subsidence monitoring programs as needed that may include surveys of wells, or measurement of pumping water levels in deep wells in known subsidence areas. The regional InSAR/LiDAR maps will be used to identify these areas.

If additional monitoring locations are added, such as the proposed extensometers, the following scientific rationale will be used:

- Add stable benchmark sites that can be easily accessed and surveyed.
- Add sites where the ground surface is unlikely to be modified by future construction and will remain undisturbed.

5.5 Data Storage and Reporting

23 CCR §352.6 *Each Agency shall develop and maintain a data management system that is capable of storing and reporting information relevant to the development or implementation of the Plan and monitoring of the basin.*

The monitoring programs within the GSAs will be coordinated within the Subbasin. RMS well locations, construction, and groundwater level data are shared or will be shared amongst the different GSAs. In addition, the monitoring programs described in this Chapter were reviewed by the GSAs and will be consistent throughout the Subbasin. Similarly, data reported to DWR will be collected and reported in a consistent format. GSP development and implementation will depend on the Data Management System's (DMS) ability to support GSP activities. The DMS shall also allow for upload and storage of information.

The GSAs have a consultant to develop a DMS to store and retrieve the necessary information for annual reporting. This database standardizes the basin-wide collection of data. The GSAs have been provided data templates which allows them to collect and enter the necessary information in a standardized format for integration into the DMS. The DMS is a repository for data storage and will be used to help generate the required information for annual reporting for the Subbasin. Some features in the DMS are linked to a Geographic Information System (GIS) when applicable (i.e., monitoring locations, crop boundaries and groundwater contours). A schematic of the DMS structure showing the DMS table relationships is included as Figure 5-6.

The DMS includes information on monitoring sites related to the Sustainable Management Criteria. The data will be subject to several levels of quality control; first, when the GSA representatives enter the data, and again when the consultant evaluates the data when preparing annual reports, and a third level when the results are reviewed by the GSAs. The DMS for the Subbasin shall be secure and will be able to generate information to support reporting as requested by the GSAs. Standardized data-entry data templates will help stakeholders organize their data so that it transfers to the DMS efficiently to reduce the amount of time spent on data entry and quality control.

The DMS will include the necessary elements required by the regulations, including:

- Well location and construction information (where available)
- Water level readings and hydrographs including water year type
- Seasonal groundwater elevation contours
- Estimated groundwater extraction by category
- Total water use by source
- Estimate of groundwater storage change, including maps and tables
- Graph with Water Year type, Groundwater Use, Annual and Cumulative Storage Change
- Subsidence Monitoring Locations

Figure 5-7 shows some examples of tables and associated fields in the DMS. The DMS table fields allow for addition of required or needed fields. The data can be combined to generate the required information for annual reporting. For example, total water use by source would be combined using information from the groundwater extraction and surface water usage tables. Additional items may be added to the DMS in the future as needed or required.

Data will be obtained by each GSA and submitted to the consultant for inclusion in the DMS. The required data will be aggregated and summarized for reporting to DWR. Groundwater contours.

will be prepared outside of the DMS using GIS analysis because of the need to evaluate the integrity of the data and generate a static contour set that has been reviewed for quality assurance and should not change once approved. Groundwater storage calculations are also performed outside of the DMS, then the results of those calculations will be uploaded to the DMS for annual reporting. Groundwater use by sector estimates, surface water deliveries by diversion point, intentional recharge, and land use data will be prepared by the GSAs using the data-entry data templates and then uploaded to the DMS for annual reporting and evaluations of trends. Surface water delivery records are maintained by the surface water agencies in separate systems already, and that data is collected by each GSA and provided to the DMS as an aggregate total by GSA. A description of how the DMS addresses required elements of a DMS and annual reporting requirements listed in the Table 5-7. The GSAs may choose to have their own separate system for additional analysis.

5.6 Data and Reporting Standards

23 CCR §352.4 Data and Reporting Standards

c) The following reporting standards apply to all categories of information required of a plan.

d) Monitoring sites shall include the following:

….c) The following standards apply to wells:

….d) Maps submitted to the Department shall meet the following requirements:

….e) Hydrographs submitted to the Department shall meet the following standards:

Table 5-8 lists the reporting standards that will be used for implementation of the GSP.

The monitoring sites will include the following information:

1. A unique site identification number and narrative description of the site location.
2. A description of the type of monitoring, type of measurement taken, and monitoring frequency.
3. Location, elevation of the ground surface, and identification and description of the reference point.
4. A description of the standards used to install the monitoring site. Sites that do not conform to best management practices shall be identified and the nature of the divergence from best management practices described.

The following standards will apply to all wells:

1. Wells used to monitor groundwater conditions installed during GSP implementation will be constructed according to applicable construction standards, and the following information in both tabular and geodatabase-compatible shapefile form will be provided:
    a. CASGEM well identification number. If a CASGEM well identification number has not been issued, appropriate well information shall be entered on forms made available by the Department, as described in Section 353.2.
    b. Well location, elevation of the ground surface and reference point, including a description of the reference point.
    c. A description of the well use, such as public supply, irrigation, domestic, monitoring, or other type of well, whether the well is active or inactive, and whether the well is a single, clustered, nested, or other type of well.
    d. Casing perforations, borehole depth, and total well depth.
    e. Well completion reports, if available, from which the names of private owners have been redacted.
    f. Geophysical logs, well construction diagrams, or other relevant information, if available.
    g. Identification of principal aquifers monitored.
    h. Other relevant well construction information, such as well capacity, casing diameter, or casing modifications, as available.
2. For GSP wells that lack casing perforations, borehole depth, or total well depth information to monitor groundwater conditions, a schedule for acquiring monitoring wells with the necessary information, or a demonstration to DWR that such information is not necessary to understand and manage groundwater in the basin, will be provided.
3. Well information used to develop the basin setting will be maintained in the DMS.

Maps submitted to the DWR will have the following:

1. Data layers, shapefiles, geodatabases, and other information provided with each map, will be submitted electronically to the DWR in accordance with SGMA-prescribed procedures.
2. The maps will be clearly labeled and will contain a level of detail to ensure that the map is informative and useful.
3. The datum will be clearly identified on the maps or in an associated legend.

Hydrographs submitted to the DWR will:

1. Be submitted electronically to the DWR in accordance with SGMA-prescribed procedures.
2. Include a unique site identification number and the ground surface elevation for each site.
3. Use the same datum and scaling to the greatest extent practical.

6.0 PROJECTS AND MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY

23 CCR §354.44 Projects and Management Actions

(a) *Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.*

(b) *Each Plan shall include a description of the projects and management actions that include the following:*

(1) *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:*

(A) *A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.*

(B) *The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.*

(2) *If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.*

(3) *A summary of the permitting and regulatory process required for each project and management action.*

(4) *The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.*

(5) *An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.*

(6) *An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.*

(7) *A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.*

(8) *A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.*

(9) *A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.*

(c) *Projects and management actions shall be supported by best available information and best available science.*

(d) *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

6.1 Introduction

The member agencies and technical advisors have developed the projects and management actions described in this chapter. Once the Groundwater Sustainability Plan (GSP) is approved, the projects and management actions previously selected by each Groundwater Sustainability Agency (GSA) will be advanced and implemented. Each GSA proposed their method to achieve sustainability utilizing a combination of projects and management actions. Section 6.5, *GSA Sustainable Methods*, describes the mix of projects and management actions chosen by each GSA to meet sustainability.

Water supply is based on historically available water and forecasted water use, which is based on information from member agencies and best available data. Historical water supply was obtained from each agency in the Tulare Lake Subbasin (Subbasin) and includes surface water and groundwater.

Projects and management actions are supported by the best available science and data. They are proposed and will be implemented in the most effective manner toward creating a sustainable yield for each sustainability indicator, as applicable. Costs for implementing each project was developed using information from previous projects in the Subbasin area and is in a unit of cost format in Section 6.3, *Projects*, of this chapter. Due to data gaps, there is a level of uncertainty associated with the Subbasin and additional efforts are needed to further develop the projects and management actions.

Management actions are generally programs or policies developed with the objective of management through reducing water demand, improving water data gathering, and/or protecting water quality. Management actions listed in this chapter are conceptual. Each GSA will utilize this list, or other options as they may arise, to further develop and refine their own management actions as needed to achieve sustainability.

Implementation and reporting will begin once the GSP is submitted by January 31, 2020. Even while the California Department of Water Resources is reviewing the GSP, Sustainable Groundwater Management Act (SGMA) implementation at the GSA level must begin. During the implementation phase, communication and engagement efforts will be shifted to educational and informational awareness of the requirements and processes for reaching groundwater sustainability as set forth in the submitted GSP. Active involvement of all stakeholders will be encouraged during this phase, and Public notices will be provided for any public meetings and, prior to imposing any fees. Public outreach for this phase will also be completed by the individual GSAs with collaborative Subbasin-wide efforts when target audiences span more than one GSA boundary.

The GSAs view projects and management criteria as a long-term implementation effort. The criteria that triggered the implementation plan was the adoption of SGMA and chronic overdraft in the Subbasin. Implementation will begin with the adoption of this GSP and as the need arises for each type of project to attain groundwater sustainability by 2040. An example of implementation information of each project type within the Subbasin is noted in Table 6-5, column Circumstances of Implementation of this chapter. Each GSA will decide what projects are best suited for their area and what policy will be developed.

6.2 Water Supply

The Subbasin is served by the State Water Project (SWP), the United States Bureau of Reclamation Central Valley Project (CVP), the Kings River, the Kaweah River, and the Tule River, as described in Section 3.4, *Management Areas*. Furthermore, flood waters occur from controlled and uncontrolled streams including the Kings River, Kaweah River, Tule River, Deer Creek, White River, Kern River, and Poso Creek. The timing and volume of surface water supply varies depending on the magnitude of the water year.

6.2.1 Kings River Supplies

The Kings River, like all southern Sierra Nevada streams, is prone to extreme annual swings in runoff, which is directly related to mountain precipitation (Kings River Water Association 2004). The River's historically lowest runoff event was approximately 391,700 acre-feet (AF) from 1923 to 1924. In contrast, the 1982 to 1983 water year produced a record runoff of 4,476,400 AF.

Pine Flat reservoir feeds into the Kings River and has a storage capacity of approximately 1,000,000 AF. The volume of flood control storage space is determined by the United States Army Corps of Engineers (USACE) Reservoir Regulation Manual. On average, flood releases generally occur every three to four years and, in some instances, consecutively. Channel losses and fishery management periodically affect delivery flexibility through restrictions in water supply to the Subbasin (Tulare Lake Basin Water Storage District 2003). It is anticipated that surface water supplies from the Kings River will be the main source for projects advanced by the GSAs to achieve sustainability, which include storage, banking, recharge, and continuation of fully appropriated stream status.

6.2.2 Kaweah River Supplies

The Kaweah River flows are controlled by Terminus Dam, creating a reservoir with the purpose of providing flood protection and storage for irrigation. Terminus Dam has a storage capacity of approximately 185,600 AF (KDWCD 2017). Flood control storage space is determined by the USACE Reservoir Regulation Manual, which contains a flood control diagram that is used from November 1 to March 1. There are rights holders within the Subbasin, and during times of heavy runoff, flood water is released causing higher than average flows. Depending on irrigation demand and the season, portions of this flood water will reach the Subbasin.

6.2.3 Tule River Supplies

Tule River water rights holders within the Subbasin and flood water can empty into the Subbasin in times of runoff. Tule River flows are controlled by Success Dam, approximately 35 miles east of Corcoran. Success Dam, operated by the USACE, provides flood control and irrigation water storage by creating a reservoir with a total storage capacity of approximately 82,300 AF (Tule River Basin 2015). The Success Reservoir is operated by USACE, who is undertaking a project to expand storage to 112,000 AF in 2022-2023.

6.2.4 Deer Creek

Deer Creek rights holders are present in the Subbasin.

6.2.5 White River

White River has no rights holders. Flood flows occasionally occur in the Subbasin.

6.2.6 Poso Creek

There are no rights holders in the Subbasin. Flood flows occasionally occur in the Subbasin.

6.2.7 Kern River

Kern River has rights holders in the Subbasin, but the water has been contracted to the Kern County Water Agency. Flood flows may pass into the Subbasin.

6.2.8 State Water Project Supplies

There are multiple SWP contractors in the Subbasin. SWP supplies have regulatory restrictions (e.g., Endangered Species Act and Water Quality Control Plan) that result in delivery reductions, which reduces surface water reliability (Tulare Lake Basin Water Storage District 2003). Surface water supply allocations to the Subbasin vary based on water year type, hydrology conditions in the San Francisco Bay Delta, and regulatory restrictions.

6.2.9 Central Valley Project Supplies

The CVP has long-term agreements to supply water to more than 250 contractors in 29 of California’s 58 counties. Kaweah Delta Water Conservation District is the only long-term Friant Division contractor in the Subbasin, but there are several other non-long-term contractors that have diverted water via transfers and exchanges.

6.2.10 Import of Additional Supplies

Each GSA is proposing to use their existing contract and rights for surface water as access to import more surface water into the Subbasin.

6.3 Projects

Projects reviewed in this chapter provide options to each of the GSAs and their respective partner agencies to use in implementation of this GSP, which is discussed in Chapter 7, *Implementation*. Each project and the potential yield were included in the modeling process; results are represented in Appendix G, *Representative Monitoring Site Forecast Hydrographs*. The milestones based on the measurable objectives (MOs) and minimum thresholds (MTs) are included in Table 4-1. Potential projects that may be utilized by the GSAs and partners include:

- Construction of new and modification of existing conveyance facilities;
- Above-ground surface water storage projects;
- Recharge basins and/or water banking in or out of the Subbasin;
- On-farm flooding; and
- Aquifer Storage and Recovery (ASR).

6.3.1 Conveyance Facilities Modifications and Construction of New Facilities

Modifications or improvements to existing facilities can be completed to increase conveyance efficiency and allow for greater flow capacity. Improvements of an existing system could increase the delivery area or delivery efficiency. Total capacity may also be increased with the construction of new conveyance systems, such as canals, check structures, and additional turnouts, to allow for surface water delivery to new areas. By providing a larger service area, more acreage would be able to use surface water, thus reducing the demand on groundwater pumping. It is anticipated that throughout the Subbasin, existing facilities will be improved by reshaping of existing canals, modification of canal control structures, and canal lining. Canal lining would prevent seepage losses and increase the total usable water volume. Conveyance construction and improvements will support other proposed projects in the area.

6.3.1.1 Location

Project locations will be identified by each GSA and their respective partners within their area as soon as the need arises and funding is available.

6.3.1.2 Project Objectives

The main objective of this project type is to increase the conveyance capacity or efficiency of the surface water distribution systems, allowing for increased surface water supplies. This project will decrease reliance on groundwater and help to maintain groundwater levels and storage. A direct relationship exists between the volume of additional surface water that can be delivered to a site and reduction in groundwater pumping. This objective will be achieved by improving the existing system, constructing new facilities (e.g., canals, pipelines, and pump stations) to increase the delivery service area, and constructing new water management structures to manage deliveries in the expanded water delivery area. All water flows that are delivered to the Subbasin will be measured appropriately.

6.3.1.3 Project Benefits and Water Reliability

Project benefits include:

- Decreased reliance on groundwater pumping;
- Increased diversion capability or efficiency at existing points of delivery; and
- Diversion in upper reaches of the Subbasin to provide flood flexibility to the lower reaches of the Subbasin.

Historically, flood releases occur every three to four years with some years being consecutive flood-release years, as discussed above in Section 6.2, *Water Supply.* This project may also be used in normal years when water is available for purchase. With implementation of the SGMA, it is anticipated that surface water management by other water rights holders will also change and the available volume of surface water may decrease. However, based on historical data, the reliability and availability of flood-release water is considered effective for the purposes of this project type.

6.3.1.4 Project Ownership

The project would be owned and managed by the local water agencies where the project will be constructed. GSAs may be involved in funding and coordinating these efforts to improve water balance conditions within the GSA service areas.

6.3.1.5 Project Cost Estimate/Acre-Foot of Yield

Although no detailed cost estimate has been prepared, preliminary estimates of typical project component costs are:

- New Canal Excavation: Approximately $45 per linear foot; assumes 8 feet deep, with a capacity of 400 cubic feet per second (cfs)
- Excavate/widen existing canal: Approximately $20 per linear foot; assumes 6 feet deep to increase capacity
- New weirs or check structures: Varies from $50,000 to $500,000 based on placement

- Pump Station: Varies from $500,000 for a 100-cfs pump station to $3,000,000 for a 500-cfs pump station (includes cost of pumps, concrete structure, and electrical work); design would be in accordance with the Hydraulic Institute's guidelines;
- Piping or concrete lining of canals: about $1-3 million per mile for a large canal.

The yield of this type of project will be determined based on the designated delivery rates. The yield will be developed as projects are identified and funding becomes available.

6.3.1.6 Circumstances of Implementation

GSAs in the Subbasin have the flexibility to choose which types of projects and management actions to pursue in attaining sustainable management. Not all projects or management actions will be pursued. Decisions regarding projects and policies will depend on conditions and management of the GSA at the board level. Should this type of project be deemed appropriate and necessary, it will be considered an integral part of the overall effort to reach sustainability. The selection of check structures and turnouts, willing participants, and the availability of funding are circumstances considered necessary to project implementation.

6.3.1.7 Project Status and Schedule

No project schedule has been determined. Some GSAs need to secure funding to begin the planning and implementation of this project. It is expected, once funding is secured, it could take from one to five years to complete a project including meeting environmental compliance.

6.3.1.8 Permitting and Regulatory Process

Each project may require a permitting evaluation and compliance with California Environmental Quality Act (CEQA) requirements. This process will be performed, as required, once the projects have been selected. If construction is going to disturb more than 5 acres, a Storm Water Pollution Prevention Plan (SWPPP) may be necessary as well.

6.3.1.9 Legal Authority

The legal authority to acquire land, grants, water rights, etc., and to operate and maintain such facilities for the purposes of carrying out the provisions of SGMA is given to GSAs by the State of California in Division 6 of the Water Code (§10726.2). Each of the GSAs may need to acquire new surface water rights or work with agencies within their boundaries that have existing rights. GSAs will likely provide funding and coordination support for this type of project.

6.3.2 Above-Ground Surface Water Storage

Above-ground storage basins will be constructed for the purpose of capturing and retaining more surface water for direct irrigation purposes. Controlled surface water storage on the valley floor would allow beneficial users to more effectively utilize each water year's available surface water. All surface water diversions into and out of the storage basins will be measured appropriately. Groundwater pumping should decrease in direct correlation to the additional volume of surface water captured and stored in the new facilities. Additionally, if the storage basin were to replace an agricultural field, demand reduction would occur within the footprint of the designated storage basin.

6.3.2.1 Location

Prospective project locations will be identified by each GSA as funding becomes available. Surface water storage basins are likely to be in locations containing a soil profile with higher clay content, due to its hydraulic properties for draining slowly. The location will likely be determined based on areas that have rights to surface water, and higher consideration will likely be given to areas near existing distribution infrastructure.

6.3.2.2 Project Objectives

The main objective of this project type is to increase surface water diversion and accordingly reduce groundwater pumping. Reducing the average annual volume of groundwater pumping will allow the GSAs to meet the MOs set in the 2022 GSP Addendum, for groundwater levels and groundwater storage change.

6.3.2.3 Project Benefits and Water Reliability

Project benefits include:

- Increased conjunctive use, such as water diversion to help meet irrigation demand;
- Additional storage capacity on the valley floor and below the major reservoirs (Pine Flat, Success, Terminus, and Isabella), affording more opportunity to capture and redistribute surface water supplies; and
- Flood protection to the Subbasin by increasing the controlled storage areas.

Historically, flood releases occur on average every three to five years, with some years being consecutive flood-release years from the eastern watershed areas. These projects may also be used in normal years when water is available for purchase. With implementation of SGMA, it is anticipated that surface water management by other water rights holders will also change and the available volume of surface water may decrease.

6.3.2.4 Project Cost Estimate/Acre-Foot of Yield

Although no detailed cost estimate has been prepared, a preliminary engineer's opinion of estimated project cost is approximately $25,000 to $40,000 per acre to construct a storage project. This estimated cost includes land purchase, construction of storage basins, and inlet and outlet structures with flow measurement devices. The estimated project cost assumes the earthwork for excavation and compaction will balance and there will be no need for excess material export.

The yield of this project will be determined based on the designated acreage. For example, if constructed on farmland, a basin with a bottom area of 100 acres and a 5-foot depth will generate approximately 500 AF of storage. Additionally, agricultural demand reduction of approximately 3.0 AF per acre (based on approximate average evapotranspiration demand of alfalfa) results in a reduction of about 300 AF of annual demand.

6.3.2.5 Circumstances of Implementation

GSAs in the Subbasin have the flexibility to choose which types of projects and management actions they would like to pursue in attaining sustainable management. Not all projects or management actions will be pursued; decisions regarding projects and policies will depend on conditions and management of the GSA at the board level. Should this type of project be deemed appropriate and necessary, it will be considered an integral piece of the overall effort to reach sustainability. Accordingly, finding a low infiltration site (clay soils area), willing participants, and the availability of funding are circumstances considered necessary to its implementation.

6.3.2.6 Project Status and Schedule

No project schedule has been determined. Some GSAs need to secure funding to begin the planning and implementation of a project. Once funding is secured, it is expected that it could take up to three years to complete a water storage project including environmental compliance. Benefits would be realized when a flood event occurs.

6.3.2.7 Permitting and Regulatory Process

To implement an above-ground water storage project, the following permits and regulatory procedures required include, but are not limited to, the following:

- CEQA
- SWPPP
- Mosquito Abatement – for operation of an open body of water that could host vectors
- Surface Mining and Reclamation Act (SMARA)
- San Joaquin Valley Air Pollution Control District (SJVAPCD) – for preparation of a Dust Control Plan for construction with disturbs a surface area of 5 acres or more
- County Grading Permit (at a minimum county notification)
- Other permit requirements based on findings from biological or cultural studies

6.3.2.8 Legal Authority

The legal authority to acquire land, grants, water rights, etc., and to operate and maintain such facilities for the purposes of carrying out the provisions of SGMA is given to GSAs by the State of California in Division 6 the Water Code (§10726.2). Each of the GSAs may need to acquire new surface water rights or work with agencies or private parties within their boundaries that have existing rights.

6.3.3 Recharge Basins/Water Banking

Recharge basins will be built with the purpose of recharging water into the aquifer system with the intent of extraction later on. By recharging water in wet years, groundwater levels will improve, creating a buffer storage volume, or a water bank, that may be extracted during periods of dryness or drought. Recharge basins will be constructed in areas containing soils associated with high infiltration rates; therefore, potential recharge volume realized is dependent upon the size of the recharge basin and the availability of flood water. Infiltration rates are anticipated to vary from 0.35 AF per acre per day to 1.5 AF per acre per day. Existing wells in the area will be used for extraction of the stored water. Furthermore, demand reduction of approximately 3.0 AF per acre per year is also associated with this type facility due to the removal of agricultural lands. These types of facilities are anticipated to be located in the northerly (South Fork Kings [SFK] GSA and Mid-Kings River [MKR] GSA) and easterly portions (El Rico [ER] GSA) of the Subbasin due to coarser-grained soil profiles.

6.3.3.1 Location

Project location will be identified by each GSA and their associated partner agencies as funding becomes available and based on where the most benefit may be realized. Location of projects will be determined based on the infiltration potential of certain soil profile zones, groundwater levels, and groundwater quality within the Subbasin.

6.3.3.2 Project Objectives

The project objective is to capture additional surface water and recharge it into the aquifer for storage and later recovery. This objective will help to maintain groundwater levels for neighboring landowners so that dry-year groundwater pumping will not cause levels to fall below MTs set in Sustainable Management Criteria. This project will also benefit the MO for groundwater storage change. To quantitatively measure the project objective, all water flows that are delivered to the project site will be measured and beneficial recharge will be estimated after accounting for any system losses to determine the allowable recovery volume to be used in later years.

6.3.3.3 Project Benefits and Water Reliability

Project Benefits include:

- Increased groundwater storage in wet years, for use in later years;
- Operational flexibility in dry years;
- Increased groundwater levels and groundwater storage, thus avoiding increased costs for pumping; and
- Potential for improvement of groundwater quality by recharging with higher quality surface water.

Historically, flood releases occur every three to five years with some years being consecutive flood-release years. This project may also be used in normal years when water is available for purchase. With implementation of SGMA, it is anticipated that surface water management by other water rights holders will also change and the available volume of surface water may decrease. However, based on historical data, the reliability and availability of flood-release water is considered good for the purposes of this project type.

6.3.3.4 Management of Groundwater Extractions and Recharge

Agreements between the involved parties will need to be formed on a project-by-project basis for decisions on ownership and operation. Policy for accounting of groundwater extraction and recharge as it pertains to intentional recharge projects has not yet been defined; however, flow into the recharge basin will be measured and accounted for in extractions.

6.3.3.5 Project Cost Estimate/Acre-Foot of Yield

Although no detailed cost estimate has been prepared, a preliminary engineer’s opinion of estimated project construction cost is approximately $30,000 to $50,000 per acre. This estimated cost includes land purchase, construction of basin, inlet structures, and installation of flow measurement devices. Limited excavation is assumed, due to balancing the levee compaction volume with extraction. Detailed soils investigations are recommended, and in some cases, the project may require deep ripping to remove clay layers, which could increase the project cost.

The yield of this project will be determined based on the designated acreage and availability of flood water. For example, an infiltration basin with a bottom area of 100 acres and an infiltration rate of 0.35 AF per acre per day would generate approximately 35 AF per acre per day of recharge, plus a reduction in annual water demand would occur at approximately 3.0 AF per acre if the basin replaced productive agricultural land.

6.3.3.6 Circumstances of Implementation

GSAs in the Subbasin have the flexibility to choose which types of projects and management actions they would like to pursue in attaining sustainable management. Not all projects or management actions will be pursued; decisions regarding projects and policies will depend on conditions and management of the GSA at the board level. Should this type of project be deemed appropriate and necessary, it will be considered an integral part of the overall effort to reach sustainability. Selecting a high infiltration area (sandy soils profile), finding willing participants, and the availability of funding are necessary circumstances to consider implementation of this type of project.

6.3.3.7 Project Status and Schedule

No project schedule has been determined. Some GSAs need to secure funding to begin planning and implementation of this type of project. It is expected, once funding is secured, it could take up to three years to complete this type of project, including environmental compliance.

6.3.3.8 Permitting and Regulatory Process

It is anticipated that the following permits and regulatory procedures may be required to implement this project:

- CEQA
- SMARA
- SWPPP
- SJVAPCD
- Mosquito Abatement
- County Grading Permit (at a minimum county notification)
- Other permit requirements based on findings from biological or cultural studies

6.3.3.9 Legal Authority

The legal authority to acquire land, grants, water rights, etc. and to operate and maintain such facilities for the purposes of carrying out the provisions of SGMA is given to GSAs by the State of California in Division 6 the Water Code (§10726.2). Each of the GSAs may need to acquire new surface water rights or work with agencies within their boundaries that have existing rights.

6.3.4 On-Farm Recharge

On-farm recharge is a form of groundwater recharge performed by flooding an existing agricultural production field. Potential locations for on-farm recharge will be determined by areas containing soil profiles with high infiltration potential. Additionally, on-farm flooding is limited by fertilization and crop type. Leaching of fertilizer chemicals into the groundwater system is not favorable, and some crops are more tolerant of saturated soils for longer periods of time than others. Alfalfa is well suited to on-farm flooding due to its ability to be inundated for long periods of time, and permanent crop types that are suitable for on-farm flooding during the dormancy period include vineyards, pistachios, and olives. It will be up to each GSA to determine the most favorable locations and decide on a minimum acreage size designated for this type of project. Voluntary participation from the landowners and their delivery facilities will be utilized as part of the project. In this effort, existing local wells will recover recharge supplies.

6.3.4.1 Location

Projects location will be identified by each GSA, partner agencies, and landowners based on most favorable conditions. As previously discussed, locations will be selected based on best potential benefits realized from certain soil profiles and existing cropped lands.

6.3.4.2 Project Objectives

The main objective of this project type is to reduce chronic lowering of groundwater water levels by providing a space where recharge can occur in off-season months of irrigation. To quantitatively measure the project objective, all water flows that are delivered to the project site will be measured through a metering device and beneficial recharge will be estimated after accounting for any system losses to determine the allowable recovery volume. Groundwater levels in the surrounding area will be compared to historical levels to observe the benefit of this project type on groundwater levels and storage.

6.3.4.3 Project Benefits and Water Reliability

Projects benefits include:

- Increased groundwater storage for recovery in later years;
- During wet years, additional use of flood water for recharge will provide greater flood control operation flexibility; and
- Increased groundwater levels and groundwater storage, thus avoiding increased costs for pumping;

Historically, flood releases occur every three to five years with some years being consecutive flood-release years. This project may also be used in normal years when water is available for purchase. With implementation of SGMA, it is anticipated that surface water management by other water rights holders will also change and the available volume of surface water may decrease. However, based on historical data, the reliability and availability of flood-release water is considered good for the purposes of this project type.

6.3.4.4 Management of Groundwater Extractions and Recharge

This project may be owned and managed by the GSA and their partner, if any, where constructed. Policy for groundwater extraction and recharge as it pertains to on-farm recharge projects has not yet been defined; however, flow into the recharge basin will be measured and accounted for in extractions.

6.3.4.5 Project Cost Estimate/Acre-Foot of Yield

Although no detailed cost estimate has been prepared, a preliminary engineer's opinion of probable project cost is approximately $500 to $1,000 per acre to implement. This estimated cost assumes that the landowner voluntarily enters into a land use agreement or easement. Limited to no excavation will occur within the designated land. Cost does include the purchase of flow measurement devices.

The yield of this project will be determined based on the designated acreage and the local recharge rate. For example, a 100-acre section of land with an infiltration rate of 0.35 AF per acre per day will yield 35 AF per day. No agricultural land will be taken out of production for this type of project.

6.3.4.6 Circumstances of Implementation

GSAs in the Subbasin have the flexibility to choose which types of projects and management actions they would like to pursue in attaining sustainable management. Not all projects or management actions will be pursued; decisions regarding projects and policies will depend on conditions and management of the GSA at the board level. Should this type of project be deemed appropriate and necessary, it will be considered an integral part of the overall effort to reach sustainability. Selecting an area with high infiltration potential (sandy soils area), appropriate crop type, willing participants, and availability of funding are circumstances considered necessary to the implementation of this project type.

6.3.4.7 Project Status and Schedule

No project schedule has been determined. Some GSAs need to secure funding to begin the planning and implementation of this project. It is expected, once funding is secured, that preparation of the policy could take a year to complete. The physical diversion of surface water can happen immediately following implementation of policy using existing distribution facilities. The schedule of actual operation may vary based on location, since some permanent crops can only be flooded during dormancy.

6.3.4.8 Permitting and Regulatory Process

- Land use agreements

6.3.4.9 Legal Authority

The legal authority to acquire land, grants, water rights, etc., and to operate and maintain such facilities for the purposes of carrying out the provisions of SGMA is given to GSAs by the State of California in Division 6 the Water Code (§10726.2). However, in this case, the GSA is not interested in owning the land, only providing the coordination to achieve project goals. Each of the GSAs may need to acquire new surface water rights or work with agencies within their boundaries that have existing rights. Agreements with landowners will be required to use their lands for recharge.

6.3.5 Aquifer Storage and Recovery

ASR is the intentional recharge by utilizing direct injection of surface water into an aquifer for later recovery, usually through the use of wells. ASR well sites will be selected to directly store water in certain geologic zones for later recovery or to stabilize groundwater levels to inhibit subsidence.

6.3.5.1 Location

Project locations, if feasible, will be identified by individual GSAs as funding becomes available. The areas outside the Subbasin (e.g. Westlands Water District GSA) are proposing ASR as part of their GSP.

6.3.5.2 Project Objectives

The main objective of this project is to reduce chronic lowering of groundwater levels and reduce subsidence by directly storing surplus water in the unconfined or confined aquifer. The objective will be measured by metering all water flows that are delivered to the project site appropriately.

6.3.5.3 Project Benefits and Water Reliability

Projects benefits include:

- Surplus water storage in the aquifer and subsequent recovery when there is demand;
- During wet years, utilization of flood flows, providing further flood protection; and
- Stabilization of groundwater levels to reduce subsidence rates.

Historically, flood releases occur every three to five years with some years being consecutive flood-release years. This project may also be used in normal years when water is available for purchase. With implementation of SGMA, it is anticipated that surface water management by other water rights holders will also change and the available volume of surface water may decrease. However, based on historical data, the reliability and availability of flood-release water is considered good for the purposes of this project type. This project would increase groundwater reliability and sustainability.

6.3.5.4 Management of Groundwater Extractions and Recharge

This project would be owned by landowners using their existing wells for ASR and managed by the GSA or partner agency where implemented. Policy for groundwater extraction and recharge as it pertains to ASR projects has not yet been defined. Landowners would have to enter into contracts with the GSA to allow for use of these private facilities.

6.3.5.5 Project Cost Estimate/Acre-Foot of Yield

Although no detailed cost estimate has been prepared, a preliminary engineer's opinion of probable project cost is approximately $250,000 to $500,000 per well to construct. This estimated cost assumes that the owner of the well will enter into an easement and or use agreement with the GSA for use of the well. A flow measurement device will be needed.

The yield of this project will be determined based on the designated number of wells. For example, utilizing 100 wells at an estimated storage rate of 4 AF per day per well will generate approximately 400 AF of storage per day.

6.3.5.6 Circumstances of Implementation

If determined cost-effective, ASR projects will be considered as part of the overall effort to reach sustainability. These facilities are expected to be used in areas where surface soils are clays and are underlain by clay zones such as the A-, C-, and E-Clays. The selection of wells, willing participants, and the availability of funding are circumstances considered necessary to this project's implementation.

6.3.5.7 Project Status and Schedule

No project schedule has been determined. It is expected that, once funding is secured, it could take up to five years to complete this project, including environmental compliance.

6.3.5.8 Permitting and Regulatory Process

It is anticipated that the following permits and regulatory procedures will be required to implement this project:

- CEQA
- Compliance with the United States Environmental Protection Agency (EPA)
- Compliance with the Regional Water Quality Control Board (RWQCB)
- Local Agency Compliance
- Division of Drinking Water (DDW)

6.3.5.9 Legal Authority

GSAs were given the authority to "perform any act necessary or proper to carry out the purposes of [SGMA]" including the adoption of rules, regulations, ordinances, and resolutions that pertain to this GSP. Chapter 5 of Division 6 of the California Water Code lays out the rest of the powers and authorities given to GSAs. Each of the GSAs may need to acquire new surface water rights or work with agencies within their boundaries that have existing rights. Agreements with landowners will be required to use their wells for recharge.

6.4 Management Actions

Management actions represent example management options available to GSAs that will help support them in the sustainable management of groundwater. Each GSA has the flexibility to choose a list of actions that they believe will be pursued and will independently develop the policies to meet the needs of their area for achieving sustainable management. The management actions will be chosen by each GSA after the implementation of this GSP. Examples of potential management actions include, but are not limited to, the following:

- Projects Policies
    - Voluntary fallowing programs
    - Above-ground surface water storage projects
    - Infiltration basins (utilizing flood flows, purchased and exchanged waters)
    - On-farm recharge (utilizing existing cropped and uncropped lands to infiltrate water, mainly during dormant seasons, for recovery in a dry period)
    - ASR
    - Conveyance facilities modifications
- Outreach
    - Education of groundwater use

    Additional Outreach Activities listed in Section 5 of the 2022 GSP Addendum.
- Assessment
    - Pumping fees for groundwater allocation exceedances
    - Pumping fees for groundwater extractions

    Additional Fee Assessments listed in Section 5 of the 2022 GSP Addendum.
- Groundwater Allocation
    - Development of GSA level groundwater allocation
    - Development of landowner groundwater allocation
    - Groundwater marketing and trade
    - Operation and management of groundwater extractions
- New Development
    - Require new developments (non-de minimis extractors) to prove sustainable water supplies if land use conversion is not a conservation measure
- Monitoring and Reporting
    - Flood flows (spills into the Subbasin), including Tule River, Deer Creek, Cross

Creek and Kings River

- Registration of extraction facilities
- Require self-reporting of groundwater extraction, water level, and water quality data
- Require well flowmeters, sounding tubes, and water quality sample ports for new well construction
- Additional Coordination and Co-management of Kings County Groundwater Regulations are listed in Section 5 of the 2022 GSP Addendum.

- Existing Surface Water Contracts
  - Flood flows (spills into the Subbasin), including Tule River, Deer Creek, and Cross Creek

6.5 GSA Sustainable Methods

Based upon work documented previously, each GSA has an estimated annual storage change target to meet to be sustainable, based upon best available data and groundwater model results. This section identifies the projects and management action targets envisioned to achieve sustainability. These preliminary amounts will be reevaluated, and conditions monitored while efforts are implemented. This will allow the GSA to compare the anticipated versus resulting change in groundwater levels, as well as other sustainability criteria to determine if additional measures need to be employed to achieve sustainability.

6.5.1 Mid-Kings River Groundwater Sustainability Agency

The average annual storage change for the MKR GSA is estimated at negative 28,490 AF. The MKR GSA plans to pursue improvements to existing basins in the area, improvement to conveyance systems and expanded surface water delivery system, a voluntary annual fallowing program, and recharge basin development. Table 6-1 summarizes the combination of projects and management actions that are proposed to offset the change in storage to achieve sustainability within the GSA boundary. Demand reduction for dedicated lands for infiltration ponds are included in the Annual Yield column of the table below. An average annual value of 3.0 AF per acre of demand reduction will be used. The estimated annualized blended costs for this type of project, assuming a 20-year funding period and 4 percent (%) interest, is approximately $85/AF. Additional costs are expected for operational costs.

6.5.2 South Fork Kings Groundwater Sustainability Agency

The average annual storage change for the SFK GSA is estimated at a negative 37,840 AF. Table 6-2 summarizes the combination of projects and management actions that are proposed to offset the change in storage to achieve sustainability within the GSA boundary. Demand reduction costs will be determined once the policy has been developed by the GSA board. It is unknown at this time if the GSA will fund the demand reduction program by charging farmers in the GSA or whether an allocation program will be implemented allowing growers to manage their water allocations and requiring individual decisions on cropping and water use. The estimated costs for the entire ASR project are listed in Table 6-2.

6.5.3 Southwest Kings Groundwater Sustainability Agency

The average annual storage change for the Southwest Kings (SWK) GSA is estimated at positive 10,820 AF (surplus), thus projects to mitigate overdraft are not currently needed in this GSA. No projects have been determined at this time. Management actions may be determined at a later time and will be based upon annual monitoring results. A management area is also identified in this region. Should development of groundwater be accomplished in the management area, a set of criteria would be employed to identify the quantity of groundwater pumping and monitoring of groundwater levels. The SWK GSA has indicated to the other GSAs in the Subbasin that it would be interested in financially participating in projects elsewhere in the Subbasin if doing so would affordably increase the water supply to the SWK GSA.

6.5.4 El Rico Groundwater Sustainability Agency

The average annual storage change for the ER GSA is estimated at negative 20,810 AF. Table 6-3 summarizes the combination of projects and management actions that are proposed to offset the change in storage to achieve sustainability within the GSA boundary. Demand reduction for dedicated lands for infiltration ponds are included in the Average Annual Yield column of Table 6-3. An average annual value of 3.0 AF per acre of demand reduction will be used. Demand reduction is assumed to consist of crop fallowing in dry years. Since crop rotation and fallowing is assumed to be accomplished by growers within the GSA, no costs are associated with this farm practice. The estimated annual cost for the capital facilities associated with storage are estimated at $330/AF based upon a 20-year funding period and 4% interest.

6.5.5 Tri-County Water Authority Groundwater Sustainability Agency

The average annual storage change for the Tri-County Water Authority (TCWA) GSA is estimated at surplus 2,560 AF. Although in surplus, Table 6-4 summarizes the combination of projects and management actions that are proposed to further secure the positive change in storage to maintain sustainability within the GSA boundary. Demand reduction for dedicated lands for infiltration ponds are included in the Average Annual Yield column of Table 6-4. An average annual value of 3.0 AF per acre of demand reduction will be used. Demand reduction costs will be determined once the policy has been developed by the GSA. The proposed schedule for demand reduction in the TCWA GSA is a 10% reduction by the year 2025 and an additional reduction by the year 2030.

7.0 PLAN IMPLEMENTATION

Upon California Department of Water Resources (DWR's) approval of this Groundwater Sustainability Plan (GSP), GSP implementation will commence in the Tulare Lake Subbasin (Subbasin). The Groundwater Sustainability Agencies (GSAs) will continue their efforts to engage the public and secure the necessary funding to successfully monitor and manage groundwater resources within the Plan Area to avoid future undesirable results related to groundwater usage in the Subbasin. GSAs' ongoing efforts to coordinate with a diverse range of stakeholders and beneficial users works to improve the Subbasin's monitoring networks. This GSP works in tandem with authorities of numerous agencies with the goal to coordinate activities in the region for the effective management of groundwater resources. Table 6-5 are examples of policies that can be adopted by the GSAs. At this time, the GSAs have not adopted polices listed in Table 6-5 due to time constraints and lack of funding.

7.1 Estimate of GSP Implementation Costs

> **23 CCR §354.6** *Agency Information. When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*
> *(e) An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.*

The Subbasin's GSP was developed by the five GSAs within the Subbasin as a singular document to address groundwater overdraft. GSAs and member agencies will coordinate and implement the actions outlined in this GSP. As such, the implementation is anticipated to be performed by multiple agencies. To identify implementation costs, a draft structure of cost has been suggested and is included below:

1. Regular/Ongoing Sustainable Groundwater Management Act (SGMA) Compliance Activities;
2. GSP Five-Year Update;
3. Plans to Fill Data Gaps;
4. Projects; and
5. Management Actions.

Table 6-5 lists estimated costs to develop each project.

7.2 Schedule for Implementation

23 CCR §350.4 *General Principles. Consistent with the State's interest in groundwater sustainability through local management, the following general principles shall guide the Department in the implementation of these regulations.*
(f) A Plan will be evaluated, and its implementation assessed, consistent with the objective that a basin be sustainably managed within 20 years of Plan implementation without adversely affecting the ability of an adjacent basin to implement its Plan or achieve and maintain its sustainability goal over the planning and implementation horizon.

Implementation of the GSP will result in the sustainable yield of groundwater resources in the Subbasin by year 2040. Some areas within the Subbasin have existing projects, which will continue to contribute to the Subbasin's groundwater sustainability. These projects are included in the groundwater model (Appendix D) but will not be shown on the schedule. The schedule of projects and management actions are outlined below. At each five-year interim milestone, updates to the schedule will occur, as applicable, dependent on achievement of Measurable Objectives (MO) for each applicable sustainability indicator. The list below demonstrates how 1,090,000 acre-feet (AF) of yield will be generated over the 20-year implementation period.

- 2020-2025-Yield 50,000 AF
    - Improved efforts to monitor across the Subbasin
    - Begin identification of management actions through policy development
    - Seek grant funding through available opportunities
    - Establish project funding for some GSAs
    - Develop program for voluntary fallowing
    - Bring on-line first projects
    - Evaluation of long-term climate change impacts over the last five years and their effects on GSP implementation
- 2026-2031-Yield 330,000 AF
    - Seek grant funding through available opportunities
    - Establish project funding for other GSAs
    - Expansion of programs, projects and bringing new projects on-line
    - If climate change impacts are significant, implement Management Actions relating to demand reduction
    - Evaluation of long-term climate change impacts over the last five years and their effects on GSP implementation
- 2032-2035-Yield 330,000 AF
    - Seek grant funding through available opportunities
    - Establish project funding for any remaining GSAs
    - Expansion of programs, projects and bringing new projects on-line,
    - If climate change impacts are significant, implement Management Actions relating to demand reduction

- 2036-2040-Yield 380,000 AF
  - Seek grant funding through available opportunities
  - Expansion of programs and projects
  - If climate change impacts are significant, implement Management Actions relating to demand reduction

7.2.1 Mid-Kings River Groundwater Sustainability Agency

7.2.1.1 Background

The Mid-Kings River (MKR) GSA is primarily a partnership between Kings County Water District (WD) and the City of Hanford. The City of Hanford has developed and maintained municipal drinking water facilities for its residents for many decades. The Kings County WD has developed facilities and programs to address surface and groundwater conditions in its service area since the 1950s. The partnership of these two agencies provides a combination of resources and experience that will significantly aid in SGMA implementation.

The MKR GSA area is crisscrossed with many different existing rivers, creeks, sloughs, ditches, canals and water delivery facilities. Kings County WD is a stockholder in Peoples Ditch Company, Settlers Ditch Company, Last Chance Water Ditch Company, Lakeside Ditch Company and Lemoore Irrigation and Canal Company. The stock associated with these water right holders provides the Kings County WD with yield from local rivers, conveyance through their distribution systems. Kings County WD annually "rents" the available stock water supplies to growers in their service area to be put to beneficial use. Also, available wet-year water is delivered to many existing basins, creeks and sloughs for groundwater recharge.

Kings County WD is an agency that has developed many different basin facilities in their service area (around 1,100 acres) in order to increase groundwater recharge during wet years. Kings County WD is also the agency responsible under State Board Decision 1290 for delivering wet year surface water in a former Kings River channel called the Old River for groundwater recharge. In 2002, Kings County WD also developed a groundwater bank at Apex Ranch that has the capacity to recharge and recover significant amounts of wet-year water.

The MKR GSA currently views that the long-term average of roughly 28,000-32,000 acre-feet per year (AF/Y) of overdraft is occurring in the service area.

7.2.1.2 Projects

New Recharge Basins

The MKR GSA currently views that roughly 1,500 acres of additional recharge basins need to be developed to address the historic groundwater overdraft. There are many discussions that need to be had related to who is responsible for the overdraft in the area, but currently the MKR GSA Board views this target as reasonable. The effort to build new recharge basins relates to the availability of sandy soils in the MKR GSA area, the availability of flood water supplies and the existence of surface water delivery facilities. Also, based on reasonable local assumptions, MKR GSA staff estimated that the development of new recharge basins could be five to ten times more effective per acre than fallowing efforts.

The MKR GSA's plan to develop new recharge basins is conceptual and will be adaptive based on the productivity of facilities, the long-term availability of local wet year supplies and progress during the implementation period. Generally, the plan is to develop several 40- to 80-acre recharge basins across the MKR GSA area near existing canals on very sandy properties. Recharge efforts are planned to be spread throughout the service area so that benefits are more connected to areas of groundwater use. The MKR GSA's desire is to work with willing landowners to acquire the properties and work with local material suppliers to excavate the sandy basin material.

Partnership with Kings County WD

As an agency, Kings County WD has slightly different goals and a separate budget to take on efforts that address surface and groundwater conditions in almost all the MKR GSA area. This has been challenging to segregate these similar efforts, but it is currently believed that the Kings County WD plans to take on local system improvements and the development of roughly 500 acres of new recharge basins through the Implementation period. However, given that Kings County WD has existing access to surface water supplies, the MKR GSA believes it is wise to work cooperatively with Kings County WD to develop the other needed basin facilities as well.

Consistent with this, Kings County WD is currently in the process of developing two different basin sites as well as investigating several others. The 80-acre Esajian Basin site along 7th Avenue between Dover and Excelsior Avenues had been identified as a very desirable recharge facility site in previous District studies. The District acquired the property earlier this year, went through the California Environmental Quality Act (CEQA) process, obtained permits for the construction, and construction has recently begun. It is expected that the new Esajian Basin facility will be put into service in 2020 or 2021.

The 30-acre Griswold basin site is north of Dover Avenue and just east of Highway 43. The Kings County WD has owned this property for several years and is currently in the planning stage of developing this new basin project. Soil explorations have been conducted across the property and have confirmed desirable characteristics for a new recharge basin. It is expected that the new Griswold Basin facility could be put into service in 2021 or 2022.

System Improvements

As SGMA implementation approaches, most surface and groundwater management entities are reconsidering their existing facilities in light of the new requirements for sustainable groundwater use by 2040. Consistent with this, Kings County WD is evaluating the current facilities used to recharge groundwater (roughly 1,100 acres) and deliver available surface water and developing projects to improve existing facilities. Most of the efforts currently identified relate to existing recharge basins and optimizing their diversion capacities given recent flood water availability periods. Other efforts may involve the modification of existing canal systems to remove current restrictions and allow for greater flows to be conveyed.

Conservation Measures

The MKR GSA is aware of many different efforts by local growers to transition from current irrigation methods to more efficient irrigation systems. Some of these efforts are sprinklers, drip irrigation, and the use of drip tape (subsurface irrigation). While these methods do not change the amount that crops need to use to grow, they will reduce the amount lost to evaporation and the amount lost past the root zone.

7.2.1.3 Programs

Voluntary Fallowing

In the MKR GSA area there is a mixture of permanent and row crops grown in the agricultural areas. The MKR GSA Board plans to develop a program to work with row crop growers that would annually lease their property to reduce groundwater pumping in the area. The details of this program are currently under development, but the developing program is thought of similarly to past Cotton Programs run by the United States Department of Agriculture. The MKR GSA reason for developing the program is to create a tool that could be used in drought times when recharge basins don’t provide benefits.

On-Farm Recharge

The MKR GSA is aware of landowners interested in on-farm recharge in the area. This effort will be continually evaluated to try to take advantage of the recharge capacity of existing fields. This will be pursued to the extent that the MKR GSA can partner with local growers on recharge efforts that are beneficial to groundwater resources and the grower's crops.

7.2.1.4 Management Actions

Meter Requirements

One of the most significant data gaps in the MKR GSA area is direct measurement of pumped groundwater from most wells. These records are available from public agencies, but generally not from private parties. The MKR GSA currently views that requiring the registration of all wells and the use of flow meters will dramatically improve the areas understanding of the most significant water balance components.

Pumping Restrictions

Currently it is believed that the historical amount of groundwater overdraft in the MKR GSA area can be addressed with new projects and programs developed through the Implementation period. However, it is acknowledged that there are significant data gaps that need to be filled before more accurate evaluations can be made and that the demand for wet-year water on local river systems will increase due to SGMA implementation. Also, evaluations of state-required potential future climate change scenarios indicate that agricultural crops demands could increase if crop evapotranspiration directly corresponds to increased temperatures. The MKR GSA will monitor these various situations and conditions and adapt MKR GSA efforts accordingly.

If long-term increased demands and/or reduced surface water availability is experienced, the MKR GSA will consider implementing groundwater pumping restrictions. There are many complicated issues with this kind of limitation and the MKR GSA plans to evaluate these prior to the implementation of such strategy. However, the current understanding is that the implementation of groundwater pumping restrictions would effectively require landowners to farm less ground without compensation for fallowed lands.

Others

The MKR GSA plans to continually evaluate potential opportunities and pursue efforts that address GSA priorities with the least impact on local landowners. As the Implementation period begins, the MKR GSA expects to learn many things over time and the hope is that this learning will help target efforts to be more and more effective.

7.2.1.5 Funding

Joint Powers Authority Member Support

The MKR GSA is currently a joint powers authority formed in 2016 whose participating agencies are Kings County, the City of Hanford and Kings County WD. These agencies currently have a cost sharing agreement that has been sustaining GSA efforts to date.

Estimated Implementation Costs

Estimated implementation costs for the GSP are based on a number of assumptions that will continue to be evaluated, adjusted, and refined over the implementation period. It is currently assumed that Kings County WD will be developing 500 acres of recharge basins in the area so that the MKR GSA will need to develop 1,000 acres. Based on assumed land purchase costs, earthwork costs, structure costs and costs for design and permitting, it was estimated that the planned effort could cost roughly $3,000,000 per year over the implementation period. It appears that if this effort is supported through groundwater pumping charges, that roughly $20 per acre-foot would be sufficient to fund the effort. However, the MKR GSA is still currently evaluating the potential revenue structure for GSA efforts and will hopefully conduct a Proposition 218 election in spring 2020.

Implementation Funding Plan

The MKR GSA is currently working with a consultant to develop a plan for GSA funding potentially through a land-based assessment and a groundwater pumping charge. The current view is that the land-based assessment would be used to sustain GSA administration while the groundwater pumping charge would be used to fund GSA projects. The use of the groundwater pumping charge is hoped to connect the amount of groundwater use to groundwater overdraft and the need for the GSA projects. MKR GSA consultants are working on developing documentation to support a local election on the funding scheme thought to be scheduled for spring 2020.

Grant Funds

The MKR GSA plans to pursue available grant fund opportunities that facilitate development of water management or monitoring facilities or allow for the study of data gap topics. Kings County WD has been successful in many competitive grant programs in the past. Grant programs through the DWR and the United States Bureau of Reclamation are planned to be regularly monitored for opportunities that might match the GSAs efforts.

7.2.2 South Fork Kings Groundwater Sustainability Agency

This section summarizes the approach that the South Fork Kings (SFK) GSA will take in implementing this GSP. It outlines specific technical issues, management actions, timelines, and funding approaches that the GSA proposes to implement starting in 2020.

7.2.2.1 Background

SFK GSA encompasses 71,310 acres in the western portion of the Subbasin. The hydrogeology of the SFK GSA differs somewhat from the surrounding Tulare Lake Subbasin GSA's in that there are three generally recognized aquifer zones:

1. A perched unconfined aquifer exists above a locally extensive clay layer (A-Clay). This aquifer is used for domestic and irrigation supply. Water quality varies from excellent (near the South Fork Kings River) to poor based on salt content (in areas toward the lake bottom near Stratford). The perched unconfined aquifer is on the order of 50-100 feet thick with a depth to water of near ground surface to 50 feet. There are insufficient data available to characterize whether and to what degree the perched aquifer is interconnected with surface water.

2. A semi-confined aquifer is present above a locally extensive clay layer (C-Clay). There are several thin, discontinuous clay layers between the A-Clay and the C-Clay that create variable and semi-confined conditions in this aquifer zone. Water quality is generally good in the semi-confined aquifer. The semi-confined aquifer is on the order of 500 to 600 feet thick with a depth to water of 100 to 250 feet. This aquifer is used primarily for irrigation, though there are a number of domestic wells completed in this aquifer. Many of the irrigation wells there are completed in both the semi-confined and the confined aquifer below the Corcoran clay. Domestic wells are typically completed in the upper portion of the semi-confined aquifer. Many wells in the semi-confined aquifer show declining water levels consistent with the deep confined wells. However, depending on the location and screen interval, some wells show limited decline in water-level. There are insufficient data available to characterize whether and to what extent the semi-confined aquifer is interconnected with the perched aquifer and/or surface water.

3. A fully confined aquifer exists below a regionally extensive clay layer (E-Clay or Corcoran Clay). The E-Clay is present at a depth of about 600 feet in the SFK GSA. This aquifer is used primarily for irrigation, but the City of Lemoore also uses this aquifer for its municipal supply. The confined aquifer is approximately 1,500 to 2,000 feet thick with a depth to water of around 200 to 500 feet. Many irrigation wells in this aquifer are completed in

both the semi-confined and underlying confined aquifer. Virtually all wells completed below the E-Clay show declining water levels. The degree to which interconnection of the semi-confined and confined aquifers via individual well completions contributes to a “regional” interconnection between the two aquifers is unknown. Recharge to the confined aquifer occurs outside the boundaries of the SFK GSA, and the groundwater levels in the confined aquifer are affected by both local pumping and the regional response to pumping and recharge across the entire Subbasin, including adjacent subbasins. Storage in this aquifer is represented by two storage concepts: the confined “specific storage” and the drainable porosity or “specific yield”. Confined storage represents the pressurized groundwater that causes water levels to rise above the Corcoran Clay confining layer. Because it represents pressure head, the volume of water in specific storage is relatively low. Drainable porosity represents the volume of groundwater that exists within the aquifer sediment matrix. The volume of storage as drainable porosity cannot be increased when water levels are above the elevation of the confining layer. As more water is added to a confined aquifer, confined storage increases, and water levels increase further above the confining layer. To reduce the volume of storage in drainable porosity, confined storage needs to decline such that water levels decline toward the confining layer. When this occurs, the structure of the confining layer changes. The confining layer essentially gets “squeezed”, which then causes subsidence at the ground surface. The amount of storage that can be taken out of drainable porosity in a confined aquifer is therefore related to the amount of associated subsidence.

7.2.2.2 Local Water Balance, Overdraft and Sustainable Yield

The water balance for the entire Tulare Lake Subbasin is described in the basin setting chapter of this GSP, local water budgets for individual GSAs have not been prepared. For the initial implementation period, SFK GSA will operate under the assumption that there is a baseline average long-term pumping volume range of about 85,000 to 140,000 AF/Y and a long-term groundwater overdraft of about 38,000 AF/Y. By subtraction, this implies a sustainable pumping yield range of about 60,000 to 100,000 AF/Y. SFK GSA’s projects and management actions will be developed, monitored and initially evaluated relative to these targets. However, there are uncertainties in the magnitude of pumping, interconnectedness between SFKGSA aquifer zones, inflows, and other outflows associated with activity both within and outside the SFK GSA jurisdictional boundary that have not yet been resolved. These issues will be revisited and addressed over the next five years through additional data collection and analysis. As more data are collected, the estimated SFK GSA overdraft, SFK GSA sustainable pumping yield, and potential for undesirable results will be refined and revised as appropriate.

7.2.2.3 Groundwater Monitoring Program

SFK GSA's groundwater level monitoring program will be generally implemented in accordance with Chapter 5 of this plan. The locations and completion intervals of the monitoring network are adequate to describe and monitor groundwater sustainability in the SFK GSA. As noted in Chapter 5, some of the monitoring thresholds for specific wells have been established based on modeling results. In the SFK GSA, there are water level data that differs from the modeling results on which the targets presented in Chapter 5 are based. SFK GSA will revise the minimum thresholds in cases where there is a difference between the actual observed water level and the modeled water level used to develop those thresholds, this effort will be part of adaptive management and can be done during the GSP update. Over time, the SFK GSA intends to rely solely on actual observed water levels rather than model results to establish progress towards sustainable pumping and avoidance of undesirable results. SFK GSA will coordinate with the Westside Subbasin on monitoring and minimum threshold differences. Because two different models were used to simulate groundwater conditions on the boundary between SFK GSA and Westside GSA, future coordination regarding boundary flows will be based primarily on data and, if necessary, focused groundwater analysis along the boundary. In addition, SFK GSA will initiate a focused investigation of perched aquifer zones and their relationship to adjacent surface waters and the underlying semi-confined aquifer.

7.2.2.4 Measurement of Groundwater Pumping

SFK GSA will initiate a measurement program to monitor groundwater pumping in the SFK GSA. The program will utilize a combination of metering at individual wells, monitoring of surface water delivery, remote sensing of cropping patterns, and grower surveys to determine crop type, irrigation sources, irrigation practices, and groundwater use. An initial survey will be sent to each parcel owner in the spring of 2020 to initiate the program and determine land cover, water use patterns, and pumping well distribution on individual parcels within the SFK GSA. Depending on the results of this survey, the SFK GSA will structure a program to deploy or calibrate flow meters, establish baseline cropping patterns, and assess the accuracy of water use based on remotely sensed measurements in the SFK GSA. The data will be maintained in a publicly accessible GIS database that will restrict the identity of individual parcels and owners and aggregate groundwater pumping and crop-type to a uniform grid. At this time, the SFK GSA is planning to encourage, but not require meters, sounding tubes, and water quality sampling ports on all wells. Kings County Building Division will be engaged to modify the water well ordinance (Ordinance No. 587) to coordinate well permitting with the GSP.

7.2.2.5 *Groundwater Accounting System*

After the program for measurement of groundwater pumping has been established (see Section 7.2.2.4), SFK GSA will begin developing an accounting system that will link the measured pumping volumes with projects and policies to achieve overdraft reduction, sustainable yield, and avoidance of undesirable results. The details of this system are still being evaluated but could range from a simple annual reporting of groundwater pumping quantities to a more comprehensive accounting and allocation system that is tied to acreage, land use classification, crop/soil type, and/or irrigation efficiency. A white paper on potential accounting approaches will be developed in the summer of 2020, after the initial pumping survey. Integration of the SMCs, water budgets, and projects and management actions in the five surrounding basins will also affect SFK GSA's final decision on its accounting system.

7.2.2.6 *Groundwater Pumping Fees*

After adopting an approach to the groundwater accounting system (see Section 7.2.2.5), SFK GSA will begin developing a fee structure for groundwater users. Fee structures that will be evaluated will include: no fees, a per-well or per parcel charge for administrative purposes, a flat rate structure based on reported pumping, and a tiered rate structure based on volume and timing of pumping. Other approaches will be considered based on public outreach. The approach to groundwater accounting will affect the decision on a pumping fee structure. For example, if a pumping allotment based on acreage is adopted, a no fee or nominal fee structure may be feasible, since reduction in groundwater pumping would be enforced through the allotment system. A volume-based fee structure would be more applicable if fees are used to discourage groundwater pumping. A hybrid between these two approaches is also possible.

7.2.2.7 *Demand Reduction Program*

Based on the currently estimated overdraft, SFK GSA intends to initiate a program to reduce demand for groundwater. For initial planning purposes, SFK GSA intends to achieve 50 percent (%) of its overdraft correction through demand reduction measures. The other 50% of overdraft reduction is expected to come from supply enhancement measures (see Section 7.2.2.8). The elements of SFK GSA's demand reduction program are as follows:

1. Enhancement of surface water delivery and on-farm efficiency improvement: The overall intent of this element is to improve delivery of surface water with the expectation that this will reduce groundwater demand. Enhancements may include canal efficiency improvements or extensions within the canal service areas. As part of the initial groundwater measurement survey, information on current irrigation practices and access to surface water will be collected. Technical assistance will be provided to growers for

areas where on-farm irrigation practices could be improved. Discussions with surface water providers will be initiated to make clear to that the intent of these improvements would be to reduce demand for groundwater. A linkage between the groundwater accounting system and delivery or on-farm efficiencies could be established and incentivized.

2. Seasonal cropping and dryland farming program: The overall intent of this element is to reduce the amount of irrigated land supplied by groundwater during dry or drought years. The seasonal cropping and dryland farming programs would establish incentives for landowners who have non-orchard lands that could be fallowed or planted with less water-intensive crops during dry or drought years. Through public outreach, landowner surveys, and an analysis of land use, candidate areas will be identified for both programs. The magnitude of seasonal cropping or dryland farming necessary to reduce overdraft and achieve sustainability is linked to other projects and management actions. It is also linked to the projected severity of any given dry or drought year. Therefore, this type of program is more complicated to manage and fund. In general, SFK GSA considers seasonal cropping or dryland farming a viable strategy to achieve sustainable groundwater pumping, but a strategy that will require sufficient financial and management resources to implement.

3. Land retirement or long-term fallowing contracts: The overall intent of this element is to reduce the amount of irrigated land supplied by groundwater on a permanent or long-term basis. Through public outreach, landowner surveys, and an analysis of land use, candidate areas will be identified for land retirement or long-term fallowing. These areas could be based on number of factors ranging from poor soils, incompatible or urbanizing adjacent land uses, or areas that are not easily serviced by surface water. The magnitude of land retirement or long-term fallowing necessary to reduce overdraft and achieve sustainability is linked to other projects and management actions. In general, SFK GSA considers land retirement or long-term fallowing a "last resort" to achieve sustainable groundwater pumping.

7.2.2.8 Supply Enhancement Program

Supply enhancement options in the SFK GSA are limited because of the hydrogeologic setting within the SFK GSA. Surface recharge of flood flows within the SFK GSA is not expected to significantly enhance groundwater levels. However, SFK GSA will consider investment in surface recharge projects being proposed in MKR GSA and other GSA's north and east of the Tulare Lake Subbasin that are tributary to the Kings River. The decision to invest in upgradient recharge basins will depend on whether there are sufficient expected benefits to groundwater levels and accessible pumping within the SFK GSA service area. The primary supply enhancement method within the SFK GSA service area will focus on Aquifer Storage and Recovery (ASR).

ASR is an established method to recharge aquifers through direct injection of water into wells. SFK GSA has initiated a pilot study to determine the efficacy of ASR and has applied for a CEQA exemption to pilot test an ASR well in 2020. Subject to a successful pilot test and approvals from the Regional Water Quality Control Board and Division of Drinking Water, SFK GSA would then develop a program that would enable individual landowners to develop and initiate ASR operations when they have access to surface water suitable for underground injection. The constraints and design requirements for implementing ASR would be prepared in a comprehensive ASR Plan that would be subject to CEQA review. The costs for individual ASR projects would be borne by landowners, with potential matching support by SFK GSA. The benefits to landowners and the linkage to the GSA groundwater accounting system would also be described in the ASR Plan.

7.2.2.9 Financing

The SFK GSA is currently financed through a maximum assessment of $9.80 per acre that was approved through a Proposition 218 election in 2017 and the assessment will sunset in 2023. SFK GSA will establish a financing program that actively seeks out grants and funding partnerships that can implement the projects and management actions outlined in the GSP. The objective will be to establish a long-term financing plan that minimizes the per-acre charge needed to fully implement the GSP before a new Proposition 218 election in 2023. The SFK GSA considers financing of the projects and management actions outlined here as a major potential obstacle to implementation. Every effort will be made to establish sufficient financial support, but the economic viability of the area will be given full consideration in the selection and timing of projects and management actions.

7.2.2.10 Timeline

The expected timeline for implementation of the various elements described above is shown in Table 7-1.

7.2.3 Southwest Kings Groundwater Sustainability Agency

The average annual storage change for the Southwest Kings (SWK) GSA is estimated to be in surplus, thus projects to mitigate overdraft are not currently needed in this GSA. No projects have been determined at this time. Management actions may be determined at a later time and will be based upon annual monitoring results. A management area is also identified in this region.

Should development of groundwater be accomplished in the management area, a set of criteria would be employed to identify the quantity of groundwater pumping and monitoring of groundwater levels. The SWK GSA has indicated to the other GSAs in the Subbasin that it would be interested in financially participating in projects elsewhere in the Subbasin if doing so would affordably increase the water supply to the SWK GSA.

The SWK GSA is applying for Proposition 1 Technical Support Services grant funding to offset some of the capital improvement costs associated with the development of new monitoring wells to fill existing data gaps in the monitoring network.

7.2.4 Tri-County Water Authority Groundwater Sustainability Agency

7.2.4.1 Background

Tri-County Water Authority (TCWA) is a Joint Powers Authority created between local agencies cooperatively working towards groundwater sustainability by establishing a GSA between Angiola WD, Deer Creek Storm Water District, W. H. Wilbur Reclamation District, and Kings County. TCWA intends to manage groundwater within its boundaries in the Tulare Lake Hydrologic Region to accomplish the goals set forth in the GSP.

Angiola WD was formed in 1957 for the purpose of delivering agricultural water. Angiola WD is located in both the Tule and Tulare Lake subbasins. Angiola WD has a comprehensive conveyance system that delivers water for beneficial use. Angiola WD’s surface water is supplied by the Kings River, Tule River, Kaweah River, Deer Creek, and the State Water Project (SWP). Angiola WD is a stockholder in New Deal Ditch Company, Tulare Lake Water Company, Tulare Lake Canal Company, Lone Oak Canal Company, Last Chance Water Ditch Company, Settlers Ditch Company, and Bayou Vista Ditch Company.

TCWA has approximately 48,000 acres located in the Tulare Lake Subbasin, of which about 4,100 acres are currently farmed. Pistachios occupy approximately 3,400 acres of the farmed acreage, with field and hay crops occupying the remaining 700 acres. There are approximately 11,200 acres that are pasture. The remaining lands are fallow. The current cropped acres rely mostly on groundwater.

7.2.4.2 Projects

The Liberty Project is a water storage project on about 20 sections of private lands within Angiola WD and Kings County. This project will enable the capture and temporary storage of winter/spring flows from the Fresno Slough – Fresno Irrigation District, Mercy Springs, the Kings, Tule and Kaweah rivers, SWP Article 21 and Central Valley Project 215 waters. The project will be built in phases and will ultimately be capable of 94,000 acre-feet of surface storage. The stored water will be used in-lieu of groundwater pumping and for aquifer recharge.

7.2.4.3 Management Actions

TCWA has acted to implement certain management strategies immediately and has recognized the ability to develop additional actions and strategies over the 20-year implementation period. Management actions will be reviewed and revised by the TCWA Board of Directors at the five-year milestones to ensure sustainability is reached.

TCWA will implement its agriculture supply well metering program in 2020. The Board of Directors has required property owners within its service area to install flow meters on all agricultural supply wells by July of 2020 and to begin reporting pumping data to TCWA starting in January of 2021.

To address overdraft conditions, a demand reduction of groundwater pumping may be implemented by TCWA. Although the implementation of projects that reduce the use of groundwater is the goal of the GSA, it is acknowledged that a demand reduction in groundwater pumping may be necessary when projects alone cannot meet sustainability goals. TCWA's Board of Directors and Technical Advisory Committee will be collecting data and developing additional management actions to meet the sustainability goals set forth in the GSP.

7.2.5 El Rico Groundwater Sustainability Agency

The El Rico GSA and technical advisors have developed the projects and management actions described in Chapter 6. Once the GSP is approved, the projects and management actions previously selected are proposed to be advanced and implemented. Each GSA proposes their method to achieve sustainability, utilizing a combination of projects and management actions. Section 6.5, *GSA Sustainable Methods*, describes the mix of projects and management actions chosen by the GSA to meet the goals.

7.3 Identify Funding Alternatives

> **23 CCR §354.6.** *Agency Information. When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*
> *(e) An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.*

The Subbasin GSAs successfully pursued grant funding to help develop the GSP. A number of the GSAs have already passed Proposition 218 elections, which secured funds to generate sufficient revenue for the initial preparation of the GSP and initial GSA administrative functions. The annual operational costs have begun and are used to fund agency operations and activities required by SGMA, including retaining consulting firms and legal counsel to provide oversight and lead the various agencies through the steps for SGMA compliance. Expenses consist of administrative support, GSP development, and GSP implementation. GSP development and GSA administrative costs are ongoing. Some other GSA specific information is also included in Section 7.2.

7.4 Data Management System

> **23 CCR §352.6**. *Data Management System. Each Agency shall develop and maintain a data management system that is capable of storing and reporting information relevant to the development or implementation of the Plan and monitoring of the basin.*

In development of this GSP, the five GSAs have developed a model that has been calibrated to estimate future scenarios. The data management system plans to build on existing data inputs in the groundwater model and develop a more formalized approach to collecting and capturing the data. As stated in Chapter 5, *Monitoring Network*, future data will be gathered to develop annual reports, as well as provide necessary information for future and ongoing update to the groundwater models at five-year intervals upon GSP implementation. The Data Management System (DMS) that will be used is a geographical relational database that will include information on water levels, surface water diversions, land elevation measurements, and water quality testing. The DMS will allow the GSAs to share data and store the necessary information for annual reporting.

The DMS will be on local servers and data will be transmitted annually to form a single repository for data analysis for the Subbasin's groundwater, as well as to allow for preparation of annual reports. GSA representatives have access to data and will be able to ask for a copy of the regional DMS. The DMS currently includes the necessary elements required by the regulations, including:

- Well location and construction information for the representative monitoring points (where available)
- Water level readings and hydrographs including water year type
- Land based measurements
- Water quality testing results
- Estimate of groundwater storage change, including map and tables of estimation
- Graph with Water Year type, Groundwater Use, Annual Cumulative Storage Change

Reporting generated from data from the GSA's will include but is not limited to:

- Seasonal groundwater elevation contours
- Estimated groundwater extraction by category
- Total water use by source

Additional items may be added to the DMS in the future as required. Data will be entered into the DMS by each GSA. The majority of the data will then be aggregated to the entity that will be responsible for the regional DMS and summarized for reporting to DWR. Groundwater contours are prepared outside of the DMS because of the need to evaluate the integrity of the data collected and generate a static contour set that has been reviewed and will not change once approved. Groundwater storage calculations are performed in accordance with the method described in Section 5.2, outside of the DMS. Results are uploaded to the DMS for annual reporting and trend monitoring. Since most of the pumping in the GSAs (and the Subbasin) are not currently measured, the groundwater pumping estimates are also calculated outside of the DMS using the methods developed by GSAs and uploaded to the DMS for annual reporting and trend analysis. Surface water deliveries are maintained by the surface water agencies in existing separate systems, so the data are collected by each GSA and provided to the DMS as an aggregate total by GSA. Table 7-2 provides how the DMS addresses each required element of the DMS and annual reporting requirements. The GSAs may choose to have their own separate system for additional analysis.

7.5 Annual Reporting

23 CCR § 356.2 *Annual Reports. Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

(a) General information, including an executive summary and a location map depicting the basin covered by the report.

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:

(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.

(B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.

(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.

(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.

(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.

(5) Change in groundwater in storage shall include the following:

> *(A) Change in groundwater in storage maps for each principal aquifer in the basin. (B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.*
>
> *I A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.*

The GSAs will provide the Plan Manager or Subbasin Coordinator the required information of groundwater levels, extraction volume, surface water use, total water use, groundwater storage changes, and progress of GSP implementation for the annual report in accordance with the timelines required to meet the April 1st deadline each year.

The annual report is anticipated to have an outline similar to the following:

- Chapter 1– Introduction
- Chapter 2– Land use and Surface Water Supplies
- Chapter 3– Groundwater Pumping
- Chapter 4– Sustainable Management Criteria
- Chapter 5– Monitoring Network Changes
- Chapter 6– Groundwater Projects and Management Actions Status

In addition to the required Subbasin-wide reporting to DWR, the annual report needs to include the following:

- Member and Participating agency project/program specific progress and status updates
- Newly identify projects and programs added to the project list
- Updates on changes in membership or organizational changes
- Policy changes or modifications
- New information collected in data gaps
- Area specific investigations or improvements
- Stakeholder engagement and outreach efforts
- GSA funding status

7.6 Periodic Evaluations

> **23 CCR §356.4** *Periodic Evaluation by Agency. Each Agency shall evaluate its Plan at least every five years and whenever the Plan is amended and provide a written assessment to the Department. The assessment shall describe whether the Plan implementation, including implementation of projects and management actions, are meeting the sustainability goal in the basin, and shall include the following:*
>
> *(a) A description of current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, interim milestones and minimum thresholds.*

(b) A description of the implementation of any projects or management actions, and the effect on groundwater conditions resulting from those projects or management actions.

(c) Elements of the Plan, including the basin setting, management areas, or the identification of undesirable results and the setting of minimum thresholds and measurable objectives, shall be reconsidered and revisions proposed, if necessary.

(d) An evaluation of the basin setting in light of significant new information or changes in water use, and an explanation of any significant changes. If the Agency's evaluation shows that the basin is experiencing overdraft conditions, the Agency shall include an assessment of measures to mitigate that overdraft.

(e) A description of the monitoring network within the basin, including whether data gaps exist, or any areas within the basin are represented by data that does not satisfy the requirements of Sections 352.4 and 354.34(c). The description shall include the following:

> *(1) An assessment of monitoring network function with an analysis of data collected to date, identification of data gaps, and the actions necessary to improve the monitoring network, consistent with the requirements of Section 354.38.*
>
> *(2) If the Agency identifies data gaps, the Plan shall describe a program for the acquisition of additional data sources, including an estimate of the timing of that acquisition, and for incorporation of newly obtained information into the Plan.*
>
> *(3) The Plan shall prioritize the installation of new data collection facilities and analysis of new data based on the needs of the basin.*

(f) A description of significant new information that has been made available since Plan adoption or amendment, or the last five-year assessment. The description shall also include whether new information warrants changes to any aspect of the Plan, including the evaluation of the basin setting, measurable objectives, minimum thresholds, or the criteria defining undesirable results.

(g) A description of relevant actions taken by the Agency, including a summary of regulations or ordinances related to the Plan.

(h) Information describing any enforcement or legal actions taken by the Agency in furtherance of the sustainability goal for the basin.

(i) A description of completed or proposed Plan amendments.

(j) Where appropriate, a summary of coordination that occurred between multiple Agencies in a single basin, Agencies in hydrologically connected basins, and land use agencies.

(k) Other information the Agency deems appropriate, along with any information required by the Department to conduct a periodic review as required by Water Code Section 10733.

The annual report will include updates or changes to the GSP or policy changes by the GSA's. Certain components of the GSP may be re-evaluated more frequently than every five years, if deemed necessary. This may occur, for example, if sustainability goals are not adequately met, additional data are acquired, or priorities are altered. Those results will be incorporated into the GSP when it is resubmitted to DWR every five years.

In addition, the annual report will provide an assessment to DWR in accordance with the regulatory requirements, at least every five years. The assessment will include and provide an update on progress in achieving sustainability including current groundwater conditions, status of projects or management actions, evaluation of undesirable results relating to MOs and minimum thresholds, changes in monitoring network, summary of enforcement or legal actions, and agency coordination efforts in accordance with 23 CCR §356.4.

As projects and management actions are being considered to mitigate for overdraft many of the projects and management actions will have implications to the farming economy within the Subbasin. Overdraft mitigation measures consist of the following project and management actions:

- Infiltration basins
- Storage ponds
- New water delivery systems
- Maintenance to existing water delivery systems
- Crop rotation
- Fallowing of lands
- Pumping restrictions

These project and management actions will reduce the farmable acres, and initiate restriction of groundwater pumping. A reduction in farmable acres may result in adverse effects (e.g., reduction in jobs). On the other hand, groundwater pumping restrictions will result in positive effects (e.g., reduction in pumping costs and drilling of new wells).

Reduction in Farmable Acreage: Kings County anticipates a lack of water sources for agricultural production has the potential to impact employment statistics in the area (Nidever 2014). In 2014, Kings County residents experienced and average of 15% unemployment in February, according to a report released by the state Employment Development Department, compared to an unadjusted rate of 8.5% for California and 7% for the nation as a whole.

Reduction in Pumping: Transitioning the Subbasin area to sustainable groundwater management is expected to impact the agricultural sector in three ways. First, institutional restrictions on groundwater extraction are likely to alter the mix of crops grown in the region and the amount produced. Second, stabilized groundwater elevations are predicted to reduce groundwater pumping costs over time, thereby lowering costs of production. Third, stabilized groundwater elevations are expected to reduce the need for capital investment to refurbish wells and develop additional wells (RMC Water and Environment 2015).

However, the reduction in groundwater pumping section states there will be an equalization of cost associated with higher groundwater levels due to pumping restrictions. This does not address the increase in the unemployment rate associated with the reduction in pumping (e.g., demand reduction). At this time there is not sufficient information to develop a financial impact due to demand reduction.

8.0 REFERENCES

Armona CSD (Armona Community Services District). 2009. *Armona Community Plan.* Accessed on: 17 July 2019. http://www.countyofkings.com/home/showdocument?id=3126

BLM (Bureau of Land Management). 2019. *BLM National Data.* Accessed on: 24 July 2019. https://blmegis.maps.arcgis.com/apps/webappviewer/index.html?id=6f0da4c7931440a8a80bfe20eddd7550%20&extent=-125,%2031.0,%20-114,%2043.0

California State Waterboard. 2019. *Irrigated Lands Regulatory Program (ILRP).* Accessed on 12 December 2019. https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/

California Open Data Portal. 2019. *NASA JPL InSAR Subsidence Data.* Accessed August 20, 2019 at: https://data.ca.gov/dataset/nasa-jpl-insar-subsidence-data

Caltrans (California Department of Transportation). 2019. *Central Valley Spatial Reference Network –CVSRN*. Accessed on August 20, 2019 at: https://dot.ca.gov/-/media/dot-media/district-6/documents/d6-land-surveys/ct-realtime-gps-networks/cvsrn_current_map_ada.pdf

CCME (Canadian Council of Ministers of the Environment). 2007. *Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses, Chapter 5. Prepared for:* Canadian Environmental Water Quality Guidelines. Accessed on: 13 July 2019. http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html

CV-Salts (Central Valley Salinity Alternatives for Long-Term Sustainability). 2013. *Salt and Nutrients: Literature Review for Stock Drinking Water Final Report.*

City of Corcoran. 2014. *2005-2025 General Plan*. Accessed on: 17 July 2019. http://www.cityofcorcoran.com/civica/filebank/blobdload.asp?BlobID=3796

City of Corcoran. 2017. *Urban Water Management Plan*. Accessed on: 17 July 2019. http://www.cityofcorcoran.com/civica/filebank/blobdload.asp?BlobID=4281

City of Hanford. 2011. *2010 Urban Water Management Plan.* Accessed on: 17 July 2019. https://water.ca.gov/LegacyFiles/urbanwatermanagement/2010uwmps/Hanford,%20City%20of/Hanford%20UWMP%20Contents.pdf

City of Hanford. 2017. *2035 General Plan Update.* Accessed on: 31 July 2019. *http://cms6.revize.com/revize/hanfordca/document_center/General%20Plan/2035%20General%20Plan%20Policy%20Document.pdf*

City of Lemoore. 2015. *2015 Urban Water Management Plan*. Accessed on: 17 July 2019. https://lemoore.com/wp-content/uploads/2018/02/lemoore_2015_uwmp_final.pdf

Croft, M.G. 1972. *Subsurface Geology of the Later Tertiary and Quaternary Water-Bearing Deposits of the Southern Part of the San Joaquin Valley, California.*

Croft, M.G., and G.V. Gordon, 1968. *Geology, Hydrology, and Quality of Water in the Hanford-Visalia Area, San Joaquin Valley, California*.

Databasin. 2019. *W.H. Wilbur Reclamation District #825.* Accessed on: 12 December 2019. https://databasin.org/maps/new#datasets=8aee127380164046b32c2c85dee44d55.

Davis, G.H., J.H. Green, F.H. Olmsted, and D.W. Brown. 1959. *Ground-Water Conditions and Storage Capacity in the San Joaquin Valley.* Prepared for: U.S. Geological Survey Water-Supply Paper 1469.

Davis, G.H., B.E. Lofgren, and S. Mack. 1964. *Use of Ground-Water Reservoirs for Storage of Surface Water in the San Joaquin Valley, California.* Prepared for: U.S. Geological Survey Water-Supply Paper 1618, 125 p.

Davis, G.H. and T.B. Coplen. 1989. *Late Cenozoic Paleohydrogeology of the Western San Joaquin Valley, California, as Related to Structural Movements in the Central Coast Ranges.* Prepared for: Geological Society of America Special Paper 234, 40 p.

DGS (Department of General Services). 2019. *SPI GIS Map Viewer.* Accessed on: 24 July 1019. https://spigis.apps.dgs.ca.gov/

DOF (Department of Finance). 2019. *Projections Organization Title*. Accessed: 17 July 2019. http://www.dof.ca.gov/Forecasting/Demographics/Projections/.

DPR (Department of Pesticide Regulation). 2019. *Surface Water Database (SURF) Access to the Data*. Accessed on: 17 July 2019. https://www.cdpr.ca.gov/docs/emon/surfwtr/surfcont.htm

Dudley Ridge WD (Dudley Ridge Water District). 2012. *2012 Agricultural Water Management Plan.* Accessed on: 17 July 2019. https://water.ca.gov/LegacyFiles/wateruseefficiency/sb7/docs/2014/plans/Dudley%20Ridge%20WD%202012%20AWMP.pdf

DTSC (Department of Toxic Substances Control). 2019. *EnviroStor*. Accessed July 17, 2019. https://www.envirostor.dtsc.ca.gov/public/

DWR (Department of Water Resources). 1981. *Water Well Standards: State of California Bulletin 74-81.* Accessed on: 17 July 2019. https://water.ca.gov/LegacyFiles/pubs/groundwater/water_well_standards__bulletin_74-81_/ca_well_standards_bulletin74-81_1981.pdf

DWR (Department of Water Resources). 1991. *California Well Standards Bulletin 74-90.* Accessed on: 17 July 2019. https://water.ca.gov/LegacyFiles/pubs/groundwater/water_well_standards__bulletin_74-90_/ca_well_standards_bulletin74-90_1991.pdf

DWR (Department of Water Resources). 2006. *San Joaquin Valley Groundwater Basin Tulare Lake Subbasin.* Accessed on: 11 July 2019. https://water.ca.gov/LegacyFiles/pubs/groundwater/bulletin_118/basindescriptions/5-22.12.pdf

DWR (Department of Water Resources). 2010. *Groundwater Elevation Monitoring Guidelines.* https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/CASGEM/Files/CASGEM-DWR-GW-Guidelines-Final-121510.pdf

DWR (Department of Water Resources). 2012. *Tulare Lake Bed Coordinated Groundwater Management Plan* Accessed on: 23 June 2019. https://water.ca.gov/LegacyFiles/groundwater/docs/GWMP/TL-23_TulareLakeBedCoordinated_GWMP_2012.pdf

DWR (Department of Water Resources). 2014. *Primary Water Uses and Water Sources* (Source for Table 2-2)

DWR (Department of Water Resources). 2016 a. *SGMA Draft Emergency Regulations for Groundwater Sustainability Plans and Alternatives*. Accessed on: 1 May 2019 https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/DRAFT_GSP_Emergency_Regulations_021816.pdf

DWR (Department of Water Resources). 2016b. *California's Groundwater Bulletin 118 Interim Update*. Accessed 12 July 2019. https://water.ca.gov/LegacyFiles/groundwater/bulletin118/docs/Bulletin_118_Interim_Update_2016.pdf

DWR (Department of Water Resources). 2016c. *Best Management Practices for the Sustainable Management of Groundwater , Hydrogeologic Conceptual Model*.

DWR (Department of Water Resources). 2016d. *Land and Water Use Section, Land Use Surveys, Fresno County 1994 and 2000, Kern County 1990, 1998, and 2006, Kings County 1991, 1996, and 2003, Tulare County 1993 and 1999.*

DWR (Department of Water Resources). 2016e. *Best Management Practices for the Sustainable Management of Groundwater, Monitoring Networks and Identification of Data Gaps*. *https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps.pdf*

DWR (Department of Water Resources). 2016f. *Best Management Practices for the Sustainable Management of Groundwater, Monitoring Protocols, Standards, and Sites.* https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-1-Monitoring-Protocols-Standards-and-Sites.pdf

DWR (Department of Water Resources). 2017a. *CADWR Land Use Viewer*. Accessed on: 10 July 2019. https://gis.water.ca.gov/app/CADWRLandUseViewer/

DWR (Department of Water Resources). 2017b. *Draft Best Management Practices for the Sustainable Management of Groundwater: Sustainable Management Criteria.*

DWR (Department of Water Resources). 2018. *Climate Action Plan*, *Phase 2: Climate Change Analysis Guidance.*

DWR (Department of Water Resources). 2019a*. Sustainable Groundwater Management Act 2019 Basin Prioritization.* Accessed on: 20 May 2019. https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization

DWR (Department of Water Resources). 2019b. *SGMA Basin Prioritization Mapper.* Accessed on: 14 August 2019. https://gis.water.ca.gov/app/bp-dashboard/p2/#

DWR (Department of Water Resources). 2019c. *Critically Overdrafted Basins*. Accessed on: 6 May 2019. https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118/Critically-Overdrafted-Basins

DWR (Department of Water Resources). 2019d. *SMGA Portal: GSAs*. Accessed on: 2 July 2019. https://sgma.water.ca.gov/portal/gsa/print/226

ECORP Consulting, Inc. 2007. *Tulare Lake Basin Hydrology and Hydrography: A Summary of the Movement of Water and Aquatic Species*. Prepared for: USEPA, Document 909R97002,

EPA (Environmental Protection Agency). 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process.*

EPA. 2019. Wellhead Protection Program. Accessed on 12 December 2019. https://www3.epa.gov/region1/eco/drinkwater/pc_wellhead_protection.html

Farr, T.G., Jones, C.E., Liu, Z. 2015. *Progress Report: Subsidence in the Central Valley, California.* Prepared for: Jet Propulsion Laboratory, California Institute of Technology.

Farr, T.G., Jones, C.E., Liu, Z., 2017. *Progress Report: Subsidence in California, March 2015 – September 2016*.

Faunt, C.C., ed. 2009. *Groundwater Availability of the Central Valley Aquifer, California: U.S. Geological Survey Professional Paper 1766, 225 p.*

Fresno County. 2010. *Fresno County General Plan.* Accessed on: 17 July 2019. *https://www.co.fresno.ca.us/home/showdocument?id=1811*

Gray, Brian. 2018. *The Public Trust and SGMA*. Posted October 7, 2018, to the California Water Blog by US Davis Center for Watershed Sciences. Accessed August 20, 2019. https://californiawaterblog.com/2018/10/07/the-public-trust-and-sgma/

Hansen, J.A., B.C. Jurgens, and M.S. Fram. 2018. *Quantifying Anthropogenic Contributions to Century-Scale Groundwater Salinity Changes, San Joaquin Valley, California, USA.*

Harder, T., and J. Van de Water. 2017. *Hydrogeological Conceptual Model and Water Budget of the Tule Subbasin, Tule Subbasin MOU Group, 49 p.*

Hilton, G.S., R.L. Klausing, and F. Kunkel. 1963. *Geology of the Terra Bella-Lost Hills Area, San Joaquin Valley, California*, Prepared for: U.S. Geological Survey Open-File Report 63-47, 158 p.

High-Speed Rail Authority. 2019. *California High-Speed Rail Authority*. Accessed on: 18 July 2019. https://www.hsr.ca.gov/communication/info_center/maps.aspx.

Home Garden CSD (Home Garden Community Service District). 2015. *Home Garden Community Plan*. Accessed on: 19 July 2019. https://www.countyofkings.com/home/showdocument?id=13507

Hopkins, J. A. 2016. *A Field Manual for Groundwater-level Monitoring at the Texas Water Development Board.*

IWP and DC (International Water Power and Dam Construction). 2004. *They might be giants – Terminus dam's new Fusegates.* Prepared for: International Water Power & Dam Construction. Accessed on: 23 June 2019. http://www.waterpowermagazine.com/features/featurethey-might-be-giants-terminus-dam-s-new-fusegates

Ireland R.L., J.F. Poland, and F.S. Riley. 1984*. Land subsidence in the San Joaquin Valley, California, as of 1980.* Prepared for: United States Geological Survey Professional Paper 437-I, 93 p. Accessed on: 2 July 2019. http://pubs.er.usgs.gov/usgspubs/pp/pp437I.

ITRC (Irrigation Training and Research Center). 2003. *California Crop and Soil Evapotranspiration for Water Balances and Irrigation Scheduling/Design*. Prepared for: California Polytechnic State University.

Irrigation Training and Research Center (Cal Poly Irrigation Training & Research Center). 2008. *Irrigation District Energy Survey.* Accessed on: 10 July 2019. http://www.itrc.org/reports/pdf/districtenergy.pdf

KCWD (Kings County Water District). 2011. *Groundwater Management Plan.*

KDWCD (Kaweah Delta Water Conservation District). 2018. *District Projects.* Accessed on: 2 August 2018. http://www.kdwcd.com/kdwcdweb_002.html

KDSA. Kenneth D. Schmidt and Associates, CDM Smith, and Summers Engineering. 2015. *Technical and Regulatory Evaluation of MUN and AGR Beneficial Uses in the Tulare Lake Bed Area*. Prepared for: Tulare Lake Drainage District and Tulare Lake Basin Water Storage District, 70 p.

KDWCD (Kaweah Delta Water Conservation District). 2017. *Groundwater Management Plan.*

Kern County. 2009. *General Plan*. Accessed on: 17 July 2019. https://kernplanning.com/planning/planning-documents/general-plans-elements/*Lemoore Urban Water Management Plan*

Kern County. 2018. *Agricultural Well Permit Information.* Accessed on: 10 June 2019. https://kernpublichealth.com/wp-content/uploads/2018/01/Agricultural-Well-Permit-Information_011618.pdf

Kern County. 2019. *A Codification of the General Ordinances of Kern County, California*. Accessed on: 10 July 2019. https://library.municode.com/ca/kern_county/codes/code_of_ordinances?nodeId=TIT14UT_CH14.08WASUSY

Kettleman City CSD (Kettleman City Community Service District). 2009. *Kettleman City Community Plan*. Accessed on: 17 July 2019. http://www.countyofkings.com/home/showdocument?id=3130

Kings County. 2000. *Ordinance No. 587: An Ordinance of the County of Kings Establishing Water Well Standards In Accordance with California Water Code Section 13801.* Accessed on: 1 July 2019. https://www.countyofkings.com/home/showdocument?id=3100

Kings County. 2001. *Code of Ordinances of the County of Kings State of California, Chapter 14A. Article 2*; *Adopted 1969, Republished 2001.* Accessed on: 4 June 2019. https://library.municode.com/ca/kings_county/codes/code_of_ordinances?nodeId=COOR_CH14AWAWE_ARTIIPE

Kings County. 2010. *2035 Kings County General Plan: Introduction, Table I-4*. Accessed on: 1 June 2019. https://www.countyofkings.com/home/showdocument?id=3108

Kings County. 2015. *Stratford Community Plan*. Accessed on: 10 July 2019. https://www.countyofkings.com/home/showdocument?id=13511

Kings County. 2019. *Kings County – About Us*. Accessed on: 13 July 2019. https://www.countyofkings.com/about-us

Kings County Agricultural Commissioner. 2017. *2017 Kings County Agricultural Report*. Accessed on: 8 June 2019. https://www.countyofkings.com/home/showdocument?id=19239

Kings County Public Health Department. 2009. *Requirements for New Wells: Community and Nontransient Noncommunity Water Systems*. Division of Environmental Health Services. Accessed on: 13 June 2019. https://www.countyofkings.com/home/showdocument?id=17230

Kings County. 2002. *Revised Dairy Element of Kings General Plan.* Accessed on: 12 December 2019. https://www.countyofkings.com/departments/community-development-agency/information/dairy-element

Kings County WD (Kings County Water District). 2011. *Groundwater Management Plan*. Accessed on: 17 July 2019. https://water.ca.gov/LegacyFiles/groundwater/docs/GWMP/TL-13_KingsCountyWD_GWMP_2011.pdf

KRCD and KRWA (Kings River Conservation District and Kings River Water Association). 2009. *The Kings River Handbook, Fifth Printing, 48 p*.

KRCD (Kings River Conservation District). 2009. *Kings River Handbook*. Accessed on: 17 July 2019. http://krcd.org/_pdf/Kings_River_Handbook_2009.pdf

Kings River Fisheries Management Program. 1999. *Kings River Fisheries Management Program Framework Agreement*. Accessed on: 17 July 2019. http://krfmp.org/_pdf_fmp/FMP_FrameworkAgreement1999.pdf

Kings River Water Association. 2004. *2003-2004 Water Master Report.*

Kings River Water Association. 2019. Accessed on: 12 December 2019. http://www.kingsriverwater.org/.

KRWQC (Kings River Water Quality Coalition). 2016. *Kings River Water Quality Coalition*. Accessed on: 20 July 2019. http://www.kingsriverwqc.org/

Kings River Water Quality Coalition (KRWQC). 2016b. *Comprehensive Groundwater Quality Management Plan.*

Lafco (Local Agency Formation Commission). 2019. Deer Creek Stormwater District. Accessed on: 12 December 2019. https://lafco.co.tulare.ca.us/lafco/index.cfm/maps/districts/districts-storm-water/

Leake, S.A. 2016. *Land Subsidence from Ground-Water Pumping.* Accessed on: 29 July 2019 https://geochange.er.usgs.gov/sw/changes/anthropogenic/subside/?

Lettis, W.R. and J.R. Unruh. 1991. *Quaternary Geology of the Great Valley, California, in Quaternary Nonglacial Geology: Conterminous U.S., Decade of North American Geology*. Prepared for: Geological Society of America, pp 164 – 176.

Lohman, S.W. 1972. *Ground-Water Hydraulics, U.S. Geological Survey Professional Paper 708, reprinted 1979*, 70 p.

Loomis, K.B. 1990. Late Neogene Depositional History and Paleoenvironments of the West-Central San Joaquin Basin, California. Prepared for: Stanford University, PhD Dissertation. 343 p.

LSCE (Luhdorff & Scalmanini Consulting Engineers, Borchers, J, Carpenter, M). 2014. *Land Subsidence from Groundwater Use in California.* Prepared for: California Water Foundation 193p

Meade, R.H. 1967. *Petrology of Sediments Underlying Areas of Land Subsidence in Central California.* Prepared for: U.S. Geological Survey Professional Paper 497-C, 83 p.

Mendenhall, W.C., R.B. Dole, and H. Stabler. 1916. Ground Water in San Joaquin Valley, California, U.S. Geological Survey Water-Supply Paper 398, 310 p, (Mendenhall et al., 1916).

Miller, R.E., J.H. Green, and G.H. Davis. 1971. *Geology of Compacting Deposits in the Los Banos-Kettleman City Subsidence Area, California*. Prepared for: U.S. Geological Survey Professional Paper 497-E, 46 p.

NASA (National Aeronautics and Space Administration). n.d. *NASA JPL InSAR Subsidence Data.* Retrieved August 22, 2019, https://data.ca.gov/dataset/nasa-jpl-insar-subsidence-data

NASA (National Aeronautics and Space Administration). 2017. *NASA Data Show California's San Joaquin Valley Still Sinking.* Accessed on: 17 July 2019. https://www.nasa.gov/feature/jpl/nasa-data-show-californias-san-joaquin-valley-still-sinking

Nidever, Seth. 2014. *Drought shadow stretches across Kings unemployment rate*. Prepared for: Hanford Sentinel.

NOAA (National Oceanographic Atmospheric Administration). 2019. *National Weather Service Forecast Office, Hanford California: Historic Average Annual Precipitation.* Accessed on: 15 March 2019. https://w2.weather.gov/climate/xmacis.php?wfo=hnx

NRCS (National Resource Conservation Service). 2018. *Web Soil Survey.* Accessed on: 2 July 2019. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx?aoissa=CA031

Page, R.W. 1973. *Base of Fresh Ground Water (Approximately 3,000 Micromhos) in the San Joaquin Valley, California.* Prepared for: U.S. Geological Survey Hydrologic Investigations Atlas HA-489, 1 p.

Page, R.W. 1981. *Data on Depths to the Upper Mya Zone of the San Joaquin Formation in the Kettleman City Area, San Joaquin Valley, California*. Prepared for: U.S. Geological Survey Open-File Report 81-699, 12 p.

Page, R.W. 1983. *Geology of the Tulare Formation and Other Continental Deposits, Kettleman City Area, San Joaquin Valley, California, with a Section on Ground-Water Management Considerations and Use of Texture Maps.* Prepared for: U.S. Geological Survey Water-Resources Investigations Report 83-4000, 24 p.

PRISM Climate Group. 2018. Prepared for: Oregon State University. Accessed on: 23 July 2019 http://prism.oregonstate.edu

Provost & Pritchard Consulting Group. 2009, *Apex Ranch Conjunctive Use Project Groundwater Monitoring Program October 2008 through September 2009, Kings County Water District.* Prepared for Kings County Water District.

Provost & Pritchard Consulting Group. 2011. *Groundwater Management Plan, Kings County Water District.* Prepared for Kings County Water District.

RMC Water and Environment. 2015. *Transitioning to Sustainability: Modeling Groundwater Sustainability in the Kings- Tulare Lake Region.* Accessed on: 3 August 2019. http://californiawaterfoundation.org/wp-content/uploads/CWF-Transitioning-to-Sustainability-Final-Report_11_09_2015.pdf

RWQCB (Regional Water Quality Control Board). 2015. *Central Valley Region, 2015, Water Quality Control Plan for the Tulare Lake Basin, Second Edition, Revised January 2015 (with Approved Amendments).* Accessed 16 July 2019. https://www.waterboards.ca.gov/rwqcb5/water_issues/basin_plans/tlbp.pdf

RWQCB (Regional Water Quality Control Board). 2017. *Central Valley Region, Amendment to the Water Quality Control Plan for the Tulare Lake Basin to Remove the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses within a Designated Horizontal and Vertical Portion of the Tulare Lake Bed, Final Staff Report.* Accessed on: 12 July 2019.

RWQCB (Regional Water Quality Control Board). 2017b. *Resolution R5-2017-0032. Amendment to the Water Quality Control Plan for the Tulare Lake Basin to Remove the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses Within a Designated Horizontal and Vertical Portion of the Tulare Lake Bed.*

Scheirer, A.H., Ed. 2007. *Petroleum Systems and Geologic Assessment of Oil and Gas in the San Joaquin Basin Province, California, 31 Chapters.* Prepared for: U.S. Geological Survey

Professional Paper 1713. Accessed on: 9 August 2018. https://pubs.usgs.gov/pp/pp1713/

Soil Survey Staff. 2018. *Natural Resources Conservation Service, United States Department of Agriculture.* Prepared for: Soil Survey Geographic (SSURGO) Database. Accessed on: 25 July 2018. https://sdmdataaccess.sc.egov.usda.gov

SCE (Southern California Edison). 2016. *Kaweah Project Relicensing, SCE Pre-Application Document, Section 3.2 River Basin.* Accessed on: 12 July 2018. https://www.sce.com/ko/regulatory/hydro-licensing/kaweah-project-relicensing/sce-pre-application-document

Stewart, Ralph. 1946. *Geology of Reef Ridge-Coalinga District, California.* Prepared for: U.S. Geological Survey Professional Paper 205-C, 34 p.

Summers Engineering, Inc. 2012. *Tulare Lake Bed Coordinated Groundwater Management Plan (SB 1938 Compliant).*

SWRCB (State Water Resources Control Board). 2006. *Resolution No. 88-63 (as revised by Resolution no. 2006-0008) Adoption of Policy Entitled "Sources of Drinking Water.*

SWRCB (State Water Resources Control Board). 2019a. *GeoTracker*. Accessed on: 17 July 2019. http://geotracker.waterboards.ca.gov. /

SWRCB (State Water Resources Control Board). 2019b. *GAMA Groundwater Information System.* https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp

SWRCB. 2019c. *Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS).* Accessed on: 22 August 2019. https://www.waterboards.ca.gov/centralvalley/water_issues/salinity/

Theide, S. 2016. *Land Subsidence Benchmarks*. Clovis: Provost and Pritchard.

Tieman, Mary. 2017. "Safe Drinking Water Act (SDWA): A summary of the Act and Its Major Requirements. Page 1.

TLBWSD (Tulare Lake Basin Water Storage District). 2015. *2015 Agricultural Water Management Plan*. Accessed on: 17 July 2019. https://water.ca.gov/LegacyFiles/wateruseefficiency/sb7/docs/2015/plans/2015%20AWMP%20-%20Tulare%20Lake%20Basin%20WSD.pdf

Tulare County. 2012. *2030 Update Tulare County General Plan*. http://generalplan.co.tulare.ca.us/documents/GP/001Adopted%20Tulare%20County%20General%20Plan%20Materials/000General%20Plan%202030%20Part%20I%20and%20Part%20II/GENERAL%20PLAN%202012.pdf

Tulare County. 2017. *Tulare County Ordinance Code Part IV. Health, Safety and Sanitation Chapter 13. Construction of Wells.* Accessed on: 13 June 2019. https://tularecountyeh.org/eh/index.cfm/guidance-library/water-wells/tulare-county-water-well-ordinance-2017

Tulare County. 2019. *Tulare County – About.* Accessed on: 1 July 2019. https://tularecounty.ca.gov/county/index.cfm/about/

Tulare Lake Basin Water Storage District. 2003. *Agricultural Water Management Plan*.

Tule River Basin. 2015*. Integrated Regional Water Management Plan.*

UNAVCO. 2019. *PBO GPS Stations Network Monitoring.* Accessed August 20, 2019 at: https://www.unavco.org/instrumentation/networks/status/pbo/gps

USACE (U.S. Army Corps of Engineers). 2017. Success Lake, Water Control Manual Deviation, Final Environmental Assessment. Accessed on: 12 June 2018. http://www.spk.usace.army.mil/Portals/12/documents/civil_works/Success/FINAL%20Success%20Lake%20Deviation%20EA.pdf?ver=2017-06-06-182303-820,

USBR (U.S. Bureau of Reclamation). 2003. *Raise Pine Flat Dam, Upper San Joaquin River Basin Storage Investigation, Surface Water Storage Option Technical Memorandum, Joint Study*. Prepared for: U.S. Bureau of Reclamation and California Department of Water Resources.

USBR. 2017. *Summary of Available Water Supplies.*

USBR. 2018. *Central Valley Project Interim Renewal Contracts for Cross Valley Contractors 2016-2018.* Accessed on: 17 July 2019. https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=31723

USBR. 2019. About the Central Valley Project. Accessed on: 12 December 2019. https://www.usbr.gov/mp/cvp/about-cvp.html

U.S. Census Bureau (United States Census Bureau). 2018. *U.S. Census Bureau QuickFacts: United States*. Accessed on: 17 July 2019. https://www.census.gov/quickfacts/fact/table/US/PST045218.

USDA (U.S. Department of Agriculture). *National Agricultural Statistics Service Cropland Data Layer: 2006-2016*. Accessed on: 2 July 2019. http://nassgeodata.gmu.edu/CropScape/USDA-NASS

USGS (United States Geological Survey). 2017. *USGS Land Subsidence Resources*. Retrieved from California Water Science Center: https://ca.water.usgs.gov/land_subsidence/california-subsidence-resources.php

USGS (United States Geological Survey). 2019. *Areas of Land Subsidence in California*. Accessed on: 17 July 2019. https://ca.water.usgs.gov/land_subsidence/california-subsidence-areas.html

WRIME (Water Resources & Information Management Engineering, Inc.). 2005. *Kings River Conservation District, Lower Kings Basin Groundwater Management Plan Update.*

Wood (Wood Environment and Infrastructure Solutions, Inc.) 2018. *First Quarter 2018 Monitoring Report for Class I Waste Management Units as Required by DTSC: Kettleman Hills Facility.* Prepared for Chemical Waste Management, Inc., 18 p, June 21.

Woodring, W.P., R. Stewart, and R.W. Richards. 1940. *Geology of the Kettleman Hills Oil Field, California, Stratigraphy, Paleontology, and Structure.* Prepared for: U.S. Geological Survey Professional Paper 195, 170 p.

WWQC (Westside Water Quality Coalition). 2019. *Westside Water Quality Coalition.* Accessed on: 24 July 2019. https://www.wwqc.org/

Tables

Table 1-1. GSP Requirements

Requirements
Groundwater conditions must be adequately defined and monitored to demonstrate the GSPs are achieving the sustainability goals for the basin
GSAs must be sufficiently defined and compatible to evaluate the effect of GSPs on adjacent basins
GSPs must meet substantial compliance standards
A GSA shall provide a description of basin setting and establish criteria that will maintain or achieve sustainable groundwater management
DWR will consider state policy regarding to the human right to water when implementing these regulations
The GSP sustainable groundwater management criteria, projects, and management actions should be based on the level of understanding of the basin setting including an understanding of uncertainty and data gaps
A GSP must achieve the sustainability goals for the basin in 20 years

Table 1-2. Participating GSA Contact Information

GSA	Plan Manager	Address	Telephone	Email
Mid-Kings River	Dennis Mills, Secretary	200 North Campus Dr. Hanford, CA 93230	(559) 584.6412	kcwdh2o@sbcglobal.net
El Rico	Jeof Wyrick, Chairman	101 W. Walnut St. Pasadena, CA 91103	(626) 583.3000	jwyrick@jgboswell.com
South Fork Kings	Charlotte Gallock, Program Administrator	4886 E. Jensen Ave. Fresno, CA 93725	(559) 242.6128	cgallock@krcd.org
Southwest Kings	Dale Melville, Executive Director	286 Cromwell Ave. Fresno, CA 93711	(559) 449.2700	dmelville@ppeng.com
Tri-County Water Authority	Deanna Jackson, Executive Director	944 Whitley Ave. Suite E. Corcoran, CA 93212	(559) 762.7240	djackson@tcwater.org

See Acronyms and Abbreviations list for definitions.

Table 1-3. GSA Member Agencies

GSA	GSA Member Agencies	
Mid-Kings River	▪ Kings County Water District ▪ City of Hanford	▪ Kings County
El Rico	▪ Alpaugh Irrigation District ▪ City of Corcoran ▪ Corcoran Irrigation District ▪ Kings County ▪ Lovelace Reclamation District No. 739	▪ Melga Water District ▪ Salyer Water District ▪ Tulare Lake Basin Water Storage District ▪ Tulare Lake Drainage District
South Fork Kings	▪ City of Lemoore ▪ Empire West Side Irrigation District ▪ Stratford Irrigation District	▪ Stratford Public Utility District ▪ Kings County
Southwest Kings	▪ Dudley Ridge Water District ▪ Tulare Lake Reclamation District No. 761	▪ Kettleman City Community Services District ▪ Tulare Lake Basin Water Storage District ▪ Kings County
Tri-County Water Authority	▪ Angiola Water District ▪ Kings County	▪ Deer Creek Storm Water District ▪ Wilbur Reclamation District #825

Table 1-4. Proportionate Costs Breakdown of Each GSA

GSA	Acres	Acreage Portion	Participant Portion	Total Cost Allocation
Mid-Kings River GSA	97,384.6	0.09084	0.1	0.19084
El Rico GSA/Alpaugh ID	228,653.4	0.21328	0.1	0.31328
South Fork Kings GSA	71,310.9	0.06652	0.1	0.16652
Southwest Kings GSA	90,037.1	0.08398	0.1	0.18398
Tri-County WA	48,656.5	0.04538	0.1	0.14538
Totals	536,042.5	0.50000	0.5	1.00000

Table 1-5. Estimate of Costs GSP Planning

Description	Mid-Kings River	South Fork Kings	El Rico	Southwest Kings	Tri-County Water Authority	Total
Model Development	$95,470.00	$83,260.00	$156,640.00	$91,990.00	$76,690.00	$500,000.00
GSP Development	$348,283.00	$303,899.00	$571,736.00	$335,764.00	$265,318.00	$1,825,000.00
Totals	$443,753.00	$387,159.00	$728,376.00	$427,754.00	$342,008.00	$2,325,000.00

See Acronyms and Abbreviations list for definitions.

Table 1-6. Estimate of Costs GSP Implementation

	Mid-Kings River		South Fork Kings		El Rico		Southwest Kings		Tri-County Water Authority		Total
	Cost (Dollars)	Annual Yield (AF/yr)	Cost (Dollars)	Annual Yield (AF/yr)	Cost (Dollars)	Annual Yield (AF/yr)	Cost (Dollars)	Annual Yield (AF/yr)	Cost (Dollars)	Annual Yield (AF/yr)	
Description											
Administration	$50,000		$50,000		$20,000		$5,000		$5,000		$130,000
Monitoring	$50,000		$50,000		$10,000		$5,000		$5,000		$120,000
Fill Data Gaps	$50,000		$50,000		$50,000		$50,000				$150,000
Annual Costs											$400,000
Projects											
Existing System Improvements	$8,800,000	6,000.00									$8,800,000
Recharge	$93,000,000	27,700.00	$28,000,000	7,000.00							$121,000,000
Aquifer Storage and Recovery			$15,000,000	13,000.00							$15,000,000
Surface Storage and Reregulation			$6,000,000	2,000.00	$100,000,000	26,000.00			$45,000,000	15,000.00	$151,000,000
On Farm Flooding											$0
Surface Water System Improvements			$5,000,000	5,000.00							$5,000,000

See Acronyms and Abbreviations list for definitions.

Table 1-6. Estimate of Costs GSP Implementation (Continued)

	Mid-Kings River		South Fork Kings		El Rico		Southwest Kings		Tri-County Water Authority		Total
	Cost (Dollars)	Annual Yield (AF/yr)	Cost (Dollars)	Annual Yield (AF/yr)	Cost (Dollars)	Annual Yield (AF/yr)	Cost (Dollars)	Annual Yield (AF/yr)	Cost (Dollars)	Annual Yield (AF/yr)	
Demand Management											
Crop Rotation/Fallowing	$1,380,000	6,250.00	$5,000,000	13,000.00		15,000.00					$6,380,000
Groundwater Measurement			$500,000	1,500.00							$500,000
On Farm Improvement			$1,000,000	2,500.00							$1,000,000
Conservation/Reuse			$1,000,000	1,000.00							$1,000,000
	$103,330,000	39,950	$61,650,000	45,000	$100,080,000	41,000	$60,000		$45,010,000	15,000	$309,680,000

See Acronyms and Abbreviations list for definitions.

Table 2-1. Land Use in Tulare Lake Subbasin (2014)

Land Use Classification	Percent of Total Area
Commercial	0.3%
Deciduous Fruit and Nuts	14.6%
Field Crops	30.1%
Grain and Hay Crops	6.2%
Idle	22.9%
Industrial	0.3%
Pasture Crops	7.1%
Residential	0.4%
Riparian Vegetation	2.8%
Semi agricultural	1.8%
Truck, Nursery, and Berry Crops	6.0%
Urban	3.8%
Urban Landscape	0.1%
Vineyards	1.5%
Water Surface	2.0%
Young Perennials	0.1%
TOTAL	**100.0%**

Source: DWR 2014.

See Acronyms and Abbreviations list for definitions.

Table 2-2. Primary Water Uses and Water Sources

Groundwater Sustainability Agency	Water Use Sector (Agency / Water Company)	Water Use	Water Source Type
El Rico GSA	Alpaugh Irrigation District	Irrigation	Groundwater
	City of Corcoran	Residential Commercial Residential	Groundwater
	Corcoran Irrigation District	Irrigation Recharge	Kings River Kaweah River St. John's River
	Corcoran Irrigation Company	Irrigation Recharge	Kings River Kaweah River St. John's River
	Peoples Ditch Company	Irrigation Recharge	Kings River
	Last Chance Water Ditch Company	Irrigation Recharge	Kings River
	Lakeside Canal Company	Irrigation Recharge	Kaweah River St. John's River CVP
	Tulare Lake Basin Water Storage District	Irrigation	Kings River Kaweah River St. John's River Tule River SWP
Tri-County Water Authority GSA	Angiola Water District	Irrigation Recharge	SWP CVP Kings River Tule River Deer Creek Groundwater Poso Creek
	Atwell Island Water District	Irrigation	Groundwater
	Deer Creek Storm Water District	Flood Control	Deer Creek Poso Creek
	W. H. Wilbur Reclamation District #825	Irrigation	Poso Creek
Mid-Kings River GSA	City of Hanford	Residential Commercial Industrial	Groundwater
	Armona Community Services District	Residential Commercial	Groundwater

See Acronyms and Abbreviations list for definitions.

Table 2-2. Primary Water Uses and Water Sources (Continued)

Groundwater Sustainability Agency	Water Use Sector (Agency / Water Company)	Water Use	Water Source Type
Mid-Kings River GSA (Continued)	Home Garden Community Services District	Residential	Groundwater
	Kings County Water District	Irrigation Recharge Banking	Kings River Kaweah River St. John's River CVP
	Lakeside Irrigation Water District & Canal Company	Irrigation Recharge	Kaweah River St. John's River CVP
	Peoples Ditch Company	Irrigation Recharge	Kings River
	Last Chance Water Ditch Company	Irrigation Recharge	Kings River
	Santa Rosa Rancheria	Residential Commercial	Groundwater
Southwest Kings GSA	Dudley Ridge Water District	Irrigation	SWP
	Tulare Lake Reclamation District #761	Irrigation	Kings River SWP Groundwater
	Tulare Lake Basin Water Storage District	Irrigation	Kings River Kaweah River St. John's River Tule River SWP
	Kettleman City Community Services District	Residential Commercial Industrial	SWP Groundwater (emergency supply)
South Fork Kings GSA	Lemoore Canal and Irrigation Company	Irrigation	Kings River
	Stratford Irrigation District	Irrigation	Kings River
	Stratford Public Utility District	Residential Commercial	Groundwater
	Santa Rosa Rancheria	Residential Commercial	Groundwater
	City of Lemoore	Municipal	Groundwater

See Acronyms and Abbreviations list for definitions.

Table 2-3. Summary of Applicable Plans

County	Plan	Online Source
Kings County	Kings County 2035 General Plan (adopted January 2010, includes Land Use, Circulation, Noise, Open Space, Resource Conservation, Health and Safety, and Air Quality Elements; Housing Element updated January 2016; Dairy Element adopted July 2002)	https://www.countyofkings.com/departments/community-development-agency/information/2035-general-plan
	Armona Community Plan (2009)	https://www.countyofkings.com/home/showdocument?id=13505
	Home Garden Community Plan (2015)	https://www.countyofkings.com/home/showdocument?id=13507
	Kettleman City Community Plan (2009)	https://www.countyofkings.com/home/showdocument?id=13509
	Stratford Community Plan (2009)	https://www.countyofkings.com/home/showdocument?id=3106
	City of Hanford – 2035 General Plan (April 2017)	http://www.cityofhanfordca.com/document_center/Planning/Plans/Hanford%20General%20Plan/2035%20General%20Plan%20%20Policy%20Document.pdf
	City of Lemoore – 2030 General Plan (May 2008)	http://lemoore.com/communitydevelopment/general-plan/
	City of Corcoran – 2025 General Plan (March 2007), 2005-2025 General Plan Enhancement (November 2014)	http://www.cityofcorcoran.com/civica/filebank/blobdload.asp?BlobID=3796
County of Tulare	County of Tulare – 2030 General Plan (August 2012)	http://generalplan.co.tulare.ca.us/documents/GP/001Adopted%20Tulare%20County%20General%20Plan%20Materials/000General%20Plan%202030%20Part%20I%20and%20Part%20II/GENERAL%20PLAN%202012.pdf
Kern County	Kern County – General Plan (September 2009)	https://kernplanning.com/planning/planning-documents/general-plans-elements/

See Acronyms and Abbreviations list for definitions.

Table 2-4. Beneficial Uses and Users by GSA

Stakeholder Group	Description
Mid-Kings River GSA	
Agricultural Users	Service area is composed of mostly agricultural lands and agricultural users.
Domestic Well Owners	There are domestic wells within the Mid-Kings River GSA, and it is understood that many rural domestic users will fall into the "de minimis extractor" category, so further work is being conducted to understand to what extent domestic users will be affected by GSP requirements.
Public Water Systems	Armona CSD, Home Garden CSD and Hardwick Water Company, as well as several transient public water systems for school districts are included in this category (Kings River-Hardwick, Pioneer, Hanford Christian).
Municipal Water Systems	City of Hanford
Local Land Use Planning Agencies	City of Hanford and Kings County
California Native American Tribes	See Appendix B, Section C.2
Disadvantaged Communities	Armona, Home Garde, Hardwick
Entities monitoring and reporting Subbasin groundwater elevations	Kings CWD monitors groundwater levels within its service area and is providing a subset of that information to the KRCD for submission to the CASGEM system.
South Fork Kings GSA	
Agricultural Users	Service area is composed of mostly agricultural lands and agricultural users.
Domestic Well Owners	There are domestic wells within the South Fork Kings GSA, and it is understood that many domestic users will fall into the "de minimis extractor" category, so further work is being conducted to understand to what extent domestic users will be affected by GSP requirements.
Municipal Well Operators	City of Lemoore, Stratford PUD
Local Land Use Planning Agencies	City of Lemoore, Kings County
California Native American Tribes	See Appendix B, Section C.2
Disadvantaged Communities	Community of Stratford
Entities monitoring and reporting Subbasin groundwater elevations	KRCD is the designated monitoring entity for the Kings and Tulare Lake Subbasins under CASGEM program. South Fork Kings GSA will coordinate its SGMA monitoring efforts with the CASGEM monitoring effort led by KRCD.
Southwest Kings GSA	
Agricultural Users	Approximately 99% of the GSA is composed of agricultural lands. Representatives of the agricultural community are currently involved on the GSA Board of Directors.
Domestic Well Owners	Only one or two landowners utilize a domestic well and are represented on the Board of Directors through member agencies.

See Acronyms and Abbreviations list for definitions.

Table 2-4. Beneficial Uses and Users by GSA (Continued)

Stakeholder Group	Description
Municipal Well Operators	Kettleman City CSD relies solely on surface water supply (effective October 2019). Their municipal wells are a back-up source to provide well water to residential and commercial customers within the GSA boundary in emergency situations when surface water is not accessible.
Local Land Use Planning Agencies	Kings County
California Native American Tribes	See Appendix D, Section C.2
Disadvantaged Communities	Kettleman City
Entities monitoring and reporting Subbasin groundwater elevations	KRCD is the designated monitoring entity for the Kings and Tulare Lake Subbasins under CASGEM program. Southwest Kings GSA will coordinate its SGMA monitoring efforts with the CASGEM monitoring effort led by KRCD.
El Rico GSA	
Agricultural Users	Represented through many of the GSA member agencies and/or by Kings County.
Domestic Well Owners	Represented through member agencies including Kings County or via exemption for small amounts of groundwater extraction.
Municipal Well Operators	City of Corcoran
Public Water Systems	City of Corcoran
Local Land Use Planning Agencies	City of Corcoran, Kings County
Surface Water Users	Represented through GSA member agencies
Disadvantaged Communities	City of Corcoran
Entities monitoring and reporting Subbasin groundwater elevations	Represented by GSA member agencies including TLBWSD that collects and reports data for multiple members of the agency via the Tulare Lake Coordinated Groundwater Management Plan.
Tri-County Water Authority GSA	
Agricultural Users	Composed almost entirely of agricultural users, including nut grower commodity groups and other agricultural use growers.
Domestic Well Owners	There are domestic wells within the GSA area, but because SGMA excludes "de minimis extractors," it is anticipated that the GSP will exclude domestic wells from such requirements.
Local Land Use Planning Agencies	Kings County
Federal Government	Bureau of Land Management
Entities monitoring and reporting Subbasin groundwater elevations	Angiola WD, TLBWSD

Source: Appendix B.

See Acronyms and Abbreviations list for definitions.

Table 3-1. Historical Hanford Precipitation (Inches), Tulare Lake Subbasin SGMA Model, Kings County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1899	M	M	M	M	M	M	M	M	0	0.67	M	0.87	M
1900	1.38	0	1.18	1.04	M	M	M	M	M	M	M	M	M
1901	M	M	M	M	M	M	M	T	1.04	T	M	0.15	M
1902	0.4	2	1.78	0.47	0.09	M	0	M	0	0.36	1.67	0.56	M
1903	1.31	0.38	1.71	0.5	0	0	0	0	0	0.05	0.47	0.15	4.57
1904	0.52	2.03	2.05	0.72	0	0	0	0	2.48	0.84	0.31	1.16	10.11
1905	1.28	1.09	2.1	0.56	0.65	0	0	0	0.07	0	1.16	0.23	7.14
1906	1.59	1.92	4.05	0.62	2.06	0.02	0	0	0	0	M	M	M
1907	M	M	M	M	M	M	M	M	M	M	M	M	M
1908	M	M	M	M	M	M	M	M	M	M	M	0.31	M
1909	M	M	M	M	M	M	M	M	M	M	M	M	M
1910	M	M	M	M	M	M	M	M	M	M	M	M	M
1911	M	M	M	M	M	M	M	M	M	M	M	M	M
1912	M	0.02	3.24	1.52	0.27	0	0	0	0	0	0.61	0.21	M
1913	1.26	1.55	0.34	0.78	0.76	0.06	0.08	0	M	M	M	1.35	M
1914	4.36	1.25	0.37	0.11	M	1.06	0	0	0	0	0.02	M	M
1915	M	M	0.3	1.37	M	M	M	M	M	M	M	M	M
1916	4.68	M	M	M	0.16	M	M	0.28	0.47	1.09	M	1.35	M
1917	M	M	M	M	0.31	M	M	M	M	M	M	M	M
1918	M	4.5	3.43	M	M	M	M	M	0.88	0.12	M	M	M
1919	M	M	1.01	0.15	0.1	M	M	M	M	M	M	M	M
1920	M	2.72	3.05	0.24	M	M	M	M	M	M	M	M	M
1921	M	0.89	M	M	0.87	M	M	M	M	M	M	M	M
1922	M	M	M	M	M	M	M	T	M	M	M	M	M
1923	M	M	M	2.43	M	M	M	M	M	M	M	0.22	M
1924	M	M	1.86	M	0	M	M	T	0	0.65	M	2.12	M
1925	M	M	1.58	M	M	M	0	M	0	M	M	M	M

See Acronyms and Abbreviations list for definitions.

Table 3-1. Historical Hanford Precipitation (Inches), Tulare Lake Subbasin SGMA Model, Kings County, California (Continued)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1926	0.82	1.44	0.2	2.67	T	0	0	0	0	0.76	3.67	0.65	10.21
1927	1.33	2.52	2.04	0.18	0.06	T	0	0.04	T	1.67	1.63	0.78	10.25
1928	0.09	0.96	1.55	0.08	0.1	0	0	0	0	T	1.47	1.69	5.94
1929	0.81	0.61	1.4	0.81	0	0.24	T	0	0.03	0	0	0.42	4.32
1930	1.66	1	1.66	0.15	0.37	0	0	0.02	0.38	0.07	0.67	0.3	6.28
1931	2.32	0.72	0.07	0.91	0.2	1.12	0	0.08	0.08	0	1.36	2.54	9.4
1932	1.85	1.52	0.47	0.71	0.13	0	0	0	0	0	0.28	0.93	5.89
1933	3.12	0.16	0.72	0.28	0.41	0.07	0	0	0	0.15	0	1.01	5.92
1934	0.17	1.53	0.05	0	0.22	0.14	0	0	0	1.06	2.15	1.84	7.16
1935	2.5	1.77	2	2.05	0	0	0.03	0	0.06	0.51	0.4	0.89	10.21
1936	0.66	4.7	0.97	0.55	T	T	0	0	0	1.84	0	2.87	11.59
1937	1.95	2.46	2.23	0.22	0	0	0	0	0	0.11	0.21	2.16	9.34
1938	1.76	3.51	4.59	1.15	0.11	0.17	0.07	0	0.13	0.19	0.19	1.42	13.29
1939	1.54	0.77	1.44	0.82	T	0.12	0	0	0.04	0.57	0.06	0.22	5.58
1940	3.53	3.61	0.99	0.18	T	T	0	0	0	0.85	T	3.61	12.77
1941	1.51	3.9	2.05	2.41	T	T	0	T	0	0.9	0.57	3.11	14.45
1942	1.21	0.88	0.94	1.19	0.16	0	0	M	0	0	0.43	1.1	M
1943	2.73	1.14	3.35	0.87	0	0	0	0	0	0.03	0.22	1.03	9.37
1944	1.28	2.97	0.22	0.86	0.28	0.23	0	0	0.02	0.23	2.25	0.97	9.31
1945	0.26	2.71	1.81	0.16	0.1	0.17	0	0	T	0.71	1.15	1.51	8.58
1946	0.34	1.53	2.56	0.07	0.41	0	0.11	0	0	1.33	1.1	2.06	9.51
1947	0.41	0.49	0.56	0.11	0.41	0	0	0	T	0.59	0.29	0.51	3.37
1948	0	0.44	1.46	1.55	0.54	0	0	0	0	0.03	0.01	0.99	5.02
1949	0.51	0.85	1.94	0.07	0.53	0	0	T	0	0	0.6	0.68	5.18
1950	1.93	1.13	1.1	0.4	0	0	0.08	0	0	0.34	0.63	1.06	6.67
1951	1.24	0.76	0.22	1.17	0.07	0	0	0	0	0.08	1.11	2.39	7.04
1952	3.08	0.27	2.18	0.79	0.01	0.02	T	0	0.17	0.05	0.65	2.96	10.18
1953	1.1	0.27	0.34	0.83	0.29	0.02	T	0	0	0.02	1.01	0.09	3.97
1954	1.89	0.78	2.21	0.52	0.34	0.08	0	0	0	0	0.66	1.61	8.09

See Acronyms and Abbreviations list for definitions.

Table 3-1. Historical Hanford Precipitation (Inches), Tulare Lake Subbasin SGMA Model, Kings County, California (Continued)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1955	3.25	1.31	M	M	0.9	0	0	M	0	0.02	0.92	4.67	M
1956	1.2	0.38	0.1	0.73	0.83	0	0	0	0	0.72	0	0.15	4.11
1957	1.39	1.17	0.56	0.67	0.63	0	0	0	0	0.2	1.39	1.41	7.42
1958	1.85	2.3	3.92	2.04	0.24	0	0	T	0.88	0	0.23	0.16	11.62
1959	0.86	1.9	0.11	0.52	T	0	0	T	0.11	0	0	0.17	3.67
1960	0.8	1.71	0.61	0.57	0	0	0.02	0	0	0.53	2.61	0.03	6.88
1961	1.34	0.22	0.67	0.22	0.37	0	0	0	0	0	1.11	1.28	5.21
1962	0.71	4.88	1.06	0	0.11	0	0	0	0.01	0.1	0	0.19	7.06
1963	1.19	1.68	1.37	2.88	0.56	0.17	0	0	0.33	0.75	1.23	0.29	10.45
1964	0.61	0.02	0.94	0.64	0.2	0	0	0.34	0	0.95	1.31	1.44	6.45
1965	1.18	0.33	0.33	1.6	0	0	0	0.05	0.07	0.05	2.15	1.97	7.73
1966	0.63	0.71	0.1	0	0.07	0.06	0.04	0	0.29	0	1.28	2.57	5.75
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1967	1.41	0.05	2.42	2.95	0.07	0.23	0	0	0.31	0	1.99	0.5	9.93
1968	0.57	0.64	1	0.5	0.08	0	0	0	0	1.33	0.98	1.64	6.74
1969	6.69	4.54	0.79	0.85	0.32	0.21	0.07	0	0.15	0.05	0.51	0.7	14.88
1970	1.6	1.33	1.42	0.16	0	T	T	0	0	T	2.4	1.23	8.14
1971	0.35	0.19	0.23	0.4	1.44	0	0	T	0.04	0.06	0.41	1.87	4.99
1972	0.04	0.35	0	0.23	0	0	0	0	0.24	0.21	2.9	0.65	4.62
1973	M	2.29	2.2	0.12	M	M	0	0	0	M	M	M	M
1974	2.97	0.11	1.75	0.03	0	0	0	0	0	0.65	0.24	1.4	7.15
1975	0.09	2.26	M	0.49	0	0	0	0	0.96	M	0.05	0.22	M
1976	T	2.94	0.19	1.47	0.03	0.51	0	0.22	1.47	0	1.15	0.96	8.94
1977	0.59	0.03	0.43	0	0.91	0.07	0	0	0	0.05	0.66	2.85	5.59
1978	2.22	5.05	4.12	1.71	0	0	0	0	1.1	0	0.79	0.5	15.49
1979	2.19	1.61	1.16	0.03	0	0	0.04	0	0.08	0.41	0.62	0.41	6.55
1980	2.9	2.71	1.28	0.05	0.04	0	0	0	0	0.09	0	0.2	7.27
1981	1.77	0.86	2.1	0.68	0.17	0	0	0	0	0.76	1.08	0.29	7.71
1982	0.84	0.38	3.52	1.75	0	0.45	0.18	0	0.64	1.03	2.15	0.71	11.65

See Acronyms and Abbreviations list for definitions.

Table 3-1. Historical Hanford Precipitation (Inches), Tulare Lake Subbasin SGMA Model, Kings County, California (Continued)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1983	3.74	2.59	3.39	1.63	0.04	0	0	0.05	0.82	0.43	1.66	1.22	15.57
1984	0.01	0.42	0.27	0.18	0	0	0	0	0	M	M	M	M
1985	0.59	M	0.7	0.12	0	0	M	0	T	M	2.11	0.66	M
1986	1.46	2.6	3.43	0.5	0	0	T	T	0.15	0	0.21	0.77	9.12
1987	1.77	2.07	2.02	0.06	0.13	0.05	0	0	0	0.58	0.47	1.7	8.85
1988	1.37	0.4	0.93	1.99	0.07	0	0	0	0	0	1.31	2.29	8.36
1989	0.17	1.04	0.85	0.02	0.39	0	0	T	0.67	0.32	0.2	0	3.66
1990	1.66	1.1	0.3	0.97	0.87	0	T	T	T	0.01	0.22	0.15	5.28
1991	0.31	0.12	6.62	0.19	T	0.12	0	0	0.11	0.41	0.14	M	M
1992	1.4	2.82	0.85	0.1	T	0	0.01	0.01	T	0.58	T	2.62	8.39
1993	3.88	2.48	2.16	0.07	0.08	0.3	0	0	0	0.24	0.64	0.66	10.51
1994	0.94	1.45	1.02	0.72	0.66	0	T	0	1.06	0.35	1.54	0.33	8.07
1995	4.7	0.51	4.77	0.65	0.87	0.04	T	0	T	0	T	1.59	13.13
1996	1.68	2.89	2.27	0.85	0.1	T	0	0	0	2.43	0.69	3.27	14.18
1997	3.02	0.12	0.21	0	0	T	T	0	0.06	0.09	1.96	1.8	7.26
1998	2	4.05	2.63	1.68	1.31	0.44	0	0	T	0.68	0.63	0.65	14.07
1999	3.01	0.56	0.43	1.37	0	0	0	T	0.01	0	0.15	T	5.53
2000	1.8	3.28	1.59	0.97	0.48	0.35	0	0	0.03	1.31	T	0.05	9.86
2001	1.98	1.48	1.24	1.12	0	0	0.09	0	T	0.18	1.84	1.99	9.92
2002	0.87	0.31	1.04	0.03	0.01	0.82	0	0	0	0	1.42	1.14	5.64
2003	0.24	1.08	1.01	1.5	0.62	0	T	0.07	0	0	0.49	2	7.01
2004	2	2.18	0.29	0.02	0.01	0	0	0	0	2.06	0.52	2.23	9.31
2005	2.63	1.58	2.24	0.71	0.83	0	0	T	0.01	0.01	0.19	2.07	10.27
2006	3.54	0.55	2.72	3.39	0.53	0	0	0	0	0.06	0.22	1.01	12.02
2007	0.65	0.89	0.26	0.33	0.01	0	0	0.12	0.37	0.35	0.12	1.32	4.42
2008	2.18	1.18	T	0	0.11	0	0	0	0	0.15	1.04	1.49	6.15
2009	0.8	1.86	0.2	0.02	0.41	0.22	0	0	0.18	1.32	0.28	1.42	6.71
2010	2.64	1.91	0.34	1.65	0.17	0	0	0	0	0.64	1.32	6.46	15.13
2011	1.52	1.53	2.87	0.3	0.4	1.04	0	0.08	0.01	0.55	0.8	0.06	9.16

See Acronyms and Abbreviations list for definitions.

Table 3-1. Historical Hanford Precipitation (Inches), Tulare Lake Subbasin SGMA Model, Kings County, California (Continued)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	M	M	M	1.39	0.03	M	T	0	0	0.28	0.49	1.9	M
2013	0.22	0.48	0.79	0.08	0.17	0	0	0	0.01	T	0.33	0.16	M
2014	0.3	1.38	0.27	0.35	T	0	0	0	0.03	0	0.94	2.52	5.79
2015	0.08	0.72	0.02	0.77	0.1	0	0.45	0	0	0.38	0.91	1.4	4.83
2016	2.56	0.58	1.99	0.57	0.02	0.09	0	0	0	0.76	0.4	1.6	8.57
2017	3.7	2.8	0.31	1.02	0.36	0.01	0	0.01	0.17	0.06	0.21	0.08	8.73
Mean	1.59	1.5	1.47	0.75	0.25	0.09	0.01	0.01	0.15	0.38	0.82	1.24	8.28
Min	6.69	5.05	6.62	3.39	2.06	1.12	0.45	0.34	2.48	2.43	3.67	6.46	15.57
	1969	1978	1991	2006	1906	1931	2015	1964	1904	1996	1926	2010	1983
Max	0	0	0	0	0	0	0	0	0	0	0	0	3.37
	1948	1900	1972	2008	2018	2015	2017	2016	2016	2014	1980	1989	1947

Source: https://w2.weather.gov/climate/xmacis.php?wfo=hnx.

Notes:
M – Data missing
T – Trace precipitation

See Acronyms and Abbreviations list for definitions.

Table 3-2. Historical Land Use, Tulare Lake Subbasin SGMA Model, Kings County, California

Tulare Lake Subbasin	1990-1995 (Acres)	1996-1998 (Acres)	1999-2006 (Acres)	2007 (Acres)	2008 (Acres)	2009 (Acres)	2010 (Acres)	2011 (Acres)	2012 (Acres)	2013 (Acres)	2014 (Acres)	2015 (Acres)	2016 (Acres)	Average (Acres)
Tulare Lake Subbasin														
Alfalfa Hay and Clover	41,604	32,564	54,301	72,459	80,600	71,504	69,685	38,789	42,131	49,318	35,820	29,665	24,245	45,987
Almonds (Adolescent)			2,908			5,127	7,927	3,222	4,464	7,476	6,526	6,222	5,365	2,470
Almonds (Mature)	7,682	5,241	4,550	12,897	11,825	9,826	8,374	10,140	10,818	11,441	12,876	15,046	15,105	7,852
Almonds (Young)		3,278	9,290	16,538	25,966	14,678	20,887	13,968	14,564	20,341	17,678	16,983	21,576	9,557
Berries	20								1	2		0		5
Carrot Single Crop								11	5	12	2	2	16	2
Citrus (no ground cover)			25		13	14	4	120	29	100	89	22	9	21
Corn and Grain Sorghum	14,280	38,896	29,349	39,271	31,762	34,643	23,031	33,780	29,175	27,566	22,638	18,826	17,400	25,404
Cotton	159,534	180,960	124,764	109,605	88,304	72,441	98,167	105,541	88,993	89,317	63,385	44,532	73,720	118,794
Dairy Single Crop*	3,816	4,077	4,385											2,438
Fallow Land*	193,695	138,392	89,606	65,169	85,144	99,688	90,192	152,391	172,697	172,486	195,172	237,790	200,972	136,159
Forest*	420	809	2,955	6	5	46	5			1		4	0	952
Grain and Grain Hay	28,708	48,533	62,962	19,266	27,870	27,406	25,980	7,758	9,968	11,194	12,213	21,196	19,069	34,833
Melons	250	56	284				14	2	11	7	797	18	86	170
Misc. field crops	17,116	12,819	51,311		2			0			2			18,531
Onions and Garlic	457	479	770			7	1,358	411	302	94	502	149	644	483
Open Water*	5,568	9,092	8,968	5,576	4,296	4,049	5,434	7,703	5,443	5,045	6,824	5,919	5,435	6,637
Pasture and Misc. Grasses	2,500	5,029	5,615	50,688	44,232	66,944	53,080	14,680	13,368	15,355	33,551	15,744	13,743	14,473
Pistachio (Adolescent)								170	218	370	882	3,575	3,836	335
Pistachio (Mature)	4,694	3,808	3,804	6,096	1,907	934	404	394	380	348	330	485	469	2,888
Pistachio (Young)		1,580	4,390	4,351	4,259	8,527	8,083	12,985	14,676	15,878	19,195	22,678	22,570	6,247
Pomegranates (Adolescent)											3	16	27	2
Pomegranates (Young)				61	1,705	545	256	5,012	804	1,395	2,207	1,312	3,111	608
Potatoes, Sugar beets, Turnip etc..	5,736	1	209	6		3		9		41		2	2	1,331
Riparian*		668	1,120	517	134	398	615	226	138	313	239	248	194	477
Small Vegetables	1,599	647	4,518	20	2	13	212	142	133	244	165	78	198	1,643
Stone Fruit (Adolescent)			1,478			14	66	100	125	69	47	191	170	412
Stone Fruit (Mature)	7,070	4,985	3,854	1,314	544	168	18	3	23	41	23	27	39	3,206
Stone Fruit (Young)		1,827	4,185	672	1,609	1,573	2,502	1,077	712	1,641	1,340	1,183	713	1,770
Tomatoes and Peppers	5,634	1,627	14,676	117	2	110	12	21,482	23,670	7,114	11,922	19,211	23,420	9,203
Urban, Industrial*	12,654	17,391	19,875	33,427	34,711	44,471	32,218	32,091	28,576	29,366	33,901	30,530	30,930	22,128
Wine Grapes with 80% canopy	2,948	3,226	5,779	5,588	3,499	2,240	2,746	5,361	9,228	4,655	6,472	4,672	10,985	4,565
Winter Wheat*				72,238	67,458	50,451	64,526	48,212	45,118	44,530	30,950	19,420	21,690	17,207
Tulare Lake Subbasin Irrigated Crop Acreage	**299,832**	**345,557**	**389,021**	**338,951**	**324,102**	**316,717**	**322,806**	**275,156**	**263,796**	**264,018**	**248,665**	**221,837**	**256,519**	**310,792**
Tulare Lake Subbasin Total Crop Acreage	**515,986**	**515,986**	**515,931**	**515,883**	**515,849**	**515,821**	**515,796**	**515,779**	**515,768**	**515,759**	**515,751**	**515,747**	**515,741**	**496,788**

Notes: Fields with an Asterisk (*) are not Irrigated; Annual Total is by Calendar Year

See Acronyms and Abbreviations list for definitions.

Table 3-3. Generalized Stratigraphic Column for Tulare Lake Subbasin

System	Series	Geologic Unit		Lithologic Character	Maximum Thickness (feet)	Water-Bearing Character	Areas Where Important
QUATERNARY	Holocene	Tulare Formation	Flood Basin Deposits	Interbedded silt, clay, and fine sand. Interfingers with and age equivalent to Younger Alluvium.	<50	Poorly permeable, poor quality water, unconfined.	Not important source of water.
			Younger Alluvium	Interstratified and discontinuous beds of clay, silt, sand, and gravel, primarily located on recent alluvial fans and along stream channels. Interfingers with flood-basin and lake bed deposits.	0 - 100	Highly permeable, but largely unsaturated or seasonally saturated. Serves as conduit for recharge to underlying units.	May provide sufficient supplies for domestic and stock use where saturated.
	Pleistocene		Older Alluvium	Poorly to well sorted fine to coarse sand, gravel, silt and clay. Represents older alluvial fan material and contains well-developed soil profiles and hardpan horizons. Interfingers with lacustrine clays.	300 - 500	Moderately to highly permeable, unconfined and semiconfined. Yields large quantities of water to wells, major aquifer.	Important source of groundwater on eastern and northern portions of TLSB.
			Lacustrine Deposits	Corcoran Clay is extensive reduced clay formed in large fresh-water lake in late Pleistocene that extended throughout most of the San Joaquin Valley. Has been deformed across valley axis and has been dated at about 600,000 Ma.	50 - 200	Poorly permeable, forms major aquitard within San Joaquin Valley.	Occurs beneath nearly the entire TLSB, including Tulare Lake. Important aquitard on eastern and northern portions of TLSB.
				Tulare Lake bed clays are thick deposits that extend vertically from the surface beneath the former lake. These beds interfinger with alluvial and continental deposits to the east and west. Croft (1972) identified several of these interfingering lacustrine clay beds as the A-D and F clays. His E-clay is equivalent to the Corcoran Clay (above).	0 - 3,000	Poorly permeable, forms significant barrier to lateral groundwater flow in the TLSB and lateral tongues can form local confining conditions in alluvial and continental deposits.	Tulare Lake bed forms clay plug on western portion of TLSB. A and C clays are thin (10 - 60 feet) beds that may be important aquitards on the northern and eastern portions of TLSB.
TERTIARY	Pliocene		Continental Deposits, undifferentiated	Poorly to moderately sorted fine to medium sand, silt, gravel, and clay. Deposits may be reduced or oxidized. Provenance may be from Sierra Nevada or Coast Ranges. Sierran deposits typically arkosic and coarser grained than Coast Ranges deposits. Deposits from each provenance interfingering in an east-west line, depending upon major transgressive deposition from each mountain range.	2,000+	Poorly to moderately permeable, semi-confined to confined conditions. Yields significant quantities of groundwater, especially below Corcoran Clay.	Important source of groundwater on eastern and northern portions of TLSB and northwest and southeast of TLSB.
		San Joaquin Formation	Marine Deposits	Poorly sorted fine-grained sandstone, siltstone, and mudstone.	1,500+	Exposed in Kettleman Hills, dips steeply to east beneath Tulare formation. Semi-consolidated to consolidated, containing connate water of poor quality. Formation is poorly permeable and forms substantial aquitard at base of Tulare Formation.	No known beneficial uses of water, typical TDS of 3,000 to 20,000 mg/L.
		Etchegoin Formation	Marine Deposits	Silty and clayey sands, sandy silt, silty clay, blue sandstone, and conglomeratic sandstone.	3,000+	Exposed in Kettleman Hills, dips steeply to east beneath San Joaquin formation. Fine grained, interbedded nature, contains saline water.	No known wells into formation, not expected to be an aquifer.
	Miocene	Santa Margarita Formation	Marine Deposits	Fairly well-sorted to well-sorted gray sandstone.	0 - 600	Contains good quality water and yields significant water to wells for irrigation in places. However, sodium chloride front exists about 7 to 10 miles east of Highway 99.	Extensively used as aquifer in area from Terra Bella to Richgrove, east of Highway 99. Not an important aquifer in the TLSB.
	Eocene/Oligocene	Other Tertiary Sediments (undifferen-tiated)	Marine and Non-Marine Deposits		----	Few formations that contain usable water quality.	Too deep to be of concern in or near TLSB.
PRE-TERTIARY	Paleozoic/ Mesozoic	Metamorphic and Igneous Rocks	Basement Complex	Crystalline rocks of metamorphosed sedimentary and igneous rocks invaded by largely granitic plutonic rocks.	----	Largely impermeable, contain fractures, faults, and joints that may yield small quantities of water to domestic and stock wells.	Used as water source only in foothills and mountain areas of Sierra Nevada.

Notes: Generalized stratigraphic column after Hilton et al., 1963; Croft and Gordon, 1968; Davis et al., 1959; Loomis, 1990; and Wood, 2018.

See Acronyms and Abbreviations list for definitions.

Table 3-4. Annual Specified Well Field Pumping, Tulare Lake Subbasin SGMA Model, Kings County, California

Date	El Rico GSA Well Field (AF/Y)	Creighton Ranch Well Field (AF/Y)	Corcoran ID Well Field (AF/Y)	Angiola Well Field (AF/Y)	Westlands Well Field (AF/Y)	Municipal Well Fields (AF/Y)	Apex Ranch Well Field (AF/Y)
1990	70,716	27,222	87,977	34,500	67,131	9,370	--
1991	57,509	38,484	84,438	23,396	98,656	9,109	--
1992	80,012	27,255	72,348	33,494	98,344	9,666	--
1993	11,395	4,035	14,248	5,956	44,056	10,208	--
1994	48,043	17,986	78,297	16,389	72,674	10,928	--
1995	2,897	905	7,145	-	27,589	10,775	--
1996	-	-	20,261	-	28,516	12,719	--
1997	-	-	15,586	-	27,000	12,775	--
1998	-	-	2,484	-	20,988	11,555	--
1999	-	-	33,406	-	37,185	13,087	--
2000	14,910	2,849	40,672	6,784	43,392	13,421	--
2001	89,799	41,120	64,353	23,244	65,947	13,895	--
2002	68,933	35,843	64,736	26,537	66,530	26,701	-
2003	32,420	10,856	62,246	22,429	40,841	19,349	526
2004	82,875	47,511	74,007	26,805	42,115	18,777	912
2005	-	468	20,138	662	14,744	16,536	-
2006	-	72	14,034	141	16,526	15,822	6,939
2007	69,863	40,266	85,434	32,894	40,373	17,221	6,319
2008	92,269	52,980	79,362	32,502	63,519	18,432	5,435
2009	78,097	45,292	81,493	37,798	69,904	16,354	7,677
2010	36,129	17,740	29,669	22,568	34,895	15,271	6,345
2011	606	314	7,328	11,336	15,509	17,042	-
2012	95,154	52,325	70,008	19,388	55,298	17,467	9,044
2013	100,275	66,005	78,175	30,528	70,940	18,411	4,970
2014	108,976	68,726	69,880	27,695	94,077	16,930	298
2015	116,254	61,050	67,982	30,220	90,723	16,146	-
2016	126,886	53,113	67,982	29,047	93,853	14,555	-
1990-2016 Average	51,260	26,386	51,618	18,308	53,382	14,908	4,847
1998-2010 Average	43,484	22,692	50,156	17,874	42,843	16,648	4,879
Well Count	99	52	98	51	150	30	5

See Acronyms and Abbreviations list for definitions.

Table 3-5. Historical Kings River Diversions, Tulare Lake Subbasin SGMA Model, Kings County, California

	GSA	Mid Kings River					South Fork Kings							Southwest Kings										El Rico													Tri-County Water Authority										
	Agency	Peoples Ditch Company	Last Chance Water Ditch Co.				Stratford Irrigation District	Empire West Side Irrigation District			Lemoore Canal & Irrigation Company					Dudley Ridge Water District-Monthly Diversions Assumed																															
Kings River Water Years	Diversion	*Peoples Canal- MKRGSA Total*	*Last Chance Canal- MKRGSA Total*	*Lakeside IWD*	Imported Water	Mid Kings	Stratford Canal	Empire West Side ID total from SWP	Empire West Side Canal	Westlake Canal	Lemoore Canal	Imported Water	South Fork Kings River	*Blakeley Canal-Kings River & Lateral A*	TLBWSD Lateral C, T203	Dudley Ridge State Turnout (DR-1), T201	Dudley Ridge State Turnout (DR-1B), T202	Dudley Ridge State Turnout (DR-1A), T204	Dudley Ridge State Turnout (DR-2), T205	Dudley Ridge State Turnout (Paramount), T207	Dudley Ridge State Turnout (DR-3), T208	Imported Water, Angiola/Green Valley Well Fields, City of Lemoore and Westlands RD 761	Southwest Kings	*Empire Weir No. 2 (over #2 weir to river extension, River Water) Modified Total-(Empire Weir No. 2 minus Tri-County Kings River*	*TLBWSD Lateral A, T200 (State Water)-Modified Total-(SWP Total for Lateral A minus Tri-County Entitlement, Then 20% taken*	*TLBWSD Lateral B, T206 (State Water)-Modified Total-(SWP Total for Lateral B minus Tri-County Entitlement)*	Lakelands Canal-Total	Tulare Lake Canal	*Melga Canal-Diversion of Peoples Canal, El Rico GSA Total*	Kern River	*Deer Creek-30% of Deer Creek Total*	Tule River-El Rico	Kaweah River	*Loan Oak/New Deal- Diversion of Last Chance, El Rico GSA Total*	Imported Water	El Rico	Poso Creek	*TLBWSD Lateral A, T200 (State Water)-Assumed Full Entitlement-25% to Lateral A*	*TLBWSD Lateral B, T206 (State Water)-Assumed Full Entitlement-75% to Lateral B*	Tule River-Tri-County	*Deer Creek-70% of Deer Creek Total*	White River	Kings River-Tri-County	Other Water	Imported Water	Tri-County	Annual Totals
		(acre-feet per year)																																													
71%	1966	107,763	50,356	-	-	158,119	2,158	-	4,770	3,604	96,079	-	106,612	20,559	-	-	-	-	-	-	-	-	20,559	2,404	-	-	14,225	17,831	71,842	-	-	-	-	21,581	-	127,884	-	-	-	-	-	-	-	-	-	0	413,173
197%	1967	136,889	78,468	-	-	215,358	3,947	-	9,622	5,861	109,323	-	128,753	29,187	-	-	-	-	-	-	-	-	29,187	82,883	-	-	71,671	42,476	91,260	-	-	-	-	33,629	-	321,919	-	-	-	-	-	-	-	-	-	0	695,217
49%	1968	75,809	31,878	-	-	107,688	3,540	1,780	13,636	12,718	91,478	-	123,153	19,692	0	3,312	949	2,372	11,388	9	5,694	-	43,416	4,673	6,208	10,256	17,218	49,218	50,540	-	-	-	-	13,662	-	151,775	-	923	2,768	-	-	-	-	-	-	3,690	429,722
256%	1969	107,636	61,339	-	-	168,975	1,139	50	2,878	6,056	87,537	-	97,659	534	0	3,942	1,130	2,824	13,554	11	6,777	-	28,771	196,219	1,751	2,893	40,568	0	71,757	-	-	-	-	26,288	-	339,477	-	260	781	-	-	-	-	-	-	1,041	635,924
78%	1970	76,723	38,772	-	-	115,495	1,884	3,548	5,359	7,305	93,441	-	111,538	0	0	5,077	1,455	3,637	17,456	15	8,728	-	36,366	0	0	0	52,483	0	51,149	-	-	-	-	16,617	-	120,248	-	0	0	-	-	-	-	-	-	0	383,648
69%	1971	86,815	35,321	-	-	122,137	4,376	5,391	4,665	10,280	96,498	-	121,210	10,521	0	5,158	1,478	3,695	17,735	15	8,867	-	47,469	0	28,648	47,329	28,610	490	57,877	-	-	-	-	15,138	-	178,091	-	4,257	12,771	-	-	-	-	-	-	17,028	485,935
50%	1972	51,631	38,190	-	-	89,820	4,062	5,216	6,188	5,133	80,465	-	101,065	20,920	0	5,333	1,528	3,820	18,335	15	9,168	-	59,119	1,099	62,463	103,195	0	7,305	34,420	-	-	-	-	16,367	-	224,849	-	9,282	27,846	-	-	-	-	-	-	37,128	511,981
125%	1973	139,667	62,672	-	-	202,339	4,411	5,233	5,964	6,543	86,382	-	108,534	22,249	0	4,429	1,269	3,172	15,228	13	7,614	-	53,973	530	27,591	45,583	19,101	31,948	93,111	-	-	-	-	26,860	-	244,723	-	4,100	12,300	-	-	-	-	-	-	16,400	625,968
122%	1974	137,406	68,454	-	-	205,860	4,082	4,085	9,291	10,508	102,115	-	130,081	37,966	0	8,390	2,404	6,010	28,849	24	14,425	-	98,069	14,906	34,058	56,123	55,482	28,336	91,604	-	0	-	-	29,337	-	309,845	0	5,157	15,472	1,402	0	0	0	0	-	22,032	765,886
92%	1975	109,458	43,937	-	-	153,395	4,570	5,803	8,763	10,939	104,388	-	134,463	36,603	0	10,191	2,920	7,300	35,040	29	17,520	-	109,602	11,905	53,639	89,737	41,833	53,125	72,972	-	0	-	-	18,830	-	342,042	0	7,224	21,671	224	0	0	2,642	0	-	31,760	771,261
32%	1976	37,828	2,255	-	-	40,083	4,284	5,811	5,915	5,004	70,925	-	91,940	22,247	0	7,770	2,226	5,566	26,716	22	13,358	-	77,906	0	28,360	47,863	3,493	45,170	25,219	-	0	-	-	967	-	151,071	0	3,541	10,624	0	0	0	9,154	0	-	23,320	384,320
23%	1977	43,393	9,542	-	-	52,935	2,203	2,120	1,598	557	42,067	-	48,545	8,903	0	3,633	1,041	2,603	12,493	10	6,246	-	34,930	1,732	11,813	21,197	0	4,003	28,929	-	0	-	-	4,090	-	71,762	0	635	1,905	0	0	0	950	0	-	3,490	211,662
201%	1978	125,769	71,577	-	-	197,346	2,859	409	10,627	9,312	80,567	-	103,774	26,094	0	7,455	2,136	5,340	25,632	21	12,816	-	79,494	33,029	2,139	3,073	31,904	49,511	83,846	-	3,000	-	-	30,676	-	237,179	1,500	624	1,873	2,476	7,000	1,000	11,956	0	-	26,430	644,222
101%	1979	125,680	64,463	-	-	190,143	6,434	1,565	15,449	9,523	107,578	-	140,549	52,496	0	9,685	2,775	6,938	33,302	28	16,651	-	121,876	2,523	55,518	97,690	34,336	32,856	83,787	-	0	-	-	27,627	-	334,337	0	4,271	12,814	185	0	0	6,575	0	-	23,846	810,750
178%	1980	101,388	64,365	-	-	165,753	3,981	805	16,100	11,566	103,714	-	136,165	53,639	0	10,061	2,883	7,207	34,594	29	17,297	-	125,710	41,353	20,733	34,131	37,277	29,258	67,592	-	1,800	-	-	27,585	-	259,729	900	3,163	9,488	2,611	4,200	600	2,819	0	-	23,780	711,136
61%	1981	89,091	47,482	-	-	136,572	4,435	7,966	7,841	9,437	89,111	-	118,790	42,806	0	9,213	2,640	6,599	31,677	26	15,839	-	108,800	8,761	78,820	140,237	9,180	19,710	59,394	-	0	742	78,485	20,349	-	415,677	0	5,033	15,099	223	0	0	8,983	0	-	29,338	809,178
181%	1982	127,200	65,413	-	-	192,613	4,479	4,379	9,396	20,983	100,153	-	139,389	41,213	0	6,968	1,997	4,992	23,960	20	11,980	-	91,130	45,602	21,698	36,788	54,659	77,268	84,800	-	5,660	63,476	171,808	28,034	-	589,793	2,830	2,598	7,793	3,090	13,207	1,887	12,547	0	-	43,951	1,056,876
261%	1983	60,994	48,013	-	-	109,007	3,808	0	6,097	10,389	58,631	-	78,926	22,250	0	7,026	2,013	5,033	24,157	20	12,078	-	72,577	238,616	278	522	21,919	1,333	40,663	-	12,150	193,800	114,301	20,577	-	644,159	6,075	0	0	340	28,350	4,050	0	0	-	38,815	943,484
115%	1984	97,831	53,649	-	-	151,480	2,533	0	2,801	3,800	99,362	-	108,496	10,003	0	8,116	2,326	5,814	27,907	23	13,954	-	68,144	17,704	1,265	1,917	42,516	0	65,220	-	19,804	17,566	120,846	22,992	-	309,830	9,902	303	909	0	46,210	6,601	0	0	-	63,925	701,875

See Acronyms and Abbreviations list for definitions.

	GSA	Mid Kings River					South Fork Kings							Southwest Kings										El Rico													Tri-County Water Authority										
	Agency	Peoples Ditch Company	Last Chance Water Ditch Co.				Stratford Irrigation District	Empire West Side Irrigation District			Lemoore Canal & Irrigation Company					Dudley Ridge Water District-Monthly Diversions Assumed																															
Kings River Water Years	Diversion	*Peoples Canal- MKRGSA Total*	*Last Chance Canal- MKRGSA Total*	*Lakeside IWD*	Imported Water	Mid Kings	Stratford Canal	Empire West Side ID total from SWP	Empire West Side Canal	Westlake Canal	Lemoore Canal	Imported Water	South Fork Kings River	*Blakeley Canal-Kings River & Lateral A*	TLBWSD Lateral C, T203	Dudley Ridge State Turnout (DR-1), T201	Dudley Ridge State Turnout (DR-1B), T202	Dudley Ridge State Turnout (DR-1A), T204	Dudley Ridge State Turnout (DR-2), T205	Dudley Ridge State Turnout (Paramount), T207	Dudley Ridge State Turnout (DR-3), T208	Imported Water, Angiola/Green Valley Well Fields, City of Lemoore and Westlands RD 761	Southwest Kings	*Empire Weir No. 2 (over #2 weir to river extension, River Water) Modified Total-(Empire Weir No. 2 minus Tri-County Kings River*	*TLBWSD Lateral A, T200 (State Water)-Modified Total-(SWP Total for Lateral A minus Tri-County Entitlement, Then 20% taken*	*TLBWSD Lateral B, T206 (State Water)-Modified Total-(SWP Total for Lateral B minus Tri-County Entitlement)*	Lakelands Canal-Total	Tulare Lake Canal	*Melga Canal-Diversion of Peoples Canal, El Rico GSA Total*	Kern River	*Deer Creek-30% of Deer Creek Total*	Tule River-El Rico	Kaweah River	*Loan Oak/New Deal- Diversion of Last Chance, El Rico GSA Total*	Imported Water	El Rico	Poso Creek	*TLBWSD Lateral A, T200 (State Water)-Assumed Full Entitlement-25% to Lateral A*	*TLBWSD Lateral B, T206 (State Water)-Assumed Full Entitlement-75% to Lateral B*	Tule River-Tri-County	*Deer Creek-70% of Deer Creek Total*	White River	Kings River-Tri-County	Other Water	Imported Water	Tri-County	Annual Totals
		(acre-feet per year)																																													
73%	1985	105,362	39,583	-	-	144,944	4,869	4,677	5,209	6,827	103,148	-	124,731	34,288	0	7,791	2,232	5,581	26,788	22	13,394	-	90,096	16,118	49,527	84,042	20,108	29,821	70,241	-	0	367	73,859	16,964	-	361,048	0	5,881	17,644	826	0	0	1,586	0	-	25,937	746,756
190%	1986	111,962	62,457	-	-	174,419	7,329	2,070	7,345	16,723	87,761	-	121,227	27,361	0	6,427	1,841	4,604	22,098	18	11,049	-	73,398	28,395	23,163	41,528	50,896	51,205	74,641	-	5,144	43,384	71,918	26,767	-	417,043	2,572	1,269	3,806	1,701	12,004	1,715	11,054	0	-	34,121	820,207
45%	1987	70,406	24,792	-	-	95,198	5,177	3,961	4,959	10,982	90,541	-	115,620	28,582	0	5,816	1,666	4,166	19,996	17	9,998	-	70,242	18,250	35,048	60,441	27,104	57,023	46,938	-	0	0	44,445	10,625	-	299,874	0	3,517	10,550	0	0	0	9,366	0	-	23,432	604,366
48%	1988	60,312	21,844	-	-	82,156	3,953	3,128	4,457	2,949	76,554	-	91,041	21,261	0	6,030	1,728	4,319	20,733	17	10,367	-	64,456	8,209	23,389	40,544	18,863	17,816	40,208	-	0	0	25,873	9,362	-	184,264	0	2,207	6,622	0	0	0	984	0	-	9,814	431,730
53%	1989	60,579	19,935	-	-	80,514	0	2,700	0	-	56,519	-	59,219	13,458	0	7,168	2,054	5,134	24,645	21	12,323	-	64,802	0	44,142	75,859	7,458	0	40,386	-	0	0	24,550	8,544	-	200,939	0	4,605	13,814	150	0	0	0	1,580	-	20,149	425,623
40%	1990	53,292	9,909	-	-	63,201	0	2,979	0	-	34,465	-	37,444	6,485	0	4,606	1,320	3,299	15,836	13	7,918	14,540	54,016	0	21,271	37,168	15,114	0	35,528	-	0	0	39,853	4,247	-	153,181	0	1,810	5,430	0	0	0	0	4,556	-	11,796	319,638
63%	1991	45,654	18,622	-	-	64,276	1,760	199	1,006	964	31,492	-	35,420	5,941	0	1,670	479	1,196	5,743	5	2,871	8,181	26,085	344	1,536	2,855	6,143	2,870	30,436	-	0	0	28,897	7,981	-	81,060	0	16	49	604	0	0	1,604	0	-	2,274	209,115
41%	1992	49,394	9,361	-	-	58,755	1,759	1,219	0	0	37,968	-	40,945	6,003	0	1,696	486	1,215	5,831	5	2,915	6,095	24,245	0	19,688	35,181	0	0	32,930	-	279	0	23,442	4,012	-	115,532	140	1,156	3,469	0	652	93	0	0	-	5,510	244,987
149%	1993	147,363	53,498	-	-	200,860	5,070	2,467	4,314	8,612	91,166	-	111,629	30,546	0	2,917	836	2,090	10,031	8	5,016	6,480	57,925	25,174	31,782	58,745	66,990	44,555	68,050	-	101	0	108,379	22,928	-	426,703	50	565	1,694	1,155	235	34	6,919	2,575	-	13,226	810,344
50%	1994	69,510	30,738	-	-	100,248	2,997	1,499	3,808	6,811	76,550	-	91,666	26,295	0	3,834	1,099	2,747	13,184	11	6,592	11,642	65,404	15,625	15,834	28,204	0	49,718	38,072	-	0	0	28,376	-	-	175,829	0	990	2,970	0	0	0	6,098	0	-	10,058	443,205
202%	1995	143,785	102,300	-	-	246,085	6,123	1,468	6,419	1,410	85,049	-	100,469	34,039	0	5,715	1,637	4,094	19,650	16	9,825	8,131	83,107	51,722	34,276	59,720	52,969	48,240	75,670	-	2,285	13,777	149,232	-	-	487,891	1,142	3,032	9,095	6,040	5,331	762	4,902	0	-	30,303	947,854
122%	1996	166,765	95,338	-	-	262,103	6,774	1,681	5,576	5,778	105,398	-	125,206	41,813	0	6,886	1,973	4,933	23,677	20	11,839	14,505	105,645	33,027	60,026	107,966	61,767	36,006	81,522	-	1,847	236	139,238	-	-	521,635	924	3,055	9,165	1,913	4,311	616	2,219	0	-	22,202	1,036,790
155%	1997	133,158	85,505	20,657	-	239,321	7,460	0	8,239	2,079	89,117	-	106,896	25,259	0	7,895	2,262	5,655	27,146	23	13,573	11,319	93,132	19,089	5,679	2,107	32,557	25,047	65,232	-	9,220	40,122	66,638	-	-	265,690	4,610	1,895	5,684	1,701	21,513	3,073	4,729	0	-	43,206	748,244
181%	1998	141,107	77,863	29,871	-	248,841	5,578	488	4,596	8,447	75,590	-	94,698	17,157	3,528	6,955	1,993	4,982	23,916	20	11,958	11,348	81,857	4,514	5,745	17,487	32,918	16,707	75,570	-	5,590	26,731	58,340	-	-	243,601	2,795	1,057	3,171	2,083	13,042	1,863	50	0	-	24,061	693,058
74%	1999	101,773	62,938	12,119	-	176,830	4,971	2,858	6,135	3,624	95,504	-	113,092	25,132	0	7,958	2,280	5,701	27,363	23	13,681	10,280	92,418	4,359	59,502	140,451	8,184	13,492	49,810	-	0	2,235	51,184	-	-	329,217	0	95	286	274	0	0	167	0	-	822	712,379
90%	2000	108,835	82,526	13,181	-	204,541	4,598	1,619	2,184	4,566	99,074	-	112,041	21,426	0	7,397	2,119	5,299	25,433	21	12,717	10,299	84,711	16,796	39,928	86,346	35,062	33,304	56,416	-	871	2,900	48,050	-	-	319,674	435	3,935	11,804	1,166	2,032	290	0	0	-	19,663	740,630
59%	2001	73,419	31,031	7,017	-	111,467	4,959	1,674	1,993	2,680	58,979	-	70,285	11,377	0	6,030	1,728	4,319	20,732	17	10,366	10,306	64,875	21,146	21,658	39,067	2,122	38,045	38,433	-	0	8	20,131	-	-	180,610	0	1,027	3,082	0	0	0	3,044	3,000	-	10,154	437,390
67%	2002	99,376	52,020	5,354	-	156,751	4,104	1,265	1,364	2,202	74,196	-	83,131	13,083	0	6,930	1,986	4,964	23,828	20	11,914	10,291	73,016	14,150	20,707	33,324	46,842	7,942	45,043	-	0	490	73,770	-	-	242,267	0	2,004	6,011	124	0	0	0	190	-	8,329	563,493
83%	2003	104,545	54,735	13,325	-	172,605	4,356	1,292	752	3,362	63,511	-	73,273	8,256	0	6,657	1,907	4,768	22,888	19	11,444	10,359	66,299	13,153	14,887	44,894	36,750	45,168	48,228	-	0	1,748	49,413	-	-	254,241	0	2,152	6,455	790	0	0	6,652	160	-	16,209	582,626
61%	2004	79,743	27,306	5,667	-	112,717	2,019	3,206	1,650	1,480	58,257	-	66,611	12,382	0	6,383	1,829	4,572	21,946	18	10,973	10,072	68,176	17,145	22,857	42,460	40,917	16,768	40,719	-	0	1,106	59,030	-	-	241,003	0	265	795	559	0	0	0	5,293	-	6,912	495,419

See Acronyms and Abbreviations list for definitions.

	GSA	Mid Kings River					South Fork Kings							Southwest Kings										El Rico													Tri-County Water Authority										
	Agency	Peoples Ditch Company	Last Chance Water Ditch Co.				Stratford Irrigation District	Empire West Side Irrigation District			Lemoore Canal & Irrigation Company					Dudley Ridge Water District-Monthly Diversions Assumed																															
Kings River Water Years	Diversion	*Peoples Canal- MKRGSA Total*	*Last Chance Canal- MKRGSA Total*	*Lakeside IWD*	Imported Water	Mid Kings	Stratford Canal	Empire West Side ID total from SWP	Empire West Side Canal	Westlake Canal	Lemoore Canal	Imported Water	South Fork Kings River	*Blakeley Canal-Kings River & Lateral A*	TLBWSD Lateral C, T203	Dudley Ridge State Turnout (DR-1), T201	Dudley Ridge State Turnout (DR-1B), T202	Dudley Ridge State Turnout (DR-1A), T204	Dudley Ridge State Turnout (DR-2), T205	Dudley Ridge State Turnout (Paramount), T207	Dudley Ridge State Turnout (DR-3), T208	Imported Water, Angiola/Green Valley Well Fields, City of Lemoore and Westlands RD 761	Southwest Kings	*Empire Weir No. 2 (over #2 weir to river extension, River Water) Modified Total-(Empire Weir No. 2 minus Tri-County Kings River*	*TLBWSD Lateral A, T200 (State Water)-Modified Total-(SWP Total for Lateral A minus Tri-County Entitlement, Then 20% taken*	*TLBWSD Lateral B, T206 (State Water)-Modified Total-(SWP Total for Lateral B minus Tri-County Entitlement)*	Lakelands Canal-Total	Tulare Lake Canal	*Melga Canal-Diversion of Peoples Canal, El Rico GSA Total*	Kern River	*Deer Creek-30% of Deer Creek Total*	Tule River-El Rico	Kaweah River	*Loan Oak/New Deal- Diversion of Last Chance, El Rico GSA Total*	Imported Water	El Rico	Poso Creek	*TLBWSD Lateral A, T200 (State Water)-Assumed Full Entitlement-25% to Lateral A*	*TLBWSD Lateral B, T206 (State Water)-Assumed Full Entitlement-75% to Lateral B*	Tule River-Tri-County	*Deer Creek-70% of Deer Creek Total*	White River	Kings River-Tri-County	Other Water	Imported Water	Tri-County	Annual Totals
		(acre-feet per year)																																													
148%	2005	131,193	54,799	24,547	-	210,539	5,619	3,451	2,664	1,946	98,279	-	111,958	24,480	0	7,366	2,111	5,276	25,327	21	12,663	11,115	88,360	73,872	27,755	75,546	42,290	64,243	67,430	-	1,767	2,372	86,750	-	-	442,024	884	116	347	1,680	4,123	589	10,632	1,235	-	19,605	872,486
172%	2006	129,571	65,459	24,718	-	219,748	6,065	2,954	5,417	2,368	96,857	-	113,661	34,147	0	7,766	2,225	5,563	26,702	22	13,351	11,115	100,891	70,800	22,444	52,463	80,614	74,920	69,623	-	2,392	17,135	171,601	-	-	561,992	1,196	126	378	795	5,581	797	14,253	0	-	23,126	1,019,418
40%	2007	84,144	20,918	3,312	-	108,374	4,836	1,876	3,810	4,727	70,288	-	85,536	25,308	0	6,090	1,745	4,363	20,940	17	10,470	9,975	78,909	21,586	20,496	39,927	17,889	31,676	46,218	-	0	153	39,474	-	-	217,420	0	50	149	0	0	0	18,083	63	-	18,345	508,584
72%	2008	81,364	29,000	6,764	-	117,128	2,037	852	1,470	1,081	59,988	-	65,428	10,209	0	5,292	1,516	3,791	18,195	15	9,097	10,016	58,131	9,553	9,155	11,833	8,051	5,282	41,851	-	0	158	37,662	-	-	123,545	0	156	468	828	0	0	4,756	0	-	6,208	370,440
79%	2009	85,743	30,617	5,829	-	122,189	2,047	148	1,811	1,771	49,297	-	55,074	7,997	0	3,982	1,141	2,852	13,691	11	6,846	12,178	48,699	855	8,865	13,750	22,036	99	43,482	-	0	1,383	62,389	-	-	152,859	0	7	21	0	0	0	0	0	-	28	378,849
121%	2010	113,146	42,817	16,103	-	172,066	4,318	2,545	3,644	2,900	90,694	-	104,101	17,655	0	4,144	1,187	2,969	14,249	12	7,125	42,300	89,641	34,789	9,185	32,026	38,210	37,297	55,771	-	0	5,059	102,754	-	-	315,091	0	2	7	1,676	0	0	10,587	282	-	12,555	693,453
180%	2011	163,801	79,589	23,764	-	267,154	4,979	1,364	4,625	4,947	109,605	-	125,519	43,781	0	3,373	966	2,416	11,597	10	5,799	34,012	101,953	89,121	13,902	25,964	88,052	78,409	83,250	-	0	11,316	140,553	-	-	530,567	0	68	205	-	0	0	0	-	-	273	1,025,466
49%	2012	80,025	30,309	4,595	-	114,929	4,203	1,151	4,594	2,289	71,207	-	83,443	22,689	0	2,775	795	1,988	9,543	8	4,771	51,435	94,006	24,964	16,910	43,921	3,483	15,977	39,616	-	0	200	60,683	-	-	205,755	0	57	170	-	0	0	0	-	-	227	498,360
41%	2013	49,246	12,881	110	-	62,236	0	536	0	0	43,206	-	43,741	3,284	0	3,591	1,029	2,572	12,346	10	6,173	19,602	48,606	0	10,771	13,062	58,140	0	27,281	-	-	-	-	-	-	109,253	0	58	174	-	0	0	0	-	-	232	264,069
32%	2014	27,801	8,824	0	-	36,626	0	158	0	0	17,905	-	18,062	567	0	2,136	612	1,530	7,345	6	3,672	23,852	39,720	0	1,858	3,681	41,472	0	12,461	-	-	-	-	-	-	59,473	0	38	115	-	0	0	0	-	-	154	154,035
21%	2015	12,430	-	0	-	12,430	0	326	0	0	14,759	-	15,085	184	0	3,271	937	2,343	11,247	9	5,623	31,718	55,333	0	605	0	21,076	0	2,493	-	-	-	-	-	-	24,175	0	45	0	-	0	0	0	-	-	45	107,068
75%	2016	67,310	20,567	2,986	-	90,863	0	-	0	0	42,532	-	42,532	-	-	-	-	-	-	-	-	34,248	34,248	0	-	-	32,114	0	27,677	-	-	-	-	-	-	59,791	0			-	0	0	0	-	-	0	227,433
204%	2017	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Annual Averages	93,943	44,985	4,312		143,240	3,669	2,156	4,804	5,315	77,554		93,499	20,737	68	5,535	1,586	3,965	19,033	16	9,516	8,734	69,598	26,210	21,684	40,175	31,229	26,107	54,847	0	1,383	8,586	45,614	10,052		268,189	705	1,816	5,446	666	3,227	470	3,333	364		16,175	590,701

Notes provided on next page.

See Acronyms and Abbreviations list for definitions.

1.) Values highlighted have been modified.
2.) Values with "0" indicate no surface water delivery to the best of our knowledge.
3.) Values with "-" have no verified data.
4.) Total flow from Peoples Canal is split 60% to Mid Kings, 40% to Melga.
5.) Last Chance Diversion is split 50% between Mid Kings and El Rico.
6.) Blakeley has added State Water from Lateral A for Southwest.
7.) Total flow from Deer Creek split 30% to El Rico, 70% to Tri-County.
8.) Tule River for El Rico includes the total of Elk Bayou and TID Spill.
8.) SWP from TLBWSD Split Throughout Tri-County & Southwest Kings.
9.) Kings River water in Tri-County was subtracted from the total in Empire Weir No. 2. 1976 and 2010 are 0 for Empire Weir No. 2 because of negative values.
10.) Lakeside is a portion of Kaweah River, Reduced Total Kaweah River between Mid Kings and El Rico
11.) Additional Tule River flow data added for Tri-County
12.) Empire West Side ID total from SWP reduce annual totals by 10%
13.) Dudley Ridge Water District reduce annual totals by 10%
14.) Lateral A (T200) & Lateral B (T206) reduce annual totals by 18% for El Rico & Tri-County
15.) Modifications to Peoples Canal and Last Chance as a result of discussions with Mid Kings River GSA 02/14/2019

Key	Average Annual
Wet Year	816,660
Dry Year	423,464
Average Precipitation	686,577
GSA Annual Totals	
Kings River Watershed Total	

Reduction in Entitlement	
Empire West Side ID Total from SWP	10%
Dudley Ridge State Turnouts	10%
Lateral A & B for El Rico & Tri-County	18%

See Acronyms and Abbreviations list for definitions.

Table 3-6A. 1990 - 2016 Historical Water Balance Total Subbasin, Tulare Lake Subbasin SGMA Model, Kings County, California

Date	Tulare Lake Drain Net (AF/Y)	Tulare Lake GHB Net (AF/Y)	Tulare Lake Well Net (AF/Y)	Tulare Lake River Net (AF/Y)	Tulare Lake Lake Net (AF/Y)	Tulare Lake Recharge Net (AF/Y)	Tulare Lake Farm Demand (AF/Y)	Tulare Lake Storage Net (AF/Y)	Tulare Lake Net Subsurface Inflow (AF/Y)	Tulare Lake Net Subsurface Outflow (AF/Y)	Tulare Lake Westside Net (AF/Y)	Tulare Lake Kings Net (AF/Y)	Tulare Lake Kaweah Net (AF/Y)	Tulare Lake Tule Net (AF/Y)	Tulare Lake Kern Net (AF/Y)	Tulare Lake Mid-Kings Net (AF/Y)	Tulare Lake El Rico Net (AF/Y)	Tulare Lake South Fork Net (AF/Y)	Tulare Lake Southwest Net (AF/Y)	Tulare Lake TCWA Net (AF/Y)	Tulare Lake Total Net (AF/Y)	Cumulative Delta Storage (AF)
1990	0	0	-618,843	212,023	0	150,920	-1,065,856	-185,926	181,209	-111,280	23,632	4,815	-3,467	-12,024	56,971	298	-6,672	5,316	22,658	-21,601	298	-185,926
1991	0	0	-577,240	164,892	0	135,941	-994,832	-224,464	164,488	-112,589	13,271	9,747	4,376	-14,187	38,693	-1,273	-6,163	2,959	24,852	-20,376	-1,273	-410,391
1992	0	0	-596,994	125,681	0	139,491	-1,012,909	-290,389	160,839	-119,495	11,225	10,812	2,987	-18,583	34,904	-245	-10,703	4,143	26,835	-20,030	-245	-700,780
1993	0	0	-248,824	231,839	0	167,981	-1,008,709	157,279	128,914	-122,683	7,344	-4,219	-20,133	-13,496	36,736	1,631	-6,528	-857	24,396	-18,642	1,631	-543,501
1994	-26	0	-491,956	139,080	0	173,457	-1,047,937	-168,707	135,909	-125,412	7,647	1,210	-8,114	-20,670	30,426	-2,370	-4,557	2,695	23,956	-19,723	-2,370	-712,208
1995	-82	0	-188,622	200,925	0	235,917	-973,503	231,421	113,880	-130,598	5,564	-14,723	-26,071	-14,705	33,217	8,131	-6,163	-10,023	24,809	-16,753	8,131	-480,786
1996	-251	0	-195,586	177,508	0	238,753	-1,067,962	186,481	102,129	-136,119	6,788	-17,826	-32,867	-19,334	29,250	12,774	1,109	-16,866	23,951	-20,968	12,774	-294,305
1997	-1,392	0	-278,726	162,833	0	252,651	-1,123,726	100,786	104,214	-139,610	10,524	-17,146	-36,466	-21,396	29,090	11,582	1,267	-17,016	25,376	-21,209	11,582	-193,519
1998	-1,870	0	-249,086	165,955	0	266,380	-1,059,009	153,536	105,817	-134,203	13,146	-18,649	-31,067	-21,177	29,362	13,428	145	-19,305	26,305	-20,573	13,428	-39,983
1999	-7,376	0	-338,241	159,660	0	201,878	-1,232,448	522	120,686	-141,114	15,099	-12,823	-38,853	-23,234	39,384	8,567	5,298	-17,001	26,326	-23,190	8,567	-39,461
2000	-17,343	0	-260,726	147,624	0	172,534	-1,127,412	43,638	116,391	-130,053	9,202	-14,008	-24,256	-20,878	36,279	12,669	-1,467	-16,122	26,034	-21,114	12,669	4,177
2001	-13,351	0	-467,326	108,934	0	119,202	-1,111,506	-243,059	128,384	-130,759	7,046	-8,208	-10,602	-19,402	28,791	13,602	-4,429	-14,996	27,329	-21,506	13,602	-238,882
2002	-10,253	0	-435,270	150,502	0	128,082	-1,201,455	-178,393	122,597	-142,986	4,116	-14,310	-17,484	-22,160	29,448	17,210	-4,785	-18,209	28,055	-22,272	17,210	-417,275
2003	-8,170	0	-385,602	145,737	0	157,010	-1,198,411	-101,083	124,533	-140,750	7,968	-14,505	-16,849	-23,580	30,749	18,229	-2,895	-22,651	29,364	-22,046	18,229	-518,358
2004	-20,849	0	-494,263	137,236	0	138,732	-1,162,011	-231,122	125,398	-137,076	7,475	-13,320	-9,952	-24,296	28,416	13,215	-6,077	-14,260	29,378	-22,256	13,215	-749,480
2005	-5,413	0	-217,488	150,074	0	227,638	-1,155,548	121,017	101,739	-138,073	4,993	-20,418	-30,344	-20,294	29,728	13,527	-585	-19,200	27,026	-20,768	13,527	-628,463
2006	-9,651	0	-205,429	138,230	0	339,860	-1,129,741	220,649	94,159	-142,864	4,446	-22,451	-40,403	-20,192	29,895	14,152	1,839	-20,925	24,221	-19,288	14,152	-407,814
2007	-14,999	0	-474,153	137,542	0	123,827	-1,183,096	-248,490	109,552	-142,905	7,330	-14,948	-17,451	-25,274	16,990	13,841	2,341	-15,691	26,046	-26,536	13,841	-656,305
2008	-13,795	0	-515,546	126,421	0	117,419	-1,083,093	-296,277	119,872	-143,019	1,856	-12,181	-14,428	-21,584	23,191	15,124	1,866	-14,493	28,346	-30,843	15,124	-952,581
2009	-4,295	0	-456,641	133,032	0	135,636	-1,091,697	-213,010	118,378	-142,215	-1,793	-15,575	-2,407	-18,590	14,527	18,226	6,659	-21,735	28,060	-31,210	18,226	-1,165,591
2010	-2,440	0	-249,776	129,805	0	171,969	-1,016,725	13,129	101,421	-138,727	-5,091	-25,818	-13,379	-16,097	23,078	17,294	7,760	-18,014	26,354	-33,394	17,294	-1,152,462
2011	-4,486	0	-77,680	147,432	0	355,590	-791,090	361,228	83,220	-144,621	-6,641	-38,331	-35,573	-11,696	30,840	15,170	-5,654	-15,516	22,355	-16,355	15,170	-791,234
2012	-3,226	0	-357,301	111,314	0	120,601	-776,133	-169,947	99,000	-141,994	-6,733	-25,065	-25,720	-10,775	25,299	16,520	-4,782	-14,082	22,062	-19,718	16,520	-961,181
2013	-8,381	0	-455,726	99,564	0	90,038	-826,405	-305,607	105,083	-143,219	-9,909	-18,283	-18,315	-13,933	22,304	14,998	-4,112	-12,022	24,044	-22,907	14,998	-1,266,788
2014	-3,579	0	-508,253	82,742	0	107,427	-757,265	-360,352	110,508	-151,969	-11,151	-13,313	-18,684	-18,842	20,529	15,626	2,274	-17,973	26,111	-26,037	15,626	-1,627,140
2015	-829	0	-524,338	60,439	0	99,444	-624,647	-392,279	114,003	-141,493	-10,951	-10,641	-15,502	-15,383	24,986	13,276	-5,612	-12,806	26,751	-21,609	13,276	-2,019,419
2016	-2,497	0	-428,423	69,718	0	123,037	-677,936	-294,325	102,102	-160,350	-9,455	-33,115	-23,497	-14,438	22,257	16,359	-11,753	-11,101	26,620	-20,125	-2,088	-2,313,744
1990-2016 Average	-5,724	0	-381,410	141,361	0	173,756	-1,018,558	-85,694	83,220	-111,280	3,961	-13,826	-19,427	-18,379	29,457	11,539	-2,310	-12,806	25,838	-22,261	10,856	-720,867
1998-2010 Average	-9,985	0	-365,350	140,827	0	176,936	-1,134,781	-73,765	181,209	-160,350	5,830	-15,939	-20,575	-21,289	27,680	14,545	436	-17,893	27,142	-24,230	14,545	-535,575

See Acronyms and Abbreviations list for definitions.

Table 3-6B. 1990 - 2016 Historical Water Balance Upper Aquifer, Tulare Lake Subbasin SGMA Model, Kings County, California

Date	Tulare Lake Drain Net (AF/Y)	Tulare Lake GHB Net (AF/Y)	Tulare Lake Well Net (AF/Y)	Tulare Lake River Net (AF/Y)	Tulare Lake Lake Net (AF/Y)	Tulare Lake Recharge Net (AF/Y)	Tulare Lake ET Net (AF/Y)	Tulare Lake Storage Net (AF/Y)	Tulare Lake Net Subsurface Inflow (AF/Y)	Tulare Lake Net Subsurface Outflow (AF/Y)	Tulare Lake Westside Net (AF/Y)	Tulare Lake Kings Net (AF/Y)	Tulare Lake Kaweah Net (AF/Y)	Tulare Lake Tule Net (AF/Y)	Tulare Lake Kern Net (AF/Y)	Tulare Lake Mid-Kings Net (AF/Y)	Tulare Lake El Rico Net (AF/Y)	Tulare Lake South Fork Net (AF/Y)	Tulare Lake Southwest Net (AF/Y)	Tulare Lake TCWA Net (AF/Y)	Tulare Lake Total Net (AF/Y)	Cumulative Delta Storage (AF)
1990	0	0	-363,970	212,023	0	150,920	0	-392,438	60,944	-52,493	10,293	-6,068	2,356	-2,438	4,309	-8,770	7,916	7,068	3,123	-9,337	-8,770	-392,438
1991	0	0	-351,785	164,892	0	135,941	0	-379,415	59,832	-44,466	9,849	-337	6,851	-3,950	2,953	-8,028	6,401	5,211	3,601	-7,185	-8,028	-771,853
1992	0	0	-345,307	125,681	0	139,491	0	-379,874	58,304	-43,733	9,211	1,619	7,092	-5,396	2,045	-6,955	5,529	3,812	3,711	-6,097	-6,955	-1,151,727
1993	0	0	-239,755	231,839	0	167,981	0	-117,785	51,892	-42,526	7,943	-136	4,801	-4,918	1,676	-4,786	5,130	2,368	3,440	-6,153	-4,786	-1,269,512
1994	-26	0	-310,055	139,080	0	173,457	0	-255,820	52,755	-44,438	7,097	625	5,581	-6,383	1,398	-4,950	4,717	2,121	3,471	-5,360	-4,950	-1,525,332
1995	-82	0	-205,637	200,925	0	235,917	0	-23,977	45,868	-50,708	5,953	-9,550	3,591	-6,120	1,286	-2,716	3,395	746	3,431	-4,856	-2,716	-1,549,309
1996	-251	0	-184,321	177,508	0	238,753	0	-4,023	42,064	-47,154	5,561	-7,356	979	-5,613	1,340	-1,526	3,881	-427	3,567	-5,495	-1,526	-1,553,331
1997	-1,392	0	-204,969	162,833	0	252,651	0	-15,247	40,618	-50,417	5,470	-9,442	-1,210	-5,876	1,259	-791	3,397	-1,403	3,400	-4,603	-791	-1,568,578
1998	-1,870	0	-191,289	165,955	0	266,380	0	17,175	38,754	-55,626	5,112	-14,784	-2,171	-6,255	1,226	-228	3,124	-2,136	3,467	-4,226	-228	-1,551,403
1999	-7,376	0	-227,049	159,660	0	201,878	0	-71,374	41,389	-47,970	5,311	-6,241	-1,422	-5,855	1,627	44	3,916	-2,399	3,599	-5,159	44	-1,622,778
2000	-17,343	0	-201,799	147,624	0	172,534	0	-76,900	41,391	-44,741	5,135	-5,270	889	-6,253	2,149	713	3,385	-2,978	3,773	-4,892	713	-1,699,678
2001	-13,351	0	-264,888	108,934	0	119,202	0	-222,719	44,167	-45,556	5,150	-3,924	1,956	-6,748	2,177	215	3,431	-2,996	3,872	-4,521	215	-1,922,397
2002	-10,253	0	-272,312	150,502	0	128,082	0	-174,685	46,006	-45,147	4,999	-2,792	3,355	-6,755	2,052	-373	3,874	-2,666	3,785	-4,620	-373	-2,097,082
2003	-8,170	0	-255,270	145,737	0	157,010	0	-133,547	45,798	-46,552	4,757	-3,317	2,678	-6,922	2,049	-308	4,005	-2,944	3,826	-4,578	-308	-2,230,628
2004	-20,849	0	-279,593	137,236	0	138,732	0	-181,729	46,099	-46,854	4,686	-2,691	2,602	-7,402	2,050	-688	3,857	-2,647	3,846	-4,368	-688	-2,412,358
2005	-5,413	0	-194,492	150,074	0	227,638	0	516	41,121	-48,908	4,301	-5,838	-1,307	-7,087	2,145	212	3,616	-3,177	3,796	-4,447	212	-2,411,841
2006	-9,651	0	-174,179	138,230	0	339,860	0	117,742	37,534	-56,025	3,971	-11,267	-6,576	-6,948	2,329	1,405	2,956	-3,767	3,678	-4,271	1,405	-2,294,099
2007	-14,999	0	-264,654	137,542	0	123,827	0	-177,972	42,192	-52,530	4,404	-5,195	-3,761	-7,669	1,883	385	3,549	-3,225	3,501	-4,210	385	-2,472,071
2008	-13,795	0	-283,431	126,421	0	117,419	0	-210,701	43,266	-49,766	4,321	-3,743	-38	-8,161	1,122	-622	4,068	-2,880	3,259	-3,825	-622	-2,682,773
2009	-4,295	0	-268,843	133,032	0	135,636	0	-170,773	43,877	-49,818	4,722	-3,492	961	-8,469	338	-626	4,176	-3,145	3,179	-3,584	-626	-2,853,545
2010	-2,440	0	-187,770	129,805	0	171,969	0	-56,332	37,974	-47,711	3,677	-4,768	-334	-8,179	-134	400	3,717	-3,559	3,094	-3,653	400	-2,909,877
2011	-4,486	0	-126,313	147,432	0	355,590	0	197,345	32,182	-58,840	2,822	-16,373	-6,573	-6,907	374	2,222	2,629	-4,345	3,147	-3,652	2,222	-2,712,533
2012	-3,226	0	-205,013	111,314	0	120,601	0	-137,135	34,819	-52,627	2,733	-7,480	-6,645	-7,386	969	1,491	2,935	-4,085	3,111	-3,452	1,491	-2,849,668
2013	-8,381	0	-252,639	99,564	0	90,038	0	-222,003	38,673	-50,934	3,106	-4,297	-4,573	-7,569	1,071	520	3,719	-3,772	3,013	-3,481	520	-3,071,671
2014	-3,579	0	-276,394	82,742	0	107,427	0	-247,305	41,277	-51,497	3,633	-2,586	-3,508	-8,263	503	-96	3,951	-3,688	2,996	-3,163	-96	-3,318,976
2015	-829	0	-283,699	60,439	0	99,444	0	-286,779	41,875	-50,653	3,580	-1,050	-3,164	-8,423	279	-674	3,899	-3,598	3,107	-2,734	-674	-3,605,754
2016	-2,497	0	-248,557	69,718	0	123,037	0	-234,011	36,829	-60,070	3,401	-14,540	-4,136	-8,370	403	-321	3,744	-3,738	3,005	-2,691	-2,088	-3,839,765
1990-2016 Average	-5,724	0	-246,814	141,361	0	173,756	0	-142,214	32,182	-42,526	5,230	-5,566	-64	-6,678	1,514	-1,291	4,034	-1,565	3,437	-4,615	-1,356	-2,160,777
1998-2010 Average	-9,985	0	-235,813	140,827	0	176,936	0	-103,177	60,944	-60,070	4,658	-5,640	-244	-7,131	1,616	41	3,667	-2,963	3,590	-4,335	41	-2,243,118

See Acronyms and Abbreviations list for definitions.

Table 3-6C. 1990 - 2016 Historical Water Balance Lower Aquifer, Tulare Lake Subbasin SGMA Model, Kings County, California

Date	Tulare Lake Drain Net (AF/Y)	Tulare Lake GHB Net (AF/Y)	Tulare Lake Well Net (AF/Y)	Tulare Lake River Net (AF/Y)	Tulare Lake Lake Net (AF/Y)	Tulare Lake Recharge Net (AF/Y)	Tulare Lake ET Net (AF/Y)	Tulare Lake Storage Net (AF/Y)	Tulare Lake Net Subsurface Inflow (AF/Y)	Tulare Lake Net Subsurface Outflow (AF/Y)	Tulare Lake Westside Net (AF/Y)	Tulare Lake Kings Net (AF/Y)	Tulare Lake Kaweah Net (AF/Y)	Tulare Lake Tule Net (AF/Y)	Tulare Lake Kern Net (AF/Y)	Tulare Lake Mid-Kings Net (AF/Y)	Tulare Lake El Rico Net (AF/Y)	Tulare Lake South Fork Net (AF/Y)	Tulare Lake Southwest Net (AF/Y)	Tulare Lake TCWA Net (AF/Y)	Tulare Lake Total Net (AF/Y)	Cumulative Delta Storage (AF)
1990	0	0	-254,873	0	0	0	0	206,511	120,265	-58,787	13,339	10,884	-5,823	-9,586	52,663	9,068	-14,587	-1,752	19,535	-12,264	9,068	206,511
1991	0	0	-225,455	0	0	0	0	154,951	104,657	-68,123	3,422	10,084	-2,475	-10,237	35,740	6,755	-12,564	-2,252	21,251	-13,191	6,755	361,463
1992	0	0	-251,686	0	0	0	0	89,485	102,535	-75,762	2,013	9,193	-4,106	-13,187	32,859	6,710	-16,232	331	23,124	-13,932	6,710	450,947
1993	0	0	-9,069	0	0	0	0	275,064	77,023	-80,157	-600	-4,082	-24,934	-8,578	35,060	6,416	-11,659	-3,226	20,957	-12,489	6,416	726,011
1994	0	0	-181,901	0	0	0	0	87,113	83,154	-80,974	550	585	-13,695	-14,288	29,028	2,579	-9,275	573	20,484	-14,362	2,579	813,124
1995	0	0	17,015	0	0	0	0	255,398	68,012	-79,891	-388	-5,174	-29,662	-8,585	31,931	10,847	-9,559	-10,769	21,378	-11,896	10,847	1,068,522
1996	0	0	-11,265	0	0	0	0	190,504	60,065	-88,966	1,227	-10,470	-33,846	-13,721	27,910	14,300	-2,772	-16,439	20,385	-15,474	14,300	1,259,026
1997	0	0	-73,758	0	0	0	0	116,032	63,597	-89,192	5,054	-7,705	-35,256	-15,520	27,831	12,373	-2,130	-15,613	21,976	-16,606	12,373	1,375,059
1998	0	0	-57,797	0	0	0	0	136,362	67,063	-78,577	8,034	-3,865	-28,896	-14,922	28,136	13,656	-2,978	-17,169	22,838	-16,347	13,656	1,511,420
1999	0	0	-111,192	0	0	0	0	71,897	79,296	-93,144	9,788	-6,582	-37,432	-17,379	37,757	8,524	1,382	-14,601	22,726	-18,031	8,524	1,583,317
2000	0	0	-58,927	0	0	0	0	120,539	75,001	-85,312	4,067	-8,738	-25,145	-14,625	34,130	11,957	-4,852	-13,144	22,261	-16,221	11,957	1,703,855
2001	0	0	-202,438	0	0	0	0	-20,340	84,217	-85,202	1,896	-4,283	-12,559	-12,654	26,614	13,388	-7,861	-12,000	23,458	-16,985	13,388	1,683,515
2002	0	0	-162,957	0	0	0	0	-3,708	76,591	-97,839	-883	-11,518	-20,839	-15,405	27,396	17,582	-8,658	-15,543	24,270	-17,652	17,582	1,679,807
2003	0	0	-130,332	0	0	0	0	32,464	78,735	-94,198	3,210	-11,188	-19,527	-16,659	28,700	18,537	-6,900	-19,706	25,538	-17,468	18,537	1,712,271
2004	0	0	-214,670	0	0	0	0	-49,393	79,299	-90,221	2,789	-10,629	-12,554	-16,894	26,366	13,904	-9,935	-11,614	25,533	-17,888	13,904	1,662,878
2005	0	0	-22,996	0	0	0	0	120,500	60,617	-89,165	692	-14,580	-29,037	-13,207	27,583	13,315	-4,201	-16,023	23,231	-16,321	13,315	1,783,378
2006	0	0	-31,250	0	0	0	0	102,907	56,625	-86,840	475	-11,184	-33,827	-13,243	27,566	12,747	-1,116	-17,157	20,543	-15,017	12,747	1,886,285
2007	0	0	-209,499	0	0	0	0	-70,518	67,360	-90,375	2,925	-9,752	-13,691	-17,605	15,108	13,455	-1,207	-12,467	22,545	-22,326	13,455	1,815,767
2008	0	0	-232,114	0	0	0	0	-85,575	76,606	-93,253	-2,465	-8,438	-14,390	-13,423	22,069	15,746	-2,202	-11,613	25,088	-27,018	15,746	1,730,191
2009	0	0	-187,798	0	0	0	0	-42,237	74,501	-92,397	-6,514	-12,082	-3,368	-10,120	14,189	18,852	2,483	-18,590	24,881	-27,626	18,852	1,687,954
2010	0	0	-62,006	0	0	0	0	69,461	63,446	-91,016	-8,768	-21,050	-13,046	-7,919	23,212	16,894	4,043	-14,456	23,260	-29,741	16,894	1,757,415
2011	0	0	48,633	0	0	0	0	163,884	51,038	-85,781	-9,463	-21,958	-28,999	-4,789	30,466	12,948	-8,283	-11,171	19,208	-12,702	12,948	1,921,299
2012	0	0	-152,288	0	0	0	0	-32,812	64,180	-89,367	-9,466	-17,585	-19,076	-3,389	24,330	15,029	-7,718	-9,997	18,951	-16,266	15,029	1,888,486
2013	0	0	-203,087	0	0	0	0	-83,604	66,410	-92,285	-13,015	-13,986	-13,742	-6,364	21,233	14,477	-7,831	-8,251	21,031	-19,426	14,477	1,804,883
2014	0	0	-231,859	0	0	0	0	-113,047	69,232	-100,472	-14,784	-10,727	-15,176	-10,580	20,026	15,722	-1,678	-14,285	23,115	-22,875	15,722	1,691,836
2015	0	0	-240,639	0	0	0	0	-105,501	72,128	-90,840	-14,531	-9,591	-12,338	-6,960	24,707	13,951	-9,511	-9,208	23,645	-18,876	13,951	1,586,335
2016	0	0	-179,866	0	0	0	0	-60,314	65,273	-100,280	-12,856	-18,575	-19,362	-6,068	21,854	16,680	-15,498	-7,363	23,614	-17,433	0	1,526,021
1990-2016 Average	0	0	-134,595	0	0	0	0	56,519	51,038	-58,787	-1,269	-8,259	-19,363	-11,700	27,943	12,830	-6,344	-11,241	22,401	-17,646	12,212	1,439,910
1998-2010 Average	0	0	-129,537	0	0	0	0	29,412	120,265	-100,472	1,173	-10,299	-20,331	-14,158	26,063	14,504	-3,231	-14,929	23,552	-19,895	14,504	1,707,542

See Acronyms and Abbreviations list for definitions.

Table 3-7. Historical and Current Water Balance, Tulare Lake Subbasin SGMA Model, Kings County, California

Land Surface Water Budget														
			Inflows						Outflows					
Year	Kings River Flows	Year Type	Effective Precipitation (AF)	Applied Surface Water (AF)	Applied Pond Water (AF)	Imported Groundwater (AF)	Applied Groundwater (AF)	Total Inflows (AF)	Drain Outflow (AF)	Farm Demand Evapotranspiration (AF)	Deep Percolation (AF)	Total Outflows (AF)	Net Inflow-Outflow (AF)
1990	40%	D	19,958	319,870	10,310	48,885	609,474	1,008,496	0	1,065,856	132,933	1,198,789	-190,293
1991	63%	D	78,722	209,568	3,793	52,225	568,130	912,439	0	994,832	125,674	1,120,507	-208,068
1992	41%	D	64,818	245,345	8,619	46,926	587,328	953,036	0	1,012,909	126,365	1,139,274	-186,238
1993	149%	W	67,191	811,312	31,153	7,533	238,616	1,155,805	0	1,008,709	124,472	1,133,181	22,624
1994	50%	D	34,514	443,731	4,237	27,612	481,028	991,122	26	1,047,937	129,432	1,177,394	-186,272
1995	202%	W	95,479	948,773	42,079	905	177,847	1,265,083	82	973,503	116,897	1,090,481	174,601
1996	122%	N	100,745	1,038,046	26,566	0	182,868	1,348,225	251	1,067,962	127,604	1,195,817	152,408
1997	155%	W	58,885	749,117	54,380	0	265,952	1,128,333	1,392	1,123,726	143,342	1,268,459	-140,126
1998	181%	W	116,167	693,908	49,104	0	237,530	1,096,709	1,870	1,059,009	128,533	1,189,412	-92,703
1999	74%	D	34,039	713,206	39,371	0	325,154	1,111,771	7,376	1,232,448	151,647	1,391,471	-279,701
2000	90%	N	70,413	741,494	35,618	6,833	247,306	1,101,664	17,343	1,127,412	95,624	1,240,379	-138,714
2001	59%	D	94,963	437,871	8,911	54,771	453,432	1,049,949	13,351	1,111,506	90,933	1,215,791	-165,841
2002	67%	D	26,034	564,134	21,817	51,428	408,568	1,071,981	10,253	1,201,455	85,417	1,297,125	-225,143
2003	83%	N	40,108	583,124	4,687	24,029	366,253	1,018,201	8,170	1,198,411	95,332	1,301,914	-283,713
2004	61%	D	74,858	495,764	25,863	63,254	475,486	1,135,226	20,849	1,162,011	86,876	1,269,736	-134,510
2005	148%	W	80,390	873,425	36,085	857	200,953	1,191,709	5,413	1,155,548	101,553	1,262,513	-70,804
2006	172%	W	104,703	1,020,922	37,530	154	189,607	1,352,916	9,651	1,129,741	108,496	1,247,887	105,029
2007	40%	D	14,800	508,886	4,613	60,608	456,931	1,045,839	14,999	1,183,096	97,935	1,296,030	-250,191
2008	72%	D	35,836	371,231	9,331	72,842	497,113	986,354	13,795	1,083,093	89,622	1,186,511	-200,157
2009	79%	N	32,367	379,590	16,632	68,391	440,286	937,266	4,295	1,091,697	94,173	1,190,165	-252,899
2010	121%	N	88,203	694,592	51,406	31,531	234,505	1,100,238	2,440	1,016,725	78,915	1,098,080	2,158
2011	180%	W	52,937	1,026,568	21,035	7,241	60,638	1,168,420	4,486	791,090	83,959	879,535	288,885
2012	49%	D	45,317	498,937	20,785	64,173	339,834	969,046	3,226	776,133	62,058	841,417	127,629
2013	41%	D	2,800	264,515	1,725	84,661	437,315	791,017	8,381	826,405	65,687	900,473	-109,456
2014	32%	D	30,586	154,346	0	85,650	491,323	761,906	3,579	757,265	62,755	823,599	-61,693
2015	21%	D	15,085	107,212	0	79,517	508,193	710,008	829	624,647	49,756	675,231	34,777
2016	75%	D	41,890	227,755	0	70,864	413,868	754,377	2,497	677,936	53,544	733,977	20,400
1990-2016 Avg	91%		56,363	560,120	20,950	37,440	366,501	1,041,375	5,724	1,018,558	100,353	1,124,635	-83,260
1998-2010 Avg	96%		62,529	621,396	26,228	33,438	348,702	1,092,294	9,985	1,134,781	100,389	1,245,155	-152,861

See Acronyms and Abbreviations list for definitions.

Table 3-7. Historical and Current Water Balance, Tulare Lake Subbasin SGMA Model, Kings County, California (Continued)

Subsurface Water Budget																	
			Inflows							Outflows							
			Deep Percolation				Interbasin Inflow			Groundwater Pumping		Interbasin Outflow			Annual Change in Storage		
Year	Kings River Flows	Year Type	Precipitation Infiltration (AF)	Applied Water Infiltration (AF)	Stream Leakage (AF)	Intentional Recharge (AF)	Upper Aquifer (AF)	Lower Aquifer (AF)	Total Inflows (AF)	Upper Aquifer (AF)	Lower Aquifer (AF)	Upper Aquifer (AF)	Lower Aquifer (AF)	Total Outflows (AF)	Upper Aquifer (AF)	Lower Aquifer (AF)	Total Aquifer (AF)
1990	40%	D	17,012	132,933	222,466	1,021	60,944	120,265	554,640	363,970	254,873	52,493	58,787	730,124	-392,438	206,512	-185,926
1991	63%	D	10,310	125,674	149,106	0	59,832	104,657	449,578	351,785	225,455	44,466	68,123	689,829	-379,415	154,951	-224,464
1992	41%	D	13,215	126,365	122,515	0	58,304	102,535	422,934	345,307	251,686	43,733	75,762	716,488	-379,874	89,485	-290,389
1993	149%	W	43,499	124,472	178,243	61	51,892	77,023	475,190	239,755	9,069	42,526	80,157	371,507	-117,785	275,064	157,279
1994	50%	D	20,701	129,432	121,447	23,540	52,755	83,154	431,028	310,055	181,901	44,438	80,974	617,368	-255,820	87,113	-168,707
1995	202%	W	58,569	116,897	160,315	60,372	45,868	68,012	510,032	205,637	17,015	50,708	79,891	353,250	-23,977	255,398	231,421
1996	122%	N	78,864	127,604	161,750	32,081	42,064	60,065	502,429	184,321	11,265	47,154	88,966	331,705	-4,023	190,504	186,481
1997	155%	W	65,946	143,342	153,373	42,787	40,618	63,597	509,662	204,969	73,758	50,417	89,192	418,336	-15,247	116,032	100,786
1998	181%	W	75,095	128,533	152,395	61,425	38,754	67,063	523,264	191,289	57,797	55,626	78,577	383,288	17,175	136,362	153,536
1999	74%	D	47,885	151,647	180,710	0	41,389	79,296	500,928	227,049	111,192	47,970	93,144	479,355	-71,374	71,897	522
2000	90%	N	51,238	95,624	159,781	23,540	41,391	75,001	446,574	201,799	58,927	44,741	85,312	390,779	-76,900	120,539	43,638
2001	59%	D	26,775	90,933	124,376	0	44,167	84,217	370,468	264,888	202,438	45,556	85,202	598,085	-222,719	-20,340	-243,059
2002	67%	D	41,347	85,417	164,069	0	46,006	76,591	413,429	272,312	162,957	45,147	97,839	578,256	-174,685	-3,708	-178,393
2003	83%	N	36,128	95,332	174,955	23,540	45,798	78,735	454,487	255,270	130,332	46,552	94,198	526,352	-133,547	32,464	-101,083
2004	61%	D	40,008	86,876	148,458	10,700	46,099	79,299	411,440	279,593	214,670	46,854	90,221	631,339	-181,729	-49,393	-231,122
2005	148%	W	64,268	101,553	185,872	58,945	41,121	60,617	512,376	194,492	22,996	48,908	89,165	355,562	516	120,500	121,017
2006	172%	W	57,791	108,496	169,501	170,266	37,534	56,625	600,213	174,179	31,250	56,025	86,840	348,293	117,742	102,907	220,649
2007	40%	D	23,538	97,935	174,019	0	42,192	67,360	405,044	264,654	209,499	52,530	90,375	617,057	-177,972	-70,518	-248,490
2008	72%	D	26,373	89,622	137,369	0	43,266	76,606	373,236	283,431	232,114	49,766	93,253	658,564	-210,701	-85,575	-296,277
2009	79%	N	29,563	94,173	167,126	10,700	43,877	74,501	419,939	268,843	187,798	49,818	92,397	598,856	-170,773	-42,237	-213,010
2010	121%	N	67,953	78,915	145,364	23,540	37,974	63,446	417,193	187,770	62,006	47,711	91,016	388,504	-56,332	69,461	13,129
2011	180%	W	88,853	83,959	180,036	180,066	32,182	51,038	616,133	126,313	48,633	58,840	85,781	319,567	197,345	163,884	361,228
2012	49%	D	46,276	62,058	126,057	10,700	34,819	64,180	344,090	205,013	152,288	52,627	89,367	499,295	-137,135	-32,812	-169,947
2013	41%	D	23,005	65,687	123,434	0	38,673	66,410	317,209	252,639	203,087	50,934	92,285	598,945	-222,003	-83,604	-305,607
2014	32%	D	20,546	62,755	92,469	23,320	41,277	69,232	309,598	276,394	231,859	51,497	100,472	660,223	-247,305	-113,047	-360,352
2015	21%	D	25,814	49,756	74,156	23,540	41,875	72,128	287,269	283,699	240,639	50,653	90,840	665,831	-286,779	-105,501	-392,279
2016	75%	D	26,426	53,544	32,070	42,659	36,829	65,273	256,801	248,557	179,866	60,070	100,280	588,773	-234,011	-60,314	-294,325
1990-2016 Avg	91%		41,740	100,353	147,460	30,474	43,981	74,331	438,340	246,814	139,458	49,547	86,978	522,797	-142,214	56,519	-85,694
1998-2010 Avg	96%		45,228	100,389	160,307	29,435	42,274	72,258	449,892	235,813	129,537	49,016	89,811	504,176	-103,177	29,412	-73,765

See Acronyms and Abbreviations list for definitions.

Table 3-8. Historical Evapotranspiration Demand, Tulare Lake Subbasin SGMA Model, Kings County, California

Tulare Lake Subbasin	1990-1995 (AF/Y)	1996-1998 (AF/Y)	1999-2006 (AF/Y)	2007 (AF/Y)	2008 (AF/Y)	2009 (AF/Y)	2010 (AF/Y)	2011 (AF/Y)	2012 (AF/Y)	2013 (AF/Y)	2014 (AF/Y)	2015 (AF/Y)	2016 (AF/Y)	Average (AF/Y)
Tulare Lake Subbasin														
Alfalfa Hay and Clover	172,519	135,032	225,167	300,041	333,752	296,086	288,555	160,621	174,457	204,219	148,325	122,839	100,395	190,580
Almonds (Adolescent)			8,113			11,218	19,864	8,127	10,631	18,529	16,937	15,155	13,714	6,332
Almonds (Mature)	26,791	18,278	15,869	47,030	43,122	35,832	30,537	36,976	39,450	41,720	46,956	54,869	55,084	28,083
Almonds (Young)		2,287	6,480	12,062	26,125	15,445	17,964	13,431	14,580	18,458	17,621	15,779	20,206	8,292
Berries	47								2	6		1		11
Carrot Single Crop								37	16	41	7	6	56	6
Citrus (no ground cover)			91		42	46	14	405	99	335	300	74	32	74
Corn and Grain Sorghum	36,877	100,450	75,793	101,418	82,027	89,467	59,478	87,236	75,344	71,190	58,462	48,619	44,935	65,605
Cotton	463,179	525,386	362,232	320,870	258,511	212,071	287,383	308,970	260,527	261,476	185,559	130,368	215,815	345,645
Dairy Single Crop*	14,290	15,268	16,421											9,129
Fallow Land*														-
Forest*														-
Grain and Grain Hay	50,167	84,811	110,025	33,572	48,563	47,755	45,271	13,518	17,369	19,505	21,282	36,934	33,228	60,837
Melons	413	92	468				21	3	16	10	1,182	27	128	275
Misc. field crops	40,450	30,296	121,265		5			1			4			43,795
Onions and Garlic	807	846	1,359			12	2,417	731	538	167	893	266	1,146	854
Open Water*														-
Pasture and Misc. Grasses	10,799	21,726	24,256	218,974	191,082	289,198	229,306	63,417	57,751	66,333	144,942	68,014	59,370	62,524
Pistachio (Adolescent)								213	315	559	1,290	4,713	5,704	474
Pistachio (Mature)	15,229	12,354	12,341	17,831	5,680	2,825	1,236	1,283	1,237	1,135	1,075	1,412	1,374	9,256
Pistachio (Young)		394	2,265	1,091	1,370	2,454	2,395	3,729	5,770	7,498	8,281	8,231	9,024	2,477
Pomegranates (Adolescent)											5	23	41	3
Pomegranates (Young)				11	303	99	52	901	210	376	537	567	746	141
Potatoes, Sugar beets, Turnip etc..	18,604	4	676	19		10		29		127		7	7	4,317
Riparian*														-
Small Vegetables	2,835	1,147	8,009	33	3	20	340	227	212	390	264	126	317	2,905
Stone Fruit (Adolescent)			4,238			28	138	232	291	171	106	414	425	1,166
Stone Fruit (Mature)	25,350	17,875	13,818	4,560	1,886	584	64	11	80	141	79	95	136	11,485
Stone Fruit (Young)		1,310	3,001	466	1,234	1,217	1,879	1,010	547	1,250	1,186	913	667	1,308
Tomatoes and Peppers	12,971	3,747	33,791	261	5	246	26	47,851	52,725	15,847	26,555	42,793	52,168	20,892
Urban, Industrial*														-
Wine Grapes with 80% canopy	7,586	8,301	14,872	14,203	8,893	5,692	6,980	13,625	23,455	11,832	16,450	11,874	27,920	11,683
Winter Wheat*														-
Tulare Lake Subbasin Irrigated ET Demand	884,626	964,336	1,044,130	1,072,442	1,002,603	1,010,305	993,918	762,584	735,624	741,315	698,299	564,117	642,636	879,019
Tulare Lake Subbasin GSA Total ET Demand	898,916	979,604	1,060,551	1,072,442	1,002,603	1,010,305	993,918	762,584	735,624	741,315	698,299	564,117	642,636	888,148

Notes: Fields with an Asterisk (*) are not Irrigated; Annual Total is by Calendar Year.

See Acronyms and Abbreviations list for definitions.

Table 5-1. Summary of Existing & Proposed Monitoring Network Sites

Existing RMS Network	Water Level	Water Quality	Land Subsidence
Mid-King River GSA	19	16	5
South Fork King GSA	24	15	5
Southwest Kings GSA	2	1	3
El Rico GSA	10	3	5
Tri-County GSA	2	0	2
Total	57	35	20
Proposed Additions to RMS Network	**Water Level**	**Water Quality**	**Land Subsidence**
Mid-King River GSA	9	TBD	0
South Fork King GSA	3	TBD	1
Southwest Kings GSA	5	TBD	0
El-Rico GSA	13	TBD	1
Tri-County GSA	3	TBD	0
Total	33	0	2

Notes:

1) Summary of network includes nested (multiple casings installed in a single borehole) or clustered monitoring wells (multiple wells located close together) for water levels and water quality.

See Acronyms and Abbreviations list for definitions.

Table 5-7. Annual Reporting Requirements

SGMA Section	Annual Reporting Requirement	Input to DMS (or link)
356.2(b)(1)(B)	Hydrographs including water year type from Jan 2015(?) to current	Generated in DMS from water level data input by GSAs
356.2(b)(1)(A)	GW Elevation Contours (spring & fall)	Generated outside DMS using data from DMS then contour maps created and a linked PDF maps from the DMS
356.2(b)(2)	GW extraction by water use sector including method of determination and map	Determined outside DMS. Total use by sector input by each GSA then summarized for subbasin in DMS as a summary table
356.2(b)(3)	Surface Water use by source	Total by GSA for input to DMS and summarized for subbasin in DMS as a summary table
356.2(b)(4)	Total Water use by sector	DMS summary table of water supplies by sector per GSA
356.2(b)(5)(A)	Change in GW Storage maps	Calculated outside DMS from contour data using basin-wide method then total per GSA input into DMS as a summary table
356.2(b)(5)(B)	Graph with Water Year type, est. GW use, annual & cumulative GW Storage change	DMS generated basin total graph using data in DMS.

Table 5-8. Reporting Standards

Category of Information	Reporting Units
Water Volumes	AF
Surface Water Flows Groundwater Flows	AF/Y or CFS AF/Y
Field Measurements of Elevations Groundwater Surface Water Land Surface	to nearest 0.1 ft relative to NAVD 88
Reference Point Elevations	To within 0.5 feet, or best available information relative to NAVD 88
Geographic Locations	GPS coordinates by latitude and longitude in decimal degrees to five decimal places, to a minimum accurate of 30 feet, relative to NAD 83

See Acronyms and Abbreviations list for definitions.

Table 6-1. Summary of Projects and Management Actions Chosen for Mid-Kings River GSA

Project	Implementing Agency	Cost	Annual Yield (AF/Y)
Rehabilitation of Existing Recharge Basins	Kings County Water District	$ 800,000	1,500
Conveyance Improvements and Construction on Riverside Canal	Kings County Water District	$ 320,000	1,500
Fallowing Program	Mid-Kings River GSA	$ 1,380,000	6,250
Cartright Basin Improvements	Kings County Water District, Lakeside Irrigation Water District	$ 884,000	650
Last Chance Side Ditch Improvements	Kings County Water District, Landowners	$ 6,798,000	1,000
Recharge Basin Construction	Kings County Water District, Mid-Kings River GSA	$ 90,000,000	44,444

Table 6-2. Summary of Projects and Management Actions Chosen for South Fork Kings GSA

Project	Implemented by	Annualized Benefit (AF/Y)	Priority	Estimated CAPEX ($)
Groundwater Measurement and Reporting	South Fork Kings GSA/Landowners	1,500	High	$ 500,000
Surface Water Delivery Improvement	South Fork Kings GSA/Landowners	5,000	High	$ 5,000,000
On-Farm Improvements	South Fork Kings GSA/Landowners	2,500	Med	$ 1,000,000
Conservation Reuse	South Fork Kings GSA/Lemoore	1,000	Med	$ 1,000,000
Cropping/Fallowing Program	South Fork Kings GSA	13,000	High	$ 5,000,000
Demand Reduction Sub-Total		**23,000**		**$ 12,500,000**
Aquifer Storage and Recovery	South Fork Kings GSA/Landowners	13,000	High	$ 15,000,000
Surface Storage	South Fork Kings GSA/Landowners	2,000	Low	$ 6,000,000
Mid-Kings Recharge Basin	South Fork Kings GSA	7,000	Med	$ 28,000,000
Supply Enhancement Sub-Total		**22,000**		**$ 49,000,000**
TOTAL		**45,000**		**$ 61,500,000**

See Acronyms and Abbreviations list for definitions.

Table 6-3. Summary of Projects and Management Actions Chosen for El Rico GSA

Project	Annual Project Use (Days)	Acres	Cost/Acre	Average Annual Yield (AF/Y)	Total Cost	Project Life (Years)
Storage Ponds	60	5,000	$20,000	26,000	$100,000,000	60
Canal Lining/Piping	150		3M/mile	25,000	$100,000,000	60
Demand Reduction	360	5,000		15,000		
Total				**76,000**		

Table 6-4. Summary of Projects and Management Actions Chosen for Tri-County Water Authority GSA

Project	Annual Project Use (Days)	Acres	Cost/Acre	Average Annual Yield (AF/Y)	Total Cost	Project Life (Years)
Storage Ponds	60	1,500	30,000	15,000	$45,000,000	
Demand Reduction						
Total				**15,000**		

See Acronyms and Abbreviations list for definitions.

Table 6-5. Project and Management Actions

§354.44 Projects and Management Actions
(a) Each Plan shall include a description of the projects and management actions the Agency has determined may achieve the sustainability goal for the Subbasin, including projects and management actions to respond to changing conditions in the Subbasin.
(b) Each Plan shall include a description of the projects and management actions that include the following 1-9:
(c) Projects and management actions shall be supported by best available information and best available science.
(d) An Agency shall take into account the level of uncertainty associated with the Subbasin setting when developing projects or management actions.

#	Management Action (b)(1) *	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, and Accrual of Benefits (b)(4)	Explanation of Benefits and Method of Evaluation (b)(5)	Explanation of Water Source and Reliability (b)(6)	Cost and Funding Options (b)(8)	Management of Groundwater Extraction and Recharge (b)(9)	Level of Uncertainty Associated with the Basin Setting, 1=uncertain 5=certain (d)
Projects												
1	Infiltration Basin Project	The Subbasin may adopt a policy to incentivize groundwater extractors through subsidies to utilize designated lands for banking only and or designated lands for scheduled banking under contract during certain periods of the season.	The goal is to encourage landowners to fallow land and replenish the groundwater, as well as encourage water trading between GSAs in the Tulare Lake Subbasin.	The policy will begin shortly after GSP approval and will solicit volunteers first. Project lands area needed will designed by GSA.	Demand reduction will be based on acreage removed from farming practices.	No permits or regulatory processes are required for the Subbasin to adopt the policy. The Subbasin has the power as outlined in the SGMA and related provisions to adopt ordinances.	Policy to be written by 2023 and implemented by 2025 and to remain indefinitely, but can be revised as needed.	A direct benefit to the groundwater levels will be accomplished through this policy. Groundwater elevation data will be utilized, and the amount (volume) of water recharged will be used as the evaluation method.	The management action may be accomplished through policy adoption by the Subbasin. Current water sources will be used in most cases and some external water sources may be needed.	Estimated cost to draft and adopt policy is $50,000. Costs associated with tracking resources have not been evaluated.	Chronic lowering of groundwater levels or depletion of supply during periods of drought may be partially offset by storing water in wetter years.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
2	Storage Project	The Subbasin may adopt a policy to incentivize groundwater extractors through subsidies to utilize designated lands for storage only and or designated lands for scheduled storage under contract during certain periods of the season.	The goal is to encourage landowners to fallow land and replenish the groundwater, as well as encourage GSA water trading between GSAs in the Tulare subbasin.	The policy will begin shortly after GSP approval and will solicit volunteers first. Project lands area needed will designed by GSA.	Demand reduction will be based on acreage removed from farming practices.	No permits or regulatory processes are required for the Subbasin to adopt the policy. The Subbasin has the power as outlined in the SGMA and related provisions to adopt ordinances.	Policy to be written by 2023 and implemented by 2025 and to remain indefinitely, but can be revised as needed.	A direct benefit to the groundwater levels will be accomplished through this policy, for in-lieu groundwater supplies. Groundwater elevations will be utilized as the evaluation method.	The management action may be accomplished through policy adoption by the Subbasin. Existing surface water sources will be used.	Estimated cost to draft and adopt policy is $50,000. Costs associated with tracking resources have not been evaluated.	Chronic lowering of groundwater levels or depletion of supply during periods of drought may be partially offset by storing water in wetter years.	Level of uncertainty of the project is 4; in wet years there is water available for this area as well as the infrastructure to deliver it.

See Acronyms and Abbreviations list for definitions.

#	Management Action (b)(1) *	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, and Accrual of Benefits (b)(4)	Explanation of Benefits and Method of Evaluation (b)(5)	Explanation of Water Source and Reliability (b)(6)	Cost and Funding Options (b)(8)	Management of Groundwater Extraction and Recharge (b)(9)	Level of Uncertainty Associated with the Basin Setting, 1=uncertain 5=certain (d)
3	Existing Infrastructure and/or Rehabilitation of New Construction	The Subbasin may adopt efforts to fund projects to rehabilitate existing facilities and construct new facilities to divert, or bank water in areas conducive of these activities. Including diversion systems, check structures, banking facilities, and storage facilities. Also, would allow groundwater trading within the Subbasin. Not intended to restrict water right holders.	The goal is to modify or develop new facilities that can deliver a larger amount of water when needed, as well as service an area that does not have a delivery system.	Development of the projects will begin shortly after GSP approval.	These projects will work in conjunction with a banking project or other projects as needed.	No permits or regulatory processes are required for the Subbasin to adopt the project. The Subbasin has the power as outlined in the SGMA and related provisions to adopt ordinances or approve projects related to SGMA.	Projects to be included in the GSP. Soon after adoption of GSP projects to begin development.	A direct benefit to the groundwater levels will be accomplished through these projects, for in-lieu groundwater supplies. Groundwater elevations will be utilized as the evaluation method.	The management action may be accomplished through policy adoption by the Subbasin. Existing water sources will be used in most cases and some external water sources may be needed.	Estimated cost to draft and adopt policy is $50,000. Project costs will vary.	Chronic lowering of groundwater levels or depletion of supply during periods of drought may be partially offset by storing water in wetter years, trading of groundwater to minimize the concentration of pumping in one area.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
4	Lining and/or piping of canals	Larger canals may be piped or lined to increase capacity and/or efficiency of water deliveries.	Increased water supply or efficiency to reduce fallowed land.	The project will begin after assessment is made and funding is secured.	Demand reduction will be minimized to capturing more water via efficient delivery.	No permits or regulatory process is required for the Subbasin to adopt the policy. The Subbasin has the power as outlined in the SGMA, and related provisions to adopt ordinances.	Project included in GSP, but funding not yet secured. Benefits would start upon completion of piping/lining. Benefits would accrue for duration of project.	A direct benefit to groundwater levels will be accomplished due to decreased pumping via increased deliveries.	Reliability is high, as many canals are used each year.	Estimated cost to line and pipe major canals is $100,000,000. Willing partners and participants are being approached.	Less extraction would occur. No extra monitoring required.	Level of uncertainty of the project is 3, because the project would save water year in and year out. However, the funding for the project is not yet certain.

See Acronyms and Abbreviations list for definitions.

#	Management Action (b)(1) *	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, and Accrual of Benefits (b)(4)	Explanation of Benefits and Method of Evaluation (b)(5)	Explanation of Water Source and Reliability (b)(6)	Cost and Funding Options (b)(8)	Management of Groundwater Extraction and Recharge (b)(9)	Level of Uncertainty Associated with the Basin Setting, 1=uncertain 5=certain (d)
5	Agricultural land fallowing subsidies	The Subbasin may adopt a policy to incentivize farmers to annually fallow land through leases.	The goal is to reduce irrigated acreage. The MO is the acreage of fallowed land and offset groundwater pumping.	The policy development will begin shortly after GSP approval.	Demand reduction will be based on acreage removed from farming practices and offset groundwater pumping.	No permits or regulatory processes are required for the Subbasin to adopt the policy. The Subbasin has the power as outlined in the SGMA and related provisions to adopt ordinances.	Policy to be written by 2023 and implemented by 2025 and to remain indefinitely, but can be revised as needed.	A direct benefit to the groundwater levels will be accomplished through this policy, based on demand reduction. Groundwater elevations will be utilized as the evaluation method.	The management action may be accomplished through policy adoption by the Subbasin. No external water source is used.	Estimated cost to draft and adopt policy is $50,000.	Chronic lowering of groundwater levels or depletion of supply during periods of drought may be partially offset by permanent fallowing.	Level of uncertainty of the project is 2; in wet years there is water available for this area as well as the infrastructure to deliver it.
6	Aquifer Storage and Recovery (ASR)	ARS is a way to recharge an aquifer directly, using an existing well. ASR utilizes the aquifer as a means of local storage for use a later period..	Increased water levels and supply and reduce groundwater demand	Implementation will occur after GSP approval and landowner agreements are in place. The projects are likely to be implemented by individual landowners .	Demand reduction will occur, as the stormwater water will be used for recharge and will offset groundwater pumping.	It is expected that permits from the State Water Resources Control Board will be needed as well as Local compliance	Project can begin after adoption and approval of GSP upon GSA's development of the program.	A direct benefit to the groundwater levels will be accomplished through this policy. Groundwater elevation data will be utilized, and the amount (volume) of water injected will be used as the evaluation method.	Reliability is high, as there are many wells. Water source will be dependent on individual participants access to water.	Estimated total program cost is $15,000,000. Individual participants will fund projects.	Chronic lowering of groundwater levels or depletion of supply during periods of drought may be partially offset by storing water in wetter years.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
Outreach												
1	Education of groundwater use per acre	The Subbasin may adopt a policy which provides groundwater extractors their approximate groundwater extraction on a per acre basis, and how SGMA will be enforced, as well as other policies developed by the Subbasin.	The goal is to provide education and promote awareness of the Subbasin overdraft condition particularly for those groundwater extractors who do not have meters. The MO is annual statements of groundwater extraction in acre-feet.	Implementation to occur at year one and thereafter, if extractor exceeds their extraction amount.	If individual extractors are over drafting, demand reduction will occur with compliance of this policy.	No permits or regulatory process is required for the Subbasin to adopt the policy.	The policy has not been drafted. It is expected to commence shortly after the adoption of the GSP and be completed within the first three years.	The expected benefit is to educate extractors of overdraft; this is the first step in policing SGMA. Extractors will be monitored.	The management action may be accomplished by Subbasin policy adoption. No external water source is used.	Estimated $50,000 cost to draft and adopt policy.	Within the education course, a description of how recharge and groundwater extraction will be credited to each extractor during drought and other periods.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.

See Acronyms and Abbreviations list for definitions.

#	Management Action (b)(1) *	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, and Accrual of Benefits (b)(4)	Explanation of Benefits and Method of Evaluation (b)(5)	Explanation of Water Source and Reliability (b)(6)	Cost and Funding Options (b)(8)	Management of Groundwater Extraction and Recharge (b)(9)	Level of Uncertainty Associated with the Basin Setting, 1=uncertain 5=certain (d)
Assessment												
1	Pumping fees for groundwater allocation exceedances	Policy for exceedance of pumping beyond the current groundwater allocation. Can increase with each occurrence.	The goal is to incentivize groundwater extractors to pump only their groundwater allocation per year. The MO is the volume of groundwater extraction in acre-feet.	First phase of the policy will be written by 2023 and implemented by Jan 2025. Fees will increase every year after 2025 and with each occurrence.	This policy reduces demand and/or charges each extractor based on the budgeted amount of groundwater.	No permits or regulatory processes are required for the Subbasin to adopt the policy. The Subbasin has the power as outlined in SGMA and related provisions to adopt ordinances, levy financial penalties, and enforce policies.	Policy is expected to be drafted and commence after the adoption of the GSP. Benefits will be added revenue to mitigate other projects in the area.	The expected benefit is to deter groundwater extractors from exceeding their allocation. Other benefits will be revenue for projects to mitigate local overdraft. The method of evaluation will be a summary of over-extractors and the reduction of those over-extractors over time.	The management action may be accomplished by Subbasin policy adoption and enforcement. No external water source is used.	Estimated $50,000 cost to draft and adopt policy. Initial GSA assessments will be needed to fund the development of this policy.	Chronic lowering of groundwater levels or depletion of supply during periods of drought may be offset by temporary increases in fee structure or groundwater pumping restrictions.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
2	Pumping fees for groundwater extractions	The Subbasin may adopt a policy to impose fees on groundwater extractors on a per acre-foot basis. Fees are intended to support GSA activities and are not intended to be overbearing.	The goal is to incentivize groundwater extractors to reduce pumping and look for other sources of water. The MO is the revenue generated to support GSA operations.	Policy to be written and implemented by 2025 and to remain indefinitely.	No direct reduction in demand.	No permits or regulatory processes are required for the Subbasin to adopt the policy. The Subbasin has the power as outlined in the SGMA and related provisions to adopt ordinances, levy financial penalties, and enforce policies.	Policy is expected to be drafted and commence after the adoption of the GSP. Benefits will be added revenue to support GSA operations.	The expected benefits will provide funding for GSAs to operate under the SGMA.	The management action may be accomplished through policy adoption by the Subbasin and enforcement. No external water source is used.	Estimated $50,000 cost to draft and adopt policy. Initial GSA assessments will be needed to fund the development of this policy.	This policy in intended to be a part of the entire GSA operational Bylaws; there is no direct offset of chronic lowering of groundwater.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
Groundwater Allocation												
1	Flood Flows (spills into the Subbasin) include Tule River, Deer Creek, Cross-Creeks and Kings River	The Subbasin may adopt a policy for actions to divert flows during flood releases to needed areas and a credit system for those who divert.	Validate Water Rights and existing agreements. MO is to allocate water to the rightful owner.	Policy to be drafted by 2023 and implemented by 2025.	This management action alone may not generate a quantifiable demand reduction. However, it allocates water to be used in the proper service area.	No permits or regulatory processes are required for the Subbasin to adopt the policy. SWRCB is paying close attention to policies within a GSA that pertain to water rights and flood water diversion.	Policy to be written by 2023 and implemented by 2025 and to remain indefinitely, but can be revised as needed.	The expected benefit is to encourage diversion of flood flows to areas to make the most groundwater level impact.	Contract holder; reliability varies based on allocation.	Estimated $25,000 cost to draft and adopt policy.	Banked water will offset a depletion of supply during periods of drought.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.

See Acronyms and Abbreviations list for definitions.

#	Management Action (b)(1) *	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, and Accrual of Benefits (b)(4)	Explanation of Benefits and Method of Evaluation (b)(5)	Explanation of Water Source and Reliability (b)(6)	Cost and Funding Options (b)(8)	Management of Groundwater Extraction and Recharge (b)(9)	Level of Uncertainty Associated with the Basin Setting, 1=uncertain 5=certain (d)
2	Development of groundwater allocation	The Subbasin may adopt a policy which provides a finite groundwater allocation, either based on the modeling efforts or the sustainable yield. Ultimate groundwater allocation may take into consideration the existing water rights holders, disadvantaged communities (DACs) and CA Native American tribes. The Subbasin may allocate to agencies or individual landowners.	The goal is to ensure a fair groundwater allocation which clearly defines the acceptable groundwater extraction volume per year at a certain rate, based on crop growing season(s). The MO is the volume of groundwater extraction in acre-feet.	Policy to be written by 2023 and implemented by 2025.	This policy will be a direct reduction in demand as extractors will need to operate within the means of the allocation. Groundwater levels and pumped volumes will be used to evaluate demand reduction.	No permits or regulatory processes are required for the Subbasin to adopt the policy. The Subbasin has the power as outlined in SGMA and related provisions to adopt ordinances.	Policy to be written by 2023 and implemented by 2025 and can be revised as needed.	The expected benefits may mitigate overdraft by ensuring groundwater supplies are withdrawn in a sustainable manner. Extractions will be monitored.	The management action may be accomplished by Subbasin policy adoption. No external water source is used.	Estimated $100,000 cost to draft and adopt policy.	Chronic lowering of groundwater levels or depletion of supply during periods of drought may be eliminated by implementation of sustainable change in groundwater allocation.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
3	Groundwater Marketing	This policy will include groundwater marketing. Marketing will include groundwater from within the Subbasin with options to market within the GSAs, between GSAs.	The goal is to set policy that encourages water marketing within the Subbasin while not causing undesirable results.	Policy to be written by 2023 and implemented by 2025.	This policy will be a direct reduction in demand as small volume extractors will be encouraged to fallow land and market groundwater within their allocated amount. Groundwater levels and market volumes will be used as the quantification of demand reduction.	No permits or regulatory processes are required for the Subbasin to conduct the study. Through the study, multiple jurisdictions and agencies may be contacted for the potential permits and regulatory requirements for new surface water supplies.	The water marketing strategy grant has been approved by the USBR; Funding opportunity to close in May of 2019. Other grant solicitations are expected.	The expected benefits include utilizing groundwater supplies within the Subbasin. Encourage demand reduction through fallowing. Groundwater levels and marketed volumes will be evaluated.	The management action may be accomplished by Subbasin policy adoption. No external water source is used.	Estimated cost is $100,000 to draft and adopt policy.	This policy will include the requirement that landowners who are a purchaser or seller of groundwater shall install a water meter on their wells and report all activities to their GSAs.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.

See Acronyms and Abbreviations list for definitions.

#	Management Action (b)(1) *	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, and Accrual of Benefits (b)(4)	Explanation of Benefits and Method of Evaluation (b)(5)	Explanation of Water Source and Reliability (b)(6)	Cost and Funding Options (b)(8)	Management of Groundwater Extraction and Recharge (b)(9)	Level of Uncertainty Associated with the Basin Setting, 1=uncertain 5=certain (d)
Development												
1	Require new developments (non-de minimis extractors) to prove sustainable water supplies	This policy requires all permitted developments (non-de minimis extractors) to prove sustainable water supplies based upon the current Subbasin groundwater allocation and constant with current State Law. The Subbasin may review and comment on all new development environmental documents to ensure water balance and corresponding mitigation measures are implemented. Requires County support.	The goal is to ensure all new developments (non-de minimis extractors) do not exceed the current Subbasin groundwater allocation and groundwater supplies are consumed or retained within the Subbasin boundary. The MO is to monitor and hold developers accountable as well as promote connection to city services where applicable.	To be implemented as a revision to the local ordinances.	Policy is to minimize undesirable effects by requiring construction of wells to be designed for MTs. To be implemented after approval of GSP.	The regulatory process may require cooperation from the county/city to ensure the Subbasin has had the opportunity to review and comment on the environmental documents prior to county/city approval. The Subbasin GSAs have the power as outlined in the SGMA and related provisions to adopt ordinances. Potential incorporation into a peer review process.	Policy to be written and implemented by 2023.	The expected benefits may mitigate overdraft by ensuring new developments utilize groundwater supplies in accordance with current Subbasin groundwater allocations, and groundwater supplies are consumed or retained within the Subbasin boundary. The method of evaluation may be quantifying the number of new developments that are approved with and without Subbasin comment/approval.	The management action may be accomplished through Subbasin policy adoption and coordination with the county/city. The Subbasin may request county/city development procedures to include the circulation of environmental documents and approval from Subbasin GSAs prior to county/city approval. No external water source is used.	Estimated cost to draft and adopt policy is $25,000.	Policy will help in data collection and extraction reporting as part of the permitting process.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
Monitoring Reporting												
1	Flood Flows (spills into the Subbasin) include Tule River, Deer Creek, Cross-Creeks and Kings River	The Subbasin may adopt a policy for actions to divert flows during flood releases to needed areas and a credit system for those who divert.	Validate the water right; MO is to allocate water to the rightful owner.	Policy will begin soon after GSP is approved and will help fill data gaps.	This management action alone may not generate a quantifiable demand reduction. However, it allocates water to be used in the proper service area.	No permits or regulatory processes are required for the Subbasin to adopt the policy. SWRCB is paying close attention to policies within a GSA that pertain to water rights and flood water diversion.	Policy to be written and implemented in 2023.	The expected benefit is the guarantee that purchased water is credited to correct area. Data gathered will fill data gaps. Groundwater elevations will be the method of evaluation.	Contract holder; reliability varies based on allocation.	Estimated cost to draft and adopt policy is $25,000.	Utilized contract volumes to be included in the calculation of the groundwater extraction proportionate share.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.

See Acronyms and Abbreviations list for definitions.

#	Management Action (b)(1) *	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, and Accrual of Benefits (b)(4)	Explanation of Benefits and Method of Evaluation (b)(5)	Explanation of Water Source and Reliability (b)(6)	Cost and Funding Options (b)(8)	Management of Groundwater Extraction and Recharge (b)(9)	Level of Uncertainty Associated with the Basin Setting, 1=uncertain 5=certain (d)
2	Registration of extraction facilities	The Subbasin may adopt a policy to require registration of a groundwater extraction facility within the Subbasin. Requires county support. Includes existing and future facilities.	The goal is to improve the Subbasin's database of groundwater extraction locations. The MO is the number of new registered facilities and fill data gaps.	The policy may be implemented shortly after the adoption of the GSP and remain until the Subbasin's overdraft has ended or indefinitely. The county must also support the policy.	This policy will help fill data gaps and give a better understanding of the groundwater within the Subbasin.	The regulatory process may require cooperation from the county to ensure new well permits issued within the Subbasin adhere to the Subbasin's policy. The Subbasin has the power as outlined in SGMA and related provisions to adopt ordinances.	Policy to be written and implemented in 2023.	The expected benefits may mitigate overdraft by improving the Subbasin's knowledge of groundwater extraction locations. The method of evaluation may be comparing the number of registered wells vs. the county/state databases known wells.	The management action may be accomplished by policy adoption by the Subbasin and coordination with the county. The Subbasin may request county well permit procedures to include the Subbasin's requirements prior to issuance. No external water source is used.	Estimated cost to draft and adopt policy is $25,000. There will be a cost to administer the policy, which is not known at this time.	Fill data gaps and include this information in the calculation of the groundwater extraction proportionate share.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
3	Require self-reporting of groundwater extraction, water level, and water quality data	The Subbasin may adopt a policy to require groundwater users (excluding de minimis extractors) to self-report groundwater extractions, static water levels, and water quality data twice per year.	The goal is to improve the Subbasin's database of groundwater extractions, water level and quality monitoring network, and serve other management actions.	This policy will fill data gaps. To be incorporated into a well testing policy for wells with meters. The policy may be implemented shortly after the adoption of the GSP and remain indefinitely or until Subbasin's overdraft has ended.	This policy will help fill data gaps and give a better understanding of the groundwater within the Subbasin.	No permits or regulatory processes are required for the Subbasin to adopt the policy. The Subbasin has the power as outlined in SGMA and related provisions to adopt ordinances, levy financial penalties, and charge administrative fees.	Policy to be written and implemented in 2023.	The expected benefits may mitigate overdraft by improving the Subbasin's knowledge of groundwater extractions, water levels, water quality and provide extractors with useful information. The method of evaluation may be reviewing the number of responses from groundwater users (excluding de minimis extractors), analyzing data validity/accuracy, and filling data gaps.	The management action may be accomplished by policy adoption by the Subbasin. The Subbasin may develop an online reporting tool. No external water source is used.	Estimated cost to draft and adopt policy is $25,000. There will be a cost to administer the policy, which is not known at this time, but is expected to be high.	Fill data gaps and include this information in the calculation of the groundwater extraction proportionate share.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.

See Acronyms and Abbreviations list for definitions.

#	Management Action (b)(1) *	Description (b)(1)	Measurable Objective (b)(1)	Circumstances of Implementation (b)(1)(A)	Quantification of Demand Reduction (b)(2)	Permitting & Regulatory Process (b)(3)	Status, Start, End, and Accrual of Benefits (b)(4)	Explanation of Benefits and Method of Evaluation (b)(5)	Explanation of Water Source and Reliability (b)(6)	Cost and Funding Options (b)(8)	Management of Groundwater Extraction and Recharge (b)(9)	Level of Uncertainty Associated with the Basin Setting, 1=uncertain 5=certain (d)
4	Require well meters, sounding tubes, and water quality sample ports	The Subbasin may adopt a policy to require meters, sounding tubes, and sample ports be installed on wells, pump and motor replacements, and well repairs (excluding de minimis extractors). Requires county support. Calibration of meters shall conform to Senate Bill 88.	The goal is to improve the Subbasin's data collection of groundwater extractions, water level and quality monitoring network. The MO is the number of well permits and filling the data gaps.	The policy may be implemented shortly after the adoption of the GSP and remain until Subbasin's overdraft has ended or indefinitely. The county must also support the policy.	This policy will help fill data gaps and give a better understanding of the groundwater within the Subbasin.	The regulatory process may require cooperation from the county to ensure new well permits issued within the Subbasin adhere to the Subbasin's policy. The Subbasin has the power as outlined in SGMA and related provisions to adopt ordinances.	Policy to be written and implemented in 2023.	The expected benefits may mitigate overdraft by improving the Subbasin's knowledge of groundwater extractions, water levels, water quality, and fill data gaps. The method of evaluation may be reviewing the number of well permits and confirming whether meters, sounding tubes, and sample ports were installed.	The management action may be accomplished by policy adoption by the Subbasin and coordination with the county. The Subbasin may request county well permit procedures to include the Subbasin's requirements prior to issuance. No external water source is used.	Estimated cost to draft and adopt policy is $25,000. There will be a cost to implement the policy, it is not known at this time, but is expected to be high.	Fill data gaps and include this information in the calculation of the groundwater extraction proportionate share.	Level of uncertainty of the project is 3; in wet years there is water available for this area as well as the infrastructure to deliver it.
Existing Contracts												
1	Flood Flows (spills into the Subbasin) include Tule River, Deer Creek, Cross-Creeks and Kings River	The Subbasin may adopt a policy for actions to divert flows during flood releases to needed areas and a credit system for those who divert.	Validate water rights and existing agreements. MO is to allocate water to the rightful owner.	Policy to be drafted by 2023 and implemented by 2025.	This management action alone may not generate a quantifiable demand reduction. However, it allocates water to be used in the proper service area.	No permits or regulatory processes are required for the Subbasin to adopt the policy. SWRCB is paying close attention to policies within a GSA that pertain to water rights and flood water diversion.	Policy to be written by 2023 and implemented by 2025 and to remain indefinitely, but can be revised as needed.	The expected benefit is to encourage diversion of flood flows to areas to make the most groundwater level impact.	Contract Holder; reliability varies based on allocation.	Estimated $25,000 cost to draft and adopt policy.	Diverted water will offset a depletion of supply during periods of drought.	Level of uncertainty of the project is 2; in wet years there is water available for this area as well as the infrastructure to deliver it.

* (b)1() refers to the subsection of §354.44 that the column addresses.
Note: The following sections were noted below because they apply to all management actions with very little variance.
Public Notice (b)(1)(B): The Subbasin may provide public notice in multiple formats and platforms, adopted policies may reside in Subbasin Board Meeting minutes and Subbasin Policy Manual available on the Subbasin website. Electronic notice may be provided to any person who requests email notifications. The Subbasin Board may hold regular monthly meetings and annual education workshops.
Legal Authority (b)(7): The Subbasin has the power as outlined in the SGMA, and related provisions to adopt ordinances, levy financial penalties, and enforce programs.
Cost & Funding Options (b)(8): Subbasin administrative and operating costs may be funded through various financial avenues discussed further in GSP Chapter 7.2.
See Section 5 of the 2022 GSP Addendum for additional Projects and Management Action items.

See Acronyms and Abbreviations list for definitions.

Table 7-1. Proposed SFK GSA GSP Implementation Timeline

	Current Year (2020)	YEAR 1 (2021)		YEAR 2 (2022)		YEAR 3 (2023)		YEAR 4 (2024)	
	Q1/2	**Q3/4**	**Q1/2**	**Q3/4**	**Q1/2**	**Q3/4**	**Q1/2**	**Q3/4**	**Q1/2**
Administrative Actions									
Pumping Measurement Program	Landowner Well Survey		**Adopt measurement standards and reporting requirements**		Land Use/Metering Update		Land Use/Metering Update		Land Use/Metering Update
Land Use/Land Cover Program	Land Cover & Demand Study								
Groundwater Accounting Program			Accounting Program White Paper	Public Outreach	**Adopt GW Accounting System**	Public Outreac h			
Monitoring Program	**Annual Report**		**Annual Report**		**Annual Report**		**Annual Report**		**Annual Report**
Data Management Program									
Annual Reports									
KRCD Admin + Legal									
GSP 5-Year Update									
Funding Activities	State/Federal						Current Funding Sunsets	Adopt New Funding Method	
	Private/Foundation/ NGO								
	Other Mechanisms								

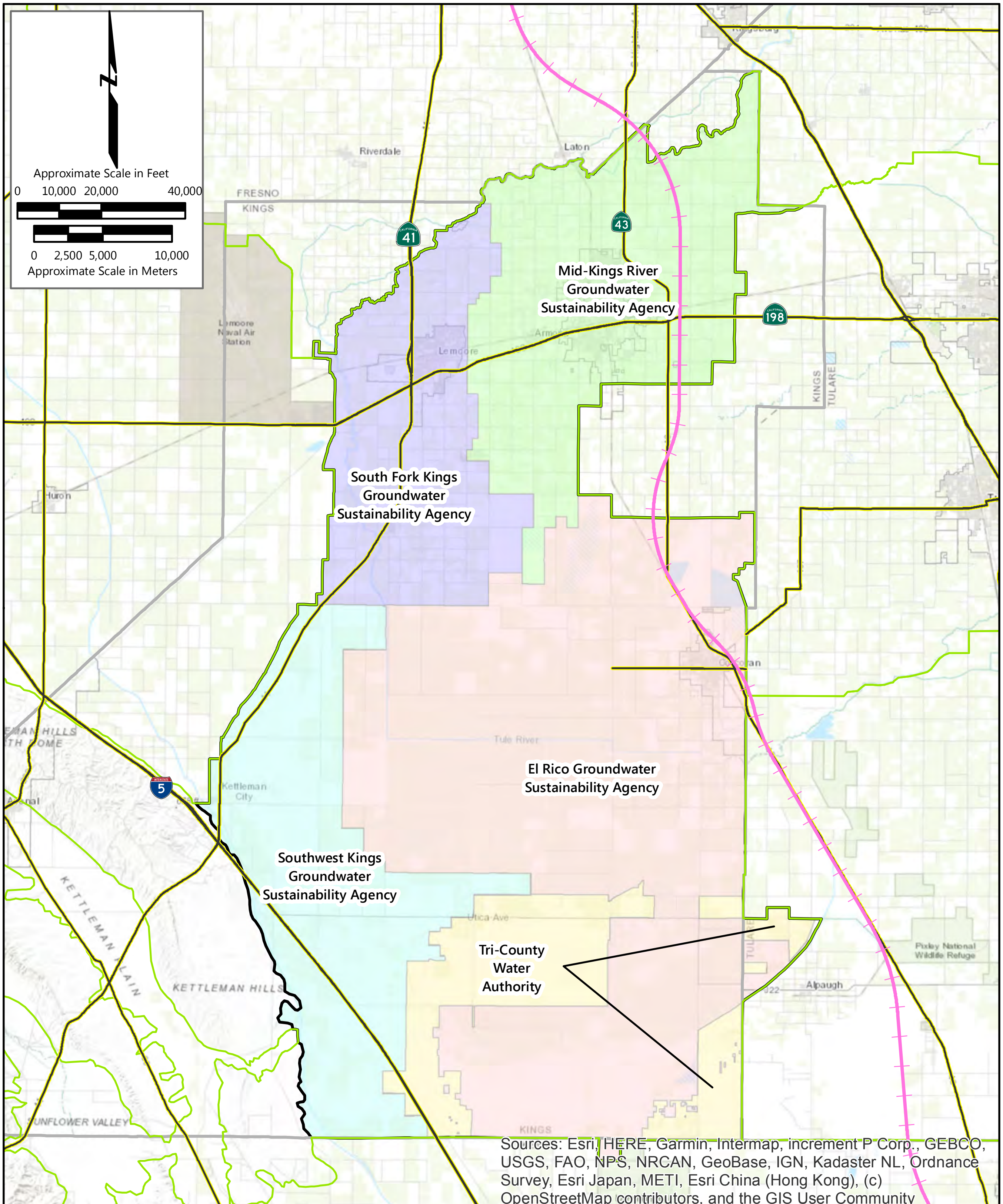
Table 7-1. Proposed SFK GSA GSP Implementation Timeline (Continued)

	Current Year (2020)	YEAR 1 (2021)		YEAR 2 (2022)		YEAR 3 (2023)		YEAR 4 (2024)	
	Q1/2	Q3/4	Q1/2	Q3/4	Q1/2	Q3/4	Q1/2	Q3/4	Q1/2
Demand Reduction Actions									
SW Delivery Improvements	SW Delivery Agreements	Surface Water Efficiency Study		**Adopt Canal Program**					
On-Farm Efficiency Improvements	Conjunctive Use White Paper	Targeted Outreach	Develop On-Farm Efficiency Targets and Dry-Farming/Fallowing Program	Public Outreach	**Develop On-Farm Efficiency Targets and Dry-Farming/Fallowing Program**	**Surface Water Improvement Implementation**		**Surface Water Improvement Implementation**	
Permanent/Long Term Fallowing									
Seasonal Fallowing Program									
Supply Enhancement Actions									
Aquifer Storage and Recovery	Work Plan			**ASR Pilot Test**		**ASR CEQA**		**ASR Implementation**	
Surface Recharge		Review & Coordinate Recharge Projects in Surrounding Basins			**Approve Surface Recharge Investments**				
Surface Storage									

Table 7-2. DMS Annual Reporting Requirements

Regulation	Requirement	Input to DMS
356.2(b)(1)(B)	Hydrographs incl water year type from Jan 2015	Generated in DMS from water level data input by GSAs
356.2(b)(1)(A)	GW Elevation Contours (spring & fall)	Generated outside DMS using data from DMS then contour lines uploaded into DMS
356.2(b)(2)	GW extraction by water use sector incl method of determination and map	Determined outside DMS. Total use by sector input by each GSA then summarized for basin in DMS
356.2(b)(3)	Surface Water use by source	Total by GSA input to DMS and summarized for basin in DMS
356.2(b)(4)	Total Water use by sector	DMS summary table of water supplies by sector per GSA
356.2(b)(5)(A)	Change in GW Storage map	Calculated outside DMS from contour data using basin-wide method then total per GSA input into DMS
356.2(b)(5)(B)	Graph with Water Year type, GW use, annual & cumulative GW Storage change	DMS generated basin total graph using data in DMS

Figures



Explanation

- CHSR proposed route
- Other groundwater subbasins (DWR 2017)
- Subbasin boundary
- County

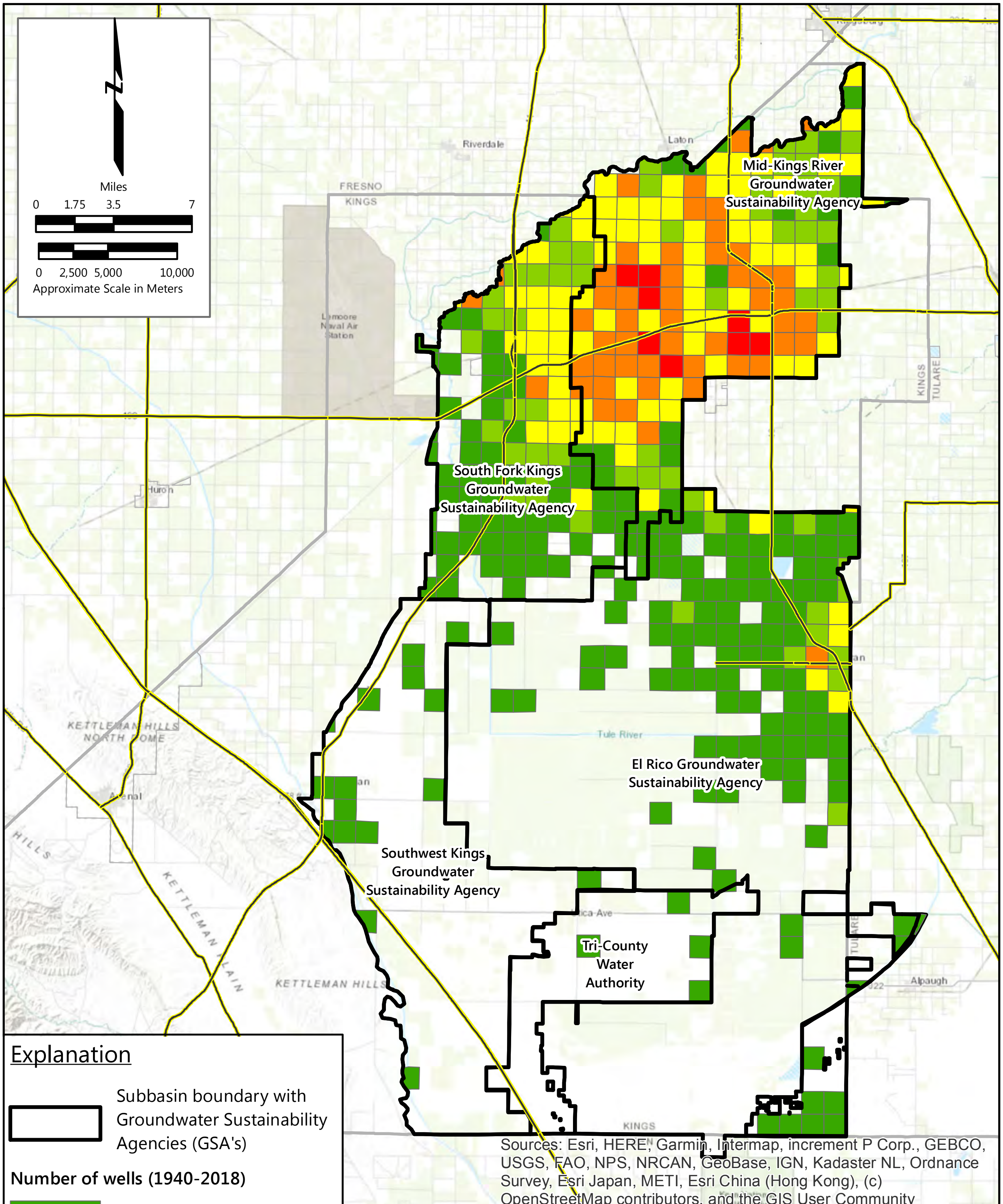
Tulare Lake Subbasin

Tulare LakeSubbasin Groundwater Sustainability Plan

Kings County, Calfiornia

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-1**

Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area_fig2-1_Subbasin.mxd



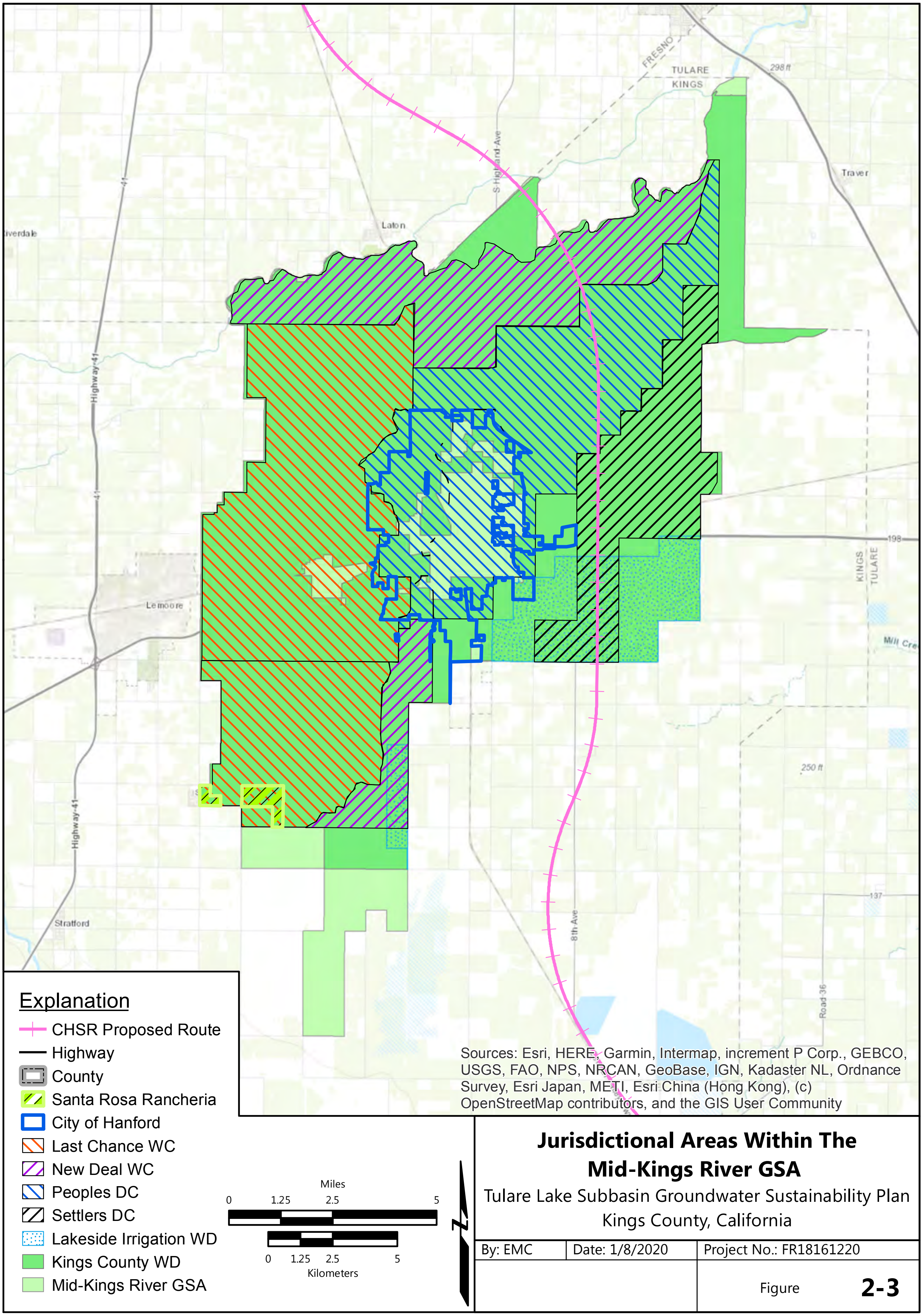
Notes:
1. Data accessed from the Department of Water Resources https://water.ca.gov/Programs/Groundwater-Management/Wells/Well-Completion-Reports November 2019

Well Density Map

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-2**

Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-2_WellDensityMap__mxd

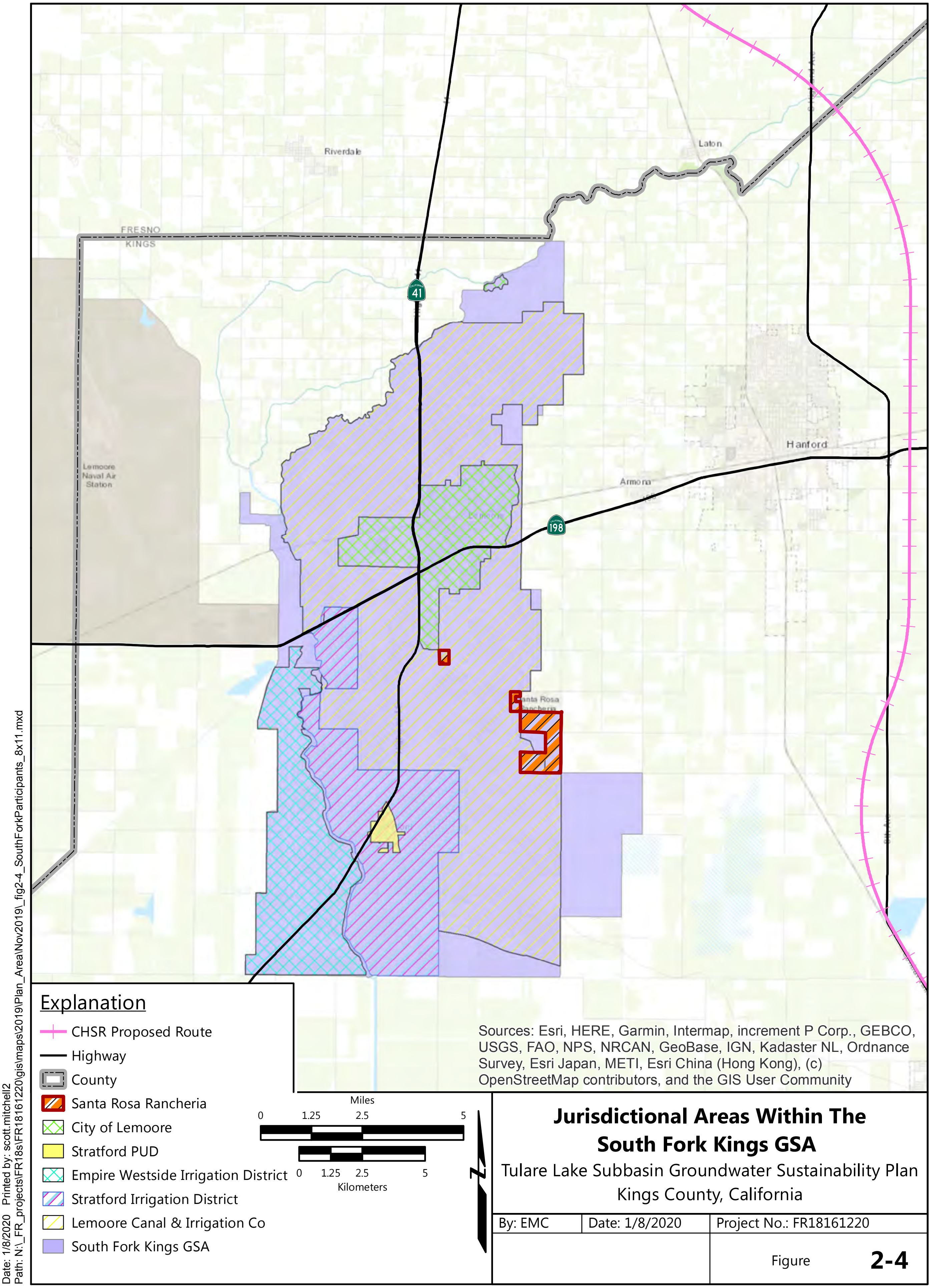


Jurisdictional Areas Within The Mid-Kings River GSA

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-3**

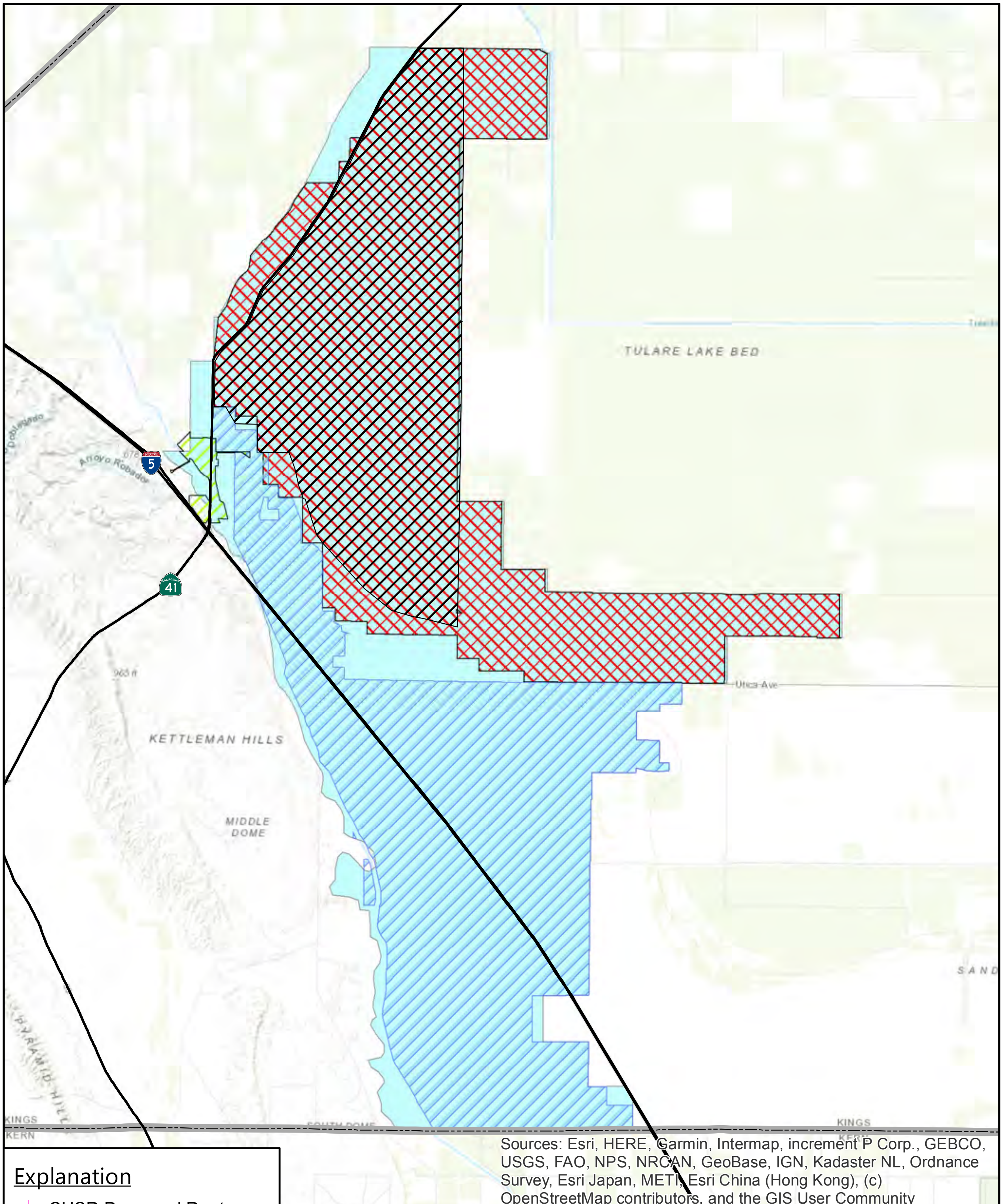
Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-3_MidKingsParticipants8x11.mxd



Jurisdictional Areas Within The South Fork Kings GSA

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-4**



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Explanation

- CHSR Proposed Route
- Highway
- County
- Reclamation District No 761
- Kettleman City CSD
- Dudley Ridge WD
- Tulare Lake Basin WSD
- Southwest Kings GSA

Miles: 0, 1.25, 2.5, 5

Kilometers: 0, 1.25, 2.5, 5

Jurisdictional Areas Within The Southwest Kings GSA

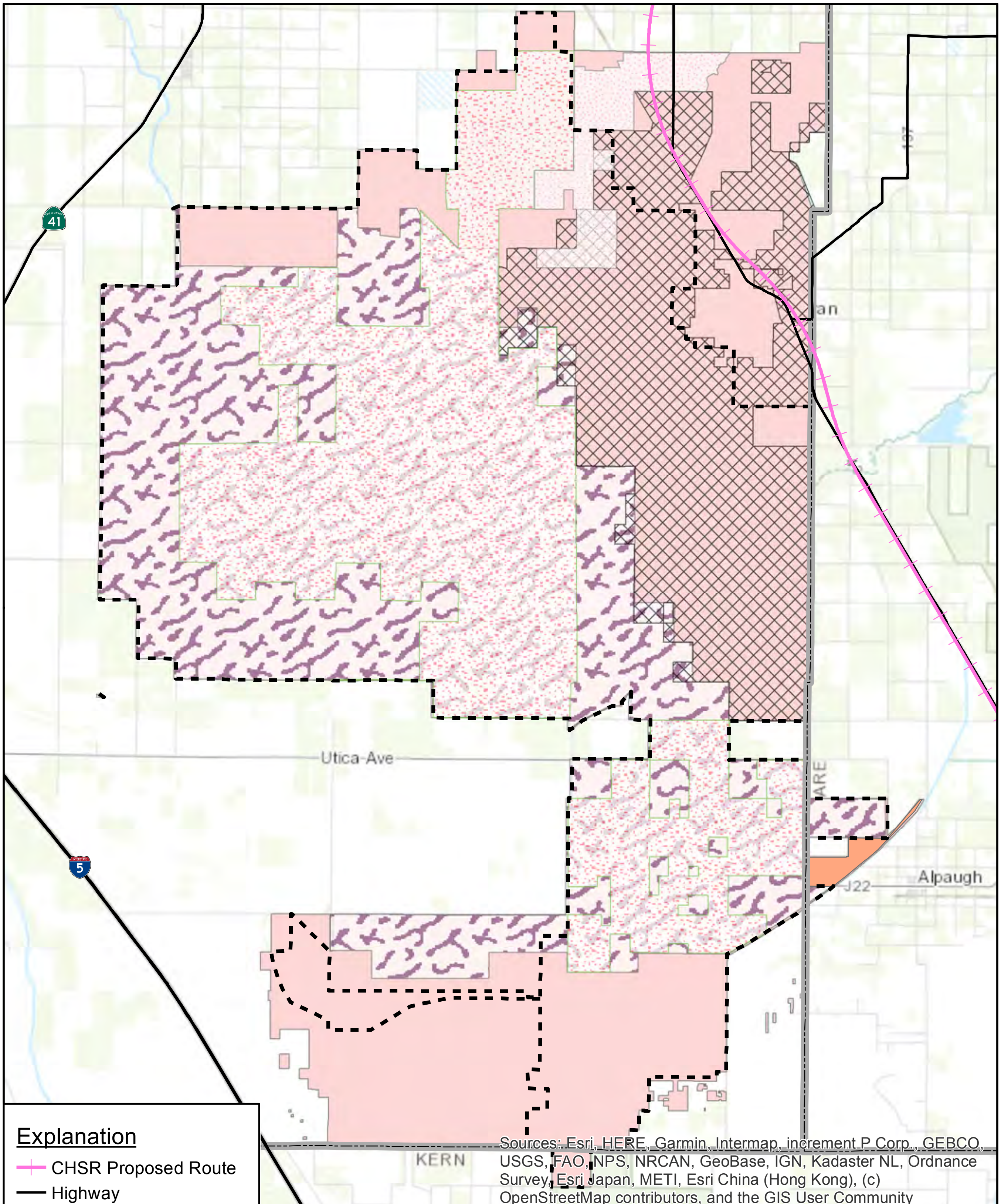
Tulare Lake Subbasin Groundwater Sustainability Plan

Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-5**

Date: 1/8/2020 Printed by: scott.mitchell2

Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-5_SWKingsParticipants_8x11.mxd



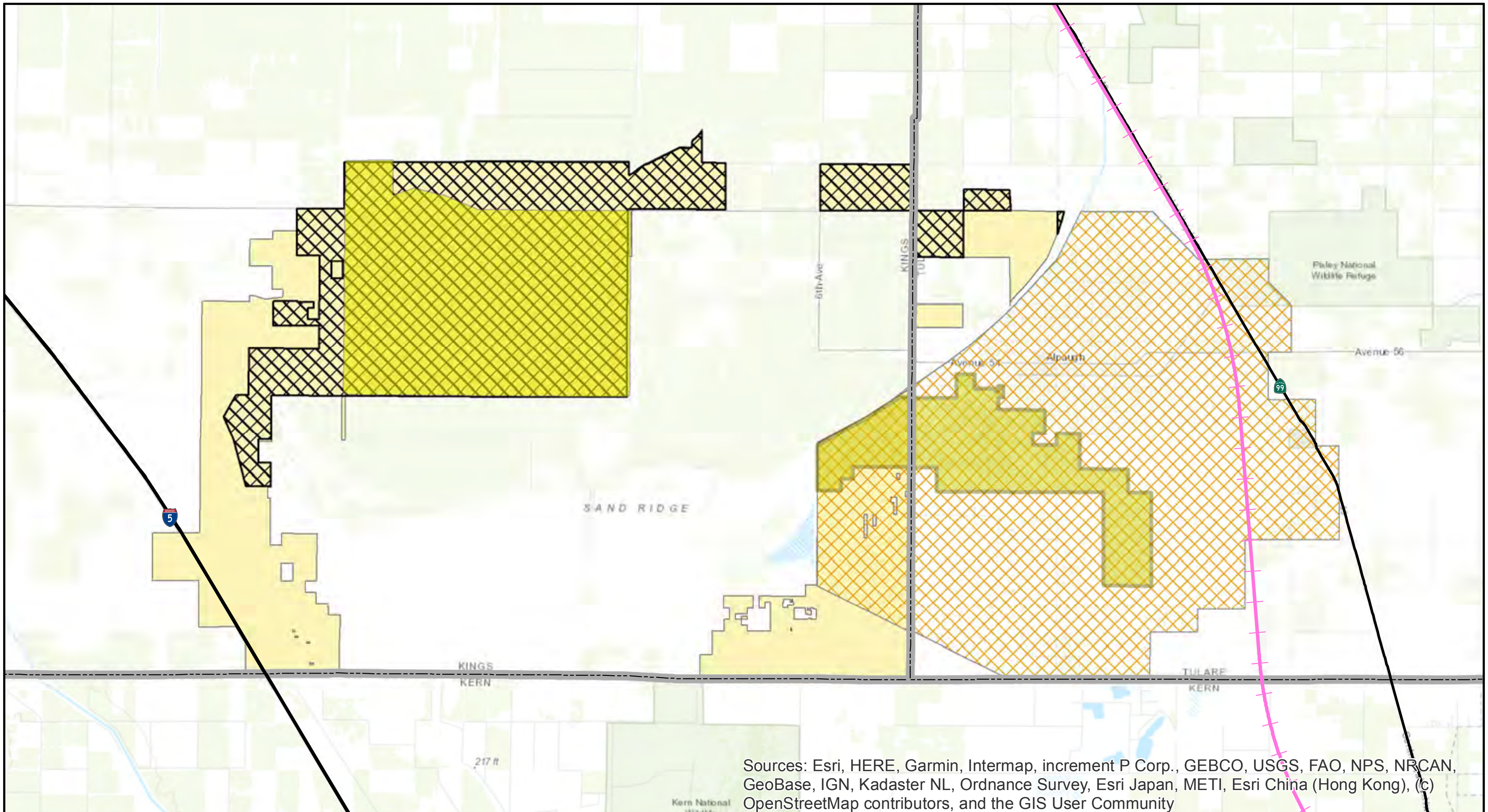
Jurisdictional Areas Within The El Rico GSA

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-6**

Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-6_ElRicoParticipants_8x11.mxd

Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-7_TriCoWaParticipants_8x11.mxd



Explanation

- CHSR Proposed Route
- Highway
- County
- Tri County WA GSA
- Wilbur Reclamation District
- Atwell Island WD
- Angiola WD
- Deer Creek Storm WD

Miles: 0, 1.25, 2.5, 5

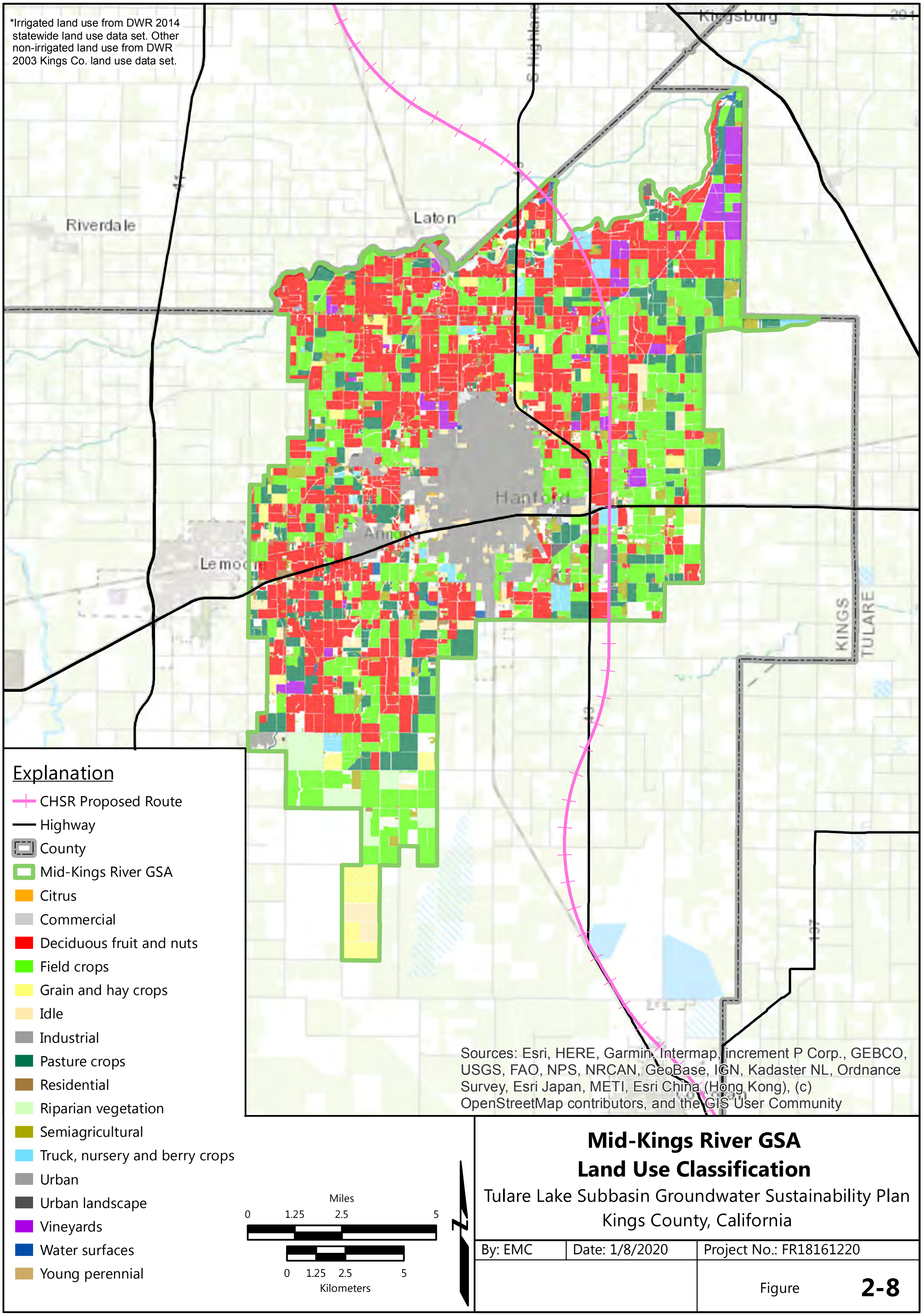
Kilometers: 0, 1.25, 2.5, 5

N

Jurisdictional Areas Within The Tri-County Water Authority GSA

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

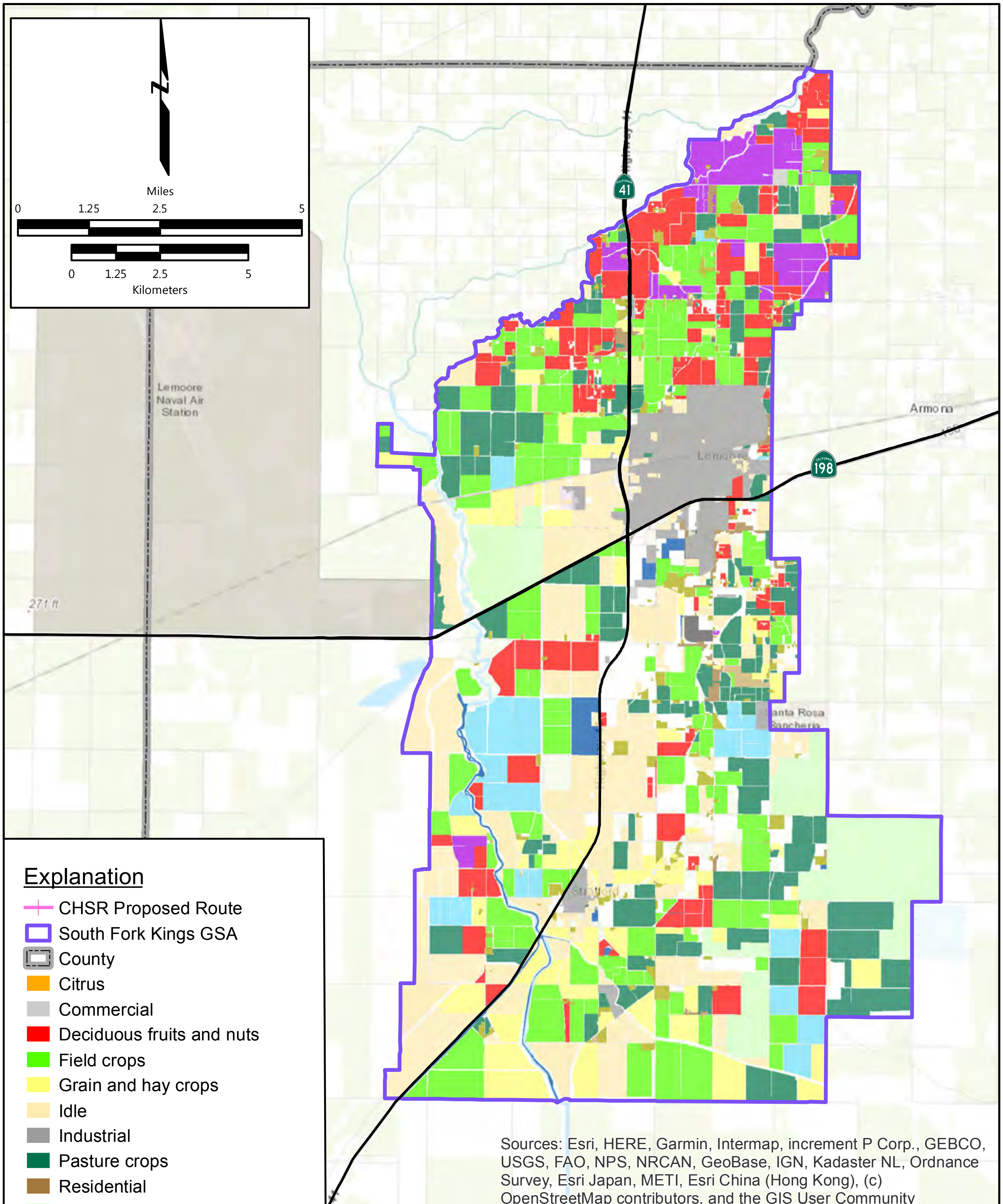
By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-7**



Mid-Kings River GSA
Land Use Classification
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-8**

Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-8_MidKings_Landuse_8x11.mxd

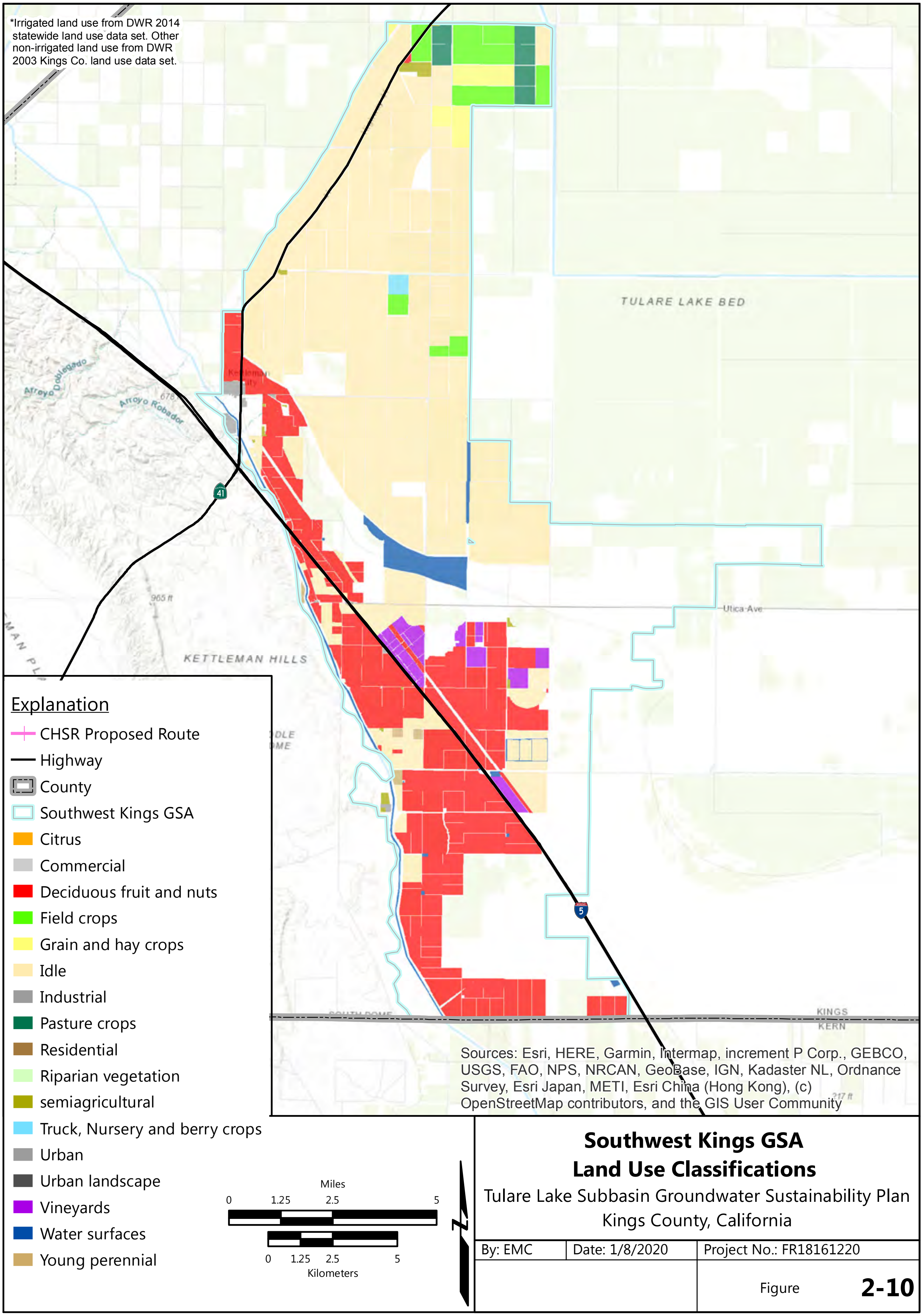


*Irrigated land use from DWR 2014 statewide land use data set. Other non-irrigated land use from DWR 2003 Kings Co. land use data set.

South Fork Kings GSA
Land Use Classifications
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-9**

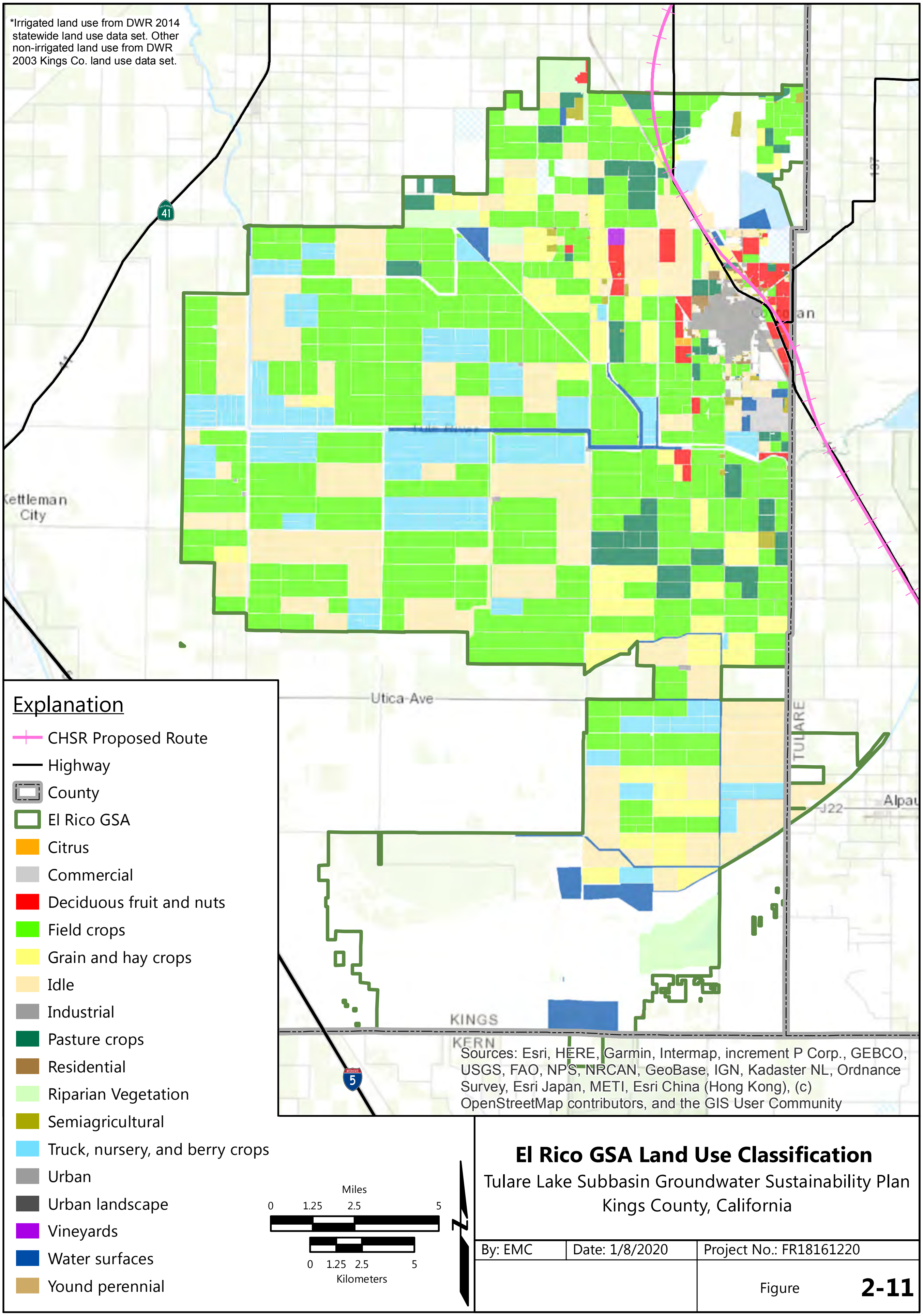
Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-9_SouthFork_Landuse_8x11.mxd



Southwest Kings GSA
Land Use Classifications
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-10**

Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-10_SWKings_LandUse_8x11.mxd



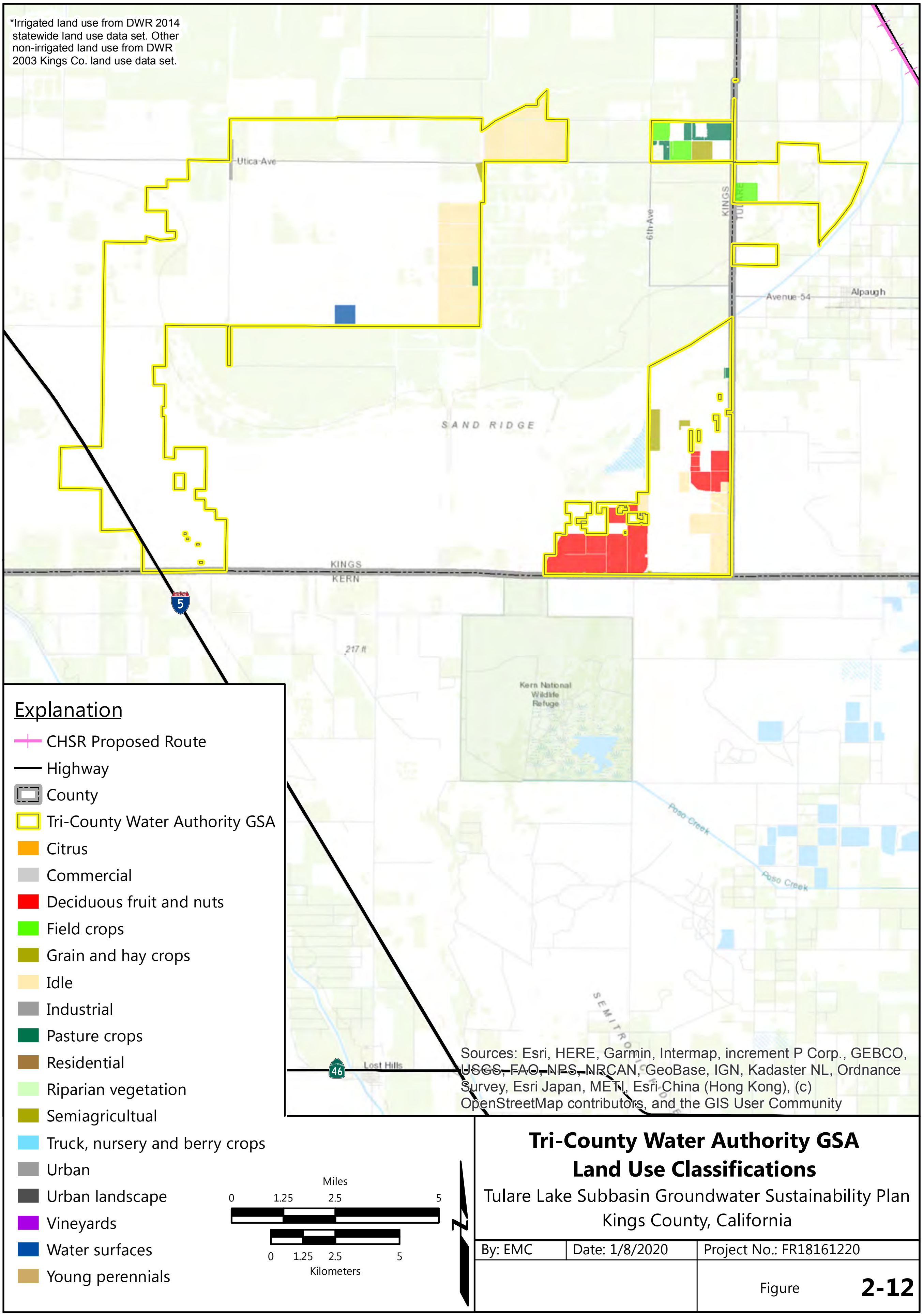
El Rico GSA Land Use Classification

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC | Date: 1/8/2020 | Project No.: FR18161220

Figure **2-11**

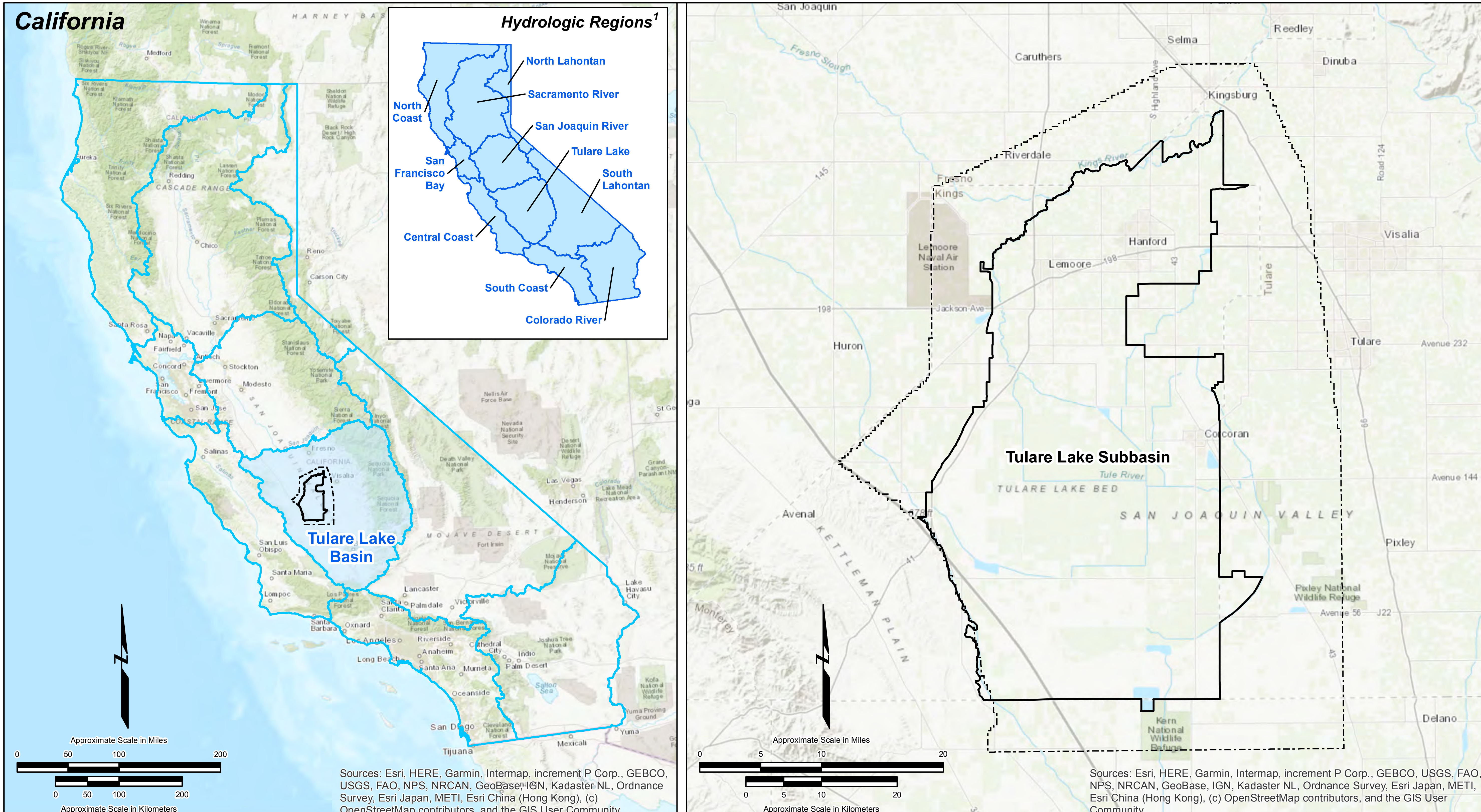
Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-11_ElRico_Landuse_8x11.mxd



Tri-County Water Authority GSA
Land Use Classifications
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/8/2020	Project No.: FR18161220
		Figure **2-12**

Date: 1/8/2020 Printed by: scott.mitchell2
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Plan_Area\Nov2019_fig2-12_TriCountyWA_LandUse_8.5x11.mxd



Explanation

- Hydrologic region
- Subbasin boundary
- Study Area

Note:

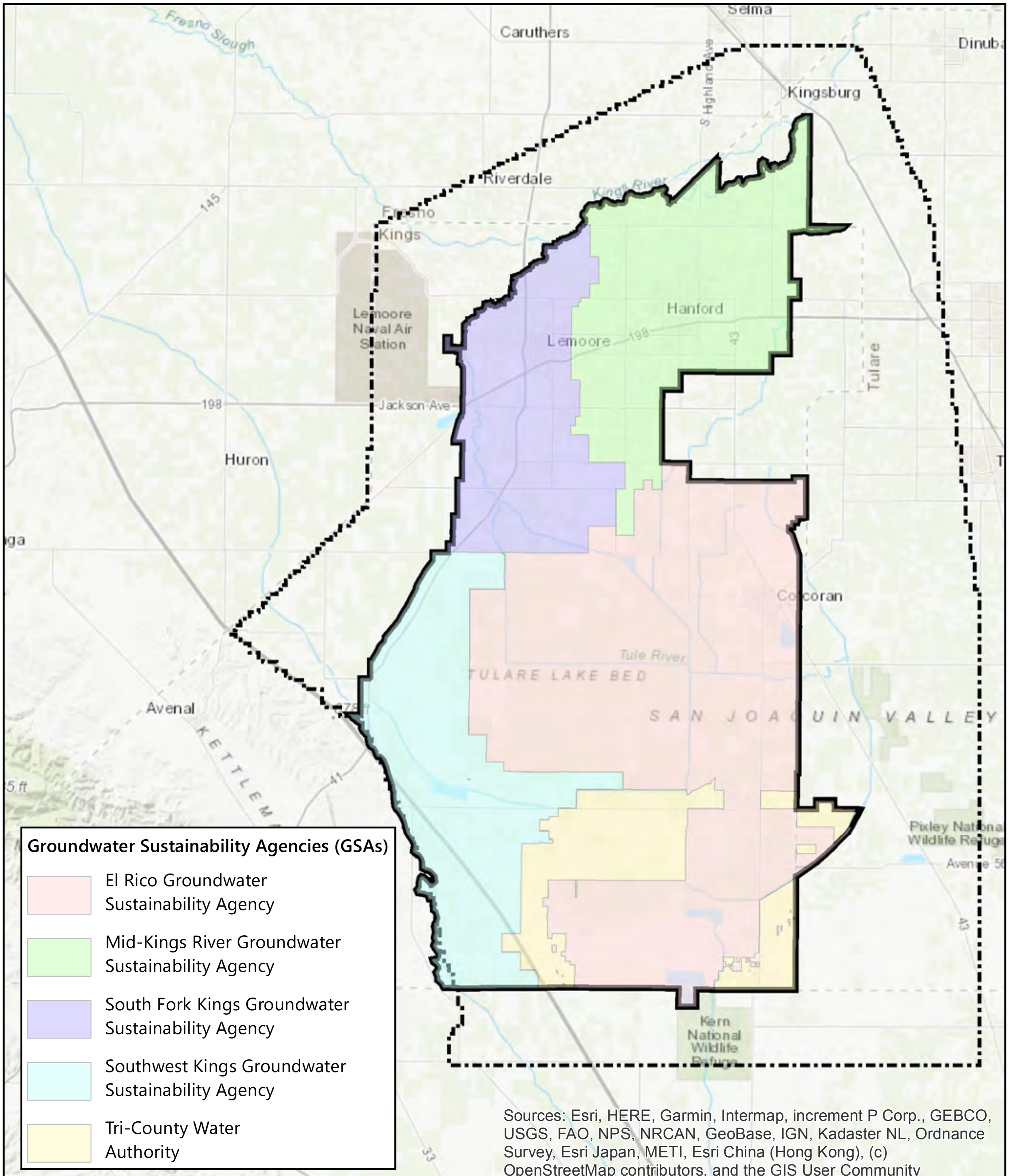
1) Hydrologic region dataset obtained from California Department of Water Resources (CA DWR), September 12, 2018.
https://data.ca.gov/dataset/hydrologic-regions

Site Location Map

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-1**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-1_SiteLocationMap.mxd



Explanation

Study area

Subbasin boundary

Miles: 0 2 4 8

Kilometers: 0 2.5 5 10

Groundwater Sustainability Agencies in Tulare Lake Subbasin

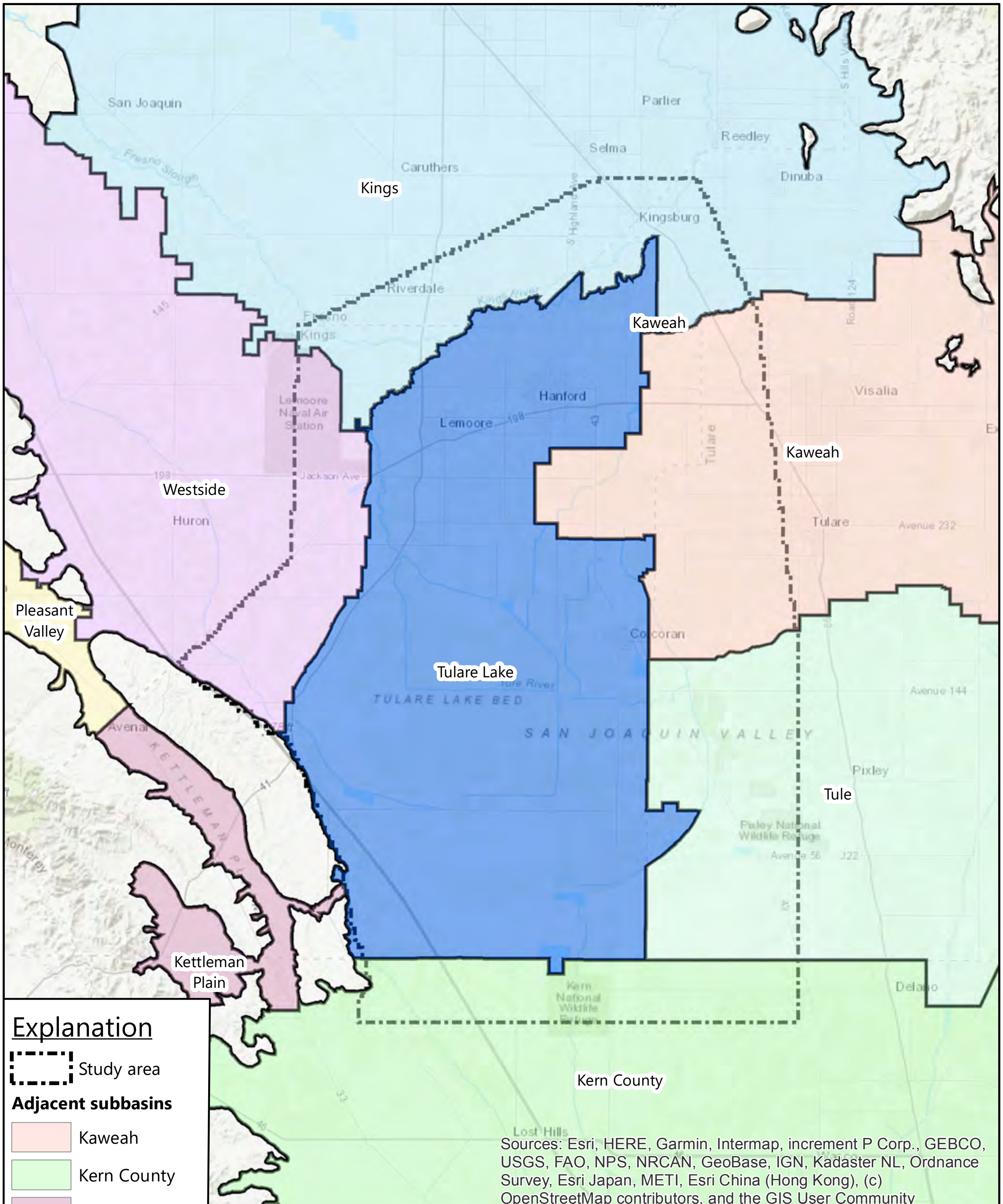
Tulare Lake Subbasin Groundwater Sustainability Plan

Kings County, California

By: EMC	Date: 11/27/2019	Project No.: FR18161220

Figure **3-2**

Date: 11/27/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-2_GSAs.mxd



Explanation

Study area

Adjacent subbasins

- Kaweah
- Kern County
- Kettleman Plain
- Kings
- Pleasant Valley
- Tulare Lake
- Tule
- Westside

Miles: 0, 2.25, 4.5, 9

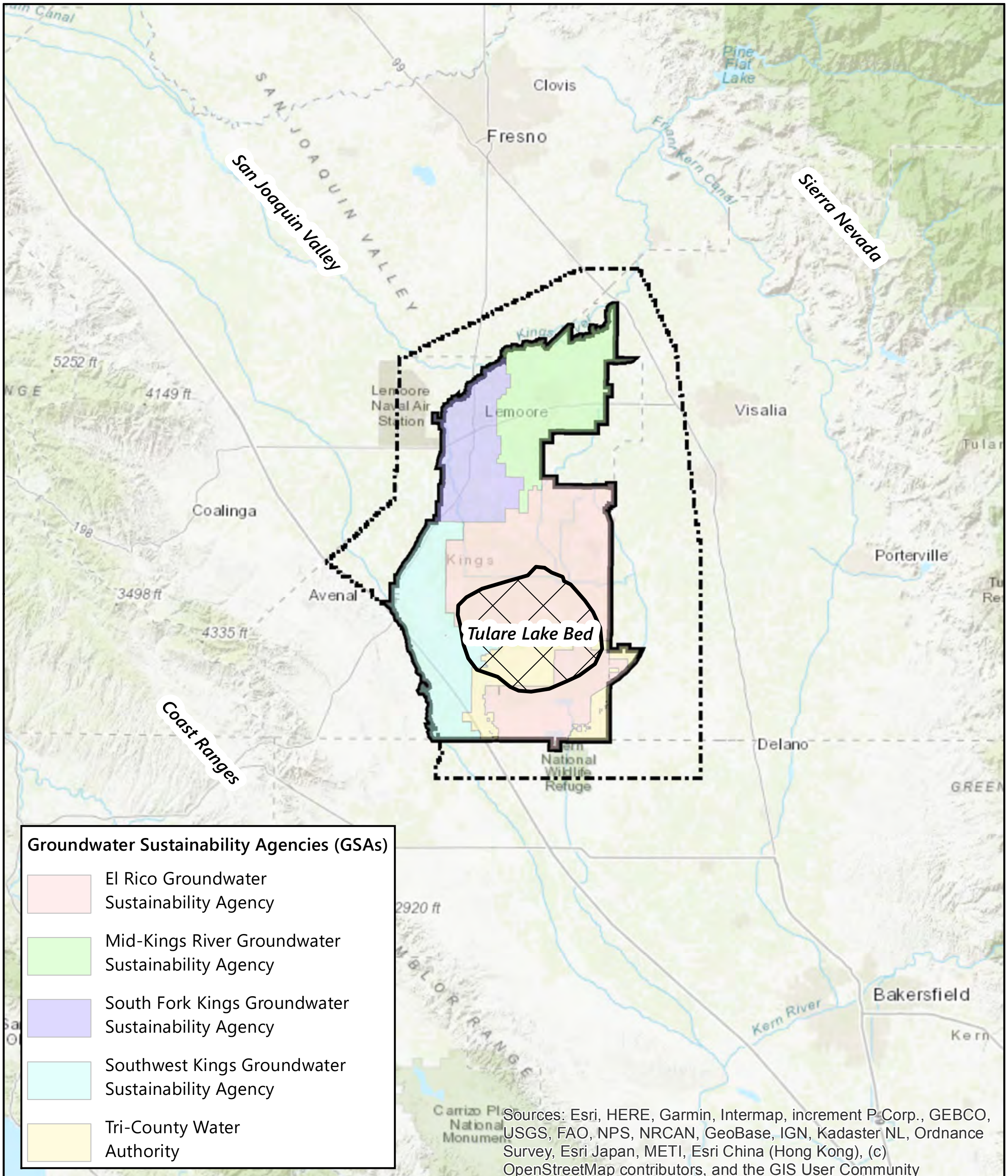
Kilometers: 0, 2.5, 5, 10

Subbasins Bounding The Tulare Lake Subbasin

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/27/2019	Project No.: FR18161220
		Figure **3-3**

Date: 11/27/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-3_adjacentsubbasins8x11.mxd



Explanation

- Study Area
- Subbasin boundary
- Clay Plug

Miles: 0, 4, 8, 16
Kilometers: 0, 5, 10, 20

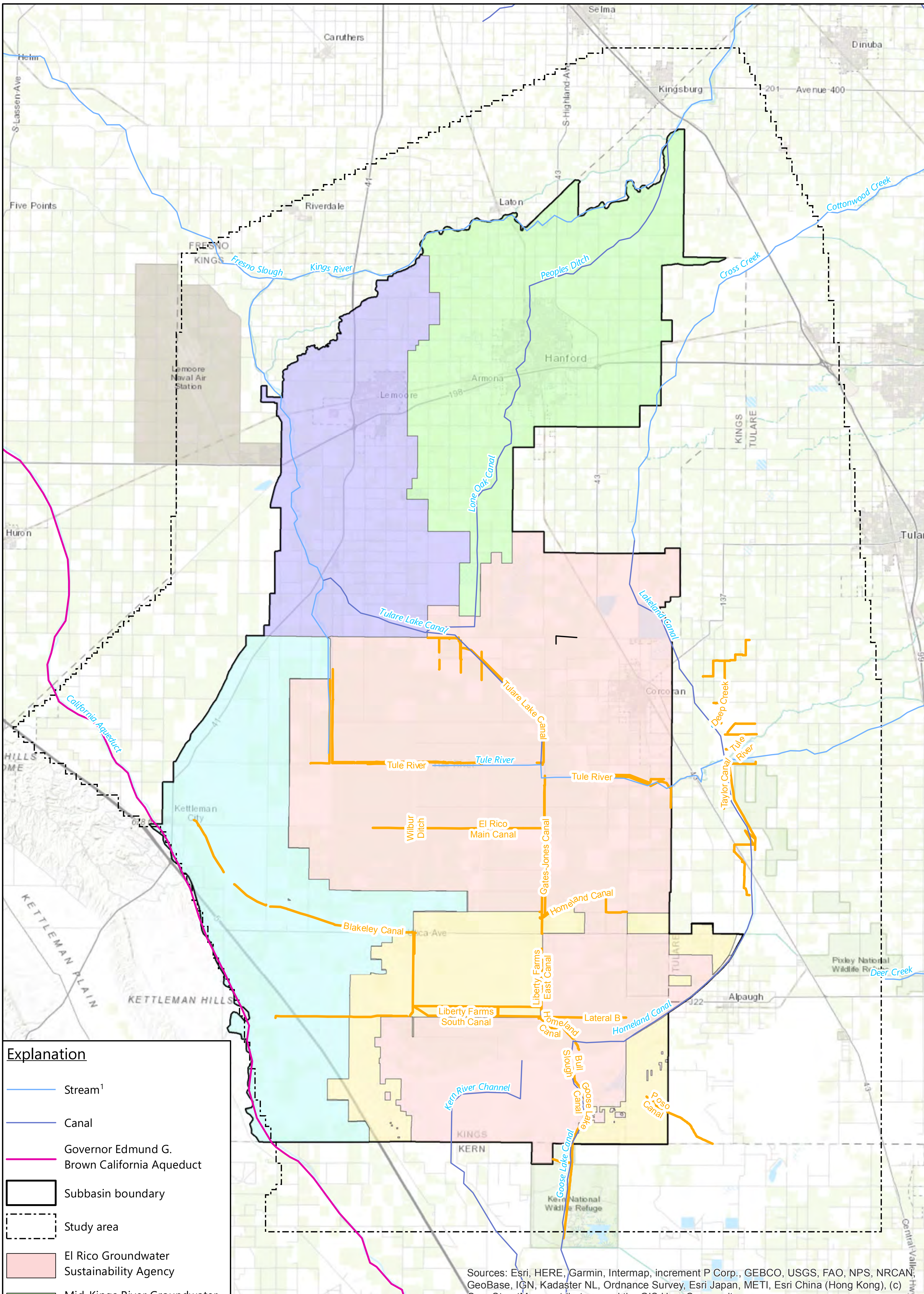
Geographic Setting of Tulare Lake Subbasin

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/7/2019	Project No.: FR18161220
		Figure **3-4**

Date: 11/7/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-4_GeographicMap.mxd

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-5_SurfaceWaterSystem.mxd



Explanation

- Stream[1]
- Canal
- Governor Edmund G. Brown California Aqueduct
- Subbasin boundary
- Study area
- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

Approximate Scale in Miles: 0 2 4 8

Approximate Scale in Kilometers: 0 2 4 8

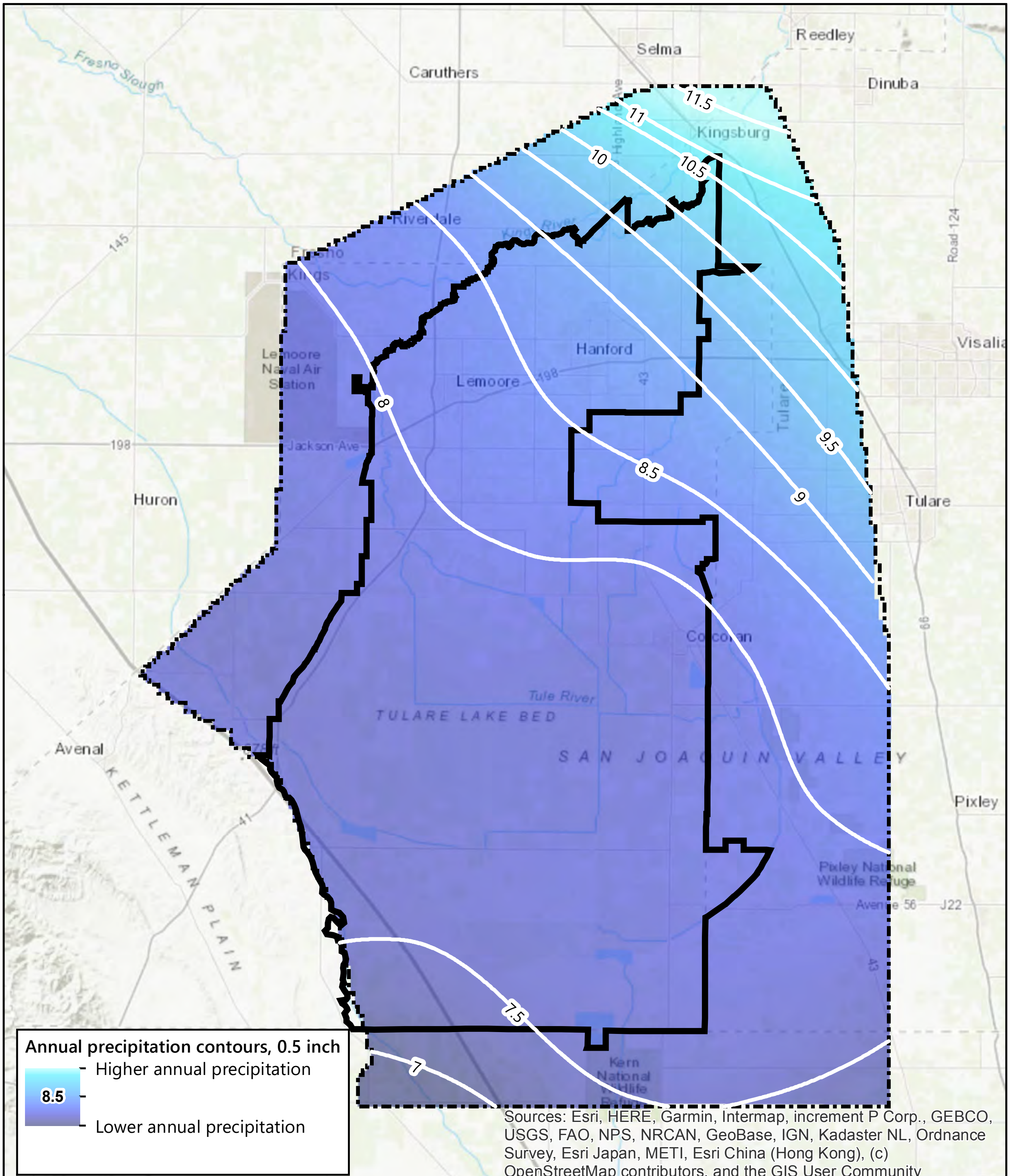
N

Notes:
1. Surface water data taken from ESRI World Hydro Basemap

Surface Water System

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-5**



Explanation

Study area

Subbasin boundary

Miles: 0, 2, 4, 8
Kilometers: 0, 2.5, 5, 10

Annual Precipitation Distribution Isohyetal Contour Map 1981-2010 30-year Normal

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

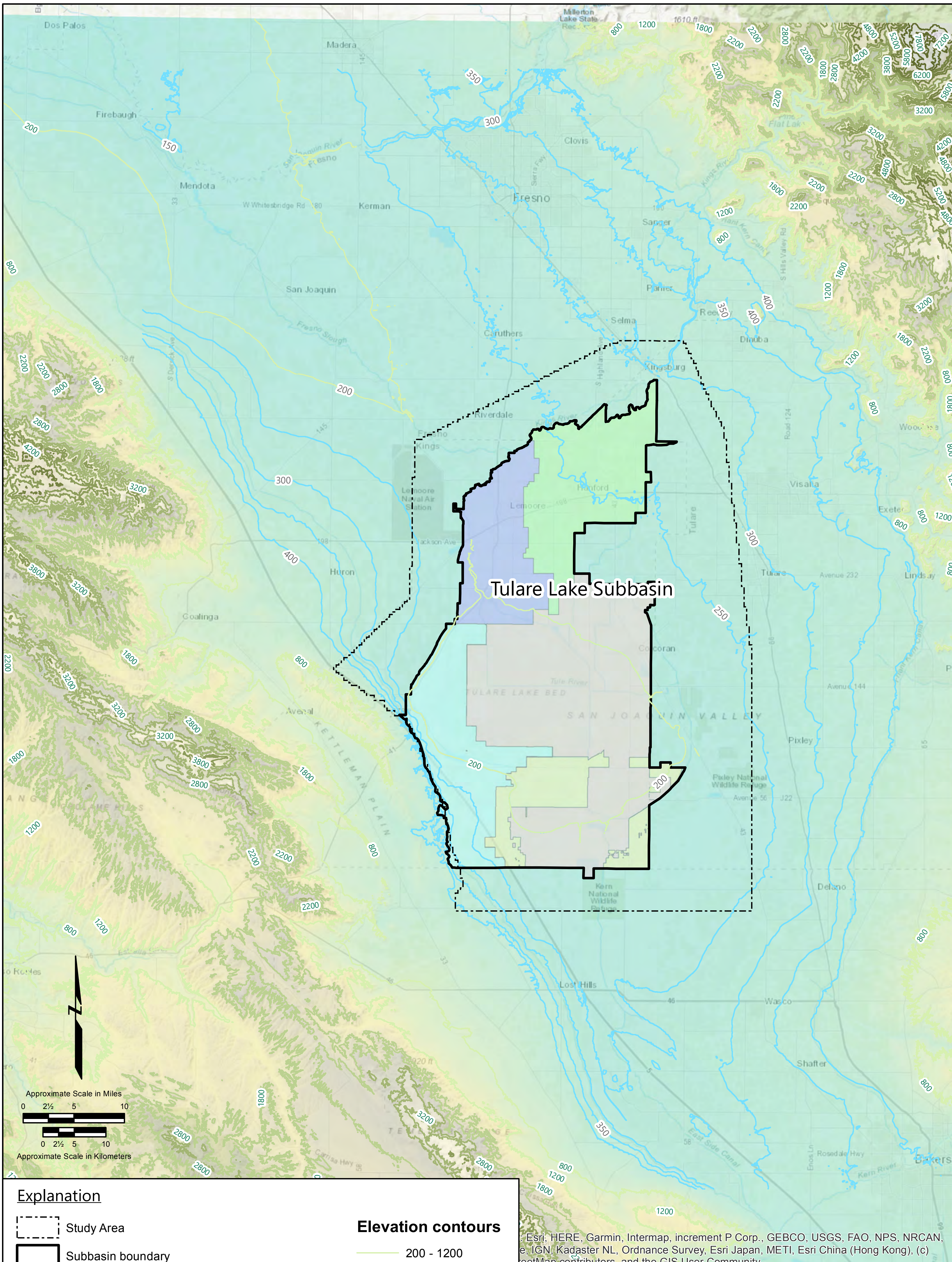
By: EMC	Date: 11/27/2019	Project No.: FR18161220
		Figure **3-6**

Notes:

1) PRISM climate group, Oregon State University, http://prism.oregonstate.edu, October 2018, (Prism, 2018)

Date: 11/27/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-6_AnnualPrecipDistribution.mxd

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-7_TopographicMap.mxd



Explanation

- Study Area
- Subbasin boundary
- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

Elevation (feet above mean sea level)

High : 9000

Low : 0

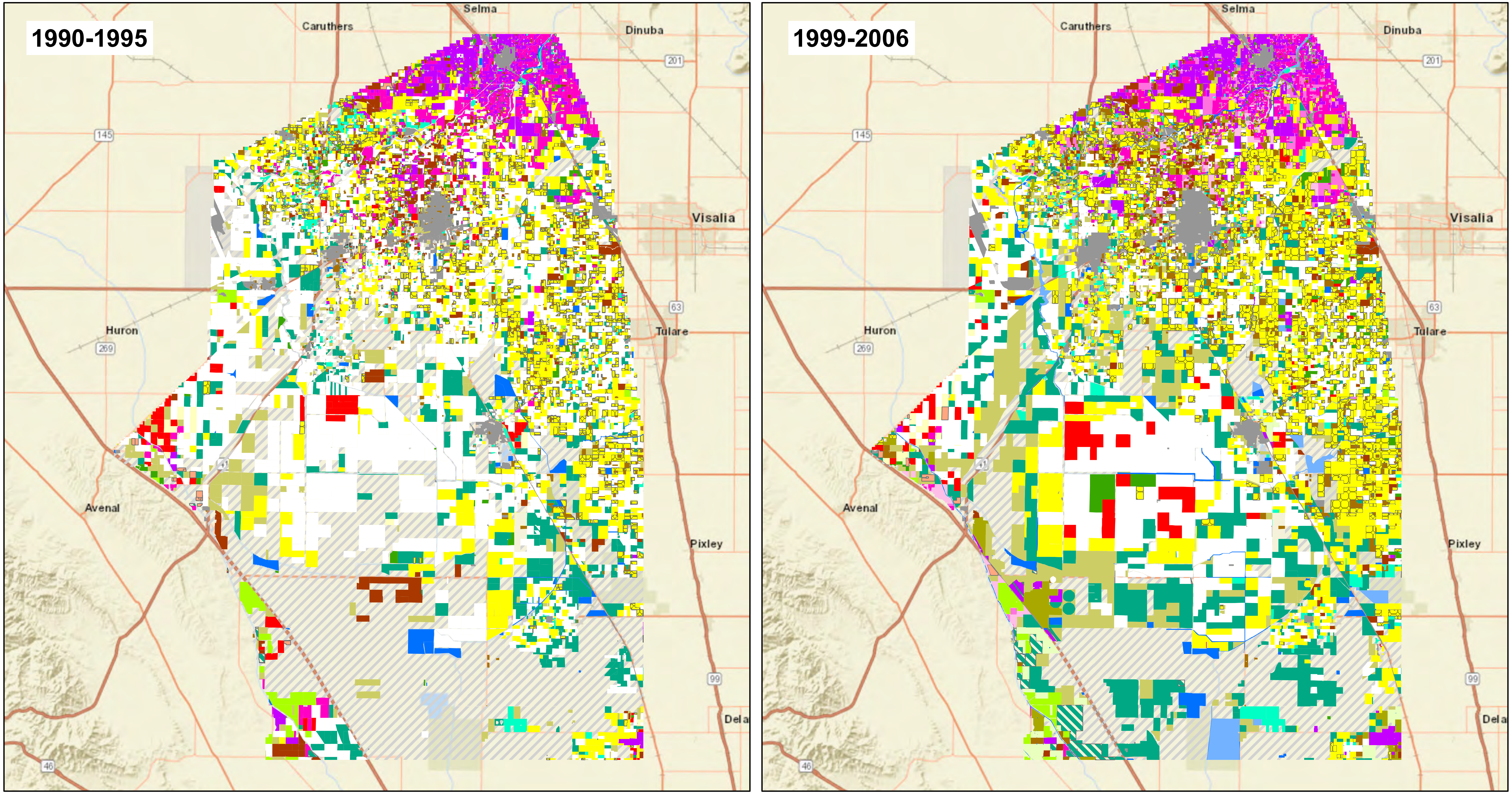
Elevation contours

- 200 - 1200
- 1201 - 2200
- 2201 - 3200
- 3201 - 4200
- 4201 - 6200
- 6201 - 8000
- **50ft elevation contour**

Topographic Map of the Tulare Lake Subbasin

Tulare Lake Subbasin Hydrologic Model
Kings County, California

By: SCM	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-7**



Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Explanation

- Alfalfa Hay and Clover
- Almonds (Young)
- Almonds (Adolescent)
- Almonds (Mature)
- Berries
- Carrot Single Crop
- Citrus (no ground cover)
- Corn and Grain Sorghum
- Cotton
- Dairy Single Crop
- Fallow Land
- Forest
- Grain and Grain Hay
- Melons
- Misc. field crops
- Onions and Garlic
- Open Water
- Pasture and Misc. Grasses
- Pistachio (Young)
- Pistachio (Adolescent)
- Pistachio (Mature)
- Pomegranates (Young)
- Pomegranates (Adolescent)
- Potatoes, Sugar beets, Turnip etc..
- Riparian
- Small Vegetables
- Stone Fruit (Young)
- Stone Fruit (Adolescent)
- Stone Fruit (Mature)
- Tomatoes and Peppers
- Urban, Commercial
- Urban, Industrial
- Wine Grapes with 80% canopy
- Winter Wheat

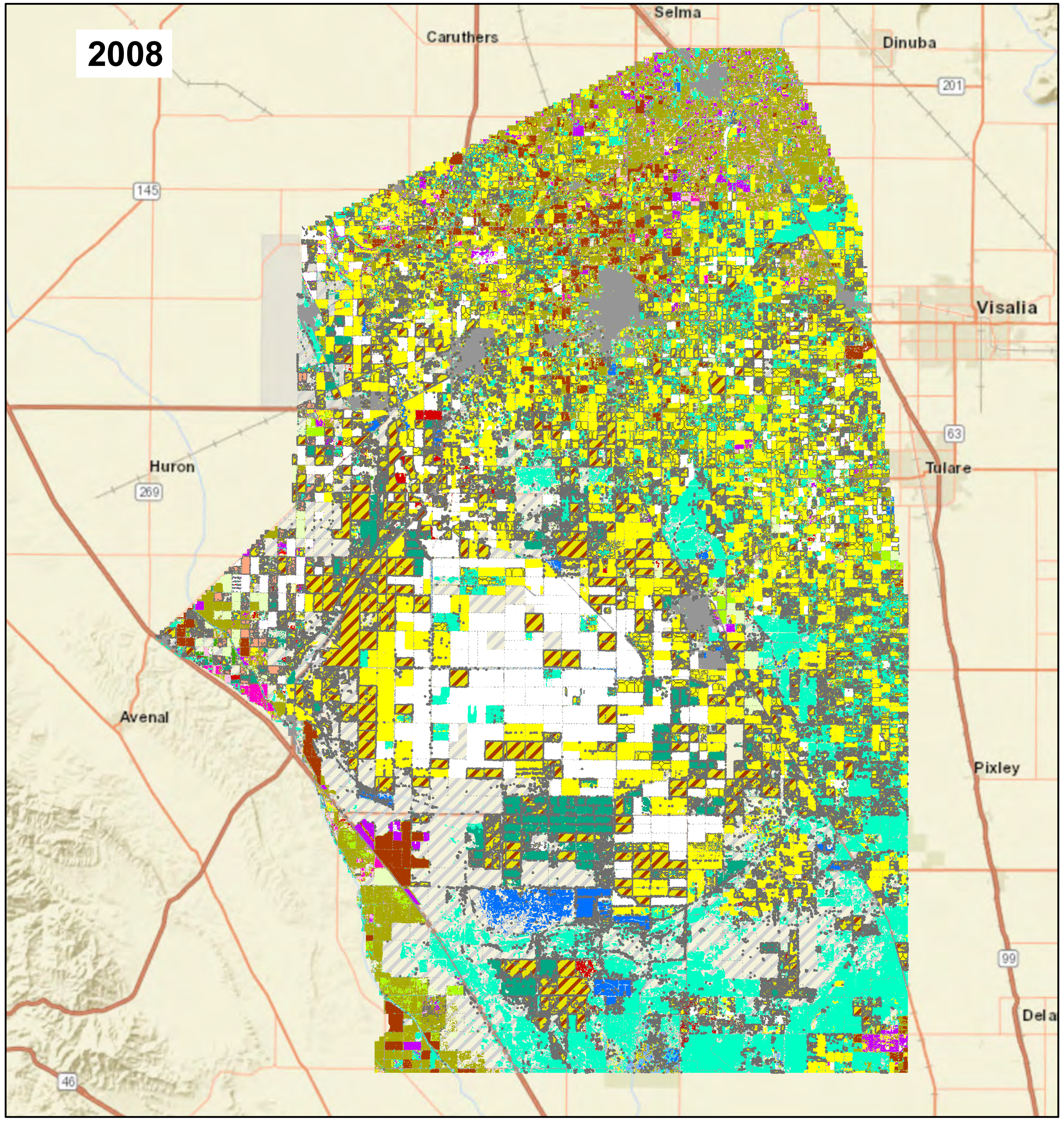
N

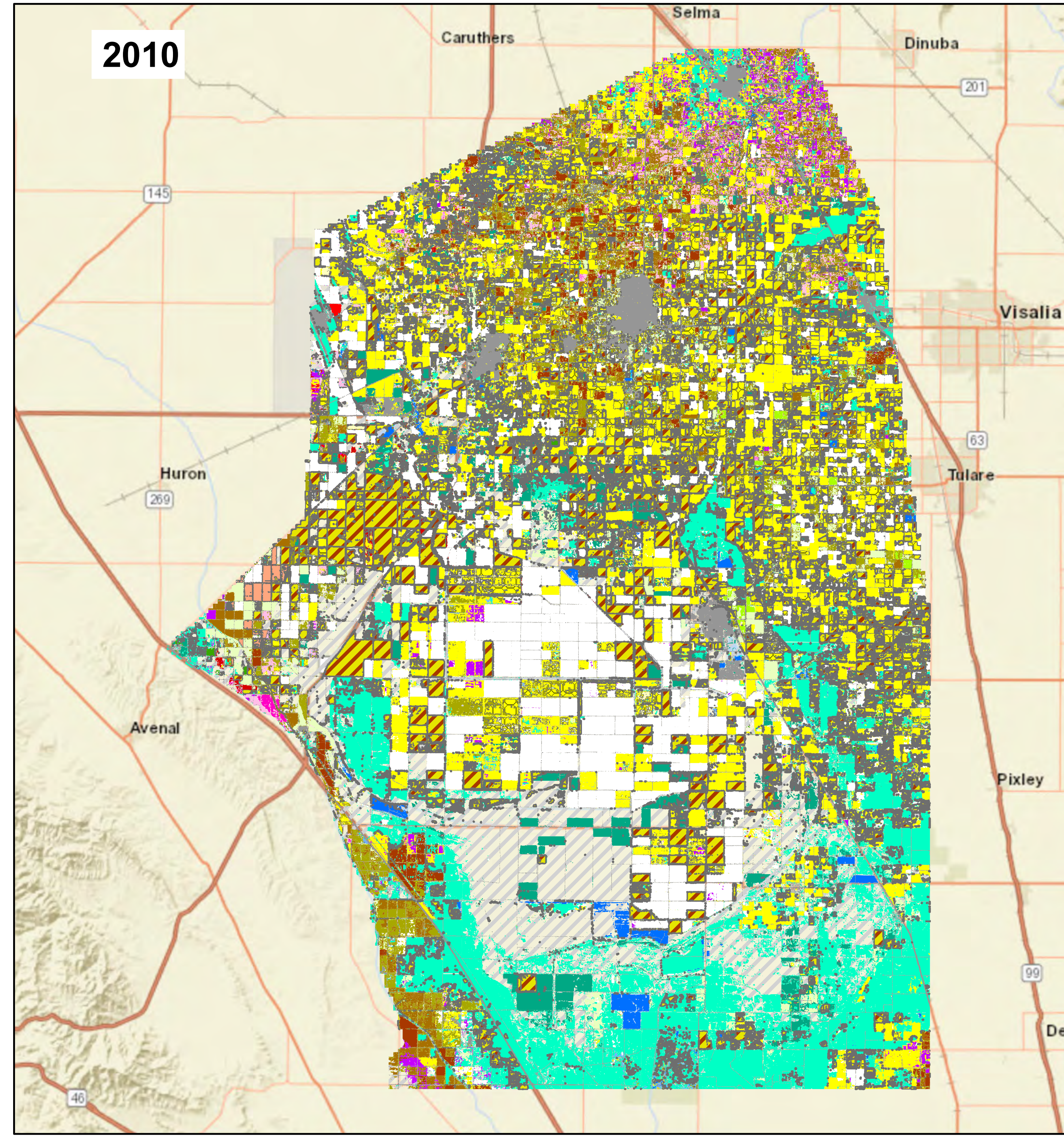
0 20,000 40,000
APPROXIMATE SCALE IN FEET

Crop Distributions
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: jmp	Date: 3/26/2019	Project No.: FR18161220
		Figure **3-8a**

\\fsn-fs1\Graphics_FR_projects\FR18s\FR18161220\gis\maps\2018\Hydrogeologic_Conceptual_Model\Arcmap 10.4_fig3-8a_CropDistributions_rev.mxd





Explanation

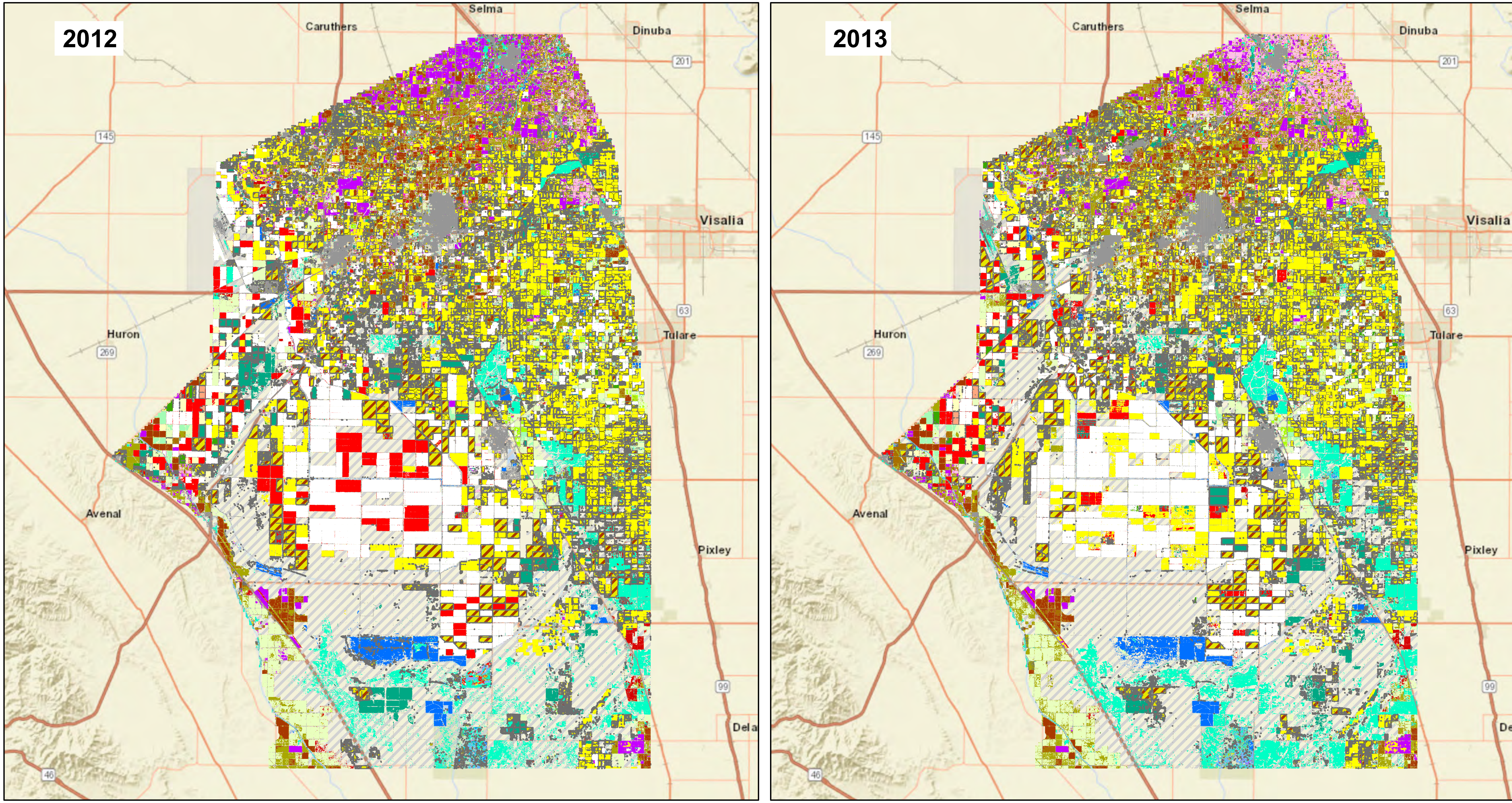
- Alfalfa Hay and Clover
- Almonds (Young)
- Almonds (Adolescent)
- Almonds (Mature)
- Berries
- Carrot Single Crop
- Citrus (no ground cover)
- Corn and Grain Sorghum
- Cotton
- Dairy Single Crop
- Fallow Land
- Forest
- Grain and Grain Hay
- Melons
- Misc. field crops
- Onions and Garlic
- Open Water
- Pasture and Misc. Grasses
- Pistachio (Young)
- Pistachio (Adolescent)
- Pistachio (Mature)
- Pomegranates (Young)
- Pomegranates (Adolescent)
- Potatoes, Sugar beets, Turnip etc..
- Riparian
- Small Vegetables
- Stone Fruit (Young)
- Stone Fruit (Adolescent)
- Stone Fruit (Mature)
- Tomatoes and Peppers
- Urban, Commercial
- Urban, Industrial
- Wine Grapes with 80% canopy
- Winter Wheat

0 20,000 40,000
APPROXIMATE SCALE IN FEET

Crop Distributions
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: jmp	Date: 3/26/2019	Project No.: FR18161220
		Figure **3-8b**

\\fsn-fs1\Graphics_FR_projects\FR18s\FR18161220\gis\maps\2018\Hydrogeologic_Conceptual_Model\Arcmap 10.4_fig3-8b_CropDistributions_rev.mxd



Explanation

- Alfalfa Hay and Clover
- Almonds (Young)
- Almonds (Adolescent)
- Almonds (Mature)
- Berries
- Carrot Single Crop
- Citrus (no ground cover)
- Corn and Grain Sorghum
- Cotton
- Dairy Single Crop
- Fallow Land
- Forest
- Grain and Grain Hay
- Melons
- Misc. field crops
- Onions and Garlic
- Open Water
- Pasture and Misc. Grasses
- Pistachio (Young)
- Pistachio (Adolescent)
- Pistachio (Mature)
- Pomegranates (Young)
- Pomegranates (Adolescent)
- Potatoes, Sugar beets, Turnip etc..
- Riparian
- Small Vegetables
- Stone Fruit (Young)
- Stone Fruit (Adolescent)
- Stone Fruit (Mature)
- Tomatoes and Peppers
- Urban, Commercial
- Urban, Industrial
- Wine Grapes with 80% canopy
- Winter Wheat

N

0 20,000 40,000

APPROXIMATE SCALE IN FEET

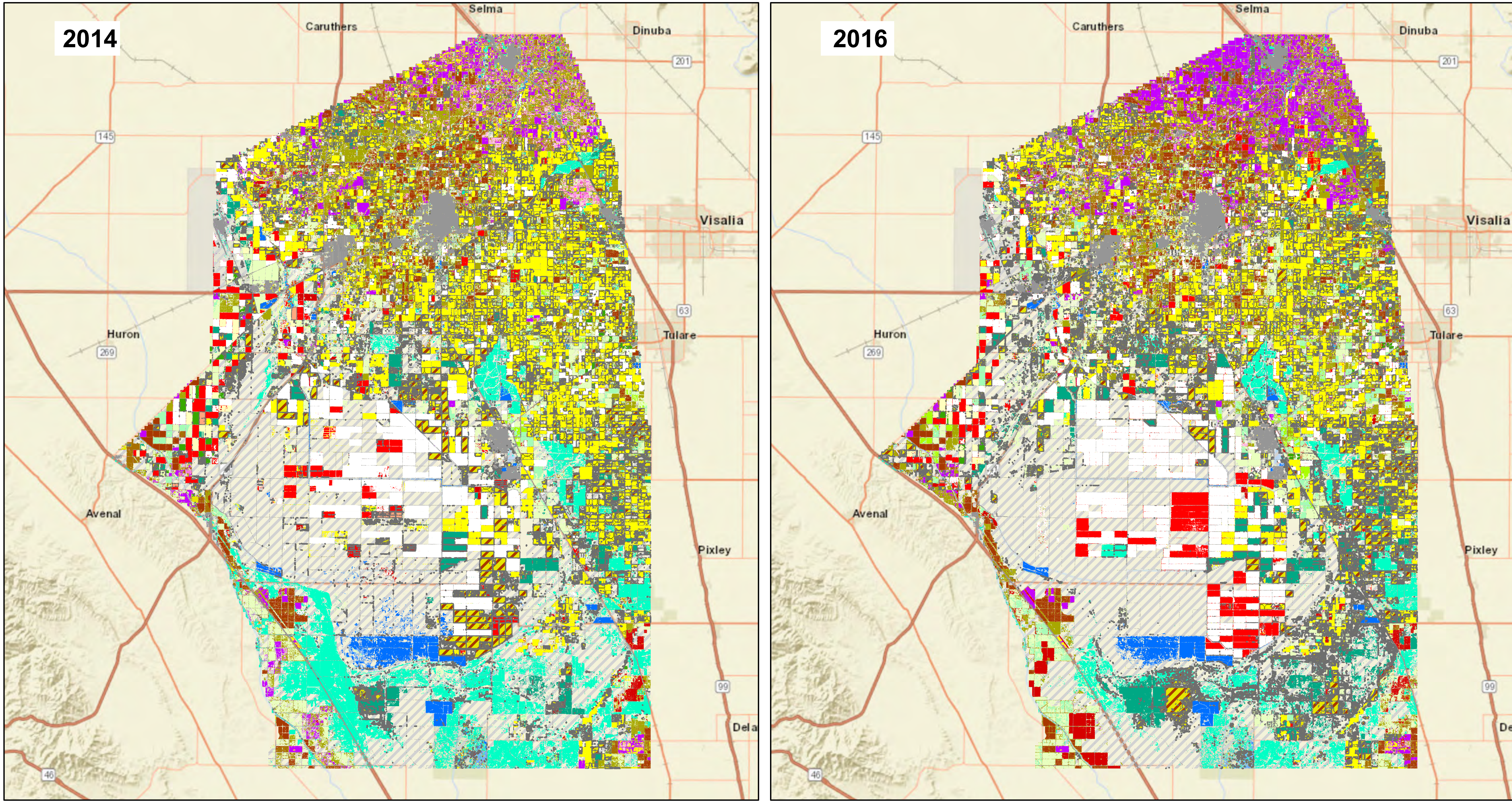
Crop Distributions

Tulare Lake Subbasin Groundwater Sustainability Plan

Kings County, California

By: jmp	Date: 3/26/2019	Project No.: FR18161220
	Figure	3-8c

\\fsn-fs1\Graphics_FR_projects\FR18s\FR18161220\gis\maps\2018\Hydrogeologic_Conceptual_Model\Arcmap 10.4_fig3-8c_CropDistributions_rev.mxd



Explanation

- Alfalfa Hay and Clover
- Almonds (Young)
- Almonds (Adolescent)
- Almonds (Mature)
- Berries
- Carrot Single Crop
- Citrus (no ground cover)
- Corn and Grain Sorghum
- Cotton
- Dairy Single Crop
- Fallow Land
- Forest
- Grain and Grain Hay
- Melons
- Misc. field crops
- Onions and Garlic
- Open Water
- Pasture and Misc. Grasses
- Pistachio (Young)
- Pistachio (Adolescent)
- Pistachio (Mature)
- Pomegranates (Young)
- Pomegranates (Adolescent)
- Potatoes, Sugar beets, Turnip etc..
- Riparian
- Small Vegetables
- Stone Fruit (Young)
- Stone Fruit (Adolescent)
- Stone Fruit (Mature)
- Tomatoes and Peppers
- Urban, Commercial
- Urban, Industrial
- Wine Grapes with 80% canopy
- Winter Wheat

N

0 20,000 40,000

APPROXIMATE SCALE IN FEET

Crop Distributions

Tulare Lake Subbasin Groundwater Sustainability Plan

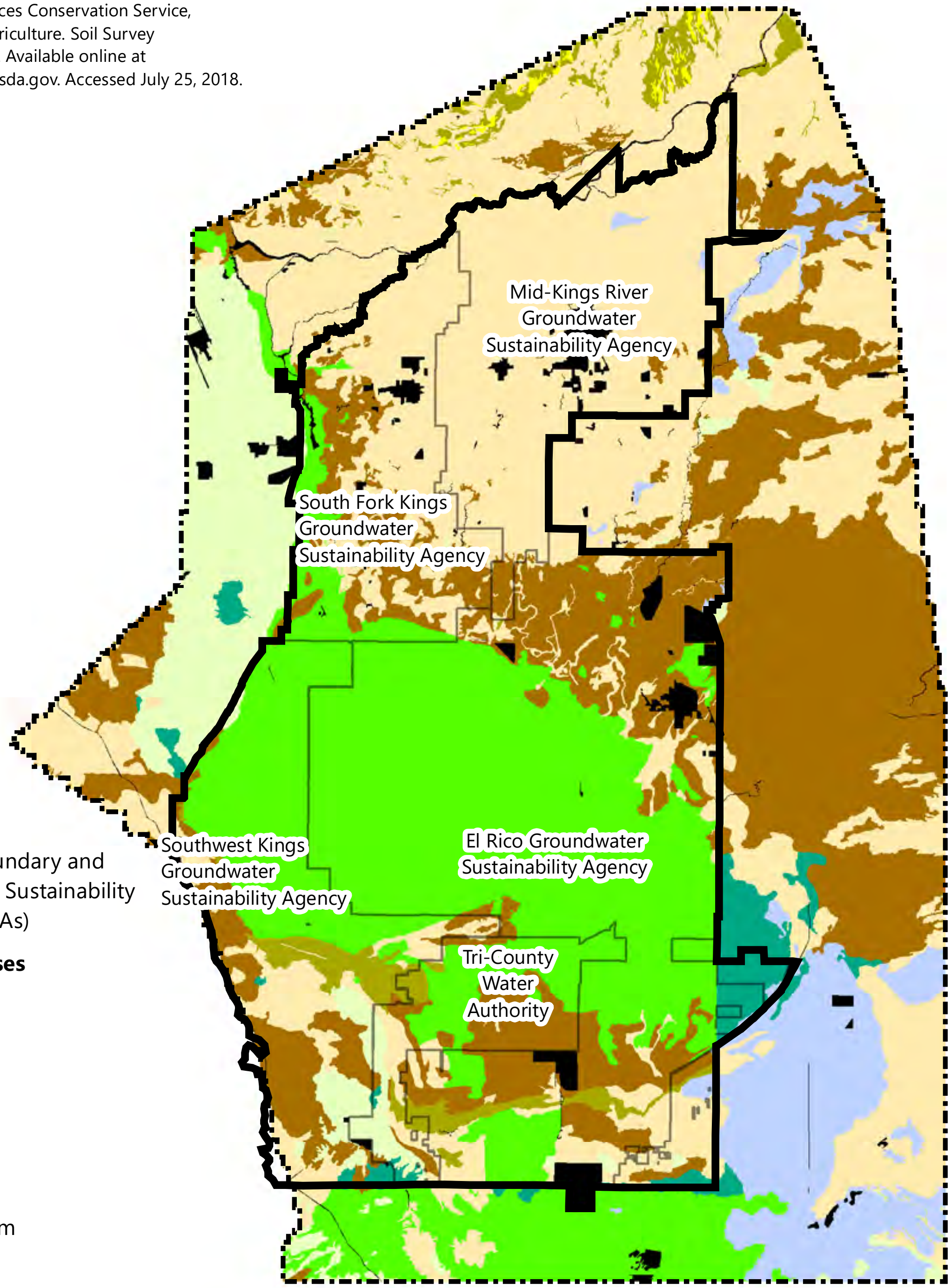
Kings County, California

By: jmp | Date: 3/26/2019 | Project No.: FR18161220

Figure 3-8d

\\fsn-fs1\Graphics_FR_projects\FR18s\FR18161220\gis\maps\2018\Hydrogeologic_Conceptual_Model\Arcmap 10.4_fig3-8d_CropDistributions_rev.mxd

Soil texture data adapted from:
Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) database. Available online at https://sdmdataaccess.sc.egov.usda.gov. Accessed July 25, 2018.



Explanation

- Study area
- Subbasin boundary and Groundwater Sustainability Agencies (GSAs)

USDA soil textural classes

- Clay
- Silty clay
- Clay loam
- Silty clay loam
- Silt loam
- Loam
- Sandy loam
- Loamy sand
- Sand
- Unweathered bedrock
- Soil data unavailable

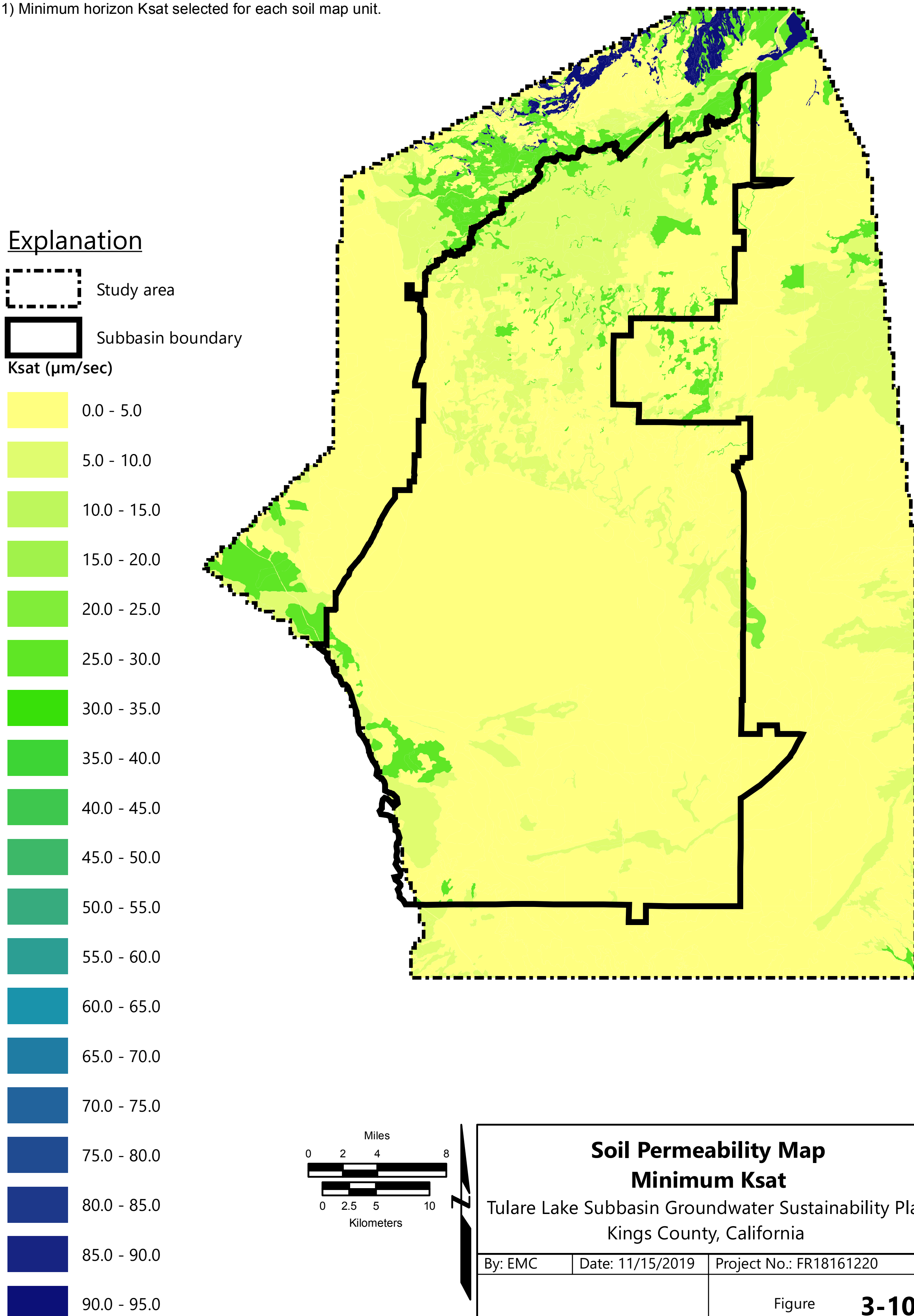
Miles: 0, 2, 4, 8
Kilometers: 0, 2.5, 5, 10

Soil Texture Map
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/15/2019	Project No.: FR18161220
		Figure **3-9**

Date: 11/15/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-9_SoilTexture.mxd

NOTES:
1) Minimum horizon Ksat selected for each soil map unit.

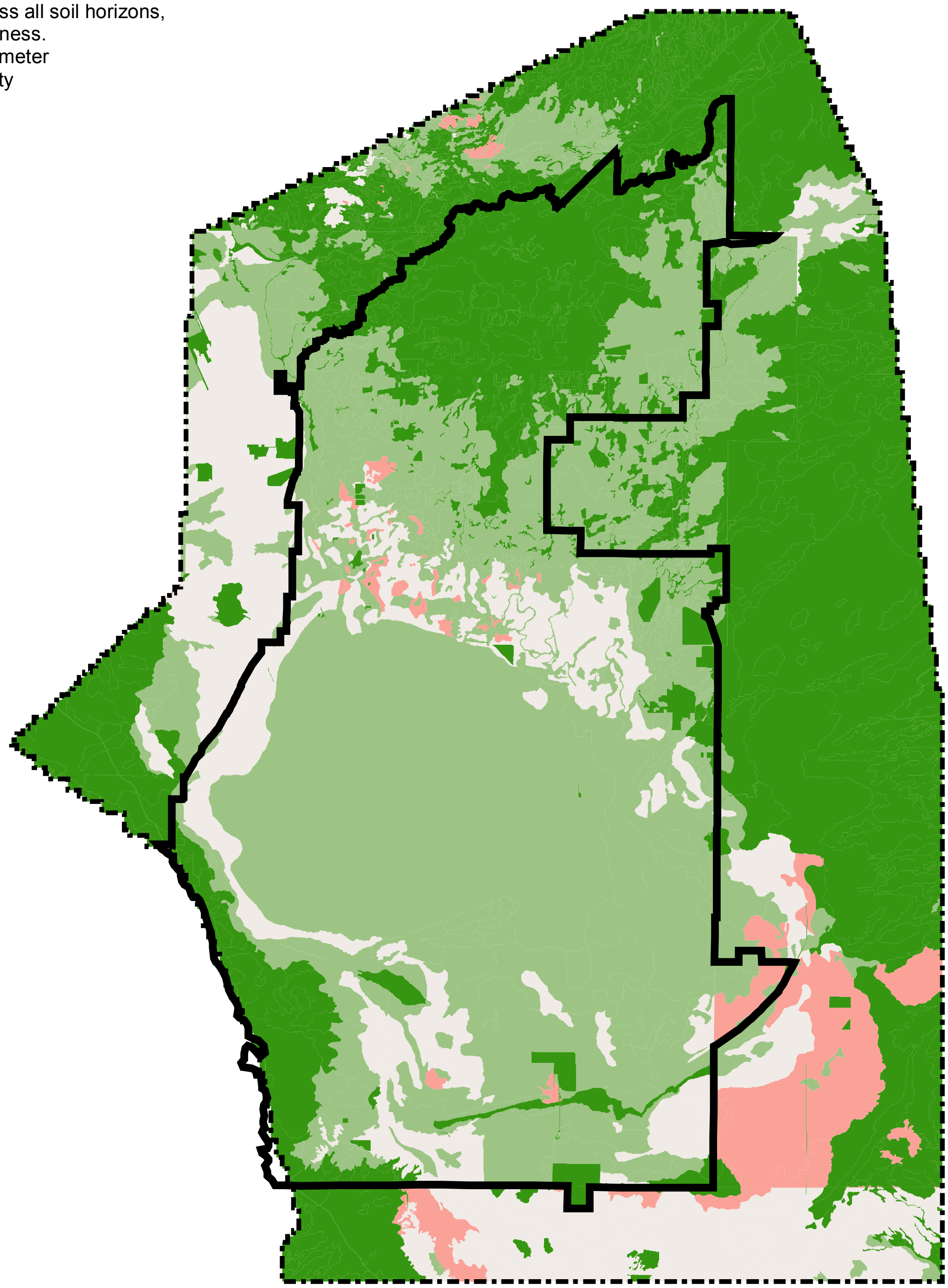


Soil Permeability Map
Minimum Ksat
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/15/2019	Project No.: FR18161220
		Figure **3-10**

Date: 11/15/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-10_SoilPermeability.mxd

Notes:
1. EC values averaged across all soil horizons, weighted by horizon thickness.
2. dS/m = deciSiemens per meter
3. EC = electrical conductivity



Explanation

Study area

Subbasin boundary

EC (dS/m)

0.0 - 4.5

4.5 - 9.0

9.0 - 15.0

15.0 - 18.0

18.0 - 25.0

Miles 0 2 4 8

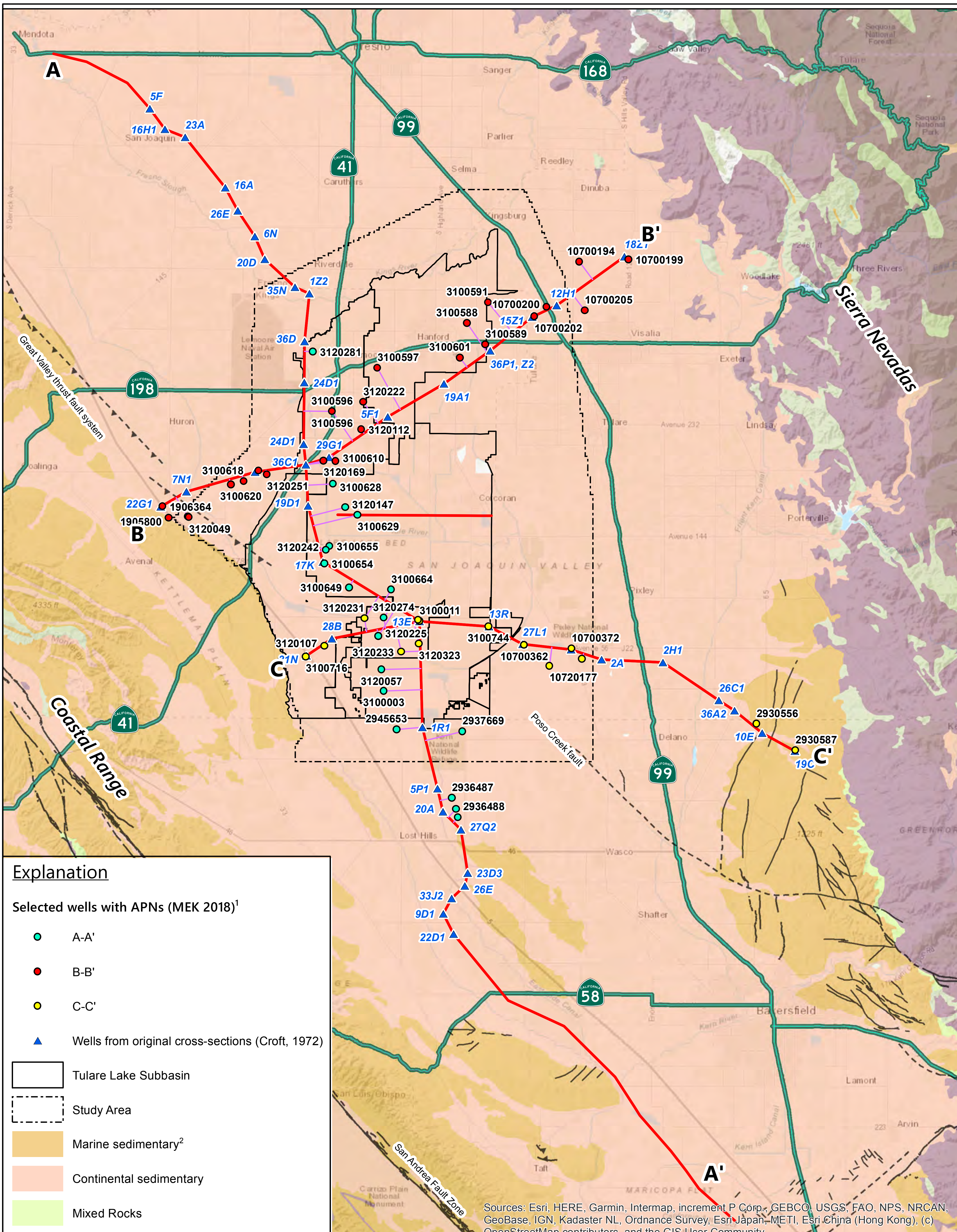
0 2.5 5 10 Kilometers

Soil Characteristics
Weighted Average on Salinity/ EC
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/15/2019	Project No.: FR18161220
		Figure **3-11**

Date: 11/15/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-11_SoilSalinity.mxd

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-12_SurficialGeology_20181106.mxd



Explanation

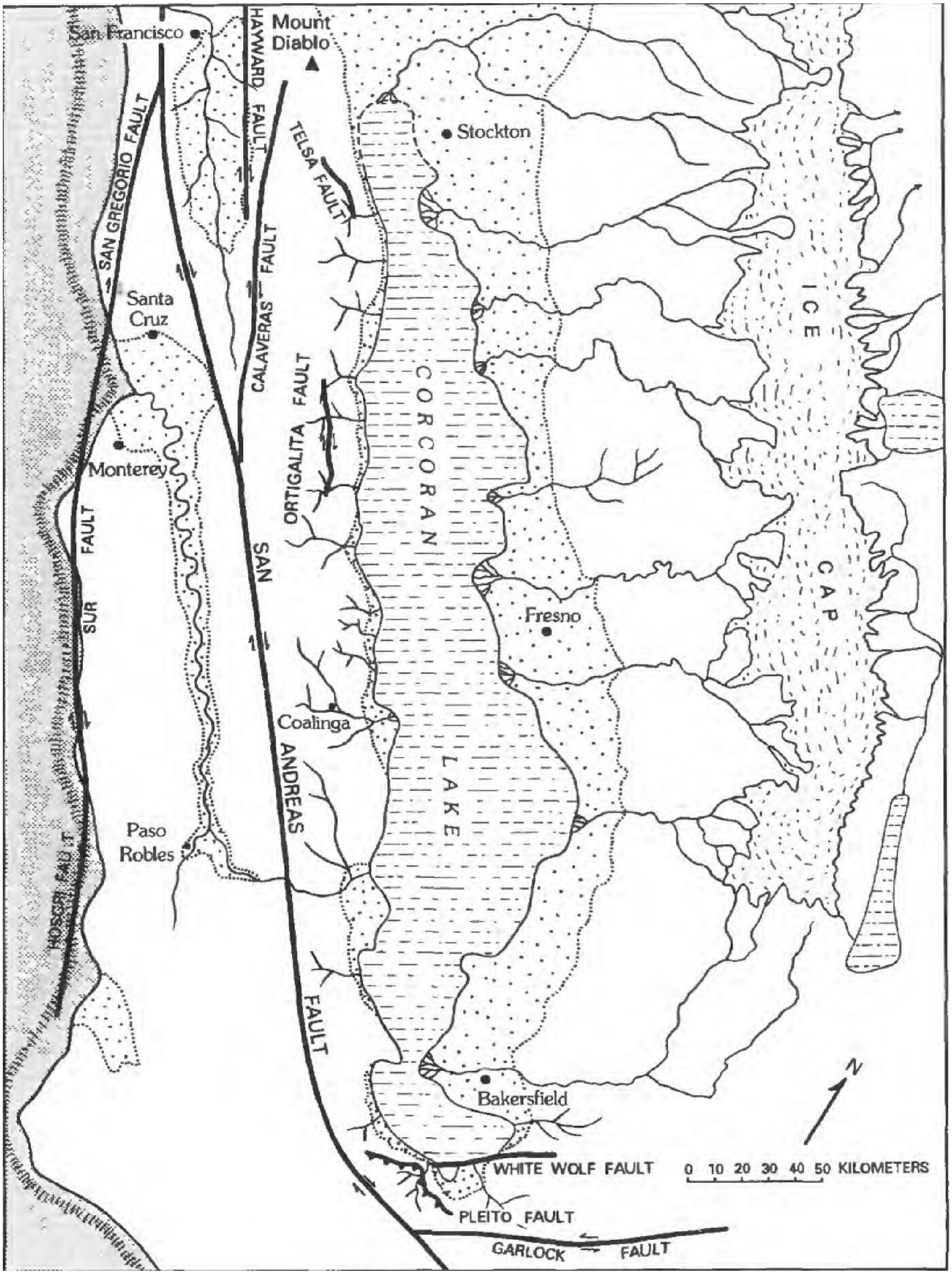
Selected wells with APNs (MEK 2018)[1]

- A-A'
- B-B'
- C-C'
- Wells from original cross-sections (Croft, 1972)
- Tulare Lake Subbasin
- Study Area
- Marine sedimentary[2]
- Continental sedimentary
- Mixed Rocks
- Igneous
- Metamorphic
- Wells projected onto cross-section lines
- Cross-section lines (Croft, 1972)
- Highways (TIGER/Line 2016)
- Constrained fault line[3]
- Inferred fault
- Inferred thrust fault

Notes:
1) Well records obtained from DOGGR well search. 2018. https://secure.conservation.ca.gov/WellSearch
2) Geologic Units derived from Geologic Map of California, 1977. USGS. https://mrdata.usgs.gov/geology/state
3) Fault data adapted from Quaternary Fault and Fold Database of the US. 2018 https://earthquake.usgs.gov/hazards/qfaults/

Geologic Map of the Southern San Joaquin Valley and Cross Section Locations
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-12**



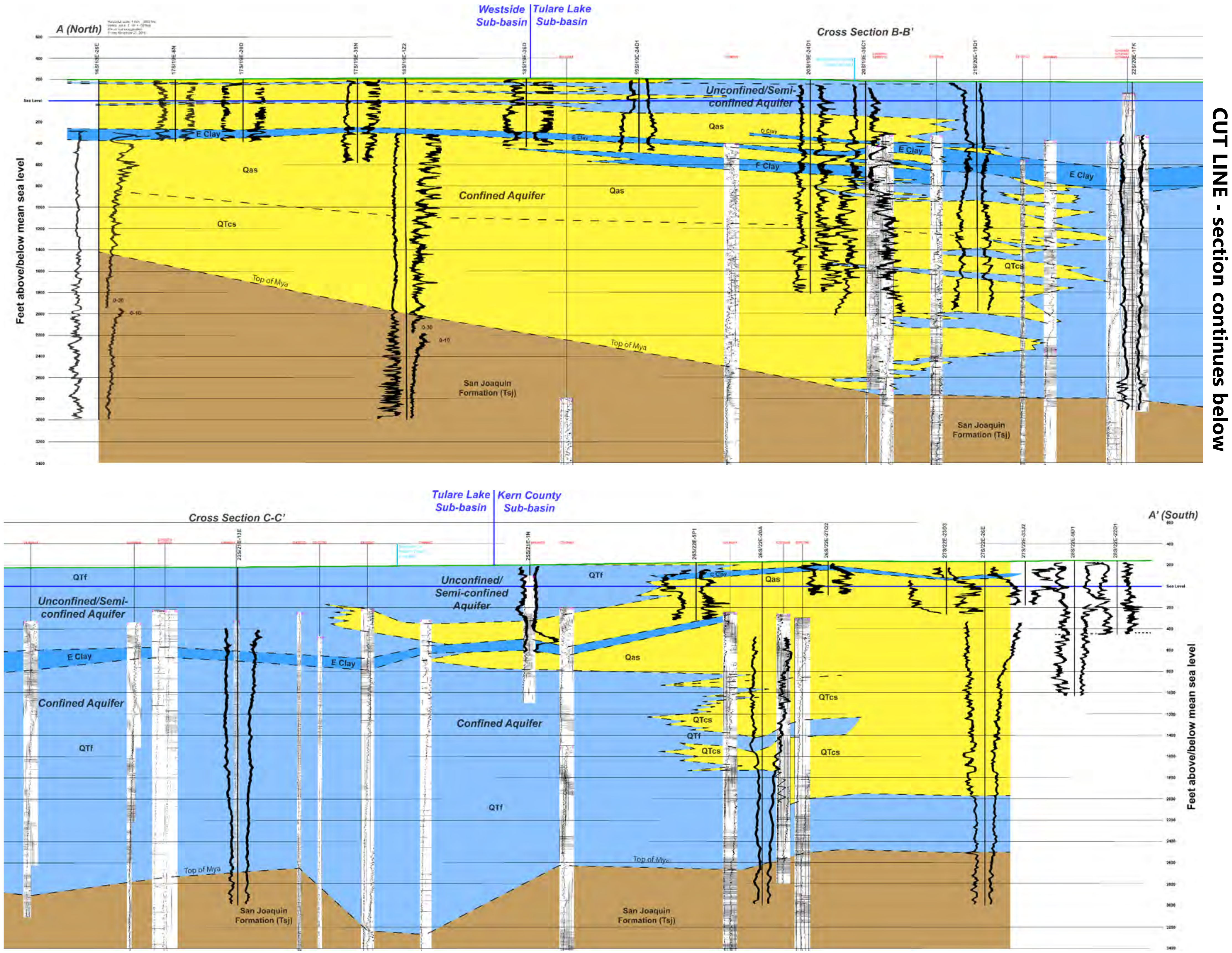
Pleistocene Extent of Corcoran Lake

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: SCM	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-13**

Note:
1) Adapted from Figure 13 of Bartow (1991).

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-13_CorcoranLake.mxd



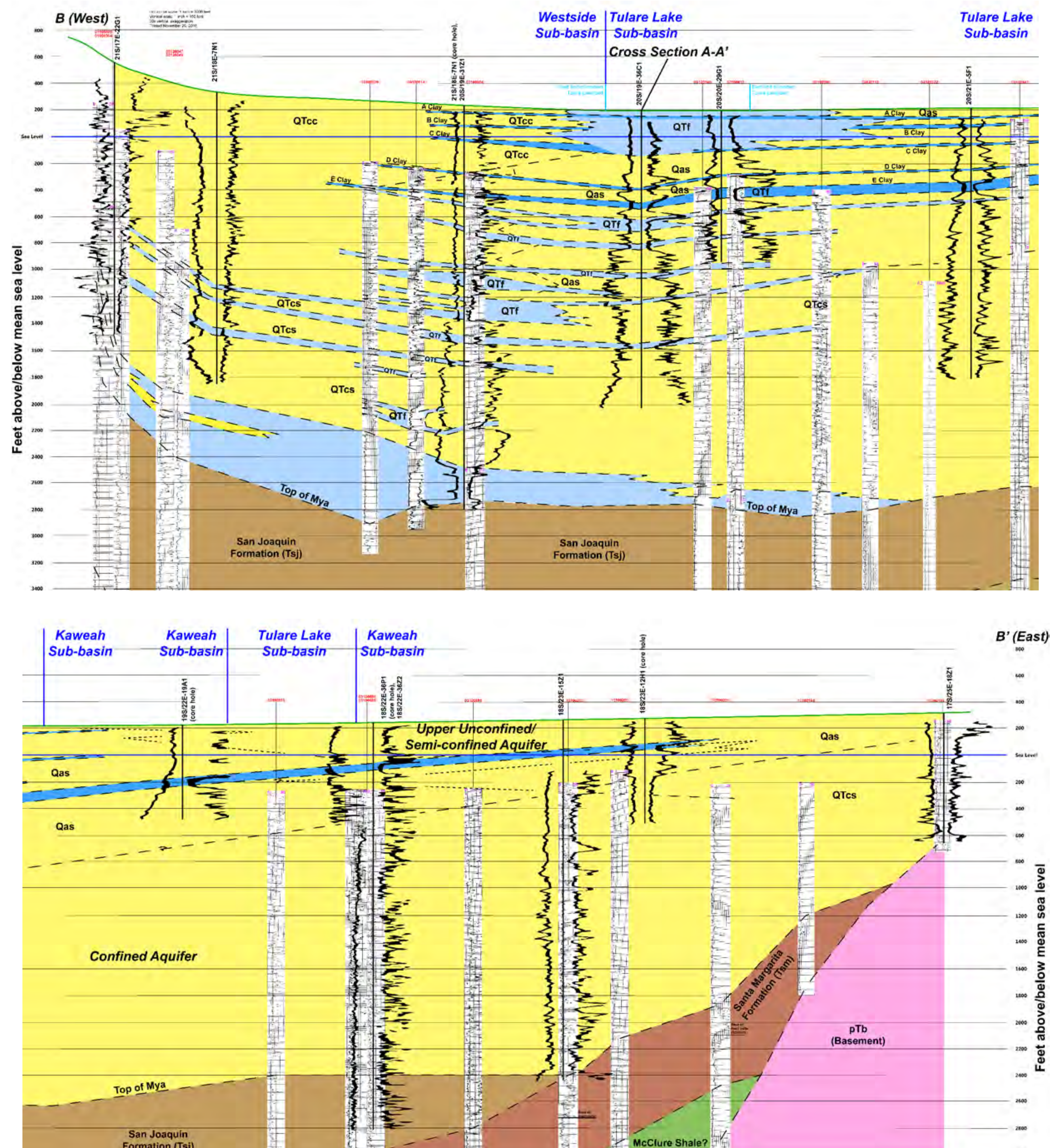
Notes:
1) Contacts dashed where inferred.
2) CA DWR = California Department of Water Resources.
2) CA DOGGR = Division of Oil, Gas, and Geothermal Resources, California Department of Conservation.

Cross Section A-A'
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings county, California

By: EMC | Date: 1/9/2020 | Project No.: FR18161220

Figure **3-14a**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-14a_xsecA-A'.mxd



Explanation

(yellow)	Coarse-grained alluvium / Tulare Formation
(tan)	San Joaquin Formation
(olive)	Etchegoin Formation
(brown)	Santa Margarita Formation
(light blue)	Alluvium / Tulare Formation lacustrine sediments
(blue)	Regional clay marker beds as defined by Croft (1972)
(pink)	Crystalline basement
25S/21E-1N	CA DWR well name
03120281	CA DOGGR well APN
0 30	Electric log resistivity scale (ohmmeters)

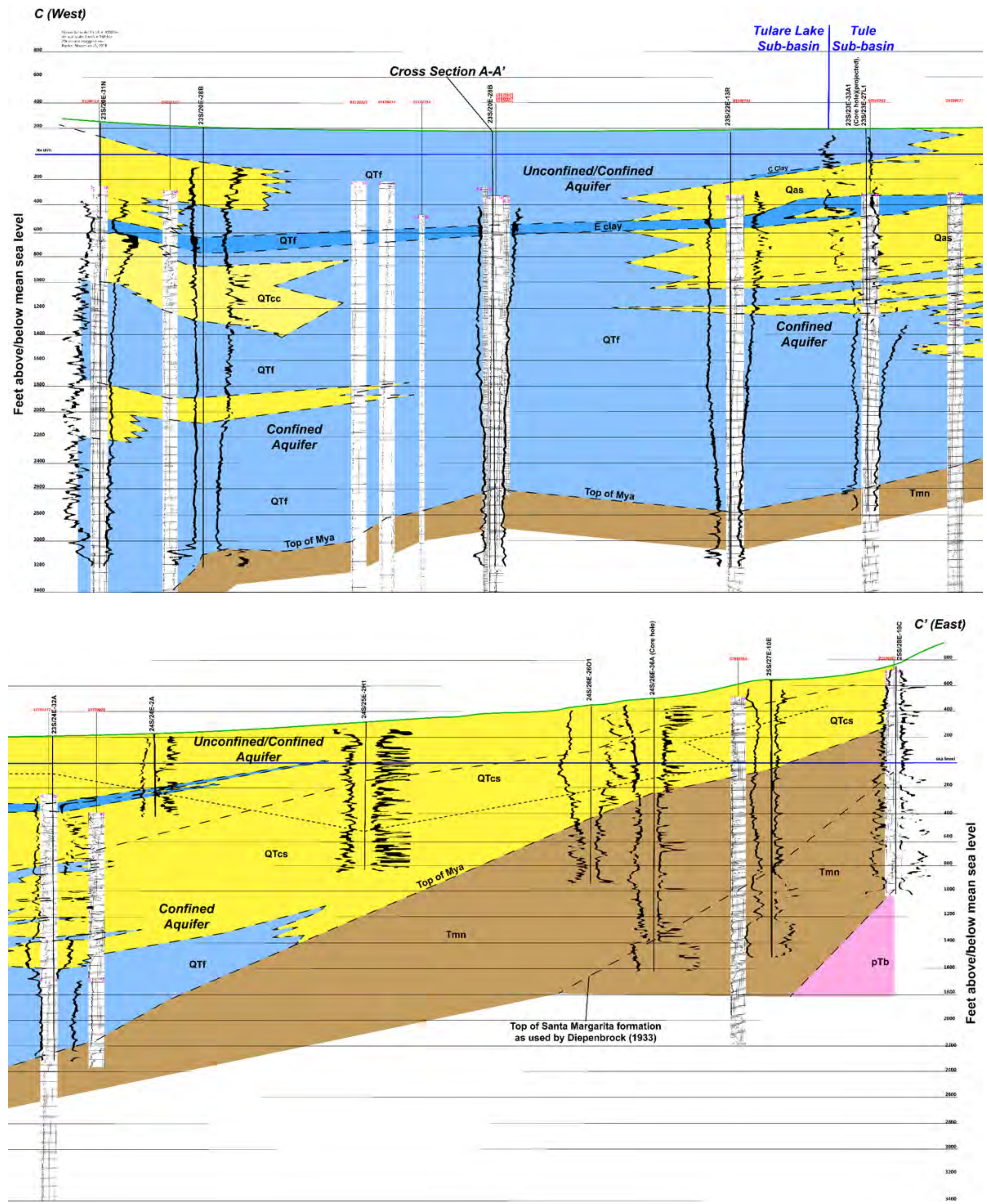
Notes:
1) Contacts dashed where inferred.
2) CA DWR = California Department of Water Resources.
2) CA DOGGR = Division of Oil, Gas, and Geothermal Resources, California Department of Conservation.

Cross Section B-B'

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-14b**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-14b_xsecB-B'.mxd



Explanation

- Coarse-grained alluvium / Tulare Formation
- San Joaquin Formation
- Alluvium / Tulare Formation lacustrine sediments
- Regional clay marker beds as defined by Croft (1972)
- Crystalline basement
- **25S/21E-1N** CA DWR well name
- **03120281** CA DOGGR well APN
- **0 30** Electric log resistivity scale (ohmmeters)

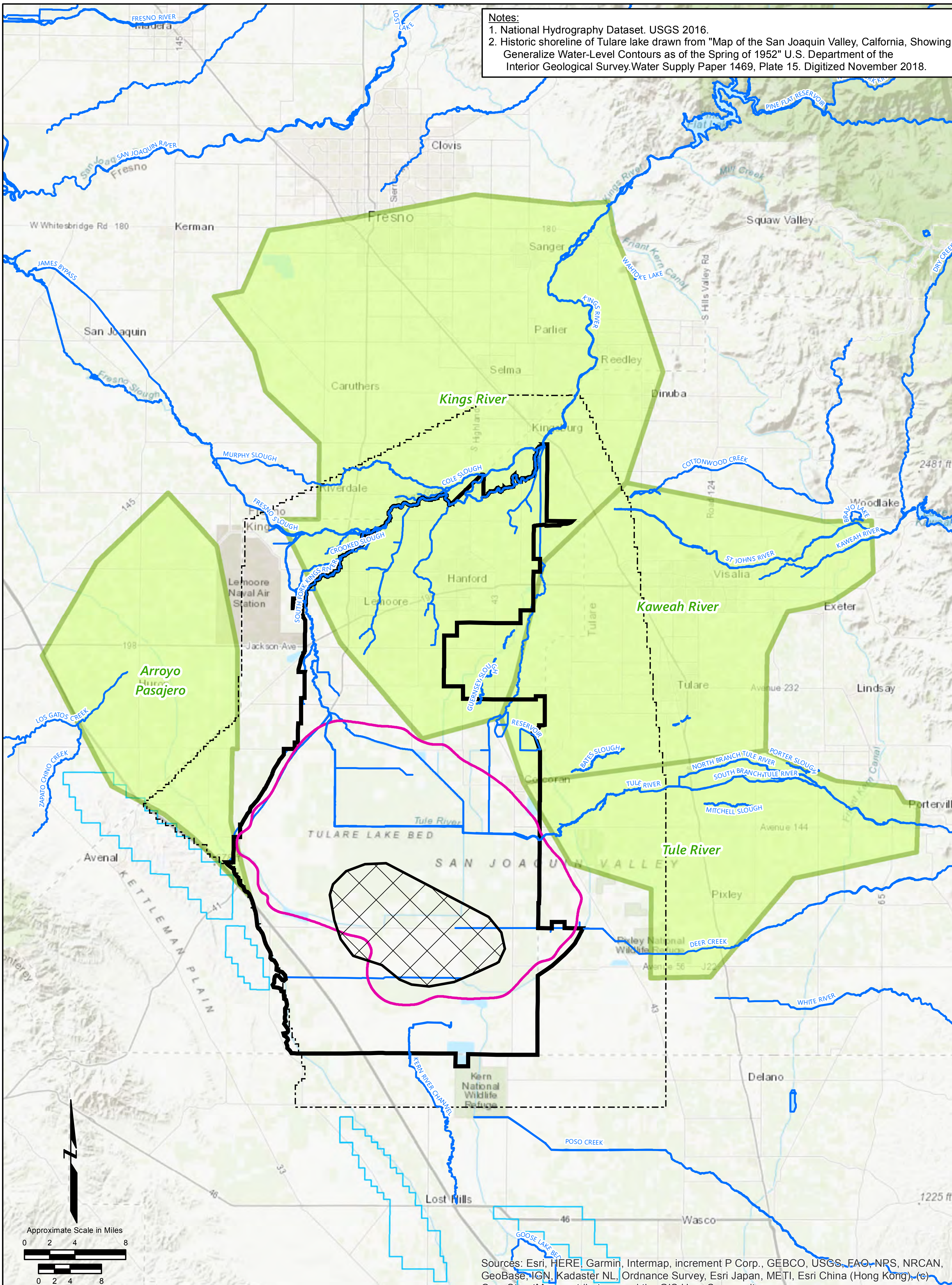
Notes:
1) Contacts dashed where inferred.
2) CA DWR = California Department of Water Resources.
3) CA DOGGR = Division of Oil, Gas, and Geothermal Resources, California Department of Conservation.

Cross Section C-C'
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-14c**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-14c_xsecC-C'.mxd

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-15_DepositionalEnvironments_GSAREV.mxd



Explanation

- NHD natural water bodies[1]
- Estimated extent of clay plug below E-clay
- Study Area
- Subbasin boundary
- Historic shoreline of Tulare Lake (modified from Summers, 1969)
- Alluvial fans (modified from Davis, 1959)
- DOGGR[2] Oil and Gas Fields

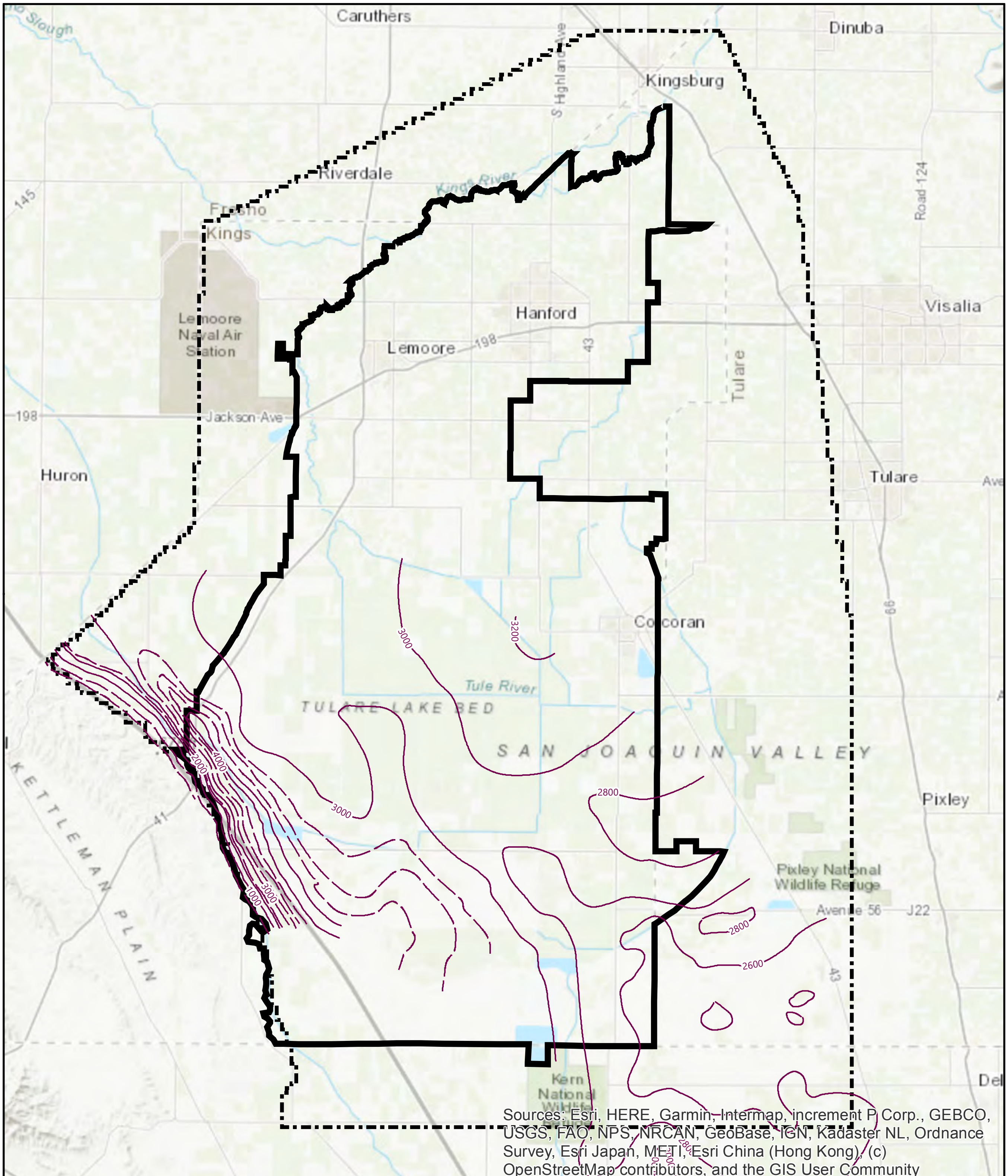
Notes:
1. NHD= National Hydrography Dataset. USGS 2016.
2. California Department of Conservation, 2017, Division of Oil, Gas, and geothermal Resources (DOGGR), http://www.conservation.ca.gov/dog/.

Depositional Environments in the Tulare Lake Subbasin

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220

Figure **3-15**



Explanation

Study area

Subbasin boundary

2000 — Line of equal depth and thickness of Tulare Formation in 200 foot intervals

Miles: 0 2 4 8

Kilometers: 0 2.5 5 10

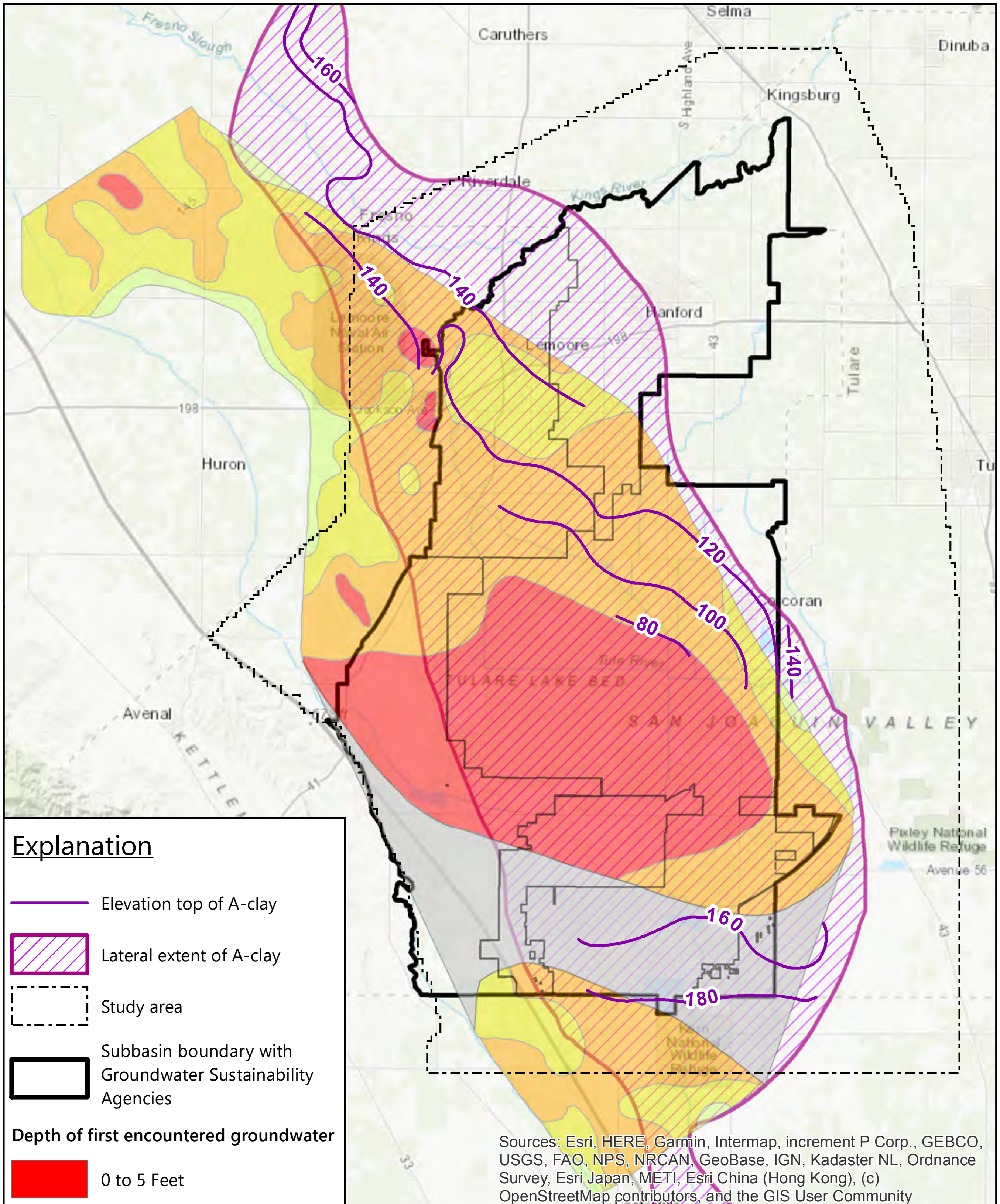
Notes: 1. Contours adapted from *Geology beyond Kettleman Hills* R.W. Page, 1980.

Map of Equal Depth to Base of Tulare Formation

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/8/2019	Project No.: FR18161220
		Figure **3-16**

Date: 11/8/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-16_baseofTulareFrm.mxd



Miles
0 2 4 8
0 2.5 5 10
Kilometers

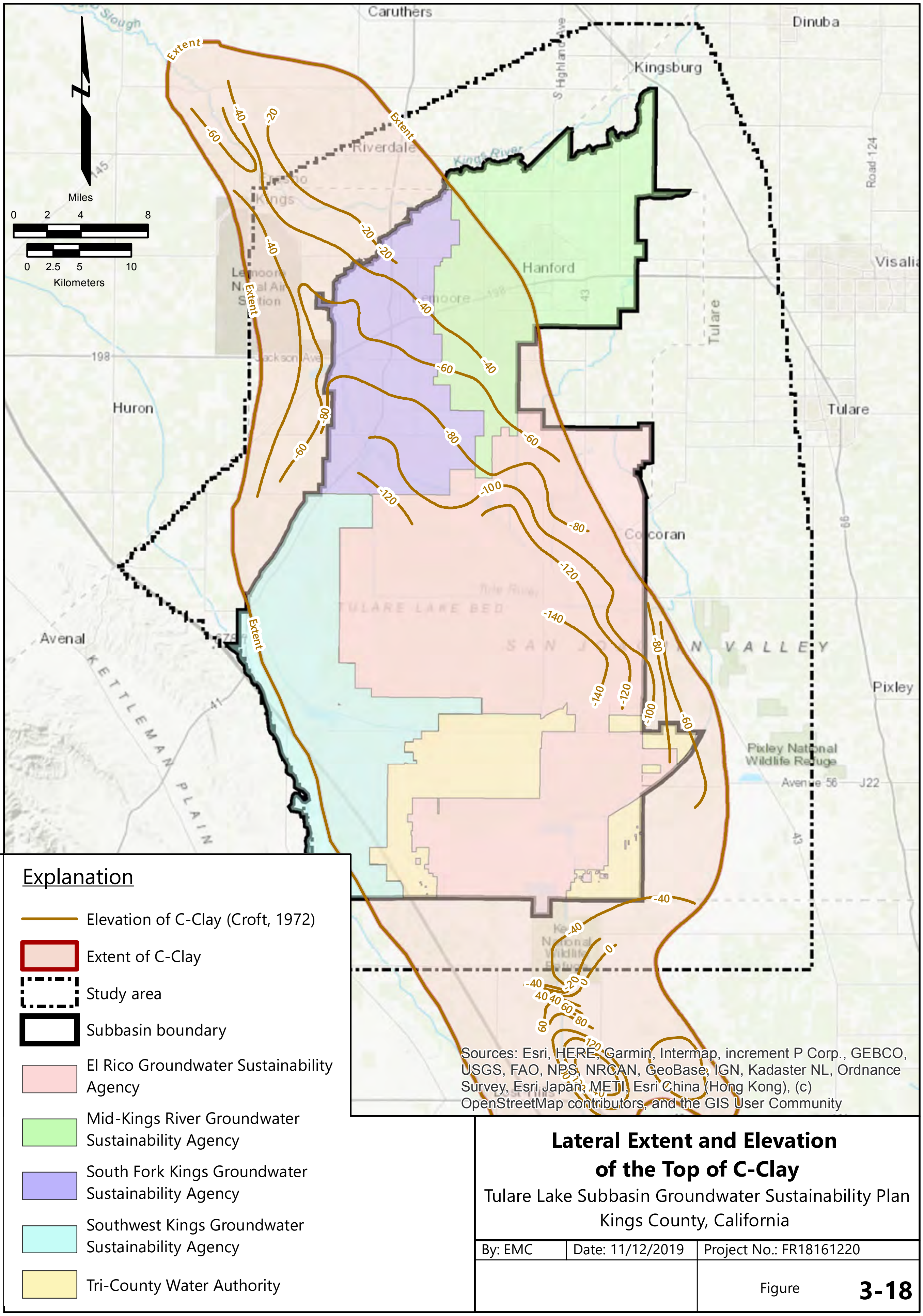
Notes:
Depth of first encountered groundwater data adapted from DWR "Present and Potential Drainage Problem Areas, San Joaquin Valley" Map, 2008

Lateral Extent and Elevation of the A-Clay and First Encountered Groundwater 2010

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 12/5/2019	Project No.: FR18161220
		Figure **3-17**

Date: 12/5/2019 Printed by: elizabeth.chapman
Path: \\fsn-fs1\Graphics_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-17_LateralExtentofAClayFirstEncounteredGW2010.mxd



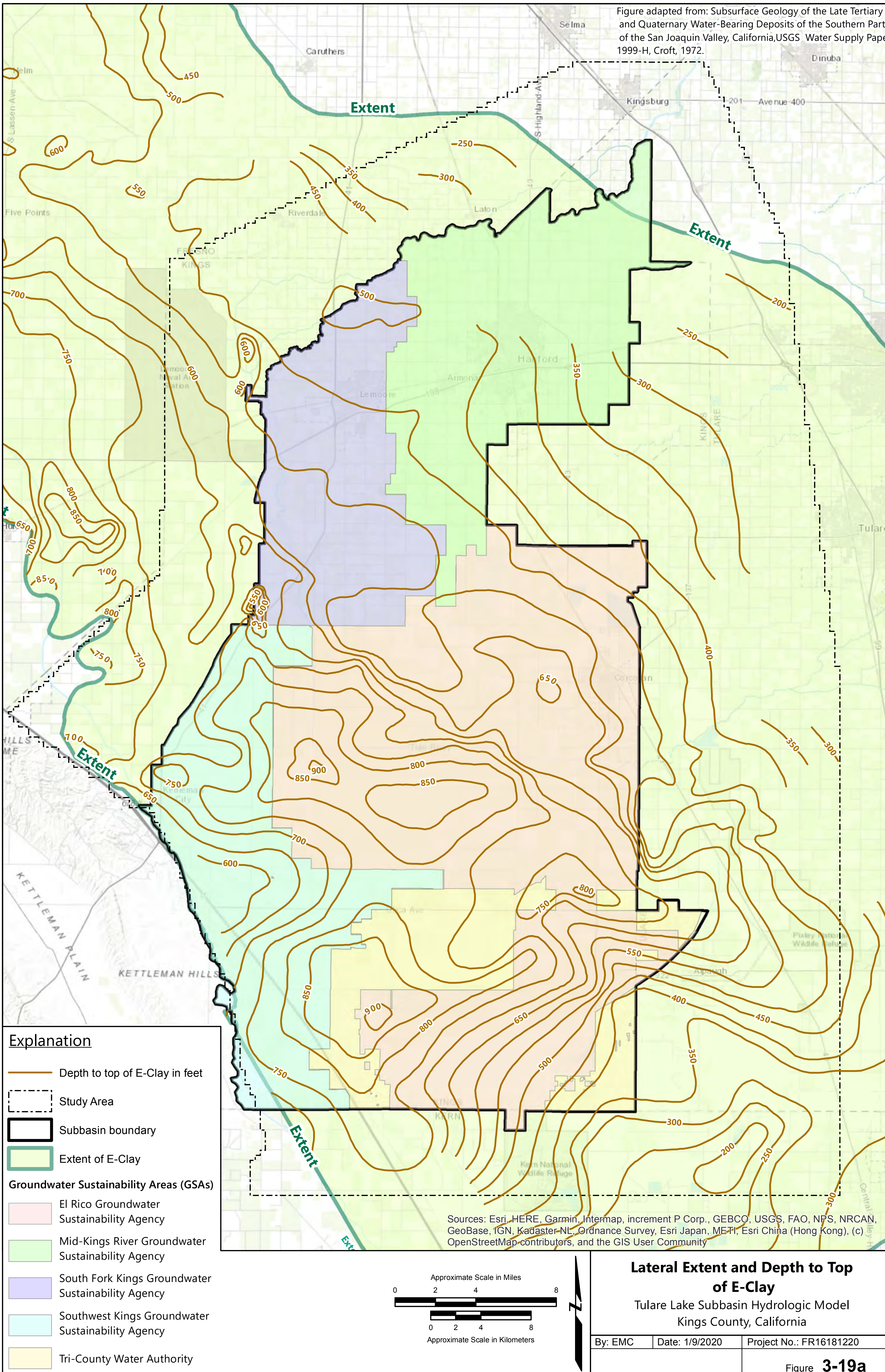
Lateral Extent and Elevation of the Top of C-Clay

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/12/2019	Project No.: FR18161220
		Figure **3-18**

Date: 11/12/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-18_LateralExtentElev_C_Clay.mxd

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-19a_Extent and Depth of E-Clay_Corcoran Clay Equivalent.mxd



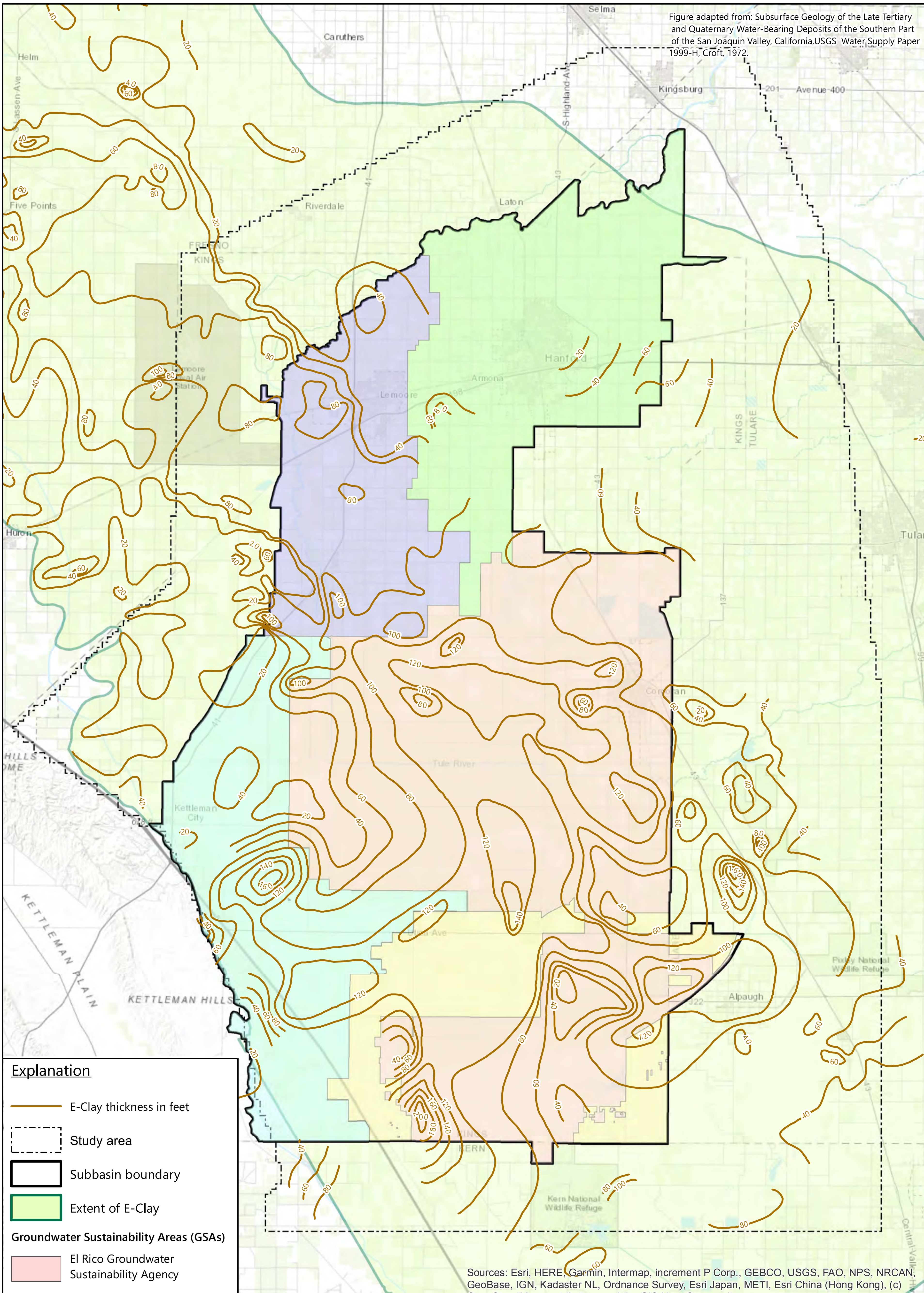
Lateral Extent and Depth to Top of E-Clay

Tulare Lake Subbasin Hydrologic Model
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR16181220

Figure **3-19a**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-19b_Extent and Thickness of E-Clay.mxd

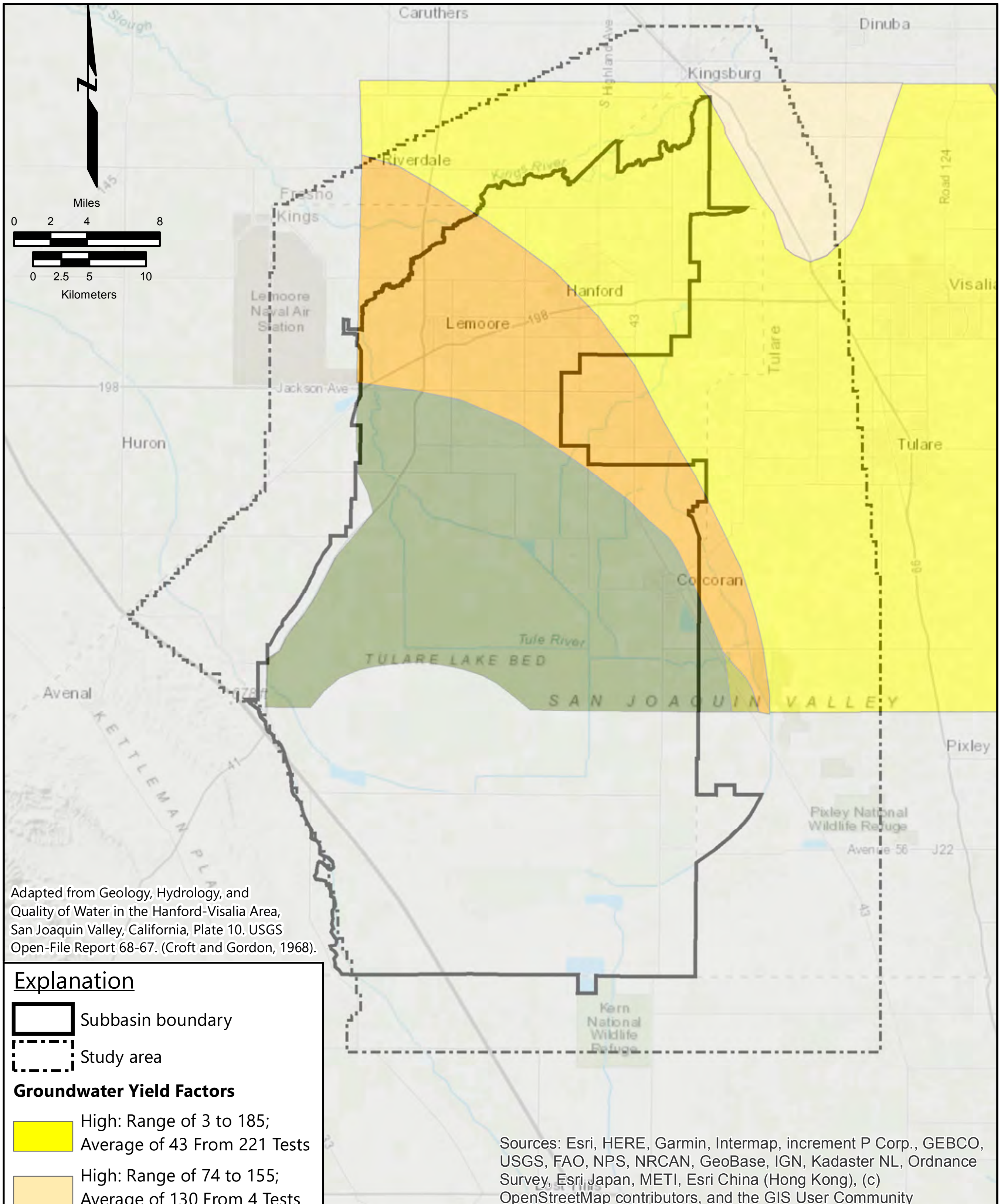


Lateral Extent and Thickness of E-Clay

Tulare Lake Subbasin Hydrologic Model
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR16181220

Figure **3-19b**



Adapted from Geology, Hydrology, and Quality of Water in the Hanford-Visalia Area, San Joaquin Valley, California, Plate 10. USGS Open-File Report 68-67. (Croft and Gordon, 1968).

Explanation

Subbasin boundary

Study area

Groundwater Yield Factors

- High: Range of 3 to 185; Average of 43 From 221 Tests
- High: Range of 74 to 155; Average of 130 From 4 Tests
- Moderate: Range of 2 to 34; Average of 14 From 30 Tests
- Moderate: Range of 8 to 19; Average not calculated
- Low: Range of 1 to 10; Average of 4.3 From 46 Tests
- Undefined

Yield Factor (YF) = 100 x specific capacity / thickness of saturated well interval

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

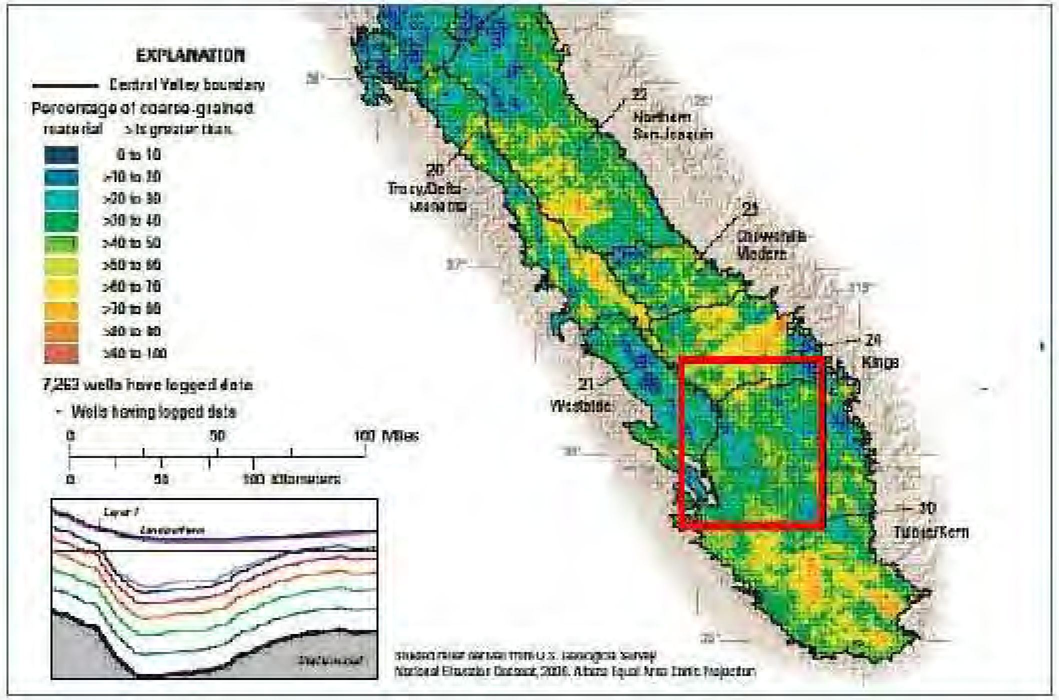
Map of Relative Permeability of Geologic Units as Interpreted from Yield Factors

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

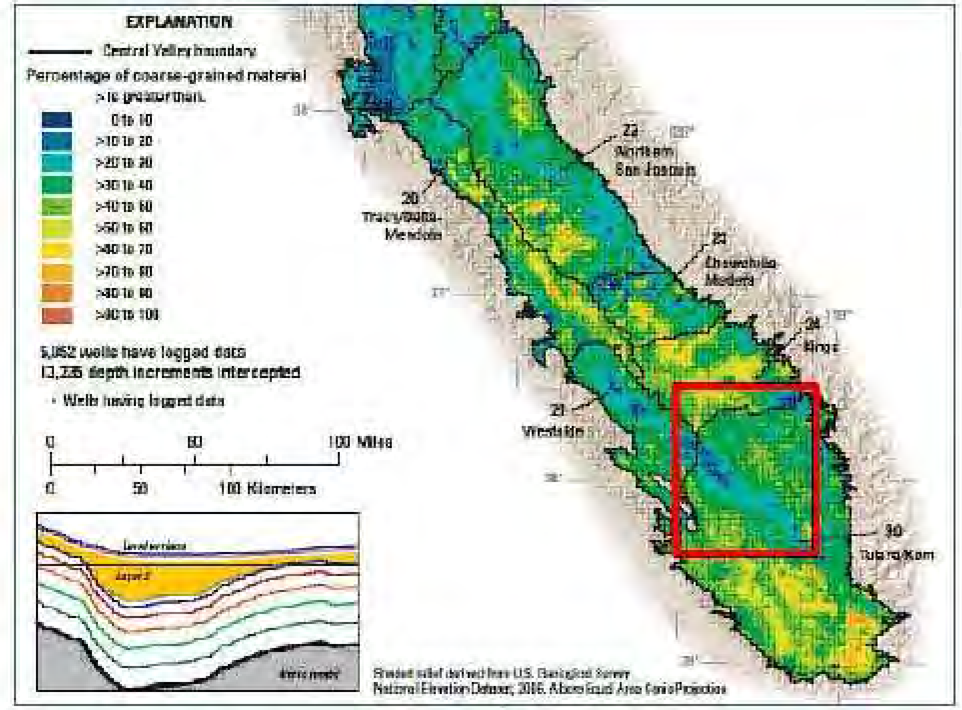
By: EMC	Date: 11/13/2019	Project No.: FR18161220
		Figure **3-20**

Date: 11/13/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-20_RelativePermeabilityFromYieldFactors.mxd

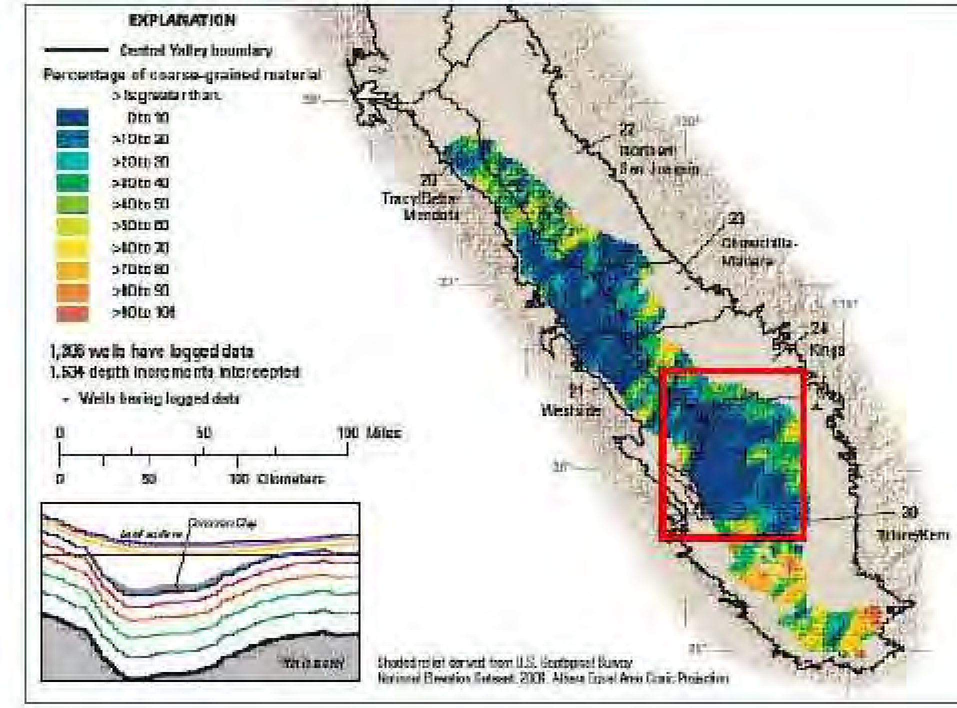
a. 0 - 50 foot depth interval



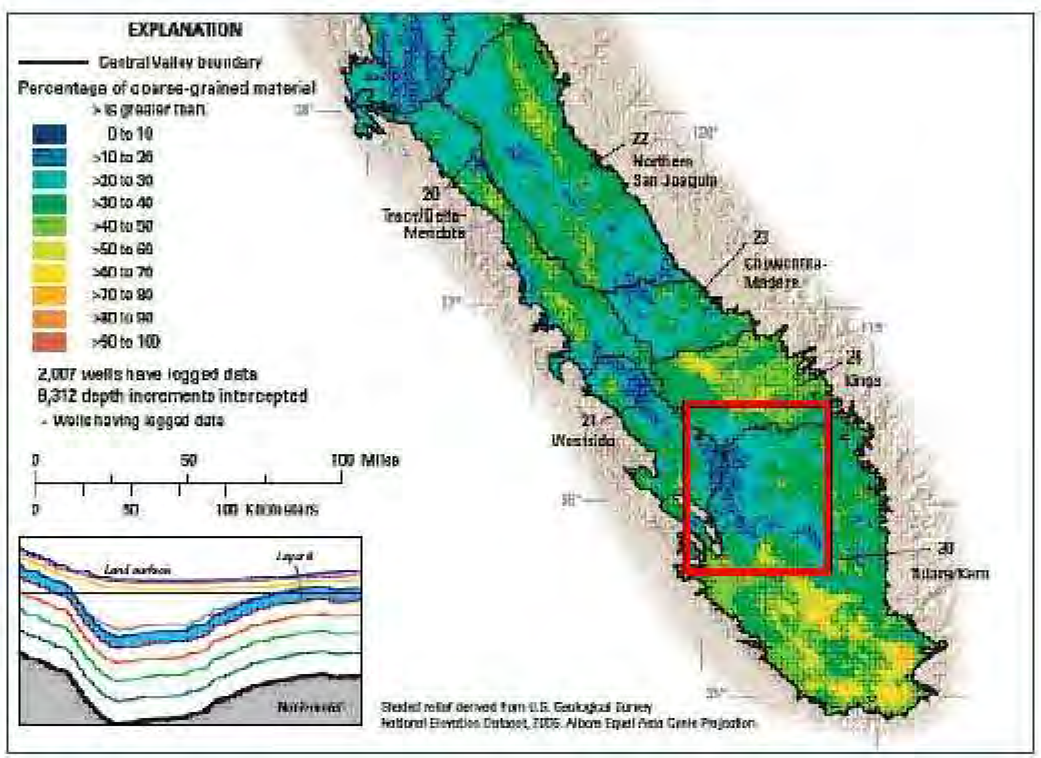
b. 50 - 200 foot depth interval



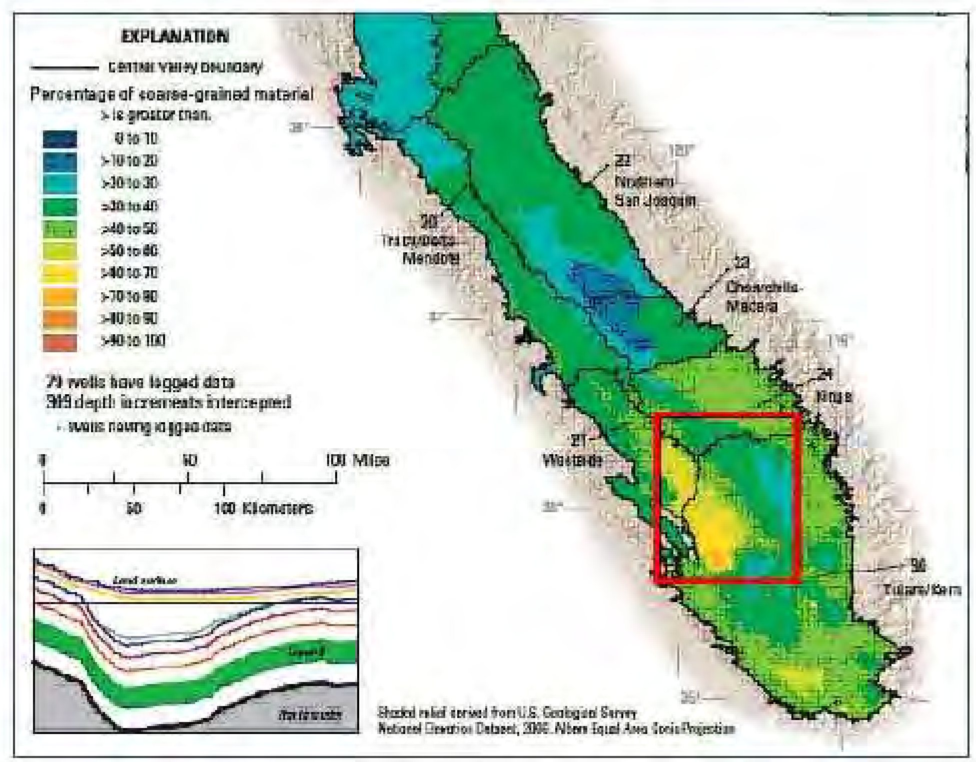
c. Corcoran Clay Depth interval



d. 100 foot depth interval immediately below Corcoran Clay



e. 200 foot depth interval from 400 to 700 feet bgs



Tulare Lake Subbasin Hydrologic Model study area

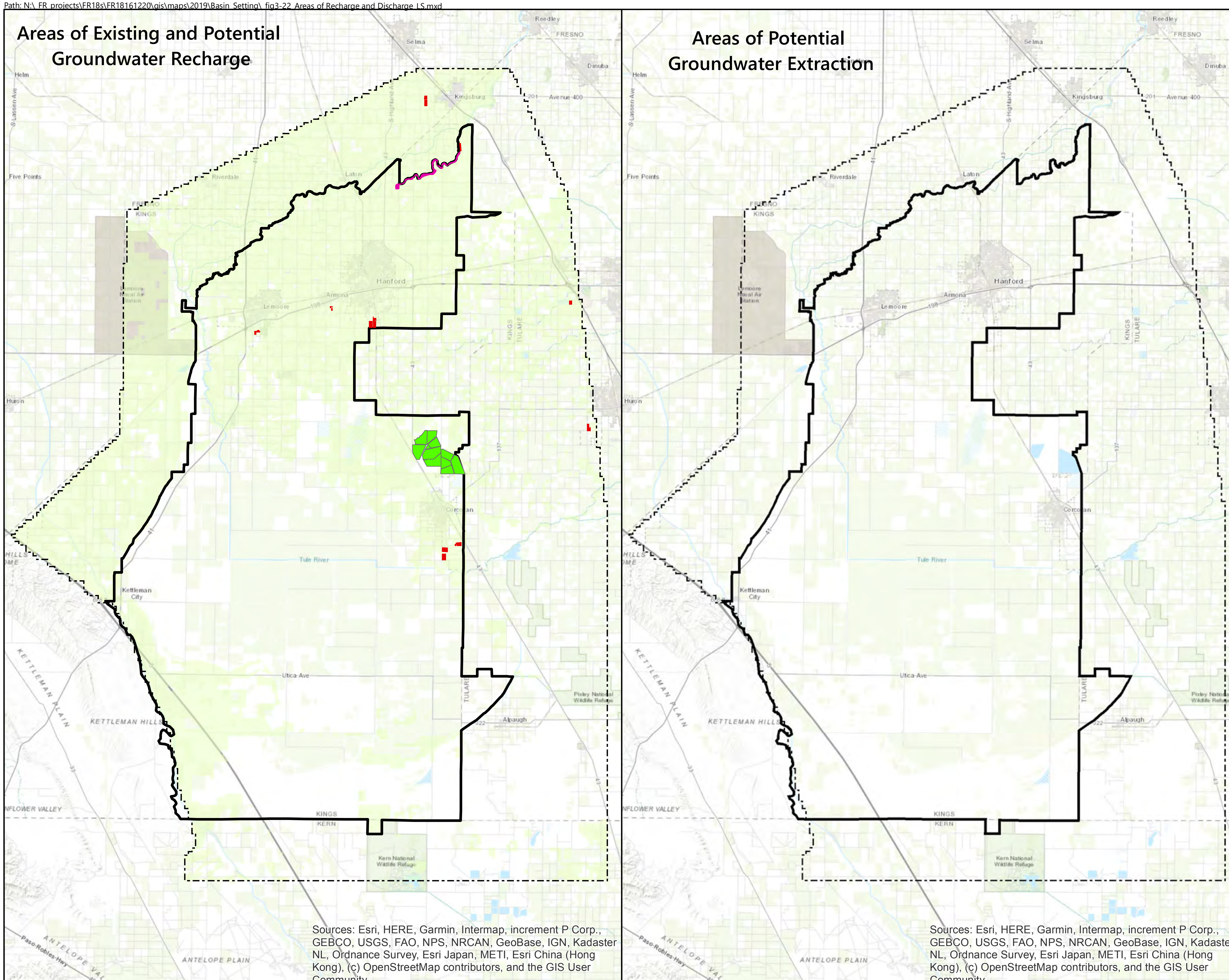
Kriged Distribution of Coarse Fraction for San Joaquin Valley Basin-Fill Sediments

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC | Date: 1/9/2020 | Project No.: FR16181220

Figure **3-21**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-22_Areas of Recharge and Discharge_LS.mxd

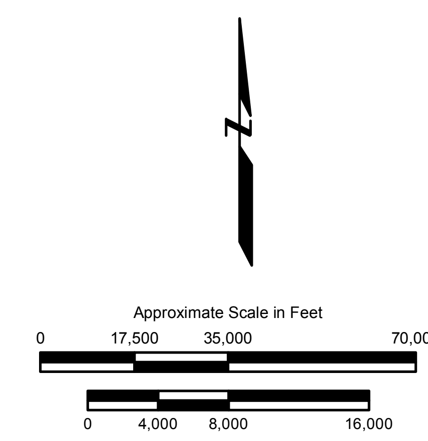


Explanation

- Study area
- Subbasin boundary
- Subsurface (tile) drained areas
- Area of potential groundwater extraction
- Stream and canal recharge
- Potential recharge area

Existing areas of intentional recharge

- Waste Water Treatment Ponds
- Corcoran Irrigation District ponds
- Old river/ APEX Ranch

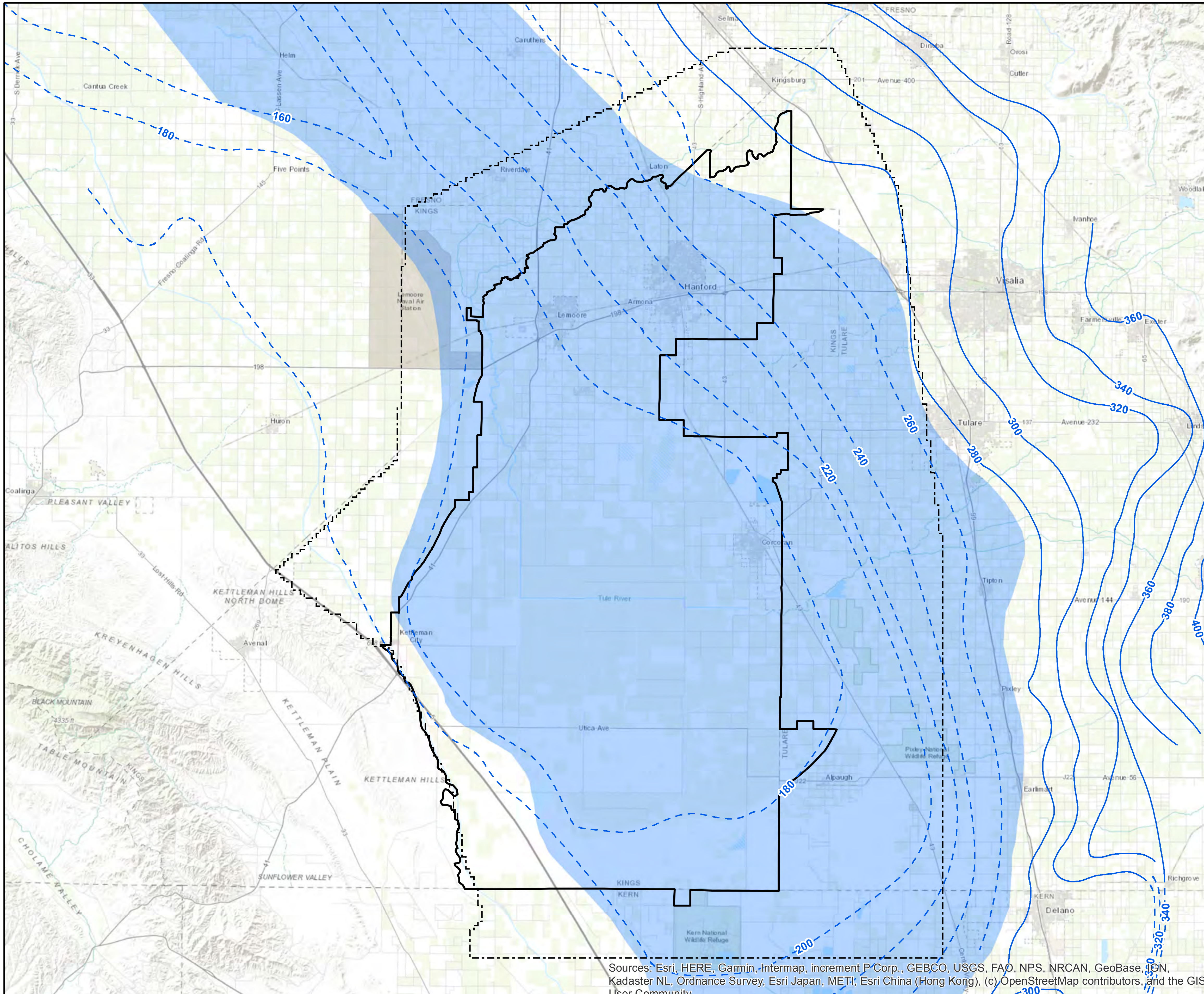


Areas of Existing and Potential Recharge and Extraction

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220

Figure **3-22**



Explanation

- Areas of flowing wells
- Study area
- Subbasin boundary

20-ft groundwater elevation contours (fmsl)

- Certain
- Uncertain

Notes:
1) Map adapted from Mendenhall et al (1916), Plate 1.
2) Elevations in feet above mean sea level.

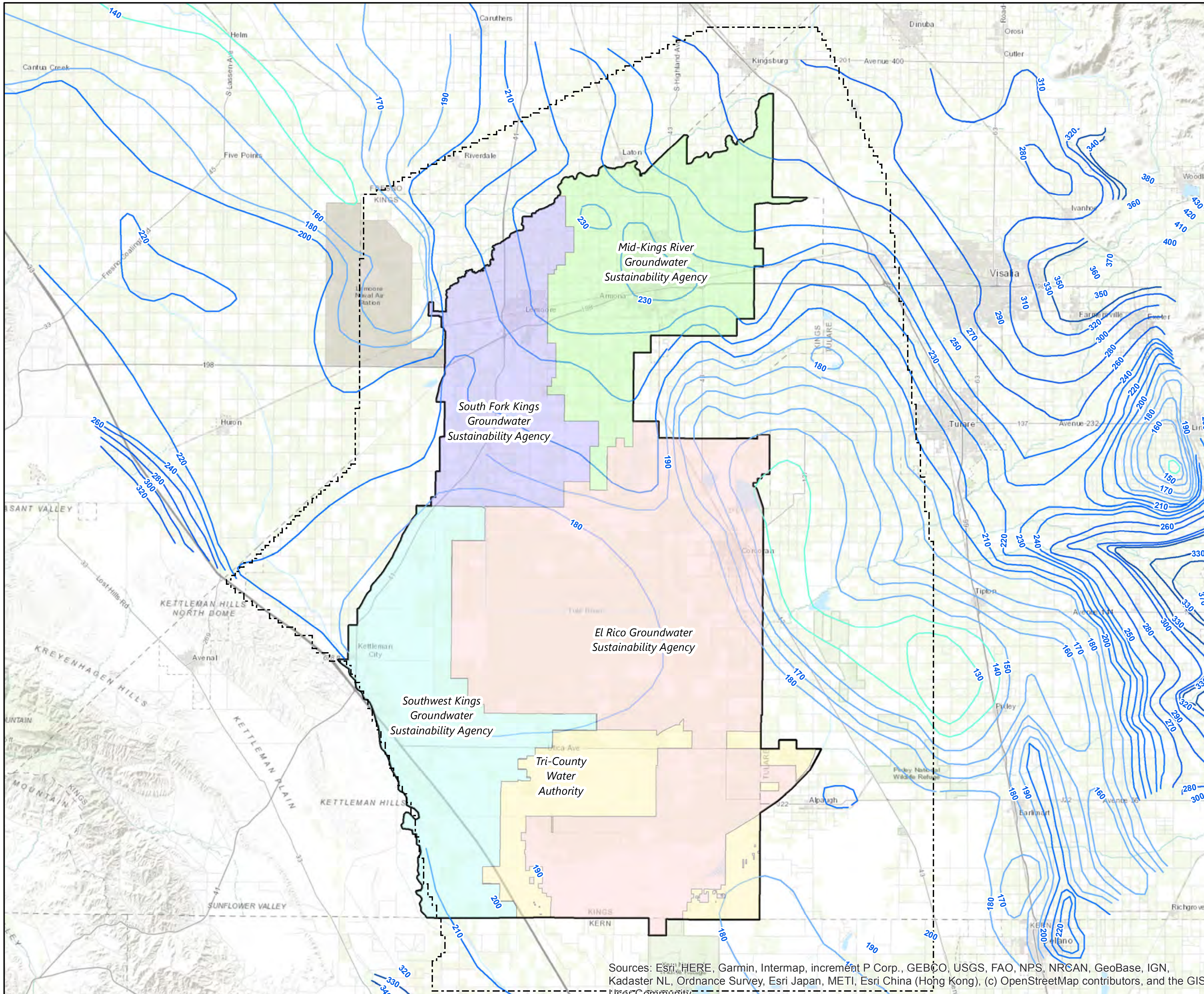
Miles: 0, 2.5, 5, 10
Kilometers: 0, 3, 6, 12

Area of Flowing Wells 1905-1907

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-23**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-23_GroundwaterConditions_1907.mxd



Explanation

Study Area

Subbasin boundary

10-ft groundwater elevation contours

- 100 - 150ft
- 150 - 200ft
- 210 - 250ft
- 260 - 300ft
- 310-450ft
- 460 - 500ft
- 510-580ft

Groundwater Sustainability Agencies (GSAs)

- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

Approximate Scale in Miles: 0, 2½, 5, 10

Approximate Scale in Kilometers: 0, 2½, 5, 10

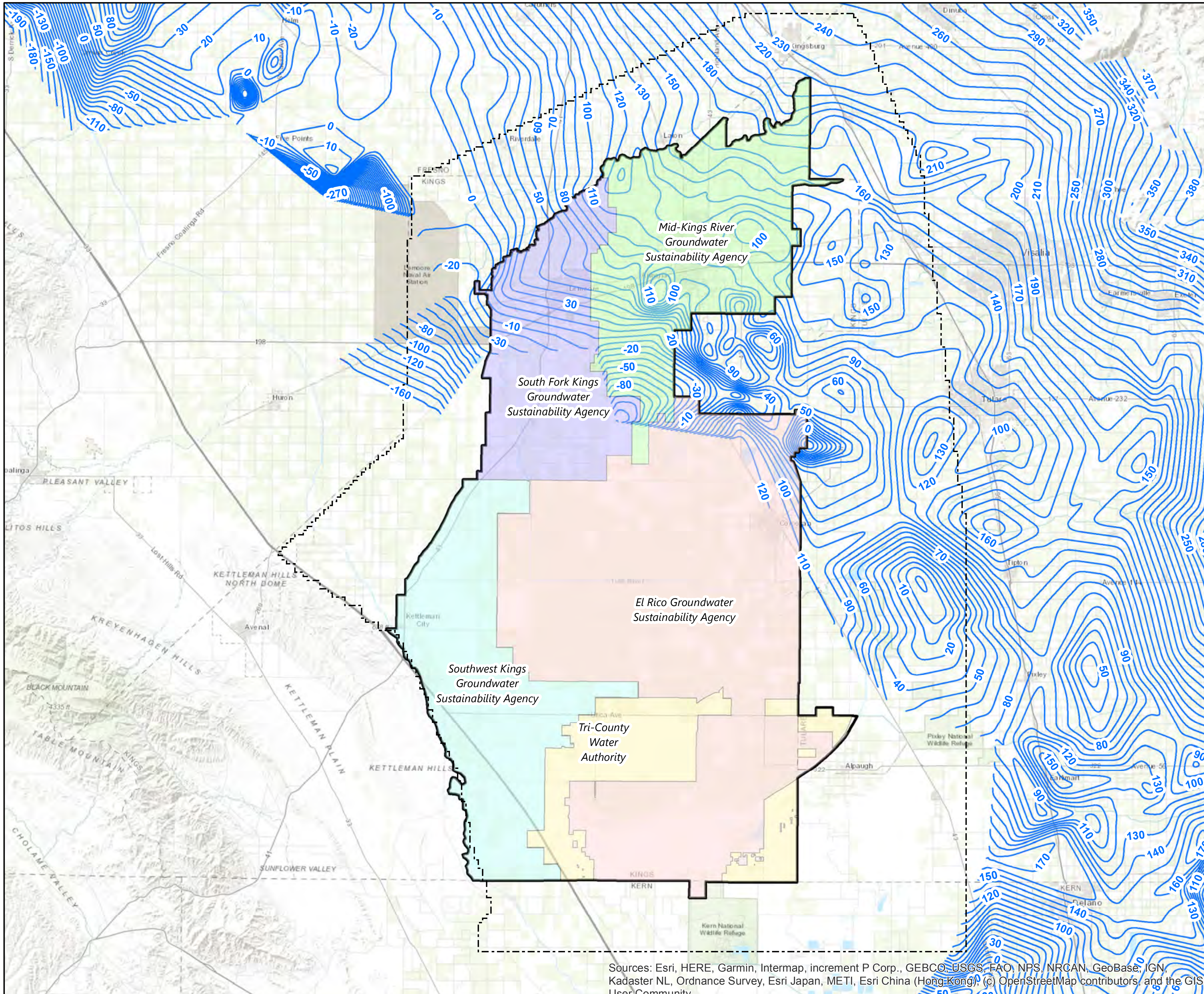
Notes:
1) Map adapted from Davis (1959), Plate 15.
2) Elevations in feet above mean sea level.

Map of Unconfined Groundwater Conditions1952

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-24**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-24_GroundwaterConditions_1952.mxd



Notes:
1) Map adapted from DWR, June 2018.
2) Elevations in feet above mean sea level.

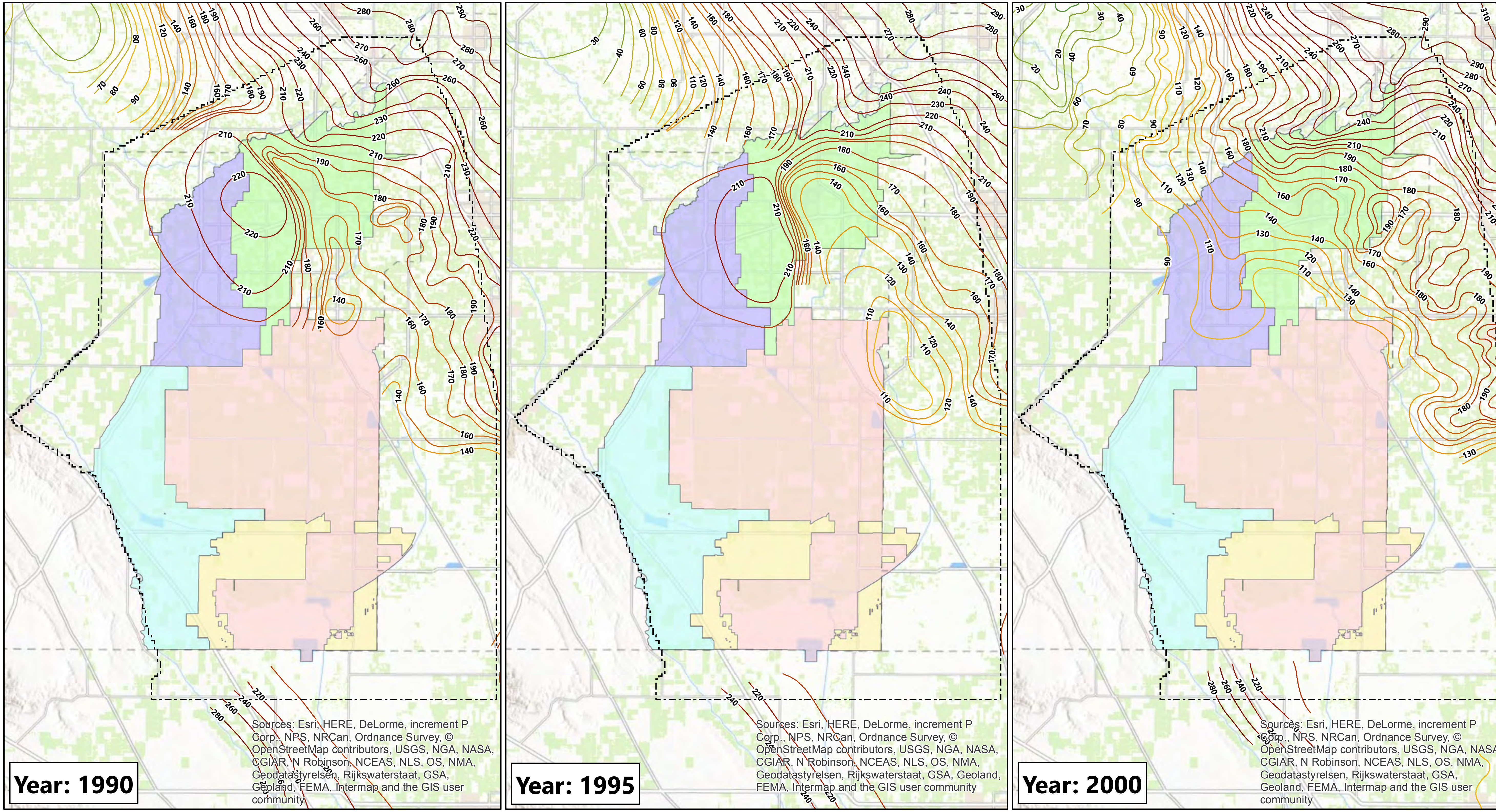
Map of Unconfined Groundwater Elevations 2016

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC | Date: 11/15/2019 | Project No.: FR18161220

Figure **3-25**

Date: 11/15/2019 Printed by: shaina.price
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-25_GroundwaterConditions_2016.mxd



Explanation

- Study area
- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

Groundwater elevation (FMSL)
-700
-350

APPROXIMATE SCALE IN MILES
0 5 10 20
0 5 10 20
APPROXIMATE SCALE IN KILOMETERS

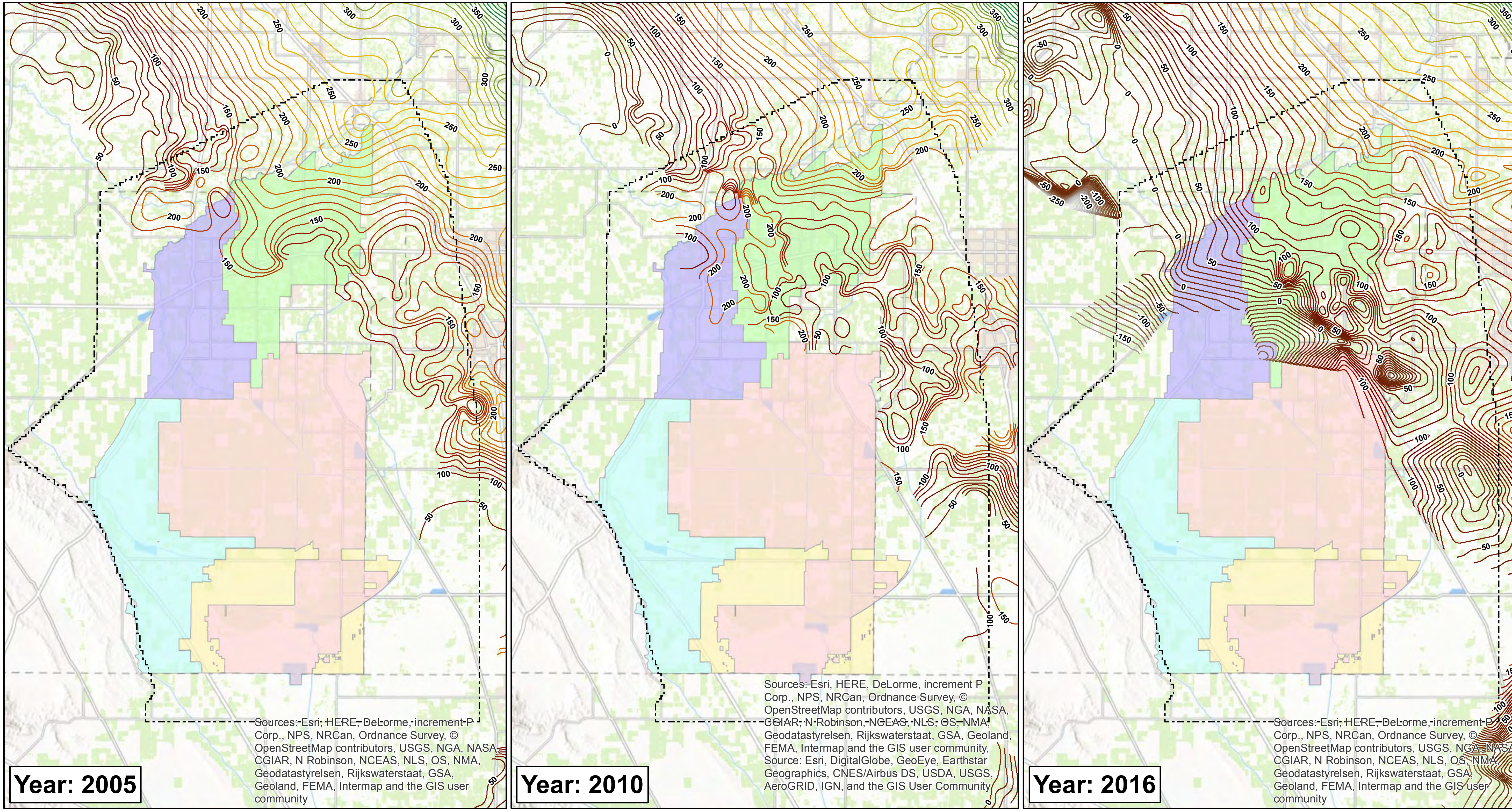
N

Historical DWR Groundwater Elevation Maps Unconfined Aquifer

Tulare Lake Subbasin Hydrologic Model
Kings County, California

By: EMC	Date: 11/15/2019	Project No.: FR18161220
		Figure **3-26**

Date: 11/15/2019 Printed by: shaina.price
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-26_RecentGroundwaterConditions_1990_1995_2000.mxd



Explanation

- Study area
- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

Groundwater elevation (FMSL)
-700
-350

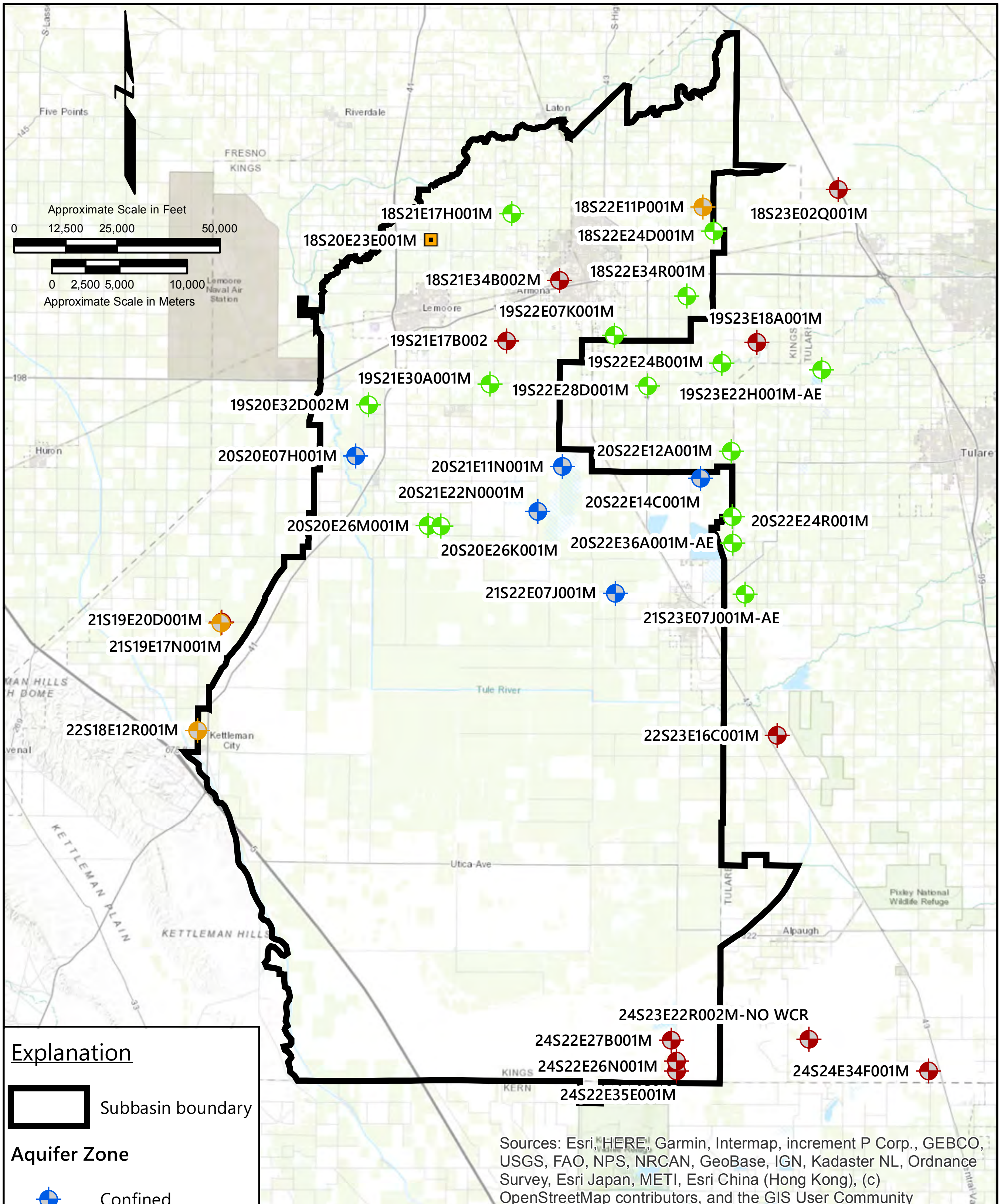
APPROXIMATE SCALE IN MILES
0 5 10 20
0 5 10 20
APPROXIMATE SCALE IN KILOMETERS

NOTE:
1) Groundwater elevation data obtained from California Department of Water Resources (CA DWR), June 2018: https://databasin.org/datasets/b05820cda86b4921a515065fa1deffcc
2) FMSL = Feet above mean sea level.

Historical DWR Groundwater Elevation Maps, Unconfined Aquifer
Tulare Lake Subbasin Hydrologic Model
Kings County, California

By: EMC	Date: 11/15/2019	Project No.: FR18161220
		Figure **3-27**

Date: 11/15/2019 Printed by: shaina.price
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-27_RecentGroundwaterConditions_2005_2010_2016.mxd



Explanation

Subbasin boundary

Aquifer Zone

- Confined
- MultiZone
- Nested
- Unconfined
- Unknown

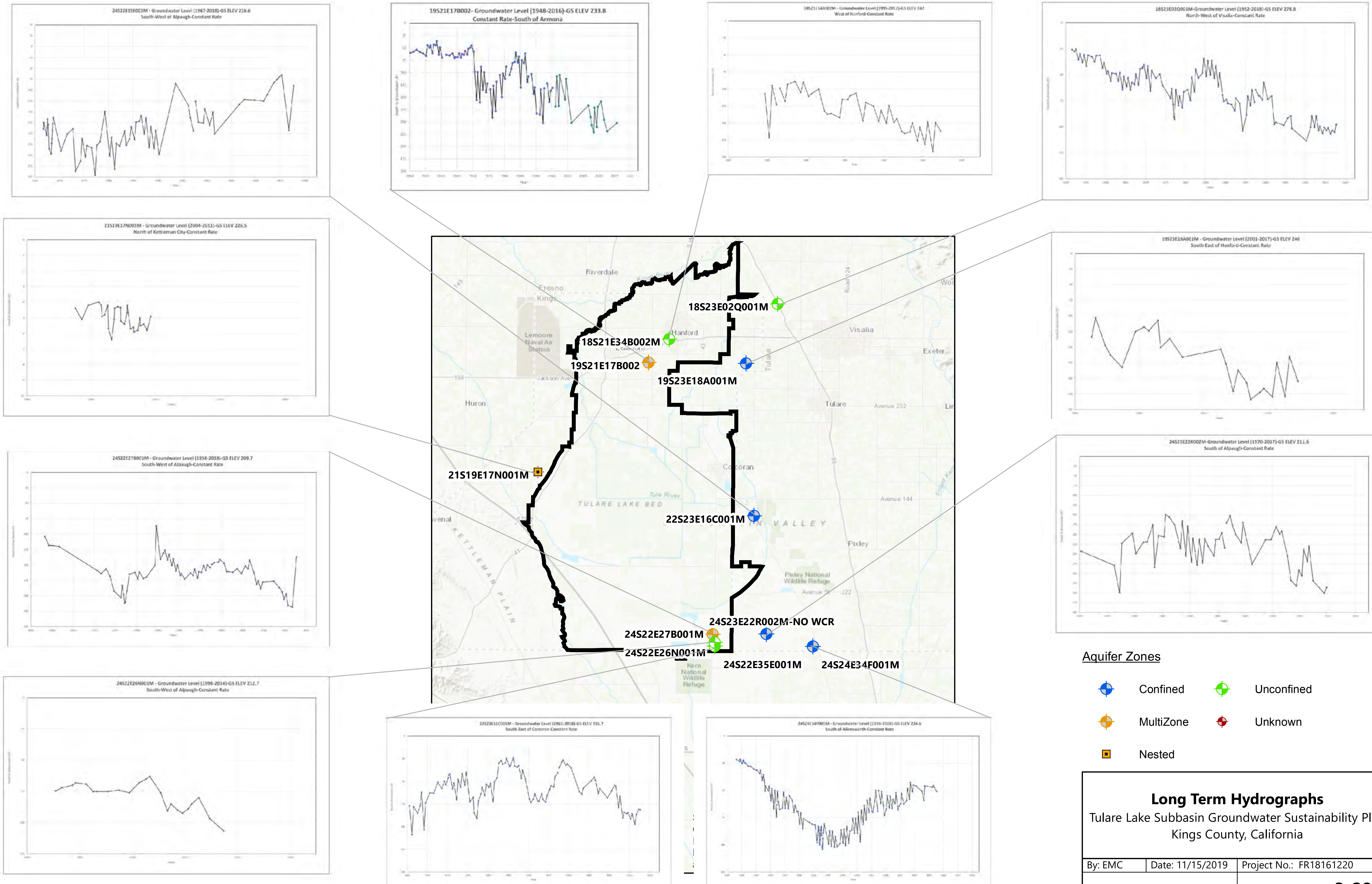
Wells with Long term Hydrographs

Tulare Lake Subbasin Groundwater Sustainability Plan

Kings County, California

By: EMC	Date: 11/26/2019	Project No.: FR18161220
		Figure **3-28a**

Date: 11/26/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-28a_WellswithLongtermHydrographs.mxd

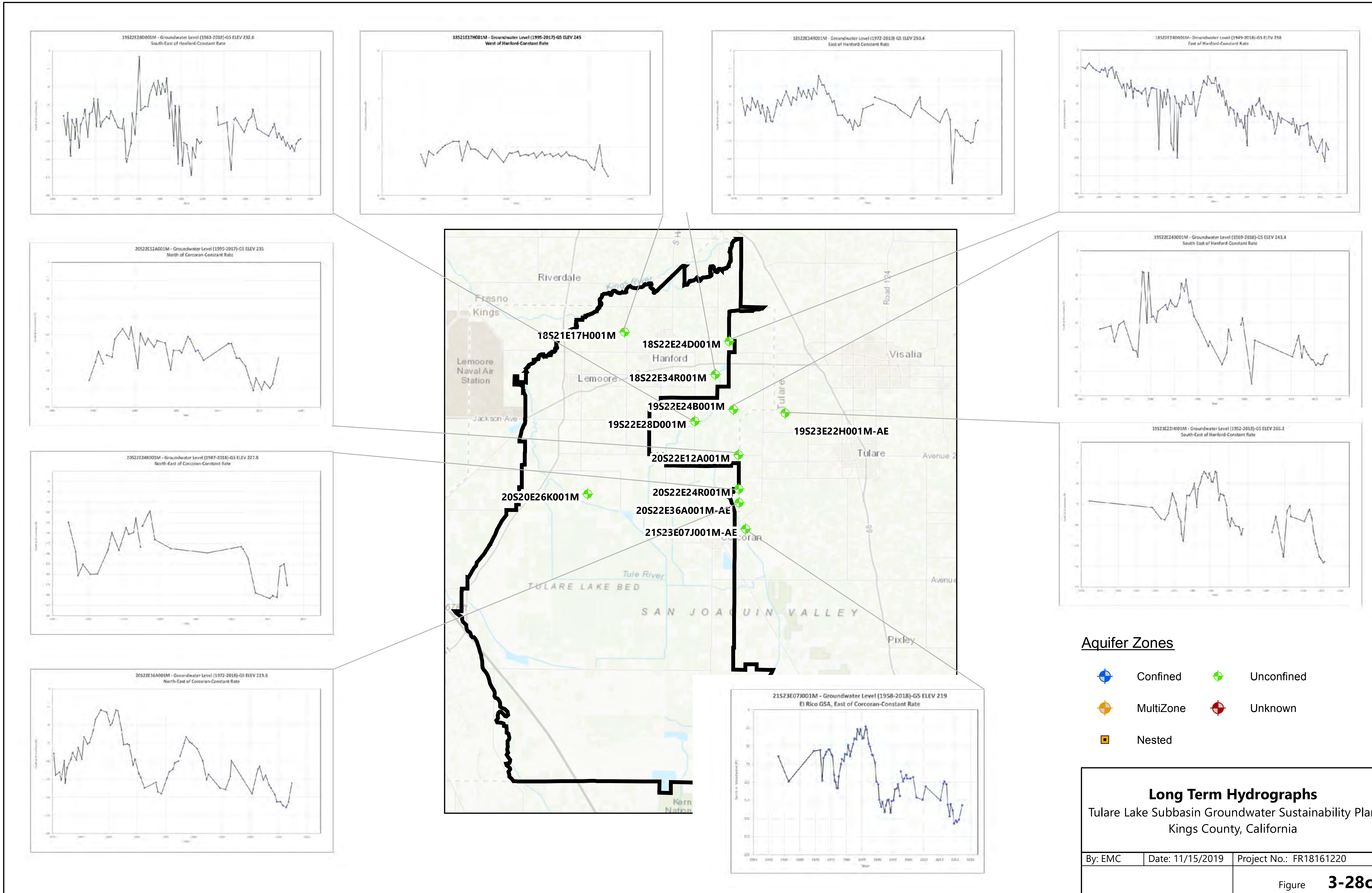


Long Term Hydrographs

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/15/2019	Project No.: FR18161220
		Figure **3-28b**

Date: 11/15/2019 Printed by: shaina.price
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-28b_UnknownAquiferZoneHydrograph.mxd



Long Term Hydrographs

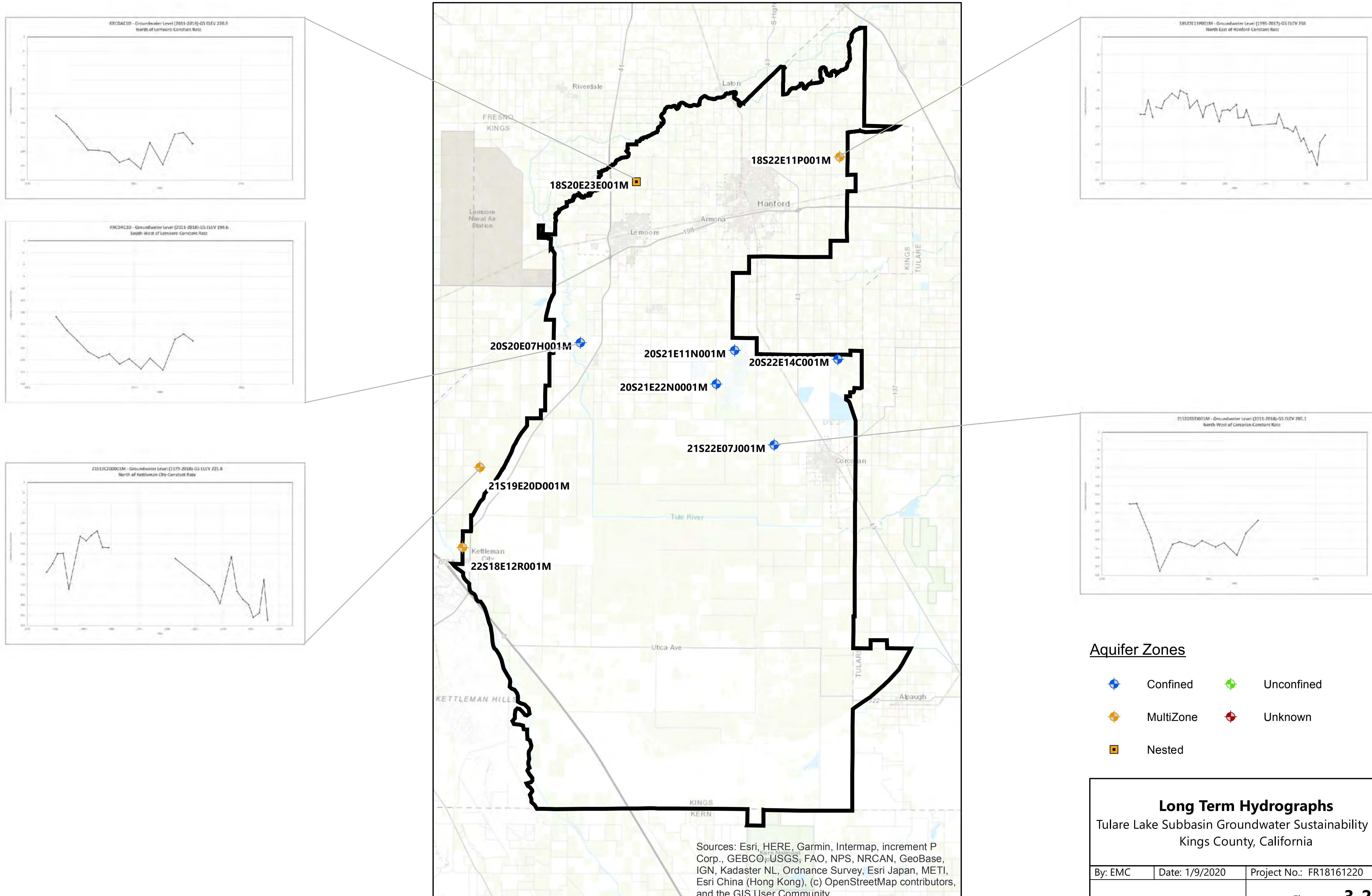
Tulare Lake Subbasin Groundwater Sustainability Plan

Kings County, California

By: EMC	Date: 11/15/2019	Project No.: FR18161220
		Figure **3-28c**

Date: 11/15/2019 Printed by: shaina.price

Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-28C_UnconfinedAquiferZoneHydrograph.mxd

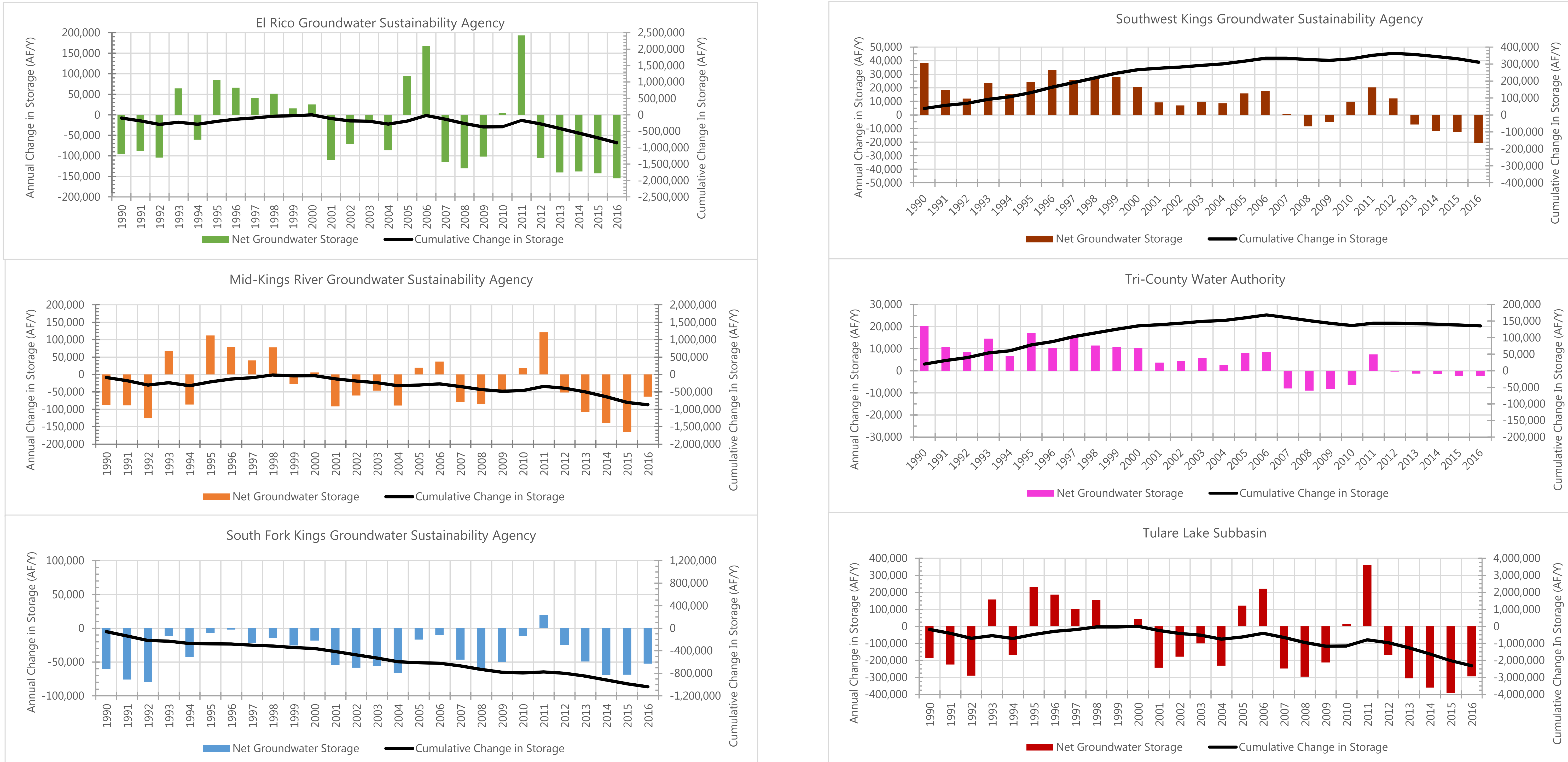


Long Term Hydrographs

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-28d**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-28D_ConfinedAquiferZoneHydrograph.mxd

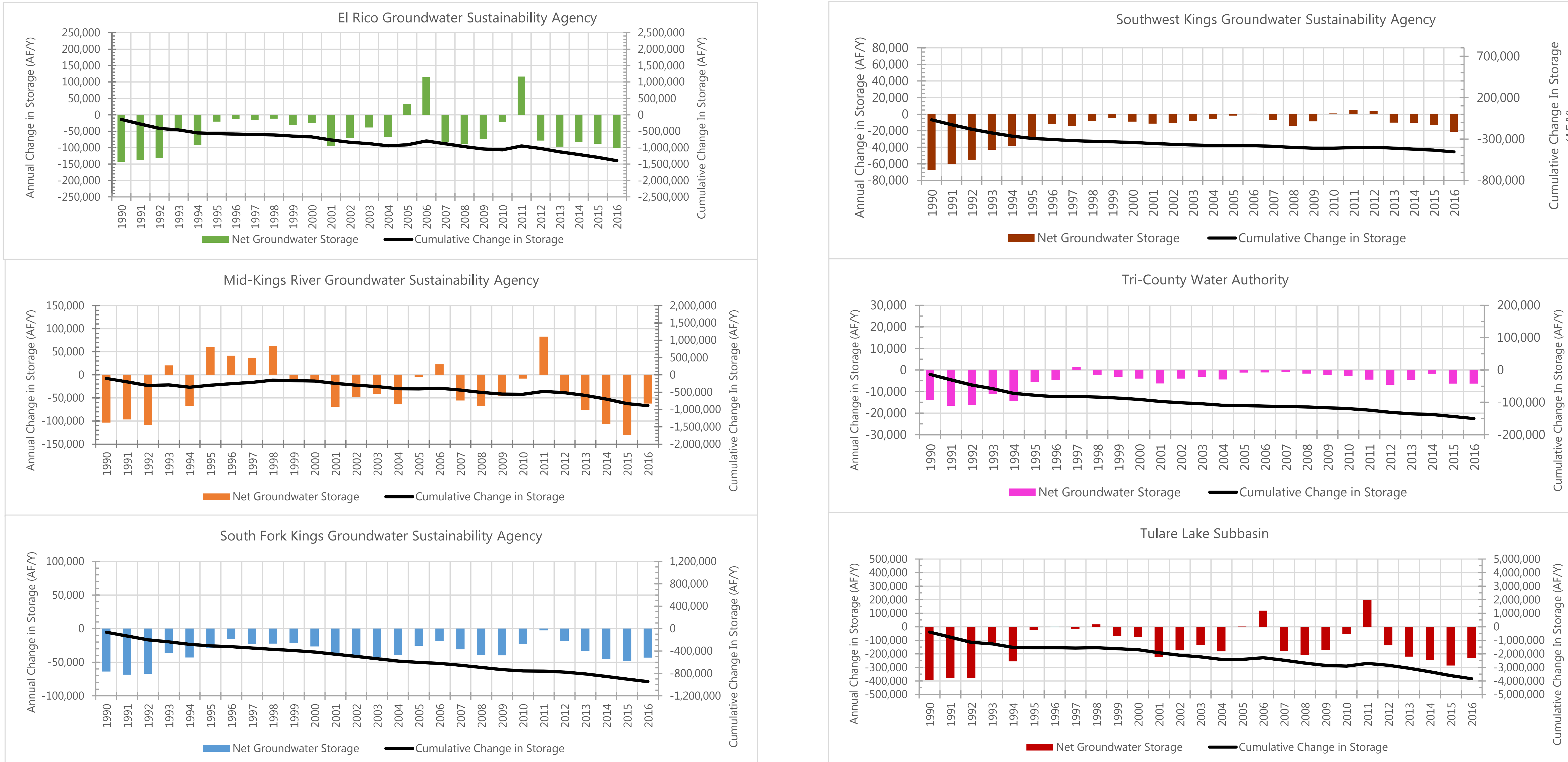


Notes:
1. AF/Y = acre-feet per year

Change in Groundwater Storage
All Aquifer Zones 1990 to 2016
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure: 3-29a

I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Figures\DAVES FOLDER\GSPFigures 3-29_3-53_120619.xlsmFigure 3-29b 1/8/2020

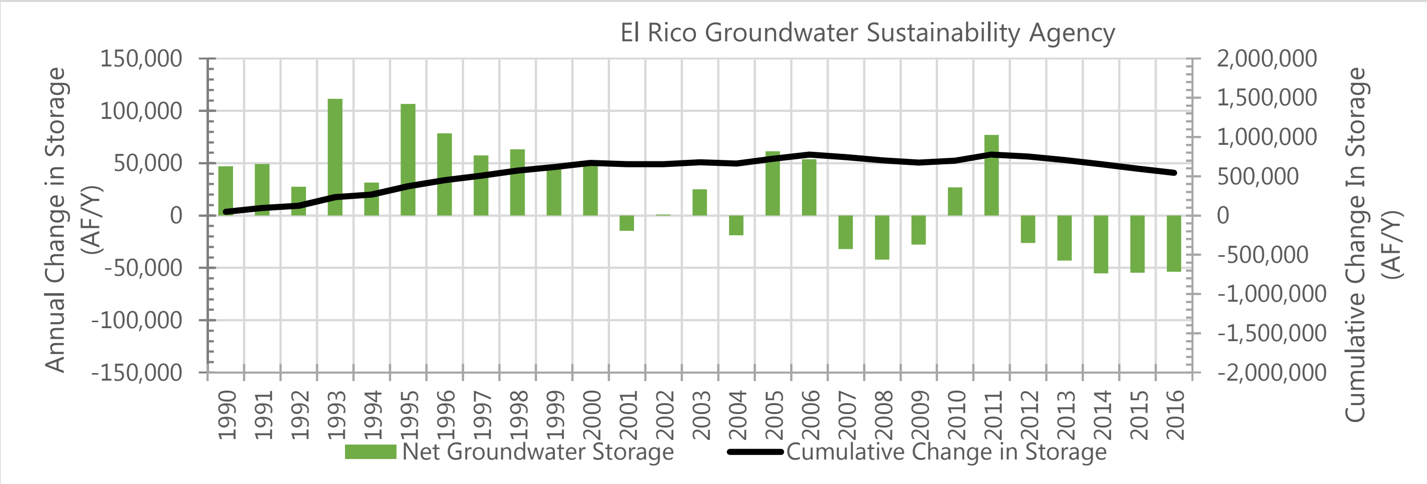


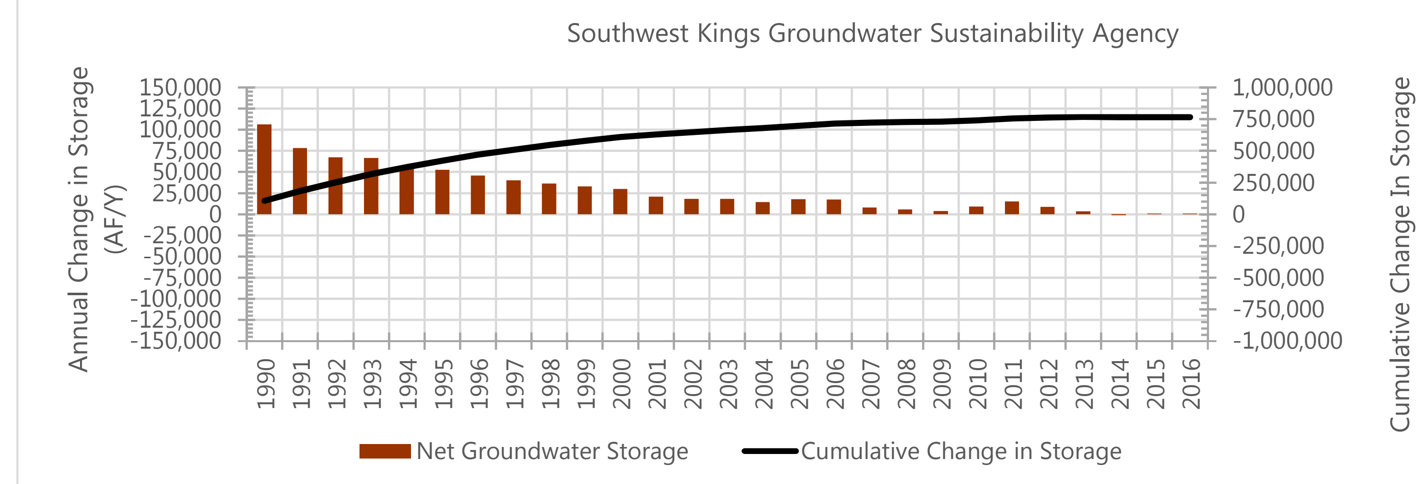
Notes:
1. AF/Y = acre-feet per year

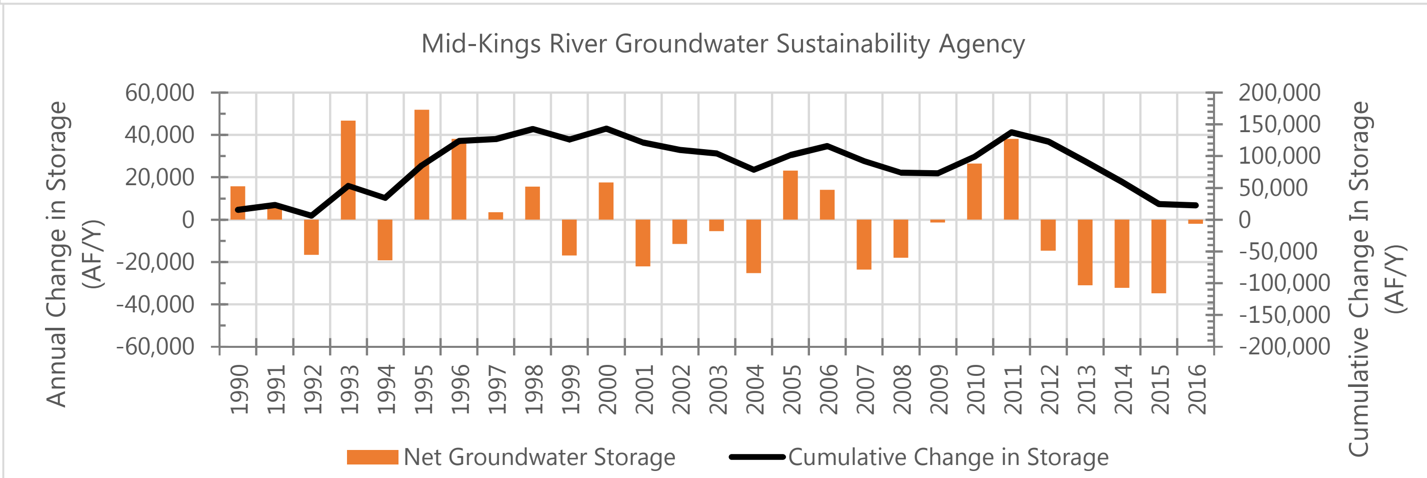
Change in Groundwater Storage
Upper Aquifer Zone 1990 to 2016
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

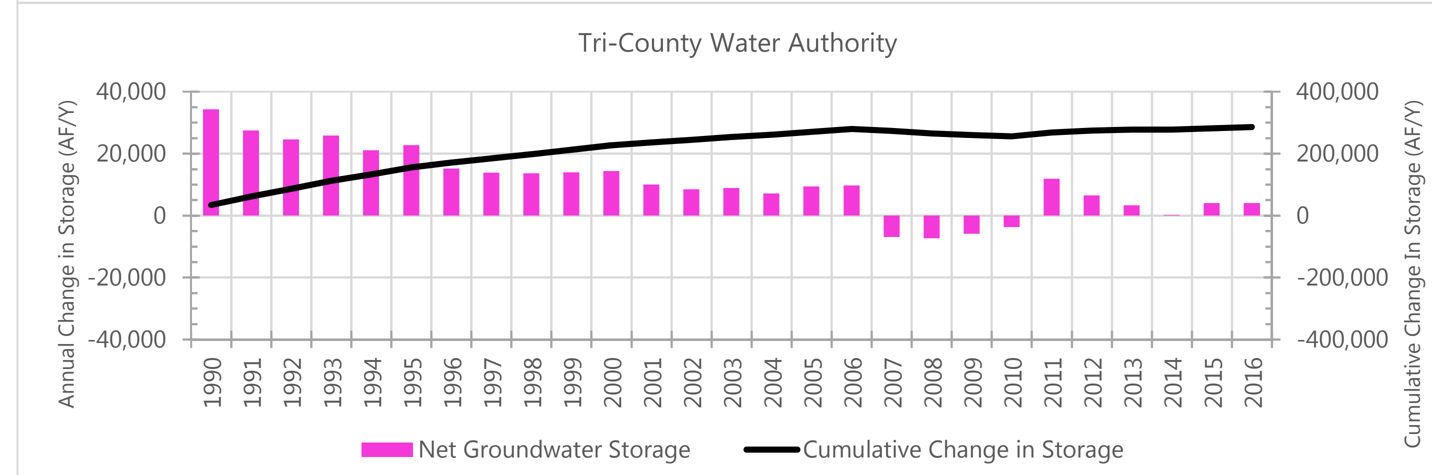
By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure: 3-29b

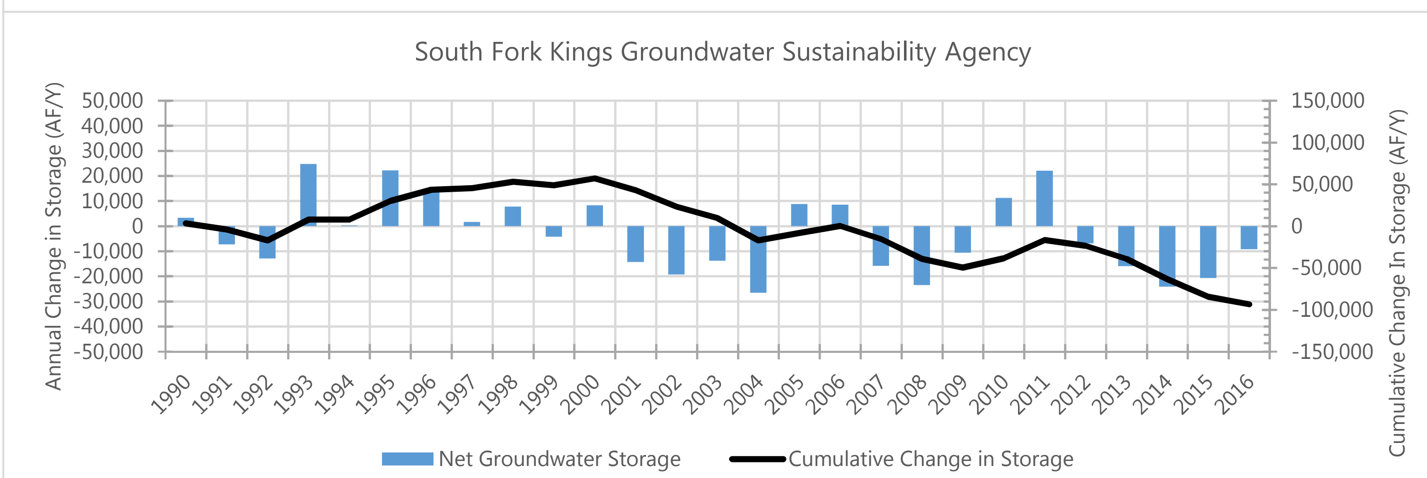
I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Figures\DAVES FOLDER\GSPFigures 3-29_3-53_120619.xlsmFigure 3-29c 1/8/2020

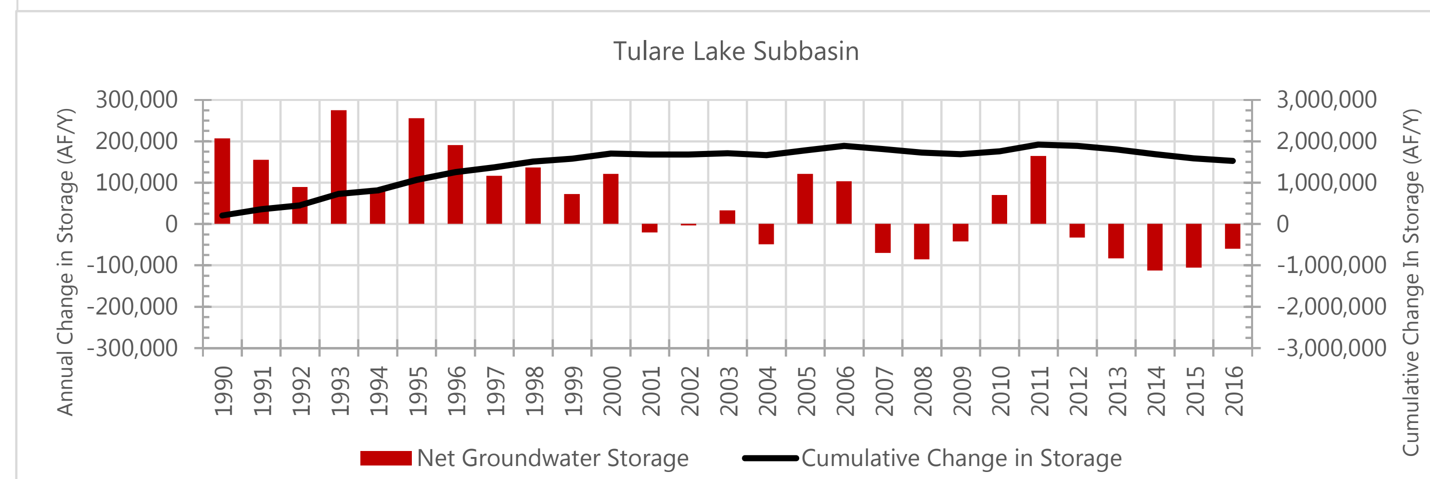










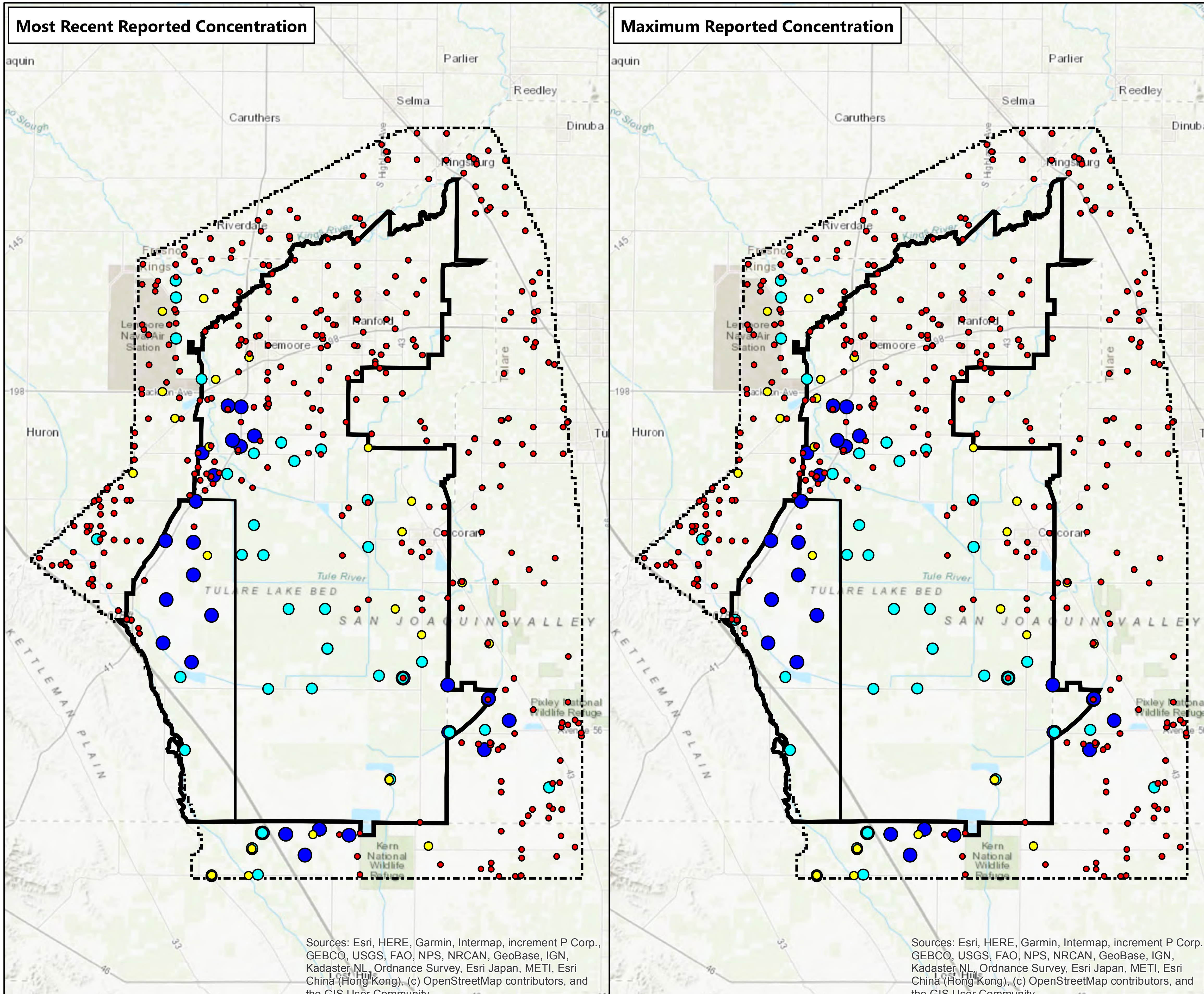


Notes:
1. AF/Y = acre-feet per year

Change in Groundwater Storage
Lower Aquifer Zone 1990 to 2016
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb | Date: 11/20/2019 | Project No.: FR18161220

Figure: 3-29c



Explanation

- <1,500 mg/L
- 1,500 - 3,000 mg/L
- 3,000 - 10,000 mg/L
- >10,000 mg/L
- Study Area
- Subbasin boundary

Notes:
1) Data compiled from California Water Boards Geotracker. November 2018: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp

Approximate Scale in Miles: 0, 5, 10, 20

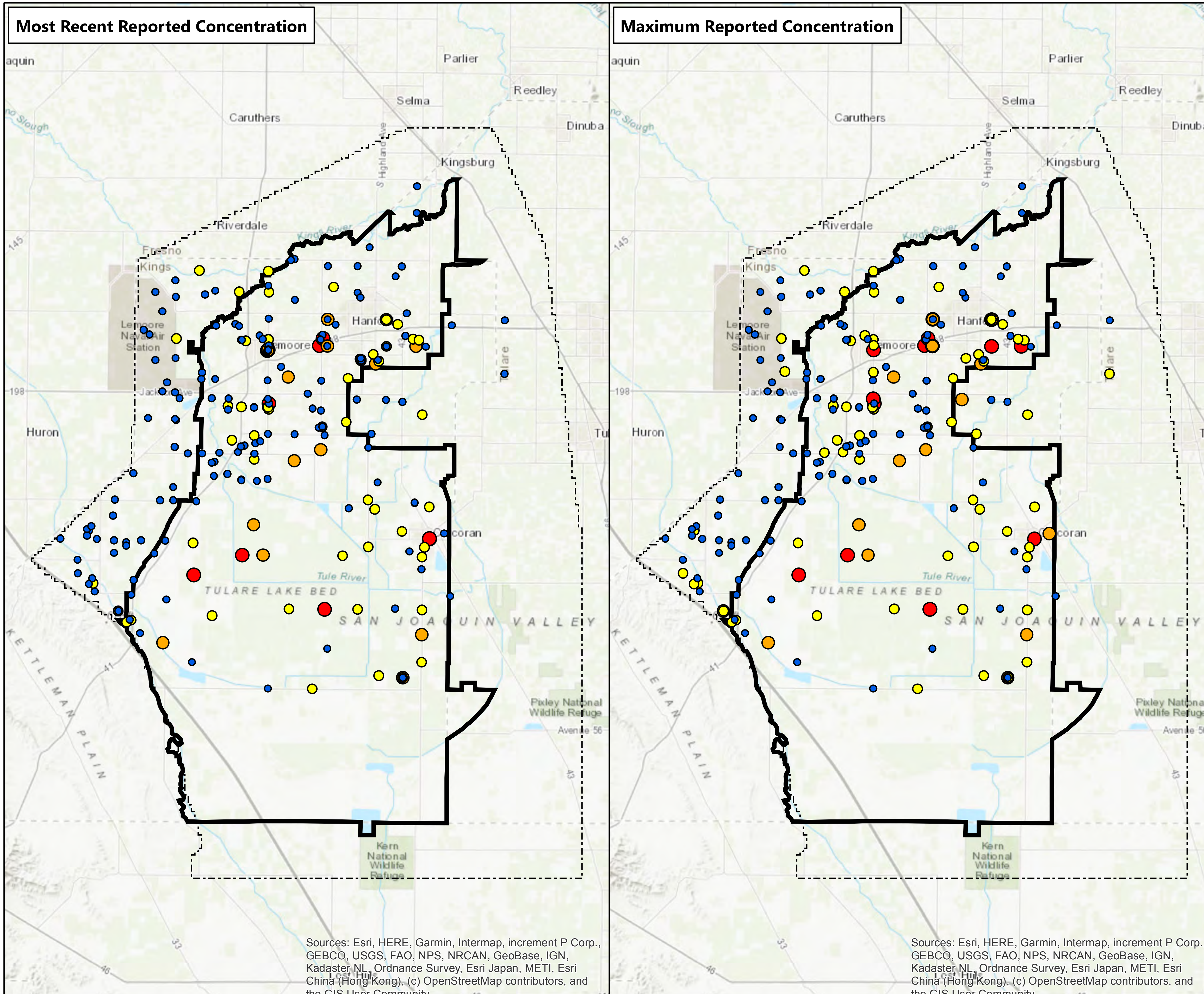
Approximate Scale in Kilometers: 0, 5, 10, 20

Total Dissolved Solids in Groundwater

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: SCM	Date: 1/9/2020	Project No.: FR16181220
		Figure **3-30**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-30_Total_Dissolved_Solids_NEW.mxd



Explanation

- <10 µg/L
- 10.01 - 50.0 µg/L
- 50.1 - 100.0 µg/L
- >100 µg/L
- Study Area
- Subbasin boundary

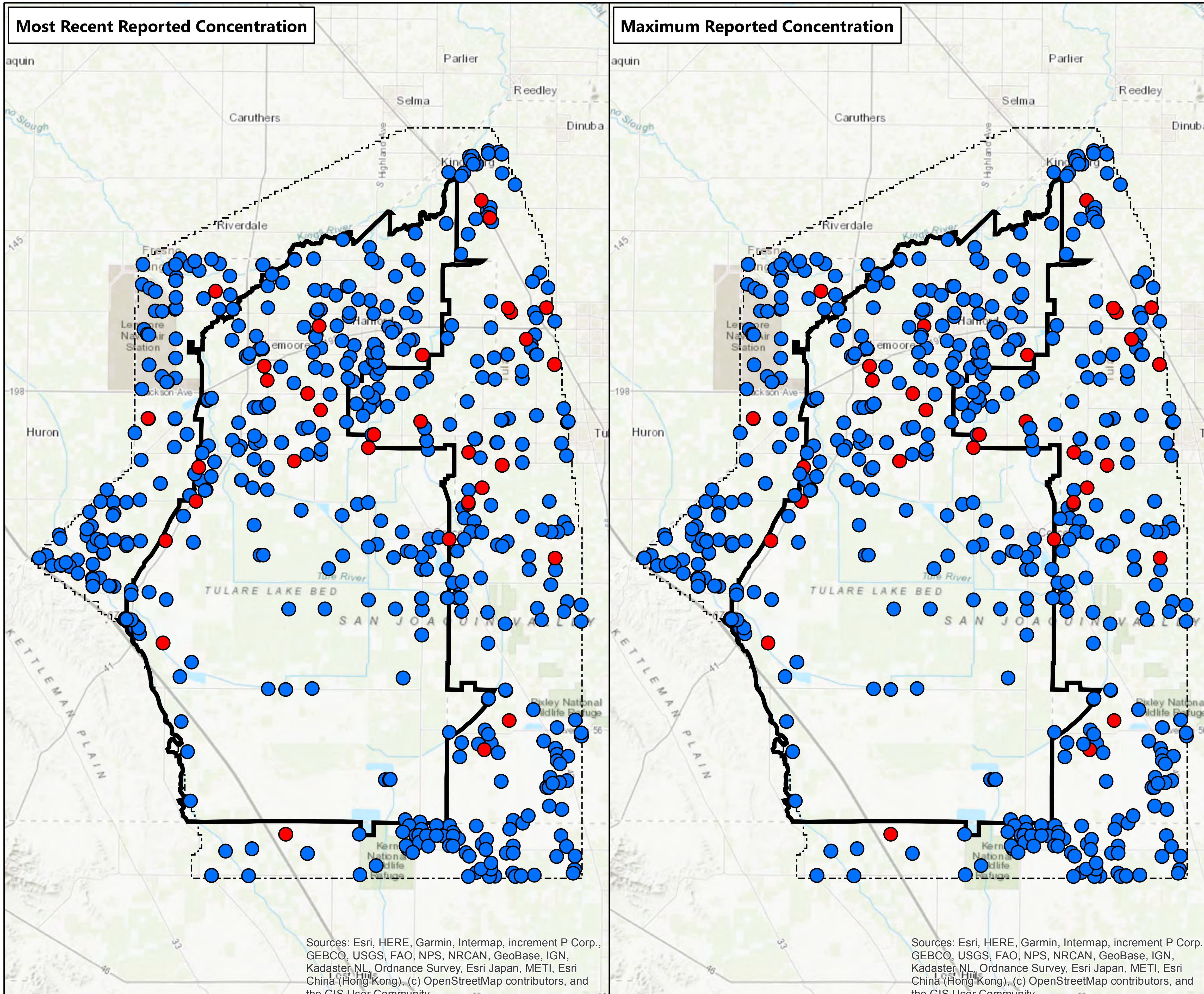
Notes:
1) Data compiled from California Water Boards. November 2018: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp

Approximate Scale in Miles: 0, 5, 10, 20
Approximate Scale in Kilometers: 0, 5, 10, 20

Arsenic in Groundwater
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: SCM	Date: 1/9/2020	Project No.: FR16181220

Figure **3-31**



Explanation

- <10 mg/L
- >10 mg/L
- Study Area
- Subbasin boundary

Notes:
1) Data compiled from California Water Boards. November 2018: https://gamagroundwater. waterboards.ca.gov/ gama/gamamap/public/Default.asp

Approximate Scale in Miles: 0, 5, 10, 20

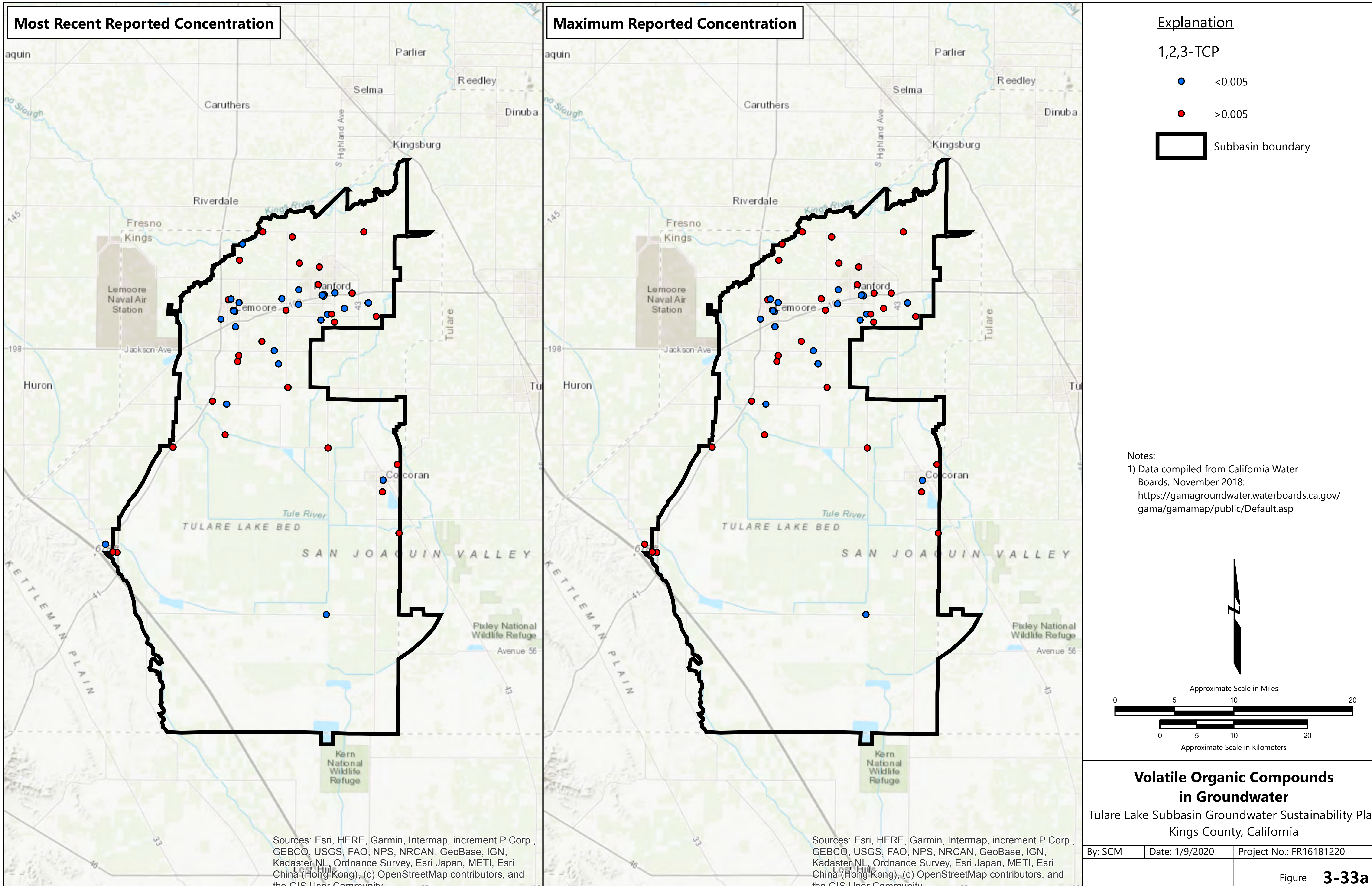
Approximate Scale in Kilometers: 0, 5, 10, 20

Nitrate in Groundwater

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: SCM	Date: 1/9/2020	Project No.: FR16181220
		Figure **3-32**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-32_Nitrate_in_Groundwater_NEW.mxd

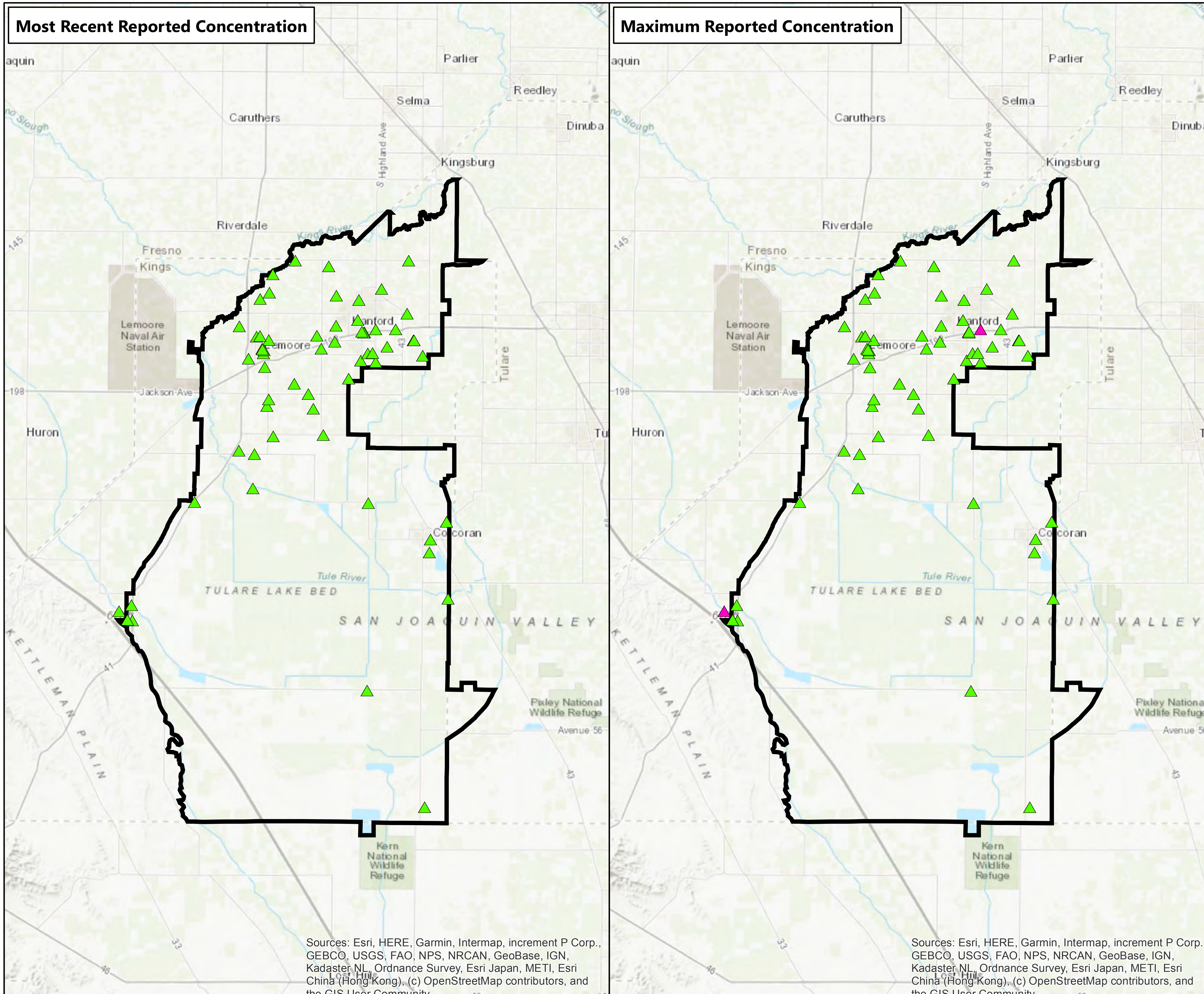


Volatile Organic Compounds in Groundwater

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: SCM	Date: 1/9/2020	Project No.: FR16181220
		Figure **3-33a**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR16181220\gis\maps\2019\Basin_Setting_fig3-33_VOCs_in_Groundwater_NEW.mxd



Explanation

DBCP

- <0.20 µg/L
- >0.21 µg/L
- Subbasin boundary

Notes:

1) Data compiled from California Water Boards. November 2018: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp

Approximate Scale in Miles: 0, 5, 10, 20

Approximate Scale in Kilometers: 0, 5, 10, 20

Volatile Organic Compounds in Groundwater

Tulare Lake Subbasin Groundwater Sustainability Plan

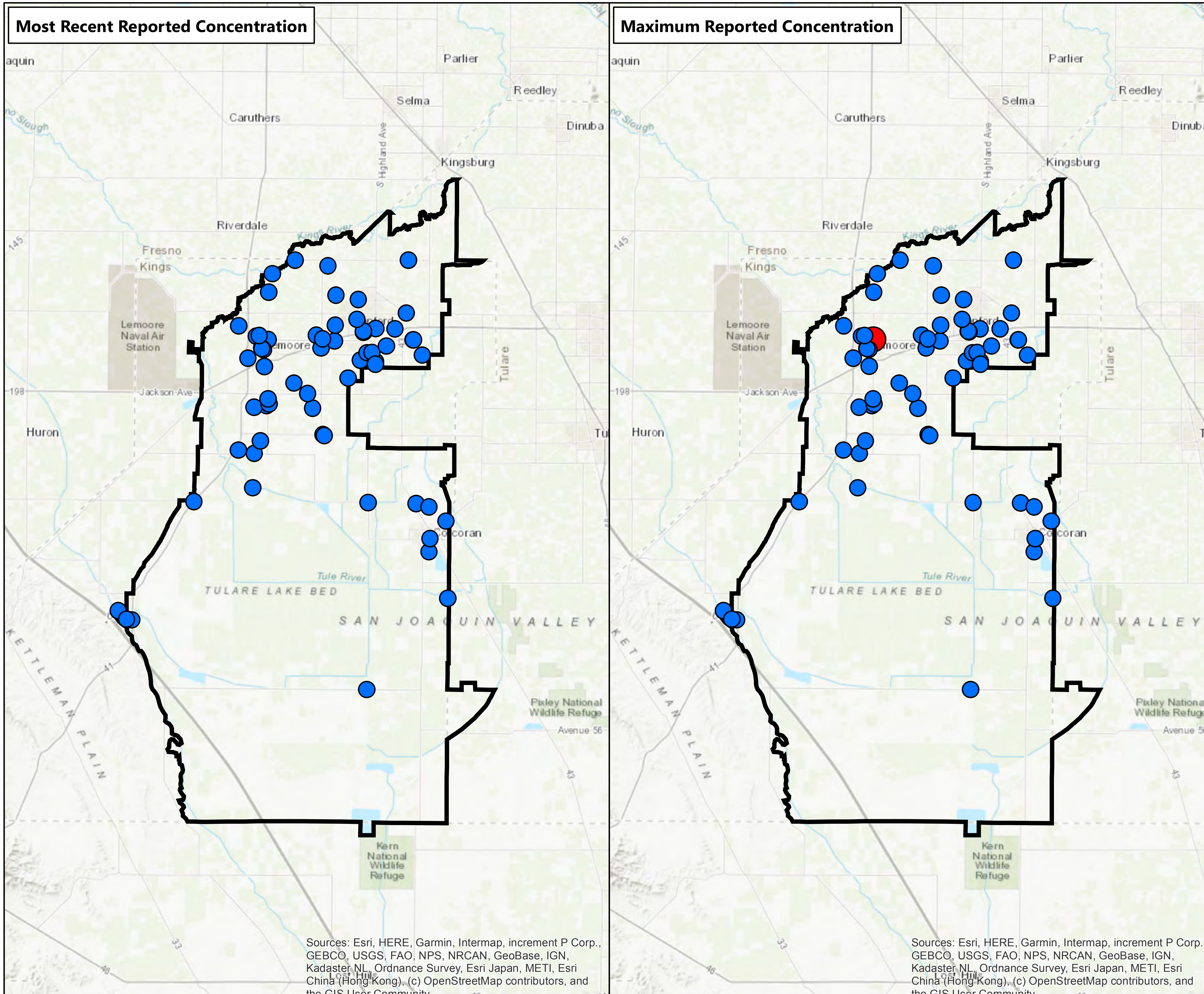
Kings County, California

By: SCM | Date: 1/9/2020 | Project No.: FR16181220

wood.

Figure 3-33b

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-33b_VOCs_in_Groundwater_DBCP.mxd



Explanation

TCE

- <5.00 µg/L
- >5.01 µg/L
- Subbasin boundary

Notes:
1) Data compiled from California Water Boards. November 2018: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp

Approximate Scale in Miles: 0 5 10 20

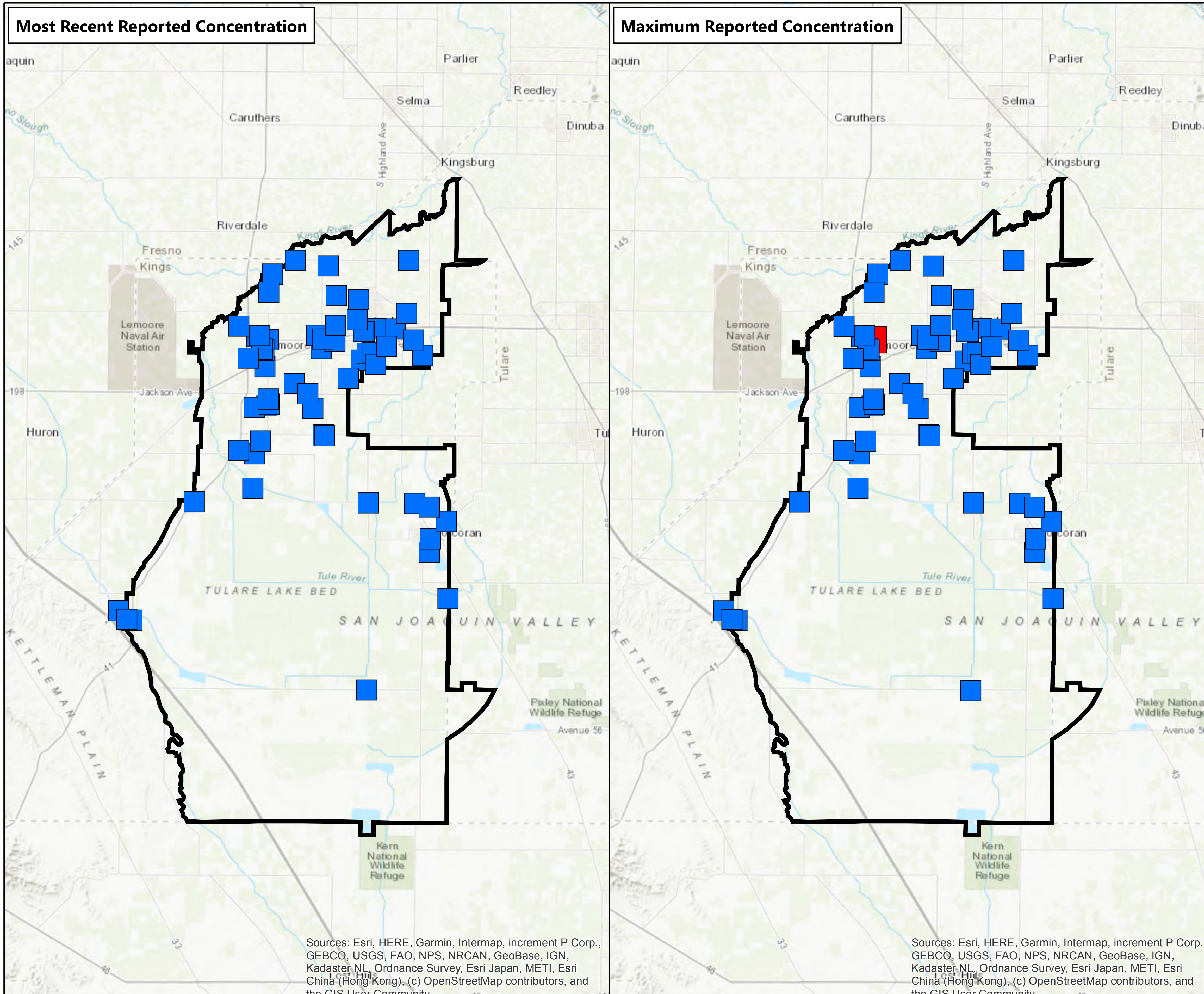
Approximate Scale in Kilometers: 0 5 10 20

Volatile Organic Compounds in Groundwater

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: SCM	Date: 1/9/2020	Project No.: FR16181220
wood.	Figure	3-33c

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-33c_VOCs_in_Groundwater_TCE.mxd



Explanation

PCE

- <5.00 µg/L
- >5.01 µg/L
- Subbasin boundary

Notes:
1) Data compiled from California Water Boards. November 2018: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp

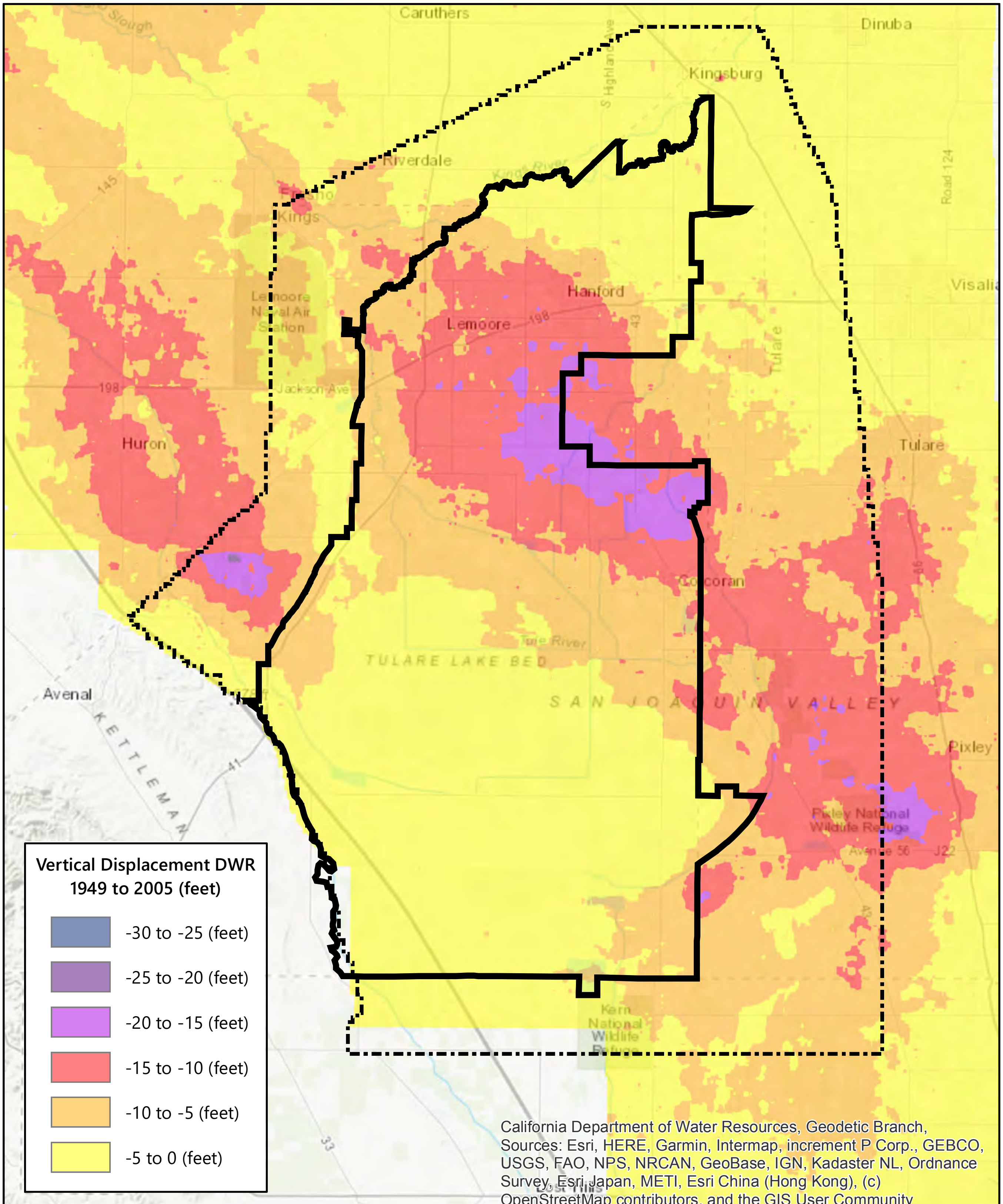
Approximate Scale in Miles: 0, 5, 10, 20
Approximate Scale in Kilometers: 0, 5, 10, 20

Volatile Organic Compounds in Groundwater

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: SCM	Date: 1/9/2020	Project No.: FR16181220
wood.		Figure 3-33d

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-33d_VOCs_in_Groundwater_PCE.mxd



Explanation

Study Area

Subbasin boundary

Miles: 0 2 4 8

Kilometers: 0 2.5 5 10

Notes:

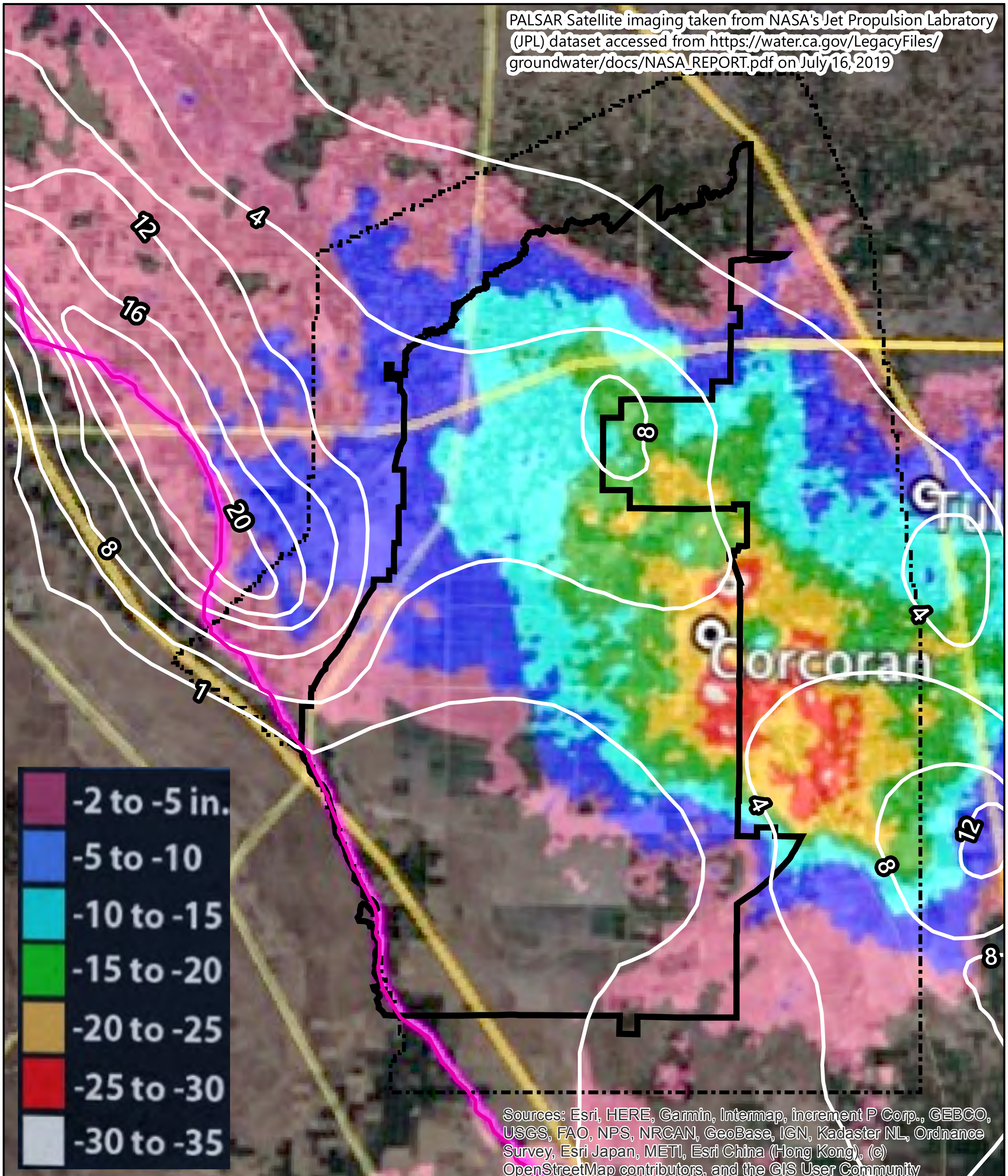
1. Vertical Displacement dataset taken from California Department of Water Resources (DWR) https://sgma.water.ca.gov/webgis. Accessed July 9, 2019.

Historical Subsidence of the Tulare Lake Subbasin

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/15/2019	Project No.: FR18161220
		Figure **3-34**

Date: 11/15/2019 Printed by: shaina.price
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-34_HistoricalSubsidenceTLSB.mxd



Explanation

- Study Area
- Subbasin boundary
- Edmund G. Brown California Aqueduct
- White line shows historical subsidence data from 1926-1970 (ft.)

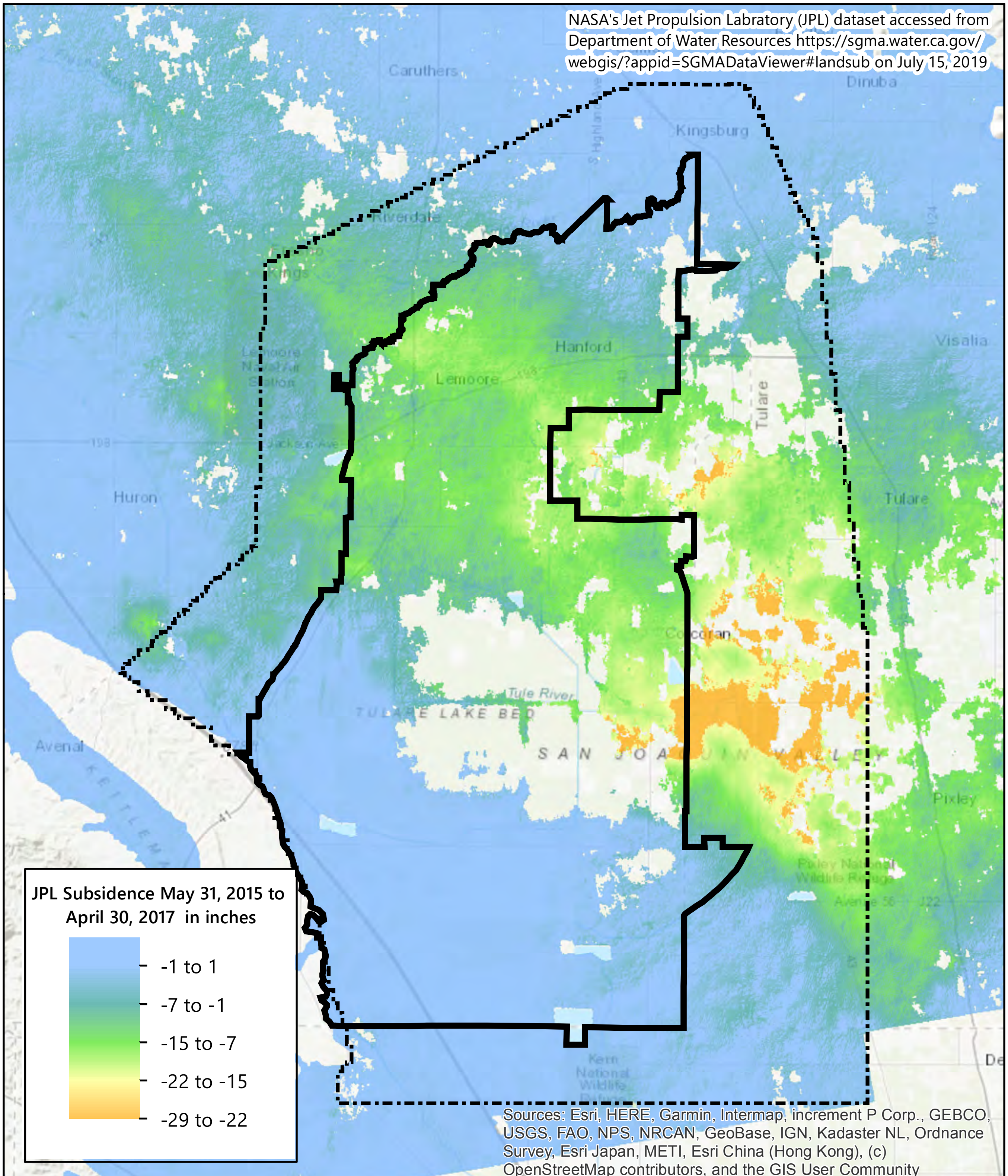
Miles: 0 2 4 8

Kilometers: 0 2.5 5 10

Subsidence in the Tulare Lake Subbasin 2007 to 2010

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/7/2019	Project No.: FR18161220
		Figure 3-35a



Explanation

Study Area

Subbasin boundary

Miles: 0, 2, 4, 8

Kilometers: 0, 2.5, 5, 10

N

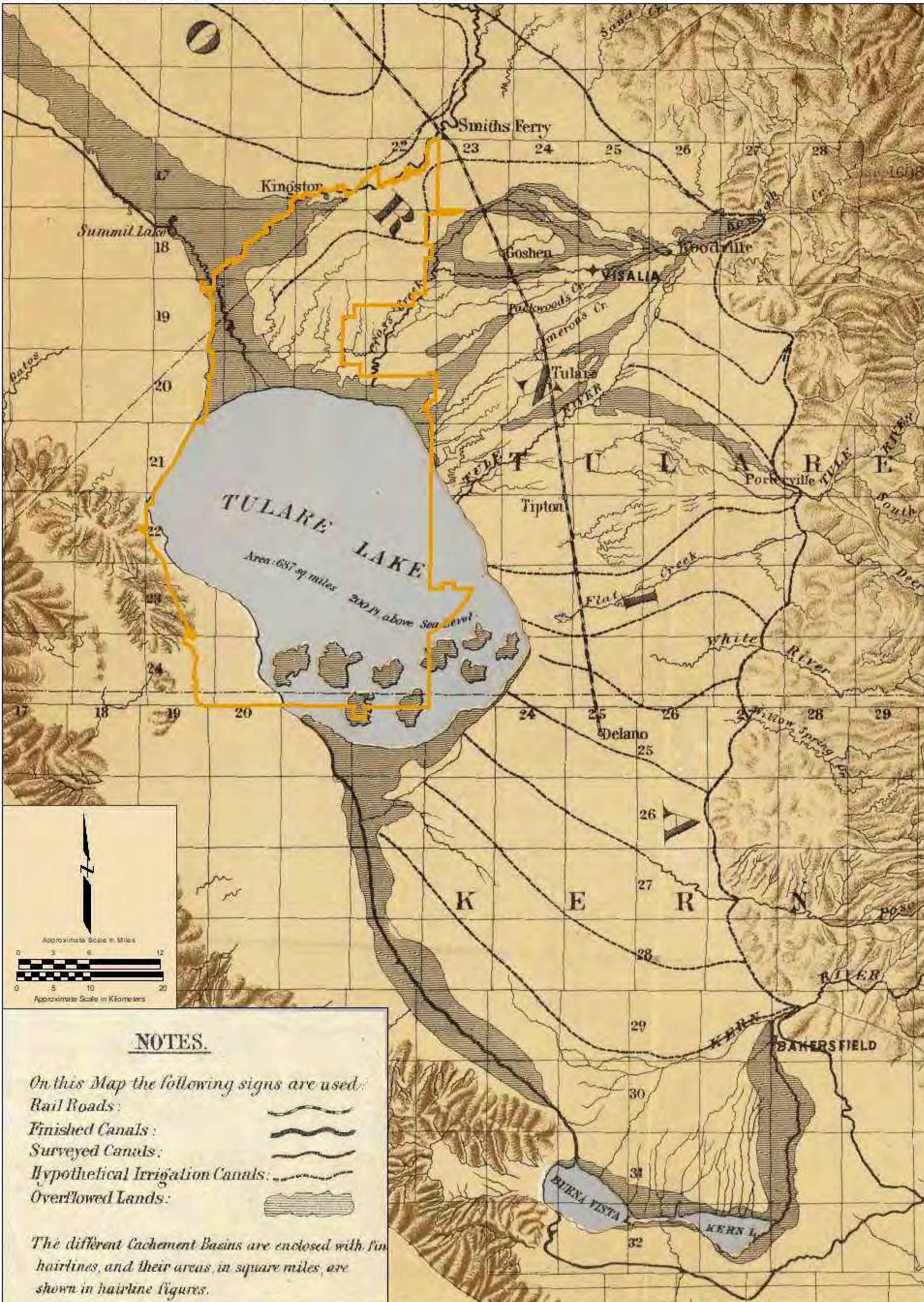
Subsidence in the Tulare Lake Subbasin 2015 to 2017

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/7/2019	Project No.: FR18161220
		Figure **3-35b**

Date: 11/7/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-35b_Subsidence2015-2017_8x11.mxd

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-36_Historic Surface Water Systems San Joaquin Valley.mxd



Explanation

Boundary of Tulare Lake Subbasin

Note:

Adapted from "Map of the San Joaquin, Sacramento and Tulare Valleys, State of California, Prepared Under The Direction of the Board of Commissioners on Irrigation, 1873"

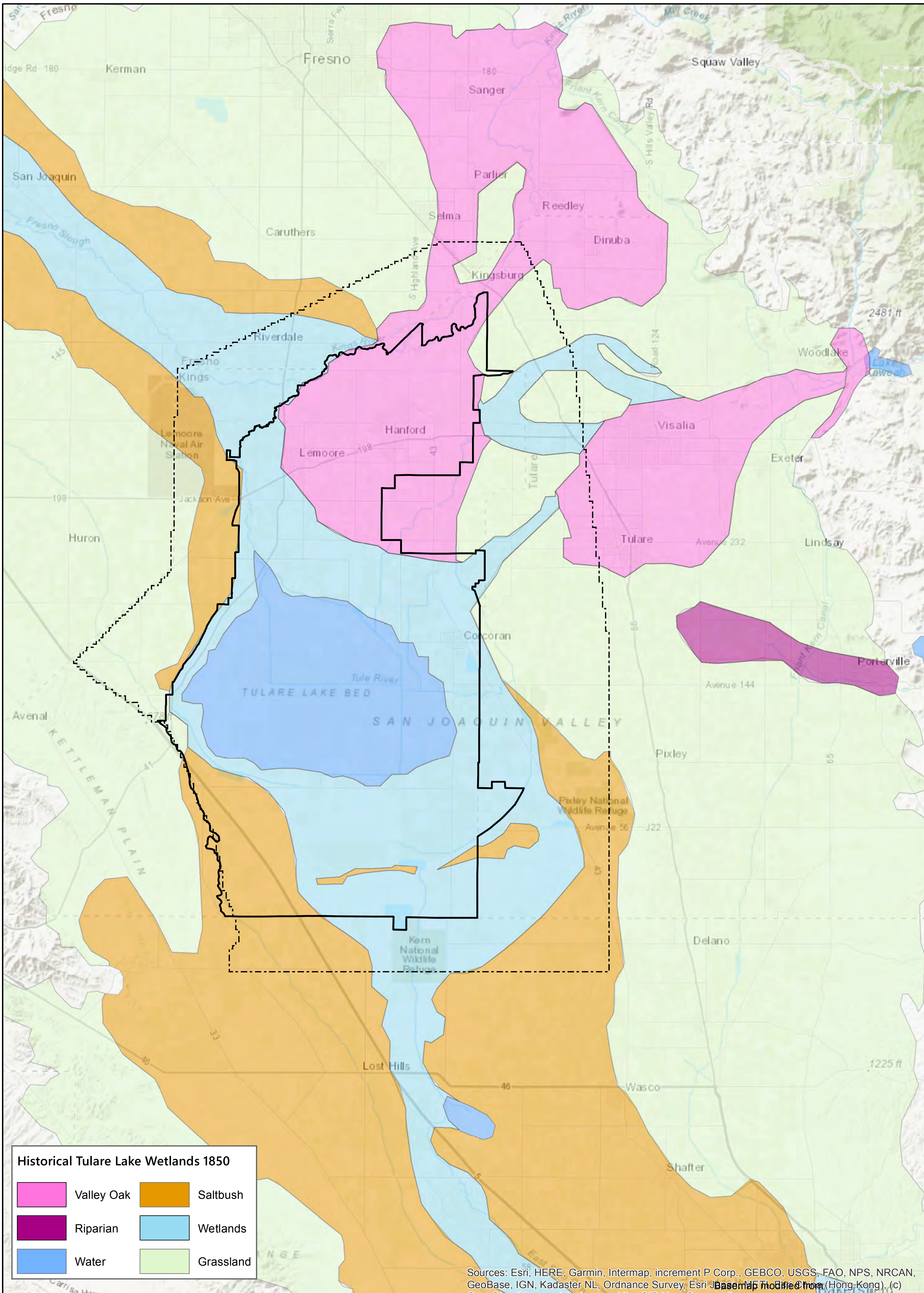
Historic Drainage System
Tulare Lake Basin

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: GLK	Date: 1/9/2020	Project No.: FR16181220

Figure **3-36**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-37_HistoricalTulareLakeWetlands.mxd



Explanation

Study area

Subbasin boundary

Miles: 0, 3.5, 7, 14

Kilometers: 0, 5, 10, 20

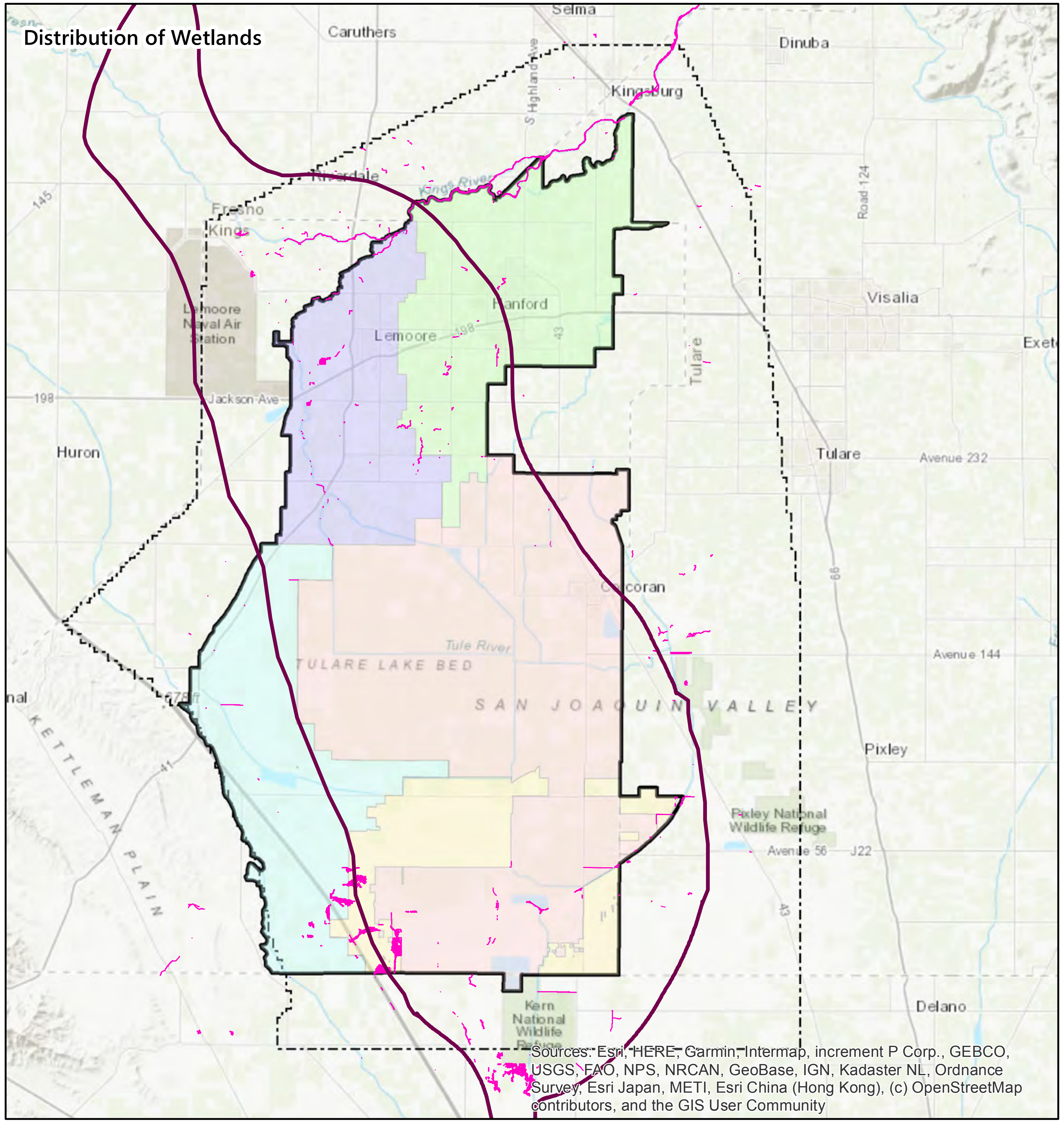
Notes:
figure adapted from http://www.tularebasinwildlifepartners.org/history.html. July 16, 2019

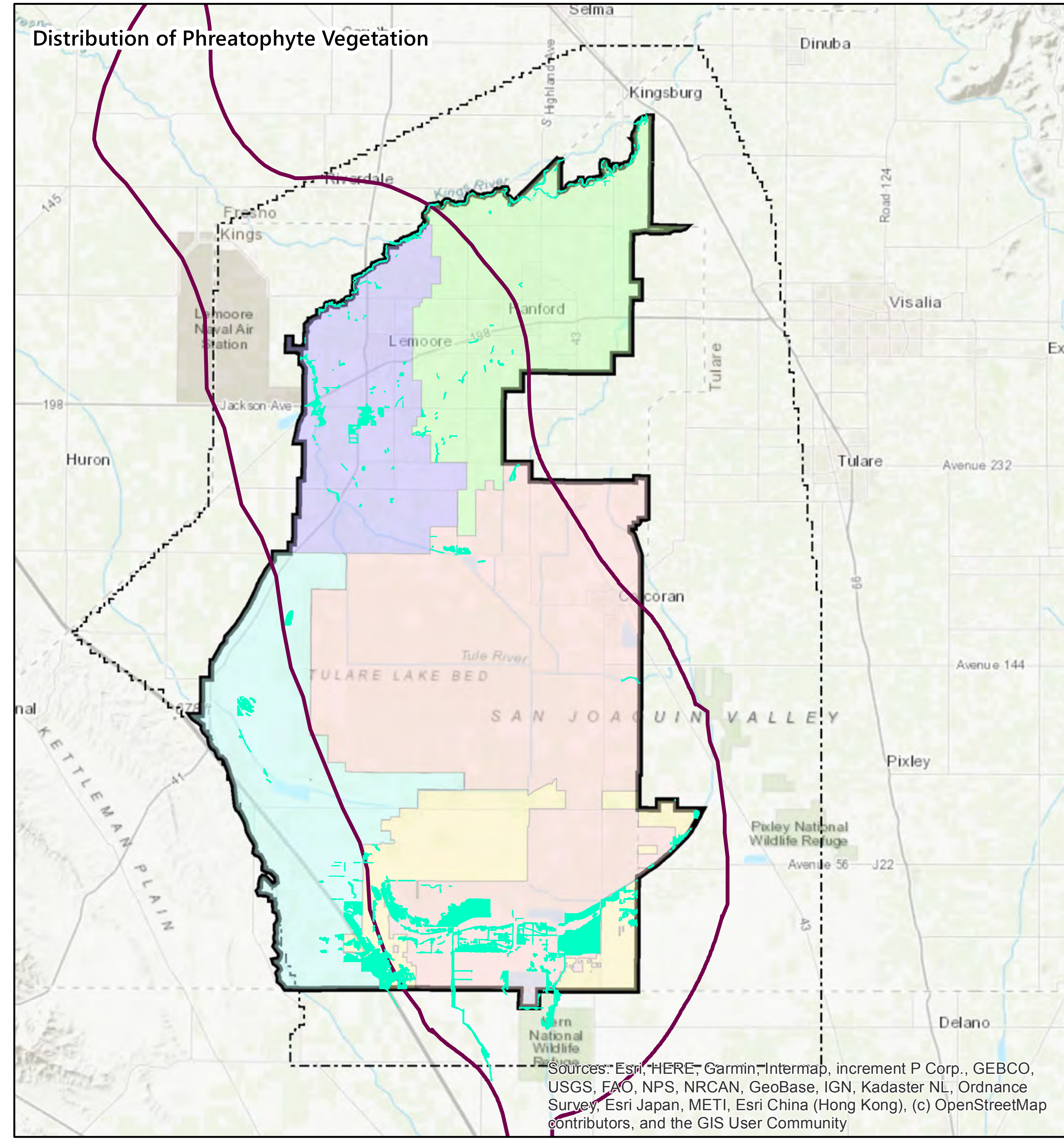
Historical Wetlands Distribution

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC | Date: 1/9/2020 | Project No.: FR18161220

Figure **3-37**





Explanation

- Extent of A-Clay
- Subbasin boundary
- Study area
- California Natural Resources Agency wetlands
- California Natural Resources Agency phreatophyte vegetation

Groundwater Sustainability Agencies (GSAs)

- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

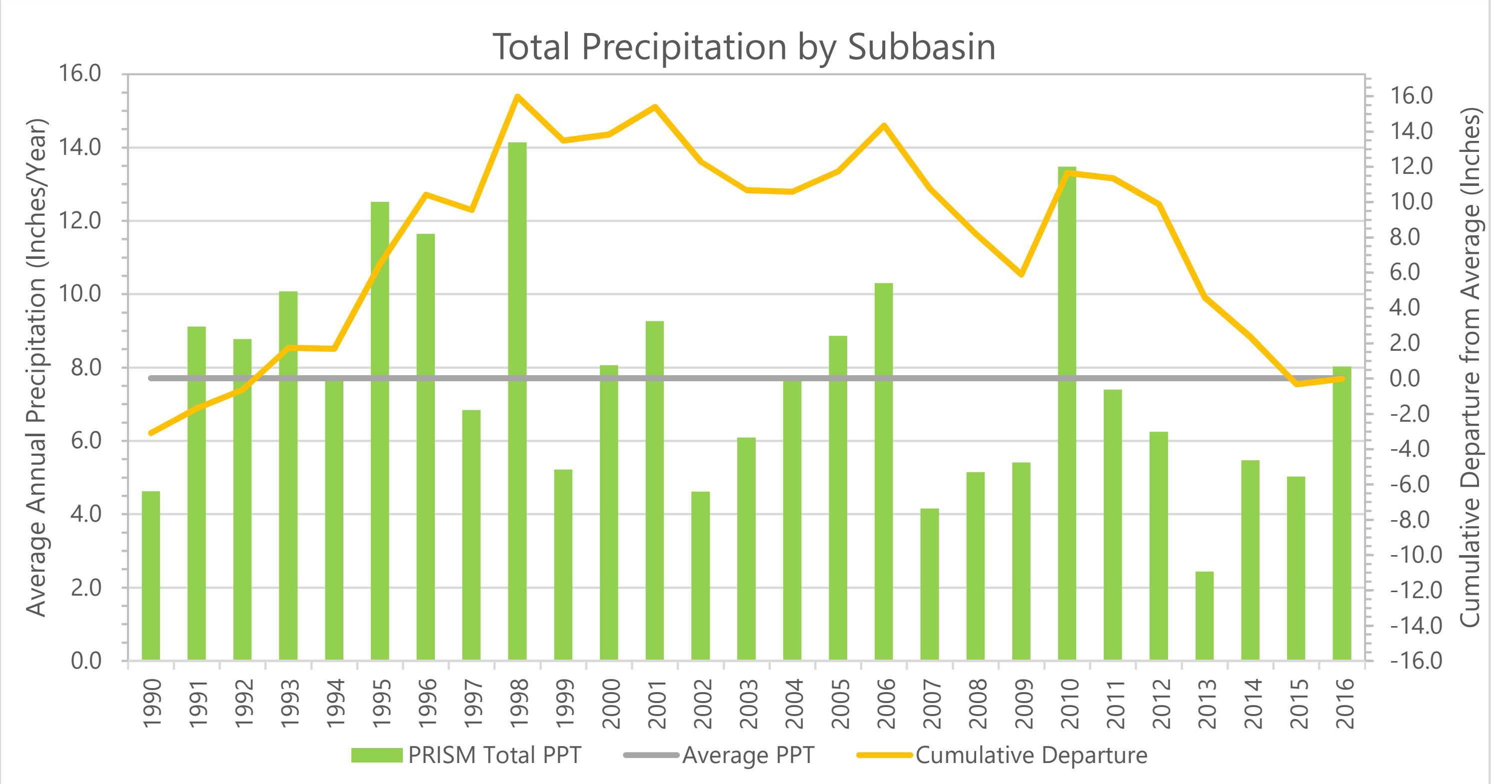
Miles: 0 4 8 16
Kilometers: 0 5 10 20

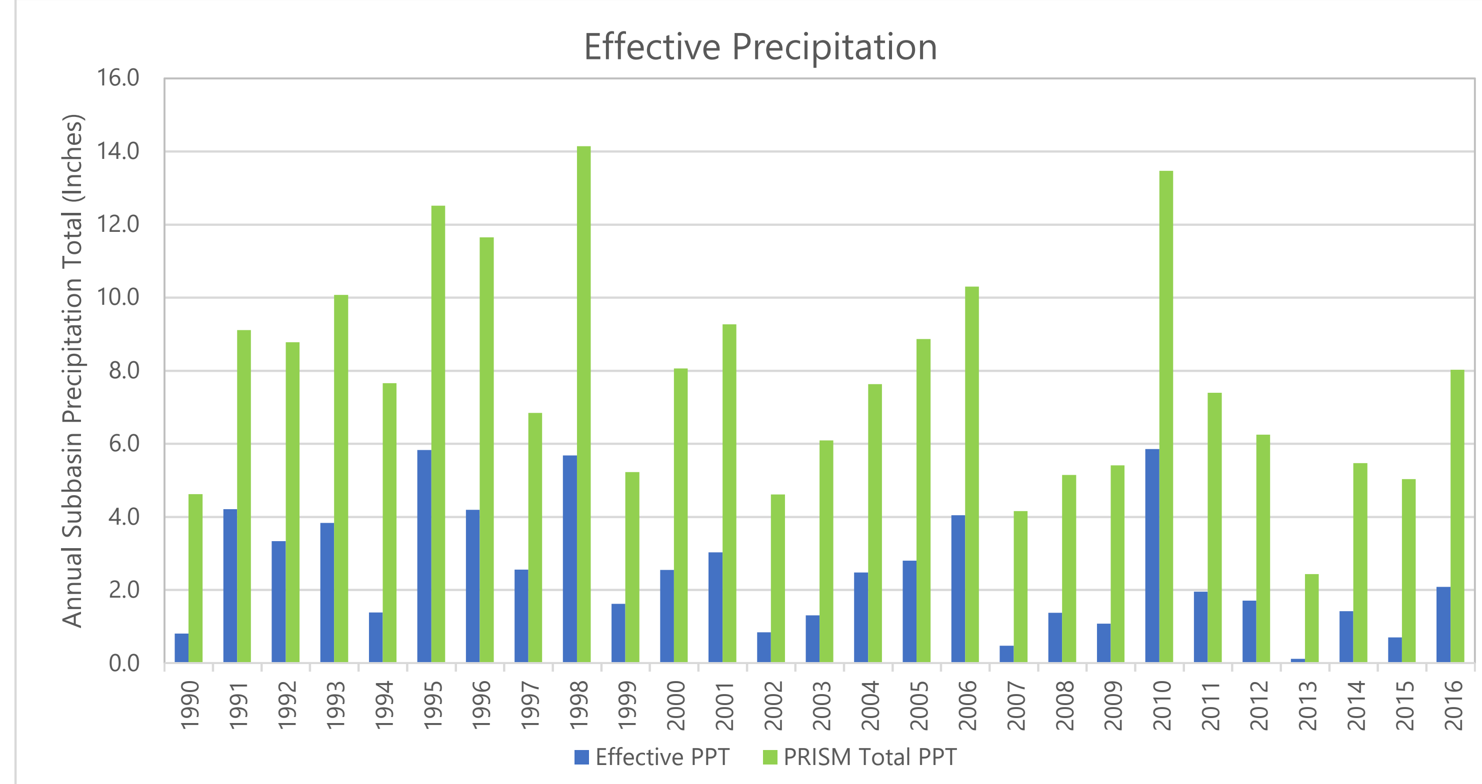
Notes:
1) California Natural Resources Agency data taken from http://resources.ca.gov/wetlands/inventories/inventories.html, accessed November 2018.

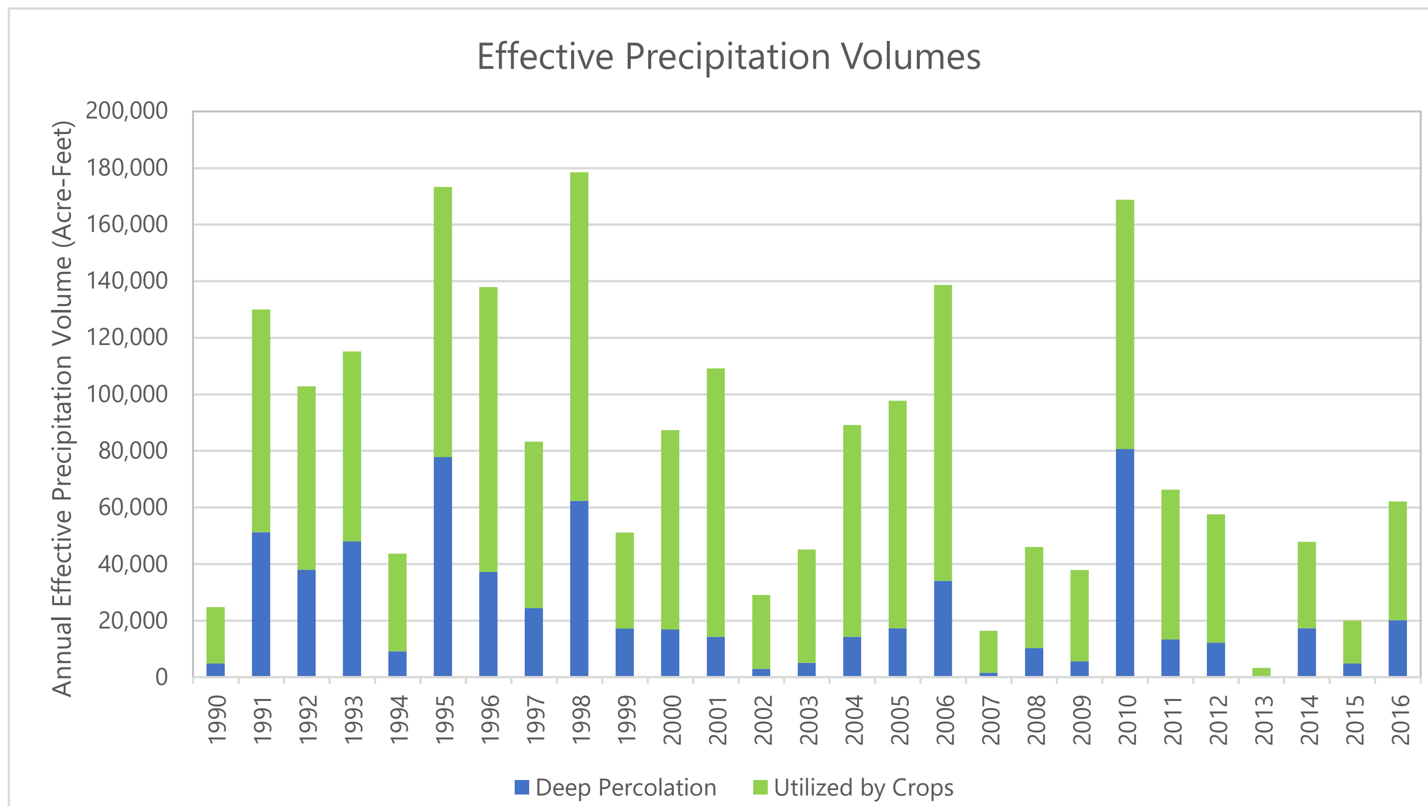
Distribution of Wetlands and Phreatophyte Vegetation
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 1/9/2020	Project No.: FR18161220
		Figure **3-38**

Date: 1/9/2020 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting_fig3-38_DistributionofWetlandsPhreatophyteVeg.mxd







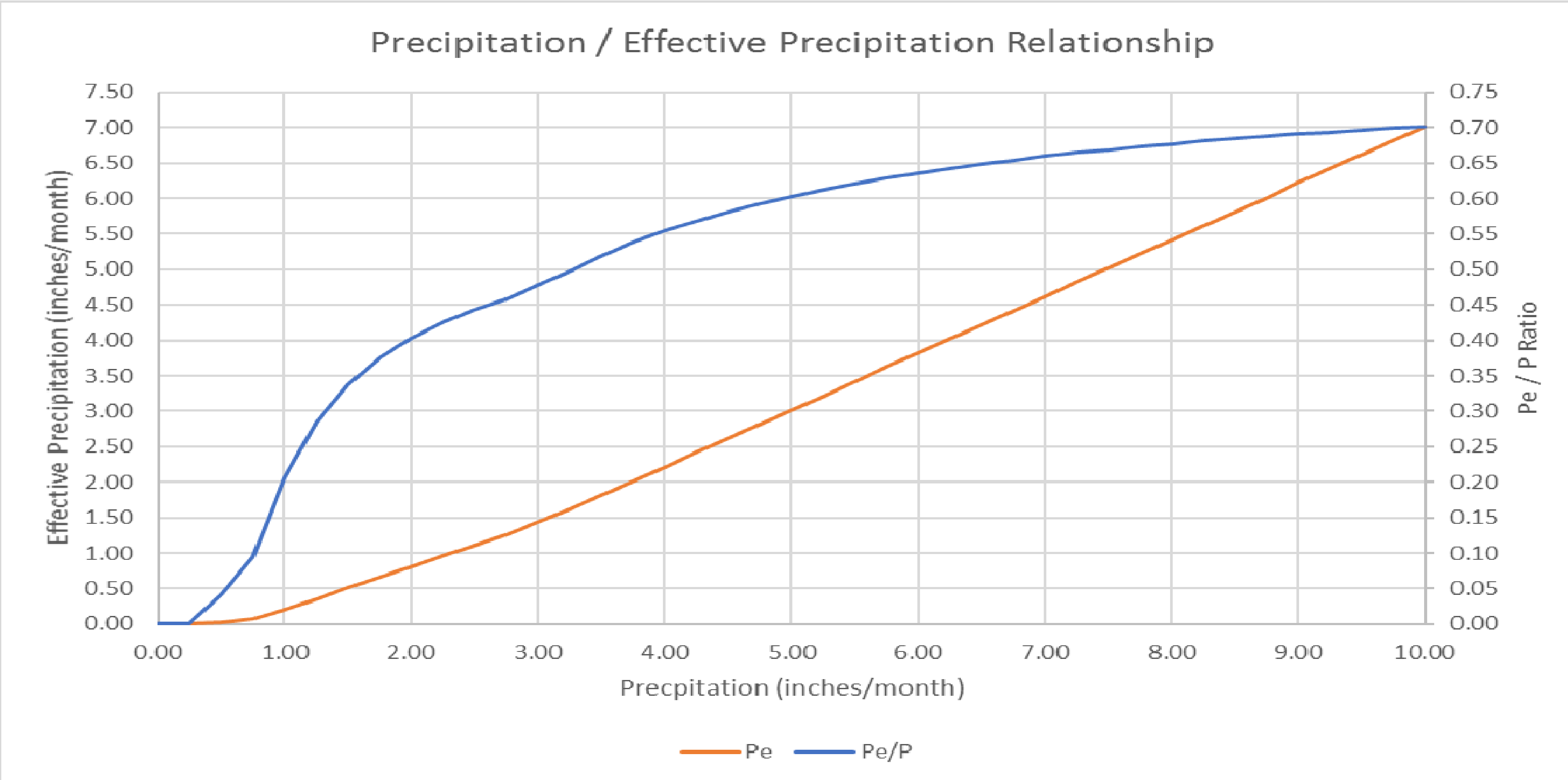
Notes:
1. PPT = precipitation
2. Climate data accessed from Parameter-elevation Regressions on Independent Slopes Model (PRISM) Climate group.. http://www.prism.oregonstate.edu/ Accessed November 2018

Annual Precipitation, Effective Precipitation, and Effective Precipitation Volumes
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb | Date: 11/20/2019 | Project No.: FR18161220

Figure: 3-39

I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Tables\Figures 3-39_3-40_062419.xlsmFigure 3-40 11/26/2019



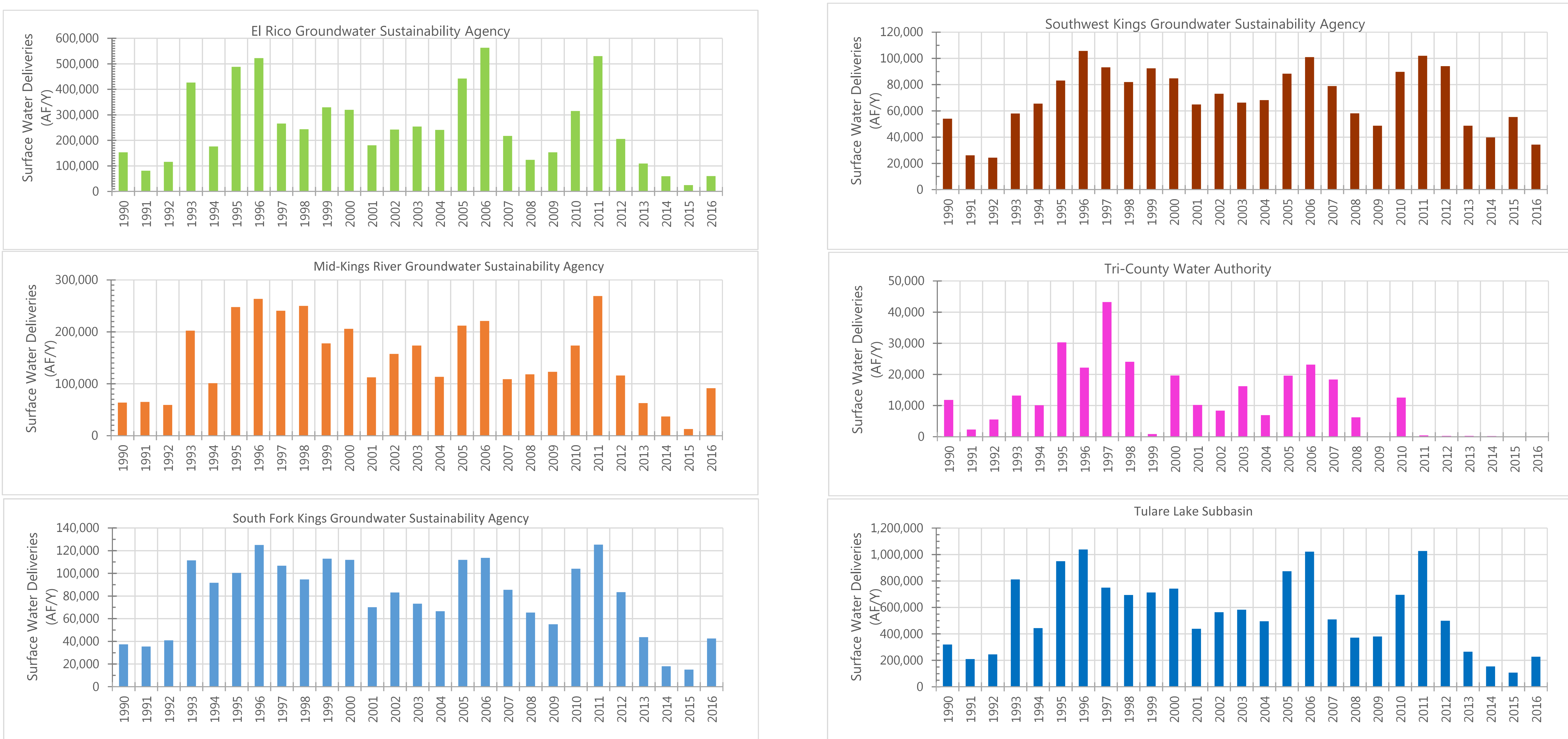
Notes:

Modified from:
United Nations Food and Agriculture Organization (FAO)
FAO 56,Chapter 3 Table 6
Precipitation (P) and Effective Precipitation (Pe) in inches/month

Precipitation Versus
Effective Precipitation
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: GLK	Date: 11/20/2018	Project No.: FR18161220
		Figure 3-40

I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Figures\DAVES FOLDER\GSPFigures 3-29_3-53_120619.xlsmFigure 3-41 1/8/2020

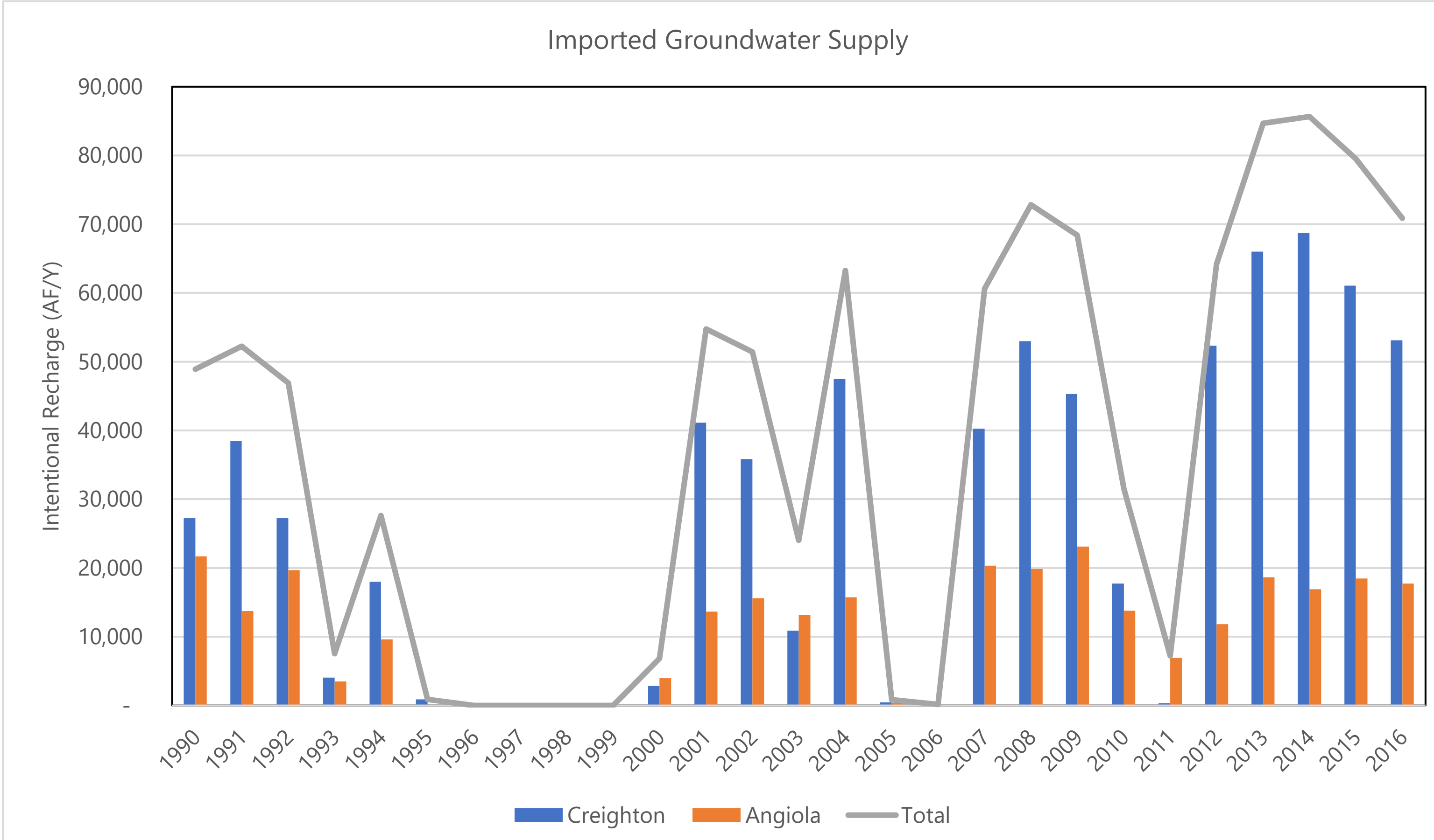


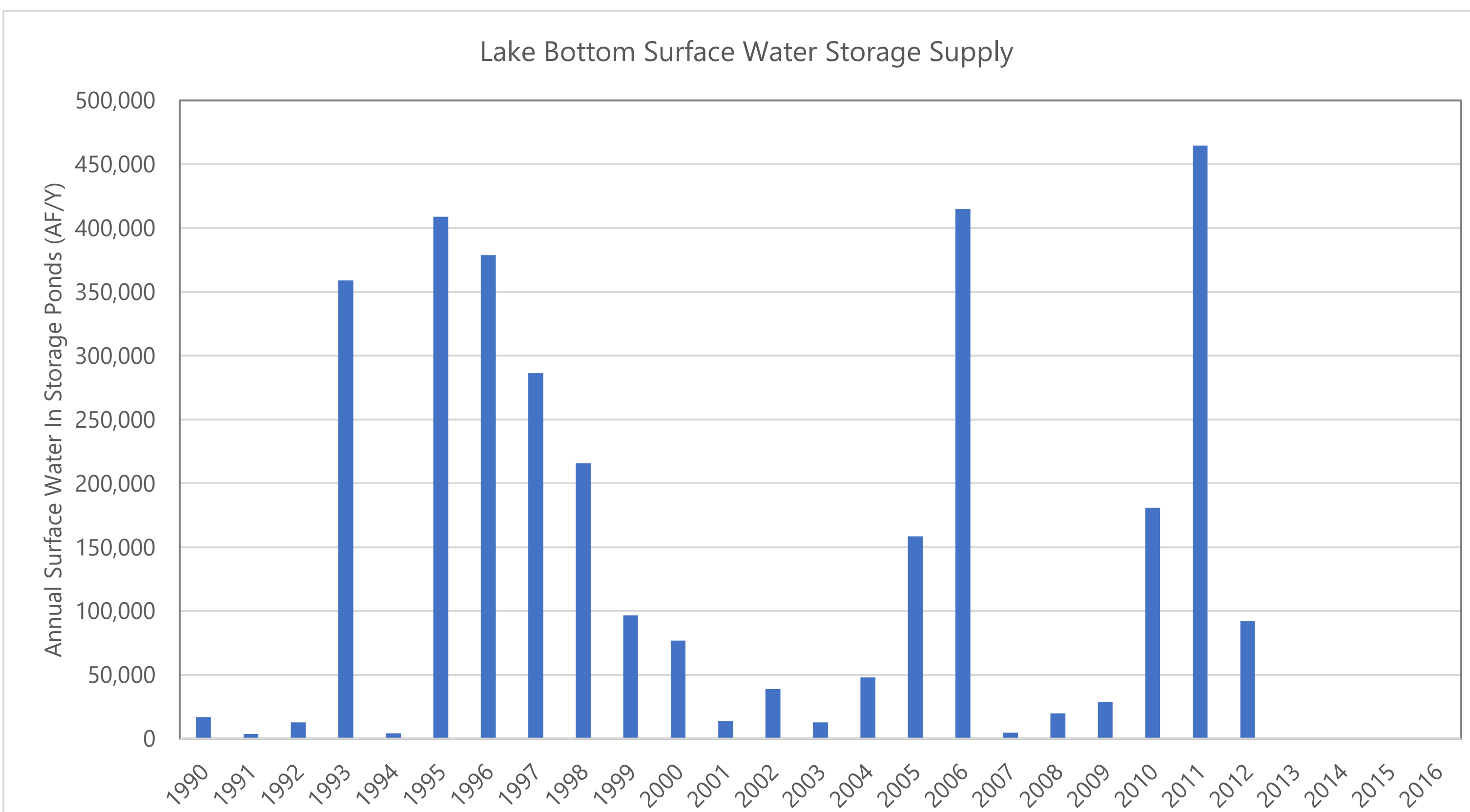
Notes:
1. AF/Y = acre-feet per year

Surface Water Diversions
1990 to 2016
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb | Date: 11/20/2018 | Project No.: FR18161220

Figure: 3-41





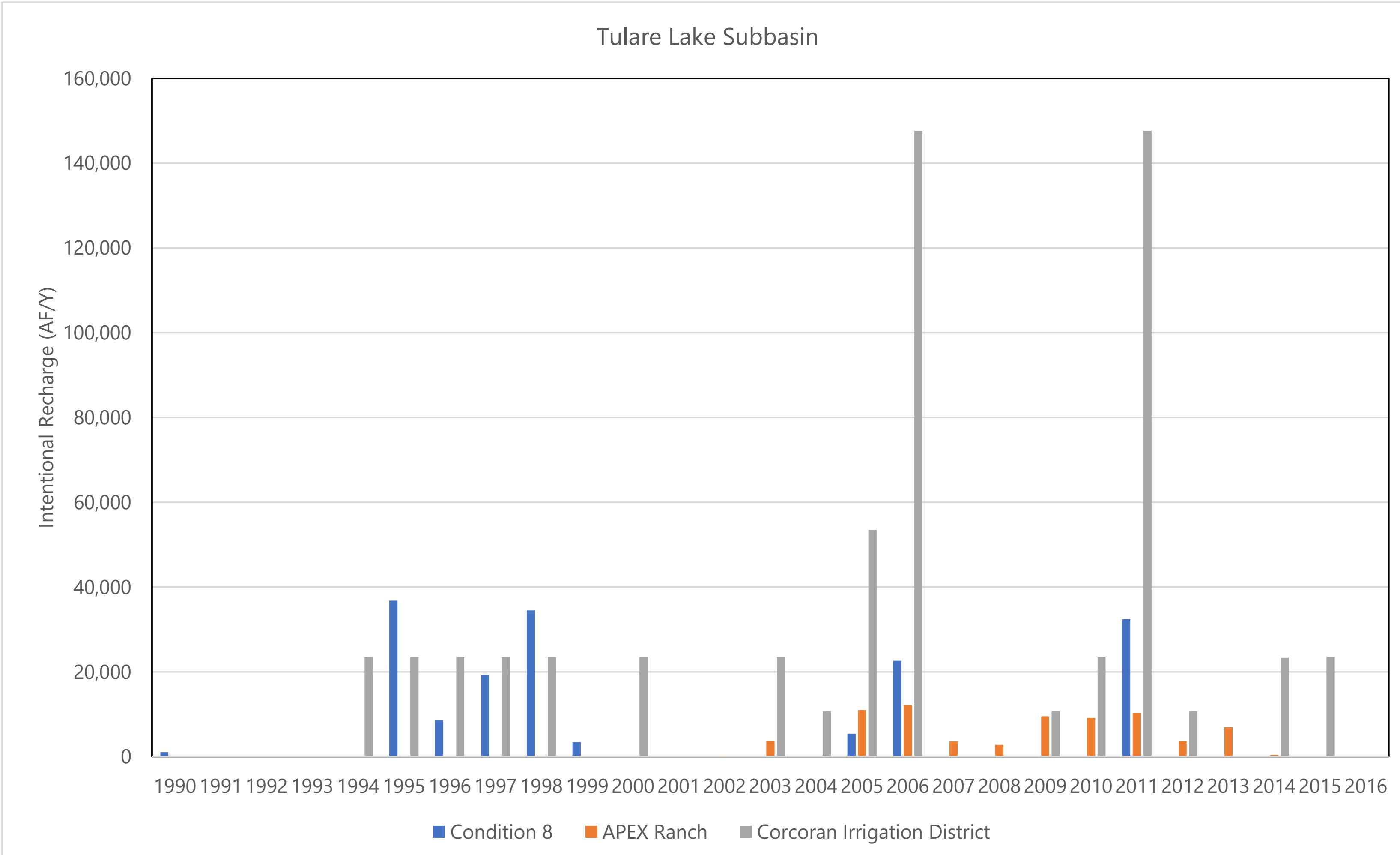
Notes:

1. Only EL Rico and TCWA GSAs import groundwater into the Tulare Lake Subbasin.
2. Only EL Rico and TCWA GSAs have significant surface water storage facilities.
3. Mid-Kings River GSA, South Fork Kings GSA, and Southwest Kings GSA do not have significant surface water storage facilities.
4. AF/Y = acre-feet per year

Lake Bottom Surface Water Storage and Imported Groundwater Supplies 1990-2016

Tulare Lake Subbasin Groundwater sustainability Plan
Kings County, California

By: dmb	Date: 07/30/19	Project No.: FR18161220
		Figure **3-42**



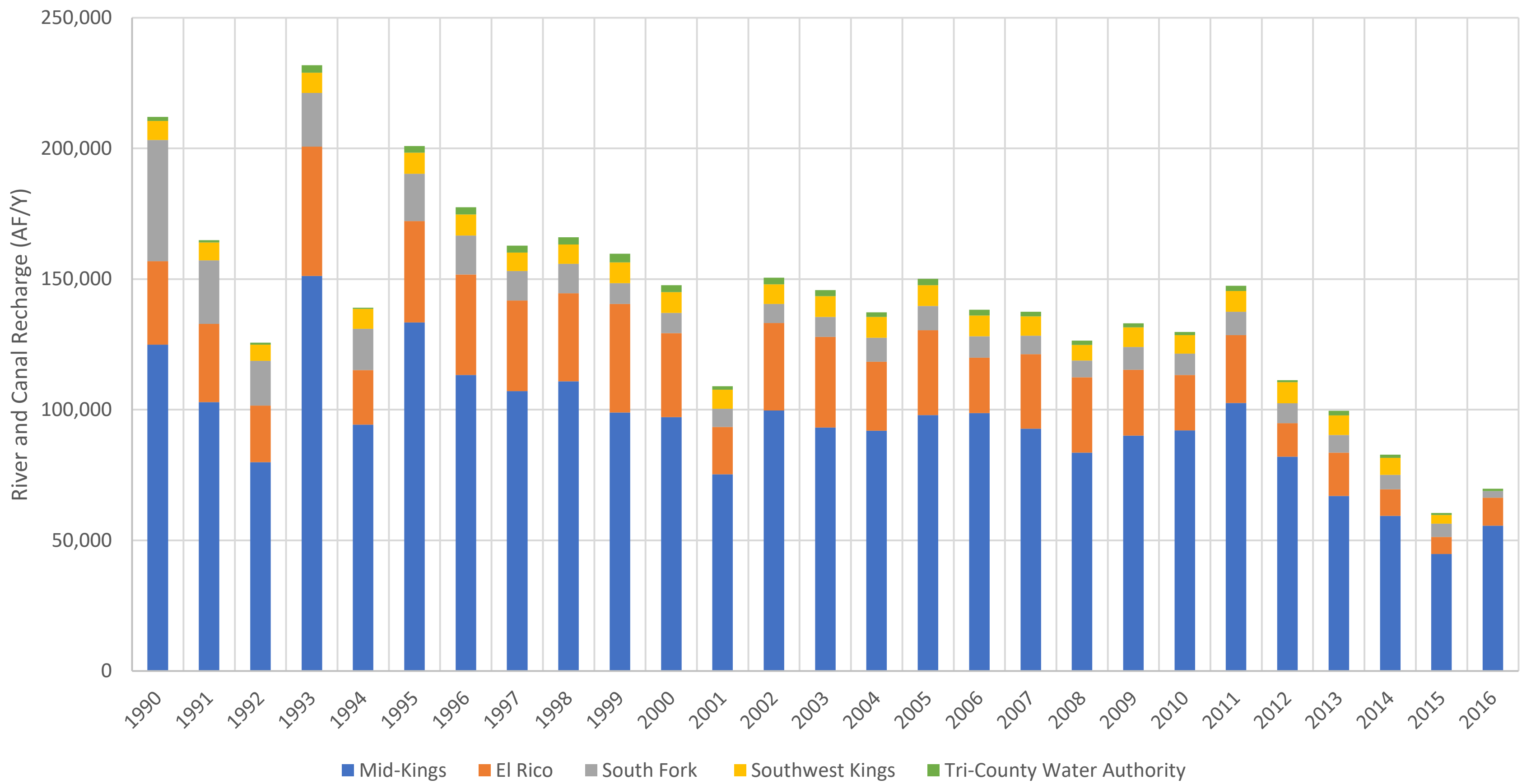
Notes:
1. The APEX Ranch recharge facility did not begin operation until 2002
Condition 8 water is only available in flood years
Corcoran Irrigation District (CID) recharge occurs in most years using only 1 or 2 ponds total 440 acres.
In flood years CID may recharge using 2,760 acres of ponds
2. AF/Y = acre-feet per year

Tulare Lake Subbasin
Intentional Recharge
1990 to 2016

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: GLK	Date: 11/20/2018	Project No.: FR18161220

Figure 3-43

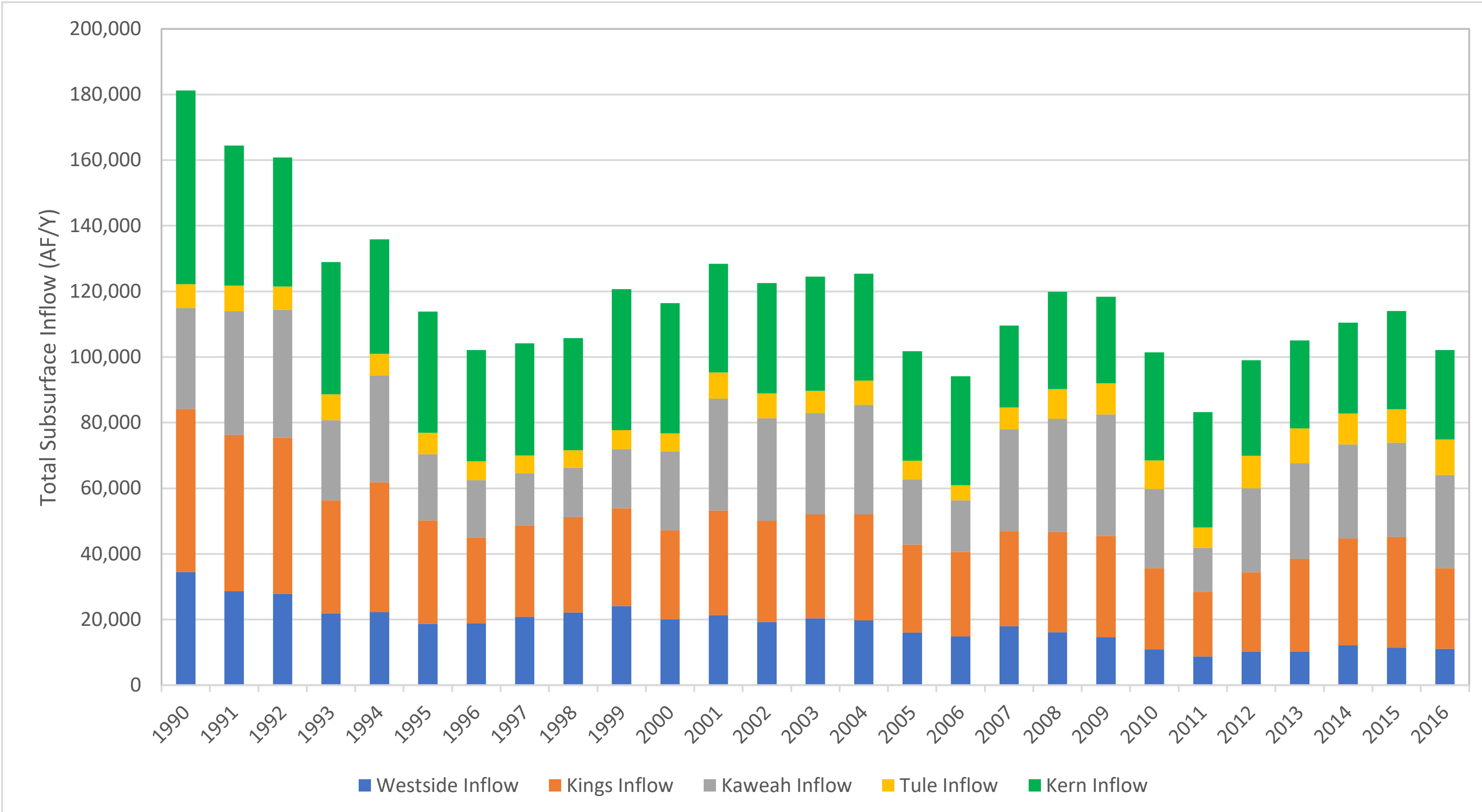


Notes:
1. AF/Y = acre-feet per year

Tulare Lake Subbasin
River and Canal Recharge
1990 to 2016

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

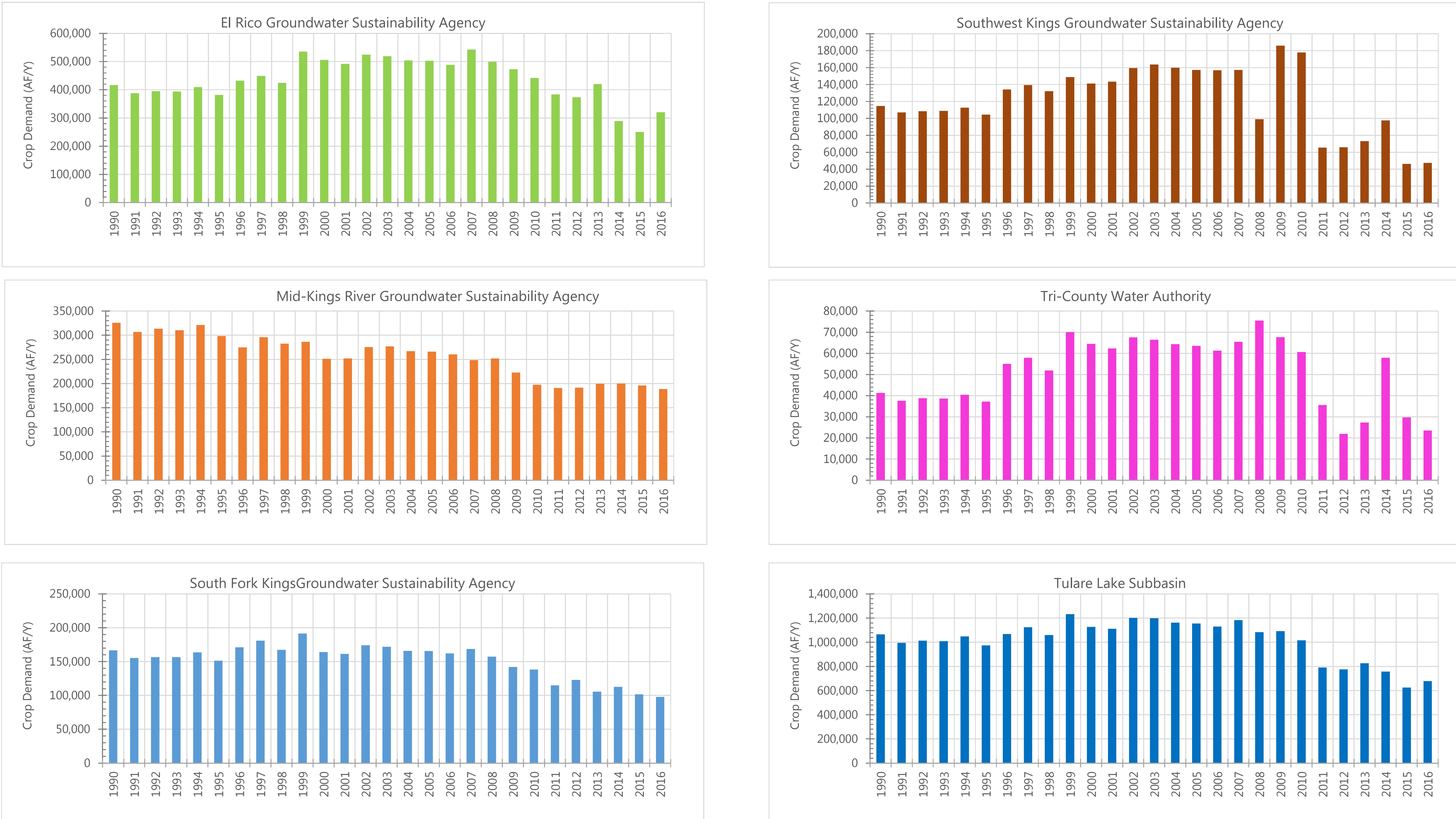
By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure 3-44



Notes:
1. AF/Y = acre-feet per year

Tulare Lake Subbasin
Total Subsurface Inflows
1990 to 2016
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure 3-45

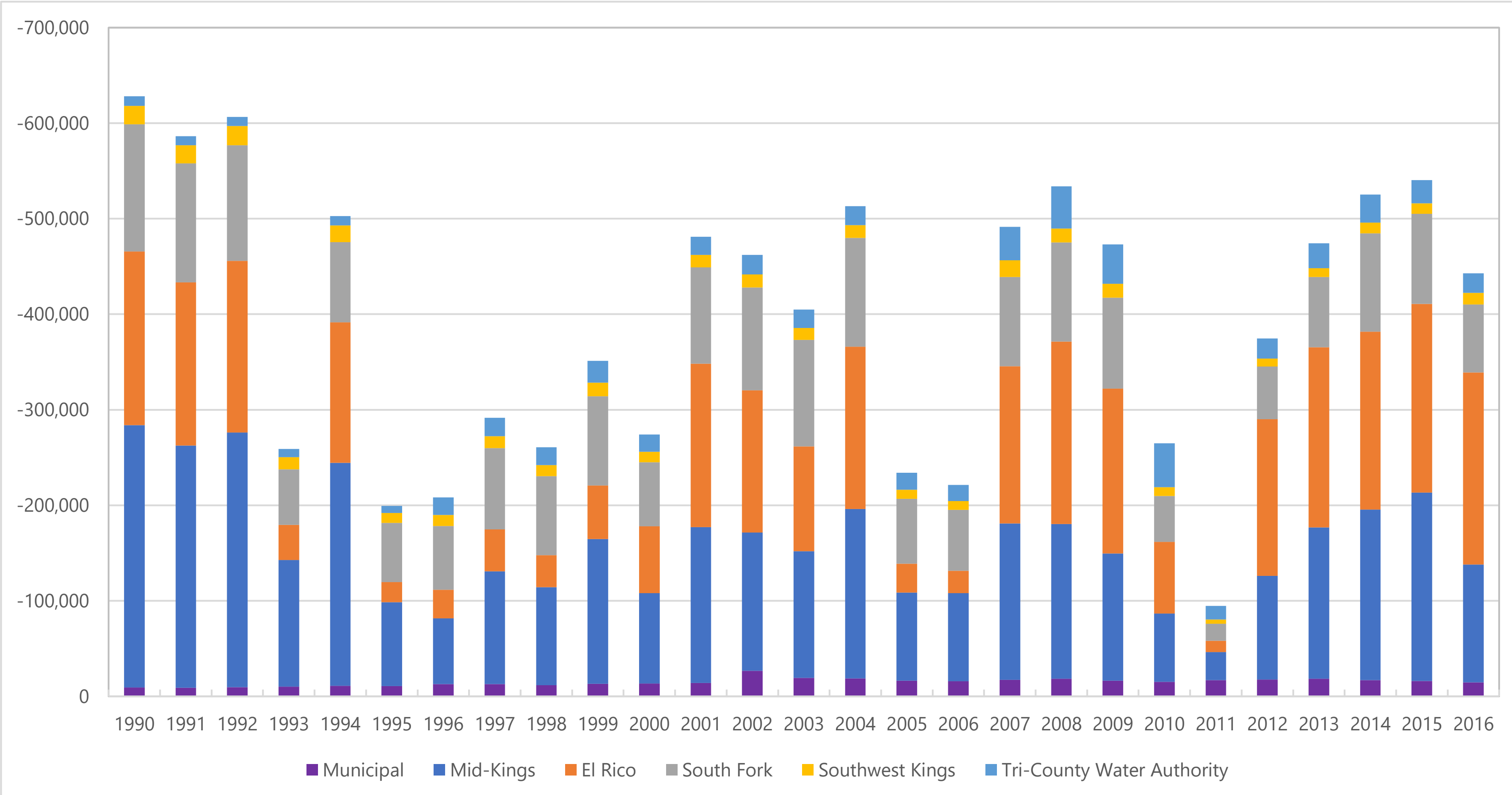


Notes:
1. AF/Y = acre-feet per year

Irrigated Crop Demand
1990 to 2016
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb | Date: 11/20/2019 | Project No.: FR18161220

Figure: 3-46

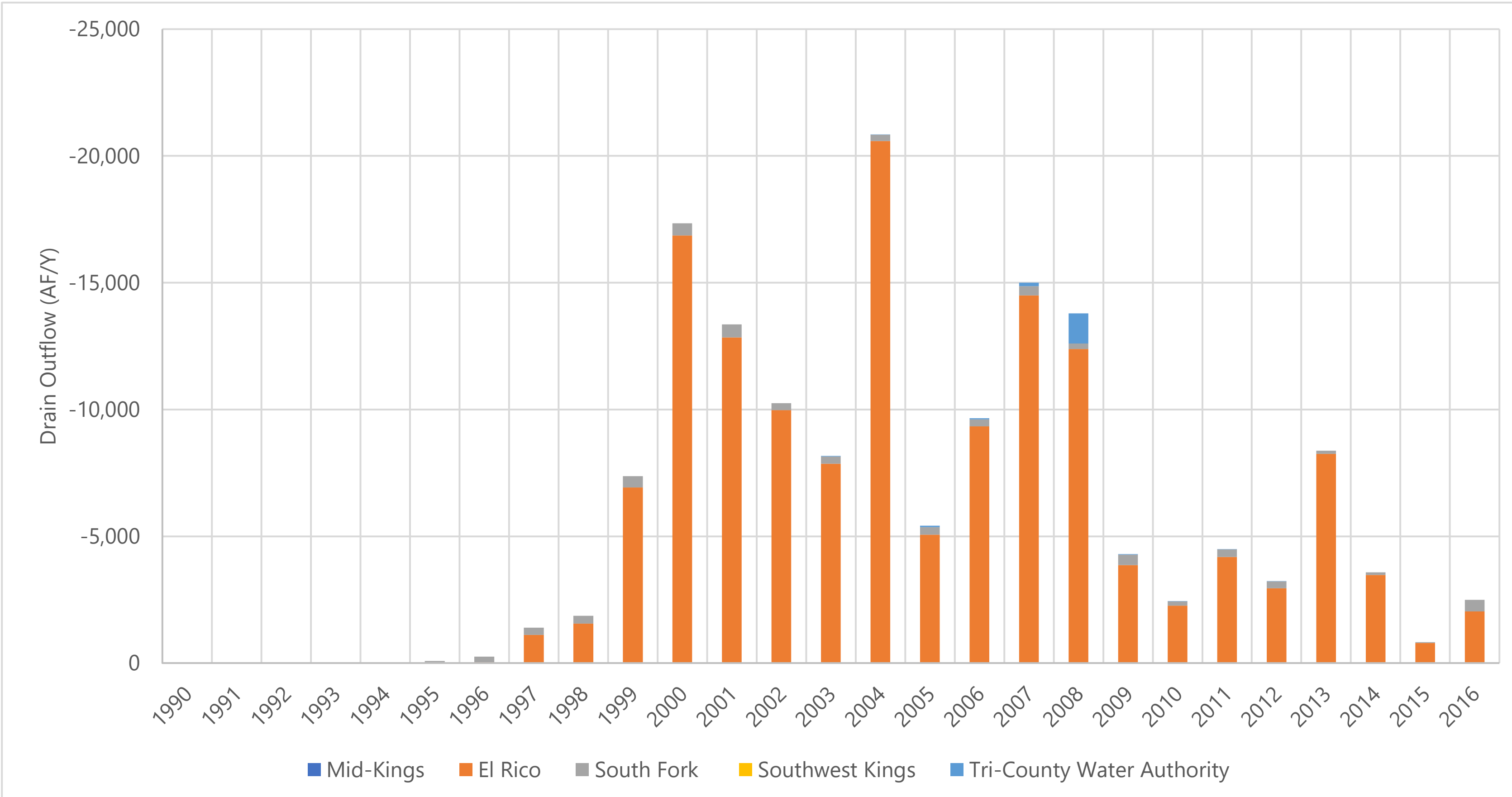


Notes:
1. AF/Y = acre-feet per year
2. TCWA = Tri-County Water Authority

Agricultural and Municipal Pumping
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure 3-47

I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Figures\DAVES FOLDER\GSPFigures 3-29_3-53_120619Figure 3-48 12/11/2019

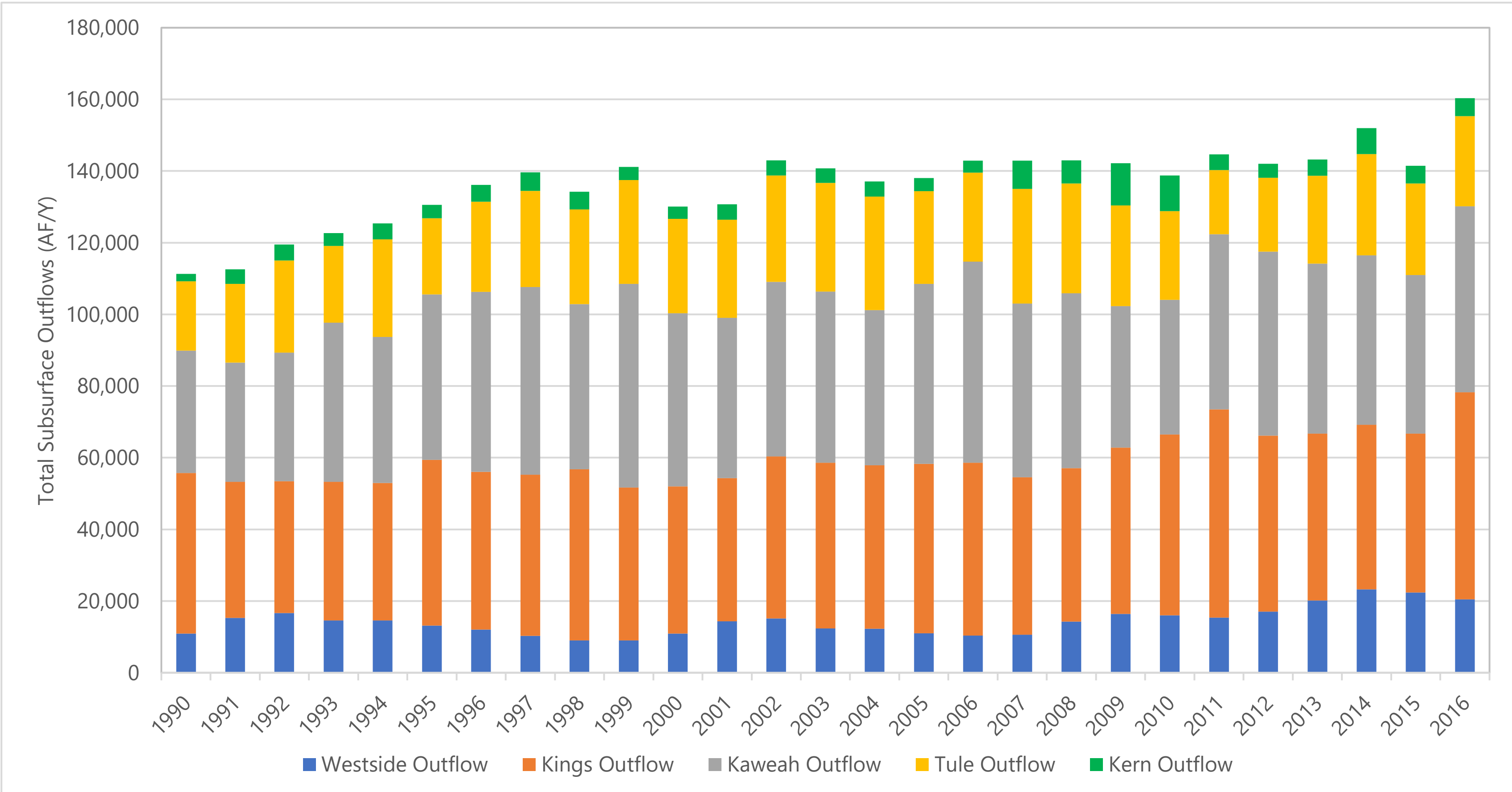


Notes:
1. Mid-Kings River GSA, South Fork Kings GSA, and Southwest Kings GSA do not have agricultural drain outflows.
2. AF/Y = acre-feet per year

Tulare Lake Subbasin Agricultural Drainage Outflows 1990 to 2016

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure 3-48



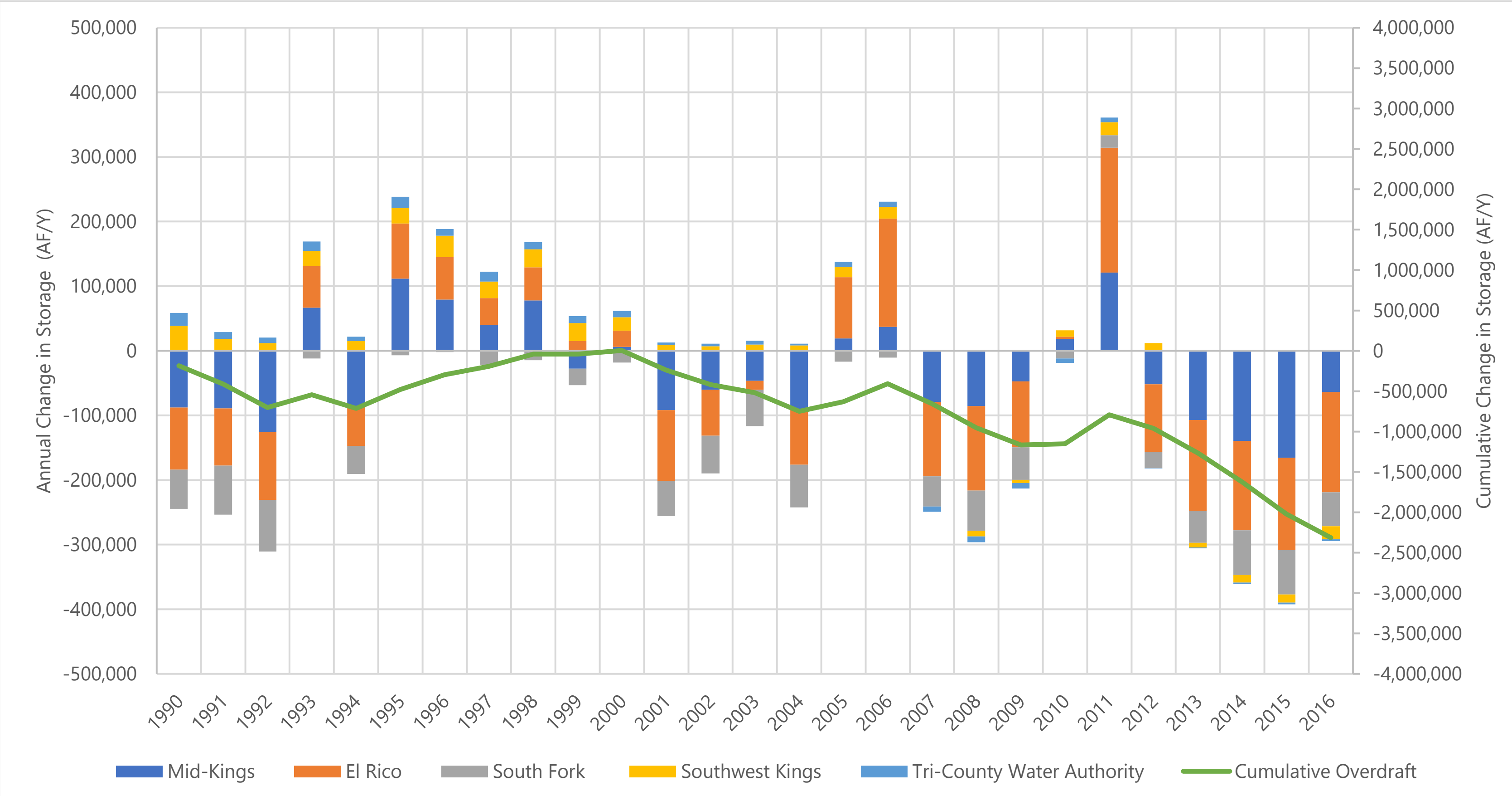
Notes:
1. AF/Y = acre-feet per year

Tulare Lake Subbasin
Total Subsurface Outflows
1990 to 2016

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure 3-49

I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Figures\DAVES FOLDER\GSPFigures 3-29_3-53_120619Figure 3-50a 12/11/2019

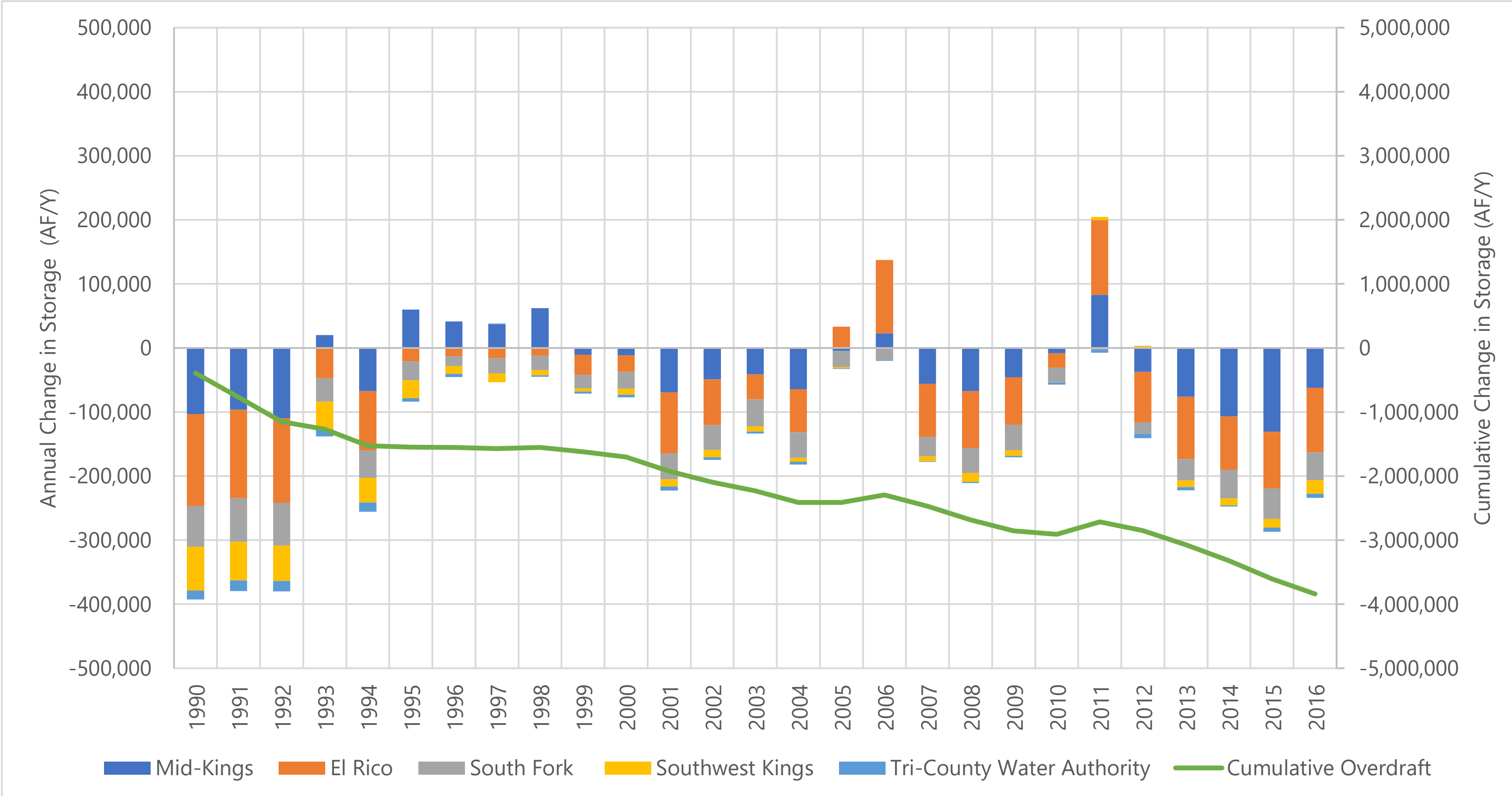


Notes:
1. AF/Y = acre-feet per year

Tulare Lake Subbasin
Total Overdraft
1990 to 2016
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure 3-50a

I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Figures\DAVES FOLDER\GSPFigures 3-29_3-53_120619Figure 3-50b 12/11/2019



Notes:
1. AF/Y = acre-feet per year

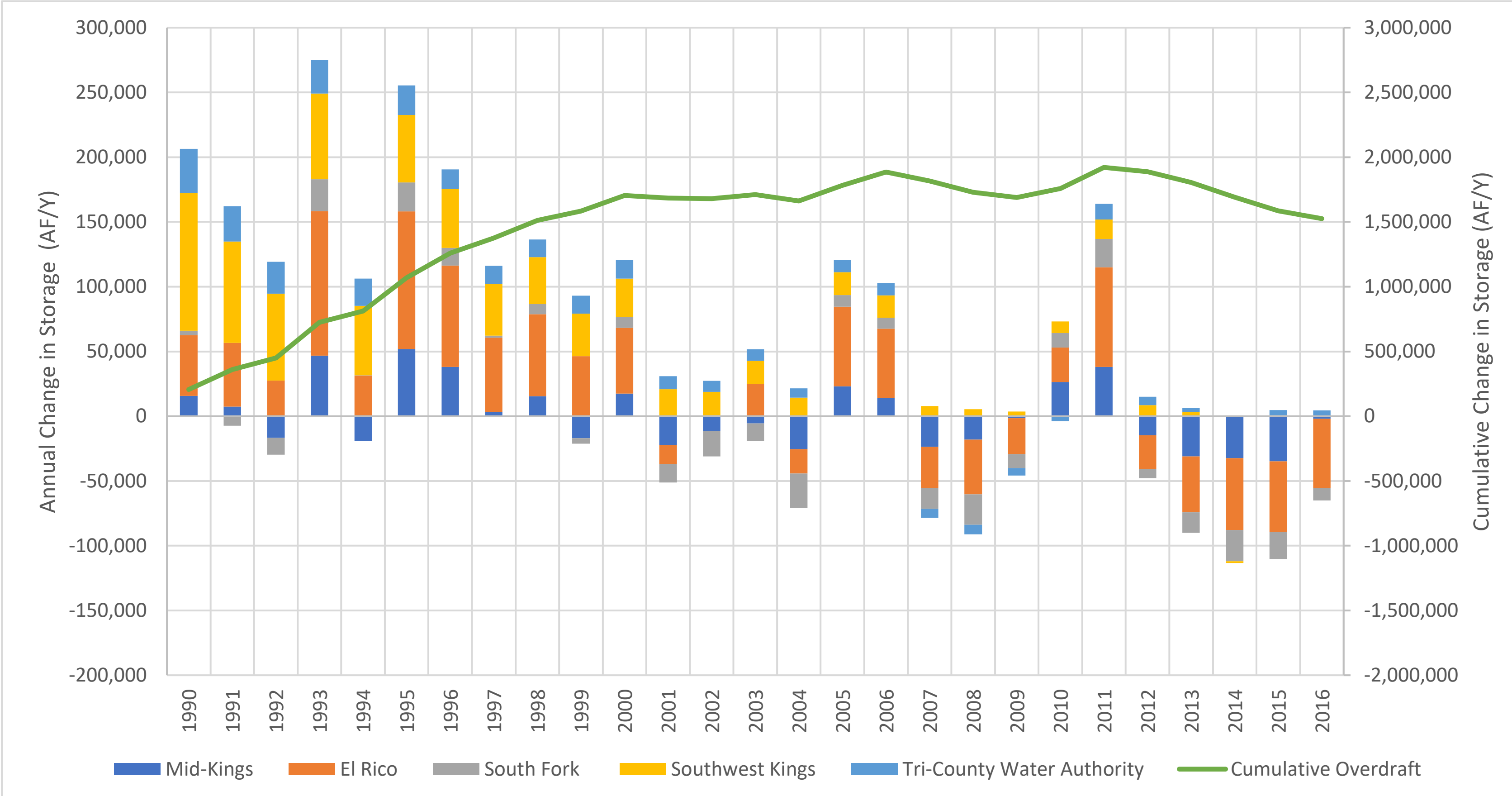
Tulare Lake Subbasin
Upper Aquifer Overdraft
1990 to 2016

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb | Date: 11/20/2019 | Project No.: FR18161220

Figure 3-50b

I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Figures\DAVES FOLDER\GSPFigures 3-29_3-53_120619Figure 3-50c 12/11/2019

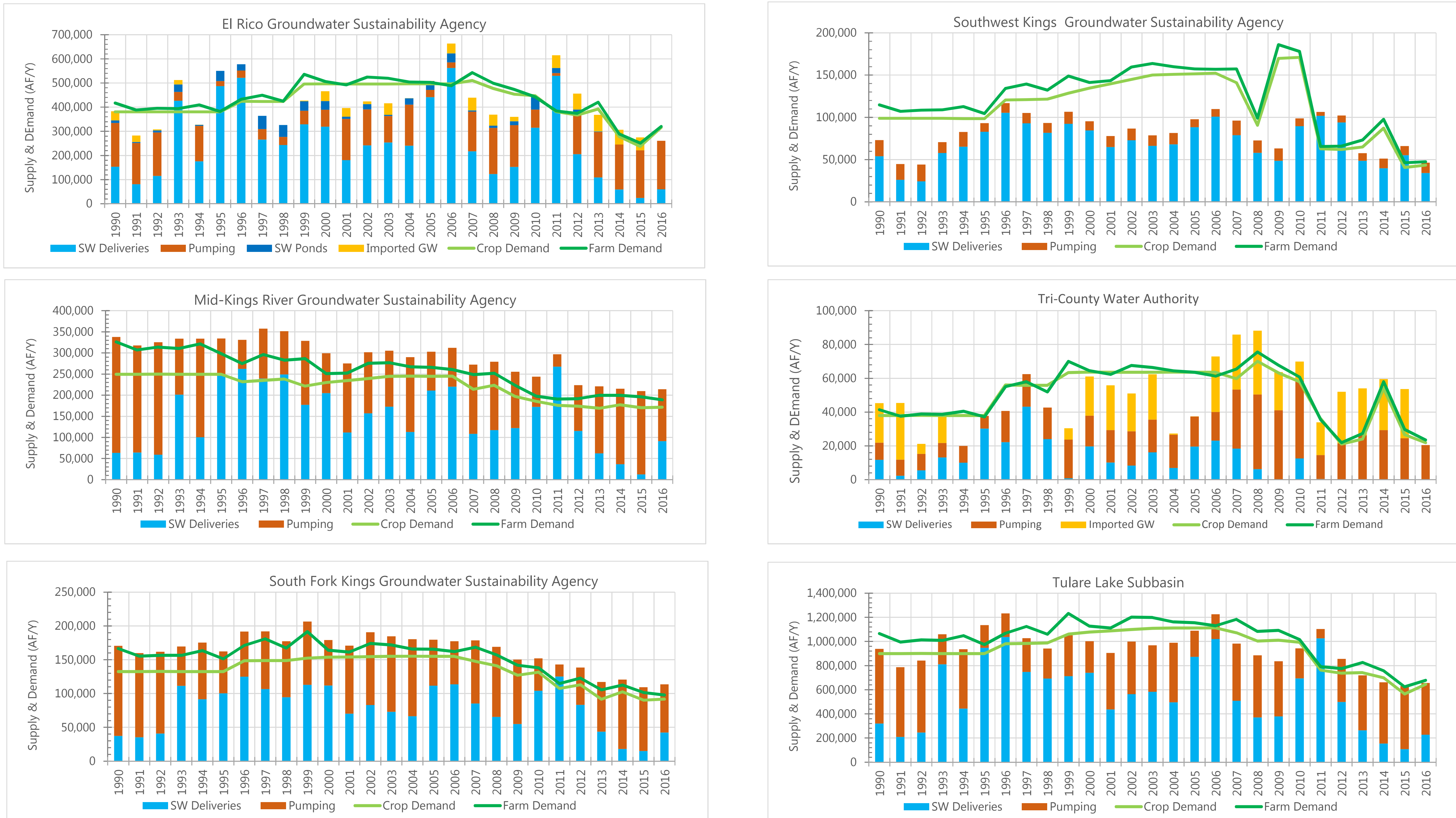


Notes:
1. AF/Y = acre-feet per year

Tulare Lake Subbasin
Lower Aquifer Overdraft
1990 to 2016

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure 3-50c



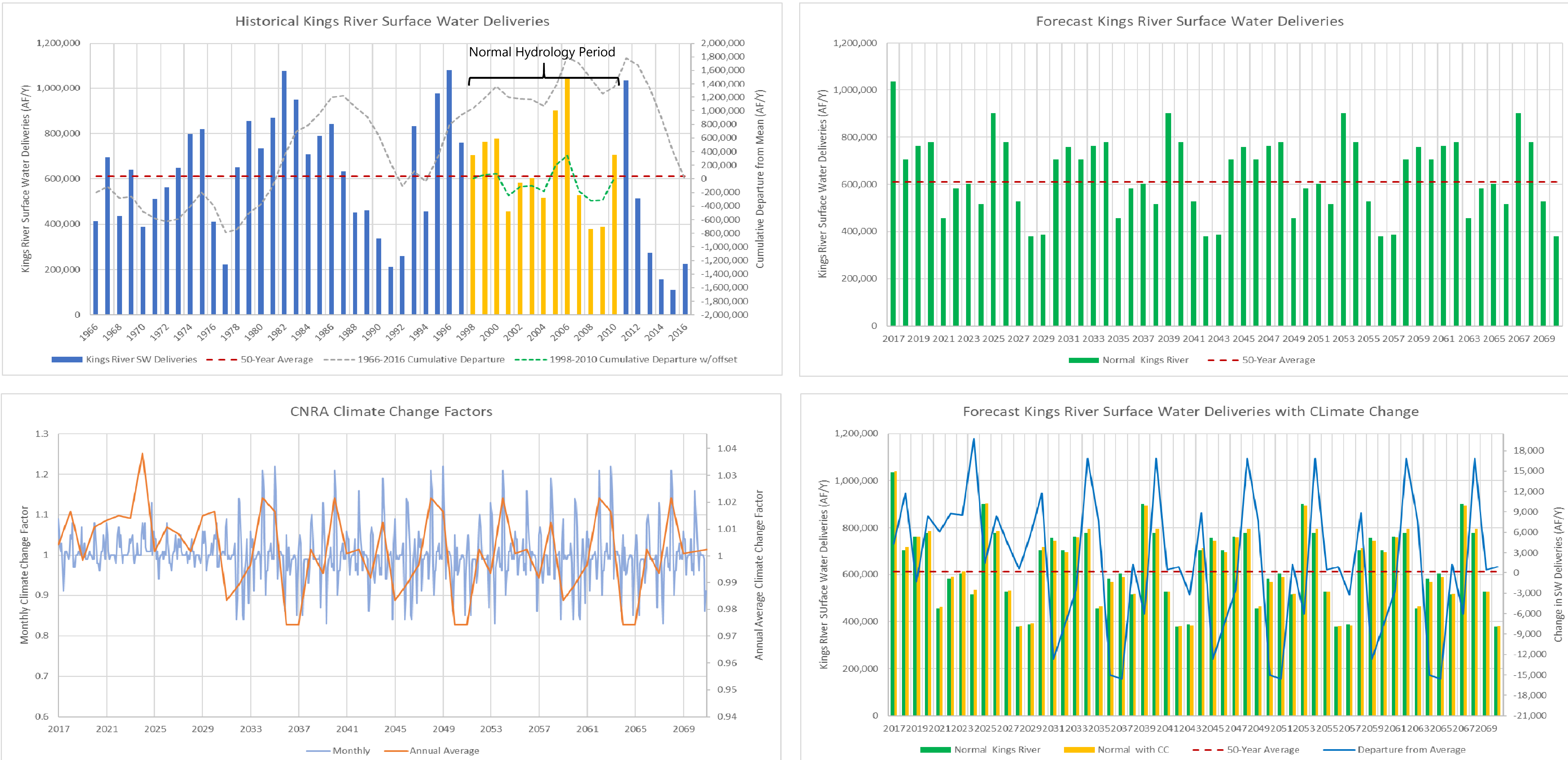
Notes:
1. AF/Y = acre-feet per year

Water Supply and Demand
1990 to 2016
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb | Date: 11/20/2019 | Project No.: FR18161220

Figure: 3-51

I:\FR18s\FR18161220 Tulare Lake GSP\Figures\3-BasinSetting\Figures\DAVES FOLDER\GSPFigures 3-29_3-53_120619.xlsmFigure 3-52 1/8/2020

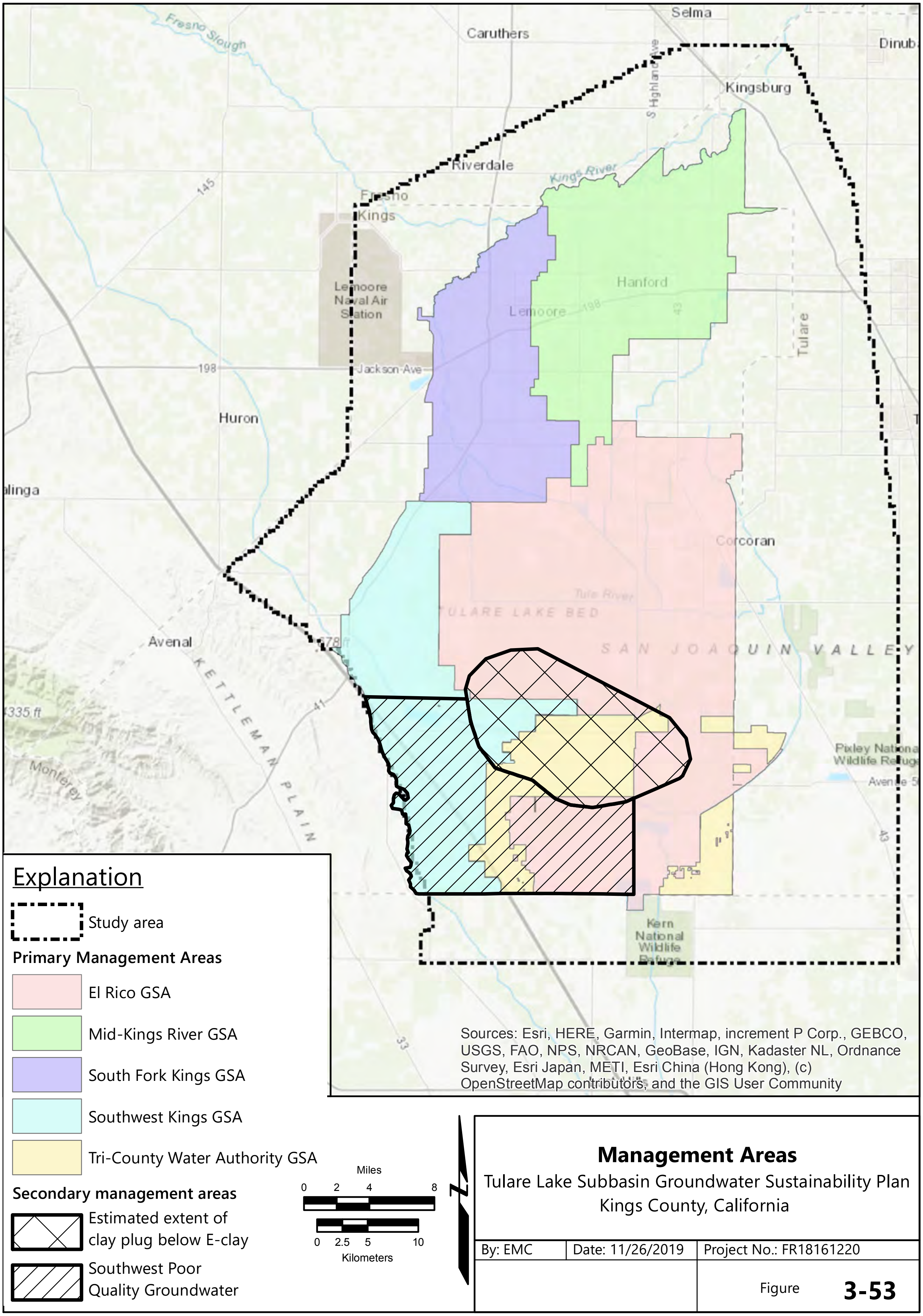


Notes:
1. AF/Y = acre-feet per year

Surface Water Delivery Foreacst with Climate Change

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 11/20/2019	Project No.: FR18161220
		Figure: 3-52



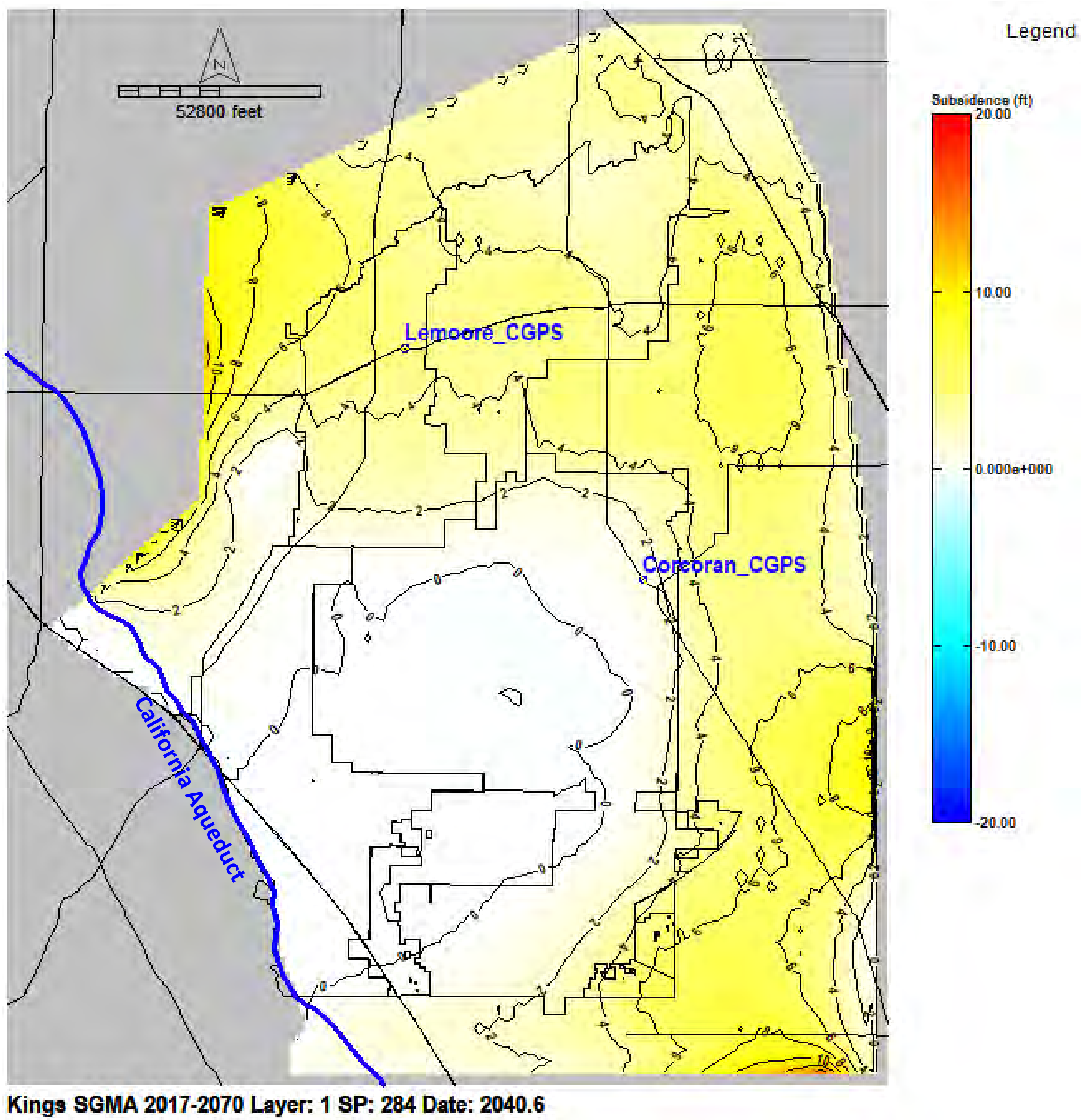
Management Areas

Tulare Lake Subbasin Groundwater Sustainability Plan

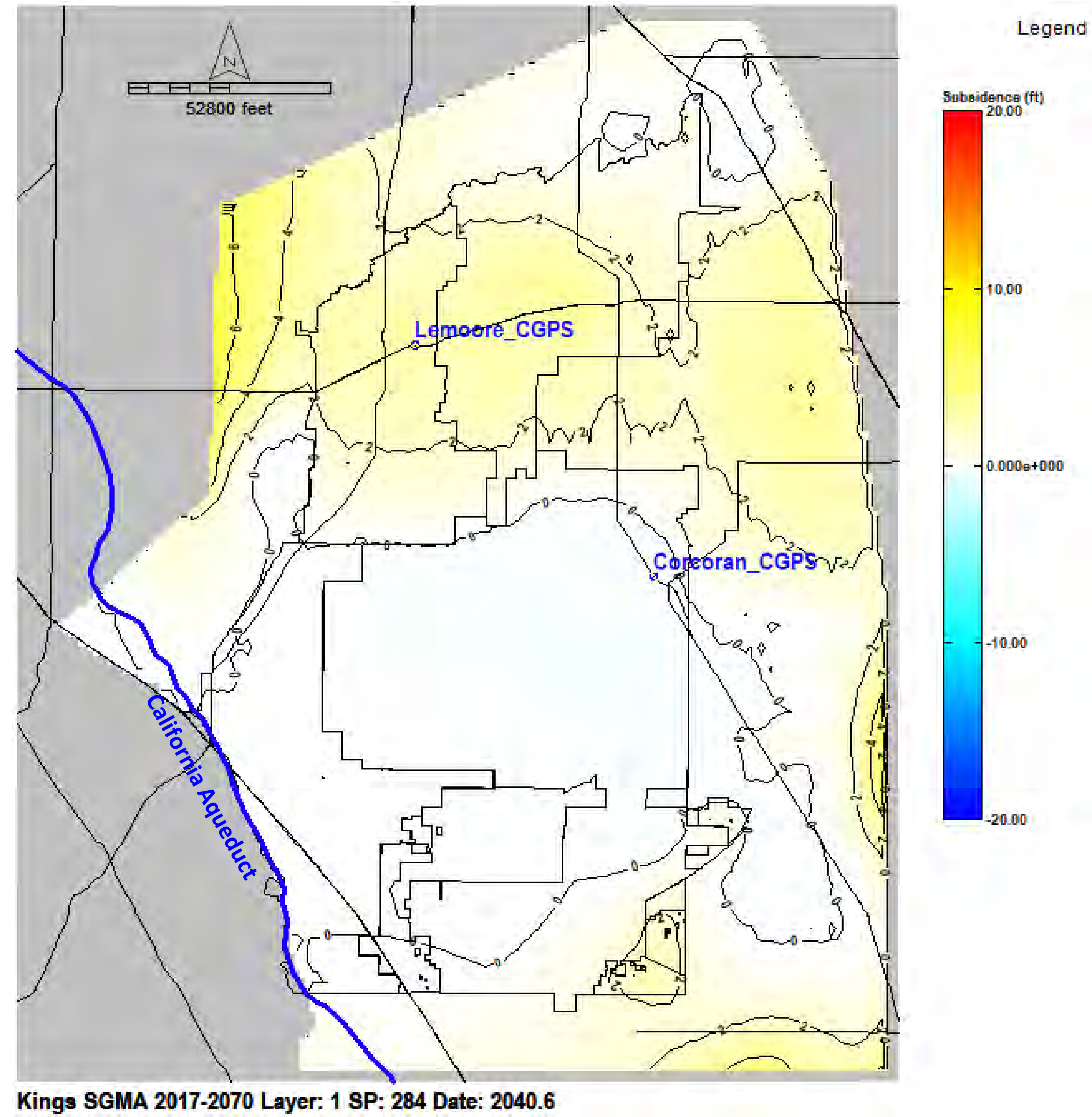
Kings County, California

By: EMC	Date: 11/26/2019	Project No.: FR18161220
		Figure **3-53**

Date: 11/26/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Basin_Setting\8.5x11_fig3-54_ManagementAreas.mxd



Baseline

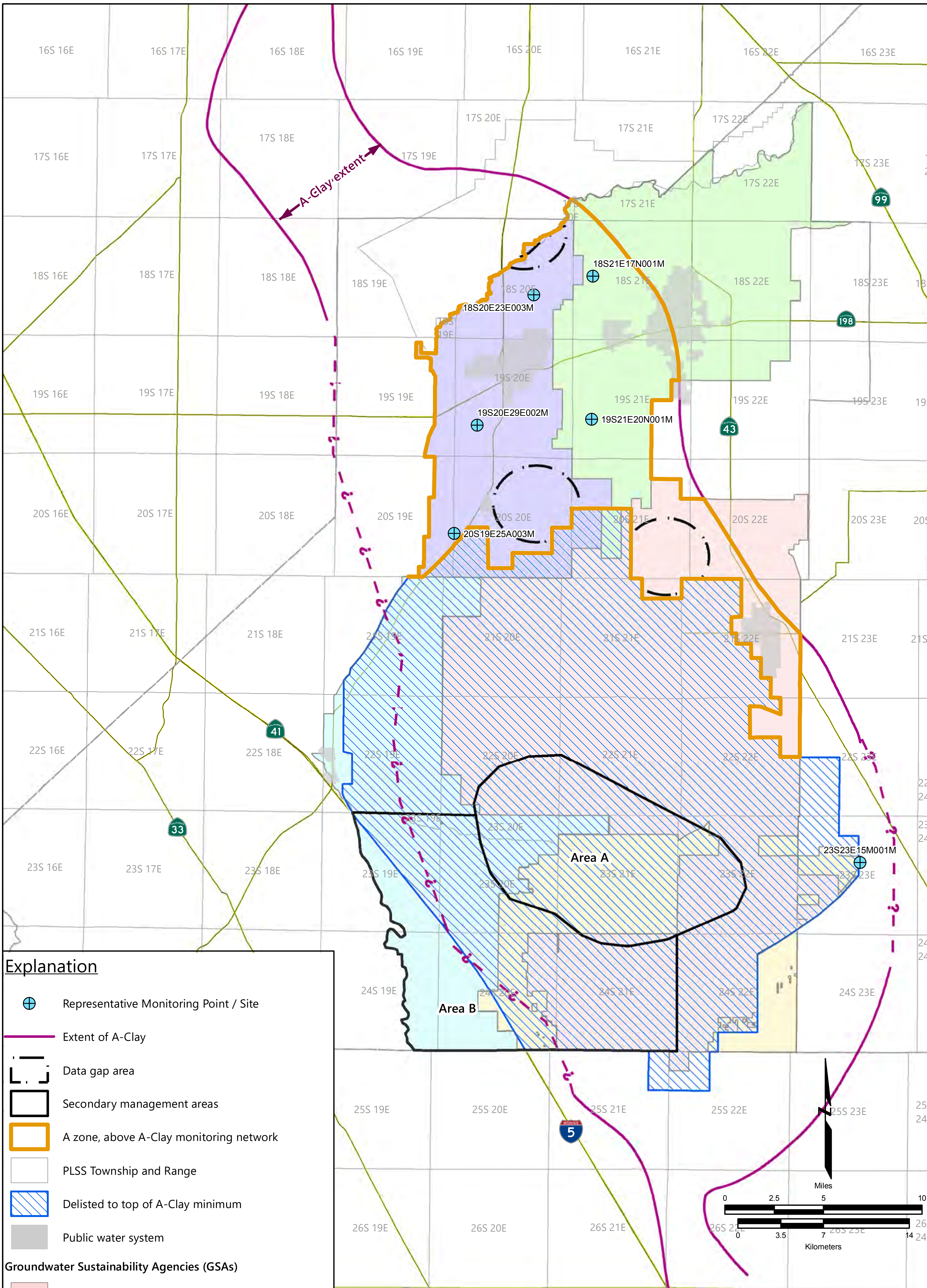


Projects

Note:
Cumulative Subsidence from January 2017 to July 2040

Forecast 2040 Subsidence
Baseline and Projects Forecast
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: dmb	Date: 01/06/2020	Project No.: FR18161220
		Figure **4-1**



Explanation

- Representative Monitoring Point / Site
- Extent of A-Clay
- Data gap area
- Secondary management areas
- A zone, above A-Clay monitoring network
- PLSS Township and Range
- Delisted to top of A-Clay minimum
- Public water system

Groundwater Sustainability Agencies (GSAs)

- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

Notes:
1. A Clay extent adapted from USGS Water-SupplyPaper 1999-H, Plate 6, Croft (1972). See Section 3.1.8.3.
2. PLSS = public land survey system

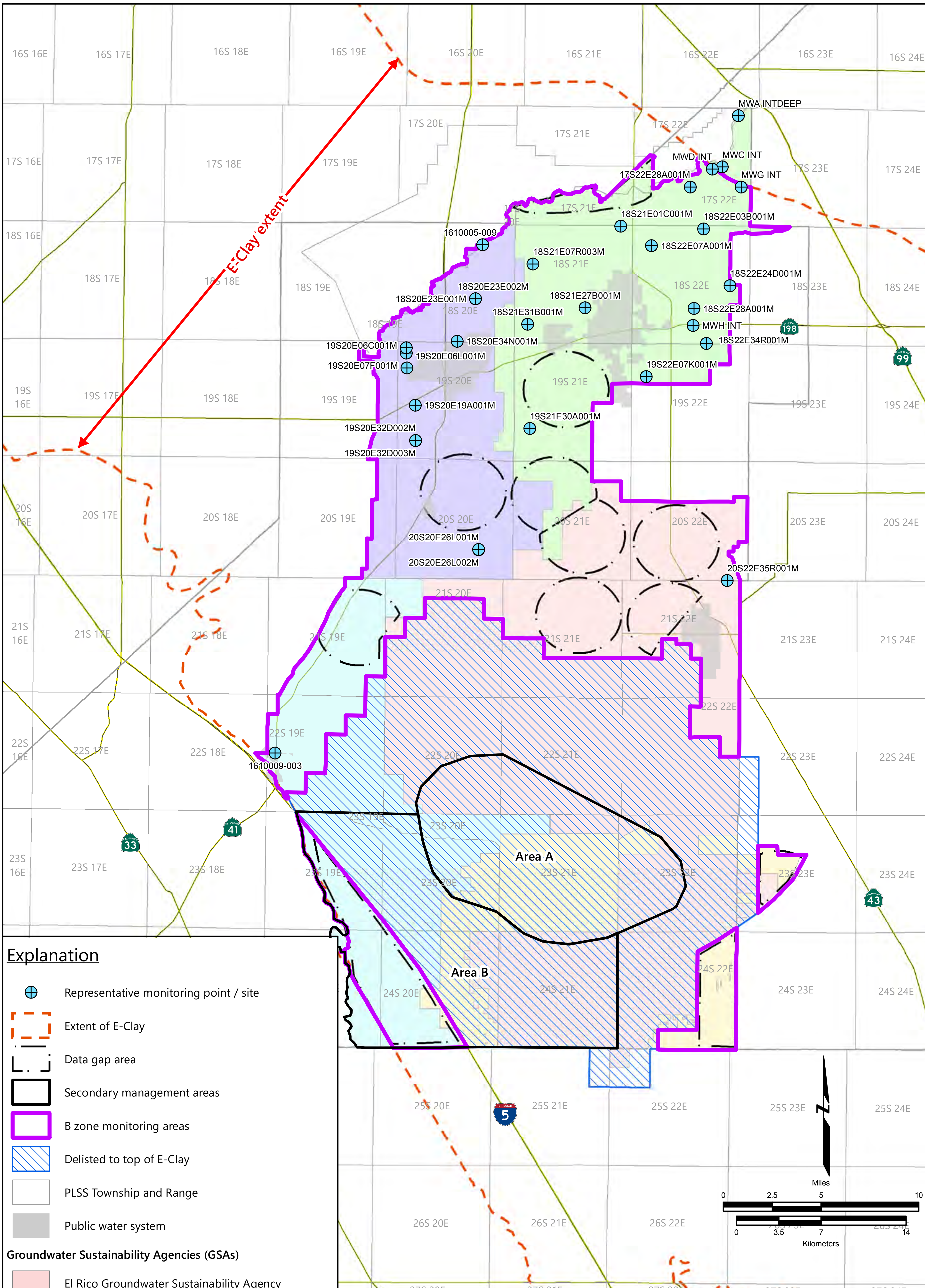
Above A-Clay and Shallow Groundwater Level Representative Monitoring Network, A Zone

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 12/17/2019	Project No.: FR18161220

Figure **5-1**

Date: 12/16/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Monitoring_Network_fig5-2_EClay_ZoneB.mxd



Explanation

- Representative monitoring point / site
- Extent of E-Clay
- Data gap area
- Secondary management areas
- B zone monitoring areas
- Delisted to top of E-Clay
- PLSS Township and Range
- Public water system

Groundwater Sustainability Agencies (GSAs)

- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

Notes:
1. E-Clay extent from USGS CVSD (2012). Based on Page (1986). See Section 3.1.8.3.
2. B Zone is above E-clay and below A-clay where the A-clay is present, and elsewhere above E-clay

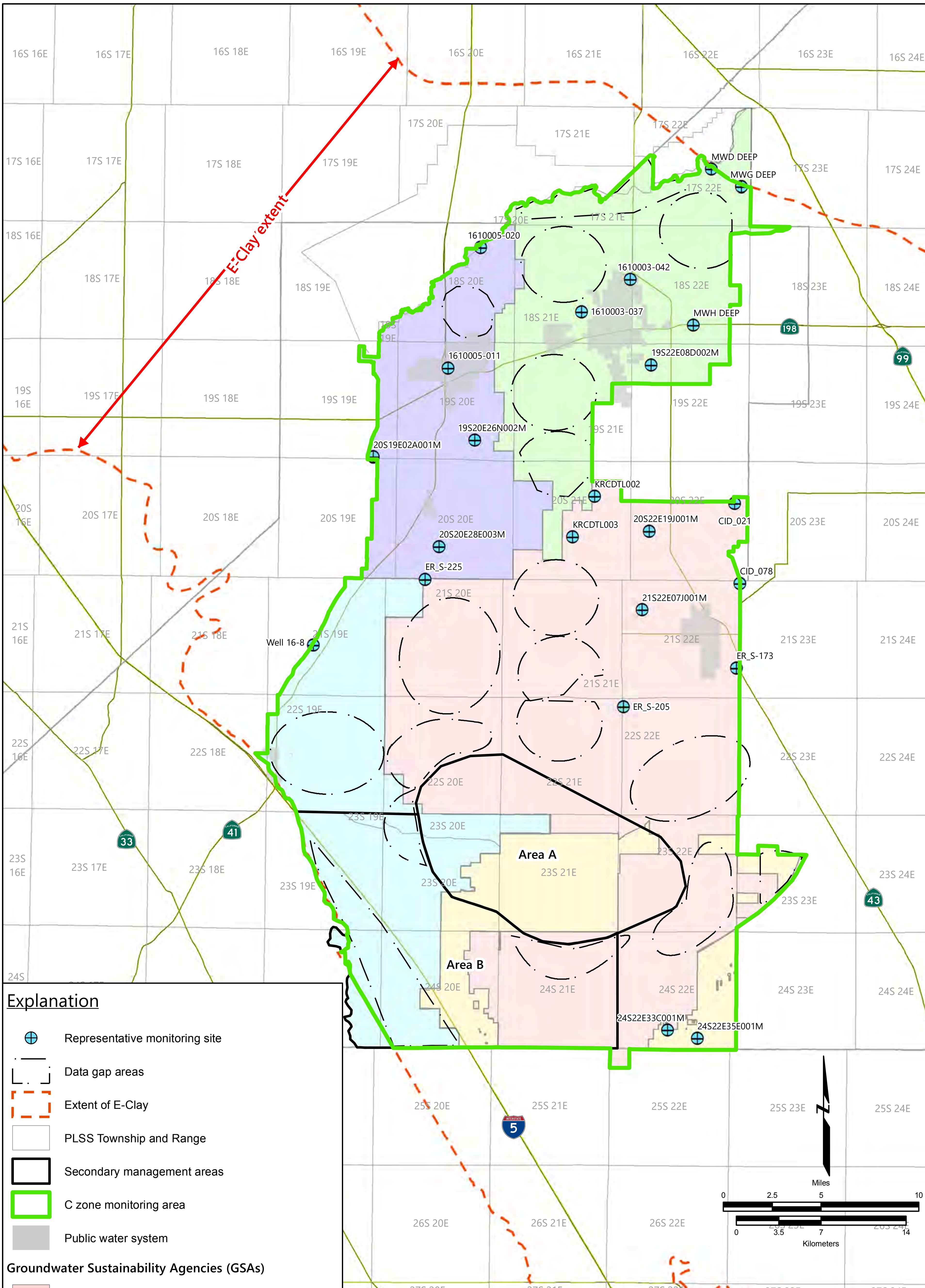
Groundwater Level Representative Monitoring Network, B Zone

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC | Date: 12/16/2019 | Project No.: FR18161220

Figure **5-2**

Date: 12/16/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Monitoring_Network_fig5-3_EClay_ZoneC.mxd



Explanation

- Representative monitoring site
- Data gap areas
- Extent of E-Clay
- PLSS Township and Range
- Secondary management areas
- C zone monitoring area
- Public water system

Groundwater Sustainability Agencies (GSAs)

- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

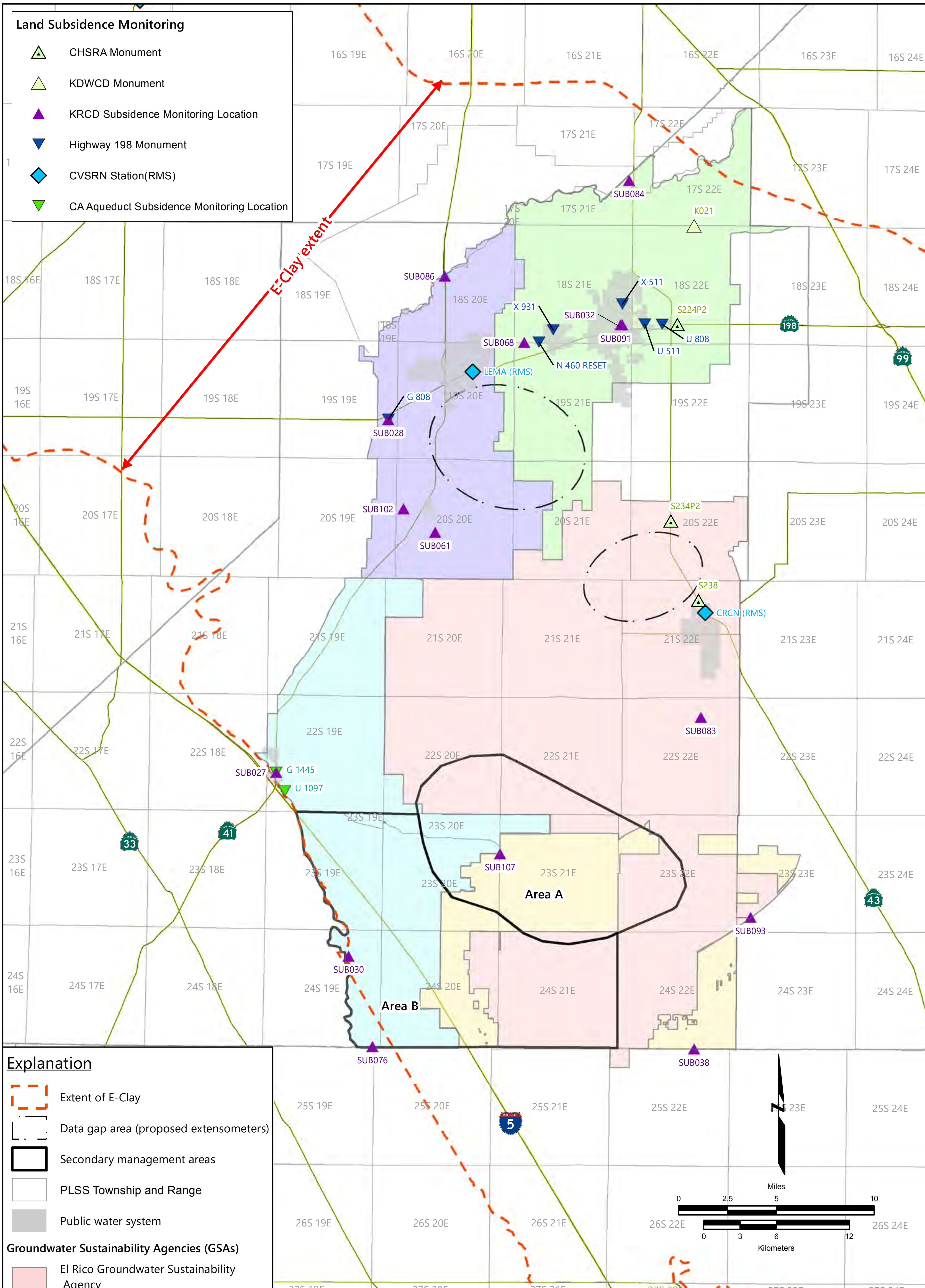
Notes:
E-Clay extent from USGS CVSD (2012). Based on Page (1986). See Section 3.1.8.3.

Below E-Clay Groundwater Level Representative Monitoring Network, C Zone

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 12/16/2019	Project No.: FR18161220
		Figure **5-3**

Date: 12/16/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Monitoring_Network_fig5-4_SubsidenceMonitoring.mxd



Explanation

- Extent of E-Clay
- Data gap area (proposed extensometers)
- Secondary management areas
- PLSS Township and Range
- Public water system

Groundwater Sustainability Agencies (GSAs)

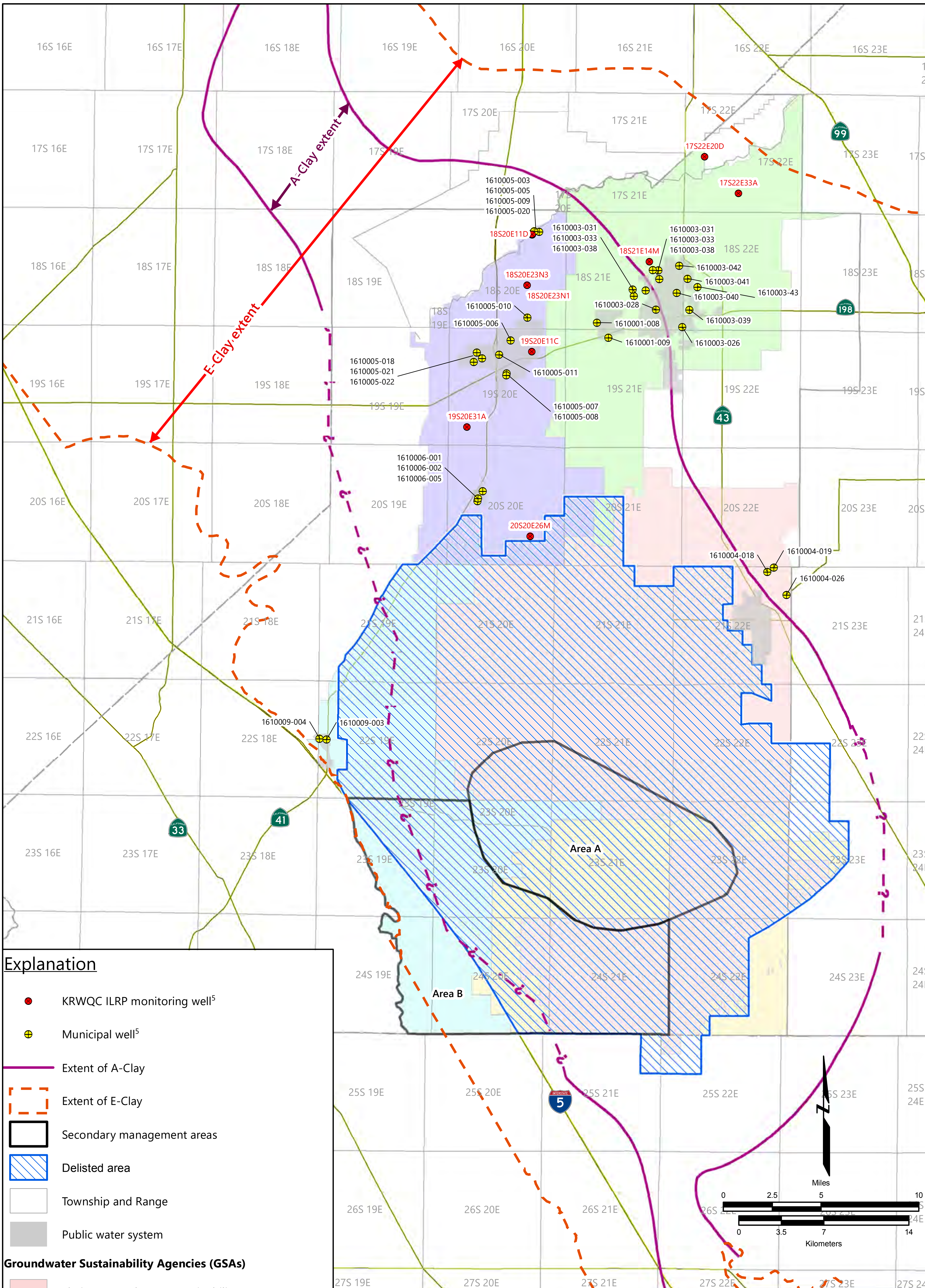
- El Rico Groundwater Sustainability Agency
- Mid-Kings River Groundwater Sustainability Agency
- South Fork Kings Groundwater Sustainability Agency
- Southwest Kings Groundwater Sustainability Agency
- Tri-County Water Authority

Notes:
1. E-Clay extent from USGS CVSD (2012). Based on Page (1986). See Section 3.1.8.3.
2. CHSRA = California High Speed Rail Authority
3. KRCD = Kings River Conservation District
4. KDWCD = Kaweah Delta Water Conservation District
5. CVSRN = Central Valley Spatial Reference Network

Subsidence Monitoring Network
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 12/16/2019	Project No.: FR18161220
		Figure **5-4**

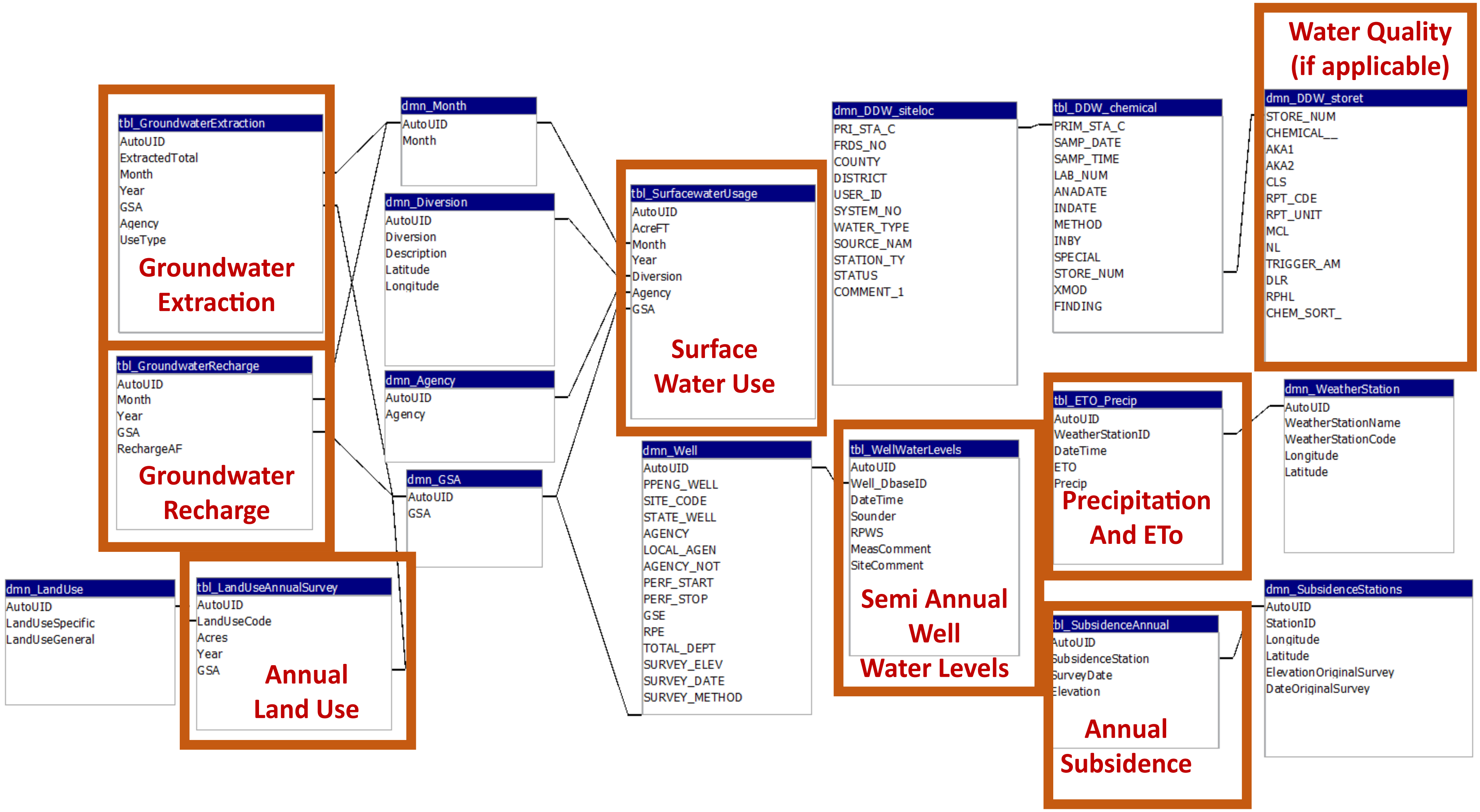
Date: 12/16/2019 Printed by: elizabeth.chapman
Path: N:_FR_projects\FR18s\FR18161220\gis\maps\2019\Monitoring_Network_fig5-5_GWQualityMonitoring_rev.mxd



Notes:
1. A-Clay extent adapted from USGS Water-SupplyPaper 1999-H, Plate 6, Croft (1972). See Section 3.1.8.3.
2. E-Clay extent from USGS CVSD (2012). Based on Page (1986). See Section 3.1.8.3.
3. KRWQA = Kings River Water Quality Coalition
4. ILRP = Irrigated Lands Regulatory Program
5. Wells are labeled with either water system ID or township, range, section designation

Groundwater Quality Monitoring Network
Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 12/16/2019	Project No.: FR18161220
		Figure **5-5**



DMS Table Relationships

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC	Date: 11/25/2019	Project No.: 006741
		Figure **5-6**

Date: 08/20/2019 Printed by Elizabeth.Chapman
Path: I:\FR18s\FR18161220 Tulare Lake GSP\Figures\5-MonitoringNetwork\Figures\November2019_fig5-6_TLSB_Draft.pdf

tbl_GroundwaterExtraction

AutoUID	ExtractedTotal	Month	Year	GSA	Agency	UseType	Click to Add
1	0	1	2016	1	1	1	
2	0	1	2016	1	2	2	
3	0	2	2016	2	4	3	

tbl_GroundwaterRecharge

AutoUID	Month	Year	GSA	RechargeAF	Click to Add
(New)		0		0	

tbl_LandUseAnnualSurvey

AutoUID	LandUseCode	Acres	Year	GSA	LUGeneral	Click to Add
5313		581.7	2014	El Rico Groundwater Sustainability Agency	FIELD CROPS	
5306		44.2	2014	El Rico Groundwater Sustainability Agency	TRUCK, NURSERY AND BERRY CROPS	
5320		451.6	2014	El Rico Groundwater Sustainability Agency	IDLE	

tbl_SubsidenceAnnual

AutoUID	SubsidenceID	Year	Elevation	SurveyDate	Click to Add
1	SUB001	2010			
2	SUB002	2010			
3	SUB003	2010			

tbl_SurfacewaterUsage

AutoUID	Month	Year	Diversion	Agency	AcreFT	GSA	Click to Add
1225	1	2016	1	1	0	1	
1226	2	2016	1	1	207	1	
1227	3	2016	1	1	0	1	

tbl_WellWaterLevels

AutoUID	PPENG_ID	SITE_CODE	COOP_ORG_NAME	COOP_AGENCY_ORG_ID	MSMT_CMT	WLM_ORG_NAME	WLM_ORG_ID	WLM_ACC_DESC	WLM_DESC
360	357320N1196997W001	357320N1196997W001	Department of Water Re	1		Department of Water Resources	1	Water level accuracy is unknown	Unknown
361	357320N1196997W001	357320N1196997W001	Department of Water Re	1		Department of Water Resources	1	Water level accuracy is unknown	Unknown
362	357320N1196997W001	357320N1196997W001	Department of Water Re	1		Department of Water Resources	1	Water level accuracy is unknown	Unknown

tbl_WellWaterLevels

WLM_DESC	WLM_QA_DESC	GSE_WSE	RPE_WSE	WSE	RDNG_RP	RDNG_WS	WLM_GSE	WLM_RPE	MSMT_DATE	WLM_ID	STN_ID_1	Click to Add
Unknown		6.3	8.3	216.08	8.3	0	222.38	224.38	7/9/2010	852041	24614	
Unknown		5.7	7.7	216.68	7.7	0	222.38	224.38	4/26/2010	852040	24614	
Unknown		6.1	8.1	216.28	8.1	0	222.38	224.38	1/28/2010	852039	24614	

Sample DMS Tables with Associated Fields

Tulare Lake Subbasin Groundwater Sustainability Plan
Kings County, California

By: EMC | Date: 11/20/2019 | Project No.: FR18161220

Figure **5-7**

Date: 08/20/2019 Printed by Elizabeth.Chapman
Path: I:\FR18s\FR18161220 Tulare Lake GSP\Figures\5-MonitoringNetwork\Figures\November2019_fig5-7_DMSTemplate.pdf

APPENDIX A

CONTACT INFORMATION FOR GSAs

APPENDIX A

Contact Information for the Tulare Lake Subbasin Groundwater Sustainability Agencies

Groundwater Sustainability Agency	Plan Manager	Address	Telephone	Email
Mid-Kings River	Dennis Mills, Secretary	200 North Campus Dr. Hanford, CA 93230	(559) 584.6412	kcwdh2o@sbcglobal.net
El Rico	Jeof Wyrick, Chairman	101 W. Walnut St. Pasadena, CA 91103	(626) 583.3000	jwyrick@jgboswell.com
South Fork Kings	Charlotte Gallock, Program Administrator	4886 E. Jensen Ave. Fresno, CA 93725	(559) 242.6128	cgallock@krcd.org
Southwest Kings	Deanna Jackson, Executive Director	944 Whitley Ave. Suite E. Corcoran, CA 93212	(559) 762.7240	djackson@tcwater.org
Tri-County Water Authority	Deanna Jackson, Executive Director	944 Whitley Ave. Suite E. Corcoran, CA 93212	(559) 762.7240	djackson@tcwater.org

APPENDIX B

STAKEHOLDER COMMUNICATION AND ENGAGEMENT PLAN

Appendix B: Stakeholder Communication & Engagement

A. Communication & Engagement Overview

As required by SGMA, GSAs must consider the interests of all beneficial uses and users of groundwater and include them in the GSP development process. The five GSAs within the Tulare Lake Subbasin developed a joint Communication & Engagement (**C&E**) Plan that addressed how stakeholders within the individual GSA boundaries (and when collaboration was plausible, at the subbasin-level) would be engaged through stakeholder education and opportunities for input and public review during the development and implementation of the GSP. This plan provides an overview of the Tulare Lake Subbasin GSAs, their stakeholders, and decision-making process; identifies opportunities for public engagement and discussion of how public input and responses would be used; describes how the Tulare Lake Subbasin GSAs encouraged the active involvement of diverse, social, cultural, and economic elements of the population within their individual boundaries and subbasin boundary; and the methods to be used to inform the public stakeholders about the progress of GSP development, public review and implementation. The Tulare Lake Subbasin GSAs' complete C&E Plan can be downloaded from the GSAs' individual websites.

As outlined by the DWR in the GSP Stakeholder Communication and Engagement Guidance Document, the Communication & Engagement Plan defines the Tulare Lake Subbasin GSAs' process for accomplishing the seven general steps in stakeholder communication and engagement:

- **Set Goals and Desired Outcomes –** Description of the situation at a high level with clear goals and objectives, identifying overriding concerns
- **Identify Stakeholders –** Development of a broad list of individuals, groups and organizations who need to be engaged in the process
- **Stakeholder Survey and Mapping –** Conducting a stakeholder survey to develop a "Lay of the Land" overview
- **Messages and Talking Points –** Definition of the key messages needed to effectively convey to the various subbasin stakeholders
- **Venues for Engaging –** Identification of opportunities (venues and methods) to engage stakeholders
- **Implementation Timeline –** Creation of a timeline to inform the process and highlight when to engage with stakeholders
- **Evaluation and Assessment –** Definition of a process to evaluate if communication and engagement goals are being met at the individual GSA level and through collaborative subbasin efforts

A.1 Communication Objectives to Support the GSP

The ultimate goal of communication objectives during the formation/coordination, GSP development, public review and implementation phases of the SGMA compliance, is to encourage active involvement of diverse, social, cultural, and economic elements of the population within the GSA boundary. The Tulare Lake Subbasin GSAs have given beneficial users and users of groundwater opportunities to engage in the GSP process, and provided educational outreach opportunities for stakeholders while reaching out through specific communication avenues. As active stakeholders, members of the Boards of Directors and Stakeholder/Advisory Committees are direct representatives of their districts, communities and industries, and they continually gather feedback/input, and the concerns/needs of their constituents and report back to their respective meetings. Any stakeholder input received was reviewed by the GSA and Subbasin technical teams and taken into consideration during GSP development.

A.1.1 Phase 1: GSA Formation and Coordination

Phase 1: GSA Formation and Coordination was the first phase completed. This phase stretched from 2015 through 2018, and consisted of forming the individual GSAs, development of a subbasin coordination agreement, establishing the List of Interested Parties, and creating the Communication & Engagement Plan to outline communication efforts for the GSP development, public review and implementation phases. Stakeholder input was utilized during the GSA formation phase, as beneficial users and stakeholders with interests in groundwater usage within the GSAs' boundaries were notified via public meeting notices as soon as the process began.

A.1.2 Phase 2: GSP Preparation and Submission

Phase 2: GSP Preparation and Submission spanned from 2018 through January 31, 2020. With the goal of having the draft GSP before the end of the third quarter in 2019, 2018 was primarily the technical development of the plan, while working with GSA Boards of Directors, technical teams/committees, and GSA management at the subbasin level, as well as stakeholders for feedback and input. During the last quarter of 2018, the first round of public outreach meetings and interaction with stakeholder groups and other community organizations and entities was held with the purpose of educating and informing stakeholders about SGMA and the GSP process, while also soliciting feedback and input from these groups to consider and possibly include feedback and input into the GSP. Public outreach for this phase was completed by the individual GSAs.

A.1.3 Phase 3: GSP Review and Evaluation

During 2019, Phase 3: GSP Review and Evaluation, the communication and engagement efforts continued. Once the draft of the GSP was completed in September 2019, the public review process began. A 90-day comment period was held, with the GSP draft posted on the Tulare Lake Subbasin GSAs' websites for all stakeholders to conveniently download and review and provide comments. Outreach meetings were held during this phase both on subbasin-wide level, as well as by individual GSAs. These meetings focused on an overview of the GSP content, while giving stakeholders a public forum to provide their feedback and comments. The public review period concluded with a public hearing regarding the GSP Draft on December 2, 2019.

Once the public review period was completed, public comments were taken into consideration and incorporated into the final version of the Tulare Lake Subbasin GSP before submitting to the DWR by January 31, 2020. Following submittal, stakeholders will be given a second 60-day comment period through the DWR's SGMA portal at http://sgma.water.ca.gov/portal/. Comments will be posted to the DWR's website prior to the state agency's evaluation, assessment and approval.

A.1.4 Phase 4: Implementation and Reporting

Phase 4: Implementation and Reporting will begin once the plan is submitted by January 31, 2020. Even while the DWR is reviewing the GSP, SGMA-implementation at the GSA-level must begin. During the implementation phase, communication and engagement efforts will be shifted to educational and informational awareness of the requirements and processes for reaching groundwater sustainability as set forth in the submitted GSP. Active involvement of all stakeholders will be encouraged during this phase, and public notices are required for any public meetings and prior to imposing, and later increasing, any fees. Public outreach for this phase will also be completed by the individual GSAs with collaborative subbasin-wide efforts when target audiences span more than one GSA boundary.

B. Tulare Lake Subbasin GSAs' Decision-Making Process

The Tulare Lake Subbasin GSAs' decision-making process is broken down by the roles of the subbasin management team, Board of Directors and Stakeholder/Advisory Committees. The roles of these subbasin and GSA entities and their responsibilities are outlined below.

- **Subbasin Management Team –** Comprised of a representative from each of the five GSAs working collaboratively to jointly manage groundwater within the Tulare Lake Subbasin and to develop a GSP. These individuals met on a monthly and then bi-weekly basis throughout the GSP development and public review phases.
- **Boards of Directors –** Adopts general policies regarding development and implementation of the individual GSAs and the GSP.
- **Stakeholder/Advisory Committees –** Representing all beneficial uses and users of groundwater within the individual GSA boundaries, makes recommendations to the Boards of Directors and technical consultants regarding feedback from stakeholders and adoption of a GSP that accounts for local interests. Not all GSAs have stakeholder/advisory committees, and while allowed within SGMA, these committees are not required.

B.1 Role of Boards of Directors

The Tulare Lake Subbasin GSAs' Boards of Directors all consistently function as the governing body of the specific GSA, formed to adopt general policies regarding development and implementation of the GSP. Governance of each GSA is described below, and meeting dates, times and locations for each board are noted. All meetings were open to the public during the formation, development and public review phases, and will continue to be open to the public during the implementation phase.

B.1.1 El Rico GSA

El Rico GSA's Board of Directors consists of seven directors: one representative appointed by the Tulare Lake Basin Water Storage District board, one representative appointed by the governing board of Salyer Water District, two representatives appointed by the Corcoran Irrigation District, two representatives appointed by Melga Water District, and one representative appointed by the Lovelace Reclamation District No. 739.

El Rico GSA's board meetings are held on the first Wednesday of each month at 1 p.m. at the Tulare Lake Basin Water Storage District's office, located at 1001 Chase Avenue in Corcoran, unless otherwise posted on the Kings River Region Groundwater Portal's calendar.

B.1.2 Mid-Kings River GSA

The Board of Directors of the Mid-Kings River GSA are appointed, three elected members of the KCWD, and one elected member of the City of Hanford. The Mid-Kings River GSA Board of Directors meet on the second Tuesday of every month at 1 p.m. at the Kings County Water District, located at 200 Campus Drive in Hanford.

B.1.3 South Fork Kings GSA

The governing board of the South Fork Kings GSA is composed of one appointee of each member agency as a "principal director." The principal director is an individual currently serving on the board or council of each of the members. Board of Directors meetings for the South Fork Kings GSA are held bi-monthly on the third Thursday of every February, April, June, August, October and December at 5:30 p.m. in the Lemoore City Council Chambers, located at 429 C Street in Lemoore.

B.1.4 Southwest Kings GSA

Southwest Kings GSA is governed by a five-person board of directors comprised of two members of the Dudley Ridge Water District, two members of the Tulare Reclamation District No. 761, and one director selected by a majority vote of the other four appointed members. The non-district member is a landowner, or his/her representative, who owns land in the white areas of the GSA boundary.

The Southwest Kings GSA's board meetings are held on the second Wednesday of every month at 3 p.m. at 286 W. Cromwell Avenue in Fresno. A monthly GSA status report is posted on the GSA's website.

B.1.5 Tri-County Water Authority GSA

The Tri-County Water Authority GSA JPA board of directors is comprised of four signatories and five board seats: Angiola Water District (general manager and a representative), Deer Creek Storm Water District (general manager and representative), Wilbur Reclamation District #825 (one representative), and County of Kings (non-voting representative). The Board of Directors meetings are held on the second Thursday of every other month at 1 p.m. at the Tri-County Water Authority Boardroom, located at 944 Whitley Avenue in Corcoran.

B.2 Role of Stakeholder/Advisory Committees

In Section 10727.8 "Public Notification and Participation; Advisory Committee" of the Sustainable Groundwater Management Act, GSAs may appoint and consult with an advisory committee for the purpose of developing and implementing a GSP. Through a stakeholder/advisory committee, a GSA is able to encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin prior to and during the development and implementation of the GSP.

B.2.1 Tri-County Water Authority GSA

The Tri-County Water Authority GSA's Technical Advisory Committee and Stakeholder Advisory Committee meet jointly on the fourth Wednesday of every month at 10 a.m. at the Tri-County Water Authority, located at the 944 Whitley Avenue in Corcoran.

C. Beneficial Uses and Users of Groundwater

Based on the applicable interests identified in SGMA, Section 10723.2 "Consideration of All Interests of All Beneficial Uses and Users of Groundwater", the five Tulare Lake Subbasin GSAs (El Rico, Mid-Kings River, South Fork Kings, Southwest Kings and Tri-County Water Authority) identified the stakeholder groups with interests within their GSA boundaries. These specific stakeholder groups have financial, political, business or personal stakes in the management of groundwater within the jurisdiction of the Tulare Lake Subbasin and were the focus of communication and engagement efforts during the GSP development and public review phases, and will continue to be engaged during the implementation phase. These stakeholders are listed by GSA in **Table 1**, **Table 2**, **Table 3**, **Table 4** and **Table 5**.

C.1 Environmental Users of Groundwater

It should be noted that environmental users of groundwater within the Tulare Lake Subbasin were investigated by the El Rico GSA, MKRGSA, SFKGSA, SWKGSA and TCWA, but there were not any identified that have specific groundwater interests within the subbasin.

C.2 Native American Tribes

The only Native American Tribe within the Tulare Lake Subbasin boundary is the Santa Rosa Rancheria Tachi-Yokut Tribe. The Tachi-Yokut Tribe was invited to participate in GSP development via a letter sent on June 28, 2016 by the then Upper Tulare Lake GSA MOU Group (now known as the South Fork Kings GSA). A copy of the letter is included in the Appendix A of the Tulare Lake Subbasin GSAs' Communication & Engagement Plan. The Tribe's EPA director attended one of the South Fork Kings GSA's board meetings, and has been on their Interested Parties List since April 2017, receiving regular updates about GSP development within the SFKGSA and the Tulare Lake Subbasin. In addition, a Sacred Lands File & Native American Contacts List Request was also sent to the Native American Heritage Commission.

C.3 Subbasin Industries and DACs

C.3.1 Industries

Collaboration meetings were held with the companies and organizations within the following industries to make sure their organizational visions and groundwater needs for facility operations were taken into consideration during GSP development and implementation phases. While an overview of the main industries within the Tulare Lake Subbasin are described below, the industries specific to each GSA are described in **Section C.4**.

Agriculture

Agriculture is one of the top three industries in Kings County. According to the 2017 Kings County Agricultural Crop Report published by the Kings County Ag Commissioner's office, the county is the tenth largest agriculture production county in California and grossed over $2 billion in 2017. With over 818,000 acres of farmland, the top commodities produced in Kings County are milk, cotton, cattle, nuts (almonds, pistachios and walnuts), tomatoes, silage corn, grapes, and stone fruit. As one of the primary industries, agriculture is the largest private employer in the county.

Because of the significant presence of agriculture production within the Tulare Lake Subbasin, agriculture industry stakeholders needed to be involved and informed during the development and public review phases of the GSP. Implementation will have a significant direct impact on the industry, and ultimately the local, state and national economies. The Tulare Lake Subbasin GSAs engaged with agriculture stakeholders routinely on an individual GSA-basis, and collaboratively at a subbasin level.

Food Processing

Kings County is a home to multiple food processors. Four of the top employers within the county are food processing facilities, accounting for over 4,000 jobs for the local workforce. Within the South Fork Kings GSA, Leprino Foods, alone, is responsible for 40 percent of water usage and provides just over 1,000 jobs. Because of their direct tie to the agricultural industry and reliance on groundwater supplies, to operate their facilities, food processors are included in the groundwater sustainability management within the subbasin boundary. The Tulare Lake Subbasin GSAs met with the food processing companies within their GSA