Appendix A-2

Tule Subbasin Coordination Agreement
Attachment 2: Tule Subbasin Setting

TULE SUBBASIN COORDINATION AGREEMENT ATTACHMENT 2

Tule Subbasin Setting

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Prepared for

Tule Subbasin Technical Advisory Committee

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B. Eastern Tule GSA Water Budgets, Land Surface Elevations at Representative Monitoring Sites, and RMS Groundwater Elevation Hydrographs

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CHAPTER 2: TULE SUBBASIN SETTING §354.12

> § 354.12. Introduction to Basin Setting
>
> This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.

The Tule Subbasin is located in the southern portion of the San Joaquin Valley Groundwater Basin in the Central Valley of California (see Figure 2-1). The area of the Tule Subbasin is defined by the latest version of CDWR Bulletin 118 (CDWR, 2016) and is shown on Figures 2-1 and 2-2. The Tule Subbasin area is approximately 744 square miles (475,895 acres) and includes the jurisdictional areas of multiple water management and service entities. The subbasin has been divided into seven individual Groundwater Sustainability Agencies (GSAs): Eastern Tule GSA, Kern-Tulare Water District GSA, Lower Tule River Irrigation District GSA, Pixley Irrigation District GSA, Delano-Earlimart Irrigation District GSA, Alpaugh Irrigation District GSA, and Tri-County Water Authority GSA (see Figure 2-3).

Communities within the subbasin include Porterville, Tipton, Woodville, Poplar, Pixley, Teviston, Earlimart, Richgrove, Ducor and Terra Bella (see Figure 2-2). Neighboring CDWR Bulletin 118 subbasins include the Kern County Subbasin to the south, the Tulare Lake Subbasin to the west, and the Kaweah Subbasin to the north.

2.1 Hydrogeologic Conceptual Model §354.14

> § 354.14. Hydrogeologic Conceptual Model
>
> (a) Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin.

The hydrogeologic conceptual model is a description of the groundwater flow system of the Tule Subbasin and how it interacts with surface water and land use of the area. The conceptual model includes a description of the geologic setting, geologic structure, and boundary conditions including the principal aquifers and aquitards. The hydrogeologic conceptual model of the Tule Subbasin, as described herein, has been developed in accordance with the requirements of California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 5, Subarticle 2 (§354.14) and in consideration of California Department of Water Resources' (CDWR) Best Management Practices (BMP) for the preparation of hydrogeologic conceptual

models. The hydrogeologic conceptual model forms the basis for the numerical groundwater flow model of the subbasin.

2.1.1. Sources of Data

Compilation, review and analysis of multiple types of data were necessary to develop the hydrogeologic conceptual model and water budget of the Tule Subbasin. The various types of data included geology, soils/lithology, hydrogeology, surface water hydrology, climate, crop types/land use, topography, remote sensing, and groundwater recharge and recovery. Data were obtained from multiple sources:

Geological Data including geologic maps and cross sections were obtained from the United States Geological Survey (USGS), the California Geological Survey (CGS), and Kenneth D. Schmidt & Associates (KDSA) (Schmidt, 2018). Geophysical logs were obtained from the California Division of Oil, Gas and Geothermal Resources (DOGGR), Angiola Water District, Alpaugh Irrigation District, Kern-Tulare Water District (KTWD), KDSA, and private well owners.

Soils/Lithological Data were obtained from drillers' logs and reports from the CDWR, the City of Porterville, the USGS and the United States Department of Agriculture (USDA).

Hydrogeological Data including groundwater levels and pumping tests were obtained from the California Statewide Groundwater Elevation Monitoring (CASGEM) website, the Deer Creek and Tule River Authority (DCTRA), Angiola Water District, Alpaugh Irrigation District, KTWD, Delano-Earlimart Irrigation District (DEID), the City of Porterville, Kern County Water Agency, 4Creeks Inc., Schmidt (2011) and Schmidt (2018). Additional hydrogeological information was obtained from USGS reports, Semitropic Water Storage District Groundwater Banking Project Biennial Reports, and the Tulare Lake Bed Groundwater Management Plan.

Groundwater Quality Data including nitrate and electrical conductivity (EC) data from the Tule Basin Water Quality Coalition, multiple reports and studies associated with the Tulare Lakebed Municipal Delisting program, and contaminants identified in the California State Water Resources Control Board Geotracker website (Geotracker, 2018).

Groundwater Recharge and Recovery Data including spreading basin locations and dimensions, artificial recharge, water well construction, well locations, groundwater production, surface water diversions, canal losses, and river losses were obtained from Lower Tule River Irrigation District (LTRID), CDWR, Tule River Association (TRA) annual reports, and DCTRA annual reports.

Hydrological (i.e. Surface Water) Data consisting of stream gage data along the Tule River, Deer Creek, and White River were obtained from the USGS, DCTRA reports and TRA annual reports. Imported water deliveries were obtained from the United States Bureau of Reclamation (USBR) and the individual agencies within the subbasin.

Climate Data was acquired from CDWR's California Irrigation Management Information System (CIMIS) and the Western Regional Climate Center website.

Land Use Data was obtained from the CDWR, LTRID, the Kern County Department of Agriculture and Measurement Stands, and the USGS Earth Resources Observation and Science Center. Political boundaries were obtained from the California Cal-Atlas Geospatial Clearinghouse, Kern-Tulare Water District, and the LTRID.

In addition to the various types of data, numerous historical reports on the geology, hydrogeology and groundwater management of the Tule Subbasin were reviewed and analyzed. These reports included USGS publications, CDWR reports and bulletins, consultant reports, and academic publications. Publications relied on for the hydrogeological conceptual model and water budget are summarized in the References Section (Section 2.5).

2.1.2. Geologic Setting §354.14 (b)(1)

> § 354.14. (b) The hydrogeologic conceptual model shall be summarized in a written description that includes the following:
>
> (1) The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.
>
> (2) Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.

The Tule Subbasin is located in the Tulare Lake Hydrologic Region of the Central Valley of California (see Figure 2-1). The Central Valley is a geographically significant structural depression that extends from the Cascade Range on the north to the Tehachapi Mountains on the south (Faunt, 2009). The Central Valley groundwater basin has been subdivided on a regional scale into the Sacramento Valley Groundwater Basin north of the Sacramento River Delta, and the San Joaquin Valley Groundwater Basin south of the Sacramento River Delta. The Tulare Lake Hydrologic Region is located in the southern portion of the San Joaquin Valley Groundwater Basin. The Tulare Lake Hydrologic Region is defined by a surface water drainage watershed that includes the Sierra Nevada Mountains to the east, the Tehachapi Mountains to the south and southeast, and the Coast Ranges to the west. The northern boundary of this hydrologic region is defined by the drainage divide between the San Joaquin River to the north and the Kings River to the south.

The portion of the Central Valley structural depression that is beneath the Tulare Lake Hydrologic Region is filled with marine and nonmarine sediments, which extend to depths of more than 32,000 feet in places (Planert and Williams, 1995). The deepest sediments were deposited within a marine environment associated with an inland sea that inundated the valley between 200 million years ago (Jurassic Period) and 2 million years ago (end of the Tertiary Period) (Croft, 1972). The deeper marine sediments are overlain by as much as 9,000 ft of nonmarine continental deposits associated

with Quaternary (2 million years to present) lacustrine and alluvial deposition (Planert and Williams, 1995). The current depositional environment consists of multiple coalescing alluvial fans along the basin margins with localized lacustrine deposits at the terminus of the fans in the central portion of the basin.

The Tule Subbasin is located on a series of coalescing alluvial fans that extend toward the center of the valley from the Sierra Nevada Mountains (see Figure 2-4). The alluvial fans merge with lacustrine deposits of the Tulare Lake bed in the western portion of the subbasin. Land surface elevations within the Tule Subbasin range from approximately 850 ft above mean sea level (amsl) along the eastern margins of the subbasin to approximately 180 ft amsl at the western boundary (see Figure 2-4).

Geologic formations observed at the land surface and in the subsurface beneath the Tule Subbasin can be grouped into five generalized geologic units, described below in order of increasing age:

Unconsolidated Continental Deposits – These sediments consist of fluvial (i.e. streambed deposits), alluvial, flood plain, and lacustrine (i.e. lake bed) deposits (labeled "surficial deposits" on Figure 2-4). The unconsolidated continental deposits range in thickness from 0 ft at the eastern contact with the Sierra Nevada Mountains to more than 3,000 ft near the margins of Tulare Lake in the western part of the subbasin (see Figure 2-5; Lofgren and Klausing, 1969). Subsurface alluvial sediments consist of highly stratified layers of more permeable sand and gravel interbedded with lower permeability silt and clay. Clear correlation of individual sand or clay layers laterally across the Tule Subbasin is difficult due to the interbedded nature of the sediments. However, it is noted that the thickness of clay sediments in the upper 1,000 ft below ground surface (bgs) generally increases in the vicinity of Tulare Lake. The unconsolidated continental deposits form the primary groundwater reservoir in the Tule Subbasin.

The unconsolidated continental deposits range in age from recent in near-surface stream channels to Upper Pliocene (approximately 2.6 million years before present) at depth. In the eastern portion of the Tule Subbasin, Pleistocene sediments (2.6 million to 11,700 years before present) crop out at the land surface along the base of the Sierra Nevada Mountains, forming what is referred to as the dissected uplands (Lofgren and Klausing, 1969). These older continental deposits are semi-consolidated and contain a high percentage of clay. As such, they generally do not yield significant water to wells.

The lowermost portion of unconsolidated continental deposits is generally correlated with the Tulare Formation. The Tulare Formation is notable in that it includes the Corcoran Clay, a regionally extensive confining layer that has also been referred to as the "E-Clay" (see Figure 2-5) (Frink and Kues, 1954). The Corcoran Clay consists of a Pleistocene diatomaceous fine-grained lacustrine deposit (primarily clay; Faunt, 2009). In the Tule Subbasin, the Corcoran Clay is as much as 150 ft thick beneath the Tulare Lake bed but

becomes progressively thinner to the east, eventually pinching out immediately east of Highway 99 (Lofgren and Klausing, 1969).

Pliocene Marine Deposits – These sediments underlie the continental deposits and consist of consolidated to loosely consolidated marine siltstone with minor interbedded sandstone beds. The marine siltstone unit thickens to the west, ranging from approximately 500 ft thick near State Highway 65 to more than 1,600 ft beneath State Highway 99 (Lofgren and Klausing, 1969; see Figures 2-5 and 2-6). The marine siltstone beds dip sharply from the base of the Sierra Nevada Mountains on the east to the central portion of the valley in the west. The Pliocene marine strata have relatively low permeability and do not yield significant water to wells.

Santa Margarita Formation – This formation occurs beneath the Pliocene marine strata and consists of Miocene age (approximately 5.3 to 23 million years before present) sand and gravel that is relatively permeable and yields water to wells. The formation consists of an upper bed of a silty, well-sorted, fine-grained sandstone and a lower bed of a fossiliferous, micaceous sandy siltstone (Page, 1986). It is approximately 150 to 520 feet thick in the KTWD area and occurs at depths ranging from 1,200 feet near State Highway 65 to greater than 3,000 feet beneath State Highway 99. This formation is a significant source of groundwater to wells in the southeastern portion of the Tule Subbasin within and near Kern-Tulare Water District (KTWD). The water quality of the groundwater in the Santa Margarita Formation becomes increasingly saline to the west.

Tertiary Sedimentary Deposits – Beneath the Santa Margarita Formation exists an interbedded assemblage of semi-consolidated to consolidated sandstone, siltstone and claystone of Tertiary age (approximately 5.3 to 66 million years before present; Page, 1986). Some irrigation wells in the southeastern part of the Tule Subbasin are known to produce fresh water from the Olcese Sand Formation, which is in the uppermost portion of the unit (Ken Schmidt, 2019. Personal Communication). The Olcese Sand is comprised of medium to coarse-grained, poorly cemented, shallow marine shelf sandstone with interbedded siltstone and conglomerate and has been observed to be over 600 feet in thickness (Page, 1986). The water quality of the groundwater in the Tertiary sedimentary deposits becomes increasingly saline to the southwest and most of the groundwater in the unit is not suitable for crop irrigation or municipal supply except near Highway 65.

Granitic Crystalline Basement – Sedimentary deposits beneath the Tule Subbasin are underlain by a basement consisting of Mesozoic granitic rocks that compose the Sierra Nevada batholith (Faunt, 2009). At depth, the basement rocks are assumed to be relatively impermeable.

There are no significant faults mapped in the Tule Subbasin that would form a groundwater flow barrier or affect groundwater flow.

2.1.3. Lateral Basin Boundaries §354.14 (b)(2)

The lateral boundaries of the Tule Subbasin are defined in CDWR Bulletin 118 and include both natural and political boundaries. The eastern boundary of the Tule Subbasin is defined by the surface contact between crystalline rocks of the Sierra Nevada and surficial alluvial sediments that make up the groundwater basin (see Figure 2-4). The northern boundary is defined by the LTRID and Porterville Irrigation District (PID) boundaries. The western boundary is defined by the Tulare County/Kings County boundary, except for a portion of the Tulare Lake Basin Water Storage District that extends east across the county boundary and is excluded from the subbasin. The southern boundary is defined by the Tulare County/Kern County boundary except for the portion of the Delano-Earlimart Irrigation District (DEID) that extends south of the county boundary and is included in the subbasin. The total area of the Tule Subbasin is approximately 744 square miles (475,895 acres).

2.1.4. Bottom of Basin §354.14 (b)(3)

> § 354.14. (b) (3) The definable bottom of the basin.

The physical bottom of the Tule Subbasin is defined by the interface between the Tertiary sedimentary deposits and the relatively impermeable granitic bedrock below them. This depth ranges from zero at the eastern margins of the subbasin where the continental deposits meet the granitic bedrock to approximately 5,000 feet below ground surface in the western portion of the subbasin (Planert and Williams, 1995).

The physical bottom of the subbasin is deeper than the bottom of the fresh water aquifer. The total dissolved solids (TDS) concentration of the groundwater generally increases with increasing depth such that below a certain level, the groundwater is not suitable for municipal, irrigation or other beneficial uses. Accordingly, a better measure of the bottom of the basin is the fresh water/brackish water interface, as defined in Page (1973) by an electrical conductivity of 3,000 micromhos per centimeter (μmohs/cm), which is approximately correlative to a total dissolved solids (TDS) concentration of 2,000 milligrams per liter (mg/L).

In the Tule Subbasin, the fresh water/brackish water interface varies across the subbasin but is generally 1,500 to 3,000 feet below land surface (Page, 1973; Planert and Williams, 1995). The deepest fresh water occurs in the Santa Margarita Formation on the east side of the subbasin and in the deeper parts of the lower aquifer in the western portion of the Tule Subbasin. Agricultural wells constructed in the Santa Margarita Formation are typically on the order of 1,700 to 2,000 feet deep. Agricultural irrigation wells in the western Tule Subbasin are as deep as 1,500 feet and some agricultural wells west of the Tulare/Kings County boundary are as deep as 2,200 feet. The bottom of the effective groundwater basin, based on the fresh water/brackish water interface, is shown on Figures 2-5 and 2-6.

2.1.5. Surface Water Features §354.14 (d)(5)

§ 354.14. (d) (5) Surface water bodies that are significant to the management of the basin.

2.1.5.1. Tulare Lake

Although now largely a dry lakebed, prior to the mid-1800s Tulare Lake was the largest freshwater lake, by area, west of the Mississippi River. The original area of the lake was approximately 570 square miles and was fed from surface water discharges at the terminus of the Kern River, Tule River, Kaweah River, and Kings River. Beginning in the mid-1800s, surface water from the rivers feeding the lake was diverted for agricultural irrigation and municipal supply. By 1900, the lake was dry except for residual marshes and wetlands and occasional flooding. This condition continues to the present.

2.1.5.2. Lake Success

Lake Success is a manmade reservoir created by the construction of Success Dam that was completed in 1961 and serves as a flood control and water conservation project for the Tule River. Success dam and reservoir are managed by the United States Army Corps of Engineers (ACOE). Water storage in Lake Success is subject to the ACOE's flood control diagram and released as directed by the ACOE and downstream water rights holders as administered by the Tule River Association (TRA), in accordance with the Tule River Water Diversion Schedule and Storage Agreement (TRA, 1966).

2.1.5.3. Tule River

The Tule River is the largest natural drainage feature in the Tule Subbasin. From its headwaters in the Sierra Nevada Mountains, the Tule River flows first into Lake Success and then, through controlled releases at the dam, flows through the City of Porterville where it is diverted at various points before flowing into the LTRID. A significant diversion point is the Porter Slough, which flows to the north and semi-parallel to the main river channel and is used to convey surface water to various recharge facilities and canals. Downstream of Porterville, the Tule River ultimately discharges onto the Tulare Lakebed during periods of above-normal precipitation. Stream flow is measured via gages located below Success Dam, at Rockford Station downstream of Porterville, and at Turnbull Weir (see Figure 2-7). From water years 1986/87 to 2022/23, releases from Lake Success to the Tule River, quantified in TRA annual reports as Tule River at Success Dam, has ranged from 5,967 acre-ft in water year 2014/15 to 512,118 acre-ft in water year 2022/23 with an annual average during this time period of approximately 119,746 acre-ft.

Releases of water below Lake Success dam are diverted from the Tule River channel at various locations in accordance with TRA (1966). Diversion points along the river are located at the Porter

Slough headgate, Campbell and Moreland Ditch Company, Vandalia Water District, Poplar Irrigation Company, Hubbs and Miner Ditch Company, and Woods-Central Ditch Company. The lower portion of the Tule River channel is also used as a conveyance mechanism to convey imported water from the Friant-Kern Canal to the PID and LTRID. Within the PID and LTRID, a combination of natural stream flow and imported water are further diverted into unlined canals for distribution to artificial recharge basins and farmers. Any residual stream flow left in the Tule River after diversions is measured at the Turnbull Weir, located at the west end of the LTRID (see Figure 2-7).

2.1.5.4. Deer Creek

Deer Creek is a natural drainage that originates in the Sierra Nevada Mountains, flowing in a westerly direction north of Terra Bella and into Pixley (see Figure 2-7). Although the Deer Creek channel extends past Pixley, discharges rarely reach the historical Tulare Lakebed. Stream flow in Deer Creek has been measured at the USGS gaging station at Fountain Springs from 1968 to present time. Average annual flow at this gage between water year 1986/87 and 2022/23 was approximately 19,500 acre-ft/yr with a low of approximately 2,000 acre-ft in water year 2014/15 and a high of approximately 96,000 acre-ft in water year 2022/23. Stream flow has also been measured at a second USGS gaging station on Deer Creek at Terra Bella although the period of record (1971 through 1987) is not as complete as the station at Fountain Springs. Friant-Kern Canal water is also diverted and monitored into Deer Creek and again measured at Trenton Weir before being delivered to riparian lands via unlined canals (see Figure 2-7). During wet years, water that reaches the terminus of Deer Creek is discharged into the Homeland Canal.

2.1.5.5. White River

The White River drains out of the Sierra Nevada Mountains east of the community of Richgrove in the southern portion of the Tule Subbasin (see Figure 2-7). Stream flow in the White River has been measured at the USGS gaging station near Ducor from 1972 to 2005. Data after 2005 has been interpolated. Average annual flow between water year 1986/87 and 2016/17 was approximately 5,800 acre-ft/yr with a low of approximately 250 acre-ft in water year 2014/15 and a high of approximately 37,000 acre-ft in 1997/98. The White River channel extends as far as State Highway 99 but does not reach the historical Tulare Lakebed.

2.1.5.6. Imported Water §354.14 (d)(6)

> § 354.14. (d) (6) The source and point of delivery for imported water supplies.

Most of the water imported into the Tule Subbasin is from the Central Valley Project (CVP) and delivered via the Friant-Kern Canal (see Figure 2-7). Angiola Water District also imports water from other various sources including the King's River and State Water Project. The water is delivered to farmers and recharge basins via the Tule River and Deer Creek channels, unlined canals, and pipeline distribution systems of PID, LTRID, Terra Bella Irrigation District, Teapot Dome Water District, DEID, and Saucelito Irrigation District.

Distribution of stream flow diversions and imported water occur via a system of manmade canals and pipeline distribution systems that extend throughout the Tule Subbasin. The largest of these is the Friant-Kern Canal, which supplies imported water through the Federal Central Valley Project (CVP). The Friant-Kern Canal is concrete lined and trends approximately north-south through the eastern part of the Tule Subbasin (see Figure 2-7). Numerous other canals and pipeline distribution systems are located within the Tule Subbasin to convey surface water from the Friant-Kern Canal, Tule River and Deer Creek to various recharge facilities and agricultural areas. The canals are unlined and occur primarily in the LTRID, Pixley Irrigation District, PID, Alpaugh Irrigation District, and Atwell Island Water District. The Angiola Water District receives deliveries from the Tule River and Kings River via the Homeland Canal and distributes that water via an internal system of unlined canals.

Many of the irrigation districts and water districts in the Tule Subbasin that receive imported water from the Friant-Kern Canal distribute the water exclusively via pipeline distribution systems. These districts include the Delano-Earlimart Irrigation District, Kern-Tulare Water District, Terra Bella Irrigation District, Saucelito Irrigation District, and Tea Pot Dome Water District.

2.1.6. Areas of Groundwater Recharge and Discharge §354.14 (d)(4)

> § 354.14. (d) (4) Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.

Groundwater recharge in the Tule Subbasin occurs within stream channels, unlined canals, in managed recharge basins, and in areas of the subbasin with irrigated agriculture. Soil types in the subbasin are shown on Figure 2-8. Favorable areas for deep percolation of surface water are characterized by relatively permeable surface soils, and lack of subsurface impediments to groundwater recharge.

The University of California at Davis has developed a Soil Agricultural Groundwater Banking Index (SAGBI) that identifies favorable areas of recharge based on deep percolation potential, root zone residence time, topography, chemical limitations, and soil surface condition. The SAGBI zones for the Tule Subbasin are shown on Figure 2-9. In general, the most favorable areas for recharge are within the stream channels of the Tule River, Deer Creek and White River, in the Porterville area, and in a north-south zone in the west-central portion of the subbasin. Areas that are not favorable for deep percolation of surface water and recharge of groundwater are in the furthest east portion of the subbasin along the base of the Sierra Nevada Mountains and in the furthest west portion of the subbasin coincident with Tulare Lake lacustrine deposits. It is noted that the SAGBI zones shown on Figure 2-9 are limited to the surface deposits and any areas to be considered for additional recharge basins should be further investigated with boreholes and recharge tests to confirm the recharge potential of the location. For example, many of DEID's recharge basins are located in areas classified as "poor" for recharge according to SAGBI but, in reality, can sustain acceptable recharge rates of 0.4 to 0.7 ft/day.

The primary source of groundwater discharge in the subbasin is pumping from wells (see Section 2.3.2.2), which occurs across most of the subbasin.

In addition to groundwater pumping, there is evidence that groundwater periodically discharges at the land surface in the streambeds of the upper reaches of the Tule River and Deer Creek during periods of above normal precipitation and runoff (see Figure 2-10; The Nature Conservancy, 2024). In the case of the Tule River, this condition is influenced by releases of surface water from Success Reservoir. The conditions under which this occurs and how it is impacted by groundwater pumping is a data gap that will be addressed by the development and implementation of an Interconnected Surface Water Monitoring Plan (see Attachment 1 of the Coordination Agreement).

2.1.7. Principal Aquifers and Aquitards §354.14 (b)(4)

§ 354.14. (b) (4) Principal aquifers and aquitards, including the following information:

(A) Formation names, if defined.

(B) Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.

(C) Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.

(D) General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.

(E) Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.

2.1.7.1 Aquifer Formations §354.14 (b)(4)(A)

In general, there are five general aquifer/aquitard units in the subsurface beneath the Tule Subbasin (see Figures 2-5 and 2-6):

1. Upper Aquifer
2. The Corcoran Clay Confining Unit
3. Lower Aquifer
4. Pliocene Marine Deposits
5. Santa Margarita Formation and Olcese Formation of the Southeastern Subbasin

The upper aquifer occurs across the entire Tule Subbasin area. This aquifer is generally unconfined to semi-confined. The upper aquifer occurs in the upper 450 ft of sediments on the western side of the subbasin and shallows to the east to less than approximately 100 ft of sediments in the Porterville area. In the southeastern portion of the basin, the upper aquifer is generally considered unsaturated although there may be local areas of groundwater.

The Corcoran Clay confining unit occurs beneath the upper aquifer in the western half of the Tule Subbasin (see Figures 2-4, 2-5 and 2-6). This unit consists primarily of blue or green diatomaceous clay although in places it is interbedded with sandy sediments. The Corcoran Clay is thickest in the western part of the subbasin and thins to the east, pinching out approximately two to three miles east of State Highway 99 (see Figure 2-4). It is noted that, in places, the Corcoran Clay, as formally defined in Frink and Kues (1954) and later Davis et al. (1959), is bounded above and below by fine-grained clay not specifically associated with the Corcoran Clay. As such, the thickness of the Corcoran Clay unit, as shown on Figures 2-5 and 2-6 has been defined to include these adjacent clays.

The lower aquifer extends across the entire western portion of the Tule Subbasin and beneath the northeastern portion of the subbasin. The total depth of this aquifer ranges from approximately 400 bgs in the eastern Tule Subbasin to more than 2,000 feet in the western portion of the subbasin. This aquifer is confined beneath the Corcoran Clay where this confining layer exists, and beneath other clay lenses in other parts of the subbasin. The lower aquifer system is conceptualized to be semi-confined in the northeastern portion of the subbasin east of the Corcoran Clay.

In the southeastern portion of the Tule Subbasin, the lower aquifer is separated from the underlying Santa Margarita Formation aquifer by a relatively thick (500 to 1,600 feet) layer of Pliocene marine deposits. These deposits consist primarily of siltstone with minor interbedded sandstone that separates the deep alluvial aquifer from the Santa Margarita Formation aquifer. While the Pliocene deposits are relatively fine-grained in nature, there are wells perforated at least partially through them and the sand lenses are assumed to contribute water to wells.

The Santa Margarita Formation and Olcese Formation underlie the Pliocene marine deposits and forms a localized aquifer in the southeastern portion of the Tule Subbasin. This aquifer is a primary source of groundwater for agricultural irrigation in the southeastern portion of the subbasin. The aquifer is relatively permeable and well yields greater than 1,500 gallons per minute have been reported (Kern-Tulare Water District, 2018). This localized aquifer is conceptualized as hydrologically separate from the upper and lower aquifers in the rest of the subbasin.

2.1.7.2 Aquifer Physical Properties §354.14 (b)(4)(B)

Where saturated in the subsurface, the permeable sand and gravel layers form the principal aquifers in the Tule Subbasin and adjacent areas to the north, south and west. Individual aquifer layers consist of lenticular sand and gravel deposits of varying thickness and lateral extent. The aquifer layers are interbedded with low permeability silt and clay lenses. In general, shallow saturated sediments in the Tule Subbasin are unconfined to semi-confined. The aquifer beneath the Corcoran Clay unit in the western portion of the basin is confined. The hydrologic characteristics of the lower aquifer system in the western portion of the subbasin are unknown but are expected to change with depth.

The ability of aquifer sediments to transmit and store water is described in terms of the aquifer parameters transmissivity, hydraulic conductivity, and storativity. The most reliable estimates of these parameters are obtained from long-term (e.g. 24-hr or more constant rate) controlled pumping tests in wells. In the absence of this type of test, estimates can be obtained through short-term pumping tests and/or assignment of literature values based on the soil types observed in driller's logs. Long-term pumping test data was obtained from KDSA, KTWD and DEID for wells located in the southeastern and southern part of the subbasin. Short-term pumping test data was obtained from driller's logs, KDSA for Angiola Water District and City of Porterville wells, and KTWD for selected wells constructed within the Santa Margarita Aquifer. Where pumping test data were not available, aquifer parameters were assigned from literature values in published in Faunt (2009).

Transmissivity is a measure of the ability of groundwater to flow within an aquifer and is defined as the rate of groundwater flow through a unit width of aquifer under a unit hydraulic gradient (Fetter, 1994). Transmissivity was estimated from short-term pumping test data based on Theis et al., 1963 and the following relationship:

$$T = \frac{S_c \; x \; 2{,}000}{E}$$

Where:

T = Transmissivity (gpd/ft);

S_c = Specific Capacity (gpm/ft);
E = Well Efficiency (assumed to be 0.7)

Transmissivity values at individual wells were converted into hydraulic conductivity (i.e. aquifer permeability) by dividing by the aquifer thickness (in this case the perforation interval of the well). Horizontal hydraulic conductivity values for the upper aquifer are shown on Figure 2-11 and range from less than 5 ft/day to greater than 160 ft/day, the higher values indicating more permeable sediments. Hydraulic conductivity values for the lower aquifer are shown on Figure 2-12 and range from less than 5 ft/day to greater than 80 ft/day.

Storage properties of the upper aquifer are expressed in terms of specific yield since the majority of this aquifer is conceptualized as unconfined. Specific yield is the ratio of the volume of water sediment will yield by gravity drainage to the volume of the sediment. Specific yield values for the upper aquifer were assigned based on a USGS texture analysis published in Faunt (2009). Textural descriptions describe the percent coarse-grained sediment as inferred from drillers' logs from boreholes or wells drilled within or immediately outside the Tule Subbasin. Higher percent coarse-grained sediment descriptions are correlated with higher specific yield (see Figure 2-13). As shown, higher percent coarse-grained sediments are observed in the upper aquifer through most of the Tule Subbasin with the exception of the southwestern portion. Values of specific yield for the upper aquifer range from 0.05 to greater than 0.2.

The lower aquifer in the Tule Subbasin is confined to semi-confined and, as such, storage properties for this aquifer are expressed in terms of storativity. Storativity is a measure of the volume of water an aquifer can release from, or take into, storage per unit of aquifer surface area per unit change in hydraulic head. Storativity is derived from long-term pumping tests where pumping interference is measured in a monitoring well located a known distance from the pumping well. As no pumping interference data are available for the Tule Subbasin, storativity values for the lower alluvial aquifer were originally based on values published in Faunt (2009) and modified during calibration of the numerical model for the Tule Subbasin. Values for storativity in the lower aquifer range from 0.00015 to 0.001 (see Figure 2-14). These values indicate confined to semi-confined aquifer conditions.

Another important storage property of the Lower Aquifer in the Tule Subbasin is specific storage. This is the unit volume of water that is stored or expelled from storage through compression or expansion of both the soil matrix and pore water per unit change in hydraulic head. Under elastic conditions, release of water from the aquifer system is reversible. Under inelastic conditions, the release of water is irreversible and the compression permanent, resulting in land subsidence. Elastic and inelastic storage properties were originally based on Faunt (2009) and modified during calibration of the numerical model of the subbasin.

2.1.7.3 Geologic Structures that Affect Groundwater Flow §354.14 (b)(4)(C)

There are no significant faults mapped in the Tule Subbasin that affect groundwater flow.

The Corcoran Clay unit is the most significant geologic feature that affects vertical groundwater flow in the Tule Subbasin. In general, the aquifer system above the clay unit is unconfined to semi-confined and the aquifer system below it is confined. The hydraulic head in the upper aquifer is higher than that of the lower aquifer, such that there is vertical downward hydraulic gradient between the two. Despite the low vertical hydraulic conductivity of the Corcoran Clay, the area for downward flow is large (hundreds of thousands of acres), and the vertical gradients are relatively steep (commonly 20 to 40 feet per 100 feet). This allows for some downward flow of water through the clay on a regional basis. In addition, many wells in the subbasin are perforated across both the upper and lower aquifers (composite wells) creating communication between the two. As such, these wells facilitate some recharge of the lower aquifer from the upper aquifer. East of the Corcoran Clay, other localized confining beds are present that separate the upper aquifer from the lower aquifer.

2.1.7.4 Aquifer Water Quality §354.14 (b)(4)(D)

Groundwater quality in the Tule Subbasin varies across the subbasin and with depth in the aquifer system. Overall, the native groundwater quality is generally very good and does not prevent its beneficial use throughout most of the subbasin. Historical electrical conductivity (EC) concentrations in subbasin wells (an indication of dissolved inorganic solids) is generally less than approximately 600 µmohs/cm (Tule Basin Water Quality Coalition, 2017). Groundwater quality issues in the subbasin include both naturally occurring constituents of concern (COC) and anthropogenic (i.e. manmade) COCs. Constituents of concern were identified as those compounds/elements that exceed applicable regulatory standards for drinking water.

Naturally Occurring Constituents of Concern

Naturally occurring COCs include:

- Arsenic (As) (Figures 2-15a, 2-16a and 2-17a)
- Uranium (U) (Figures 2-15b, 2-16b and 2-17b)
- Hexavalent chromium (Cr(VI)) (Figures 2-15c, 2-16c and 2-17c)

Arsenic in groundwater is naturally sourced from the dissolution of rocks and minerals containing the element. The MCL for As is 10 micrograms per liter (µg/L). Arsenic has been detected in groundwater samples at concentrations above the MCL in a few isolated wells across the subbasin, including an Upper Aquifer well in the northern LTRID GSA (see Figure 2-16a) and Lower Aquifer wells in Richgrove, Alpaugh, and western LTRID (see Figure 2-17a).

Uranium is a naturally occurring COC sourced from rocks and minerals containing the element. The MCL for U is 30 picocuries per liter (pCi/L). Uranium has been detected in groundwater samples at concentrations above the MCL in a few isolated wells mainly along the northern LTRID boundary (see Figure 15b).

Hexavalent chromium is a form of elemental chromium, a naturally occurring element found in rocks and soils. Sources of concentrations of this element in groundwater are primary from the weathering and erosion of rocks and sediments that make up the aquifer system. The MCL for Cr(VI) is 10 µg/L.

Anthropogenic Constituents of Concern

Anthropogenic COCs in the Tule Subbasin include:

- Total dissolved solids (TDS) (Figures 2-15d, 2-16e and 2-17e),
- 1,2,3-tricholoropropane (1,2,3-TCP) (Figures 2-15e, 2-16d and 2-17d),
- Dibromo-3-chloropropane (DBCP) (Figures 2-15f, 2-16f and 2-17f),
- Chloride (Cl) (Figure 2-15g),
- Perchlorate (Figure 2-15h),
- Nitrate as N (Figures 2-15i, 2-16g and 2-17g)

Total dissolved solids provide an indication of the dissolved mineral content of the groundwater. The TDS concentration in some isolated wells in the subbasin has been detected above the maximum contaminant level (MCL) of 1,000 milligrams per liter (mg/L)(Figure 2-15d), which is higher than ambient concentrations suggesting anthropogenic impact. Repeated crop irrigation and drying can concentrate salts in the soil zone, which become mobilized upon rewetting and increase the TDS of the groundwater. Elevated chloride concentrations are generally caused by the same land use.

Anthropogenic COCs whose concentrations in groundwater are often associated with agricultural land use (although they also have industrial sources) include 1,2,3-TCP, DBCP, and nitrate. 1,2,3-TCP and DBCP are organic chlorinated hydrocarbons that were historically used as soil fumigants in agriculture although both have been banned for this application. The MCLs are 5 nanograms per liter (ng/L) and 0.2 µg/L for 1,2,3-TCP and DBCP, respectively. Nitrate is mobilized into the groundwater from leaching of applied fertilizers, dairy waste, and wastewater discharges. Nitrate concentrations in groundwater exceeding the MCL of 10 mg/L have been detected throughout much of the cultivated portions of the subbasin (see Figures 2-16g and 2-17g).

Active water quality discharge permits for the Tule Subbasin exist under four programs: Animal Waste (Figure 2-18a), Stormwater (Figure 2-18b), Individual Waste Discharge Requirements (Figure 2-18c) and National Pollutant Discharge Elimination Systems (Figure 2-18d).

Currently there are 15 active cleanup sites in the Tule Subbasin identified on the California Geotracker website (see Figure 2-19; Table 2-1). Five of the point source contamination sites are associated with leaking underground storage tanks (LUSTs) for which the primary contaminant is petroleum hydrocarbons (gasoline, diesel and kerosene). There are three Regional Water Quality Control Board Cleanup Program or Department of Toxic Substance Control (DTSC) sites within the subbasin (see Figure 2-19). Contaminants associated with these sites include metals, volatile organic compounds (VOCs; including tetrachloroethene), pesticides, herbicides, cyanide, and polyaromatic hydrocarbons (PAHs). Groundwater contaminant plumes associated with these sites are highly localized.

A Basin Plan Amendment under Resolution R5-2017-0032 has been approved for the Tulare Lake Basin along the western edge of the Tule Subbasin to de-designate these areas for beneficial uses due to naturally poor water quality (see Figure 2-20). Groundwater in this region is naturally high in sodium and has been de-designated for municipal, domestic and agricultural use. This de-designation of groundwater use prevents the Tule Subbasin GSA's from determining degradation of groundwater quality due to lowering of groundwater levels.

To better monitor and track groundwater quality issues in the Tule subbasin, the GSA's have adopted the use of the Public Supply Assessment Grid System (PSAG) developed by the USGS for the Groundwater Ambient Monitoring and Assessment - Priority Basin Project (GAMA PBP Study) (Figure 2-21). The PSAG will be used to determine regional baseline groundwater quality characteristics for assigning minimum thresholds at groundwater quality representative monitoring sites when COC data is not historically available.

2.1.7.5 Aquifer Primary Uses §354.14 (b)(4)(E)

The predominant beneficial use of groundwater in the Tule Subbasin is agricultural irrigation. Other beneficial uses include municipal water supply, private domestic water supply, livestock washing and watering, industrial supply, and environmental.

2.1.8. Uncertainty in the Hydrogeologic Conceptual Model §354.14 (b)(5)

> § 354.14. (b) (5) Identification of data gaps and uncertainty within the hydrogeologic conceptual model

The primary sources of uncertainty in the hydrogeologic conceptual model include:

- Knowledge of the hydraulic interaction between the upper and lower aquifers
- Lack of aquifer-specific groundwater levels with adequate spatial distribution to enable preparation of representative groundwater level maps of each aquifer in parts of the subbasin
- Characteristics of the Santa Margarita Formation aquifer

- Groundwater underflow into the alluvial aquifer system from the Sierra Nevada Mountain block
- Aquifer characteristics of hydraulic conductivity, transmissivity and storativity
- Agricultural groundwater pumping and well locations
- Well construction and pumping distribution between the upper and lower aquifers
- Canal seepage
- Travel time for recharge from the land surface through the unsaturated zone to the groundwater
- Locations and extent of Interconnected Surface Water (ISW)
- Nature and extent of Groundwater Dependent Ecosystems (GDEs)
- Impact of groundwater pumping on GDE health

Uncertainty in the hydrogeologic conceptual model is being addressed through a sensitivity and uncertainty analysis of the numerical model results from the Tule Subbasin model (TH&Co, 2020) (see Section 2.3.2.7). Monitoring features to address data gaps are described in the Tule Subbasin Monitoring Plan (Attachment 1 to the Coordination Agreement).

2.2 Groundwater Conditions §354.16

§ 354.16. Groundwater Conditions

Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:

2.2.1 Groundwater Occurrence and Flow §354.16 (a)

§ 354.16. (a) Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:

(1) Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.

(2) Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.

In general, groundwater in the Tule Subbasin flows from areas of natural recharge along major streams at the base of the Sierra Nevada Mountains on the eastern boundary towards a groundwater pumping depression in the west-central portion of the subbasin. The pumping depression in the upper aquifer has reversed the natural groundwater flow direction in the western portion of the subbasin, inducing subsurface inflow along the southern and western boundaries.

2.2.1.1 Upper Aquifer

In the upper aquifer, the pumping depression is most pronounced between the Tule River and Deer Creek west of Highway 99 and east of Highway 43 (see Figures 2-22 and 2-23). The pumping depression has persisted in this area since at least 1987, even during periods of above-normal precipitation when groundwater levels temporarily recovered. Recharge from the Tule River results in a groundwater flow divide in the upper aquifer along the northern boundary of the Tule Subbasin. As such, upper aquifer groundwater on the north side of the river flows to the north and out of the subbasin. Groundwater flow patterns in the upper aquifer have generally not changed significantly since 1990.

Groundwater level changes over time can be observed from hydrographs developed from wells monitored in the Tule Subbasin. Despite a relatively wet hydrologic period between 1995 and 1999 and periodic wet years (2005 and 2011), groundwater levels in upper aquifer wells showed a persistent downward trend between approximately 1987 and 2015 (see Figure 2-24). After 2015, upper aquifer groundwater levels generally stabilized in many of the Tule Subbasin wells (see Figure 24). At some City of Porterville wells, groundwater levels are higher than they were when measured in 2015.

2.2.1.2 Lower Aquifer

In the lower aquifer, groundwater generally flows in a west/southwest direction (see Figures 2-25 and 2-26). While the general groundwater flow directions have not changed over time, comparison of groundwater contour maps from predeveloped conditions (Lofgren and Klausing, 1969; Figures 22 and 23) with recent groundwater contour maps (Figures 2-25 and 2-26) indicate that groundwater pumping in the central and west side of the subbasin have created a pumping depression in the Lower Aquifer in this portion of the subbasin. Comparison of the spring and fall groundwater level contour maps for 2022 shows local changes in flow direction from season to season, which are likely due to localized changes in groundwater pumping patterns.

Groundwater level trends in wells perforated exclusively in the lower aquifer vary depending on location in the subbasin. In the northwestern part of the subbasin, lower aquifer groundwater levels have shown a persistent downward trend from 1999 to 2023. In the southern part of the subbasin, groundwater levels were relatively stable between 1987 and 2007 but began declining after 2007 (see Figure 2-27).

2.2.1.3 Pliocene Deposits

Available data indicate that there are wells in the ETGSA, DEID and KTWD area that are perforated through Pliocene deposits that separate the lower aquifer from the Santa Margarita Formation aquifer. The KTWD has indicated that some private domestic wells in their GSA are perforated in this formation (personal communication with KTWD, 2024). Groundwater levels

measured in wells perforated exclusively in these deposits suggest that they are, at least locally, higher than groundwater levels measured in either the lower aquifer or Santa Margarita aquifer (see Figure 2-28). Historical groundwater levels in well 24S26E1R1M indicate levels are currently higher than they were in 2012 and have generally been stable since 2015. The characteristics of groundwater flow direction and gradients in this aquifer are a data gap that will be addressed through the identification and monitoring of additional monitoring wells.

2.2.1.4 Santa Margarita Aquifer

Groundwater levels in the Santa Margarita Aquifer follow both seasonal and longer-term trends. Seasonally, groundwater levels in this aquifer can fluctuate as much as approximately 140 feet between seasonal high and seasonal low levels (see Figure 2-29). The magnitude of the seasonal differences are greatest during dry hydrologic conditions. On a longer term basis, seasonal high groundwater levels vary within a range of approximately 20 to 30 feet but have generally been stable since approximately 2013 when groundwater level records became available.

Although data are limited, groundwater flow in the Santa Margarita Aquifer in the southeastern part of the subbasin (KTWD area) has historically been to the west/southwest (Lofgren and Klausing, 1969). Comparison of groundwater levels on hydrographs from different wells perforated in the Santa Margarita Aquifer suggest that this is still the case in the wet season (October to May; see Figure 2-29). During the pumping season (June to September), groundwater levels in the central KTWD area appear to reverse and flow to the east, as indicated from a comparison of seasonal low groundwater levels for 24Q1 and TSMW-6SM as shown on Figure 2-29.

2.2.1.5 Groundwater Flow Between Aquifers

Comparisons of hydrographs from wells perforated in the upper aquifer with wells perforated predominantly in the lower aquifer show that groundwater levels in the upper aquifer are higher than groundwater levels in the lower aquifer (see Figure 2-30). This indicates a downward hydraulic gradient and that the upper aquifer is capable of recharging the lower aquifer of the Tule Subbasin. This is corroborated by depth-specific isolated aquifer zone testing conducted by the City of Porterville in three wells in which the equilibrated groundwater level (i.e. hydraulic head) in the deepest isolated zones, which also correspond to the lower aquifer, were as much as 180 ft lower than the groundwater level in the shallowest isolated zones (Schmidt, 2009). The vertical flow of water from the upper aquifer to the lower aquifer is more prevalent in the eastern parts of the subbasin where the Corcoran Clay is not present. While the Corcoran Clay is not a perfect groundwater flow barrier between the upper aquifer and lower aquifer, it inhibits flow between the two where it exists. Faunt (2009) has suggested that the recharge of the lower aquifer via wells that are perforated across both aquifers has increased with the number of deep wells constructed in the San Joaquin Valley.

2.2.2 Groundwater Storage §354.16 (b)

> § 354.16. (b) A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.

Changes in groundwater storage within the Tule Subbasin have been estimated for the period from 1986/87 to 2022/23 for both the Upper and Lower aquifers, the primary production aquifers in the subbasin.

2.2.2.1 Upper Aquifer

Changes in groundwater storage for the Upper Aquifer were estimated based on a combination of the historical water budget prior to Water Year 2018/19 and an analysis of spatial change in groundwater level for each year between 2018/19 and 2022/23. For the period from 1986/87 to 2018/19, the water budget and associated change in storage for the Upper Aquifer is based, in part, from the calibrated groundwater flow model of the Tule Subbasin (TH&Co, 2021a; see Table 2-3). For the period from 2019/20 through 2022/23, which is after the most recent calibration period for the groundwater flow model, the change in storage was estimated based on the following equation:

$$V_w = S_y A \Delta h$$

Where:

V_w	=	the volume of groundwater storage change (acre-ft).
S_y	=	specific yield of aquifer sediments (unitless).
A	=	the surface area of the aquifer within the Tule Subbasin/GSA (acres).
Δh	=	the change in hydraulic head (i.e. groundwater level) (feet).

The calculations were made using a Geographic Information System (GIS) map of the Tule Subbasin discretized into 600-foot by 600-foot grid cells to allow for spatial representation of aquifer specific yield and groundwater level change. The areal distribution of specific yield for the upper aquifer is based on the values obtained from the updated calibrated groundwater flow model of the Tule Subbasin (TH&Co, 2021a). The areal distribution of change in hydraulic head across the Tule Subbasin was estimated by plotting the difference in fall groundwater levels and then interpolating the subbasin-wide changes in groundwater levels in GIS using a kriging algorithm. Change in hydraulic head (groundwater level) at any given location was assigned to the overlapping grid cell. The change in groundwater storage was estimated for each grid cell by multiplying the change in groundwater level by the specific yield and then by the area of the cell.

2.2.2.2 Lower Aquifer

The change in storage for the Lower Aquifer was estimated using the groundwater flow model prior to 2018/19 and as a function of measured land subsidence from InSAR data between 2018/19 and 2022/23. As the majority of the lower aquifer in the Tule Subbasin is under confined conditions, the change in storage associated with groundwater level changes is a function of the compressibility of the sediments and, to a lesser degree, the compressibility of water. Absent the model after 2018/19, the change in storage for the lower aquifer was estimated as the volume of water associated with compression of aquitards between fall 2019 and fall 2023. This approximation was based on the premise that this volume is equal to the volume of land subsidence that occurred during this time. The change in storage of the Lower Aquifer was estimated based on the following equation:

$$V_w = A\Delta b$$

Where:

V_w	=	the volume of water released from (or taken into) storage (acre-ft).
A	=	the surface area of the aquifer within the Tule Subbasin/GSA (acres).
Δb	=	the change in aquitard thickness (i.e., subsidence) (feet).

The areal distribution of land subsidence between fall 2019 and fall 2023 was based on InSAR data. Because the InSAR data is not layer-specific but, rather, reflects compression that occurs in all layers in the Tule Subbasin, the change in storage of the lower aquifer using these data is likely an overestimate. That is, it was assumed that the water released is from the lower aquifer and the clay interbeds within the confining layer between the upper and lower aquifers. The calculations were made using a GIS map of the Tule Subbasin discretized into 1,000-foot by 1,000-foot grid cells to allow for spatial representation of land subsidence. The change in aquitard storage was estimated for each grid cell by multiplying the InSAR land subsidence by the area of the cell, and the total storage change within each GSA's boundaries was summed.

2.2.2.3 Cumulative Change in Storage

A graphic showing cumulative and annual groundwater storage change over time is presented on Figure 2-31. As of the 2022/23 water year, the cumulative change in groundwater storage since 1986/87 is approximately -7,000,000 acre-ft. The average annual change in groundwater storage from 1986/87 through 2022/23 is approximately -192,800 acre-ft/yr of which approximately -69,400 acre-ft/yr of storage change is specific to the upper aquifer and approximately -123,400 acre-ft/yr is from the lower aquifer.

2.2.3 Seawater Intrusion §354.16 (c)

§ 354.16. (c) Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.

Seawater intrusion cannot occur in the Tule Subbasin due to its location with respect to the Pacific Ocean. The Tule Subbasin is approximately 110 miles inland of the Pacific Ocean (see Figure 2-1) and is separated from the ocean by approximately 90 miles of sedimentary rocks that make up the Coast Ranges. These sedimentary rocks effectively separate the Pacific Ocean hydraulically from the aquifer system in the San Joaquin Valley. Further, the Coast Ranges are dissected by multiple northwest trending faults, the largest of which is the San Andreas Fault. These faults form groundwater flow barriers, which further act to separate the San Joaquin Valley aquifers from the Pacific Ocean. Accordingly, groundwater pumping in the Tule Subbasin cannot induce seawater intrusion.

2.2.4 Groundwater Quality Issues §354.16 (d)

§ 354.16. (d) Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.

Groundwater quality issues have been designated based on agricultural and drinking water beneficial uses of groundwater in the Tule Subbasin. The nine constituents of concern for drinking water beneficial uses are:

- Naturally occurring
  - Arsenic (As)
  - Uranium (U)
  - Hexavalent chromium (Cr(VI))
- Anthropogenic
  - TDS
  - 1,2,3-TCP
  - DBCP
  - Chloride
  - Perchlorate
  - Nitrate as N

Details regarding potential sources and locations of groundwater quality issues are provided in Section 2.1.7.4 herein. Existing groundwater quality monitoring programs within the Tule Subbasin are summarized in the following table:

Programs or Data Portals	Tule Subbasin Agency Coordinating with GSAs	Parameters	Monitoring Frequency	Program Objectives
AB-3030 and SB-1938 Groundwater Management Plans	Tule Subbasin GSAs, requirements incorporated into GSP Annual Reports	• Water levels are typically monitored annually. • Ag Suitability analysis (limited suite of general minerals) monitoring frequency between annual to once every 3 years.	Semiannual to Annual	-
California SDWIS	Varies Public Water Systems	Database for all public water system wells and historical sample results. Data available includes all Title 22 regulated constituents.	• Title 22 General Minerals and Metals every 3 years. • Nitrate as N annually, if ≥ 5 ppm, sampled quarterly • VOCs and SOCs sampled every 3 years. • Uranium sampling depends on historical results but varies between 1 sample every 3 (when ≥ 10 pCi/L), 6 (when < 10 pCi/L) or 9 (when no historical detection) years.	Demonstrate compliance with Drinking Water Standards through monitoring and reporting water quality data.
CV-SALTS	Tule Basin Management Zone, Tule Basin Water Foundation	Sampling parameters required through Waste Discharge Requirements (WDR): typically include monthly sodium, chloride, electrical conductivity, nitrogen species (N, NO2, NO3, NH3), pH and other constituents of concern identified in the Report of Waste Discharge. A limited suite of general minerals is required quarterly from the source and annually from the wastewater.	Most constituents sampled monthly, quarterly general minerals from source water and annual general minerals from waste discharge.	To monitor degradation potential from wastewaters discharged to land application areas and provide interim replacement water when MCL for nitrate as N is exceeded while developing long term solutions for safe drinking water.
Department of Pesticide Regulation	County of Tulare	Pesticides	Annual	DPR samples groundwater to determine: (1) whether pesticides with the potential to pollute groundwater are present, (2) the extent and source of pesticide contamination, and (3) the effectiveness of regulatory mitigation measures.
GAMA (Collaboration with SWQCB, RWQCB, DWR, DPR, NWIS, LLNL)		• Constituents sampled vary by the Program Objectives. • Typically, USGS is the technical lead in conducting the studies and reporting data.	Varies	• Improve statewide comprehensive e groundwater monitoring. • Increase the availability of groundwater quality and contamination information to the public.
Geotracker and Envirostor Databases		Many contaminants of concern, organic and inorganic.	Depends on program. Monthly, Semiannually, Annually, etc.	Records database for cleanup program sites, permitted waste dischargers
ILRP	Tule Basin Water Quality Coalition	• Annually: static water level, temperature, pH, electrical conductivity, nitrate as nitrogen, and dissolved oxygen. • Once every five years: general minerals collection	Annual and Every 5 years	Monitor impacts of agricultural and fertilizer
USGS California Water Science Center		Conducted multiple groundwater quality studies of the Tule Subbasin.	Reports, factsheet, and data publications range from 1994through 2017.	Special studies related to groundwater quality that provide comprehensive studies to characterize the basin.

2.2.5 Land Subsidence §354.16 (e)

§ 354.16. (e) The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or the best available information.

Land surface subsidence in the Tule Subbasin as a result of lowering the groundwater level from groundwater production has been well documented (Lofgren and Klausing, 1969; Ireland et al., 1984; Faunt, 2009; Luhdorff and Scalmanini, 2014). Prior to 1970, as much as 12 ft of land surface subsidence was documented for the area immediately south of Pixley (Ireland et al., 1984). As groundwater levels rose in the area throughout the 1970s and early 1980s, land subsidencerates slowed considerably. During this time, monitoring for land subsidence that had previously been conducted along the portion of the Friant-Kern Canal that is within the Tule Subbasin was discontinued.

From the late 1980s into the 2000s, it is suspected that land subsidence in the Tule Subbasin was reactivated as groundwater levels declined. Groundwater flow model simulations of land subsidence in the Central Valley by Faunt et al. (2009), which were calibrated to historical land subsidence that occurred in the 1960s, simulated an additional two to four feet of land subsidence between 1986 and 2003.

The reactivation of land subsidence was confirmed in the late 2000s based on data from Interferometric Synthetic Aperture Radar (InSAR) satellites and one Global Positioning System (GPS) station located in Porterville, California. InSAR data showed as much as four feet of additional land subsidence occurring in the northwestern portion of the Tule Subbasin between 2007 and 2011 (Luhdorff and Scalmanini, 2014). Approximately 0.4 ft of land subsidence occurred in the Porterville area between 2007 and 2011. From 2015 through 2023, land subsidence in the Tule Subbasin, as observed from InSAR data, continued with as much as 6.5 ft of additional land subsidence observed in the northwest portion of the subbasin and as much as 2.5 ft of additional land subsidence at the Porterville GPS station (see Figure 2-32).

The rate of land subsidence in the Tule Subbasin varies both spatially, according to the geology of the subsurface sediments, and temporally with changes in groundwater levels. The average rate of change in land surface elevation between 2015 and 2023 for the area of maximum subsidence (central and northwest part of the subbasin) was estimated to be approximately 1.2 ft/yr. At the Porterville GPS station, the annual rate of subsidence between 2015 and 2023 was approximately 0.3 ft/yr (see Figure 2-32). From 2006 and 2015, the land subsidence rate at this station was approximately 0.11 ft/yr but increased to approximately 0.3 ft/yr between 2015 and 2023.

Differential land subsidence rates along the portion of the Friant-Kern Canal that extends through the Tule Subbasin has impacted the ability of the Friant Water Authority (FWA) to deliver surface water downstream of the impacted areas. Based on benchmarks located along the Friant-Kern

Canal and monitored by the FWA, cumulative land subsidence along the canal between 1959 and 2019 has ranged from approximately 3 ft in the Porterville area to 13 feet in the vicinity of Deer Creek (see Figures 2-33 and 2-34). The Friant-Kern Canal is a regional water delivery canal that extends from Millerton Reservoir northeast of Fresno to the Kern River in Bakersfield. The differential land subsidence along the canal has resulted in a low spot in the vicinity of Deer Creek that restricts flow in the canal to downstream areas. As of 2019, the flow capacity of the canal at Deer Creek had been reduced from the original design capacity of 5,300 cubic feet per second (cfs) to approximately 1,900 cfs (United States Bureau of Reclamation, 2019). In 2021, the FWA initiated a project to raise the canal in portions of the ETGSA and DEID GSAs to restore the canal flow capacity. As of 2024, Phase 1 of this project has been completed.

2.2.6 Interconnected Surface Water Systems §354.16 (f)

> § 354.16. (f) 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.

Interconnected surface water (ISW) is 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.[1] The interaction between surface water and groundwater are part of the natural hydrologic system and can be summarized in three ways (DWR, 2024):

1. Surface water gains water from groundwater (i.e. "gaining stream").
2. Surface water loses water to groundwater (i.e. "losing stream").
3. Both, gaining in some locations and losing in other locations or gaining at some times and losing at other times.

Losing streams can be connected to the underlying aquifer from a continuous saturated zone or can be disconnected from the aquifer system by an unsaturated zone, the latter being a disconnected surface water system. Changes in the relationship between surface water and groundwater can occur naturally from seasonal precipitation changes and seasonal pumping. In areas where groundwater naturally discharges at the land surface (gaining stream), lowering of groundwater levels from pumping near the discharge point can impact the flow in the stream. Other factors that can affect flow in the stream include releases of water from upstream reservoirs, managed recharge near the stream channel, long-term precipitation trends, and post-2015 conditions of the aquifer system.

In the Tule Subbasin, the exact location and timing of ISW is not known. However, based on the best available data, ISW conditions likely exist in certain parts of the Subbasin (see Figure 2-10).

[1] California Code of Regulations, Title 23 Waters, Division 2 Department of Water Resources, Chapter 1.5 Groundwater Management, Subchapter 2 Groundwater Sustainability Plans, Article 2 Definitions, Section 351 (o)

To identify areas of potential ISWs for further study, an analysis was conducted consistent with method utilized by The Nature Conservancy's ICON database of ISW in the Central Valley (The Nature Conservancy, 2024). The method categorizes the likelihood of the ISW connection based on the minimum depth to groundwater and uses the following four categories:

- Likely Connected – Gaining: Groundwater elevation is equal to or greater than the surface water elevation and thus groundwater is likely flowing into the surface water body.
- Likely Connected – Losing: Groundwater elevation is between 0 and 20 feet below the surface water elevation and thus groundwater is likely receiving water from the surface water body through a continuous saturated zone.
- Uncertain: Conditions where the groundwater elevation is between 20 and 50 feet below the surface water elevation are labeled as uncertain because the groundwater may or may not be connected to surface water.
- Likely Disconnected: Groundwater elevation is greater than 50 feet below the surface water elevation and thus is likely disconnected from the surface water body.

Based on the ICONS database and an initial review of available data, three areas of potential ISWs were identified in the Tule Subbasin (see Figure 2-10):

- Upper Tule River from the Subbasin Boundary at Success Dam to Road 192
- Upper Deer Creek from the Subbasin Boundary to the Friant-Kern Canal
- Upper White River from the Subbasin Boundary to Highway 65

2.2.6.1 Tule River

Evaluation of Upper Aquifer groundwater levels in the upper reaches of the Tule River (below Success Reservoir Dam) suggests that groundwater is periodically interconnected with surface water in this area. During wet hydrologic conditions, such as occurred during the 2022/23 water year, groundwater levels in some shallow wells near the river rose to within 25 feet of the land surface and, when compared to the streambed elevation of the river, were near the streambed elevation. At ETGSA-01, a nested monitoring well constructed in 2022 and located approximately 0.5-mile south of the river channel (see Figure 2-35), the groundwater level in the Upper Aquifer completion of the well rose to within 10 feet of the land surface during the above-normal precipitation and runoff conditions of winter and spring 2023 (see Figure 2-36). It is noted that this well is located adjacent to managed recharge basins operated by the Vandalia Water District and the groundwater levels may not be representative of groundwater levels beneath the Tule River channel. Nonetheless, the groundwater levels were above the streambed elevation and suggest that it is likely that groundwater levels closer to the river channel were also at or above the river channel. Similar conditions were observed at City of Porterville R-11 and Village Market monitoring well MW-1, located near the river and west of the Friant Kern Canal (see Figures 2-30 and 2-37). These wells are also located near managed recharge basins.

There are no monitoring wells located along the Tule River streambed that are constructed for the express purpose of monitoring interconnected surface water and groundwater. As such, this is a data gap that is addressed in Attachments 1 and 8 of the Coordination Agreement. Until monitoring features are established, six existing Upper Aquifer monitoring wells have been identified to monitor shallow groundwater levels near the river. In addition, stream flow at the Success Reservoir dam and at Rockford Station downstream of the dam will be monitored and reported (see Attachment 1 to the Coordination Agreement - Monitoring Plan).

2.2.6.2 Deer Creek

Upper Aquifer wells near the Upper Deer Creek Area show groundwater elevations within 15 feet of the Deer Creek stream channel during high groundwater conditions (February 2023; see Figure 2-38). The alluvial aquifer system in this area is relatively thin and underlain by shallow granitic bedrock. Groundwater elevations in wells further but east of the Friant-Kern Canal are approximately 70 to over 100 ft below the Deer Creek streambed. Groundwater levels in monitoring wells adjacent to recharge basins at the Deer Creek-Friant Kern Canal Water Bank range from 0 to greater than 50 ft below ground surface from 2019 through 2023 (see Figure 2-39). Groundwater levels at this location are influenced by native Deer Creek flows, which are relatively low, imported water from the Friant-Kern Canal released into the Deer Creek channel, and nearby recharge operations.

There are no monitoring wells located along the Deer Creek streambed that are constructed for the express purpose of monitoring interconnected surface water and groundwater. As such, this is a data gap that is addressed in Attachments 1 and 8 of the Coordination Agreement. Until monitoring features are established, six existing Upper Aquifer monitoring wells have been identified to monitor shallow groundwater levels near the river. In addition, stream flow at Road 272 will be monitored and reported (see Attachment 1 to the Coordination Agreement - Monitoring Plan).

2.2.6.3 White River

Availability of Upper Aquifer groundwater level data in the Upper White River Area is limited to one well located approximately 4.5 miles west of Highway 65 (the western edge of the Upper White River Area) and outside the area identified as potential ISW in the ICONs database (see Figure 2-10). Groundwater levels measured in this well have been approximately 250 ft bgs over the available period of record (see Figure 2-40) and are too deep to be considered interconnected with surface water. Additional monitoring features specific to addressing ISW along White River are needed east of Highway 65 to determine the potential for ISW, per Attachment 1 of the Coordination Agreement.

2.2.7 Groundwater Dependent Ecosystems §354.16 (g)

> § 354.16. (g) Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.

Groundwater dependent ecosystems (GDEs) require shallow groundwater or groundwater that discharges at the land surface. Potential GDEs in the Tule Subbasin were identified with California Department of Fish and Wildlife's (CDFW) Vegetation Classification and Mapping Program (VegCAMP) data (CDFW, 2018; CDFW, 2023) (see Figure 41). GDEs may be related to ISWs in that ISW features (rivers and shallow groundwater) are hydrologic systems likely to host aquatic communities or species that may be dependent on groundwater (Klausmeyer, et al., 2018).

In the Upper Tule River Area, the majority of potential GDEs are between Success Dam and Martin Hill, though some groves of trees are mapped in the Tule River channel between Martin Hill and the Friant-Kern Canal (see Figure 42). The GDEs consist primarily of riparian trees, including Sycamore, Fremont Cottonwood, and Willow. In the Upper Deer Creek Area, the majority of potential GDEs are located east of Highway 65 and consist Sycamore, Oak, and Willow (see Figure 43). In the Upper White River Area, most potential GDEs are located within the upper 3 miles of the channel closest to the Subbasin boundary and consist of Sycamore, Oak, and Willow (see Figure 44).

2.3 Water Budget §354.18

> § 354.18. Water Budget
>
> (a) Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.

2.3.1. Surface Water Budget

The surface water budget for the Tule Subbasin was developed for the 33-year period from 1986/87 to 2018/19 (see Table 2-2a for Inflow Terms and Table 2-2b for Outflow Terms). Inflow terms for the surface water budget include precipitation, stream inflow, imported water, and discharge to the land surface from wells. Outflow terms include infiltration of precipitation, evapotranspiration of precipitation from areas of native vegetation and crops, stream infiltration, canal loss, recharge in basins, return flow, and consumptive use.

Ideally, the total surface water inflow to the subbasin would equal the total surface water outflow, indicating a complete and accurate accounting of water at the surface. In reality, there is uncertainty in many of the surface water budget terms for the Tule Subbasin that does not allow

for a perfect surface water accounting. These include estimates for agricultural groundwater production, crop consumptive use, precipitation recharge, surface water outflow to Homeland Canal from Deer Creek, and others. For the Tule Subbasin surface water budget, the percent difference between the average annual surface water inflow (1,534,000 acre-ft; Table 2-2a) and average annual outflow (1,541,000 acre-ft; Table 2-2b) is approximately 0.2 percent. This represents a very good match between surface water inflows and outflows and indicates that the water budget is a good representation of actual conditions. As additional data become available, it is anticipated that the surface water budget will become more accurate with time.

It is noted that many of the surface water outflow terms are also groundwater inflow (i.e. groundwater recharge) terms. Of the surface water outflow terms that become groundwater inflow, many are associated with water diverted in accordance with pre-existing water rights or purchased imported water that is stored in the aquifer for the purpose of later extraction by the water rights holder or owner. Sources of surface water outflow that become groundwater inflow for the purpose of storage in accordance with existing rights and/or imported water deliveries are indicated with magenta-colored columns in Table 2-2b. Surface water losses that become groundwater recharge and are not associated with existing rights and/or imported water deliveries are indicated with blue-colored columns in Table 2-2b. Surface water losses that do not become groundwater inflow, such as through evapotranspiration, crop consumptive use, or surface water outflow are indicated with yellow-colored columns in Table 2-2b (page 2).

Details of the individual surface water budget terms are provided in the following sections.

2.3.1.1 Surface Water Inflow §354.18 (b)(1)

> § 354.18. (b) The water budget shall quantify the following, either through direct measurements or estimates based on data:
>
> (1) Total surface water entering and leaving a basin by water source type.

2.3.1.1.1. Precipitation

The annual volume of water entering the Tule Subbasin as precipitation was estimated for the surface water budget based on the long-term average annual isohyetal map shown on Figure 2-45 and the annual precipitation data reported for the Porterville precipitation station. As annual precipitation values are not available throughout the entire Tule Subbasin, it was assumed that the relative precipitation distribution for each year was the same as that shown on the isohyetal map. The magnitude of annual precipitation within each isohyetal zone was varied from year to year based on the ratio of annual precipitation at the Porterville Station (see Figure 2-46) to annual average precipitation at the Porterville isohyetal zone multiplied by the isohyetal zone average annual precipitation. Using this method, total annual precipitation in the Tule Subbasin between

water years 1986/87 and 2018/19 ranged from approximately 147,000 to 761,000 acre-ft/yr with an average of 361,000 acre-ft/yr (see Column A of Table 2-2a).

2.3.1.1.2. Stream Inflow

Surface water inflow to the Tule Subbasin occurs primarily via three native streams: Tule River, Deer Creek, and the White River (see Columns B through D of Table 2-2a). Flow in the Tule River is controlled through releases from Lake Success, which are documented in TRA annual reports. For water years 1986/87 to 2018/19, annual surface water inflow to the Tule Subbasin via the Tule River, measured as releases from Lake Success, ranged from 8,820 to 439,125 acre-ft/yr with an average of 120,100 acre-ft/yr. The long-term 116-year average (1904 to 2019) inflow to Lake Success via the Tule River channels is approximately 139,000 acre-ft/year.

Annual inflow from Deer Creek is measured at Fountain Springs by the USGS and has varied from approximately 2,000 to 88,000 acre-ft/yr with an average of 18,400 acre-ft/yr over water years 1986/87 to 2018/19. The long-term average inflow via Deer Creek for the period of record from 1920 to 2019 is approximately 22,000 acre-ft/year. It is noted that although the Fountain Springs gage is located approximately five miles upstream of the Tule Subbasin, the creek flows over granitic bedrock between the gage and the alluvial basin boundary and losses along this reach are assumed to be limited to evapotranspiration.

Surface water inflow from the White River is based on USGS stream gage data from the White River station near Ducor. The measured data from this station is only available from 1971 to 2005. To estimate annual streamflow from 1986/87 to 2018/19, it was assumed that the magnitude of flow in the White River is proportional to the magnitude of flow in Deer Creek. TH&Co plotted monthly White River streamflow against monthly Deer Creek streamflow for the period 1971 to 2005. A linear regression through the data resulted in a correlation coefficient of 0.91, suggesting that the relationship is applicable (see Figure 2-47). White River streamflow between 2006 and 2017 was based on the linear interpolation of measured data. Based on the measured and interpolated data, annual inflows from the White River ranged from approximately 250 to 37,000 acre-ft/yr and averaged 6,000 acre-ft/yr from water years 1986/87 to 2018/19.

2.3.1.1.3. Imported Water

Imported water is delivered to eleven water agencies within the Tule Subbasin from the Friant-Kern Canal (see Columns E through O of Table 2-2a). Data from PID, Saucelito Irrigation District, Tea Pot Dome Water District, Alpaugh Irrigation District, Atwell Island Irrigation District, and Terra Bella Irrigation District was obtained from USBR Central Valley Operation Annual Reports. Imported water data for the other agencies was provided by the respective agencies. Based on these data, an average of 352,900 acre-ft/yr was imported into the Tule Subbasin for the period from 1986/87 to 2018/19.

2.3.1.1.4. Discharge to Crops from Wells

Water applied to crops from wells is assumed to be the total applied water minus surface water deliveries from imported water and diverted streamflow (see Figure 2-48). The total crop demand was estimated based on consumptive use estimates and an assumed irrigation efficiency of 79 percent. The estimated average annual discharge to crops from wells for water years 1986/87 to 2018/19 was approximately 651,000 acre-ft/yr (see Column P of Table 2-2a).

2.3.1.1.5. Municipal Deliveries from Wells

Groundwater pumping for municipal supply is conducted by the City of Porterville and small municipalities for the local communities in the Tule Subbasin. From water years 1986/87 to 2018/19, municipal pumping from wells was estimated to average approximately 19,600 acre-ft/yr (see Column Q of Table 2-2a).

It is noted that there are some households in the Tule Subbasin that rely on private wells to meet their domestic water supply needs. Based on query of the DWR's Online System of Well Completion Records (OSWCR) database, there are approximately 1,700 domestic wells in the Tule Subbasin. Assuming a daily water demand of 250 gallons per day per household (well), the total groundwater pumping demand from these wells is estimated to be approximately 425,000 gallons per day, or 476 acre-ft/yr. This is approximately 0.07 percent of the 699,100 acre-ft/yr average annual groundwater production from other pumpers.

2.3.1.2 Surface Water Outflow

2.3.1.2.1 Areal Recharge from Precipitation

Areal recharge from precipitation falling on the valley floor in the Tule Subbasin was estimated based on Williamson et al., (1989). As part of a regional hydrogeological study of the California Central Valley, Williamson et al., (1989) developed a monthly soil-moisture budget for the Sacramento Valley and San Joaquin Valley areas. The soil moisture budget was based on precipitation records for the 50-yr period from 1922 to 1971. The analysis considered potential evapotranspiration, assumed plant root depth, soil moisture-holding capacity, and precipitation. Monthly precipitation that exceeded monthly potential evapotranspiration and soil-moisture storage was computed as net infiltration to the groundwater system. The results were simplified with a linear regression model that estimates net infiltration (i.e. groundwater recharge) from annual precipitation (herby referred to as the Williamson Method). The resulting relationship for the San Joaquin Valley region was:

$$PPT_{ex} = (0.64)PPT - 6.2$$

Where:

PPT_{ex} = Excess Annual Precipitation (ft/yr);
PPT = Annual Precipitation (ft/yr)

It is noted that the Williamson Method applied to the San Joaquin Valley results in no groundwater recharge if average annual precipitation is less than 9.69 inches per year. Results of the net infiltration analysis from Williamson et al., (1989) were used in the development of the Central Valley Groundwater Model developed by the USGS and documented in Faunt (2009).

For each year, annual groundwater recharge from precipitation (i.e. PPT_{ex}) was estimated for each isohyetal zone (see Section 2.3.1.1.1 and Figure 2-45) using the above equation from the Williamson Method. The resulting annual groundwater recharge from areal precipitation for the period 1986/87 to 2018/19ranged from 0 acre-ft/yr to 241,000 acre-ft/yr with an average of approximately 33,000 acre-ft/yr (see Column A of Table 2-2b) or approximately 9 percent of total precipitation.

2.3.1.2.2 Streambed Infiltration (Channel Loss)

Tule River

The Tule River is a losing stream such that infiltration of surface water within the stream channel recharges the groundwater system beneath it. Total channel loss (i.e. streambed infiltration) in the Tule River between Lake Success and Oettle Bridge is based on TRA annual reports. Streambed infiltration in the Tule River between Oettle Bridge and Turnbull Weir was estimated based on LTRID monthly water use summaries and TRA annual reports. Measured channel loss includes infiltration as well as evapotranspiration. Therefore, infiltration is equal to channel loss, as reported in TRA reports, minus evapotranspiration (described in Section 2.3.1.2.6).

It is noted that there are two sources of water in the Tule River channel: 1) native flow associated with releases from Lake Success and 2) imported water from the Friant-Kern Canal. Surface water in the Tule River channel from Lake Success to Oettle Bridge is exclusively native water (Column B of Table 2-2b). Surface water in the Tule River channel from Oettle Bridge to Turnbull Weir is primarily native flow but periodically includes imported water released to the channel from the Friant-Kern Canal.

As there is no current accounting of Tule River channel loss from Oettle Bridge to Turnbull Weir, it was necessary to estimate it based on available data and an assumed loss factor. The loss factor was based on the assumption that the ratio of streamflow to channel losses upstream of Oettle Bridge is the same as the ratio downstream. Thus, the ratio of streamflow to channel losses observed upstream of Oettle Bridge (the “loss factor”) was applied to measured flow Below Oettle Bridge. The loss factor was applied separately to native Tule River water and imported water releases to develop streambed infiltration estimates specific to both. From water years 1986/87 to

2018/19, average annual streambed infiltration from Success to Oettle Bridge was approximately 16,700 acre-ft/yr (Column B of Table 2-2b). During the same time period, average annual streambed infiltration between Oettle Bridge and Turnbull Weir was approximately 3,000 acre-ft/yr (see Column C of Table 2-2b).

Deer Creek

Deer Creek is a losing stream such that infiltration of surface water within the stream channel recharges the groundwater system beneath it. Streambed infiltration (channel loss) is estimated for the stream reaches between the Fountain Springs gaging station and Trenton Weir and between Trenton Weir and Homeland Canal. The difference in streamflow between Fountain Springs station and Trenton Weir is assumed to be total channel loss along this section. Streambed and canal infiltration in the Deer Creek channel between Trenton Weir and Homeland Canal were estimated based on Pixley Irrigation District monthly water use summaries. Measured channel loss includes infiltration as well as evapotranspiration. Therefore, infiltration is channel loss minus evapotranspiration (described in Section 2.3.1.2.6).

It is noted that there are two sources of water in the Deer Creek channel: 1) native flow and 2) imported water from the Friant-Kern Canal. Imported water is introduced into the Deer Creek channel by the Friant Water Authority via controlled and measured releases from the Friant-Kern Canal upstream of Trenton Weir. Thus, until a stream gage is established upstream of the Friant-Kern Canal/Deer Creek intersection, the separate accounting of losses associated with imported water and native Deer Creek surface flow will have to be approximated.

Deer Creek channel loss from Fountain Springs to Trenton Weir was estimated based on the difference in measured flows between the two stations. The surface flow between these two stations is assumed to be, for this water budget, native Deer Creek water. Average annual infiltration from Fountain Springs to Trenton Weir was approximately 11,500 acre-ft/yr between water years 1986/87 to 2018/19 (see Column D of Table 2-2b).

Flow in the Deer Creek channel from Trenton Weir to Homeland Canal is a combination of native Deer Creek water and imported water purchased by the Pixley Irrigation District for distribution in their service area. For this water balance, it is assumed that all of the water that flows through Trenton Weir is either delivered to riparians and farmers or becomes channel or canal loss (i.e. there is no data available to document surface flow from the Deer Creek channel to Homeland Canal although it is known that this occurs during periods of above normal precipitation). The infiltration of native Deer Creek water in the Deer Creek channel downstream of Trenton Weir is estimated for each month based on Pixley Irrigation District's annual water use summaries in the following way:

1. Imported water deliveries discharged from the Friant-Kern Canal to the Deer Creek channel were subtracted from the total flow measured at Trenton Weir to estimate the volume entering Pixley Irrigation District that is attributed to native Deer Creek flow.
2. Pixley Irrigation District sales and deliveries to basins were subtracted from the total flow through Trenton Weir to determine the volume of water presumably lost as infiltration in the Deer Creek channel and canals.
3. The total loss in No. 2 was multiplied by the ratio of Deer Creek water to total water measured at Trenton Weir to estimate the total losses attributed to native Deer Creek water.
4. A ratio was developed for the length of Deer Creek channel versus the length of canals downstream of the Trenton Weir (0.21).
5. The total loss attributed to native Deer Creek flow, as estimated from No. 3, was multiplied by the ratio of Deer Creek channel length to canal length from No. 4 to estimate the volume of native Deer Creek flow loss estimated to occur in the Deer Creek channel.
6. The volume of native Deer Creek flow lost in canals was estimated as the total loss (No. 3) minus the loss estimated to occur in the Deer Creek channel (No. 5).

Using the methodologies described above, average annual native Deer Creek infiltration from Fountain Springs to Trenton Weir for water years 1986/87 to 2018/19 was 11,500 acre-ft/yr (see Column D of Table 2-2b). The average annual native Deer Creek infiltration in the Deer Creek channel between Trenton Weir and Homeland Canal was approximately 600 acre-ft/yr (see Column E of Table 2-2b).

White River

All of the surface water flow measured or interpolated at the White River stream gage, after accounting for ET losses, is assumed to become streambed infiltration. Average annual infiltration from White River flow for water year 1986/87 to 2018/19 was estimated to be approximately 5,800 acre-ft/yr (see Column F of Table 2-2b).

2.3.1.2.3 Canal Losses

Canal Losses from Tule River Diversions

A portion of the native Tule River water that is diverted into unlined canals is lost through infiltration into the subsurface groundwater subbasin. For PID, Vandalia Water District, and Woods-Central Ditch Co., delivery losses in unlined canals are accounted for in the portion of the water budget that address deep percolation of applied water.

In the LTRID, canal losses attributed to Tule River diversions are estimated from the District's annual water use summaries reports. Total canal losses within the LTRID (which include both native river water and imported water) are estimated by subtracting streambed infiltration and ET

from the total losses reported in the annual water use summaries. Canal losses attributed to native Tule River water are based on the ratio of native Tule River water to imported water (Table 2-2b, Column G). The average annual Tule River canal loss from water years 1986/87 to 2018/19was approximately 23,300 acre-ft/yr.

Canal Losses from Deer Creek Diversions

It is assumed that canal losses from delivery of native Deer Creek water to riparians and farmers occur only within the Pixley Irrigation District. To estimate canal losses within the Pixley Irrigation District, the estimated infiltration and ET within the Deer Creek channel (see Section 2.3.1.2.6) was subtracted from total losses. The average annual Deer Creek canal loss for water years 1986/87 to 2018/19 was approximately 2,500 acre-ft/yr (see Column H of Table 2-2b).

Canal Losses from Imported Water Deliveries

With the exception of canal losses within the Angiola Water District and PID, imported water that infiltrates into the subsurface groundwater subbasin from the Tule River channel, Deer Creek channel, and unlined canals is grouped together. Within the Angiola Water District and PID, canal losses are accounted for in the portion of the water budget that addresses deep percolation of applied water.

For the LTRID GSA and Pixley Irrigation District GSA areas, imported water losses in channels and canals are estimated by subtracting infiltration losses attributed to native Tule River and Deer Creek water from the total losses estimated to occur in the LTRID and Pixley Irrigation District service areas as documented in their respective annual water use summary reports. The resulting estimate of average annual imported water canal loss for water years 1986/87 to 2018/19 was approximately 52,800 acre-ft (see Column I of Table 2-2b).

2.3.1.2.4 Managed Recharge in Basins

Managed Recharge of Tule River Diversions

Managed recharge (i.e. recharge in basins) of diverted streamflow, imported water, and recycled water is accomplished within the Tule Subbasin via multiple recharge facilities (see Figure 2-7). Native Tule River water is diverted to basins for recharge by Pioneer Water Company, Campbell and Moreland Ditch Company, Vandalia Water District, PID, and LTRID. All of the water diverted to basins by Campbell and Moreland Ditch Company and Vandalia Water District is native Tule River flow. To estimate the portion of basin recharge attributable to native Tule River water in LTRID basins downstream of Oettle Bridge, TH&Co multiplied the ratio of Tule River gaged flow below Oettle Bridge to the total water delivered to the LTRID by the total recharge in basins reported in the LTRID annual water use summaries. Using this methodology, the average

annual Tule River recharge in basins from water years 1986/87 to 2018/19 was approximately 30,200 acre-ft (see Column J of Table 2-2b).

Managed Recharge of Deer Creek Diversions

Managed recharge (i.e. recharge in basins) of diverted Deer Creek streamflow is accomplished via multiple recharge facilities (see Figure 2-7). Native Deer Creek water is diverted to basins for recharge by Pixley Irrigation District and DCTRA. Artificial recharge attributed to native Deer Creek water is estimated by multiplying the total recharge in basins reported in Pixley Irrigation District annual water use summaries by the ratio of native Deer Creek water to total water flowing through the Trenton Weir. The average annual Deer Creek recharge in basins for water years 1986/87 to 2018/19 was estimated to be approximately 2,300 acre-ft/yr (see Column K of Table 2-2b).

Managed Recharge of Imported Water

Managed recharge of imported water is accomplished via multiple recharge facilities within the LTRID, Pixley Irrigation District, PID, Teapot Dome Water District and DEID. Managed recharge attributed to imported water in the LTRID is estimated by multiplying the total recharge in basins reported in annual water use summaries by the ratio of imported water to total surface water flow available. Managed recharge attributed to imported water in the Pixley Irrigation District is estimated by multiplying the total recharge in basins reported in annual water use summaries by the ratio of imported water to total water flowing through the Trenton Weir. Volumes of imported water delivered to recharge in basins for PID, Teapot Dome Water District, and DEID were provided by the respective agencies. The resulting estimated average annual imported water recharge in basins for water years 1986/87 to 2018/19 was approximately 14,500 acre-ft (see Column L of Table 2-2b).

Recharge of Recycled Water in Basins

A portion of recycled water from the City of Porterville is discharged to basins where it infiltrates into the subsurface. Artificial recharge of recycled water was estimated as 75 percent of all available recycled water from 1990/91 to 2003/04 based on California Regional Water Quality Control Board Order No. R5-2008-0034. Artificial recharge was assumed to be 2,000 acre-ft/yr from 2004/05 to 2009/10 based on Schmidt (2009). The average annual recycled water recharge for water years 1986/87 to 2018/19 was estimated to be approximately 1,800 acre-ft/yr (see Table 2-2b, Column M).

2.3.1.2.5 Deep Percolation of Applied Water

Deep Percolation of Applied Tule River Diversions

A portion of native Tule River water that is delivered and applied for agricultural irrigation is assumed to infiltrate below the root zones of plants and become deep percolation to the groundwater. Deep percolation from irrigated agriculture was applied to the various land uses in the Tule Subbasin according to the irrigation method (e.g. drip irrigation, flood irrigation, micro sprinkler, etc.) for each land use type reported in CDWR on-line land use maps. Irrigation efficiencies were applied to the different irrigation methods based on tables reported in California Energy Commission (2006).

Tule River water is diverted for agricultural irrigation by the Pioneer Water Company, Porter Slough Headgate, Porter Slough Ditch Company, Campbell and Moreland Ditch Company, Poplar Irrigation Company, Woods-Central Ditch Company, Hubbs and Miner Ditch Company, and LTRID. In the LTRID, applied water attributed to native Tule River water is based on the ratio of total native Tule River water entering the LTRID to the total water available to the district (including imports) multiplied by the volume of water delivered for irrigation. Using this methodology, the average annual deep percolation of native Tule River water for water years 1986/87 to 2018/19 was approximately 22,200 acre-ft/yr (see Column N of Table 2-2b).

Deep Percolation of Applied Deer Creek Diversions

The portion of native Deer Creek water delivered for agricultural use within the Pixley Irrigation District is estimated by multiplying the total deliveries reported in Pixley Irrigation District annual water use summaries by the ratio of native Deer Creek water to total water flowing through the Trenton Weir. Deep percolation of applied Deer Creek diversions is estimated based on the irrigation method (e.g. drip irrigation, flood irrigation, micro sprinkler, etc.) for each land use type reported in DWR on-line land use maps. Irrigation efficiencies were applied to the different irrigation methods based on tables reported in California Energy Commission (2006). From water years 1986/87 to 2018/19, average annual deep percolation of native Deer Creek water was estimated to be approximately 1,100 acre-ft/yr (see Column O of Table 2-2b).

Deep Percolation of Applied Imported Water

The estimate of imported water delivered and applied to crops within the agencies that receive imported water is based on the total imported water delivery minus losses and recharge in basins. Deep percolation of applied imported water is estimated based on the irrigation method (e.g. drip irrigation, flood irrigation, micro sprinkler, etc.) for each land use type reported in DWR on-line land use maps. Irrigation efficiencies were applied to the different irrigation methods based on tables reported in California Energy Commission (2006). For water years 1986/87 to 2018/19, the

estimated average annual deep percolation from imported water was approximately 96,900 acre-ft/yr (see Column P of Table 2-2b).

Deep Percolation of Applied Recycled Water

The estimate of recycled water delivered and applied to crops was provided by the City of Porterville. Deep percolation of applied recycled water is estimated based on the irrigation method (e.g. drip irrigation, flood irrigation, micro sprinkler, etc.) for each land use type reported in DWR on-line land use maps. Irrigation efficiencies were applied to the different irrigation methods based on tables reported in California Energy Commission (2006). For water years 1986/87 to 2018/19, the estimated average annual deep percolation from recycled water was approximately 1,800 acre-ft/yr (see Column Q of Table 2-2b).

Deep Percolation of Applied Native Groundwater for Agricultural Irrigation

The balance of agricultural irrigation demand not met by imported water or stream diversions is assumed to be met by groundwater pumping. Deep percolation of applied native groundwater is estimated based on the irrigation method (e.g. drip irrigation, flood irrigation, micro sprinkler, etc.) for each land use type reported in DWR on-line land use maps. Irrigation efficiencies were applied to the different irrigation methods based on tables reported in California Energy Commission (2006). For water years 1986/87 to 2018/19, average annual deep percolation from applied agricultural pumping was approximately 148,200 acre-ft/yr (see Column R of Table 2-2b).

Deep Percolation of Applied Native Groundwater for Municipal Irrigation

Deep percolation from applied landscape irrigation was estimated for the urbanized portions of the Tule Subbasin. Because the cities within the Tule Subbasin do not have surface water rights on the Tule River or Deer Creek and do not purchase imported water, 100 percent of their water demand is met from groundwater pumping. For the City of Porterville, landscape irrigation was estimated to be 47 percent of the total water delivered to each home based on an analysis of the total groundwater production and influent flows to the wastewater treatment plant (City of Porterville draft Urban Water Management Plan 2010 Update, 2014). Of the water used for irrigation, 25 percent was assumed to become return flow.

For the other smaller communities in the Tule Subbasin, wastewater discharge was assumed to be through individual septic systems. For water discharged to septic systems, it was assumed that 100 percent of the discharge became return flow. As with the City of Porterville, 47 percent of total water use was assumed to be for landscape irrigation and 25 percent of the landscape irrigation is assumed to become return flow.

For water years 1986/87 to 2018/19, average annual return flow from municipal production was estimated to be approximately 6,900 acre-f/yr (see Column S of Table 2-2b).

2.3.1.2.6 Evapotranspiration

Evapotranspiration of Precipitation from Crops and Native Vegetation

Evapotranspiration (ET) is the loss of water to the atmosphere from free-water evaporation, soil-moisture evaporation, and transpiration by plants (Fetter, 1994). Evapotranspiration of precipitation is assumed to be the balance between total precipitation and areal recharge. This value includes evapotranspiration of precipitation from crops as well as native vegetation. From water years 1986/87 to 2018/19, evapotranspiration of precipitation was estimated to average approximately 328,000 acre-ft/yr (see Column T of Table 2-2b, Page 2).

Evapotranspiration of Surface Water within the Tule River Channel

Evapotranspiration of surface water within the Tule River channel is a function of the ET rate and wetted channel surface area. The ET rate was based on published data for riparian vegetation in an intermittent stream (Leenhouts et al., 2005). As the channel width of the Tule River varies, TH&Co identified reaches with similar average channel width using aerial photographs (Google Earth). The ET rate was applied to the surface area of each reach to obtain an estimate of ET. The sum of reach by reach ET estimates between Lake Success and the western Tule Subbasin boundary represents the total Tule River ET shown in Table 2-2b, Page 2, Column U. The resulting average annual ET is approximately 400 acre-ft/yr for water years 1986/87 to 2018/19 (see Table 2-2b, Page 2, Column V).

Evapotranspiration of Surface Water within the Deer Creek Channel

Evapotranspiration within the Deer Creek channel was estimated using the same methodology as for the Tule River. Average annual ET within the Deer Creek channel was estimated to be approximately 300 acre-ft/yr for water years 1986/87 to 2018/19 (see Table 2-2b, Page 2, Column X).

Evapotranspiration of Surface Water within the White River Channel

Evapotranspiration in the White River channel was estimated using the same methodology as for the Tule River. For water year 1986/87 to 2018/19, the average annual evapotranspiration was estimated to be approximately 100 acre-ft/yr (see Column Y of Table 2-2b, Page 2).

Evapotranspiration of Recycled Water in Basins

Evapotranspiration of recycled water delivered to recharge basins was estimated to be 50 acre-ft/yr (see Column AB of Table 2-2b, Page 2) based on Schmidt (2009).

Agricultural Consumptive Use

Columns U, W, Z, AA and AC of Table 2-2b includes agricultural consumptive use of applied water, not including the portion of the consumptive use met by precipitation, which is included in Column T. Historical agricultural crop water demand (i.e. applied water demand) was estimated based on records of the types and areas of crops grown, estimates of consumptive use for each crop, and estimates of the irrigation efficiency. Information on the types and areas of crops for the LTRID and Pixley Irrigation District were obtained from annual crop surveys from each respective district. The types and areas of crops in other parts of the Tule Groundwater Subbasin within Tulare County were estimated from land use maps and associated data published by the CDWR for 1993, 1999, and 2007 (see Figure 2-49). For the portion of the Subbasin in Kern County (DEID), land use maps were obtained from CDWR (1990) and Kern County Department of Agriculture and Measurement Standards (1999 and 2007). Consumptive use estimates for the various crop types were based on crop coefficients published in ITRC (2003). In order to estimate a total agricultural irrigation water demand, the consumptive use estimates for each crop were multiplied by the area of the crop, which in turn was multiplied by a return flow factor reflecting the irrigation efficiency (see Section 2.3.1.2.5).

The estimated average annual agricultural consumptive use for the period of the groundwater budget was approximately 724,000 acre-ft/yr (sum of Columns U, W, Z, AA and AC of Table 2-2b).

Municipal Consumptive Use

Consumptive use of landscaping associated with applied municipal groundwater pumping was estimated based on an assumed applied water to landscaping and return flow factor. As presented in Section 2.3.1.2.5, it is assumed 47 percent of municipal water use is applied to landscaping. It is assumed that 75 percent of applied water to landscaping is consumptively used by the plants and 25 percent becomes return flow. For water years 1986/87 to 2018/19, estimated average annual municipal consumptive use was approximately 6,900 acre-ft/yr (see Column AD of Table 2-2b).

2.3.1.2.7 Surface Water Outflow

Tule River

Any residual stream flow in the Tule River that reaches the Turnbull Weir, located at the west (downstream) end of the Tule Subbasin, is assumed to flow out of the subbasin (see Figure 2-7). From water years 1986/87 to 2018/19, surface water outflow ranged from 0 to 121,000 acre-ft/yr and averaged 12,000 acre-ft/yr (see Table 2-2b, Page 2, Column AE).

It is noted that additional outflow may occur at smaller canal outlets at the west end of the Tule Subbasin. The data for these outflows was unavailable for this report.

Deer Creek

During periods of above-normal precipitation, residual stream flow left in the Deer Creek after diversions has historically flowed into Homeland Canal, located at the west end of the Tule Subbasin (see Figure 2-7). The data for this outflow was unavailable for this report (see Column AF of Table 2-2b, Page 2). As this data becomes available, it will be incorporated into the surface water budget.

2.3.2. Groundwater Budget §354.18 (b)(2)

The groundwater budget describes the sources and estimates the volumes of groundwater inflow and outflow within the Tule Subbasin (see Table 2-3). A fundamental premise of the groundwater budget is the following relationship:

$$\text{Inflow} - \text{Outflow} = +/- \Delta S$$

Inflow terms include areal recharge from precipitation, infiltration in stream/river channels, managed infiltration of water in basins for the purpose of groundwater storage, canal losses, return flow, release of water from compression of aquitards, and subsurface inflow. It is noted that many of the groundwater inflow terms are surface water outflow terms from Table 2-2b. Outflow terms include groundwater pumping, evapotranspiration, and subsurface outflow. The difference between the sum of inflow terms and the sum of outflow terms is the change in groundwater storage (ΔS) (see Table 2-3).

As with the surface water budget tables, the individual columns in the groundwater budget table are color coded to delineate inflows and outflows associated with natural recharge and agricultural pumping return flow (blue columns) from inflows associated with pre-existing water rights or purchased imported water that is stored in the aquifer for the purpose of later extraction by the water rights holder or owner. Sources of groundwater inflow that are associated with pre-existing water rights and/or imported water deliveries are indicated with magenta-colored columns in Table 2-3. Groundwater pumping is shown as yellow-colored columns in Table 2-3.

2.3.2.1 Sources of Groundwater Inflow §354.18 (b)(2)

> § 354.18. (b) (2) Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.

2.3.2.1.1 Areal Recharge

Groundwater recharge from precipitation falling on the valley floor in the Tule Subbasin was estimated based on Williamson et al., (1989) (see Section 2.3.1.1.1). The resulting annual groundwater recharge from areal precipitation using this method ranged from 0 acre-ft/yr to 241,000 acre-ft/yr with a 33-yr average of approximately 33,000 acre-ft/yr (see Column A, Table 2-3).

2.3.2.1.2 Groundwater Recharge from the Tule River

Groundwater recharge of native Tule River water occurs as streambed infiltration, infiltration of water in unlined canals, recharge in basins, and deep percolation of applied water. Tule River water that becomes groundwater recharge is described in Section 2.3.1.2 and summarized in Columns B through F of Table 2-3. Average annual groundwater recharge of native Tule River water was estimated to be approximately 95,400 acre-ft/yr for water years 1986/87 to 2018/19.

2.3.2.1.3 Groundwater Recharge from Deer Creek

Groundwater recharge of native Deer Creek water occurs as streambed infiltration, canal loss, recharge in basins, and deep percolation of applied water. Deer Creek water that becomes groundwater recharge is described in Section 2.3.1.2 and summarized in Columns G through K of Table 2-3. For water years 1986/87 to 2018/19 average annual groundwater recharge of native Deer Creek water was estimated to be approximately 18,000 acre-ft/yr.

2.3.2.1.4 Streambed Infiltration in the White River

Groundwater recharge of White River water occurs as streambed infiltration as described in Section 2.3.1.2 and summarized in Column L of Table 2-3. Estimated average annual groundwater recharge from White River water was approximately 5,800 acre-ft/yr for water years 1986/87 to 2018/19.

2.3.2.1.5 Groundwater Inflow from Imported Water Deliveries

Groundwater inflow of imported water occurs as canal loss, infiltration in basins, and deep percolation of applied water as described in Section 2.3.1.2 and summarized in Columns M through O of Table 2-3. For water years 1986/87 to 2018/19 average annual groundwater inflow from imported water was estimated to be approximately 164,300 acre-ft/yr.

2.3.2.1.6 Recycled Water

Groundwater inflow of recycled water occurs as infiltration in basins and return flow of applied water as described in Section 2.3.1.2 and summarized in Columns R and S of Table 2-3. For water years 1986/87 to 2018/19 average annual groundwater inflow from recycled water was estimated to be approximately 3,600 acre-ft/yr.

2.3.2.1.7 Deep Percolation of Applied Water from Groundwater Pumping

A portion of irrigated agriculture and municipal applied water from groundwater pumping becomes deep percolation and groundwater inflow as described in Section 2.3.1.2.5 and summarized in Columns P and Q of Table 2-3. For water years 1986/87 to 2018/19 average annual groundwater recharge associated with return flow from groundwater pumping was estimated to be approximately 155,000 acre-ft/yr.

2.3.2.1.8 Release of Water from Compression of Aquitards

Prolonged lowering of groundwater levels in the Tule Subbasin results in the drainage of water from low permeability subsurface aquitards that occur beneath the potentiometric groundwater surface. Aquitards are low permeability layers with relatively high silt and clay content. As the aquitards are compressible, the release of pore pressure caused by the lowering of groundwater levels also results in compression of the low permeability layers. Within a limited range of groundwater level fluctuation, the compressed aquitard can accept water back into its structure when groundwater levels rise resulting in elastic rebound. However, if groundwater levels are maintained at low elevations for long enough periods of time as a result of groundwater pumping, the compression of aquitards becomes permanent. This permanent compression of subsurface layers results in land surface subsidence, which has been observed in the Tule Subbasin prior to 1970 (Ireland et al., 1984) and between 2007 and 2011 (Luhdorff and Scalmanini, 2014). The slow release of water from the permanent compaction of subsurface aquitards also results in a one-time contribution of water to the aquifer system. However, it is noted that this is not a renewable source of water to the aquifer.

The estimate of the volume of water contributed to the aquifer through compression of aquitards between 1986 and 2019 was based on groundwater flow model analysis and output using the subsidence package in MODFLOW. The total volume of water contributed to the aquifer from aquitard compression during this time period is estimated to be approximately 4,055,000 acre-ft with an annual average of approximately 123,000 acre-ft/yr.

2.3.2.1.9 Subsurface Inflow

The Tule Subbasin is not a closed basin and the aquifer is in hydrologic connection with adjacent subbasins to the north, west and south. Groundwater flow into and out of the Tule Subbasin along these boundaries varies over time in accordance with the groundwater level conditions and flow

patterns within and outside the subbasin. The only source of subsurface inflow to the Tule Subbasin along the eastern boundary is mountain-front inflow resulting from infiltration of precipitation in the secondary porosity features (joints and fractures) of the bedrock east of the basin and along the mountain front. This recharge enters the alluvial groundwater basin where the alluvium is in hydrologic connection with the fractures in the bedrock in the subsurface.

A summary of subsurface inflow values estimated for 1986/87 to 2018/19 is provided in Table 2-3 (Columns T and U). As shown, inflow into the subbasin through the upper aquifer ranges from 19,000 acre-ft in 99/2000 to 26,000 acre-ft in 2011/12 with an average over the years of interest of 23,000 acre-ft/yr. Inflow into the subbasin through the lower aquifer ranges from 32,000 acre-ft in 2018/19 to 68,000 acre-ft in 1998/99 with an average over the years of interest of 52,000 acre-ft/yr. The average net inflow into the Tule Subbasin along the south and west boundaries for the time period is approximately -7,000 acre-ft/yr after accounting for outflow (see Section 2.3.2.3.4).

2.3.2.1.10 Mountain Front Recharge

Mountain front recharge represents the infiltration of precipitation into the fractures in the bedrock east of the Tule Subbasin, which eventually flows into the alluvial aquifer system of the Tule Subbasin in the subsurface where the fractured rock aquifer system in in hydrologic communication with the alluvial aquifer system. Subsurface inflow along the eastern Tule Subbasin boundary was estimated through a parameter estimation calibration process of the groundwater flow model of the subbasin. In this calibration method, the model was given a wide range of potential recharge along the eastern Tule Subbasin. The model automatically varied aquifer parameters and mountain-front recharge through an iteration process until it arrived at an optimum fit of measured and model-generated groundwater levels. Tule Subbasin mountain-front recharge that resulted in the best model calibration was approximately 33,000 acre-ft/yr (see Column V of Table 2-3 and Column J of Table 2-4).

2.3.2.2 Sources of Groundwater Discharge §354.18 (b)(3)

> § 354.18. (b) (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.

2.3.2.2.1 Municipal Groundwater Pumping

Groundwater pumping for municipal supply is conducted by the City of Porterville and small municipalities for the local communities in the Tule Subbasin as described in Section 2.3.1.1.5. For water years 1986/87 to 2018/19, municipal groundwater production was estimated to average approximately 19,600 acre-ft/yr (see Column W of Table 2-3, Page 2).

2.3.2.2.2 Agricultural Groundwater Pumping

Agricultural groundwater production is estimated as the total applied water demand for crops minus surface deliveries. It is noted that some of this groundwater pumping is recovering stored water associated with water rights or imported water. The estimated average annual discharge to crops from wells for water years 1986/87 to 2018/19 is approximately 651,000 acre-ft/yr (see Column X of Table 2-3, Page 2).

2.3.2.2.3 Groundwater Pumping for Export Out of the Tule Subbasin

Some of the groundwater pumping that occurs on the west side of the Tule Subbasin is exported out of the subbasin for use elsewhere. Angiola Water District and the Boswell/Creighton Ranch have historically exported pumped groundwater out of the Tule Subbasin. Annual groundwater exports have ranged from 0 between 1995 and 1999 to 63,600 acre-ft in the 2012/13 water year (see Column Y of Table 2-3, Page 2) with the average for water years 1986/87 to 2018/19 of 28,000 acre-ft/yr. This water is accounted for separately because the water is not applied within the subbasin and there is no associated return flow.

2.3.2.2.4 Subsurface Outflow

Outflow estimates for the upper aquifer (Table 2-3; Column AA) range from 9,000 acre-ft in 2015/16 to 16,000 acre-ft in 1998/99, with an average of 12,000 acre-ft/yr. Outflow estimates for the lower aquifer (Table 2-3; Column AB) range from 44,000 acre-ft in 2005/06 to 124,000 acre-ft in 2015/16, with an average of 70,000 acre-ft/yr.

2.3.2.3 Changes in Groundwater Storage §354.18 (b)(4)

> § 354.18. (b) (4) The change in the annual volume of groundwater in storage between seasonal high conditions.

Comparison of the groundwater inflow elements of the water budget with the outflow elements shows a cumulative change in groundwater storage over the period between 1986/87 to 2018/19 of approximately -6,497,000 acre-ft (see Table 2-3). Of this change in storage, -4,055,000 acre-ft was from the lower aquifer and -2,442,000 acre-ft was from the upper aquifer. The average annual change in storage resulting from the groundwater budget is approximately-197,000 acre-ft/yr. It is noted that this time period was used as it matches the calibration period for the Tule Subbasin groundwater flow model used to evaluate future projects and management actions for the subbasin. However, the average hydrology over the time period is relatively dry (see Figure 2-46) and the resulting change in storage is not representative of long-term average conditions. A groundwater change in storage value representative of average hydrological conditions is provided in Section 2.3.2.4 for the period 1990/91 to 2009/10.

2.3.2.4 Overdraft §354.18 (b)(5)

> § 354.18. (b) (5) If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.

The average annual change in groundwater storage over the period from 1990/91 to 2009/10, which represents average hydrologic conditions within the Tule Subbasin, was approximately -182,750 acre-ft/yr. This value represents the average annual historical overdraft of the subbasin. The average annual groundwater pumping during this time period was approximately 725,600 acre-ft/yr.

2.3.2.5 Water Year Type §354.18 (b)(6)

> § 354.18. (b) (6) The water year type associated with the annual supply, demand, and change in groundwater stored.

All water budget elements and change in groundwater storage presented herein are based on a water year, which begins October 1 and ends September 30. Water year types with respect to hydrologic conditions (i.e. above average, average or below average precipitation conditions based on Figure 2-38) are shown in the historical water budget tables (Tables 2-2a, 2-2b, and 2-3).

2.3.2.6 Sustainable Yield §354.18 (b)(7)

> § 354.18. (b) (7) An estimate of sustainable yield for the basin.

Sustainable yield is defined in the Sustainable Groundwater Management Act (SGMA) Chapter 2, §10721 (v) 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.

The Sustainable Yield of the Tule Subbasin is a function of the overall water balance of the area. Changes in surface water/groundwater inflow to the basin and surface water/groundwater outflow from the basin impact the Sustainable Yield. As groundwater management and land use changes impact the water balance, they also impact the Sustainable Yield. A generalized expression of the water balance is as follows:

$$\text{Inflow} - \text{Outflow} = +/- \text{ Change in Storage} \quad (1)$$

The water balance equation for pre-developed conditions (prior to human occupation) can be further expressed as:

$$(I_{pr} + I_{str} + I_{ss} + I_{mb}) - (O_{ss} + O_{et}) = \Delta S \qquad (2)$$

Where:

I_{pr} = Inflow from Areal Recharge of Precipitation

I_{str} = Inflow from Infiltration of Runoff in Stream Beds

I_{ss} = Inflow from Subsurface Underflow

I_{mb} = Inflow from Mountain-Block Recharge

O_{ss} = Subsurface Outflow

O_{et} = Evapotranspiration

ΔS = Change in Groundwater Storage

Under pre-developed conditions, the groundwater basin would be in a state of equilibrium such that the inflow and outflow would balance and there would be no significant long-term change in storage assuming a static climatic condition. Under these conditions, groundwater levels would be relatively stable.

Under developed land use conditions, the water balance changes as groundwater is pumped from the basin for irrigation and municipal supply. Lowering of the groundwater table resulting from pumping reduces the amount of groundwater that would otherwise leave the basin and reduces evapotranspiration losses in areas of shallow groundwater (e.g. Tulare Lake). Some of the pumped groundwater used for irrigation infiltrates past the roots of the plants and returns to the groundwater as return flow. Water imported into the area is applied to crops but some is lost as infiltration in unlined canals and as return flow. Groundwater return flow also occurs as a result of discharges from individual septic systems. Other sources of recharge to the groundwater under developed land use include wastewater treatment plant discharges and artificial recharge in spreading basins.

The water balance equation for developed land use conditions can be modified as follows:

$$(I_{pr} + I_{str} + \mathbf{I_{can}} + \mathbf{I_{ar}} + \mathbf{I_{rfgw}} + \mathbf{I_{rfimp}} + \mathbf{I_{com}} + I_{ss} + I_{mb}) - (O_{ss} + O_{et} + \mathbf{O_p}) = \Delta S \qquad (3)$$

Where:

I_{can} = Inflow from Canal Losses

I_{ar} = Inflow from Artificial Recharge

I_{rfgw} = Inflow from Return Flow of Applied Water from Groundwater Pumping

I_{rfimp} = Inflow from Return Flow of Applied Water from Imported Water

I_{com} = Inflow of Water Released from Compression of Aquitards

O_p= Outflow from Groundwater Pumping

If the inflow terms exceed the outflow terms, then the groundwater in storage increases (become positive) and groundwater levels rise. If the outflow terms exceed the inflow, then the groundwater in storage decreases (become negative) and groundwater levels drop. It is assumed that the Sustainable Yield of the Tule Subbasin is the long-term average groundwater pumping rate, under projected land use conditions, that results in no significant long-term net negative change in groundwater storage in the basin and avoids undesirable results. Based on this premise, the water balance equation can be rearranged and simplified to estimate Sustainable Yield:

$$\text{Sustainable Yield} = \Delta S + O_p \qquad (4)$$

Thus, if the change in groundwater storage over the planning period is zero and there is no release of water from compression of aquitards, then the Sustainable Yield is equal to the pumping. Any release of water from compression of aquitards is not indicative of a sustainable groundwater condition as this is a one-time contribution of water to the aquifer system from confining layers. This relationship is valid if the following conditions are met:

1. The Sustainable Yield incorporates a hydrology that is representative of a relatively long period of record that includes multiple wet and dry hydrologic cycles.
2. The land use conditions are representative of the time period.

Applying Equation 4 to the historical water budget of the Tule Subbasin does not result in a representative Sustainable Yield because the subbasin was in overdraft during the historical water budget period. Groundwater pumping depressions that have developed in the western portion of the subbasin have historically captured groundwater that would have otherwise left the subbasin. This increase in groundwater inflow and subsequent decrease in groundwater outflow increased the apparent Sustainable Yield, which was approximately 502,000 acre-ft/yr based on the water budget shown in Table 2-3 for water year 1986/87 to 2018/19. However, since the downward groundwater trends that resulted in this condition are not sustainable, the associated Sustainable Yield from this water budget is not representative.

The Sustainable Yield of the Tule Subbasin will change in the future as a result of changes in groundwater levels and flow associated with planned projects and management actions and changes in deep percolation of applied water (i.e. return flow) from reduced groundwater pumping. Most of the GSAs in the subbasin plan management actions that include a reduction in irrigated acreage to address the need to reduce groundwater production. This new land use condition will change the water budget by not only decreasing outflow from groundwater pumping but also

reducing deep percolation of applied water (return flow) and changing the dynamics of inflow and outflow at the subbasin boundaries. The resulting Sustainable Yield is different from what was realized historically. Thus, the Sustainable Yield of the Tule Subbasin presented herein was estimated based on the forecasted future water budget (see Section 2.3.5), which is more representative than the Sustainable Yield from the historical water budget.

The forecasted water budget that was the basis for the Sustainable Yield estimate was developed using a calibrated groundwater flow model of the Tule Subbasin (TH&Co, 2021a). The forecasted water budgets incorporated all planned projects and management actions of the Tule Subbasin GSAs as well as adjustments to hydrology and water deliveries from climate change guidelines provided by the CDWR (see Section 2.3.5). The projected future Sustainable Yield of the Tule Subbasin is approximately 408,000 acre-ft/yr, which is the average annual groundwater pumping during the 2040 to 2070 forecast when the change in groundwater storage is near zero (see Table 2-4).

2.3.3. Current Water Budget §354.18 (c)(1)

> § 354.18. (c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:
>
> (1) Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.

The surface water and groundwater budget for the Tule Subbasin in 2019 is shown in Tables 2-2a, 2-2b, and 2-3. Total groundwater inflow to the subbasin for water year 2018/19 was approximately 903,000 acre-ft. Total groundwater outflow from the subbasin for water year 2018/19 was approximately 521,000 acre-ft. The net change in storage during the water year was approximately 382,000 acre-ft.

2.3.4. Historical Water Budget §354.18 (c)(2)

> § 354.18. (c) (2) Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:
>
> (A) A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.
>
> (B) A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.
>
> (C) A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.

The historical surface water and groundwater budgets for the Tule Subbasin are shown in Tables 2-2a, 2-2b, and 2-3 and described in Sections 2.3.1 and 2.3.2. Historical surface water and groundwater budgets for each of the seven GSAs in the subbasin are provided in:

- Appendix A - LTRID GSA.
- Appendix B – ETGSA
- Appendix C – DEID GSA
- Appendix D – Pixley GSA
- Appendix E – Tri-County Water Authority GSA
- Appendix F – Alpaugh GSA
- Appendix G – Kern-Tulare Water District GSA

Sources of surface water supply to agriculture in the Tule Subbasin include diverted stream flow from the Tule River and Deer Creek and imported supplies delivered via the Friant-Kern Canal, State Water Project, and other diverted streamflow from streams located outside the subbasin (i.e. King's River). A comparison of water rights and annual water deliveries for the 10-yr period from 2007/08 to 2016/17 is provided for the Tule River and Friant-Kern Canal in Table 2-5. As shown, total Tule River water diversions during the 10-yr period are approximately 90 percent of the sum of diversion rights over that period. The primary reason for this is that the 10-yr period from 2007/08 to 2016/17 was relatively dry with precipitation approximately 69 percent of long-term average (see Figure 2-38). Friant-Kern Canal deliveries to agencies with contracts within the Tule Subbasin have also been below the sum of Class I and Class II contract amounts for most of the 10-yr period. However, many contractors sell a portion of their available supply from the canal to

other agencies. Likewise, some contractors (e.g. Kern-Tulare Water District) purchase additional supplies from the canal from other contractors. Thus, while precipitation trends do effect the volume of water available to Friant-Kern Canal contractors (the precipitation amounts during the 10-yr period from 2007/08 to 2016/17 are below average), it is difficult to compare planned versus actual deliveries based on these data.

The primary surface water supply issue affecting the ability of agencies to operate within the Sustainable Yield of the subbasin is reduced delivery capacity in the Friant-Kern Canal due to land subsidence. Land subsidence has lowered the canal elevation in certain areas resulting in a reduction in downstream canal delivery capacity. Reduced deliveries due to land subsidence can result in greater groundwater pumping to meet agricultural water demand. While the reduced supply capacity of the Friant-Kern Canal is not the primary reason for the overdraft observed in the Tule Subbasin from 1986/87 to 2018/19, it is a contributing factor.

2.3.5. Forecasted Water Budget §354.18 (c)(3)

A forecasted water budget for the Tule Subbasin has been developed to incorporate the planned projects and management actions of each of the six GSAs for achieving sustainability (see Tables 2-6 and 2-7). The projects and management actions were incorporated into the groundwater flow model of the Tule Subbasin for the projected time period from 2020 to 2070 in order to assess the sustainability of the planned actions, assess the interaction of the planned actions on groundwater levels between the GSAs, and estimate the Sustainable Yield of the subbasin. The model projection also incorporated adjustments to the hydrology and water deliveries to account for potential climate change. The projected surface water and groundwater budgets are shown in Tables 2-4, 2-8a, and 2-8b. Projected water budgets for each of the six GSAs are provided in Appendices A through F.

Baseline Tule River flows, Friant-Kern Canal deliveries, and the State Water Project's California Aqueduct deliveries used in the future projection for the model were adjusted to account for projections of future climate change. Adjustments were applied based on output from the DWR's CalSim-II model, which provided adjusted historical hydrology for major drainages and imported supplies based on scenarios recommended by the DWR Climate Change Technical Advisory Group.[2] Climate change adjustments to hydrology and surface water deliveries were applied over two time periods within the SGMA planning horizon, as defined by California Water Commission (2016)[3]:

[2] DWR Climate Change Technical Advisory Group, 2015. Perspectives and Guidance for Climate Change Analysis. DWR Technical Information Record.

[3] California Water Commission, 2016. Technical Reference – Water Storage Investment Program. Dated November 2016.

1. A 2030 central tendency time period, which provides near-term projections of potential climate change impacts on hydrology, centered on the year 2030, and
2. A 2070 central tendency time period, which provides long-term projections of potential climate change impacts on hydrology, centered on the year 2070.

For imported water supplies from the Friant-Kern Canal, TH&Co utilized projected delivery schedules from the Friant Water Authority (Friant Water Authority, 2018). The projected water deliveries include adjustments to supplies associated with the planned San Joaquin River Restoration Project (SJRRP). Adjustments to Friant-Kern Canal supplies to account for climate change and SJRRP were applied beginning in 2025. The adjustments were applied incrementally between 2025 and 2030 such that the full adjustments were in effect in 2030. TH&Co applied the 2070 central tendency time period climate-related adjustments to imported water deliveries in the Tule Subbasin model projection for the period from 2050 to 2070.

2.4 Management Areas §354.20

> § 354.20. Management Areas
>
> (a) Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.

Of the seven GSAs within the Tule Subbasin, five have identified separate management areas within their boundaries (see Figure 2-50). The management areas are as follows:

LTRID GSA

Agricultural Management Area
Municipal Management Area
Tulare County MOU Management Area

ETGSA

Friant-Kern Canal Land Subsidence Management Area
Porterville Community Management Area
Terra Bella Community Management Area
Ducor Community Management Area
Kern-Tulare Management Area
Greater Eastern Tule Management Area

DEID GSA

Richgrove Community Services District Management Area
Earlimart Public Utilities District Management Area

Pixley GSA

Pixley Irrigation District Management Area
Pixley Public Utilities District Management Area
Teviston Management Area

Tri-County Water Authority GSA

North Management Area
Southeast Management Area

2.4.1 Criteria for Management Areas §354.20 (b)(1)

> § 354.20. (b) A basin that includes one or more management areas shall describe the following in the Plan:
>
> (1) The reason for the creation of each management area.

Community Management Areas

The majority of the management areas in the Tule Subbasin are associated with communities that provide municipal water supply. These communities have been delineated separately because the beneficial use of the groundwater produced within the management areas (municipal supply) is different than the beneficial use of groundwater across the majority of the subbasin (agriculture). Other management areas were identified for portions of the subbasin with unique hydrogeology and areas where access to imported water is different than other portions of the GSA in which they are located.

Management Areas categorized under the Community Management Area Type have been created to specifically address the needs of the Tule Subbasin's population centers and communities. Future projects and management actions focused in these areas will seek to achieve the Tule Subbasin sustainability goal and improve access to safe, reliable drinking water supplies. The boundaries for each Community Management Area consider existing County and/or City adopted Urban Development Boundaries, as well as the service area boundaries of the public water suppliers providing services to residents within these areas.

Lower Tule River Irrigation District GSA Management Area

In addition to community management areas, LTRID GSA has delineated a management area, the Tulare County MOU Management Area, associated with lands outside and to the southwest of the

LTRID service area that were annexed to the LTRID GSA (see Figure 2-50). This management area was formed because it does not have the same access to surface water deliveries as the LTRID service area and, therefore, will require separate management actions than the rest of the GSA.

Tri-County Water Authority GSA Management Areas

TCWA GSA has delineated two separate management areas, the North and Southeast Management Areas. The North Management Area receives surface water and groundwater on the lands located within the Angiola Water District. It is noted that some areas within the North Management Area are outside the Angiola Water District but are included in the management area due to their proximity to Angiola Water District. The Southeast Management area is an undistracted area dependent on groundwater.

Eastern Tule GSA Land Subsidence Management Area

A separate ETGSA Land Subsidence Management Area has been identified on either side of the Friant-Kern Canal (see Figure 2-51; TH&Co, 2021b) in the ETGSA. This Management Area extends two miles on either side of the Friant-Kern Canal (FKC) from the Tule River to the southern boundary of the ETGSA. Preliminary analysis using a groundwater flow model showed that reducing groundwater pumping in this area had the greatest impact on groundwater levels in the immediate vicinity of the canal and were most effective at mitigating future land subsidence in this area.

Management actions within the Land Subsidence Management Area are separate from, and different than, management actions published in the ETGSA GSP for the greater ETGSA. The FWA is currently repairing the FKC to restore the original flow capacity. Recognizing the regional importance and value of the FKC, the ETGSA developed a Land Subsidence Monitoring Plan[4] and Management Plan[5] for the areas on either side of the canal. The goal of the Land Subsidence Monitoring and Management Plans is to implement groundwater management measures necessary to minimize future non-recoverable land subsidence along the FKC in the SGMA transition period from 2020 – 2040 and to stop nonrecoverable land subsidence along the FKC after 2040.

The ETGSA Land Subsidence Monitoring Plan includes:

- An enhanced benchmark and groundwater level monitoring network,
- Establishment of a Land Subsidence Monitoring and Management Committee, and
- Annual Reporting

[4] TH&Co, 2021. Eastern Tule Groundwater Sustainability Agency Land Subsidence Monitoring Plan. Dated September 2021.
[5] ETGSA, 2022. Eastern Tule Groundwater Sustainability Agency Land Subsidence Management Plan. Dated February 2022.

The Land Subsidence Management Plan establishes management action criteria for implementing enhanced management actions should land subsidence in any given Management Area reach certain thresholds. Four land subsidence thresholds, or "Tiers" have been established:

- Tier 1 – 0 to 1.49 ft of land subsidence
- Tier 2 – 1.5 to 1.99 ft of land subsidence
- Tier 3 – 2.0 to 2.49 ft of land subsidence
- Tier 4 – 2.5 to 2.99 ft of land subsidence.

Progressively aggressive management actions have been identified for each tier. Land subsidence in any given Management Area that exceeds the criteria, as measured semi-annually using InSAR data, triggers the management actions in the next higher tier.

2.4.2 Minimum Thresholds and Measurable Objectives §354.20 (b)(2)

> § 354.20. (b) (2) The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.

Minimum thresholds and measurable objectives for each groundwater level and land subsidence representative monitoring site in each GSA are shown on the hydrographs and in the tables provided in Appendices A through F. The rational and methodologies for determining the minimum thresholds and measurable objectives for the individual management areas are consistent with those used for the other areas of the GSAs. The methodologies for determining minimum thresholds and measurable objectives are presented in the Tule Subbasin Coordination Agreement (see Attachments 4, 5, 6, and 7 of that document).

2.4.3 Monitoring Plan §354.20 (b)(3)

> § 354.20. (b) (3) The level of monitoring and analysis appropriate for each management area.

The Tule Subbasin Technical Advisory Committee has developed a subbasin-wide monitoring plan, which describes the monitoring network and monitoring methodologies to be used to collect the data to be included in Tule Subbasin GSPs and annual reports. The subbasin-wide monitoring plan is included as Attachment 1 to the Coordination Agreement. Separate monitoring networks have been established for groundwater levels (see Figure 2-52), groundwater quality (see Figure 2-53), land subsidence (see Figure 2-54) and interconnected surface water. For each monitoring network, the monitoring plan describes the monitoring features included in the plan, the monitoring procedure to be followed to collect the data, and the monitoring frequency. The monitoring plan also includes an assessment of data gaps and a data management plan.

A subset of groundwater level monitoring features in the monitoring plan have been identified as representative monitoring sites to be relied on for the purpose of assessing progress with respect to groundwater level sustainability in the subbasin. The representative groundwater level monitoring sites are shown on Figure 2-52. At least one representative groundwater level monitoring site has been identified within each management area. Where possible based on available wells, representative monitoring sites have been chosen with perforations exclusively in either the Upper or Lower Aquifer. To provide adequate spatial coverage of the subbasin, some representative monitoring sites include perforations across multiple aquifers until new monitoring features can be constructed. Representative groundwater level monitoring wells will be equipped with pressure transducers to measure groundwater levels on a daily basis.

A land surface elevation and subsidence monitoring network has also been established and is shown on Figure 2-53. The monitoring network consists of 94 benchmarks installed in 2020 and 2021. Each benchmark is a representative monitoring site for land subsidence. The elevations of the benchmarks are surveyed annually.

2.4.4 Coordination with Adjacent Areas §354.20 (b)(4)

> § 354.20. (b) (4) An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.

The minimum thresholds and measurable objectives for the Tule Subbasin, including the management areas, have been determined through a coordinated process among the GSAs to avoid significant and unreasonable impacts to beneficial uses and users and prevent undesirable results. Management of the Tule Subbasin is adaptive. As management actions and projects are implemented throughout the subbasin and as additional data are collected through the Tule Subbasin Monitoring Plan, minimum threshold values and measurable objectives may be adjusted. Changes to basin management to address undesirable results will be conducted through the Tule Subbasin TAC in accordance with the Tule Subbasin Coordination Agreement.

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Tables

Summary of Active Cleanup Sites Within the Tule Subbasin

Geotracker Global ID	Site Type	Status	Constituent of Concern
T10000013751	Cleanup Program Site	Open - Assessment & Interim Remedial Action	PCE, TCE, Vinyl Chloride
T0610700023	Cleanup Program Site	Open - Assessment & Interim Remedial Action	Gasoline, Benzene
SL375384617	Cleanup Program Site	Open - Remediation	Gasoline, Diesel, other Petroleum
SLT5FU104564	Cleanup Program Site	Open - Site Assessment	Pesticides/Herbicides
T0610740454	LUST Cleanup Site	Open - Assessment & Interim Remedial Action	Gasoline
T10000018540	LUST Cleanup Site	Open - Site Assessment	Diesel, Ethylbenzene, Naphthalene
T0610793749	LUST Cleanup Site	Open - Site Assessment	Gasoline
T0610700064	LUST Cleanup Site	Open - Site Assessment	Gasoline
T0610700099	LUST Cleanup Site	Open - Remediation	Gasoline

Notes:

LUST = Leaky underground storage tank
PCE = Perchloroethylene
TCE = Trichloroethylene
Source = https://geotracker.waterboards.ca.gov

Table 2-2a
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Tule Subbasin Historical Surface Water Budget - Inflow

	Surface Water Inflow (acre-ft)																			
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
		Stream Inflow			Imported Water														Discharge from Wells		
Water Year	Precipitation	Tule River	Deer Creek	White River	Saucelito ID	Terra Bella ID	Porterville ID	Tea Pot Dome WD	City of Porterville	Hope WD	Ducor ID	LTRID	Pixley ID	Delano-Earlimart ID	Angiola WD	Alpaugh ID	Kern-Tulare WD	Recyled Water	Agriculture Pumping	Municipal Pumping	Total In
1986/87	371,000	70,029	8,386	2,496	23,879	13,136	15,337	5,490	0	0	0	89,541	9,356	114,782	7,278	1,901	10,900	2,200	595,000	13,600	1,354,000
1987/88	317,000	39,842	6,090	1,420	19,666	21,961	13,067	5,493	0	0	0	64,654	0	110,345	3,530	0	12,210	2,200	671,000	15,200	1,304,000
1988/89	263,000	49,667	7,791	1,942	22,426	22,561	13,106	6,226	0	0	0	63,922	5,289	105,980	6,026	0	11,990	3,300	688,000	15,800	1,287,000
1989/90	309,000	29,342	4,706	778	16,166	23,159	11,520	6,193	0	0	0	24,325	0	83,837	3,847	0	11,370	3,700	716,000	16,400	1,260,000
1990/91	411,000	51,275	7,250	1,362	19,848	18,725	11,322	5,636	0	0	0	71,430	0	106,877	925	0	9,760	3,800	500,000	16,800	1,236,000
1991/92	318,000	34,325	4,082	739	21,566	20,743	15,569	6,607	0	0	0	51,949	0	92,567	1,611	0	11,700	4,000	747,000	17,100	1,348,000
1992/93	473,000	115,640	15,132	3,623	41,261	18,180	12,310	6,968	0	0	0	321,973	96,890	133,359	3,420	18,642	13,110	4,800	550,000	17,300	1,846,000
1993/94	318,000	61,313	6,821	1,148	22,064	18,740	12,895	6,526	0	0	0	71,784	7,793	92,394	3,640	5,604	14,210	5,300	858,000	17,700	1,524,000
1994/95	609,000	218,479	32,235	10,596	37,477	16,186	9,455	6,562	0	0	0	229,683	55,365	124,388	8,918	13,658	13,890	5,200	606,000	17,700	2,015,000
1995/96	309,000	174,473	23,264	5,957	48,924	21,617	13,808	7,993	0	0	0	236,845	60,931	144,069	12,551	16,397	14,630	4,900	810,000	17,900	1,923,000
1996/97	437,000	353,968	58,823	12,920	40,908	20,158	13,379	7,298	0	0	0	192,934	37,048	153,967	12,383	0	16,370	5,400	687,000	18,800	2,068,000
1997/98	761,000	439,125	88,359	36,764	28,221	13,165	10,159	4,913	0	0	0	101,180	41,823	119,815	7,460	0	13,430	5,100	541,000	18,000	2,230,000
1998/99	339,000	108,466	18,410	7,469	37,062	17,567	16,107	9,218	0	0	0	183,971	34,736	124,051	9,778	0	15,490	3,300	734,000	18,100	1,677,000
1999/00	341,000	102,354	15,230	4,878	39,734	19,200	15,545	7,191	0	0	0	177,192	40,076	134,272	8,118	253	17,500	4,800	704,000	19,000	1,650,000
2000/01	311,000	55,249	7,015	4,695	25,252	19,194	15,436	6,456	0	0	0	83,405	9,098	117,746	3,824	0	18,780	5,100	753,000	19,200	1,454,000
2001/02	263,000	73,206	10,369	6,176	26,131	20,234	13,628	6,388	0	0	0	78,511	13,588	126,747	2,932	0	16,380	5,000	851,000	21,000	1,534,000
2002/03	317,000	125,004	15,690	5,875	33,692	18,356	14,646	5,844	0	0	0	131,470	32,195	121,277	4,728	104	15,680	6,300	666,000	20,700	1,535,000
2003/04	257,000	51,738	6,883	2,350	26,988	20,352	14,698	6,913	0	0	0	71,472	9,839	127,364	3,434	0	16,580	6,200	935,000	21,800	1,579,000
2004/05	514,000	172,558	22,743	6,502	42,840	15,266	14,748	5,217	0	0	0	247,595	59,211	119,847	11,741	14,490	13,920	5,300	525,000	20,700	1,812,000
2005/06	477,000	195,667	23,876	7,588	45,106	21,763	13,251	6,436	0	0	0	194,019	60,634	121,005	10,909	16,112	15,140	5,200	396,000	21,700	1,631,000
2006/07	188,000	38,587	6,908	1,815	16,280	20,797	9,775	5,489	0	0	0	33,174	7,200	79,111	6,641	0	15,740	5,000	954,000	22,800	1,411,000
2007/08	254,000	74,030	8,395	2,355	24,083	18,192	12,988	6,894	0	0	0	71,872	12,243	106,470	2,165	0	18,070	4,800	805,000	23,100	1,445,000
2008/09	215,000	54,737	6,618	1,751	31,282	19,701	18,000	6,165	0	0	0	113,189	23,620	111,556	191	2,131	16,040	5,300	626,000	22,600	1,274,000
2009/10	393,000	144,778	16,480	5,080	42,855	17,574	14,335	5,845	0	0	0	200,064	32,972	118,671	3,243	2,671	14,410	5,000	405,000	21,900	1,444,000
2010/11	598,000	266,473	44,873	14,997	46,733	16,381	9,387	6,105	0	0	0	229,763	48,391	127,447	6,476	10,951	13,970	5,600	295,000	21,900	1,762,000
2011/12	422,000	87,532	11,311	3,334	19,189	19,757	9,318	4,680	0	0	0	67,684	5,914	114,108	3,156	943	15,070	5,600	453,000	22,600	1,265,000
2012/13	165,000	30,284	4,777	1,145	14,102	20,628	10,298	4,354	0	0	0	37,073	5,012	87,302	1,492	0	15,710	4,800	746,000	22,800	1,171,000
2013/14	147,000	13,171	2,957	535	5,724	12,390	178	1,030	0	0	0	0	0	38,106	1,048	0	10,590	5,500	869,000	22,000	1,129,000
2014/15	239,000	8,820	1,994	253	1,503	12,012	114	260	0	0	0	0	0	18,591	575	0	5,610	5,100	770,000	19,800	1,084,000
2015/16	371,000	74,330	14,559	4,547	20,049	14,357	13,271	4,627	0	0	0	73,382	3,442	93,806	587	0	11,520	5,200	514,000	19,800	1,238,000
2016/17	499,000	356,920	64,976	22,113	51,137	16,089	21,651	6,694	0	0	0	273,151	82,363	137,773	12,146	2,368	13,220	5,400	499,000	20,200	2,084,000
2017/18	218,000	66,673	9,047	2,545	28,219	17,800	12,706	6,858	0	0	0	121,447	19,070	124,484	625	0	14,010	6,300	620,000	21,100	1,289,000
2018/19	495,000	223,636	32,582	10,667	55,019	15,825	60,853	6,524	0	0	0	216,118	70,457	133,860	4,289	3,100	12,970	5,700	385,000	20,800	1,752,000
86/87-18/19 Avg	361,000	120,100	18,400	6,000	29,600	18,200	14,000	5,900	0	0	0	125,000	26,800	111,100	5,100	3,300	13,900	4,900	651,000	19,600	1,534,000

Table 2-2b
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Tule Subbasin Historical Surface Water Budget - Outflow

	Surface Water Outflow (acre-ft)																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
		Streambed Infiltration					Canal Loss			Recharge in Basins				Deep Percolation of Applied Water					
Water Year	Areal Recharge of Precipitation	Tule River		Native Deer Creek		White River	Tule River	Deer Creek	Imported Water	Tule River	Deer Creek	Imported Water	Recycled Water	Tule River	Deer Creek	Imported Water	Recycled Water	Agricultural Pumping	Municipal Pumping
		Success to Oettle Bridge	Oettle Bridge to Turnbull Weir	Before Trenton Weir	Trenton Weir to Homeland Canal														
1986/87	24,000	11,600	1,100	7,300	0	2,400	20,700	0	52,400	26,100	800	0	100	13,000	0	81,300	1,100	148,600	5,305
1987/88	12,000	8,000	900	5,300	0	1,300	8,800	0	32,700	13,800	500	0	100	10,500	0	70,000	1,000	170,400	5,605
1988/89	4,000	8,700	0	7,500	0	1,800	7,400	0	20,500	13,600	0	0	800	7,100	0	64,400	1,300	170,800	5,705
1989/90	12,000	5,000	0	4,400	0	700	2,900	0	7,400	6,600	0	0	1,200	4,200	0	50,800	1,300	180,700	5,705
1990/91	34,000	6,400	300	6,900	0	1,300	6,800	0	24,300	12,000	0	0	1,500	8,100	0	88,700	1,600	128,900	5,905
1991/92	3,000	4,300	0	2,700	0	700	3,100	0	16,100	6,800	1,100	0	800	4,400	0	49,800	1,900	186,700	6,005
1992/93	57,000	18,500	3,000	10,800	0	3,500	27,800	0	184,400	36,000	4,000	5,600	1,300	25,200	0	192,000	2,300	129,700	6,005
1993/94	0	6,100	200	3,900	0	1,100	14,200	0	35,600	19,200	2,600	700	1,400	10,200	0	53,800	2,100	207,500	6,105
1994/95	143,000	36,400	10,400	18,100	1,000	10,500	39,500	3,800	128,500	47,300	5,200	10,400	1,700	54,900	2,000	137,200	2,100	141,400	6,205
1995/96	1,000	20,700	4,000	11,300	700	5,900	26,200	2,800	87,700	34,000	3,300	39,600	2,100	47,100	3,700	138,400	1,500	192,200	6,205
1996/97	33,000	34,600	9,700	43,800	1,800	12,800	47,300	6,900	64,100	52,700	3,300	14,200	2,400	49,800	2,500	154,500	1,800	163,100	6,405
1997/98	241,000	41,100	9,000	12,900	12,700	36,600	79,100	48,800	54,100	83,200	2,900	16,100	3,500	69,400	7,000	112,300	700	125,100	6,405
1998/99	4,000	14,300	2,800	9,000	600	7,300	19,500	2,500	58,100	25,700	4,600	19,700	1,900	21,100	1,000	132,200	600	175,200	6,405
1999/00	8,000	16,900	2,900	9,400	600	4,700	11,100	2,400	64,300	16,600	1,200	13,100	3,500	20,300	1,200	135,600	600	168,800	6,505
2000/01	5,000	12,300	0	5,100	0	4,600	7,000	0	28,500	11,800	1,600	2,700	3,700	8,600	0	85,000	700	186,000	6,605
2001/02	0	14,800	700	7,700	0	6,100	13,400	0	24,800	19,200	2,400	0	3,600	12,700	0	72,800	700	210,200	7,015
2002/03	3,000	19,700	3,700	12,600	100	5,700	22,800	400	53,600	29,100	1,300	5,000	3,300	13,100	200	84,900	1,800	142,300	6,915
2003/04	0	9,900	300	4,900	0	2,300	7,700	0	19,600	11,600	1,700	0	1,900	6,400	0	61,600	2,500	197,100	7,125
2004/05	82,000	24,200	4,700	13,800	400	6,400	22,900	1,500	91,100	30,100	3,500	32,000	1,000	28,100	1,600	153,200	3,100	106,500	7,125
2005/06	60,000	28,100	7,200	13,400	900	7,500	40,500	3,400	77,900	47,300	4,100	26,700	800	50,900	1,100	169,900	3,500	84,100	7,335
2006/07	0	6,200	1,500	6,500	0	1,700	5,100	0	15,500	10,100	100	100	1,100	4,600	0	39,400	2,400	199,600	7,535
2007/08	0	11,700	1,100	7,600	0	2,300	15,900	0	22,000	22,500	500	1,600	1,500	13,500	0	56,600	1,800	171,100	7,645
2008/09	1,000	9,500	1,400	3,100	0	1,600	7,100	0	43,800	12,900	7,000	8,100	1,600	8,000	0	66,800	2,100	134,600	7,645
2009/10	17,000	25,600	4,500	13,100	0	5,000	34,600	0	72,600	51,600	3,200	29,900	1,700	33,800	0	128,900	2,200	86,700	7,655
2010/11	142,000	37,100	7,500	24,200	1,300	14,800	82,400	5,000	89,500	93,000	9,700	45,600	1,900	68,300	6,200	172,800	2,800	63,700	7,555
2011/12	30,000	13,600	300	6,700	0	3,200	17,800	0	23,000	24,800	4,500	7,100	1,300	14,900	100	97,900	3,100	99,700	7,765
2012/13	3,000	4,900	0	3,100	0	1,000	4,400	0	13,100	9,800	1,300	100	1,100	4,000	100	35,800	1,800	159,400	7,765
2013/14	5,000	2,300	0	2,500	0	400	0	0	0	4,100	0	0	1,800	2,000	200	16,000	1,800	180,300	7,875
2014/15	3,000	1,000	0	1,600	0	200	0	0	0	4,600	0	0	1,800	1,400	200	9,900	1,500	161,300	7,675
2015/16	16,000	16,000	5,500	14,000	0	4,400	11,400	0	28,600	18,300	100	3,700	2,000	9,200	200	65,000	2,000	110,900	7,685
2016/17	73,000	42,100	15,900	50,600	800	22,000	82,600	3,100	133,700	98,300	3,700	75,500	2,100	65,300	6,000	158,200	2,000	101,400	7,785
2017/18	9,000	9,600	0	8,400	0	2,400	13,000	0	62,000	22,300	0	15,500	1,800	7,200	300	89,000	2,600	128,600	7,895
2018/19	75,000	30,200	500	28,500	200	10,500	65,400	900	112,900	81,500	600	106,300	2,300	36,400	1,800	173,500	2,100	79,100	7,895
86/87-18/19 Avg	33,000	16,700	3,000	11,500	600	5,800	23,300	2,500	52,800	30,200	2,300	14,500	1,800	22,200	1,100	96,900	1,800	148,200	6,900

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Tule Subbasin Historical Surface Water Budget - Outflow

	Surface Water Outflow (acre-ft)												
	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	
	Evapotranspiration										Surface Outflow		
Water Year	Precipitation Crops/Native	Tule River		Deer Creek		White River	Imported Water	Ag. Cons. Use from Pumping	Recycled Water	Municipal (Landscape ET)	Tule River	Deer Creek	Total Out
		Agricultural Cons. Use	Stream Channel	Agricultural Cons. Use	Stream Channel	Stream Channel	Agricultural Cons. Use		Agricultural Cons. Use				
1986/87	346,000	18,200	400	0	300	100	155,400	449,000	1,000	4,715	0	0	1,371,000
1987/88	306,000	7,000	300	0	300	100	146,500	506,000	1,000	5,315	0	0	1,313,000
1988/89	259,000	14,700	300	0	300	100	170,900	522,000	1,200	5,615	0	0	1,288,000
1989/90	298,000	5,200	400	0	300	100	120,200	545,000	1,200	5,715	0	0	1,259,000
1990/91	376,000	12,800	300	0	300	100	129,800	378,000	700	6,015	0	0	1,231,000
1991/92	315,000	7,900	400	0	300	100	154,700	569,000	1,300	6,015	0	0	1,342,000
1992/93	417,000	24,600	400	0	400	100	277,600	422,000	1,200	6,115	0	0	1,857,000
1993/94	318,000	17,700	300	0	300	100	162,400	654,000	1,800	6,215	0	0	1,526,000
1994/95	466,000	49,600	400	2,000	400	100	234,000	465,000	1,300	6,315	25,000	0	2,050,000
1995/96	309,000	45,400	400	1,100	400	100	306,500	618,000	1,400	6,415	7,000	0	1,924,000
1996/97	403,000	36,800	400	200	400	100	260,000	523,000	1,400	6,715	121,000	0	2,058,000
1997/98	521,000	68,300	400	5,300	400	200	155,900	416,000	900	6,415	95,000	0	2,232,000
1998/99	334,000	29,100	400	300	400	200	236,200	558,000	700	6,415	0	0	1,672,000
1999/00	334,000	32,200	400	100	400	100	243,600	536,000	600	6,715	5,000	0	1,647,000
2000/01	306,000	19,300	300	0	300	100	181,500	570,000	600	6,815	0	0	1,454,000
2001/02	263,000	17,200	400	0	300	100	205,100	648,000	700	7,415	0	0	1,538,000
2002/03	315,000	34,300	400	700	400	100	232,700	529,000	1,100	7,315	5,000	0	1,536,000
2003/04	257,000	16,200	400	0	300	100	214,600	744,000	1,800	7,725	1,000	0	1,578,000
2004/05	431,000	29,700	400	1,500	400	100	256,200	420,000	1,100	7,325	22,000	0	1,783,000
2005/06	417,000	35,800	400	600	400	100	227,100	312,000	800	7,725	11,000	0	1,648,000
2006/07	188,000	12,800	300	0	300	100	137,400	762,000	1,500	8,025	0	0	1,412,000
2007/08	254,000	17,200	300	0	300	100	190,700	642,000	1,500	8,135	1,000	0	1,453,000
2008/09	214,000	20,300	400	0	300	100	222,000	502,000	1,400	7,935	0	0	1,285,000
2009/10	377,000	29,500	400	0	400	100	222,600	324,000	1,100	7,635	0	0	1,481,000
2010/11	456,000	26,100	400	100	400	200	205,800	233,000	1,000	7,735	8,000	0	1,814,000
2011/12	393,000	29,400	400	100	300	100	130,000	362,000	1,300	7,945	0	0	1,280,000
2012/13	162,000	8,500	400	100	300	100	145,100	596,000	1,800	8,045	0	0	1,173,000
2013/14	143,000	400	300	200	300	100	51,100	695,000	2,000	7,745	0	0	1,124,000
2014/15	236,000	1,000	300	100	200	100	27,600	615,000	1,800	7,055	0	0	1,083,000
2015/16	355,000	14,800	300	200	300	100	136,900	410,000	1,100	6,955	0	0	1,241,000
2016/17	427,000	32,600	400	500	400	200	259,200	396,000	1,200	7,155	71,000	0	2,140,000
2017/18	208,000	13,500	400	100	300	100	178,500	490,000	1,800	7,455	1,000	0	1,281,000
2018/19	421,000	35,500	400	100	400	200	195,500	304,000	1,300	7,365	12,000	0	1,793,000
86/87-18/19 Avg	328,000	23,100	400	400	300	100	187,100	506,500	1,200	6,900	12,000	0	1,541,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Tule Subbasin Historical Groundwater Budget

	Groundwater Inflows (acre-ft)																						
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	
Water Year	Areal Recharge from Precipitation	Tule River Infiltration					Deer Creek Infiltration					White River Infiltration	Imported Water Deliveries			Agricultural Pumping Return Flow	Municipal Pumping			Sub-surface Inflow		Mountain-Block Recharge	Total In
		Success to Oettle Bridge Infiltration	Oettle Bridge to Turnbull Weir Infiltration	Canal Loss	Recharge in Basins	Return Flow	Before Trenton Weir Infiltration	Trenton Weir to Homeland Canal Infiltration	Canal Loss	Recharge in Basins	Return Flow		Canal Loss	Recharge in Basins	Return Flow		Return Flow	Recycled Water					
																		Agricultural Return Flow	Artificial Recharge	Upper Aquifer	Lower Aquifer		
1986/87	24,000	11,600	1,100	20,700	26,100	13,000	7,300	0	0	800	0	2,400	52,400	0	81,300	148,600	5,305	1,100	100	20,000	52,000	32,000	500,000
1987/88	12,000	8,000	900	8,800	13,800	10,500	5,300	0	0	500	0	1,300	32,700	0	70,000	170,400	5,605	1,000	100	23,000	57,000	33,000	454,000
1988/89	4,000	8,700	0	7,400	13,600	7,100	7,500	0	0	0	0	1,800	20,500	0	64,400	170,800	5,705	1,300	800	26,000	57,000	34,000	431,000
1989/90	12,000	5,000	0	2,900	6,600	4,200	4,400	0	0	0	0	700	7,400	0	50,800	180,700	5,705	1,300	1,200	25,000	53,000	33,000	394,000
1990/91	34,000	6,400	300	6,800	12,000	8,100	6,900	0	0	0	0	1,300	24,300	0	88,700	128,900	5,905	1,600	1,500	25,000	51,000	33,000	436,000
1991/92	3,000	4,300	0	3,100	6,800	4,400	2,700	0	0	1,100	0	700	16,100	0	49,800	186,700	6,005	1,900	800	25,000	59,000	33,000	404,000
1992/93	57,000	18,500	3,000	27,800	36,000	25,200	10,800	0	0	4,000	0	3,500	184,400	5,600	192,000	129,700	6,005	2,300	1,300	24,000	53,000	33,000	817,000
1993/94	0	6,100	200	14,200	19,200	10,200	3,900	0	0	2,600	0	1,100	35,600	700	53,800	207,500	6,105	2,100	1,400	22,000	56,000	34,000	477,000
1994/95	143,000	36,400	10,400	39,500	47,300	54,900	18,100	1,000	3,800	5,200	2,000	10,500	128,500	10,400	137,200	141,400	6,205	2,100	1,700	22,000	52,000	33,000	907,000
1995/96	1,000	20,700	4,000	26,200	34,000	47,100	11,300	700	2,800	3,300	3,700	5,900	87,700	39,600	138,400	192,200	6,205	1,500	2,100	20,000	57,000	32,000	737,000
1996/97	33,000	34,600	9,700	47,300	52,700	49,800	43,800	1,800	6,900	3,300	2,500	12,800	64,100	14,200	154,500	163,100	6,405	1,800	2,400	20,000	63,000	32,000	820,000
1997/98	241,000	41,100	9,000	79,100	83,200	69,400	12,900	12,700	48,800	2,900	7,000	36,600	54,100	16,100	112,300	125,100	6,405	700	3,500	22,000	53,000	33,000	1,070,000
1998/99	4,000	14,300	2,800	19,500	25,700	21,100	9,000	600	2,500	4,600	1,000	7,300	58,100	19,700	132,200	175,200	6,405	600	1,900	20,000	68,000	34,000	629,000
1999/00	8,000	16,900	2,900	11,100	16,600	20,300	9,400	600	2,400	1,200	1,200	4,700	64,300	13,100	135,600	168,800	6,505	600	3,500	19,000	71,000	34,000	612,000
2000/01	5,000	12,300	0	7,000	11,800	8,600	5,100	0	0	1,600	0	4,600	28,500	2,700	85,000	186,000	6,605	700	3,700	21,000	62,000	34,000	486,000
2001/02	0	14,800	700	13,400	19,200	12,700	7,700	0	0	2,400	0	6,100	24,800	0	72,800	210,200	7,015	700	3,600	24,000	62,000	34,000	516,000
2002/03	3,000	19,700	3,700	22,800	29,100	13,100	12,600	100	400	1,300	200	5,700	53,600	5,000	84,900	142,300	6,915	1,800	3,300	24,000	60,000	33,000	527,000
2003/04	0	9,900	300	7,700	11,600	6,400	4,900	0	0	1,700	0	2,300	19,600	0	61,600	197,100	7,125	2,500	1,900	25,000	63,000	34,000	457,000
2004/05	82,000	24,200	4,700	22,900	30,100	28,100	13,800	400	1,500	3,500	1,600	6,400	91,100	32,000	153,200	106,500	7,125	3,100	1,000	24,000	55,000	33,000	725,000
2005/06	60,000	28,100	7,200	40,500	47,300	50,900	13,400	900	3,400	4,100	1,100	7,500	77,900	26,700	169,900	84,100	7,335	3,500	800	25,000	51,000	33,000	744,000
2006/07	0	6,200	1,500	5,100	10,100	4,600	6,500	0	0	100	0	1,700	15,500	100	39,400	199,600	7,535	2,400	1,100	24,000	61,000	34,000	420,000
2007/08	0	11,700	1,100	15,900	22,500	13,500	7,600	0	0	500	0	2,300	22,000	1,600	56,600	171,100	7,645	1,800	1,500	24,000	56,000	34,000	451,000
2008/09	1,000	9,500	1,400	7,100	12,900	8,000	3,100	0	0	7,000	0	1,600	43,800	8,100	66,800	134,600	7,645	2,100	1,600	24,000	49,000	34,000	423,000
2009/10	17,000	25,600	4,500	34,600	51,600	33,800	13,100	0	0	3,200	0	5,000	72,600	29,900	128,900	86,700	7,655	2,200	1,700	23,000	36,000	33,000	610,000
2010/11	142,000	37,100	7,500	82,400	93,000	68,300	24,200	1,300	5,000	9,700	6,200	14,800	89,500	45,600	172,800	63,700	7,555	2,800	1,900	25,000	35,000	32,000	967,000
2011/12	30,000	13,600	300	17,800	24,800	14,900	6,700	0	0	4,500	100	3,200	23,000	7,100	97,900	99,700	7,765	3,100	1,300	26,000	35,000	33,000	450,000
2012/13	3,000	4,900	0	4,400	9,800	4,000	3,100	0	0	1,300	100	1,000	13,100	100	35,800	159,400	7,765	1,800	1,100	25,000	48,000	33,000	357,000
2013/14	5,000	2,300	0	0	4,100	2,000	2,500	0	0	0	200	400	0	0	16,000	180,300	7,875	1,800	1,800	25,000	49,000	34,000	332,000
2014/15	3,000	1,000	0	0	4,600	1,400	1,600	0	0	0	200	200	0	0	9,900	161,300	7,675	1,500	1,800	25,000	43,000	34,000	296,000
2015/16	16,000	16,000	5,500	11,400	18,300	9,200	14,000	0	0	100	200	4,400	28,600	3,700	65,000	110,900	7,685	2,000	2,000	25,000	39,000	33,000	412,000
2016/17	73,000	42,100	15,900	82,600	98,300	65,300	50,600	800	3,100	3,700	6,000	22,000	133,700	75,500	158,200	101,400	7,785	2,000	2,100	24,000	38,000	32,000	1,038,000
2017/18	9,000	9,600	0	13,000	22,300	7,200	8,400	0	0	0	300	2,400	62,000	15,500	89,000	128,600	7,895	2,600	1,800	23,000	39,000	33,000	475,000
2018/19	75,000	30,200	500	65,400	81,500	36,400	28,500	200	900	600	1,800	10,500	112,900	106,300	173,500	79,100	7,895	2,100	2,300	24,000	32,000	32,000	904,000
86/87-18/19 Avg	33,000	16,700	3,000	23,300	30,200	22,200	11,500	600	2,500	2,300	1,100	5,800	52,800	14,500	96,900	148,200	6,900	1,800	1,800	23,000	52,000	33,000	583,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Tule Subbasin Groundwater Budget

	Groundwater Outflows (acre-ft)							Change in Storage (acre-ft)		
	W	X	Y	Z	AA	AB				
	Groundwater Pumping				Sub-surface Outflow					
Water Year	Municipal	Irrigated Agriculture	Exports	Groundwater Banking Extraction	Upper Aquifer	Lower Aquifer	Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage
1986/87	13,600	595,000	6,600	0	13,000	58,000	686,000	-79,000	-107,000	-186,000
1987/88	15,200	671,000	34,200	0	11,000	59,000	790,000	-105,000	-231,000	-336,000
1988/89	15,800	688,000	38,300	0	10,000	64,000	816,000	-116,000	-269,000	-385,000
1989/90	16,400	716,000	50,400	0	10,000	68,000	861,000	-152,000	-315,000	-467,000
1990/91	16,800	500,000	46,300	0	10,000	73,000	646,000	-73,000	-137,000	-210,000
1991/92	17,100	747,000	41,300	0	10,000	65,000	880,000	-188,000	-288,000	-476,000
1992/93	17,300	550,000	14,600	0	14,000	69,000	665,000	-63,000	215,000	152,000
1993/94	17,700	858,000	11,200	0	13,000	58,000	958,000	-174,000	-307,000	-481,000
1994/95	17,700	606,000	10,700	0	13,000	55,000	702,000	-65,000	270,000	205,000
1995/96	17,900	810,000	0	0	16,000	47,000	891,000	-120,000	-34,000	-154,000
1996/97	18,800	687,000	0	0	16,000	48,000	770,000	-67,000	117,000	50,000
1997/98	18,000	541,000	0	0	15,000	48,000	622,000	-19,000	467,000	448,000
1998/99	18,100	734,000	0	0	16,000	49,000	817,000	-58,000	-130,000	-188,000
1999/00	19,000	704,000	7,700	0	14,000	48,000	793,000	-30,000	-151,000	-181,000
2000/01	19,200	753,000	30,600	0	11,000	62,000	876,000	-124,000	-266,000	-390,000
2001/02	21,000	851,000	44,500	0	11,000	60,000	988,000	-171,000	-301,000	-472,000
2002/03	20,700	666,000	25,400	0	10,000	49,000	771,000	-92,000	-152,000	-244,000
2003/04	21,800	935,000	37,600	0	10,000	52,000	1,056,000	-277,000	-322,000	-599,000
2004/05	20,700	525,000	12,400	0	10,000	51,000	619,000	-40,000	146,000	106,000
2005/06	21,700	396,000	100	0	11,000	44,000	473,000	27,000	244,000	271,000
2006/07	22,800	954,000	37,900	0	11,000	46,000	1,072,000	-223,000	-429,000	-652,000
2007/08	23,100	805,000	56,300	0	10,000	71,000	965,000	-245,000	-269,000	-514,000
2008/09	22,600	626,000	52,100	550	10,000	87,000	798,000	-187,000	-188,000	-375,000
2009/10	21,900	405,000	30,500	68	11,000	93,000	561,000	-63,000	112,000	49,000
2010/11	21,900	295,000	8,200	0	14,000	79,000	418,000	27,000	522,000	549,000
2011/12	22,600	453,000	43,600	3,859	13,000	82,000	618,000	-66,000	-102,000	-168,000
2012/13	22,800	746,000	63,600	5,990	11,000	108,000	957,000	-207,000	-393,000	-600,000
2013/14	22,000	869,000	58,000	5,586	10,000	122,000	1,087,000	-366,000	-389,000	-755,000
2014/15	19,800	770,000	53,300	1,153	10,000	119,000	973,000	-349,000	-328,000	-677,000
2015/16	19,800	514,000	50,000	68	9,000	124,000	717,000	-198,000	-107,000	-305,000
2016/17	20,200	499,000	12,100	0	13,000	87,000	631,000	-62,000	469,000	407,000
2017/18	21,100	620,000	33,600	0	13,000	89,000	777,000	-113,000	-189,000	-302,000
2018/19	20,800	385,000	11,600	0	13,000	91,000	521,000	-17,000	400,000	383,000
86/87-18/19 Avg	19,600	651,000	28,000	500	12,000	70,000	781,000	-123,000	-74,000	-197,000
							Cummulative Change in Storage	-4,055,000	-2,442,000	-6,497,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Table 2-4
DRAFT-FINAL

Projected Future Tule Subbasin Groundwater Budget

	Groundwater Inflows (acre-ft)																					
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	
Water Year	Areal Recharge from Precipitation	Tule River Infiltration					Deer Creek Infiltration					White River Infiltration	Imported Water Deliveries			Agricultural Pumping Return Flow	Municipal Pumping			Sub-surface Inflow		Mountain-Block Recharge	Total In
		Success to Oettle Bridge Infiltration	Oettle Bridge to Turnbull Weir Infiltration	Canal Loss	Recharge in Basins	Return Flow	Before Trenton Weir Infiltration	Trenton Weir to Homeland Canal Infiltration	Canal Loss	Recharge in Basins	Return Flow		Canal Loss	Recharge in Basins	Return Flow		Return Flow	Recycled Water					
																		Agricultural Return Flow	Artificial Recharge	Upper Aquifer	Lower Aquifer		
2019/20	38,000	18,100	4,000	17,000	23,700	18,800	10,200	600	2,200	2,500	1,050	6,200	65,100	19,800	95,200	163,800	8,500	1,500	3,000	23,000	33,000	32,000	587,000
2020/21	38,000	18,100	4,000	17,000	23,700	18,800	10,200	600	2,200	2,500	1,050	6,200	65,100	22,000	96,100	162,200	8,500	1,500	3,100	23,000	32,000	32,000	588,000
2021/22	38,000	18,100	4,000	17,000	23,700	18,800	10,200	600	2,200	2,500	1,050	6,200	65,100	22,000	96,100	161,100	8,500	1,600	3,100	23,000	31,000	32,000	586,000
2022/23	38,000	18,100	4,000	17,000	23,700	18,800	10,200	600	2,200	2,500	1,050	6,200	65,100	23,667	96,100	159,800	8,600	1,700	3,200	22,000	29,000	32,000	584,000
2023/24	38,000	18,100	4,000	17,000	23,700	19,000	10,200	600	2,200	2,500	1,050	6,200	65,100	27,667	96,700	138,800	8,600	1,700	3,300	22,000	27,000	32,000	565,000
2024/25	38,000	18,100	4,000	18,100	25,200	19,500	10,200	600	2,200	2,500	1,050	6,200	62,300	28,567	96,100	137,000	8,700	1,800	3,400	22,000	27,000	32,000	565,000
2025/26	38,000	18,100	4,000	18,400	25,500	19,500	10,200	600	2,200	2,500	1,250	6,200	59,500	27,967	96,000	135,900	8,700	1,900	3,500	23,000	27,000	32,000	562,000
2026/27	38,000	18,100	4,000	18,700	25,800	19,500	10,200	600	2,200	2,500	1,250	6,200	56,700	27,367	95,400	135,400	8,800	2,000	3,600	23,000	27,000	32,000	558,000
2027/28	38,000	18,100	4,000	19,000	26,100	19,500	10,200	600	2,200	2,500	1,250	6,200	53,900	26,667	94,500	134,900	8,800	2,000	3,600	23,000	28,000	32,000	555,000
2028/29	38,000	18,100	4,000	19,200	26,300	19,500	10,200	600	2,200	2,500	1,250	6,200	51,100	26,067	94,000	134,200	8,900	2,100	3,700	23,000	29,000	32,000	552,000
2029/30	38,000	17,900	4,000	19,400	26,500	19,200	10,200	600	2,200	2,500	1,250	6,200	48,300	25,467	93,600	128,100	8,900	2,200	3,800	23,000	28,000	31,000	540,000
2030/31	38,000	17,900	4,000	19,400	26,500	19,300	10,100	600	2,100	2,500	1,250	6,200	48,300	25,467	93,900	124,500	9,000	2,300	3,900	23,000	28,000	31,000	537,000
2031/32	38,000	17,900	4,000	19,400	26,500	19,300	10,100	600	2,100	2,500	1,250	6,200	48,300	25,467	94,100	121,200	9,100	2,300	4,000	23,000	28,000	31,000	534,000
2032/33	38,000	17,900	4,000	19,400	26,500	19,300	10,100	600	2,100	2,500	1,250	6,200	48,300	25,467	94,200	117,700	9,100	2,400	4,100	23,000	27,000	31,000	530,000
2033/34	38,000	17,900	4,000	19,400	26,500	19,400	10,100	600	2,100	2,500	1,250	6,200	48,300	25,467	94,400	114,500	9,200	2,500	4,200	22,000	27,000	31,000	527,000
2034/35	38,000	17,900	4,000	19,400	26,500	19,400	10,100	600	2,100	2,500	1,250	6,200	48,300	25,467	94,500	109,600	9,200	2,600	4,300	22,000	26,000	31,000	521,000
2035/36	38,000	17,900	4,000	19,400	26,500	19,400	10,100	600	2,100	2,500	1,250	6,200	48,300	25,467	94,800	107,700	9,300	2,700	4,400	22,000	25,000	31,000	519,000
2036/37	38,000	17,900	4,000	19,400	26,500	19,400	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	94,900	106,000	9,400	2,800	4,500	22,000	25,000	31,000	517,000
2037/38	38,000	17,900	4,000	19,400	26,500	19,400	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,000	104,400	9,400	2,900	4,700	22,000	25,000	31,000	516,000
2038/39	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,000	102,200	9,500	3,000	4,800	22,000	25,000	31,000	514,000
2039/40	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,200	98,900	9,600	3,100	4,900	22,000	24,000	31,000	511,000
2040/41	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,400	98,900	9,600	3,100	4,900	22,000	24,000	31,000	511,000
2041/42	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,400	99,000	9,600	3,100	4,900	22,000	24,000	31,000	511,000
2042/43	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,400	99,000	9,600	3,100	4,900	22,000	24,000	31,000	511,000
2043/44	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,300	99,900	9,600	3,100	4,900	22,000	24,000	31,000	512,000
2044/45	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,300	99,900	9,600	3,100	4,900	22,000	24,000	31,000	512,000
2045/46	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,300	99,900	9,600	3,100	4,900	22,000	23,000	31,000	511,000
2046/47	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,300	100,000	9,600	3,100	4,900	22,000	23,000	30,000	510,000
2047/48	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,300	100,000	9,600	3,100	4,900	22,000	23,000	31,000	511,000
2048/49	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,300	100,000	9,600	3,100	4,900	21,000	23,000	30,000	509,000
2049/50	38,000	17,900	4,000	19,400	26,500	19,500	10,100	600	2,100	2,500	1,350	6,200	48,300	25,467	95,300	100,100	9,600	3,100	4,900	21,000	23,000	30,000	509,000
2050/51	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	102,600	9,600	3,100	4,900	22,000	24,000	30,000	500,000
2051/52	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	102,700	9,600	3,100	4,900	22,000	24,000	30,000	500,000
2052/53	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	102,800	9,600	3,100	4,900	22,000	24,000	30,000	500,000
2053/54	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	102,900	9,600	3,100	4,900	22,000	24,000	30,000	500,000
2054/55	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,000	9,600	3,100	4,900	22,000	24,000	30,000	500,000
2055/56	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,000	9,600	3,100	4,900	22,000	24,000	30,000	500,000
2056/57	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,100	9,600	3,100	4,900	22,000	24,000	30,000	501,000
2057/58	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,100	9,600	3,100	4,900	22,000	24,000	30,000	501,000
2058/59	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	22,000	24,000	30,000	501,000
2059/60	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	22,000	24,000	30,000	501,000
2060/61	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	22,000	24,000	30,000	501,000
2061/62	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	22,000	24,000	30,000	501,000
2062/63	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	22,000	24,000	30,000	501,000
2063/64	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	23,000	25,000	30,000	503,000
2064/65	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	23,000	25,000	30,000	503,000
2065/66	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	23,000	25,000	30,000	503,000
2066/67	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	23,000	25,000	30,000	503,000
2067/68	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	23,000	25,000	30,000	503,000
2068/69	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	23,000	25,000	30,000	503,000
2069/70	38,000	17,400	3,800	19,200	25,700	19,600	9,800	500	2,100	2,500	1,340	6,100	43,500	24,467	89,800	103,200	9,600	3,100	4,900	23,000	25,000	30,000	503,000
19/20-69/70 Avg	38,000	17,700	3,900	19,000	25,800	19,400	10,000	600	2,100	2,500	1,300	6,200	48,900	25,000	93,000	112,900	9,300	2,700	4,500	22,000	25,000	31,000	521,000

Table 2-4
DRAFT-FINAL

Projected Future Tule Subbasin Groundwater Budget

	Groundwater Outflows (acre-ft)							Change in Storage (acre-ft)			
	W	X	Y	Z	AA	AB					
	Groundwater Pumping				Sub-surface Outflow						
Water Year	Municipal	Irrigated Agriculture	Exports	Groundwater Banking Extraction	Upper Aquifer	Lower Aquifer	Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage	Sustainable Yield (acre-ft)
2019/20	25,300	653,000	22,916	3,000	13,000	71,000	788,000	-58,000	-143,000	-201,000	N/A
2020/21	25,700	648,000	22,916	3,000	12,000	72,000	784,000	-77,000	-119,000	-196,000	N/A
2021/22	26,100	642,000	22,916	3,000	11,000	73,000	778,000	-85,000	-107,000	-192,000	N/A
2022/23	26,400	636,000	22,916	3,000	11,000	74,000	773,000	-92,000	-97,000	-189,000	N/A
2023/24	26,900	547,000	22,916	3,000	10,000	75,000	685,000	-57,000	-63,000	-120,000	N/A
2024/25	27,300	538,000	22,916	3,000	10,000	75,000	676,000	-55,000	-56,000	-111,000	N/A
2025/26	27,700	531,000	10,006	3,000	10,000	75,000	657,000	-53,000	-42,000	-95,000	N/A
2026/27	28,100	529,000	10,006	3,000	9,000	75,000	654,000	-53,000	-43,000	-96,000	N/A
2027/28	28,600	524,000	10,006	3,000	9,000	74,000	649,000	-53,000	-41,000	-94,000	N/A
2028/29	29,000	522,000	10,006	3,000	9,000	74,000	647,000	-54,000	-41,000	-95,000	N/A
2029/30	29,500	485,000	10,006	3,000	8,000	74,000	610,000	-48,000	-22,000	-70,000	N/A
2030/31	30,000	468,000	7,096	3,000	8,000	75,000	591,000	-42,000	-12,000	-54,000	N/A
2031/32	30,400	455,000	7,096	3,000	8,000	76,000	579,000	-37,000	-8,000	-45,000	N/A
2032/33	30,900	442,000	7,096	3,000	8,000	77,000	568,000	-32,000	-6,000	-38,000	N/A
2033/34	31,500	426,000	7,096	3,000	7,000	78,000	553,000	-27,000	1,000	-26,000	N/A
2034/35	32,000	401,000	7,096	3,000	7,000	79,000	529,000	-21,000	13,000	-8,000	N/A
2035/36	32,500	393,000	4,185	3,000	7,000	81,000	521,000	-19,000	17,000	-2,000	N/A
2036/37	33,100	385,000	4,185	3,000	7,000	82,000	514,000	-17,000	20,000	3,000	N/A
2037/38	33,600	379,000	4,185	3,000	7,000	83,000	510,000	-15,000	21,000	6,000	N/A
2038/39	34,200	370,000	4,185	3,000	7,000	85,000	503,000	-12,000	23,000	11,000	N/A
2039/40	34,800	354,000	1,275	3,000	7,000	87,000	487,000	-9,000	33,000	24,000	N/A
2040/41	34,800	354,000	1,275	3,000	7,000	87,000	487,000	-8,000	32,000	24,000	
2041/42	34,800	354,000	1,275	3,000	7,000	87,000	487,000	-8,000	32,000	24,000	
2042/43	34,800	355,000	1,275	3,000	7,000	88,000	489,000	-7,000	29,000	22,000	
2043/44	34,800	358,000	1,275	3,000	7,000	88,000	492,000	-7,000	27,000	20,000	
2044/45	34,800	358,000	1,275	3,000	7,000	88,000	492,000	-7,000	27,000	20,000	
2045/46	34,800	358,000	1,275	3,000	7,000	88,000	492,000	-7,000	26,000	19,000	
2046/47	34,800	358,000	1,275	3,000	7,000	88,000	492,000	-7,000	25,000	18,000	
2047/48	34,800	358,000	1,275	3,000	7,000	88,000	492,000	-6,000	25,000	19,000	
2048/49	34,800	358,000	1,275	3,000	7,000	88,000	492,000	-6,000	23,000	17,000	
2049/50	34,800	359,000	1,275	3,000	6,000	88,000	492,000	-6,000	23,000	17,000	
2050/51	34,800	369,000	1,275	3,000	6,000	87,000	501,000	-10,000	9,000	-1,000	
2051/52	34,800	370,000	1,275	3,000	6,000	87,000	502,000	-9,000	7,000	-2,000	
2052/53	34,800	370,000	1,275	3,000	6,000	87,000	502,000	-9,000	7,000	-2,000	
2053/54	34,800	370,000	1,275	3,000	6,000	86,000	501,000	-9,000	8,000	-1,000	
2054/55	34,800	371,000	1,275	3,000	6,000	86,000	502,000	-9,000	7,000	-2,000	
2055/56	34,800	371,000	1,275	3,000	6,000	86,000	502,000	-9,000	7,000	-2,000	412,000
2056/57	34,800	371,000	1,275	3,000	6,000	86,000	502,000	-9,000	8,000	-1,000	
2057/58	34,800	371,000	1,275	3,000	6,000	85,000	501,000	-9,000	9,000	0	
2058/59	34,800	371,000	1,275	3,000	6,000	85,000	501,000	-9,000	9,000	0	
2059/60	34,800	371,000	1,275	3,000	6,000	85,000	501,000	-9,000	9,000	0	
2060/61	34,800	371,000	1,275	3,000	6,000	85,000	501,000	-9,000	9,000	0	
2061/62	34,800	371,000	1,275	3,000	6,000	85,000	501,000	-8,000	8,000	0	
2062/63	34,800	371,000	1,275	3,000	6,000	85,000	501,000	-8,000	8,000	0	
2063/64	34,800	371,000	1,275	3,000	6,000	85,000	501,000	-8,000	10,000	2,000	
2064/65	34,800	371,000	1,275	3,000	6,000	84,000	500,000	-8,000	11,000	3,000	
2065/66	34,800	371,000	1,275	3,000	6,000	84,000	500,000	-8,000	11,000	3,000	
2066/67	34,800	371,000	1,275	3,000	6,000	84,000	500,000	-8,000	11,000	3,000	
2067/68	34,800	371,000	1,275	3,000	6,000	84,000	500,000	-8,000	11,000	3,000	
2068/69	34,800	371,000	1,275	3,000	6,000	84,000	500,000	-8,000	11,000	3,000	
2069/70	34,800	371,000	1,275	3,000	6,000	84,000	500,000	-7,000	10,000	3,000	
19/20-69/70 Avg	32,700	418,000	5,500	3,000	7,000	82,000	548,000	-23,000	-4,000	-27,000	

Groundwater Inflows to be Included in Native Yield Estimates
Groundwater Inflows to be Excluded from the Native Yield Estimates
Surface Water or Groundwater Outflows Not Included Native Yield Estimates
N/A = Not applicable

Historical Planned versus Actual Water Deliveries
2007/08 - 2016/17

Water Year	Water Year Type	Tule River			Friant-Kern Canal								
					Saucelito ID			Terra Bella ID			Kern-Tulare WD		
		Total Diversion Right	Total Delivered	Percent of Diversion Right (%)	Contract Amount[1]	Total Delivered[2]	Percent of Contract (%)	Contract Amount[1]	Total Delivered[2]	Percent of Contract (%)	Contract Amount[1]	Total Delivered[2]	Percent of Contract (%)
2007 - 2008	Below Average	57,100	41,974	74%	54,300	24,083	44%	29,000	18,192	63%	5,000	17,689	354%
2008 - 2009	Below Average	57,100	32,290	57%	54,300	31,282	58%	29,000	19,701	68%	5,000	15,524	310%
2009 - 2010	Average	57,100	60,570	106%	54,300	42,855	79%	29,000	17,574	61%	5,000	14,027	281%
2010 - 2011	Above Average	57,100	106,619	187%	54,300	46,733	86%	29,000	16,381	56%	5,000	13,405	268%
2011 - 2012	Below Average	57,100	66,992	117%	54,300	19,189	35%	29,000	19,757	68%	5,000	14,309	286%
2012 - 2013	Below Average	57,100	23,406	41%	54,300	14,102	26%	29,000	20,628	71%	5,000	14,955	299%
2013 - 2014	Below Average	57,100	9,747	17%	54,300	5,724	11%	29,000	12,390	43%	5,000	9,986	200%
2014 - 2015	Below Average	57,100	6,417	11%	54,300	1,503	3%	29,000	12,012	41%	5,000	5,438	109%
2015 - 2016	Below Average	57,100	36,752	64%	54,300	20,049	37%	29,000	14,357	50%	5,000	11,805	236%
2016 - 2017	Below Average	57,100	128,361	225%	54,300	51,137	94%	29,000	16,089	55%	5,000	14,203	284%
	Total:	571,000	513,128	90%	543,000	256,657	47%	290,000	167,081	58%	50,000	131,341	263%

Water Year	Water Year Type	Friant-Kern Canal											
		LTRID			Delano-Earlimart ID			Porterville ID			Tea Pot Dome WD		
		Contract Amount[1]	Total Delivered[2]	Percent of Contract (%)	Contract Amount[1]	Total Delivered[2]	Percent of Contract (%)	Contract Amount[1]	Total Delivered[2]	Percent of Contract (%)	Contract Amount[1]	Total Delivered[2]	Percent of Contract (%)
2007 - 2008	Below Average	299,200	71,872	24%	183,300	106,470	58%	45,000	12,988	29%	7,200	6,894	96%
2008 - 2009	Below Average	299,200	113,189	38%	183,300	111,556	61%	45,000	18,000	40%	7,200	6,165	86%
2009 - 2010	Average	299,200	200,064	67%	183,300	118,671	65%	45,000	14,335	32%	7,200	5,845	81%
2010 - 2011	Above Average	299,200	229,763	77%	183,300	127,447	70%	45,000	9,387	21%	7,200	6,105	85%
2011 - 2012	Below Average	299,200	67,684	23%	183,300	114,108	62%	45,000	9,318	21%	7,200	4,680	65%
2012 - 2013	Below Average	299,200	37,073	12%	183,300	87,302	48%	45,000	10,298	23%	7,200	4,354	60%
2013 - 2014	Below Average	299,200	0	0%	183,300	38,106	21%	45,000	178	0%	7,200	1,030	14%
2014 - 2015	Below Average	299,200	0	0%	183,300	18,591	10%	45,000	114	0%	7,200	260	4%
2015 - 2016	Below Average	299,200	73,382	25%	183,300	93,806	51%	45,000	13,271	29%	7,200	4,627	64%
2016 - 2017	Below Average	299,200	273,151	91%	183,300	137,773	75%	45,000	21,651	48%	7,200	6,694	93%
	Total:	2,992,000	1,066,178	36%	1,833,000	953,830	52%	450,000	109,540	24%	72,000	46,654	65%

Notes: [1]Sum of Class 1 and Class 2 Fraint-Kern Canal Contract Amount

[2]Total delivered water may include 16B, Cross Valley Canal water, Kern River water, and water purchased from other Friant-Kern Canal contractors. Likewise, delivered water may not reflect available supplies as contractors periodically sell water under their contract.

Summary of Water Supply Projects Exclusive of Transitional Pumping

Eastern Tule GSA										
No.	Lead Entity	Project Name	Description	Start Date/ Timeframe	Permitting and Regulatory Process Requirements	Public Noticing Process	Annual Volume	Water Source	Surface Water Rights Description	Status
1	City of Porterville	Population Increase	Increase GW Production	2.5%/yr 2020-2040			9,500 af/yr by 2040	N/A		
2	City of Porterville	Recycling Increase	Increase RW Applied to Ag	2.5%/yr 2020-2040			1,900 af/yr by 2040	Recycled Water		
3	City of Porterville	Recycling Increase	Increase RW Recharge	2.5%/yr 2020-2040			1,600 af/yr by 2040	Recycled Water		
4	City of Porterville	Tule River Recharge	Recharge Project	Starting 2019/20			900 af/yr	Tule River		
5	City of Porterville	FKC Recharge	Recharge Project	Starting 2020/21			1,100 af/yr	FKC via Porterville ID		
6	Porterville ID	SA 1 & 2	Expand distribution system	Starting 2018/19			3,200 af/yr	Tule River and FKC		
7	Porterville ID	SA 3 & 4	Expand distribution system	Starting 2025			1,800 af/yr	Tule River and FKC		
8	Porterville ID	Falconer Bank	Develop water bank	Starting 2020/21			3,300 af/yr of leave-behind	FKC and others		
9	Porterville ID	Recharge Policy	On-Farm recharge	Starting 2019/20			3,000 af/yr	Tule River and FKC		
10	Saucelito ID	Conway Bank	Develop water bank	Starting 2020/21			1,100 af/yr of leave-behind	FKC and others		
11	Saucelito ID	Recharge Policy	On-Farm recharge	Starting 2019/20			2,000 af/yr	FKC		
12	Terra Bella ID	Deer Creek Recharge	Divert and recharge DC	Starting 2017/18			800 af/yr	Deer Creek		
13	PWC, VWD, & CMDC	SREP	Success Dam Enlargement	Start August 2020 Completion 2024			400 af/yr	Tule River		
14	Hope WD	In-District Recharge	Recharge Project	Starting 2022/23			5,000 af/yr every 3 years	FKC and others / unknown		
15	Ducor ID	In-District Recharge	Pipeline and Recharge Project	Starting 2023/24			4,000 af/yr	FKC and others / unknown		

=Indicates Project is from the 2020 GSP and has not been confirmed in 2024

Summary of Water Supply Projects Exclusive of Transitional Pumping

Lower Tule River ID GSA

No.	Lead Entity	Project Name	Description	Start Date/ Timeframe	Permitting and Regulatory Process Requirements	Public Noticing Process	Annual Volume	Water Source	Surface Water Rights Description	Status
1	LTRID	Creighton Ranch	Groundwater exports	Ongoing			Unknown	Not applicable	Not applicable	Ongoing
2	LTRID	LTRID - Pixley ID FKC	Continue FKC transfers to Pixley ID	Ongoing			13,670 af/yr	FKC	Exercise of Rights	Ongoing
3	LTRID	SREP	Success Dam Enlargement	Start August 2020 Completion 2024			2,600 af/yr	Tule River	Exercise of Rights	Construction Phase

Pixley ID GSA

No.	Lead Entity	Project Name	Description	Start Date/ Timeframe	Permitting and Regulatory Process Requirements	Public Noticing Process	Annual Volume	Water Source	Surface Water Rights Description	Status
1	Pixley ID	LTRID - Pixley ID FKC	Continue FKC transfers from LTRID	Ongoing			13,670 af/yr	FKC	Existing LTRID Rights	Ongoing
2	Pixley ID	Deer Creek Basin	Groundwater Recharge Basin	Ongoing	CEQA, SWPPP, DCP, Grading Permit, Air Permit		1,200 af/yr	FKC		Ongoing
3	Pixley ID	Lateral #4 Canal	New delivery system that will serve groundwater reliant area, roughly 5,500 acres	Start August 2024 Completion June 2026	CEQA, NEPA, SWPPP, DCP		1,620 af/yr	FKC		Design Phase

Delano-Earlimart ID GSA

No.	Lead Entity	Project Name	Description	Start Date/ Timeframe	Permitting and Regulatory Process Requirements	Public Noticing Process	Annual Volume	Water Source	Surface Water Rights Description	Status
1	DEID	Turnipseed Water Banking Project - Phase III	320-acre recharge facility	Start June 2018, Complete	CEQA	CEQA Public Noticing	9,505 af/yr	DEID C1/C2 CVP Supply	Existing DEID 9(d) Contract	Complete
2	DEID	Turnipseed Water Banking Project - Phase IV	160-acre recharge facility	Start July 2019, Complete	CEQA	CEQA Public Noticing	4,753 af/yr	DEID C1/C2 CVP Supply	Existing DEID 9(d) Contract	Complete
3	DEID	Turnipseed Water Banking Project - Phase V	156-acre recharge facility	Start January 2020, Complete	CEQA/NEPA	CEQA Public Noticing	4,634 af/yr	DEID C1/C2 CVP Supply	Existing DEID 9(d) Contract	Complete
4	DEID	Turnipseed Water Banking Project - Phase VI	148-acre recharge facility	Start August 2021, Completion Sept 2024	CEQA/NEPA	CEQA Public Noticing	4,396 af/yr	DEID C1/C2 CVP Supply	Existing DEID 9(d) Contract	Construction Phase

Summary of Water Supply Projects Exclusive of Transitional Pumping

Tri-County Water Authority										
No.	**Lead Entity**	**Project Name**	**Description**	**Start Date/ Timeframe**	**Permitting and Regulatory Process Requirements**	**Public Noticing Process**	**Annual Volume**	**Water Source**	**Surface Water Rights Description**	**Status**
1	Angiola WD	Deep Pumping Reduction	Replace deep pumping with 24 new shallow wells	Start in 2019/20, completed in 2023/24			24,000 af/yr	Not applicable	Not applicable	Complete
2	Angiola WD	Recharge Basin	Capture and recharge flood water	Completed by 2026			1,200 to 1,800 af/yr	Deer Creek		
3	TCWA	Fallowing Program	Taking Ag land out of production	Completed 2025			1,200 af/yr	Not applicable	Not applicable	
4	TCWA	Allensworth Basin	Capturing White River Flood Flow	Completed 2025	CEQA		1,200 af/yr	White River		

Alpaugh GSA										
No.	**Lead Entity**	**Project Name**	**Description**	**Start Date/ Timeframe**	**Permitting and Regulatory Process Requirements**	**Public Noticing Process**	**Annual Volume**	**Water Source**	**Surface Water Rights Description**	**Status**
1	Alpaugh ID	Water Capture	Deer Creek flood capture	Starting in 2022/23			1,100 af 2.5x per yr every 2 yrs	Deer Creek		
2	Alpaugh ID	Cropping Changes	Install drip irrigation on 1,900 acres	Starting 2019/20			Not applicable	Not applicable		

=Indicates Project is from the 2020 GSP and has not been confirmed in 2024

Summary of Water Supply Projects Exclusive of Transitional Pumping

Kern-Tulare WD GSA										
No.	Lead Entity	Project Name	Description	Start Date/ Timeframe	Permitting and Regulatory Process Requirements	Public Noticing Process	Annual Volume	Water Source	Surface Water Rights Description	Status
1	Kern-Tulare WD	Connect Rag Gulch and Ave 4 Systems	Construction of pipeline to increase the delivery capability in the Rag Gulch and Avenue 4 distribution systems	Completed 2023	N/A (Complete)	Stakeholder Meetings, Board Meetings	260 af/yr	CVP supplies	Exercise of Rights	Implemented
2	Kern-Tulare WD	Quinn Pumping Plant and Pipeline	Construction Pumping Plant, distribution system piping, and turnouts to improve delivery capability	Initiated 2023 Complete by 2025	Complete	Stakeholder Meetings, Board Meetings, Prop 218	1,130 af/yr	CVP supplies	Exercise of Rights	In-Process
3	Kern-Tulare WD	Improved Conveyance to Ave 24	Constructs the necessary improvements to allow for 177 acres to added to the Service Area	Initiated 2023 Complete by 2025	Complete	Stakeholder Meetings, Board Meetings, Prop 218	480 af/yr	CVP supplies	Exercise of Rights	In-Process
4	Kern-Tulare WD	Replace Twin Pipes Pumping Plant	Increasing the horsepower at the pumping plant to improve delivery capability to 1,488 acres	Initiated 2024 Complete by 2025		Stakeholder Meetings, Board Meetings	270 af/yr	CVP supplies	Exercise of Rights	In-Process
5	Kern-Tulare WD	Provide Full Service to Southern Service Area	Replacement and replacement of pumping plants and pipeline to increase the annual delivery capability	As-Needed 2035-2040	CEQA/NEPA	Stakeholder Meetings, Board Meetings, Prop 218	9,470 af/yr	CVP supplies	Exercise of Rights	As-needed
6	Kern-Tulare WD	Produced Water Project - Phase 2	Obtain additional sources of produced water	As-Needed 2025-2030	WDR	Stakeholder Meetings, Board Meetings	3,000 af/yr	Produced Water Supplies	New Local Supply	As-needed
7	Kern-Tulare WD	In-District Surface Storage	Construct two potential reservoir sites to capture wet year water.	As-Needed 2035-2040	CEQA/NEPA	Stakeholder Meetings, Board Meetings, Prop 218	2,000 af/yr	CVP water, additional wet year water for purchase	Supplemental Water Use	As-needed
8	Kern-Tulare WD	Modify District Pricing Structure	Reduce groundwater pumping by providing a pricing mechanism that causes groundwater to cost more than surface water. Includes installation of meters on all ag wells.	Complete	N/A (Complete)	N/A (Complete)	5,580 af/yr	N/A	N/A	Implemented

Notes:

N/A= Not Available
af/yr = acre-foot per year
ID = Irrigation District
GW = Groundwater
RW = Recycled water
Ag = Agricultural
DC = Deer Creek
FKC = Friant-Kern Canal
SA = Service Area
CRC = California Resources Corporation
PWC = Pioneer Water Company
VMD = Vandalia Water District
CMDC = Campbell Moreland Ditch Company
SREP = Success Reservoir Enlargement Project
WD = Water District
MA = Management Area
FID = Fresno Irrigation District (Fresno Slough)
KR = Kaweah River
TR = Tule River
KW = Kaweah River
SWP = State Water Project
CEQA = California Environmental Quality Act
NEPA = National Environmental Policy Act
WDR = Waste Discharge Requirements

Table 2-7
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Planned Transitional Pumping by GSA

Water Year	Eastern Tule GSA[1]		LTRID GSA			Pixley ID GSA			DEID GSA	TCWA			Alpaugh GSA		Kern-Tulare WD GSA
	2020 and 2024 GSP Plan Description	Numerical Annual Transitional Pumping for Model	2020 GSP Plan Description	2024 GSP Accelerated Rampdown Description	Numerical Annual Transitional Pumping for Model	2020 GSP Plan Description	2024 GSP Accelerated Rampdown Description	Numerical Annual Transitional Pumping for Model	2020 and 2024 GSP Plan Description	2020 GSP Plan Description	2024 GSP Accelerated Rampdown Description	Numerical Annual Transitional Pumping for Model	2020 and 2024 GSP Plan Description	Numerical Annual Transitional Pumping for Model	2024 Plan Description
2019/20	90% of over-pumping[2]	100%	2.0 af/ac Over Cons. Use Target	N/A	100%	Fallow 5,000 acres; Remaining no change	N/A	100%	No Change/ Sustainable	100% of over-pumping	N/A	100%	Reduce cropped area by 880 acres; 80% of overpumping	100%	No Change/ Sustainable
2020/21		90%			98%			98%				100%		98%	
2021/22		90%			95%			95%				100%		96%	
2022/23		90%			93%			93%				100%		94%	
2023/24		90%		50% Accelerated Rampdown	45%		50% Accelerated Rampdown	45%				100%		92%	
2024/25	80% of over-pumping	80%	1.5 af/ac Over Cons. Use Target		44%	Fallow 5,000 acres; Remaining 1.5 af/ac Over Cons. Use Target[3]		44%		Reduce pumping 10,000 af/yr	Reduce pumping by additional 10,000 af/yr	91%		90%	
2025/26		80%			43%			43%				82%		88%	
2026/27		80%			42%			42%				73%		86%	
2027/28		80%			41%			41%				64%		84%	
2028/29		80%			40%			40%				55%		82%	
2029/30	30% of over-pumping	30%	1.0 af/ac Over Cons. Use Target		35%	Fallow 5,000 acres; Remaining 1.0 af/ac Over Cons. Use Target		35%				45%	50% of overpumping	80%	
2030/31		30%			30%			30%				36%		73%	
2031/32		30%			25%			25%				27%		65%	
2032/33		30%			20%			20%				18%		58%	
2033/34		30%			15%			15%				9%		50%	
2034/35	Sustainable	0%	0.5 af/ac Over Cons. Use Target		12%	Fallow 5,000 acres; Remaining 0.5 af/ac Over Cons. Use Target		12%		Sustainable		0%	20% of overpumping	43%	
2035/36		0%			9%			9%				0%		35%	
2036/37		0%			6%			6%				0%		28%	
2037/38		0%			3%			3%				0%		20%	
2038/39		0%			0%			0%				0%		0%	
2039/40+	Sustainable	0%	Sustainable	Sustainable	0%	Sustainable	Sustainable	0%		Sustainable		0%	Sustainable	0%	

Notes:

[1]Land Subsidence Management Area subject to additional pumping restrictions.
[2]Over-pumping means pumping in excess of the consumptive use target
[3]Over consumptive use target means over pumping

Table 2-8a
DRAFT

Projected Future Tule Subbasin Surface Water Budget

Water Year	Surface Water Inflow (acre-ft)																					
	Precipitation	Stream Inflow			Imported Water													Recyled Water	Discharge from Wells			Total In
		Tule River	Deer Creek	White River	Saucelito ID	Terra Bella ID	Porterville ID	Tea Pot Dome WD	City of Porterville	Hope WD	Ducor ID	LTRID	Pixley ID	Delano-Earlimart ID	Angiola WD	Alpaugh ID	Kern-Tulare WD	Private		Agriculture Pumping	Municipal Pumping	Water Bank	
2019/20	368,000	132,249	19,729	6,347	27,567	18,786	13,603	6,528	0	0	0	143,186	31,763	118,778	7,554	3,680	15,161	0	6,480	653,000	25,300	3,000	1,601,000
2020/21	368,000	132,249	19,729	6,347	28,667	18,786	13,603	6,528	1,100	0	0	143,186	31,763	118,778	8,555	3,680	17,761	0	6,580	648,000	25,700	3,000	1,602,000
2021/22	368,000	132,249	19,729	6,347	28,667	18,786	13,603	6,528	1,100	0	0	143,186	31,763	118,778	9,557	3,680	17,761	0	6,780	642,000	26,100	3,000	1,598,000
2022/23	368,000	132,249	19,729	6,347	28,667	18,786	13,603	6,528	1,100	1,667	0	143,186	31,763	118,778	10,559	3,680	17,761	0	6,880	636,000	26,400	3,000	1,595,000
2023/24	368,000	132,249	19,729	6,347	28,667	18,786	13,603	6,528	1,100	1,667	4,000	143,186	31,763	118,778	10,559	3,680	17,761	0	7,080	547,000	26,900	3,000	1,510,000
2024/25	368,000	135,249	19,729	6,347	29,543	20,304	14,839	6,594	1,100	1,667	4,000	135,513	31,763	119,224	10,559	3,680	17,920	1,500	7,180	538,000	27,300	3,000	1,503,000
2025/26	368,000	135,249	19,729	6,347	30,418	21,823	16,075	6,661	1,100	1,667	4,000	127,841	31,763	119,671	10,559	4,813	17,400	1,500	7,380	531,000	27,700	3,000	1,494,000
2026/27	368,000	135,249	19,729	6,347	31,293	23,341	17,312	6,727	1,100	1,667	4,000	120,168	31,763	120,117	10,559	4,751	16,879	1,500	7,480	529,000	28,100	3,000	1,488,000
2027/28	368,000	135,249	19,729	6,347	32,168	24,860	18,548	6,793	1,100	1,667	4,000	112,496	31,763	120,564	10,559	4,689	16,358	1,500	7,680	524,000	28,600	3,000	1,480,000
2028/29	368,000	135,249	19,729	6,347	33,044	26,378	19,785	6,860	1,100	1,667	4,000	104,823	31,763	121,010	10,559	4,627	15,838	1,500	7,880	522,000	29,000	3,000	1,474,000
2029/30	368,000	134,235	19,729	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	4,565	17,055	1,500	7,980	485,000	29,500	3,000	1,434,000
2030/31	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	5,737	17,055	1,500	8,180	468,000	30,000	3,000	1,419,000
2031/32	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	5,737	17,055	1,500	8,380	455,000	30,400	3,000	1,406,000
2032/33	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	5,737	17,055	1,500	8,580	442,000	30,900	3,000	1,394,000
2033/34	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	5,737	17,055	1,500	8,780	426,000	31,500	3,000	1,379,000
2034/35	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	5,737	17,055	1,500	8,980	401,000	32,000	3,000	1,354,000
2035/36	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	6,970	17,055	1,500	9,180	393,000	32,500	3,000	1,348,000
2036/37	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	6,970	17,055	1,500	9,380	385,000	33,100	3,000	1,341,000
2037/38	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	6,970	17,055	1,500	9,580	379,000	33,600	3,000	1,336,000
2038/39	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	6,970	17,055	1,500	9,780	370,000	34,200	3,000	1,328,000
2039/40	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	6,970	17,055	1,500	9,980	354,000	34,800	3,000	1,312,000
2040/41	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	354,000	34,800	3,000	1,313,000
2041/42	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	354,000	34,800	3,000	1,313,000
2042/43	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	355,000	34,800	3,000	1,314,000
2043/44	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	358,000	34,800	3,000	1,317,000
2044/45	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	358,000	34,800	3,000	1,317,000
2045/46	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	358,000	34,800	3,000	1,317,000
2046/47	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	358,000	34,800	3,000	1,317,000
2047/48	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	358,000	34,800	3,000	1,317,000
2048/49	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	358,000	34,800	3,000	1,317,000
2049/50	368,000	134,235	19,411	6,347	33,919	27,897	21,021	6,926	1,100	1,667	4,000	97,151	31,763	121,457	10,264	7,793	17,055	1,500	9,980	359,000	34,800	3,000	1,318,000
2050/51	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	369,000	34,800	3,000	1,296,000
2051/52	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	370,000	34,800	3,000	1,297,000
2052/53	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	370,000	34,800	3,000	1,297,000
2053/54	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	370,000	34,800	3,000	1,297,000
2054/55	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2055/56	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2056/57	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2057/58	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2058/59	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2059/60	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2060/61	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2061/62	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2062/63	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2063/64	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2064/65	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2065/66	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2066/67	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2067/68	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2068/69	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
2069/70	368,000	130,581	18,944	6,143	32,278	26,278	18,941	6,524	1,100	1,667	4,000	84,084	31,763	112,046	10,043	7,793	17,055	1,500	9,980	371,000	34,800	3,000	1,298,000
19/20-69/70 Avg	368,000	132,700	19,300	6,300	32,500	25,900	19,100	6,700	1,100	1,600	3,700	98,800	31,800	117,400	10,100	6,700	17,100	1,400	9,200	418,000	32,700	3,000	1,360,000

Table 2-8b
DRAFT

Projected Future Tule Subbasin Surface Water Budget

	Surface Water Outflow (acre-ft)																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
		Streambed Infiltration					Canal Loss			Recharge in Basins				Deep Percolation of Applied Water					
Water Year	Areal Recharge of Precipitation	Tule River		Native Deer Creek		White River	Tule River	Deer Creek	Imported Water	Tule River	Deer Creek	Imported Water	Recycled Water	Tule River	Deer Creek	Imported Water	Recycled Water	Agricultural Pumping	Municipal Pumping
		Success to Oettle Bridge	Oettle Bridge to Turnbull Weir	Before Trenton Weir	Trenton Weir to Homeland Canal														
2019/20	38,000	18,100	4,000	10,200	600	6,200	17,000	2,200	65,100	23,700	2,500	19,800	3,000	17,000	1,050	91,900	1,500	168,800	8,500
2020/21	38,000	18,100	4,000	10,200	600	6,200	17,000	2,200	65,100	23,700	2,500	22,000	3,100	17,000	1,050	92,800	1,500	167,300	8,500
2021/22	38,000	18,100	4,000	10,200	600	6,200	17,000	2,200	65,100	23,700	2,500	22,000	3,100	17,000	1,050	92,800	1,600	166,100	8,500
2022/23	38,000	18,100	4,000	10,200	600	6,200	17,000	2,200	65,100	23,700	2,500	23,667	3,200	17,000	1,050	92,900	1,700	164,800	8,600
2023/24	38,000	18,100	4,000	10,200	600	6,200	17,000	2,200	65,100	23,700	2,500	27,667	3,300	17,300	1,050	93,600	1,700	143,700	8,600
2024/25	38,000	18,100	4,000	10,200	600	6,200	18,100	2,200	62,300	25,200	2,500	28,567	3,400	17,600	1,050	93,100	1,800	141,900	8,700
2025/26	38,000	18,100	4,000	10,200	600	6,200	18,400	2,200	59,500	25,500	2,500	27,967	3,500	17,500	1,250	92,900	1,900	140,900	8,700
2026/27	38,000	18,100	4,000	10,200	600	6,200	18,700	2,200	56,700	25,800	2,500	27,367	3,600	17,400	1,250	92,400	2,000	140,600	8,800
2027/28	38,000	18,100	4,000	10,200	600	6,200	19,000	2,200	53,900	26,100	2,500	26,667	3,600	17,300	1,250	91,500	2,000	140,200	8,800
2028/29	38,000	18,100	4,000	10,200	600	6,200	19,200	2,200	51,100	26,300	2,500	26,067	3,700	17,100	1,250	91,000	2,100	139,600	8,900
2029/30	38,000	17,900	4,000	10,200	600	6,200	19,400	2,200	48,300	26,500	2,500	25,467	3,800	16,700	1,250	90,700	2,200	133,500	8,900
2030/31	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	3,900	16,800	1,250	90,900	2,300	130,000	9,000
2031/32	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,000	16,800	1,250	91,200	2,300	126,600	9,100
2032/33	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,100	16,800	1,250	91,200	2,400	123,200	9,100
2033/34	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,200	16,900	1,250	91,500	2,500	119,900	9,200
2034/35	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,300	16,900	1,250	91,600	2,600	115,100	9,200
2035/36	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,400	16,900	1,250	91,900	2,700	113,100	9,300
2036/37	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,500	16,900	1,350	91,900	2,800	111,400	9,400
2037/38	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,700	17,000	1,350	92,100	2,900	109,800	9,400
2038/39	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,800	17,000	1,350	92,100	3,000	107,600	9,500
2039/40	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,100	1,350	92,300	3,100	104,200	9,600
2040/41	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,100	1,350	92,500	3,100	104,300	9,600
2041/42	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,100	1,350	92,500	3,100	104,300	9,600
2042/43	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,100	1,350	92,500	3,100	104,400	9,600
2043/44	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,000	1,350	92,400	3,100	105,300	9,600
2044/45	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,000	1,350	92,400	3,100	105,300	9,600
2045/46	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,000	1,350	92,400	3,100	105,300	9,600
2046/47	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,000	1,350	92,400	3,100	105,300	9,600
2047/48	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,000	1,350	92,400	3,100	105,400	9,600
2048/49	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,000	1,350	92,400	3,100	105,400	9,600
2049/50	38,000	17,900	4,000	10,100	600	6,200	19,400	2,100	48,300	26,500	2,500	25,467	4,900	17,000	1,350	92,400	3,100	105,500	9,600
2050/51	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,200	9,600
2051/52	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,300	9,600
2052/53	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,400	9,600
2053/54	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,500	9,600
2054/55	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,600	9,600
2055/56	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,600	9,600
2056/57	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,700	9,600
2057/58	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,700	9,600
2058/59	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2059/60	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2060/61	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2061/62	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2062/63	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2063/64	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2064/65	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2065/66	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2066/67	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2067/68	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2068/69	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
2069/70	38,000	17,400	3,800	9,800	500	6,100	19,200	2,100	43,500	25,700	2,500	24,467	4,900	16,900	1,340	87,000	3,100	108,800	9,600
19/20-69/70 Avg	38,000	17,700	3,900	10,000	600	6,200	19,000	2,100	48,900	25,800	2,500	25,000	4,500	17,000	1,300	90,100	2,700	118,300	9,300

Table 2-8b
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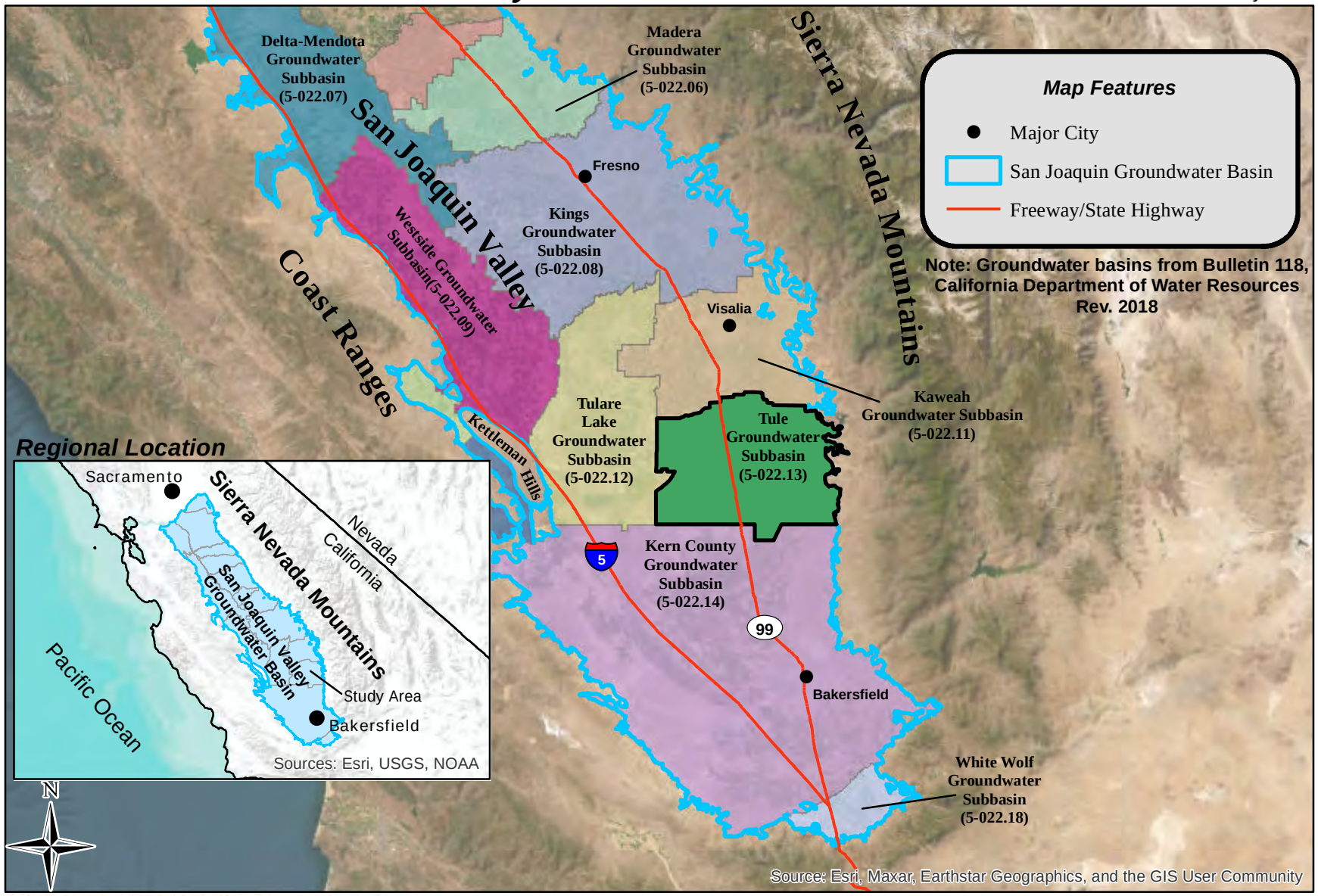
Projected Future Tule Subbasin Surface Water Budget

	Surface Water Outflow (acre-ft)												
	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	
	Evapotranspiration										Surface Outflow		
Water Year	Precipitation Crops/Native	Tule River		Deer Creek		White River	Imported Water	Ag. Cons. Use from Pumping	Recycled Water	Municipal (Landscape ET)	Tule River	Deer Creek	Total Out
		Agricultural Cons. Use	Stream Channel	Agricultural Cons. Use	Stream Channel	Stream Channel	Agricultural Cons. Use		Agricultural Cons. Use				
2019/20	331,000	38,100	400	3,000	300	100	207,400	508,000	2,000	11,200	15,000	0	1,616,000
2020/21	331,000	38,100	400	3,000	300	100	209,000	504,000	2,000	11,400	8,000	0	1,608,000
2021/22	331,000	38,100	400	3,000	300	100	209,000	500,000	2,000	11,600	8,000	0	1,603,000
2022/23	331,000	38,100	400	3,000	300	100	209,000	496,000	2,000	11,800	8,000	0	1,600,000
2023/24	331,000	38,100	400	3,000	300	100	208,900	428,000	2,000	12,000	8,000	0	1,516,000
2024/25	331,000	38,800	400	3,000	300	100	208,100	419,000	2,000	12,300	8,000	0	1,507,000
2025/26	331,000	38,600	400	3,000	300	100	208,200	416,000	2,000	12,500	8,000	0	1,500,000
2026/27	331,000	38,300	400	3,000	300	100	206,500	410,000	2,000	12,700	8,000	0	1,489,000
2027/28	331,000	38,000	400	3,000	300	100	204,900	410,000	2,000	12,900	7,000	0	1,482,000
2028/29	331,000	37,700	400	3,000	300	100	203,300	409,000	2,000	13,200	7,000	0	1,475,000
2029/30	331,000	36,500	400	3,000	300	100	202,700	374,000	2,000	13,400	7,000	0	1,429,000
2030/31	331,000	36,500	400	2,900	300	100	203,600	363,000	2,000	13,600	7,000	0	1,416,000
2031/32	331,000	36,500	400	2,900	300	100	203,500	353,000	2,000	13,900	7,000	0	1,403,000
2032/33	331,000	36,500	400	2,900	300	100	203,400	341,000	2,000	14,100	7,000	0	1,388,000
2033/34	331,000	36,500	400	2,900	300	100	203,300	330,000	2,000	14,400	7,000	0	1,374,000
2034/35	331,000	36,500	400	2,900	300	100	203,100	308,000	2,000	14,700	7,000	0	1,348,000
2035/36	331,000	36,500	400	2,900	300	100	204,000	301,000	2,000	15,000	7,000	0	1,341,000
2036/37	331,000	36,500	400	2,900	300	100	204,000	295,000	2,000	15,200	7,000	0	1,334,000
2037/38	331,000	36,500	400	2,900	300	100	203,900	291,000	2,000	15,500	7,000	0	1,329,000
2038/39	331,000	36,500	400	2,800	300	100	203,900	283,000	2,000	15,800	7,000	0	1,319,000
2039/40	331,000	36,500	400	2,800	300	100	203,800	272,000	2,000	16,100	7,000	0	1,306,000
2040/41	331,000	36,500	400	2,800	300	100	204,500	272,000	2,000	16,100	7,000	0	1,307,000
2041/42	331,000	36,500	400	2,800	300	100	204,500	272,000	2,000	16,100	7,000	0	1,307,000
2042/43	331,000	36,500	400	2,800	300	100	204,500	272,000	2,000	16,100	7,000	0	1,307,000
2043/44	331,000	36,500	400	2,800	300	100	204,500	275,000	2,000	16,100	7,000	0	1,310,000
2044/45	331,000	36,500	400	2,800	300	100	204,500	275,000	2,000	16,100	7,000	0	1,310,000
2045/46	331,000	36,500	400	2,800	300	100	204,500	275,000	2,000	16,100	7,000	0	1,310,000
2046/47	331,000	36,500	400	2,800	300	100	204,500	275,000	2,000	16,100	7,000	0	1,310,000
2047/48	331,000	36,500	400	2,800	300	100	204,500	275,000	2,000	16,100	7,000	0	1,311,000
2048/49	331,000	36,500	400	2,800	300	100	204,500	275,000	2,000	16,100	7,000	0	1,311,000
2049/50	331,000	36,500	400	2,800	300	100	204,500	276,000	2,000	16,100	7,000	0	1,312,000
2050/51	331,000	35,600	400	2,800	300	100	187,500	286,000	2,000	16,100	6,000	0	1,292,000
2051/52	331,000	35,600	400	2,800	300	100	187,500	286,000	2,000	16,100	6,000	0	1,292,000
2052/53	331,000	35,600	400	2,800	300	100	187,500	286,000	2,000	16,100	6,000	0	1,292,000
2053/54	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,293,000
2054/55	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,293,000
2055/56	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,293,000
2056/57	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,293,000
2057/58	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,293,000
2058/59	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2059/60	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2060/61	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2061/62	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2062/63	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2063/64	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2064/65	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2065/66	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2066/67	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2067/68	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2068/69	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
2069/70	331,000	35,600	400	2,800	300	100	187,500	287,000	2,000	16,100	6,000	0	1,294,000
19/20-69/70 Avg	331,000	36,500	400	2,900	300	100	198,200	323,300	2,000	15,000	7,000	0	1,360,000

Groundwater Inflows to be Included in Native Yield Estimates
Groundwater Inflows to be Excluded from the Native Yield Estimates
Surface Water or Groundwater Outflows Not Included Native Yield Estimates

Figures

Tule Subbasin Technical Advisory Committee



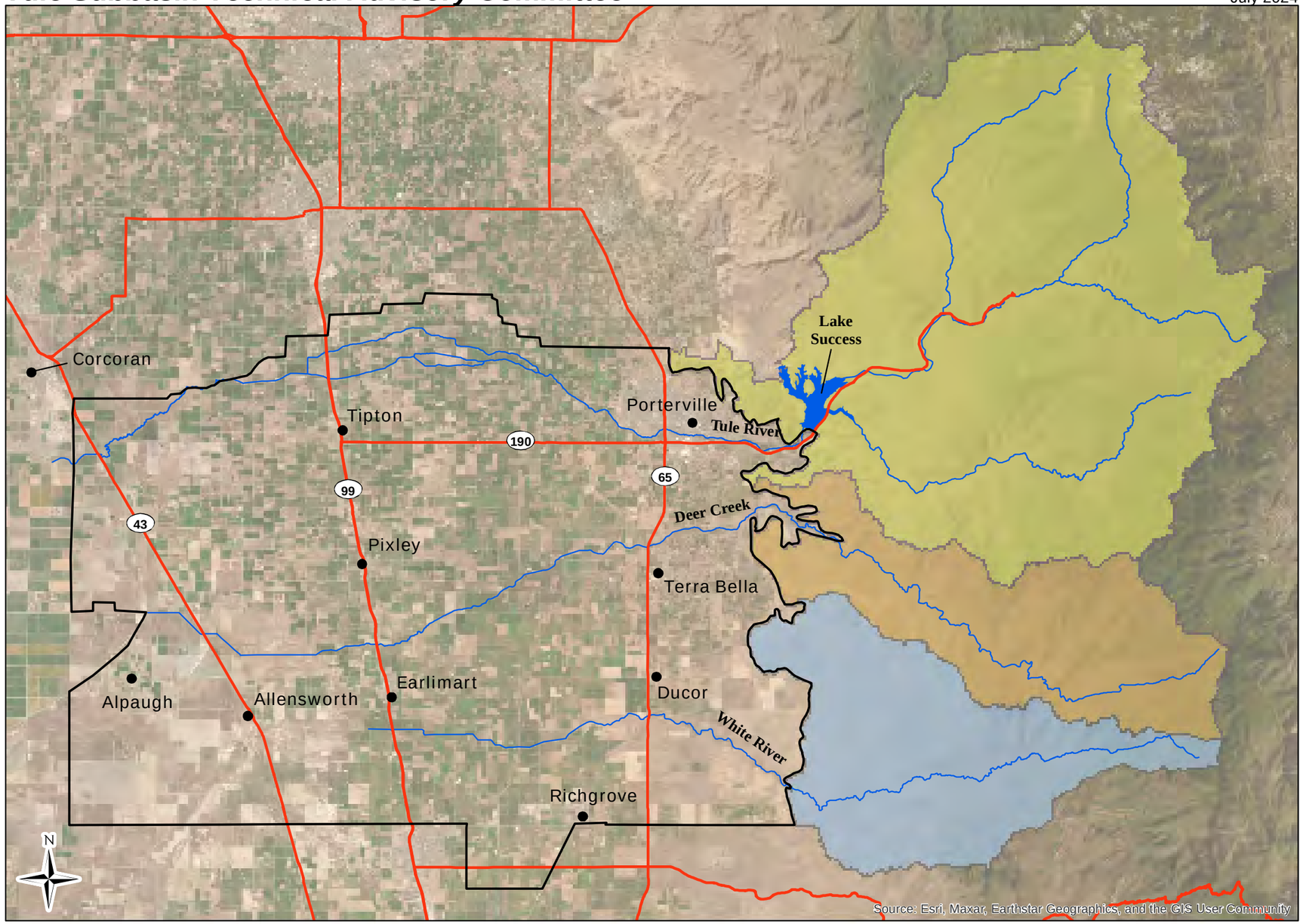
Thomas Harder & Co.
Groundwater Consulting

0 10 20 40 Miles
NAD 83 State Plane Zone 4

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Regional Map
Figure 2-1

Tule Subbasin Technical Advisory Committee

July 2024



NAD 83 State Plane Zone 4

Map Features

- Tule River Drainage Basin
- California Hot Springs Drainage Basin
- White River Drainage Basin
- City or Community
- Major Hydrologic Feature
- Subbasin Boundary
- State Highway/Major Road

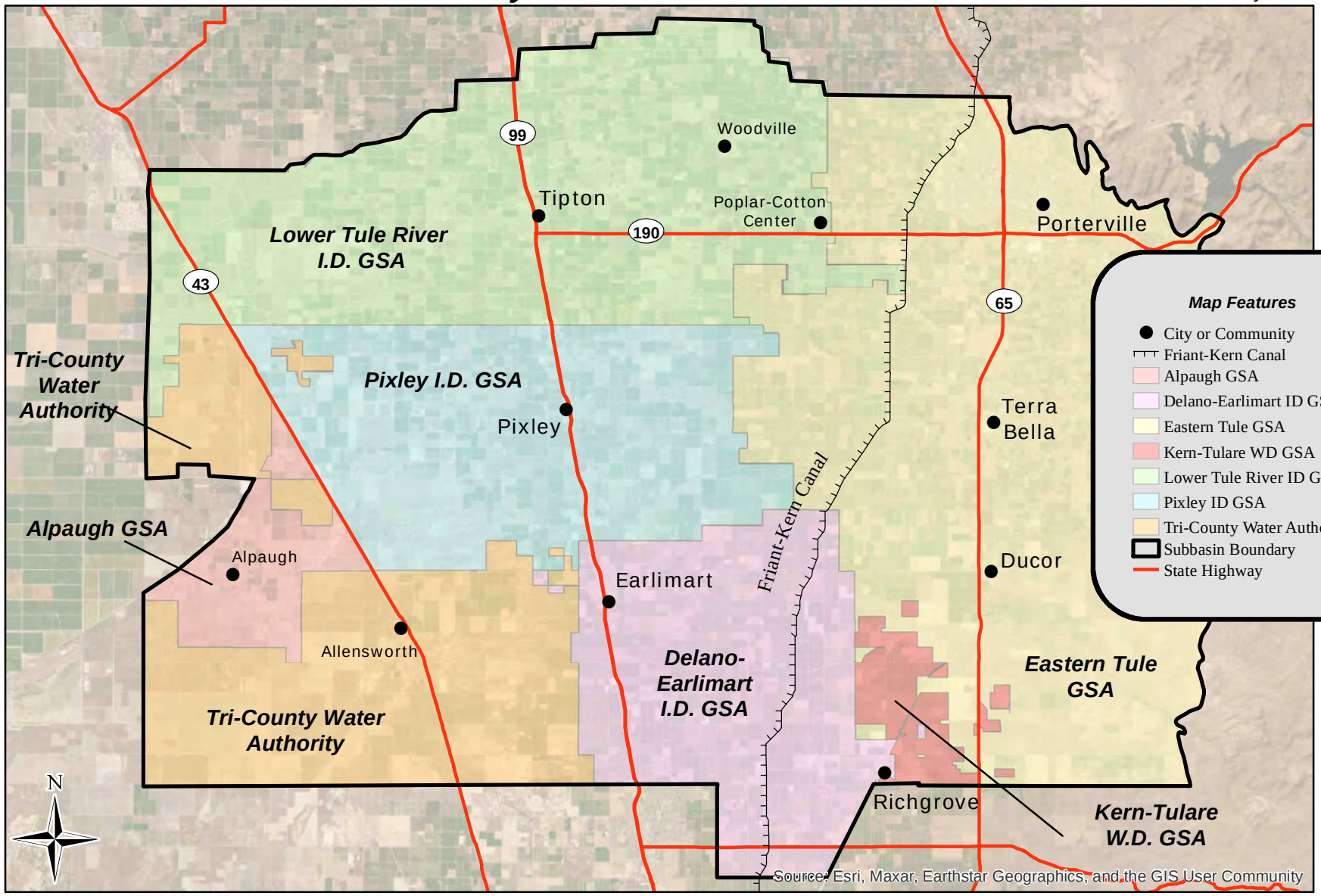
Notes: Drainage basins from California Interagency Watershed Map of 1999, California Department of Water Resources.

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Tule Subbasin Area

Figure 2-2

Tule Subbasin Technical Advisory Committee



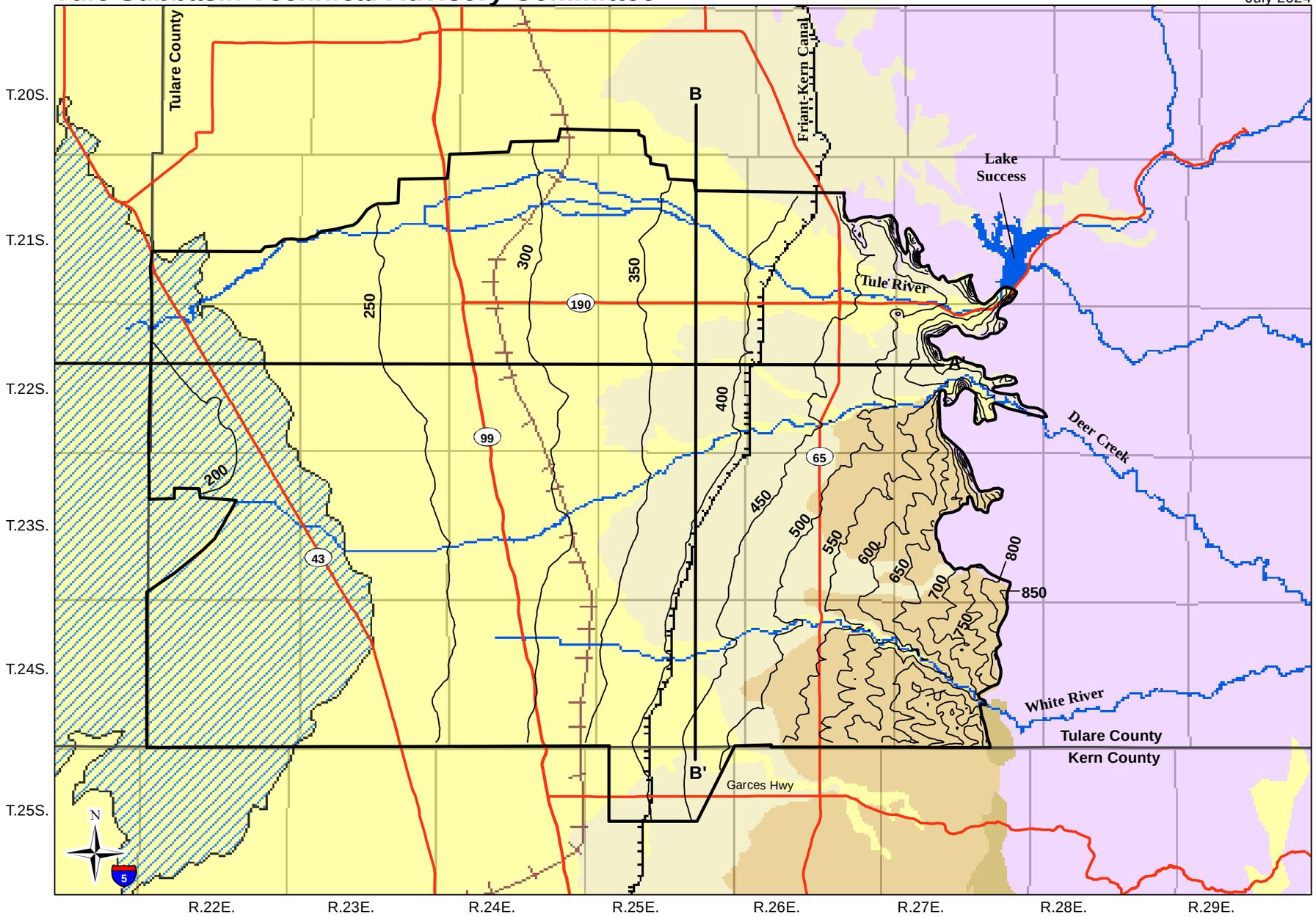
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0 2.5 5 10 Miles
NAD 83 State Plane Zone 4

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GSA Boundaries
Figure 2-3

Tule Subbasin Technical Advisory Committee

July 2024



Map Features

- Younger Alluvium
- Older Alluvium
- Continental Sedimentary Rocks
- Santa Margarita Formation
- Crystalline Basement
- Approximate Eastern Extent of the Corcoran Clay
- Tulare Lake Surface Deposits
- County Border
- Cross Section Location
- Major Hydrologic Feature
- Friant-Kern Canal
- Subbasin Boundary
- State Highway/Major Road

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

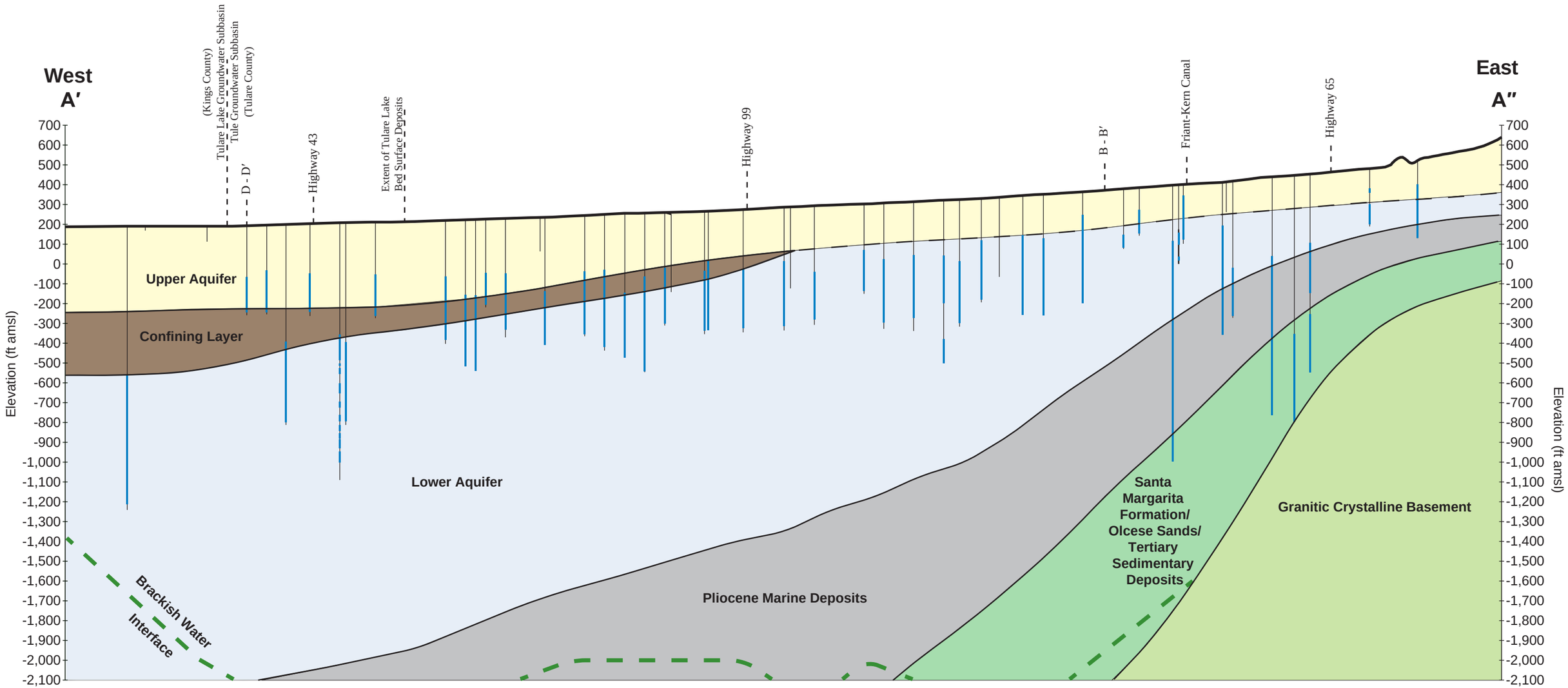
Lake Deposits from California Geological Survey
Geologic Atlas of California Map No. 002
1:250,000 scale, Compiled by A.R. Smith, 1964
and Geologic Atlas of California Map No. 005,
1:250,000 scale, Compiled by: R.A. Matthews and J.L. Burnett

DRAFT-FINAL

Geology and Cross Section Location

Figure 2-4

Thomas Harder & Co.
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Vertical Scale
0
100
200
400
Feet

Horizontal Scale
0 1/2 1 2 Miles

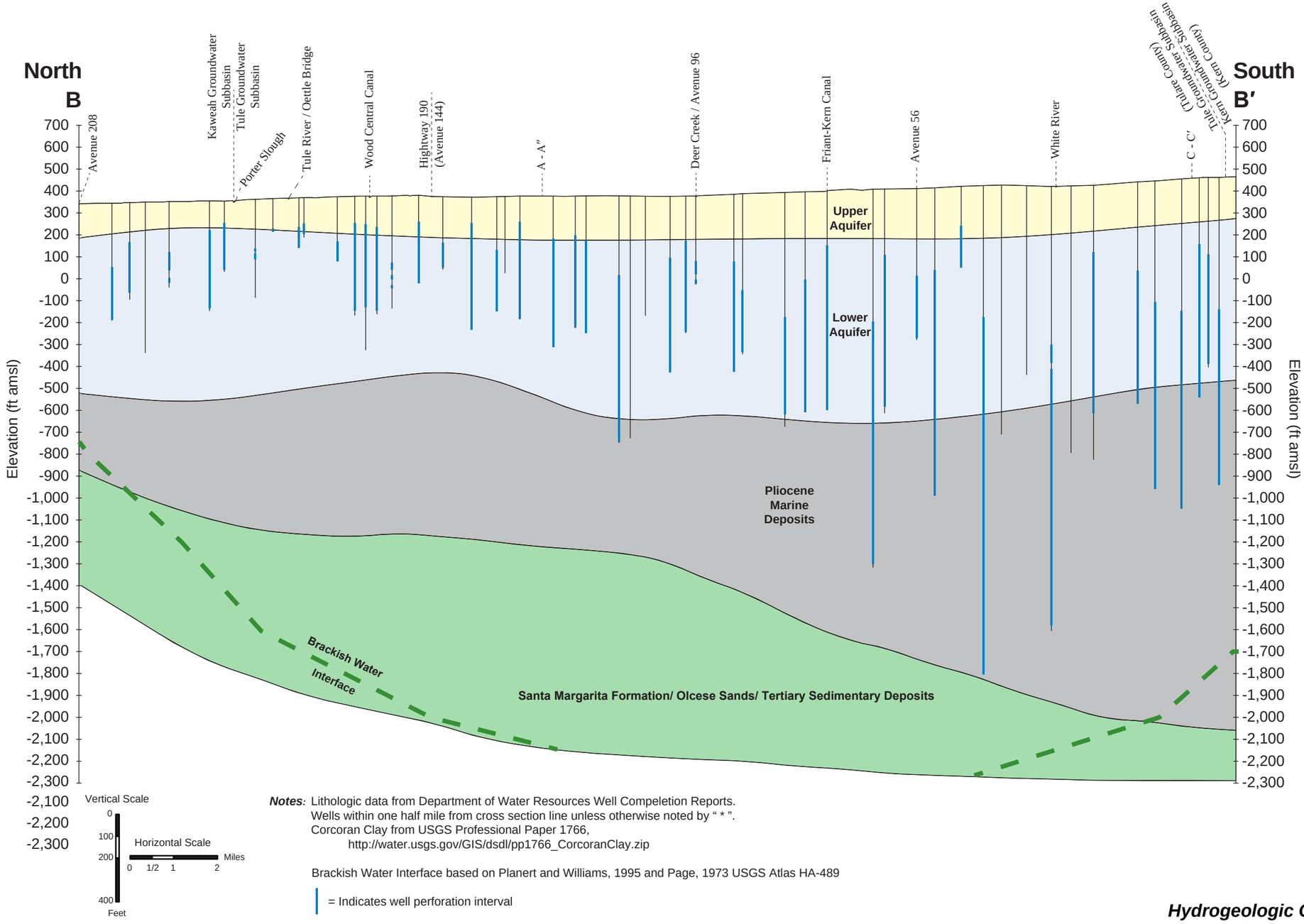
Notes: Lithologic data from Department of Water Resources Well Compeletion Reports.
Wells within one half mile from cross section line unless otherwise noted by " * ".
Corcoran Clay from USGS Professional Paper 1766,
http://water.usgs.gov/GIS/dsdl/pp1766_CorcoranClay.zip

Brackish Water Interface based on Planert and Williams, 1995 and Page, 1973 USGS Atlas HA-489

= Indicates well perforation interval

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Hydrogeologic Cross Section A'-A"
Tule Groundwater Subbasin
Figure 2-5
July 2024



Notes: Lithologic data from Department of Water Resources Well Compeletion Reports.
Wells within one half mile from cross section line unless otherwise noted by " * ".
Corcoran Clay from USGS Professional Paper 1766,
http://water.usgs.gov/GIS/dsdl/pp1766_CorcoranClay.zip

Brackish Water Interface based on Planert and Williams, 1995 and Page, 1973 USGS Atlas HA-489

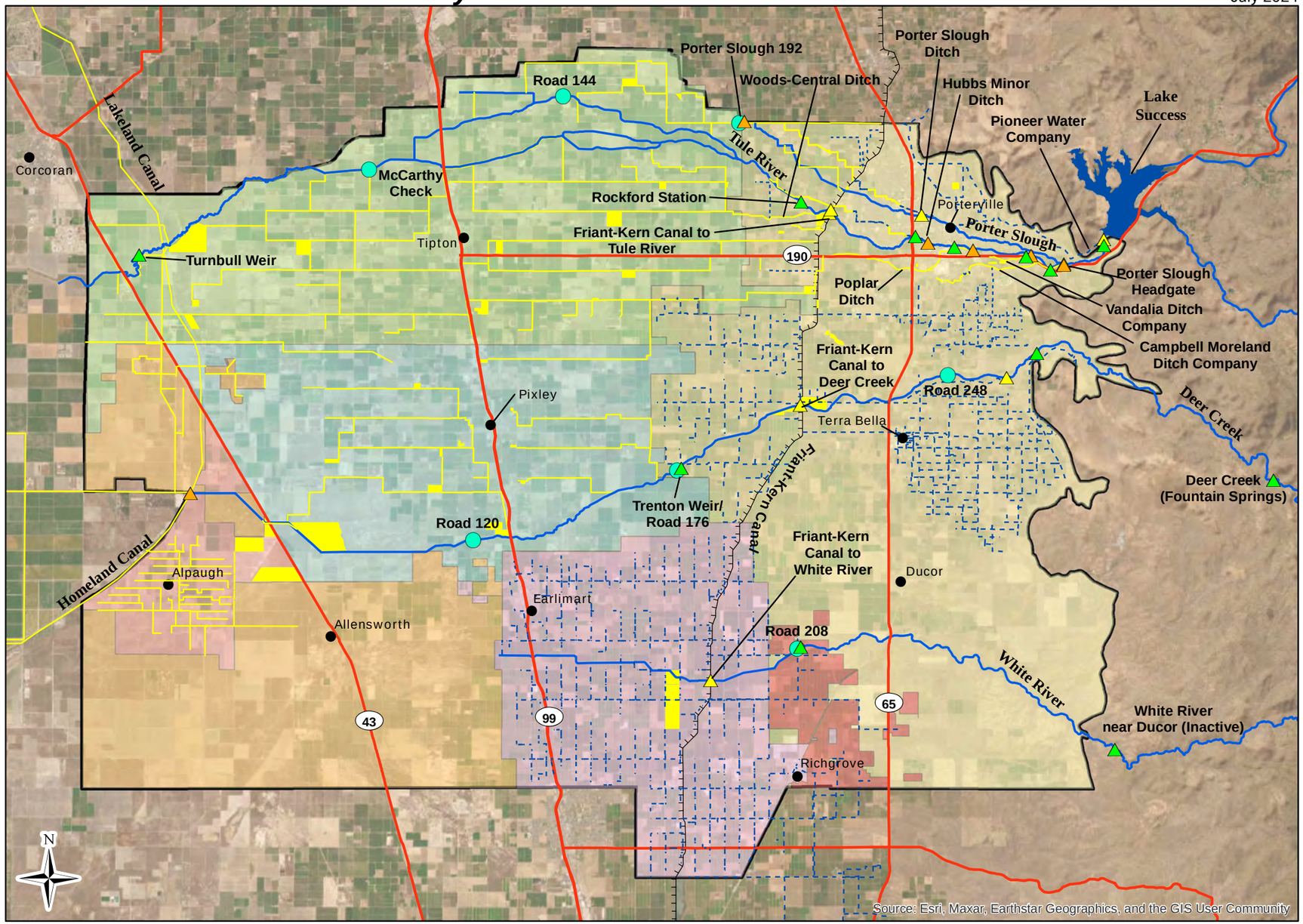
| = Indicates well perforation interval

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Hydrogeologic Cross Section B-B'
Tule Groundwater Subbasin
Figure 2-6
July 2024

Tule Subbasin Technical Advisory Committee

July 2024



Map Features

- Diversion Headgate
- Diversion Gage
- Instream Gage
- QM
- City or Community
- Canal
- Pipe
- Major Hydrologic Feature
- Friant-Kern Canal
- Recharge Basin
- Alpaugh GSA
- Delano-Earlimart ID GSA
- Eastern Tule GSA
- Kern-Tulare WD GSA
- Lower Tule River ID GSA
- Pixley ID GSA
- Tri-County Water Authority
- Subbasin Boundary
- Freeway/State Highway

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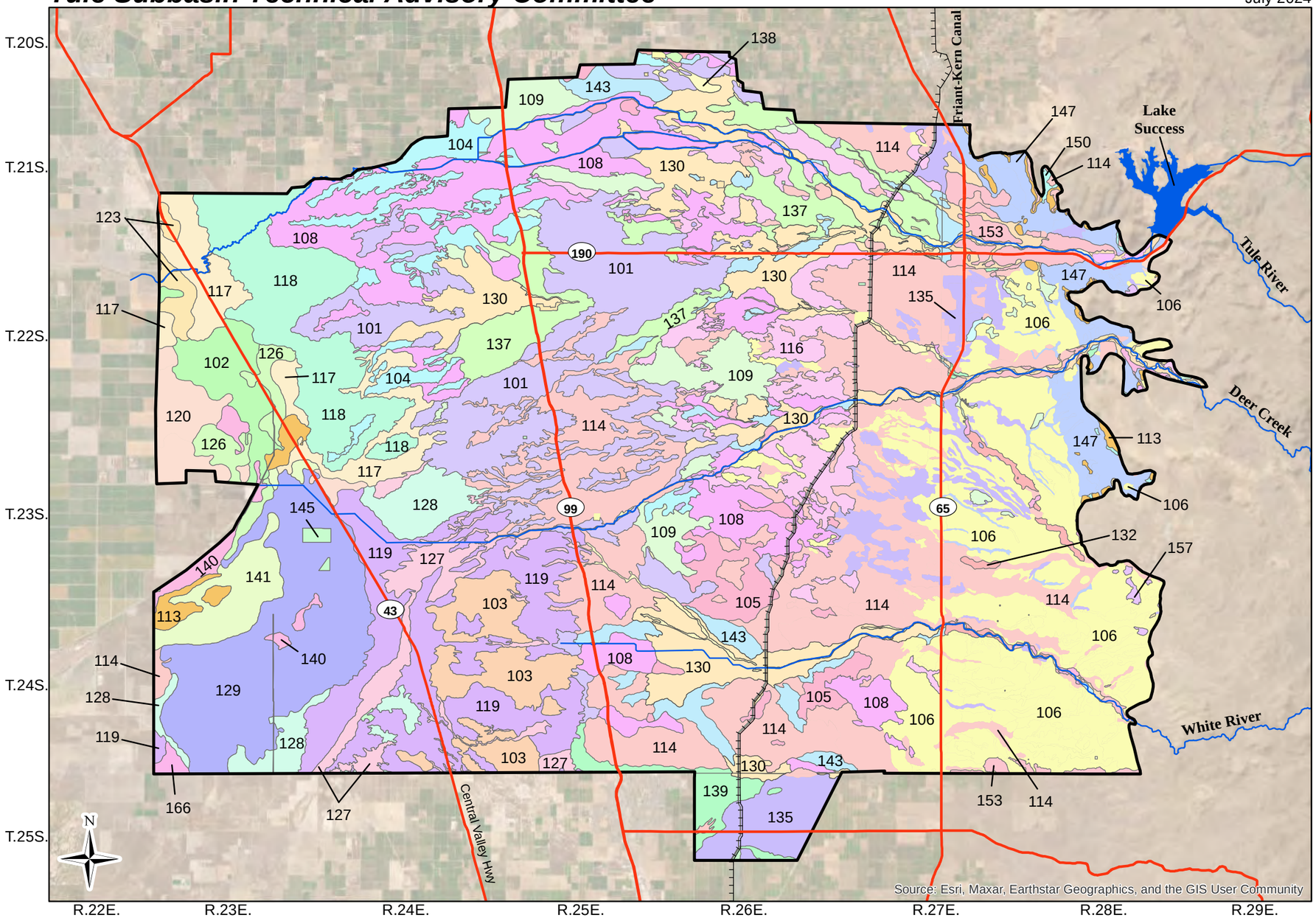
DRAFT-FINAL

Surface Water Features in the Tule Subbasin and Vicinity

Figure 2-7

Tule Subbasin Technical Advisory Committee

July 2024



Map Features

- 101 - Akers-Akers, saline-sodic, complex, 0 to 2 percent slopes
- 102 - Armona sandy loam, partially drained, 0 to 1 percent slopes
- 103 - Atesh-Jerryslu association, 0 to 2 percent slopes
- 104 - Biggriz-Biggriz, saline-sodic, complex, 0 to 2 percent slopes
- 105 - Calgro-Calgro, saline-sodic, complex, 0 to 2 percent slopes
- 106 - Centerville clay, 0 to 30 percent slopes
- 108 - Colpien loam, 0 to 2 percent
- 109 - Crosscreek-Kai association, 0 to 2 percent slopes
- 113 - Cibo clay, 15 - 30 percent slopes
- 114 - Exeter loam, 0 to 5 percent slopes
- 116 - Flamen loam, 0 to 2 percent slopes
- 117 - Gambogy loam, drained, 0 to 1 percent slopes
- 118 - Gambogy-Biggriz, saline-sodic, association, drained, 0 to 2 percent slopes
- 119 - Gareck-Garces association, 0 to 2 percent slopes
- 120 - Gepford silty clay, partially drained, 0 to 1 percent slopes
- 123 - Grangeville fine sandy and silty loam, saline-sodic, 0 to 1 percent slopes
- 126 - Houser silty clay, drained, 0 to 1 percent slopes
- 127 - Kimberlina fine sandy loam, 0 to 2 percent slopes
- 128 - Lethent silt loam, 0 to 1 percent slopes
- 129 - Nahrub silt loam, overwashed, 0 to 1 percent slopes
- 130 - Nord fine sandy loam, 0 to 2 percent slopes
- 132 - Greenfield sandy loam, 0 to 5 percent slopes
- 134 - Riverwash/Havala loam, 0 to 2 percent slopes
- 135 - San Joaquin loam, 0 to 2 percent slopes
- 137 - Tagus loam, 0 to 2 percent slopes
- 138 - Tujunga loamy sand, 0 to 2 percent slopes
- 139 - Honcut sandy loam, 0 to 2 percent slopes
- 140 - Westcamp silt loam, partially drained, 0 to 2 percent slopes
- 141 - Posochanet silt loam, 0 to 2 percent slopes
- 143 - Yettem sandy loam, 0 to 2 percent slopes
- 144 - Youd loam, 0 to 1 percent slopes
- 145 - Water, perennial
- 146 - Pits
- 147 - Porterville clay, 0 to 15 percent slopes
- 150 - Porterville cobbly clay, 2 to 15 percent slopes
- 151 - Riverwash; 178; 179
- 152 - Rock outcrop
- 153 - San Emigdio loam
- 157 - Sesame sandy loam, 15 to 30 percent
- 164 - Tujunga Sand
- 166 - Vista coarse sandy loam, 15 to 30 percent slopes; 166ki
- 168 - Vista-Rock outcrop complex, 9 to 50 percent slopes
- 175 - Xerofluvents, flooded
- Major Hydrologic Feature
- Friant-Kern Canal *Friant-Kern Canal and California Aqueduct*

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0 2.5 5 10 Miles

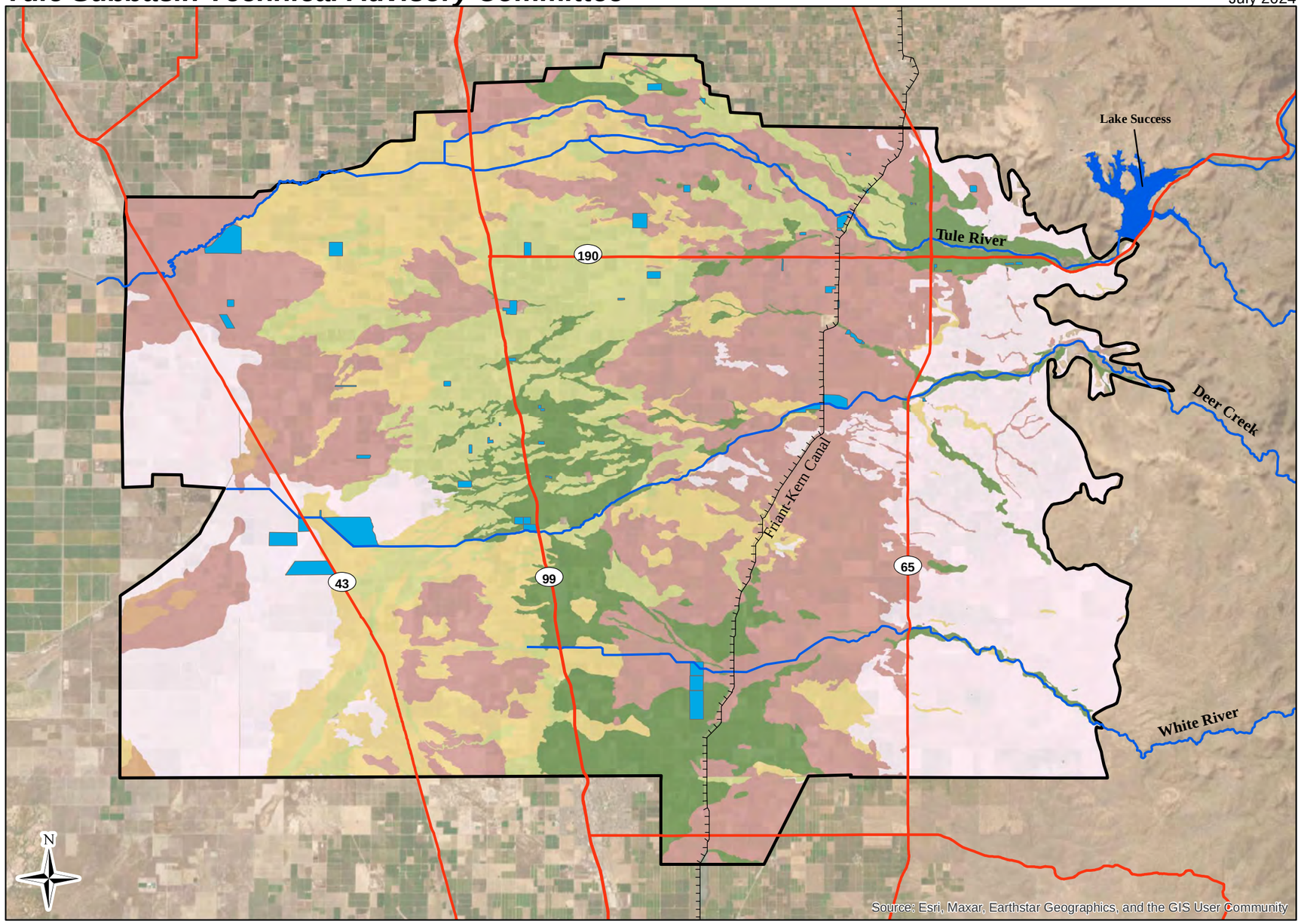
NAD 83 State Plane Zone 4

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.

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Soil Map
Figure 2-8

Tule Subbasin Technical Advisory Committee

July 2024



0 3 6 12 Miles

NAD 83 State Plane Zone 4

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Map Features

SAGBI Index
- Excellent
- Good
- Moderately Good
- Moderately Poor
- Poor
- Very Poor
- Artificial Recharge Basin
- Major Hydrologic Feature
- Friant-Kern Canal
- Subbasin Boundary
- State Highway/Major Road

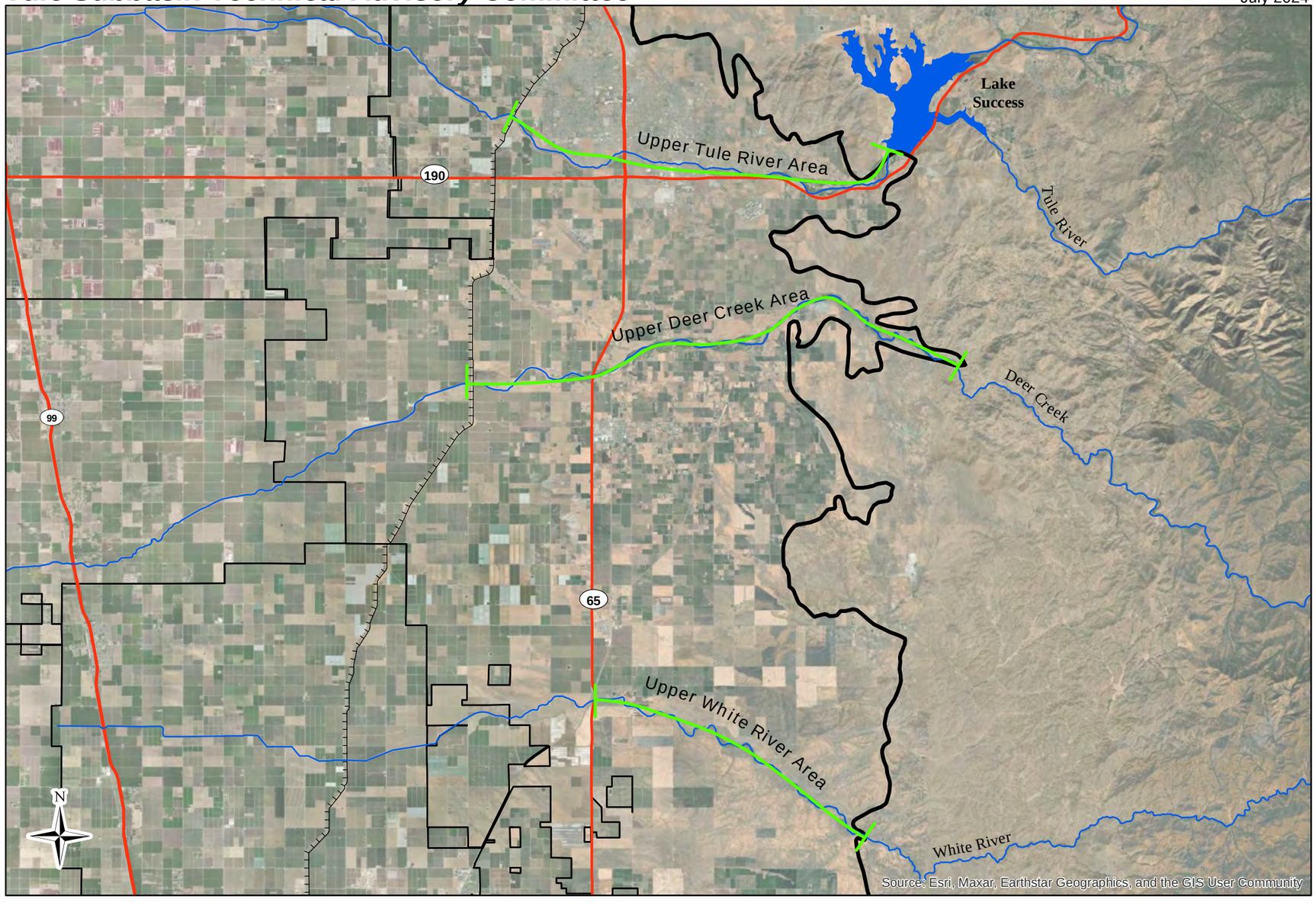
The Soil Agricultural Groundwater Banking Index (SAGBI) is a suitability index for groundwater recharge on agricultural land. It is based on five factors: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition.

Source: SAGBI | Soil Agricultural Groundwater Banking Index interactive map. https://casoilresource.lawr.ucdavis.edu/sagbi/

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Recharge Basins and Favorable Areas for Recharge

Figure 2-9



0 2 4 8 Miles

NAD 83 State Plane Zone 4

Map Features

- Area of Potential Interconnected Surface Water
- Major Hydrologic Feature
- Friant-Kern Canal
- GSA Boundary
- Subbasin Boundary
- State Highway/Major Road

Note: Areas of Potential Interconnected Surface Water identified after review of The Nature Conservancy's ICONS Dataset accessed from https://icons.codefornature.org/ and review of other available data.

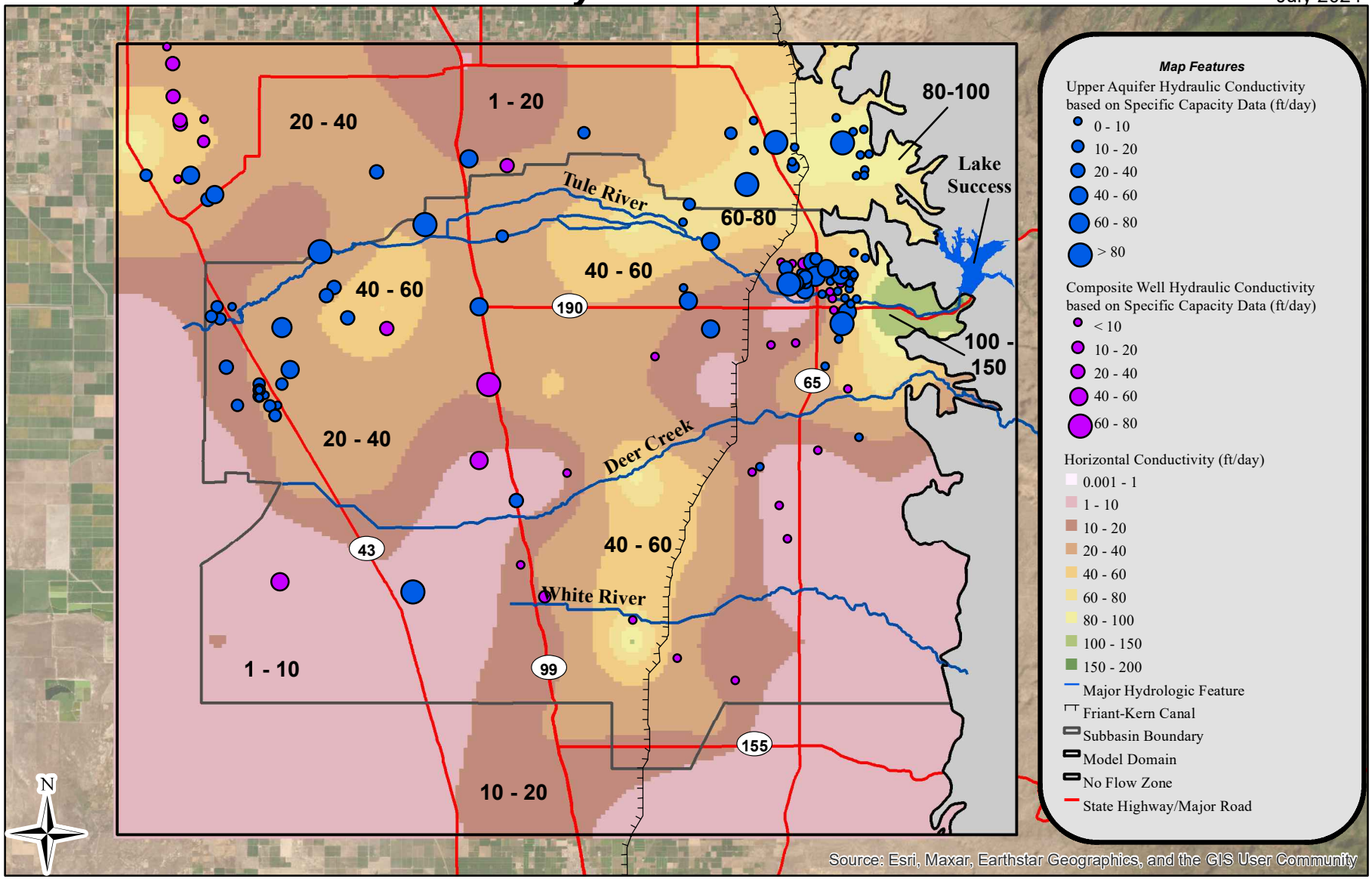
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Areas of Potential Interconnected Surface Water

Figure 2-10

Tule Subbasin Technical Advisory Committee



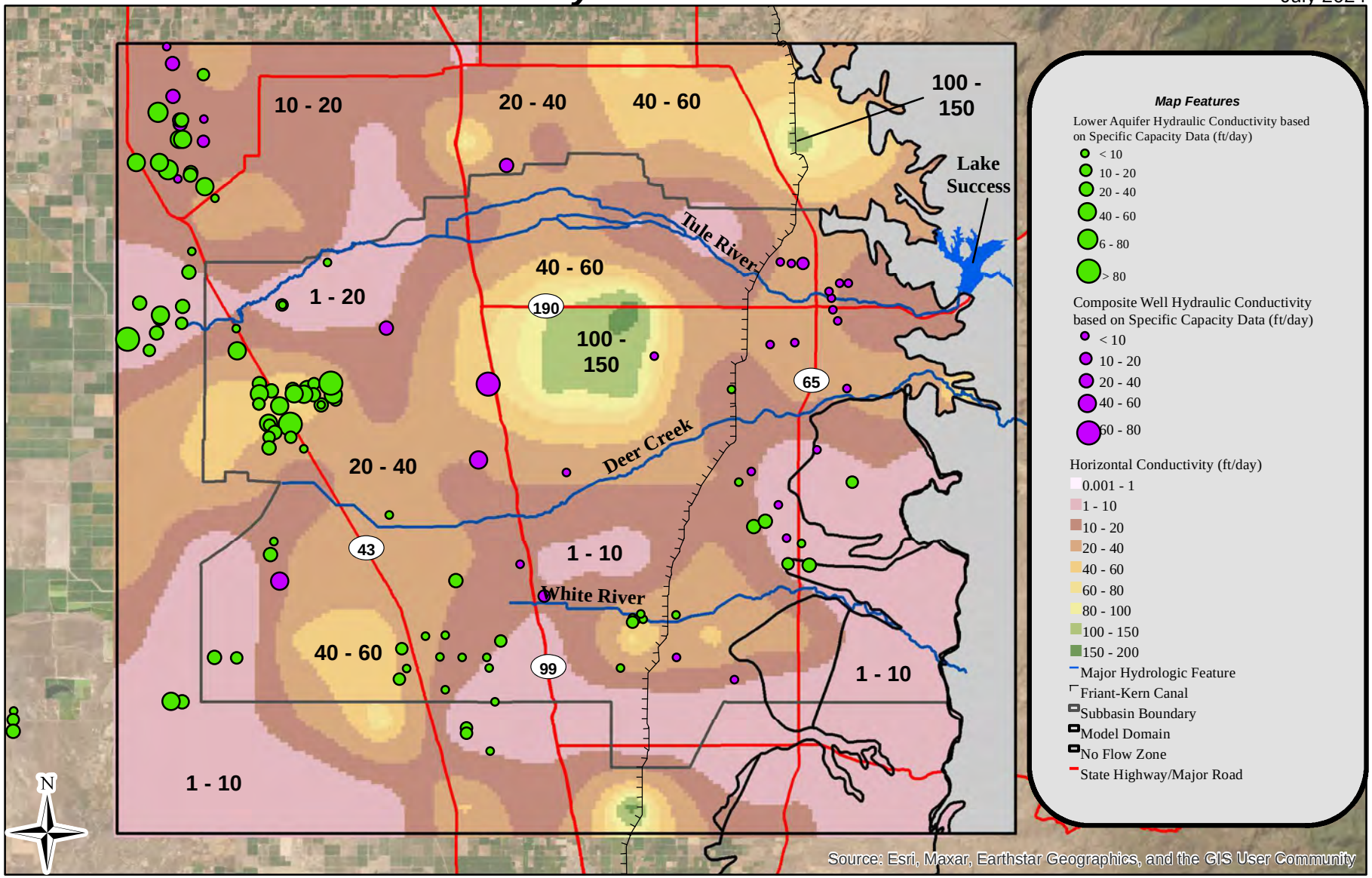
Thomas Harder & Co.
Groundwater Consulting

0 3 6 12 Miles
NAD 83 State Plane Zone 4

Upper Aquifer Horizontal Hydraulic Conductivity

Figure 2-11

Tule Subbasin Technical Advisory Committee



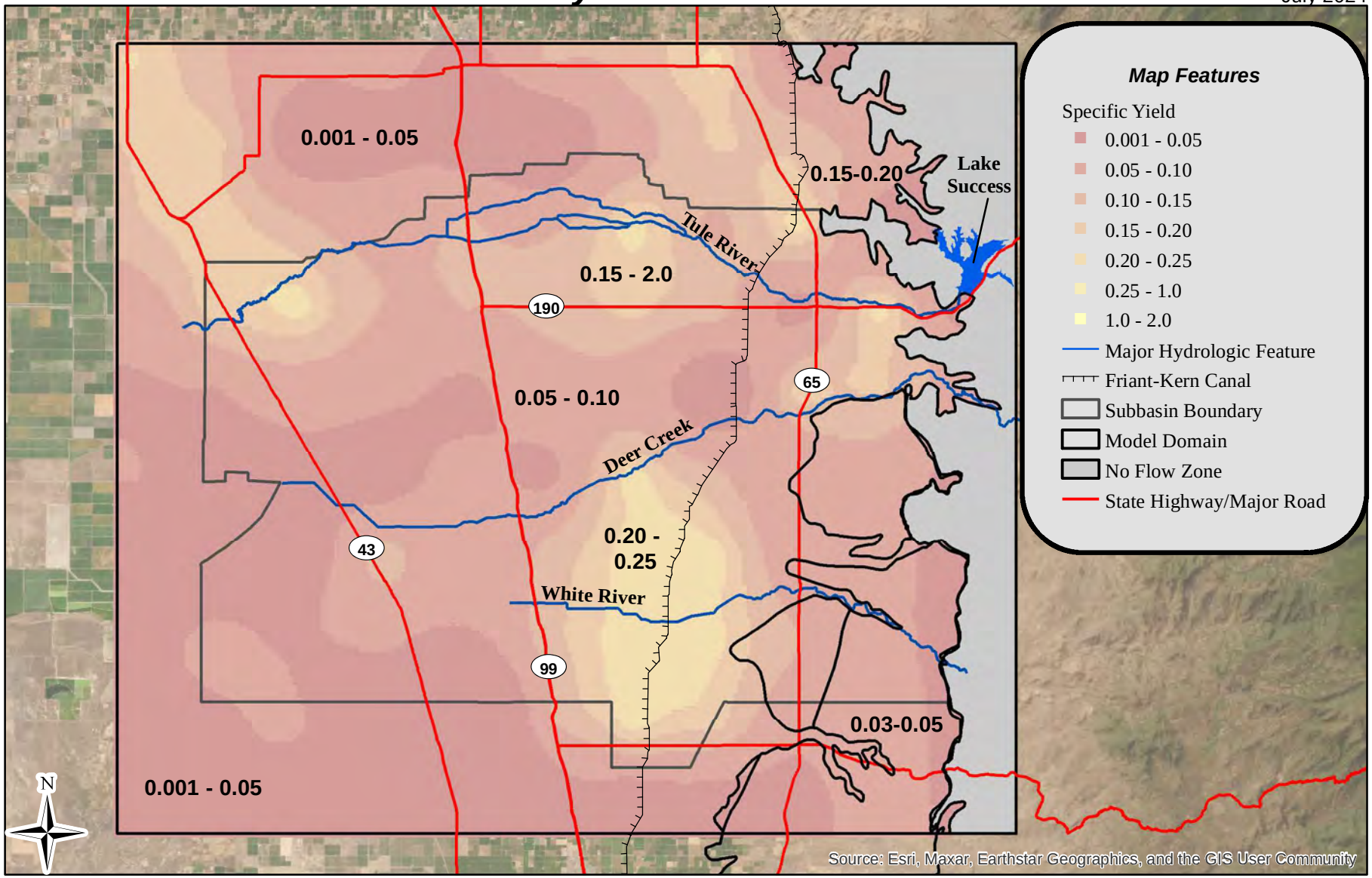
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0 2.5 5 10 Miles
NAD 83 State Plane Zone 4

Lower Aquifer Horizontal Hydraulic Conductivity

Figure 2-12

Tule Subbasin Technical Advisory Committee



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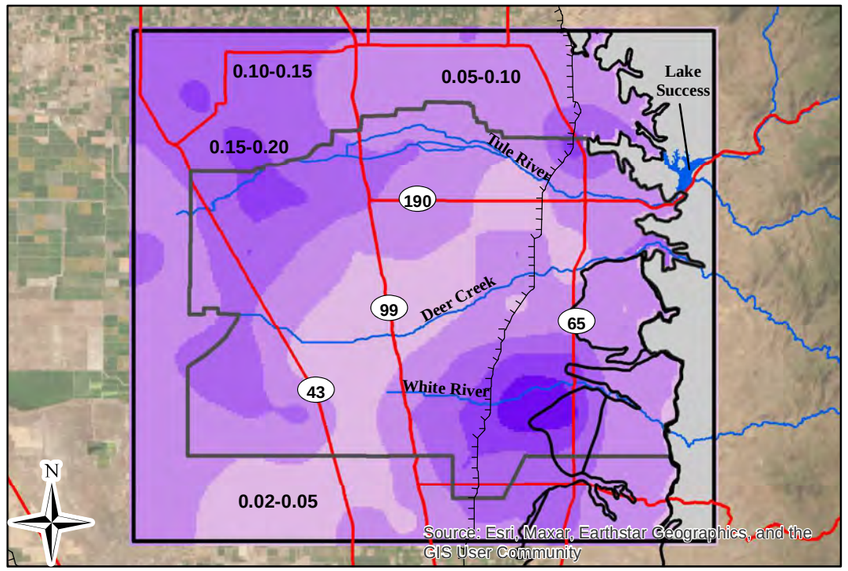
0 3 6 12
Miles
NAD 83 State Plane Zone 4

DRAFT-FINAL

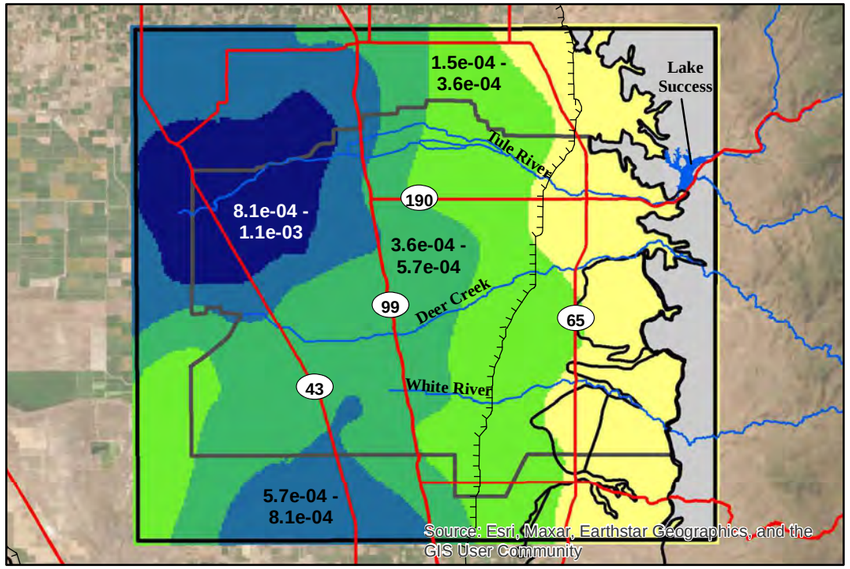
Upper Aquifer Specific Yield

Figure 2-13

Specific Yield



Storativity



Map Features

Specific Yield (Under Unconfined Conditions)
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- 0.15 - 0.20
- 0.20 - 0.25

Storativity (Under Confined Conditions)
- 8.0e-06 - 1.5e-04
- 1.5e-04 - 3.6e-04
- 3.6e-04 - 5.7e-04
- 5.7e-04 - 8.1e-04
- 8.1e-04 - 1.1e-03
- Major Hydrologic Feature
- Friant-Kern Canal
- Subbasin Boundary
- Model Domain
- No Flow Zone
- State Highway/Major Road

Note: Specific Yield values apply to areas of the subbasin where groundwater levels are below the top of the aquifer (primarily the east side of the subbasin).Storativity values apply to areas of the subbasin where groundwater levels are confined beneath the Corcoran clay or other confining beds.

0 5 10 20
Miles

NAD 83 State Plane Zone 4

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Lower Aquifer Storage Properties

Figure 2-14

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

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Figure 2-15a

N

0 1.75 3.5 Miles

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Terra Bella
Eastern Tule GSA
Teviston
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Constituent: Arsenic
MCL: 10 µG/L

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

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Figure 2-15b

N

0 1.75 3.5 Miles

Constituent: Uranium
MCL: 30 pCi/L

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Teviston
Terra Bella
Eastern Tule GSA
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

DRAFT-FINAL
Figure 2-15c

N

0 1.75 3.5 Miles

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Teviston
Terra Bella
Eastern Tule GSA
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Constituent: Hexavalent Chromium
MCL: 10 µG/L

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

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Figure 2-15d

N

0 1.75 3.5 Miles

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Teviston
Terra Bella
Eastern Tule GSA
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Constituent: Total Dissolved Solids
MCL: 1000 mg/L

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

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Figure 2-15e

N

0 1.75 3.5 Miles

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Teviston
Terra Bella
Eastern Tule GSA
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Constituent: 1,2,3-Trichloropropane (1,2,3 TCP)
MCL: 0.005 µG/L

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

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Figure 2-15f

N

0 1.75 3.5 Miles

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Teviston
Terra Bella
Eastern Tule GSA
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Constituent: 1,2-Dibromo-3-chloropropane (DBCP)
MCL: 0.2 µG/L

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

DRAFT-FINAL
Figure 2-15g

N

0 1.75 3.5 Miles

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Teviston
Terra Bella
Eastern Tule GSA
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Constituent: Chloride
MCL: 500 mg/L

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

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Figure 2-15h

N

0 1.75 3.5 Miles

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Teviston
Terra Bella
Eastern Tule GSA
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Constituent: Perchlorate
MCL: 6 µG/L

Tule Subbasin
Sustainable Groundwater Management Act

Constituent of Concern MCL Exceedances 2005-2023

Legend

- MCL Exceedance Locations
- County Boundary
- Tule Subbasin Boundary
- GSA Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

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Figure 2-15i

N

0 1.75 3.5 Miles

Waukena
Corcoran
Plainview
Strathmore
Woodville
LTRID GSA
Tipton
Poplar
Porterville
Lake Success
Kings County
Tulare County
Pixley
Pixley ID GSA
Teviston
Terra Bella
Eastern Tule GSA
Ducor
Alpaugh GSA
Alpaugh
Earlimart
Allensworth
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Constituent: Nitrate as N
MCL: 10 mg/L

Tule Subbasin
Sustainable Groundwater Management Act

Upper Aquifer Ambient Arsenic 2018 - 2023

Legend

Ambient Arsenic (µG/L)

- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+
- Tule Subbasin Boundary
- GSA Boundary
- County Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Ambient Upper Aquifer Arsenic (µG/L)

- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+

DRAFT-FINAL
Figure 2-16a

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Corcoran
Plainview
Strathmore
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
LTRID GSA
Tipton
Lake Success
Porterville
Porter Slough
Poplar
Kings County
Tulare County
Pixley
Pixley ID GSA
Terra Bella
Eastern Tule GSA
Friant-Kern Canal
Teviston
Deer Creek
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
White River
TCWA GSA
DEID GSA
KTWD GSA
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Upper Aquifer Ambient Uranium 2018 - 2023

Legend

Ambient Uranium (pCi/L)

- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 10.0
- 10.0 - 15.0

- Tule Subbasin Boundary
- GSA Boundary
- County Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Ambient Upper Aquifer Uranium (pCi/L)

- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 10.0
- 10.0 - 15.0
- 15.0+

DRAFT-FINAL
Figure 2-16b

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
South Branch Tule River
Middle Branch Tule River
Tule River
Woodville
LTRID GSA
Tipton
Poplar
Lake Success
Porterville
Porter Slough
Kings County
Tulare County
Pixley
Pixley ID GSA
Terra Bella
Eastern Tule GSA
Friant-Kern Canal
Teviston
Deer Creek
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
White River
TCWA GSA
DEID GSA
KTWD GSA
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Upper Aquifer Ambient Hexavalent Chromium 2018 - 2023

Legend

Ambient Hexavalent Chromium (µG/L)

- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+
- Tule Subbasin Boundary
- GSA Boundary
- County Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Ambient Upper Aquifer Hexavalent Chromium (µG/L)

- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+

DRAFT-FINAL
Figure 2-16c

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5 Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
LTRID GSA
Tipton
Poplar
Lake Success
Porterville
Porter Slough
Kings County
Tulare County
Pixley
Pixley ID GSA
Terra Bella
Eastern Tule GSA
Friant-Kern Canal
Teviston
Deer Creek
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
White River
TCWA GSA
DEID GSA
KTWD GSA
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Upper Aquifer Ambient 1,2,3-TCP 2018 - 2023

Legend

Ambient 1,2,3-TCP (µG/L)

- 0.0 - 0.00125
- 0.00125 - 0.0025
- 0.0025 - 0.00375
- 0.00375 - 0.005
- 0.005+
- Tule Subbasin Boundary
- GSA Boundary
- County Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Ambient Upper Aquifer 1,2,3-TCP (µG/L)

- 0.0 - 0.00125
- 0.00125 - 0.0025
- 0.0025 - 0.00375
- 0.00375 - 0.005
- 0.005+

DRAFT-FINAL
Figure 2-16d

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Corcoran
Plainview
Strathmore
Lake Success
Woodville
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
LTRID GSA
Tipton
Poplar
Porterville
Porter Slough
Kings County
Tulare County
Pixley
Pixley ID GSA
Terra Bella
Eastern Tule GSA
Friant-Kern Canal
Teviston
Deer Creek
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
White River
TCWA GSA
DEID GSA
KTWD GSA
Richgrove
Tulare County
Kern County
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Upper Aquifer Ambient Total Dissolved Solids 2018 - 2023

Legend

Total Dissolved Solids (mg/L)
- 100.0 - 250.0
- 250.0 - 500.0
- 500.0 - 750.0

Tule Subbasin Boundary
GSA Boundary
County Boundary
Lake Success
Friant-Kern Canal
Waterways
Major Roads
Roads

Ambient Upper Aquifer Total Dissolved Solids (mg/L)
- 100.0 - 250.0
- 250.0 - 500.0
- 500.0 - 750.0

DRAFT-FINAL
Figure 2-16e

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5 Miles

Waukena
Plainview
Strathmore
Corcoran
Tule River
North Branch Tule River
South Branch Tule River
Middle Branch Tule River
Woodville
Lake Success
Tipton
Poplar
Porterville
Porter Slough
Kings County
Tulare County
Pixley
Terra Bella
Friant-Kern Canal
Teviston
Deer Creek
Ducor
Alpaugh
Earlimart
Allensworth
White River
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Upper Aquifer Ambient DBCP 2018 - 2023

Legend

Ambient DBCP (µG/L)

- 0.0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.15
- 0.15 - 0.2
- 0.2+
- Tule Subbasin Boundary
- GSA Boundary
- County Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Ambient Upper Aquifer DBCP (µG/L)

- 0.0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.15
- 0.15 - 0.2
- 0.2+

DRAFT-FINAL
Figure 2-16f

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lake Success
LTRID GSA
Tipton
Porterville
Poplar
Porter Slough
Kings County
Tulare County
Pixley
Pixley ID GSA
Terra Bella
Eastern Tule GSA
Teviston
Friant-Kern Canal
Deer Creek
Alpaugh GSA
Alpaugh
Ducor
Earlimart
Allensworth
White River
TCWA GSA
DEID GSA
KTWD GSA
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Upper Aquifer Ambient Nitrate as N 2018 - 2023

Legend

Ambient Nitrate as N (mg/L)
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+
- Tule Subbasin Boundary
- GSA Boundary
- County Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Ambient Upper Aquifer Nitrate as N (mg/L)
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+

DRAFT-FINAL
Figure 2-16g

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
LTRID GSA
Tipton
Lake Success
Porterville
Poplar
Porter Slough
Kings County
Tulare County
Pixley
Terra Bella
Eastern Tule GSA
Pixley ID GSA
Teviston
Friant-Kern Canal
Deer Creek
Alpaugh GSA
Alpaugh
Ducor
Earlimart
Allensworth
White River
KTWD GSA
TCWA GSA
DEID GSA
Richgrove
Tulare County
Kern County
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Ambient Lower Aquifer Arsenic 2018 - 2023

Legend

Ambient Arsenic (µG/L)
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+

Tule Subbasin Boundary
GSA Boundary
County Boundary
Lake Success
Friant-Kern Canal
Waterways
Major Roads
Roads

Ambient Arsenic (µG/L)
0.0 - 2.5
2.5 - 5.0
5.0 - 7.5
7.5 - 10.0
10.0+

DRAFT-FINAL
Figure 2-17a

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lake Success
Porterville
Porter Slough
Tipton
Poplar
Kings County
Tulare County
Pixley
Terra Bella
Friant-Kern Canal
Teviston
Deer Creek
Alpaugh
Earlimart
Ducor
Allensworth
White River
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Ambient Lower Aquifer Uranium 2018 - 2023

Legend

Ambient Uranium (pCi/L)
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 10.0
- 10.0 - 15.0

Tule Subbasin Boundary
GSA Boundary
County Boundary
Lake Success
Friant-Kern Canal
Waterways
Major Roads
Roads

Ambient Uranium (pCi/L)
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 10.0
- 10.0 - 15.0
- 15.0+

DRAFT-FINAL
Figure 2-17b

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lake Success
Porterville
Porter Slough
Tipton
Poplar
Kings County
Tulare County
Pixley
Terra Bella
Friant-Kern Canal
Teviston
Deer Creek
Alpaugh
Earlimart
Ducor
Allensworth
White River
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Ambient Lower Aquifer Hexavalent Chromium 2018 - 2023

Legend

Ambient Hexavalent Chromium (µG/L)
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+

Tule Subbasin Boundary
GSA Boundary
County Boundary
Lake Success
Friant-Kern Canal
Waterways
Major Roads
Roads

Ambient Hexavalent Chromium (µG/L)
0.0 - 2.5
2.5 - 5.0
5.0 - 7.5
7.5 - 10.0
10.0+

DRAFT-FINAL
Figure 2-17c

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5 Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lake Success
Porterville
Porter Slough
Tipton
Poplar
Kings County
Tulare County
Pixley
Terra Bella
Friant-Kern Canal
Teviston
Deer Creek
Ducor
Alpaugh
Earlimart
Allensworth
White River
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Ambient Lower Aquifer 1,2,3-TCP 2018 - 2023

Legend

Ambient 1,2,3-TCP (µG/L)
- 0.0 - 0.00125
- 0.00125 - 0.0025
- 0.0025 - 0.00375
- 0.00375 - 0.005
- 0.005+

Tule Subbasin Boundary
GSA Boundary
County Boundary
Lake Success
Friant-Kern Canal
Waterways
Major Roads
Roads

Ambient 1,2,3-TCP (µG/L)
- 0.0 - 0.00125
- 0.00125 - 0.0025
- 0.0025 - 0.00375
- 0.00375 - 0.005
- 0.005+

DRAFT-FINAL
Figure 2-17d

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lake Success
Porterville
Porter Slough
Tipton
Poplar
Kings County
Tulare County
Pixley
Terra Bella
Friant-Kern Canal
Teviston
Deer Creek
Ducor
Alpaugh
Earlimart
Allensworth
White River
Richgrove
Tulare County
Kern County
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Ambient Lower Aquifer Total Dissolved Solids 2018 - 2023

Legend

Total Dissolved Solids (mg/L)
- 0.0 - 150.0
- 150.0 - 250.0
- 250.0 - 500.0
- 500.0 - 750.0
- 750.0+
- Tule Subbasin Boundary
- GSA Boundary
- County Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Ambient Lower Aquifer Total Dissolved Solids (mg/L)
- 0.0 - 100.0
- 100.0 - 250.0
- 250.0 - 500.0
- 500.0 - 750.0
- 750.0+

DRAFT-FINAL
Figure 2-17e

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lake Success
Porterville
Porter Slough
Tipton
Poplar
Kings County
Tulare County
Pixley
Terra Bella
Friant-Kern Canal
Teviston
Deer Creek
Alpaugh
Earlimart
Ducor
Allensworth
White River
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Ambient Lower Aquifer DBCP 2018 - 2023

Legend

Ambient DBCP (µG/L)
- 0.0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.15
- 0.15 - 0.2
- 0.2+

Tule Subbasin Boundary
GSA Boundary
County Boundary
Lake Success
Friant-Kern Canal
Waterways
Major Roads
Roads

Ambient DBCP (µG/L)
- 0.0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.15
- 0.15 - 0.2
- 0.2+

DRAFT-FINAL
Figure 2-17f

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lake Success
Porterville
Porter Slough
Tipton
Poplar
Kings County
Tulare County
Pixley
Terra Bella
Teviston
Friant-Kern Canal
Deer Creek
Alpaugh
Earlimart
Ducor
Allensworth
White River
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin
Sustainable Groundwater Management Act

Ambient Lower Aquifer Nitrate as N 2018 - 2023

Legend

Ambient Nitrate as N (mg/L)

- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+

- Tule Subbasin Boundary
- GSA Boundary
- County Boundary
- Lake Success
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

Ambient Nitrate as N (mg/L)

- 0.0- 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0+

DRAFT-FINAL
Figure 2-17g

Data based on GAMA Groundwater Information System (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/), June 11, 2024.

N

0 1.75 3.5
Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lake Success
Porterville
Porter Slough
Tipton
Poplar
Kings County
Tulare County
Pixley
Terra Bella
Teviston
Friant-Kern Canal
Deer Creek
Alpaugh
Earlimart
Ducor
Allensworth
White River
Tulare County
Kern County
Richgrove
Delano

Tule Subbasin

Sustainable Groundwater Management Act

Active Water Quality Permits

Program: Animal Waste

Legend

Regulatory Measure Type

- Enrollee - WDR (141)
- WDR (1)
- Major Roads
- Roads
- Community Service Districts
- Tule Subbasin Boundary
- Townships

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

DRAFT-FINAL
Figure 2-18a

0 2.75 Miles

Environ ipsum

4CREEKS

Waukena
Plainview
Strathmore
Woodville
Tipton CSD
Poplar CSD
Porterville
Pixley
Teviston CSD
Terra Bella
Alpaugh CSD
Earlimart
Allensworth CSD
Ducor CSD
Richgrove CSD
Delano

20S 22E 20S 23E 20S 24E 20S 25E 20S 26E 20S 27E 20S 28E 20S 29E
21S 22E 21S 23E 21S 24E 21S 25E 21S 26E 21S 27E 21S 28E 21S 29E
22S 22E 22S 23E 22S 24E 22S 26E 22S 27E 22S 28E
23S 22E 23S 23E 23S 24E 23S 25E 23S 26E 23S 27E 23S 28E 23S 29E
24S 22E 24S 23E 24S 24E 24S 25E 24S 26E 24S 27E 24S 28E 24S 29E
25S 22E 25S 23E 25S 24E 25S 25E 25S 26E 25S 27E 25S 28E

CA 137 CA 190 CA 65 CA 99 CA 43 CA 155

N

Tule Subbasin

Sustainable Groundwater Management Act

Active Water Quality Permits

Program: Stormwater

Legend

Regulatory Measure Type

- Enrollee - NPDES (1)
- Stormwater Construction (39)
- Stormwater Industrial (20)
- Major Roads
- Roads
- Community Service Districts
- Tule Subbasin Boundary
- Townships

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

DRAFT-FINAL
Figure 2-18b

0 2.75 Miles

4CREEKS

Waukena
Plainview
Strathmore
Woodville
Tipton CSD
Poplar CSD
Teviston CSD
Alpaugh CSD
Allensworth CSD
Ducor CSD
Richgrove CSD
Delano

20S 22E | 20S 23E | 20S 24E | 20S 25E | 20S 26E | 20S 27E | 20S 28E | 20S 29E
21S 22E | 21S 23E | 21S 24E | 21S 25E | 21S 26E | 21S 27E | 21S 28E | 21S 29E
22S 22E | 22S 23E | 22S 24E | 22S 26E | 22S 27E | 22S 28E
23S 22E | 23S 23E | 23S 24E | 23S 25E | 23S 26E | 23S 27E | 23S 28E | 23S 29E
24S 22E | 24S 23E | 24S 24E | 24S 25E | 24S 26E | 24S 27E | 24S 28E | 24S 29E
25S 22E | 25S 23E | 25S 24E | 25S 25E | 25S 26E | 25S 27E | 25S 28E

137 | 190 | 65 | 99 | 43 | 155

N

Tule Subbasin

Sustainable Groundwater Management Act

Active Water Quality Permits

Program: Individual Waste Discharge Requirements

Legend

Regulatory Measure Type

- Co-Permitee (1)
- Enrollee - WDR (10)
- Enrollee - Waiver (2)
- Reclamation Requirements (2)
- WDR (23)
- Major Roads
- Roads
- Community Service Districts
- Tule Subbasin Boundary
- Townships

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

DRAFT-FINAL

Figure 2-18c

0 2.75 Miles

4CREEKS

Waukena
Plainview
Strathmore
Tipton CSD
Poplar CSD
Porterville
Pixley
Teviston CSD
Alpaugh CSD
Earlimart
Allensworth CSD
Ducor CSD
Richgrove CSD
Delano

20S 22E 20S 23E 20S 24E 20S 25E 20S 26E 20S 27E 20S 28E 20S 29E
21S 22E 21S 23E 21S 24E 21S 25E 21S 26E 21S 27E 21S 28E 21S 29E
22S 22E 22S 23E 22S 24E 22S 26E 22S 27E 22S 28E
23S 22E 23S 23E 23S 24E 23S 25E 23S 26E 23S 27E 23S 28E 23S 29E
24S 22E 24S 23E 24S 24E 24S 25E 24S 26E 24S 27E 24S 28E 24S 29E
25S 22E 25S 23E 25S 24E 25S 25E 25S 26E 25S 27E 25S 28E

CA 137 CA 190 CA 99 CA 43 CA 65 CA 155

N

Tule Subbasin

Sustainable Groundwater Management Act

Active Water Quality Permits

Program: National Pollutant Discharge Elimination Systems

Legend

Regulatory Measure Type

- 401 Certification (4)
- Co-Permitee (5)
- Enrollee - 401 Certification (2)
- Enrollee - NPDES (1)
- Enrollee - WDR (2)
- WDR (2)
- Waiver (1)
- Major Roads
- Roads
- Community Service Districts
- Tule Subbasin Boundary
- Townships

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

DRAFT-FINAL
Figure 2-18d

Order No.: 2022-0103-DWQ

0 2.75 Miles

4CREEKS

Waukena
Plainview
Strathmore
Woodville
Tipton CSD
Poplar CSD
Porterville
Pixley
Teviston CSD
Terra Bella
Alpaugh CSD
Earlimart
Allensworth CSD
Ducor CSD
Richgrove CSD
Delano

20S 22E 20S 23E 20S 24E 20S 25E 20S 26E 20S 27E 20S 28E 20S 29E
21S 22E 21S 23E 21S 24E 21S 25E 21S 26E 21S 27E 21S 28E 21S 29E
22S 22E 22S 23E 22S 24E 22S 26E 22S 27E 22S 28E
23S 22E 23S 23E 23S 24E 23S 25E 23S 26E 23S 27E 23S 28E 23S 29E
24S 22E 24S 23E 24S 24E 24S 25E 24S 26E 24S 27E 24S 28E 24S 29E
25S 22E 25S 23E 25S 24E 25S 25E 25S 26E 25S 27E 25S 28E

137 190 65 99 43 155

N

Tule Subbasin
Sustainable Groundwater Management Act

Active Remediation Locations

Legend

- Roads
- Major Roads
- Friant-Kern Canal
- Waterways
- County Boundary
- Lake Success
- Tule Subbasin Boundary
- GSA Boundary

Geotracker Cleanup Sites by Type

- Cleanup Program Site
- LUST Cleanup Site
- School
- State Response or NPL
- Voluntary Agreement

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Figure 2-19

N

0 1.5 3 Miles

Waukena
Plainview
Strathmore
Corcoran
North Branch Tule River
Middle Branch Tule River
South Branch Tule River
Tule River
Woodville
Lower Tule River Irrigation District GSA
Lake Success
Porterville
Tipton
Poplar
Porter Slough
Kings County
Tulare County
Pixley
Terra Bella
Pixley ID GSA
Eastern Tule GSA
Teviston
Friant-Kern Canal
Deer Creek
Alpaugh GSA
Alpaugh
Earlimart
Ducor
Allensworth
White River
Tri-County Water Authority GSA
Delano-Earlimart Irrigation District GSA
Kern-Tulare Water District GSA
Richgrove
Tulare County
Kern County
Delano

Tule Subbasin

Sustainable Groundwater Management Act

Tulare Lake Bed Beneficial Use Exemption Areas

Legend

- Tule Subbasin Boundary
- County Boundary
- GSA Boundary
- Friant-Kern Canal
- Waterways
- Major Roads
- Roads

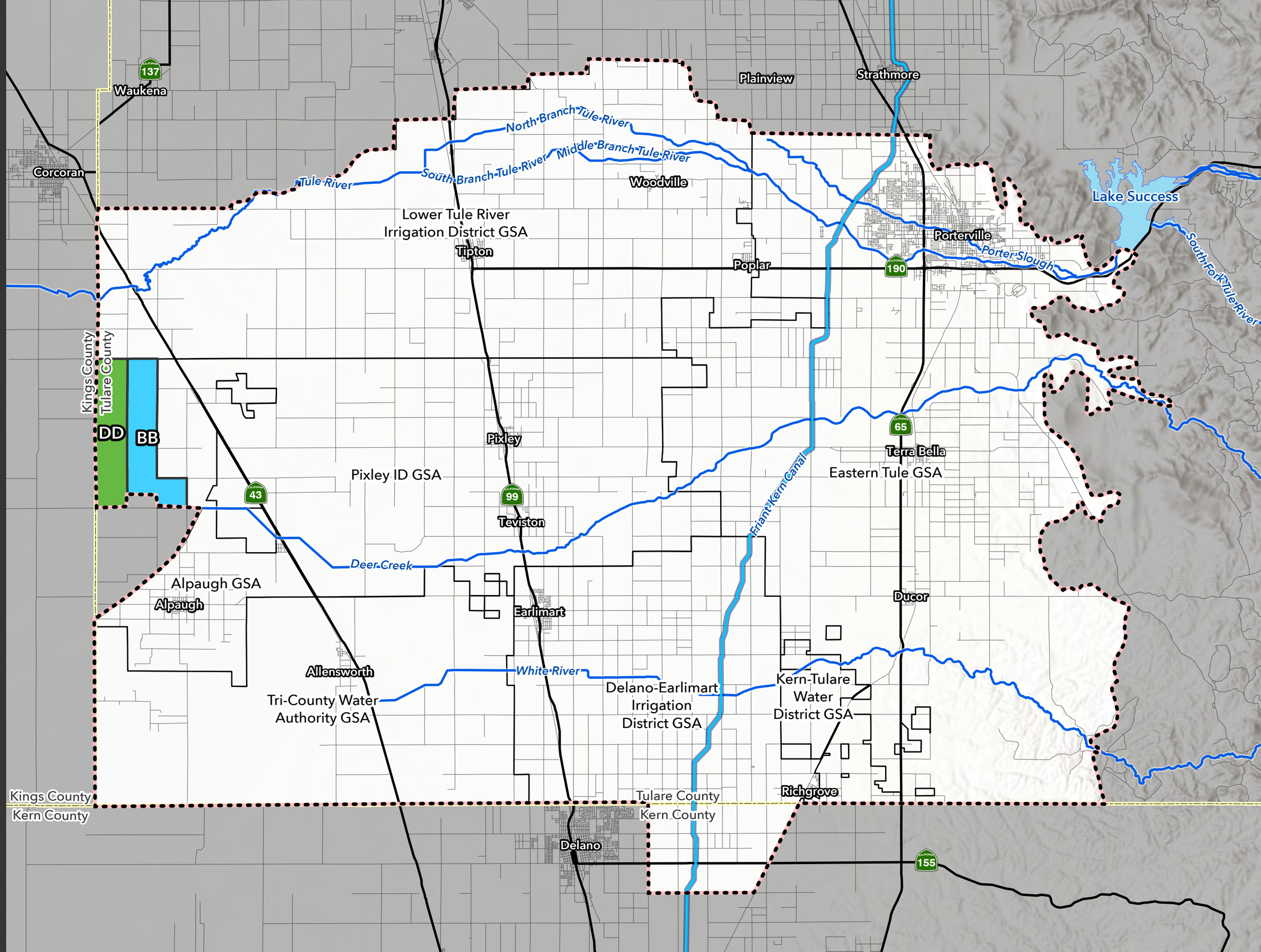
Beneficial Use Exemption Areas

- BB - De-designate to Top of A-Clay (Minimum of 110 feet in depth)
- DD - De-designate to Top of Corcoran Clay

DRAFT-FINAL
Figure 2-20

0 1.5 3 Miles

N



Tule Subbasin
Sustainable Groundwater Management Act

GAMA PBP Grids

Legend

- Roads
- Major Roads
- Waterways
- GAMA PBP Grids
- County Boundary
- Lake Success
- Tule Subbasin Boundary

Groundwater Sustainability Agencies

- Alpaugh GSA
- Delano-Earlimart Irrigation District GSA
- Eastern Tule GSA
- Kern-Tulare Water District GSA
- Lower Tule River Irrigation District GSA
- Pixley ID GSA
- Tri-County Water Authority GSA

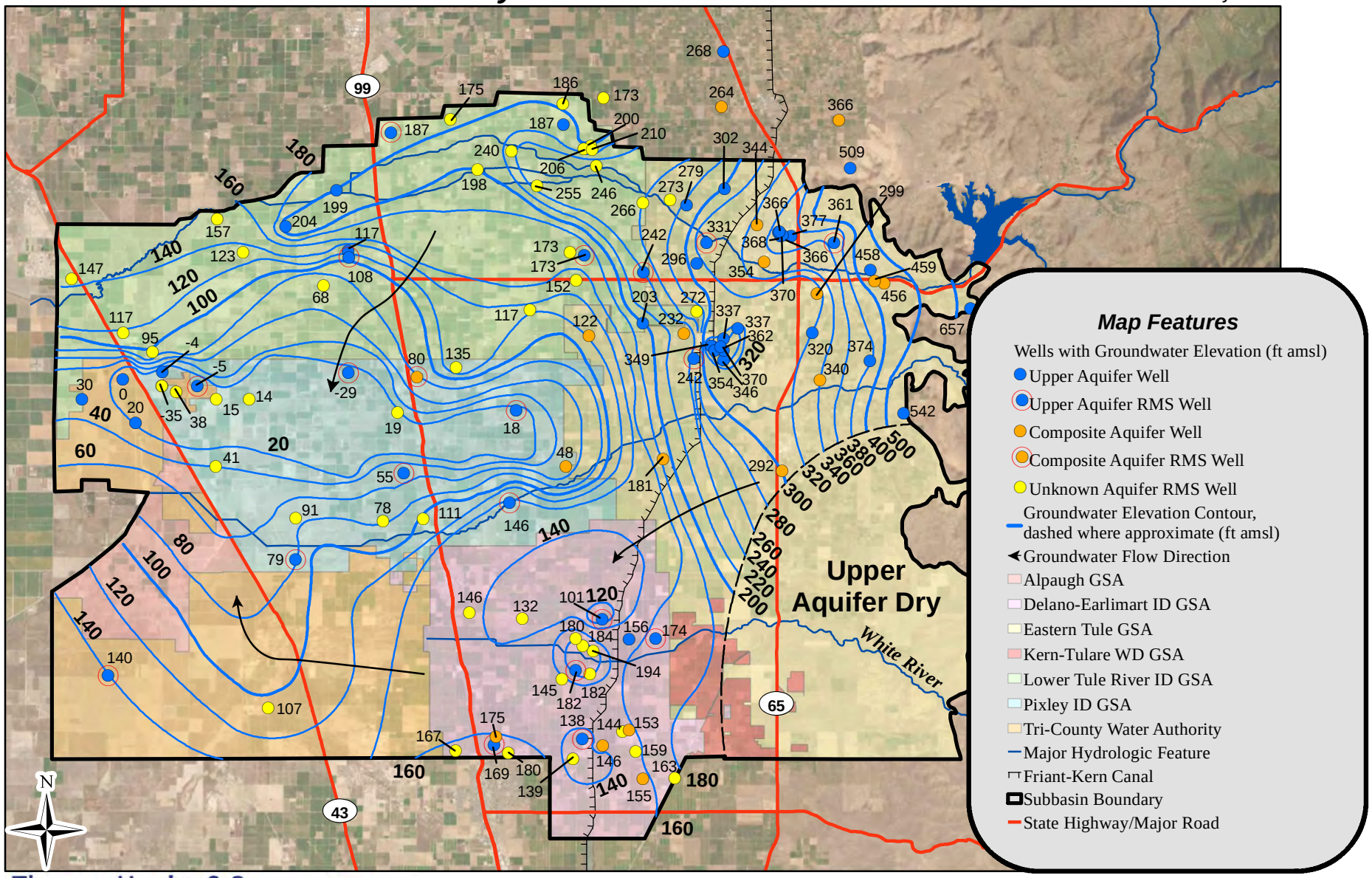
DRAFT-FINAL
Figure 2-21

N

0 1.5 3
Miles

Waukena
Plainview
Strathmore
Lake Success
Woodville
Tipton
Poplar
Porterville
Pixley
Teviston
Terra Bella
Alpaugh
Earlimart
Ducor
Allensworth
Richgrove
Delano
Kings County
Tulare County
Kern County
Tule River
North Branch Tule River
South Branch Tule River
Porter Slough
Deer Creek
White River
Friant-Kern Canal
SJV_Tule1
SJV_Tule2
SJV_Tule3
SJV_Tule4
SJV_Tule5
SJV_Tule6
SJV_Tule7
SJV_Tule8
SJV_Tule9
SJV_Tule10
SJV_Tule11
SJV_Tule12
SJV_Tule13
SJV_Tule14
SJV_Tule15
SJV_Tule16
SJV_Tule17
SJV_Tule18
SJV_Tule19
SJV_Tule20
SJV_Tulare19
SJV_Kern100
SJV_Kern78
SJV_Kern77
SJV_Kern79

Tule Subbasin Technical Advisory Committee



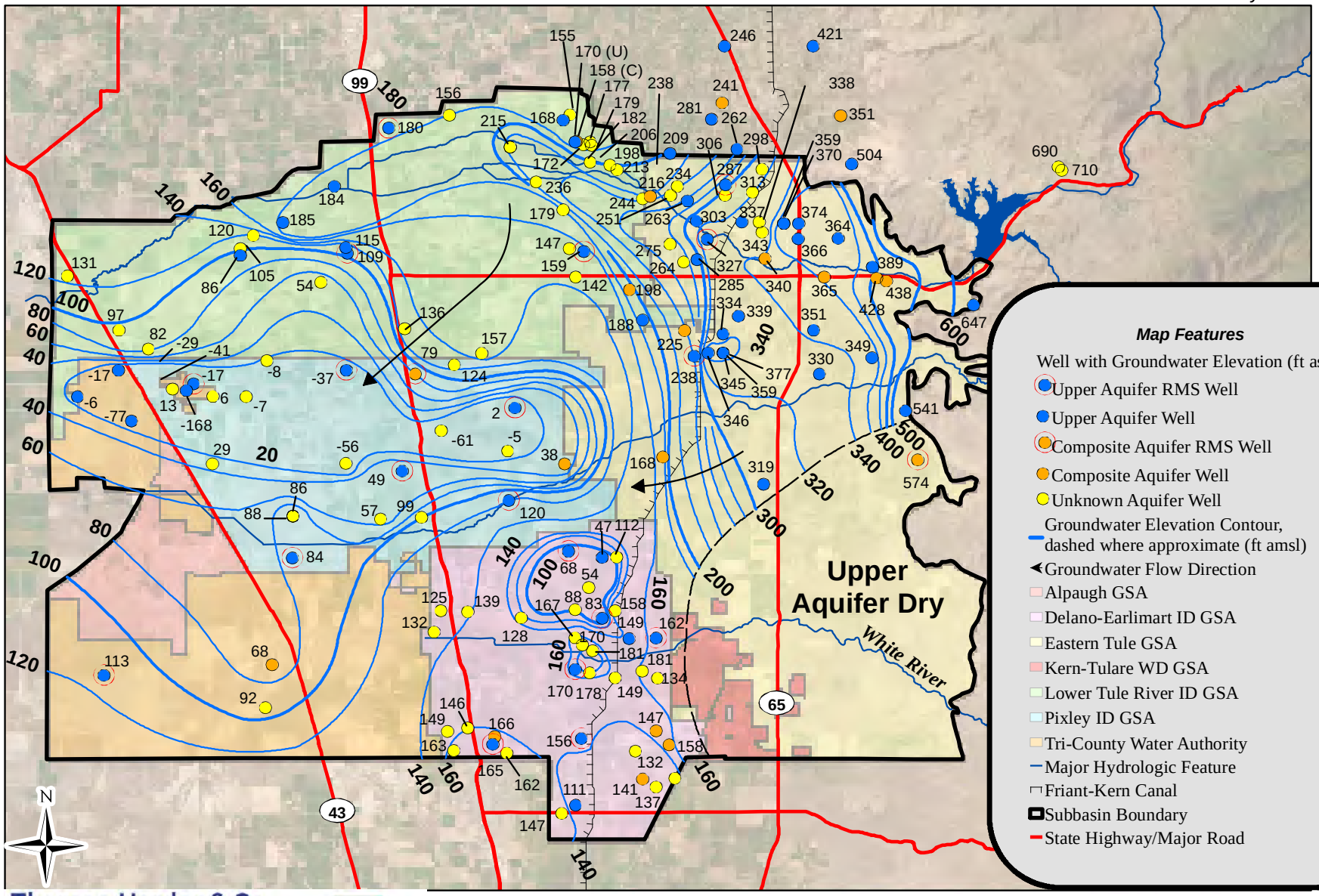
Thomas Harder & Co.
Groundwater Consulting

NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2022 Upper Aquifer Groundwater Elevation Contours
Figure 2-22

Tule Subbasin Technical Advisory Committee

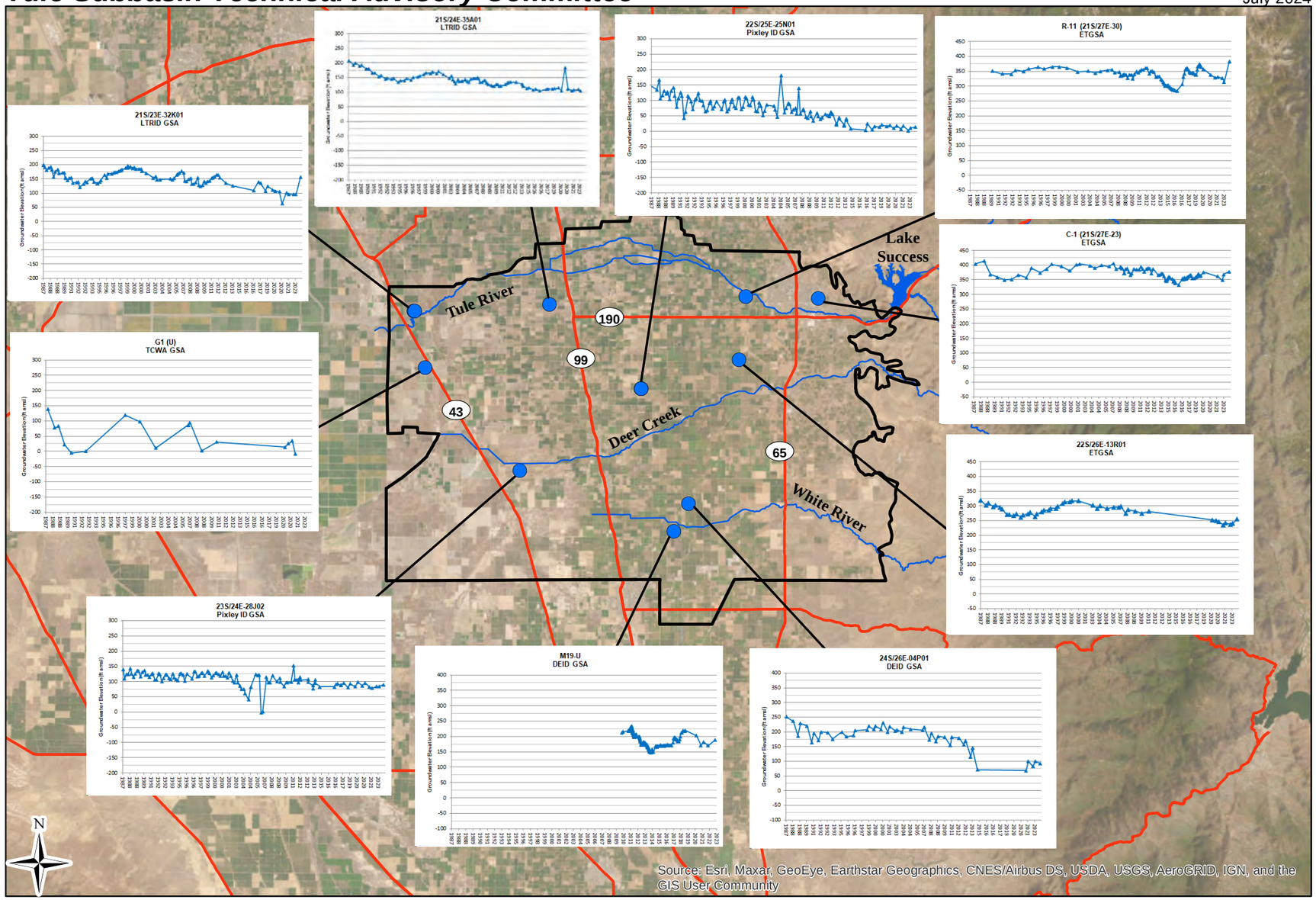


Thomas Harder & Co.
Groundwater Consulting

NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Fall 2022 Upper Aquifer Groundwater Elevation Contours
Figure 2-23



Map Features

- Hydrograph Well
- Major Hydrologic Feature
- Subbasin Boundary
- State Highway/Major Road

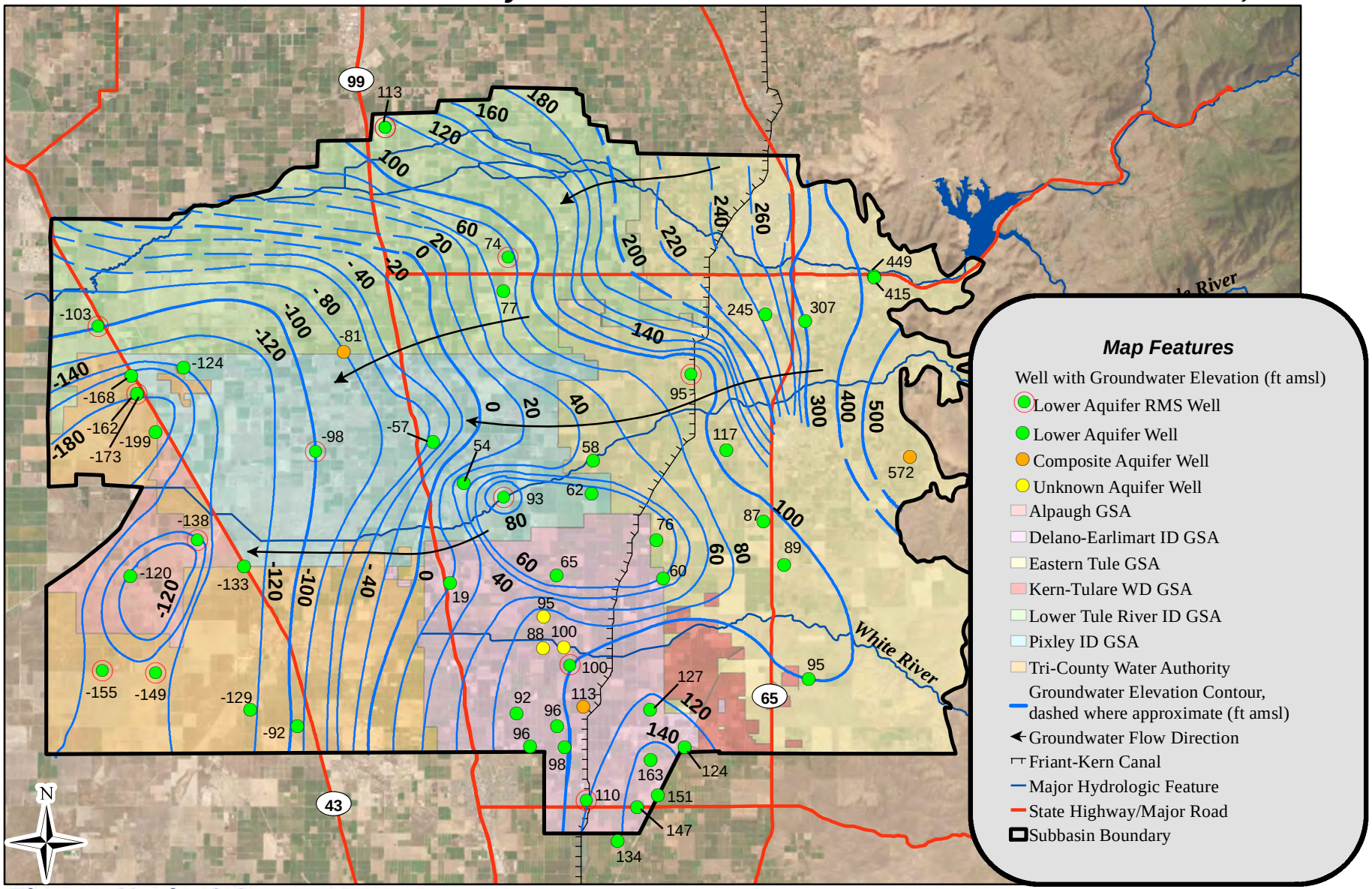
0 5 10 20
Miles

NAD 83 State Plane Zone 4

Thomas Harder & Co.
Groundwater Consulting

DRAFT-FINAL
Upper Aquifer Groundwater Level Hydrographs
Figure 2-24

Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

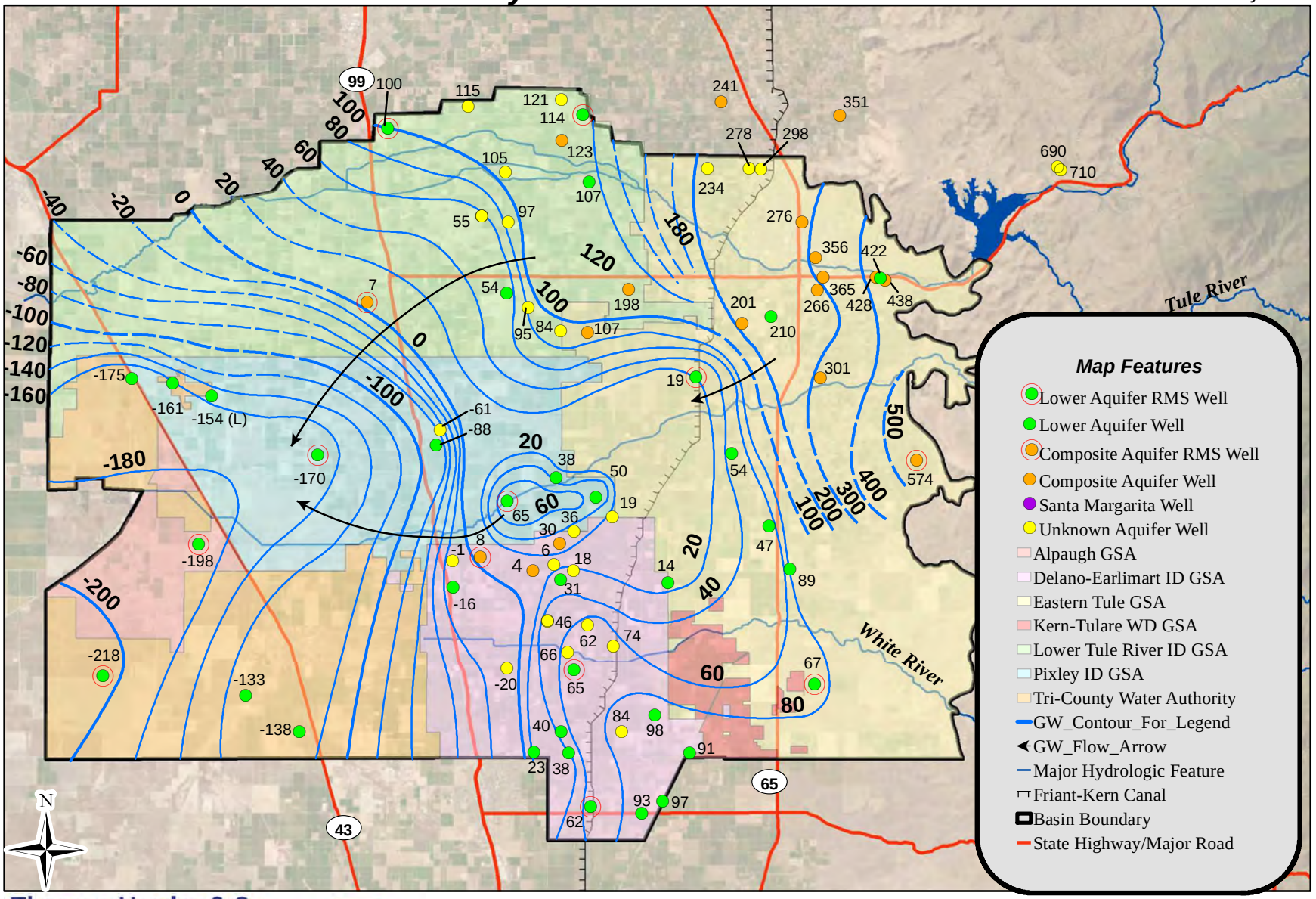
0 2.5 5 10
Miles

NAD 83 State Plane Zone 4

Note: All groundwater elevations are in feet above mean sea level.

Spring 2022 Lower Aquifer Groundwater Elevation Contours
Figure 2-25

Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
Groundwater Consulting

NAD 83 State Plane Zone 4

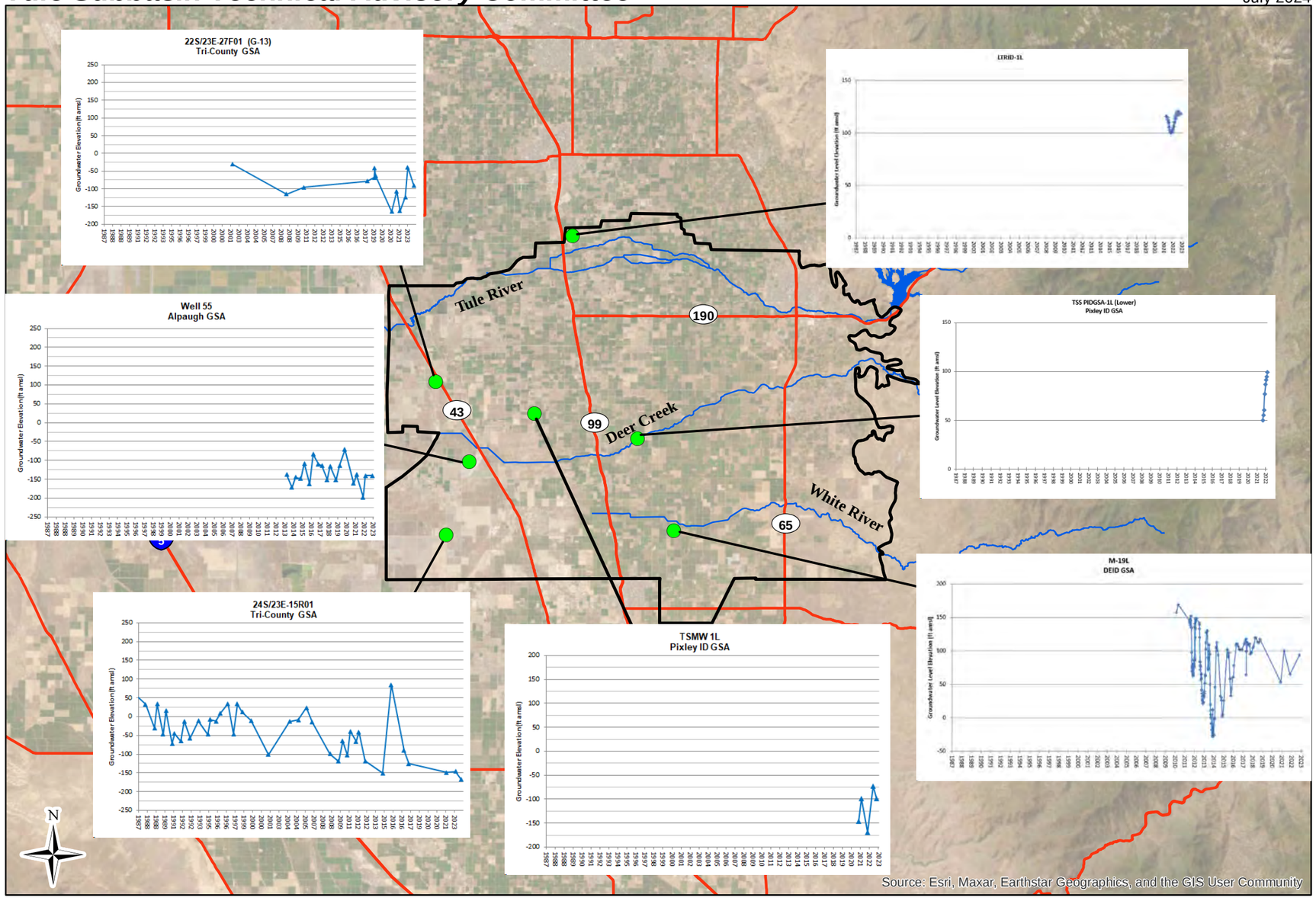
Note: All groundwater elevations are in feet above mean sea level.

Fall 2022 Lower Aquifer Groundwater Elevation Contours

Figure 2-26

Tule Subbasin Technical Advisory Committee

July 2024



0 3.5 7 14
Miles

NAD 83 State Plane Zone 4

Map Features

- Hydrograph Well
- Major Hydrologic Feature
- Subbasin Boundary
- State Highway/Major Road

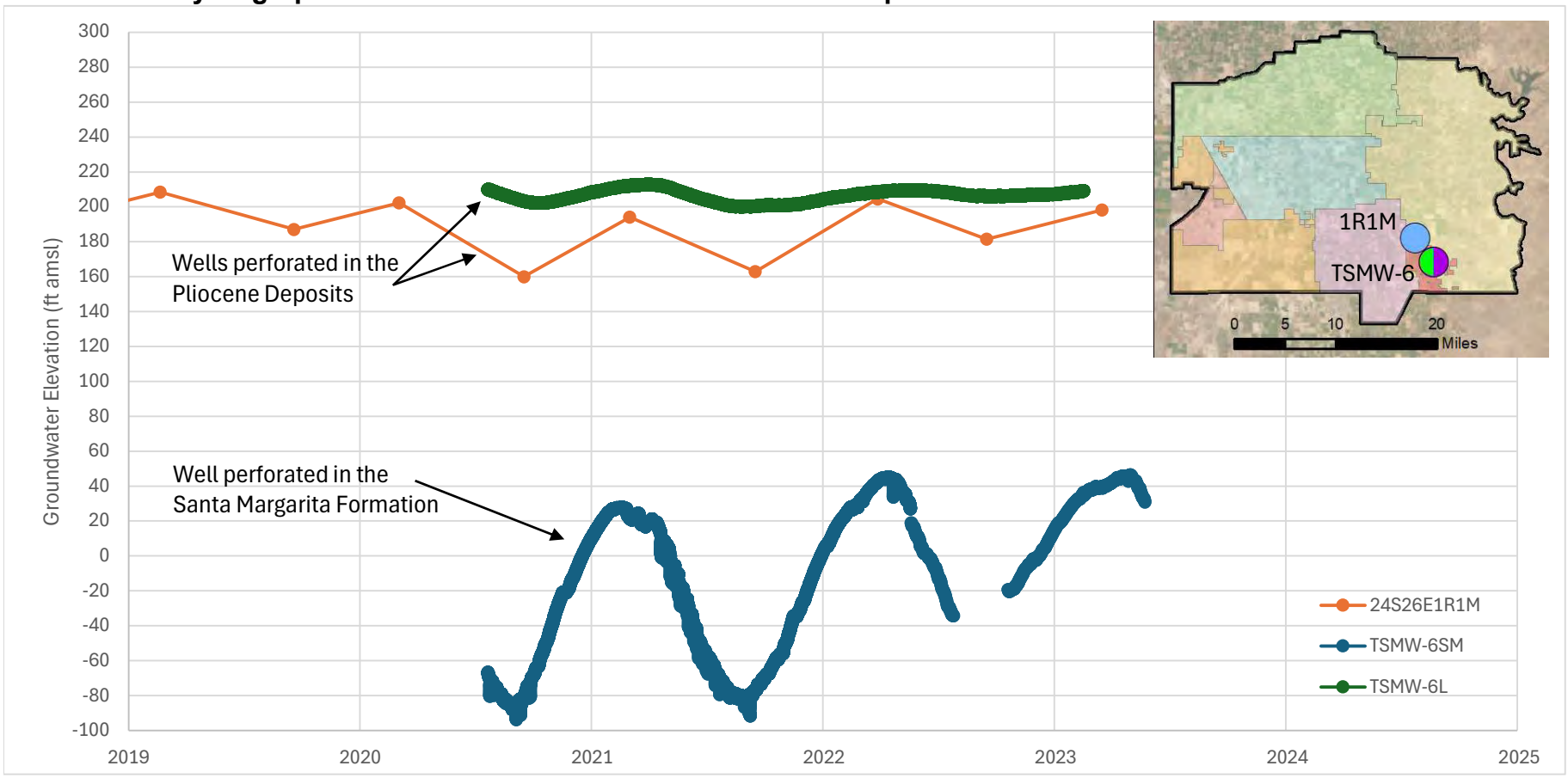
Thomas Harder & Co.
Groundwater Consulting

DRAFT-FINAL

Lower Aquifer Groundwater Level Hydrographs

Figure 2-27

Hydrographs for Wells Constructed in the Pliocene Deposits – Kern-Tulare Water District GSA

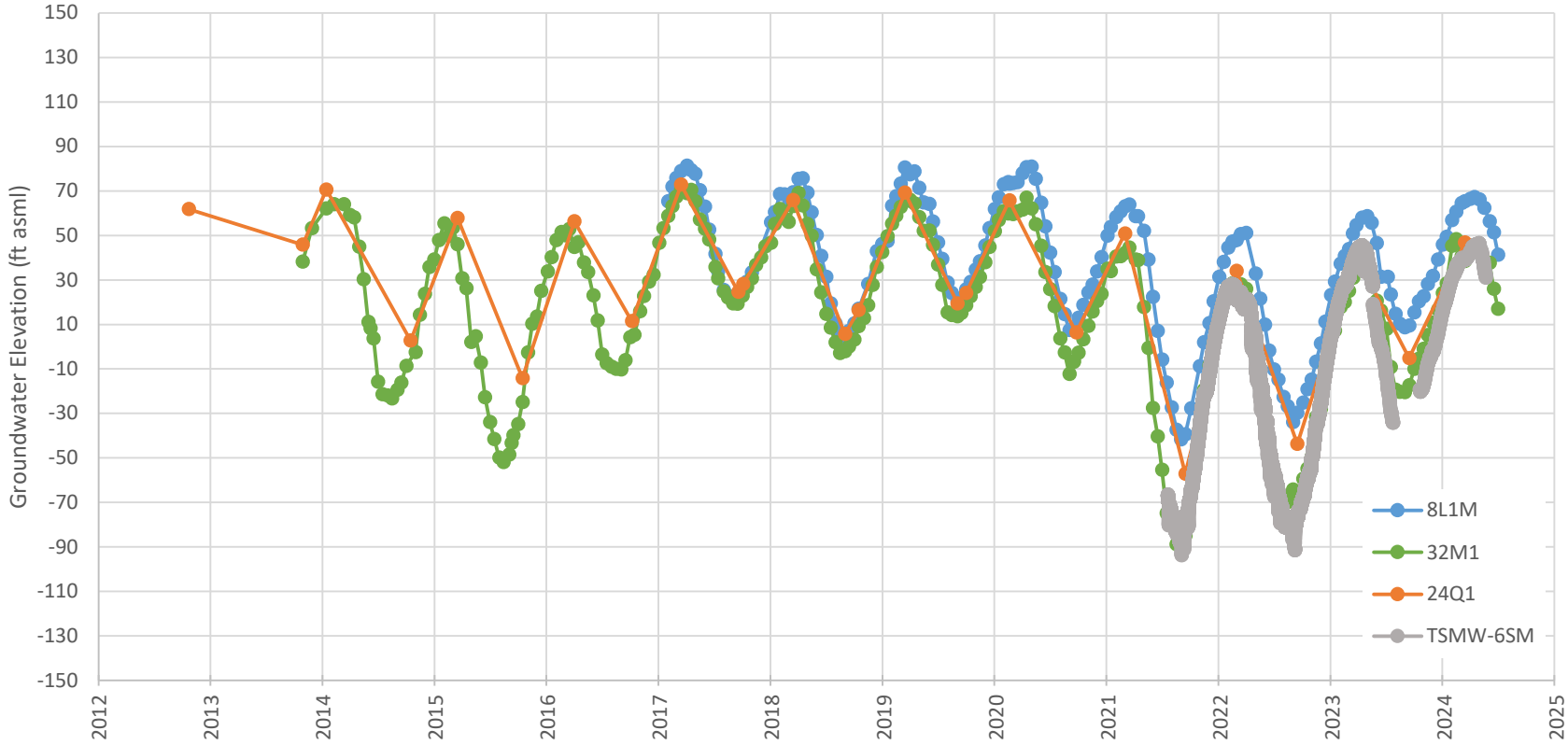


Notes:

ft amsl = feet above mean sea level

Reference Point Elevation: 1R1M = 268.3 ft amsl
TSMW-6SM = 516.6 ft amsl
TSMW-6L = 519.3 ft amsl

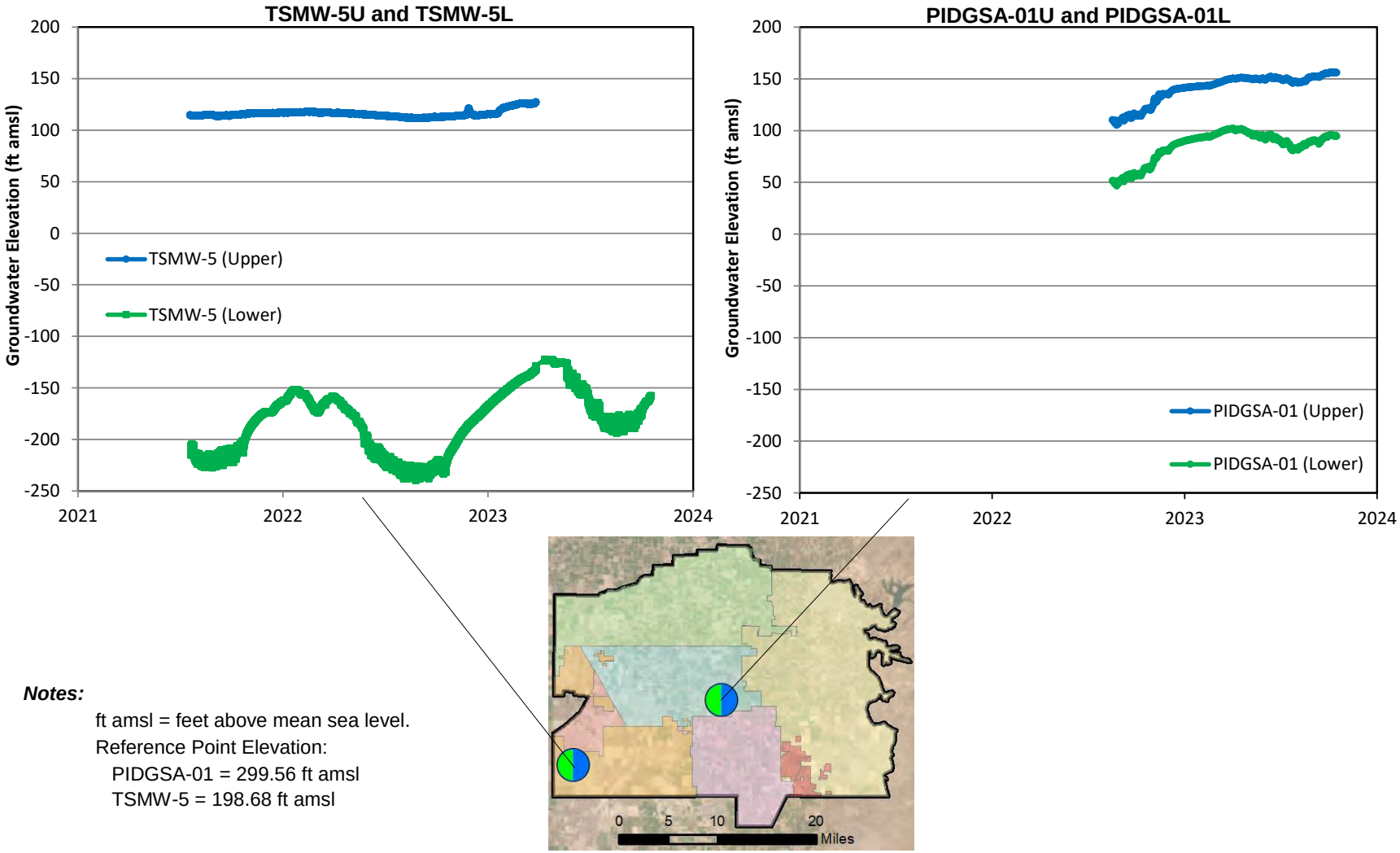
Santa Margarita Well Hydrographs in Kern-Tulare Water District GSA



Notes:

8L1M reference point elevation (RPE) = 507.07 ft amsl
32M1 RPE = 536.31 ft amsl
24Q1 RPE = 471.91 ft amsl
TSMW-6SM RPE = 516.55 ft amsl

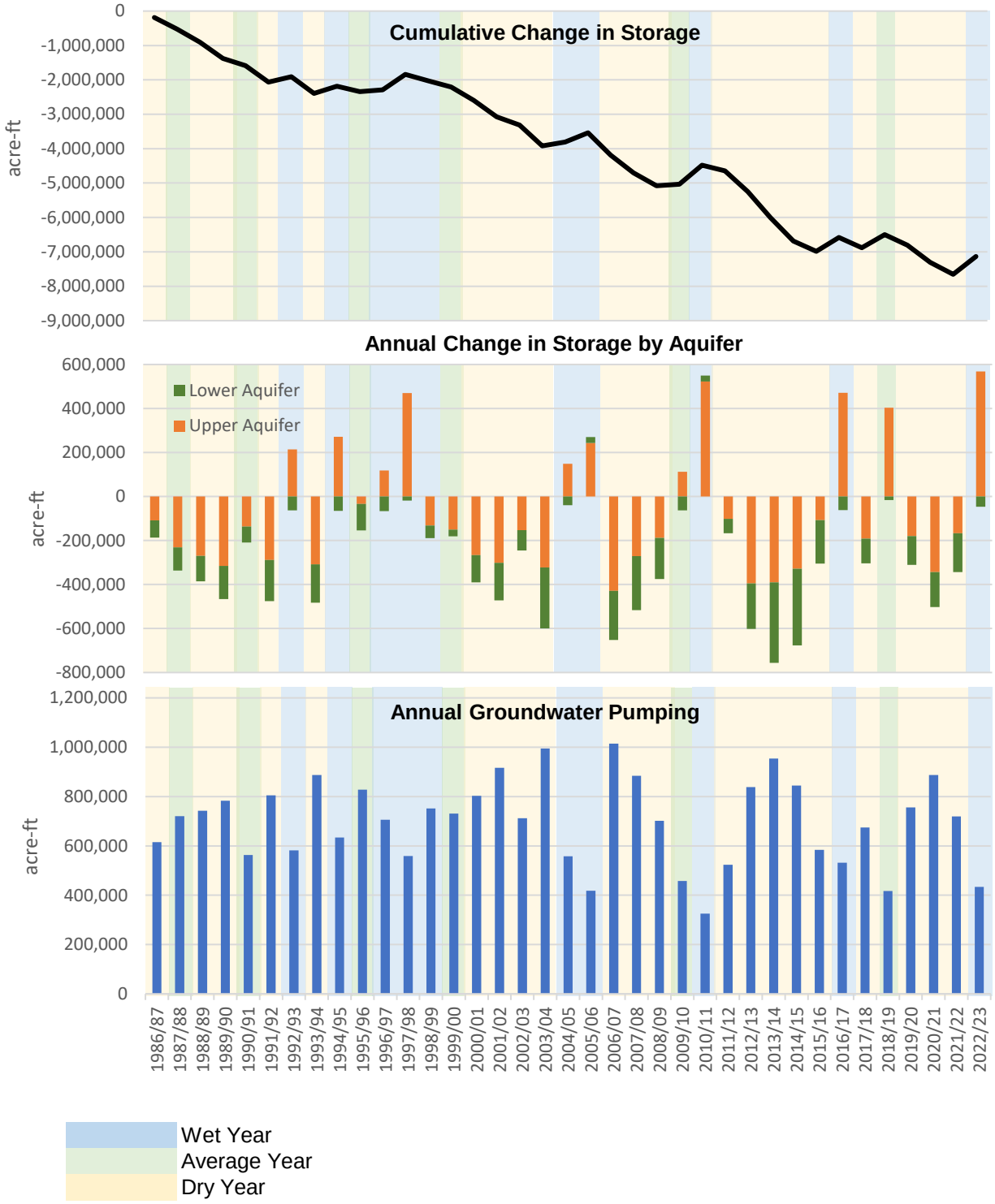
Groundwater Levels In Nested Monitoring Wells



Notes:

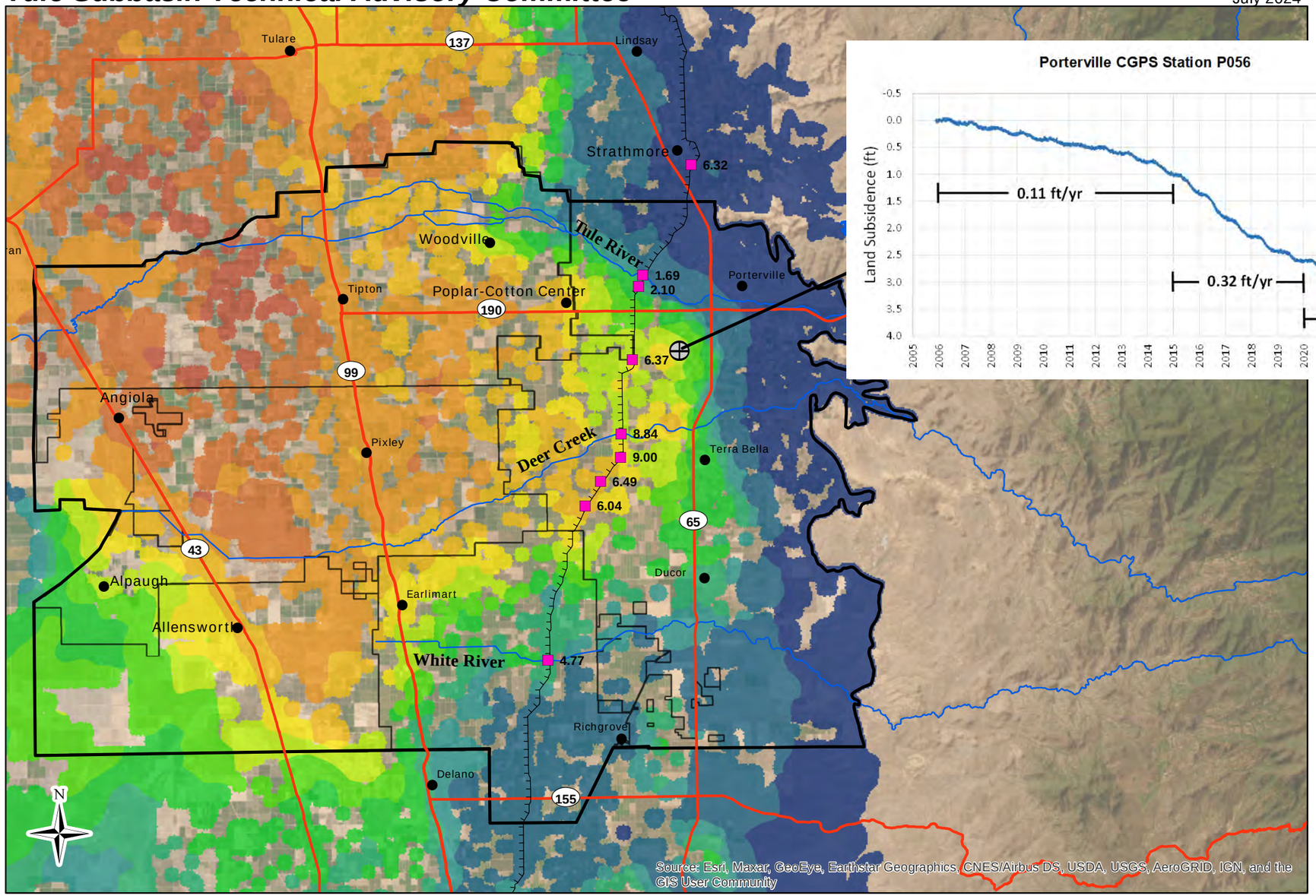
ft amsl = feet above mean sea level.
Reference Point Elevation:
PIDGSA-01 = 299.56 ft amsl
TSMW-5 = 198.68 ft amsl

Tule Subbasin Groundwater Use and Change in Storage 1986/87 to 2022/23



Tule Subbasin Technical Advisory Committee

July 2024



Map Features

Land Sunsidence* (ft)

- 6.00 to 7.04
- 5.00 to 6.00
- 4.00 to 5.00
- 3.00 to 4.00
- 2.50 to 3.00
- 2.00 to 2.50
- 1.50 to 2.00
- 1.00 to 1.50
- 0.75 to 1.00
- 0.50 to 0.75
- 0.00 to 0.50
- < 0.00 (Uplift)
- Subbasin Boundary
- Measured Subsidence Points along the Friant-Kern Canal (ft) 1959 - 2017
- City or Community
- GPS Station
- Major Hydrologic Feature
- State Highway/Major Road
- Friant-Kern Canal

June 2015 to December 2023

0 2.5 5 10 Miles

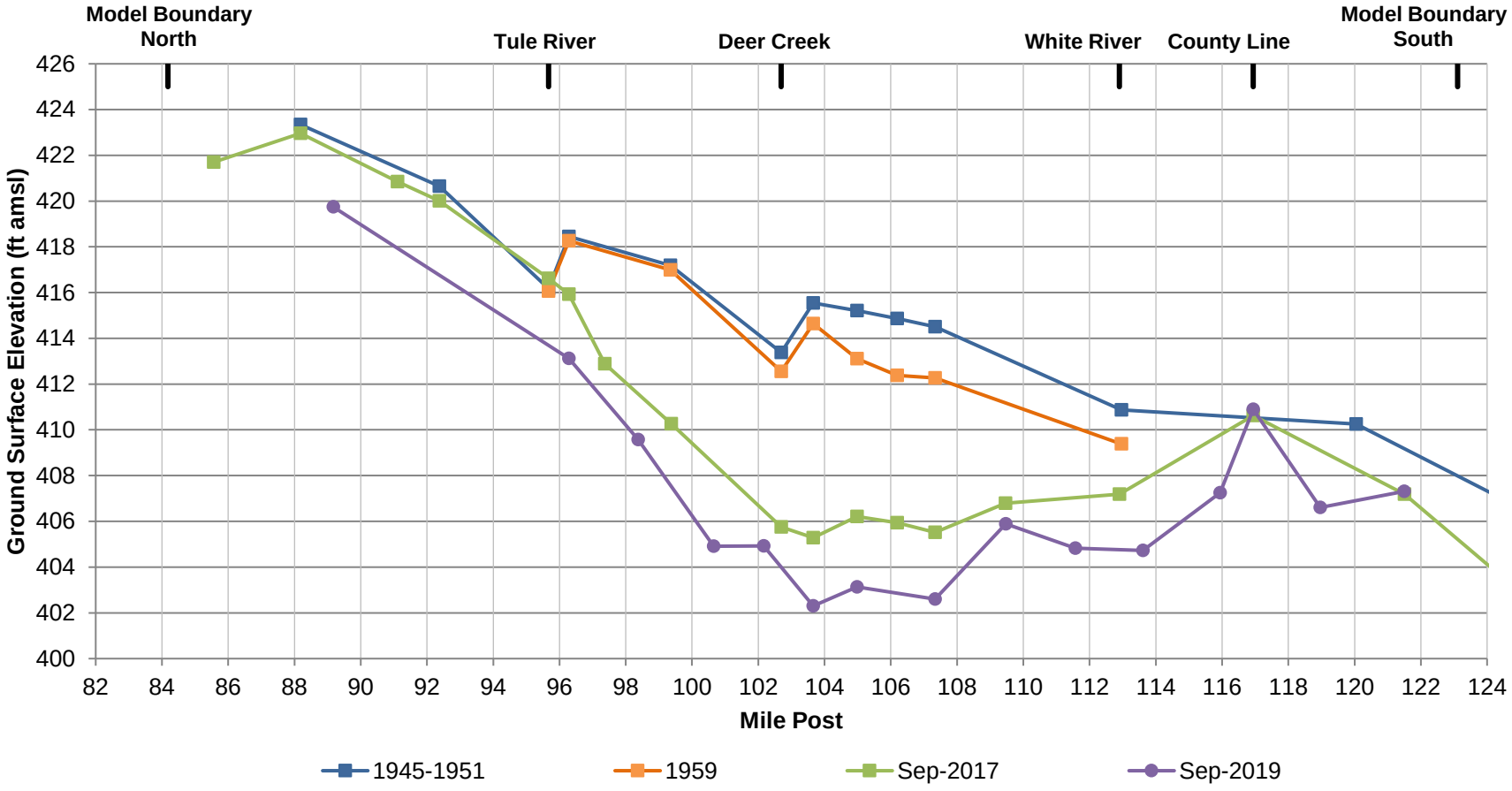
NAD 83 State Plane Zone 4

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Groundwater Consulting

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2015 to 2023 Land Subsidence

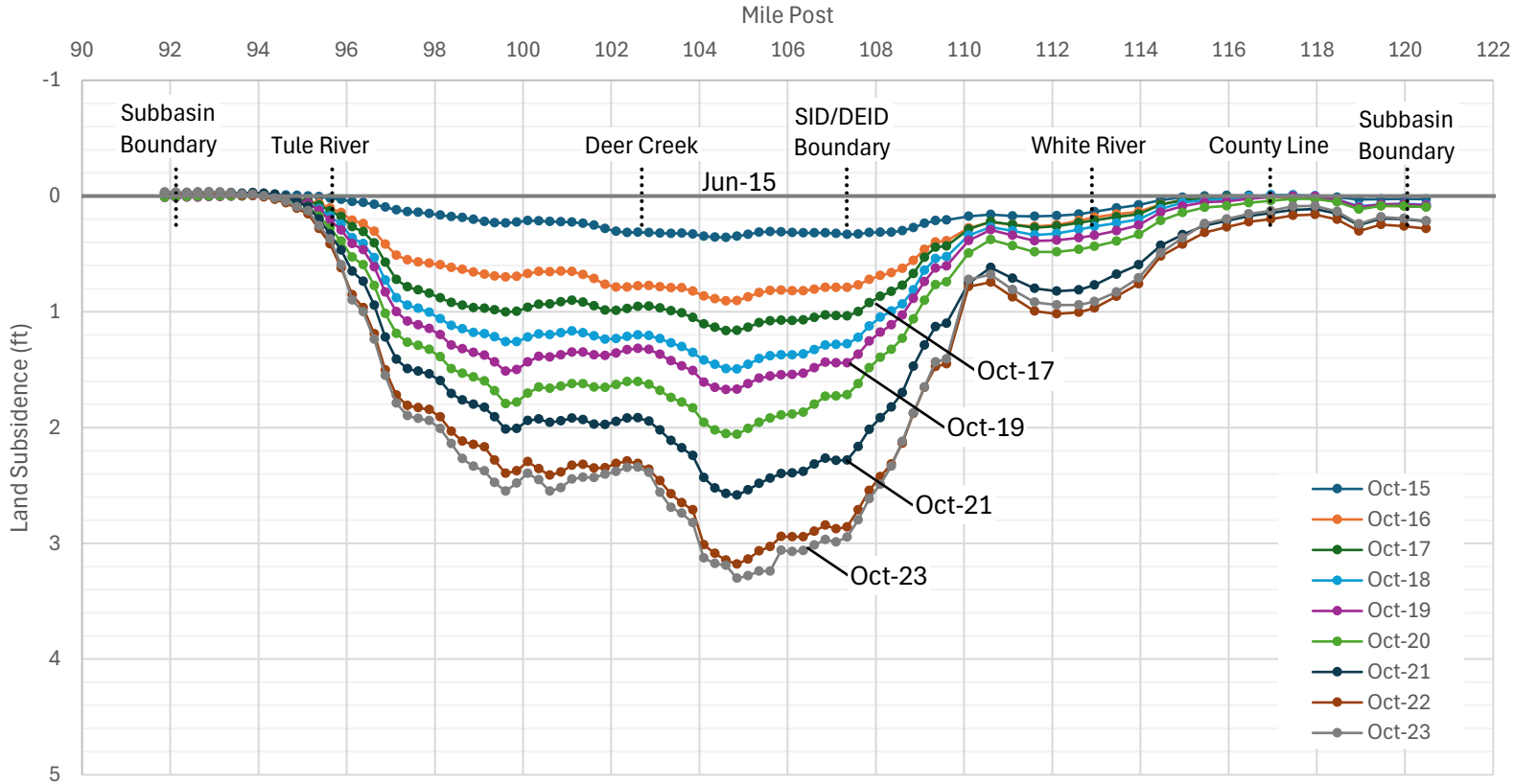
Figure 2-32

Profile of Historical Land Surface Elevation Change Along the Friant-Kern Canal



Note: Historical elevations from Stantec. 2019 GPS data not shown.

Friant-Kern Canal Profile with InSAR Land Subsidence
June 2015 through October 2023



Notes:

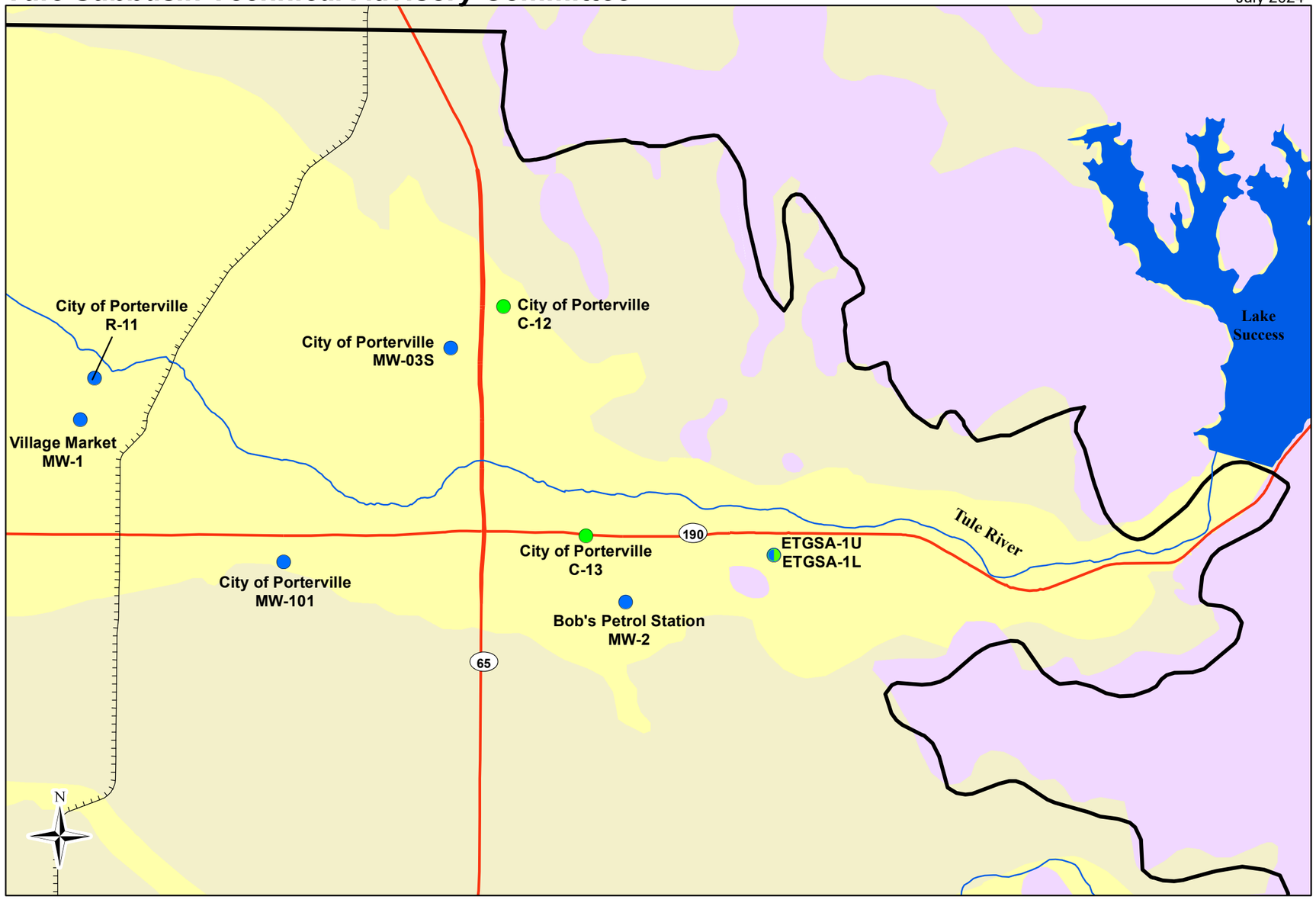
"Oct" = October 1, representative of the end of the Water Year

All values relative to 13-Jun-15

InSAR data from https://gis.water.ca.gov/arcgisimg/rest/services/SAR

Tule Subbasin Technical Advisory Committee

July 2024



Map Features

- Upper Aquifer Well with Hydrograph
- Lower Aquifer Well with Hydrograph
- Major Hydrologic Feature
- Friant-Kern Canal
- Younger Alluvium
- Older Alluvium
- Continental Sedimentary Rocks
- Santa Margarita Formation
- Crystalline Basement
- Subbasin Boundary
- State Highway/Major Road

0 0.5 1 2 Miles

NAD 83 State Plane Zone 4

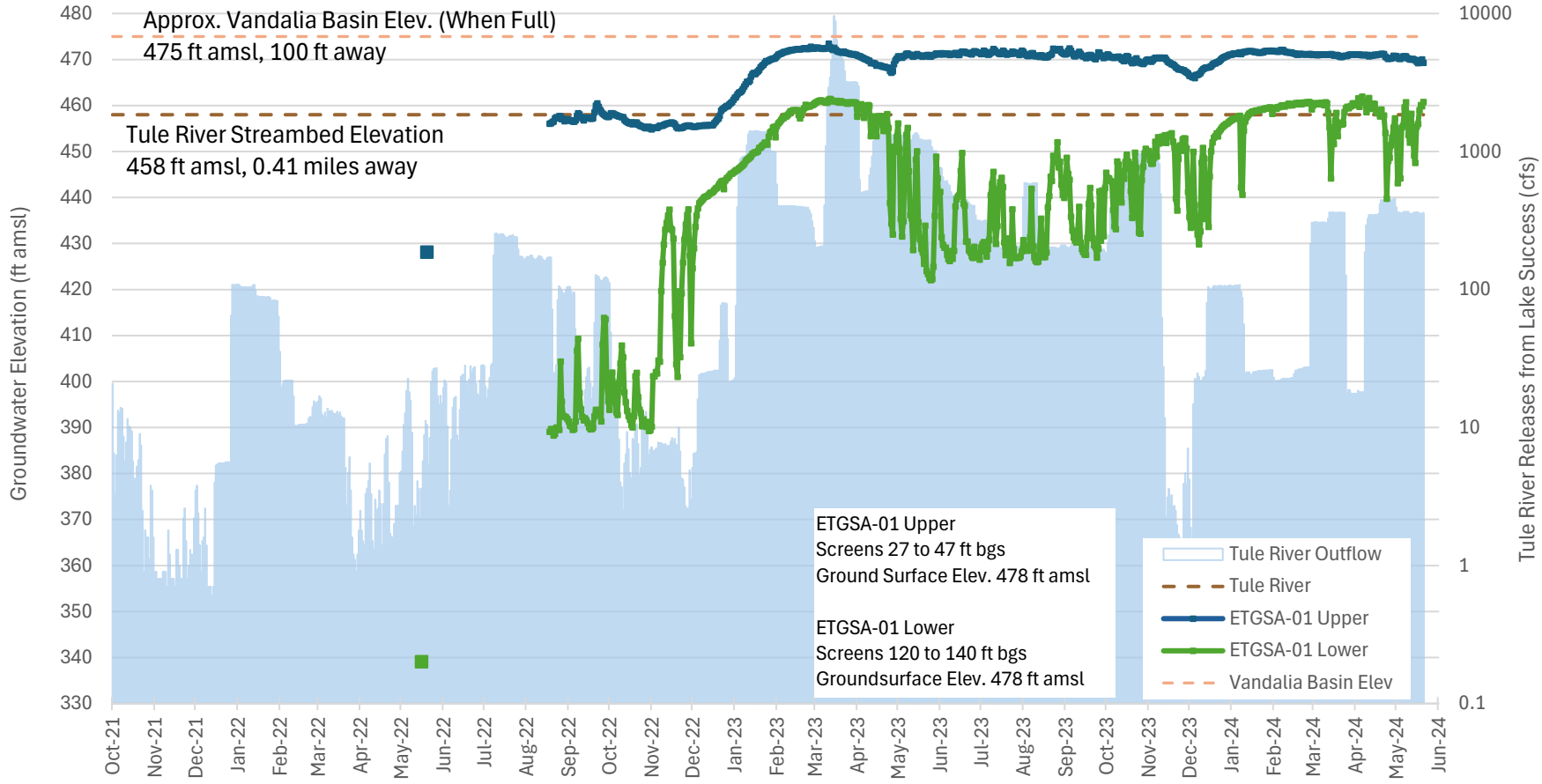
Thomas Harder & Co.
Groundwater Consulting

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Upper Tule River Area - Wells with Hydrographs

Figure 2-35

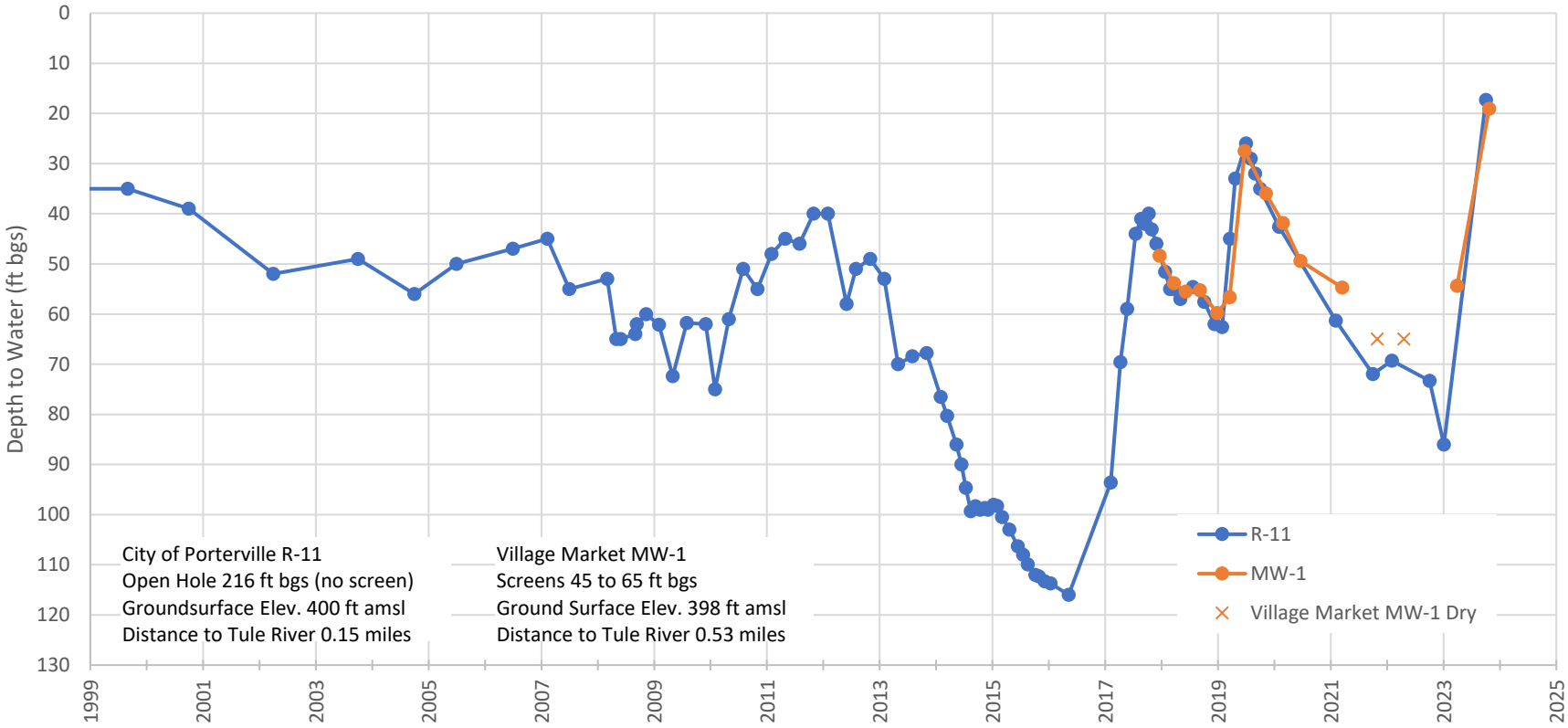
Upper vs Lower Aquifer Groundwater Levels (Elevation)
ETGSA-01 Upper and ETGSA-01 Lower



Note:

Data from Tule Subbasin Technical Advisory Committee.

Upper Aquifer Groundwater Levels (Depth)
City of Porterville R-11 and Village Market MW-1



Notes:

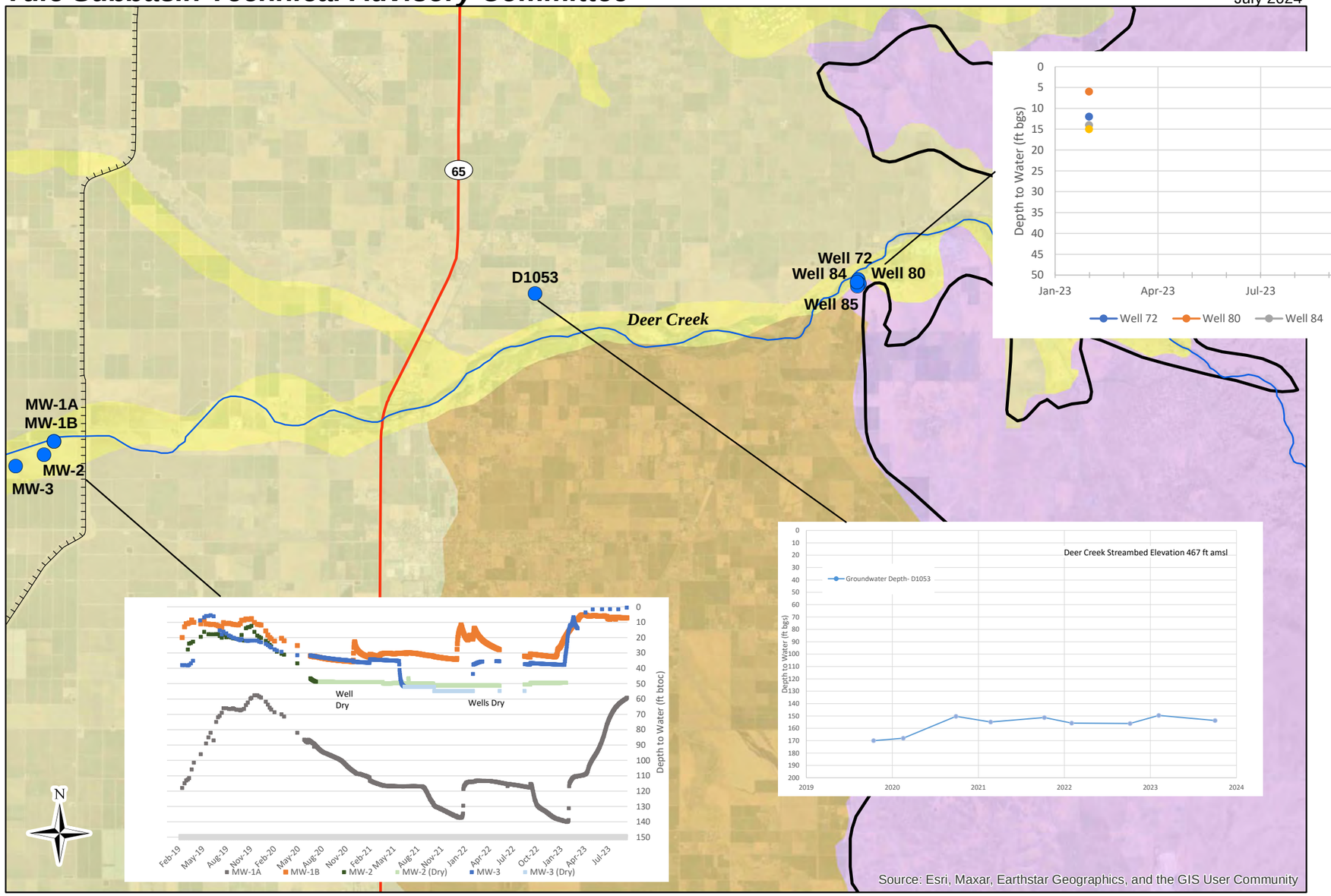
R-11 data from City of Porterville

Village Market MW-1 data from https://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0610700099.

Wells located are less than 1,100 ft from the Tule River-Friant Kern Canal Water Bank basins which started recharge operations in 2017 may influence groundwater levels at the wells.

Tule Subbasin Technical Advisory Committee

July 2024



Map Features

- Upper Aquifer Well with Hydrograph
- Deer Creek
- Friant-Kern Canal
- Younger Alluvium
- Older Alluvium
- Continental Sedimentary Rocks
- Santa Margarita Formation
- Crystalline Basement
- Subbasin Boundary
- State Highway/Major Road

0 0.5 1 2 Miles

NAD 83 State Plane Zone 4

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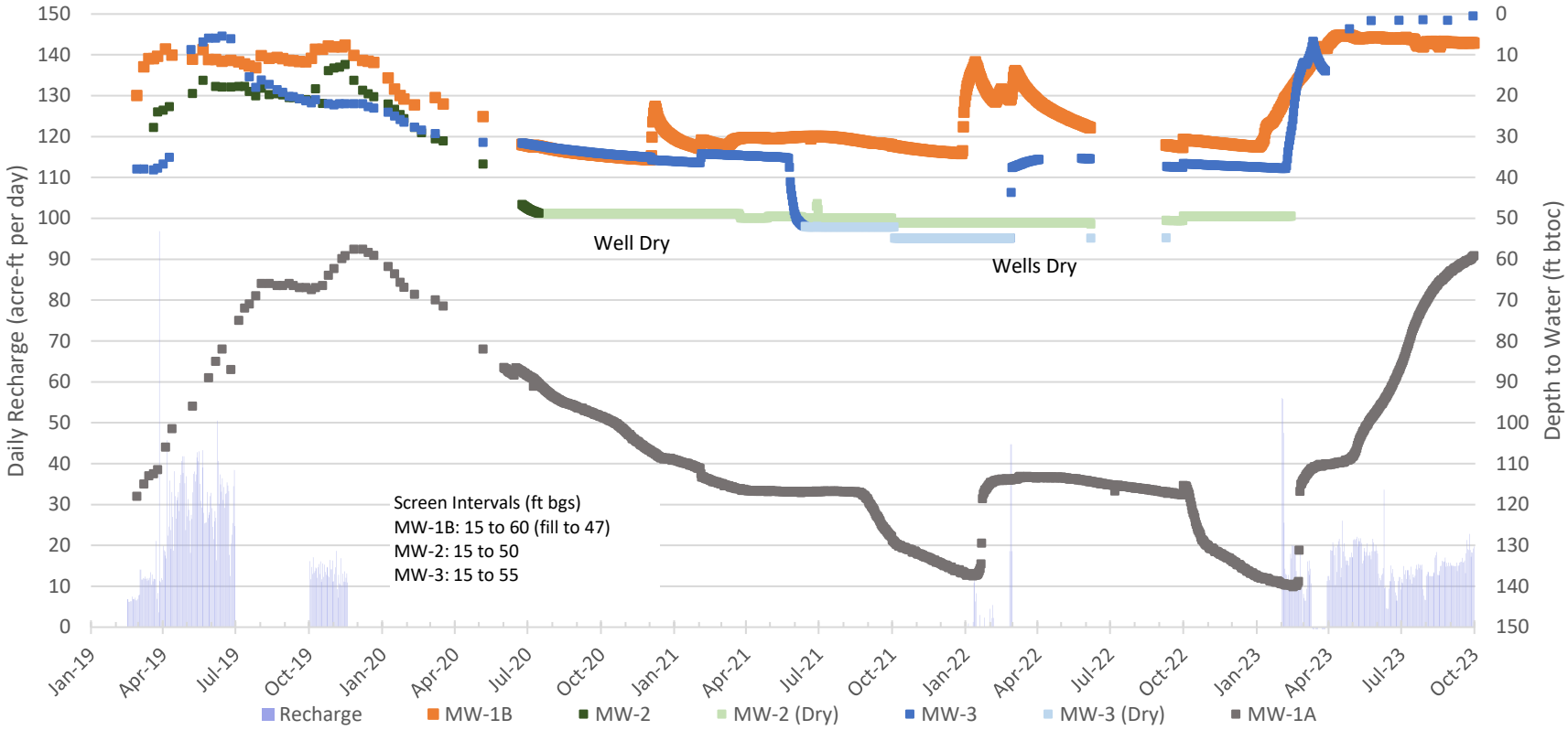
DRAFT-FINAL

Upper Deer Creek Area - Wells with Hydrographs

Figure 2-38

Figure 2-39
DRAFT-FINAL

Deer Creek - Friant Kern Canal Water Bank
Groundwater Levels and Recharge

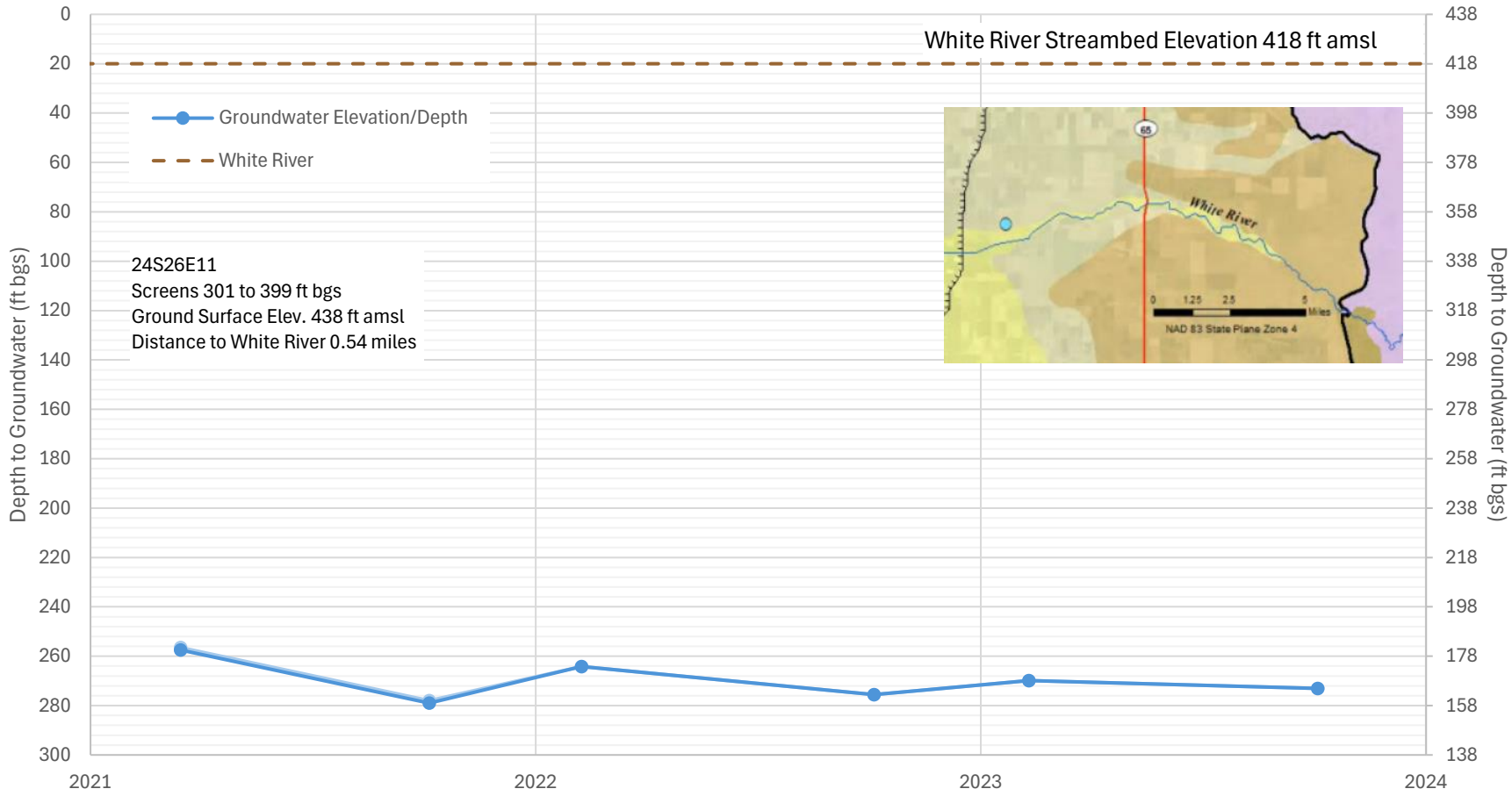


Notes:

Data from GSI Water Solutions, 2024. Deer Creek – Friant Kern Canal Water Bank Project 2023 Annual Report Monitoring and Operational Constraint Plan (MOCP). Prepared for Saucelito Irrigation District.

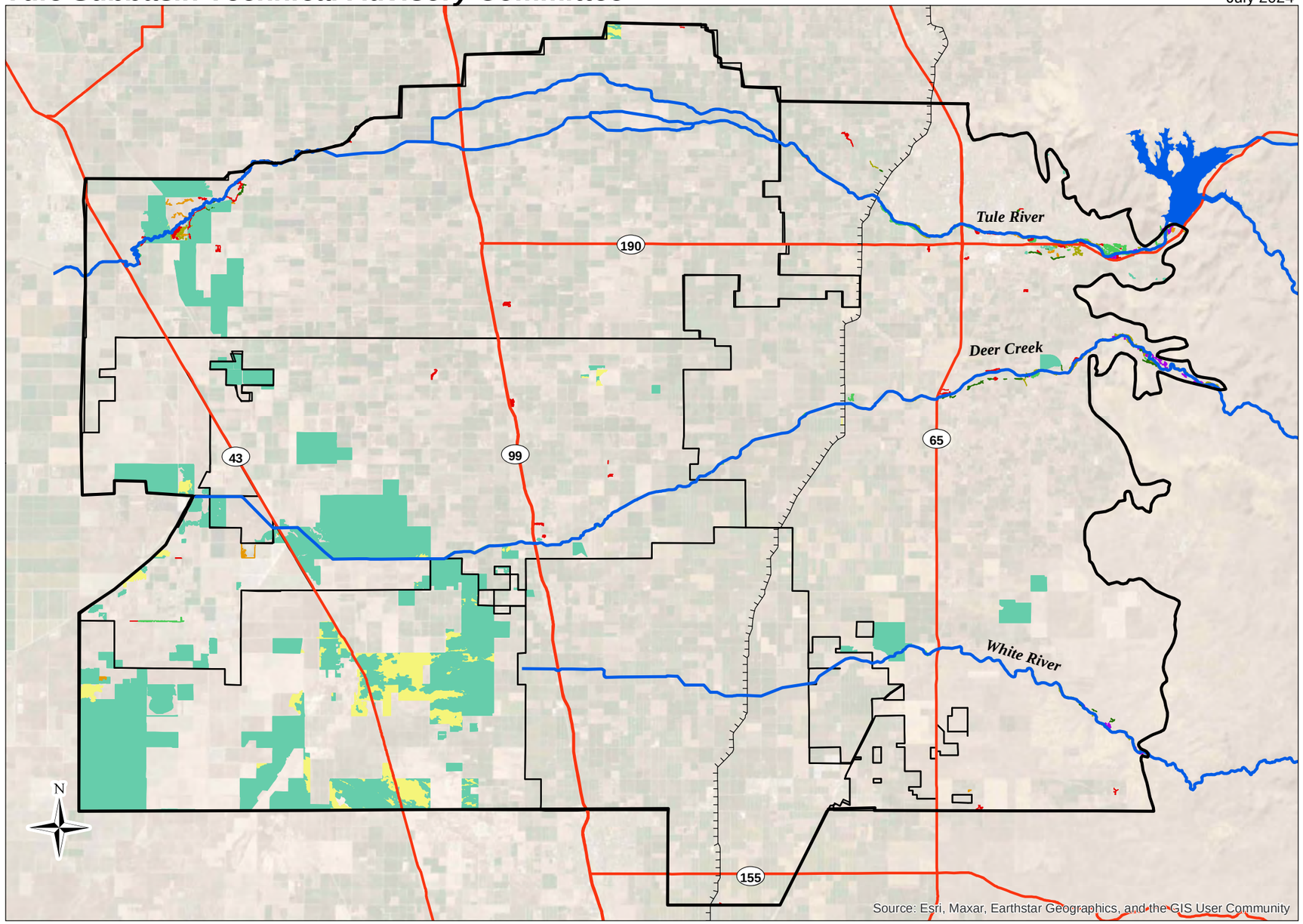
Groundwater levels may be influenced by other nearby recharge (e.g. native Deer Creek flows, imported water released into Deer Creek channel, and DKTRA recharge) and discharge (e.g. pumping) sources.

Upper Aquifer Groundwater Levels
24S26E11



Notes:

Data from Tule Subbasin Technical Advisory Committee.



0 2 4 8 Miles

NAD 83 State Plane Zone 4

Map Features

- Vernal Pool/Wet Meadow
- Scrub
- Fremont Cottonwood
- Hardwood
- Riparian Mixed Shrub
- Oak
- Willow
- California Sycamore
- Friant-Kern Canal
- Major Hydrologic Feature
- Subbasin Boundary
- State Highway/Major Road

Notes:
Data Modified from VegCAMP Vegetation Classification and Mapping Program,
https://map.dfg.ca.gov/metadata/ds2632.html
https://map.dfg.ca.gov/metadata/ds3073.html

Grasses and Forbs not shown.

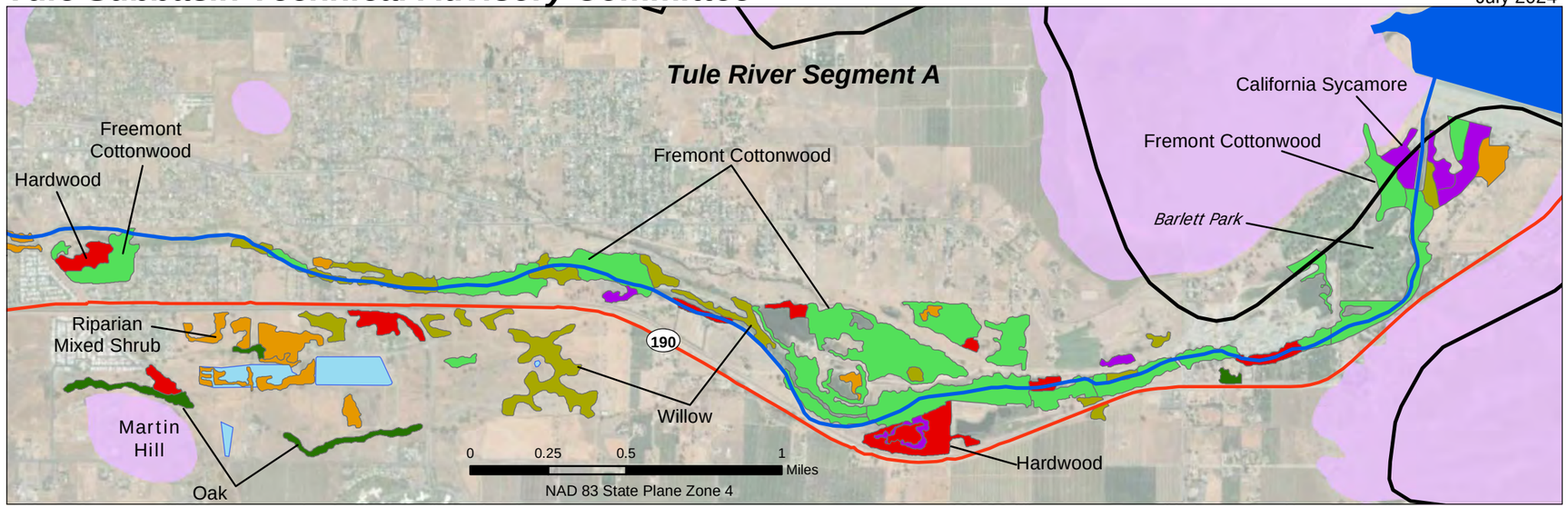
Vegetation outside Subbasin Boundary or on mapped bedrock not shown.

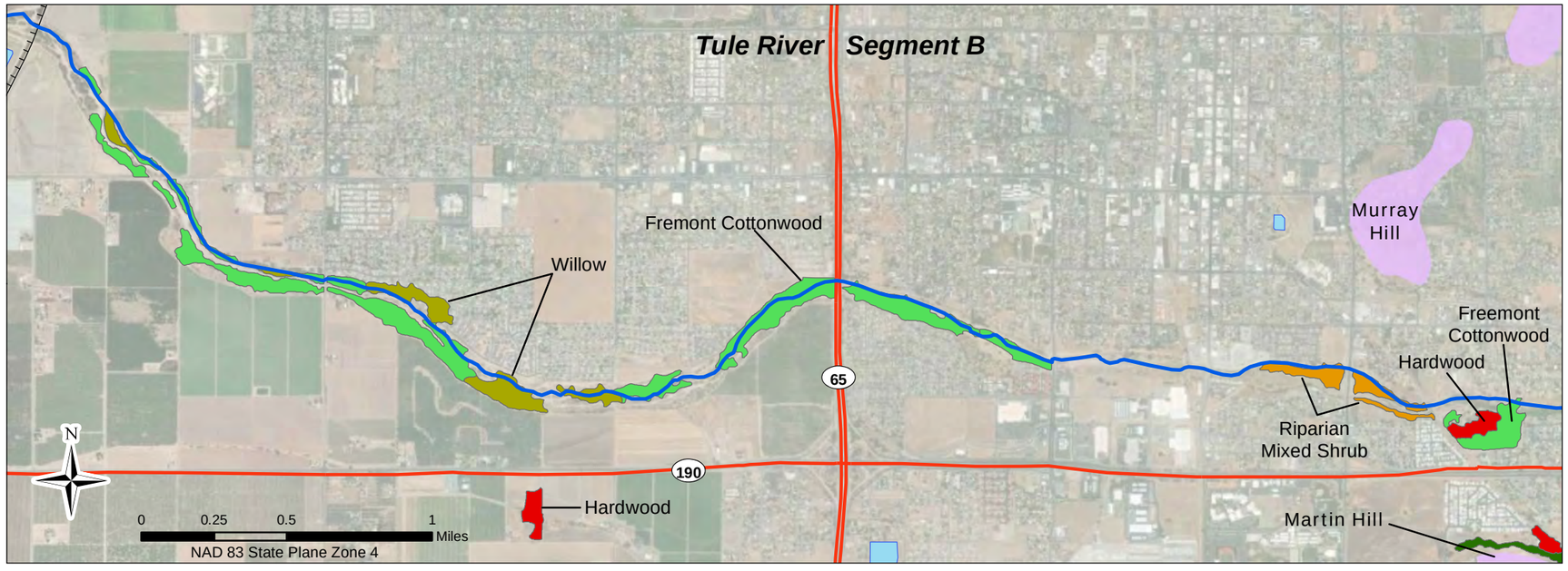
DRAFT-FINAL

Potential Groundwater Dependent Ecosystems

Figure 2-41

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Groundwater Consulting





Map Features

- Fremont Cottonwood
- Willow
- California Sycamore
- Hardwood
- Oak
- Riparian Mixed Shrub
- Recharge Basin
- Bedrock
- Major Hydrologic Feature
- Friant-Kern Canal
- Subbasin Boundary
- State Highway/Major Road

Notes:
Data Modified from VegCAMP Vegetation Classification and Mapping Program,,
https://map.dfg.ca.gov/metadata/ds2632.html
https://map.dfg.ca.gov/metadata/ds3073.html

Grasses and Forbs not shown.

Vegetation outside Subbasin Boundary or on mapped bedrock not shown

Thomas Harder & Co.
Groundwater Consulting

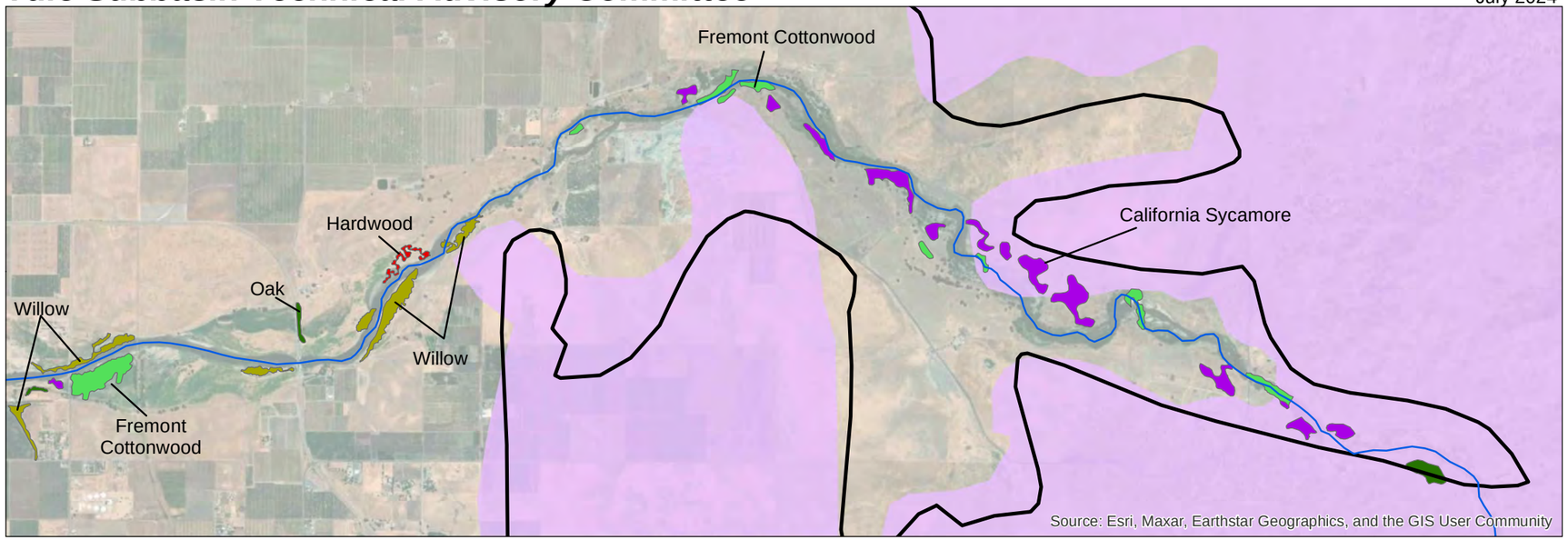
DRAFT-FINAL

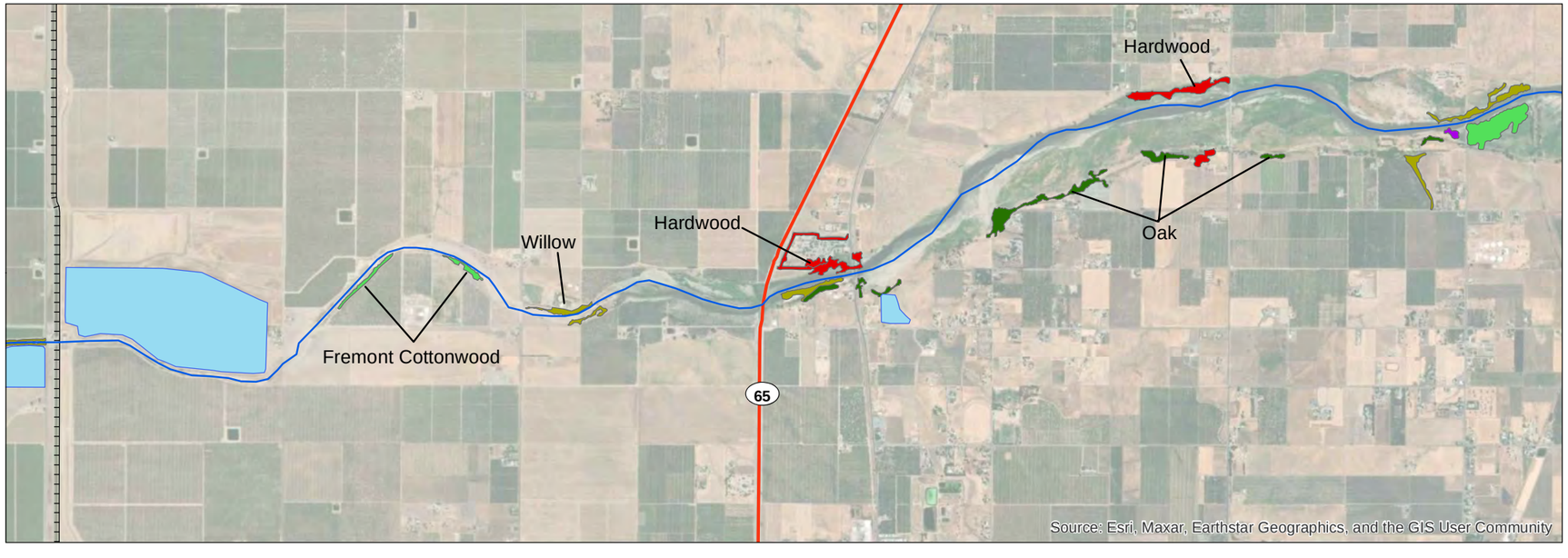
Upper Tule River Area - Potential Groundwater Dependent Ecosystems

Figure 2-42

Tule Subbasin Technical Advisory Committee

July 2024





0 0.5 1 2 Miles

NAD 83 State Plane Zone 4

Thomas Harder & Co.
Groundwater Consulting

Map Features

- Fremont Cottonwood
- Willow
- California Sycamore
- Hardwood
- Oak
- Riparian Mixed Shrub
- Recharge Basin
- Bedrock
- Deer Creek
- Friant-Kern Canal
- Subbasin Boundary
- State Highway/Major Road

Notes:
Data Modified from VegCAMP Vegetation Classification and Mapping Program,,
https://map.dfg.ca.gov/metadata/ds2632.html
https://map.dfg.ca.gov/metadata/ds3073.html

Grasses and Forbs not shown.

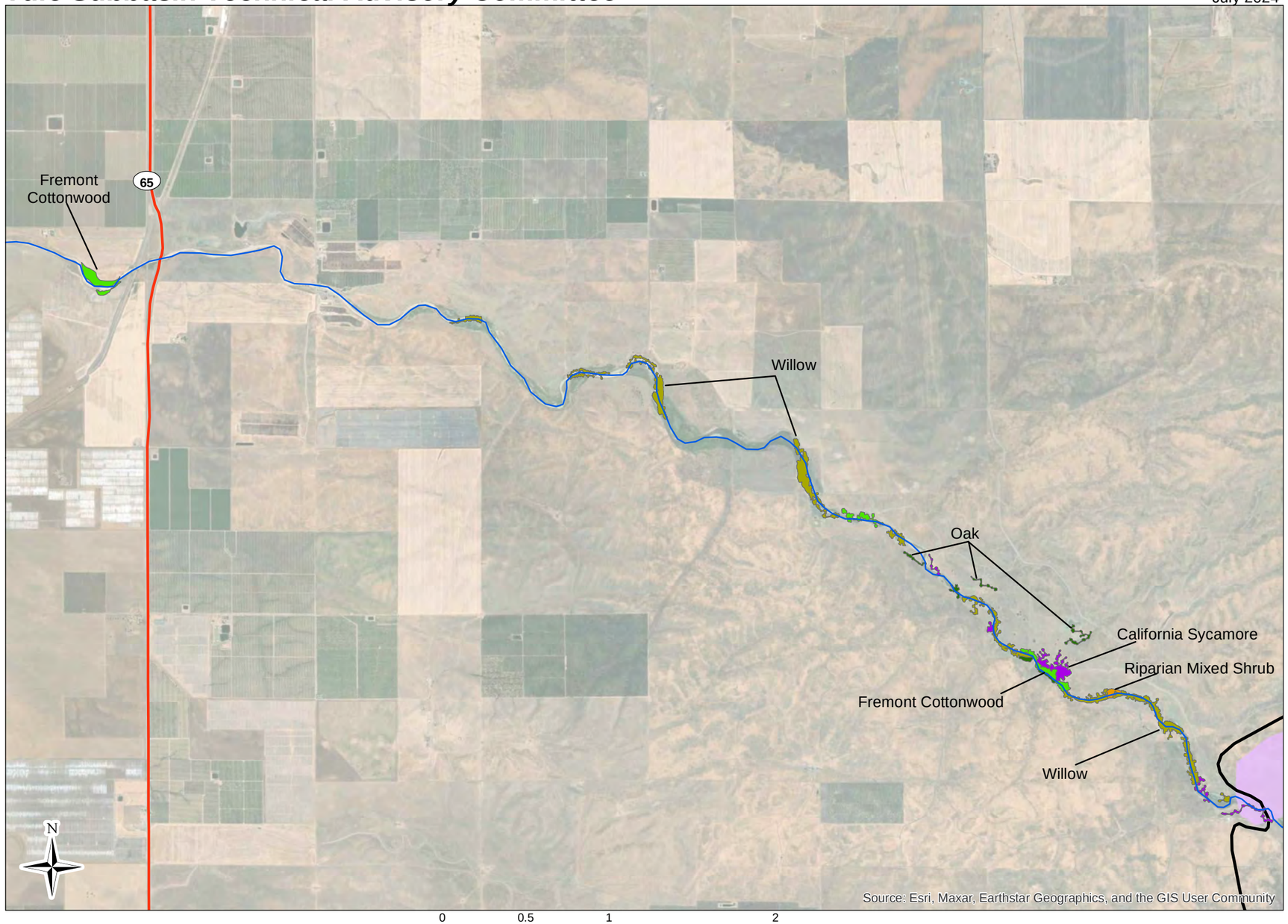
Vegetation outside Subbasin Boundary or on mapped bedrock not shown

Deer Creek Segment West of the Friant-Kern Canal was not used in analysis

DRAFT-FINAL

Upper Deer Creek Area - Potential Groundwater Dependent Ecosystems

Figure 2-43



NAD 83 State Plane Zone 4

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Groundwater Consulting

Map Features

- Fremont Cottonwood
- Willow
- California Sycamore
- Hardwood
- Oak
- Riparian Mixed Shrub
- Bedrock
- White River
- Friant-Kern Canal
- Subbasin Boundary
- State Highway/Major Road

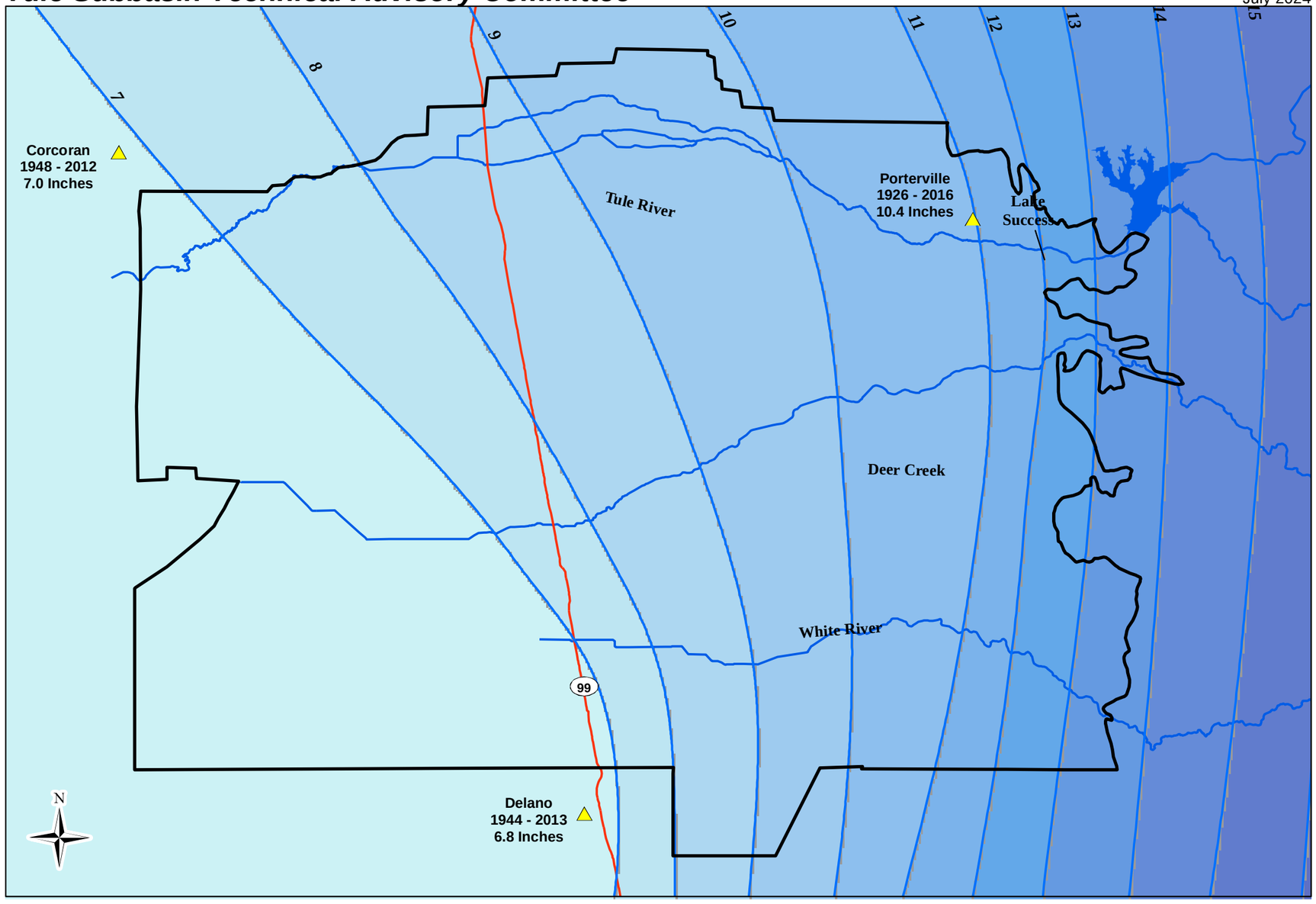
Notes:
Data Modified from VegCAMP Vegetation Classification and Mapping Program,,
https://map.dfg.ca.gov/metadata/ds2632.html
https://map.dfg.ca.gov/metadata/ds3073.html

Grasses and Forbs not shown.

DRAFT-FINAL

Upper White River Area - Potential Groundwater Dependent Ecosystems

Figure 2-44



NAD 83 State Plane Zone 4

Map Features

Lindsay
1927 - 2012
11.7 Inches

- Precipitation Station, Period of Record, and Average Annual Precipitation
- Average Annual Precipitation Inches Per Year
- Major Hydrologic Feature
- Subbasin Boundary
- Freeway/State Highway

Notes: Precipitation station data from Western Regional Climate Center (www.wrcc.dri.edu) and California Irrigation Management Information System.

Isohyetal data from Average Annual Precipitation Zones from the California Department of Forestry and Fire Protection (1998). Data for 1900 through 1960.

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Groundwater Consulting

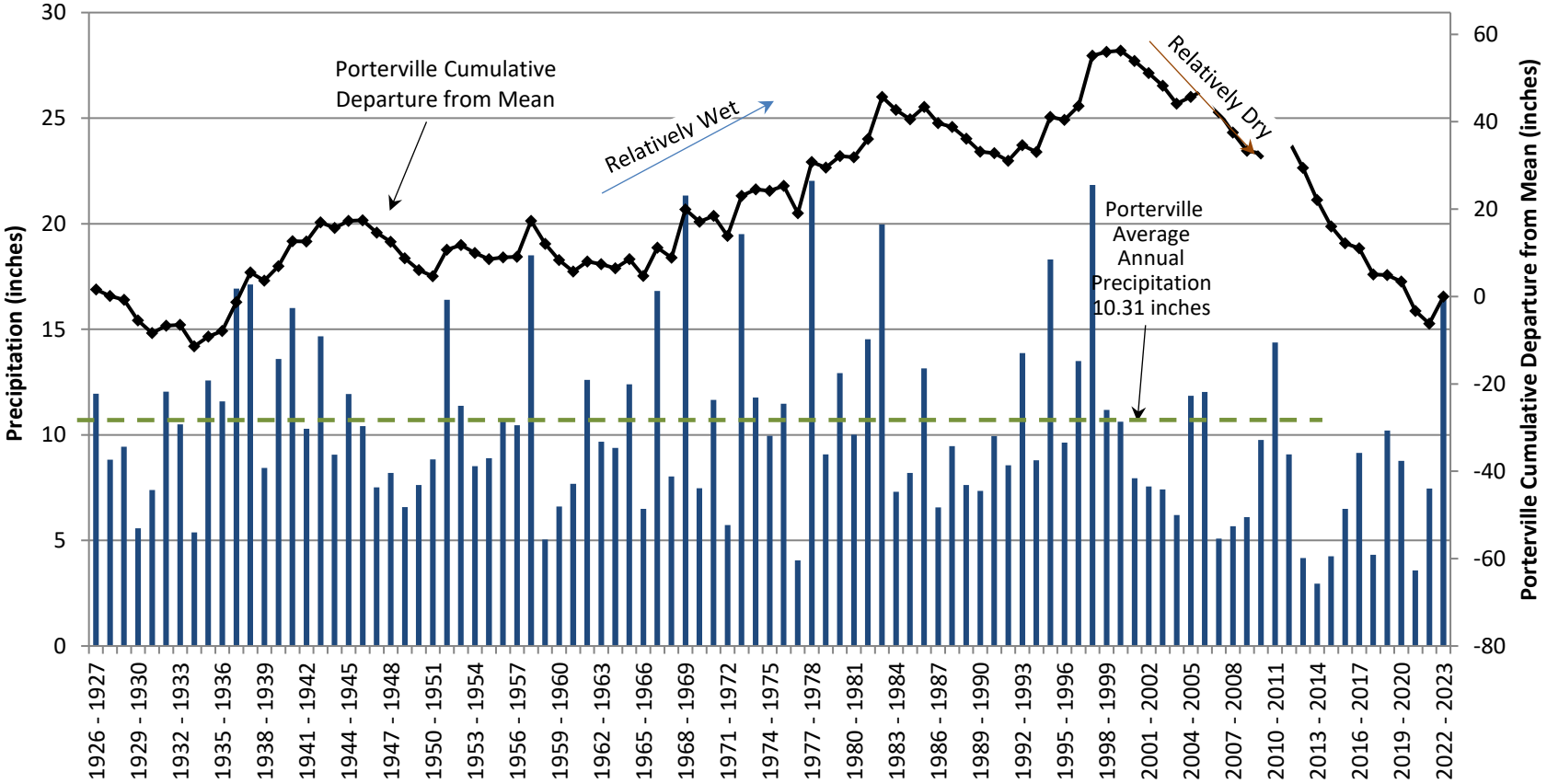
DRAFT-FINAL

Isohyetal Map

Figure 2-45

Figure 2-46
DRAFT-FINAL

Historical Annual Precipitation - Porterville Station

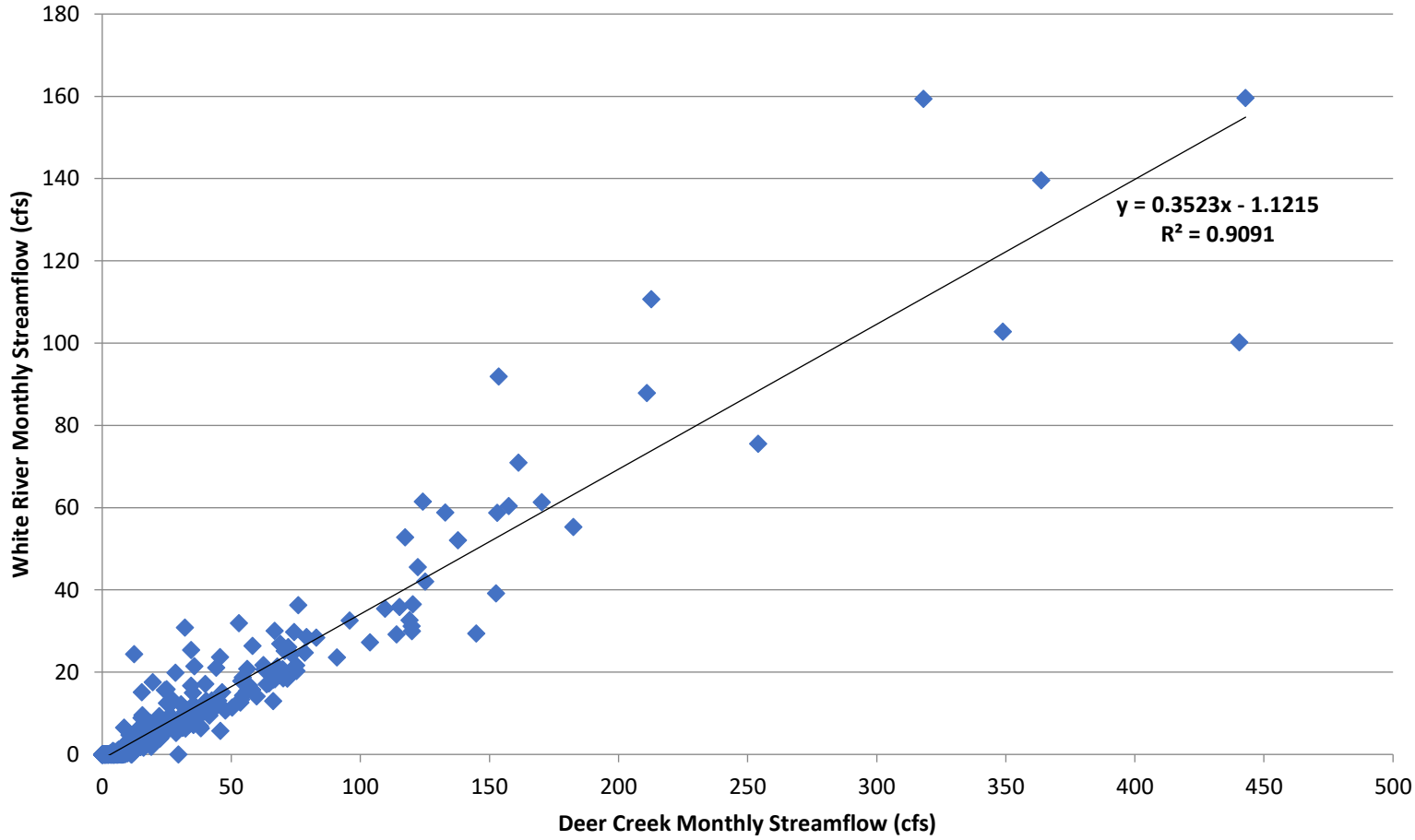


Notes:

Data in water years (October 1 to September 30).
Data from Western Regional Climate Center (1926-2001), California Irrigation Management Information System (2002- March 2023), LandIQ (April 2023 - September 2023).

Figure 2-47
DRAFT-FINAL

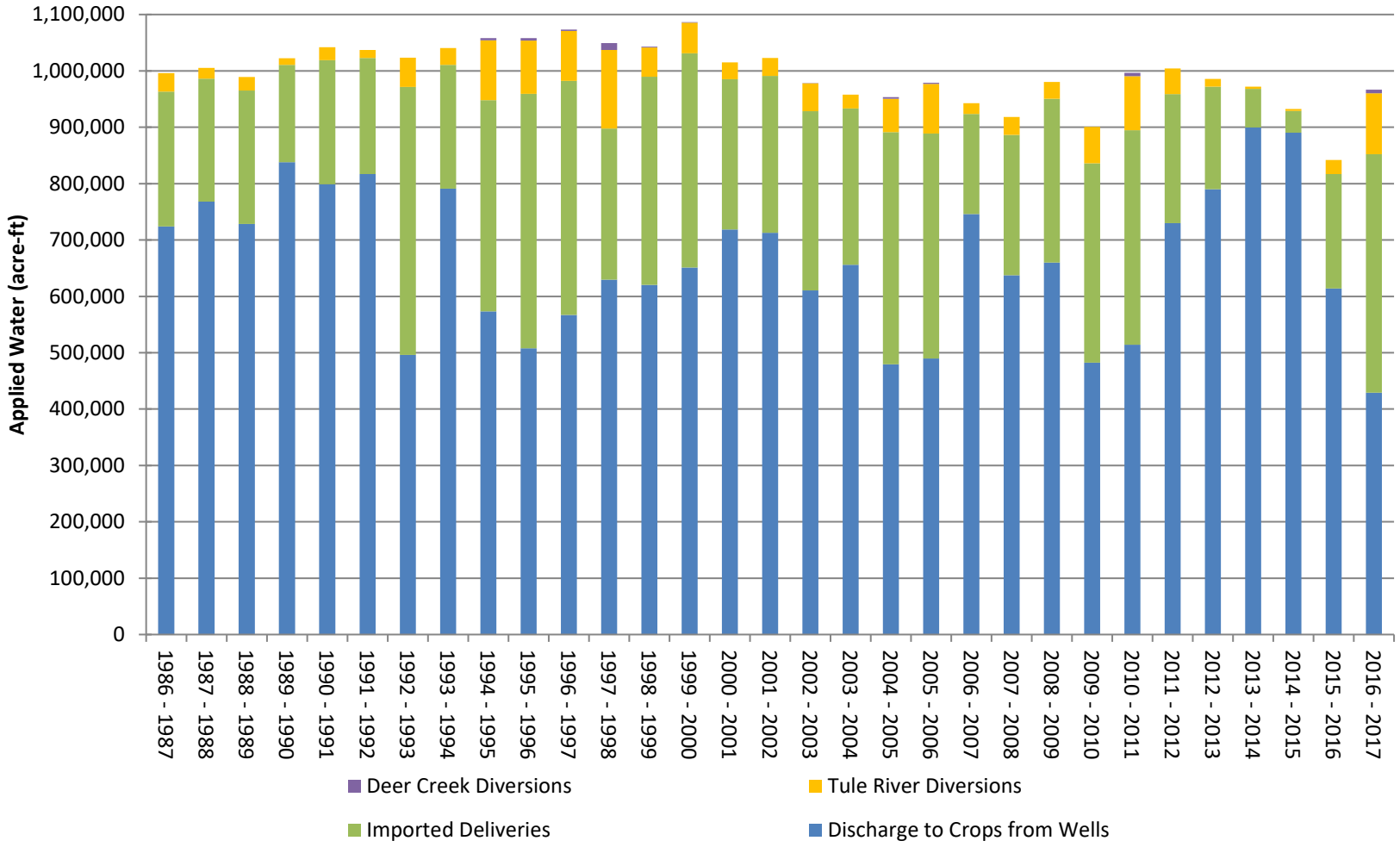
Deer Creek versus White River Monthly Streamflow
1971 - 2005



Thomas Harder & Co.
Groundwater Consulting

Figure 2-48
DRAFT-FINAL

Applied Water to Irrigated Agriculture by Source

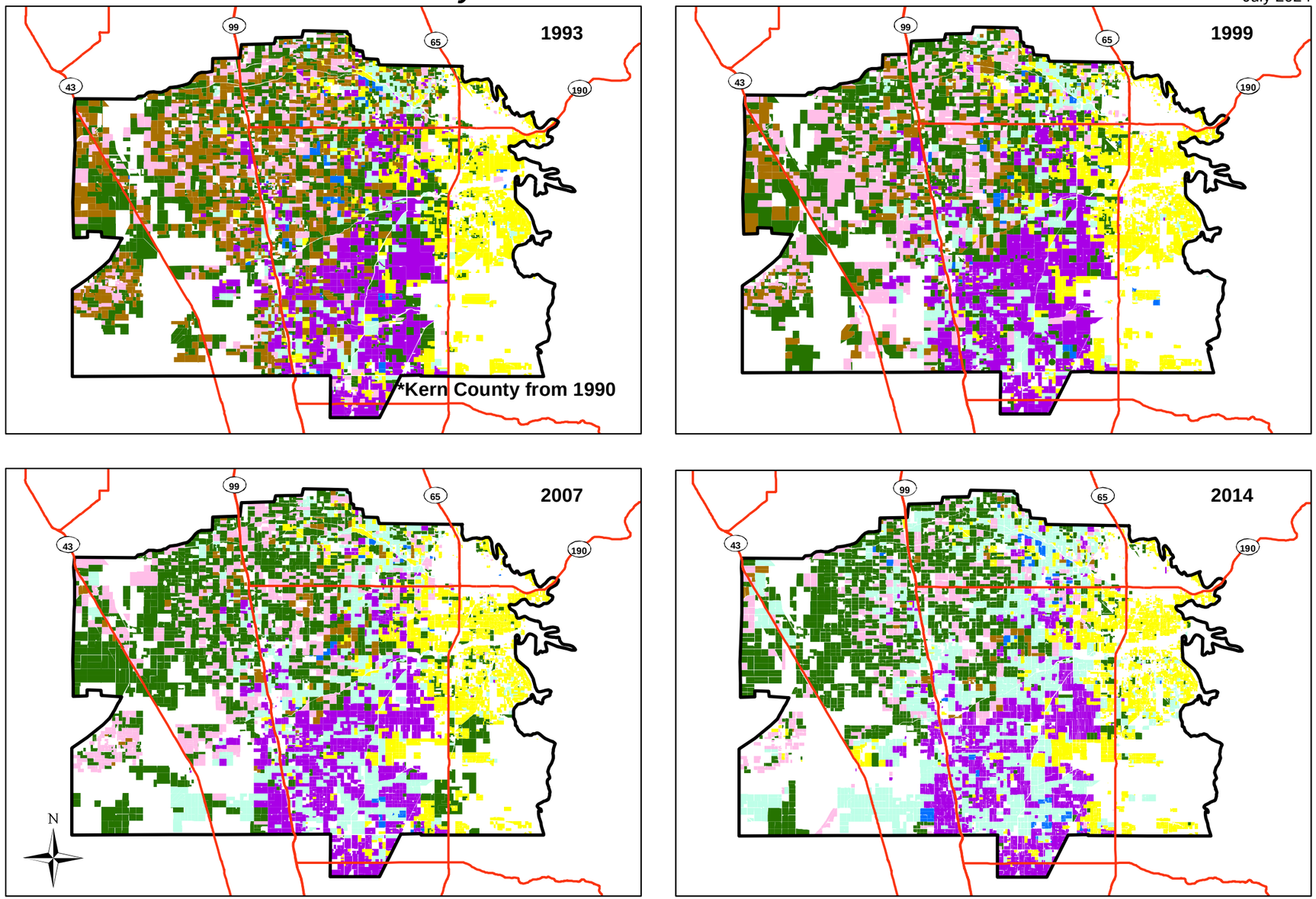


Thomas Harder & Co.
Groundwater Consulting

July 2024

Tule Subbasin Technical Advisory Committee

July 2024



Map Features

- Alfalfa, Pasture
- Corn, Grain, Grain Hay, and Misc. Field Crops
- Cotton
- Deciduous & Fruit Trees
- Grapes
- Nuts
- Truck Crops
- Subbasin Boundary
- Major Road

Notes: Data from California Department of Water Resources and Kern County Department of Agriculture and Measurement Standards

Irrigated crops only.

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Groundwater Consulting

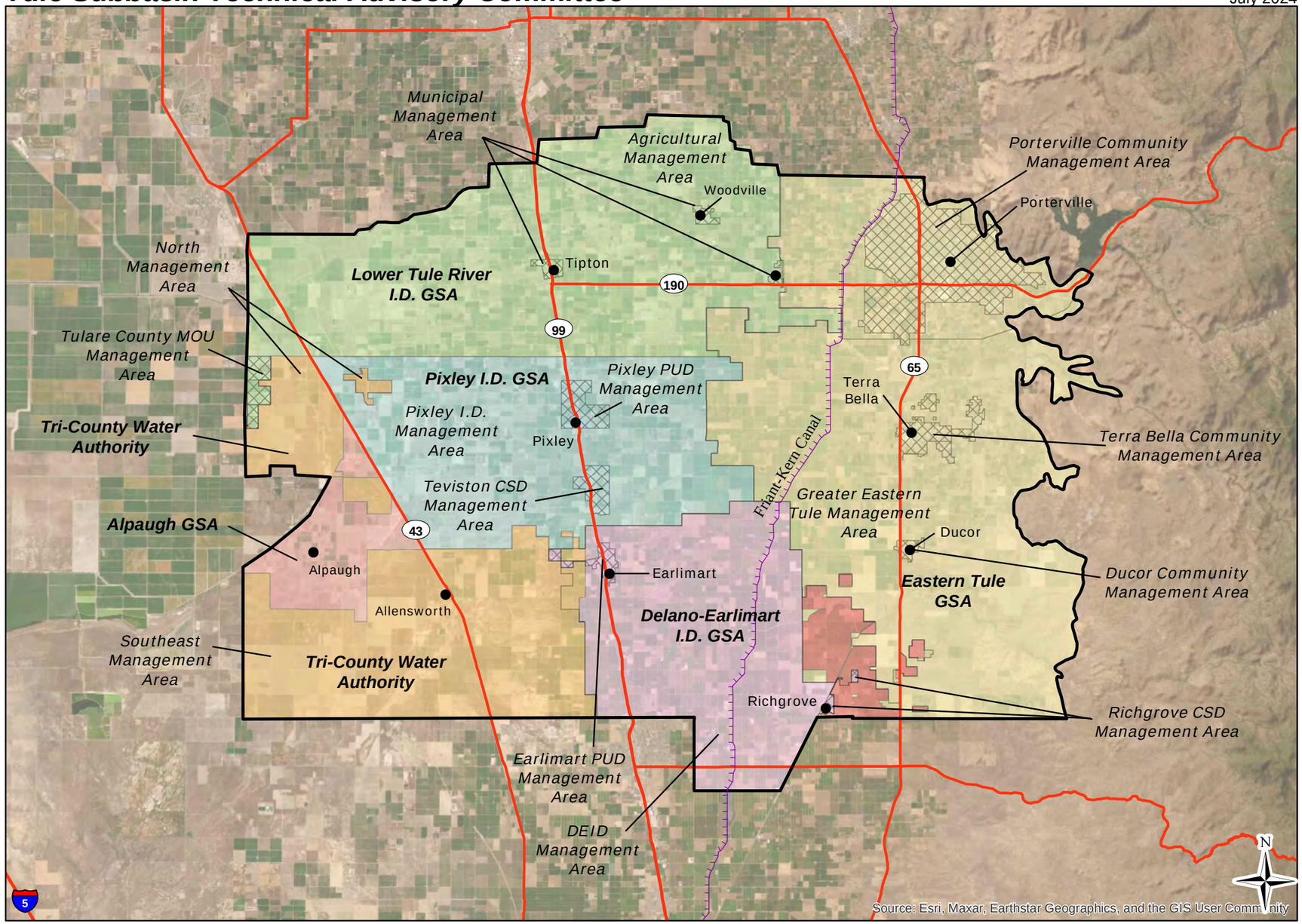
DRAFT-FINAL

Tule Groundwater Subbasin Historical Crop Patterns

Figure 2-49

Tule Subbasin Technical Advisory Committee

July 2024



Map Features

- Alpaugh GSA
- Delano-Earlimart ID GSA
- Eastern Tule GSA
- Kern-Tulare WD GSA
- Lower Tule River ID GSA
- Pixley ID GSA
- Tri-County Water Authority
- GSA Management Area
- Subbasin Boundary
- City or Community
- Friant-Kern Canal
- State Highway/Major Road

0 3 6 12 Miles

NAD 83 State Plane Zone 4

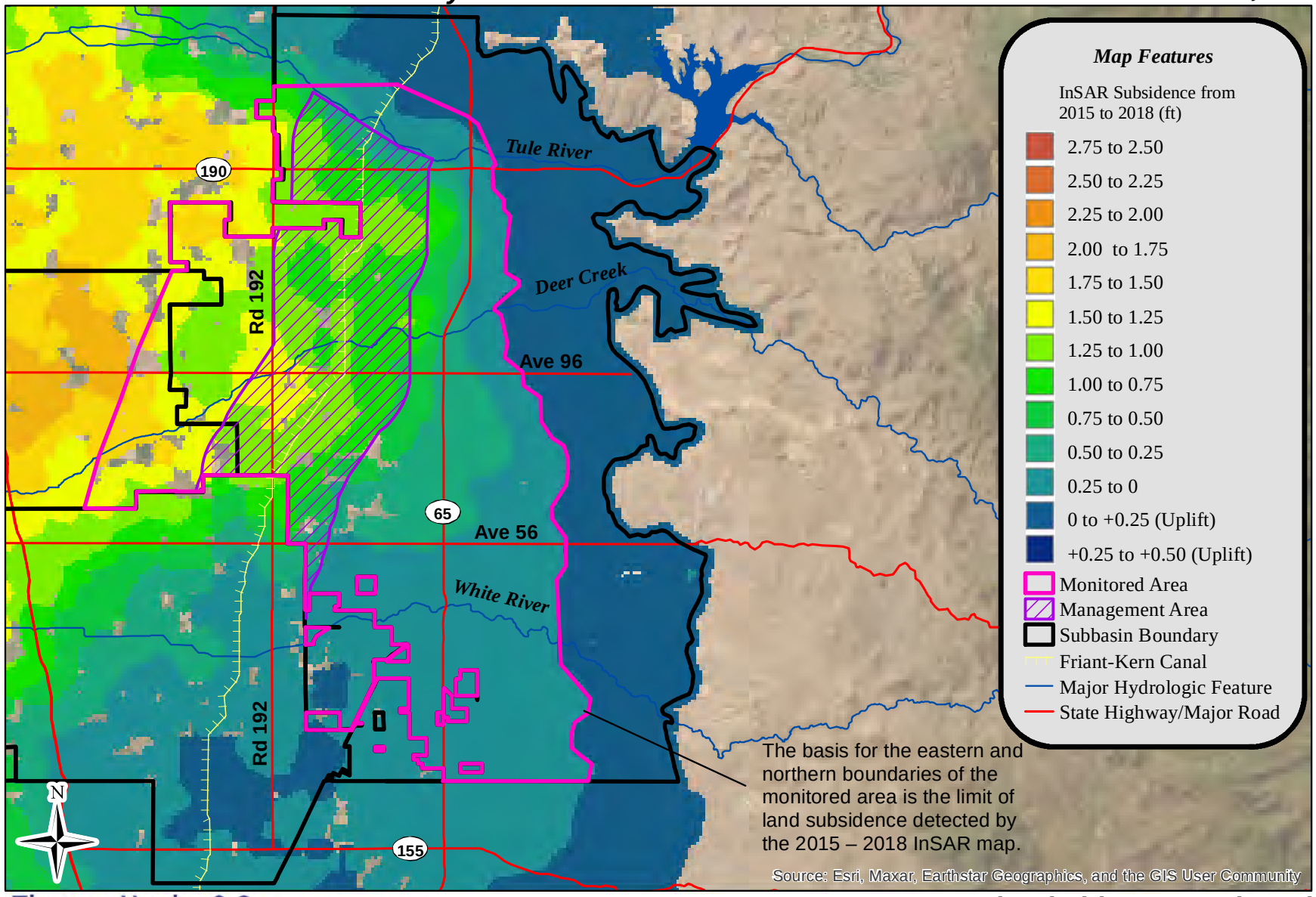
Thomas Harder & Co.
Groundwater Consulting

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GSA Management Areas

Figure 2-50

Tule Subbasin Technical Advisory Committee



Thomas Harder & Co.
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0 2 4 8 Miles

NAD 83 State Plane Zone 4

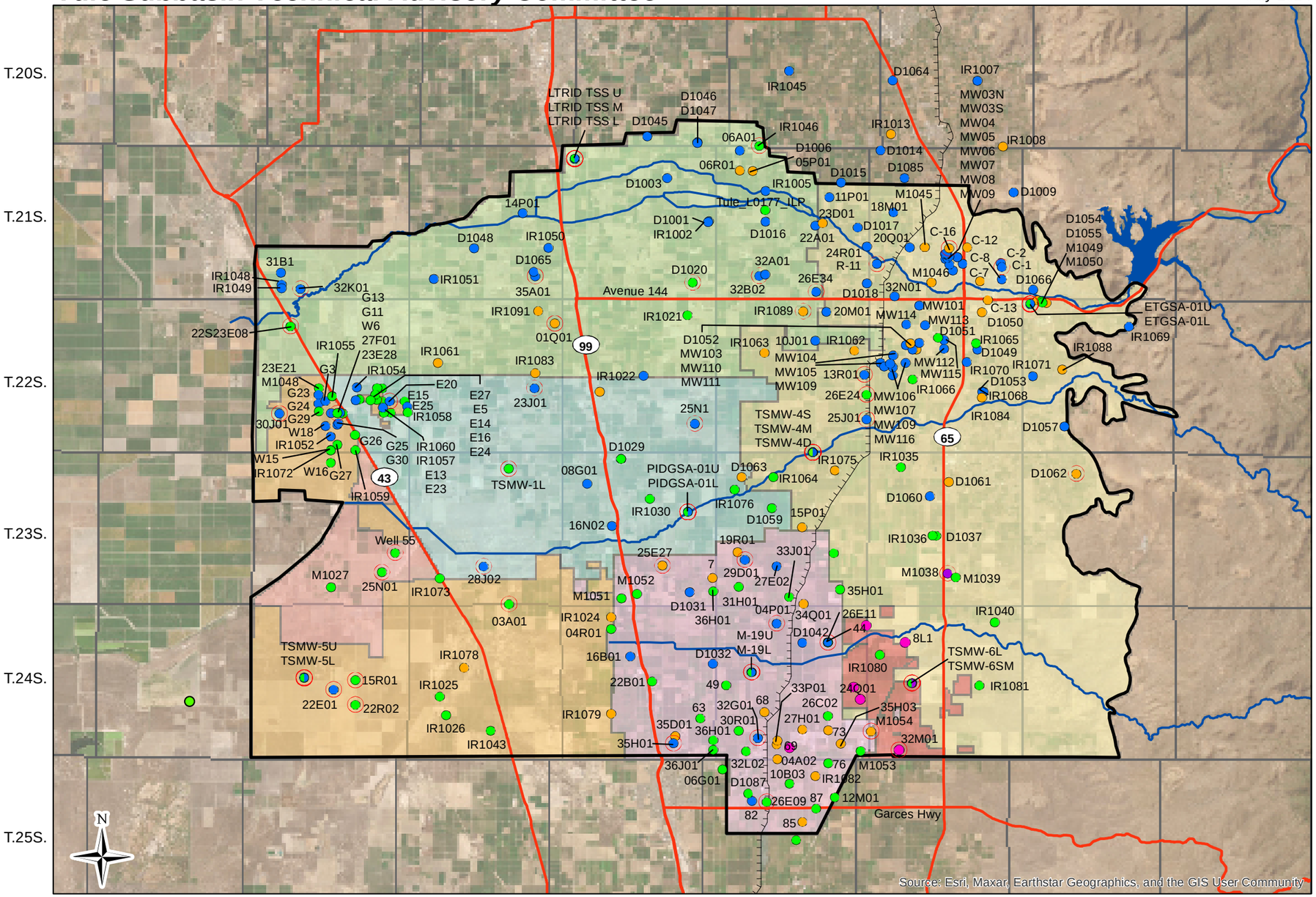
Land Subsidence Monitored and Managed Areas

Figure 2-51

DRAFT-FINAL

Tule Subbasin Technical Advisory Committee

July 2024



0 2.5 5 10 Miles

NAD 83 State Plane Zone 4

Thomas Harder & Co.
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Map Features

- KTWD_Wells
- Upper Aquifer Well
- Upper Aquifer RMS Well
- Lower Aquifer Well
- Lower Aquifer RMS Well
- Composite Aquifer Well
- Composite Aquifer RMS Well
- Santa Margarita Aquifer Well
- Santa Margarita Aquifer RMS Well
- Major Hydrologic Feature
- Friant-Kern Canal
- Alpaugh GSA
- Delano-Earlimart ID GSA
- Eastern Tule GSA
- Kern-Tulare WD GSA
- Lower Tule River ID GSA
- Pixley ID GSA
- Tri-County Water Authority GSA
- Subbasin Boundary
- State Highway

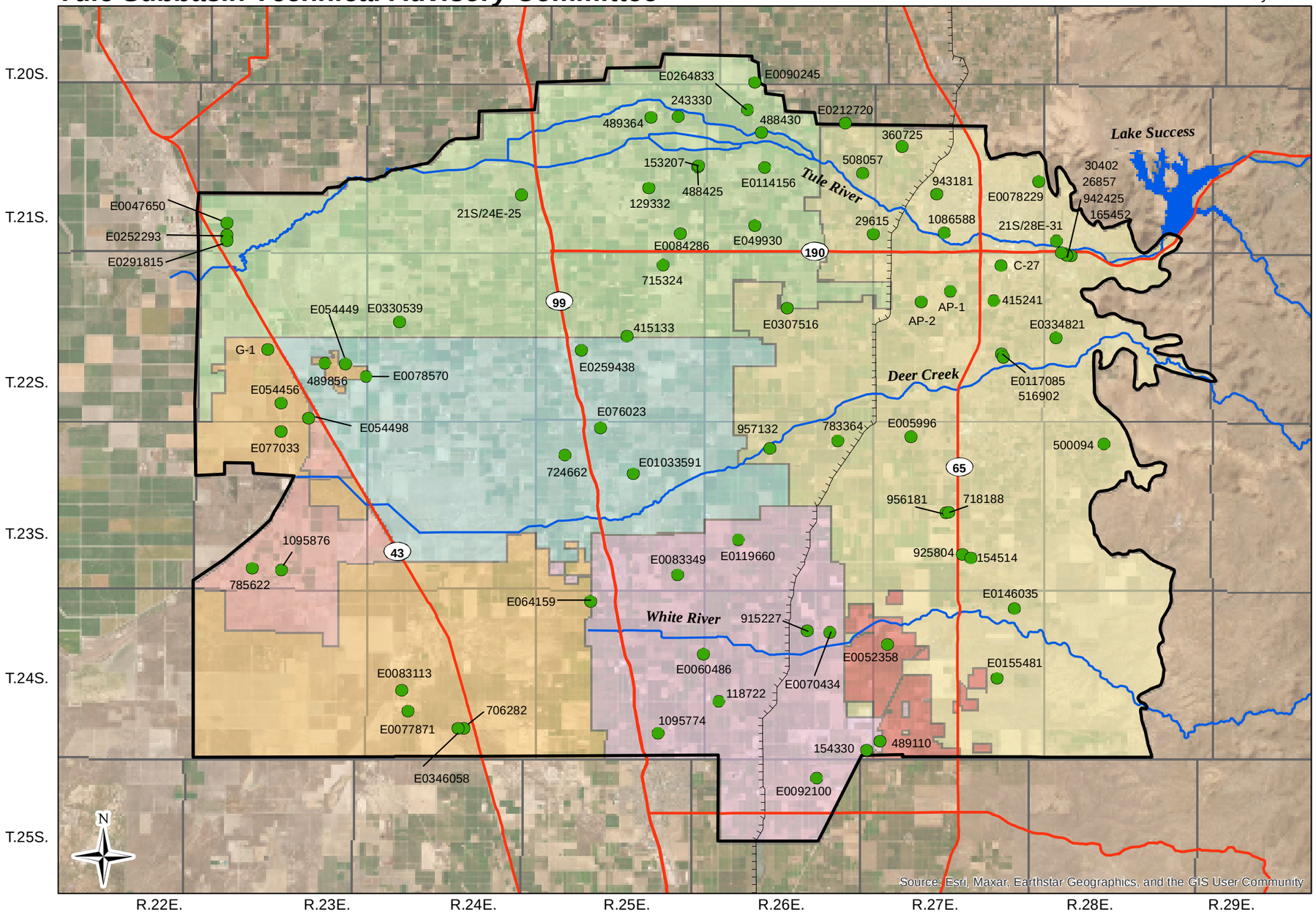
DRAFT-FINAL

Groundwater Level Monitoring Network

Figure 2-52

Tule Subbasin Technical Advisory Committee

July 2024



0 2.5 5 10 Miles

NAD 83 State Plane Zone 4

Map Features

- Groundwater Quality Well
- Major Hydrologic Feature
- Friant-Kern Canal
- Alpaugh GSA
- Delano-Earlimart ID GSA
- Eastern Tule GSA
- Kern-Tulare WD GSA
- Lower Tule River ID GSA
- Pixley ID GSA
- Tri-County Water Authority GSA
- Subbasin Boundary
- State Highway/Major Road

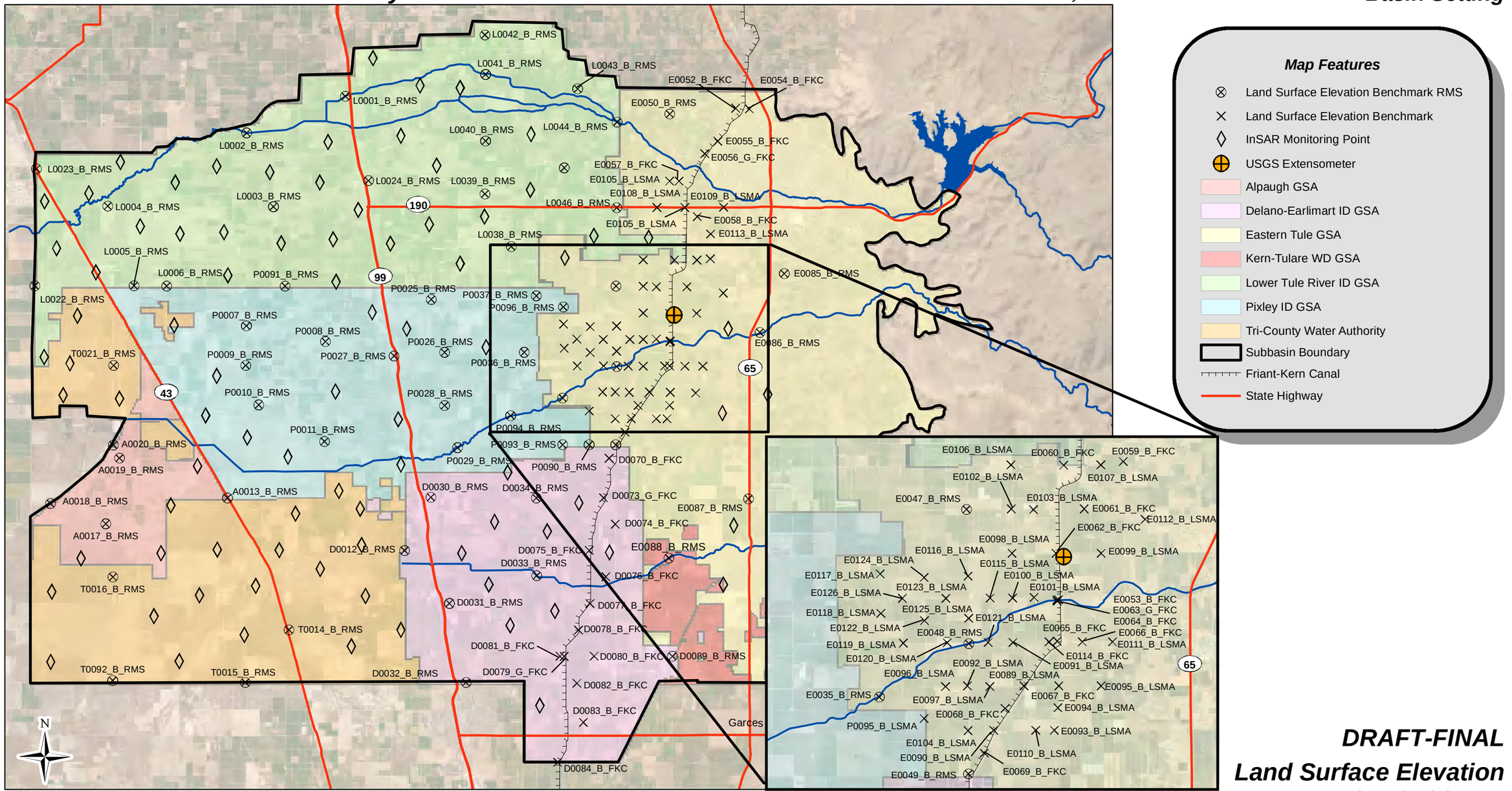
Well Location data from:
Tule Basin Water Quality Coalition, 2017

Thomas Harder & Co.
Groundwater Consulting

DRAFT-FINAL

Groundwater Quality Monitoring Network

Figure 2-53



Map Features

- Land Surface Elevation Benchmark RMS
- Land Surface Elevation Benchmark
- InSAR Monitoring Point
- USGS Extensometer
- Alpaugh GSA
- Delano-Earlimart ID GSA
- Eastern Tule GSA
- Kern-Tulare WD GSA
- Lower Tule River ID GSA
- Pixley ID GSA
- Tri-County Water Authority
- Subbasin Boundary
- Friant-Kern Canal
- State Highway

0 2.5 5 10 Miles

NAD 83 State Plane Zone 4

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Land Surface Elevation and Subsidence Monitoring Network

Figure 2-54

Appendix A

Lower Tule River Irrigation District GSA

Lower Tule River Irrigation District GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Inflow (acre-ft)					Total In
	Precipitation	Stream Inflow	Imported Water	Discharge from Wells		
		Tule River	LTRID	Agricultural	Municipal	
1986/87	82,000	40,421	89,541	240,000	1,400	453,000
1987/88	70,000	14,702	64,654	284,000	1,400	435,000
1988/89	60,000	22,873	63,922	262,000	1,400	410,000
1989/90	71,000	7,103	24,325	289,000	1,400	393,000
1990/91	94,000	22,727	71,430	210,000	1,400	400,000
1991/92	72,000	9,869	51,949	288,000	1,400	423,000
1992/93	107,000	57,632	321,973	167,000	1,400	655,000
1993/94	69,000	31,263	71,784	305,000	1,400	478,000
1994/95	137,000	142,879	229,683	155,000	1,400	666,000
1995/96	71,000	105,949	236,845	231,000	1,400	646,000
1996/97	100,000	250,253	192,934	200,000	1,400	745,000
1997/98	164,000	286,694	101,180	131,000	1,400	684,000
1998/99	72,000	70,954	183,971	226,000	1,400	554,000
1999/00	75,000	64,026	177,192	225,000	1,400	543,000
2000/01	71,000	27,525	83,405	276,000	1,400	459,000
2001/02	60,000	32,853	78,511	309,000	1,500	482,000
2002/03	70,000	77,642	131,470	214,000	1,500	495,000
2003/04	58,000	24,494	71,472	331,000	1,600	487,000
2004/05	114,000	91,549	247,595	144,000	1,600	599,000
2005/06	110,000	129,184	194,019	142,000	1,700	577,000
2006/07	38,000	19,981	33,174	354,000	1,800	447,000
2007/08	61,000	42,745	71,872	304,000	1,800	481,000
2008/09	47,000	29,196	113,189	242,000	1,900	433,000
2009/10	87,000	82,489	200,064	136,000	1,800	507,000
2010/11	134,000	191,791	229,763	107,000	1,900	664,000
2011/12	91,000	58,763	67,684	180,000	1,900	399,000
2012/13	35,000	14,374	37,073	297,000	1,800	385,000
2013/14	31,000	0	0	311,000	1,800	344,000
2014/15	54,000	0	0	286,000	1,800	342,000
2015/16	82,000	35,381	73,382	187,000	1,800	380,000
2016/17	110,000	187,807	273,151	162,000	1,900	735,000
2017/18	49,000	30,226	121,447	217,000	1,900	420,000
2018/19	106,000	145,701	216,118	137,000	1,900	607,000
86/87-18/19 Avg	80,000	71,200	125,000	229,000	1,600	507,000

Lower Tule River Irrigation District GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Outflow (acre-ft)																	
	Areal Recharge of Precipitation	Streambed Infiltration Tule River Oettle Bridge to Turnbull Weir Infiltration	Canal Loss		Recharge in Basins		Deep Percolation of Applied Water				Evapotranspiration						Surface Outflow	Total Out
												Tule River		Imported Water	Ag. Cons. Use from Pumping	Municipal (Landscape ET)		
			Tule River	Imported Water	Tule River	Imported Water	Tule River	Imported Water	Agricultural Pumping	Municipal Pumping	Precipitation Crops/Native	Agricultural Cons. Use	Stream Channel	Agricultural Cons. Use			Tule River	
1986/87	2,000	1,100	20,700	44,200	0	0	6,900	16,800	67,200	900	80,000	11,700	0	28,500	172,000	500	0	453,000
1987/88	1,000	900	8,800	32,700	0	0	2,100	16,000	79,800	900	69,000	2,900	0	16,000	204,000	500	0	435,000
1988/89	0	0	7,400	18,800	0	0	4,400	12,700	73,600	900	60,000	11,100	0	32,400	189,000	500	0	411,000
1989/90	2,000	0	2,900	7,400	0	0	1,700	4,700	81,200	900	70,000	2,400	0	12,100	208,000	500	0	394,000
1990/91	7,000	300	6,800	24,300	0	0	5,600	18,300	58,900	900	88,000	10,100	0	28,800	151,000	500	0	401,000
1991/92	0	0	3,100	16,100	0	0	1,900	10,100	80,700	900	72,000	4,900	0	25,800	207,000	500	0	423,000
1992/93	14,000	3,000	27,800	141,000	0	0	13,200	79,200	46,800	900	93,000	13,600	0	101,800	120,000	500	0	655,000
1993/94	0	200	14,200	27,800	0	0	5,000	12,400	85,600	900	69,000	11,800	0	31,600	220,000	500	0	479,000
1994/95	33,000	10,400	39,500	108,800	0	0	33,400	45,000	43,400	900	104,000	34,300	0	75,900	111,000	500	25,000	665,000
1995/96	0	4,000	26,200	69,600	13,400	33,800	26,100	50,100	64,800	900	71,000	29,700	0	83,300	166,000	500	7,000	646,000
1996/97	9,000	9,700	47,300	51,200	19,900	7,000	26,700	53,700	56,000	900	90,000	25,600	0	81,000	144,000	500	121,000	744,000
1997/98	51,000	9,000	79,100	39,200	28,000	10,800	45,400	18,000	36,600	900	113,000	58,000	0	33,200	94,000	500	95,000	712,000
1998/99	0	2,800	19,500	45,800	11,400	15,800	14,800	44,800	63,300	900	72,000	22,600	0	77,700	162,000	500	0	554,000
1999/00	1,000	2,900	11,100	51,300	3,400	8,000	13,800	42,200	63,100	900	75,000	28,900	0	75,100	162,000	500	5,000	544,000
2000/01	0	0	7,000	25,900	200	2,000	5,700	15,600	77,300	900	71,000	14,600	0	39,900	198,000	500	0	459,000
2001/02	0	700	13,400	20,800	0	0	5,300	16,200	86,700	1,000	60,000	13,500	0	41,500	222,000	500	0	482,000
2002/03	0	3,700	22,800	42,700	5,900	3,300	10,300	20,300	52,000	1,000	70,000	30,000	0	65,100	162,000	500	5,000	495,000
2003/04	0	300	7,700	16,600	0	0	3,800	13,100	78,800	1,000	58,000	12,100	0	41,800	252,000	600	1,000	487,000
2004/05	19,000	4,700	22,900	76,200	11,800	23,500	17,400	44,500	34,400	1,100	95,000	21,900	0	94,000	110,000	600	22,000	599,000
2005/06	16,000	7,200	40,500	62,500	16,500	17,000	22,500	38,300	33,800	1,100	94,000	31,300	0	76,100	108,000	600	11,000	576,000
2006/07	0	1,500	5,100	12,700	0	0	3,200	4,900	84,200	1,100	38,000	10,200	0	15,500	270,000	600	0	447,000
2007/08	0	1,100	15,900	18,200	900	600	9,000	14,300	72,300	1,200	61,000	15,000	0	38,700	231,000	600	1,000	481,000
2008/09	0	1,400	7,100	36,400	400	4,300	4,900	17,500	57,500	1,200	47,000	15,600	0	56,000	184,000	700	0	434,000
2009/10	3,000	4,500	34,600	61,600	5,800	15,100	16,000	38,200	32,300	1,200	84,000	21,600	0	85,100	103,000	600	0	507,000
2010/11	31,000	7,500	82,400	80,300	31,800	27,700	38,100	45,900	25,500	1,200	103,000	24,000	0	75,800	82,000	700	8,000	665,000
2011/12	5,000	300	17,800	21,200	1,500	4,200	11,500	10,300	42,900	1,200	86,000	27,800	0	32,000	138,000	700	0	400,000
2012/13	0	0	4,400	11,400	0	0	2,400	6,100	70,600	1,100	35,000	7,600	0	19,600	226,000	600	0	385,000
2013/14	0	0	0	0	0	0	0	0	74,100	1,200	31,000	0	0	0	237,000	600	0	344,000
2014/15	0	0	0	0	0	0	0	0	68,100	1,200	54,000	0	0	0	218,000	600	0	342,000
2015/16	2,000	5,500	11,400	27,400	800	0	5,200	20,300	44,400	1,200	80,000	12,500	0	25,800	142,000	600	0	379,000
2016/17	16,000	15,900	82,600	113,100	28,400	34,000	32,600	47,200	38,500	1,200	94,000	28,300	0	78,900	123,000	700	71,000	805,000
2017/18	0	0	13,000	55,200	400	5,600	4,000	19,100	51,500	1,200	49,000	12,800	0	41,500	165,000	700	1,000	420,000
2018/19	14,000	500	65,400	90,000	15,700	29,300	29,400	52,300	32,700	1,200	93,000	33,300	0	44,000	105,000	700	12,000	619,000
86/87-18/19 Avg	7,000	3,000	23,300	44,000	5,900	7,300	12,800	25,700	59,400	1,000	74,000	18,200	0	47,700	169,000	600	11,700	511,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Lower Tule River Irrigation District GSA
Historical Groundwater Budget 1986/87 to 2018/19

Water Year	Groundwater Inflows (acre-ft)													Groundwater Outflows (acre-ft)						Change in Storage (acre-ft)		
	Areal Recharge from Precipitation	Tule River				Imported Water Deliveries			Agricultural Pumping	Municipal Pumping	Sub-surface Inflow		Total In	Groundwater Pumping			Sub-surface Outflow		Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage
		Oettle Bridge to Turnbull Weir Infiltration	Canal Loss	Recharge in Basins	Return Flow	Canal Loss	Recharge in Basins	Return Flow	Return Flow	Return Flow	From Outside Subbasin	From Other GSAs		Muni-cipal	Agri-cultural	Exports	To Outside Subbasin	To Other GSAs				
1986/87	2,000	1,100	20,700	0	6,900	44,200	0	16,800	67,200	900	49,000	42,000	251,000	1,400	240,000	0	18,000	94,000	353,000	-44,000	-58,000	-102,000
1987/88	1,000	900	8,800	0	2,100	32,700	0	16,000	79,800	900	56,000	40,000	238,000	1,400	284,000	15,940	18,000	85,000	404,000	-51,000	-115,000	-166,000
1988/89	0	0	7,400	0	4,400	18,800	0	12,700	73,600	900	57,000	40,000	215,000	1,400	262,000	26,160	20,000	75,000	385,000	-38,000	-132,000	-170,000
1989/90	2,000	0	2,900	0	1,700	7,400	0	4,700	81,200	900	52,000	39,000	192,000	1,400	289,000	26,590	19,000	71,000	407,000	-60,000	-155,000	-215,000
1990/91	7,000	300	6,800	0	5,600	24,300	0	18,300	58,900	900	52,000	38,000	212,000	1,400	210,000	28,190	18,000	63,000	321,000	-31,000	-78,000	-109,000
1991/92	0	0	3,100	0	1,900	16,100	0	10,100	80,700	900	58,000	43,000	214,000	1,400	288,000	17,420	22,000	66,000	395,000	-56,000	-125,000	-181,000
1992/93	14,000	3,000	27,800	0	13,200	141,000	0	79,200	46,800	900	43,000	41,000	410,000	1,400	167,000	7,940	31,000	73,000	280,000	-7,000	137,000	130,000
1993/94	0	200	14,200	0	5,000	27,800	0	12,400	85,600	900	50,000	41,000	237,000	1,400	305,000	0	24,000	68,000	398,000	-40,000	-121,000	-161,000
1994/95	33,000	10,400	39,500	0	33,400	108,800	0	45,000	43,400	900	39,000	38,000	391,000	1,400	155,000	0	25,000	77,000	258,000	-1,000	134,000	133,000
1995/96	0	4,000	26,200	13,400	26,100	69,600	33,800	50,100	64,800	900	42,000	38,000	369,000	1,400	231,000	0	25,000	85,000	342,000	-12,000	39,000	27,000
1996/97	9,000	9,700	47,300	19,900	26,700	51,200	7,000	53,700	56,000	900	43,000	37,000	361,000	1,400	200,000	0	23,000	87,000	311,000	0	50,000	50,000
1997/98	51,000	9,000	79,100	28,000	45,400	39,200	10,800	18,000	36,600	900	43,000	35,000	396,000	1,400	131,000	0	21,000	91,000	244,000	6,000	146,000	152,000
1998/99	0	2,800	19,500	11,400	14,800	45,800	15,800	44,800	63,300	900	49,000	39,000	307,000	1,400	226,000	0	24,000	89,000	340,000	-4,000	-29,000	-33,000
1999/00	1,000	2,900	11,100	3,400	13,800	51,300	8,000	42,200	63,100	900	50,000	37,000	285,000	1,400	225,000	2,820	23,000	86,000	338,000	-3,000	-50,000	-53,000
2000/01	0	0	7,000	200	5,700	25,900	2,000	15,600	77,300	900	57,000	41,000	233,000	1,400	276,000	17,290	23,000	79,000	397,000	-32,000	-132,000	-164,000
2001/02	0	700	13,400	0	5,300	20,800	0	16,200	86,700	1,000	59,000	41,000	244,000	1,500	309,000	25,590	21,000	71,000	428,000	-41,000	-143,000	-184,000
2002/03	0	3,700	22,800	5,900	10,300	42,700	3,300	20,300	52,000	1,000	51,000	36,000	249,000	1,500	214,000	20,610	21,000	71,000	328,000	-16,000	-63,000	-79,000
2003/04	0	300	7,700	0	3,800	16,600	0	13,100	78,800	1,000	58,000	37,000	216,000	1,600	331,000	17,440	17,000	63,000	430,000	-83,000	-131,000	-214,000
2004/05	19,000	4,700	22,900	11,800	17,400	76,200	23,500	44,500	34,400	1,100	42,000	32,000	330,000	1,600	144,000	7,720	22,000	69,000	244,000	-6,000	92,000	86,000
2005/06	16,000	7,200	40,500	16,500	22,500	62,500	17,000	38,300	33,800	1,100	40,000	32,000	327,000	1,700	142,000	0	23,000	67,000	234,000	4,000	89,000	93,000
2006/07	0	1,500	5,100	0	3,200	12,700	0	4,900	84,200	1,100	53,000	37,000	203,000	1,800	354,000	27,930	18,000	57,000	459,000	-60,000	-196,000	-256,000
2007/08	0	1,100	15,900	900	9,000	18,200	600	14,300	72,300	1,200	54,000	43,000	231,000	1,800	304,000	26,140	24,000	62,000	418,000	-90,000	-97,000	-187,000
2008/09	0	1,400	7,100	400	4,900	36,400	4,300	17,500	57,500	1,200	50,000	47,000	228,000	1,900	242,000	21,470	30,000	67,000	362,000	-70,000	-64,000	-134,000
2009/10	3,000	4,500	34,600	5,800	16,000	61,600	15,100	38,200	32,300	1,200	34,000	48,000	294,000	1,800	136,000	10,770	38,000	76,000	263,000	-20,000	51,000	31,000
2010/11	31,000	7,500	82,400	31,800	38,100	80,300	27,700	45,900	25,500	1,200	33,000	43,000	447,000	1,900	107,000	3,880	39,000	74,000	226,000	4,000	217,000	221,000
2011/12	5,000	300	17,800	1,500	11,500	21,200	4,200	10,300	42,900	1,200	38,000	42,000	196,000	1,900	180,000	21,600	34,000	68,000	306,000	-19,000	-91,000	-110,000
2012/13	0	0	4,400	0	2,400	11,400	0	6,100	70,600	1,100	51,000	51,000	198,000	1,800	297,000	39,910	36,000	64,000	439,000	-65,000	-176,000	-241,000
2013/14	0	0	0	0	0	0	0	0	74,100	1,200	52,000	51,000	178,000	1,800	311,000	37,120	37,000	62,000	449,000	-135,000	-136,000	-271,000
2014/15	0	0	0	0	0	0	0	0	68,100	1,200	46,000	51,000	166,000	1,800	286,000	33,170	38,000	59,000	418,000	-143,000	-109,000	-252,000
2015/16	2,000	5,500	11,400	800	5,200	27,400	0	20,300	44,400	1,200	43,000	50,000	211,000	1,800	187,000	28,300	40,000	64,000	321,000	-73,000	-37,000	-110,000
2016/17	16,000	15,900	82,600	28,400	32,600	113,100	34,000	47,200	38,500	1,200	38,000	47,000	495,000	1,900	162,000	6,810	38,000	69,000	278,000	-16,000	233,000	217,000
2017/18	0	0	13,000	400	4,000	55,200	5,600	19,100	51,500	1,200	41,000	49,000	240,000	1,900	217,000	6,810	41,000	75,000	342,000	-26,000	-76,000	-102,000
2018/19	14,000	500	65,400	15,700	29,400	90,000	29,300	52,300	32,700	1,200	34,000	49,000	414,000	1,900	137,000	6,810	42,000	77,000	265,000	-3,000	152,000	149,000
86/87-18/19 Avg	7,000	3,000	23,300	5,900	12,800	44,000	7,300	25,700	59,400	1,000	47,000	42,000	278,000	1,600	229,000	14,700	27,000	73,000	345,000	-37,000	-30,000	-67,000
																			Cumulative Change in Storage	-1,231,000	-974,000	-2,205,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Appendix B

Eastern Tule GSA

Eastern Tule GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Inflow (acre-ft)														
		Stream Inflow			Imported Water								Discharge from Wells		
	Precip-itation	Tule River	Deer Creek	White River	Saucelito ID	Terra Bella ID	Porterville ID	Tea Pot Dome WD	City of Porterville	Hope WD	Ducor ID	Recyled Water	Agricultural	Municipal	Total In
1986/87	145,000	70,029	8,386	2,496	23,879	13,136	15,337	5,490	0	0	0	2,200	111,000	9,100	406,000
1987/88	123,000	39,842	6,090	1,420	19,666	21,961	13,067	5,493	0	0	0	2,200	121,000	10,700	364,000
1988/89	98,000	49,667	7,791	1,942	22,426	22,561	13,106	6,226	0	0	0	3,300	137,000	11,200	373,000
1989/90	117,000	29,342	4,706	778	16,166	23,159	11,520	6,193	0	0	0	3,700	132,000	11,700	356,000
1990/91	145,000	51,275	7,250	1,362	19,848	18,725	11,322	5,636	0	0	0	3,800	89,000	12,100	365,000
1991/92	107,000	34,325	4,082	739	21,566	20,743	15,569	6,607	0	0	0	4,000	149,000	12,300	376,000
1992/93	171,000	115,640	15,132	3,623	41,261	18,180	12,310	6,968	0	0	0	4,700	154,000	12,500	555,000
1993/94	114,000	61,313	6,821	1,148	22,064	18,740	12,895	6,526	0	0	0	5,100	204,000	12,900	466,000
1994/95	218,000	218,479	32,235	10,596	37,477	16,186	9,455	6,562	0	0	0	5,100	155,000	12,800	722,000
1995/96	117,000	174,473	23,264	5,957	48,924	21,617	13,808	7,993	0	0	0	4,800	183,000	12,900	614,000
1996/97	156,000	353,968	58,823	12,920	40,908	20,158	13,379	7,298	0	0	0	5,300	174,000	13,800	857,000
1997/98	275,000	439,125	88,359	36,764	28,221	13,165	10,159	4,913	0	0	0	4,900	134,000	13,000	1,048,000
1998/99	128,000	108,466	18,410	7,469	37,062	17,567	16,107	9,218	0	0	0	3,200	174,000	12,900	532,000
1999/00	132,000	102,354	15,230	4,878	39,734	19,200	15,545	7,191	0	0	0	4,700	179,000	13,800	534,000
2000/01	105,000	55,249	7,015	4,695	25,252	19,194	15,436	6,456	0	0	0	5,000	157,000	13,900	414,000
2001/02	98,000	73,206	10,369	6,176	26,131	20,234	13,628	6,388	0	0	0	4,900	205,000	15,600	480,000
2002/03	123,000	125,004	15,690	5,875	33,692	18,356	14,646	5,844	0	0	0	6,200	181,000	15,200	545,000
2003/04	93,000	51,738	6,883	2,350	26,988	20,352	14,698	6,913	0	0	0	6,100	248,000	16,200	493,000
2004/05	175,000	172,558	22,743	6,502	42,840	15,266	14,748	5,217	0	0	0	5,200	149,000	14,900	624,000
2005/06	173,000	195,667	23,876	7,588	45,106	21,763	13,251	6,436	0	0	0	5,100	81,000	15,800	589,000
2006/07	74,000	38,587	6,908	1,815	16,280	20,797	9,775	5,489	0	0	0	4,900	219,000	16,700	414,000
2007/08	93,000	74,030	8,395	2,355	24,083	18,192	12,988	6,894	0	0	0	4,600	201,000	16,900	462,000
2008/09	84,000	54,737	6,618	1,751	31,282	19,701	18,000	6,165	0	0	0	5,000	141,000	16,200	384,000
2009/10	144,000	144,778	16,480	5,080	42,855	17,574	14,335	5,845	0	0	0	4,800	96,000	15,500	507,000
2010/11	210,000	266,473	44,873	14,997	46,733	16,381	9,387	6,105	0	0	0	5,300	59,000	15,400	695,000
2011/12	149,000	87,532	11,311	3,334	19,189	19,757	9,318	4,680	0	0	0	5,200	86,000	16,000	411,000
2012/13	58,000	30,284	4,777	1,145	14,102	20,628	10,298	4,354	0	0	0	4,300	148,000	16,200	312,000
2013/14	57,000	13,171	2,957	535	5,724	12,390	178	1,030	0	0	0	4,800	183,000	15,300	296,000
2014/15	88,000	8,820	1,994	253	1,503	12,012	114	260	0	0	0	4,500	163,000	13,000	293,000
2015/16	145,000	74,330	14,559	4,547	20,049	14,357	13,271	4,627	0	0	0	4,600	111,000	12,900	419,000
2016/17	178,000	356,920	64,976	22,113	51,137	16,089	21,651	6,694	0	0	0	4,700	124,000	13,100	859,000
2017/18	83,000	66,673	9,047	2,545	28,219	17,800	12,706	6,858	0	0	0	5,300	123,000	13,900	369,000
2018/19	190,000	223,636	32,582	10,667	55,019	15,825	60,853	6,524	0	0	0	4,600	82,000	13,500	695,000
86/87-18/19 Avg	132,000	120,100	18,400	6,000	29,600	18,200	14,000	5,900	0	0	0	4,600	147,000	13,900	510,000

Eastern Tule GSA
Historical Subbasin Surface Water Budget 1986/87 to 2016/17

Water Year	Surface Water Outflow (acre-ft)																													
	Areal Recharge of Precip-itation	Streambed Infiltration			Recharge in Basins				Deep Percolation of Applied Water						Evapotransportation											Surface Outflow				Total Out
		Tule River	Deer Creek	White River	Tule River	Deer Creek	Imported Water	Recyled Water	Tule River	Deer Creek	Imported Water	Recycled Water	Agri-cultural Pumping	Muni-cipal Pumping	Precip-itation Crops/ Native	Tule River		Deer Creek		White River	Imported Water	Ag. Cons. Use from Pumping	Recycled Water	Muni-cipal (Land-scape ET)	Tule River		Deer Creek	White River	
		Success to Oettle Bridge Infiltration	Before Trenton Weir Infiltration													Agri-cultural Cons. Use	Stream Channel	Agri-cultural Cons. Use	Stream Channel	Stream Channel	Agri-cultural Cons. Use		Agri-cultural Cons. Use		To LTIRD GSA	To FKC	To Pixley GSA	To DEID GSA	
1986/87	22,000	11,600	7,300	2,400	5,400	800	0	100	6,100	0	21,500	1,100	21,200	2,400	122,000	6,500	400	0	300	100	34,700	90,000	1,000	3,200	40,400	0	0	0	401,000
1987/88	11,000	8,000	5,300	1,300	5,000	500	0	100	8,400	0	20,300	1,000	23,900	2,600	113,000	4,100	300	0	300	100	38,200	97,000	1,000	3,800	14,700	0	0	0	360,000
1988/89	4,000	8,700	7,500	1,800	6,200	0	0	800	2,700	0	19,400	1,300	26,600	2,700	94,000	3,600	300	0	300	100	43,300	110,000	1,200	4,000	22,900	0	0	0	361,000
1989/90	10,000	5,000	4,400	700	3,700	0	0	1,200	2,500	0	18,700	1,300	26,100	2,700	107,000	2,800	400	0	300	100	36,600	106,000	1,200	4,100	7,100	0	0	0	342,000
1990/91	25,000	6,400	6,900	1,300	5,200	0	0	1,500	2,500	0	16,100	1,600	17,800	2,800	120,000	2,700	300	0	300	100	37,800	71,000	700	4,300	22,700	0	0	0	347,000
1991/92	3,000	4,300	2,700	700	3,700	1,100	0	800	2,500	0	15,300	1,900	28,700	2,900	104,000	3,000	400	0	300	100	47,500	120,000	1,300	4,300	9,900	0	0	0	358,000
1992/93	31,000	18,500	10,800	3,500	8,200	4,000	0	1,300	12,000	0	27,200	2,200	26,700	2,900	140,000	11,000	400	0	400	100	49,800	127,000	1,200	4,400	57,600	0	0	0	540,000
1993/94	0	6,100	3,900	1,100	5,000	2,600	0	1,400	5,200	0	13,900	2,000	36,800	3,000	114,000	5,900	300	0	300	100	44,600	167,000	1,700	4,500	31,300	0	0	0	451,000
1994/95	61,000	36,400	18,100	6,600	7,800	3,400	0	1,700	21,500	0	23,600	2,000	26,400	3,000	157,000	15,300	400	0	400	100	44,400	128,000	1,300	4,500	142,900	0	10,400	3,900	720,000
1995/96	1,000	20,700	11,300	4,600	7,800	2,600	0	2,100	21,000	0	30,000	1,400	31,800	3,000	117,000	15,700	400	0	400	100	60,700	151,000	1,300	4,600	105,900	0	9,000	1,300	605,000
1996/97	21,000	34,600	43,800	6,100	5,400	1,400	0	2,400	23,100	0	26,900	1,700	29,600	3,200	135,000	11,200	400	0	400	100	53,200	144,000	1,300	4,900	250,300	36,400	13,300	6,700	856,000
1997/98	98,000	41,100	12,900	9,500	4,100	2,000	0	3,500	24,000	0	16,000	600	22,100	3,100	178,000	10,300	400	0	400	200	38,700	112,000	900	4,600	286,700	0	74,600	27,100	971,000
1998/99	4,000	14,300	9,000	7,100	6,200	4,200	0	1,900	6,300	0	25,300	600	30,100	3,100	123,000	6,500	400	0	400	200	52,900	144,000	700	4,600	71,000	0	4,800	200	521,000
1999/00	7,000	16,900	9,400	4,100	5,500	700	0	3,500	6,500	0	28,300	600	32,000	3,200	125,000	3,300	400	0	400	100	51,700	147,000	600	4,900	64,000	0	4,800	600	521,000
2000/01	5,000	12,300	5,100	4,300	4,800	1,600	0	3,700	2,900	0	18,100	700	28,600	3,300	100,000	4,700	300	0	300	100	46,600	128,000	600	4,900	27,500	0	0	300	404,000
2001/02	0	14,800	7,700	5,000	5,800	2,400	0	3,600	7,400	0	17,800	600	37,300	3,500	98,000	3,700	400	0	300	100	46,900	168,000	700	5,500	32,900	0	0	1,100	464,000
2002/03	3,000	19,700	12,600	5,100	6,300	1,000	0	3,300	2,800	0	18,700	1,800	29,000	3,400	121,000	4,300	400	0	400	100	52,100	152,000	1,100	5,400	77,600	0	1,700	600	523,000
2003/04	0	9,900	4,900	2,300	3,900	1,700	0	1,900	2,600	0	16,400	2,400	39,600	3,500	93,000	4,100	400	0	300	100	50,800	208,000	1,700	5,700	24,500	0	0	0	478,000
2004/05	34,000	24,200	13,800	5,100	7,200	600	0	1,000	10,700	0	27,700	3,100	22,800	3,400	142,000	7,800	400	0	400	100	48,400	126,000	1,100	5,300	91,500	0	8,000	1,300	586,000
2005/06	34,000	28,100	13,400	5,100	6,800	900	0	800	28,400	0	37,700	3,500	12,800	3,500	139,000	4,500	400	0	400	100	47,000	68,000	800	5,600	129,200	0	9,200	2,400	582,000
2006/07	0	6,200	6,500	1,700	5,000	100	0	1,100	1,400	0	11,700	2,400	35,300	3,600	74,000	2,600	300	0	300	100	38,800	183,000	1,400	5,900	20,000	0	0	0	401,000
2007/08	0	11,700	7,600	2,300	6,600	500	0	1,500	4,500	0	14,600	1,700	32,200	3,600	93,000	2,200	300	0	300	100	45,500	169,000	1,400	6,000	42,700	0	0	0	447,000
2008/09	1,000	9,500	3,100	1,600	5,800	7,000	0	1,600	3,100	0	16,000	2,000	22,400	3,500	83,000	4,700	400	0	300	100	57,100	119,000	1,300	5,700	29,200	0	0	0	377,000
2009/10	14,000	25,600	13,100	5,000	17,000	3,200	0	1,700	17,800	0	30,000	2,100	14,800	3,500	131,000	7,900	400	0	400	100	48,600	81,000	1,000	5,500	82,500	0	0	0	506,000
2010/11	63,000	37,100	24,200	8,300	10,600	0	0	1,900	30,200	100	39,900	2,600	9,800	3,400	147,000	2,100	400	100	400	200	36,900	49,000	900	5,400	191,800	10,000	20,200	6,500	702,000
2011/12	20,000	13,600	6,700	3,200	7,000	4,500	0	1,300	3,400	100	20,400	2,800	14,400	3,500	129,000	1,600	400	100	300	100	30,700	71,000	1,100	5,600	58,800	0	0	0	400,000
2012/13	3,000	4,900	3,100	1,000	5,400	1,300	0	1,100	1,600	100	9,700	1,600	25,000	3,600	55,000	900	400	100	300	100	37,800	123,000	1,500	5,700	14,400	0	0	0	301,000
2013/14	5,000	2,300	2,500	400	4,100	0	0	1,800	2,000	200	5,900	1,500	31,000	3,400	53,000	400	300	200	300	100	11,400	152,000	1,600	5,400	0	0	0	0	285,000
2014/15	3,000	1,000	1,600	200	4,600	0	0	1,800	1,400	200	4,200	1,200	27,300	3,200	85,000	1,000	300	100	200	100	8,500	136,000	1,500	4,600	0	0	0	0	287,000
2015/16	14,000	16,000	14,000	4,400	6,900	100	0	2,000	4,000	200	20,100	1,600	18,300	3,200	131,000	2,300	300	200	300	100	31,200	92,000	900	4,500	35,400	0	0	0	403,000
2016/17	36,000	42,100	50,600	6,900	15,700	0	14,500	2,100	32,700	200	41,900	1,600	19,800	3,200	143,000	4,300	400	100	400	200	49,200	102,000	900	4,600	187,800	0	13,800	15,100	789,000
2017/18	9,000	9,600	8,400	2,400	9,300	0	2,900	1,800	3,200	300	26,100	2,100	20,900	3,300	73,000	700	400	100	300	100	36,300	101,000	1,300	4,900	30,200	0	0	0	348,000
2018/19	48,000	30,200	28,500	7,200	16,100	0	43,800	2,300	7,000	300	56,900	1,400	12,900	3,200	142,000	2,200	400	100	400	200	47,500	66,000	900	4,800	145,700	0	3,300	3,300	675,000
86/87-18/19 Avg	18,000	16,700	11,500	3,700	6,900	1,500	1,900	1,800	9,400	100	22,300	1,700	25,300	3,200	115,000	5,000	400	0	300	100	42,600	121,000	1,100	4,900	71,200	1,400	5,200	2,100	494,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Eastern Tule GSA
Historical Groundwater Budget 1986/87 to 2018/19

Water Year	Groundwater Inflows (acre-ft)															Groundwater Outflows (acre-ft)					Change in Storage (acre-ft)		
	Areal Recharge from Precip-itation	Tule River			Deer Creek	White River	Imported Water Deliveries	Agricultural Pumping	Municipal Pumping	Recycled Water		Sub-surface Inflow		Mountain-Block Recharge	Total In	Groundwater Pumping		Sub-surface Outflow		Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage
		Success to Oettle Bridge Infiltration	Recharge in Basins	Return Flow	Infiltration Before Trenton Weir	Infiltration Before DEID	Return Flow	Irrigated Agriculture	Return Flow	Agricultural Return Flow	Artificial Recharge	From Outside Subbasin	From Other GSAs			Muni-cipal	Agri-culture	To Outside Subbasin	To Other GSAs				
1986/87	22,000	11,600	5,400	6,100	7,300	2,400	21,500	21,200	2,400	1,100	100	10,000	41,000	31,000	183,000	9,100	111,000	2,000	85,000	207,000	-2,000	-22,000	-24,000
1987/88	11,000	8,000	5,000	8,400	5,300	1,300	20,300	23,900	2,600	1,000	100	12,000	39,000	31,000	169,000	10,700	121,000	3,000	77,000	212,000	-6,000	-37,000	-43,000
1988/89	4,000	8,700	6,200	2,700	7,500	1,800	19,400	26,600	2,700	1,300	800	13,000	38,000	31,000	164,000	11,200	137,000	2,000	76,000	226,000	-14,000	-48,000	-62,000
1989/90	10,000	5,000	3,700	2,500	4,400	700	18,700	26,100	2,700	1,300	1,200	12,000	37,000	31,000	156,000	11,700	132,000	2,000	76,000	222,000	-12,000	-54,000	-66,000
1990/91	25,000	6,400	5,200	2,500	6,900	1,300	16,100	17,800	2,800	1,600	1,500	11,000	35,000	31,000	164,000	12,100	89,000	3,000	75,000	179,000	1,000	-16,000	-15,000
1991/92	3,000	4,300	3,700	2,500	2,700	700	15,300	28,700	2,900	1,900	800	11,000	35,000	31,000	144,000	12,300	149,000	2,000	81,000	244,000	-34,000	-66,000	-100,000
1992/93	31,000	18,500	8,200	12,000	10,800	3,500	27,200	26,700	2,900	2,200	1,300	11,000	38,000	31,000	224,000	12,500	154,000	3,000	69,000	239,000	-21,000	6,000	-15,000
1993/94	0	6,100	5,000	5,200	3,900	1,100	13,900	36,800	3,000	2,000	1,400	13,000	36,000	31,000	158,000	12,900	204,000	3,000	72,000	292,000	-32,000	-102,000	-134,000
1994/95	61,000	36,400	7,800	21,500	18,100	6,600	23,600	26,400	3,000	2,000	1,700	11,000	40,000	31,000	290,000	12,800	155,000	4,000	69,000	241,000	-7,000	56,000	49,000
1995/96	1,000	20,700	7,800	21,000	11,300	4,600	30,000	31,800	3,000	1,400	2,100	11,000	39,000	31,000	216,000	12,900	183,000	4,000	72,000	272,000	-16,000	-40,000	-56,000
1996/97	21,000	34,600	5,400	23,100	43,800	6,100	26,900	29,600	3,200	1,700	2,400	12,000	40,000	31,000	281,000	13,800	174,000	4,000	71,000	263,000	-13,000	31,000	18,000
1997/98	98,000	41,100	4,100	24,000	12,900	9,500	16,000	22,100	3,100	600	3,500	10,000	39,000	31,000	315,000	13,000	134,000	5,000	63,000	215,000	5,000	95,000	100,000
1998/99	4,000	14,300	6,200	6,300	9,000	7,100	25,300	30,100	3,100	600	1,900	10,000	39,000	31,000	188,000	12,900	174,000	5,000	68,000	260,000	-14,000	-58,000	-72,000
1999/00	7,000	16,900	5,500	6,500	9,400	4,100	28,300	32,000	3,200	600	3,500	12,000	39,000	31,000	199,000	13,800	179,000	4,000	65,000	262,000	-7,000	-56,000	-63,000
2000/01	5,000	12,300	4,800	2,900	5,100	4,300	18,100	28,600	3,300	700	3,700	10,000	37,000	31,000	167,000	13,900	157,000	3,000	67,000	241,000	-11,000	-63,000	-74,000
2001/02	0	14,800	5,800	7,400	7,700	5,000	17,800	37,300	3,500	600	3,600	11,000	37,000	31,000	183,000	15,600	205,000	3,000	71,000	295,000	-31,000	-81,000	-112,000
2002/03	3,000	19,700	6,300	2,800	12,600	5,100	18,700	29,000	3,400	1,800	3,300	12,000	37,000	31,000	186,000	15,200	181,000	2,000	66,000	264,000	-22,000	-56,000	-78,000
2003/04	0	9,900	3,900	2,600	4,900	2,300	16,400	39,600	3,500	2,400	1,900	13,000	37,000	31,000	168,000	16,200	248,000	2,000	70,000	336,000	-55,000	-113,000	-168,000
2004/05	34,000	24,200	7,200	10,700	13,800	5,100	27,700	22,800	3,400	3,100	1,000	11,000	37,000	31,000	232,000	14,900	149,000	3,000	61,000	228,000	-12,000	16,000	4,000
2005/06	34,000	28,100	6,800	28,400	13,400	5,100	37,700	12,800	3,500	3,500	800	10,000	34,000	31,000	249,000	15,800	81,000	3,000	60,000	160,000	15,000	74,000	89,000
2006/07	0	6,200	5,000	1,400	6,500	1,700	11,700	35,300	3,600	2,400	1,100	10,000	32,000	31,000	148,000	16,700	219,000	3,000	71,000	310,000	-40,000	-122,000	-162,000
2007/08	0	11,700	6,600	4,500	7,600	2,300	14,600	32,200	3,600	1,700	1,500	11,000	36,000	31,000	164,000	16,900	201,000	2,000	70,000	290,000	-35,000	-91,000	-126,000
2008/09	1,000	9,500	5,800	3,100	3,100	1,600	16,000	22,400	3,500	2,000	1,600	9,000	34,000	31,000	144,000	16,200	141,000	2,000	69,000	228,000	-18,000	-66,000	-84,000
2009/10	14,000	25,600	17,000	17,800	13,100	5,000	30,000	14,800	3,500	2,100	1,700	7,000	33,000	31,000	216,000	15,500	96,000	3,000	65,000	180,000	-3,000	39,000	36,000
2010/11	63,000	37,100	10,600	30,200	24,200	8,300	39,900	9,800	3,400	2,600	1,900	7,000	33,000	31,000	302,000	15,400	59,000	4,000	60,000	138,000	19,000	145,000	164,000
2011/12	20,000	13,600	7,000	3,400	6,700	3,200	20,400	14,400	3,500	2,800	1,300	6,000	31,000	31,000	164,000	16,000	86,000	3,000	65,000	170,000	-3,000	-3,000	-6,000
2012/13	3,000	4,900	5,400	1,600	3,100	1,000	9,700	25,000	3,600	1,600	1,100	6,000	33,000	31,000	130,000	16,200	148,000	2,000	76,000	242,000	-22,000	-90,000	-112,000
2013/14	5,000	2,300	4,100	2,000	2,500	400	5,900	31,000	3,400	1,500	1,800	6,000	34,000	31,000	131,000	15,300	183,000	2,000	81,000	281,000	-41,000	-109,000	-150,000
2014/15	3,000	1,000	4,600	1,400	1,600	200	4,200	27,300	3,200	1,200	1,800	5,000	36,000	31,000	122,000	13,000	163,000	2,000	76,000	254,000	-37,000	-95,000	-132,000
2015/16	14,000	16,000	6,900	4,000	14,000	4,400	20,100	18,300	3,200	1,600	2,000	6,000	35,000	31,000	177,000	12,900	111,000	2,000	68,000	194,000	-10,000	-7,000	-17,000
2016/17	36,000	42,100	15,700	32,700	50,600	6,900	41,900	19,800	3,200	1,600	2,100	6,000	34,000	31,000	324,000	13,100	124,000	4,000	68,000	209,000	-6,000	121,000	115,000
2017/18	9,000	9,600	9,300	3,200	8,400	2,400	26,100	20,900	3,300	2,100	1,800	6,000	33,000	31,000	166,000	13,900	123,000	3,000	73,000	213,000	-1,000	-46,000	-47,000
2018/19	48,000	30,200	16,100	7,000	28,500	7,200	56,900	12,900	3,200	1,400	2,300	5,000	34,000	31,000	284,000	13,500	82,000	4,000	68,000	168,000	6,000	110,000	116,000
86/87-18/19 Avg	18,000	16,700	6,900	9,400	11,500	3,700	22,300	25,300	3,200	1,700	1,800	10,000	36,000	31,000	198,000	13,900	147,000	3,000	70,000	234,000	-15,000	-23,000	-37,000
																				Cummulative Change in Storage	-479,000	-748,000	-1,227,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Appendix C

Delano-Earlimart Irrigation District GSA

Delano-Earlimart Irrigation District GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Inflow (acre-ft)					
	Precipitation	Stream Inflow	Imported Water	Discharge from Wells		Total In
		White River	Delano-Earlimart ID	Agricultural	Municipal	
1986/87	37,000	0	114,782	34,000	2,100	188,000
1987/88	32,000	0	110,345	39,000	2,100	183,000
1988/89	28,000	0	105,980	48,000	2,200	184,000
1989/90	29,000	0	83,837	67,000	2,200	182,000
1990/91	43,000	0	106,877	41,000	2,300	193,000
1991/92	35,000	0	92,567	70,000	2,300	200,000
1992/93	49,000	0	133,359	27,000	2,300	212,000
1993/94	36,000	0	92,394	52,000	2,400	183,000
1994/95	65,000	3,867	124,388	27,000	2,400	223,000
1995/96	29,000	1,276	144,069	37,000	2,500	214,000
1996/97	46,000	6,659	153,967	9,000	2,500	218,000
1997/98	85,000	27,100	119,815	26,000	2,600	261,000
1998/99	37,000	205	124,051	19,000	2,600	183,000
1999/00	35,000	626	134,272	27,000	2,700	200,000
2000/01	35,000	296	117,746	36,000	2,700	192,000
2001/02	28,000	1,067	126,747	31,000	2,800	190,000
2002/03	32,000	646	121,277	22,000	2,800	179,000
2003/04	27,000	0	127,364	27,000	2,900	184,000
2004/05	60,000	1,298	119,847	15,000	2,900	199,000
2005/06	48,000	2,384	121,005	7,000	3,000	181,000
2006/07	22,000	0	79,111	52,000	3,100	156,000
2007/08	25,000	0	106,470	23,000	3,100	158,000
2008/09	21,000	0	111,556	17,000	3,200	153,000
2009/10	42,000	0	118,671	18,000	3,300	182,000
2010/11	65,000	6,543	127,447	13,000	3,300	215,000
2011/12	49,000	0	114,108	25,000	3,400	192,000
2012/13	20,000	0	87,302	67,000	3,400	178,000
2013/14	16,000	0	38,106	117,000	3,500	175,000
2014/15	25,000	0	18,591	94,000	3,600	141,000
2015/16	37,000	0	93,806	47,000	3,600	181,000
2016/17	56,000	15,107	137,773	52,000	3,700	265,000
2017/18	23,000	0	124,484	56,000	3,700	207,000
2018/19	53,000	3,290	133,860	37,000	3,800	231,000
86/87-18/19 Avg	38,000	2,100	111,100	39,000	2,900	193,000

Delano-Earlimart Irrigation District GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Outflow (acre-ft)										Total Out
	Areal Recharge of Precipitation	Streambed Infiltration	Recharge in Basins	Deep Percolation of Applied Water			Evapotranspiration				
		White River	Imported Water	Imported Water	Agricultural Pumping	Municipal Pumping	Precipitation Crops/Native	Imported Water Agricultural Cons. Use	Ag. Cons. Use from Pumping	Municipal (Landscape ET)	
1986/87	0	0	0	32,000	6,400	1,300	37,000	82,800	28,000	700	188,000
1987/88	0	0	0	27,100	7,300	1,400	32,000	83,200	32,000	700	184,000
1988/89	0	0	0	25,100	8,900	1,400	28,000	80,800	39,000	800	184,000
1989/90	0	0	0	20,400	12,600	1,400	29,000	63,400	55,000	800	183,000
1990/91	0	0	0	49,000	7,600	1,500	43,000	57,900	33,000	800	193,000
1991/92	0	0	0	21,000	13,100	1,500	35,000	71,500	57,000	800	200,000
1992/93	2,000	0	5,600	56,700	5,000	1,500	47,000	71,000	22,000	800	212,000
1993/94	0	0	700	21,400	9,700	1,500	36,000	70,300	42,000	800	182,000
1994/95	12,000	3,900	4,500	47,300	5,000	1,600	53,000	72,700	22,000	900	223,000
1995/96	0	1,300	1,300	33,700	7,000	1,600	29,000	109,200	30,000	900	214,000
1996/97	0	6,700	5,300	57,000	1,700	1,600	46,000	91,700	7,000	900	218,000
1997/98	25,000	27,100	2,900	62,300	4,800	1,700	60,000	54,600	21,000	900	260,000
1998/99	0	200	2,700	48,200	3,500	1,700	37,000	73,100	15,000	900	182,000
1999/00	0	600	4,400	48,800	5,100	1,700	35,000	81,000	22,000	900	200,000
2000/01	0	300	600	41,900	6,700	1,700	35,000	75,300	29,000	1,000	192,000
2001/02	0	1,100	0	31,300	5,800	1,800	28,000	95,400	25,000	1,000	189,000
2002/03	0	600	0	35,200	3,100	1,800	32,000	86,000	19,000	1,000	179,000
2003/04	0	0	0	25,900	3,900	1,900	27,000	101,400	23,000	1,000	184,000
2004/05	9,000	1,300	100	59,100	2,200	1,900	51,000	60,700	13,000	1,000	199,000
2005/06	1,000	2,400	1,200	67,800	900	1,900	47,000	52,100	6,000	1,100	181,000
2006/07	0	0	100	17,300	7,500	2,000	22,000	61,700	44,000	1,100	156,000
2007/08	0	0	0	21,100	3,400	2,000	25,000	85,400	20,000	1,100	158,000
2008/09	0	0	2,500	25,300	2,500	2,100	21,000	83,800	15,000	1,100	153,000
2009/10	0	0	5,800	48,600	2,600	2,100	42,000	64,300	16,000	1,100	183,000
2010/11	12,000	6,500	9,400	62,700	1,900	2,100	53,000	55,300	11,000	1,200	215,000
2011/12	2,000	0	1,100	57,300	3,600	2,200	47,000	55,700	21,000	1,200	191,000
2012/13	0	0	0	15,800	9,700	2,200	20,000	71,500	58,000	1,200	178,000
2013/14	0	0	0	6,800	17,000	2,300	16,000	31,300	100,000	1,200	175,000
2014/15	0	0	0	4,000	13,600	2,300	25,000	14,600	80,000	1,300	141,000
2015/16	0	0	3,600	19,800	6,800	2,300	37,000	70,300	40,000	1,300	181,000
2016/17	6,000	15,100	16,400	41,500	7,500	2,400	50,000	79,900	44,000	1,300	264,000
2017/18	0	0	6,200	35,800	8,000	2,400	23,000	82,400	48,000	1,300	207,000
2018/19	4,000	3,300	23,200	40,500	5,300	2,500	49,000	70,200	32,000	1,300	231,000
86/87-18/19 Avg	2,000	2,200	2,200	36,500	6,300	1,800	36,000	71,200	32,000	1,000	191,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Delano-Earlimart Irrigation District GSA
Historical Groundwater Budget 1986/87 to 2018/19

Water Year	Groundwater Inflows (acre-ft)									Groundwater Outflows (acre-ft)						Change in Storage (acre-ft)		
	Areal Recharge from Precipitation	White River	Imported Water Deliveries		Agricultural Pumping	Municipal Pumping	Sub-surface Inflow		Total In	Groundwater Pumping			Sub-surface Outflow		Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage
		Streambed Infiltration	Recharge in Basins	Return Flow	Return Flow	Return Flow	From Outside Subbasin	From Other GSAs		Municipal	Agricultural	Groundwater Banking Extraction	To Outside Subbasin	To Other GSAs				
1986/87	0	0	0	32,000	6,400	1,300	5,000	10,000	55,000	2,100	34,000	0	26,000	35,000	97,000	0	-42,000	-42,000
1987/88	0	0	0	27,100	7,300	1,400	5,000	10,000	51,000	2,100	39,000	0	24,000	36,000	101,000	-1,000	-49,000	-50,000
1988/89	0	0	0	25,100	8,900	1,400	6,000	11,000	52,000	2,200	48,000	0	23,000	35,000	108,000	-3,000	-53,000	-56,000
1989/90	0	0	0	20,400	12,600	1,400	7,000	14,000	55,000	2,200	67,000	0	26,000	31,000	126,000	-5,000	-66,000	-71,000
1990/91	0	0	0	49,000	7,600	1,500	7,000	15,000	80,000	2,300	41,000	0	27,000	30,000	100,000	1,000	-21,000	-20,000
1991/92	0	0	0	21,000	13,100	1,500	7,000	16,000	59,000	2,300	70,000	0	20,000	31,000	123,000	-6,000	-58,000	-64,000
1992/93	2,000	0	5,600	56,700	5,000	1,500	6,000	11,000	88,000	2,300	27,000	0	22,000	33,000	84,000	1,000	3,000	4,000
1993/94	0	0	700	21,400	9,700	1,500	6,000	11,000	50,000	2,400	52,000	0	19,000	33,000	106,000	-7,000	-49,000	-56,000
1994/95	12,000	3,900	4,500	47,300	5,000	1,600	5,000	10,000	89,000	2,400	27,000	0	18,000	34,000	81,000	1,000	7,000	8,000
1995/96	0	1,300	1,300	33,700	7,000	1,600	5,000	9,000	59,000	2,500	37,000	0	17,000	37,000	94,000	-4,000	-31,000	-35,000
1996/97	0	6,700	5,300	57,000	1,700	1,600	5,000	8,000	85,000	2,500	9,000	0	22,000	39,000	73,000	1,000	11,000	12,000
1997/98	25,000	27,100	2,900	62,300	4,800	1,700	5,000	9,000	138,000	2,600	26,000	0	19,000	33,000	81,000	0	57,000	57,000
1998/99	0	200	2,700	48,200	3,500	1,700	5,000	8,000	69,000	2,600	19,000	0	20,000	38,000	80,000	0	-11,000	-11,000
1999/00	0	600	4,400	48,800	5,100	1,700	5,000	8,000	74,000	2,700	27,000	0	19,000	38,000	87,000	0	-13,000	-13,000
2000/01	0	300	600	41,900	6,700	1,700	6,000	10,000	67,000	2,700	36,000	0	23,000	36,000	98,000	-4,000	-27,000	-31,000
2001/02	0	1,100	0	31,300	5,800	1,800	5,000	10,000	55,000	2,800	31,000	0	23,000	40,000	97,000	-3,000	-39,000	-42,000
2002/03	0	600	0	35,200	3,100	1,800	5,000	8,000	54,000	2,800	22,000	0	21,000	38,000	84,000	-1,000	-29,000	-30,000
2003/04	0	0	0	25,900	3,900	1,900	5,000	9,000	46,000	2,900	27,000	0	22,000	41,000	93,000	-5,000	-42,000	-47,000
2004/05	9,000	1,300	100	59,100	2,200	1,900	5,000	8,000	87,000	2,900	15,000	0	21,000	37,000	76,000	2,000	9,000	11,000
2005/06	1,000	2,400	1,200	67,800	900	1,900	5,000	7,000	87,000	3,000	7,000	0	19,000	33,000	62,000	4,000	21,000	25,000
2006/07	0	0	100	17,300	7,500	2,000	5,000	9,000	41,000	3,100	52,000	0	20,000	37,000	112,000	-13,000	-58,000	-71,000
2007/08	0	0	0	21,100	3,400	2,000	5,000	9,000	41,000	3,100	23,000	0	26,000	40,000	92,000	-4,000	-47,000	-51,000
2008/09	0	0	2,500	25,300	2,500	2,100	6,000	9,000	47,000	3,200	17,000	600	29,000	39,000	89,000	-5,000	-37,000	-42,000
2009/10	0	0	5,800	48,600	2,600	2,100	5,000	9,000	73,000	3,300	18,000	100	27,000	33,000	81,000	-1,000	-7,000	-8,000
2010/11	12,000	6,500	9,400	62,700	1,900	2,100	5,000	9,000	109,000	3,300	13,000	0	25,000	29,000	70,000	2,000	37,000	39,000
2011/12	2,000	0	1,100	57,300	3,600	2,200	6,000	10,000	82,000	3,400	25,000	3,900	28,000	29,000	89,000	-3,000	-4,000	-7,000
2012/13	0	0	0	15,800	9,700	2,200	7,000	16,000	51,000	3,400	67,000	6,000	29,000	33,000	138,000	-16,000	-71,000	-87,000
2013/14	0	0	0	6,800	17,000	2,300	8,000	21,000	55,000	3,500	117,000	5,600	31,000	28,000	185,000	-38,000	-92,000	-130,000
2014/15	0	0	0	4,000	13,600	2,300	7,000	20,000	47,000	3,600	94,000	1,200	28,000	25,000	152,000	-26,000	-79,000	-105,000
2015/16	0	0	3,600	19,800	6,800	2,300	7,000	15,000	55,000	3,600	47,000	100	30,000	27,000	108,000	-10,000	-43,000	-53,000
2016/17	6,000	15,100	16,400	41,500	7,500	2,400	6,000	14,000	109,000	3,700	52,000	0	22,000	26,000	104,000	-5,000	10,000	5,000
2017/18	0	0	6,200	35,800	8,000	2,400	6,000	14,000	72,000	3,700	56,000	0	19,000	27,000	106,000	-6,000	-28,000	-34,000
2018/19	4,000	3,300	23,200	40,500	5,300	2,500	5,000	12,000	96,000	3,800	37,000	0	19,000	27,000	87,000	-2,000	11,000	9,000
86/87-18/19 Avg	2,000	2,100	3,000	36,600	6,400	1,900	6,000	11,000	69,000	2,900	39,000	500	23,000	34,000	99,000	-5,000	-25,000	-30,000
															Cumulative Change in Storage	-156,000	-830,000	-986,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Appendix D

Pixley Irrigation District GSA

Pixley Irrigation District GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Inflow (acre-ft)					
	Precipitation	Stream Inflow	Imported Water	Discharge from Wells		Total In
		Deer Creek	Pixley ID	Agricultural	Municipal	
1986/87	48,000	0	9,356	149,000	700	207,000
1987/88	42,000	0	0	157,000	700	200,000
1988/89	36,000	0	5,289	162,000	700	204,000
1989/90	43,000	0	0	156,000	700	200,000
1990/91	58,000	0	0	118,000	700	177,000
1991/92	46,000	0	0	174,000	700	221,000
1992/93	66,000	0	96,890	120,000	700	284,000
1993/94	44,000	0	7,793	199,000	700	251,000
1994/95	85,000	10,445	55,365	145,000	700	297,000
1995/96	43,000	8,989	60,931	186,000	700	300,000
1996/97	61,000	13,322	37,048	174,000	700	286,000
1997/98	105,000	74,587	41,823	121,000	700	343,000
1998/99	45,000	4,770	34,736	176,000	700	261,000
1999/00	46,000	4,791	40,076	164,000	700	256,000
2000/01	44,000	0	9,098	179,000	700	233,000
2001/02	36,000	0	13,588	199,000	800	249,000
2002/03	42,000	1,697	32,195	162,000	800	239,000
2003/04	36,000	0	9,839	214,000	800	261,000
2004/05	73,000	7,994	59,211	130,000	800	271,000
2005/06	67,000	9,156	60,634	116,000	900	254,000
2006/07	24,000	0	7,200	207,000	900	239,000
2007/08	36,000	0	12,243	197,000	900	246,000
2008/09	29,000	0	23,620	166,000	900	220,000
2009/10	54,000	0	32,972	124,000	900	212,000
2010/11	84,000	20,157	48,391	89,000	1,000	243,000
2011/12	59,000	0	5,914	124,000	1,000	190,000
2012/13	23,000	0	5,012	179,000	1,000	208,000
2013/14	19,000	0	0	190,000	1,000	210,000
2014/15	32,000	0	0	166,000	1,000	199,000
2015/16	48,000	0	3,442	132,000	1,100	185,000
2016/17	69,000	13,754	82,363	114,000	1,100	280,000
2017/18	29,000	0	19,070	161,000	1,100	210,000
2018/19	66,000	3,342	70,457	102,000	1,100	243,000
86/87-18/19 Avg	50,000	5,200	26,800	156,000	800	239,000

Pixley Irrigation District GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Outflow (acre-ft)																
	Areal Recharge of Precipitation	Streambed Infiltration	Canal Loss		Recharge in Basins		Deep Percolation of Applied Water				Evapotranspiration					Surface Outflow	Total Out
		Deer Creek Trenton Weir to Homeland Canal Infiltration	Deer Creek	Imported Water	Deer Creek	Imported Water	Deer Creek	Imported Water	Agricultural Pumping	Municipal Pumping	Precipitation Crops/Native	Deer Creek Agricultural Cons. Use	Imported Water Agricultural Cons. Use	Ag. Cons. Use from Pumping	Municipal (Landscape ET)	Deer Creek	
1986/87	0	0	0	8,200	0	0	0	1,200	38,000	500	48,000	0	0	111,000	200	0	207,000
1987/88	0	0	0	0	0	0	0	0	40,000	500	42,000	0	0	117,000	200	0	200,000
1988/89	0	0	0	1,700	0	0	0	900	41,200	500	36,000	0	2,700	121,000	200	0	204,000
1989/90	0	0	0	0	0	0	0	0	39,900	500	43,000	0	0	117,000	200	0	201,000
1990/91	2,000	0	0	0	0	0	0	0	30,000	500	56,000	0	0	88,000	300	0	177,000
1991/92	0	0	0	0	0	0	0	0	44,500	500	46,000	0	0	130,000	300	0	221,000
1992/93	6,000	0	0	43,400	0	0	0	17,300	30,500	500	60,000	0	36,200	89,000	300	0	283,000
1993/94	0	0	0	7,800	0	0	0	0	50,600	500	44,000	0	0	148,000	300	0	251,000
1994/95	18,000	1,000	3,800	19,700	1,800	5,900	2,000	8,700	36,800	500	67,000	2,000	21,000	108,000	300	0	297,000
1995/96	0	700	2,800	18,100	700	4,500	3,700	12,200	47,500	500	43,000	1,100	26,200	139,000	300	0	300,000
1996/97	3,000	1,800	6,900	12,900	1,900	1,900	2,500	8,200	44,300	500	58,000	200	14,000	129,000	300	0	285,000
1997/98	31,000	12,700	48,800	14,900	900	2,400	7,000	6,300	30,800	500	74,000	5,300	18,200	90,000	300	0	343,000
1998/99	0	600	2,500	12,300	400	1,200	1,000	6,600	44,800	500	45,000	300	14,500	131,000	300	0	261,000
1999/00	0	600	2,400	13,000	500	700	1,200	8,700	41,700	500	46,000	100	17,700	122,000	300	0	255,000
2000/01	0	0	0	2,600	0	100	0	1,600	45,500	500	44,000	0	4,800	133,000	300	0	232,000
2001/02	0	0	0	4,000	0	0	0	2,400	50,800	500	36,000	0	7,100	149,000	300	0	250,000
2002/03	0	100	400	10,900	300	1,700	200	4,400	36,600	500	42,000	700	15,200	126,000	300	0	239,000
2003/04	0	0	0	3,000	0	0	0	1,500	47,700	500	36,000	0	5,300	166,000	300	0	260,000
2004/05	10,000	400	1,500	14,900	2,900	8,400	1,600	9,400	29,000	500	62,000	1,500	26,400	101,000	300	0	270,000
2005/06	7,000	900	3,400	15,400	3,200	8,500	1,100	11,000	25,700	600	60,000	600	25,800	90,000	300	0	254,000
2006/07	0	0	0	2,800	0	0	0	1,000	46,200	600	24,000	0	3,500	161,000	300	0	239,000
2007/08	0	0	0	3,800	0	1,000	0	2,500	43,900	600	36,000	0	4,900	153,000	300	0	246,000
2008/09	0	0	0	7,400	0	1,300	0	3,300	36,900	600	29,000	0	11,600	129,000	300	0	219,000
2009/10	0	0	0	11,000	0	9,000	0	4,300	27,600	600	54,000	0	12,300	96,000	300	0	215,000
2010/11	18,000	1,300	5,000	9,200	9,700	8,500	6,100	10,700	19,800	600	66,000	0	20,600	69,000	300	0	245,000
2011/12	2,000	0	0	1,800	0	1,800	0	500	27,700	600	57,000	0	1,800	97,000	300	0	191,000
2012/13	0	0	0	1,700	0	100	0	700	39,900	600	23,000	0	2,500	139,000	400	0	208,000
2013/14	0	0	0	0	0	0	0	0	42,200	700	19,000	0	0	147,000	400	0	209,000
2014/15	0	0	0	0	0	0	0	0	37,000	700	32,000	0	0	129,000	400	0	199,000
2015/16	0	0	0	1,200	0	100	0	500	29,300	700	48,000	0	1,700	102,000	400	0	184,000
2016/17	8,000	800	3,100	20,600	3,700	10,600	5,800	16,600	25,300	700	61,000	400	34,600	88,000	400	0	280,000
2017/18	0	0	0	6,800	0	800	0	2,900	35,900	700	29,000	0	8,600	125,000	400	0	210,000
2018/19	6,000	200	900	22,900	600	8,900	1,500	16,800	22,700	700	60,000	0	21,900	79,000	400	0	243,000
36/87-18/19 Avg	3,000	600	2,500	8,800	800	2,300	1,000	4,900	37,300	600	46,000	400	10,900	119,000	300	0	238,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Pixley Irrigation District GSA
Historical Groundwater Budget 1986/87 to 2018/19

Water Year	Groundwater Inflows (acre-ft)													Groundwater Outflows (acre-ft)					Change in Storage (acre-ft)		
	Areal Recharge from Precipitation	Native Deer Creek				Imported Water Deliveries			Agricultural Pumping	Municipal Pumping	Sub-surface Inflow		Total In	Groundwater Pumping		Sub-surface Outflow		Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage
		Trenton Weir to Homeland Canal Infiltration	Canal Loss	Recharge in Basins	Return Flow	Canal Loss	Recharge in Basins	Return Flow	Return Flow	Return Flow	From Outside Subbasin	From Other GSAs		Municipal	Agri-cultural	To Outside Subbasin	To Other GSAs				
1986/87	0	0	0	0	0	8,200	0	1,200	38,000	500	0	134,000	182,000	700	149,000	0	38,000	188,000	-15,000	9,000	-6,000
1987/88	0	0	0	0	0	0	0	0	40,000	500	0	127,000	168,000	700	157,000	0	47,000	205,000	-22,000	-15,000	-37,000
1988/89	0	0	0	0	0	1,700	0	900	41,200	500	0	117,000	161,000	700	162,000	0	47,000	210,000	-28,000	-21,000	-49,000
1989/90	0	0	0	0	0	0	0	0	39,900	500	0	109,000	149,000	700	156,000	0	51,000	208,000	-40,000	-19,000	-59,000
1990/91	2,000	0	0	0	0	0	0	0	30,000	500	0	100,000	133,000	700	118,000	0	47,000	166,000	-27,000	-6,000	-33,000
1991/92	0	0	0	0	0	0	0	0	44,500	500	0	110,000	155,000	700	174,000	0	54,000	229,000	-57,000	-17,000	-74,000
1992/93	6,000	0	0	0	0	43,400	0	17,300	30,500	500	0	106,000	204,000	700	120,000	0	51,000	172,000	-12,000	44,000	32,000
1993/94	0	0	0	0	0	7,800	0	0	50,600	500	0	108,000	167,000	700	199,000	0	51,000	251,000	-54,000	-30,000	-84,000
1994/95	18,000	1,000	3,800	1,800	2,000	19,700	5,900	8,700	36,800	500	0	108,000	206,000	700	145,000	0	45,000	191,000	-15,000	30,000	15,000
1995/96	0	700	2,800	700	3,700	18,100	4,500	12,200	47,500	500	0	118,000	209,000	700	186,000	0	52,000	239,000	-30,000	0	-30,000
1996/97	3,000	1,800	6,900	1,900	2,500	12,900	1,900	8,200	44,300	500	0	122,000	206,000	700	174,000	0	46,000	221,000	-18,000	3,000	-15,000
1997/98	31,000	12,700	48,800	900	7,000	14,900	2,400	6,300	30,800	500	0	115,000	270,000	700	121,000	0	55,000	177,000	1,000	92,000	93,000
1998/99	0	600	2,500	400	1,000	12,300	1,200	6,600	44,800	500	0	121,000	191,000	700	176,000	0	59,000	236,000	-13,000	-32,000	-45,000
1999/00	0	600	2,400	500	1,200	13,000	700	8,700	41,700	500	0	120,000	189,000	700	164,000	0	57,000	222,000	-7,000	-26,000	-33,000
2000/01	0	0	0	0	0	2,600	100	1,600	45,500	500	0	116,000	166,000	700	179,000	0	58,000	238,000	-34,000	-38,000	-72,000
2001/02	0	0	0	0	0	4,000	0	2,400	50,800	500	0	116,000	174,000	800	199,000	0	60,000	260,000	-56,000	-30,000	-86,000
2002/03	0	100	400	300	200	10,900	1,700	4,400	36,600	500	0	112,000	167,000	800	162,000	0	51,000	214,000	-34,000	-13,000	-47,000
2003/04	0	0	0	0	0	3,000	0	1,500	47,700	500	0	109,000	162,000	800	214,000	0	52,000	267,000	-82,000	-23,000	-105,000
2004/05	10,000	400	1,500	2,900	1,600	14,900	8,400	9,400	29,000	500	0	102,000	181,000	800	130,000	0	40,000	171,000	-9,000	19,000	10,000
2005/06	7,000	900	3,400	3,200	1,100	15,400	8,500	11,000	25,700	600	0	103,000	180,000	900	116,000	0	32,000	149,000	3,000	28,000	31,000
2006/07	0	0	0	0	0	2,800	0	1,000	46,200	600	0	97,000	148,000	900	207,000	0	45,000	253,000	-58,000	-47,000	-105,000
2007/08	0	0	0	0	0	3,800	1,000	2,500	43,900	600	0	105,000	157,000	900	197,000	0	56,000	254,000	-69,000	-28,000	-97,000
2008/09	0	0	0	0	0	7,400	1,300	3,300	36,900	600	0	111,000	161,000	900	166,000	0	64,000	231,000	-50,000	-20,000	-70,000
2009/10	0	0	0	0	0	11,000	9,000	4,300	27,600	600	0	117,000	170,000	900	124,000	0	62,000	187,000	-18,000	1,000	-17,000
2010/11	18,000	1,300	5,000	9,700	6,100	9,200	8,500	10,700	19,800	600	0	107,000	196,000	1,000	89,000	0	49,000	139,000	2,000	55,000	57,000
2011/12	2,000	0	0	0	0	1,800	1,800	500	27,700	600	0	105,000	139,000	1,000	124,000	0	56,000	181,000	-21,000	-21,000	-42,000
2012/13	0	0	0	0	0	1,700	100	700	39,900	600	0	108,000	151,000	1,000	179,000	0	67,000	247,000	-54,000	-42,000	-96,000
2013/14	0	0	0	0	0	0	0	0	42,200	700	0	101,000	144,000	1,000	190,000	0	66,000	257,000	-82,000	-31,000	-113,000
2014/15	0	0	0	0	0	0	0	0	37,000	700	0	95,000	133,000	1,000	166,000	0	67,000	234,000	-77,000	-24,000	-101,000
2015/16	0	0	0	0	0	1,200	100	500	29,300	700	0	97,000	129,000	1,100	132,000	0	67,000	200,000	-55,000	-16,000	-71,000
2016/17	8,000	800	3,100	3,700	5,800	20,600	10,600	16,600	25,300	700	0	96,000	191,000	1,100	114,000	0	52,000	167,000	-16,000	40,000	24,000
2017/18	0	0	0	0	0	6,800	800	2,900	35,900	700	0	108,000	155,000	1,100	161,000	0	60,000	222,000	-39,000	-28,000	-67,000
2018/19	6,000	200	900	600	1,500	22,900	8,900	16,800	22,700	700	0	104,000	185,000	1,100	102,000	0	54,000	157,000	-5,000	33,000	28,000
36/87-18/19 Avg	3,000	600	2,500	800	1,000	8,800	2,300	4,900	37,300	600	0	110,000	172,000	800	156,000	0	53,000	210,000	-33,000	-5,000	-38,000
																			Cumulative Change in Storage	-1,091,000	-173,000	-1,264,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Appendix E

Tri-County Water Authority

Tri-County Water Authority
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Inflow (acre-ft)					
	Precipitation	Imported Water		Discharge from Wells		Total In
		Alpaugh ID / Atwell Island WD	Angiola WD	Agricultural	Municipal	
1986/87	43,000	756	7,278	28,000	100	79,000
1987/88	36,000	0	3,530	35,000	100	75,000
1988/89	30,000	0	6,026	42,000	100	78,000
1989/90	35,000	0	3,847	35,000	100	74,000
1990/91	52,000	0	925	15,000	100	68,000
1991/92	43,000	0	1,611	31,000	100	76,000
1992/93	58,000	4,821	3,420	58,000	100	124,000
1993/94	41,000	1,489	3,640	61,000	100	107,000
1994/95	77,000	3,935	8,918	91,000	100	181,000
1995/96	35,000	4,016	12,551	129,000	100	181,000
1996/97	54,000	0	12,383	86,000	100	152,000
1997/98	97,000	0	7,460	91,000	100	196,000
1998/99	41,000	0	9,778	95,000	100	146,000
1999/00	39,000	162	8,118	67,000	100	114,000
2000/01	41,000	0	3,824	68,000	100	113,000
2001/02	30,000	0	2,932	68,000	100	101,000
2002/03	36,000	6	4,728	53,000	100	94,000
2003/04	31,000	0	3,434	73,000	100	108,000
2004/05	68,000	830	11,741	63,000	100	144,000
2005/06	58,000	923	10,909	34,000	100	104,000
2006/07	22,000	0	6,641	73,000	100	102,000
2007/08	29,000	0	2,165	44,000	100	75,000
2008/09	25,000	122	191	32,000	100	57,000
2009/10	49,000	153	3,243	11,000	100	63,000
2010/11	77,000	627	6,476	13,000	100	97,000
2011/12	55,000	54	3,156	14,000	100	72,000
2012/13	22,000	0	1,492	25,000	100	49,000
2013/14	17,000	0	1,048	35,000	100	53,000
2014/15	29,000	0	575	27,000	100	57,000
2015/16	43,000	0	587	19,000	100	63,000
2016/17	63,000	136	12,146	27,000	100	102,000
2017/18	25,000	0	625	43,000	100	69,000
2018/19	58,000	0	4,289	17,000	100	79,000
86/87-18/19 Avg	44,000	500	5,100	49,000	100	99,000

Tri-County Water Authority
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Outflow (acre-ft)									
	Areal Recharge of Precipitation	Recharge in Basins	Deep Percolation of Applied Water			Evapotranspiration				Total Out
			Imported Water	Agricultural Pumping	Municipal Pumping	Precipitation Crops/Native	Imported Water Agricultural Cons. Use	Ag. Cons. Use from Pumping	Municipal (Landscape ET)	
1986/87	0	0	3,900	8,100	65	43,000	3,300	22,000	35	80,000
1987/88	0	0	1,500	11,300	65	36,000	2,000	30,000	35	81,000
1988/89	0	0	2,000	11,800	65	30,000	4,000	34,000	35	82,000
1989/90	0	0	1,700	12,600	65	35,000	2,100	31,000	35	82,000
1990/91	0	0	600	8,200	65	51,000	300	14,000	35	74,000
1991/92	0	0	700	11,400	65	43,000	900	28,000	35	84,000
1992/93	2,000	0	1,300	15,100	65	57,000	2,100	45,000	35	123,000
1993/94	0	0	1,200	16,200	65	41,000	2,500	49,000	35	110,000
1994/95	13,000	0	3,800	22,200	65	63,000	5,100	70,000	35	177,000
1995/96	0	0	3,900	31,200	65	35,000	8,600	98,000	35	177,000
1996/97	0	0	4,200	20,700	65	54,000	8,200	65,000	35	152,000
1997/98	26,000	0	3,500	21,900	65	71,000	4,000	69,000	35	195,000
1998/99	0	0	3,100	22,900	65	41,000	6,700	72,000	35	146,000
1999/00	0	0	2,500	17,300	65	39,000	5,600	52,000	35	116,000
2000/01	0	0	1,700	18,700	65	41,000	2,200	54,000	35	118,000
2001/02	0	0	1,000	20,500	65	30,000	1,900	54,000	35	107,000
2002/03	0	0	1,500	14,100	65	36,000	3,300	43,000	35	98,000
2003/04	0	0	1,000	18,100	65	31,000	2,400	62,000	35	115,000
2004/05	7,000	0	3,500	12,800	65	60,000	8,200	51,000	35	143,000
2005/06	1,000	0	3,500	7,200	65	57,000	7,400	27,000	35	103,000
2006/07	0	0	1,700	15,700	65	22,000	5,000	65,000	35	109,000
2007/08	0	0	600	11,100	65	29,000	1,600	41,000	35	83,000
2008/09	0	0	100	8,900	65	25,000	100	33,000	35	67,000
2009/10	0	0	800	4,900	65	49,000	2,400	12,000	35	69,000
2010/11	13,000	0	3,100	3,600	65	64,000	3,400	11,000	35	98,000
2011/12	0	0	1,900	5,700	65	55,000	1,300	16,000	35	80,000
2012/13	0	0	500	7,600	65	22,000	1,000	26,000	35	57,000
2013/14	0	0	800	9,300	65	17,000	300	33,000	35	60,000
2014/15	0	0	200	8,500	65	29,000	400	25,000	35	63,000
2015/16	0	0	400	8,200	65	43,000	200	18,000	35	70,000
2016/17	5,000	0	5,800	6,400	65	59,000	6,400	22,000	35	105,000
2017/18	0	0	200	8,200	65	25,000	500	35,000	35	69,000
2018/19	1,000	1,100	1,700	3,800	65	57,000	1,100	13,000	35	79,000
86/87-18/19 Avg	2,000	0	1,900	12,900	65	42,000	3,200	40,000	35	102,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Tri-County Water Authority
Historical Groundwater Budget 1986/87 to 2018/19

Water Year	Groundwater Inflows (acre-ft)						Groundwater Outflows (acre-ft)					Change in Storage (acre-ft)		
		Imported Water Deliveries	Agricultural Pumping	Sub-surface Inflow			Groundwater Pumping		Sub-surface Outflow					
	Areal Recharge from Precipitation	Return Flow	Return Flow	From Outside Subbasin	From Other GSAs	Total In	Agricultural	Exports	To Outside Subbasin	To Other GSAs	Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage
1986/87	0	3,900	8,100	4,000	50,000	66,000	28,000	6,550	20,000	41,000	96,000	-17,000	-13,000	-30,000
1987/88	0	1,500	11,300	4,000	60,000	77,000	35,000	18,240	21,000	45,000	119,000	-21,000	-21,000	-42,000
1988/89	0	2,000	11,800	4,000	59,000	77,000	42,000	12,130	23,000	49,000	126,000	-27,000	-22,000	-49,000
1989/90	0	1,700	12,600	5,000	63,000	82,000	35,000	23,840	26,000	47,000	132,000	-28,000	-22,000	-50,000
1990/91	0	600	8,200	5,000	60,000	74,000	15,000	18,120	30,000	43,000	106,000	-14,000	-18,000	-32,000
1991/92	0	700	11,400	5,000	69,000	86,000	31,000	23,840	25,000	54,000	134,000	-29,000	-19,000	-48,000
1992/93	2,000	1,300	15,100	15,000	72,000	105,000	58,000	6,610	18,000	52,000	135,000	-20,000	-10,000	-30,000
1993/94	0	1,200	16,200	6,000	68,000	91,000	61,000	11,220	19,000	52,000	143,000	-36,000	-16,000	-52,000
1994/95	13,000	3,800	22,200	15,000	64,000	118,000	91,000	1,320	15,000	43,000	150,000	-38,000	6,000	-32,000
1995/96	0	3,900	31,200	14,000	73,000	122,000	129,000	0	14,000	40,000	183,000	-50,000	-11,000	-61,000
1996/97	0	4,200	20,700	16,000	65,000	106,000	86,000	0	13,000	43,000	142,000	-30,000	-6,000	-36,000
1997/98	26,000	3,500	21,900	12,000	74,000	137,000	91,000	0	15,000	39,000	145,000	-26,000	18,000	-8,000
1998/99	0	3,100	22,900	18,000	78,000	122,000	95,000	0	13,000	46,000	154,000	-21,000	-11,000	-32,000
1999/00	0	2,500	17,300	17,000	75,000	112,000	67,000	4,900	12,000	49,000	133,000	-11,000	-10,000	-21,000
2000/01	0	1,700	18,700	7,000	77,000	104,000	68,000	13,310	20,000	50,000	151,000	-35,000	-12,000	-47,000
2001/02	0	1,000	20,500	6,000	80,000	108,000	68,000	18,930	18,000	52,000	157,000	-33,000	-16,000	-49,000
2002/03	0	1,500	14,100	12,000	69,000	97,000	53,000	13,050	10,000	50,000	126,000	-16,000	-13,000	-29,000
2003/04	0	1,000	18,100	9,000	72,000	100,000	73,000	20,360	16,000	47,000	156,000	-40,000	-16,000	-56,000
2004/05	7,000	3,500	12,800	18,000	59,000	100,000	63,000	4,000	13,000	36,000	116,000	-12,000	-4,000	-16,000
2005/06	1,000	3,500	7,200	19,000	51,000	82,000	34,000	150	7,000	38,000	79,000	-1,000	4,000	3,000
2006/07	0	1,700	15,700	11,000	65,000	93,000	73,000	21,570	14,000	41,000	150,000	-42,000	-15,000	-57,000
2007/08	0	600	11,100	6,000	76,000	94,000	44,000	23,950	24,000	51,000	143,000	-38,000	-11,000	-49,000
2008/09	0	100	8,900	6,000	88,000	103,000	32,000	27,390	29,000	61,000	149,000	-35,000	-11,000	-46,000
2009/10	0	800	4,900	10,000	88,000	104,000	11,000	17,760	26,000	69,000	124,000	-17,000	-3,000	-20,000
2010/11	13,000	3,100	3,600	13,000	72,000	105,000	13,000	4,180	17,000	58,000	92,000	-1,000	14,000	13,000
2011/12	0	1,900	5,700	9,000	77,000	94,000	14,000	21,980	24,000	56,000	116,000	-16,000	-6,000	-22,000
2012/13	0	500	7,600	7,000	90,000	105,000	25,000	23,730	42,000	69,000	160,000	-41,000	-14,000	-55,000
2013/14	0	800	9,300	6,000	85,000	101,000	35,000	20,900	54,000	65,000	175,000	-61,000	-13,000	-74,000
2014/15	0	200	8,500	7,000	84,000	100,000	27,000	20,100	51,000	67,000	165,000	-54,000	-11,000	-65,000
2015/16	0	400	8,200	7,000	88,000	104,000	19,000	21,690	49,000	67,000	157,000	-42,000	-11,000	-53,000
2016/17	5,000	5,800	6,400	10,000	72,000	99,000	27,000	4,520	27,000	55,000	114,000	-16,000	1,000	-15,000
2017/18	0	200	8,200	7,000	84,000	99,000	43,000	4,520	29,000	59,000	136,000	-34,000	-3,000	-37,000
2018/19	1,000	1,700	3,800	8,000	78,000	93,000	17,000	4,520	28,000	58,000	108,000	-11,000	-4,000	-15,000
36/87-18/19 Avg	2,000	1,900	12,900	10,000	72,000	99,000	49,000	12,500	23,000	51,000	136,000	-28,000	-9,000	-37,000
											Cumulative Change in Storage	-913,000	-299,000	-1,212,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Appendix F

Alpaugh Irrigation District GSA

Alpaugh ID GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Inflow (acre-ft)				
	Precipitation	Imported Water	Discharge from Wells		Total In
		Alpaugh ID / Atwell Island WD	Agricultural	Municipal	
1986/87	9,000	1,145	27,000	200	37,000
1987/88	8,000	0	29,000	200	37,000
1988/89	6,000	0	31,000	200	37,000
1989/90	8,000	0	29,000	200	37,000
1990/91	11,000	0	23,000	200	34,000
1991/92	9,000	0	30,000	200	39,000
1992/93	13,000	13,821	20,000	200	47,000
1993/94	8,000	4,115	30,000	200	42,000
1994/95	16,000	9,723	26,000	200	52,000
1995/96	8,000	12,381	34,000	200	55,000
1996/97	12,000	0	40,000	200	52,000
1997/98	20,000	0	32,000	200	52,000
1998/99	9,000	0	40,000	200	49,000
1999/00	8,000	91	35,000	200	43,000
2000/01	9,000	0	35,000	200	44,000
2001/02	6,000	0	33,000	200	39,000
2002/03	8,000	98	29,000	200	37,000
2003/04	7,000	0	35,000	200	42,000
2004/05	14,000	13,660	21,000	300	49,000
2005/06	13,000	15,189	15,000	300	43,000
2006/07	4,000	0	42,000	300	46,000
2007/08	6,000	0	34,000	300	40,000
2008/09	5,000	2,009	27,000	300	34,000
2009/10	10,000	2,518	18,000	300	31,000
2010/11	17,000	10,324	12,000	300	40,000
2011/12	11,000	889	22,000	300	34,000
2012/13	4,000	0	27,000	300	31,000
2013/14	4,000	0	23,000	300	27,000
2014/15	6,000	0	23,000	300	29,000
2015/16	9,000	0	13,000	300	22,000
2016/17	13,000	2,232	11,000	300	27,000
2017/18	5,000	0	13,000	400	18,000
2018/19	12,000	3,100	3,000	400	19,000
86/87-18/19 Avg	9,000	2,800	26,000	300	38,000

Alpaugh ID GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Outflow (acre-ft)								
	Areal Recharge of Precip-itation	Deep Percolation of Applied			Evapotranspiration				Total Out
		Imported Water	Agri-cultural Pumping	Municipal Pumping	Precipitation Crops/Native	Imported Water / Agricultural Cons. Use	Ag. Cons. Use from Pumping	Municipal (Landscape ET)	
1986/87	0	1,100	6,900	140	9,000	0	21,000	80	38,000
1987/88	0	0	7,400	140	8,000	0	22,000	80	38,000
1988/89	0	0	7,900	140	6,000	0	24,000	80	38,000
1989/90	0	0	7,300	140	8,000	0	22,000	80	38,000
1990/91	0	0	5,900	140	11,000	0	18,000	80	35,000
1991/92	0	0	7,400	140	9,000	0	22,000	80	39,000
1992/93	1,000	5,200	4,900	140	12,000	8,700	15,000	80	47,000
1993/94	0	1,000	7,500	140	8,000	3,100	22,000	80	42,000
1994/95	3,000	3,500	6,500	140	13,000	6,300	20,000	80	53,000
1995/96	0	4,800	8,600	140	8,000	7,600	26,000	80	55,000
1996/97	0	0	10,100	140	12,000	0	30,000	80	52,000
1997/98	5,000	0	7,900	140	15,000	0	24,000	80	52,000
1998/99	0	0	9,900	140	9,000	0	30,000	80	49,000
1999/00	0	0	8,700	140	8,000	100	26,000	80	43,000
2000/01	0	0	8,800	140	9,000	0	26,000	80	44,000
2001/02	0	0	8,200	150	6,000	0	25,000	80	39,000
2002/03	0	0	6,600	150	8,000	100	22,000	80	37,000
2003/04	0	0	8,000	160	7,000	0	27,000	90	42,000
2004/05	1,000	5,400	4,800	160	13,000	8,200	16,000	90	49,000
2005/06	0	5,500	3,500	170	12,000	9,700	12,000	90	43,000
2006/07	0	0	9,700	170	4,000	0	33,000	90	47,000
2007/08	0	0	7,900	180	6,000	0	26,000	100	40,000
2008/09	0	500	6,100	180	5,000	1,500	20,000	100	33,000
2009/10	0	2,300	4,100	190	10,000	200	14,000	100	31,000
2010/11	3,000	3,900	2,800	190	14,000	6,400	9,000	100	39,000
2011/12	0	200	5,000	200	11,000	700	17,000	110	34,000
2012/13	0	0	6,100	200	4,000	0	21,000	110	31,000
2013/14	0	0	5,300	210	4,000	0	18,000	110	28,000
2014/15	0	0	5,300	210	6,000	0	18,000	120	30,000
2015/16	0	0	2,900	220	9,000	0	10,000	120	22,000
2016/17	1,000	500	2,500	220	12,000	1,700	9,000	120	27,000
2017/18	0	0	3,100	230	5,000	0	10,000	120	18,000
2018/19	0	700	800	230	12,000	2,400	3,000	130	19,000
86/87-18/19 Avg	0	1,000	6,300	170	9,000	1,700	20,000	90	38,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Alpaugh GSA
Historical Groundwater Budget 1986/87 to 2018/19

Water Year	Groundwater Inflows (acre-ft)							Groundwater Outflows (acre-ft)					Change in Storage (acre-ft)		
	Areal Recharge from Precipitation	Imported Water Deliveries	Agricultural Pumping	Municipal Pumping	Sub-surface Inflow		Total In	Groundwater Pumping		Sub-surface Outflow		Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage
		Return Flow	Return Flow	Return Flow	From Outside Subbasin	From Other GSAs		Municipal	Agricultural	To Outside Subbasin	To Other GSAs				
1986/87	0	1,100	6,900	100	2,000	24,000	34,000	200	27,000	3,000	9,000	39,000	-3,000	-2,000	-5,000
1987/88	0	0	7,400	100	2,000	30,000	40,000	200	29,000	4,000	13,000	46,000	-4,000	-2,000	-6,000
1988/89	0	0	7,900	100	2,000	33,000	43,000	200	31,000	4,000	15,000	50,000	-5,000	-2,000	-7,000
1989/90	0	0	7,300	100	2,000	32,000	41,000	200	29,000	4,000	16,000	49,000	-5,000	-3,000	-8,000
1990/91	0	0	5,900	100	2,000	30,000	38,000	200	23,000	5,000	15,000	43,000	-3,000	-2,000	-5,000
1991/92	0	0	7,400	100	2,000	35,000	45,000	200	30,000	6,000	18,000	54,000	-7,000	-2,000	-9,000
1992/93	1,000	5,200	4,900	100	1,000	32,000	44,000	200	20,000	8,000	19,000	47,000	-4,000	1,000	-3,000
1993/94	0	1,000	7,500	100	2,000	34,000	45,000	200	30,000	6,000	17,000	53,000	-6,000	-2,000	-8,000
1994/95	3,000	3,500	6,500	100	2,000	28,000	43,000	200	26,000	5,000	15,000	46,000	-5,000	2,000	-3,000
1995/96	0	4,800	8,600	100	4,000	27,000	45,000	200	34,000	3,000	15,000	52,000	-8,000	1,000	-7,000
1996/97	0	0	10,100	100	5,000	30,000	45,000	200	40,000	2,000	12,000	54,000	-7,000	-2,000	-9,000
1997/98	5,000	0	7,900	100	6,000	27,000	46,000	200	32,000	3,000	13,000	48,000	-4,000	2,000	-2,000
1998/99	0	0	9,900	100	6,000	32,000	48,000	200	40,000	3,000	13,000	56,000	-6,000	-2,000	-8,000
1999/00	0	0	8,700	100	5,000	34,000	48,000	200	35,000	3,000	14,000	52,000	-2,000	-2,000	-4,000
2000/01	0	0	8,800	100	3,000	33,000	45,000	200	35,000	4,000	15,000	54,000	-8,000	-1,000	-9,000
2001/02	0	0	8,200	100	3,000	35,000	46,000	200	33,000	5,000	18,000	56,000	-6,000	-4,000	-10,000
2002/03	0	0	6,600	200	3,000	35,000	45,000	200	29,000	5,000	17,000	51,000	-3,000	-3,000	-6,000
2003/04	0	0	8,000	200	3,000	33,000	44,000	200	35,000	4,000	16,000	55,000	-10,000	-1,000	-11,000
2004/05	1,000	5,400	4,800	200	3,000	23,000	37,000	300	21,000	3,000	13,000	37,000	-2,000	2,000	0
2005/06	0	5,500	3,500	200	2,000	23,000	34,000	300	15,000	4,000	13,000	32,000	1,000	1,000	2,000
2006/07	0	0	9,700	200	4,000	31,000	45,000	300	42,000	2,000	14,000	58,000	-10,000	-3,000	-13,000
2007/08	0	0	7,900	200	3,000	34,000	45,000	300	34,000	5,000	17,000	56,000	-9,000	-2,000	-11,000
2008/09	0	500	6,100	200	2,000	38,000	47,000	300	27,000	8,000	22,000	57,000	-8,000	-2,000	-10,000
2009/10	0	2,300	4,100	200	2,000	40,000	49,000	300	18,000	10,000	24,000	52,000	-4,000	1,000	-3,000
2010/11	3,000	3,900	2,800	200	2,000	32,000	44,000	300	12,000	8,000	19,000	39,000	0	5,000	5,000
2011/12	0	200	5,000	200	2,000	34,000	41,000	300	22,000	7,000	19,000	48,000	-5,000	-2,000	-7,000
2012/13	0	0	6,100	200	2,000	41,000	49,000	300	27,000	10,000	23,000	60,000	-8,000	-3,000	-11,000
2013/14	0	0	5,300	200	2,000	36,000	44,000	300	23,000	9,000	22,000	54,000	-9,000	-1,000	-10,000
2014/15	0	0	5,300	200	1,000	37,000	44,000	300	23,000	10,000	23,000	56,000	-10,000	-2,000	-12,000
2015/16	0	0	2,900	200	2,000	36,000	41,000	300	13,000	12,000	24,000	49,000	-7,000	-1,000	-8,000
2016/17	1,000	500	2,500	200	2,000	29,000	35,000	300	11,000	9,000	17,000	37,000	-2,000	0	-2,000
2017/18	0	0	3,100	200	2,000	32,000	37,000	400	13,000	10,000	21,000	44,000	-7,000	0	-7,000
2018/19	0	700	800	200	2,000	28,000	32,000	400	3,000	11,000	19,000	33,000	-2,000	1,000	-1,000
36/87-18/19 Avg	0	1,000	6,300	200	3,000	32,000	43,000	300	26,000	6,000	17,000	49,000	-5,000	-1,000	-6,000
Cumulative Change in Storage													-178,000	-30,000	-208,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Appendix G

Kern-Tulare Water District GSA

Kern-Tulare Water District GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Inflow (acre-ft)				
	Precipitation	Imported Water	Recyled Water (Oilfield Produced Water)	Agricultural Discharge from Wells	Total In
1986/87	7,000	10,900	0	6,000	24,000
1987/88	6,000	12,210	0	5,000	23,000
1988/89	5,000	11,990	0	6,000	23,000
1989/90	6,000	11,370	0	7,000	24,000
1990/91	8,000	9,760	0	3,000	21,000
1991/92	6,000	11,700	0	6,000	24,000
1992/93	9,000	13,110	100	5,000	27,000
1993/94	6,000	14,210	130	7,000	27,000
1994/95	11,000	13,890	130	7,000	32,000
1995/96	6,000	14,630	130	9,000	30,000
1996/97	8,000	16,370	120	5,000	29,000
1997/98	15,000	13,430	110	7,000	36,000
1998/99	7,000	15,490	80	5,000	28,000
1999/00	6,000	17,500	100	6,000	30,000
2000/01	6,000	18,780	100	3,000	28,000
2001/02	5,000	16,380	100	6,000	27,000
2002/03	6,000	15,680	70	6,000	28,000
2003/04	5,000	16,580	100	7,000	29,000
2004/05	10,000	13,920	90	3,000	27,000
2005/06	8,000	15,140	70	1,000	24,000
2006/07	4,000	15,740	130	7,000	27,000
2007/08	4,000	18,070	260	2,000	24,000
2008/09	4,000	16,040	280	2,000	22,000
2009/10	7,000	14,410	280	3,000	25,000
2010/11	11,000	13,970	330	2,000	27,000
2011/12	8,000	15,070	470	3,000	27,000
2012/13	3,000	15,710	530	4,000	23,000
2013/14	3,000	10,590	700	10,000	24,000
2014/15	5,000	5,610	600	10,000	21,000
2015/16	7,000	11,520	600	7,000	26,000
2016/17	10,000	13,220	720	10,000	34,000
2017/18	4,000	14,010	1,030	7,000	26,000
2018/19	10,000	12,970	1,080	6,000	30,000
86/87-18/19 Avg	7,000	13,900	300	6,000	27,000

Kern-Tulare Water District GSA
Historical Surface Water Budget 1986/87 to 2018/19

Water Year	Surface Water Outflow (acre-ft)								
	Areal Recharge of Precip-itation	Deep Percolation of Applied Water			Evapotranspiration				Total Out
		Imported Water	Recyled Water (Oilfield	Agri-cultural Pumping	Precipitation Crops/Native	Agricultural Cons. Use			
						Imported Water	Recyled Water	Pumping	
1986/87	0	4,800	0	800	7,000	6,100	0	5,000	24,000
1987/88	0	5,100	0	700	6,000	7,100	0	4,000	23,000
1988/89	0	4,300	0	800	5,000	7,700	0	5,000	23,000
1989/90	0	5,300	0	1,000	6,000	6,000	0	6,000	24,000
1990/91	0	4,700	0	500	7,000	5,000	0	3,000	20,000
1991/92	0	2,700	0	900	6,000	9,000	0	5,000	24,000
1992/93	1,000	5,100	100	700	8,000	8,000	0	4,000	27,000
1993/94	0	3,900	100	1,100	6,000	10,300	100	6,000	28,000
1994/95	3,000	5,300	100	1,100	9,000	8,600	0	6,000	33,000
1995/96	0	3,700	100	1,300	6,000	10,900	100	8,000	30,000
1996/97	0	4,500	100	700	8,000	11,900	100	4,000	29,000
1997/98	5,000	6,200	100	1,000	10,000	7,200	0	6,000	36,000
1998/99	0	4,200	0	700	7,000	11,300	0	4,000	27,000
1999/00	0	5,100	0	900	6,000	12,400	0	5,000	29,000
2000/01	0	6,100	0	400	6,000	12,700	0	2,000	27,000
2001/02	0	4,100	100	900	5,000	12,300	0	5,000	27,000
2002/03	0	4,800	0	900	6,000	10,900	0	5,000	28,000
2003/04	0	3,700	100	1,000	5,000	12,900	100	6,000	29,000
2004/05	2,000	3,600	0	500	8,000	10,300	0	3,000	27,000
2005/06	1,000	6,100	0	200	8,000	9,000	0	1,000	25,000
2006/07	0	2,800	0	1,000	4,000	12,900	100	6,000	27,000
2007/08	0	3,500	100	300	4,000	14,600	100	2,000	25,000
2008/09	0	4,100	100	300	4,000	11,900	100	2,000	23,000
2009/10	0	4,700	100	400	7,000	9,700	100	2,000	24,000
2010/11	2,000	6,600	200	300	9,000	7,400	100	2,000	28,000
2011/12	1,000	7,300	300	400	8,000	7,800	200	2,000	27,000
2012/13	0	3,000	200	500	3,000	12,700	300	3,000	23,000
2013/14	0	2,500	300	1,400	3,000	8,100	400	8,000	24,000
2014/15	0	1,500	300	1,500	5,000	4,100	300	9,000	22,000
2015/16	0	3,900	400	1,000	7,000	7,700	200	6,000	26,000
2016/17	1,000	4,700	400	1,400	8,000	8,500	300	8,000	32,000
2017/18	0	4,900	500	1,000	4,000	9,200	500	6,000	26,000
2018/19	2,000	4,600	700	900	8,000	8,400	400	6,000	31,000
86/87-18/19 Avg	1,000	4,500	100	800	6,000	9,500	100	5,000	27,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate

Kern-Tulare Water District
Historical Groundwater Budget 1986/87 to 2018/19

Water Year	Groundwater Inflows (acre-ft)						Groundwater Outflows (acre-ft)				Change in Storage (acre-ft)		
	Areal Recharge from Precipitation	Imported Water Deliveries	Agricultural Pumping	Sub-surface Inflow		Total In	Groundwater Pumping	Sub-surface Outflow		Total Out	Aquitard Change in Storage	Aquifer Change in Storage	Total Change in Storage
		Return Flow	Return Flow	From Outside Subbasin	From Other GSAs		Agricultural	To Outside Subbasin	To Other GSAs				
1986/87	0	4,800	800	1,000	15,000	22,000	6,000	2,000	14,000	22,000	2,000	-2,000	0
1987/88	0	5,100	700	1,000	12,000	19,000	5,000	2,000	14,000	21,000	0	-2,000	-2,000
1988/89	0	4,300	800	1,000	12,000	18,000	6,000	1,000	15,000	22,000	0	-4,000	-4,000
1989/90	0	5,300	1,000	1,000	13,000	20,000	7,000	1,000	17,000	25,000	0	-5,000	-5,000
1990/91	0	4,700	500	1,000	13,000	19,000	3,000	1,000	17,000	21,000	0	-2,000	-2,000
1991/92	0	2,700	900	2,000	15,000	21,000	6,000	1,000	19,000	26,000	-1,000	-4,000	-5,000
1992/93	1,000	5,100	700	1,000	12,000	20,000	5,000	1,000	17,000	23,000	0	-3,000	-3,000
1993/94	0	3,900	1,100	2,000	11,000	18,000	7,000	1,000	16,000	24,000	0	-6,000	-6,000
1994/95	3,000	5,300	1,100	1,000	12,000	22,000	7,000	1,000	17,000	25,000	0	-3,000	-3,000
1995/96	0	3,700	1,300	2,000	12,000	19,000	9,000	1,000	15,000	25,000	0	-6,000	-6,000
1996/97	0	4,500	700	1,000	10,000	16,000	5,000	1,000	15,000	21,000	0	-5,000	-5,000
1997/98	5,000	6,200	1,000	1,000	9,000	22,000	7,000	1,000	14,000	22,000	0	0	0
1998/99	0	4,200	700	1,000	9,000	15,000	5,000	1,000	13,000	19,000	0	-4,000	-4,000
1999/00	0	5,100	900	2,000	9,000	17,000	6,000	0	14,000	20,000	0	-3,000	-3,000
2000/01	0	6,100	400	1,000	9,000	17,000	3,000	0	15,000	18,000	0	-1,000	-1,000
2001/02	0	4,100	900	1,000	10,000	16,000	6,000	0	15,000	21,000	0	-5,000	-5,000
2002/03	0	4,800	900	1,000	10,000	17,000	6,000	0	14,000	20,000	0	-3,000	-3,000
2003/04	0	3,700	1,000	1,000	10,000	16,000	7,000	1,000	15,000	23,000	-1,000	-6,000	-7,000
2004/05	2,000	3,600	500	1,000	8,000	15,000	3,000	0	14,000	17,000	0	-2,000	-2,000
2005/06	1,000	6,100	200	1,000	7,000	15,000	1,000	0	13,000	14,000	1,000	0	1,000
2006/07	0	2,800	1,000	1,000	8,000	13,000	7,000	0	14,000	21,000	-1,000	-7,000	-8,000
2007/08	0	3,500	300	1,000	8,000	13,000	2,000	1,000	15,000	18,000	0	-5,000	-5,000
2008/09	0	4,100	300	1,000	8,000	13,000	2,000	1,000	15,000	18,000	0	-5,000	-5,000
2009/10	0	4,700	400	1,000	9,000	15,000	3,000	0	14,000	17,000	0	-2,000	-2,000
2010/11	2,000	6,600	300	1,000	8,000	18,000	2,000	0	14,000	16,000	0	2,000	2,000
2011/12	1,000	7,300	400	1,000	9,000	19,000	3,000	1,000	16,000	20,000	0	-1,000	-1,000
2012/13	0	3,000	500	1,000	12,000	17,000	4,000	0	19,000	23,000	-1,000	-5,000	-6,000
2013/14	0	2,500	1,400	1,000	16,000	21,000	10,000	0	22,000	32,000	-1,000	-10,000	-11,000
2014/15	0	1,500	1,500	1,000	17,000	21,000	10,000	1,000	21,000	32,000	-1,000	-10,000	-11,000
2015/16	0	3,900	1,000	1,000	14,000	20,000	7,000	1,000	18,000	26,000	0	-6,000	-6,000
2016/17	1,000	4,700	1,400	1,000	14,000	22,000	10,000	1,000	18,000	29,000	0	-7,000	-7,000
2017/18	0	4,900	1,000	1,000	14,000	21,000	7,000	1,000	18,000	26,000	0	-5,000	-5,000
2018/19	2,000	4,600	900	1,000	14,000	23,000	6,000	1,000	17,000	24,000	0	-1,000	-1,000
36/87-18/19 Avg	1,000	4,500	800	1,000	11,000	18,000	6,000	1,000	16,000	23,000	0	-4,000	-4,000
									Cumulative Change in Storage		-3,000	-128,000	-131,000

Groundwater Inflows to be Included in the Native Yield Estimate
Groundwater Inflows to be Excluded from the Native Yield Estimate
Surface Water or Groundwater Outflows Not Included in Native Yield Estimate