

Deficiency LS-2b – Some Minimum Thresholds appear to exceed subsidence limits set in other pre-existing agreements and there are Minimum Thresholds discrepancies between documents.

The DWR 2022 GSPs Inadequate Determination notes that MTs for multiple RMS appear to exceed the allowable subsidence along the Friant-Kern Canal. DWR staff note that ETGSA and Pixley GSA have an agreement with the Friant Water Authority to limit subsidence along the canal to less than three feet. However, MTs at multiple RMS allow more than three feet of subsidence, with MTs ranging from 0.88 to 4.01 total feet of allowable subsidence by 2040 (2022 ETGSA GSP, Section 5, p. 40). Additionally, the ETGSA GSP lists different subsidence MTs than those listed in the WY 2022 ETGSA Annual Report, making it difficult for Board staff to evaluate MT values and subsidence conditions.

Potential Action LS-2b – Ensure Minimum Thresholds conform with current agreements with other agencies and match between documents.

MTs should harmonize with the terms of the agreement with the Friant Water Authority to keep subsidence along the canal to below three feet. Additionally, subsidence MTs listed in the GSPs should align with those used in the annual reports.

Deficiency LS-3 – The GSPs do not provide adequate implementation details and are not on track to avoid serious impacts to the Friant-Kern Canal.

What SGMA Requires: Each GSP is required to include a description of the projects and management actions the GSA has determined will achieve groundwater sustainability in the basin. The description must include project management actions, summary of data used to support proposed actions, and a review of the uncertainty associated with the basin setting when developing projects or management actions (Cal. Code Regs., tit. 23, § 354.44).

In reviewing GSPs, DWR must consider, among other questions, "whether sustainable management criteria and projects and management actions are commensurate with the level of understanding of the basin setting, based on the level of uncertainty, as reflected in the plan" and "whether the projects and management actions are feasible and likely to prevent undesirable results and ensure that the basin is operated within its sustainable yield" (Cal. Code Regs., tit. 23, § 355.4, subd. (b)(3), (5)).

Deficiency: The 2022 DWR Inadequate Determination notes that the 2022 Coordination Agreement provides little detail about projects and management actions to slow subsidence. DWR also notes that subsidence along the Friant-Kern Canal has already exceeded 1.5 feet since 2020. Board staff concur, and further note concern that subsidence along the Friant-Kern Canal may indicate that the ETGSA Land Subsidence Management Plan is not adequately slowing subsidence rates. DWR further notes that the lack of adequate project and management actions detail indicates that the GSPs do not appear to have plans to prevent monitoring sites from exceeding their MT of three feet of subsidence. DWR staff note that the 2022 GSPs "[have] not indicated the rate at which land subsidence will be abated" and is concerned that the plan is "not on track to meet its goals" (2022 GSPs Inadequate Determination, p. 16).

Recent InSAR data spanning June 2015 to October 2023 indicate total land subsidence ranging from zero to a maximum of 3.4 ft (near Terra Bella) in one mile buffer areas adjacent to the Friant-Kern Canal. The rates of subsidence along the Friant-Kern Canal are especially concerning given that the 2022 GSPs MTs are not designed to avoid undesirable results and appear inconsistent with existing agreements to protect the canal in some areas. It is therefore crucial that the GSPs provide adequate detail about projects and management actions to evaluate feasibility. It is unlikely current subsidence rates provide operational flexibility against undesirable results.

Board staff proposes the below Potential Actions LS-3a, LS-3b, and LS-3c to address the deficiency.

Potential Action LS-3a – Develop and implement a plan to trigger sufficient management actions when subsidence exceeds defined thresholds, especially near critical infrastructure/facilities.

Water Board staff recognize the ETGSA Land Subsidence Management Plan includes plans for subsidence abatement, but the GSPs should include detailed demand management plans for the entire subbasin to provide contingency in case future conditions are more difficult than anticipated. The GSAs should develop and implement reasonable actions (e.g., pumping reductions for nearby wells) to halt subsidence along critical infrastructure when it exceeds defined thresholds, and ensure these thresholds are established in a manner that avoids undesirable results. Because pumping is the primary cause of subsidence in the subbasin, GSAs should identify the wells that have the greatest impact on subsidence near critical infrastructure and the specific aquifers from which they pump and reduce or eliminate pumping from these wells if thresholds are exceeded.

These management plans should ensure that subsidence is monitored frequently enough that triggered actions avoid undesirable results. If actions aren't triggered, for example, until right before MTs are exceeded, the quarterly monitoring provided by InSAR data may not be frequent enough to avoid exceedances. In these cases, continuous, ground-based GPS monitoring may be necessary.

Potential Action LS-3b – Reduce pumping and do not allow new wells in areas where subsidence threatens critical infrastructure.

GSAs should develop a well registration program to prevent new wells from being installed near, and move existing wells away from, critical infrastructure. The GSAs should proactively analyze the ongoing impacts of subsidence on critical infrastructure to determine not just where new wells should not be installed, but also where existing wells should be relocated or decommissioned to protect essential infrastructure. Moreover, GSAs should limit groundwater pumping to prevent subsidence from substantially interfering with the Friant-Kern Canal.

Potential Action LS-3c - Develop infrastructure mitigation programs with clear triggers, eligibility requirements, metrics, and funding sources.

GSAs should minimize or avoid subsidence, as it causes irreversible harm; however, GSAs should also develop mitigation plans to repair infrastructure damaged by subsidence. The mitigation plans should:

- Identify infrastructure that may be damaged by subsidence and estimate associated repair costs.
- Identify adequate and reliable funding sources for mitigation efforts commensurate with the magnitude of impacts allowed under the GSPs' MTs; demonstrating adequate funding may involve projecting out fee revenues to demonstrate financial capacity that matches expected need. Board staff notes that fee revenues levied by the GSAs on groundwater extractions are a more reliable funding source than grants and subsidies.
- Coordinate with local agencies responsible for maintaining and repairing infrastructure so that they understand how to apply for mitigation funds.

GSAs should not plan to fund infrastructure repairs necessitated by land subsidence with state or federal funding. For example, GSAs should develop funding necessary to restore capacity to canals rather than planning to rely on funding from DWR.

Deficiency LS-4 – The Tri-County Water Authority GSP does not define Undesirable Results and Sustainable Management Criteria consistent with the Subbasin Coordination Agreement.

What SGMA Requires: Agencies choosing to develop multiple GSPs "shall enter into a coordination agreement to ensure that the Plans are developed and implemented utilizing the same data and methodologies and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting" (Cal. Code Regs., tit. 23, § 357.4a).

Deficiency: The TCWA GSP's definition of an undesirable result and SMC differs from the Subbasin Coordination Agreement and other GSPs within the subbasin. The TCWA is located in both the Tule and Tulare Lake basins, and it appears that the TCWA GSP for the Tule basin defined its undesirable result and SMC consistent with the 2022 Tulare Lake GSP. It is therefore unclear whether the GSPs in the Tule subbasin are coordinated.

Potential Action LS-4 – Define undesirable results consistently throughout the subbasin.

The TCWA GSP should be revised to define an undesirable result and related SMC consistent with the goals of SGMA and the remainder of the Tule subbasin.

Deficiency LS-5 – The GSPs do not address undesirable results caused by land subsidence after 2040, and instead allow for residual subsidence to continue after 2040.

What SGMA Requires: SGMA requires that basins achieve their sustainability goal within 20 years of plan implementation (Wat. Code § 10727.2 subd. (b)(1)), which requires operating the basin within its sustainable yield (Wat. Code § 10721 subd. (u)) while avoiding undesirable results (Wat. Code § 10721 subd. (v)). SGMA does not differentiate between total and residual subsidence, so GSPs must also consider residual subsidence when avoiding undesirable results.

Deficiency: The 2022 Coordination Agreement states "residual land subsidence resulting from historical groundwater conditions may occur after 2040," yet the GSAs do not ensure this continued subsidence will not cause undesirable results (ibid. p. 55). DWR's 2022 Determination Letter notes that "SGMA and the GSP Regulations does not differentiate residual subsidence; therefore, GSAs should assess total subsidence impacts causes by groundwater pumping" and that "SGMA requires GSAs to avoid or minimize subsidence and the GSAs have not demonstrated the Plan's intent to accomplish this" (ibid. p. 19).

Potential Action LS-5 – Do not allow land subsidence to occur past 2040.

The GSAs should prevent or minimize all subsidence and consider all subsidence when defining an undesirable result. GSAs should evaluate pumping data in conjunction with subsidence data and limit pumping to ensure groundwater extractions do not cause any subsidence after 2040, and that continued pumping prior to 2040 ramps down to ensure subsidence will stop prior to 2040. GSAs should ensure that demand management actions or other mitigation measures are implemented if existing projects and management actions do not work as planned.

4.1.3 Deficiency GWQ – Degraded Groundwater Quality

Another consideration under SGMA is avoiding "significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies" (Wat. Code, § 10721, subd. (x)(4)). Degradation of water quality can limit local water supplies and beneficial uses, and SGMA requires GSAs to consider the interests of all beneficial uses and users of groundwater such as: drinking water uses (Municipal, Public Water system, and Domestic well), agricultural uses, and environmental uses (Wat. Code, § 10723.2). Water quality degradation that significantly and unreasonably affects the supply or suitability of groundwater for use in drinking water systems is an undesirable result. SGMA also requires that each GSP shall develop a sufficient monitoring network (Cal. Code Regs § 354.34).

DWR concluded that the Tule Subbasin 2020 GSP did not provide sufficient information to justify their approach for setting SMC for degraded groundwater quality because: (1) the GSPs did not specify which groundwater conditions are suitable for agricultural irrigation and domestic users, (2) the GSPs do not explain how the use of a 10-year running average for setting SMC will avoid undesirable results, and (3) the GSPs do not explain how the SMC relate to existing groundwater regulatory requirements in the subbasin and how the GSAs will coordinate with local agencies. DWR gave the GSAs 180 days to address and resolve this deficiency.

DWR conducted another review of the Tule Subbasin 2022 GSPs submitted after the 180 days and concluded that the GSAs took sufficient actions to correct the deficiencies by redefining groundwater quality conditions suitable for agricultural and domestic use based on existing regulatory agency standards. Board staff acknowledge the effort the subbasin made in resolving the DWR deficiency. However, board staff also reviewed the 2022 GSPs and have additional concerns on the potential impacts the SMC for groundwater quality, monitoring network, and projects and management actions would have on beneficial uses and users in the subbasin.

Table 4-4 – Summary of DWR's Degraded Groundwater Quality Deficiency and Relevant Components of the 2020 and 2022 Tule Subbasin GSPs

2020 GSPs	**DWR's 2020 GSP Incomplete Determination**
• The GSPs define an undesirable result as "the significant and unreasonable reduction in groundwater quality due to pumping and recharge projects such that groundwater is no longer generally suitable for agriculture or domestic use." • undesirable results occur when 50% or more of RMS exceed MTs because of groundwater pumping or groundwater recharge. • Four GSPs set MOs and MTs based on running 10-year averages of existing exceedances while two GSPs do not set MOs or MTs • GSPs do not explain how undesirable results would affect beneficial uses and users within the subbasin	The GSP do not provide sufficient information to justify the proposed Sustainable Management Criteria for degraded water quality. • The GSPs do not specify what groundwater conditions are considered suitable for agricultural irrigation and domestic use. • GSPs do not explain how continued degradation of groundwater quality will avoid groundwater quality conditions that are generally not suitable for agricultural irrigation and domestic use. • GSPs do not explain how MTs may impact beneficial

	uses and users within the Subbasin.
2022 GSPs	**DWR's 2022 GSP Inadequate Determination**
The GSAs revised the coordination agreement to include a technical memorandum developed in response to DWRs 2022 groundwater quality deficiency. The technical memorandum includes the following revisions: • Undesirable result is defined as "the exceedances of an MT at a groundwater quality representative monitoring site in any given GSA boundary resulting from the implementation of the plan." • MTs are set to regulatory maximum contaminant limits or water quality objectives (WQOs) based on the beneficial uses and users of the individual representative monitoring site. • Representative monitoring sites SMC are defined based on Title 22 drinking water standards if the RMS is located within an urban area, within 1-mile of a PWS, or the primary beneficial use is drinking water. • Representative monitoring sites SMC are defined as WQO if the primary use is agricultural and is not located within an urban area, within 1-mile of a PWS, or the primary beneficial use is drinking water.	DWR staff believe sufficient actions have been taken to address the deficiency related to degraded groundwater quality.

4.1.3.1 Tule Subbasin 2020 Groundwater Sustainability Plans

This subsection and the following subsections describe the portions of each GSP or DWR determination relevant to the proposed Board deficiencies.

Plain-language Definition of an Undesirable Result

The 2020 GSPs defined the undesirable result as "the significant and unreasonable reduction in groundwater quality due to pumping and recharge projects such that

groundwater is no longer generally suitable for agriculture or domestic use" but do not define what is suitable groundwater quality for agricultural and domestic use.

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

The 2020 GSPs defined a water quality undesirable result to be when 50% of RMS are exceeded within the subbasin. Two of the GSAs, Alpaugh and Tri-County did not identify constituents of concern within their management areas. The remaining GSAs set MOs at 110% and MTs at 115% of a 10-year running average of established constituents of concern, where defined. Associated impacts to beneficial uses and users are not discussed in the GSPs. Additionally, the GSPs do not explain how the sustainable management criteria for degraded water quality relate to existing groundwater regulatory requirements in the subbasin, and how the GSAs will coordinate with existing agencies and programs to assess whether implementation of the GSPs is contributing to the degradation of water quality throughout the subbasin.

Monitoring

The 2020 Tule Coordination agreement included the Tule Subbasin Monitoring Plan (TSMP; Attachment 1). The purpose of the TSMP is to ensure that sufficient data is collected (in quantity, areal distribution, frequency, and accuracy) to achieve the measurable objectives of each GSA and to achieve the sustainability goal of the subbasin (2020 Coordination Agreement, Attachment 1. p. 2). The TSMP proposes collecting and analyzing groundwater samples annually during summer months from 76 wells throughout the Subbasin (**Figure 4-1**). Of the 76 identified RMS, 15 contain construction information. The TCWA GSP is missing construction information. The listed RMS would include 6 composite wells (wells screened between multiple aquifers). At these RMS, the GSAs would sample Nitrate as N, pH, dissolved oxygen (DO), temperature and electrical conductivity (EC). Every five years, GSAs would sample additional analytes, major cations and anions, and TDS. The GSPs do not define how the sampling of these constituents at these intervals is protective of all beneficial uses and users within the subbasin.

The TSMP states, "Groundwater quality degradation in the Tule Subbasin is being monitored and regulated under the ILRP and CV-salts regulatory programs. Monitoring of groundwater quality as it is related to the sustainability of the Tule subbasin is focused on potential changes in the direction and/or flow rate of existing point-source groundwater contaminant plumes. As changes in the movement of the plumes occur because of changes in the groundwater levels, the RMS identified for groundwater levels serves as a proxy representative monitoring sited for potential movement of existing groundwater contaminant plumes." Additionally, the TCWA GSP recommended that water samples be collected from all active irrigation and dairy wells in the TCWA

GSA, during periods of heavy pumping, at least once every three years for analyses of irrigation suitability parameters.

4.1.3.2 DWR's 2020 GSP Incomplete Determination

In its January 28, 2022, incomplete determination letter, DWR identified a deficiency in the subbasin's 2020 GSPs related to water quality SMC:

> Deficiency 3 – The [2020] GSPs do not provide sufficient information to justify the proposed sustainable management criteria for degraded water quality.
>
> [This] deficiency relates to the three sub-deficiencies defined by DWR:
>
> 1. The GSPs do not specify what groundwater conditions are considered suitable for agricultural irrigation and domestic use. The GSPs do not explain the choice of constituents (pH, conductivity, and nitrate) as a means of evaluating impacts to beneficial uses and users, especially for agricultural irrigation.
> 2. The GSPs do not explain how the use of a 10-year running average to establish the sustainable management criteria will avoid undesirable results due to degraded groundwater quality and related potential effects of the undesirable results to existing regulatory standards. The GSPs do not explain undesirable results criteria and rational and how they would avoid significant and unreasonable effects associated with groundwater pumping and other aspects of the GSAs' implementation of their GSPs.
> 3. The GSPs do not explain how the sustainable management criteria for degraded water quality relate to existing groundwater regulatory requirements in the Subbasin and how the GSAs will coordinate with existing agencies and programs to assess whether or not implementation of the GSPs is contributing to the degradation of water quality throughout the Subbasin (2020 GSPs Incomplete Determination, p. 18-21).

Plain-Language Definition of an Undesirable Result

DWR staff noted that an undesirable result due to degraded water quality was defined in the Tule Coordination agreement as, "the significant and unreasonable reduction in groundwater quality due to groundwater pumping and recharge projects such that the groundwater is no longer generally suitable for agricultural irrigation and domestic use" (ibid).

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

The DWR Determination letter stated, "DWR staff found that the GSPs do not explain how continued degradation of groundwater quality… will avoid groundwater quality conditions that are not generally suitable for agricultural irrigation and drinking water use. This allowable continued degradation approach appears incapable of maintaining water quality above known water quality standards for agricultural irrigation and domestic use. Without a discussion of what is considered suitable for agricultural irrigation and domestic use, or a discussion of how the proposed sustainable management criteria relate to existing groundwater quality regulatory requirements in the Subbasin (e.g., Irrigated Lands Regulatory Program, Drinking Water Standards, Central Valley Salinity Alternatives for Long-Term Sustainability, etc.), DWR staff cannot assess whether the proposed sustainable management criteria will avoid undesirable results. Further, the GSAs do not explain how minimum thresholds may affect the interest of beneficial uses and users of groundwater in the Subbasin" (ibid., p. 20).

DWR's 2020 GSP Corrective Actions

To address the water quality deficiency in the 2020 GSPs, DWR staff recommended that the GPSs discuss:

> 1. What groundwater quality conditions are considered suitable for agricultural irrigation and domestic use using the best available information and science, including information from existing groundwater quality programs, agencies, and regulatory standards. The GSPs should also explain why pH and conductivity in addition to nitrate are suitable constituents to evaluate impacts to beneficial uses and users, especially agricultural irrigation.
>
> 2. How… the sustainable management criteria for degraded water quality will avoid undesirable results due to degraded groundwater quality and relate potential effects of the undesirable results to existing regulatory standards. Clarify how the criteria defining when undesirable results occur in the Subbasin were established, the rationale behind the approach, and why it is consistent with avoiding the significant and unreasonable effects associated with groundwater pumping and other aspects of the GSAs' implementation of their GSPs. Additionally, the GSPs should describe and disclose how the GSAs will assess whether any future degradation in groundwater quality is due to groundwater pumping and recharge projects occurring during GSP implementation.
>
> 3. How the sustainable management criteria for degraded water quality relate to existing groundwater quality regulatory requirements in the Subbasin and how the GSAs will coordinate with existing agencies and programs to assess whether or not

implementation of the GSPs are contributing to the degradation of water quality throughout the Subbasin (ibid., p. 20-21).

4.1.3.3 Tule Subbasin 2022 GSP Submission and WY 2022 Annual Report

The GSAs submitted a revised GSP to DWR on July 27, 2022, in compliance with the 180-day resubmittal deadline. While not considered in DWR's assessment of the 2022 GSPs, the GSAs also filed six WY 2022 Annual Reports, for each GSP, in the subbasin on March 31, 2023. Additionally, the GSPs submitted a revised coordination agreement.

Plain-Language Definition of an Undesirable Result

The 2022 Coordination Agreement defines an undesirable result, relating to groundwater quality, as:

> The significant and unreasonable degradation of groundwater quality due to groundwater pumping and recharge projects such that the quality of groundwater is no longer generally suitable for agricultural and/or domestic use (2022 Coordination Agreement, p. 53).

The definition is consistent with the 2020 Coordination Agreement definition of an Undesirable Result. However, the Tri-County Water Authority defines an undesirable result as occurring for degradation for groundwater quality when:

> The result is stemming from a casual nexus between groundwater-related activities, such as groundwater extraction or recharge, and a degradation in groundwater quality that causes a significant and unreasonable reduction in long-term viability of domestic, agricultural, municipal, or environmental uses over the planning and implementation horizon of this GSP (2022 TCWA GSP, GSP Addendum, p. 29).

This is consistent with the defined undesirable result in the [2022] Tulare Lake GSP for groundwater quality and is not consistent with the undesirable result defined in the Tule subbasin Coordination agreement. (ibid., p. 29 and 2022 Tulare Lake Subbasin GSP, Addendum, p. 37).

Quantitative Definition of an Undesirable Result, Minimum Thresholds and Measurable Objectives and Associated Impacts

The 2022 Coordination agreement defined constituents of concern within the subbasin for drinking water users and agricultural groundwater use. The nine drinking water constituents of concern for drinking water beneficial uses are arsenic, nitrate, hexavalent chromium, dibromochloropropane (DBCP), 1,2,3-Trichloropropane (TCP), tetrachloroethene (PCE), chloride, total dissolved solids (TDS), and perchlorate concentrations (2022 Coordination Agreement, Attachment 2, p. 18). Constituents

defined for agricultural use were chloride (Cl), sodium (Na), and total dissolved solids (TDS) (ibid.). These constituents were defined as constituents of concern based on 2017-2022 groundwater quality data (ibid.).

Additionally, the GSAs amended the plain-language definition of an undesirable result. The 2022 Coordination Agreement defines an undesirable result to occur when:

> The exceedance of a minimum threshold at a groundwater quality RMS in any given GSA resulting from the implementation of a GSP. This condition would indicate that more aggressive management actions were needed to mitigate the overdraft (ibid, p. 53).

The GSPs defined, in the 2022 Coordination agreement, a new approach for setting MTs dependent on beneficial uses and users. The 2022 coordination agreement defined the new criteria to set MT for groundwater quality will be established based on local regulatory thresholds (MCLs/SMCLs), for drinking water RMS, or the WQO, for agricultural RMS. The type of RMS and MTs set are dependent on the dominant user for that area and is defined based on the following scenarios (ibid., p. 61):

- If the majority of the beneficial use (greater than 50% the [sic] wells within a determined area) is agricultural and there are no public water systems (including schools) the minimum threshold would be a host of agricultural water quality constituents.
- If an RMS well is located within an urban area, within one mile of a public water system, which includes schools, or the dominant beneficial use (greater than 50% of the wells within the determined area) is drinking water, then the minimum threshold would be set at the MCL for drinking water.
- In cases where both of the above criteria are found to be true, the minimum thresholds would be established for both drinking water MCLs and agricultural WQO's and minimum thresholds would be set at the most stringent of the two when considering common constituents.
- If drinking water MCLs or agricultural WQOs were historically exceeded at an RMS well or found not be a result of implementation of a GSP, the GSA will coordinate with the responsible regulatory agency to prevent GSA SGMA activities from further degrading groundwater quality.

Minimum Thresholds set in accordance with the above criteria are defined in Table 4-5 (ibid., p. 60). To summarize, RMS wells categorized for drinking water set MTs at MCL, and SMCL for TDS, for Title 22 constituents listed in Table 4-5. Wells where RMS are categorized as Agricultural MTs were set at WQO's.

Table 4-5 Table of Regulatory thresholds and water quality objectives (2022 Coordination Agreement, p. 60)

Constituent	Unit	Minimum Threshold		Measurable Objective	
		Drinking Water Limits (MCL/SMCL)	Agricultural WQOs	Drinking Water Limits (MCL/SMCL)	Agricultural WQO
Arsenic	ug/L	10	N/A	7.5	N/A
Nitrate as N	mg/L	10	N/A	7.5	N/A
Hexavalent Chromium	ug/L	10	N/A	7.5	N/A
Dibromochloropropane (DBCP)	ug/L	0.2	N/A	0.15	N/A
1,2,3-Trichloropropane (TCP)	ug/L	0.005	N/A	3.75	N/A
Tetrachloroethene (PCE)	ug/L	5	N/A	3.75	N/A
Chloride	mg/L	500	106	375	79.5
Sodium	mg/L	N/A	69	N/A	51.75
Total Dissolved Solids (TDS)	mg/L	1,000	450	750	337.5
Perchlorate	ug/L	6	N/A	4.5	N/A

Attachment 5 of the [2022] Coordination Agreement is a technical memorandum (TM) included to address DWRs groundwater quality comments on the [2020] GSPs. The TM states that RMS wells are categorized as drinking water or agricultural use based on the following criteria:

> **Drinking Water**: The RMS well is within an urban area or 1-mile of a public water system.
>
> **Agricultural**: Greater than 50% of the pumping within the representative area is determined to be agricultural and there are no public water systems within a 1-mile radius.

(2022 Coordination Agreement, Attachment 5, Technical Memorandum, p. 3).

The Coordination agreement states, “each MO and IM are defined and described individually for each RMS by each GSA in the GSP,” and the technical memorandum stated that MOs for groundwater quality are set at 75% of the regulatory limits as defined in Table 4-5 (ibid, p. 4 and 2022 Coordination Agreement, p. 64). And, for RMS wells that already have historical exceedances of the MCLs or WQOs which was not caused by implementation of a GSP, MTs will not be set at MCLs or WQOs, but rather the pre-2015 implementation concentration. These RMS wells closely monitored [sic] to evaluate if further degradation is occurring at the RMS site as a result of GSP implementation into the future (ibid., p. 4). The exact SMC values are not defined in the GSP documents for RMS where regulatory thresholds have already been exceeded.

All six 2022 GSPs define the quantitative definition of the occurrence of undesirable result consistent with the 2022 coordination agreement for degradation of groundwater quality. However, only five of the six GSPs – DEID, LTRID, Pixley, Alpaugh, and ETGSA – set SMC consistent with the 2022 Coordination agreement. The GSPs further state that additional local agencies within local management areas will have an ongoing opportunity to propose MT for additional constituents and determine whether additional changes to the monitoring network should be made to address water quality issues. The sixth GSP, TCWA, did not define SMC for degraded groundwater quality consistent with the coordination agreement.

The TCWA GSP states, “to assess groundwater quality conditions considered suitable for agricultural irrigation and domestic use the SMCs were developed based on drinking water primary MCLs and secondary MCLs (SMCL) as provided in the California Code of regulations Title 22 (Title 22) for drinking water and agricultural water quality goals (Ag WQGs)… The TCWA will develop the SMCs using statistical approaches developed for Title 27 as opposed to the previous method of using a 10-year running average” (Tri-County Groundwater Sustainability Agency, 2022, p. 29). However, according to TCWA GSA’s WY 2022 annual report, IM and MO have been set consistent with the coordination agreement (TCWA Annual Report, WY 2022).

Monitoring

The 2022 Tule Subbasin Coordination agreement included the Tule Subbasin Monitoring Plan (TSMP; Attachment 1). The purpose of the TSMP is to describe the monitoring features and methodologies used to collect data to be included in the GSPs and annual reports. The TSMP states that groundwater samples shall be collected and analyzed annually, during summer months, from wells shown on Figure A1-6.

In the 2022 GSPs, GSAs propose to continue monitoring groundwater quality using 76 RMS as defined in the original 2020 coordination agreement. The water quality monitoring network consists of public water system wells, irrigation wells, and individual owner wells. According to the 2022 Coordination Agreement, 11 wells are proposed to

be monitored in the TCWA GSA area, 17 within the LTRID GSA area, 32 within the ETGSA area, 9 within the DEID GSA area, 2 within Alpaugh GSA area, and 5 within the Pixley GSA area (2022 Coordination Agreement, Attachment 1, Figure A1-6). Although these RMS are listed in the coordination agreement, the construction and source of many of the wells is unknown and not defined or specified in each of the GSPs. Additionally, IM, MOs, and MTs have not been established for the majority of these proposed RMS locations.

Each of the six 2022 amended GSPs identified a portion of the wells proposed to be monitored by the GSAs for degradation of groundwater quality as follows: LTRID identified 7 RMS, TCWA identified 2 RMS, DEID identified 5 RMS, ETGSA identified 6 RMS, Alpaugh identified 1, and Pixley identified 5 RMS. However, of the 26 RMS wells identified in the GSPs, many do not contain complete location or construction information and/or are identified as composite wells. Additionally, many of these RMS wells do not have a clearly defined MT or MO in the GSP (2022 Alpaugh GSP, p. 3-29; 2022 DEID GSP, p. 4-10; 2022 ETGSA GSP, p. 6-9; 2022 LTRID GSP, p. 4-11; 2022 Pixley GSP, p. 4-10; 2022 TCWA GSP, Figure 4-1).

While not evaluated in the 2023 DWR determination, the WY 2022 annual reports defined the number of RMS for each GSA as the following: LTRID identified 4 RMS, TCWA identified 1 RMS, DEID identified 3 RMS, ETGSA identified 3 RMS, Alpaugh identified 1 RMS, and Pixley GSA identified 3 RMS in each of their WY 2022 annual reports. However, five of the six GSAs mention the addition of analyzing municipal supply wells, with the exception being TCWA, whose single analyzed well is the community of Allensworth's municipal supply well (Annual Reports, WY 2022: Alpaugh GSA, p. 18; DEID GSA, p. 26; ETGSA, p. 27; LTRID GSA, Section. 7, p. 4; Pixley GSA, sec. 7 p. 3; TCWA GSA, p. 20).

According to the WY 2022 annual reports for all 6 GSAs, many of the constituents proposed to be sampled were not measured, due to the new proposed parameters of the revised GSPs not yet being implemented. Additionally, the basin appears to already contain exceedances of MTs of Nitrate as N (D1031 in DEID, Woodville PUD in LTRID, 22S/25E-30 in Pixley) and Hexavalent Chromium (Earlimart PUD in DEID) (ibid).

The 2022 Coordination Agreement includes an additional attachment called the Mitigation Program Framework Coordination Agreement (2022 Coordination Agreement, Attachment 7). According to attachment 7, each of the GSAs agrees to individually implement a Mitigation Program as needed to offset impacts associated with GSP allowed activities (2022 Coordination Agreement, Attachment 7, p. 1). The goal of the framework is to establish a standard for mitigation programs. Mitigation for degradation of groundwater quality may result in demand management, modification of project operations, providing temporary or alternative water sources, consolidation of existing water systems, and other means of mitigation as necessary with approval from affected users (ibid., p. 3)

4.1.3.4 Proposed State Water Board Deficiencies and Potential Actions

In DWR's 2022 GSP Inadequate Determination dated March 2, 2023, DWR staff determined that the GSAs had corrected the degradation of water quality deficiency in the 2022 GSPs. DWR's March 2, 2023, Inadequate Determination states:

In all, Department staff concluded that:

> Department staff find that the Agencies approach to degradation of water quality will require continued collaboration and coordination with existing regulatory agencies and programs to help avoid undesirable results and achieve the sustainability goal for the Subbasin. Based on the review of the resubmitted Plan, Department staff believe that sufficient actions have been taken to address the deficiency related to degraded water quality as identified in the Department's incomplete determination letter (2022 GSPs Inadequate Determination, p. 22-23).

Board staff concur with DWR's findings in their 2022 GSP Inadequate Determination in that the subbasin has taken significant steps in improving the methods in setting SMC consistent with the goal of SGMA and will require continued collaboration and coordination with existing regulatory agencies to avoid undesirable results. However, after reviewing all six GSPs, the Subbasin Coordination Agreement, the WY 2022 annual reports, and existing groundwater quality data in the basin, Board staff have identified additional issues with the GSA's SMC methodology and monitoring network. Board staff also find that the GSPs do not consider how projects and management actions could impact water quality. Below, Board staff break down their proposed deficiencies for the subbasin related to water quality degradation. Deficiencies include:

- GWQ-1 through GWQ-5: Identified by Board staff.

Deficiency Groundwater Quality (GWQ)-1 – The 2022 GSPs do not clearly define the conditions that would be considered an undesirable result.

What SGMA Requires: The GSP Regulations require a GSA to "describe...the processes and criteria relied upon to define undesirable results applicable to the basin." This description must include the cause of past or potential undesirable results, "the criteria used to define when and where the effects of the groundwater conditions cause undesirable results," and the potential effects of undesirable results on groundwater uses and users and land uses and property interests (Cal. Code Regs., tit. 23, § 354.26).

Deficiency: The 2022 GSPs and coordination agreement defines an undesirable result as "the significant and unreasonable degradation of groundwater quality **due to groundwater pumping and recharge projects** such that the quality of groundwater is no longer generally suitable for agricultural and/or domestic use" (2022 Coordination

Agreement, p. 53). GSPs do not clearly describe how the subbasin would determine if SMC exceedances are “due to the result of groundwater pumping and recharge projects” as opposed to other factors. GSAs and the State Water Board therefore cannot evaluate whether the proposed SMC are adequate or if the broader quantitative definition of an undesirable result would guide day-to-day basin management as appropriate for avoiding plain-language undesirable results.

Moreover, Board staff note that an undesirable result is defined in part by the “groundwater conditions occurring throughout the basin” rather than by conditions caused by groundwater management (Wat. Code, § 10721 subd. (x)). Undesirable result definitions should therefore not require GSAs to demonstrate that the results are caused by their management of the basin. If basin management actions cannot mitigate or eliminate undesirable results, the GSPs should explain why.

Potential Action GWQ-1 – Add information about the impacts of basin management on groundwater quality.

At a minimum, GSPs should clearly explain how they would determine the water quality impacts of:

1) Projects and management actions. Board staff note that recharge projects could result in the mobilization of shallow constituents into wells. Recharge projects may influence the migration of legacy constituents within the vadose zone (unsaturated zone between the ground surface and the top of the water table) or may change groundwater conditions that may favor the mobilization of constituents not previously in solution.

2) Subsidence. Subsidence can mobilize constituents as the aquifer matrix or clay layers compact, as oxic groundwater levels decline, or as flooding frequency or severity increase (U.S. Department of the Interior, 1999; Haugen et al, 2021; Smith et al. 2018). Much of the Tule subbasin has subsided due to continued and extensive groundwater extractions, so the GSP should consider associated impacts when assessing the relationship between basin management and degraded groundwater quality, allowing continued subsidence, or switching to pumping of the shallow aquifer to avoid subsidence.

3. Continued pumping. Continued pumping may increase constituent concentrations via declining groundwater levels. Board staff also note that continued pumping in certain areas of the subbasin may cause changes in groundwater flow direction and/or gradients. These changing gradients may allow existing constituents to migrate to new areas. This is especially concerning near the 26 existing cleanup sites within the subbasin, which the GSAs state to be highly localized.

Deficiency GWQ-2 – Minimum thresholds set by the 2022 GSPs are not consistent with GSP Regulations.

What SGMA Requires: The GSP Regulations require GSAs to base their MTs for degradation of water quality on "the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin." Also, GSAs must consider "local, state, and federal water quality standards applicable to the basin" in setting MTs (Cal. Code Regs., tit. 23, § 354.28, subd. (c)(4)). In describing MTs, GSPs must describe how MTs "may affect the interests of beneficial uses and users of groundwater or land uses and property interests." (Cal. Code Regs., tit. 23, § 354.28, subd. (b)(4)). The Basin Setting shall include "groundwater quality issues that may affect the supply and beneficial uses of groundwater" (Cal. Code Regs § 354.16, subd. (d)) and MT shall be based on "concentrations of constituents determined by the Agency to be of concern for the basin…" (Cal. Code Regs § 354.28 subd. (c)(4)).

GSPs are not required to address undesirable results that occurred before, and were not corrected by, January 1, 2015.

Deficiency: The 2022 GSPs use historical data to establish MTs when pre-2015 conditions exceeded MCLs or SMCLs. Board staff understand that GSAs do not have to address undesirable results that occurred before 2015, and Board staff understand that this is why GSAs are establishing MTs from historical data. But Board staff note multiple deficiencies concerning how these historical data are used and the resulting MTs. These deficiencies are summarized below as GWQ-2a, GWQ-2b, GWQ-2c.

Deficiency GWQ-2a – The GSPs do not define Minimum Thresholds consistent with prevention of further degradation of groundwater quality where pre-2015 undesirable results occurred.

The 2022 Coordination Agreement for setting MTs states that "for RMS wells that already have historical exceedances of the MCLs or WQOs which was not caused by implementation of a GSP, MTs will not be set at MCLs or WQOs, but rather the pre-2015 implementation concentration." The 2022 GSPs therefore establish MTs that exceed primary MCLs or upper SMCLs yet does not demonstrate that exceeding health- or quality-protective standards is not an undesirable result. While GSAs are not required to address undesirable results for groundwater quality that occurred prior to January 1, 2015, pre-2015 undesirable results should still be identified and MTs established as directed in Potential Action GWQ-2a.

Potential Action GWQ-2a – Establish RMS within areas of known regulatory threshold exceedances and set SMC consistent with the GSP Regulations.

While GSAs are not required to address undesirable results for groundwater quality that occurred prior to January 1, 2015, pre-2015 undesirable results should still be identified and reasonable SMC established to prevent further groundwater quality degradation. Generally, MTs should not exceed health-protective or quality-protective regulatory thresholds without demonstrating that exceeding health-protective or quality-protective regulatory thresholds is not an undesirable result. However, where GSAs claim that MTs should exceed these regulatory thresholds due to pre-2015 undesirable results, they should provide detailed analyses so that data can be verified, and reasoning can be understood.

Where it is reasonable to establish MTs that exceed health-protective and quality-protective regulatory thresholds, MTs should still prevent continued degradation of groundwater quality. It is therefore reasonable for GSAs to evaluate pre-2015 groundwater conditions to 1) determine if there were already undesirable results that SGMA does not require GSAs to address and 2) quantify the pre-2015 conditions that the GSA inherited so that the basin can establish reasonable SMC. However, if constituent concentrations anomalously exceeded MCLs for a short period sometime prior to 2015 but thereafter returned to levels below MCLs, then the GSA did not inherit an undesirable result. It instead experienced a temporary exceedance of MCLs, and the GSA should therefore not use the exceedance data to determine MTs.

Deficiency GWQ-2b – The GSPs do not consider all constituents with known exceedances.

The 2022 GSPs do not consider all known constituents with regulatory exceedances in the Basin Setting. The Basin Setting should include all groundwater quality issues that may affect the supply and beneficial uses of groundwater (Cal. Code Regs § 354.16, subd. (d)). Nor do the GSPs establish SMC for all known constituents with regulatory exceedances. GSPs should establish SMC for all known constituents with regulatory exceedances unless they demonstrate that constituent exceedances are not a concern for the basin (Cal. Code Regs § 354.28 subd. (c)(4)).

If appropriate, GSAs may demonstrate specific locations where pre-2015 undesirable results are occurring. In these instances, MOs and MTs potentially exceeding regulatory thresholds may be appropriate, so long as they are limited to RMS in the pre-2015 undesirable result locations. Importantly, these MOs and MTs should still prevent the further degradation of groundwater quality.

While the GSPs do not fully consider constituents, Board staff recognize and appreciate that the GSPs consider arsenic in the unconfined aquifer due to pumping-caused

declining oxic groundwaters. This issue has been noted in recent publications (e.g., Haugen et. al., 2021).

Potential Action GWQ-2b – Use the best available data when defining constituents and set SMC for all constituents in the basin that may impact beneficial uses and users.

The Board developed the SGMA Groundwater Quality Tool to provide guidance to GSAs in determining which constituents GSPs should consider. The tool uses the Board's GAMA water quality database to identify constituents with exceedances in three or more basin wells. GSPs should consider these constituents in their Basin Settings and establish associated SMC unless they demonstrate that exceedances are not a concern for the basin. For the Tule basin, Basin Settings should at least consider uranium and nitrite, in addition to the constituents already considered. GSPs should also establish SMC for these additional constituents if appropriate. Board staff also note that while a majority of nitrates within the subbasin are likely nitrate, nitrite should be considered a potential constituent of concern where nitrification and denitrification are actively occurring. Additionally, GSAs should consider monitoring for PFAS and PFOA, which have been detected at concentrations greater than notification levels in monitoring wells within the subbasin.

Deficiency GWQ-2c – Minimum Thresholds based on agricultural standards are applied to domestic wells.

The GSPs establish contradictory methods for categorizing RMS as agricultural; one method relies on the number of wells and the other on the volume of pumping. Moreover, both methods could result in impacts to domestic users within areas where agricultural standards (WQOs) are applied to nearby RMS wells.

The 2022 GSPs and Coordination Agreement define an undesirable result as "the significant and unreasonable degradation of groundwater quality due to groundwater pumping and recharge projects such that the quality of groundwater is no longer generally suitable for agricultural and/or domestic use" (2022 Coordination Agreement, p. 53).

The 2022 Coordination Agreement categorizes RMS as either agricultural or drinking water. MTs for agricultural RMS are based on agricultural standards (WQOs), and MTs for drinking water RMS are based on drinking water standards (MCL/SMCL). These categorizations and associated MTs are defined based on the following scenarios:

- If the majority of beneficial use (greater than 50% the [sic] wells within a determined area) is agricultural and there are no public water systems (including schools) the minimum threshold would be a host of agricultural water quality constituents.

- If an RMS well is located within an urban area, within one mile of a public water system, which includes schools, or the dominant beneficial use (greater than 50% of the wells within the determined area) is drinking water, then the minimum threshold would be set at the MCL for drinking water.
- In cases where both the above criteria are found to be true, the minimum thresholds would be established for both drinking water MCLs and Ag WQO's and minimum thresholds would be set at the most stringent of the two when considering common constituents.
- If drinking water MCLs or Ag WQOs were historically exceeded at an RMS well or found not be [sic] a result of implementation of a GSP, the GSA will coordinate with the responsible regulatory agency to prevent GSA SGMA activities from further degrading groundwater quality.

The TM states that RMS wells are categorized as Drinking Water or Agricultural use based on the following criteria:

Drinking Water: The RMS well is within an urban area or 1-mile of a public water system.

Agricultural: Greater than 50% of the pumping within the representative area is determined to be agricultural and there are no public water systems within a 1-mile radius.

This approach does not allow GSAs to determine if the "quality of groundwater is no longer generally suitable" for domestic wells in agricultural areas. In these areas, MTs are established based on agricultural WQOs rather than drinking water standards. This means that water quality in domestic wells could degrade below drinking water standards without being considered an undesirable result.

Potential Action GWQ-2c – Revise criteria to categorize RMS and describe potential impacts to all beneficial uses and users.

Water quality SMC for drinking water wells should not be based on agricultural standards. If the GSAs choose to categorize RMS, they should ensure that RMS still protects all beneficial uses and users within the subbasin rather than the majority or highest need of groundwater. The GSP should therefore incorporate and consider designated beneficial uses and domestic wells. If any drinking water wells are present within an area, or if the designated beneficial use is municipal and domestic supply (MUN), then GSAs should categorize the RMS well as drinking water. Additionally, the GSAs should set the radius for the RMS based on known distances or extents of contaminants or describe the method for setting 1-mile radius as a determining factor for RMS well categorization.

GSAs should consider impacts to all beneficial uses and users within the subbasin, especially domestic users, and describe them consistent with the goals of SGMA.

Deficiency GWQ-3 – The Tri-County Water Authority GSP does not define Undesirable Results and Sustainable Management Criteria consistent with the Subbasin Coordination Agreement.

What SGMA Requires: Agencies intending to develop and implement multiple Plans pursuant to Water Code Section 10727(b)(3) shall enter into a coordination agreement to ensure that the Plans are developed and implemented utilizing the same data and methodologies and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting (Cal. Code Regs., tit. 23, § 357.4a).

Deficiency: The TCWA GSP's definition of an undesirable result and SMC differ from the Subbasin Coordination Agreement and other GSPs within the subbasin. The TCWA sits in both the Tule and Tulare Lake basins, and it appears that the TCWA GSP for the Tule basin defined its undesirable result and SMC consistent with the 2022 Tulare Lake GSP. It is therefore unclear whether the subbasin is coordinated. Board staff identify two related deficiencies, which are summarized below as GWQ-1a and GWQ-1b.

Deficiency GWQ-3a – The Tri-County Water Authority GSP defined undesirable result is inconsistent with the subbasin wide definition of an undesirable result.

The TCWA 2022 GSP defined the undesirable result definition as, "being the result is stemming from a casual nexus between groundwater-related activities, such as groundwater extraction or recharge, and a degradation in groundwater quality that causes a significant and unreasonable reduction in long-term viability of domestic, agricultural, municipal, or environmental uses over the planning and implementation horizon of this GSP" (2022 TCWA GSP, GSP addendum, p. 29). The Coordination agreement and other five GSPs, however, define an undesirable result as "the significant and unreasonable degradation of groundwater quality due to groundwater pumping and recharge projects such that the quality of groundwater is no longer generally suitable for agricultural and/or domestic use" (2022 Coordination Agreement, p. 53).

Potential Action GWQ-3a – Define undesirable results consistent with the goals of SGMA and the Tule Subbasin Coordination Agreement.

After deficiency GWQ-1 is addressed, the TCWA GSP should be revised to define an undesirable result consistent with the remainder of the Subbasin.

Deficiency GWQ-3b – The TCWA method of setting SMC is not consistent with the goals of SGMA or the Tule Subbasin Coordination Agreement.

The 2022 Coordination Agreement defines groundwater quality MT criteria based on regulatory thresholds (MCLs/SMCLs) for drinking water RMS or the WQO for agricultural RMS. The TCWA GSP, however, states that "to assess groundwater quality conditions considered suitable for agricultural irrigation and domestic use the SMCs were developed based on drinking water primary MCLs and secondary MCLs (SMCL) as provided in the California Code of regulations Title 22 (Title 22) for drinking water and agricultural water quality goals (Ag WQGs) […] The TCWA will develop the SMCs using statistical approaches developed for Title 27 as opposed to the previous method of using a 10-year running average" (2022 TCWA GSP, GSP Addendum , p. 29). According to TCWA GSA's WY 2022 annual report, however, IM and MO established consistent with the coordination agreement (TCWA GSP Annual Report, WY 2022). Given that the defined SMC in the TCWA GSP and WY 2022 annual report differ, the board staff find it difficult to determine if the plans are coordinated.

Potential Action GWQ-3b – Define methodology consistent with the goals of SGMA and the Tule Subbasin Coordination Agreement.

After GWQ-2 is addressed, the TCWA GSP should be revised to set SMC consistent with the remainer of the Subbasin.

Deficiency GWQ-4a – The proposed monitoring network in the 2022 GSPs is inconsistent with the 2022 Coordination Agreement defined RMS wells.

It is unclear how the RMS defined in the 2022 Coordination Agreement correlate to RMS defined in GSPs. The Tule Subbasin Coordination Agreement includes Figure A1-6, which is a map of 76 RMS wells for degradation of groundwater quality. The GSPs define 26 RMS, primarily in tables. It is therefore unclear:

- Which wells are being monitored and evaluated as RMS
- If the GSAs know which aquifers are monitored by each well
- If the proposed monitoring network adequately monitors key aquifers
- Whether the proposed monitoring network includes composite wells
- Whether the scientific rationale for selecting RMS is adequate

Potential Action GWQ-4a – Ensure the monitoring networks described in GSPs are consistent with the monitoring network described in the 2022 Coordination Agreement.

The monitoring networks described in the GSPs should be consistent with the monitoring networks described in the 2022 Coordination Agreement. Board Staff cannot current evaluate the monitoring networks because it is unclear which wells will be monitored. Board Staff therefore note that after monitoring networks are consistently and clearly described, GSAs should ensure that GSPs:

- Include a list of all wells that are being used to evaluate the degradation of groundwater quality within the subbasin and specify the RMS that are being monitored for groundwater quality. Additionally, RMS should be depicted on a map to demonstrate sufficient distribution to characterize basin groundwater quality.

- Define the aquifer that each well represents. GSAs should then consider whether additional RMS are necessary to adequately monitor key aquifers.

- Identify well location information, well depth, and screened intervals. This information should be added to the list of all RMS noted in Potential Action GWQ-4a. This information is necessary to evaluate the scientific rationale for and adequacy of RMS locations.

- Do not use composite wells for RMS. Samples from these wells are not representative of specific aquifer conditions. Moreover, the GSPs identify the shallow aquifer as having poorer water quality than the confined aquifer. GSAs should therefore consider whether composite wells pose a risk to confined aquifer water quality (DWR Well Standards, sec. 13, 1991).

- Describe the scientific rationale used to select RMS. GSAs should select RMS wells based on beneficial uses and users, horizontal and vertical distribution, and known groundwater quality conditions. The de-designated area, as defined in the Central Valley Water Board Resolution R5-2017-0032, should be considered when determining RMS wells. Additionally, the GSAs should consider establishing RMS wells within the de-designation fringe area to ensure GSAs have sufficient data to prevent migration of de-designated waters outside of the de-designated area. GSAs should also consider beneficial uses and users in the de-designated area whose beneficial use has not been de-designated, for example, environmental uses.

Deficiency GWQ-4b – The proposed monitoring frequency is insufficient to detect short-term and seasonal trends.

The GSAs propose to collect only annual summer groundwater samples from RMS wells (2022 Coordination Agreement, attachment 1, p.11). GSP regulations require GSAs to determine the frequency of measurements needed to demonstrate short-term, seasonal, and long-term trends. Board staff do not believe annual sampling is sufficient to demonstrate short-term and seasonal trends.

Potential Action GWQ-4b – Increase the sampling frequency for the groundwater quality monitoring network.

The GSAs should increase monitoring sampling frequency to quarterly or twice a year (during wet and dry seasons) so that short-term and seasonal trends can be detected.

Deficiency GWQ-5 – Management actions are not responsive to water quality degradation.

What SGMA Requires: Each GSP is required to include a description of the projects and management actions the GSA has determined will achieve groundwater sustainability in the basin. The GSAs must include projects and management actions "that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent" (Cal. Code Regs., tit. 23, § 354.44, subd. (b)(1)).

The description must include project management actions, a summary of data used to support proposed actions, and a review of the uncertainty associated with the basin setting when developing projects or management actions (Cal. Code Regs., tit. 23, § 354.44).

In reviewing GSPs, DWR must consider, among other questions, "whether sustainable management criteria and projects and management actions are commensurate with the level of understanding of the basin setting, based on the level of uncertainty, as reflected in the plan" (Cal. Code Regs., tit. 23, § 355.4, subd. (b)(3)).

Deficiency: Deficiencies GWQ-5a and GWQ-5b concern deficiencies associated with management actions that should be responsive to MT exceedances.

Deficiency GWQ-5a – Additional sampling is not triggered when Minimum Thresholds are exceeded.

The 2022 GSPs do not include management actions that are responsive to MT exceedances. Board staff note that elevated concentrations of arsenic, nitrate, uranium, gross alpha, and other constituents can severely impact human health. It is difficult to

understand how GSAs can avoid significant and unreasonable impacts from degradation of groundwater quality if MT exceedances don't trigger additional monitoring to better characterize risks to beneficial uses and users.

Potential Action GWQ-5a – Plan additional sampling when water quality is degraded.

GSAs should plan to add RMS wells where project management and actions are implemented and should increase sampling frequency when MTs are exceeded. This is especially true for exceedances of regulatory threshold MCLs, as elevated concentrations of these thresholds can severely impact human health. MT exceedances should trigger further sampling to guide additional management actions and better understand the risk to drinking water beneficial uses and users—especially domestic well users. Additional sampling could include increased sampling frequency and sampling of additional nearby wells completed within the same aquifer.

Additionally, the subbasin should create a clear mitigation plan on how MT exceedances are investigated and addressed to prevent further degradation.

Deficiency GWQ-5b – Well mitigation plans don't address water quality degradation.

The 2022 GSPs do not include a well mitigation plan. Instead, it includes a framework for a well mitigation plan. As Board staff note in above Deficiency GWQ-5a, elevated concentrations of some constituents severely impact human health. It is therefore difficult for Board staff to understand how GSAs can avoid significant and unreasonable impacts from degradation of groundwater quality if the GSAs have not developed a well mitigation plan that can be reasonably implemented to address water quality degradation. Relatedly, MT exceedances have already been noted in the WY 2022 annual report, but GSAs propose only to continue monitoring.

Deficiency GWQ-5b is addressed by Groundwater Level Potential Action GL-8.

4.1.4 Deficiency ISW – Interconnected Surface Water

Under SGMA, achieving sustainability involves, among other things, avoiding "depletions of interconnected surface water (ISW) that have significant and unreasonable adverse impacts on beneficial uses of the surface water" (Wat. Code, § 10721, subd. (x)(6)). GSP regulations define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Cal. Code Regs, tit. 23, § 351, subd. (o)). Depletion of ISW within the basin may have adverse impacts on surface

water uses, such as degradation or loss of groundwater dependent ecosystems (GDEs) and reduced downstream surface water flow to users (Barlow and Stanley, 2012).

The GSP regulations state that “An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators” (Cal. Code Regs, tit. 23, § 354.26, subd. (d)). However, after analysis of the Coordination Agreement and the six 2020 and 2022 GSPs submitted for the Tule Subbasin, Board staff have concluded that the GSPs do not adequately justify an approach for identifying ISW in accordance with SGMA, and incorrectly define ISW for the basin.

While other basins began implementing plans for ISWs in 2020 that are now approved (i.e., Paso Robles, Santa Cruz Mid-County), the Tule subbasin does not yet have an adequate plan to address the depletion of ISWs and achieve groundwater sustainability by 2040. To meet this timeline, Tule GSAs must adequately define, monitor, and assess ISW within the basin in accordance with the SGMA Statute and DWR’s Best Management Practices (BMPs). Failure to reasonably assess ISW could produce undesirable results, likely causing significant and unreasonable impacts to surface water users prior to the 2025 GSP evaluation period.

4.1.4.1 Tule Subbasin 2020 GSP

Sustainable Management Criteria

In both the 2020 and 2022 GSPs, the GSAs claim there are no ISW in the subbasin. Therefore, the GSAs did not define undesirable results or set sustainable management criteria for ISWs. The GSAs based this conclusion on a January 2015 depth-to-groundwater raster (map) contained in the GSA’s Coordination Agreement Basin Setting (2022 Coordination Agreement, Attachment 2, Figure 2-26). According to the raster, groundwater levels were at least 25 feet below ground surface in all parts of the subbasin in January 2015 (2022 Coordination Agreement, Attachment 2, p. 21). This depth, according to the GSAs, would preclude ISW.

The GSPs, however, do note that the ISW conditions “will be evaluated every five years during the five-year review process to confirm no change of the Tule Subbasin conditions” (2020 ETGSA GSP, Section 5, p. 7; 2022 DEID GSP Section 3, p.3; 2022 TCWA GSP p. 214; 2022 Alpaugh GSP, p. 49, 2022 Pixley GSP, Section 3, p.3; 2022 LTRID GSP, Section 3, p.3.)

Interconnected Surface Water Evaluation

The Coordination Agreement Basin Setting uses a depth to groundwater raster from January 2015 to conclude that there is no perennial ISW within the basin (2022

Coordination Agreement, Attachment 2, p. 21). In drawing this conclusion, the Coordination Agreement Basin Setting states:

> It is noted that there may be periods of time when the groundwater level temporarily rises to within 25 feet of the land surface in only a few relatively small areas of the Tule Subbasin, namely along the Tule River in and upstream of Porterville, and in the upper reaches of Deer Creek and White River. However, this condition, if it occurs, would be temporary and is not the normal hydrologic relationship between surface water and groundwater in these areas (2022 Coordination Agreement, Attachment 2, p. 21).

In their GSP, ETGSA states: “only if the four elements above are met… (1. A subsurface channel must be present; 2. The channel must have a relatively impermeable bed and banks; 3. The course of the channel must be known or capable of being determined by reasonable inference; and 4. Groundwater must be flowing in the channel) could any waters arguably be considered ‘interconnected surface waters.’’

4.1.4.2 Proposed State Water Board Deficiencies

In both DWR’s 2020 GSP Incomplete Determination and 2022 GSP Inadequate Determination, DWR staff did not include depletions of ISWs as a deficiency. However, as 2025 plan evaluations quickly approach, Board Staff find it necessary to include depletions of ISWs within the Tule Subbasin as an additional deficiency based on best available data from the ICONS Interconnected Surface Water in California dataset and the Natural Communities Commonly Associated with Groundwater (NCCAG) Dataset which indicate potential ISWs and GDEs, respectively, within the basin. Board staff also note that the GSAs did not use the best available data to identify ISW, nor did they correctly define ISW in the GSPs. Therefore, Board staff have determined that if the proposed deficiencies are not resolved before the 2025 evaluation, then undesirable results caused by the depletion of ISWs may continue or worsen. Below, the State Water Board identifies ISW deficiencies for the subbasin. Deficiencies include:

- ISW-1 through ISW-3: Identified by Board staff.

Deficiency Interconnected Surface Water (ISW)-1 – The 2022 GSPs claim that there is no ISW in the Tule basin, but the analysis is limited and relies on incomplete data.

What SGMA Requires: The GSP Regulations require GSAs to provide “Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information,” (Cal. Code Regs., tit. 23, § 354.16, (f)).

Deficiency: The GSPs do not provide adequate technical justification to demonstrate ISW is not present in the subbasin.

It is unclear which datasets or wells were used to generate the depth to groundwater raster, making it difficult to assess the accuracy of the raster in areas near streams. This is especially true of the ETGSA management area, where higher groundwater elevations and natural recharge are more likely to occur (2022 Coordination Agreement, Attachment 2, Figure 2-26, Figure 2-27). Board Staff assume that the GSAs relied on groundwater elevation data reported to DWR from the groundwater elevation monitoring wells. This network only includes three groundwater elevation monitoring sites located near potential GDEs, and 5 monitoring sites near the ICONS dataset rivers and streams, only one of which is within the ETGSA management area where ISWs are more likely to occur. Depth-to-groundwater raster maps are developed by interpolating groundwater levels based on observed groundwater levels at certain points. Groundwater level estimates become less certain the further away a point is from those observed data. Without a description of the groundwater elevation data used to develop the raster map, staff cannot assess whether the map demonstrates surface water-groundwater disconnection throughout the basin.

Moreover, although using groundwater depth as a proxy to determine the presence of ISW may be a sufficient method, groundwater-surface water interconnection varies within and across years. A single month in a multi-year drought, even a winter month, does not provide sufficient technical justification to demonstrate the absence of ISW. For example, since the GSAs developed the original GSPs in 2020, The Nature Conservancy has developed an Interconnected Surface Water in California (ICONS) tool, which relies on multiple years of data. The ICONS dataset indicates the presence of ISWs throughout portions of the Deer Creek and the Tule River in the eastern reaches of the subbasin, an area where there is already limited groundwater elevation monitoring. These data use DWR's groundwater elevations from Spring 2011-2012 and Spring and Fall 2013 – 2018 to generate groundwater elevation rasters across the Central Valley, which are then subtracted from digital elevation models to estimate where groundwater elevations are equal to or greater than the surface water elevation (TNC 2021). The ICONS dataset, coupled with the GSAs groundwater elevation data may provide a better indication of where ISW may be occurring within the basin.

Finally, the GSAs do not describe how they considered available stream gage data in determining the potential presence of ISW in the subbasin. Section 2.6 of the Tule Subbasin Coordination Agreement includes a robust description of surface water monitoring stations for ISWs along the Tule River, White River, and Deer Creek (2022 Coordination Agreement, Attachment 1, p. 17). However, the Coordination Agreement did not explain how these stations were used in evaluating the presence or absence of ISW. GSAs could potentially use stream bed elevation data and flow rate data from

these gage stations to improve their evaluation of potential hydraulic connection along those water bodies.

Board staff propose the below Potential Actions ISW-1a and ISW-1b to address the deficiency.

Potential Action ISW-1a – Use the best available data for identifying interconnected surface waters in the subbasin.

The GSAs should consider a range of hydrogeologic conditions for the depth to groundwater map to observe seasonal and yearly impacts on groundwater levels and surface water flow. For example, GSAs should incorporate historical wet years such as 2017 and 2019, since the time span used for groundwater level measurements (January 2015) was relatively dry. The GSAs may use ICONS data or other best available data as appropriate.

The GSAs should also incorporate groundwater quality data and surface water monitoring data, such as surface water flow data and stream bed elevations, into their evaluation of the presence or absence of ISW. These data are essential to understanding potential hydraulic connections with groundwater.

Potential Action ISW-1b – Explain which groundwater level monitoring network was used to justify the absence of ISWs with the basin.

Section 2.2.3 of the Coordination Agreement Basin Setting should clearly state which wells were used to generate the depth to groundwater raster for Figure 2-26 in Attachment 2 of the Coordination Agreement. The GSAs should further explain how they determined that the datapoints used to generate the groundwater depth rasters are temporally and spatially sufficient to demonstrate the absence of ISW.

Deficiency ISW-2 – The 2022 GSPs do not correctly define Interconnected Surface Water.

What SGMA Requires: The GSP Regulations state that ISWs refer to “surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted,” (Cal. Code Regs., tit. 23, § 351, (o)).

Deficiency: As mentioned in Deficiency ISW-1, the Coordination Agreement Basin Setting uses a depth to groundwater raster to conclude that there are no continuously occurring ISWs within the basin (2022 Coordination Agreement, Attachment 2, p. 21). However, the Coordination Agreement contradicts this finding by stating that there are periods where groundwater is within the 25 ft-bgs threshold from the ground surface,

which would allow for ISW to occur. Therefore, the GSAs' understanding of ISW within the basin is inconsistent with SGMA's definition of ISW: groundwater levels connected to surface water on a temporary basis or in limited portions of the subbasin meet the requirements of an ISW (Cal. Code Regs, tit. 23, § 351, subd. (o)). As a result, the GSAs failed to identify potential ISWs in accordance with SGMA regulations.

Furthermore, ETGSA conflates ISW with the legal definition of "subterranean streams," set forth in Water Code Section 1200, by using the Garrapata four-part test established in State Water Resources Control Board Decision 1639 (State Water Resources Control Board, 1998). The SGMA statute clearly defines ISWs as groundwater and any occurrence of surface water that are hydraulically connected at any point (Cal. Code Regs, tit. 23, § 351, subd. (o)). The definition of ISW does not include the criteria that must be met to legally define a subterranean stream. Board staff propose the below Potential Actions ISW-2a and ISW-2b to address the deficiency.

Potential Action ISW-2a – Reevaluate ISWs within the basin using the understanding that ISWs may be intermittent.

GSAs need to reevaluate the definition of ISWs as outlined by SGMA. Board Staff reiterate that ISWs are defined by SGMA as groundwater that is in hydraulic connection at any time with a stream or surface water body (whether gaining or losing). Given that the Coordination Agreement Basin Setting states "there may be periods of time when the groundwater level temporarily rises to within 25 feet of the land surface," the GSAs should reevaluate the potential for intermittent or localized interconnection (2022 Coordination Agreement, Attachment 2, p. 21).

Potential Action ISW-2b – Remove the reference to subterranean streams.

The criteria for a subterranean stream is not relevant to identifying ISW. ETGSA should remove the discussion of subterranean streams from its plan.

Conditional Deficiency ISW-3 – If depletions of Interconnected Surface Water occur in the subbasin, the GSAs must set Sustainable Management Criteria for depletions of Interconnected Surface Water and establish a shallow water monitoring network.

What SGMA Requires: "Sustainable management criteria and projects and management actions shall be commensurate with the level of understanding of the basin setting, based on the level of uncertainty and data gaps, as reflected in the Plan" (Cal. Code Regs., tit. 23, § 350.4, (d)).

The GSP Regulations state that "Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term

trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation" (Cal. Code Regs., tit. 23, § 354.34).

Deficiency: Board staff recognize that the GSAs did not establish ISW SMC under the assumption that depletions of ISW are not occurring in the subbasin or are not likely to occur in the subbasin. However, if in addressing Deficiencies ISW-1 and ISW-2, the GSAs find evidence of the presence of depletions of ISW, then GSAs will need to develop SMC, create a monitoring network, and identify associated projects or management actions for the depletion of ISW.

Board staff propose the below Potential Actions ISW-3a through ISW-3d to address the deficiency.

Potential Action ISW-3a – Create an ISW monitoring network near established surface monitoring stations to fill data gaps.

Board Staff recommend creating a dedicated ISW monitoring network by identifying or constructing shallow wells within a reasonable distance to surface waters and associated surface water monitoring sites. According to DWR's Monitoring Network BMPs, the "network should extend perpendicular and parallel to stream flow to provide adequate characterization" (DWR, 2016). The addition of shallowly screened wells, specifically along the easternmost reaches of the Tule River, White River, and Deer Creek, will better characterize the spatial and temporal exchanges between surface water and groundwater.

Potential Action ISW-3b – Use the ISW network to model surface water hydraulic connection to the underlying aquifer via a continuous saturated zone.

Board Staff recommend supplementing groundwater elevation data with ISW modeling efforts. Modeling will more accurately identify areas where surface water and groundwater may be in hydraulic connection. According to DWR's Monitoring Network BMPs, accurate modeling requires, "empirical observations determining the extent of the connection of surface water and groundwater systems, the timing of those connections, the flow dynamics of both the surface water and groundwater systems, and hydrogeologic properties of the geologic framework connecting these systems" (DWR, 2016).

Potential Action ISW-3c – Identify wells where excessive groundwater pumping could lower the hydraulic gradient, reduce the surface water supply, and impact nearby vegetation and ecosystems.

An ISW network is also essential to understanding how groundwater extractions adjacent to streams may impact surface water flow. Pump tests should be conducted at

nearby production wells to understand interactions between groundwater and surface water under projected demand stressors. Wells that are found to pump from zones or aquifers that lead to significant impacts on surface water flow or to groundwater dependent ecosystems may need increased monitoring during dry seasons or be placed on hiatus.

Potential Action ISW-3d – Develop SMC for the depletion of interconnected surface water.

Board staff recognize that ISW SMC were not established in the 2022 GSPs since depletion of ISW were not identified in the subbasin. However, if the above ISW deficiency actions are addressed, and GSAs find sufficient evidence to establish ISWs as a sustainability indicator, then GSAs will need to develop SMC, create an RMS network, and determine future PMAs for the depletion of ISW. Potential Actions ISW-3a, 3b, and 3c would inform development of SMC.

4.2 Exclusions from Probationary Status

The State Water Board must exclude from probation any portions of the basin for which a GSA demonstrates compliance with the sustainability goal (Wat. Code, § 10735.2, subd. (e)). Staff believe no GSAs in the subbasin have demonstrated compliance with the sustainability goal. All seven GSAs have adopted and are implementing six developed GSPs, which DWR has determined to be inadequate. Staff recommends the State Water Board not exclude any portions of the subbasin from the probationary designation.

4.3 Modification to Water Year and Reporting Dates

Staff do not recommend the State Water Board modify the water year for reporting extractions, but staff do recommend modifying the extraction reporting deadline for groundwater extraction reports required pursuant to Water Code section 5202.

4.3.1 Proposed Change

For basins designated probationary, SGMA requires groundwater extraction data for the preceding water year be submitted to the State Water Board by February 1 of each year (Wat. Code § 5202, subd. (b)). Board staff recommend modifying the extraction reporting deadline for reporters in the Tule subbasin to December 1 of each year. Staff do not recommend any modifications to the water year.

4.3.2 Justification

As stated in section 4.0 above, the overall goal of a probationary designation is to gather information to help local GSAs address deficiencies in their plans so they can sustainably manage their groundwater resources as soon as possible without outside help.

Requiring extraction reports be submitted to the State Water Board by December 1 of each year rather than February 1 will make extraction data available to staff, and GSAs if requested, two months sooner compared to relying on the default reporting date. Obtaining these data sooner means that staff and GSAs will fill data gaps sooner, potentially enabling GSAs to better address plan deficiencies and forestalling the need for the Board to develop and implement an interim plan. If GSAs do not address plan deficiencies, the earlier reporting deadline will give staff additional time to evaluate extraction reporting information when evaluating the need to develop an interim plan.

Groundwater pumpers subject to reporting in a probationary basin must begin measuring and recording extractions 90 days after the probationary designation (Wat. Code, § 5202, subd. (a)(1)). If the State Water Board designates the subbasin probationary on September 17, 2024, pumpers would start recording extractions on December 12, 2024.

4.4 Requirements for Installation and Use of Measuring Devices

As part of a probationary designation, the State Water Board may require groundwater extraction reporters to install and use measuring devices, such as flow meters, for measuring their groundwater extractions (Wat. Code § 10735.2, subd. (c)(3)).

4.4.1 Proposed Requirement

Board staff recommends the Board:

- Require any person extracting more than two AFY for any reason or extracting water for any reason other than domestic purposes to report their groundwater extractions and pay fees.
- Require any person extracting more than 500 AFY to install and use meters that meet the requirements of Cal. Code Regs., tit. 23, § 1042 on all their production wells within the basin.
- Require any person extracting groundwater from the wells located in the Friant-Kern Canal subsidence management areas to install and use meters that meet

the requirements of Cal. Code Regs., tit. 23, § 1042 on all their production wells within the basin.

- Exclude any person who extracts two AF or less per year for domestic uses (de minimis users) from reporting requirements and paying fees. This exception includes most household users, including those extracting from wells located in the Friant Kern Canal subsidence management areas.

These recommendations are specific to the water use and landownership patterns of the Tule subbasin, as described below in Section 4.4.1.3.

4.4.1.1 Importance of Measuring Groundwater Extractions with Meters

Despite the importance of monitoring water for management purposes, most agricultural water use worldwide—both from groundwater and surface water—remains unmetered (OECD, 2015). In the United States, only 36% of groundwater irrigation wells are equipped with flow meters (USDA, 2019), with large monitoring gaps in states such as California that have experienced severe aquifer depletion over recent decades (Scanlon et al., 2012; Liu et al., 2022). Many western states affected by long-term overdraft and severe drought conditions have begun requiring meters on groundwater extractions to fill these data gaps (e.g., Idaho Code § 42-701; Idaho Eastern Snake Plain Aquifer measurement order; Oregon ORS 540.435; Oregon ORS 537.780; Washington RCW 90.44.450; Arizona § 45-604 Water measuring devices, Montana Rule 36.12.1211, New Mexico statewide groundwater measurement specifications, Colorado well metering, Wyoming meter selection specification, Nevada NRS 534.180 and NRS 534.193).

The sustainable management of groundwater under SGMA will be difficult without measuring groundwater extractions by the subbasin's groundwater users. Estimating the volume of groundwater extractions using indirect methods can provide valuable information such as total water use. However, these methods have some drawbacks. For example, satellite measurements of evapotranspiration (ET) cannot be used to estimate groundwater extractions for sectors that do not apply groundwater for irrigation purposes (e.g., dairy operations, groundwater exports, commercial uses, and oil and gas injection). Estimates of groundwater extractions using crop water demand can vary due to climatic conditions, such as rainfall or temperature, and involves determining and monitoring agricultural practices, which can be a challenge (Meza-Gastelum et al., 2022).

The most appropriate and robust method for collecting groundwater use data is the measurement of groundwater extractions by metering devices. Requiring well owners to install meters and report groundwater extractions will help improve analysis of groundwater conditions and lead to more effective management of groundwater in the subbasin. Board staff recommend that the Board 1) require groundwater extractors who extract over 500 AFY of groundwater to install meters, 2) require groundwater extractors

who extract groundwater in the Friant Kern Canal subsidence management areas to install meters, and 3) encourage other extractors using less than 500 AFY of groundwater to install meters voluntarily to improve the accuracy of pumping measurements in the subbasin.

4.4.1.2 Existing GSA Requirements for Metering in the Subbasin

Presently, none of the seven GSAs in the subbasin have a measuring device requirement according to the Plans and Annual Reports.

4.4.1.3 Rationale for Proposed Meter Requirement

Accurate measurement of groundwater extraction with meters will fill key data gaps that limit our understanding of overdraft conditions and effects on all beneficial uses in the subbasin.

In order to evaluate potential thresholds for requiring meters, board staff used OpenET[17] to estimate how much water is used by groups of landowners (grouped by water use) in the subbasin. While using ET data alone has limitations mentioned above, this was the best proxy for groundwater use in the subbasin that staff could use to evaluate potential thresholds. Staff evaluated OpenET data for Water Year 2022 (October 2021-September 2022) for the subbasin to evaluate water use. At this time, surface water accounted for 22% of total water use (excluding precipitation) and included Central Valley Project allocation (20%), managed local supplies allocation (Tule River and Deer Creek; 1%), and local imported supplies allocation (1%) (Annual Reports, WY 2022). The remaining 78% of consumed water was supplied by groundwater (77%), recycled and reused water (1%) (ibid.).

Board staff summarized OpenET data for each non-residential parcel and consolidated the water use for all parcels owned by each parcel owner. Water users of more than 500 AFY of water as measured by OpenET:

- Are 579 landowners (or 14.0% of 4,124 owners of non-residential parcels in the subbasin).
- Own 77.5% of lands in the subbasin.
- Use 79.8% of water in the subbasin.

[17] OpenET provides satellite-based estimates of the total amount of water that is transferred from the land surface to the atmosphere through the process of evapotranspiration [OpenET website].

Staff find that the proposed requirement that all groundwater extractors of more than 500 AFY install meters will provide accurate extraction information for a large percentage of groundwater use in the basin while only impacting a small percentage of all groundwater extractors. If, after collecting reports, staff find that meters are needed for well owners extracting less than 500 AFY in order to evaluate basin conditions and potentially implement an interim plan, staff may adjust meter requirements for groundwater extractors in the subbasin via subsequent State Water Board action.

5.0 Additional Considerations

This section describes how the state intervention process is CEQA exempt and details the State Water Board's obligations to consider the Human Right to Water and the Public Trust Doctrine.

5.1 The California Environmental Quality Act

Pursuant to Water Code section 10736.2, the California Environmental Quality Act (Division 13 [commencing with Section 21000] of the Public Resources Code) does not apply to the State Water Board's designation of a basin as probationary under SGMA.

5.2 Human Right to Water

Assembly Bill 685 (2012) made California the first state in the nation to legislate the Human Right to Water. Section 106.3 of the Water Code states that "every human being has the right to safe, clean, affordable, and accessible water for human consumption, cooking, and sanitary purposes." The State Water Board holds the Human Right to Water as a top priority and core value and Senate Bill 200 tasks them with administration of the Safe and Affordable Drinking Water Fund.

5.2.1 Human Right to Water in the Subbasin

Access in the subbasin to safe, clean, and affordable water to human consumption would be enhanced by addressing the recommended deficiencies related to lowering groundwater levels (Section 0) and groundwater quality degradation (Section **Error! Reference source not found.**). According to the DWR's My Dry Wells tool (as of January 2024), 740 domestic supply wells have been reported as dry since 2014, 527 of those reported dry since 2015. Thirty-eight wells were reported dry in 2022, eight in 2023, and thus far in 2024, there have been no domestic wells reported dry in the Subbasin. There are 19 reported State Small Water Systems within the Subbasin. According to the State Water Board analysis, 13 of these systems are considered At-Risk (Harlien's Rentals, Henderson's HOA, Chase St WC, Pettis WC, Bodley WC-North,

Bodley WC-South, Clem WC, Cleo Properties WS, Crescent Apartments, E Date St WS, Garden Place WC, McKinney Rentals #1, and Prospect Apartments) and six are considered Potentially-At-Risk (Clark Pencall & Samaduroff, McKinney Rentals #2, Murray WS, Stark WS, Alta Vista MHP, Davison WC). If management leads to a drop in groundwater elevations to MTs, there is a risk of dewatering more domestic and public supply wells; those risks are summarized earlier in this document.

5.3 Public Trust

5.3.1 General Principles and Brief History

The public trust doctrine is rooted in ancient Roman codes and English common law judicial opinions about public rights to use water, air, wildlife, and common spaces that are held in trust by the sovereign for the benefit of the public. The sovereign in the public trust doctrine refers to the entity charged with protecting resources within the public trust. Within SGMA, the entities acting on behalf of the people are the State of California and local jurisdictions implementing SGMA. California incorporated English common law into its legal framework prior to statehood and subsequent California legal decisions have explicitly recognized that the public trust doctrine provides for protection of coastlines, navigable surface waters, their non-navigable tributaries, aquatic resources, and the ecosystems that rely on them.

In a 2018 decision, *Environmental Law Foundation v. State Water Resources Control Board* (2018) 26 Cal.App.5th 844 (*Environmental Law Foundation*), the court recognized that “the public trust doctrine applies if extraction of groundwater adversely impacts a navigable waterway to which the public trust doctrine does apply.” (26 Cal.App.5th at 859.) *Environmental Law Foundation* concerned increased pumping of groundwater near the Scott River, which had greatly affected the Scott River system and, in some years, left the system nearly dry. The court found that the passage of SGMA had not preempted application of the public trust doctrine and that both “coexist and neither occupies the field to the exclusion of the other.” (*Id.* at pp. 854, 855.)

5.3.2 The Public Trust Doctrine in the SGMA Context

When the state or its subdivisions are engaged in the planning and allocation of water resources, the public trust doctrine requires consideration of the potential impacts of groundwater extractions on public trust resources and protection of those resources where feasible. This duty arises in the SGMA context because SGMA involves the planning (Wat. Code, § 10727) and allocation (Wat. Code, § 10726.4) of water resources. Moreover, sustainable management under SGMA is defined as avoiding undesirable results in a basin, including “[d]epletions of interconnected surface water

that have significant and unreasonable adverse impacts on beneficial uses of surface water." (Wat. Code, § 10721, subd. (x)(6).) GSPs that meet SGMA's requirements will assist in evaluating impacts to public trust resources, such as fish and wildlife beneficial uses, because they will include a physical description of groundwater-surface water interaction in the basin and, if applicable, monitoring and management of changes in surface flow and surface water quality caused by groundwater extraction in the basin (Wat. Code, § 10727.2, subds. (a)(2), (d)(2)).

5.3.3 Public Trust Doctrine in the Subbasin

The record snowfall and precipitation in the Sierra Nevada and Tulare Basin during the 2022-23 winter, amplified in part by extreme precipitation events and climate change, points to a future hydrology where flooding is expected to occur more frequently. Portions of the western Tule basin were flooded in spring 2023, and the year's massive snowpack was posing continued flood risk in the basin. Sustainable groundwater management efforts in the subbasin should consider how altered hydrologic, surface water and flooding patterns may impact public trust resources. This should include consideration of public trust when operating or permitting wells in places where groundwater and surface water may be connected.

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Appendix A – Summary Table of Proposed Deficiencies and Potential Actions to Address Deficiencies

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency Groundwater Levels (GL)-1 – The 2022 GSPs plain-language undesirable results do not clearly describe the impacts from groundwater level decline that would constitute a "lack of access to water supplies."	The GSP Regulations require a GSA to describe the "Potential impacts on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(3)).	**DWR Inadequate Determination summary**: The revised qualitative undesirable result was defined as the "continued chronic lowering of groundwater levels below those needed to accommodate continued pumping during the transitional period of temporary overdraft**…"** or "…lack of access to water supplies for all beneficial uses and users due to lowered groundwater levels**…"** (2022 Coordination Agreement, Section 4.3.1). The quantitative undesirable result was defined as the "lowering of the groundwater elevation below the MT at an RMS in any given GSA for the area and beneficial uses and users associated with the RMS." As DWR notes in their 2022 Inadequate Determination, the GSPs indicate that 776 wells would be impacted if groundwater levels declined to MTs, so it is not clear how the GSP quantifies "lack of access to water supplies." **Board additional issues**: None.	**Potential Action GL-1 –** Clearly describe the impacts from groundwater level decline that would constitute a "lack of access to water supplies" in the definition of undesirable results.
Deficiency GL-2 – The Tri-County Water Authority GSP quantitative undesirable result definition is unclear and inconsistent with the Coordination Agreement.	The GSP Regulations require the criteria for undesirable results be "based on a quantitative description of the combination of MT exceedances that cause significant and unreasonable effects in the basin" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(2)). Moreover, GSAs choosing to develop multiple GSPs "shall enter into a coordination agreement to ensure that the Plans are developed and implemented utilizing the same data and methodologies and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting" (Cal. Code Regs., tit. 23, § 357.4, subd. (a)).	**DWR Inadequate Determination summary**: The 2022 TCWA GSP Addendum does not include a quantitative undesirable result definition. It is not clear that the 2022 TCWA Addendum adopts the Coordination Agreement quantitative undesirable result definition, because the qualitative undesirable result defined in the Addendum differs from the qualitative undesirable result in the Coordination Agreement. **Board additional issues**: None.	**Potential Action GL-2 –** The Tri-County Water Authority GSP should include a quantitative undesirable result. Tule portion of GSA should be managed by GSP consistent with Tule subbasin.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency GL-3 – The GSPs use modeled rather than observed 2015 groundwater levels to identify wells that were already impacted before SGMA.	The GSP Regulations require that description of undesirable results include discussion of the "potential effects on the beneficial uses and users of groundwater" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(1)), "based on information described in the basin setting, and other data or models as appropriate" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(1)).	**DWR Inadequate Determination summary**: The GSPs use modeled, rather than observed, 2015 groundwater elevations to estimate the number of wells that would have already been impacted before SGMA. The GSPs identify these wells as part of their analysis of the impacts of undesirable results on beneficial uses and users of groundwater. **Board additional issues**: None.	**Potential Action GL-3 –** Use observed 2015 groundwater levels to identify wells may have been impacted before SGMA.
Deficiency GL-4 – GSPs do not provide a reasonable path to achieve sustainability goal by 2040.	The GSP Regulations requires for "an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon" (Cal. Code Regs., tit. 23, § 354.24). The sustainability goal is "the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield." (Wat. Code § 107.21 subd. (u)).	**DWR Inadequate Determination summary**: DWR finds that the 2022 Coordination Agreement describes expected groundwater pumping to exceed 400,000 acre-feet per year after the 20-year implementation period for SGMA (2020-2040). This exceeds the subbasin's 130,000 acre-feet per year sustainable yield, which means that the current GSPs do not provide a reasonable path to achieve sustainability by 2040. **Board issues**: • While Board staff acknowledge and appreciate the substantial efforts of the Tule subbasin GSAs to establish groundwater allocations, Board staff also note concerns with the subbasin's allocation plans: It does not appear to Board staff that allocation plans rely on adaptative management. Allocations appear to be scheduled over time based on modeled transitional pumping. • Eastern Tule GSA's Groundwater Accounting Action includes a Precipitation Credit based on a running long-term average of precipitation in the ETGSA area, which may overestimate precipitation as climate change increases the frequency, duration, and intensity of drought. • The Groundwater Accounting Action applies to the Greater Tule Management Area, and the ETGSA 2022 GSP states that a groundwater accounting management action is "to be determined" for the Kern Tulare Water District Management Area. • Staff note that the only pumping reductions planned for the DEID GSA area apply to the Western Management Area, which consists of 7,554 acres of "white lands". The DEID 2022 GSP does not propose transitional pumping or demand reduction actions in the DEID Management Area.	**Potential Action GL-4a** – Further investigate the water budget and update the GSPs accordingly. **Potential Action GL-4b** – Update GSPs with details necessary to evaluate the feasibility of proposed supply augmentation projects. **Potential Action GL-4c** – GSPs should identify groundwater levels at key indicator wells in each aquifer that will trigger specific demand management actions, ensuring sufficient spatial coverage to represent beneficial uses and users in each aquifer. **Potential Action GL-4d** – Track how allocation and trading may be affecting achievement of the sustainability goal or beneficial uses or users.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency GL-5 – The 2022 GSPs Minimum Thresholds do not clearly represent undesirable results.	The GSP Regulations require that MTs "for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results" (Cal. Code Regs., tit. 23, § 354.28, subd. (c)(1)).	**DWR Inadequate Determination summary**: The 2022 defined minimum thresholds do not clearly represent undesirable results, as the 2022 GSPs do not clearly define undesirable results. Instead, MTs often represent projected, future groundwater elevations. In 2020 Incomplete Determination, DWR noted that MTs were based on groundwater modeling results rather than elevations that indicated "depletion of supply... that may lead to undesirable results". DWR's Inadequate Determination noted that GSPs still often established MTs based on groundwater projections. **Board additional issues**: Board Staff concur and further clarify that model results or other projections can be used to establish MTs that represent realistic water surfaces provided that the MTs clearly represent the depletion of supply that may cause undesirable results.	**Potential Action GL-5** – Set Minimum Thresholds that represent undesirable results rather than projected groundwater elevations.
Deficiency GL-6 – The number of impacted wells differs between the Coordination Agreement and the Delano-Earlimart Irrigation District GSP.	The GSP Regulations require multiple agencies producing GSPs for a subbasin to enter into a coordination agreement "to ensure that the plans are developed and implemented utilizing the same data and methodologies, and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting" (Cal. Code Regs., tit. 23, § 357.4, subd. (a)). The GSP Regulations also require that MTs "for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results" (Cal. Code Regs., tit. 23, § 354.28, subd. (c)(1)) and that description of undesirable results include "potential effects on the beneficial uses and users of groundwater" (Cal. Code Regs., tit. 23, § 354.26, subd. (b)(1)).	**DWR Inadequate Determination summary:** GSPs and the Coordination Agreement should consistently present estimates of wells that may be dewatered at groundwater levels corresponding to sustainable management criteria. The revised 2022 DEID GSP indicates that MTs would impact 28 wells, the revised Coordination Agreement indicates the MTs would impact only 8 wells. Furthermore, while the DEID GSP distinguishes between upper and lower aquifer wells, there is no such distinction in the Coordination Agreement, exacerbating the discrepancy. **Board additional issues**: None.	**Potential Action GL-6** – Resolve the discrepancy between the Coordination Agreement and the Delano-Earlimart Irrigation District GSP.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency GL-7 – The Tri-County Water Authority GSP does not explain how it chose the 90th percentile threshold for well completion elevations as the Minimum Threshold for upper aquifer wells.	The GSP Regulations require that the description of MTs includes "the information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator" (Cal. Code Regs., tit. 23, § 354.28, subd. (b)(1)). Furthermore, there should be description for "how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators" (Cal. Code Regs., tit. 23, § 354.28, subd. (b)(2)).	**DWR Inadequate Determination summary:** The DWR Inadequate Determination noted that the Tri-County Water Authority GSA does not explain why it uses a 90th percentile threshold to establish MTs. The 90th percentile threshold means that MTs would protect at least 90 percent of wells completed in the upper aquifer). Because the GSP does not clarify the qualitative undesirable result, it's not clear why a 90th percentile threshold is used. **Board additional issues**: None.	**Potential Action GL-7a –** Clearly describe the impacts from groundwater level decline that would constitute a "lack of access to water supplies" in the definition of undesirable results. **Potential Action GL-7b –** Set MTs that represent undesirable results rather than projected groundwater elevations.
Deficiency GL-8 – The well mitigation framework provided in the GSPs lacks necessary detail.	Although SGMA and the GSP Regulations do not require development of a well impact mitigation plan, many GSAs have proposed to couple such plans with MTs to allow for greater groundwater level declines while avoiding undesirable results. The 2022 Coordination Agreement states that "during the transition period between 2020 and 2040, each GSA will adopt a Mitigation Program or Programs" (2022 Coordination Agreement, p. 49).	**DWR Inadequate Determination summary:** The mitigation framework included in the 2022 GSPs and Coordination Agreement does not provide enough detail about how and when impacted wells would be mitigated. DWR also expresses concern that the mitigation framework may rely on modeled rather than observed pre-SGMA groundwater elevations to potentially exclude wells. **Board additional issues**: Board staff notes that some wells are excluded from mitigation. Wells should not be excluded from mitigation unless they have been continuously impacted since before SGMA. Board staff clarify, however, that it may be reasonable for GSAs to use imperfect estimations of wells impacted before SGMA to inform cost or impact analyses, so long as these estimations are not used as a basis to deny mitigation.	**Potential Action GL-8** – Establish accessible, comprehensive, and appropriately funded well impact mitigation programs that mitigate impacts to wells affected by lowering of groundwater levels and and/or degradation of water quality. Develop well mitigation programs with clear triggers, eligibility requirements, metrics, and funding sources.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency GL-9 – There are inconsistencies in the description of the proposed groundwater level monitoring network between the text, tables, and maps of the 2022 Coordination Agreement. Questions we have: ○ Which wells? ○ Which aquifers? ○ Adequate? ○ Composite? ○ Rationale?	The GSP Regulations require that all GSPs include description of the "location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used" (Cal. Code Regs., tit. 23, § 354.34, subd. (h)).	**DWR Inadequate Determination summary:** None. **Board additional issues**: Board staff notes that there are discrepancies between the text, tables, and maps in the description of the groundwater level monitoring network in the 2022 Coordination Agreement. Board staff notes that GSAs are using composite wells as RMSs. Composite wells that contain screen perforation intervals across multiple aquifers are not ideal groundwater level RMSs and may degrade groundwater quality by providing conduits for constituents to travel between aquifers.	**Potential Action GL-9** – Resolve monitoring network discrepancies int the Coordination Agreement text, figures, and tables.
Deficiency Land Subsidence (LS)-1 - The 2022 GSPs do not clearly describe subsidence conditions that would reasonably be expected to cause undesirable results.	The GSP Regulations require a GSA to "describe...the processes and criteria relied upon to define undesirable results applicable to the basin." This description must include the cause of past or potential undesirable results, "the criteria used to define when and where the effects of the groundwater conditions cause undesirable results," and the potential effects of undesirable results on groundwater uses and users, land uses, and property interests (Cal. Code Regs., tit. 23, § 354.26).	**DWR Inadequate Determination summary:** The 2022 Coordination Agreement indicates that ongoing subsidence at current rates would not cause undesirable results for "low priority land uses" and therefore fails to establish reasonable subsidence SMC. The GSAs "determined that the forecasted land subsidence during the transition period, which was of a similar magnitude to what had been historically measured, was not anticipated to result in undesirable results to land uses or critical infrastructure because no undesirable results had previously been reported as a result of historical land subsidence in those areas." This is problematic, because the 2022 GSP used this determination to establish quantitative undesirable result definitions and associated MTs that allowed continued subsidence at near-current rates. In addition to not quantifying the undesirable results for areas of the Subbasin not adjacent to the Friant-Kern Canal, "the GSAs have also not defined the criteria for when undesirable results occur in the Subbasin". **Board additional issues**: None.	**Potential Action LS-1** – Clearly define the subsidence conditions that would result in an undesirable result for the basin and provide enough detail that associated MTs can be determined (Cal. Code Regs., tit. 23 § 354.28).

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency LS-2 - The GSAs did not set Minimum Thresholds in accordance with DWR Regulations. • **Deficiency LS-2a** – Minimum Thresholds were not established based on avoiding undesirable results. • **Deficiency LS-2b** – Some MTs appear to exceed subsidence limits set in other pre-existing agreements and there are MT discrepancies between documents.	The GSP Regulations state that MTs for land subsidence should identify the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. These quantitative values should be supported by: The identification of land use or property interests potentially affected by land subsidence An explanation of how impacts to those land use or property interests were considered when establishing minimum thresholds Maps or graphs showing the rates and extents of land subsidence defined by the minimum thresholds (Cal. Code Regs., tit. 23, § 354.28, subd. (c)(5)). MOs for land subsidence must be based on the same metrics and monitoring sites used for MTs. MOs must "provide a reasonable margin of operational flexibility under adverse conditions" (Cal. Code Regs., tit. 23, § 354.30, subd. (c) & (d)).	**DWR Inadequate Determination summary:** The DWR Inadequate Determination found that "the Plan does not quantify the amount of land subsidence that would result in undesirable results for areas not adjacent to the [Friant-Kern] Canal". • **LS-2a** - The DWR Inadequate Determination found that "the GSAs have not identified a cumulative amount of tolerable subsidence that, if exceeded, would substantially interfere with groundwater and land surface beneficial uses and users in the Subbasin" Instead, the 2022 GSP established MTs for areas not adjacent to the Friant-Kern Canal based on the unsupported claim that the current rate of subsidence could continue through 2040 without causing undesirable results. Moreover, the GSPs MTs for "low priority land uses," which they define as "highways and bridges, railroads, other pipelines, wastewater collection, utilities, and buildings," are based on the unsupported claim that "low priority land uses" would not be impacted by ongoing subsidence at current rates. These "low priority land use" MTs are therefore based on projections of anticipated subsidence through 2040 at near-current rates rather than on avoiding significant and unreasonable impacts. • **LS-2b** - The DWR Inadequate Determination notes that MTs for multiple RMS appear to exceed the maximum subsidence allowed along the Friant-Kern Canal (3 ft), according to the agreement between Friant Water Authority and Eastern Tule and Pixley GSAs. **Board additional issues:** • **LS-2a** – None. • **LS-2b –** The Eastern Tule GSA GSP lists different subsidence MTs than those listed in the WY 2022 Annual Report, making it difficult for Board staff to evaluate MT values and subsidence conditions.	**Potential Action LS-2a** – Define and clearly list Minimum Thresholds based on the level of subsidence at each RMS that would cause the undesirable results conditions that the GSAs are trying to avoid. **Potential Action LS-2b** – Ensure Minimum Thresholds conform with current agreements with other agencies and match between documents.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency LS-3 – The GSPs do not provide adequate implementation details and are not on track to avoid serious impacts to the Friant-Kern Canal.	Each GSP is required to include a description of the projects and management actions the GSA has determined will achieve groundwater sustainability in the basin. The description must include project management actions, summary of data used to support proposed actions, and a review of the uncertainty associated with the basin setting when developing projects or management actions (Cal. Code Regs., tit. 23, § 354.44). In reviewing GSPs, DWR must consider, among other questions, "whether sustainable management criteria and projects and management actions are commensurate with the level of understanding of the basin setting, based on the level of uncertainty, as reflected in the plan" and "whether the projects and management actions are feasible and likely to prevent undesirable results and ensure that the basin is operated within its sustainable yield" (Cal. Code Regs., tit. 23, § 355.4, subd. (b)(3), (5)).	**DWR Inadequate Determination summary:** The 2022 DWR Inadequate Determination notes that the 2022 Coordination Agreement provides little detail about projects and management actions to slow subsidence. DWR also notes that subsidence along the Friant-Kern Canal has already exceeded 1.5 feet since 2020. DWR further notes that the lack of adequate project and management detail indicates that the GSPs do not appear to have plans to prevent monitoring sites from exceeding their MT of three feet of subsidence. DWR staff notes that the 2022 GSP "has not indicated the rate at which land subsidence will be abated" and is concerned that the plan is "not on track to meet its goals" **Board additional issues**: Board staff note that the 1.5 feet of subsidence identified by DWR may indicate that the Eastern Tule GSA Land Subsidence Management Plan is not adequately slowing subsidence rates. Recent InSAR data spanning June 2015 to October 2023 indicate land subsidence ranging from zero to a maximum of 3.4 ft (near Terra Bella) in one mile buffer areas adjacent to the Friant-Kern Canal. The rates of subsidence along the Friant-Kern Canal are especially concerning given that the 2022 GSPs MTs may not avoid undesirable results and appear to violate existing agreements to protect the canal in some areas.	**Potential Action LS-3a** – Develop and implement a plan to trigger sufficient management actions when subsidence exceeds defined thresholds, especially near critical infrastructure/facilities. **Potential Action LS-3b** – Reduce pumping and do not allow new wells in areas where subsidence threatens critical infrastructure. **Potential Action LS-3c** – Develop infrastructure mitigation programs with clear triggers, eligibility requirements, metrics, and funding sources.
Deficiency LS-4 – The Tri-County Water Authority GSP does not define Undesirable Results and Sustainable Management Criteria consistent with the Subbasin Coordination Agreement.	Agencies choosing to develop multiple GSPs "shall enter into a coordination agreement to ensure that the Plans are developed and implemented utilizing the same data and methodologies and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting" (Cal. Code Regs., tit. 23, § 357.4a).	**DWR Inadequate Determination summary:** The Tri-County Water Authority GSP's definition of an undesirable result and SMC differs from the Subbasin Coordination Agreement and other GSPs within the subbasin. **Board additional issues**: The Tri-County Water Authority is located in both the Tule and Tulare Lake basins, and it appears that the Tri-County Water Authority GSP for the Tule basin defined its undesirable result and SMC consistent with the 2022 Tulare Lake GSP. It is therefore unclear whether the subbasin is coordinated.	**Potential Action LS-4** – Define undesirable results consistently throughout the subbasin.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency LS-5 – The GSPs do not address undesirable results caused by land subsidence after 2040, and instead allow for residual subsidence to continue after 2040.	SGMA requires that basins achieve their sustainability goal within 20 years of plan implementation (Wat. Code § 10727.2 subd. (b)(1)), which requires operating the basin within its sustainable yield (Wat. Code § 10721 subd. (u)) while avoiding undesirable results (Wat. Code § 10721 subd. (v)). SGMA does not differentiate between total and residual subsidence, so GSPs must also consider residual subsidence when avoiding undesirable results.	**DWR Inadequate Determination summary:** The 2022 Coordination Agreement states "residual land subsidence resulting from historical groundwater conditions may occur after 2040", yet the GSAs do not ensure this continued subsidence will not cause undesirable results. DWR's 2022 Determination Letter notes that "SGMA and the GSP Regulations does not differentiate residual subsidence; therefore, GSAs should assess total subsidence impacts causes by groundwater pumping" and that "SGMA requires GSAs to avoid or minimize subsidence and the GSAs have not demonstrated the Plan's intent to accomplish this". **Board additional issues**: None.	**Potential Action LS-5** – Do not allow land subsidence to occur past 2040.
Deficiency Groundwater Quality (GWQ)-1 – The 2022 GSPs do not clearly define the conditions that would be considered an undesirable result.	The GSP Regulations require a GSA to "describe...the processes and criteria relied upon to define undesirable results applicable to the basin." This description must include the cause of past or potential undesirable results, "the criteria used to define when and where the effects of the groundwater conditions cause undesirable results," and the potential effects of undesirable results on groundwater uses and users and land uses and property interests (Cal. Code Regs., tit. 23, § 354.26).	**DWR Inadequate Determination summary**: None. **Board issues**: The 2022 GSPs and coordination agreement defines an undesirable result as "the significant and unreasonable degradation of groundwater quality **due to groundwater pumping and recharge projects** such that the quality of groundwater is no longer generally suitable for agricultural and/or domestic use" (2022 Coordination Agreement, p. 53). GSPs do not clearly describe how the subbasin would determine if SMC exceedances are "due to the result of groundwater pumping and recharge projects" as opposed to other factors.	**Potential Action GWQ-1** – Add information about the impacts of basin management on groundwater quality. Explain how they would determine the water quality impacts of: • Projects and management actions • Subsidence • Continued pumping

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency GWQ-2 – Minimum thresholds set by the 2022 GSP are not consistent with GSP Regulations. • **Deficiency GWQ-2a** – The 2022 GSPs do not define minimum thresholds consistent with prevention of further degradation of groundwater quality where pre-2015 undesirable results occurred. • **Deficiency GWQ-2b** – The GSPs do not consider all constituents with known exceedances. • **Deficiency GWQ-2c** – Minimum Thresholds based on agricultural standards are applied to domestic wells.	The 2022 GSPs use historical data to establish MTs when pre-2015 conditions exceeded MCLs or SMCLs. Board staff understand that GSAs do not have to address undesirable results that occurred before 2015, and Board staff understand that this is why GSAs are establishing MTs from historical data. But Board staff note multiple deficiencies concerning how these historical data are used and the resulting MTs. These deficiencies are summarized below as GWQ-2a, GWQ-2b, GWQ-2c. The plan may, but is not required to, address undesirable results that occurred before, and have not been corrected by, January 1, 2015.	**DWR Inadequate Determination summary**: None. **Board issues**: • **GWQ-2a** – The 2022 Coordination Agreement for setting MTs states that "for RMS wells that already have historical exceedances of the MCLs or WQOs... [MTs will be set at] pre-2015 implementation concentration." The 2022 GSPs therefore establish MTs that exceed primary MCLs or upper SMCLs yet does not demonstrate that exceeding health- or quality-protective standards is not an undesirable result. • **GWQ-2b** – The GSPs do not consider all the constituents with exceedances (This is based on the SGMA Groundwater Quality Visualization Tool). • **GWQ-2c** – MTs for RMS in agricultural areas are based on Water Quality Objectives rather than MCLs. **This means that water quality in domestic wells could degrade below drinking water standards without being considered an undesirable result.**	**Potential Action GWQ-2** – Update minimum thresholds to be consistent with GSP Regulations. • **Potential Action GWQ-2a** – Establish RMS within areas of known regulatory threshold exceedances and set SMC consistent with the GSP Regulations. • **Potential Action GWQ-2b** – Use the best available data when defining constituents and set SMC for all constituents in the basin that may impact beneficial uses and users. • **Potential Action GWQ-2c** – Revise criteria to categorize RMS and describe potential impacts to all beneficial uses and users.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency GWQ-3 – The Tri-County Water Authority GSP does not define Undesirable Results and Sustainable Management Criteria consistent with the Subbasin Coordination Agreement. • **Deficiency GWQ-3a** – The Tri-County Water Authority GSP defined undesirable result is inconsistent with the subbasin wide definition of an undesirable result. • **Deficiency GWQ-3b** – The Tri-County Water Authority method of setting SMC is not consistent with the goals of SGMA or the Tule Subbasin Coordination Agreement.	Agencies intending to develop and implement multiple Plans pursuant to Water Code Section 10727(b)(3) shall enter into a coordination agreement to ensure that the Plans are developed and implemented utilizing the same data and methodologies and that elements of the Plans necessary to achieve the sustainability goal for the basin are based upon consistent interpretations of the basin setting (Cal. Code Regs., tit. 23, § 357.4a).	**DWR Inadequate Determination summary**: None. **Board issues**: The TCWA GSA is located in both the Tule and Tulare Lake subbasins. The Tule TCWA GSP is consistent with the Tulare Lake TCWA GSP rather than the 2022 Tule Coordination Basin.	**Potential Action GWQ-3** – Update SMCs to be consistent with the Subbasin Coordination Agreement. • **Potential Action GWQ-3a** – Define undesirable results consistent with the goals of SGMA and the Tule Subbasin Coordination Agreement. • **Potential Action GWQ-3b** – Define SMC methodology consistent with the goals of SGMA and the Tule Subbasin Coordination Agreement.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency

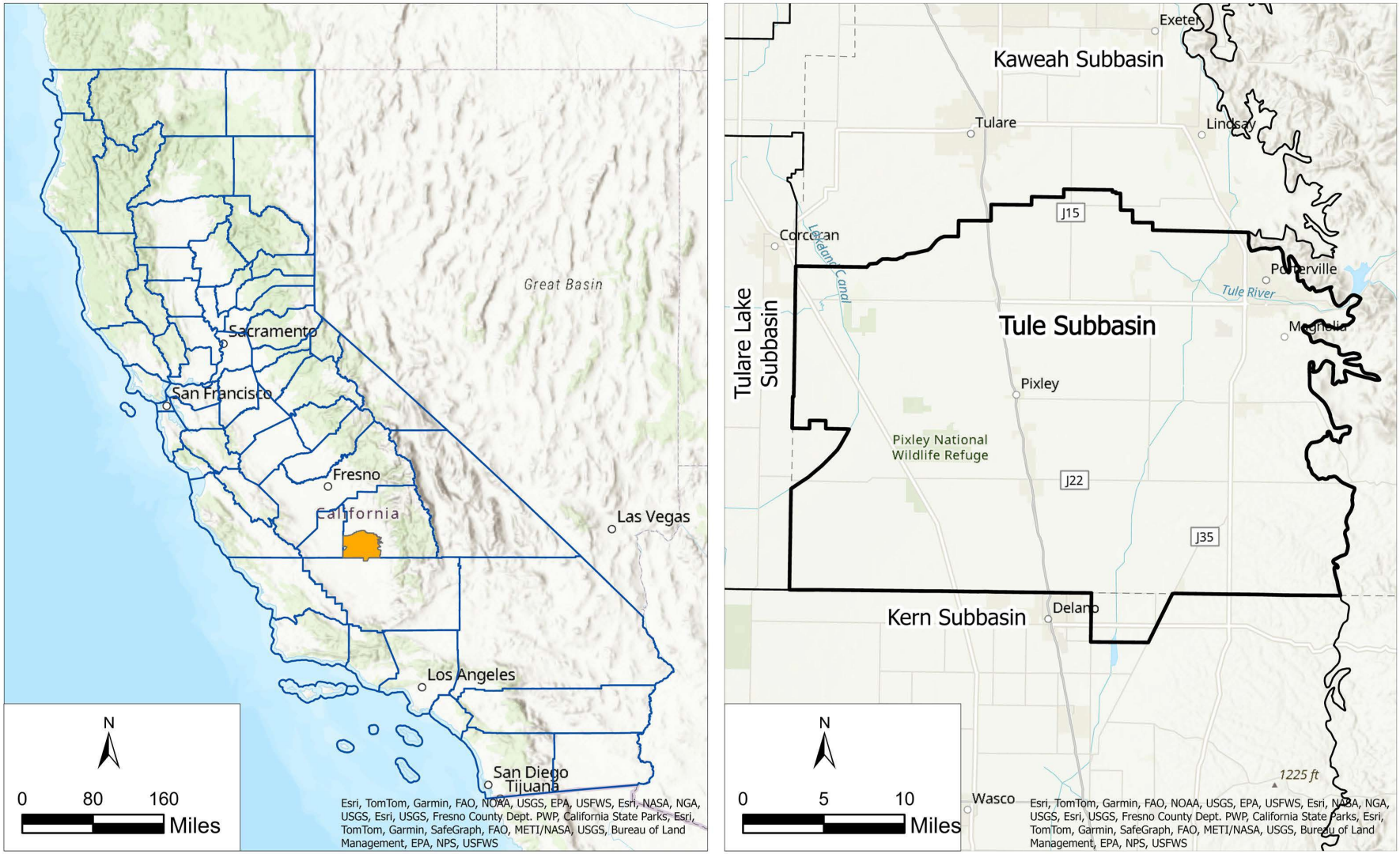
Deficiency GWQ-4 – The water quality monitoring plan in the 2022 GSP is not consistent with GSP regulations.
• **Deficiency GWQ-4a** – The proposed monitoring network in the 2022 GSPs is inconsistent with the 2022 Coordination Agreement defined RMS wells. Questions we have:
  ○ Which wells?
  ○ Which aquifers?
  ○ Adequate?
  ○ Composite?
  ○ Rationale?
• **Deficiency GWQ-4b** – The proposed monitoring frequency is insufficient to detect short-term and seasonal trends.
	The GSP Regulations require GSPs to include a description of the monitoring network objectives for the basin, including how the GSA will "monitor impacts to the beneficial uses or users of groundwater" (Cal. Code Regs., tit. 23, § 354.34, subd. (b)(2)). The monitoring network must be "capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate [GSP] implementation." (Cal. Code Regs., tit. 23, § 354.34, subd. (a)). Data collected must be of "sufficient quality, frequency, and distribution" to characterize and evaluate groundwater conditions (Cal. Code Regs., tit. 23, § 354.32).
	GSAs "may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin...", known as RMSs (Cal. Code Regs., tit. 23, § 354.36). GSAs identify MTs, MOs, and IMs at these sites. "The designation of [an RMS] shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area" (Cal. Code Regs., tit. 23, § 354.36, subds. (a) & (c)).
		DWR Inadequate Determination summary:
		None.
		Board issues:
		• **GWQ-4a** – The monitoring network described in the 2022 Coordination Agreement differs substantially from the monitoring networks described in the GSPs. The Coordination Agreement indicates there are 76 RMS; GSPs indicate there are 26. It's not clear: 1) which wells are being monitored; 2) if the GSAs know which aquifers the wells monitor; 3) if the monitoring network adequately monitors key aquifers; 4) if the network relies on composite wells; and 5) whether the scientific rationale for selecting RMS is adequate.
		• **GWQ-4b** – The GSAs propose to collect only annual summer groundwater samples from RMS wells
			Potential Action GWQ-4 – Update the water quality monitoring plan in the 2022 GSP to be consistent with GSP regulations.
			• **Potential Action GWQ-4a** – Ensure the monitoring networks described in GSPs are consistent with the monitoring network described in the 2022 coordination agreement.
			  ○ List wells
			  ○ List aquifers
			  ○ List information
			  ○ No composite wells
			  ○ Describe rationale
			• **Potential Action GWQ-4b** – Increase the sampling frequency for the groundwater quality monitoring network.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency GWQ-5 – Management actions are not responsive to water quality degradation. • **Deficiency GWQ-5a** – Additional sampling is not triggered when Minimum Thresholds are exceeded. • **Deficiency GWQ-5b** – Well mitigation plans don't address water quality degradation.	Each GSP is required to include a description of the projects and management actions the GSA has determined will achieve groundwater sustainability in the basin. The GSAs must include projects and management actions "that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent" (Cal. Code Regs., tit. 23, § 354.44, subd. (b)(1)).	**DWR Inadequate Determination summary**: None. **Board issues**: NA	**Potential Action GWQ-5** – Update management actions to be responsive to water quality degradation. • **Potential Action GWQ-5a** – Plan additional sampling when water quality is degraded. • **Potential Action GL-8** – Develop well mitigation programs with clear triggers, eligibility requirements, metrics, and funding sources. (This action supports addressing both Deficiency GL-8 and Deficiency GWQ-5b.)
Deficiency Interconnected Surface Water (ISW)-1 – The 2022 GSPs claim that there is no ISW in the Tule basin, but the analysis is limited and relies on incomplete data.	The GSP Regulations require GSAs to provide an "Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information," (Cal. Code Regs., tit. 23, § 354.16, (f)).	**DWR Inadequate Determination summary**: None. **Board issues**: The 2022 GSPs do not provide adequate technical justification to demonstrate ISW are not present in the subbasin. The 2022 Coordination Agreement Basin Setting uses a depth to groundwater raster to conclude that there are no continuously occurring ISWs within the basin, however, Board staff notes that it is unclear which datasets or wells were used to generate the depth to groundwater raster, making it difficult to assess the accuracy of the raster in areas near streams. Moreover, although using groundwater depth as a proxy to determine the presence of ISW may be a sufficient method, groundwater-surface water interconnection varies within and across years. A single month in a multi-year drought, even a winter month, not provide sufficient technical justification to demonstrate the absence of ISW. Finally, the GSAs do not describe how they considered available stream gage data in determining the potential presence of ISW in the subbasin.	**Potential Action ISW-1a –** Use the best available data for identifying interconnected surface waters in the subbasin. **Potential Action ISW-1b –** Explain which groundwater level monitoring network was used to justify the absence of ISWs with the basin.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency ISW-2 – The 2022 GSPs do not correctly define Interconnected Surface Water.	The GSP Regulations state that ISWs refer to "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted," (Cal. Code Regs., tit. 23, § 351, (o)).	**DWR Inadequate Determination summary**: None. **Board additional issues**: Board staff notes that the GSAs' understanding of ISW within the basin is inconsistent with SGMA's definition of ISW. The 2022 Coordination Agreement Basin Setting uses a depth to groundwater raster to conclude that there are no continuously occurring ISWs within the basin. However, the Coordination Agreement contradicts this finding by stating that there are periods where groundwater is within the 25 ft below ground surface threshold from the ground surface, which would allow for ISW to occur. As a result, the GSAs failed to identify potential ISWs in accordance with SGMA regulations. Furthermore, Eastern Tule GSA conflates ISW with subterranean streams. SGMA statute clearly defines ISWs as groundwater and any occurrence of surface water that are hydraulically connected at any point (Cal. Code Regs, tit. 23, §351, subd. (o)). The definition of ISW does not refer to subterranean streams.	**Potential Action ISW-2a –** Reevaluate ISWs within the basin using the understanding that ISWs may be intermittent. **Potential Action ISW-2b –** Remove the reference to subterranean streams.

Deficiency	What SGMA Requires	Deficiency Summary	Potential Actions to Correct the Deficiency
Deficiency ISW-3 (Conditional) – If depletions of Interconnected Surface Water occur in the subbasin, the GSAs must set Sustainable Management Criteria for depletions of Interconnected Surface Water and establish a shallow water monitoring network.	"Sustainable management criteria and projects and management actions shall be commensurate with the level of understanding of the basin setting, based on the level of uncertainty and data gaps, as reflected in the Plan" ((Cal. Code Regs., tit. 23, § 350.4, (d)).	**DWR Inadequate Determination summary**: None. **Board additional issues**: Board staff recognize that the GSAs did not establish ISW SMC under the assumption that depletions of ISW are not occurring in the subbasin or are not likely to occur in the subbasin. However, if in address Deficiencies ISW-1 and ISW-2, the GSAs find evidence of the presence of depletions of ISW, then GSAs will need to develop SMC, create a monitoring network, and identify associated projects or management actions for the depletion of ISW.	**Potential Action ISW-3a –** Create an ISW monitoring network near established surface monitoring stations to fill data gaps. **Potential Action ISW-3b –** Use the ISW network to model if surface water is hydraulically connected to the underlying aquifer via a continuous saturated zone. **Potential Action ISW-3c –** Identify wells where excessive groundwater pumping could lower the hydraulic gradient, reduce the surface water supply, and impact nearby vegetation and ecosystems. **Potential Action ISW-3d –** Develop SMC for the depletion of interconnected surface water.

Appendix B – Figures



Tule Subbasin

California Counties

Figure ES-1

Location of the Tule Subbasin

Draft Staff Report
Tule Subbasin
March 2024

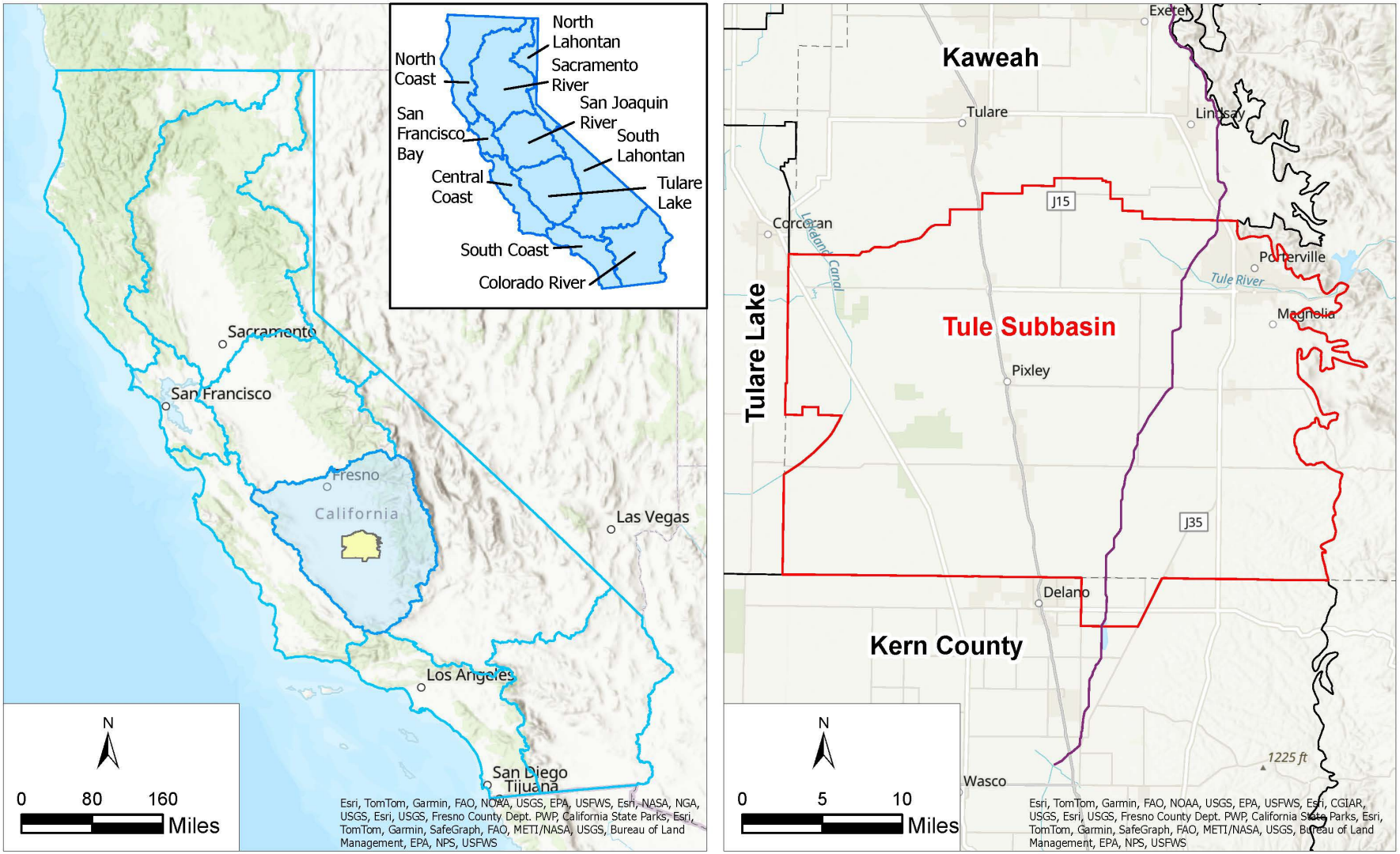


Figure 3-1

Overview of the Tule Subbasin

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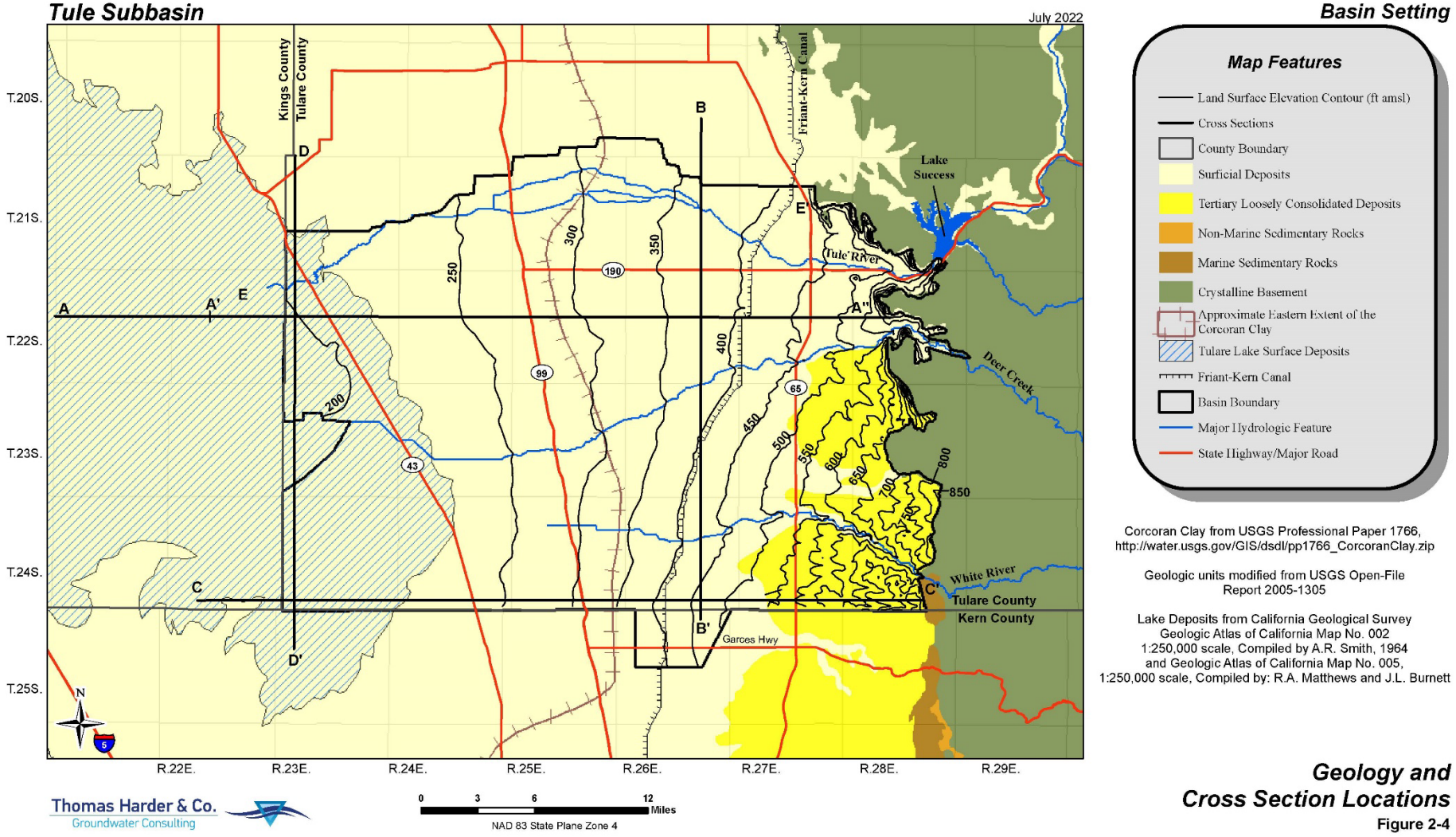
Tule Subbasin
March 2024

- Tule Subbasin
- Hydrologic Regions
- Tulare Lake Hydrologic Region
- Friant Kern Canal

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

Figure 3-2: Topographic Map of the Tule Subbasin

Excerpt from the Tule Subbasin 2022 Coordination Agreement



Corcoran Clay from USGS Professional Paper 1766, http://water.usgs.gov/GIS/dsdl/pp1766_CorcoranClay.zip

Geologic units modified from USGS Open-File Report 2005-1305

Lake Deposits from California Geological Survey Geologic Atlas of California Map No. 002 1:250,000 scale, Compiled by A.R. Smith, 1964 and Geologic Atlas of California Map No. 005, 1:250,000 scale, Compiled by: R.A. Matthews and J.L. Burnett

Geology and Cross Section Locations

Figure 2-4

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March 2024

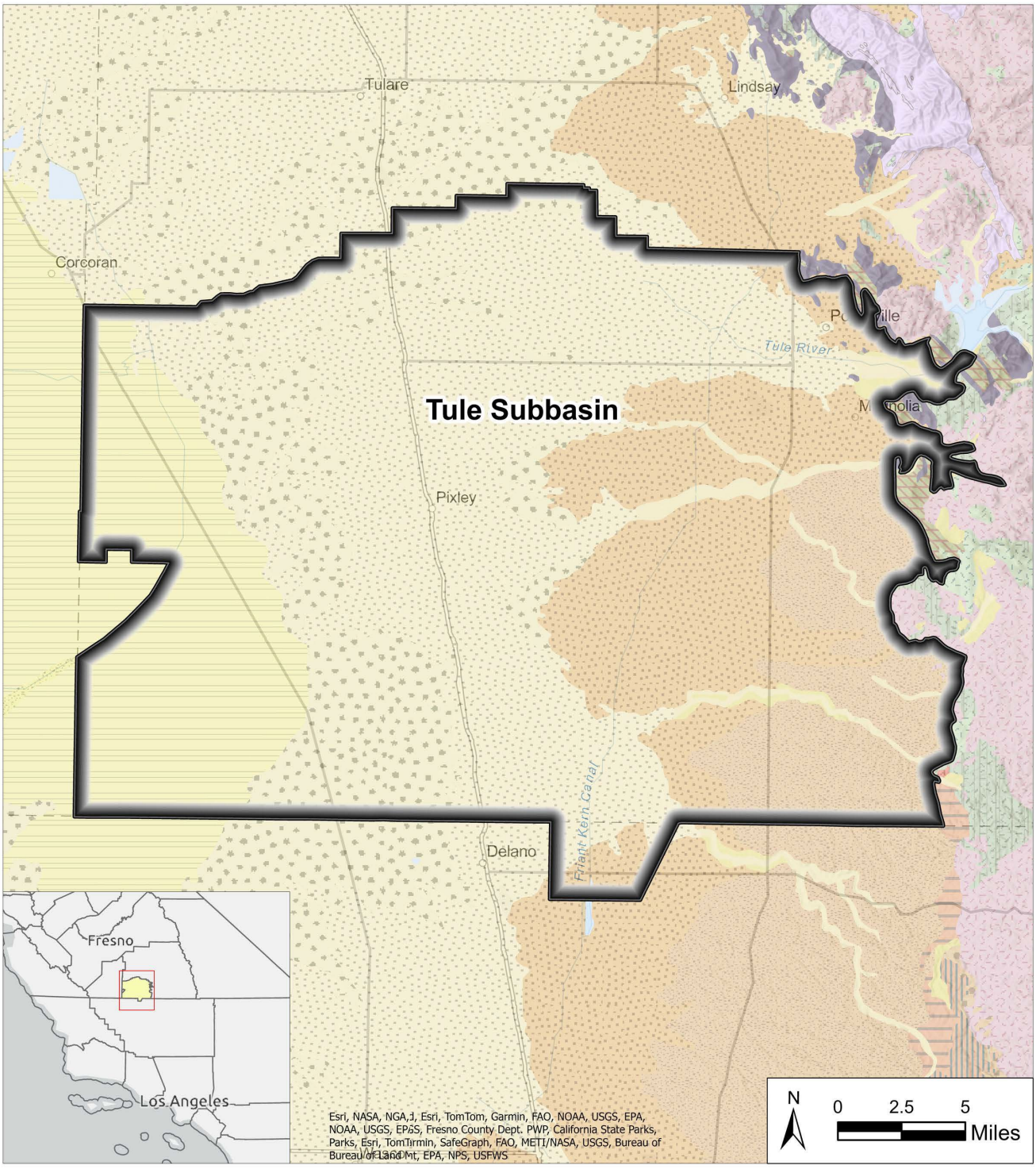

Figure 3-3

Geology of the Tule Subbasin

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March 2024

Tule Subbasin

Geologic Unit

water
Mm
Ml
Mu
Mvp
QP
Qal
Qb
Qc
Qf
Ql
Qs
Qt
Tc
bi
gr
grg
grt
m
ms
mv
ub

Source: CA Dept. of Conservation Regional Geologic Maps

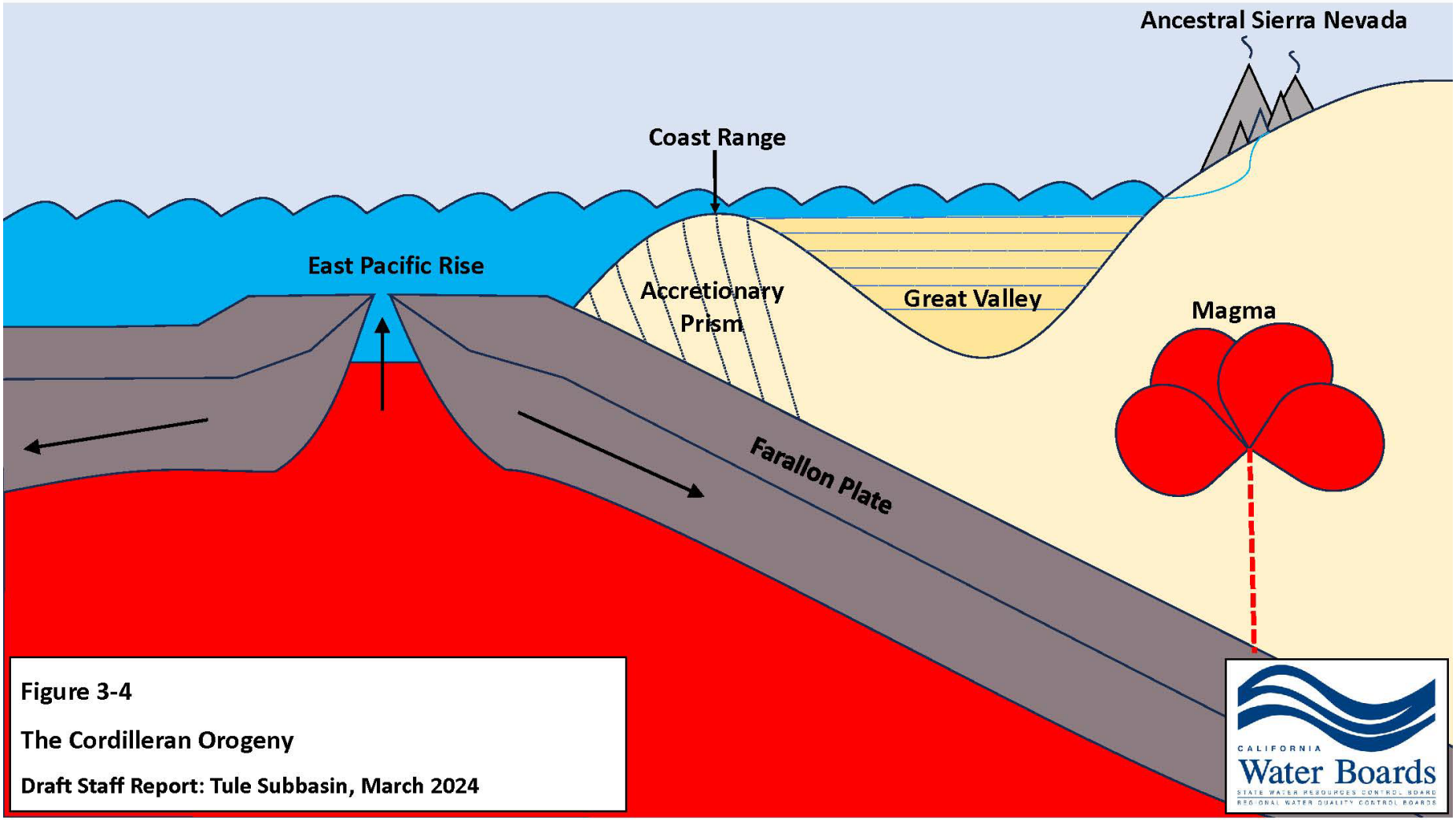

Figure 3-4

The Cordilleran Orogeny

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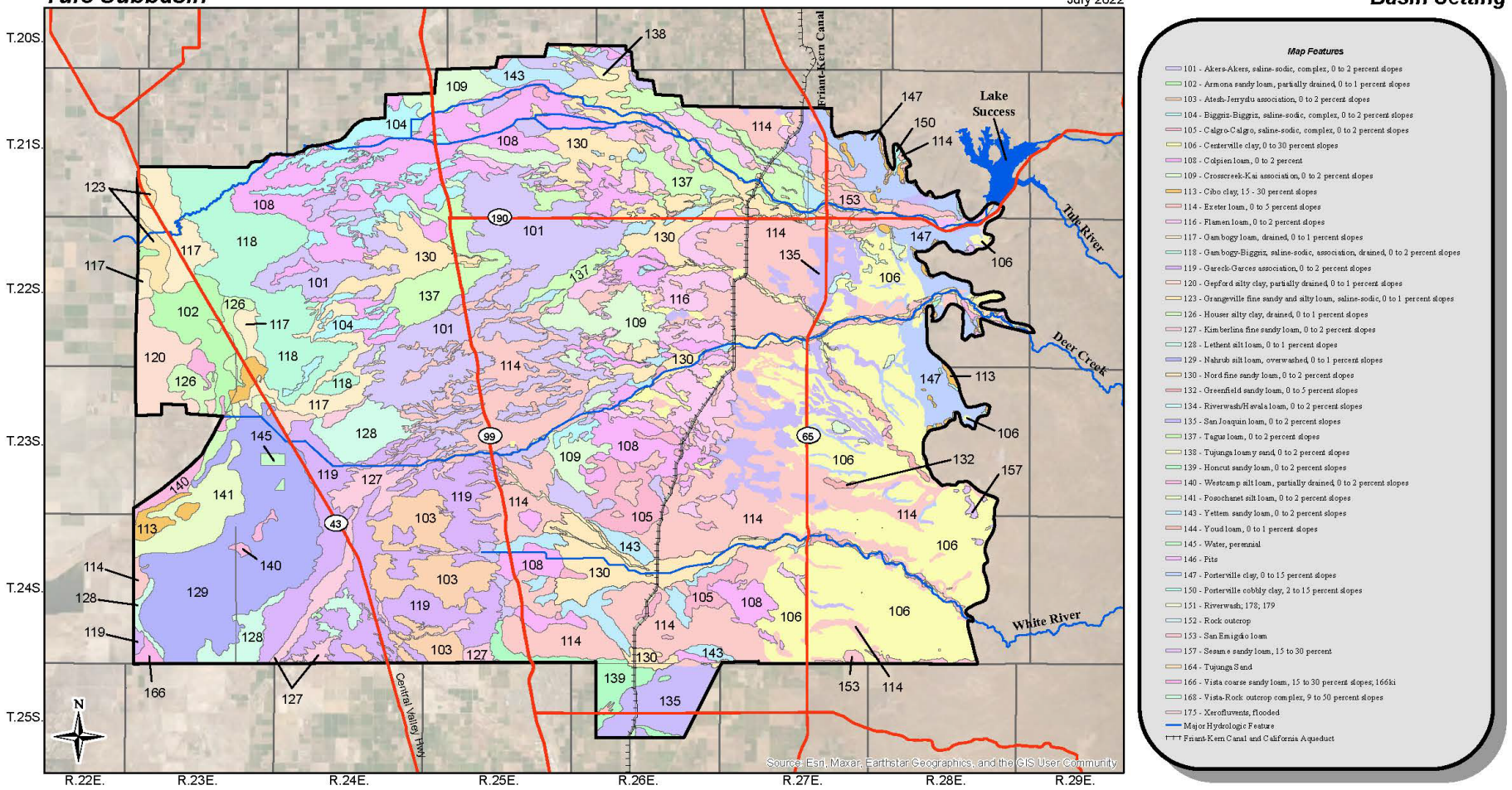
Figure 3-5: Soil Texture in the Tule Subbasin

Excerpt from the Tule Subbasin 2022 Coordination Agreement



Thomas Harder & Co.
Groundwater Consulting

Source: USDA National Resources Conservation Service Soils - Web Soil Survey.
Associated reports inclued: USDA; Soil Survey of Tulare County, California, Western Part.
USDA; Soil Survey of Tulare County, California, Central Part.
and USDA; Soil Survey of Kern County, Northeastern Part, and Southeastern Part of Tulare County, California.

Soil Map
Figure 2-8

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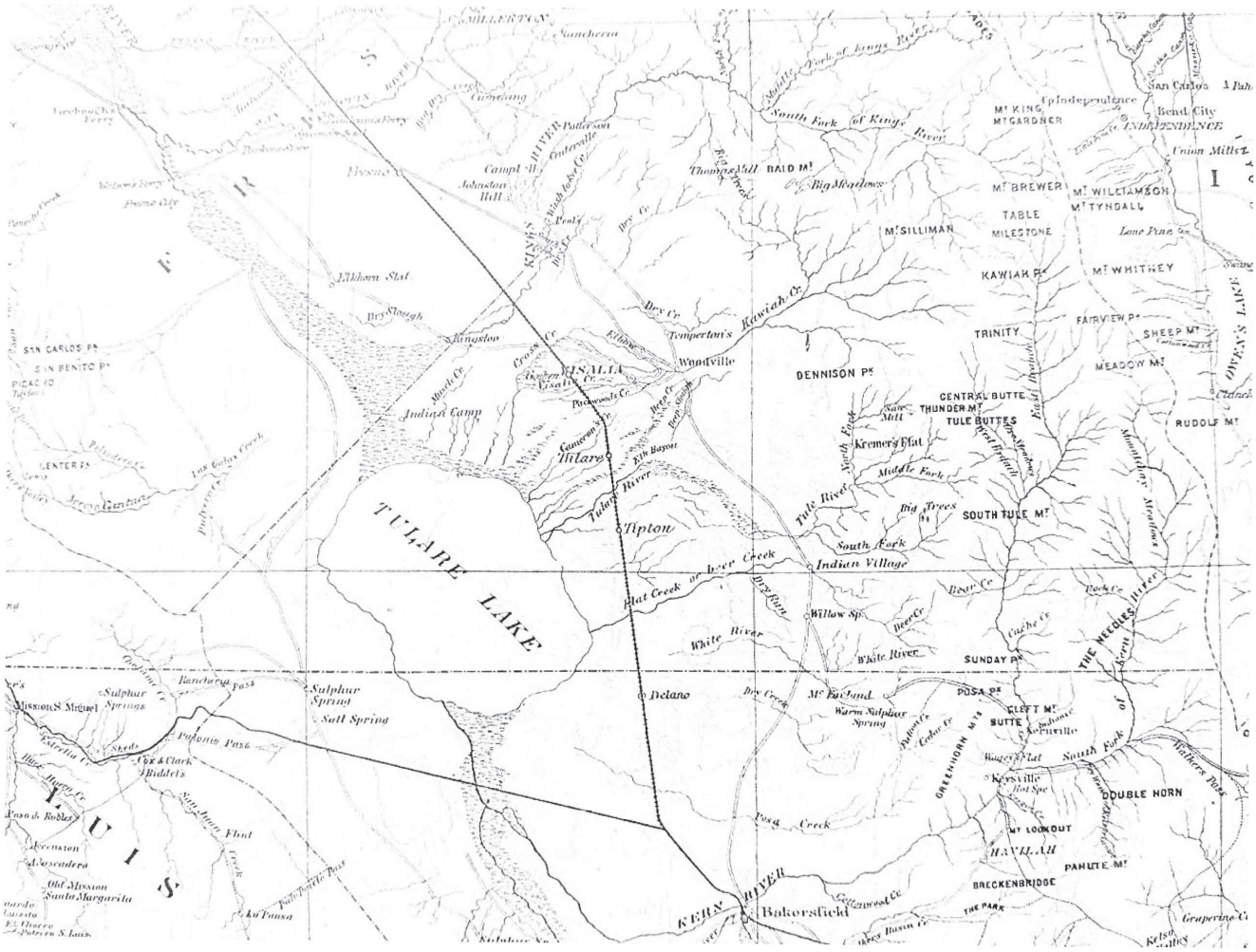
March 2024

Figure 3-6: Historical Map of Tulare Lake (1873)



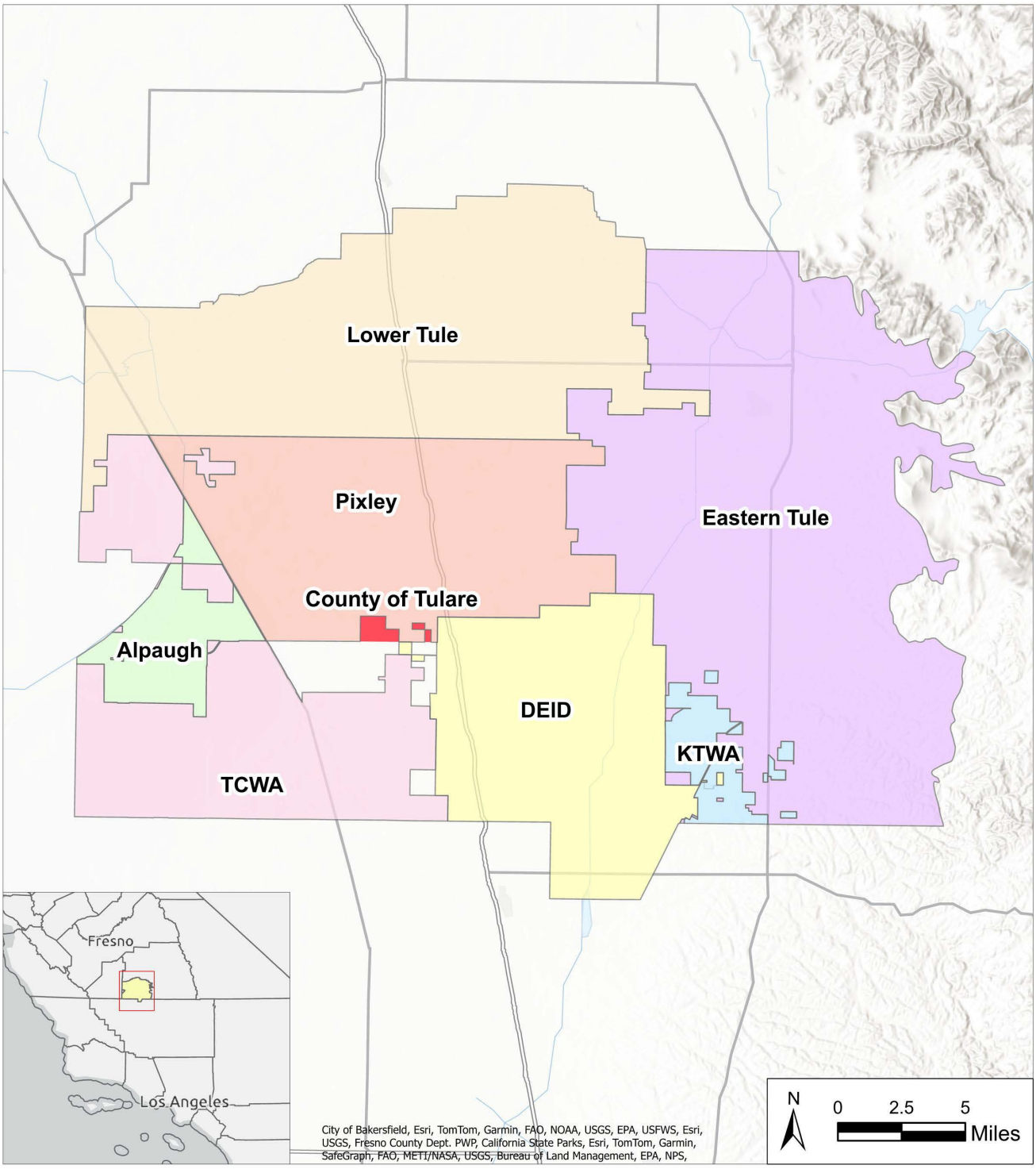


Figure 3-7

GSAs in the Tule Subbasin

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March 2024

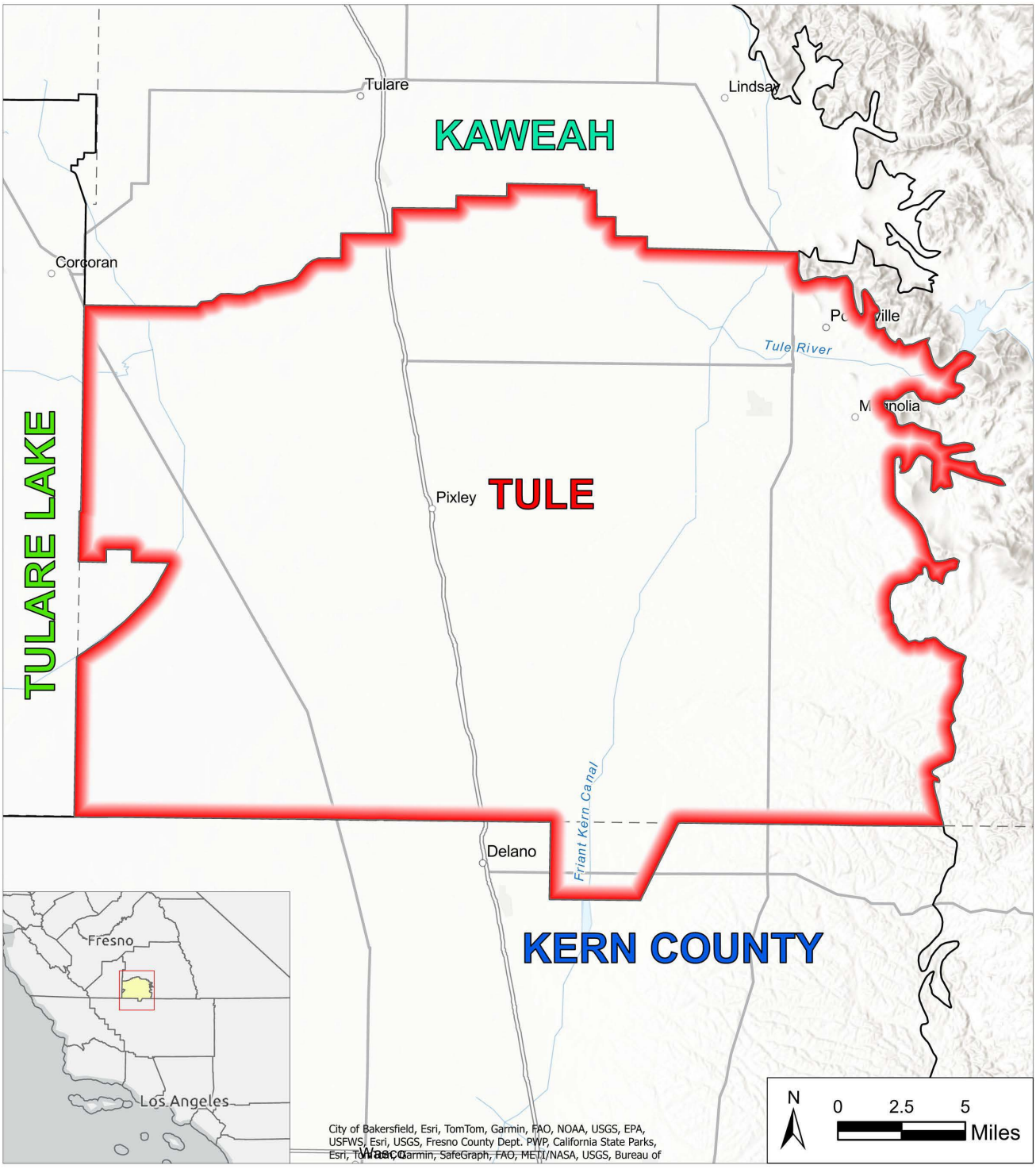

Figure 3-8

Subbasins Adjacent to Tule Subbasin

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March 2024

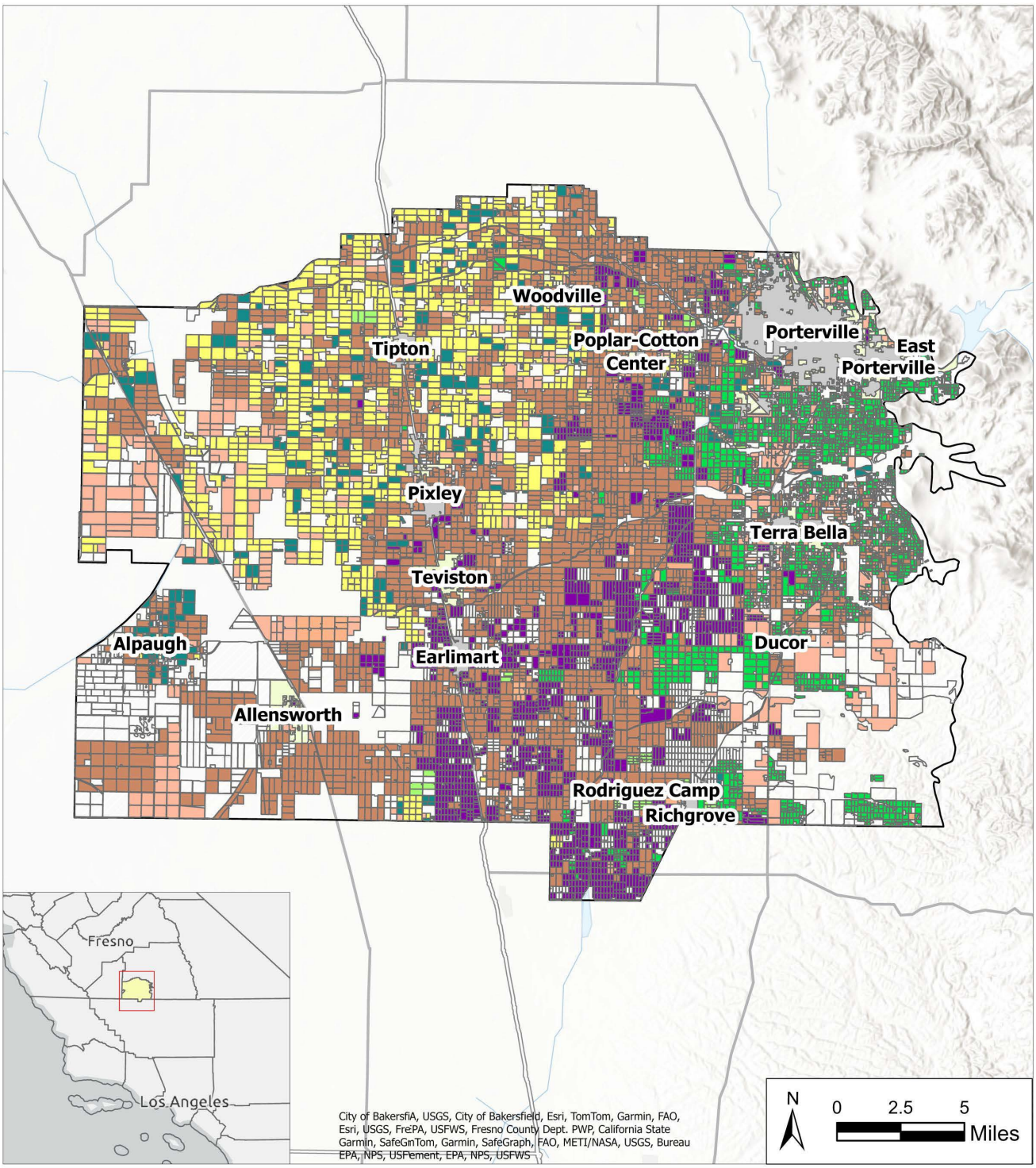

Figure 3-9

2020 Land Use in the Tule Subbasin

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March 2024

- Citrus and Subtropical
- Deciduous Fruits
- Field Crops
- Grain and Hay Crop
- Idle
- Pasture
- Tule Subbasin
- Truck Nursery and Berry Crops
- Urban Unspecified
- Urban Landscape
- Vineyard
- Unclassified
- Young Perennial

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Source: 2020 DWR Crop Mapping Dataset

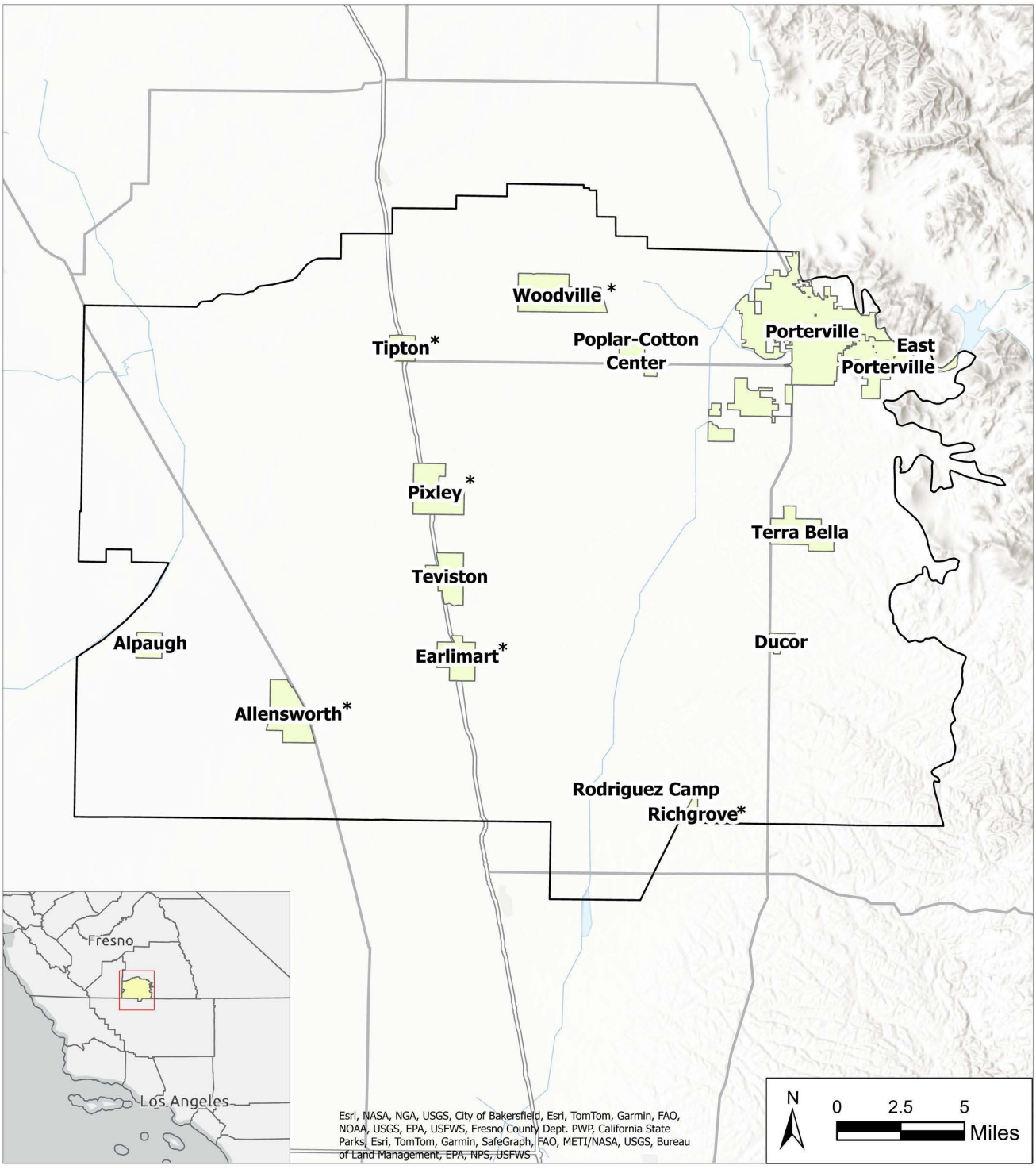

Figure 3-10

DACs in the Tule Subbasin

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Tule Subbasin

Disadvantaged Communities in the Tule Subbasin

* Failing Drinking Water System (DDW)

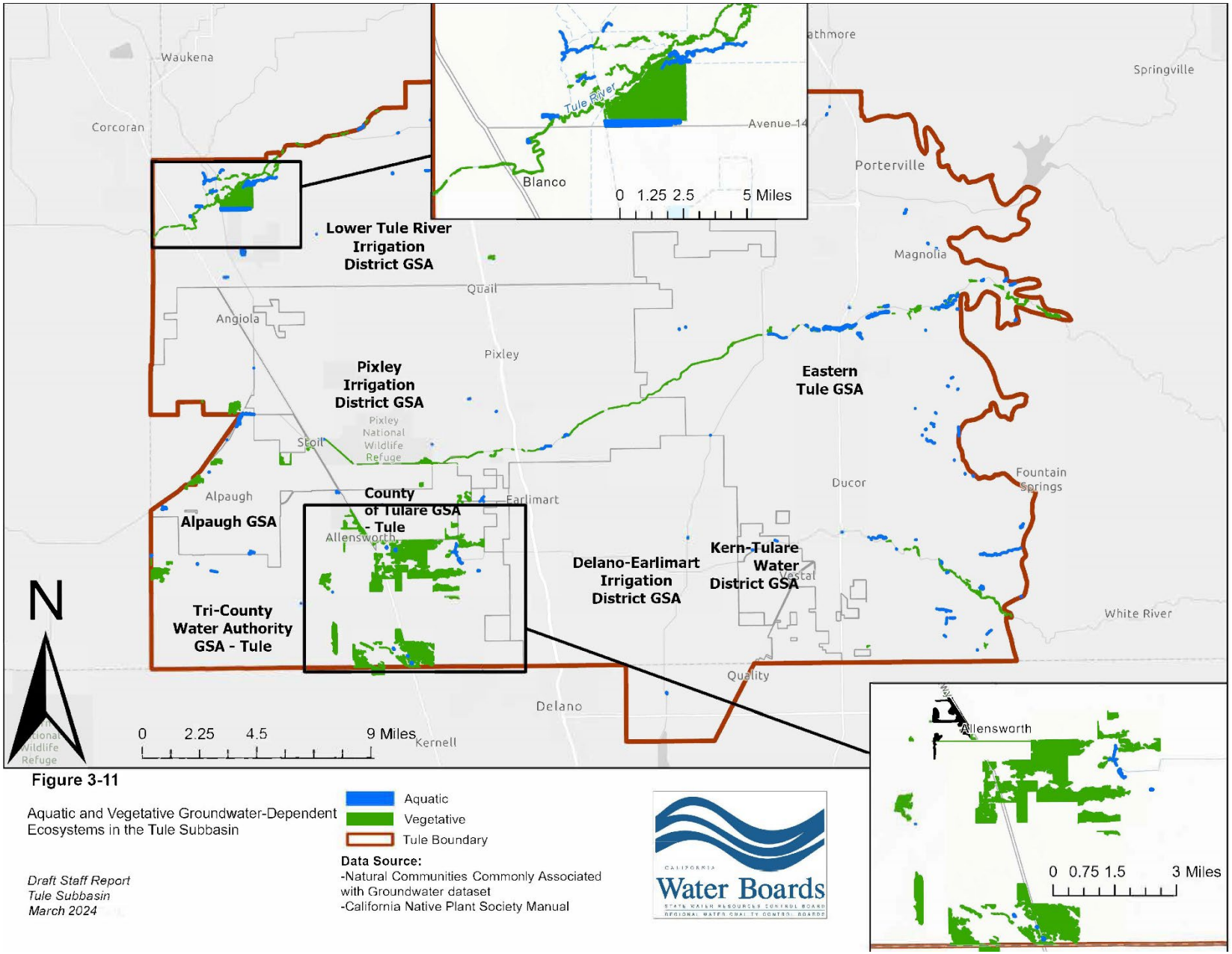

Figure 3-11

Aquatic and Vegetative Groundwater-Dependent Ecosystems in the Tule Subbasin

Aquatic
Vegetative
Tule Boundary

Data Source:
-Natural Communities Commonly Associated with Groundwater dataset
-California Native Plant Society Manual

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March 2024

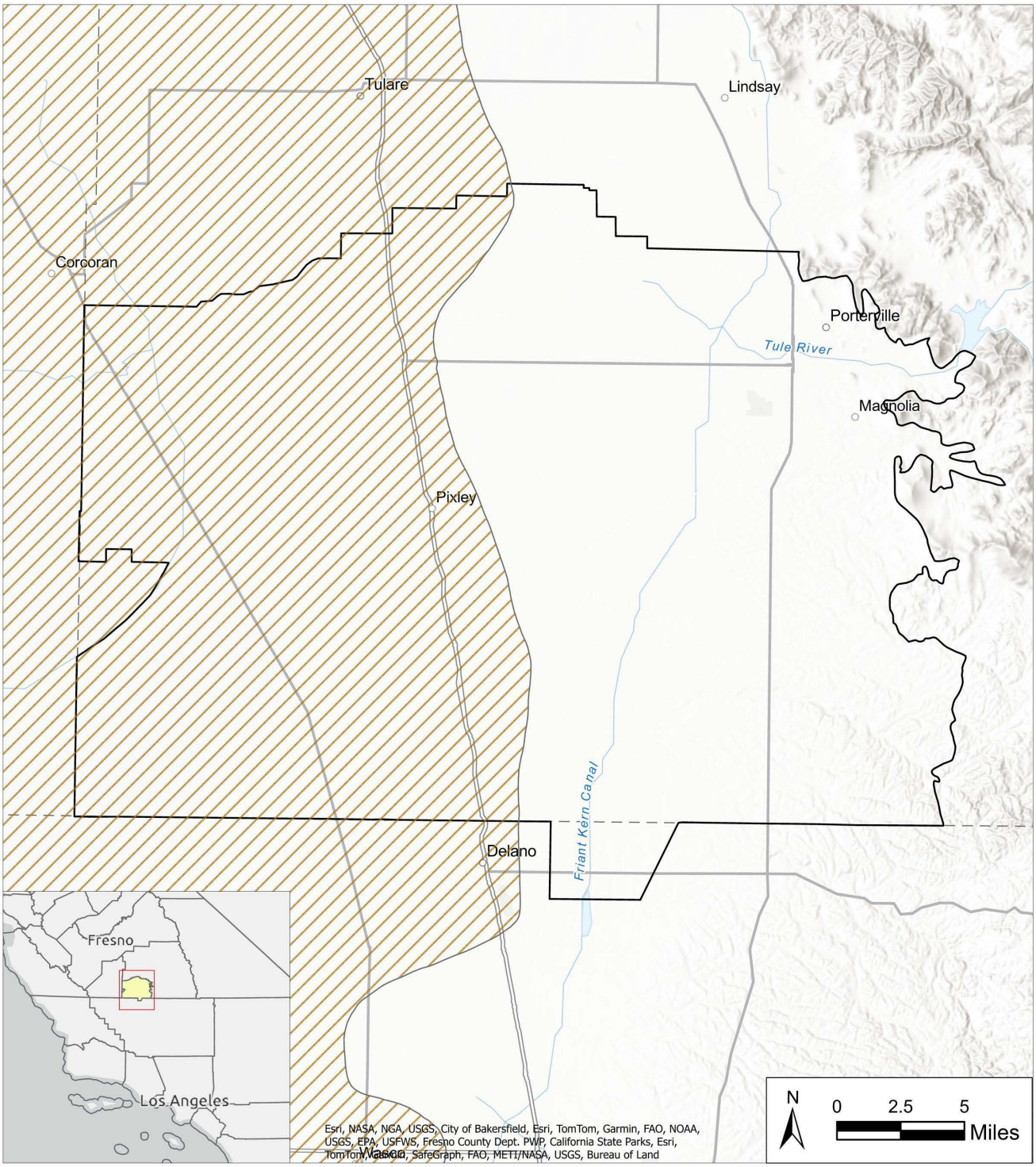

Figure 3-12

Corcoran Clay in the Tule Subbasin

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Tule Subbasin
March 2024

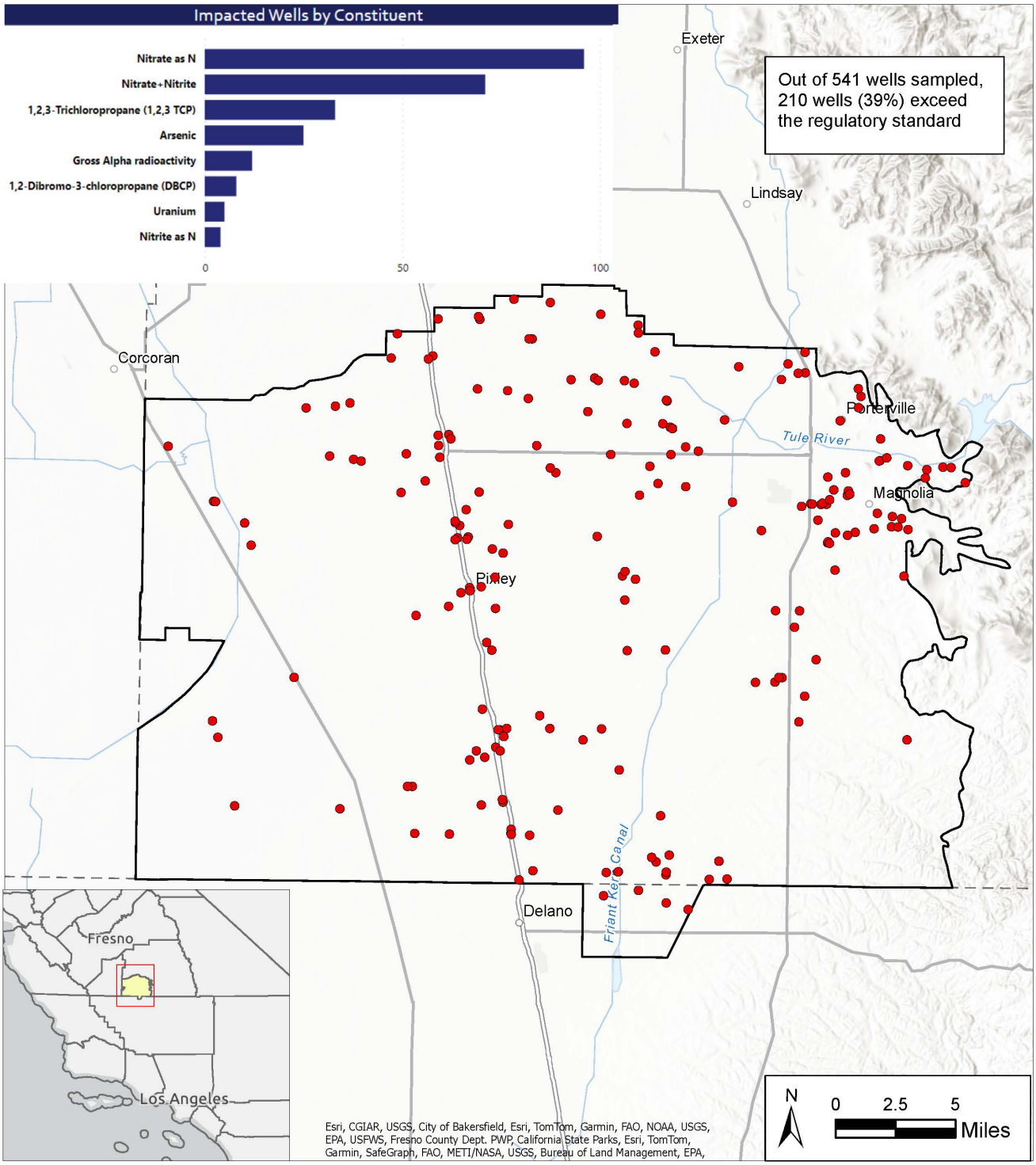

Figure 3-13

Wells with Constituent Detections Greater than the Comparable Concentration Value

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Tule Subbasin: March 2024

Source: SGMA Groundwater Quality Visualization Tool

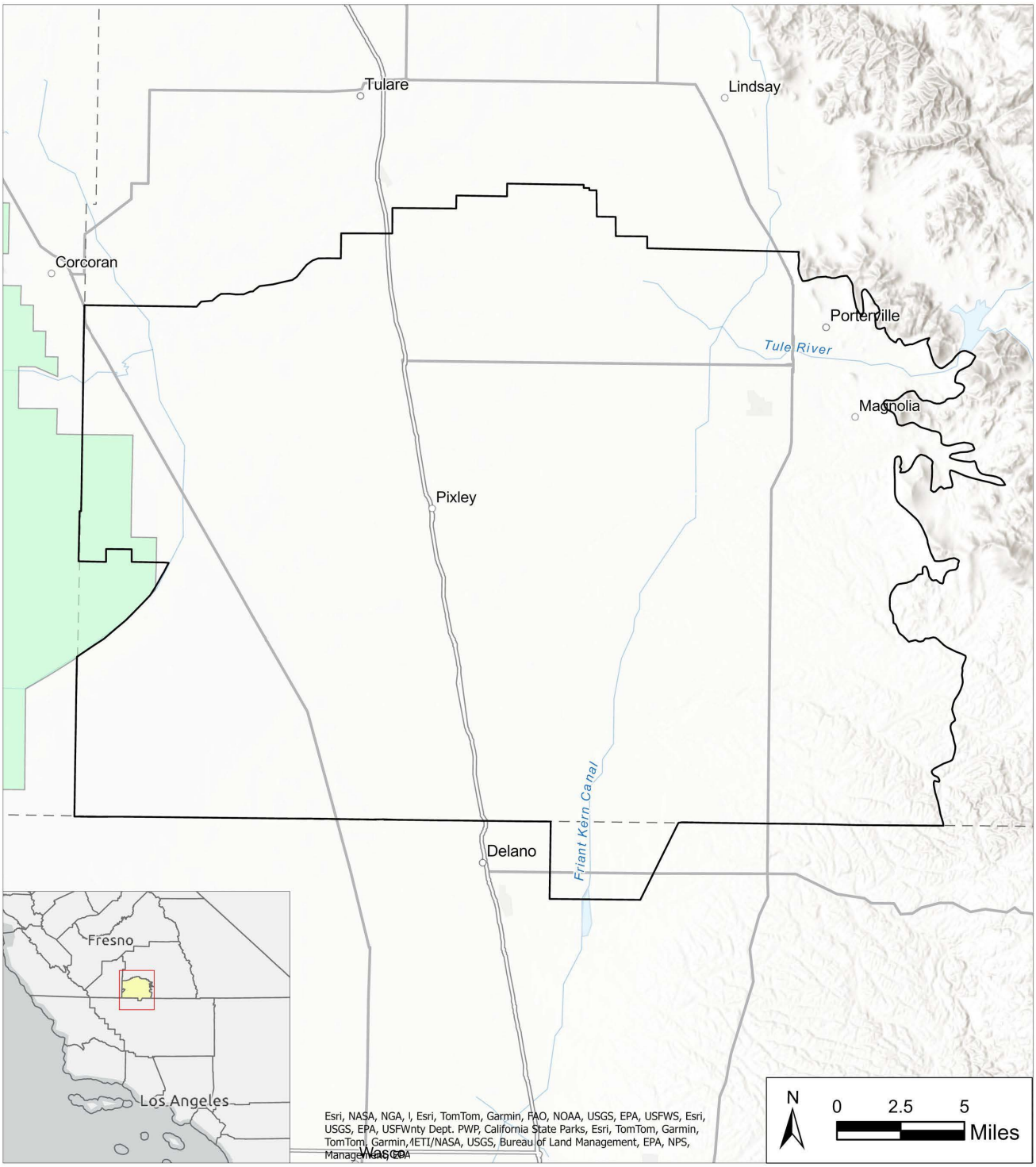

Figure 3-14

De-Designated Area in the Tule Subbasin

Tule Subbasin

De-Designated Area (Res. R5-2017-0032)
*A Vertical boundary exists above the E-Clay (Within the Upper and Lowe Aquifer)

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Tule Subbasin
March 2024

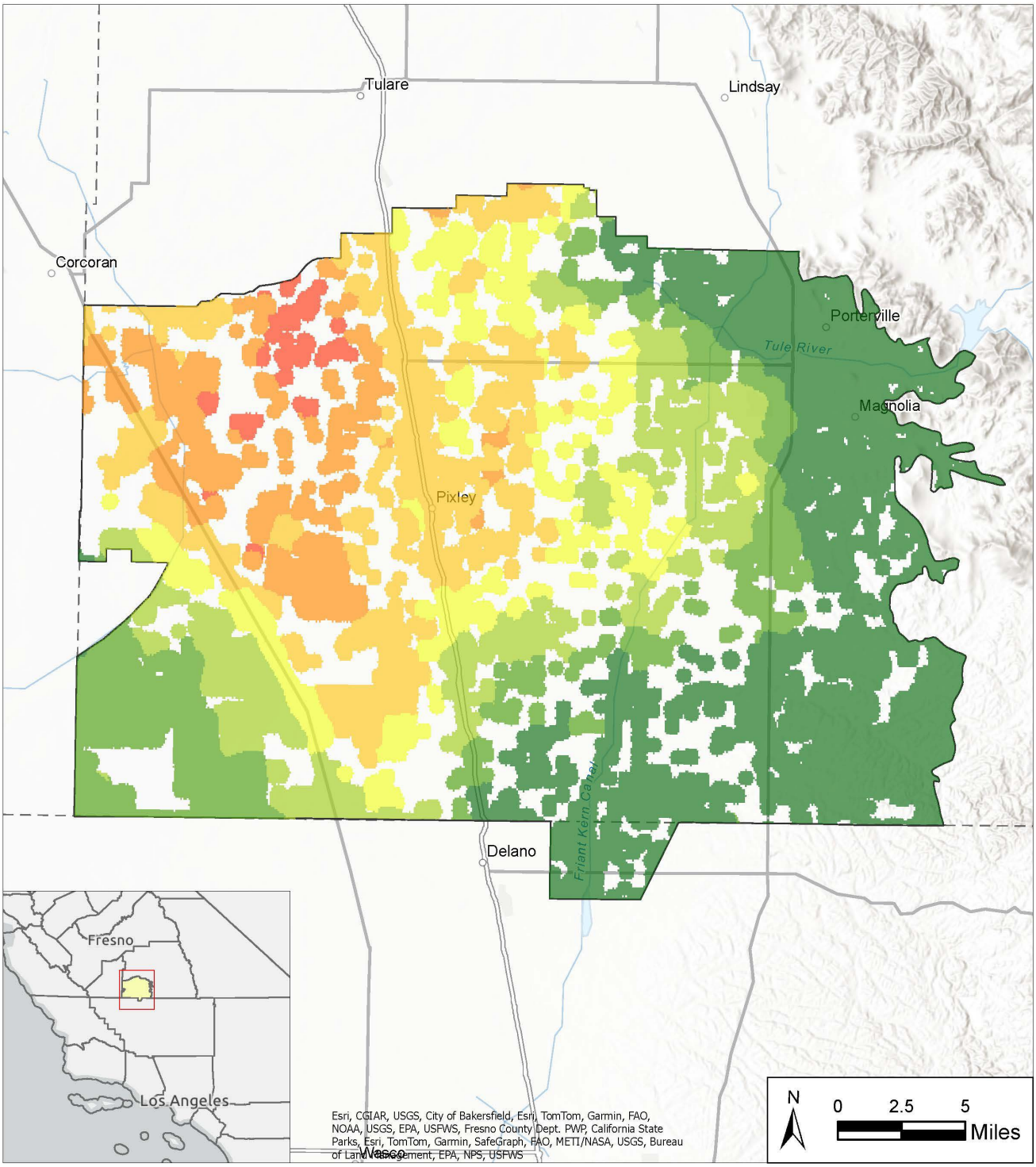

Figure 3-15

Subsidence in the Tule Subbasin (Jun '15 - Oct '23)

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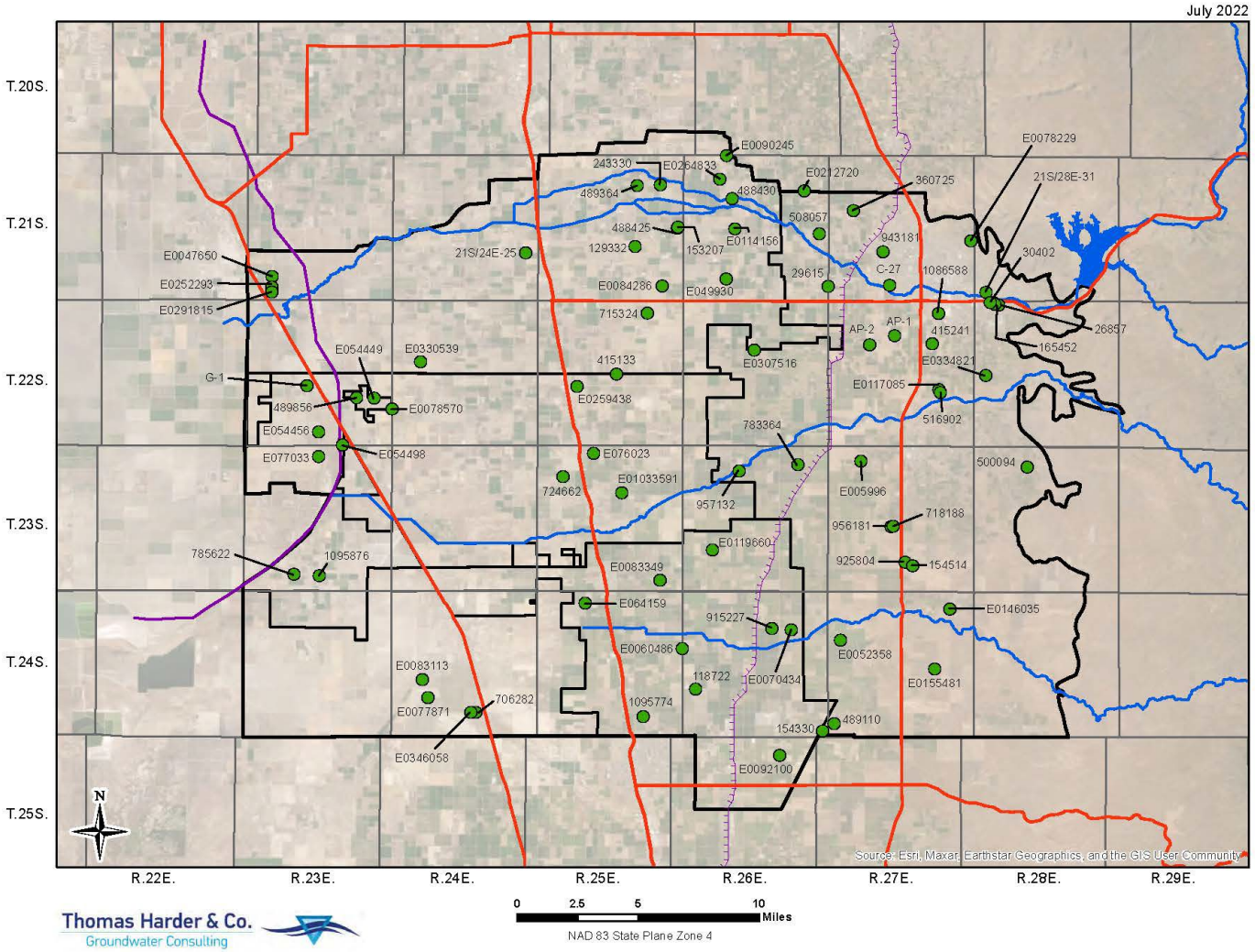
March 2024

Figure 4-1: GWQ Monitoring Network for the Tule Subbasin

Excerpt from the Tule Subbasin 2022 Coordination Agreement



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