Management Area Plan

for the Shafter-Wasco Irrigation District 7th Standard Annex Management Area of the Kern County Subbasin

Prepared by:

EKI Environment & Water, Inc.

For:

Shafter-Wasco Irrigation District

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List of Abbreviations

1,2,3-TCP	1,2,3-Trichloropropane
AB	Assembly Bill
ACSD	Arvin Community Services District
AEWSD	Arvin-Edison Water Storage District
AF	acre-feet
AFY	acre-feet per year
BMP	Best Management Practice
C2VSim	California Central Valley Groundwater-Surface Water Simulation Model
C2VSim-FG	California Central Valley Groundwater-Surface Water Simulation Model – Fine Grid
CalEPA	California Environmental Protection Agency
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CDM	California Division of Mines
CDMG	California Division of Mines and Geology
CE	Categorical Exemption
CEQA	California Environmental Quality Act
CGS	California Geological Survey
CIMIS	California Irrigation Management Information System
COCs	Constituents of Concern
CSA	County Service Area
CVRWQCB	Central Valley Regional Water Quality Control Board
CV-SALTS	Central Valley-Salinity Alternatives for Long-Term Sustainability
CWC	California Water Code
CWD	Cawelo Water District
DAC	Disadvantaged Community
DBCP	Dibromochloropropane
DMS	Data Management System
DOGGR	Division of Oil, Gas and Geothermal Resources
DTSC	Department of Toxic Substances Control
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ET	Evapotranspiration
FEMA	Federal Emergency Management Agency
ft bgs	feet below ground surface
ft msl	feet above mean sea level

ft/day	feet per day
ft/yr	feet per year
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	Groundwater dependent ecosystem
GPS	Global Positioning System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	Hydrogeologic Conceptual Model
ILRP	Irrigated Lands Regulatory Program
IM	Interim Milestone
InSAR	Interferometric Synthetic Aperture Radar
IRWMP	Integrated Regional Water Management Plan
IS	Initial Study
ITRC-METRIC	Irrigation Training and Research Center's "Mapping Evapotranspiration at High Resolution with Internalized Calibration"
IWFM	Integrated Water Flow Model
JPA	Joint Powers Agreement
JPL	Jet Propulsion Laboratory
KCWA	Kern County Water Agency
KFMC	Kern Fan Monitoring Committee
KGA	Kern Groundwater Authority
KTWD	Kern-Tulare Water District
KWBA	Kern Water Bank Authority
LAFCO	Local Agency Formation Commission
LUST	leaking underground storage tank
M&I	Municipal and Industrial
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MND	Mitigated Negative Declaration
MO	Measurable Objective
MT	Minimum Threshold
NASA	National Aeronautics and Space Administration
NCCAG	Natural Communities Commonly Associated with Groundwater
ND	Negative Declaration
NEPA	National Environmental Policy Act
NHD	National Hydrograph Dataset
NKWSD	North Kern Water Storage District
NORSD	North of River Sanitary District
NPDES	National Pollution Discharge Elimination System
P&MAs	Projects and Management Actions
PGA	Pacific Geotechnical Associates, Inc.
PLSS	Public Land Survey System
PRC	Public Resources Code

PWRPA	Power and Water Resources Pooling Authority
RMSs	Resource Management Strategies
RRBWSD	Rosedale-Rio Bravo Water Storage District
SCEP	Stakeholder Communication and Engagement Plan
SDWIS	Safe Drinking Water Information System
SJVAPCD	San Joaquin Valley Air Pollution Control District
SMARA	Surface Mining and Reclamation Act
SMC	Sustainable Management Criteria
SMCL	Secondary Maximum Contaminant Level
SMWC	Superior Mutual Water Company
SpC	Specific Conductance
SSJMUD	Southern San Joaquin Municipal Utility District
SSURGO	Soil Survey Geographic Database
SWID	Shafter-Wasco Irrigation District
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWSD	Semitropic Water Storage District
TCWD	Tejon-Castac Water District
TDS	Total Dissolved Solids
TNC	The Nature Conservancy
ug/l	microgram per liter
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USDA-NRCS	United States Department of Agriculture Natural Resources Conservation Service
USDW	Underground Sources of Drinking Water
USGS	United States Geological Survey
WDWA	Westside District Water Authority
WKWD	West Kern Water District
WRMWSD	Wheeler Ridge-Maricopa Water Storage District
WWTP	Wastewater Treatment Plant
WY	Water Year
µmhos/cm	micromhos per centimeter

EXECUTIVE SUMMARY

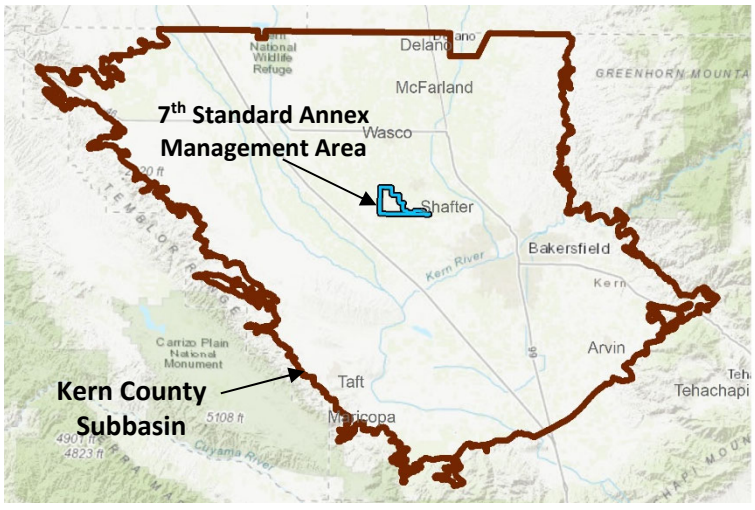
☑ 23 CCR § 354.4(a)

ES.1. Introduction

On 16 September 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. SGMA empowers local agencies to form Groundwater Sustainability Agencies (GSAs) to manage basins sustainably and requires those GSAs to adopt Groundwater Sustainability Plans (GSPs) for crucial groundwater basins in California. The Kern County Subbasin (also referred to herein as the "basin") of the San Joaquin Valley Groundwater Basin (Department of Water Resources [DWR] Basin No. 5-022.14) is one of 21 basins and subbasins identified by the DWR as being in a state of critical overdraft.

The Kern Groundwater Authority (KGA) GSA is one of the ~~11~~14 GSAs within the basin. The other ~~10~~ GSAs that are located within the basin include Kern River GSA, Greenfield County Water District, Buena Vista Water Storage District, Olcese GSA, Henry Miller Water District, Semitropic Water Storage District, West Kern Water District, Cawelo GSA, Pioneer GSA, ~~and McFarland GSA.~~McFarland GSA, and the South of Kern River GSAs (including Arvin GSA, Wheeler Ridge-Maricopa GSA, and Tejon-Castac Water District [TCWD] GSA). These GSAs were formed by several other GSA-eligible public agencies in the basin and several are preparing separate GSP documents that will be coordinated with the GSP prepared by the KGA GSA.

Figure ES-1
Kern County Subbasin and 7th Standard Annex Management Area

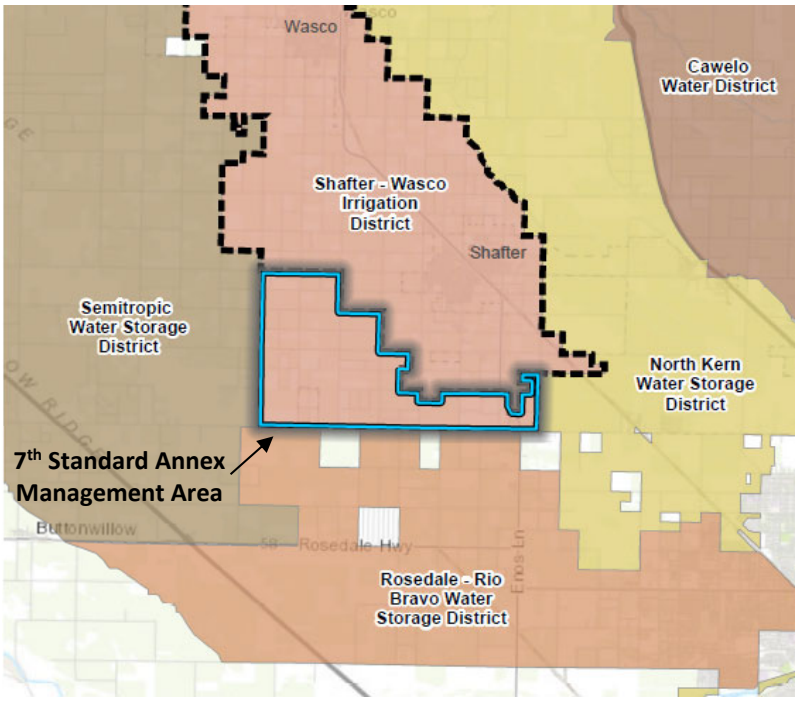


In 2017, in response to SGMA, a Joint Powers Agreement (JPA) was executed and the KGA GSA Board was formed, which is comprised of one representative from each of the ~~sixteen general~~KGA member agencies (~~Arvin Community Services District [ACSD], Arvin-Edison Water Storage District [AEWSD],~~ Cawelo Water District [CWD], Kern County Water Agency [KCWA], Kern-Tulare Water District [KTWD], Kern Water Bank Authority [KWBA], North Kern Water Storage District [NKWSD], Rosedale-Rio Bravo Water Storage District [RRBWSD], Semitropic Water Storage District [SWSD], Shafter-Wasco Irrigation District [SWID], Southern San Joaquin Municipal Utility District [SSJMUD], ~~Tejon-Castac Water District [TCWD],~~ West Kern Water District [WKWD], and Westside District Water Authority [WDWA~~] and Wheeler Ridge-Maricopa Water Storage District [WRMWSD~~] plus one representative from the County as well as the City of Shafter).

SWID is a member of the multi-agency KGA GSA, which, in coordination with its members, has prepared an "Umbrella GSP" to document SGMA compliance for its portion of the basin. The 7th Standard Annex Management Area (also referred to herein as the "Annex Area" or "Management Area") includes

approximately 10,000 acres just south of the original SWID boundary. Full annexation of the Management Area by SWID was completed 4 December 2019, following the passage of a proposition 218 election, with a 92% approval vote. Management Area landowners ~~will~~are now ~~be~~ assessed property tax fees to fund Projects & Management Actions and other SGMA-compliance activities~~.~~, including a Well Dewatering Mitigation Plan. This Management Area (MA) Plan was developed by SWID for the 7th Standard Annex Management Area and ~~supplements~~supplemented by the information provided in the KGA Umbrella GSP with locally specific information for the Management Area~~.~~ as an amended MA Plan for submission to DWR in response to their 28 January 2022 letter entitled *Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin*. This MA Plan includes, among other things: (1) development of local historical and projected water budgets, (2) an assessment of SGMA-defined undesirable results, (3) development of Sustainable Management Criteria (SMCs) specific to the Management Area, (4) identification of a monitoring network to demonstrate compliance within the Management Area, and (5) identification of local Projects & Management Actions to increase the sustainability of the basin within the Management Area.

Figure ES-2
7th Standard Annex Management Area and Nearby KGA Members



The KGA Umbrella GSP and this MA Plan have been developed to meet SGMA regulatory requirements ~~by the 31 January 2020 deadline~~ for critically-overdrafted basins while reflecting local needs and preserving local control over water resources. Together, these documents provide a path to achieve and document sustainable groundwater management within 20 years following GSP adoption, promoting the long-term sustainability of locally-managed groundwater resources now and into the future. ~~The sustainability goal for the Management Area is to maintain an economically-viable groundwater resource for the beneficial use of Annex Area landowners, residents, and businesses by utilizing the area's groundwater resources within the local sustainable yield.~~

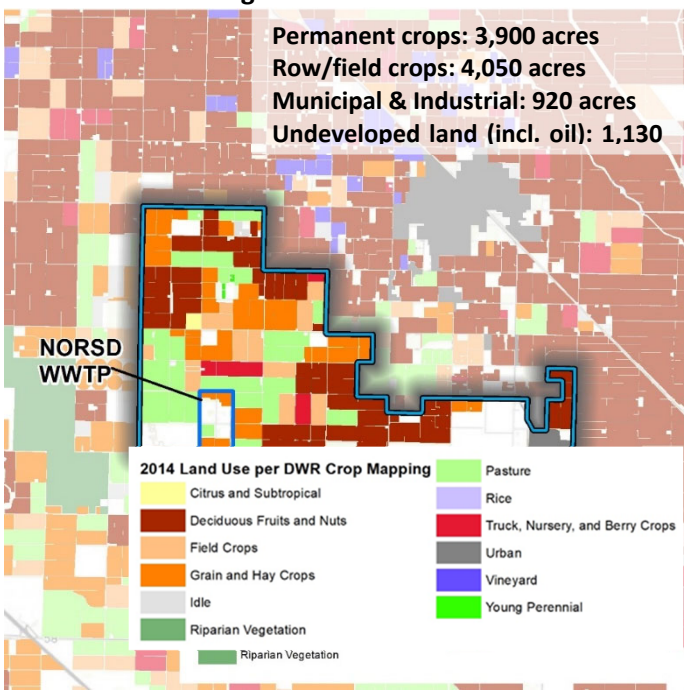
It is recognized that additional, more recent data (i.e., through 2022) are available at the time of preparation of this amended Management Area Plan. However, as the Management Area Plan does not constitute a five-year update to a GSP, but rather a response to the DWR determination letter, those additional data are not incorporated herein, with minor exceptions.

ES.2. Plan Area

The 7th Standard Annex Management Area overlies a portion of the basin. The basin is bounded on the north by the Tulare Lake Subbasin (DWR Basin 5-022.12), the Tule Subbasin (DWR Basin 5-022.13), the Kettleman Plain Subbasin (DWR Basin 5-022.17) and on the south by the White Wolf Subbasin (DWR Basin 5-022.18). The 7th Standard Annex Management Area is located roughly in the middle of the basin, just south of the ~~Shafter-Wasco Irrigation District (SWID)~~SWID Management Area (**Figure ES-1** and **Figure ES-2**).

The Management Area is located between the historical SWID boundary prior to the annexation of the 7th Standard Management Area (also designated as the SWID Management Area) and the 7th Standard Road.

Figure ES-3
Management Area Land Use



Agencies near SWID and the 7th Standard Annex Management Area include: Pond Poso Improvement District, Semitropic Water Storage District, Rosedale-Rio Bravo Water Storage District, Western Acres Mutual Water Company, Vaughn Water Company, Rosedale-Ranch Irrigation District, North Kern Water Storage District, and the City of Shafter.

Land use within the Management Area is predominantly agriculture, including permanent crops, row and field crops, and dairies. The area also includes industrial land uses, an oil field, limited rural residential use, and the North of River Sanitary District (NORSD) wastewater treatment plant (**Figure ES-3**). The Management Area relies on groundwater and treated effluent from the NORSD plant for water supplies. The majority of the industrial area is served water by the Superior Mutual Water Company (SMWC), which operates two wells located in the eastern portion of the Management Area.

Table ES-1
Stakeholder Engagement Meeting Summary
(Through June 2022)

Public Meeting Type	Number of Meetings
KGA GSA Board Meetings	48
KGA GSA SGMA Stakeholder Workshops, Meetings, and Open House	29
SWID Board Meetings	47
Annex Area Landowner Committee Meetings	34
Annex Area Stakeholder Workshops	5
One-on-one Meetings with Nearby Districts	9
Total Meetings to Date	**172**

ES.3. Outreach Effort

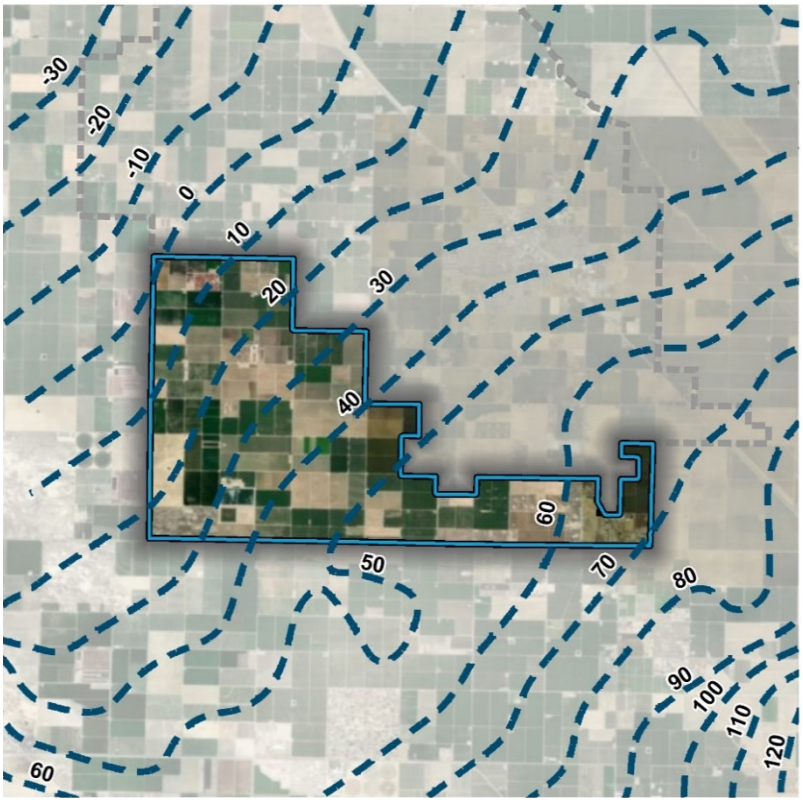
SWID has developed a Stakeholder Communication and Engagement Plan (SCEP) for the 7th Standard Annex Management Area to fulfill notice and communication requirements and enable the interests of all beneficial users of groundwater within the Management Area during

the development and implementation of the GSP and ~~Management~~MA Plan. The goal of the outreach efforts is to encourage open and transparent engagement by diverse stakeholders and gain knowledge and perspectives provided by basin stakeholders. Stakeholders were asked to provide input and comments throughout the GSP and MA Plan development process at venues, including: 7th Standard Annex Management Area SGMA Stakeholder Workshops, SWID Board meetings, KGA GSA Stakeholder Workshops and Meetings, and KGA GSA Board meetings. Other outreach to Annex Area stakeholders through the GSP development and/or amendment process has included: one-on-one coordination meetings with nearby districts, meetings with the Annex Area Agricultural Landowner Committee, distribution and collection of a Stakeholder Survey, distribution of a request for Stakeholder well data, and outreach to key major water users within the Management Area. A summary of SGMA-specific public meetings are shown in **Table ES-1**.

ES.4. Basin Setting

The Kern County Subbasin is located in the southern end of the San Joaquin Valley. The San Joaquin Valley is the portion of California's Central Valley that lies south of the San Joaquin/ Sacramento River Delta. The 7th Standard Annex Management Area is located roughly in the center of the basin, at the confluence of the alluvial fans of Poso Creek to the north and the Kern River to the south. This area primarily overlies the Tulare, Kern River, and Chanac geologic formations at lower depths. Collectively, these units are generally considered to be functioning as a single principal aquifer system in the Management Area. The northern portion of the Management Area consists predominantly of clay loam soil with moderate and slow infiltration rates, and the southern portion of the Management Area consists predominantly of silt loam with very slow infiltration rates; some smaller areas of moderate and high infiltration rates are present. No major natural surface water bodies are present in the Management Area.

Figure ES-4
Spring 2015 Groundwater Elevation
(As Feet Above Mean Sea Level)



ES.5. Existing Groundwater Conditions

Water Levels: Limited historical records of groundwater elevation and water quality data are available for wells within the 7th Standard Annex Management Area. In general, groundwater levels within and near the Annex Area have been decreasing over time. Groundwater levels are consistently lower in the northwestern portion of the 7th Standard Annex Management Area

than in the southeastern portion. Flow direction throughout the Management Area is predominantly from the southeast to the northwest (**Figure ES-4**). Groundwater depth within the Management Area is more than 260 feet below ground surface (ft bgs) and as a result, there are no interconnected surface water bodies or groundwater-dependent ecosystems (GDEs) located within the 7th Standard Annex Management Area, based on the GDE-identification methodology developed by The Nature Conservancy (TNC, 2019).

Groundwater Storage: Change in groundwater storage within the 7th Standard Annex Management Area was estimated based on water level data. The cumulative change in storage from March 1994 through February 2014, based on seasonal water level highs, is estimated to have decreased by 19,660 acre-feet (AF) over this 20-year period, or approximately -980 acre-feet per year (AFY). Based on the historic water budget (Water Years [WYs] 1995-2014), described below, the annual change in storage is -1,080 AFY.

Water Quality: Concentrations of Total Dissolved Solids (TDS), nitrate, arsenic, and 1,2,3-trichloropropane (1,2,3-TCP) ~~have been detected in groundwater within or near the Management Area above drinking water standards and/or agricultural water quality goals.~~are generally below drinking water standards (Maximum Contaminant Level [MCL]) and/or agricultural water quality goals within the Management Area, with some localized exceedances. A detailed analysis of available data was conducted and a correlation between groundwater quality and groundwater levels has not been established in the MA Plan area, with the exception of a suspected correlation between groundwater levels and arsenic concentration. Therefore, the available data indicate that groundwater extractions or recharge (i.e., actions that can be managed by GSAs) will not exacerbate degraded water quality conditions for the above constituents.

Per CWC § 10727.2(b)(4), "The plan may, but is not required to, address undesirable results that occurred before, and have not been corrected by, January 1, 2015." Agricultural use is the dominant beneficial use within the Management Area, and groundwater quality is generally suitable for agricultural uses. Water quality issues related to deep percolation of agricultural chemicals such as nitrate are regulated separately under the Irrigated Lands Regulatory Program (ILRP) and Central Valley-Salinity Alternatives for Long-Term Sustainability (CV-SALTS). Additionally, water quality issues related to drinking water ~~such as 1,2,3-TCP~~ are regulated by the State Water Resources Control Board (SWRCB). ~~Based on the available data, there does not appear to be a correlation between~~ Further, GSAs are responsible for "management of groundwater ~~elevations and constituent concentrations. Future monitoring efforts will include routine collection of water~~ quality ~~data, which will fill the current water~~, groundwater quality ~~data gap for the area. These~~degradation, inelastic land surface subsidence, and changes in surface flow and ~~other data from nearby wells outside of the Management Area will be periodically reviewed and~~surface water quality ~~trends will be evaluated as part of future GSP implementation efforts for the Management Area.~~that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin" (CWC § 10727.2(d)(2); emphasis added).

Subsidence: There is no Regional Critical Infrastructure located within the 7th Standard Annex Management Area and there has been little to no historical or recent land subsidence within the ~~7th Standard Annex~~ Management Area and no observed negative effects associated with any such limited subsidence.

Seawater Intrusion: The 7th Standard Annex Management Area is located far from coastal areas. As a result, seawater intrusion is not considered to be an issue for this area.

ES.6. Water Budget

The Kern County Subbasin is designated by DWR in its latest version of *Bulletin 118 – California's Groundwater* as being in a condition of critical overdraft (DWR, 2016d). Overdraft occurs where the average annual amount of groundwater extraction exceeds the long-term average annual supply of water to the basin. All GSAs in the basin coordinated and collaborated on the development of a groundwater model (Model) to evaluate historical, baseline and projected groundwater conditions. The Model results reflect basin-wide conditions and do not allocate water shortages/surpluses, nor do the results allocate the "ownership" of water. The GSAs, through a coordinated effort, developed the Checkbook (an analytical water budget) that estimates current conditions for each GSA that are generally consistent with the Model results under baseline condition. As a part of this MA Plan, historical, current, and future water budgets were also developed for the 7th Standard Management Area (local water budget), to supplement the basin-wide Model and Checkbook water budgets. These water budgets account for the physical inflows to the Management Area (including precipitation, subsurface inflows, and imported recycled water) and outflows from the Management Area (including evapotranspiration by crops and native vegetation, municipal and industrial use, and subsurface outflows).[1] Each water budget method ~~is~~was developed based upon the best available information to date, and it is expected that each method will be further refined through SGMA implementation. For purposes of developing proposed Projects and Management Actions for the Management Area, the upper end of the deficit estimated ~~by~~using the three methods was used (i.e., -16,976 AFY per the Checkbook).

The historical water budget for the Management Area (WYs 1995 – 2014) shows a net decline in groundwater storage of -1,080 AFY, on average. The basin-wide numerical Model for the Management Area estimates a decline in groundwater storage of -760 AFY over this same period.[2,3] In order to evaluate the net water supply deficit to be addressed through Projects and Management Actions to prevent Undesirable Results in the Management Area, a future water budget projection was developed, which accounts for anticipated climate change effects per DWR guidance (DWR, 2018). Three projected water budget scenarios were evaluated for the Management Area: a Baseline Scenario (reflecting no climate change effects), a 2030 Climate Change Scenario, and a 2070 Climate Change Scenario. The change in storage under each scenario was evaluated in absence of Projects and Management Actions, based on estimated net

Table ES-2
Projected Water Budget Results, in Absence of Projects & Management Actions

Scenario	Estimated Annual Change in Storage by 2040
Baseline (No climate change)	-1,510 AFY to -16,976 AFY
2030 Climate Change Conditions (Moderate climate change effects)	-2,333 AFY to -16,976 AFY
2070 Climate Change Conditions (High climate change effects)	-3,648 AFY to -16,976 AFY

[1] Nothing in this water budget information presented herein is meant to be viewed as a determination of water rights.
[2] Due to the cell size and configuration used in the numerical model, these results do not reflect the exact boundary or total area of the Management Area. The model approximation of the Management Area consists of a total of 9,338 acres, approximately 93% of the actual total acreage of the Management Area.
[3] Management Area level model results provided by Todd Groundwater on 4 June 2019.

subsurface inflows. The results of this assessment are shown in **Table ES-2**. The estimated change in storage under the Checkbook ~~Accounting~~ approach ~~are~~is shown as the upper end of each climate change scenario. For purposes of developing the proposed Projects and Management Actions for the Management Area, the upper end of the deficit range was used (i.e., -16,976 AFY).

ES.7. Sustainable Management Criteria ~~Indicators~~

SGMA introduces several terms to measure sustainability, including:

Sustainability Indicators – Sustainability indicators refer to adverse effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results. The six sustainability indicators identified by DWR are the following:

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

Undesirable Results – Undesirable Results are the significant and unreasonable impacts that adversely affect groundwater use in the basin. Definitions of Undesirable Results for the basin have been developed through a coordinated effort of the basin GSAs and are described in the KGA GSA Umbrella GSP. The basin-wide definitions of Undesirable Results were considered and adjusted where necessary to better reflect the 7th Standard Annex Management Area groundwater conditions.

Minimum Thresholds – Minimum thresholds (MTs) are the numeric criteria for each Sustainability Indicator that, if exceeded, may cause Undesirable Results. Where appropriate, the Minimum Thresholds for the Sustainability Indicators have been set using groundwater levels as a proxy.

Measurable Objectives – Measurable objectives (MOs) are a specific set of quantifiable goals for the maintenance or improvement of groundwater conditions.

Interim Milestones – Interim milestones (IMs) are a set of target values representing measurable groundwater conditions in increments of five years.

Collectively, the Sustainability Goal, IMs, MOs, and MTs are referred to as the Sustainable Management Criteria (SMCs).

Chronic Lowering of Groundwater Levels is arguably the most fundamental Sustainability Indicator, as it influences several other key Sustainability Indicators, including Reduction of Groundwater Storage and possibly Land Subsidence and Depletions of Interconnected Surface Water.

The ~~same~~ methodology used to develop the MOs and MTs for water levels by the larger neighboring management areas (i.e., ~~Semitropic Water Storage District,~~ SWID Management Area~~,~~ and north Kern Water Storage District) was applied for the Management Area, resulting in a consistent approach for the region. This method involves projecting a theoretical future water groundwater elevation ("trendline projection" method) based on an assumption that the conditions experienced over the ten-year period 2006 – 2016 (Spring measurements) continue from 2016 through 2040, thus representing a continued and prolonged drought period~~. The theoretical~~, and then increased by 50 feet to be more protective of local

beneficial uses and users and to maintain the MT gradient to be consistent with the current groundwater elevation ~~in 2040 is set as the~~gradient. The theoretical MT for the Management Area ~~(-137~~is -87 feet above mean sea level ~~[(~~ft msl~~)]~~ and the theoretical ~~groundwater elevation in 2030~~ MO is ~~set as the MO (-79~~-29 ft msl~~).~~. Because the Management Area is so small (approximately 10,000 acres), the same MO and MTs are set for all three ~~monitoring points~~water level Representative Monitoring Wells (RMWs) within the area. Given that the water level MOs are lower than the current water levels, the IMs are therefore set to be equal to the MOs throughout the SGMA implementation period (2040).

Reduction of Groundwater Storage is closely tied to Chronic Lowering of Groundwater Levels and therefore the SMCs set for the latter are used as a proxy for the former.

Several criteria, or "tests", were utilized by the Management Area to systematically and transparently assess which water quality constituents warranted the development of SMCs for to be consistent based on the understanding of groundwater conditions, the relationship between groundwater management (i.e., extraction and recharge to water quality), the regulatory landscape, and relevant regulations. The Management Area then only developed SMCs for those constituents that passed all of the applicable tests. The only constituent applicable for the development of Degraded Water Quality Sustainable Management Criteria within the MA Plan area is arsenic. A MT for Degraded Water Quality is set for arsenic at three water quality RMWs in the Management Area using the California Drinking Water MCL of 10 ug/L. The MO is also set to the MCL.

No SMCs are currently defined for Seawater Intrusion~~, Degraded Water Quality~~, Land Subsidence, and Depletion of Interconnected Surface Water, although the development of SMCs for Land Subsidence ~~and Degraded Water Quality~~ will be evaluated periodically based on future ~~date~~data. See **Table ES-3** for a summary of the evaluation of each of the sustainability indicators.

Table ES-3
Summary of SMC Evaluation

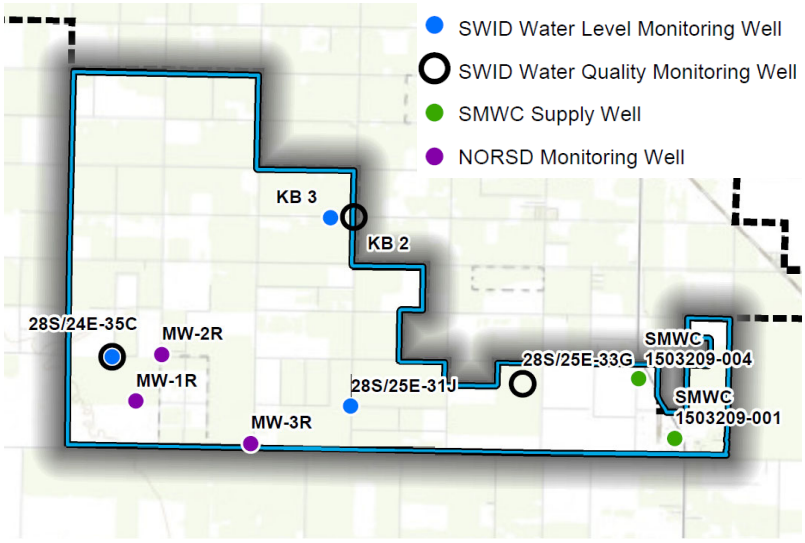
Sustainability Indicator	Evaluation
Chronic Lowering of GW Levels	SMCs have been established for water levels, and are consistent with methodology used for SWID and North Kern WSD, which considers historical groundwater level trends based on the assumption that the conditions experience over the ten-year period 2006-2016 continue from 2016 through 2040. The resulting MOs and MTs for the Management Area are -29 ft msl and -87 ft msl, respectively. The well impact analysis shows that although the proposed MTs could potentially result in some wells being impacted, the impacts would not be unreasonable because fewer wells in the Management Area were impacted due to Chronic Lowering of Groundwater Levels than the assumed natural well replacement rate (51%) based of the well age analysis, and could be mitigated through the existing Well Dewatering Mitigation Program. Water levels will be monitored semi-annually within the Annex Area. Implementation of Projects and Management Actions will be necessary to maintain water levels above the MOs/MTs. To date, water levels in the Management Area have been maintained above the MOs.
Reduction of GW Storage	SMCs for lowering of groundwater levels will be used as a proxy for the reduction of groundwater storage since it is demonstrated that a correlation exists between the two metrics. A calculation was performed to determine the fraction of total usable groundwater storage that would be removed from the Principal Aquifer if groundwater levels were to decline from current (Spring 2016) levels to their respective Minimum Thresholds for Chronic Lowering of Groundwater Level. This volume is then compared to the volume of usable storage, and it is shown that the usable storage is substantially greater, and therefore the Minimum Thresholds for Chronic Lowering of Groundwater Levels are protective for the Reduction of

	Groundwater Storage Sustainability Indicator. Because hydrogeologic storage properties and the MA Plan area are constant when looking at the change in storage (Change in Storage = MA Plan Area * Storage Coefficient * Change in Saturated Thickness), the following analysis is presented in terms of saturated thickness, which is mathematically equivalent to storage volume. The change in saturated thickness from current (Spring 2016) groundwater elevations (13.7 ft msl) to the Chronic Lowering of Groundwater Levels MTs (-87 ft msl) is approximately 101 ft. The total usable groundwater storage is calculated to be 624 ft of saturated thickness within the Management Area based on current groundwater elevations and the deepest groundwater extractions from well construction information (-710 ft msl) within the MA Plan Area plus 100 ft reserve for well pumping operations. Therefore, the reduction in usable storage volume if groundwater levels were to decline to the MTs amounts to 16%. Because volume of usable groundwater storage can be represented by changes in groundwater elevations and the amount of recoverable storage is substantially greater than the volume associated with a reduction in groundwater levels to the MTs for Chronic Lowering of Groundwater Levels, those MTs are considered protective for the Reduction of Groundwater Storage Sustainability Indicator. To date, water levels in the Management Area have been maintained above the MOs.
Seawater Intrusion	No saltwater bodies are present near the Annex area. Therefore, no MOs/MTs have been developed for this indicator.
Water Quality Degradation	Water is generally suitable for the dominant beneficial use in the Management Area (i.e., agriculture); therefore, in order to be considered a "significant and unreasonable" impact, water quality would need to negatively impact potable supply (the most sensitive beneficial user) in a significant portion of the management areas (i.e., not a well-specific issue). Per CWC § 10727.2, GSAs only need to address degradation of water quality caused by groundwater management (i.e., extraction and recharge) in the basin, and are not required to address URs that occurred before January 1, 2015. As such, it is not under the purview of the GSA to regulate "legacy" constituents of concern. In addition, State, federal, and local entities have greater authority to enforce water quality standards, especially for anthropogenic-derived pollutant constituents and water quality issues related to deep percolation of agriculture chemicals (e.g., nitrates) are already regulated separately under the ILRP and CV-SALTS. The SWRCB's Division of Drinking Water regulates the quality of water served by the single public water system in the 7th Standard Annex Management Area (the Superior Mutual Water Company [SMWC]), and the water quality criteria under which that program operates (i.e., MCLs) is not superseded by SGMA. Further, and most importantly, a detailed analysis of available data was conducted and a correlation between groundwater quality and groundwater levels has not been established in the MA Plan area indicating that groundwater extractions or recharge will not exacerbate degraded water quality conditions in the Management Area, with the exception of a suspected correlation between groundwater levels and arsenic concentration. Therefore, SMCs is conservatively developed for arsenic to be consistent with other GSPs in the basin. A MT and a MO are set for arsenic at the three water quality RMWs using its MCL of 10 ug/L since the most sensitive beneficial use of groundwater in the Management Area is for potable supply. Water quality will be monitored annually within the Annex Area. These data will be evaluated regularly, and if the data suggest that other constituents are actually being affected due to groundwater management practices (i.e., a causal nexus is established between groundwater extraction or recharge and water quality), SMCs for other appropriate water quality constituents will be developed as part of the next 5-year update. To date, arsenic concentrations in the Management Area have been maintained below the MOs.

Land Subsidence	As demonstrated on the KGA Umbrella GSP subsidence map, there is no Regional Critical Infrastructure within the Management Area (i.e., the California Aqueduct and the Friant Kern Canal). In addition, no significant subsidence and no undesirable results have been observed within the Annex Area. Therefore, no SMCs have been developed for this indicator at this time. A basin-wide subsidence monitoring program is developed and will be implemented. The results of this basin-wide monitoring will be reviewed periodically and the need for SMCs will be assessed, if the data suggest subsidence could affect Regional or Management Area Critical Infrastructure in the Management Area. Further discussion of the SMC development for other portions of the basin and subsidence monitoring plan is available in the KGA Umbrella GSP.
Surface Water Depletion	No interconnected surface waters present in Annex area. Groundwater is approximately 260 feet below ground surface or deeper. Therefore, no SMCs have been developed for this indicator.

ES.8. Monitoring Network

Figure ES-5
Monitoring Well Locations



The objectives of the 7th Standard Annex Management Area Monitoring Network are to: (1) collect sufficient data for the assessment of the sustainability indicators relevant to the Management Area, including those for which SMCs have been set and those for which additional data are needed, (2) evaluate potential impacts to the beneficial uses and users of groundwater, and (3) assess the effectiveness of Projects and Management Actions by the 7th Standard Annex Area and nearby management areas. This MA Plan outlines the Monitoring Network for SGMA compliance purposes, which consists of three representative monitoring ~~sites~~wells (RMW) for water levels and three RMW for water quality spaced across the Management Area, with a density of approximately one monitoring well per 3,300 acres. The locations of these wells are shown on **Figure ES-5**. The figure also shows the locations of the public water supply wells and NORSD monitoring wells within the Management Area that area routinely monitored for water quality. ~~Although no water quality SMCs have been defined, SWID will monitor three additional wells for water quality to assess future groundwater conditions.~~ The SGMA-compliance network for the Management Area supplements other monitoring networks and programs in the basin such as DWR California Statewide Groundwater Elevation Monitoring (CASGEM), Central Valley-Salinity Alternatives for Long-term Sustainability (CV-SALTS), Kern County Water Agency [KCWA] semiannual groundwater monitoring program, among others, and basin-wide monitoring networks related to SGMA compliance such as the KGA's land subsidence network.

To date, water levels have been maintained above the MO for Chronic Lowering of Groundwater Levels for all three water level RMWs. Based on the recent measurements, arsenic concentrations are below the MO at all three water quality RMWs. As such no URs are currently present within the Management Area.

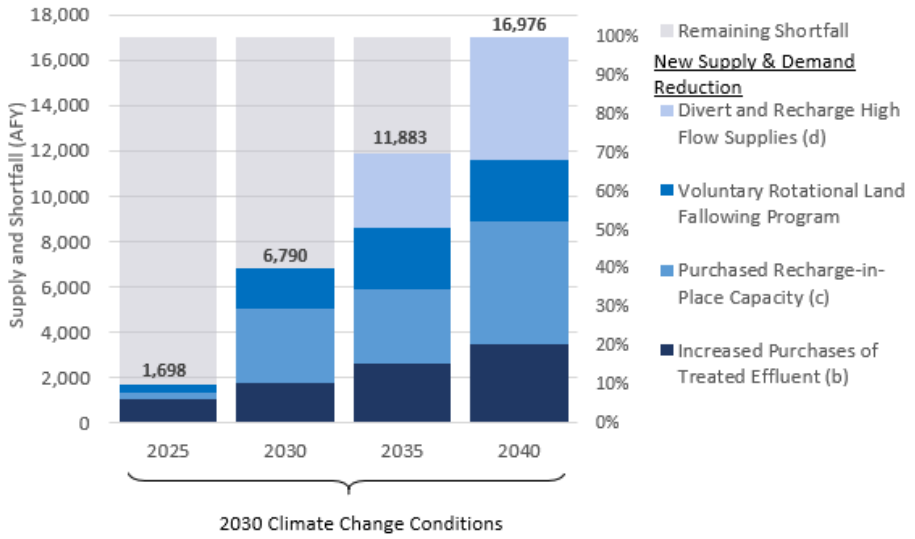
ES.9. Data Management System

Monitoring data collected within the Management Area will continue to be uploaded to the Data Management System (DMS) maintained for the basin and reported to the DWR in accordance with the Monitoring Protocols developed for the basin as described in the KGA Umbrella GSP. In addition, local data will be stored and managed in a 7th Standard Annex Management Area-specific DMS. Additional data collected by SWID and other entities as part of other regular monitoring programs may also be used for annual reporting and five-year updates for the 7th Standard Annex Management Area.

ES.10. Project and Management Actions

Achieving sustainability within the Management Area will require the implementation of Projects and Management Actions (P&MAs) and adaptive management. Implementation of P&MAs is estimated to be phased, with the goal of closing the identified shortfall by 2040, as well as in response to observed groundwater conditions relative to the associated Sustainability Indicators.

Figure ES-6
P&MA Implementation Glide Path



The supply shortfall under 2030 climate change conditions is currently estimated to be between -2,333 AFY and -16,976 AFY. For P&MA and funding planning purposes, the upper end of this range ((-16,976 AFY) is used; this estimate is based on the current KGA ~~"checkbook balance."~~ Checkbook. Over the next five years, the KGA intends to refine its approach to water budgeting, and therefore the shortfall values and range may change. As needed, the Management Area will adjust its P&MAs to address revised shortfall estimates and in response to local groundwater conditions. The anticipated implementation glide path is illustrated in **Figure ES-6**. The proposed P&MAs include projects to both reduce water demand and augment water supply to the area. It is anticipated that by 2040 approximately 10% of the shortfall will be met by demand reduction and 90% will be met by supply augmentation.

Projects to Increase Groundwater Storage/Recharge

1. Evaluation of Potential to Utilize Shafter-Wasco Irrigation District (SWID) Kimberlina Ponds or Other Facilities for Recharge
2. Evaluation of Potential to Partner in Kern Fan Groundwater Storage Project

3. 7th Standard Annex Management Area ~~Storage Pond~~Recharge Project
4. Identify Opportunities to Utilize Existing Infrastructure
5. On-Farm Groundwater Recharge

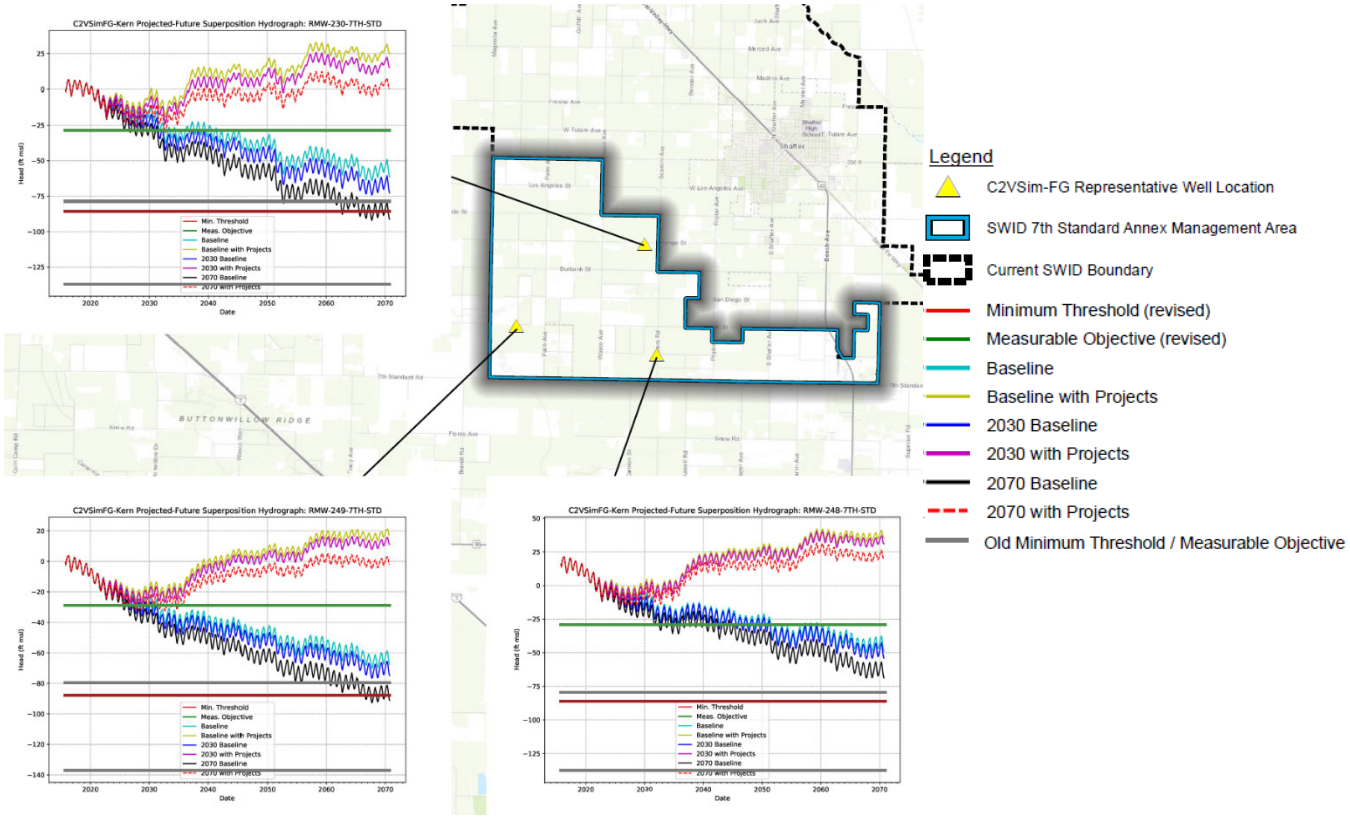
Projects to Increase Delivery Flexibility

6. Flat Rock Canal Extension
7. Develop Policy for and Construction of New Interconnections Within SWID's Conveyance System and Improve "Bottleneck" Issues
8. Increased Recycled Water Deliveries and Recharge

Management Actions/Policies to Reduce Overall Water Demand

9. On-Farm Water Conservation and Participation in Irrigation Scheduling using Remote Sensing
10. Voluntary Rotational Land Fallowing Program
11. Education of Groundwater Use per Acre
12. Well Dewatering Mitigation Program
13. Mandatory Pumping Restriction and/or Land Fallowing

Figure ES-7
Model Projected Water Levels With and Without P&MA Implementation



The P&MAs listed above provide a menu of options for water supply augmentation or water demand reduction that can be implemented in the Management Area. These projects require further analysis and permitting to determine feasibility and cost-effectiveness. In general, P&MAs being considered for implementation will be discussed during regular SWID Board Meetings, which are open to the public.

Additional stakeholder outreach efforts will be conducted prior to and during P&MA implementation.

Based on analysis by the KGA using the basin-wide numerical model, water levels within the Management Area are expected to remain above the water level MOs and MTs with full implementation of P&MAs by SWID and the other basin entities. **Figure ES-7** shows the projected water levels at each of the three compliance monitoring wells for the Management Area with and without the implementation of P&MAs. In the event that the water level MOs are not maintained for three consecutive years despite the implementation of P&MAs in the Management Area, as a contingency, SWID will ~~develop~~implement a mandatory pumping restriction and/or land fallowing policy, and work to maintain water levels above the MTs. Further, if the implemented P&MAs are not meeting the identified glide path, consistent with coordinated checkbook balance method as it evolves, then the Management Area will adapt and increase P&MAs to close the shortfall by 2040.

ES.11. GSP Implementation

The MA Plan describes the activities that have been or will be performed by SWID as part of ~~GSP~~the MA Plan implementation within the 7th Standard Annex Management Area, with a focus on the first five years. With the passage of a Proposition 218 election (with a 92% yes vote) in November 2019 and full annexation by SWID in December 2019, the Annex Area landowners have taken the critical first steps to: (1) establish a governance structure, (2) become a member of the KGA under SWID, and (3) secure a robust funding mechanism to support the development of P&MAs and other SGMA-compliance actions. Other ongoing and planned key GSP implementation activities to be undertaken by ~~the District~~SWID over the next five years include:

- Water level and water quality monitoring and data collection;
- Technical and non-technical coordination with other water management entities within the basin, including the KGA;
- Continued outreach and engagement with stakeholders;
- Annual reporting and five-year updates, which will include evaluation and updates to the MA Plan, as appropriate;
- P&MA implementation, including policy development to support GSP implementation; and
- Enforcement and response actions, as necessary.

As shown in **Figure ES-6**, the Management Area has set a goal to make up for 10% of the total shortfall by 2025, and an additional 30% every five-year period thereafter, closing the total shortfall of -16,976 AFY by 2040. The Management Area plans to have construction of projects complete by 2035 to allow for full use of the infrastructure before 2040. The Management Area will evaluate its progress towards meeting the shortfall on an annual basis and will adapt and adjust its P&MA implementation, including increasing efforts as necessary, to respond to groundwater conditions and the coordinated checkbook method as it evolves. In addition to the P&MAs to increase supply and reduce demand, ~~Plan implementation will include the development and funding of an Impacted~~a Well Dewatering Mitigation Program is developed and funded to address wells impacted by lowering groundwater levels, including agricultural and domestic supply wells.

The costs of regular/ongoing SGMA Compliance Activities are estimated to be $217,000 per year on average and the costs of implementation of P&MAs over the next 20 years is currently estimated to be

$1,416,000 per year for the first five years between 2020 and 2025 and $2,034,000 per year after 2025. To meet these costs, ~~the District~~SWID will need to establish new funding sources or increase existing funding sources. SGMA grants GSAs certain financial authorities (California Water Code [CWC] § 10725.4 and 10730 through 10731), including the ability to raise revenue through use of fees, assessments, pump taxes, and other methods to pay for the costs incurred by the GSA for SGMA compliance. As part of the annexation into SWID, the Annex Area went through a Proposition 218 process to levy assessments within this area amounting to over $7 million over the next five years, primarily for purposes of funding SGMA compliance activities and P&MAs. Therefore, it is anticipated that Annex Area will meet the estimated SGMA implementation costs through 2040 through a combination of the following:

- District revenue from assessments/fees;
- Special assessments/fees for specific projects;
- Grant funding or other financing options; and/or
- Penalties levied on prohibited activities.

P&MAs and other actions that have been implemented to date include:

- MA Plan Area successfully organized and held election under Proposition 218 to fund MA Plan administration and reporting and MA Plan P&MAs, including the Well Dewatering Mitigation Program.
- Developed a program with Land IQ to increase the accuracy of ET and precipitation measurements by installing and monitoring weather stations to provide ground truthing of the satellite data.
- Developed preliminary plans for construction of two groundwater recharge facilities. One of the projects is expected to be operational in 2023.
- Participated the Subsidence Study and Basin Study being coordinated by the KGA.
- Developed implementation policies from the MA Plan to help manage water supplies to achieve groundwater sustainability.
- Implemented voluntary land fallowing program and meeting the 5-year interim goal within the first two years.

INTRODUCTION

1. PURPOSE OF THE GROUNDWATER SUSTAINABILITY PLAN (GSP OR PLAN)

The purpose of this Groundwater Sustainability Plan (GSP) Management Area Plan (MA Plan) is to, in combination with the other Management Area plans being developed by the Kern Groundwater Authority (KGA) Groundwater Sustainability Agency (GSA) members and GSPs being developed by the KGA GSA and the other GSAs in the Kern County Subbasin (basin), meet the regulatory requirements set forth in the three-bill legislative package consisting of Assembly Bill (AB) 1739 (Dickinson), Senate Bill (SB) 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act (SGMA). The SGMA defines sustainable groundwater management as "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results". Undesirable results are defined by SGMA as any of the following effects caused by groundwater conditions occurring throughout the basin (California Department of Water Resources [DWR], 2017):

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply;
- Significant and unreasonable reduction of groundwater storage;
- Significant and unreasonable seawater intrusion;
- Significant and unreasonable degraded water quality;
- Significant and unreasonable land subsidence; and
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

The 7th Standard Annex Management Area (also referred to herein as the "Annex Area" or "Management Area") includes approximately 10,000 acres within the Shafter-Wasco Irrigation District (SWID). Finalization of annexation of the Management Area was authorized by the Kern County Local Agency Formation Commission (LAFCO) on 4 December 2019, following passage of a Proposition 218 election on 13 November 2019, with a 92% approval vote. The Management Area overlies a portion of the Kern County Subbasin, which is designated by the California Department of Water Resources (DWR) as being in a condition of critical overdraft (DWR, 2016d) and is prioritized under the DWR California Statewide Groundwater Elevation Monitoring (CASGEM) as a "high priority" basin.

SWID is a member of the multi-agency KGA GSA, which, in coordination with its members, has prepared an "Umbrella GSP" to document SGMA compliance for its portion of the basin. This Management Area Plan supplements the information provided in the KGA Umbrella GSP with locally specific information for the Management Area, including, among other things: (1) development of local historical and projected water budgets, (2) an assessment of undesirable results and development of Sustainable Management Criteria specific to the Management Area, (3) identification of a monitoring network to demonstrate

compliance within the Management Area, and (4) identification of local Projects & Management Actions (P&MAs) to increase the sustainability of the basin within the Management Area.

The KGA Umbrella GSP and this Management Area Plan ~~have been~~were developed to meet SGMA regulatory requirements by the 31 January 2020 deadline for critically-overdrafted basins while reflecting local needs and preserving local control over water resources. Together, these documents provide a path to achieve and document sustainable groundwater management within 20 years following GSP adoption, promoting the long-term sustainability of locally-managed groundwater resources now and into the future. This MA Plan was approved for inclusion in the KGA GSA Umbrella GSP by the SWID Board on 11 December 2019 (**Appendix G**~~).~~).

As described below, in coordination with other basin GSAs, the MA Plan has been revised to address the 28 January 2022 comment letter from the California Department of Water Resources (DWR) entitled *Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin*. The amended version of this MA Plan (in response to DWR comments) was approved for inclusion in the KGA GSA Umbrella GSP by the SWID Board on 13 July 2022 (**Appendix G**). It is recognized that additional, more recent data (i.e., through 2022) are available at the time of preparation of this amended MA Plan. However, as the MA Plan does not constitute a five-year update to a GSP, but rather a response to the DWR determination letter, those additional data are not incorporated herein, with minor exceptions.

1.1. Revisions Made to the MA Plan

The following revisions are made to the MA Plan in response to DWR 28 January 2022 comment letter, and are consistent with the revision summary tables shown in the KGA GSA Umbrella GSP (excerpted here as **Table INTRO-1** and **Table INTRO-2**):

- **Executive Summary**
  - Modify Executive Summary sections about Plan Area, Basin Setting, Sustainable Management Criteria (SMC), P&MAs, and Plan Implementation (and others as necessary), consistent with what is decided below.
- **Plan Area Section (and others as necessary)**
  - Revise to include mention of new GSAs formed since 2020 (Arvin GSA, Wheeler-Ridge Maricopa GSA, and Tejon-Castac Water District [TCWD] GSA) and South of Kern River (SOKR) GSP.
  - Update public meeting summary and coordination with other neighboring management areas.
- **Basin Setting Section 7.4 Groundwater Quality Concerns**
  - Add discussion about the recent water quality measurement in 2020. Based on the recent measurement in 2020, TDS, nitrate, and arsenic concentrations are below their recommended SMCL or MCL respectively in all three water quality Representative Monitoring Wells (RMWs), indicating that the domestic wells that tap the same local aquifer are likely similarly not at risk. Arsenic concentrations are below the established Minimum Threshold (MT), which is further discussed below.

- **Basin Setting Section 7.5 Land Subsidence**
  - Add a figure (**Figure GWC-13**) showing the MA Plan area relative to Regional Critical Infrastructure within the basin as identified by the KGA GSA. As shown in **Figure GWC-13**, the only Regional Critical Infrastructure located within the MA Plan area is a small section of a high-pressure gas pipeline which the basin GSAs have determined does not warrant further consideration (i.e., basin is only concerned with the California Aqueduct and the Friant Kern Canal).
  - Add a figure (**Figure GWC-15**) showing the MA Plan area relative to the Interferometric Synthetic Aperture Radar (INSAR) data that represents total vertical ground surface displacement between 2015 and 2021. Update **Figure GWC-14** (previously Figure GWC-13) to show recent (2015-2016) land subsidence with the INSAR data. As shown in **Figure GWC-14** and **Figure GWC-15**, both historical and recent subsidence data indicate that there has not been significant inelastic subsidence within the MA Plan area. As such, the data indicate that the Management Area is not at risk given the low level of subsidence observed over the historical record (1926-2021).
  - Reiterate argument that subsidence is not a relevant Sustainability Indicator for the MA Plan, but that basin-level issues in this portion of the basin.
- **SMC Sections**
  - Clearly identify Beneficial Users for each applicable Sustainability Indicator.
  - Update Local Undesirable Results Criteria (i.e., Trigger) for each applicable Sustainability Indicators to be consistent with basin-wide definition.
  - For each applicable Sustainability Indicator, clearly identify its relationship with other Sustainability Indicators, impact to adjacent Management Areas and basins, impact to Beneficial Users, State/Federal/Local standards, and measurement of MT, as shown in **Table SMC-2**. Demonstrate that all SMCs have been met to date.
  - For Chronic Lowering of Groundwater Levels, add a well age analysis to the justification of Local Undesirable Results Criteria. Expand the well impact analysis by well types and the discussion of Well Dewatering Mitigation Program, as shown in **Table SMC-2**.
  - For Chronic Lowering of Groundwater Levels, adjust MT based on coordination with adjacent Management Areas to maintain MT gradient to be similar to the current groundwater elevation gradient in vicinity of the Management Area, as shown in **Table SMC-2**.
  - For Reduction of Groundwater Storage, add a total usable groundwater storage as saturated thickness analysis to the justification of Local Undesirable Results Criteria, as shown in **Table SMC-2**.
  - For Degraded Water Quality, several criteria or "tests" are utilized to systematically and transparently assess which constituents warranted the development of SMCs for to be consistent with the understanding of groundwater conditions, the relationship between groundwater management (i.e., extraction and recharge to water quality), the regulatory landscape, and relevant regulations, as discussed in **Section 12.4.3**. The only constituent

that passes all of the "tests" is arsenic, and SMC is developed for arsenic. A MT and a MO are set for arsenic at the three water quality RMWs using its MCL of 10 ug/L since the most sensitive beneficial use of groundwater in the Management Area is for potable supply.

- **Projects and Management Actions**
  - List "Well Dewatering Mitigation Program" and "Mandatory Pumping Restriction and/or Land Fallowing" as P&MAs and assign P&MA number. Note that the MA Plan originally included these two programs, but they are not identified as P&MAs.
  - Updated the status of other P&MAs.
- **Plan Implementation Section**
  - Add description about the MA Plan Area successfully organized and held election under Proposition 218 to fund MA Plan administration and reporting and MA Plan P&MAs, including the Well Dewatering Mitigation Program.
  - Add description about the program developed with Land IQ to increase the accuracy of ET and precipitation measurements by installing and monitoring weather stations to provide ground truthing of the satellite data.
  - Add description about the preliminary plans developed for construction of two groundwater recharge facilities. One of the projects is expected to be operational in 2023.
  - Add description about the MA Plan Area participating the Subsidence Study and Basin Study being coordinated by the KGA.
  - Add description about the implementation policies developed from the MA Plan to help manage water supplies to achieve groundwater sustainability.
  - Add description about implementing the voluntary land fallowing program and meeting the 5-year interim goal within the first two years.

Table INTRO-1. KGA Revision Summary (SMC and MN Matrix)
Shafter-Wasco Irrigation District
7th Standard Annex Management Area

Monitoring Sites				Lowering of Groundwater Levels				Sustainability Indicators with Proxy			Undesirable Results				Management Area Exceedance Trigger			
				Minimum Threshold		Measurable Objective					Is the basin-wide definition included in MAP/GSP? (Y/N)				Management Area Plan Definition - Triggers			
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Value	Unit	Value	Unit	Reduction of Groundwater Storage	Degraded Water Quality (In Progress)	Land Subsidence (In Progress)	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality (Revisions in Progress)	Land Subsidence (Revisions in Progress)
Shafter-Wasco Irrigation District	MA-2 7TH Standard Annex	28S/25E 19G	RMW-269	-137	ft msl	-79	ft msl	X			Y	Y	Y	Y	~~Undesirable Results are triggered if the MT is exceeded at one or more of the three RMSs over three consecutive monitoring periods (events).~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area ~~the RMWs~~ over four consecutive bi-annual SGMA required monitoring events. ~~seasonal measurements~~.	~~Undesirable Results are triggered if and when groundwater storage is reduced by an amount that could cause the groundwater levels in one or more RMSs to exceed their MTs for Chronic Lowering of Groundwater Levels.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area ~~the RMWs~~ over four consecutive bi-annual SGMA required monitoring events. ~~seasonal measurements.~~	~~Undesirable Results for Degraded Water Quality are not defined.~~ Until additional groundwater level and groundwater quality information is available to refine the correlation analysis, it is considered a local undesirable results for degraded water quality within the management area if the arsenic concentrations exceed the MTs in 40% or more of the representative monitoring wells within the management area over two consecutive annual SGMA required monitoring events, such that it cannot be managed to provide drinking water supply (i.e., that treatment or blending is not possible or practicable).	Based on the limited to no historical subsidence observed in the management area, the lack of regional critical infrastructure (i.e., the California Aqueduct and the Friant Kern Canal), and mapping of the Corcoran clay in the basin which suggests that it does not extend in the management area, undesirable results for land subsidence are not defined.
		Well 31J	RMW-248	-137	ft msl	-79	ft msl	X										
		28S/24E-35C	RMW-249	-137	ft msl	-79	ft msl	X										

Table INTRO-2. KGA Revision Summary 2 (Deficiency 2 Table)
Shafter - Wasco Irrigation District
7th Standard Annex Management Area

Kern Groundwater Authority GSP	Summary of DWR Plan Interpretation	DWR Suggested Corrective Action	Proposed Response	Coordination with Neighboring Districts
SWID 7th Standard Annex	The KGA GSP Shafter-Wasco Irrigation District management area calculates the minimum thresholds for chronic lowering of groundwater levels by "projecting a theoretical future water groundwater elevation based on the assumption that the conditions experienced over the ten-year period 2006-2016 (Spring measurements) continue through 2016 to 2040" at each of the three well sites. The management area plan claims this is done to be consistent with what is being used by surrounding management areas. The management area plan examined the impacts of the minimum thresholds and measurable objectives on wells within the area and determined that there they would potentially experience "excessive dewatering, [but] the impacts would not be unreasonable and would be mitigated through an Impacted Well Mitigation Program." It's unclear if all the wells in the management area were included in this impact analysis.	The KGA GSP must explain the selection of groundwater level minimum thresholds for the Shafter-Wasco Irrigation District Management Area, including how they represent site-specific levels of depletion that could cause undesirable results and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels indicating a depletion of supply, the minimum thresholds should be revised accordingly.	SWID 7th Standard Annex Management Area will raise the MTs for Chronic Lowering of Groundwater Levels by 50 feet based on coordination with adjacent Management Areas to maintain the MT gradient to be similar to the current groundwater elevation gradient and to reduce risk of creating Undesirable results. The SMC section of the SWID 7th Standard Annex Map ("the MAP") will be reorganized to make it more consistent with the DWR BMPs and Determination Letter. More explicit section headers will be added, including Relationship with Other Sustainability Indicators, Impact to Adjacent Management Areas and Basins, Impact to Beneficial Users, State/Federal/Local Standards, and Measurement of MTs. Some sections will be expanded to better address DWR's comments on the MAP in its Determination Letter. Refinements will be made to standardize language and triggers to match Basin-wide definitions. The MAP will clarify that MTs for Chronic Lowering of Groundwater Levels were set at levels that would avoid depletion of supply that would lead to Undesirable Results. Local Undesirable Results criteria justification will be updated with a well age analysis and an expanded well impact analysis by beneficial user category. The MAP will clarify that the well impact analysis includes all wells within the Management Area, including wells compiled from the stakeholder survey and domestic well information from the DWR database. The Impacted Well Mitigation Program that was considered by SWID landowners and funded in the Proposition 218 in 2019 will be explained to include more details.	The SWID 7th Standard Annex MAP (Section 4.5.2 Public Meetings Summary) documents the direct outreach and coordination efforts with neighboring districts that addressed identified potential conflicts of MT and MT development processes. The MTs within the SWID 7th Standard Annex MAP have been developed in consideration of and in coordination with the MTs established in neighboring water agencies within the Kern Subbasin. The methodology used to develop the MTs is generally consistent with the approach taken in several surrounding Management Areas (i.e., Shafter-Wasco Irrigation District Management Area, Rosedale-Rio Brave Water Storage District, and North Kern Water Storage District Management Area), in that all of the approaches consider historical water level trends, well construction information, and projected groundwater levels. The SWID 7th Standard Annex Management Area will raise the MTs and MOs for Chronic Lowering of Groundwater Levels by 50 feet based on coordination with adjacent Management Areas.

2. SUSTAINABILITY GOAL

☑ **23 CCR § 354.24**

~~The sustainability goal for the Management Area is to maintain an economically viable groundwater resource for the beneficial use of Annex Area landowners, residents, and businesses by utilizing the area's groundwater resources within the local sustainable yield. Long-term groundwater sustainability will be achieved through the implementation of projects and management actions to both increase water supplies and reduce demands within the Annex Area.~~

~~The local sustainability goal, above, is consistent with and in addition to~~ The basin-wide sustainability goal being adopted by all GSAs in the Kern County Subbasin~~,~~ (basin), defined below:

"The sustainability goal of the Kern County Subbasin is to:

- Achieve sustainable groundwater management in the Kern County Subbasin through the implementation of projects and management actions at the member agency level of each GSA
- Maintain its groundwater use within the sustainable yield of the basin~~.~~ as demonstrated by monitoring and reporting groundwater conditions
- Operate within the established sustainable management criteria, which are based on the collective technical information presented in the GSPs in the Subbasin.
- ~~Implement projects and management actions that include a variety of water supply development and demand management actions.~~
- Collectively bring the Subbasin into sustainability and to maintain sustainability over the implementation and planning horizon~~.~~."

~~Further, the Subbasin sustainability goal includes a commitment to monitor and report groundwater conditions, as required by SGMA, and to continue coordination among the KGA member agencies and all other GSA's in the Subbasin to identify the potential for, or presence of, undesirable results and actions to prevent undesirable results. The coordination process established in the development of this GSP and memorialized in the Coordination Agreement will ensure that the Subbasin is managed as a shared groundwater resource and that the districts within the Subbasin work collaboratively towards achieving and maintaining sustainable groundwater use."~~

3. AGENCY INFORMATION

3.1. Name and Mailing Address of the Groundwater Sustainability Agency

☑ 23 CCR § 354.6(a)

The Kern Groundwater Authority (KGA) Groundwater Sustainability Agency (GSA) is the GSA for the portion of the Kern County Subbasin of the San Joaquin Valley Groundwater Basin (Department of Water Resources [DWR] Basin No. 5-022.14) that underlies the 7th Standard Annex Management Area.

The mailing address for the KGA GSA is:

Kern Groundwater Authority
(c/o Provost & Pritchard Consulting Group)
1800 30th Street, Suite 280
Bakersfield, CA 93301

3.2. Organization and Management Structure of the Groundwater Sustainability Agency

☑ 23 CCR § 354.6(b)

Per the Joint Powers Agreement (JPA) executed on 22 March 2017, the KGA GSA Board is composed of one representative from each of the general member agencies (~~Arvin Community Services District [ACSD], Arvin-Edison Water Storage District [AEWSD],~~ Cawelo Water District [CWD], Kern County Water Agency [KCWA], Kern-Tulare Water District [KTWD], Kern Water Bank Authority [KWBA], North Kern Water Storage District [NKWSD], Rosedale-Rio Bravo Water Storage District [RRBWSD], Semitropic Water Storage District [SWSD], Shafter-Wasco Irrigation District [SWID], Southern San Joaquin Municipal Utility District [SSJMUD], ~~Tejon-Castac Water District [TCWD],~~ West Kern Water District [WKWD], and Westside District Water Authority [WDWA~~] and Wheeler Ridge-Maricopa Water Storage District [WRMWSD~~] plus one representative from the County as well as the City of Shafter).

The KGA GSA is governed by a ~~16~~12-member Board of Directors. Information regarding current KGA GSA Board members can be found on the KGA's website at http://www.kerngwa.com/. Current KGA GSA Board Members include:

- Board Chairman – ~~Dennis Mullins, Wheeler Ridge-Maricopa~~Dan Waterhouse, Semitropic Water Storage District;
- Vice Chairman – ~~Jason Selvidge, Rosedale-Rio Bravo Water Storage District;~~
- ~~Bob Rodriguez, Arvin Community Services District;~~
- ~~Kevin Pascoe, Arvin-Edison Water Storage~~Brandon Morris, Southern San Joaquin Municipal Utility District;
- John Gaugel, Cawelo Water District;
- Chad Givins, City of Shafter;
- Royce Fast, Kern County Water Agency;
- Andrew Pandol, Kern-Tulare Water District;
- ~~Bill Taube~~Kim Brown, Kern Water Bank Authority;
- Kevin Andrew, North Kern Water Storage District;

- ~~Rick Wegis, Semitropic~~Gary Unruh, Rosedale Rio Bravo Water Storage District~~;~~
- ~~Mark Franz~~Randy Bloemhof, Shafter-Wasco Irrigation District;
- ~~Jim Regan, Southern San Joaquin Municipal Utility District;~~
- ~~Dennis Atkinson, Tejon-Castaic Water District;~~
- Gary Morris, West Kern Water District; and
- Rob Goff, Westside Water Authority.

3.3. Plan Manager

☑ 23 CCR § 354.6(c)

The KGA GSP Plan Manager is Patricia Poire. Ms. Poire can be reached at:

Patricia Poire, Planning Manager
Telephone: (661) 479-7171
Fax: (661) 479-7172
Email: ppoire@kerngwa.com

3.4. Management Area Plan Manager

The Manager for the development of the Annex Area Management Area Plan is ~~Rick Iger.~~Ken Bonesteel. Mr. ~~Iger~~Bonesteel, of Provost & Pritchard Consulting Group, has been hired by SWID to manage the Management Area Plan for the 7th Standard Annex Management Area independent of the development of the Management Area Plan for the SWID Management Area. Mr. ~~Iger~~Bonesteel can be reached at:

~~Rick Iger~~Ken Bonesteel, Principal Engineer
Telephone: (~~209) 829-1685~~661) 616-5900 EXT. ~~711~~740
Email: KBonesteel@ppeng.com

3.5. Legal Authority of the GSA

☑ 23 CCR § 354.6(d)

The KGA GSA applied for and was granted GSA status under Water Code Section 10723(c). Refer to the KGA Umbrella GSP for information regarding the Legal Authority of the KGA GSA.

3.6. Estimated Cost of Implementing the GSP and the Agency's Approach to Meet Costs

☑ 23 CCR § 354.6(e)

The KGA GSA's approach to meeting GSP implementation costs is discussed in the Umbrella GSP. Information on estimated costs to implement the 7th Standard Annex Management Area Management Area Plan and SWID's plan to meet those costs is provided in **Section 17**.

3.7. GSP Organization

This Management Area Plan is organized as follows:

- **Section Executive Summary** provides an executive summary, or overview, of the Management Area Plan;
- **Sections 1 through 3** comprise the Introduction, including purpose of this Management Area Plan, Sustainability Goal for the basin, and the KGA GSA information;
- **Section 4** provides a description of the geographic areas covered by this Management Area Plan;
- **Sections 5 through 9** present information about the physical setting, characteristics, and current conditions of the Management Area, including the identification of data gaps and levels of uncertainty, which comprise the Basin Setting that serves as the basis for defining and assessing reasonable Sustainable Management Criteria and Projects and Management Actions.
- **Sections 10 through 15** define conditions that constitute sustainable groundwater management for the Management Area, including Undesirable Results, Minimum Threshold, Measurable Objective, and Interim Milestones. Also presents in these sections is the Monitoring Network for the Management Area.
- **Section 16** presents the Projects and Management Actions for the Management Area that can be maintained over the planning and implementation horizon.
- **Section 17** presents Plan Implementation, including Estimate of GSP Implementation Costs, Schedule for Implementation, and requirements for Annual Reporting and Periodic Evaluation.
- References and Technical Studies are included at the end of this document.
- Supporting information is provided in appendices as follows:
    - **Appendix A**. Stakeholder Communication and Engagement Plan
    - **Appendix B**. Public Comments Received on Draft Management Area Plan
    - **Appendix C**. Methods and Data Used in the Water Budget Spreadsheet Model Approach
    - **Appendix D**. Preparation Checklist for GSP Submittal Completed for SWID 7th Standard Annex Management Area
    - **Appendix E**. Water Quality Trend Analysis and Sources
    - **Appendix F**. KGA Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater
    - **Appendix G.** Board Resolution

PLAN AREA

4. DESCRIPTION OF THE PLAN AREA

☑ 23 CCR § 354.8

This section presents a description of the Plan Area for the 7th Standard Annex Management Area (also referred to as "Management Area"), and a summary of the relevant jurisdictional boundaries and other key land use features potentially relevant to the sustainable management of groundwater in the Management Area. This section also describes the water monitoring programs, water management programs, and general plans relevant to the Management Area and their influence on the development and execution of this Groundwater Sustainability Plan (GSP) Management Area Plan~~.~~ (MA Plan).

This MA Plan has been revised to address the 28 January 2022 comment letter from the California Department of Water Resources (DWR) entitled *Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin*. It is recognized that additional, more recent data (i.e., through 2022) are available at the time of preparation of this amended MA Plan. However, as the MA Plan does not constitute a five-year update to a GSP, but rather a response to the DWR determination letter, those additional data are not incorporated herein, with minor exceptions.

4.1. Summary of Jurisdictional Areas and Other Features

4.1.1. Plan Area Setting

☑ 23 CCR § 354.8(a)(1)
☑ 23 CCR § 354.8(b)

The 7th Standard Annex Management Area overlies a portion of the Kern County Subbasin (basin; ~~California Department of Water Resources [~~DWR~~]~~ Basin 5-022.14). The basin is not adjudicated and no portion of the basin is being managed under an Alternative plan. The basin is bounded on the north by the Tulare Lake Subbasin (DWR Basin 5-022.12), the Tule Subbasin (DWR Basin 5-022.13), the Kettleman Plain Subbasin (DWR Basin 5-022.17) and on the south by the White Wolf Subbasin (DWR Basin 5-022.18). The 7th Standard Annex Management Area is located roughly in the middle of the basin, just south of the Shafter-Wasco Irrigation District (SWID) Management Area (**Figure PA-1**).

The 7th Standard Annex Area includes approximately 10,000 acres, which was recently annexed by SWID, which is a member of the multi-agency Kern Groundwater Authority (KGA) Groundwater Sustainability Agency (GSA) (see **Figure PA-1**).[4] There are ~~10~~13 other GSAs that are located within the Kern County Subbasin: Kern River GSA, Greenfield County Water District, Buena Vista Water Storage District, Olcese GSA, Henry Miller Water District, Semitropic Water Storage District, West Kern Water District, Cawelo GSA, Pioneer GSA, ~~and McFarland GSA.~~McFarland GSA, and the South of Kern River GSAs (included Arvin

[4] The annexation of the Management Area by SWID was completed in December 2019, following the passage of a Proposition 218 election and approval by the Kern County LAFCO.

GSA, Wheeler Ridge-Maricopa GSA, and Tejon-Castac Water District [TCWD] GSA). These GSAs were formed by several other GSA-eligible public agencies in the basin and several are preparing separate GSP documents that will be coordinated with the GSP prepared by the KGA GSA. Refer to the KGA Umbrella GSP for the location of these GSAs.

4.1.2. Jurisdictional Boundaries

☑ 23 CCR § 354.8(a)(3)
☑ 23 CCR § 354.8(b)

The 7th Standard Annex Management Area falls entirely within Kern County. As shown on **Figure PA-1**, agencies near SWID and the 7th Standard Annex Management Area include: Pond Poso Improvement District, Semitropic Water Storage District, Rosedale-Rio Bravo Water Storage District, Western Acres Mutual Water Company, Vaughn Water Company, Rosedale-Ranch Irrigation District, North Kern Water Storage District, and the City of Shafter.

According to the information made available by DWR[5] through the SGMA Data Viewer, there are no tribal, state, or federal lands within the 7th Standard Annex Management Area. The California Department of Fish & Wildlife Buttonwillow Ecological Reserve is located approximately 1 mile west of the Management Area, within the Semitropic Water Storage District Management Area, but is not shown on **Figure PA-1** as it is outside of the boundaries of the Annex Area.

The 7th Standard Annex Management Area is located within the Kern County General Plan area, the City of Shafter General Plan area, and the Metropolitan Bakersfield General Plan area. The Kern County General Plan further identifies the Western Rosedale Specific Plan area, which covers portions of the Management Area. The Smith's Corner Specific Plan area, the Mexican Colony – Cherokee Strip Specific Plan area and the Beech Avenue Specific Plan area are located proximate to, but not within, the Management Area.

4.1.3. Land Use and Well Density per Square Mile

☑ 23 CCR § 354.8(a)(4)
☑ 23 CCR § 354.8(a)(5)
☑ 23 CCR § 354.8(b)

Agriculture is the primary land use within the 7th Standard Annex Management Area (**Figure PA-2**), with approximately 7,800 acres irrigated and used for agricultural purposes. According to the DWR Land Use Viewer, of the irrigated area in 2014, 35% was used for cultivation of almonds (2,770 acres), 25% for cultivation of alfalfa and alfalfa mixtures (1,960 acres), 21% for cultivation of wheat (1,660 acres), 8% for cultivation of corn and sorghum (600 acres), and the remaining 11% for other crops (850 acres) (**Figure PA-2**). These lands are irrigated primarily with groundwater. Portions of the agricultural lands also receive recycled water from the North of River Sanitary District (NORSD) Wastewater Treatment Plant (WWTP).

In addition, portions of the Management Area are used for dairies, industrial use, and some rural residential use. The Superior Mutual Water Company (SMWC) supplies portions of the 7th Standard Annex

[5] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer, accessed on 22 May 2019.

Management Area with both industrial and domestic water supply. Groundwater is used to meet all of these municipal and industrial (M&I) water demands.

Figure PA-3 shows the density of wells per square mile within the 7th Standard Annex Management Area, based on Well Completion Report records compiled by DWR.[6] According to these records, 55 production wells, seven domestic wells, and one public supply well have been installed within the 17 Public Land Survey System (PLSS) sections that fall partially or entirely within the Management Area.[7,8]

4.1.4. Communities Dependent Upon Groundwater

Limited population resides within the 7th Standard Annex Management Area. As shown on **Figure PA-4**, no areas within the Management Area are zoned as residential or rural residential. A small population, approximately 61 people,[9] rely on water served by the SMWC, which relies solely on groundwater. SMWC's service area extends beyond the Management Area and is the only public water system within the Management Area; SMWC has been an active participant in the MA Plan development process. In addition, approximately seven private domestic wells may be present within the Management Area based on well completion report information made available through DWR.

4.2. Water Resources Monitoring and Management Programs

4.2.1. Existing Monitoring Programs in the 7th Standard Annex Management Area

☑ **23 CCR § 354.8(c)**
☑ **23 CCR § 354.8(d)**

The KGA Umbrella GSP provides a detailed description of the existing groundwater, surface water, and subsidence monitoring networks and programs in the basin. Those located in the vicinity of the Management Area are identified and briefly discussed below.

The NORSD WWTP routinely monitors groundwater at its facility, including groundwater levels, and selected groundwater quality constituents. This monitoring is performed pursuant to a Waste Discharge Requirement (WDR) Order from the Central Valley Regional Water Quality Control Board (CVRWQCB).

The California Statewide Groundwater Elevation Monitoring (CASGEM) Program tracks long-term groundwater elevation trends in groundwater basins throughout California. The program's mission is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. SWID has been a Monitoring Entity under the CASGEM Program since 2011; however, the Management Area is not currently included within its CASGEM monitoring network. It is

[6] DWR Well Completion Report Map Application website:https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37, accessed on 15 November 2018.
[7] Based on information provided by the Superior Mutual Water Company (SMWC), two production wells are currently located within the Management Area.
[8] Each PLSS section represents approximately 1 square mile of area (i.e., 640 acres).
[9] Population served by Superior Mutual Water Company was obtained from SDWIS website, accessed on 4 March 2019. https://sdwis.waterboards.ca.gov/PDWW/index.jsp

anticipated that the SWID will extend its monitoring network to include the Management Area in the future as part of SGMA implementation.

Of particular relevance to groundwater is the Central Valley-Salinity Alternatives for Long-term Sustainability (CV-SALTS) process. CV-SALTS is a collaborative stakeholder driven and managed program to develop sustainable salinity and nitrate management planning for the Central Valley. The Kern Subbasin is a Priority 2 basin for nitrate management. ~~Consequently, the nitrate control program schedule is set to begin in 2021 as described in the KGA GSA's Umbrella GSP.~~Further, water quality issues related to deep percolation of agricultural chemicals such as nitrate are also regulated under the Irrigated Lands Regulatory Program (ILRP).

Land subsidence data within and in the vicinity of the Management Area is available through the vertical displacement estimates derived from Interferometric Synthetic Aperture Radar (InSAR) data that are collected by the European Space Agency (ESA) Sentinel-1A satellite and processed by TRE ALTAMIRA Inc. (TRE).

Additional groundwater and surface water monitoring programs are active within the Kern County Subbasin (e.g., Kern County Water Agency [KCWA] semiannual groundwater monitoring program, California Data Exchange Center [CDEC], Groundwater Ambient Monitoring and Assessment Program [GAMA], United States Geological Survey [USGS] National Water Information System, Kern Fan Monitoring Committee [KFMC], Semitropic Water Storage District Water Banking Project, etc.), but there are limited monitoring points within or proximate to the 7th Standard Annex Management Area. These programs are discussed in the KGA Umbrella GSP.

The water resource monitoring programs active in the region are not expected to limit operational flexibility in the 7th Standard Annex Management Area portion of the basin.

4.2.2. Water Management Programs in the 7th Standard Annex Management Area

☑ **23 CCR § 354.8(c)**
☑ **23 CCR § 354.8(d)**

The 7th Standard Annex Management Area is included in the June 2014 Poso Creek Integrated Regional Water Management Plan (Poso Creek IRWMP). SWID was involved in the development of the 2014 Poso Creek IRWMP, which occurred prior to the annexation of the Management Area. The IRWMP is currently being updated and is expected to be complete in 2019. The Poso Creek IRWM Region covers portions of northern Kern County and a small portion of southern Tulare County.

The primary and secondary goals for the Poso Creek Region, according to the Poso Creek IRWMP, include the following:

- Primary Goals:
    - No.1 – maintain and enhance water supply reliability;
    - No.2 – improve operational efficiency and flexibility;
    - No.3 – reduce water demand;
    - No.4 – protect quality of water supply;
    - No.5 – maintain economic viability of water use in region;

- Secondary Goals:
  - No.6 – practice regional resource stewardship and environmental awareness; and
  - No.7 – improve flood management.

The Resource Management Strategies (RMSs) considered by the Poso Creek IRWMP to be most applicable to the Poso Creek Region are the ongoing water management activities that are being practiced by the districts, communities, and environmental organizations in the Poso Creek Region.

The 2014 Poso Creek IRWMP identified specific water resources projects planned and being implemented in the Poso Creek Region, none of which are located within the 7th Standard Annex Management Area. Several projects located just north of the Management Area were identified in the 2014 Poso Creek IRWMP, including:

- GW-Banking (SWID at Kimberlina): Expand direct recharge facilities;
- Shafter-Wasco/Semitropic Intertie on Kimberlina Road: Modify water conveyance systems;
- Shafter-Wasco/Semitropic Intertie on Madera Avenue: Modify water conveyance systems; and
- South Shafter Wastewater Treatment Plant Update: Assist economically-disadvantaged communities (wastewater treatment).

IRWMP and GSP development are complimentary management processes. To the extent that the issues identified for the greater IRWMP region affect the 7th Standard Annex Management Area, these issues are identified in the following sections of this Management Area Plan. The implementation of this Management Area Plan will contribute to the sustainable use of water supplies within the IRWMP region. Similarly, the IRWM program is not expected to limit operational flexibility in the Management Area.

4.2.3. Conjunctive Use in the 7th Standard Annex Management Area

☑ **23 CCR § 354.8(e)**

There are no formal conjunctive use conveyance systems within the 7th Standard Annex Management Area. Recycled water deliveries from the NORSD WWTP supplement and offset groundwater use to meet irrigation demands in portions of the Management Area. The coordinated use of these water resources is not expected to limit operational flexibility in the 7th Standard Annex Management Area.

4.3. Land Use Elements or Topic Categories of Applicable General Plans

4.3.1. Kern County General Plan

☑ **23 CCR § 354.8(f)(1)**
☑ **23 CCR § 354.8(f)(2)**
☑ **23 CCR § 354.8(f)(3)**

The 7th Standard Annex Management Area is located within the Kern County General Plan area (Kern County, 2009). The current Kern County General Plan was first adopted in 2004 and has undergone several amendments, the most recent amendment was approved in 2009 (General Plan). The County is currently working to update its General Plan through 2040, with completion of the "2040 General Plan" expected in 2019. This section identifies relevant policies in the current General Plan that could: (1) affect water

demands in the 7th Standard Annex Management Area (e.g., due to population growth and development of the built environment), (2) influence the Management Area Plan's ability to achieve sustainable groundwater use, and (3) affect implementation of General Plan land use policies.

Figure PA-4 shows the current General Plan land use designations within the 7th Standard Annex Management Area. The land use designations include primarily agriculture, industrial, and rural residential. These designations are generally consistent with the predominantly agricultural land use within the 7th Standard Annex Management Area as shown in **Figure PA-2**.

The General Plan identifies several Specific Plan areas in the vicinity of the Management Area. The Western Rosedale Specific Plan area includes approximately 320 acres of the southeast portion of the 7th Standard Annex Management Area (**Figure PA-4**). In addition, the Smith's Corner Specific Plan area, the Mexican Colony – Cherokee Strip Specific Plan area and the Beech Avenue Specific Plan area are located proximate to the Management Area.

The Land Use, Open Space, and Conservation Element (Chapter 1) of the General Plan includes the following goals, policies, and implementation measures that are related to groundwater or land use management, and that could potentially influence the implementation of this Management Area Plan.

Physical and Environmental Constrains

- **Implementation Measure C.** Cooperate with the Kern County Water Agency to classify lands in the County overlying groundwater according to groundwater quantity and quality limitations.

Public Facilities and Services

- **Goal 5.** Ensure that adequate supplies of quality (appropriate for intended use) water are available to residential, industrial, and agricultural users within Kern County.
- **Goal 7.** Facilitate the provision of reliable and cost-effective utility services to residents of Kern County.
- **Policy 2.** The efficient and cost-effective delivery of public services and facilities will be promoted by designating areas for urban development which occur within or adjacent to areas with adequate public service and facility capacity.
    - **Policy 2.a.** Ensure that water quality standards are met for existing users and future development

Residential

- **Goal 6.** Promote the conservation of water quantity and quality in Kern County.
- **Goal 7.** Minimize land use conflicts between residential and resource, commercial, or industrial land uses.

Industrial

- **Goal 2.** Promote the future economic strength and well-being of Kern County and its residents without detriment to its environmental quality.

Resource

- **Policy 7.** Areas designated for agricultural use, which include Class I and II and other enhanced agricultural soils with surface delivery water systems, should be protected from incompatible residential, commercial, and industrial subdivision and development activities.
- **Policy 10.** To encourage effective groundwater resource management for the long-term economic benefit of the County the following shall be considered:
    - **Policy 10.a.** Promote groundwater recharge activities in various zone districts.
    - **Policy 10.c.** Support the development of groundwater management plans.
    - **Policy 10.d.** Support the development of future sources of additional surface water and groundwater, including conjunctive use, recycled water, conservation, additional storage of surface water and groundwater and desalination.

General Provisions

- **Goal 1.** Ensure that the County can accommodate anticipated future growth and development while maintaining a safe and healthful environment and a prosperous economy by preserving valuable natural resources, guiding development away from hazardous areas, and assuring the provision of adequate public services.
- **Policy 40.** Encourage utilization of community water systems rather than the reliance on individual wells.
- **Policy 41.** Review development proposals to ensure adequate water is available to accommodate projected growth.
- **Policy 45.** New high consumptive water uses, such as lakes and golf courses, should require evidence of additional verified sources of water other than local groundwater. Other sources may include recycled stormwater or wastewater.
- **Implementation Measure U.** The Kern County Environmental Health Services Department will develop guidelines for the protection of groundwater quality which will include comprehensive well construction standards and the promotion of groundwater protection for identified degraded watersheds.

The above goals, policies and implementation measures established by the General Plan are complementary to sustainable groundwater management of the 7th Standard Annex Management Area relative to future land use development and conservation (i.e., the General Plan encourages development of the County's groundwater supply to ensure that existing users have access to high quality water, and states that future growth should be accommodated only while ensuring that adequate high-quality water supplies are available to existing and future users). Successful implementation of this Management Area Plan will help to ensure that the 7th Standard Annex Management Area groundwater supply is managed in a sustainable manner, and will provide routine reporting of groundwater conditions that Kern County and others can use to inform local decisions on growth and development. Therefore, implementation of General Plan policies is not expected to affect the ability of the Management Area to achieve groundwater sustainability. Likewise, implementation of this Management Area Plan is not anticipated to significantly affect the water supply assumptions or land use plans over the planning horizon. Given that the General Plan is being updated concurrently with the development of this Management Area Plan, and the County has been engaged in the process of GSP development through its past participation in the KGA GSA, it is

anticipated that the 2040 General Plan would take into account this Management Area Plan and utilize consistent water supply assumptions over the 2040 planning horizon.

4.3.2. City of Shafter General Plan

☑ 23 CCR § 354.8(f)(1)
☑ 23 CCR § 354.8(f)(2)
☑ 23 CCR § 354.8(f)(3)

The eastern portion of the 7th Standard Annex Management Area is also located within the City of Shafter General Plan area (City of Shafter, 2005). This section identifies relevant policies in the City of Shafter General Plan that could potentially affect water management in the Management Area.

Land use designations identified by the City of Shafter General Plan within the 7th Standard Annex Management Area include agriculture/open space, industrial (facilities associated with various industrial, warehouse, and distribution uses), and resource management (facilities associated with the extraction of mineral resources). These designations are generally consistent with the predominantly agricultural land use within the 7th Standard Annex Management Area and land use designations used by the Kern County General Plan.

The Land Use Program (Chapter II) of the City of Shafter General Plan includes the following objectives and policies that are related to groundwater or land use management, and that could potentially influence the implementation of this Management Area Plan.

Land Use Organization

- **Objective.** Organize Shafter's physical environment into a logical, functional, and visually pleasing pattern, defining the amount, location, and distribution of various types of land uses within the City and its General Plan study area.
- **Policy 3.** Maintain a buffer of agricultural and rural residential uses surrounding Shafter's urbanizing core area to provide a physical separation between the area and industrial uses to the east, south, and southeast.

Agricultural/Open Space Uses

- **Objective.** Recognize and retain commercial agriculture as a desirable land use and as a major segment of the community's identity and economic base.
- **Policy 1.** Recognize that the agricultural land use designation indicates the intended long- term developed use of land in the same manner as other General Plan land use designations, and not as a temporary "holding zone."
    - **Policy 1a.** Apply agricultural land use designations only to areas or parcels capable of supporting long-term production of food, fiber, or plant materials, maintaining agricultural production as the highest priority use within lands designated for agricultural use.
    - **Policy 1b.** Avoid designating lands for long-term agricultural use in locations where they will be surrounded by lands designated for incompatible urban and rural development.

    - **Policy 1c.** Ensure that adequate land is designated for urban and rural development to meet long-term needs for housing, employment, shopping, recreation, and other non-agricultural activities.
    - **Policy 1d.** Recognize that Shafter General Plan land use map is a plan for the ultimate build out of the community, and not a projection of land use needs for a particular date. Thus, it is not intended that, in the future, as build out approaches, the General Plan be modified to provide for further expansion of lands designated for urban and rural uses.

- **Policy 3.** Maintain the viability of commercial agricultural operations within areas designated for agricultural use by requiring appropriate minimum parcel sizes and limiting the intensity of permitted land uses.
- **Policy 4.** Limit the extension of urban services into or through areas that are designated for agricultural uses, and avoid their inclusion in assessment districts and other financing mechanisms intended for the provision of urban services and facilities.
- **Policy 5.** Within lands designated for rural residential or urban development, permit existing agricultural operations as interim uses, protecting their continued operation through the implementation of a right-to- farm ordinance and the provision of suit- able buffers as part of new development proposed on adjacent land.
- **Policy 6.** Promote regulations that allow farmers to manage their operations in an efficient, economic manner with minimal conflict from non-agricultural uses.
- **Policy 8.** Within areas currently under agricultural production, as well as areas designated for industrial use, support the retention and development of agriculturally related industries and support services (e.g., food processing, storage yards, equipment sales and rentals, etc.) to assist in maintaining the long-term economic viability of lands designed for agricultural use.
- **Policy 9.** Work with Kern County to protect lands designated for agricultural use, minimizing the influence of speculative land transactions on the price of farmland, and providing incentives for long-term agricultural use.
- **Policy 11.** Pursue an Agricultural Conservation Easement program pursuant to the California Farmland Conservancy Program (Public Resources Code [PRC] § 10200 *et. seq.*).
    - **Policy 11a.** Identify specific target areas and strategies for the establishment of conservation easements and fee title acquisition.

The Public Services and Facilities Program (Chapter IV) of the City of Shafter General Plan includes the following goal, objectives and policies that are related to groundwater or land use management, and that could potentially influence the implementation of this Management Area Plan.

- **Goal.** To provide for the ongoing provision and timely expansion of high quality public services and infrastructure for existing and future residents and businesses.

Sewer Facilities

- **Objective.** Provide a wastewater collection, treatment, and disposal system capable of meeting the daily and peak sewer service needs of existing and future residences, businesses, and other uses during peak use conditions without exhibiting restricted flow (except for force mains) or

exceeding the rated capacity of the Shafter- North of the River Regional Wastewater Treatment Facility.

- **Policy 4.** Encourage water conservation as a means of reducing sewage generation and the need for expanding sewage treatment capacity.
- **Policy 5.** Work with the NORSD and Kern County to explore and develop uses for treated wastewater. Where reclaimed wastewater can be economically delivered, encourage the installation of dual water systems and facilitate the use of reclaimed water sup- plies for irrigation and industrial purposes.
- **Policy 6.** Incorporate expected reductions in sew- age flow projections and the need for sewage treatment capacity resulting from water conservation programs based on actual experience with the implementation of such programs.

Drainage and Flooding

- **Objective.** Protect structures for human occupancy and roadways identified as evacuation routes from inundation during the 100-year flood event.
- **Policy 1.** Require dedication and improvement of stormwater detention, retention, and conveyance facilities as a condition of approval for new development where needed to protect on-site and downstream development from flooding.
- **Policy 2.** Require adequate infrastructure to be in place and operational prior to occupancy of new development, such that new development will not negatively impact the performance of drainage facilities serving existing developed areas.
- **Policy 3.** Where they are required, design retention and detention facilities as multi-use recreation areas, where safe and feasible.
- **Policy 4.** Require implementation of Best Management Practices in the design of drainage systems to reduce discharge of non-point source pollutants originating in streets, parking lots, paved industrial work areas, and open spaces involved with pesticide applications.

Coordination with Service Agencies

- **Objective.** To maintain coordinated implementation of Shafter's planning and development review programs with the expansion of services and facilities provided by outside agencies within the City.
- **Policy 1.** Provide relevant services with timely information on the developments being reviewed by the City, and involve these agencies in the review process.
- **Policy 2.** On an annual basis, meet with service agencies operating within the City of Shafter to review the relationship between the City's growth projections and the agencies' ability to provide services and facilities.

The Environmental Management Program (Chapter VI) of the City of Shafter General Plan includes the following objectives and policies that are related to groundwater or land use management, and that could potentially influence the implementation of this Management Area Plan.

Open Space

- **Objective.** Maintain and preserve a comprehensive open space system and its associated natural resources by protecting agricultural and oil production lands where appropriate; providing parks for active and passive recreation; and by preserving natural, scenic, and other open space resources.
- **Policy 1.** Establish a comprehensive system of open space that is available to the public, including facilities for organized recreation; active informal play; passive recreation; and enjoyment of the natural environment.
- **Policy 2.** Protect the viability of lands for agricultural use through the policies set forth in Section 2.4 of the General Plan Land Use Program.

Water Resources

- **Objective.** Provide adequate water supplies to meet present and future needs for domestic consumption and emergencies, while obtaining maximum benefit from limited water resources.
- **Policy 1.** Promote water conservation through application of appropriate landscaping and site planning techniques which may include:
    - Use of drought-tolerant vegetation in landscaping in new subdivisions and commercial/industrial developments.
    - Use of reclaimed water for large-scale irrigation and for dust control during grading where such water can be economically delivered; and
    - Installation of computerized irrigation controllers and drip irrigation systems.
- **Policy 2.** To ensure that land use changes will not adversely affect the groundwater basin, applicants for General Plan and zoning ordinance amendments shall provide a factual statement of the following:
    - Current water demand: The amount of water necessary to support development under existing general plan and zoning designations.
    - Proposed water demand: The amount of water necessary to support development under the proposed General Plan and zoning designations.
    - Potential conservation: The amount of water that can be conserved by application of water conservation techniques in the proposed project.
    - Water from new sources: The amount of water necessary that can be specifically committed to this project.
- **Policy 3.** Require new development to be equipped with water conservation devices, including dual water systems where reclaimed wastewater can be economically provided.
- **Policy 4.** Work with the North of the River Sanitation District to facilitate the use of reclaimed wastewater.
- **Policy 5.** As a part of the City's environmental review process, evaluate potential water consumption of proposed uses, identifying uses that will consume large quantities of water, and apply appropriate mitigation measures to reduce water consumption.

- **Policy 6.** Cooperate with Kern County to ensure that all development projects within the Planning Area comply with discharge permit requirements established by the Regional Water Quality Control Board.
- **Policy 7.** Secure supplemental water supplies as needed to avoid groundwater overdraft.
- **Policy 8.** Protect existing water recharge facilities from incompatible land uses to ensure their continuing operation.
- **Policy 9.** Protect the existing groundwater basin by promoting informational programs on ways to reduce water usage in homes and businesses.
- **Policy 10.** Protect surface waters from the potentially adverse impacts associated with urban runoff.
- **Policy 11.** Promote the multiple use of surface water resources, such as combining water re-charge capacity in flood control basins, recreational areas, and waterfowl habitat areas.

Mineral Resources

- **Objective.** Provide for the proper management of mineral resources within the General Plan study area.
- **Policy 1.** Protect areas with significant mineral resources from incompatible uses.
- **Policy 2.** Ensure that the development of mineral extraction operations minimizes the impacts that the extraction operation will have on existing and future adjacent land uses.
- **Policy 3.** Protect the environment in and around mineral processing operations, including:
    - Minimizing the visual impacts of the processing operation;
    - Avoiding, whenever possible, the large-scale displacement or earth;
    - Protecting the watershed from runoff; and
    - Minimizing biological resource impacts.
- **Policy 4.** The locations of all oil or gas wells on proposed development sites shall be identified in development plans. Project sponsors of development containing existing or former oil or gas wells shall submit documentation demonstrating that all abandoned wells have been properly abandoned pursuant to the requirements of the California Department of Conservation Oil, Gas, and Geothermal Resources.

The above goals, objectives and policies established by the City of Shafter General Plan are complementary to sustainable groundwater management of the 7th Standard Annex Management Area relative to future land use development and conservation. Successful implementation of this Management Area Plan will help to ensure that the 7th Standard Annex Management Area groundwater supply is managed in a sustainable manner. Therefore, implementation of City of Shafter General Plan policies is not expected to affect the ability of the Management Area to achieve groundwater sustainability. Likewise, implementation of this Management Area Plan is not anticipated to affect the City of Shafter's water supply assumptions or land use plans.

4.3.3. Metropolitan Bakersfield General Plan

☑ 23 CCR § 354.8(f)(1)
☑ 23 CCR § 354.8(f)(2)
☑ 23 CCR § 354.8(f)(3)

The southeast portion of the 7th Standard Annex Management Area (approximately 320 acres) falls within the Metropolitan Bakersfield General Plan planning area (City of Bakersfield, 2016). The current City General Plan was first adopted in 2002 and updated in January 2016 (City General Plan). This section identifies relevant policies in the City General Plan that could potentially affect water management in the Management Area.

The City General Plan land use designations include primarily residential - low density, residential - rural, residential - suburban, resource - extensive, open space - slopes (areas with greater than equal to thirty percent slope), and open space (floodplains and resource management areas and agriculture uses). These designations are generally consistent with the predominantly agricultural land use within the 7th Standard Annex Management Area shown in **Figure PA-2**.

The Land Use Element (Chapter II) of the City General Plan includes the following goals, policies, and implementation measures that are related to groundwater or land use management, that could potentially influence the implementation of this Management Area Plan.

- **Goal 6.** Accommodate new development that is sensitive to the natural environment, and accounts for environmental hazards.
- **Policy 77.** Allow for the continuance of agricultural uses in areas designated for future urban growth.
- **Policy 79.** Provide for an orderly outward expansion of new "urban" development (any commercial, industrial, and residential development having a density greater than one unit per acre) so that it maintains continuity of existing development, allows for the incremental expansion of infrastructure and public services, minimizes impacts on natural environmental resources, and provides a high-quality environment for living and business.
- **Policy 80.** Assure that General Plan Amendment proposals for the conversion of designated agricultural lands to urban development occur in an orderly and logical manner giving full consideration to the effect on existing agricultural areas.
- **Implementation 7.** Environmental Review. Local guidelines for project processing shall reflect California Environmental Quality Act (CEQA) Guidelines which state that the environmental effects of a project must be taken into account as part of project consideration.

The Conservation Element (Chapter V) of the City General Plan includes the following goals, policies, and implementation measures that are related to groundwater or land use management, that could potentially influence the implementation of this Management Area Plan.

Mineral Resources

- **Goal 4.** Protect land, water, air quality and visual resources from environmental damage resulting from mineral and energy resource development.

Soils and Agriculture

- **Goal 2.** Promote soil conservation and minimize development of prime agricultural land.
- **Goal 3.** Establish urban development patterns and practices that promote soil conservation and that protect areas of agricultural production of food and fiber crops, and nursery products.
- **Policy 4.** Monitor the amount of prime agricultural land taken out of production for urban uses or added within the plan area
- **Policy 10**. Encourage landowners to retain their lands in agricultural production.
- **Policy 14.** When considering proposals to convert designated agricultural lands to nonagricultural use, the decision-making body of the City and County shall evaluate the following factors to determine the appropriateness of the proposal: Ability to be provided with urban services (sewer, water, roads, etc.).

Water Resources

- **Goal 1.** Conserve and augment the available water resources of the planning area.
- **Goal 2.** Assure that adequate groundwater resources remain available to the planning area.
- **Goal 3.** Continue cooperative planning for and implementation of programs and projects which will resolve water resource deficiencies and water quality problems.
- **Goal 5.** Achieve a continuing balance between competing demands for water resource usage.
- **Goal 6.** Maintain effective cooperative planning programs for water resource conservation and utilization in the planning area by involving all responsible water agencies in the planning process.
- **Policy 1.** Develop and maintain facilities for groundwater recharge in the planning area
- **Policy 2.** Minimize the loss of water which could otherwise be utilized for groundwater recharge purposes and benefit planning area groundwater aquifers from diversion to locations outside the area.
- **Policy 3.** Support programs to convey water from other than San Joaquin Valley basin sources to the planning area.
- **Policy 4.** Support programs and policies which assure continuance or augmentation of Kern River surface water supplies.
- **Policy 5.** Work towards resolving the problem of groundwater resource deficiencies in the upland portions of the planning area.
- **Policy 6.** Protect planning area groundwater resources from further quality degradation.
- **Policy 7.** Provide substitute or supplemental water resources to areas already impacted by groundwater quality degradation by supporting facilities construction for surface water diversions.
- **Policy 8.** Consider each proposal for water resource usage within the context of total planning area needs and priorities-major incremental water transport, groundwater recharge, flood control, recreational needs, riparian habitat preservation and conservation.
- **Policy 9.** Encourage and implement water conservation measures and programs.

- **Implementation measure 2.** Support all financially feasible and practical groundwater projects, for the augmentation of groundwater recharge for the south San Joaquin Valley basin by the construction and operation of additional recharge facilities or the importation of additional water for basin recharge.
- **Implementation measure 5.** Initiate and/or support planning, financing, construction and implementation programs for supplying upland portions of the planning area having groundwater deficiencies with an adequate water supply.
- **Implementation measure 10.** Support additional water conservation measures and programs of benefit to the planning area.

The above goals, policies and implementation measures established by the City General Plan are complementary to sustainable groundwater management of the 7th Standard Annex Management Area relative to future land use development and conservation. The City General Plan establishes as a general goal for groundwater management to reach a condition of "safe yield" for the groundwater basin. Furthermore, it acknowledges the need to provide a stable water supply and considers water resources as a major factor for development decisions. Successful implementation of this Management Area Plan will help to ensure that the 7th Standard Annex Management Area groundwater supply is managed in a sustainable manner. Therefore, implementation of City General Plan policies is not expected to affect the ability of the Management Area to achieve groundwater sustainability. Likewise, implementation of this Management Area Plan is not anticipated to affect the City's water supply assumptions or land use plans.

4.3.4. Well Permitting Process

☑ 23 CCR § 354.8(f)(4)

Well permits within the 7th Standard Annex Management Area are issued by the Kern County Public Health Services Department (KCPHSD) Water Well Program. The Water Well Program issues permits to construct, reconstruct and destroy water wells. All wells must be constructed in accordance with Kern County Ordinance Code, Section 14.08, and the State Department of Water Resources' Bulletin 74-81 and Bulletin 74-90, except as modified by subsequent revisions. The ordinance requires, among other things, that domestic and agricultural wells be installed a minimum distance from potential pollution and contaminant sources, water quality be tested for new and reconstructed wells, an NSF 61 Approved flowmeter be installed, and the final well construction be inspected by County staff. Recently, the KCPHSD released a supplemental well application for wells intended to be installed in overdrafted basins. This new form additionally requires water district and GSA information, and grants GSAs review power.

Executive Order (EO) N-7-22 was signed by Governor Newsom on 28 March 2022 and amends prior proclamations for states of emergency due to California's ongoing drought conditions. The KGA GSA, in coordination with other Basin GSAs, are working with the County of Kern to implement the EO's new well-permitting requirements

4.3.5. Implementation of Land Use Plans Outside the Basin

☑ 23 CCR § 354.8(f)(5)

Given that the 7th Standard Annex Management Area is located roughly in the center of the basin (inset on **Figure PA-1**), land use plans outside of the basin would not be expected to have any discernable

impacts on the ability of the Management Area to achieve sustainable groundwater management. Potential impacts to areas the basin boundaries are acknowledged in the KGA Umbrella GSA, Section 2.1.3.

4.4. Additional GSP Elements

☑ 23 CCR § 354.8(g)

Per California Water Code Section 10727.4, a GSP shall include, where appropriate and in collaboration with the appropriate agencies, all of the following:

1) Control of saline water intrusion

Because the basin is located far from coastal areas, seawater intrusion is not considered to be an issue and therefore no control measures for saline water intrusion have been established.

2) Wellhead protection

The Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct and destroy water wells (see **Section 4.3.4 *Well Permitting Process***).

3) Migration of contaminated groundwater

The mitigation, remediation, and management of groundwater contamination plumes is regulated in the basin by the CVRWQCB, Department of Toxic Substances Control (DTSC), and the County of Kern. As discussed in **Section 7.4.2 *Point-Source Contamination Sites***, there are no identified sites within the Management Area that would be expected to have a significant impact on groundwater.

4) Well abandonment and well destruction program

The Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct and destroy water wells (see **Section 4.3.4 *Well Permitting Process***).

5) Replenishment of groundwater extractions

The groundwater system underlying the 7th Standard Annex Management Area is recharged from several sources, including return flow from excessive irrigation water, percolation from the North of River Sanitary District (NORSD) unlined ponds, and percolation from precipitation (see **Section 6.3.4 *Recharge and Discharge Areas***).

6) Conjunctive use and underground storage

There are no formal conjunctive use conveyance systems within the 7th Standard Annex Management Area (see **Section 4.2.3 *Conjunctive Use in the 7th Standard Annex Management Area***). Portions of the Management Area obtains recycled water deliveries from the NORSD WWTP to offset groundwater use.

7) Well construction policies

The Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct and destroy water wells (see **Section 4.3.4 *Well Permitting Process***).

8) Groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects

There are no open groundwater contamination cleanup sites within the 7th Standard Annex Management Area[10] (see **Section 7.4.2 *Point-Source Contamination Sites*** for closed cleanup sites); oversight of groundwater contamination cleanup in this area is provided by the CVRWQCB, DTSC, and County of Kern.

SWID recently adopted a Buried Recharge policy that policy that allows for on-farm water banking within the District. Given this, the landowners in the Management Area may now purchase and recharge non-SWID water on their own properties, as well as those within the original SWID boundary.

While no formal water management efficiency program exists, individual growers have adapted water conservation and irrigation efficiency practices as part of their growing practices.

As discussed in **Section 6.3.6 *Source and Point of Delivery for Imported Water Supplies***, recycled water produced by the NORSD WWTP is used for crop irrigation within portions of the Management Area to offset the use of groundwater.

There are currently no conveyance or extraction projects underway in the Management Area; as discussed under **Section 16.2 *List of Projects and Management Actions,*** a new canal is contemplated as a potential management action for the Management Area.

9) Efficient water management practices

The 7th Standard Annex Management Area is included in the June 2014 Poso Creek IRWMP and the IRWMP is currently being updated (see **Section 4.2.2 *Water Management Programs in the 7th Standard Annex Management Area*)**. One of the primary goals of the IRWMP is to improve operational efficiency and flexibility. Additionally, the 7th Standard Annex Management Area has included management actions to improve water use efficiency in the proposed Projects and Management Actions described in **Section 16**.

10) Relationships with State and federal regulatory agencies

The 7th Standard Annex Management Area currently does not have any water supply contracts or other agreements with State and federal regulatory agencies.

11) Land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity

Applicable land use planning documents and processes are discussed in **Section 4.3 *Land Use Elements or Topic Categories of Applicable General Plans***.

12) Impacts on Groundwater Dependent Ecosystems

No Groundwater Dependent Ecosystems (GDEs) have been identified within the Management Area. An assessment of GDE presence is provided in **Section 7.7 *Groundwater Dependent Ecosystems***.

[10] One land disposal site and one oil and gas produced water pond sites are located within the Management Area and currently under active regulatory oversight; however, based on the available information these sites have not resulted in an impact to groundwater.

4.5. Notice and Communication

☑ 23 CCR § 354.10

SWID has developed a Stakeholder Communication and Engagement Plan (SCEP) for the 7th Standard Annex Management Area to fulfill notice and communication requirements. The SCEP is included herein as **Appendix A**. ~~Following the public process described herein, the SWID Board approved this MA Plan for inclusion in the KGA GSA Umbrella GSP by the SWID Board on 11 December 2019, as documented in .~~

In coordination with other basin GSAs, the MA Plan has been revised to address the 28 January 2022 comment letter from the California Department of Water Resources (DWR) entitled *Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin*. The amended version of this MA Plan (in response to DWR comments) was approved for inclusion in the KGA GSA Umbrella GSP by the SWID Board on 13 July 2022 (**Appendix G**).

4.5.1. Beneficial Uses and Users of Groundwater

☑ 23 CCR § 354.10(a)

Per 23-California Code of Regulations (CCR) §354.10(a), beneficial uses and users of groundwater shall include land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties. As part of the SCEP, beneficial uses and users of groundwater in the Management Area were identified (see SCEP Section 3), including agricultural users, domestic well owners, public water systems, local land use planning agencies, environmental users of groundwater, disadvantaged communities,[11] and groundwater monitoring entities. Additionally, a Stakeholder Constituency "Lay of the Land" exercise was developed which identified basin stakeholders, key interests and issues, and the level of engagement expected with each stakeholder (see SCEP Table 1). This exercise will be updated during select phases of GSP development and/or implementation. Beneficial users were assessed as part of the Sustainable Management Criteria development process. As discussed in **Section 12** through **Section 14**, beneficial users that could be impacted by each of the applicable Sustainability Indicators and potential effects of Undesirable Results on these beneficial users were identified, and how Minimum Threshold and Measurable Objective my affect the interests of beneficial users were evaluated.

4.5.2. Public Meetings Summary

☑ 23 CCR § 354.10(b)

The list below identifies public meetings, workshops, and direct outreach specific to GSP development, as of ~~July 2019~~June 2022.

[11] Based on DWR's definition of a DAC and the DAC Mapping Tool (https://gis.water.ca.gov/app/dacs/), the only area within the Management Area designated as a DAC at the Census Place level is the NORSD wastewater treatment plant property, as this property has been incorporated into the City of Shafter. Therefore, no DAC populations reside within the 7th Standard Management Area.

KGA GSA

KGA Stakeholder meetings are held the first Monday of each month at 3:30 p.m., at the Rosedale Rio-Bravo Water Storage District office (849 Allen Rd, Bakersfield).

KGA Board meetings are held at 8 a.m. on the fourth Wednesday of every month~~, at either the Kern County Supervisor's office (1115 Truxtun Avenue, Bakersfield) or the Greater Bakersfield Chamber of Commerce (1725 Eye Street, Bakersfield).~~. Location of the KGA Board meeting is determined and posted prior to each meeting.

The KGA has hosted numerous informational workshops and solicited comments in a variety of forums including on-line stakeholder surveys in both English and Spanish. Below is a list of the public workshops and meetings hosted to date by the KGA as part of the GSP development process. Refer to the KGA Umbrella GSP for additional information about these workshops:

- Stakeholder Workshop #1 – 24 October 2016
- Stakeholder Workshop #2 – 1 November 2016
- Stakeholder Workshop #3 – 15 November 2016
- Stakeholder Workshop #4 – 28 November 2016
- Stakeholder Workshop #5 – 5 December 2016
- Stakeholder Workshop #6 – 20 December 2016
- Groundwater Workshop #1 – 26 April 2018
- Groundwater Workshop #2 – 21 May 2018
- Stakeholder Meeting – 8 January 2018
- Stakeholder Meeting – 5 February 2018
- Stakeholder Meeting – 5 March 2018
- Stakeholder Meeting – 2 April 2018
- Stakeholder Meeting – 7 May 2018
- Stakeholder Meeting – 4 June 2018
- Stakeholder Meeting – 2 July 2018
- Stakeholder Meeting – 1 October 2018
- Stakeholder Meeting – 7 January 2019
- Stakeholder Meeting – 4 February 2019
- Stakeholder Meeting – 14 May 2019
- Stakeholder Meeting – 3 June 2019
- Stakeholder Meeting – 1 July 2019
- Stakeholder Meeting – 5 August 2019
- Stakeholder Meeting – 7 October 2019
- Stakeholder Meeting – 4 November 2019
- Informational Meeting on Sustainable Groundwater Plan, Compliance & State Intervention – 20 September 2018
- SGMA Open House (hosted with the Kern County Farm Bureau) – 14 May 2019
- GSP Public Review Open House – 26 September 2019

SWID Board Meetings

SWID Board meetings are open to the public and were previously held at 2:00 pm on the 2nd Tuesday of the month at the SWID District office (corner of Highway 43 and Kimberlina Road). Following July 2019, Board meetings are held at 9:00 am on the 2nd Wednesday of the month.

Annex Area Stakeholder Workshops

In order to inform the public on the Annex Area Management Area Plan development, the following public workshops were held at the Shafter Veterans Hall (309 California Avenue, Shafter):

- Annex Area Stakeholder Workshop 1 – 4 September 2018
- Annex Area Stakeholder Workshop 2 – 8 April 2019
- Annex Area Stakeholder Workshop 3 – 21 August 2019
- Annex Area Stakeholder Workshop 4 – 1 June 2022
- Annex Area Stakeholder Workshop 5 – 6 July 2022

It is anticipated that additional periodic workshops will be held to inform the public of progress on the implementation of the Annex Area Management Area Plan.

Direct Outreach to Annex Area Stakeholders

- Annex Landowner Committee Meetings (August 2018, December 2018, March 2019, July 2019~~),~~, and monthly meetings that are held every first Wednesday of a month since January 2020); Annual Report is distributed in these meetings
- Stakeholder Survey distribution and response (September 2018-November 2018); survey is available on the SWID website[12]
- Stakeholder data request distribution and response (September 2018-December 2018)
- Outreach to Superior Mutual Water Company, Annex Agricultural Landowner Committee, ~~and~~ Plains All American, and Dairy Council Group

Direct Outreach to and Coordination with Nearby Districts

- ~~Three~~Five meetings with Rosedale Rio-Bravo Water Storage District
- One meeting with North Kern Water Storage District
- One meeting with Buena Vista Water Storage District
- Two meetings with Semitropic Water Storage District
- Weekly meetings with other management areas and GSAs to address DWR's comment letter issued on 28 January 2022

4.5.3. Public Comments on the GSP / Management Area Plan

☑ 23 CCR § 354.10(c)

Table PA-1 below summarizes the public comments received in workshops and the SWID response. The majority of comments and feedback from stakeholders centered around interest in what options were available to them to increase supplies to the area in order to reach sustainability. These public workshops were used to discuss options and interest in such options, which were then incorporated into the Projects and Management Actions presented in **Section 16**. In addition, the landowners in the area chose to appoint an informal "Landowner Committee" of representatives to provide input and feedback throughout the Management Area Plan development process outside of the workshop setting. SWID and its consultants met with the Landowner Committee to discuss major findings related to major elements of the Management Area Plan and critical developments and decisions made at the KGA and basin level.

Written comments received on the Management Area Plan and responses to these are included in **Appendix B**. This includes written comments received both before and during the KGA GSA GSP 90-day public review and comment period. **Table PA-1** and **Appendix B** will continue to be updated as comments are received during GSP implementation period.

[12] http://www.swid.org/index.php/notices

Table PA-1. Public Comments on the Management Area Plan and SWID Responses

Public Comment	SWID Response
Public Workshop: How can we bring new water into the Management Area?	Several projects and management actions have been identified and may be pursued with the support of the 7th Standard Annex Area landowners and SWID Board. These include partnerships with other entities to utilize existing infrastructure for recharge, voluntary fallowing of lands, and new infrastructure projects such as the proposed Flat Rocks Canal or construction of recharge facilities within the Annex area.
Public Workshop: How is the Annex Area represented on the KGA Board?	SWID is a member of the KGA and has a seat on the KGA Board. With the completion of the annexation by SWID, SWID now represents the Annex Area.
Public Workshop: How does the Zone of Benefit fee that landowners pay get addressed within SGMA?	The landowners within the Management Area are a part of the KCWA Zone of Benefit (Zones 17 and 19) and pay a portion of the costs of State Water Project (SWP) deliveries to the basin, commensurate with the benefits they receive (KCWA, 2018). According to the Report to the Board of Directors of the Kern County Water Agency on Zones of Benefit for Fiscal Year 2019-20, these benefits include the "improvement in underground supplies" and higher water table elevations due to SWP imported to the basin, among others. The zones of benefit were established pursuant to the Kern County Water Agency Act (Statutes of 1961, Chapter 1003, as amended). This water is a portion of the groundwater inflows to the Management Area.
Public Workshop: If the landowners have an opportunity to buy water, how can it be banked such that the Annex Area receive credit for it?	Annex Area landowners can complete a transfer of water they obtain to the SWID system and receive a water banking credit, provided the correct conveyance is available to affect the water transfer. Landowners may also utilize SWID's new Buried Recharge Policy to bank and store water on private land.
Public Workshop: How much will this process cost?	Costs to implement the GSP and the identified projects and management actions. The costs are likely to be substantial and will require investment from the Annex Area landowners. Some grant funding is expected to be available from the State, but it should be noted that these grant processes are often highly competitive and no guarantees of funding amounts available to the Annex Area can be made.

4.5.4. Communication

☑ 23 CCR § 354.10(d)

The SCEP outlines SWID's communication goals for the 7th Standard Annex Management Area.

Decision-Making Process

The SCEP Section 2.2 outlines the decision-making process for the Management Area and the KGA GSA. Key Management Area Plan development and implementation decisions are made by the SWID Board of Directors. SWID Board and KGA GSA Board meetings schedule are provided in the SCEP Section 2.2.1 and 2.2.2.

Public Engagement Opportunities

The SCEP Section 6 discusses public engagement opportunities and SCEP Sections 5 and 6 discuss how public input and responses will be handled.

Stakeholder Involvement

The SCEP Section 5 outlines the ~~GSA's~~SWID's goals, including open and transparent engagement with diverse stakeholders. Additionally, SCEP Section 4 outlines describes the Stakeholder Survey which SWID used to gain additional knowledge on basin stakeholders. Specifically, results from 17 Stakeholder Survey responses received indicate that:

- Approximately 94% of stakeholders within the Management Area use groundwater; one user supplements groundwater with treated municipal ~~waste water~~wastewater (recycled water); approximately 55% of stakeholders are agricultural groundwater users; approximately 50% are domestic well users; approximately 10% of stakeholders are commercial or industrial users; and approximately 6% of users receive water from the Superior Mutual Water Company (SMWC).
- All but two stakeholders indicated some familiarity with SGMA regulations.
- Twelve stakeholders (71%) are currently engaged in groundwater management activities or discussions; one stakeholder (6%) is "slightly" engaged in groundwater management activities or discussions; and four stakeholders (24%) are not actively engaged in groundwater management activities or discussions.
- Eleven stakeholders have concerns about groundwater management, and topics of particular concern include:
    - The ability to continue farming and dairy operations;
    - The ability to continue industrial operations;
    - Protecting economic investments in land and potential for land to be devalued due to limited water availability;
    - Ensuring adequate water supply; and
    - Concerns that increased government regulation will affect the ability of water.

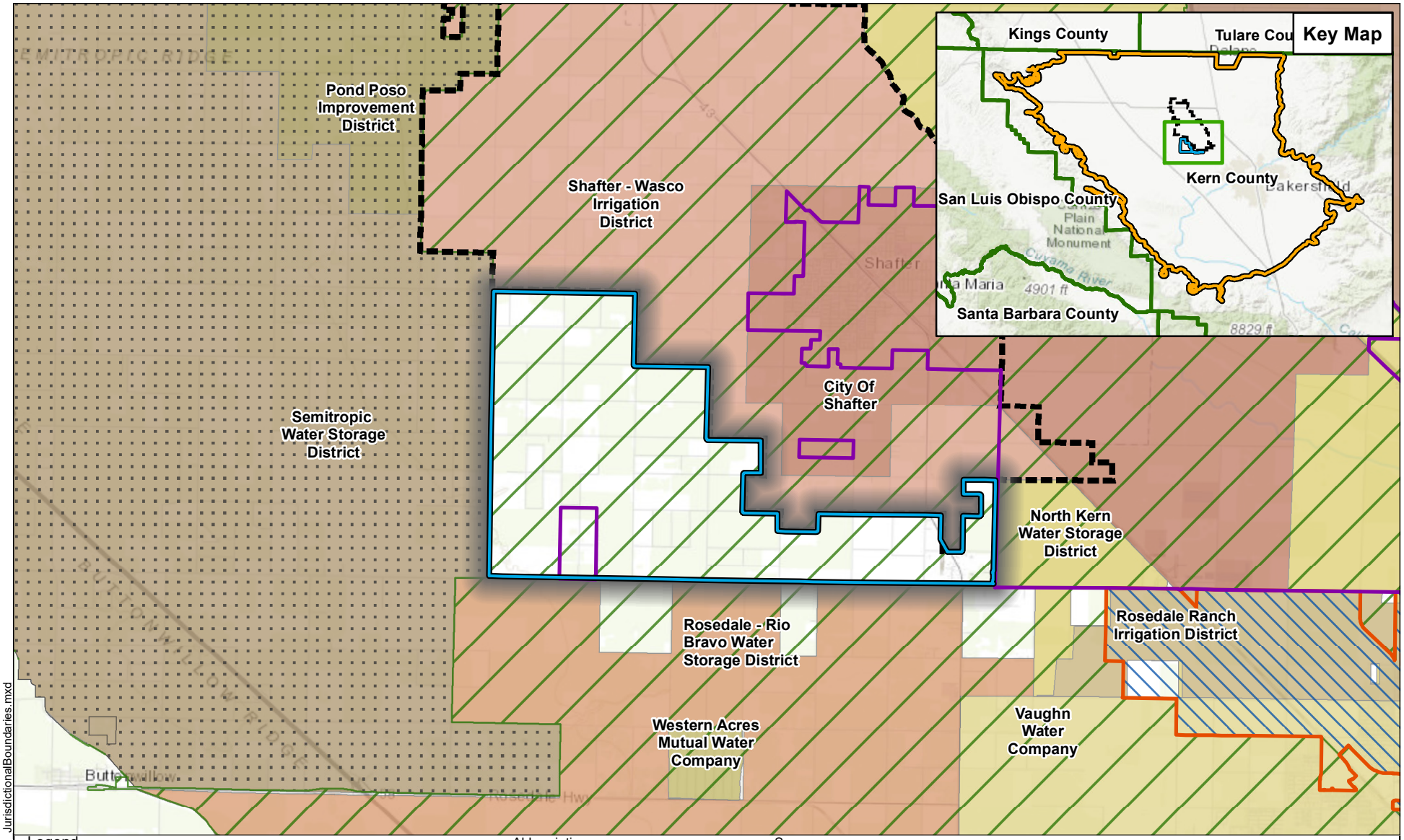
As a result of the Stakeholder Survey and outreach efforts, 15 stakeholders provided data on their wells for consideration and inclusion in the GSP. Data included well locations, well construction information, depth to water measurements, estimated pumping rates, lithologic and geophysical logs, water quality data, and pump tests. These data were added to the Management Area Data Management System (DMS) and considered during assessment of groundwater conditions (**Section 6.4**).

Public Notification

The Sections 5 and 6 of the SCEP detail the methodology that is being followed to inform the public on ~~GSP~~MA Plan updates, status, and actions.

Public Comment

Additional public comments received on draft Management Area Plan are listed in **Appendix B**, which will be updated and incorporated throughout the development process of the draft ~~Management Area~~MA Plan.


Pond Poso Improvement District
Shafter - Wasco Irrigation District
Semitropic Water Storage District
City Of Shafter
North Kern Water Storage District
Rosedale - Rio Bravo Water Storage District
Rosedale Ranch Irrigation District
Western Acres Mutual Water Company
Vaughn Water Company
Key Map
Kings County
Tulare Cou
Kern County
San Luis Obispo County
Santa Barbara County
Shafter
Bakersfield
Plain National Monument
4901 ft
8829 ft
Buttonwillow
Legend
County Boundary
Kern County Subbasin (DWR 5-022.14)
City of Shafter City Limits
City of Bakersfield City Limits
Shafter-Wasco Irrigation District
SWID 7th Standard Annex Management Area
GSA Name
Kern Groundwater Authority Groundwater Sustainability Agency
Kern River Groundwater Sustainability Agency
Semitropic Water Storage District
Abbreviations
DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency
SWID = Shafter-Wasco Irrigation District
Notes
1. All locations are approximate.
2. The pastel filled areas represent public and private water systems neighboring the Management Area.
3. The entire displayed area is coverd by the Kern County General Plan.
Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - 2018 Update.
3. List of GSA and Public and Private Water Systems are obtained from the GSA Map Viewer on 24 May 2018.
4. City of Bakersfield boundary was obtained from the City of Bakersfield Data Library on 27 November 2018.
5. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.
N
0
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3
(Scale in Miles)
Plan Area of SWID 7th Standard Annex Management Area and Relevant Boundaries
SWID 7th Standard Annex Management Area
December 2019
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Figure PA-1
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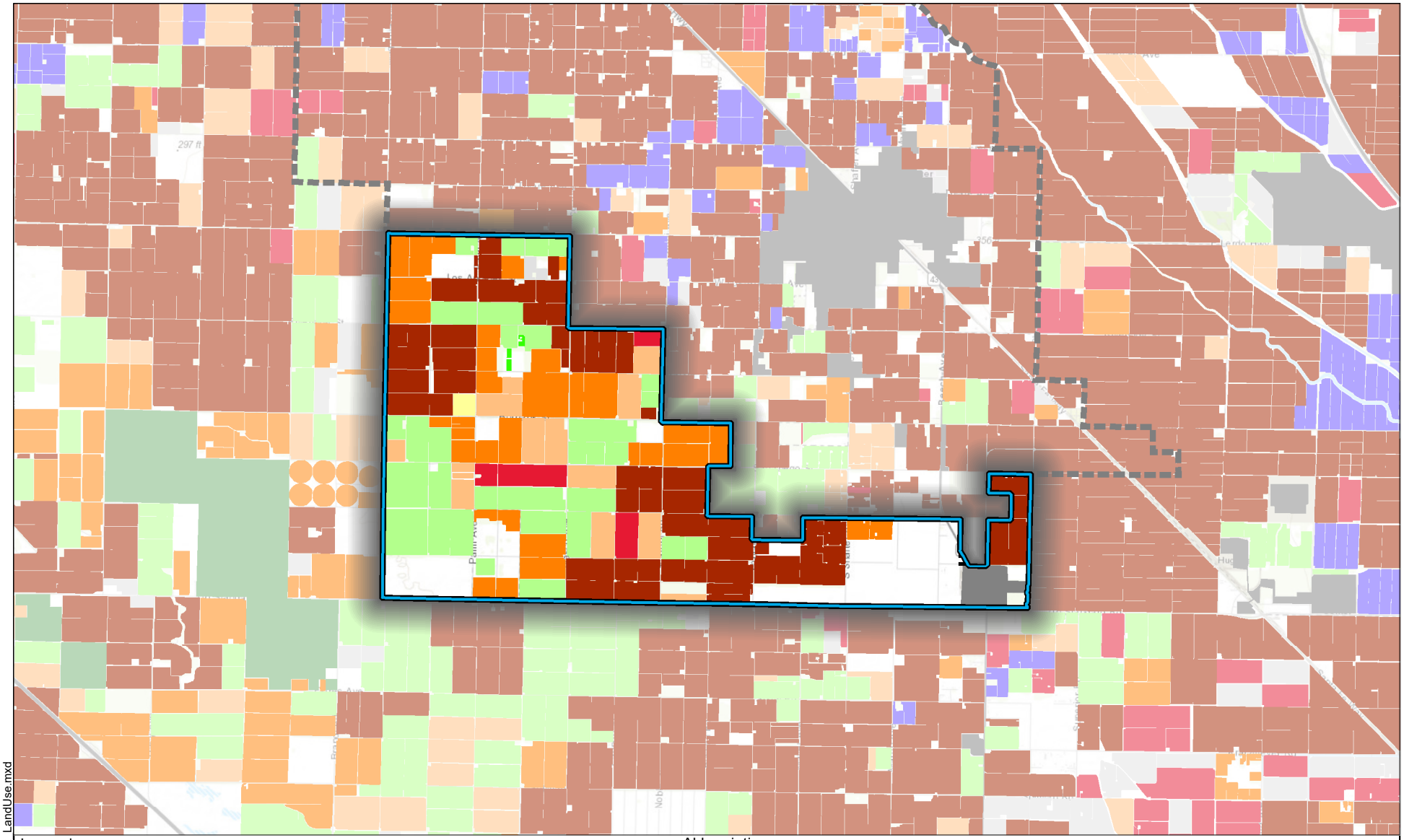

Legend

Shafter-Wasco Irrigation District

SWID 7th Standard Annex Management Area

2014 Land Use per DWR Crop Mapping

- Citrus and Subtropical
- Deciduous Fruits and Nuts
- Field Crops
- Grain and Hay Crops
- Idle
- Riparian Vegetation
- Pasture
- Rice
- Truck, Nursery, and Berry Crops
- Urban
- Vineyard
- Young Perennial

Abbreviations

DWR = Department of Water Resources
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. Land use data was obtained from the DWR Land Use Viewer accessed on 11 May 2018 (https://gis.water.ca.gov/app/CADWRLandUseViewer/).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

2014 Land Use

SWID 7th Standard Annex Management Area
December 2019
B80079.00

Figure PA-2

eki environment & water

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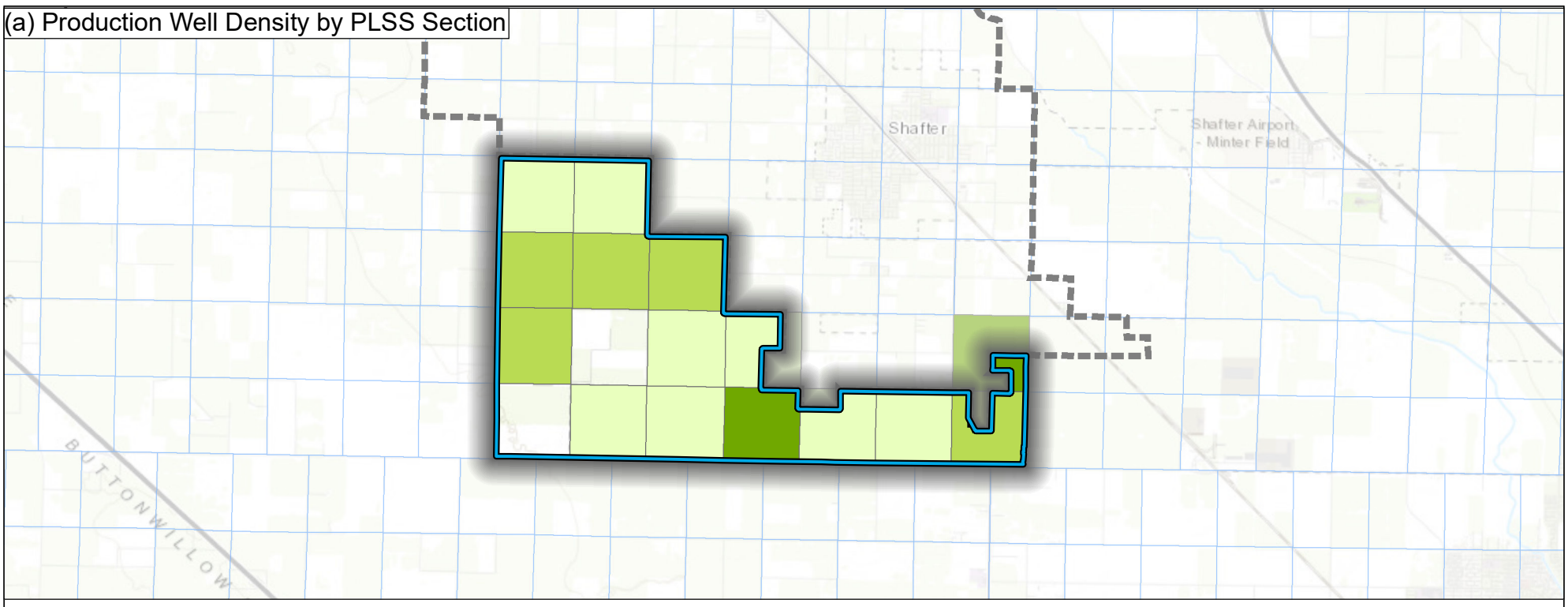
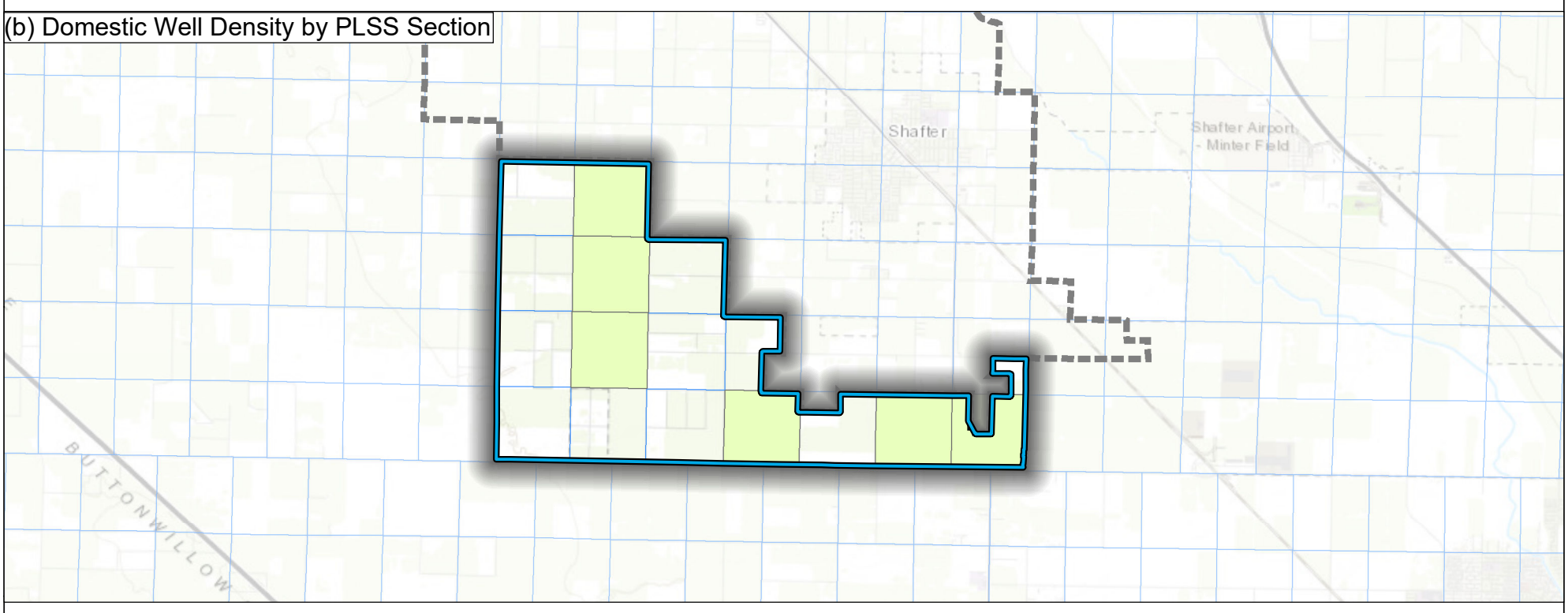
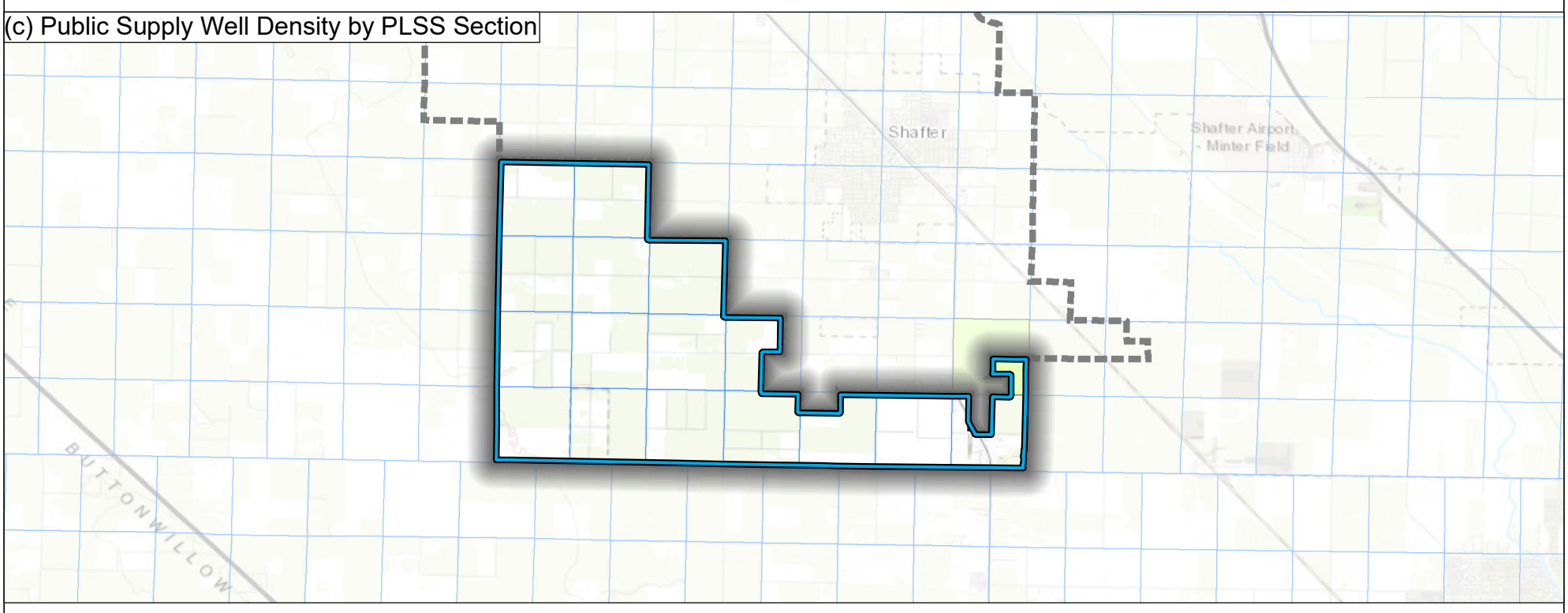
(a) Production Well Density by PLSS Section



(b) Domestic Well Density by PLSS Section



(c) Public Supply Well Density by PLSS Section



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- PLSS Section

Production Well Density per PLSS Section

- 1 - 3
- 4 - 5
- 6 - 7

Domestic Well Density per PLSS Section

- 1 - 2

Public Supply Well Density per PLSS Section

- 1

N

0 2 4

(Scale in Miles)

Abbreviations

DWR	= California Department of Water Resources
PLSS	= Public Land Survey System
SWID	= Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Well density per PLSS Section is shown in sections within the SWID 7th Standard Annex Management Area.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. Well Count per square mile (PLSS section) was obtained from Well Completion Report Map Application on 15 November 2018 (https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

Well Density

SWID 7th Standard Annex Management Area
December 2019
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Figure PA-3

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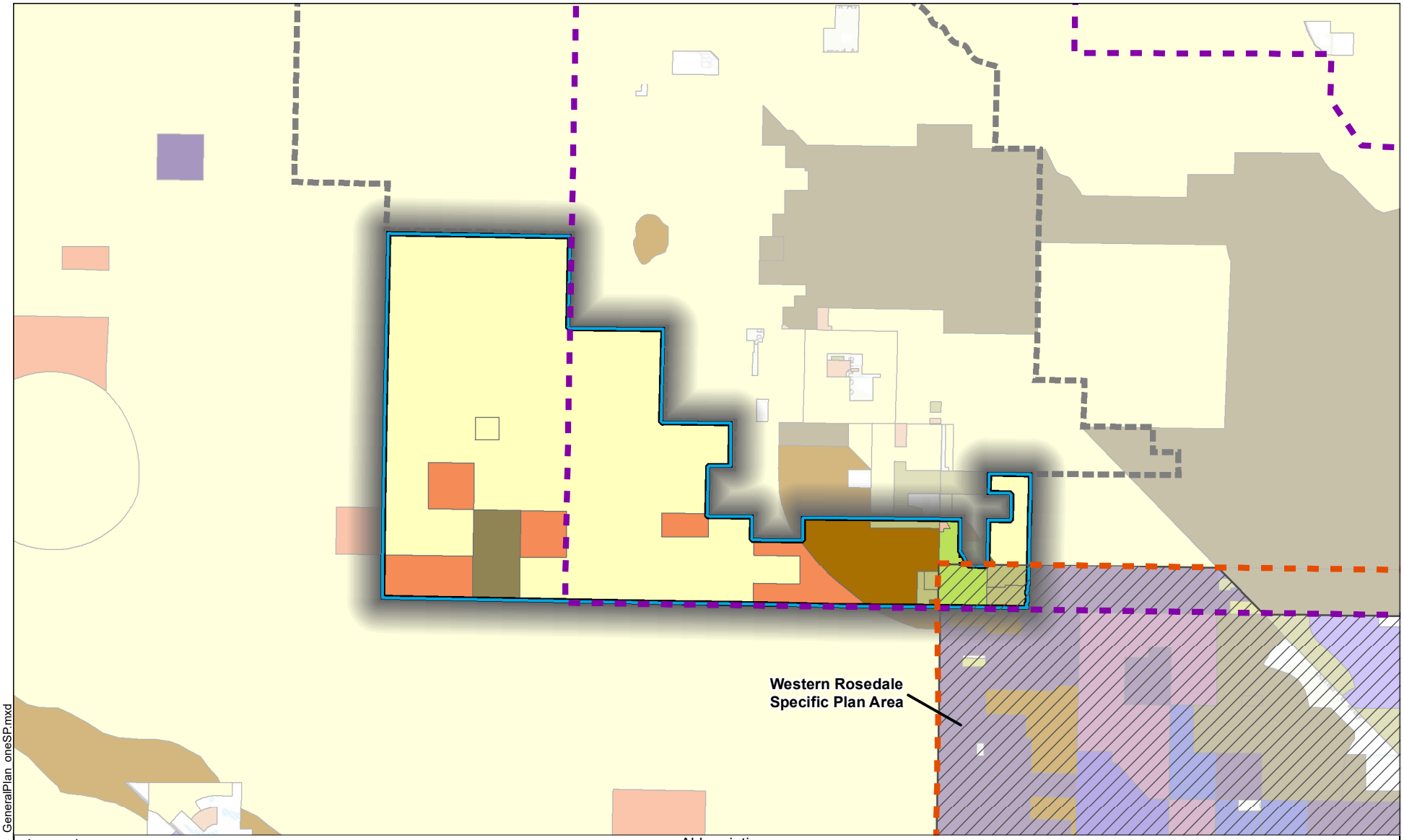

Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- City of Shafter General Plan Area
- City of Bakersfield General Plan Area
- Specific Plan Area

Kern County General Plan Land Use Designation

- Estate Residential
- Low Medium Density Residential
- Suburban Residential
- Intensive Agriculture
- Intensive Agriculture (Min. 20 Acre Parcel Size)
- Extensive Agriculture (Min. 20 Acre Parcel Size)
- Mineral and Petroleum
- Heavy Industrial
- Rural Residential
- Service Industrial
- Incorporated Cities
- Solid Waste Facilities
- Maximum 10 Units/Net Acre
- Light Industrial

Abbreviations

DWR = Department of Water Resources
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Kern County General Plan information obtained on 16 August 2018 from http://esps.kerndsa.com/gis/gis-download-data
2. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

Kern County General Plan Land Use Designation

SWID 7th Standard Annex Management Area
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Figure PA-4

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BASIN SETTING

5. INTRODUCTION TO BASIN SETTING

☑ **23 CCR § 354.12**

This section presents Basin Setting information for the 7th Standard Annex Management Area. As discussed previously in **Section 4**, the 7th Standard Annex Management Area is located between the historical Shafter-Wasco Irrigation District (SWID) boundary prior to the annexation of the 7th Standard Management Area (also designated as the SWID Management Area) and the 7th Standard Road, and comprises approximately 10,000 acres of the Kern Groundwater Authority (KGA) Groundwater Sustainability Agency (GSA) (**Figure HCM-1**). In some cases, Basin Setting information for areas proximal to, but outside of, the 7th Standard Annex Management Area is provided for context. Basin Setting information includes the Hydrogeologic Conceptual Model (HCM), Groundwater Conditions, and Water Budget.

It is recognized that additional, more recent data (i.e., through 2022) are available at the time of preparation of this amended Management Area (MA) Plan. However, as the MA Plan does not constitute a five-year update to a GSP, but rather a response to the California Department of Water Resources (DWR) determination letter, those additional data are not incorporated herein, with minor exceptions

6. HYDROGEOLOGIC CONCEPTUAL MODEL

☑ 23 CCR § 354.14(a)

This section presents HCM for the 7th Standard Annex Management Area. As described in the *Hydrogeological Conceptual Model Best Management Practices* (BMP) document (California Department of Water Resources [DWR], 2016a), an HCM provides, through descriptive and graphical means, an understanding of the physical characteristics of an area that affect the occurrence and movement of groundwater, including geology, hydrology, land use, aquifers and aquitards, and water quality. This HCM serves as a foundation for subsequent Basin Setting analysis including water budgets (**Section 8**), the development of sustainable management criteria (**Sections 10** through **14**), and monitoring network development (**Section 15**). The HCM information presented herein is supplemental to the HCM provided in the KGA Umbrella Groundwater Sustainability Plan (GSP) and provides refined detail on HCM topics specific to the Management Area.

6.1. General Description

☑ 23 CCR § 354.14(b)

6.1.1. Geological and Structural Setting

☑ 23 CCR § 354.14(b)(1)

The 7th Standard Annex Management Area is located in the southern end of the San Joaquin Valley. The San Joaquin Valley is the portion of California's Central Valley that lies south of the San Joaquin/ Sacramento River Delta. The San Joaquin Valley is a structural trough filled with tens of thousands of feet of Cenozoic continental and shallow marine sedimentary deposits shed from the surrounding mountains, which include the Sierra Nevada Mountains to the east, the Coast Range Mountains to the west, and the San Emigdio and Tehachapi Mountains to the south (Davis et al., 1959). The structural trough is asymmetric, with its axis located west of the valley's centerline at land surface (Scheirer, 2013). The reader is referred to the basin-wide geologic and structural setting discussion included in the KGA's Umbrella GSP for additional information and figures.

6.1.2. Lateral Basin Boundaries

☑ 23 CCR § 354.14(b)(2)

This Management Area Plan (MA Plan) covers only the 7th Standard Annex Management Area (see **Figure HCM-1**), which is an approximately 10,000-acre area located entirely within the larger Kern County Subbasin. The 7th Standard Annex Management Area does not coincide with any part of the Kern County Subbasin boundary, and therefore a complete discussion of the lateral basin boundaries is not provided herein, but rather in the KGA Umbrella GSP.

6.1.3. Bottom of the Basin

☑ 23 CCR § 354.14(b)(3)

As noted above, the southern San Joaquin Valley is a deep structural trough filled with a thick sequence of Tertiary sediments including sandstone, siltstone, shale, and conglomerate. Different approaches and sources of information can be used to define the "bottom of the basin" for purposes of SGMA, including (a) information on the base of fresh water; (b) the presence, location and depth of oil and gas fields; and (c) depth of groundwater extraction.

The KGA Umbrella GSP identifies the bottom of the basin by two methods: (1) the depth of groundwater with a specific conductance (SpC) less than 3,000 micromhos per centimeter (µmhos/cm) and/or total dissolved solids (TDS) concentrations less than 2,000 milligrams per liter (mg/L), as determined by Page (1973) and (2) the depth of groundwater with a TDS of 10,000 mg/L (or base of Underground Sources of Drinking Water [USDW]) as identified in recent research on the basin by Gillespie et. al. (2017). This and additional datasets relevant to identification of the bottom of the basin beneath the Management Area are summarized in **Table HCM-1**.

As shown on **Figure HCM-2**, the base of fresh groundwater within and proximate to the 7th Standard Annex Management Area is estimated by Page (1973) to range from approximately -2,200 to -700 feet mean sea level (ft msl). Based on this, there is a significant decrease in the bottom of the basin elevation from west to east. This is generally consistent with local data provided by stakeholders, including depth of groundwater pumping and water quality data, as well as the base of freshwater recorded in Division of Oil, Gas, and Geothermal Resources (DOGGR) oil field records (see **Figure HCM-3**). The DOGGR records indicate that the base of fresh groundwater in the western portion of the Management Area is approximately -1,200 ft msl, which is deeper than indicated by Page (1973), but reflects the trend of decreasing depth from west to east. The base of USDW within and proximate to the 7th Standard Annex Management Area is estimated to range from approximately -2,500 to -1,800 ft msl (Gillespie et al. 2017), which shows a similar trend that the bottom of basin decreases from west to east across the Management Area.

The HCM BMP (DWR, 2016a) states that "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions" (DWR, 2016a). Basin representation within groundwater flow models, specifically the DWR California Central Valley Groundwater-Surface Water Simulation Model Fine Grid Beta version (C2VSim-FG, Beta version), reflects similar bottom of the basin depths as identified in the KGA Umbrella GSP.[13] Based on C2VSim-FG, the depth of the bottom of Layer 2 (the deepest pumped layer in the model) is approximately -1,000 to -720 ft msl and appears to capture the majority of well depths within the 7th Standard Annex Management Area.

Taken together, the available data sources reflect a similar range of depths for the bottom of the basin, generally consistent with the bottom of basin as identified in the KGA Umbrella GSP, with the basin bottom being significantly deeper in the eastern portion of the Management Area than it is in the western portion.

[13] C2VSim has been developed over many years and iterations, and the most current "full release" of the model is the coarse-grid (CG) version R374, released June 2013[13]. The new fine-grid (FG) version of C2VSim, released by DWR as a "beta" version (i.e., still under development) in May 2018, is undergoing further calibration with a full release expected in 2019. http://baydeltaoffice.water.ca.gov/modeling/hydrology/C2VSim/index_C2VSIM.cfm

Table HCM-1. Information Relevant to Definition of the Bottom of the Basin

Type of Information/ Source(s)	Approximate Range within the 7th Standard Annex Management Area	
	Elevation Range (ft msl)	Depth Range (ft bgs)
Base of Fresh Water *Page, 1973 (KGA Umbrella GSP)*	-700 to -2,200	1,010 to 2,540
Base of USDW *Gillespie et. al., 2017 (KGA Umbrella GSP)*	-1,800 to -2,500	2,100 to 2,830
Oil Field Base of Fresh Water Information *DOGGR, 1998*	Garrison City (Abd; northwest of Management Area): -1,250	1,550
	Shafter Southeast Gas (Abd; north of central Management Area): -1,170	1,500
	Rio Bravo (eastern side of Management Area): -1,670 to -2,170	2,000 to 2,500
	Greeley (southeast of Management Area): -2,070	2,400
Deepest GW Extractions from Well Construction Information *Stakeholder-Provided Data, 2018*	-710	1,030
Deepest GW Extractions from Regional Groundwater Model *Brush et al., 2016; DWR, 2018*	-1,025	1,353

Abbreviations: Abd = Abandoned; GW = groundwater
Note: Shaded cells indicate estimated values based on approximate ground surface elevation.

6.1.4. Principal Aquifer(s) and Aquitard(s)

☑ 23 CCR § 354.14(b)(4)

The KGA Umbrella GSP describes the principal alluvial aquifer system of the Kern County Subbasin, including the aquifer and aquitard physical properties, specific yield and storage, general water quality, and beneficial uses. The 7th Standard Annex Management Area is located roughly in the center of the basin and primarily overlies the Tulare formation, Kern River formation, and Chanac Formation at deeper depths. Collectively these units are generally considered to be functioning as a single principal aquifer system in the Management Area. This is particularly the case given that the 7th Standard Annex Management Area is located near the eastern boundary of the Corcoran clay layer (see **Figure HCM-4**), which is a significant confining and semi-confining aquitard encountered in the western and southern portions of the basin. Relevant aquifer characteristics specific to the 7th Standard Annex Management Area, including a discussion of the regional Corcoran clay layer, are discussed below. The surficial geology

within the 7th Standard Annex Management Area is discussed further below in **Section 6.3 *Physical Characteristics***.

Physical Properties of Aquifer(s) and Aquitard(s)

☑ **23 CCR § 354.14(b)(4)(B)**

The range of lithologies and grain sizes vary significantly across the basin and are summarized in the KGA Umbrella GSP. Specific data are not available: therefore, hydraulic conductivity and storage parameters for the principal aquifer in the vicinity of the 7th Standard Annex Management Area are estimated based on the DWR's "beta" version of the C2VSim-FG and are presented in **Table HCM-2** below. This table summarizes the hydraulic property information for C2VSim-FG nodes in Layers 1 and 2 within the 7th Standard Annex Management Area. **Figure HCM-5** shows selected hydraulic property values for the 14 C2VSim-FG nodes within the Management Area, including hydraulic conductivity for Layers 1 and 2, specific yield for Layer 1, and specific storage for Layer 2.

Table HCM-2. Hydraulic Properties Extracted from C2VSim-FG Model

Parameter	C2VSim-FG (Beta version)
Number of Nodes within the 7th Standard Annex Management Area	14
Layer 1 Node Properties: Average (Min to Max)	
Hydraulic Conductivity (ft/day)	28.7 (21.9 to 45.2)
Specific Yield (-)	0.085 (0.081 to 0.093)
Specific Storage (-)	N/A
Layer 2 Node Properties: Average (Min to Max)	
Hydraulic Conductivity (ft/day)	13.9 (13.2 to 14.6)
Specific Yield (-)	0.080 (0.079 to 0.081)
Specific Storage (-)	0.0015 (0.0014 to 0.0015)

ft/day = feet per day
N/A = not applicable

As shown in the table above, the upper unconfined zone, represented by Layer 1 in the C2VSim-FG, is somewhat more permeable than the confined zone represented by Layer 2. However, these values may change in C2VSim-FG upon completion of model calibration by DWR. In Layer 1 (an unconfined system), the specific yield in the central portion of the 7th Standard Annex Management area is about 0.09, whereas it is about 0.08 in the eastern and western portions. Specific storage in Layer 2 (a confined system) is generally consistent throughout the 7th Standard Annex Management Area, with a value of 0.0015 in the northern and eastern portions of the 7th Standard Annex Management Area and 0.0014 in the southwestern portion.

Structural Properties of the Basin that Restrict Groundwater Flow Within the Principal Aquifer(s)

☑ 23 CCR § 354.14(b)(4)(C)

As discussed above and in the KGA Umbrella GSP, the Corcoran clay acts as a regional aquitard that limits vertical flow to some extent between the unconfined and confined portions of the aquifer western and southern portions of the basin. Above the Corcoran clay (and where it does not exist) groundwater occurs under unconfined conditions (Croft, 1972).

As shown on **Figure HCM-4**, available sources indicate that the eastern edge of the Corcoran clay is located in the vicinity of the Management Area, but significant uncertainty exists regarding its exact boundary and depth (Page, 1986; DWR, 1981; Pacific Geotechnical Associates, Inc. [PGA], 1991). A study of regional geologic structure conducted for the Kern County Water Agency (KCWA)[14], reflects very similar uncertainties, indicating that Corcoran clay may be present in the western portion of the Management Area at a depth of 200 feet below ground surface (ft bgs), but that the edge of the clay is not well defined in this area (PGA, 1991). Well construction reports for wells within the area note that Corcoran clay (which is generally described as "blue clay" in well driller logs [Croft, 1972]) is present, but the depths and locations indicate that the clay is discontinuous.[15] Taken together, the available information does not suggest that a significant or continuous layer of Corcoran clay is present beneath the 7th Standard Annex Management Area and therefore only one principal aquifer is assumed to be present for purposes of SGMA compliance.

General Water Quality of the Principal Aquifer(s)

☑ 23 CCR § 354.14(b)(4)(D)

The KGA Umbrella GSP provides a discussion of the general water quality in the basin, including maps and data of the primary constituents of concern in the basin: TDS, nitrate, and arsenic. A more detailed discussion of groundwater quality issues in the 7th Standard Annex Management Area is provided further below in **Section 7.4 *Groundwater Quality Concerns***.

Primary Uses of Each Aquifer

☑ 23 CCR § 354.14(b)(4)(E)

The predominant use of groundwater from the principal aquifer in the 7th Standard Annex Management Area is for irrigated agriculture. This includes groundwater pumped by individual landowners for use on their crops. There are also several known domestic wells in the 7th Standard Annex Management Area, but the full extent and distribution of active domestic wells within the Management Area is currently unknown. Three commercial dairies, a natural gas fractionation and isomerization plant and other industrial land uses are present within the 7th Standard Annex Management Area, as well as a small public water system (the Superior Mutual Water Company).

[14] KCWA Study of the Regional Geologic Structure Related to Groundwater Aquifers in the Southern San Joaquin Valley Groundwater Basin was prepared by the Pacific Geotechnical Associates, Inc. (PGA) in 1991.

[15] The well construction report for a well located at the southeast corner of Poplar Avenue and Cobra Court within the 7th Standard Annex Management Area indicates that clay is present between 420 ft to 460 ft below ground surface (bgs). The well completion report for a well located at the northwest corner of 7th Standard Road and Scaroni Road, approximately 1 mile to the west of the well at Poplar Avenue and Cobra Court, indicates that Corcoran clay is present between 723 to 773 ft bgs.

6.2. Cross-Sections

☑ 23 CCR § 354.14(c)

The KGA Umbrella GSP includes two hydrogeologic cross-sections (A-A' and B-B'), which are both located in close proximity to the 7th Standard Annex Management Area. The location of these cross-sections relative to the 7th Standard Annex Management Area is shown on **Figure HCM-6**. The development and interpretation of these cross-sections is discussed in the KGA Umbrella GSP. The cross-sections incorporate the following:

- General lithology from well drilling logs;
- Surficial geologic along with folds and faults by the California Geological Survey;
- The approximate depth of the top and bottom of the Corcoran Clay from several sources;
- Groundwater surface for Spring 2016, and land surface;
- Base of fresh water mapped by the United States Geological Survey (USGS); and
- GIS sourced land surface elevations.

Information presented in the above referenced cross-sections is in general agreement with the understanding of conditions within the Management Area and no refinements or additional cross sections have been made herein.

6.3. Physical Characteristics

☑ 23 CCR § 354.14(d)

6.3.1. Topographic Information

☑ 23 CCR § 354.14(d)(1)

Figure HCM-8 shows the topography within the 7th Standard Annex Management Area. Topography in the Management Area is generally flat, with a gradual slope from approximately 330 ft msl in the northeast to approximately 300 ft msl in the southwestern portion of the Management Area.

6.3.2. Surficial Geology

☑ 23 CCR § 354.14(d)(2)

The KGA Umbrella GSP includes information and map figures on surficial geology throughout the basin. As shown on **Figure HCM-6** and **Figure HCM-7**, the predominant surficial geologic unit of the 7th Standard Annex Management Area is Pleisto-Holocene unconsolidated and semi-consolidated alluvium, and is generally located at the confluence of the Poso Creek and Kern River alluvial fans (California Geological

Survey [CGS], 2010). Other surficial geologic units in vicinity of the Management Area include older Quaternary alluvium, and Plio-Pleistocene loosely consolidated sandstone[16].

6.3.3. Soil Characteristics

☑ 23 CCR § 354.14(d)(3)

The KGA Umbrella GSP includes information and map figures on soil characteristics throughout the basin. As shown on the figure of soils of Kern County Subbasin in the KGA Umbrella GSP, the predominant soil type within the 7th Standard Annex Management Area is Aridisol soils, which are arid soils containing high levels of calcium carbonates, gypsum, and sodium. Entisol soils, which exhibit little to no soil development other than the presence of a horizon due to recent deposition or active erosion under extreme wet or dry conditions, are also present in the vicinity of the Management Area[17].

Figure HCM-9 shows the predominant soil map units and hydrologic soil group designations per the U.S Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) Soil Survey Geographic Database (SSURGO). The northern portion of the 7th Standard Annex Management Area consists predominantly of clay loam soil of hydrologic soil groups B and C and the southern portion of the Management Area consists predominantly of silt loam of hydrologic soil group D. Hydrologic soil groups B and C indicate soils with moderate and slow infiltration rates, respectively, and corresponding moderately low and moderately high runoff potential, respectively. Hydrologic soil group D indicates soils with very slow infiltration rates, and high runoff potential.

6.3.4. Recharge and Discharge Areas

☑ 23 CCR § 354.14(d)(4)

The groundwater system underlying the 7th Standard Annex Management Area is recharged from several sources, including return flow from excess irrigation water applied to agricultural lands (i.e., due to inherent irrigation inefficiency), and percolation from the North of River Sanitary District (NORSD) unlined ponds located within the Management Area. The NORSD facility is identified on **Figure HCM-10**. Recharge of precipitation via deep percolation likely occurs primarily during particularly wet time periods and is likely more limited during normal and dry periods.

Discharge of groundwater is predominantly through groundwater pumping from wells. Because water levels are far below the land surface, no significant springs, seeps, or wetlands exist within the 7th Standard Annex Management Area.

Outside of the 7th Standard Annex Management Area, recharge areas include spreading grounds associated with water banking operations conducted by others and agricultural lands, and discharge areas are primarily to groundwater supply and recovery wells. These facilities are identified and mapped in the KGA Umbrella GSP.

[16] The KGA Umbrella GSP presents surficial geology within the KCS as documented by a variety of previous investigations (Bartow, 1991; Page, 1986; and CGS, 2010).
[17] The KGA Umbrella GSP presents the soil distribution within the basin as defined by U.S. Dept. of Agriculture (USDA), National Resources Conservation Service, Soil Survey Geographical Database (SSURGO) as obtained from the DWR SGMA Data Viewer website (2018).

6.3.5. Surface Water Bodies

☑ 23 CCR § 354.14(d)(5)

Based on mapping by the USGS National Hydrograph Dataset (NHD) and as show on the figure of surface water features in the KGA Umbrella GSP, two small ephemeral streams are present in the southwestern portion of the 7th Standard Annex Management Area (NHD, 2018). The ephemeral streams are mapped by the USGS as being largely within actively farmed areas and/or the NORSD wastewater treatment plant property. No other natural surface water bodies are present in the Management Area.

6.3.6. Source and Point of Delivery for Imported Water Supplies

☑ 23 CCR § 354.14(d)(6)

The 7th Standard Annex Management Area does not directly receive any imported water supplies other than treated municipal wastewater (i.e., recycled water). The NORSD Wastewater Treatment Plant (WWTP), located in the southwestern portion of the Management Area, receives municipal wastewater from the unincorporated community of Oildale and the northern portion of County Service Area 71 (CSA 71), which includes portions of the City of Shafter and the City of Bakersfield.[18] The source of the potable water served in this area is a blend of groundwater from those areas and treated surface water from the KCWA Henry C. Garnett Water Purification Plant. Treated wastewater from the NORSD WWTP is stored in unlined ponds within the Management Area and is also used to irrigated crops within the Management Area (**Figure HCM-1**). Prior to the construction of the NORSD WWTP in 1999 lands in the 7th Standard Annex Management Area received recycled water from the predecessor WWTP in Oildale (i.e., since the early 1950s).

While the Management Area does not receive imported surface water supplies directly, the landowners within the Management Area are a part of the KCWA Zone of Benefit (Zones 17 and 19) and pay a portion of the costs of State Water Project (SWP) deliveries to the basin, commensurate with the benefits they receive (KCWA, 2018). According to the Report to the Board of Directors of the Kern County Water Agency on Zones of Benefit for Fiscal Year 2019-20, these benefits include the "improvement in underground supplies" and higher water table elevations due to SWP imported to the basin, among others. The zones of benefit were established pursuant to the Kern County Water Agency Act (Statutes of 1961, Chapter 1003, as amended) and originally included ten zones; in 1983, this process and set of zones were revised to the process currently in use today (KCWA, 2018).

6.4. Data Gaps

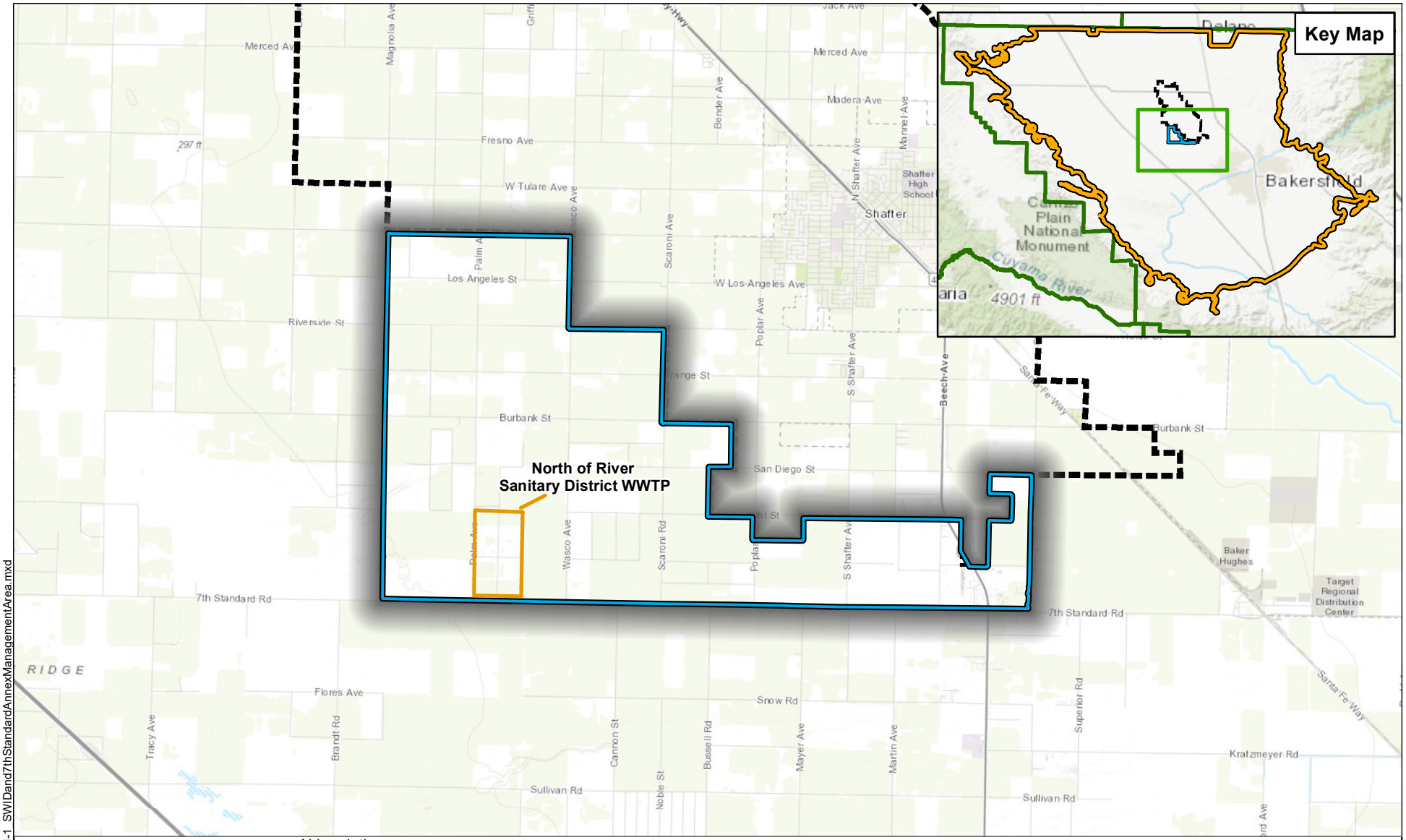
☑ 23 CCR § 354.14(b)(5)

Several data gaps and uncertainties have been identified during development of this HCM for the 7th Standard Annex Management Area. These include:

- Uncertainty in hydraulic properties (hydraulic conductivity, specific yield) of the principal aquifer;

[18] Service area of the NORSD is obtained from the NORSD Master Sewer Plan Update published on 30 March 2018.

- Uncertainty in the degree to which the Corcoran clay represents a confining layer in this area;
- Uncertainty about well construction details, including well screen intervals (i.e., many available well logs are old and no longer legible, or the well logs cannot be accurately mapped to the correct well location);
- Uncertainty about well location and status (i.e., whether or not certain wells are active); and
- Uncertainty about total groundwater usage from the principal aquifer.



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Legend

- County Boundary
- Kern County Subbain (DWR 5-022.14)
- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

Abbreviations

DWR	= California Department of Water Resources
SWID	= Shafter-Wasco Irrigation District
WWTP	= Wastewater Treatment Plant

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

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(Scale in Miles)

SWID 7th Standard Annex Management Area

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SWID 7th Standard Annex Management Area
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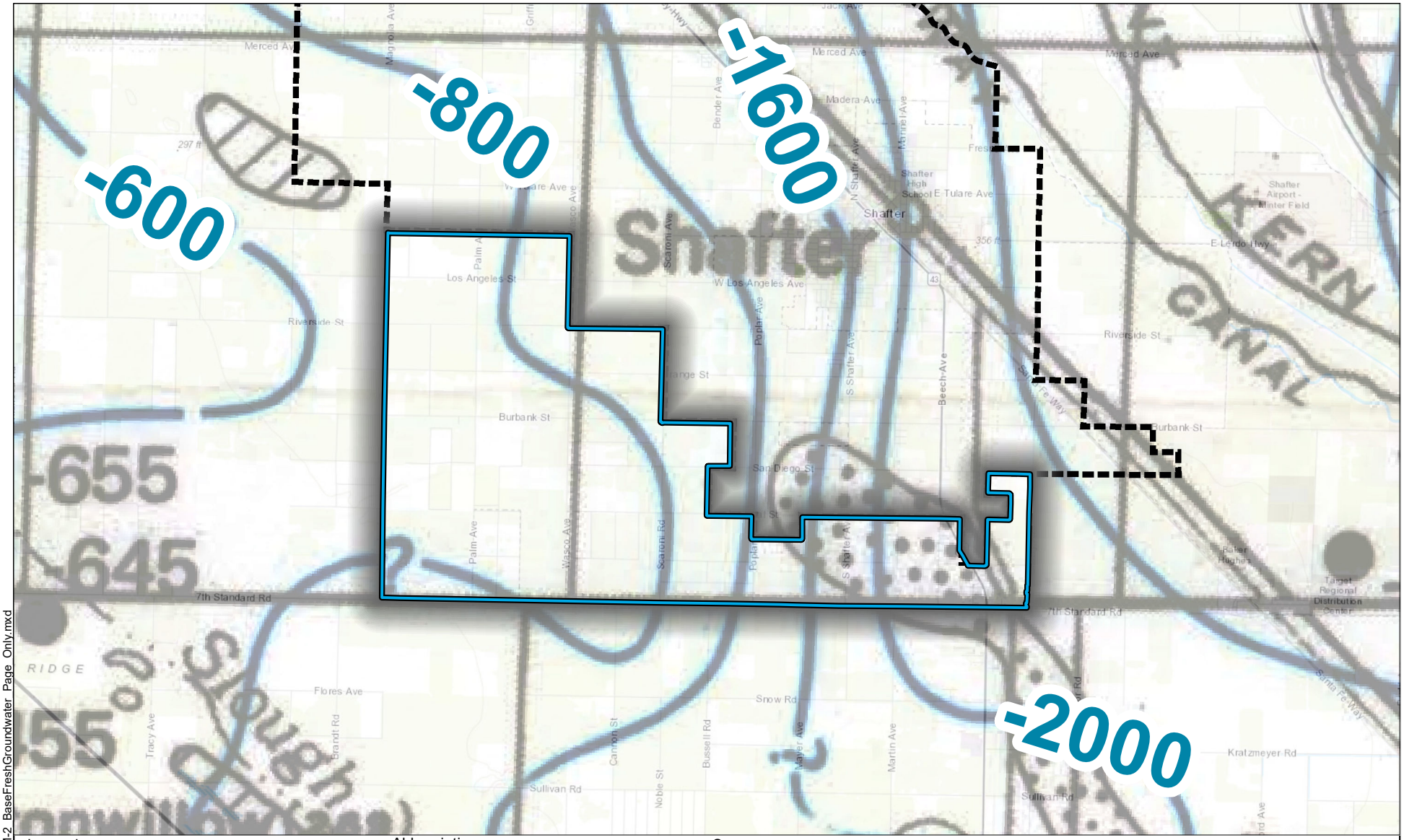
Figure HCM-1



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Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Base of Fresh Groundwater (ft msl)
- Oil Field
- Gas Field

Abbreviations

DWR	= California Department of Water Resources
ft msl	= feet above mean sea level
SWID	= Shafter-Wasco Irrigation District
USGS	= United States Geological Survey

Notes

1. All locations are approximate.
2. Contour lines show the bottom of basin based on the base of freshwater as determined by Page (1973), as mapped in the KGA Umbrella GSP.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.
3. Page, R.W., 1973, Base of Fresh Ground Water (Approximately 3,000 Micromhos) in the San Joaquin Valley, California, U.S. Geological Survey Hydrologic Investigations Atlas HA-489.

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(Scale in Miles)

Bottom of Basin Based on Base of Fresh Groundwater

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SWID 7th Standard Annex Management Area
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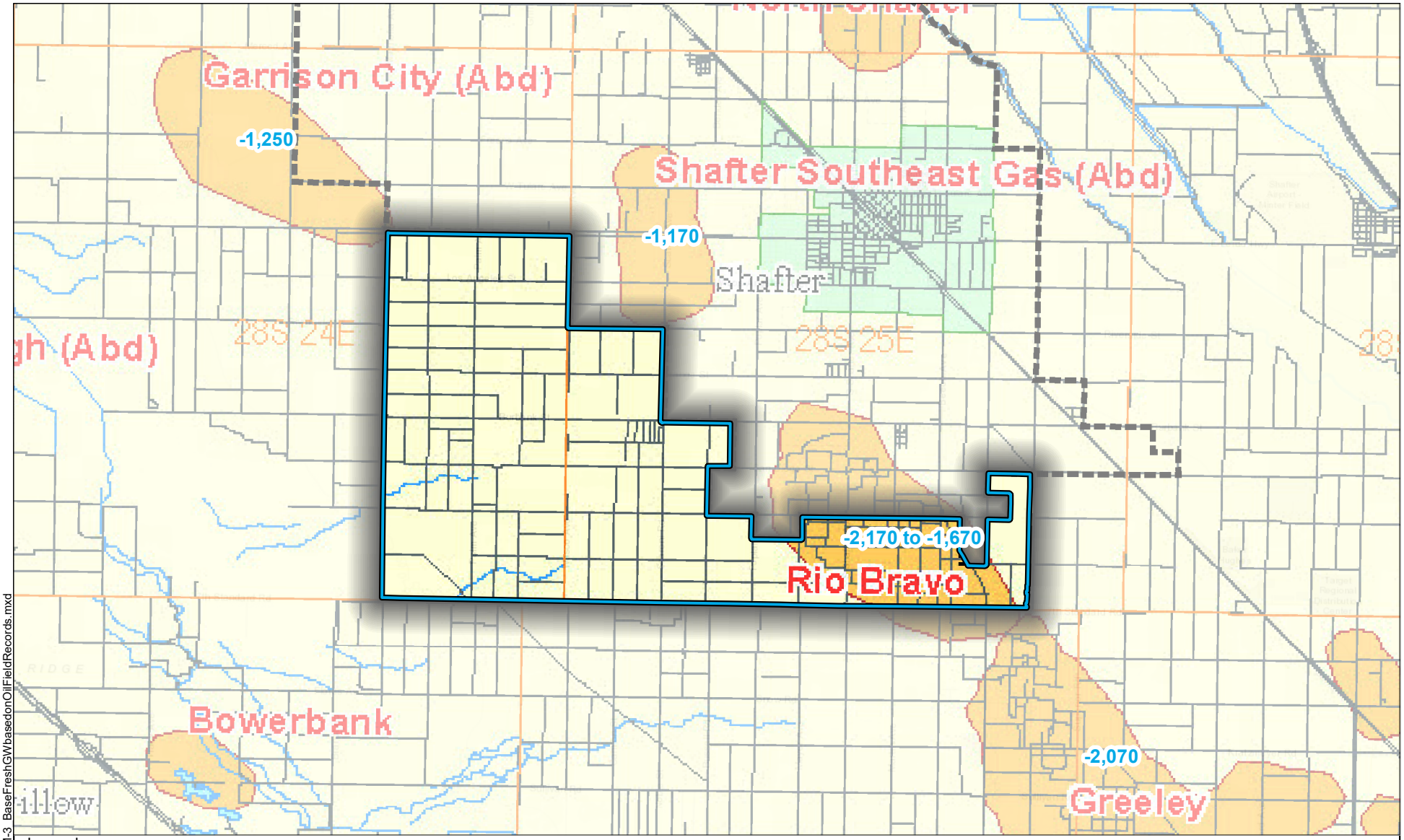
Figure HCM-2



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Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- DOGGR Oil Field
- -1,250 Base of Fresh Groundwater (ft msl)

Abbreviations

Abd	= Abandoned
DOGGR	= California Division of Oil, Gas, and Geothermal Resources
DWR	= California Department of Water Resources
ft msl	= feet above mean sea level
SWID	= Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Base of fresh groundwater according to DOGGR field data sheets.

Sources

1. Oil fields map obtained from DOGGR website (ftp://ftp.consrv.ca.gov/pub/oil/maps/dist4/Dist4_fields.pdf) on 6 April 2017.
2. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

Base of Fresh Goundwater Based on Oil Field Records

SWID 7th Standard Annex Management Area
December 2019
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Figure HCM-3

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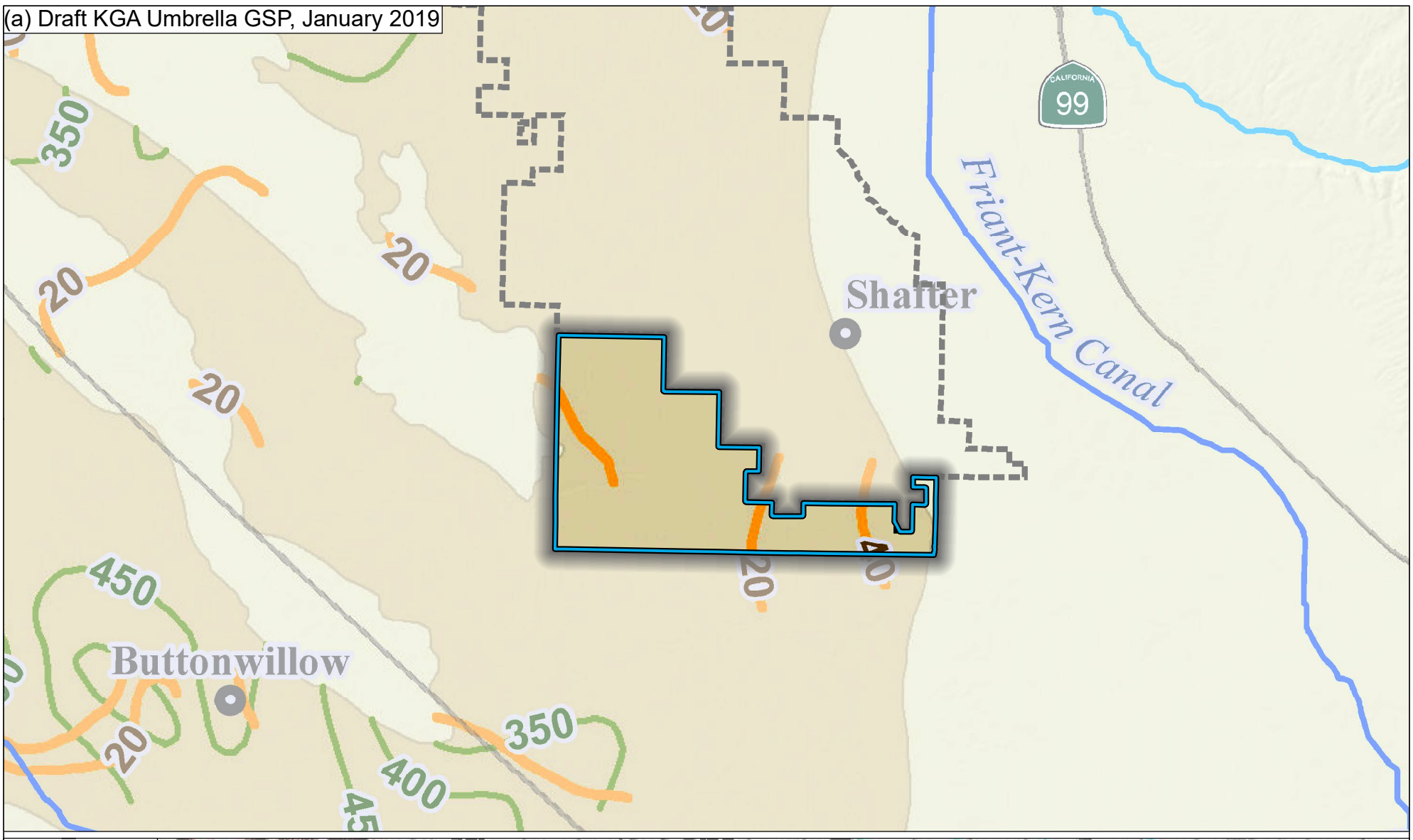
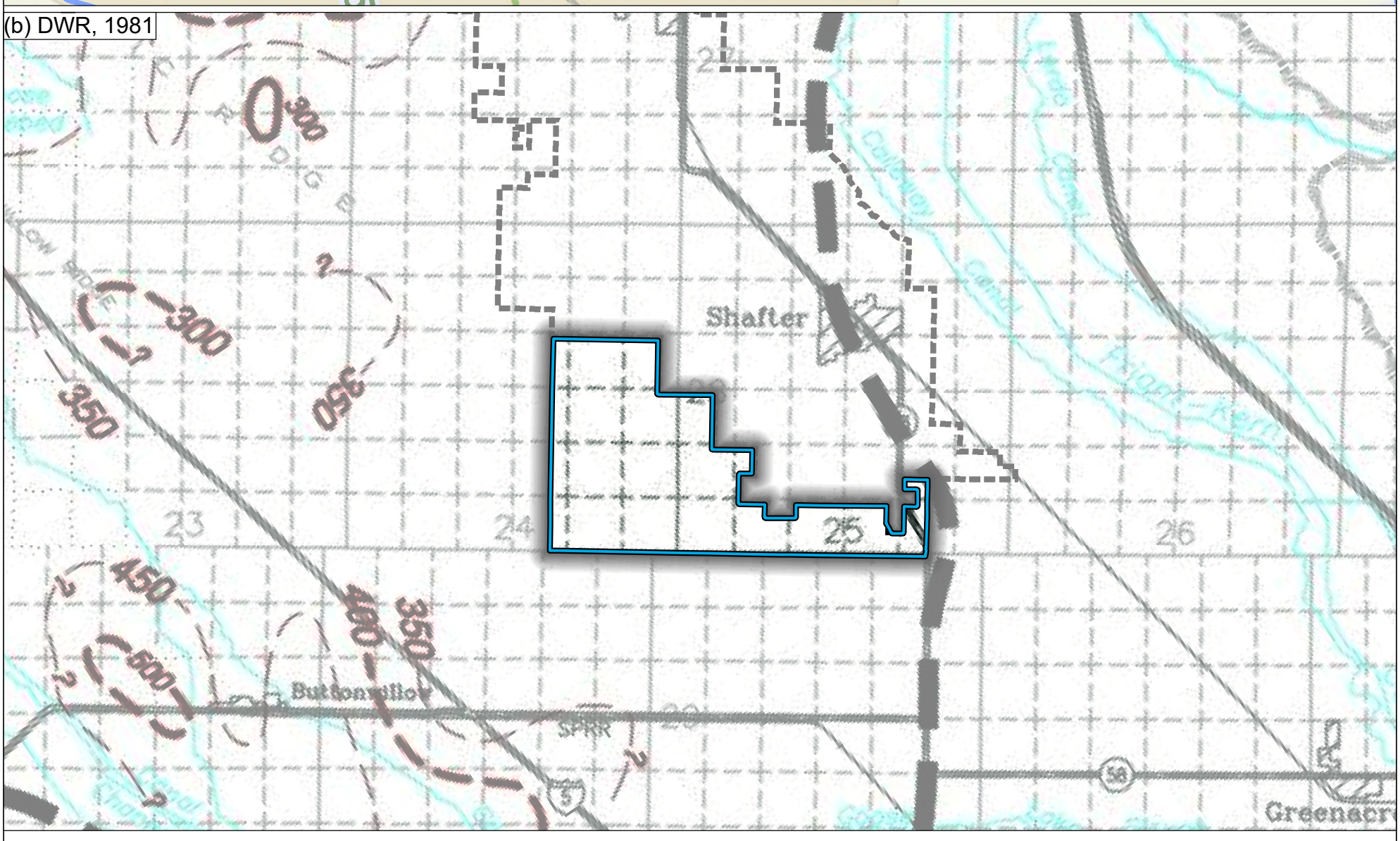
(a) Draft KGA Umbrella GSP, January 2019



(b) DWR, 1981



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

Draft KGA Umbrella GSP, January 2019

- USGS Corcoran Clay Thickness (ft)
- USGS Corcoran Clay Depth (ft)
- USGS Extent of Corcoran Clay

DWR, 1981 (Note 2)

- Corcoran Clay Depth Contour (50-ft interval)
- Approximate Boundary of Corcoran Clay

Abbreviations

DWR	= California Department of Water Resources
ft	= feet
GSP	= Groundwater Sustainability Plan
KGA	= Kern Groundwater Authority
SWID	= Shafter-Wasco Irrigation District
USGS	= United States Geological Survey

Notes

1. All locations are approximate.
2. In panel (b), question marks indicate that the contour or boundary is poorly controlled.
3. The KGA Umbrella GSP uses Page, 1986 as the source for mapping approximate thickness and extent of the e-modified corcoran clay.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. Kern Groundwater Authority, 2019, Draft Kern County Subbasin Basin Setting, GEI Consultants, Inc., dated January 2019.
3. California Department of Water Resources (DWR). 1981. Depth to The Top of Corcoran Clay. San Joaquin District.
4. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

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(Scale in Miles)

Corcoran Clay Layer

SWID 7th Standard Annex Management Area
December 2019
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Figure HCM-4

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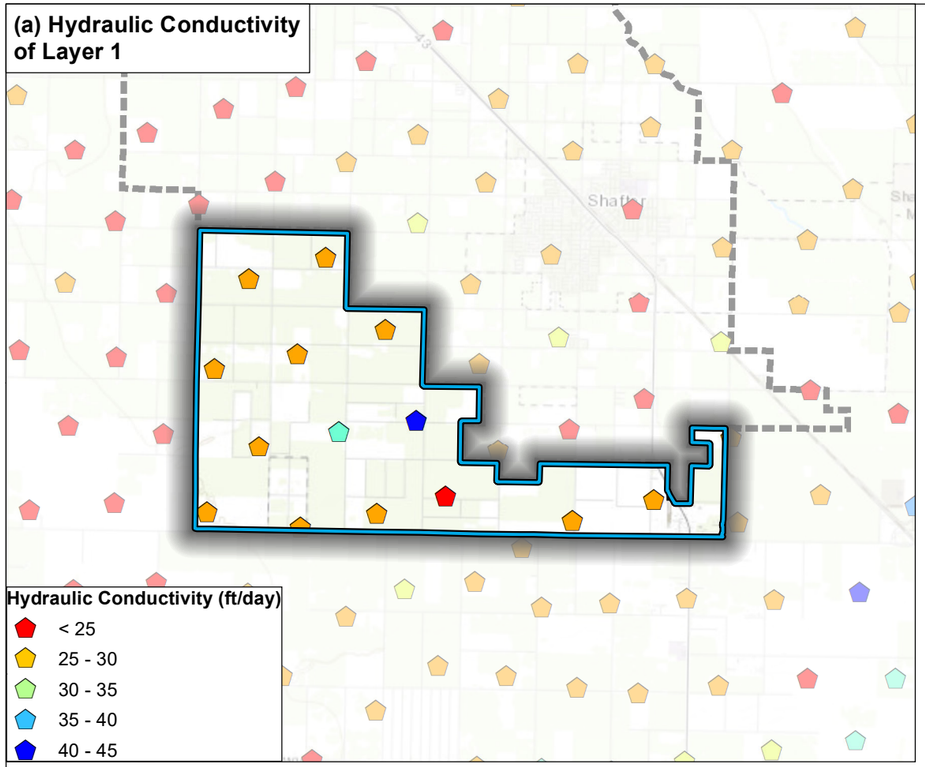
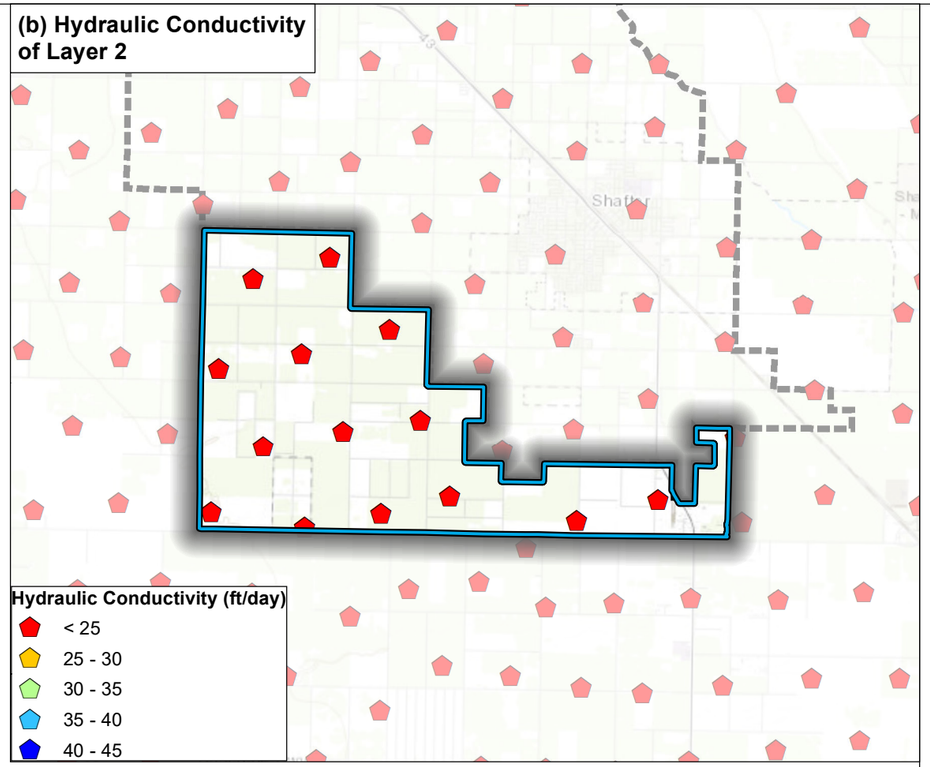
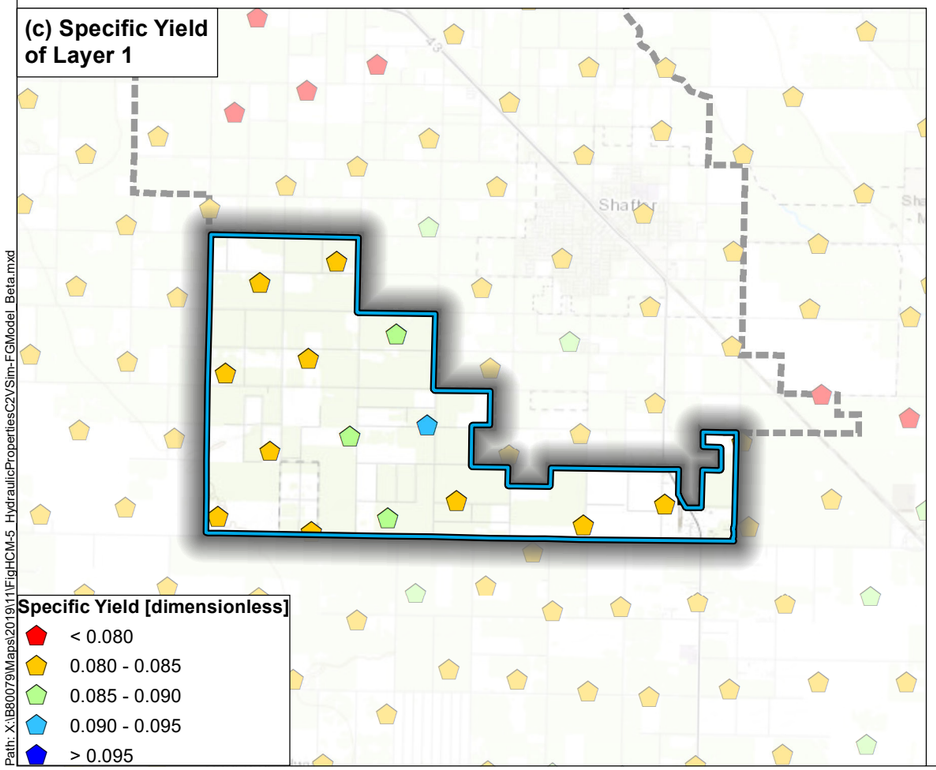
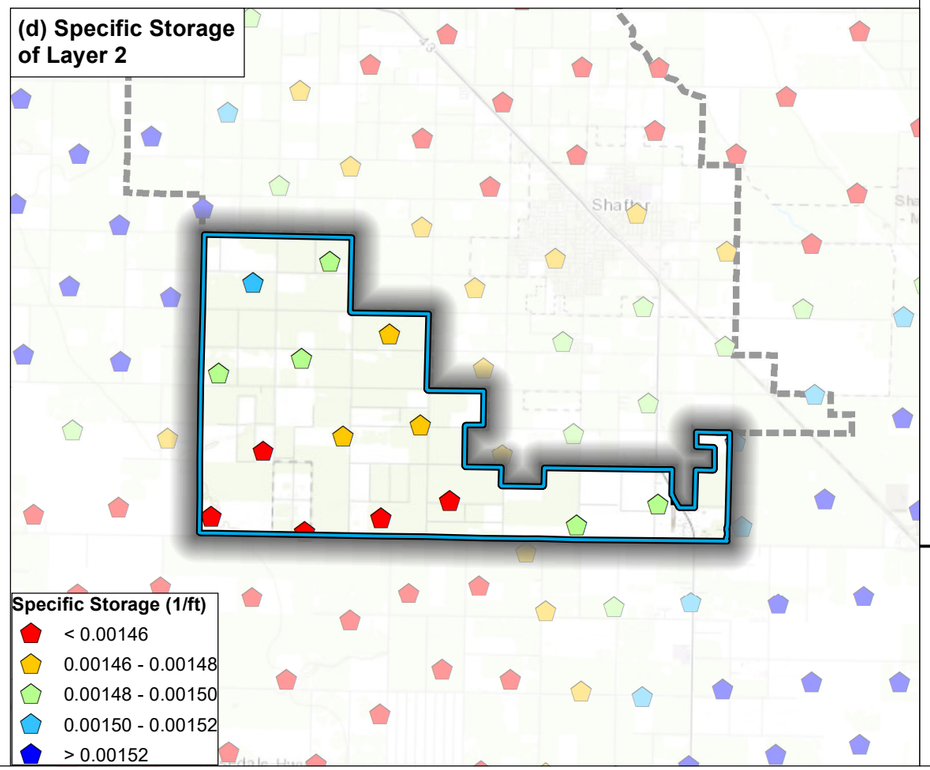
Path: X:\B80079\Maps\2019\11\FigHCM-4_CorcoranClay.mxd









Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

Abbreviations

C2VSim-FG	= California Central Valley Groundwater-Surface Water Simulation Model - Fine Grid
CNRA	= California Natural Resources Agency
ft	= feet
ft/day	= feet per day
SWID	= Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Layers 1 and 2 are the representative "pumped layers" of C2VSim-FG Model.
3. Depth to the bottom of Layer 2 of the C2VSim-FG Beta Model ranges from 726 to 1025 ft bgs within SWID Management Area.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. C2VSim-FG Model data obtained from CNRA website (https://data.cnra.ca.gov/dataset/c2vsimfg-beta-model) on 30 April 2018.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

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(Scale in Miles)

Hydraulic Properties in C2VSim-FG Model (Beta Version)

SWID 7th Standard Annex Management Area

December 2019

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Figure HCM-5

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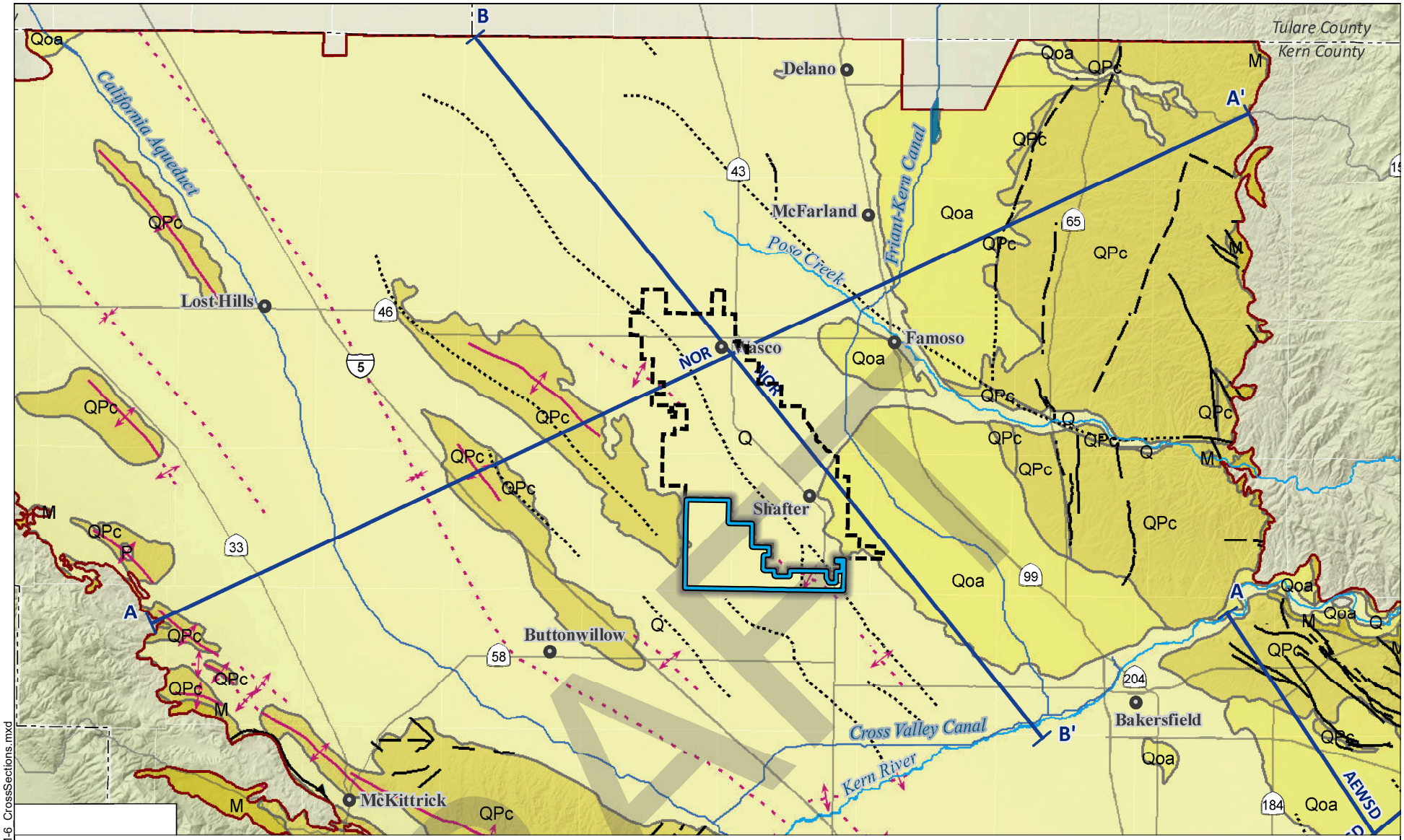
Path: X:\B80079\Maps\2019\11\FigHCM-5_HydraulicPropertiesC2VSim-FGModel_Beta.mxd



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Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Cross-Section Location

Geologic Units

Q	Pleisto-Holocene	Mc/M	Miocene
Qoa	Quaternary	O	Oligocene
QPc	Plio-Pleistocene	TC	Undivided Tertiary
P	Pliocene		

Abbreviations

DWR = California Department of Water Resources
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. The KGA Umbrella GSP uses California Geological Survey (CGS), 2010 as the source for mapping surficial geology.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 27 November 2019.
2. Kern Groundwater Authority, 2019, Draft Groundwater Sustainability Plan, GEI Consultants Inc., dated August 2019.

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0 6 12

(Scale in Miles)

Surficial Geology and Cross-Section Locations

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SWID 7th Standard Annex Management Area
December 2019
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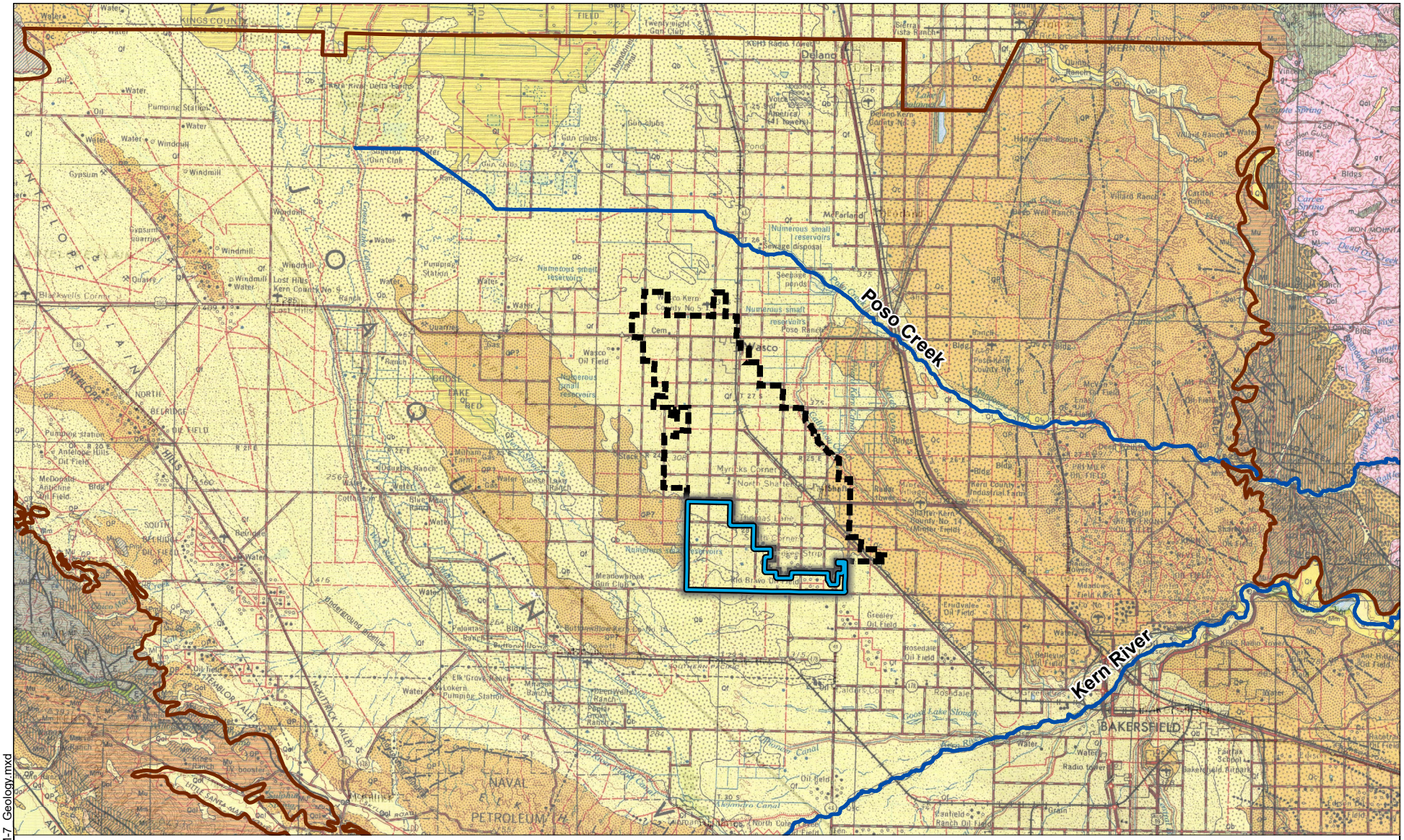
Figure HCM-6



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Kern County Subbasin

Sedimentary and Metasedimentary Rocks

- Qal Alluvium
- Qf Fan Deposits
- Qb Basin Deposits
- Qc Pleistocene Nonmarine
- QP Plio-Pleistocene Nonmarine

Abbreviations

SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.
2. Smith, A.R., 1964. *Geologic map of California : Bakersfield sheet*, California Division of Mines and Geology Unseriesed.

N

0 6 12

(Scale in Miles)

Surface Geology - Sedimentary Rock Types

SWID 7th Standard Annex Management Area
December 2019
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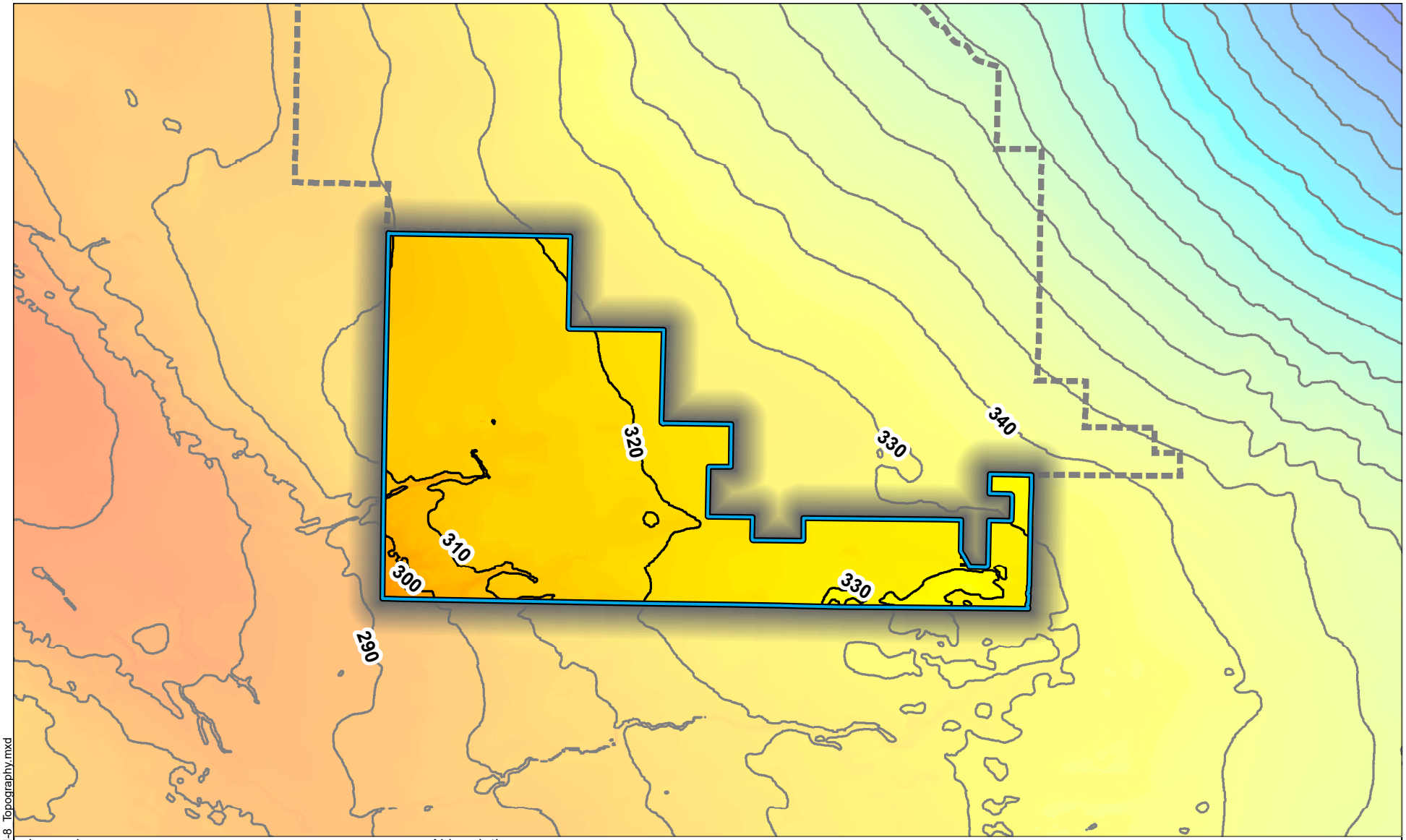
Figure HCM-7

eki environment & water

Path: X:\B80079\Maps\2019\11\FigHCM-7_Geology.mxd



Legend

Shafter-Wasco Irrigation District

SWID 7th Standard Annex Management Area

Elevation Contour (10-ft interval)

Land Surface Elevation (ft msl)

High : 500

Low : 250

Abbreviations

ft msl	= feet above mean sea level
NED	= National Elevation Dataset
SWID	= Shafter-Wasco Irrigation District
USGS	= United States Geological Survey

Notes

1. All locations are approximate.

Sources

1. Surface elevation data was obtained from USGS NED on 6 April 2017. (https://viewer.nationalmap.gov/basic/)
2. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

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0 1.5 3

(Scale in Miles)

Topography

SWID 7th Standard Annex Management Area

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Figure HCM-8

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Path: X:\B80079\Maps\2019\11\FigHCM-8_Topography.mxd

(a) Soil Map Units

Soil Map Unit
- Fine Sandy Loam
- Loam
- Loamy Sand
- Sandy Clay Loam
- Sandy Loam
- Clay Loam
- Silt Loam
- Other

(b) Hydrologic Soil Group

Hydrologic Soil Groups
- A-High Infiltration Rate
- B-Moderate Infiltration Rate
- C-Slow Infiltration Rate
- D-Very Slow Infiltration Rate

Legend
- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

Abbreviations
DWR = California Department of Water Resources
SSURGO = Soil Survey Geographic Database
SWID = Shafter-Wasco Irrigation District

Notes
1. All locations are approximate.
2. Map units extracted from SSURGO data.
3. Only the soil units of greatest extent are included in their own category. Additonal soil units grouped as "Other".
4. Hydrologic soil groups extracted from SSURGO data.

Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. Soil data was obtained from SSURGO on 19 June 2018(https://gdg.sc.egov.usda.gov/GDGOrder.aspx#).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

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(Scale in Miles)

Soil Map Units and Hydrologic Soil Group

SWID 7th Standard Annex Management Area
December 2019
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Figure HCM-9

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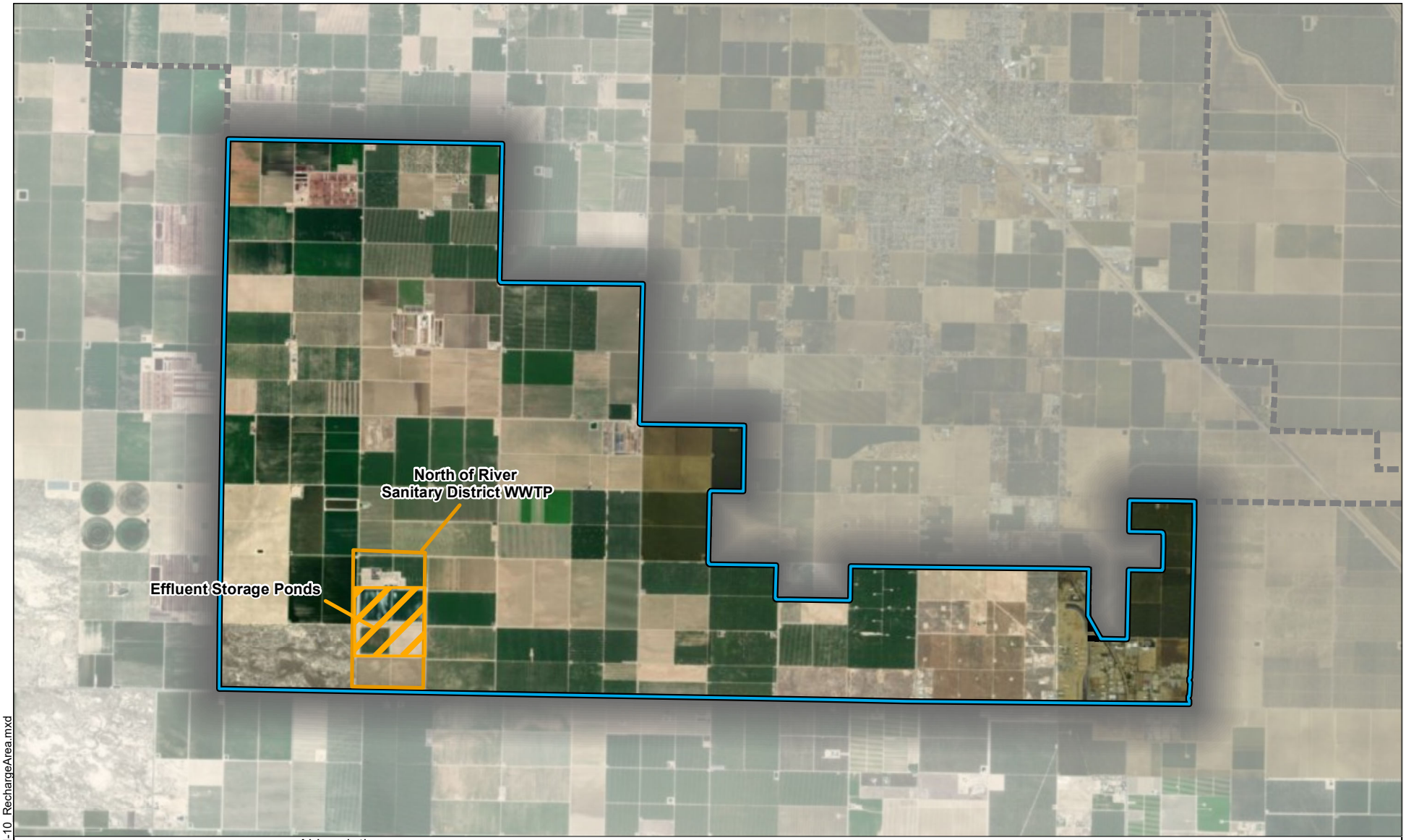
Path: X:\B80079\Maps\2019\11\FigHCM-9_SoilMapUnits_HydrologicSoilGroup.mxd



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

Abbreviations

DWR	= California Department of Water Resources
NORSD	= North of River Sanitary District
SWID	= Shafter-Wasco Irrigation District
WWTP	= Wastewater Treatment Plant

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. NORSD WWTP boundary and effluent storage ponds' location were plotted based on the Waste Discharge Requirement received on 28 August 2018.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

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(Scale in Miles)

Recharge Areas within the Management Area

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December 2019
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Figure HCM-10

Path: X:\B80079\Maps\2019\11\FigHCM-10_RechargeArea.mxd

7. CURRENT AND HISTORICAL GROUNDWATER CONDITIONS

☑ 23 CCR § 354.16

This section presents information on historical and current groundwater conditions within the 7th Standard Annex Management Area based on available data. Sources of data used to inform this assessment are described within each data topic section and include data from landowners within the Management Area, various state and federal databases, and other reports.

For the purposes of this assessment, "current conditions" refers to conditions in DWR Water Year (WY) 2015 (i.e., the effective date of SGMA; October 2014 through September 2015), which is consistent with how "current" is defined by the KGA in the Umbrella GSP. Likewise, "historical" refers herein to the period from DWR WY 1995 to 2014 (i.e., October 1994 through September 2014), which is the period being used by KGA and its member entities for historical water budget development. As a whole, this period is climatically close to normal/average, but includes the majority of a significantly dry (drought) period between 2012 and 2015, as well as other years that were drier or wetter than normal. It should also be noted that this period starts after a wet year and ends during a dry period.

It is recognized that additional, more recent data (i.e., through 2022) are available at the time of preparation of this amended Management Area (MA) Plan. However, as the MA Plan does not constitute a five-year update to a GSP, but rather a response to the DWR determination letter, those additional data are not incorporated herein, with minor exceptions

7.1. Groundwater Elevations and Flow Direction

☑ 23 CCR § 354.16(a)

The KGA Umbrella GSP presents basin-wide historical groundwater trends based on annual seasonal high groundwater elevation contour maps prepared by the KCWA. The KGA Umbrella GSP presents groundwater contour maps for the basin for Spring 2015 and Fall 2015. Based on the groundwater level data from the DWR SGMA Data Viewer[19] for wells within and proximate to the 7th Standard Annex Management Area, the groundwater elevations and contours in the vicinity of the Management Area appear to be consistent with the information presented in the KGA Umbrella GSP. Additional information regarding groundwater elevations beneath the Management Area is presented below.

Groundwater Elevation Contour Maps

☑ 23 CCR § 354.16(a)(1)

Groundwater elevation contour maps for "current conditions" – Spring 2015 and Fall 2015 – are presented on **Figure GWC-1** and **Figure GWC-2**, respectively. The following generalities can be made based on groundwater elevation data in the vicinity of the 7th Standard Annex Management Area.

[19] The data sources of water level for the DWR SGMA Data Viewer include the California Statewide Groundwater Elevation Monitoring (CASGEM) online system, the Water Data Library, and the California Natural Resources Agency Open Data Platform.

- Groundwater levels are consistently lower in the northwestern portion of the 7th Standard Annex Management Area than in the southeastern portion.
- Assuming groundwater flow is perpendicular to groundwater elevation contours, flow direction throughout the 7th Standard Annex Management Area is predominantly from the southeast to the northwest.
- Groundwater elevation during Spring 2015 (seasonal high) ranged from approximately 0 to 70 ft msl within the 7th Standard Annex Management Area.
- Groundwater elevation during Fall 2015 (seasonal low) ranges from approximately -20 to 60 ft msl within the 7th Standard Annex Management Area.
- The 10- to 20-foot decrease of groundwater elevation observed from Spring to Fall 2015 is likely due to pumping to meet irrigation and other demands.

In general, groundwater elevations and flow directions in the vicinity of the 7th Standard Annex Management Area are consistent with the groundwater trends presented in the KGA Umbrella GSP.

Depth to Groundwater

As shown on **Figure GWC-3**, depth to groundwater for "current conditions" in Spring 2015 within the 7th Standard Annex Management Area varied from about 260 to 305 ft bgs, with shallower depths in the southeastern portion and deeper depths in the northwestern portion. The fact that depth to water is more than 260 ft bgs indicates that interconnected surface water and groundwater-dependent ecosystems (GDEs) are unlikely to occur with respect to the principal aquifer in the 7th Standard Annex Management Area. These topics are discussed further below in **Section 7.6 *Interconnected Surface Water Systems*** and **Section 7.7 *Groundwater Dependent Ecosystems***, respectively.

Long-Term Groundwater Elevation Trends

☑ 23 CCR § 354.16(a)(2)

Very limited historical records of groundwater elevation data are available for wells within the 7th Standard Annex Management Area. Therefore, in order to evaluate long-term trends in groundwater levels, wells located outside, but in close proximity to the Management Area were also considered. Hydrographs for selected wells located within and near the 7th Standard Annex Management Area for which an extended period of record is available (generally going back to the early 1970s) are shown on **Figure GWC-4**. Based on these data, the wells have shown slightly decreasing groundwater levels over the long-term. The effects of drought cycles (e.g., late 1980s/early 1990s) are apparent in most of the wells, with greater declines during dry periods and recovery during wet periods.

To evaluate long-term water level trends, linear regression of the water level data was used (recognizing that this method can be slightly biased by the data's temporal frequency and distribution). The trends show a range from -2.4 feet per year (ft/yr) of water level decline to -0.03 ft/yr, with an average of approximately -1 ft/yr over the period of record.

Table GWC-1 below shows the DWR Water Year Hydrologic Classification Index for the San Joaquin Valley (i.e., water year type).[20,21] Based on this index, for the 21 Water Years from 1995 through 2015, the period included five "critical" (dry) years, four dry years, two below normal years, three above normal year, and seven wet years. The first third of this period was relatively wet, the middle third was a mix of wet and dry years, and the last third of the period was extremely dry. This climatic variation is reflected in the hydrographs which tend to exhibit water level increases in the 1990s, relative stability in the early 2000s, and then greater decreases starting in the late 2000s.

Table GWC-1. Summary of DWR Water Year Types, 1995 - 2015

Water Year	WY Index	Water Year	WY Index	Water Year	WY Index
1995	Wet	2003	Below Normal	2011	Wet
1996	Wet	2004	Dry	2012	Dry
1997	Wet	2005	Wet	2013	Critical Dry
1998	Wet	2006	Wet	2014	Critical Dry
1999	Above Normal	2007	Critical Dry	2015	Critical Dry
2000	Above Normal	2008	Critical Dry	--	--
2001	Dry	2009	Below Normal	--	--
2002	Dry	2010	Above Normal	--	--

Regional Pumping Patterns

Figure GWC-6 shows estimated annual groundwater pumpage within the 7th Standard Annex Management Area, which ranges from 20,000 acre-feet per year (AFY) to 32,000 AFY[22]. As shown on **Figure GWC-6**, the estimated pumping pattern remains relatively stable over the past 20 years within the Management Area.

7.2. Change in Groundwater Storage

☑ **23 CCR § 354.16(b)**

Due to limitations in available water level data within the Management Area (discussed above), for the purposes of this calculation, annual change in storage estimates were extracted from the output of the Water Budget model, described further in **Section 8 *Water Budget Information***.

Figure GWC-5 shows the estimated annual change in storage between seasonal water level highs (i.e., from March of each year to March of the following year) and Water Year type based on DWR's San Joaquin

[20] http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST
[21] DWR defines a Water Year as extending from October 1st of the previous year to September 30th of the year in question. For example, Water Year 2005 extends from 1 October 2004 through 30 September 2005.
[22] Annual groundwater pumpage includes agricultural, dairy industrial, and domestic pumping. Agricultural pumping was estimated based on Irrigation Training and Research Center's (ITRC) evapotranspiration (ET) data. Dairy, industrial, and domestic pumping was estimated primarily based on information provided by the users.

Valley Water Year Index[23]. As shown on **Figure GWC-5**, annual change in storage within the 7th Standard Annex Management Area ranged from an increase of 21,770 acre-feet (AF) for the period from March 2003 – February 2004 to a decrease of -29,220 AF for the period between March 2004 and February 2005. Change in storage tends to be more negative during dry year and more positive during wet years.

Figure GWC-6 shows the estimated historical cumulative change in storage and annual groundwater pumpage from March 1994 to February 2014. The cumulated change in storage over this time period, based on seasonal water level highs, was estimated to be a decrease of 19,660 AF or -980 acre-feet per year (AFY). Also shown on **Figure GWC-6** is the annual total groundwater pumpage, which is approximately 27,050 AFY.

We note that 2015 represented the worst drought on record for the basin, the impacts of which are reflected in the above water budget and storage change estimates. Based on water level data over the period of record (see **Figure GWC-4**), there have been other time periods where water level changes within the Management Area, and associated change in storage (see **Figure GWC-5**), have been negligible or increased during wet periods.

Figures GWC-7 and GWC-8 show the change in groundwater elevation between Spring 2004 to Spring 2014 and Fall 2004 to Fall 2014, respectively, based on DWR data[24]. These data were used to support the change in groundwater storage assessment discussed in **Section 8.2.3** ***Change in Groundwater Storage***.

7.3. Seawater Intrusion

☑ 23 CCR § 354.16(c)

The 7th Standard Annex Management Area is located far from coastal areas. As a result, seawater intrusion is not considered to be an issue for this area.

7.4. Groundwater Quality Concerns

☑ 23 CCR § 354.16(d)

Groundwater quality constituents that may affect the supply and beneficial uses of groundwater in the 7th Standard Annex Management Area and greater basin were examined in the KGA Umbrella GSP. The KGA Umbrella GSP identifies TDS, sodium, chloride, nitrate, arsenic, boron, hexavalent chromium, pesticides (dibromochloropropane [DBCP], 1,2,3-trichloropropane [1,2,3-TCP]), and hydrocarbons as key constituents in the basin. The KGA Umbrella GSP includes basin-level discussion of each of these key constituents. TDS, nitrate, arsenic, and 1,2,3-TCP were identified as the most common water quality issues

[23] The seasonal high groundwater condition occurs typically in late Winter or Spring and for the purposes of **Figure GWC-5** is assumed to occur in March. March groundwater levels are affected by both the amount of pumping during the prior summer (i.e., previous DWR Water Year) as well as the amount of precipitation during the Winter months of the current DWR Water Year. In **Figure GWC-5**, the color of each bar is based on the Water Year type for the year that begins in the October between the March and February.

[24] Changes in groundwater level data were obtained from the Groundwater Information Center Interactive Map Application (https://gis.water.ca.gov/app/gicima/) on 26 August 2016.

in the basin and their concentrations based on data available for the Management Area are discussed below.

Nitrate, arsenic, and 1,2,3-TCP in drinking water are subject to primary Maximum Contaminant Levels (MCLs)[25] (i.e., health risk-based), while TDS in drinking water is subject to a secondary maximum contaminant level (SMCL)[26] (i.e., aesthetically-based). In addition, Agricultural Water Quality Goals have been identified by the Food and Agriculture Organization of the United Nations for TDS and arsenic, which are intended to be protective of a variety of agricultural uses of water. Limited water quality data are available for wells near the 7th Standard Annex Management Area. In addition to data available from the KGA, the online water quality data sources identified in **Appendix E** and water quality measurements collected by SWID on 11 September 2020 were reviewed and used to supplement the analysis described in this and the following section. **Figure GWC-9**, **Figure GWC-10**, and **Figure GWC-11** show the available data for TDS, nitrate, and arsenic, respectively, in this area, based on information provided in the KGA Umbrella GSP.

- Historical TDS concentrations (between 1930 and 2000) detected within the 7th Standard Annex Management area have been below the recommended SMCL of 500 mg/L, although concentrations exceeding the upper SMCL and short-term SMCLs (1,000 mg/L and 1,500 mg/L, respectively) and the Agricultural Water Quality Goal of 450 mg/L, were detected just north and east of the Management Area. Limited recent sampling data for TDS are available within the Management Area. The recent (between 2001 and 2017) sampling data shown on **Figure GWC-9** indicates that TDS was present at a concentration above the recommended SMCL but below the upper SMCL along the northeastern edge of the Management Area. In addition to the sample shown on **Figure GWC-9**, samples are routinely collected from the Superior Mutual Water Company (SMWC) water supply wells located in the eastern portion of the Management Area. The maximum detected concentration since 2001 in this area was 300 mg/L (detected in March 2013), which is below the recommended SMCL. Recent measurement in 2020 shows that TDS concentrations are below the recommended SMCL of 500 mg/L in all three water quality Representative Monitoring Wells (RMWs).
- The primary MCL for nitrate as nitrogen is 10 mg/L. The available historical (1900-2000) nitrate as nitrogen concentrations indicate groundwater beneath the Management Area was below the nitrate MCL, although concentrations exceeding the MCL were present to the north of the Management Area. Limited recent sampling data for nitrate as nitrogen are available within the Management Area. In addition to the sample shown on **Figure GWC-10**, samples are routinely collected from the SMWC water supply wells located in the eastern portion of the Management Area. Based on these data, nitrate as nitrogen is present in groundwater at concentrations below the MCL (maximum concentration since 2010 of 3.1 mg/L, detected August 2018). However, data collected to the north, south, and west of the Management Area indicate that nitrate as nitrogen is present at concentrations above the MCL in those areas (**Figure GWC-10**). Recent measurement

[25] Primary MCLs are drinking water standards set by the USEPA and California Environmental Protection and Agency (CalEPA) based on human health considerations.

[26] SMCLs are non-health related drinking water standards set by the State Water Resources Control Board based on aesthetic characteristics of drinking water such as taste, odor, and color. For four common constituents – TDS, specific conductance, chloride, and sulfate – the SWRCB sets three levels of SMCL for consumer acceptance, referred to as (lowest to highest concentration): "recommended", "upper", and "short term."

in 2020 shows that nitrate as nitrogen concentrations are below the MCL of 10 mg/L in all three water quality RMWs.

- The primary MCL for arsenic is 10 micrograms per liter (ug/L) and the Agricultural Water Quality Goal is 100 ug/L. The maximum historical (preceding 2000) arsenic concentrations were detected at concentrations below 10 ug/L within the 7th Standard Annex Management Area, but above the MCL in areas to the north, south, and west of the Management Area. Limited recent sampling data for arsenic are available within the Management Area. In addition to the sample shown on **Figure GWC-11**, samples are routinely collected from the SMWC water supply wells located in the eastern portion of the Management Area. Based on these data, arsenic is present in groundwater at concentrations below the MCL (maximum concentration since 2010 of 8.1 ug/L, detected August 2013). However, data collected to the north and southwest of the Management Area indicate that arsenic is present at concentrations above the MCL in those areas (**Figure GWC-11**). Recent measurements in 2020 show that arsenic concentrations are below the MCL of 10 ug/L, which is also the Measurable Objective (MO) and Minimum Threshold (MT) established for arsenic, in all three water quality RMWs.

- As reported to the State Water Resources Control Board (SWRCB), 1,2,3-TCP and coliform have been detected in groundwater samples from public supply wells operated by the Superior Mutual Water Company (SMWC)[27] located within the eastern portion of the 7th Standard Annex Management Area, at concentrations above MCLs. Based on the Safe Drinking Water Information System (SDWIS) data, 1,2,3-TCP has been detected in these wells at concentrations up to 0.057 ug/L,[28] which exceeds the California primary MCL of 0.005 ug/L by an order of magnitude. Although detected coliform concentrations are not available, the SDWIS website reports that SMWC has received 14 violations for coliform from 1996 through 2016. According to SMWC, wellhead treatment systems to address 1,2,3-TCP contamination in water prior to distribution are currently being developed.[29]

Based on the ~~limited~~ water quality data available for this area, TDS, nitrate, arsenic, and 1,2,3-TCP, are potential ~~water quality concerns~~Constituents of Concern (COC) for the Management Area within the 7th Standard Annex Management Area. However, based on input provided by the agricultural stakeholders, the growers have not experienced any changes in water quality as groundwater elevations have declined over time. The most sensitive beneficial use of groundwater is for potable supply. Based on the recent measurement in 2020, TDS, nitrate, and arsenic concentrations are below their recommended SMCL or MCL respectively in all three water quality RMWs, indicating that the domestic wells that tap the same local aquifer are likely similarly not at risk. Groundwater served by public water systems must meet water quality regulatory standards (i.e., MCLs) and these systems are regulated by the SWRCB, which they are in the process of achieving through treatment.

[27] Water quality information of the Superior Mutual Water Company were obtained from the Safe Drinking Water Information System (SDWIS) website, accessed on 2 November 2018.
https://sdwis.waterboards.ca.gov/PDWW/JSP/Violations.jsp?tinwsys_is_number=1635&tinwsys_st_code=CA
[28] Maximum reported concentration from Well 01(1503209-001) raw water, collected 20 July 2018.
[29] Phone call with Taylor Howze (SMWC), 28 November 2018.

7.4.1. Water Quality Trends

Available TDS, nitrate, and arsenic water quality data are presented in **Appendix E *Water Quality Trend Analysis***. Available concentration data was evaluated with respect to changes over time and in relationship to water levels. Water quality measurement data within the 7th Standard Annex Management Area are ~~very~~ limited and statistically significant temporal trends cannot be identified based on this limited dataset. That being said, based on the available data, there does not appear to be a correlation between groundwater elevations and constituent concentrations, as shown in **Appendix E**~~.~~, indicating that groundwater extractions or recharge will not exacerbate degraded water quality conditions in the Management Area, with the exception of a suspected correlation between groundwater levels and arsenic concentration. As discussed in **Section 15.1.4**, future monitoring efforts will include routine collection of water quality data, and such data and any associated trends will be evaluated in future reporting for the Management Area.

7.4.2. Point-Source Contamination Sites

In addition to the non-point source groundwater quality constituents of concern identified above, there are a small number of point-source contamination sites within the 7th Standard Annex Management Area. These sites, shown on **Figure GWC-12**, are typically associated with certain industrial or commercial land uses (e.g., land disposal sites).

As shown on **Figure GWC-12**, there are a total of two closed Cleanup Program sites, one open land disposal site, one produced water pond site, and one certified (closed) State Response site located within the 7th Standard Annex Management Area. Two closed Leaking Underground Storage Tank (LUST) Cleanup sites are also located just north of the Management Area. These sites are summarized in **Table GWC-2**, below, based on information provided on the SWRCB Geotracker and Department of Toxic Substances Control (DTSC) Envirostor websites. Contaminants of concerns associated with these sites include volatile organic compounds, "other solvents," petroleum hydrocarbons including gasoline and crude oil, metals, and pesticides.

Based on data available on Geotracker and Envirostor, there does not appear to be any identified groundwater contamination resulting from the two active sites. Given that most of these sites have received regulatory closure and that groundwater is generally hundreds of feet below the surface and separated from near-surface contamination by numerous thin low permeability layers, the threat to groundwater from these identified sites is likely minor.

Table GWC-2. Summary of Active Point-Source Contamination Sites

Global ID	Site Name	Site Type	Regulatory Oversight Agency	Potential Contaminants of Concern	Status
Open sites					
L10009869916	Shafter Burn Dump	Land Disposal Site	Central Valley Regional Water Quality Control Board (CVRWQCB)	None Listed	Open
T10000006733	Rio Bravo Oil Field	Produced Water Ponds	CVRWQCB	Crude Oil	Open - Inactive
Closed Sites					
15490014	Rio Bravo Disposal Facility	State Response or NPL	DTSC	Metals, Organochlorine Pesticides, Volatile Organics	Certified as of 4/1/1997
SLT5FQ664626	Rio Bravo Haz Waste Site	Cleanup Program Site	DTSC	None Listed	Completed - Case Closed
SL0602928705	Sii ChemTech Facility	Cleanup Program Site	CVRWQCB	Other Solvent or Non-Petroleum Hydrocarbon	Completed - Case Closed
T0602900452	Concrete Pipe & Products	LUST Cleanup Site	Kern County	Gasoline	Completed - Case Closed
T0602900733	Woods Stone Ranches	LUST Cleanup Site	Kern County	Gasoline	Completed - Case Closed

7.5. Land Subsidence

☑ 23 CCR § 354.16(e)

Figure GWC-13~~The KGA Umbrella GSP provides information on basin-wide historical and recent subsidence. Subsidence~~ shows the Management Area relative to Regional Critical Infrastructure within the basin~~ has been caused primarily by extensive withdrawal of groundwater below certain confining clay layers~~. The only infrastructure located ~~in portions of the basin. Subsidence due to oil and gas production has also occurred in some areas of~~within the ~~basin but to~~ Management Area Plan (MA Plan) area is a ~~lesser extent. shows maps of historical (1926-1970) and recent (2007-2010, and 2015-2016) subsidence in~~ small section of a high-pressure gas pipeline; no Regional Critical Infrastructure (i.e., California Aqueduct and the ~~vicinity of~~Friant Kern Canal) are located within the 7th Standard Annex Management Area. **Figure GWC-14** and **Figure GWC-15** shows the MA Plan area relative to the historical and recent subsidence, which are discussed below. The KGA Umbrella GSP provides additional information on subsidence throughout the basin and over time, and with particular reference to Critical ~~delivery system~~ Infrastructure such as the California Aqueduct and the Friant-Kern Canal. The recent land subsidence monitoring data used in the KGA Umbrella GSP includes satellite and aircraft-based ~~Interferometric Synthetic Aperture Radar~~ (InSAR) data from programs led by the National Aeronautics and Space Administration (NASA) and Jet Propulsion Laboratory (JPL) provided by DWR, as well as other international researchers.

Historical Subsidence

Based on the KGA Umbrella GSP, cumulative subsidence within the basin has been documented to be between 12 and 96 inches between 1926 to 1970, with an annual subsidence rate of approximately 0.3 to 2.2 inches per year, based on topographic maps and leveling data (Ireland et al., 1984). **Figure GWC-14**~~As shown on (a),~~(a) shows maps of historical (1926-1970) subsidence in the vicinity of the Management Area; the line of equal cumulative subsidence of 1 foot (12 inches) between 1926 to 1970 traverses across the northern portion of the 7th Standard Annex Management Area.

Recent Subsidence

Subsidence due to water level declines has continued in recent times in portions of the basin. **Figure GWC-14**(b) and **Figure GWC-14**~~As shown on~~ (c) shows maps of recent (2007-2010, and 2015-2016) subsidence in the vicinity of the Management Area. As shown on **Figure GWC-14**(b), land subsidence between 2007 and 2011 ranged from 0 to 1 inch in the northern and eastern portions of the 7th Standard Annex Management Area, and from 1 to 3 inches in the southwestern portion of the Management Area, based on ~~Interferometric Synthetic Aperture Radar (~~InSAR~~)~~ data. One of the Global Positioning System (GPS) stations located approximately 3.0 miles to the southwest of the Management Area (station number P563 as shown on **Figure GWC-14**(b)) shows land subsidence of 1.4 inches between 2007 and 2011. Between 2015 and 2016, the ~~western~~entire portion of the 7th Standard Annex Management Area is mapped as having experienced ~~3~~-0.1 to ~~10 inches~~0.1 ft of subsidence~~, and the eastern portion is mapped as having experienced 0 to 3 inches,~~ based on InSAR data as shown on **Figure GWC-14**(c).

Figure GWC-15~~GPS station P563~~ shows ~~land subsidence of 1.4 inches~~the Management Area relative to the Interferometric Synthetic Aperture Radar (INSAR) data that represents total vertical ground surface displacement between 2015 and 2021. As shown on **Figure GWC-15**~~2016 as shown on (c).~~, total subsidence between 2015 and 2021 within the Management Area ranged from -0.05 to -0.11 ft. Annual average ground surface vertical displacement between 2015 to 2021 ranged from -0.03 ft to 0.02 ft.

Based on the available data, while some limited subsidence has potentially occurred within the Management Area, the amount of subsidence in this area is significantly less than that observed in other areas of the basin, as documented in the KGA Umbrella GSP, and is within the range of possible error in subsidence measurement methods using remote sensing (i.e., on the order of 0.25 to 4 inches).

Both historical and recent subsidence data indicate that there has not been significant inelastic subsidence within the Management Area. Mapping of the Corcoran Clay in the basin suggests that it does not extend in the Management Area (**Figure HCM-4**). As such, even though there may be local infrastructure, the data indicate that they are not at risk given the low level of subsidence observed over the historical record (1926-2021) and the favorable geologic conditions.

7.6. Interconnected Surface Water Systems

☑ 23 CCR § 354.16(f)

As discussed above and shown on **Figure GWC-3**, groundwater levels in the principal aquifer are far below the ground surface (well over 200 feet below ground surface~~)~~ [ft bgs]) within the 7th Standard Annex Management Area, and therefore there is no interconnected surface water. In addition, as discussed in **Section 6.3.5** ***Surface Water Bodies***, based on mapping by the USGS National Hydrograph Dataset, there are no natural surface water bodies located within the 7th Standard Annex Management Area other than

two small ephemeral streams identified largely within actively farmed areas and the NORSD wastewater treatment plant property. Given the significant depth to groundwater in this area, these ephemeral streams would be expected to be fed by periodic rainfall and not be connected to the groundwater table located over 200 ~~feet below~~ft bgs. Therefore, depletion of interconnected surface water is not considered to be an issue in the Management Area.

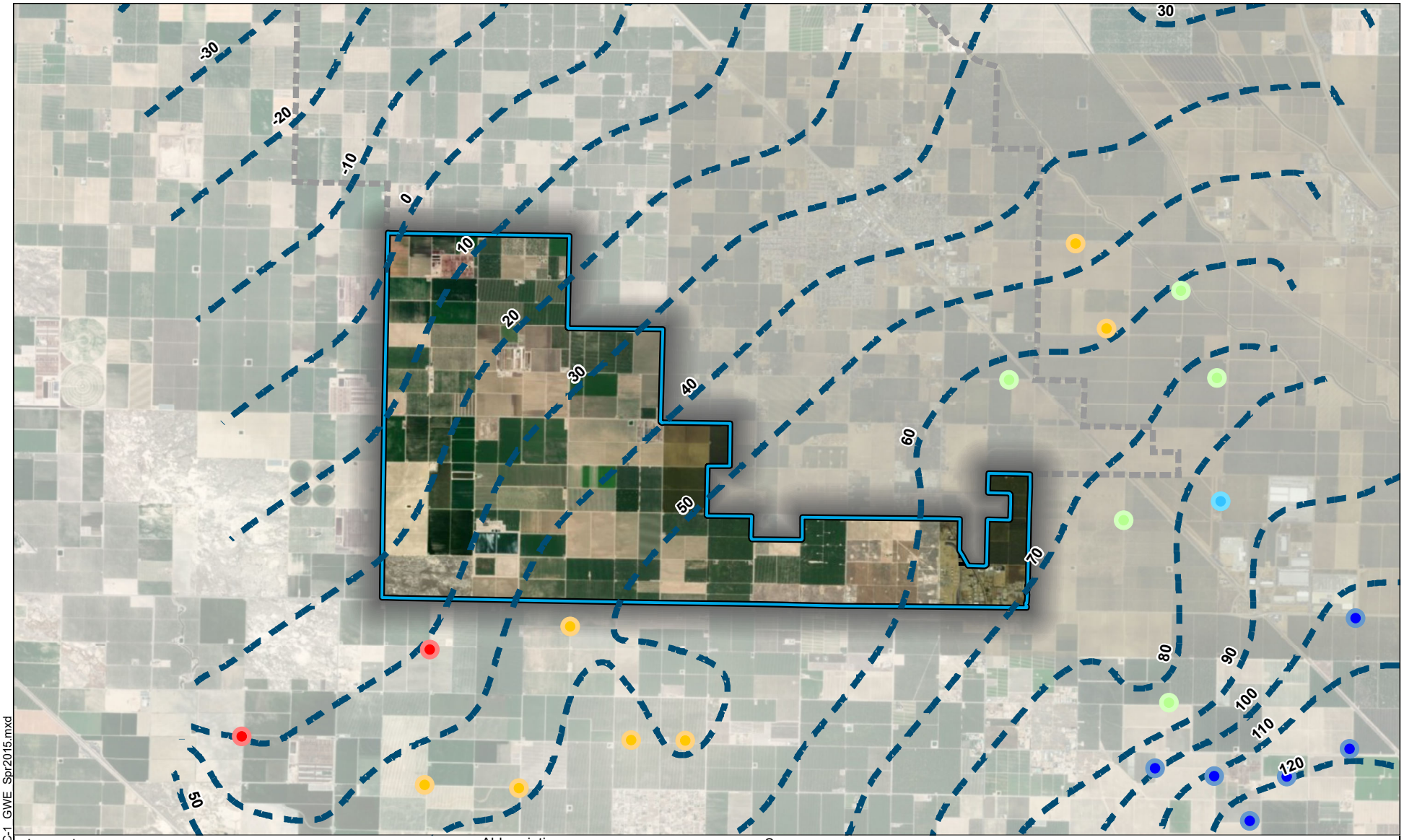
7.7. Groundwater Dependent Ecosystems

☑ 23 CCR § 354.16(g)

Groundwater dependent ecosystems (GDEs) are natural communities that depend on near-surface groundwater as a source of water. Guidance for identification of GDEs developed by The Nature Conservancy (TNC) states that groundwater depths less than 30 ~~feet below ground surface~~ft bgs are "generally accepted as being a proxy" for confirming that potential GDEs are actually supported by groundwater (TNC, 2019).[30] As discussed above and shown in **Figure GWC-3**, depths to groundwater in the principal aquifer are several hundred feet below ground surface (i.e., depths to groundwater range from 270 ft bgs to 310 ft bgs within the Management Area in Spring 2015 as shown in **Figure GWC-5**), and have been so since the earliest available historical records, and it is therefore highly unlikely that any ecosystems depend on groundwater from this aquifer system.

DWR has developed a map of "Natural Communities Commonly Associated with Groundwater" (NCCAG) for use by GSAs in identifying potential GDEs. **Figure GWC-16** shows the distribution of NCCAG identified by DWR as potential GDEs within the 7th Standard Annex Management Area. As shown on **Figure GWC-16**, four non-contiguous areas of NCCAG were identified in the western portion of the 7th Standard Annex Management Area, totaling approximately 7 acres. More extensive, contiguous areas of NCCAG vegetation and wetland areas are identified to the west of the Management Area. The wetlands and vegetation identified within the Management Area may be connected to perched groundwater atop the fine-grained "basin" deposits in that area.[31] Due to the great depth to the principal aquifer, these vegetation communities (i.e., identified as areas of quailbush and spinescale) are likely not dependent on groundwater from the principal aquifer system. Further, given that groundwater in this area is used for irrigation, which, due to irrigation inefficiency, inevitably results in some deep percolation of applied water below the root zone, there is likely a net addition of water to the shallow subsurface on an annual basis. This suggests that the pumping operations are unlikely to have any detrimental effects on the natural communities identified by DWR within the 7th Standard Annex Management Area. Based on this assessment, there are no GDEs located within the 7th Standard Annex Management Area. This conclusion is consistent with the guidance developed by The Nature Conservancy (TNC, 2019).

[30] https://groundwaterresourcehub.org/public/uploads/pdfs/TNC_NCdataset_BestPracticesGuide_2019.pdf
[31] Perched water in this area is limited and not considered to be a primary aquifer.



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Spring 2015 Groundwater Elevation Contour (10-ft interval)

Spring 2015 Groundwater Elevation (ft msl)

- < 40
- 40 - 60
- 60 - 80
- 80 - 100
- > 100

Abbreviations

DWR	= California Department of Water Resources
ft	= feet
ft msl	= feet above mean sea level
SWID	= Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Groundwater elevation contours were created by DWR using an interpolation process called kriging and are less certain in areas with sparse data.
3. Only selected wells with available Spring 2015 data are shown.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 22 November 2019.
2. Water level data and contours acquired from DWR's Groundwater Information Center Interactive Map Application on 26 August 2016 (https://gis.water.ca.gov/app/gicima/).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

Groundwater Elevation Spring 2015

SWID 7th Standard Annex Management Area

December 2019

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Figure GWC-1

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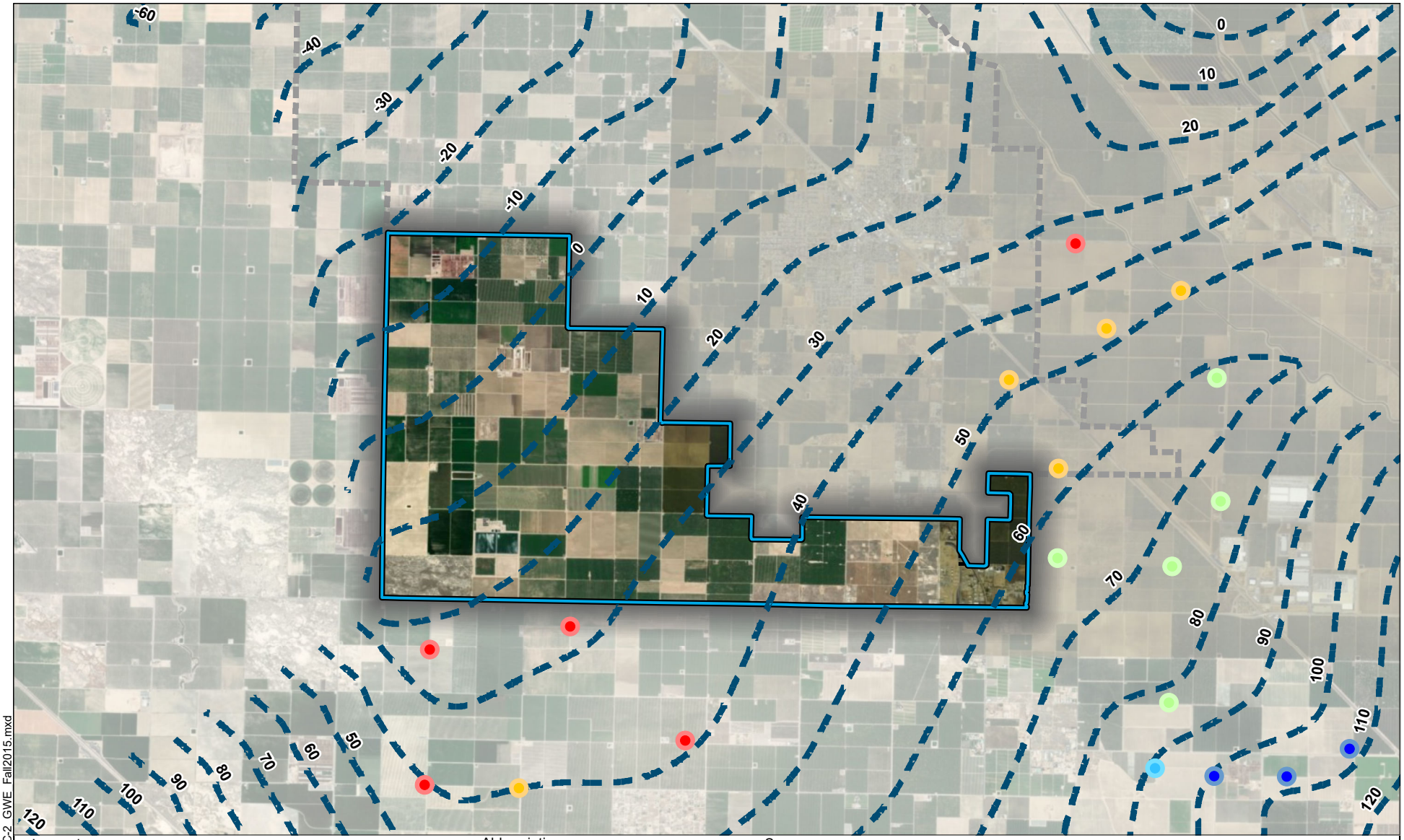
Path: X:\B80079\Maps\2019\11\FigGWC-1_GWE_Spr2015.mxd



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Fall 2015 Groundwater Elevation Contour (10-ft interval)

Fall 2015 Groundwater Elevation (ft msl)

- < 40
- 40 - 60
- 60 - 80
- 80 - 100
- > 100

Abbreviations

DWR	= California Department of Water Resources
ft	= feet
ft msl	= feet above mean sea level
SWID	= Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Groundwater elevation contours were created by DWR using an interpolation process called kriging and are less certain in areas with sparse data.
3. Only selected wells with available Fall 2015 data are shown.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 22 November 2019.
2. Water level data and contours acquired from DWR's Groundwater Information Center Interactive Map Application on 26 August 2016 (https://gis.water.ca.gov/app/gicima/).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

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(Scale in Miles)

Groundwater Elevation Fall 2015

SWID 7th Standard Annex Management Area

December 2019

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Figure GWC-2

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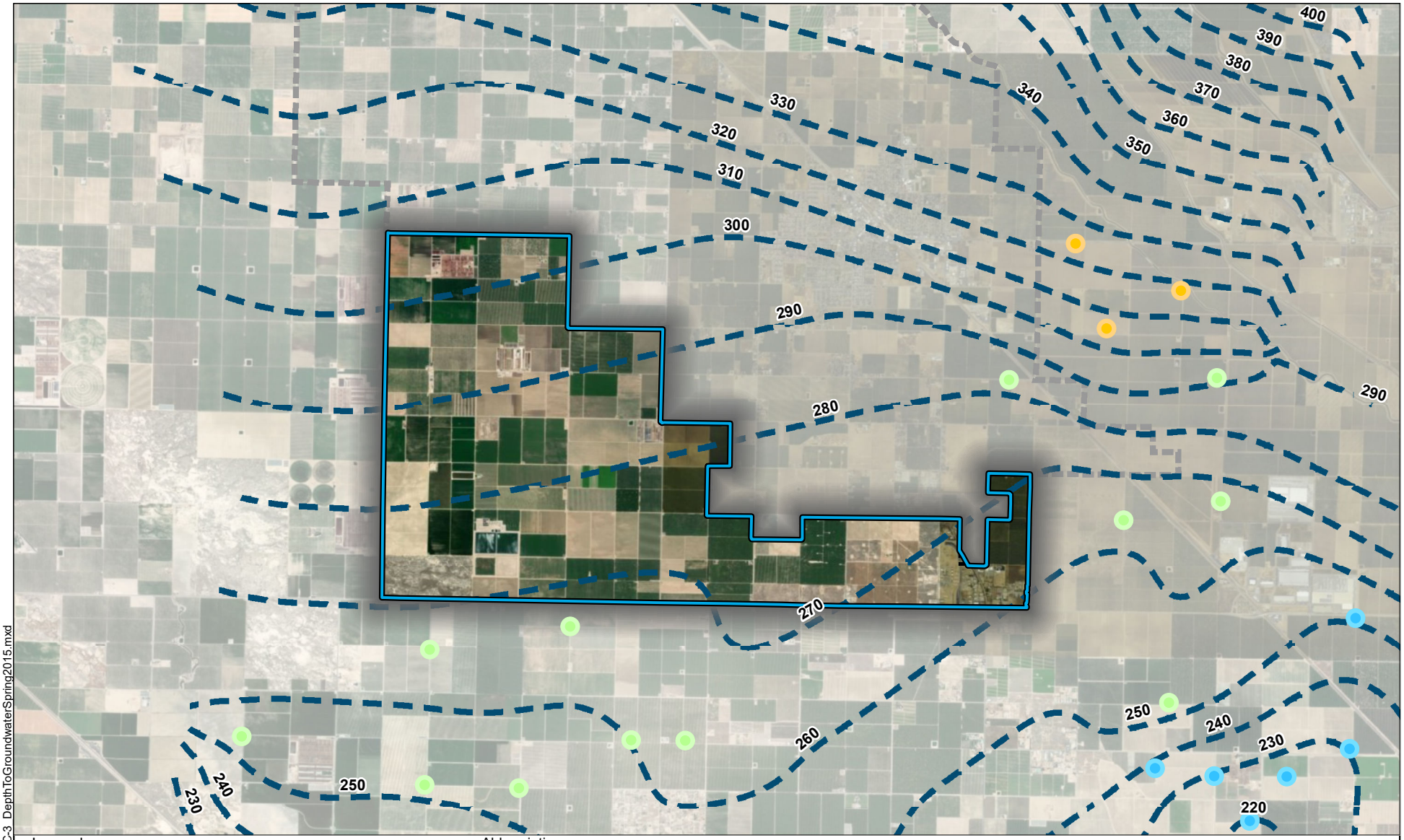
Path: X:\B80079\Maps\2019\11\FigGWC-2_GWE_Fall2015.mxd



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Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Spring 2015 Depth to Groundwater Contour (10-ft interval)

Fall 2015 Groundwater Elevation (ft bgs)

- < 200
- 200 - 250
- 250 - 300
- 300 - 350
- > 350

Abbreviations

DWR	= California Department of Water Resources
ft	= feet
ft bgs	= feet below ground surface
SWID	= Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Depth to groundwater contours were created by DWR using an interpolation process called kriging and are less certain in areas with sparse data.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 22 November 2019.
2. Depth to groundwater data and contours acquired from DWR's Groundwater Information Center Interactive Map Application on 26 August 2016 (https://gis.water.ca.gov/app/gicima/).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

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(Scale in Miles)

Depth to Groundwater Spring 2015

SWID 7th Standard Annex Management Area

December 2019

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Figure GWC-3

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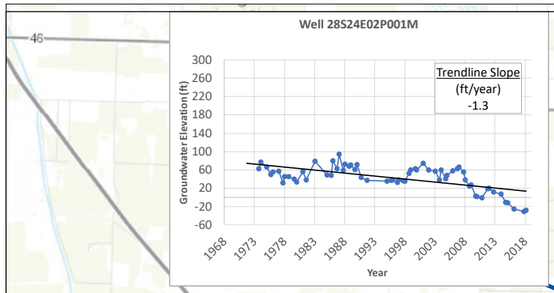

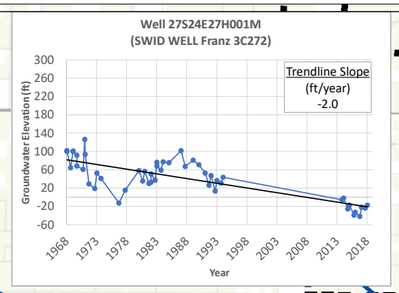

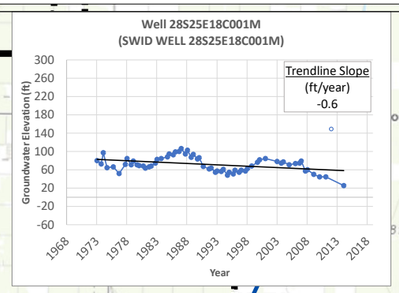

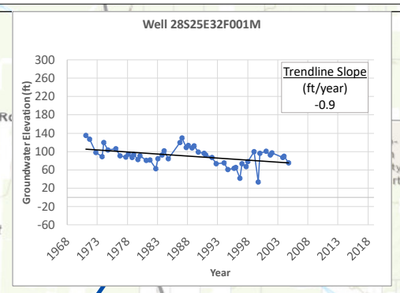

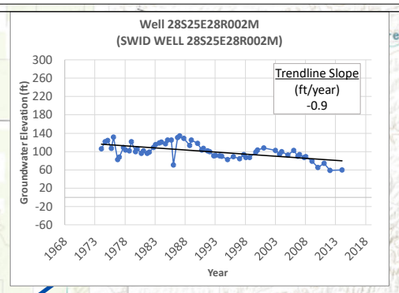

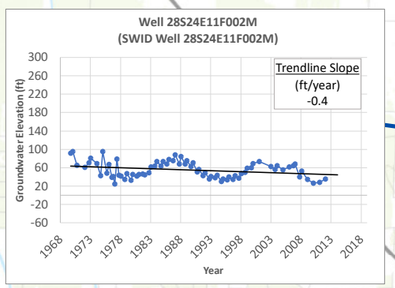

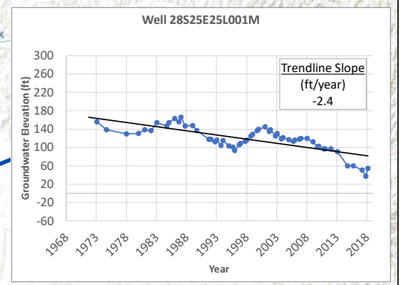

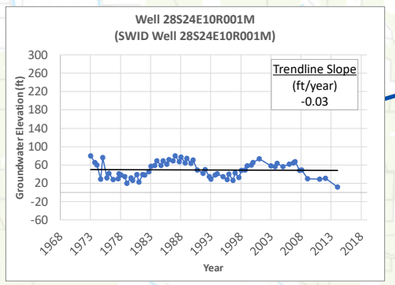

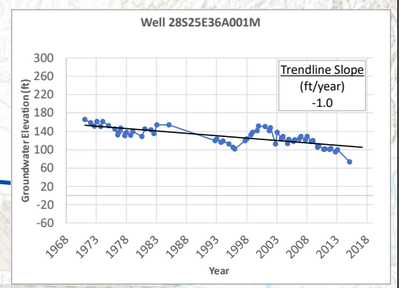

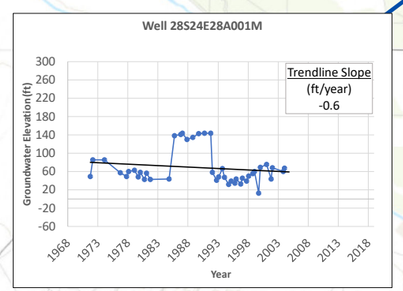

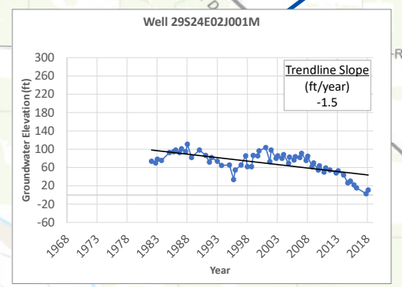

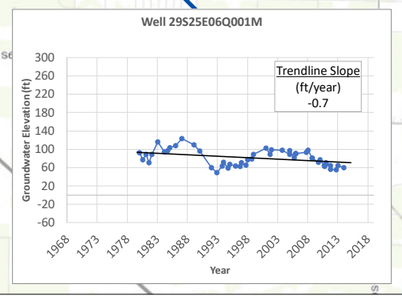

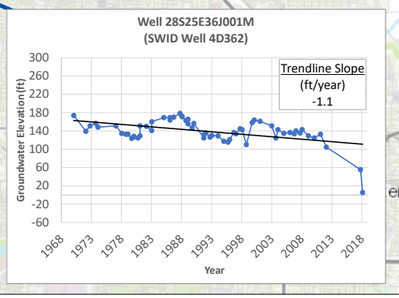

SEMITROPIC RIDGE
BUTTONWILLOW RIDGE
Shafter
Shafter Airport
Minter Field
Poso Creek
Highway 65
East Hills Mall
ersfield
1225 ft

Legend

- Current SWID Boundary
- SWID 7th Standard Annex Management Area
- Groundwater Monitoring Well
- Groundwater Elevation Measurement
- Groundwater Elevation Measurement, Apparent Outlier

Abbreviations

DWR = Department of Water Resources
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Wells in and proximate to the SWID 7th Standard Annex Management Area with available data spanning generally from 1970 to 2015 were selected and presented in the map.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 22 November 2019.
2. Water level data were acquired from DWR's SGMA Data Viewer on 07 November 2018 (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 2.5 5
(Scale in Miles)

Groundwater Elevation Hydrographs

SWID 7th Standard Annex Management Area
December 2019
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Figure GWC-4

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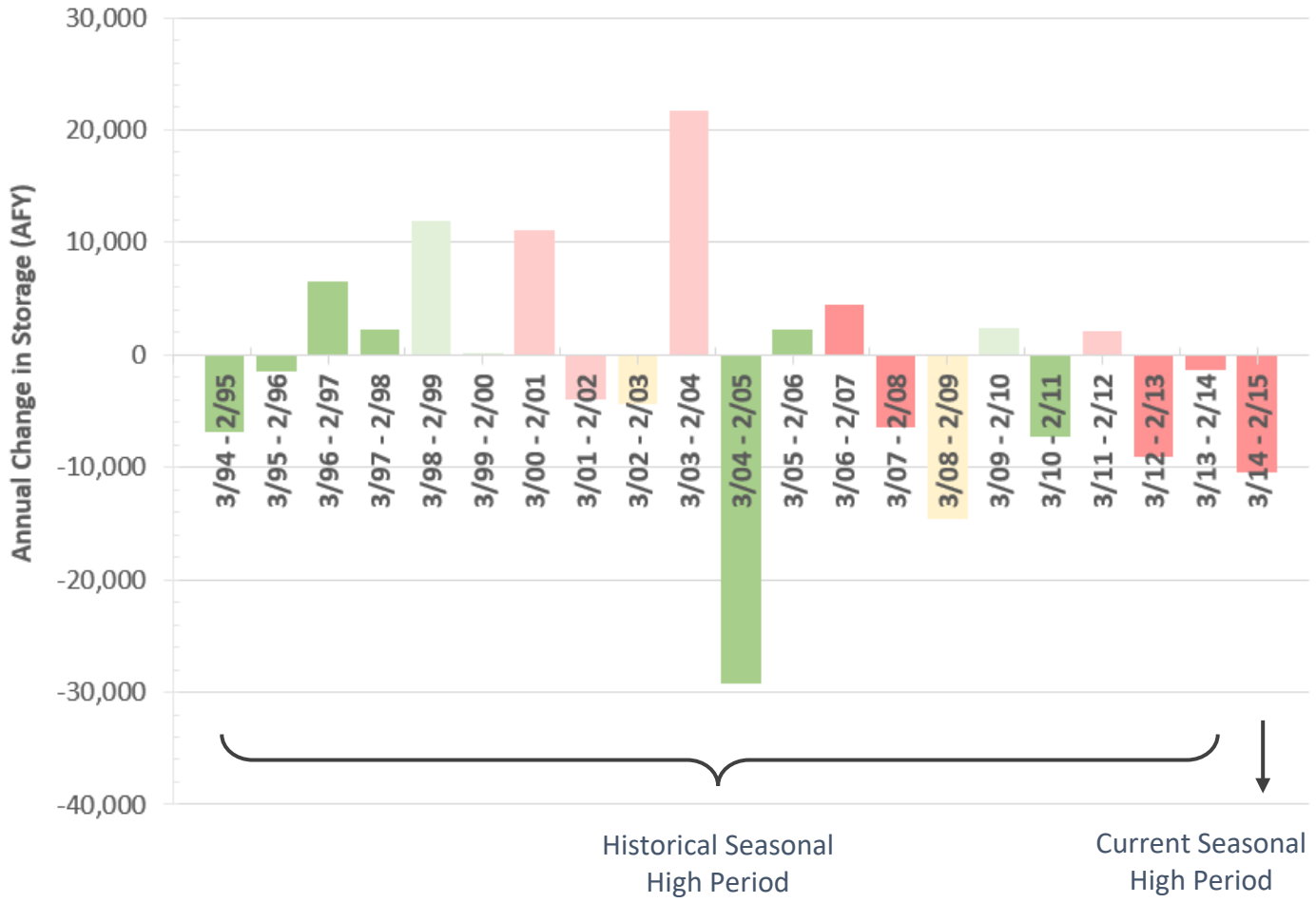

Legend

DWR Water Year Type

- Wet
- Above Normal
- Below Normal
- Dry
- Critical

Abbreviations

AFY = acre-feet per year

DWR = California Department of Water Resources

Notes

1. "Seasonal high" condition is defined as March of the previous year – Feburary of the current year.
2. The color of each bar is based on the Water Year type for the Water Year that begins in the October between the March and February represented by the bar.

Sources

1. DWR Water Year Type is from DWR's Water Year Hydrologic Classification Indices for the San Joaquin Valley (http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST).

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Annual Change in Storage Between Seasonal Highs vs. DWR Water Year Type

SWID 7th Standard Annex Management Area

December 2019

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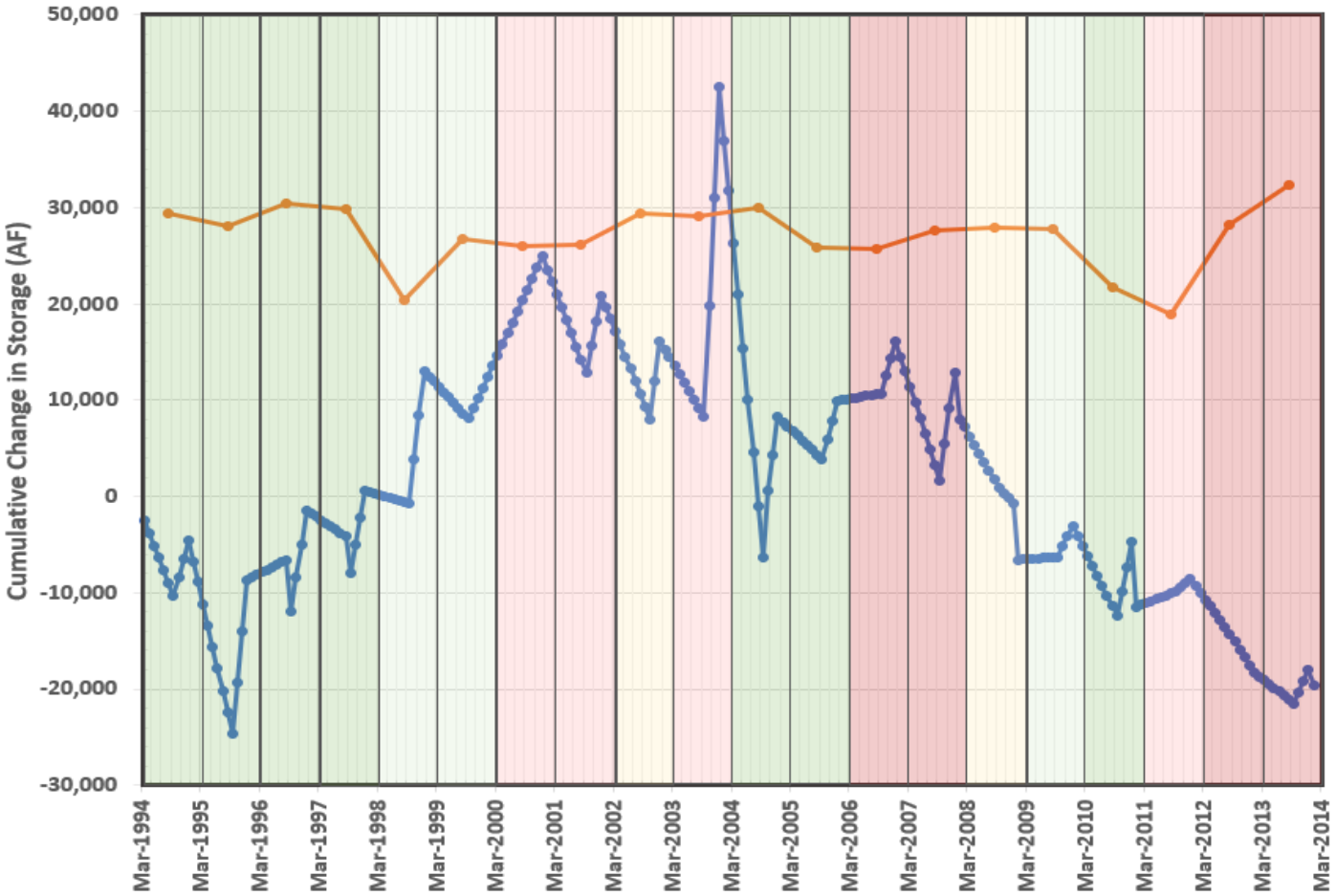
Figure GWC-5



Legend

DWR Water Year Type

- Wet
- Above Normal
- Below Normal
- Dry
- Critical

- Modeled cumulative change in storage
- Annual groundwater pumpage

Abbreviations

AFY = acre-feet per year
DWR = California Department of Water Resources

Sources

1. DWR Water Year Type is from DWR's Water Year Hydrologic Classification Index for the San Joaquin Valley, (http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST).

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Modeled and Observed Cumulative Change in Storage, and Pumpage vs. DWR Water Year Type

SWID 7th Standard Annex Management Area
December 2019
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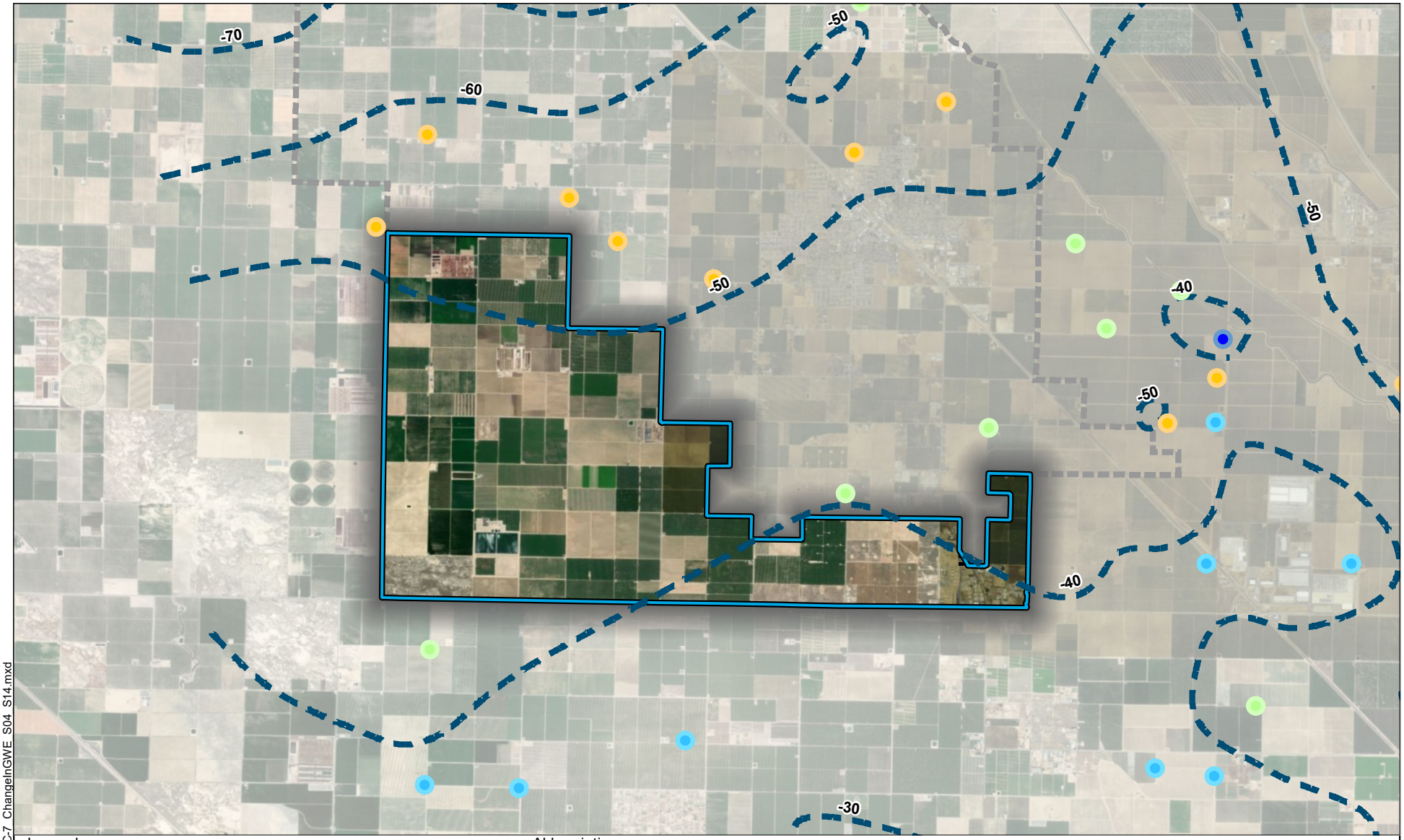
Figure GWC-6



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Spring 2004 - Spring 2014 Change in Groundwater Elevation (10-ft interval)

Change in Groundwater Elevation (ft) Spring 2004 to Spring 2014

- > -65
- -65 to -50
- -50 to -40
- -40 to -30
- < -30

Abbreviations

DWR = California Department of Water Resources
ft = feet
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 22 November 2019.
2. Change in groundwater elevation data and contour acquired from DWR's Groundwater Information Center Interactive Map Applicaiton on 26 August 2016 (https://gis.water.ca.gov/app/gicima/).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

Change in Groundwater Elevation Spring 2004 to Spring 2014

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SWID 7th Standard Annex Management Area
December 2019
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Figure GWC-7

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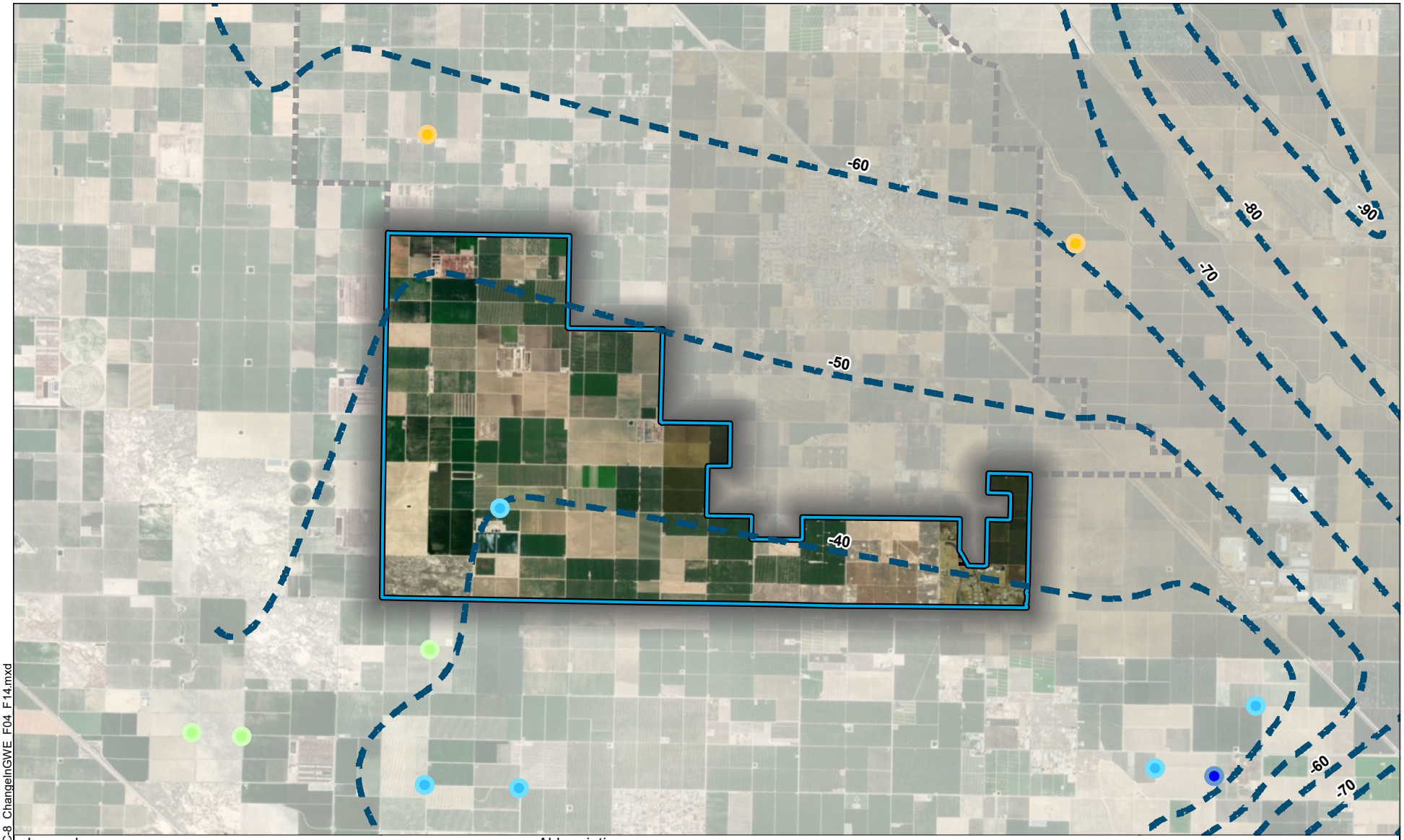

Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Fall 2004 - Fall 2014 Change in Groundwater Elevation (10-ft interval)

Change in Groundwater Elevation (ft) Fall 2004 to Fall 2014

- > -65
- -65 to -50
- -50 to -40
- -40 to -30
- < -30

Abbreviations

DWR = California Department of Water Resources
ft = feet
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 22 November 2019.
2. Change in groundwater elevation data and contour acquired from DWR's Groundwater Information Center Interactive Map Applicaiton on 26 August 2016 (https://gis.water.ca.gov/app/gicima/).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

Change in Groundwater Elevation Fall 2004 to Fall 2014

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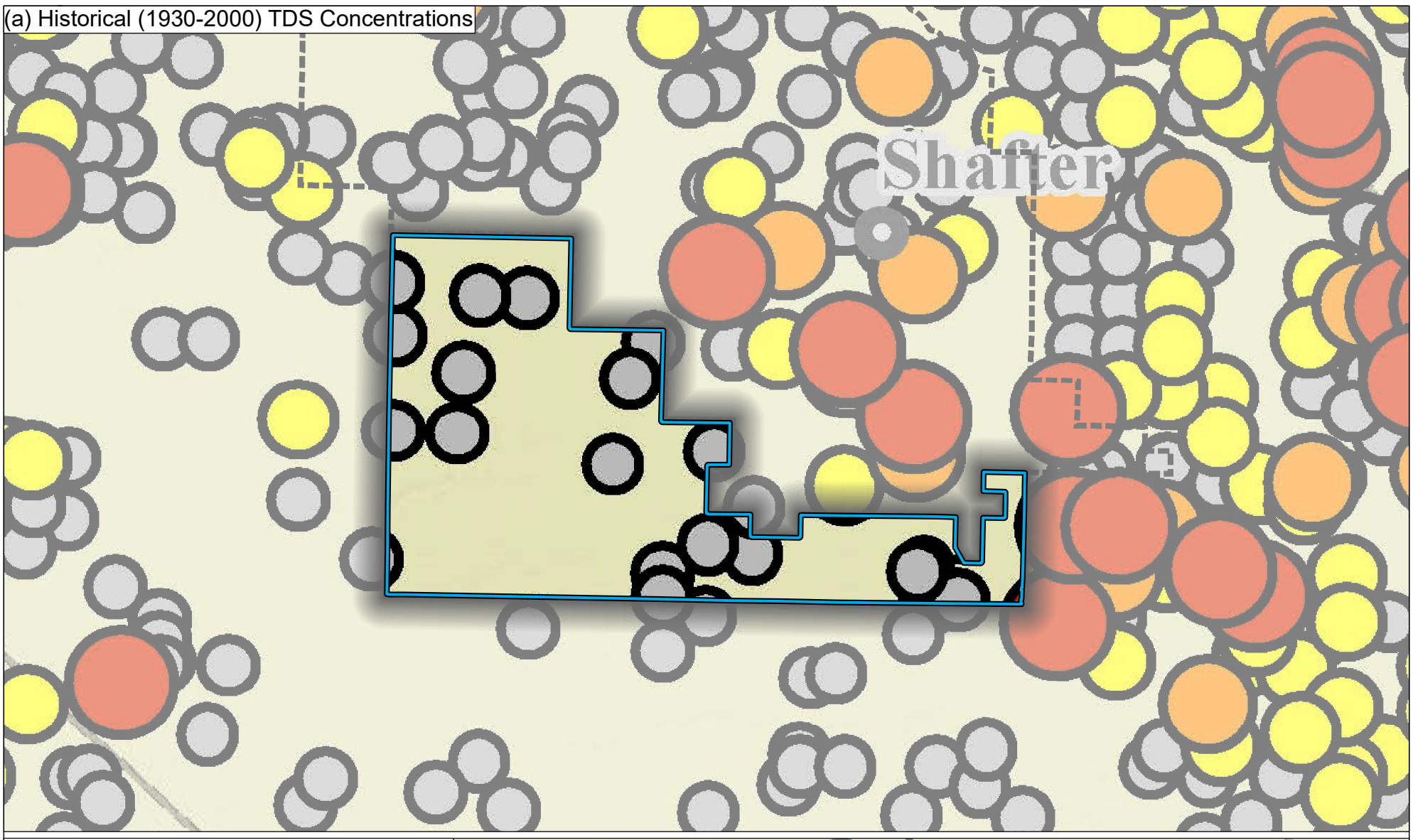
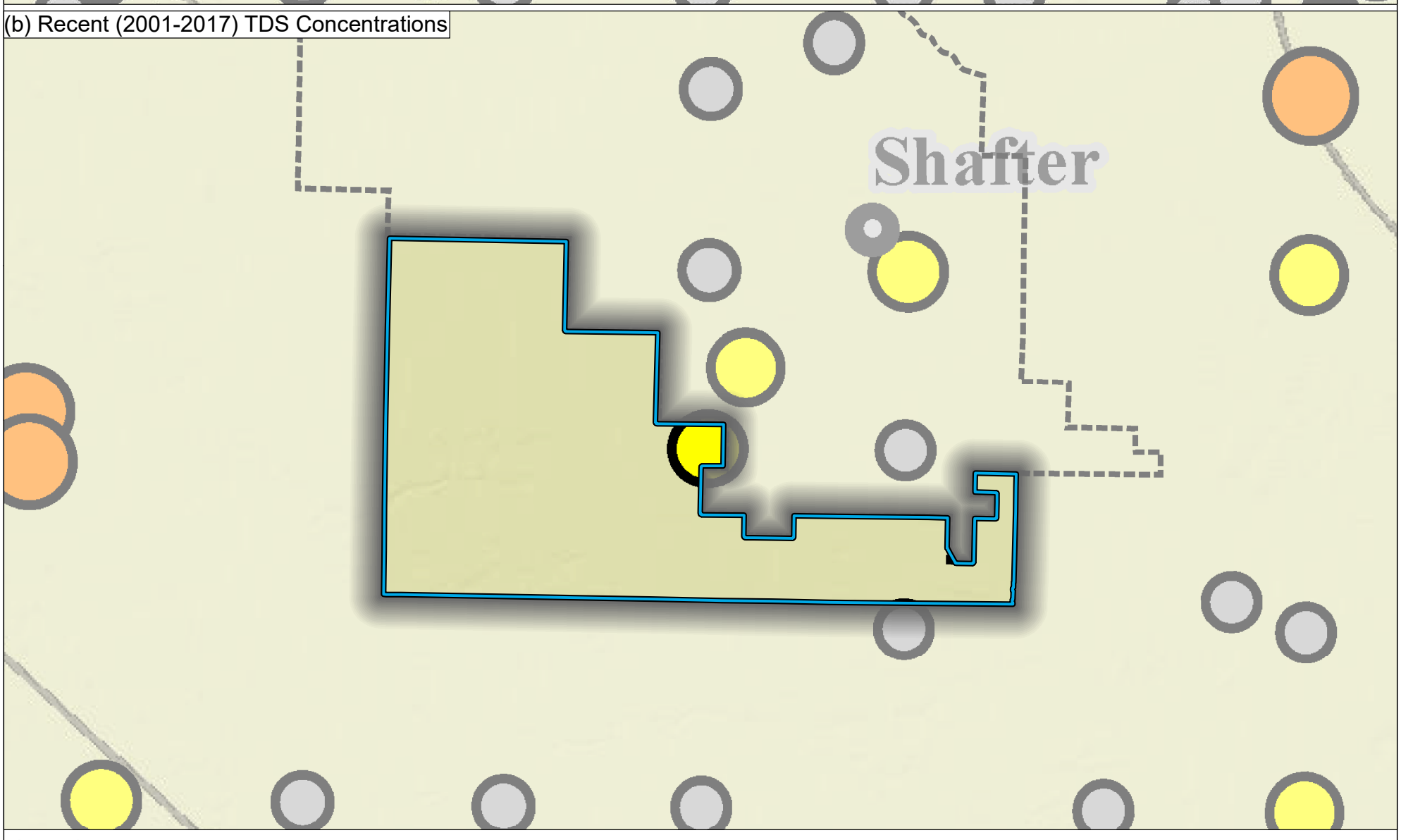
SWID 7th Standard Annex Management Area
December 2019
B80079.00
Figure GWC-8

Path: X:\B80079\Maps\2019\11\FigGWC-8_ChangeInGWE_F04_F14.mxd

(a) Historical (1930-2000) TDS Concentrations



(b) Recent (2001-2017) TDS Concentrations



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

Maximum TDS Concentration

- ≤ 500 mg/L
- 501 - 1,000 mg/L (Exceeding Recommended SMCL)
- 1,001 - 1,500 mg/L (Exceeding Upper SMCL)
- >1,500 mg/L (Exceeding Short Term SMCL)

Abbreviations

DWR	= California Department of Water Resources
mg/L	= miligrams per liter
SMCL	= Secondary Maximum Contaminant Level
SWID	= Shafter-Wasco Irrigation District
TDS	= Total Dissolved Solids

N

0 1.5 3

(Scale in Miles)

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 22 November 2019.
2. Water quality data was based on the Groundwater Ambient Monitoring and Assessment Program (GAMA) website: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/, accessed on 18 November 2019.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

Groundwater Quality – Recent (2001-2017) and Historical (1930-2000) TDS Concentrations

eki environment & water

SWID 7th Standard Annex Management Area
December 2019
B80079.00

Figure GWC-9

Path: X:\B80079\Maps\2019\11\FigGWC-9_HistoricalRecentTDS.mxd

(a) Historical (1900-2000) Nitrate Concentrations

Shafter

(b) Recent (2001-2017) Nitrate Concentrations

Shafter

Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

Maximum Nitrate Concentration

- ≤10 mg/L (Below MCL)
- 10.1 - 20 mg/L (Exceeding MCL)
- >20 mg/L (Exceeding 2x MCL)

Abbreviations

MCL = Maximum Contaminant Level
mg/L = miligrams per liter
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 27 November 2019.
2. Water quality data was based on the Groundwater Ambient Monitoring and Assessment Program (GAMA) website: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/, accessed on 18 November 2019.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

Groundwater Quality – Recent (2001-2017) and Historical (1900-2000) Nitrate Concentrations

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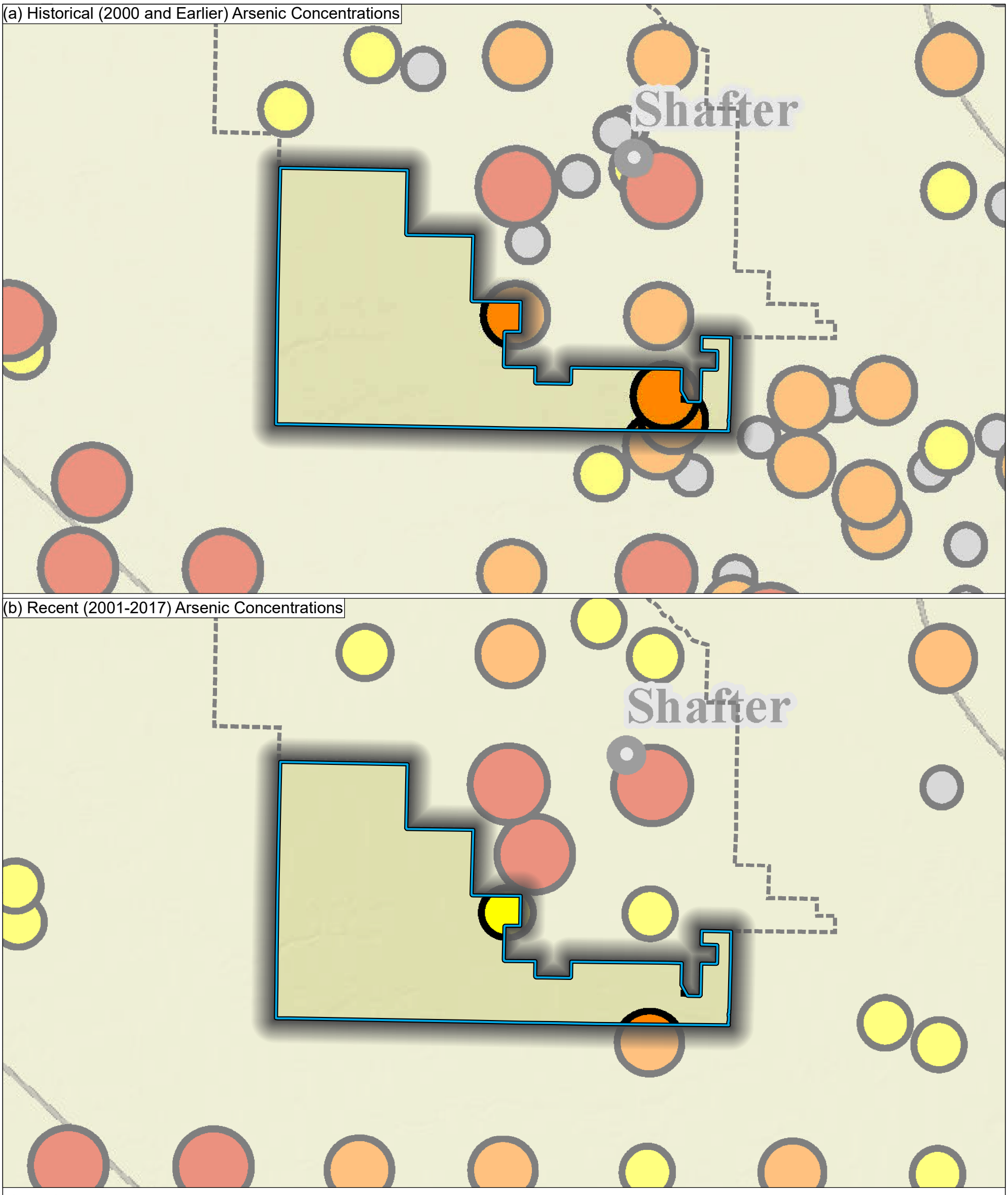
SWID 7th Standard Annex Management Area
December 2019
B80079.00

Figure GWC-10

Path: X:\B80079\Maps\2019\11\FigGWC-10_HistoricalRecentNO3.mxd

(a) Historical (2000 and Earlier) Arsenic Concentrations



(b) Recent (2001-2017) Arsenic Concentrations

Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

Maximum Arsenic Concentration

- Non Detect
- <5 ug/L
- 5 - 10 ug/L
- >10 ug/L (Exceeding MCL)

Abbreviations

MCL = Maximum Contaminant Level
ug/L = micrograms per liter
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 27 November 2019.
2. Water quality data was based on the Groundwater Ambient Monitoring and Assessment Program (GAMA) website: https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/, accessed on 18 November 2019.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

Groundwater Quality – Recent (2001-2017) and Historical (2000 and Earlier) Arsenic Concentrations

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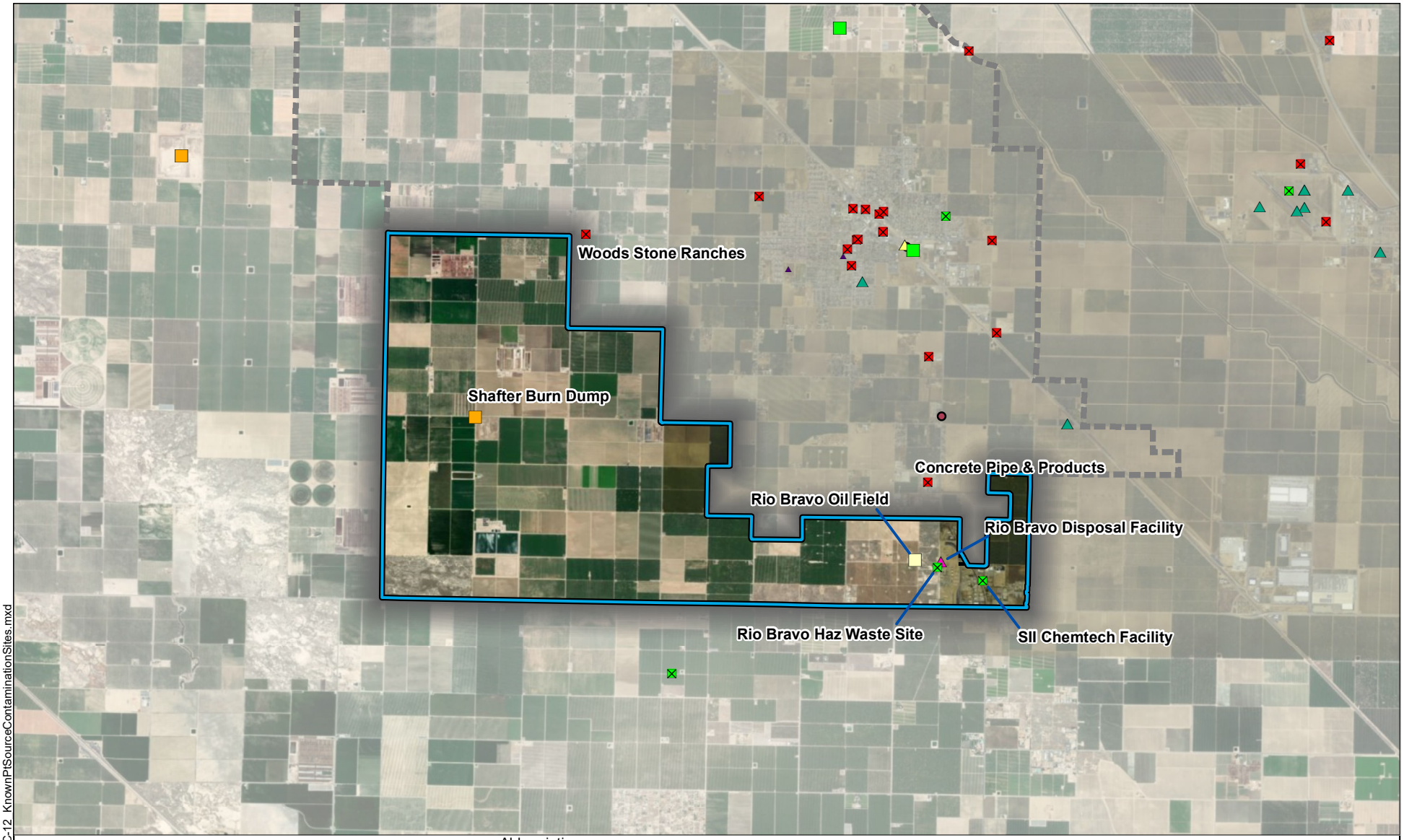
SWID 7th Standard Annex Management Area
December 2019
B80079.00

Figure GWC-11

Path: X:\B80079\Maps\2019\11\FigGWC-11_HistoricalRecentArsenic.mxd



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area

GeoTracker Sites

- Cleanup Program Site, Open
- Cleanup Program Site, Closed
- LUST Cleanup Site, Closed
- Land Disposal Site, Open
- Other

EnviroStor Sites

- Certified, State Response
- Active State Response
- Inactive - Needs Evaluation
- School Investigation, No (Further) Action
- Closed Hazardous Waste Site
- Hazardous Waste Site Undergoing Closure

Abbreviations

LUST	= Leaking Underground Storage Tank
SWID	= Shafter-Wasco Irrigation District
SWRCB	= State Water Resources Control Board

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 22 November 2019.
2. Locations of contamination sites from SWRCB GeoTracker website accessed 28 September 2018, and Department of Toxic Substances Control EnviroStor website accessed 11 May 2018.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 1.5 3

(Scale in Miles)

Known Point Source Contamination Sites

SWID 7th Standard Annex Management Area

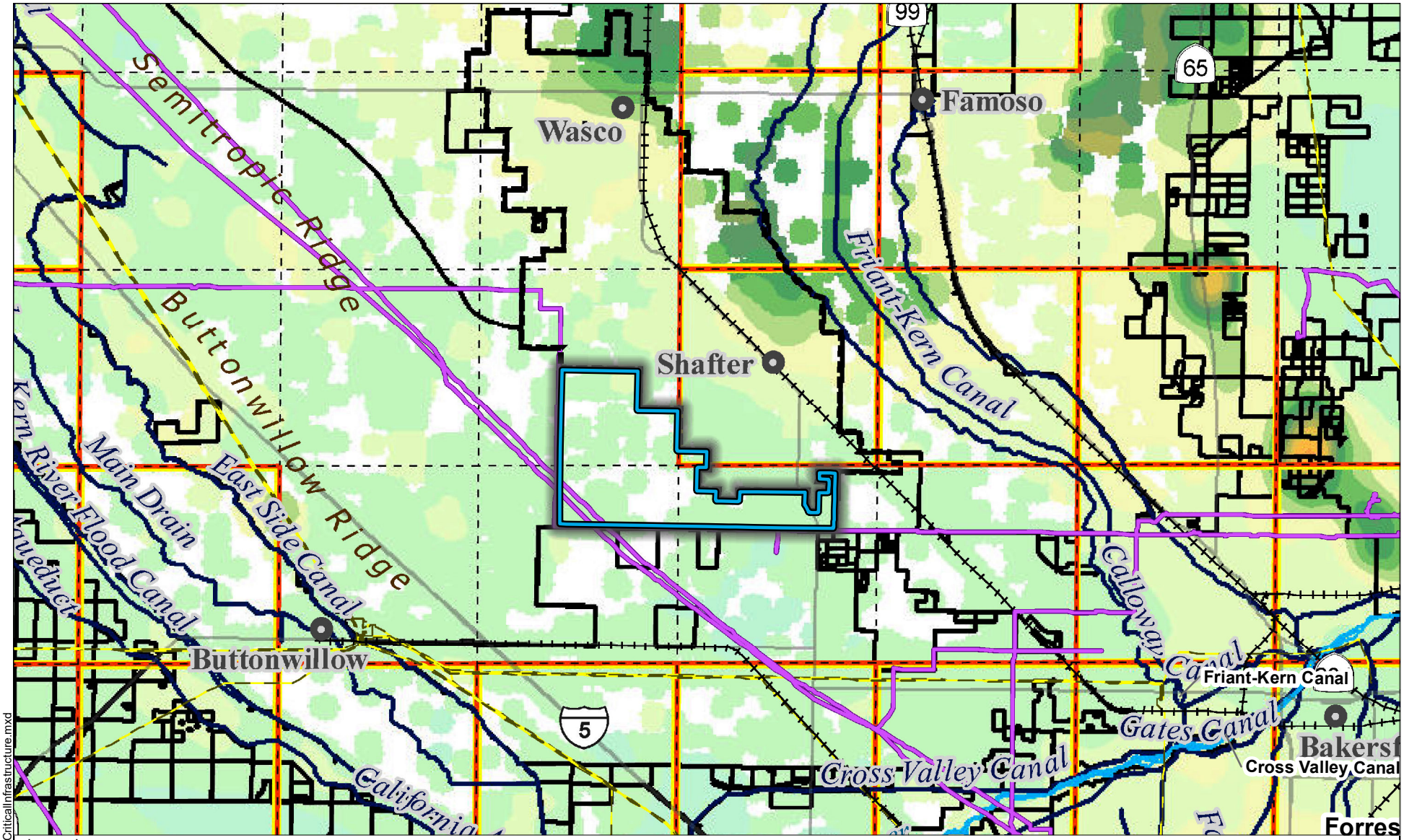
December 2019

B80079.00

Figure GWC-12

eki environment & water

Path: X:\B80079\Maps\2019\11\FigGWC-12_KnownPtSourceContaminationSites.mxd



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- California Rail Network 2020
- Major Electrc Transmission (>115 kV)
- Natural Gas Pipeline (>13 in)
- Major Conveyance
- 5mi Grid Lines
- 5mi Grid Cell selected for Subsidence Monitoring
- Management Area

Other Features

- Highway
- Named River

Subsidence 2016-2020 *(TRE Altamira inSAR 2020 / White = No Data)*

-1.73 - -1.7 ft	-0.79 - -0.7 ft
-1.69 - -1.6 ft	-0.69 - -0.6 ft
-1.59 - -1.5 ft	-0.59 - -0.5 ft
-1.49 - -1.4 ft	-0.49 - -0.4 ft
-1.39 - -1.3 ft	-0.39 - -0.3 ft
-1.29 - -1.2 ft	-0.29 - -0.2 ft
-1.19 - -1.1 ft	-0.19 - -0.1 ft
-1.09 - -1 ft	-0.09 - 0 ft
-0.99 - -0.9 ft	0.01 - 0.1 ft
-0.89 - -0.8 ft	0.11 - 0.2 ft

Abbreviations

SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 6 May 2022.
2. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

0 3.5 7

(Scale in Miles)

Critical Infrastructure

SWID 7th Standard Annex Management Area

May 2022

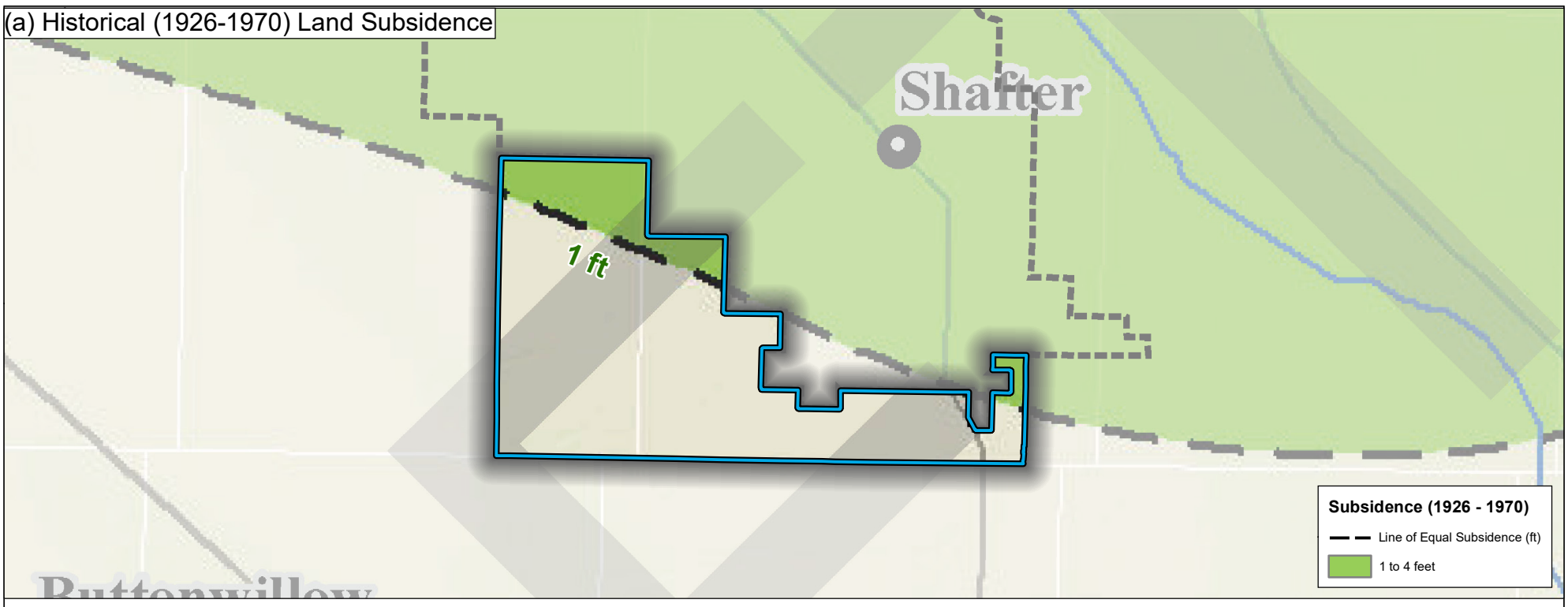
B80079.00

Figure GWC-13

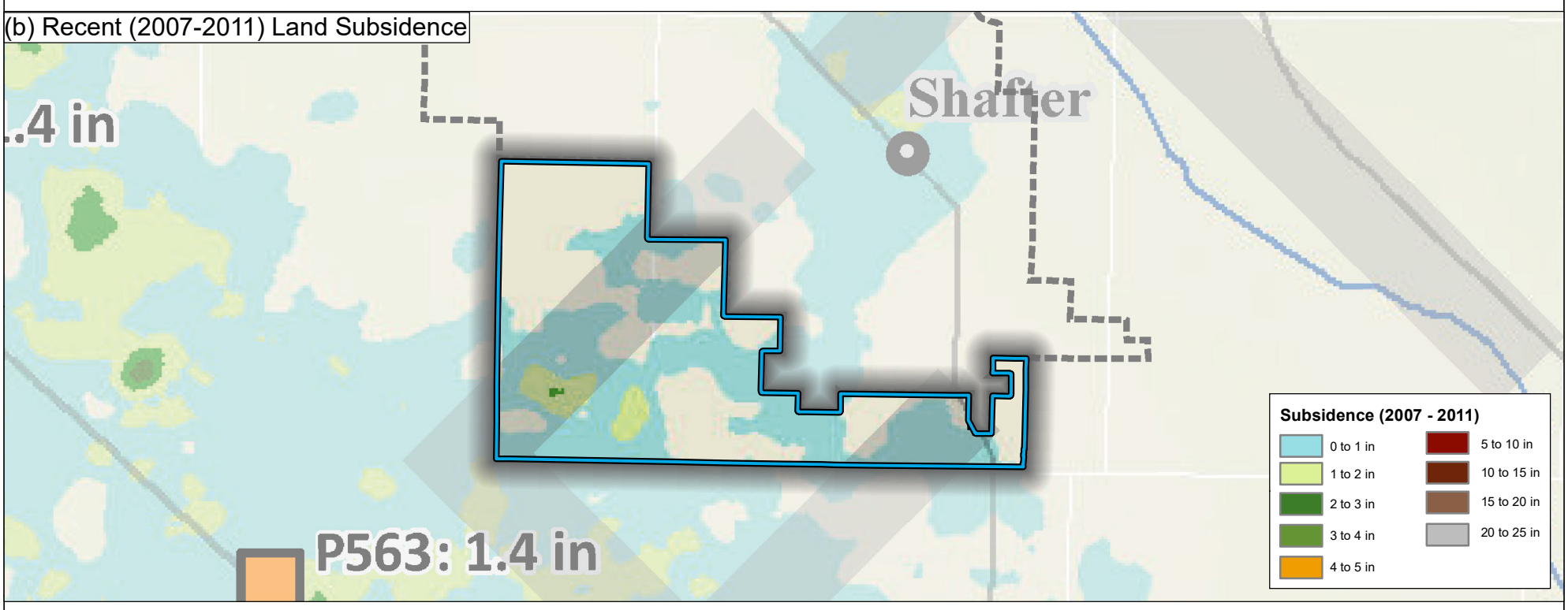
eki environment & water

Path: X:\B80079\Maps\2022\05\FigXX_CriticalInfrastructure.mxd

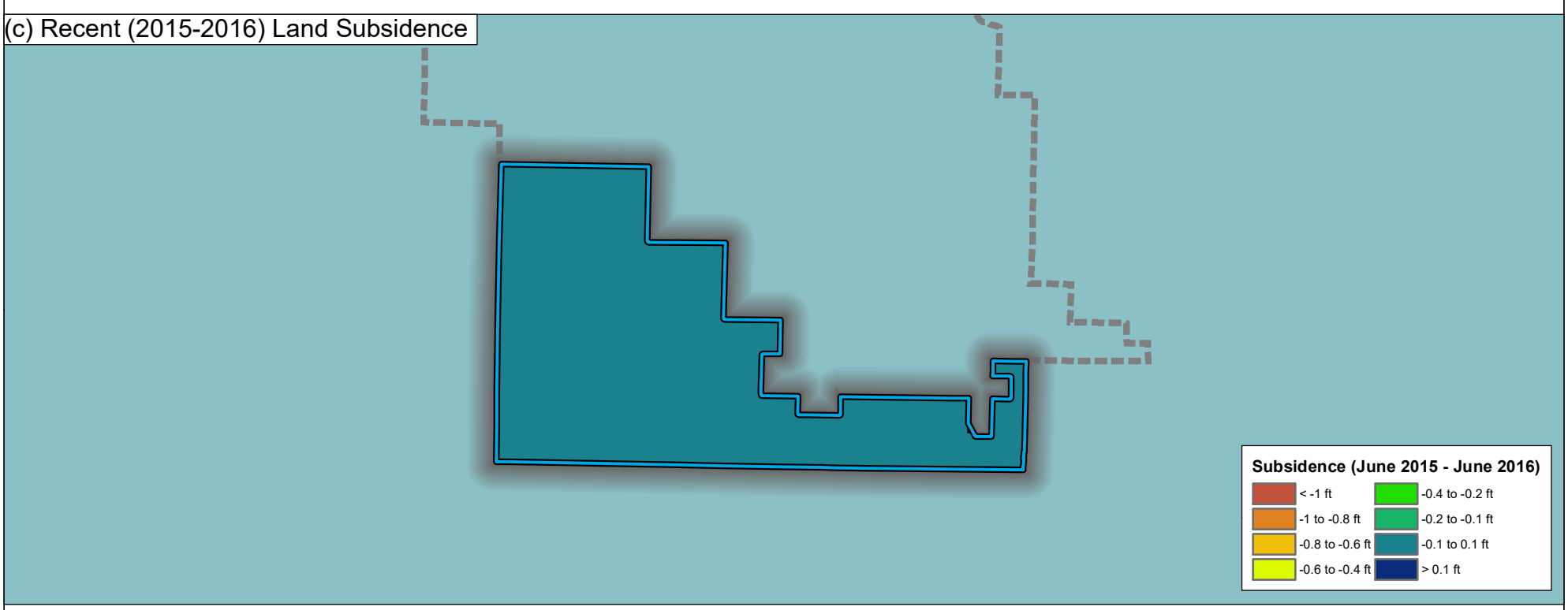
(a) Historical (1926-1970) Land Subsidence



(b) Recent (2007-2011) Land Subsidence



(c) Recent (2015-2016) Land Subsidence



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- SOPAC Continuous GPS Station
- Friant-Kern Canal

N

0 2 4

(Scale in Miles)

Abbreviations

GPS	= Global Positioning System
SOPAC	= Scripps Orbit and Permanent Array Center
SWID	= Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 5 May 2022.
2. Kern Groundwater Authority, 2019, Draft Groundwater Sustainability Plan, GEI Consultants, Inc., dated August 2019.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.
4. June 2015-June 2016 recent land subsidence data was obtained from the Interferometric Synthetic Aperture Radar (INSAR) data, downloaded on 5 May 2022.

Historical (1926-1970) and Recent (2007-2011, 2015-2016) Land Subsidence

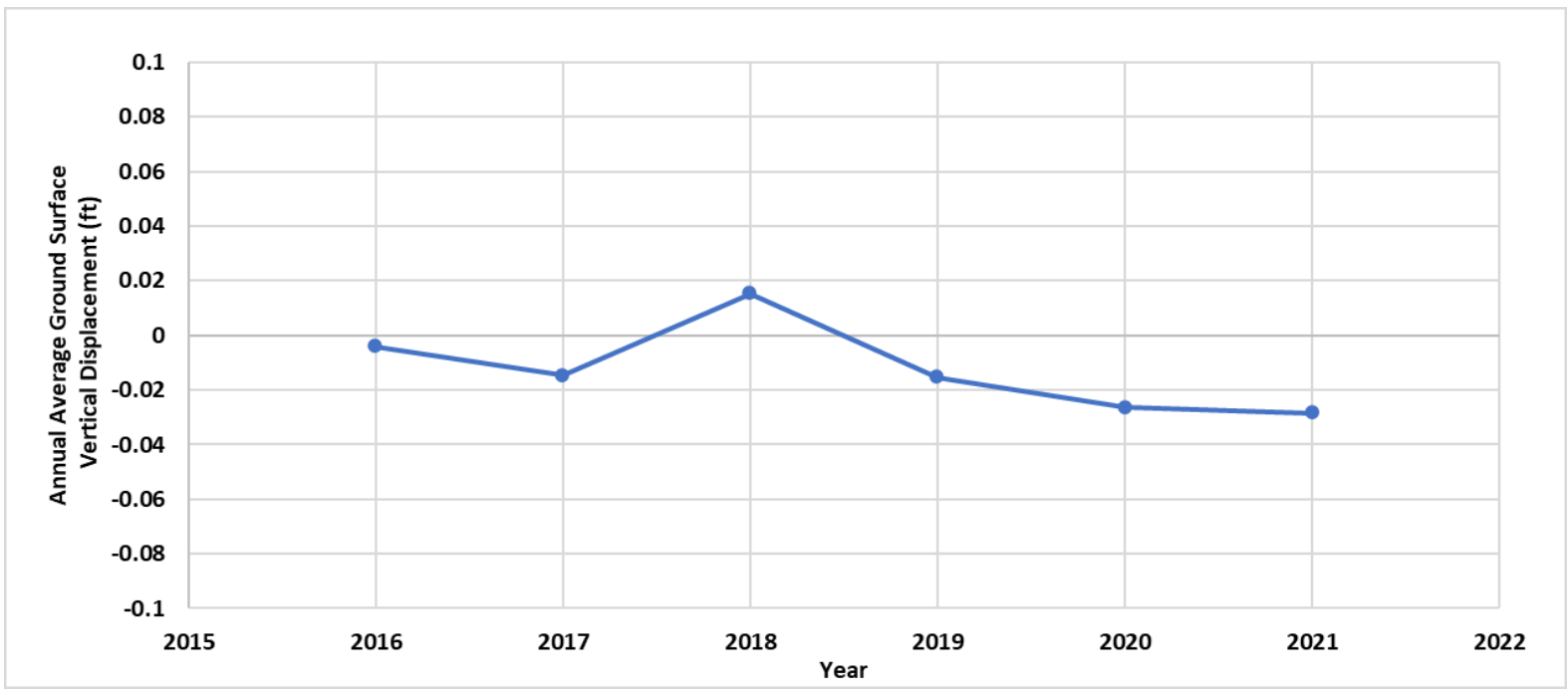
SWID 7th Standard Annex Management Area
May 2022
B80079.00
Figure GWC-14

eki environment & water

Path: X:\B80079\Maps\2022\05\FigGWC-13_Subsidence_HistoricalRecent.mxd

(a) Recent (2015-2021) Land Subsidence

(b) Annual Average Ground Surface Vertical Displacement (2015-2021)



Legend

SWID 7th Standard Annex Management Area

Shafter-Wasco Irrigation District

Total Subsidence (June 2015 - Jun 2021), feet

High : 1.26615

Low : -4.91226

N

0 2 4

(Scale in Miles)

Abbreviations

INSAR = Interferometric Synthetic Aperture Radar
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 6 May 2022.
2. Kern Groundwater Authority, 2019, Draft Groundwater Sustainability Plan, GEI Consultants, Inc., dated August 2019.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.
4. June 2015-June 2021 annual and total land subsidence data was obtained from the Interferometric Synthetic Aperture Radar (INSAR) data, downloaded on 5 May 2022.

Annual and Total Subsidence based on INSAR Data (2015-2021)

SWID 7th Standard Annex Management Area
May 2022
B80079.00

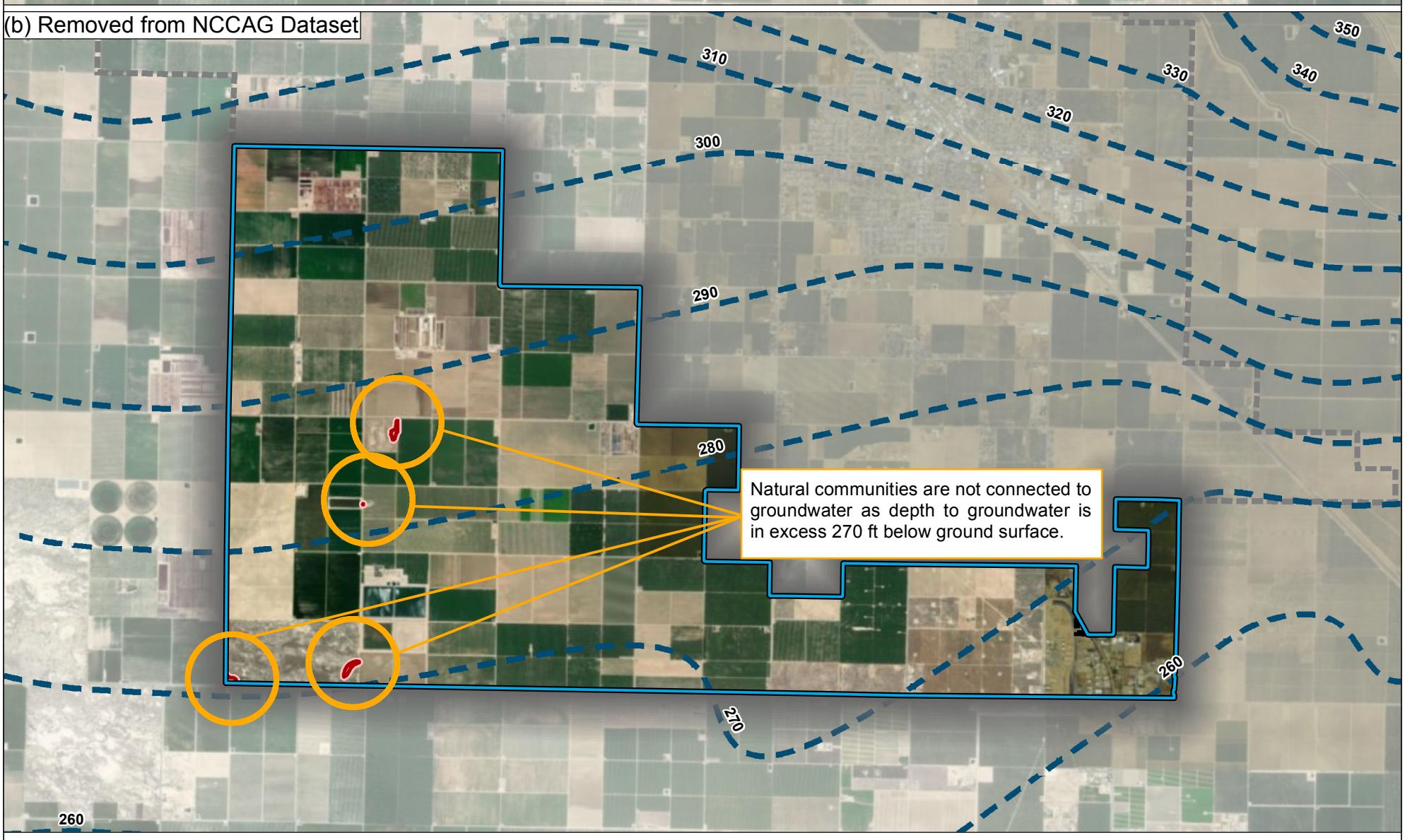
Figure GWC-15

eki environment & water

Path: X:\B80079\Maps\2022\05\FigXX_INSAR.mxd

(a) NCCAG Wetland and Vegetation - Identified by DWR as Potential GDEs

(b) Removed from NCCAG Dataset



Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- NCCAG Wetland
- NCCAG Vegetation
- Removed NCCAG Vegetation or Wetland
- Spring 2015 Depth to Groundwater Contour (10-ft interval)

N

0 1 2

(Scale in Miles)

Abbreviations

DWR = California Department of Water Resources
NCCAG = Natural Communities Commonly Associated with Groundwater
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 22 July 2019.
2. DWR NCCAG dataset was obtained from NC Dataset Viewer (https://gis.water.ca.gov/app/NCDatasetViewer/) on 10 May 2018.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

Natural Communities Commonly Associated with Groundwater (DWR)

SWID 7th Standard Annex Management Area
December 2019
B80079.00

Figure GWC-16

eki environment & water

Path: X:\B80079\Maps\2019\07\FigGWC-14_NCCAG.mxd

8. WATER BUDGET INFORMATION

☑ 23 CCR § 354.18(a)
☑ 23 CCR § 354.18(f)

All GSAs in the Kern County subbasin (Subbasin) coordinated and collaborated on the development of a groundwater model (Model) to evaluate historical, baseline and projected groundwater conditions. The GSAs entered into a Cost Share Agreement with the Kern River GSA who took the lead and contracted with Todd Groundwater to develop the Model on behalf of the Subbasin. The contract required that Todd Groundwater use the C2VSim model provided by DWR. Considerable effort and resources were expended to update the C2VSim model with local data to better represent Subbasin conditions. The process Todd Groundwater used to update C2VSim is more fully described in the Historical and Projected Future Water Budget Development (see Attachment H in the KGA Umbrella GSP). Basin-wide water budget results from the Model are provided in Attachment H and show the Subbasin, as a whole, has a total storage deficit of approximately 324,326 acre-feet per year (AFY) over the baseline period.

The Subbasin's dynamic conjunctive use programs, water banking operations, and water transfers/exchanges made it necessary to coordinate a GSA level water accounting system (Checkbook) using Subbasin specific values for supply, demand and net results. The Model results reflect Subbasin-wide conditions and do not allocate water shortages/surpluses, nor do the results allocate the "ownership" of water. As a result, the GSAs, through a coordinated effort, developed the Checkbook that estimates current conditions for each GSA that are generally consistent with the Model results under baseline condition. The Checkbook and Model budgets are based upon best available information, recognizing however, each estimate includes data gaps and has varying degrees of accuracy and/or reliability in the interest of developing a Subbasin coordinated approach.

To ensure the individual water budgets reflected actual conditions, the KGA members developed the Checkbook budget and coordinated water accounting methodology. The result of that effort indicates a current baseline shortage/deficit for KGA members of approximately -~~256,300~~225,533 AFY. This reflects the difference between a total demand for KGA members of 1,~~939,400~~475,358 AFY, and a total supply of 1,~~683,100~~249,825 AFY. Of the shortage/deficit of the KGA, the 7th Standard Annex Management Area's portion of the KGA shortage/deficit is -16,976 AFY, or a difference in demand of 27,555 AFY and a water supply of 10,579 AFY.

As is mentioned above, each estimate includes data gaps and has varying degrees of accuracy and/or reliability. The Checkbook is complimentary to the Model and reflects the allocation of water supply benefits and obligations independent of geographic constraints within the Subbasin. This was important to recognize and ensure the coordination of the various groundwater banking projects and water management programs amongst the various GSA's within the groundwater basin.

The two basin-level water budgeting efforts (i.e., the Model and the Checkbook) and the local water budget assessment (**Sections 8.1** through **8.4)** provide a range of results. **Table WB-1** below shows a comparison of results for change in groundwater storage from the three water budget approaches for several time periods. Change in groundwater storage is considered an appropriate term for comparison, as it amounts to an integration of all of the other inflow and outflow terms and represents the overall quantitative balance of the system.

The range of change in groundwater storage results shown in **Table WB-1** is due to several reasons. These include:

- Slight differences in the spatial area considered by the numerical model and the other two approaches (i.e., due to the fact that the model's grid cells/elements do not exactly align with the boundaries of the 7th Standard Annex Management Area);
- Slight differences in the way that projects and management actions are implemented over time within the model methodologies;
- Inherently different levels of spatial resolution between methods, affecting the parameterization and subsequent calculation of subsurface flow across boundaries; and
- Slight differences in the way in which land surface processes are treated (i.e., evapotranspiration demand, and precipitation).

Despite these differences, each approach provides valuable information that can support effective groundwater management within the basin and the 7th Standard Annex Management Area. Given the uncertainty among the local analytical spreadsheet model, the basin-wide numerical model, and the checkbook accounting approach, the 7th Standard Annex Management Area has chosen to use the high range of the deficit for planning purpose for Projects and Management Actions as described in **Section 16**, which is the deficit based on the checkbook accounting approach, i.e., 16,976 AFY. Through SGMA implementation, the Management Area will continue to refine the water budget parameters based on additional data and modeling and actual groundwater conditions within the basin.[32]

It is recognized that additional, more recent data (i.e., through 2022) are available at the time of preparation of this amended MA Plan. However, as the MA Plan does not constitute a five-year update to a GSP, but rather a response to the DWR determination letter, those additional data are not incorporated herein, with minor exceptions

[32] Nothing in this water budget information presented herein is meant to be viewed as a determination of water rights.

Table WB-1. Comparison of Change in Groundwater Storage Estimates from Three Water Budget Estimation Methods

Period / Scenario	Basin-wide Numerical Model	Local Analytical Spreadsheet Model	Basin-wide Checkbook Accounting Approach
Historical Period (WY 1995 – 2014)	-760 (a)	-1,084 (b)	NA
Current Period (WY 2015)	-13,457 (a)	-4,544 (b)	NA
Projected Period Baseline with no Projects	NA	-1,510 (c)	-16,976 (d)
Projected Period 2030 Climate Change with Projects (2)	NA	0 (e)	NA

Abbreviations
NA = not available

Notes:
(1) All values are in AFY.
(2) The Projected Period is 50 years in length. For the 2030 Climate Change with Projects scenario, the Basin-wide numerical model approach includes a 20-year (2021-2040) "implementation period" and a 30-year (2041-2070) "sustainability period". The Analytical Spreadsheet Model results assumes projects and management actions are fully implemented for the entire 50-year projected period.

Sources:
(a) Table 1of "FINAL_7thStandard-Hist-WBG.xlsx", received from Todd, 4 June 2019.
(b) Table WB-6
(c) Table WB-9
(d) "SKM_C25819111413180.pdf", received from KGA on 14 November 2019.
(e) Table PMA-2

8.1. Water Budget Methods and Data Sources

☑ **23 CCR § 354.18(d)**
☑ **23 CCR § 354.18(e)**

The Management Area-level water budget information presented herein is based on a spreadsheet model that quantifies each flow component and enforces mass balance principles for each "subdomain" that collectively comprise the water budget domain (the 7th Standard Annex Management Area).

The spreadsheet model approach was developed for the 7th Standard Annex Management Area to serve as an independent check on the estimates of the historical and current water budget derived from the basin numerical model described in the Umbrella GSP. The spreadsheet model approach uses a variety of data and analytical methods to quantify each water budget flow component (see **Appendix C**). Processes and groups of processes are grouped into "subdomains" and "flow components." These water budget flow components are quantified on a monthly timestep for the period from January 1994 through December 2015 (i.e., generally consistent with the water budgeting period being used for the remainder of the KGA). As identified further below, and consistent with the approach used in the KGA Umbrella GSP,

the period of WY 1995 – 2014 is used as the historical period, and WY 2015 is used as the current water budget period.

8.1.1. Water Budget Subdomains

The water budget is divided into five internal subdomains, each influenced by a number of flow components and within which mass-balance is enforced (i.e., the sum of inflow components is balanced by the sum of outflow components and/or a change in storage component). **Figure WB-1** shows the water budget domain, and the following internal subdomains:

a. Agricultural lands
b. Groundwater system
c. Industrial and domestic lands
d. NORSD WWTP
e. Artificial pipelines

In addition to the five internal subdomains, two external subdomains are incorporated into the spreadsheet model. These include the atmosphere which is a source of precipitation and sink for evapotranspiration, and the adjacent and connected portions of the groundwater basin (i.e. as source of net groundwater inflow). The spreadsheet model does not explicitly account for the vadose (unsaturated) zone between the land surface and the (saturated) groundwater system, but instead incorporates temporal lag factors to account for the movement of water through this zone. An implicit assumption in this approach, therefore, is that the vadose zone does not experience any change in storage over time.

8.1.2. Water Budget Flow Components

Within and between each subdomain are 17 water budget flow components that route water through the 7th Standard Annex Management Area. **Figure WB-2** shows a conceptual diagram of the individual water budget flow components between subdomains as well as flow components that are external to the overall water budget domain (i.e., serve only as an inflow or outflow to the entire system, rather than a flow between subdomains).

Certain components are based on "raw" data which are directly measured and based on historical records. These "raw" components are considered to have a relatively high degree of certainty. Other components are estimated using a variety of analytical methods and are thus subject to uncertainty based on the parameters used in their estimation. Some components (i.e., groundwater pumping for agricultural use) constitute major proportions of the overall water budget and have thus been given significant attention. Others are relatively minor in magnitude (e.g., seepage from artificial pipelines) and are, to some degree, less significant to the overall water budget and less well defined.

8.1.3. Data Sources

Per 23-CCR §354.18(e), the best-available data were used to evaluate the water budget for the 7th Standard Annex Management Area using the spreadsheet model and include the following:

- Precipitation Records from closest California Irrigation Management Information System (CIMIS) stations including:
    - Shafter climate station; *Monthly, January 1994 – September 2018*
    - Belridge climate station; *Monthly, October 1998 – September 2018*

- Satellite Evapotranspiration (ET) Data from the Cal Poly Irrigation Training and Research Center's "Mapping Evapotranspiration at High Resolution with Internalized Calibration" (ITRC-METRIC) Study, funded by the Kern Groundwater Authority (KGA)[33]; *Monthly, January 1993 -December 2015* [34]
- NORSD WWTP data from the NORSD including:
    - Water Budget; *Monthly*, *2009 – 2017*
    - Influent Data; *Annually*, *2007 – 2008*
    - Effluent Data; *Annually*, *1995 – 2006*
- Land Use Classifications (Crop Mapping) from the DWR SGMA Data Viewer; *2014*
- Historical Groundwater Level Records for selected wells within the Management Area from the DWR SGMA Data Viewer; *Seasonal resolution, Spring 1968 – Spring 2018 (data availability varies by well)*
- Water Use Data from industrial and domestic users provided by Plains All American and SMWC (data availability varies by users and time)

8.1.4. Intended Purpose of Water Budget

The water budget spreadsheet model described herein (as well as the basin-wide numerical modelling approach to water budget estimation described in the Coordination Agreement and Appendices thereto) aims to assess the water budget from a purely quantitative, physical perspective, which is consistent with SGMA and the GSP Emergency Regulations (i.e., CWC § 10720.5 and 23 § CCR 354.18(a)). The spreadsheet model does not aim to evaluate the water budget from the perspective of water rights. As discussed above in the beginning of **Section 8**, the "checkbook accounting" approach does attempt to evaluate the water budget with some consideration of water rights (e.g., through allocation of a uniform "native yield" component to all lands within the Basin). However, no determination is made therein, or anywhere in this MA Plan, as to the actual legal water rights as they pertain to groundwater within the 7th Standard Annex Management Area.

8.2. Water Budget Results

This section presents results of the water budget. The modeled values were calculated on a monthly time step period; however, for summary purposes, results are presented below as annual values during the entire current and historical water budget period (WYs 1995 – 2015), as well as long-term averages over the historical water budget period of WYs 1995 – 2014. The time periods used herein are consistent with those used in the KGA Umbrella GSP. As discussed in the KGA Umbrella GSP, the 20-year period of WYs 1995 – 2014 was selected because, as a whole, this period is climatically close to normal/average. It should be acknowledged, however, that the period also includes the majority of a significantly dry (drought) period between 2012 and 2015, as well as other years that were drier or wetter than normal, and that this

[33] Howes, D. 2017. 1993-2015 ITRC-METRIC ETc for Kern County. prepared for the Kern Groundwater Authority on behalf of the Cal Poly Irrigation Training and Research Center.
[34] There is no ITRC satellite ET data for calendar year 2012, as the LANDSAT satellite system employed in the ITRC-METRIC analysis was non-operational during this period.

period starts after a wet year and ends during a dry period. Consistent with the KGA Umbrella GSP, WY 2015 was selected to represent current conditions across the basin.

It should be noted that some information presented here aligns with the requirements of the current and historical water budgets described under **Section 8.3 *Current and Historical Water Budget*** below, and is therefore not repeated in the subsequent section.

8.2.1. Surface Water Inflows and Outflows

☑ 23 CCR § 354.18(b)(1)

Per 23-CCR §354.18(b)(1), **Table WB-2** presents annual summaries of the total surface water inflows to and outflows from the 7th Standard Annex Management Area for the historical and current periods. **Figure WB-3** shows the total surface water inflows by type, which include: (1) recycled water deliveries from the NORSD WWTP and (2) total precipitation. For summary purposes, annual averages over the historical water budget period are discussed below.

- The NORSD WWTP has provided secondary-level treated effluent for agricultural irrigation in the 7th Standard Annex Management Area since the early 1950s. Based on the data provided by the NORSD, recycled water is used to irrigate 2,500 acres[35] of agriculture lands within the Management Area. On average, the amount of recycled water used for irrigation was 3,559 AFY during the WY 1995-2014 time period. Cumulative recycled water import over this time period is shown on Figure WB-4.
- Precipitation on lands within the 7th Standard Annex Management Area contribute some water to the overall water budget and is grouped herein with "surface water inflows." Based on the data from the Shafter and Belridge CIMIS stations, annual rainfall over the period from WY 1995-2014 averaged of 6.4 inches per year, which is approximately equivalent to 5,290 AFY.[36]

Overall, total surface water inflows to the 7th Standard Annex Management Area averaged approximately 8,850 AFY during the WY 1995-2014 time period.

There is no natural streamflow or imported surface water sources other than the recycled water deliveries flowing into and leaving from the 7th Standard Annex Management Area. Water from precipitation serves to wet the near surface soil and then either evaporates, contributes to crop water demand, or (when a rainfall event is intense enough or long enough) percolates through the root zone to eventually recharge groundwater. In addition, all the treated recycled water received from the NORSD WWTP is applied to the agricultural land or infiltrates to groundwater through unlined ponds. Therefore, surface water outflows from the 7th Standard Annex Management Area are essentially zero.

[35] Total reclamation area was obtained from data provided by the NORSD staff on 14 August 2018.
[36] The record of precipitation data from the Shafter station is incomplete for the WY 1995-2014. When data were not available from the CIMIS station, data from the Belridge station were correlated and used to interpolate the missing Shafter data.

8.2.2. Groundwater Inflows and Outflows

☑ 23 CCR § 354.18(b)(2)
☑ 23 CCR § 354.18(b)(3)

Per 23-CCR §354.18(b)(2) and (b)(3), **Table WB-3** and **Figure WB-5** provide an annual summary of inflows to and outflows from the groundwater system by water source type for WYs 1995 – 2015. In addition, **Table WB-3** and **Figure WB-6** provide average results over the historical period of WY 1995 – 2014.

Total inflows to the groundwater system averaged approximately 25,970 AFY over WYs 1995 – 2014. Sources of inflow to the groundwater system include:

- Net subsurface groundwater inflow;
- Infiltration of precipitation;
- Infiltration of applied agricultural water;
- Infiltration of recycled water deliveries (irrigation);
- Infiltration of recycled water within the NORSD WWTP (ponds); and
- Infiltration of return flow from dairy and domestic water use.

The net subsurface groundwater inflow to the Management Area includes water from a variety of sources, including: water recharged from the Kern River, Friant-Kern flood flows, accretions below Lake Isabella that flow past Rocky Point Weir, and minor streams, which make up native safe yield; and imported State Water Project (SWP) as acknowledged by the Zone of Benefit assessment (**Section 6.3.6**).

Total outflows from the groundwater system averaged approximately 27,050 AFY over WYs 1995 – 2014 and were dominated by the extraction from private agricultural pumpers[37]. The other outflow components include industrial, domestic, and dairy water use.

8.2.3. Change in Groundwater Storage

☑ 23 CCR § 354.18(b)(4)
☑ 23 CCR § 354.18(b)(6)

Per 23-CCR §354.18(b)(4), **Figure GWC-5**, **Figure GWC-6**, and **Table WB-4** present the annual and cumulative change in groundwater storage between seasonal high conditions, which are defined in this chapter to be March of the previous year through February of the current year, to represent the winter conditions for the selected 20-year historical period. Note that this time window is distinct from DWR's definition of the "Water Year", which runs from October of the previous year to September of the current year (e.g., DWR WY 2015 is October 2014 – September 2015); thus the values presented in **Table WB-4** are slightly different than the annual and cumulative change in storage estimates provided for DWR WY 1995–2015 in **Table WB-3**, **Table WB-5**, and **Table WB-6**.

As discussed in **Section 7.2 *Change in Groundwater Storage***, annual change in groundwater storage under the 7th Standard Annex Management Area averaged -980 AFY between seasonal high conditions for the

[37] Extraction from private agricultural pumpers is estimated based on ET data developed by ITRC.

historical period of record (March 1994 – February 2014), with a cumulative change in storage of approximately -19,660 AF over the same period (as shown on **Figure GWC-5** and **Figure GWC-6**). **Figure WB-7**, **Figure WB-8**, and **Table WB-5** compare the annual and cumulative change in storage in the Management Area between WYs 1995 – 2014 and associated water year type based on DWR's San Joaquin Valley Water Year Index. These exhibits depict a clear relationship between change in groundwater storage to WY type, whereby change in storage becomes more positive with an increasing "wet" condition and more negative with an increasing "dry" condition. The net benefit of a "wet" period on groundwater conditions is especially evident in WYs 1996 – 2000, whereas the impact of a severe multi-year drought is evident in WYs 2001 – 2004 and WYs 2012 – 2015.

Figure WB-9 shows a comparison of the spreadsheet model-based change in groundwater elevation against the water level of a selected well[38] within the 7th Standard Annex Management Area. As shown on **Figure WB-9**, the spreadsheet model-predicted elevation correlates well with the measured water level. Further, the model-based change in groundwater elevation between Spring 2004 to Spring 2014 (-66 ft) and Fall 2004 to Fall 2014 (-40 ft) are consistent with the information on change in groundwater elevation presented in **Figure GWC-7**and **Figure GWC-8** (i.e., approximately -47 ft and -48 ft[39] over the same periods of interest).

The change in groundwater storage over time within the Management Area was estimated using the spreadsheet model was compared against an estimate based on the DWR change in groundwater level data[40], an estimated storage coefficient (storativity), and the area of the 7th Standard Annex Management Area (~10,000 acres) as follows:

$$Change\ in\ Storage = [Ending\ Water\ Level - Starting\ Water\ Level] * Storativity * Management\ Area$$

Based on the DWR change in groundwater level maps, between Spring 2004 and Spring 2014, the change in groundwater elevation ranged from -38 to -55 ft across the 7th Standard Annex Management Area (see **Figure GWC-7**). Assuming an average storage coefficient of 0.08[41], the calculated change in storage over that time period was approximately -37,000 acre-feet (AF), or approximately -3,700 AFY[42]. The spreadsheet model estimated a similar change in storage over this same time period of -5,660 AFY (for a cumulative change in storage of -56,600 AF). **Table WB-7** summarizes the change in storage in the 7th Standard Annex Management Area for selected time periods using the various methodologies described herein. The results of the C2VSim-FG model generally agree with the spreadsheet model results over the historical water budget period, though, it should be noted that due to the cell size and configuration used in the numerical model, these results do not reflect the exact boundary or total area of the Management Area. During the drought year of WY 2015, the C2VSim-FG model change in storage result is approximately three times the estimate change in storage for the Management Area based on the spreadsheet model.

[38] Well with state well number of 28S24E259001M was selected given its long-term water level data and its location within the Management Area.
[39] Average change in groundwater elevation across the Management Area was used here.
[40] Changes in groundwater level are obtained from the Groundwater Information Center Interactive Map Application (https://gis.water.ca.gov/app/gicima/) on 26 August 2016.
[41] Storage coefficient of 0.08 was estimated from the average specific yield of Layer 2 within the Management Area based on the C2VSim-FG (See **Table HCM-2**).
[42] Average change in groundwater elevations between Spring 2005 to Spring 2015 and Fall 2005 to Fall 2015 were used to estimate the change in groundwater storage. The groundwater elevation contours from the Groundwater Information Center Interactive Map Application are subject to uncertainty due to sparse data within and proximate to the Management Area.

Table WB-7. Change in Storage for Selected Time Periods

Period	Methodology	Total Change in Storage (AF)	Annual Rate of Change in Storage (AFY)
Spring 2004 – Spring 2014	DWR Water Level Maps	-37,000	-3,700
	Spreadsheet Water Budget Model	-56,600	-5,660
	C2VSim-FG	-32,538[43,44]	-2,958[43,44]
WY 1995 – WY 2014	Spreadsheet Water Budget Model	-21,670	-1,080
	C2VSim-FG	-15,205[43, 44]	-760[43, 44]
WY 2015	Spreadsheet Water Budget Model	-4,540	-4,540
	C2VSim-FG	-13,457[43, 44]	-13,457[43, 44]

8.2.4. Overdraft Conditions

☑ 23 CCR § 354.18(b)(5)

The Kern County Subbasin is designated by DWR in its latest version of *Bulletin 118 – California's Groundwater* as being in a condition of critical overdraft (DWR, 2016d). With respect to overdraft conditions and basins subject to those conditions, DWR has made the following statements:

- "A basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts." (DWR, 1980)
- Groundwater overdraft is "... the condition of a groundwater basin or subbasin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years. If overdraft continues for a number of years, significant adverse impacts may occur, including increased extraction costs, costs of well deepening or replacement, land subsidence, water quality degradation, and environmental impacts." (DWR, 2003)

[43] Due to the cell size and configuration used in the numerical model, these results do not reflect the exact boundary or total area of the Management Area. The model approximation of the Management Area consists of a total of 9,338 acres, approximately 93% of the actual total acreage of the Management Area.
[44] The results for the 7th Standard Annex Management Area were provided by the KGA GSA on 4 June 2019. Since the results are provided for Water Year (WY), total change in storage and annual rate of change in storage between Spring 2004 and Spring 2014 presented herein are the results for WY 2004 to WY 2014.

- "Overdraft occurs where the average annual amount of groundwater extraction exceeds the long-term average annual supply of water to the basin. Effects of overdraft result can include seawater intrusion, land subsidence, groundwater depletion, and/or chronic lowering of groundwater levels."[45]

The basin-wide Model and local water budget information discussed herein covers the period from WY 1995 through 2014[46] (i.e., it does not cover the entire period used in DWR's evaluation). The basin-wide Model and Checkbook and local water budget all indicate that historically, a decline in storage has been occurring over time in the Management Area. The Checkbook method estimates an overdraft amount of 16,976 AFY for the SWID 7th Standard Management Area (i.e., the difference in an estimated supply of 10,579 AFY and estimated demand of 27,555 AFY).

8.2.5. Sustainable Yield

☑ 23 CCR § 354.18(b)(7)

SGMA defines sustainable yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result" (California Water Code [CWC], §10721(w)). DWR's Water Budget BMP (DWR, 2016c), further states that "Water budget accounting information should directly support the estimate of sustainable yield for the basin and include an explanation of how the estimate of sustainable yield will allow the basin to be operated to avoid locally defined undesirable results." Inherent to the codified definition and the BMP statement is the avoidance of Undesirable Results, which include significant and unreasonable effects for any of the six SGMA sustainability indicators. Therefore, determination of the sustainable yield for the 7th Standard Annex Management Area depends upon how the Undesirable Results are defined.

While no exact method for defining the sustainable yield is required by SGMA or promoted by DWR in its Water Budget BMP, the BMP does emphasize that water budget accounting information should be used. It follows that an estimate of the sustainable yield of the groundwater system underlying the 7th Standard Annex Management Area can be made by adding the average annual change in storage to the average annual groundwater extraction. This simplified approach provides a sustainable yield number corresponding to the volume of water that, if pumped over the water budget period of interest, would have resulted in zero change in storage – a reasonable metric for sustainability. Based on the average annual change in groundwater storage over the water budget period WY 1995–2014 (i.e., approximately -1,080 AFY) and the average annual groundwater extraction (i.e., approximately 27,050 AFY), the sustainable yield is estimated at approximately 25,970 AFY under current supply and demand conditions.

Using the above simplified methodologies, **Table WB-8** below provides a summary of a range of potential sustainable yield estimates based on different selected time periods. However, this assessment does not take into consideration water rights, ownership of water, and other factors that ultimately will drive the volume of groundwater that can be sustainably extracted from this Management Area (see the beginning of **Section 8** and **16**).

[45] https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118/Critically-Overdrafted-Basins, accessed 1 July 2018.

Table WB-8. Sustainable Yield for Selected Time Periods

Time Period	Relevance of Time Period	Average Annual Change in Groundwater Storage (AFY)	Average Annual Groundwater Extraction (AFY)	Sustainable Yield (AFY)
WY 1995 - 2014	Historical Water Budget Period of Interest	-1,080	27,050	25,970
WY 1997 - 2009	DWR Overdraft Evaluation Period (**Section 8.2.4**)	20	27,080	27,100
WY 2004 - 2014	Recent Ten-Year Period excluding WY 2015	-3,620	26,800	23,180
WY 1995 - 2015	Entire Water Budget Period of Interest	-1,250	27,330	26,080
WY 1995 - 2011	17-year Period Excluding the Recent Drought	-60	26,570	26,510
WY 1995 - 2000	Data available within Bulletin 118 Assessment Period (1970 – 2000)	4,900	27,050	31,950

8.3. Current and Historical Water Budget

8.3.1. Current Water Budget

☑ **23 CCR § 354.18(c)(1)**

This section presents results for the "current" water budget, based on values extracted from the spreadsheet model for WY 2015. This is consistent with "current" period defined by the KGA in the Umbrella GSP. Water Year 2015 was classified as the third consecutive "Critical" (dry) Water Year and fourth consecutive "Dry" or "Critical" Water Year within the San Joaquin Valley and is thus representative of perhaps the worst drought condition in recent history within the region.

Per 23-CCR §354.18(d)(1), **Table WB-6** and **Figure WB-10** provide a summary of total inflows and outflows to the 7th Standard Annex Management Area for WY 2015, while **Table WB-3** and **Figure WB-11** provide a summary of groundwater inflows and outflows.

Total inflows to the 7th Standard Annex Management Area amounted to approximately 26,930 AF in WY 2015, including subsurface groundwater inflow, precipitation, and total inflow to the NORSD WWTP. This resulted in a total inflow to the groundwater system of approximately 28,450 AF, including subsurface groundwater inflow, infiltration of recycled water deliveries, infiltration of effective precipitation, infiltration of agricultural pumping water, infiltration of recycled water within the NORSD WWTP, and infiltration of dairy and domestic water use.

Total outflows from the 7th Standard Annex Management Area amounted to approximately 30,340 AF in WY 2015, including evapotranspiration (consumptive use by vegetation), consumptive industrial and domestic water use, and consumptive dairy water use. This resulted in a net outflow from the

groundwater system of approximately 33,000 AF, including agricultural pumping, industrial and domestic water use, and dairy water use.

As evident from these water budget values, the 7th Standard Annex Management Area (like nearly all areas in the Kern County Subbasin and San Joaquin Valley as a whole) was impacted significantly by the extreme drought condition of WY 2015, resulting in a net loss of over -4,540 AF of groundwater storage during this timeframe. However, as evidenced by the recovery of water levels and storage following previous dry periods, the groundwater system is resilient, and the "current" (WY 2015) conditions are not indicative of a normal condition but rather represent the late stages of a major drought period from which the groundwater system has already started to recover (see **Figure GWC-4**).

8.3.2. Historical Water Budget

☑ **23 CCR § 354.18(c)(2)**

Water budget results are presented for the historical water budget period in **Section 8.2 *Water Budget Results***, including associated figures and tables, and are not repeated here. Rather, this section focuses on providing: (a) a quantitative evaluation of historical recycled water availability and reliability (23-CCR §354.18(d)(2)(A)), (b) a quantitative assessment of the historical water budget (23-CCR §354.18(d)(2)(B)), and (c) a description of how historical conditions have impacted the ability of the 7th Standard Annex Management Area to be operated within its sustainable yield (23-CCR §354.18(d)(2)(C)).

Historical Recycled Water Availability and Reliability

☑ **23 CCR § 354.18(c)(2)(A)**

As described above, the 7th Standard Annex Management Area's only source of surface water supply is the recycled water deliveries from the NORSD WWTP. Agricultural lands in the Management Area have received recycled water since early 1950s. Between WY 1995 and 2014, the 7th Standard Annex Management Area received an average of 3,560 AFY of recycled water (16% of the total inflows into the Management Area).

Quantitative Assessment of Historical Water Budget

☑ **23 CCR § 354.18(c)(2)(B)**

Based on the DWR San Joaquin Valley Water Year Index for the 20-year period from WY 1995 through 2014, this period included four "critical" (dry) years, four dry years, two below normal years, three above normal year, and seven wet years. The first third of this period was relatively wet, the middle third was a mix of wet and dry years, and the last third of the period was extremely dry. This climatic factor is clearly reflected in the water budget for the 7th Standard Annex Management Area, whereby the groundwater system shows consistent increases in storage with "wetter" conditions and decreases in storage under "drier" conditions (see **Figure WB-7**, **Figure WB-8**, and **Table WB-5**).

Table WB-6 and **Figure WB-12** provide a tabular breakdown of total inflows and outflows to the 7th Standard Annex Management Area for WYs 1995 - 2015, and **Figure WB-13** provides a summary of average annual total inflows and outflows between WYs 1995 - 2014. The same information for the groundwater system only are provided in **Table WB-3** and on **Figure WB-5** and **Figure WB-6**.

Total inflows to the 7th Standard Annex Management Area amounted to an average of 25,660 AFY for WYs 1995 - 2014, comprised of subsurface groundwater inflow, precipitation, and of total inflow to the NORSD WWTP. This resulted in an average net inflow to the groundwater system of approximately 25,970 AFY, comprised of subsurface groundwater inflow, infiltration of agricultural pumping water, infiltration of effective precipitation, infiltration of recycled water deliveries, infiltration of recycled water within the NORSD WWTP, and infiltration of dairy and domestic water use.

Total annual outflows from the 7th Standard Annex Management Area amounted to 26,880 AFY for WYs 1995 – 2014, comprised of evapotranspiration (consumptive use by vegetation), consumptive industrial and domestic water use, and consumptive dairy water use. This resulted in a net outflow from the groundwater system of approximately 27,050 AFY, 97% of which was caused by agricultural pumping.

Operation within Sustainable Yield

☑ 23 CCR § 354.18(c)(2)(C)

Average annual change in groundwater storage within the 7th Standard Annex Management Area amounted to approximately -1,080 AFY between WYs 1995–2014, resulting in a cumulative change in groundwater storage of -21,700 AF during this period, based on observed water levels. Although the overall net change during this period is negative, the calculated transient change in storage and water levels measured in wells within the 7th Standard Annex Management Area (see **Figure WB-14** and **Figure GWC-4**) demonstrate that the groundwater system is sensitive to climatic variability and the Management Area operations, with decreases in storage during drought followed by increases in storage during wet periods. It is noted that this assessment does not take into consideration water rights, ownership of water, and other factors that ultimately will drive the volume of groundwater that can be sustainably extracted from this Management Area. As discussed in the beginning of **Section 8**, the sustainable yield value for the basin will be refined further refined through SGMA implementation.

8.4. Projected Water Budget

☑ 23 CCR § 354.18(c)(3)

Per 23-CCR §354.18(e)(2), projected water budgets are required as a way to estimate future conditions of water supply and demand within a basin, as well as the aquifer response to implementation of the Plan over the planning and implementation horizon. To develop the projected water budget, the same tools and similar spreadsheet methodologies that were used for the historical and current water budget were used, with updated inputs for climate variables (i.e., precipitation and evapotranspiration [ET]) and water supply assumptions (i.e., native safe yield). The chief purpose of this projected water budget analysis is to assess the magnitude of the net water supply deficit in the future, accounting for climate change variability. Another projected water budget based on the Checkbook Accounting Approach was discussed in the beginning of **Section 8**. The results from these two projected water budget methods form a range of shortfall volumes for the 7th Standard Annex Management Area; the high end of the range will be used for planning purposes and will be addressed through Projects and Management Actions to prevent Undesirable Results (discussed further in **Section 16**) and achieve the Sustainability Goal. This section describes the development and results of the projected water budget for the 7th Standard Annex Management Area using the spreadsheet methodologies.

8.4.1. Development of 50-Year Analog Period

☑ 23 CCR § 354.18(c)(3)(A)
☑ 23 CCR § 354.18(c)(3)(B)
☑ 23 CCR § 354.18(c)(3)(C)

Per 23-CCR §354.18(e)(2)(A), the projected water budgets must use 50 years of historical precipitation, evapotranspiration, and streamflow information as the basis for evaluating future conditions under baseline and climate-modified scenarios. To develop the required 50 years-worth of hydrologic input information, an "analog period" was created from the 20 years-worth of historical (WY 1995-2014) information by combining the years in a specific way that, on average, maintained the long-term average hydrologic conditions. This approach, which was used for both the spreadsheet water budget model approach and the basin-wide C2VSim-FG modeling approach, allowed for the creation of a complete 50-year period to inform the projected water budget analysis, even when certain component datasets were not available for that length of time. The sequence of actual years that were combined to create the 50-year analog period is as follows:

- Analog Years 1-12: Based on actual years 2003-2014
- Analog Years 13-32: Based on actual years 1995-2014
- Analog Years: 33-50: Based on actual years 1995-2012

The above mapping of actual years to analog years within the required 50-year projected water budget period applies to precipitation, surface water supplies and ET datasets.

8.4.2. Development of Projected Water Budget Scenarios

☑ 23 CCR § 354.18(c)(3)(A)
☑ 23 CCR § 354.18(c)(3)(B)
☑ 23 CCR § 354.18(c)(3)(C)

The basin-wide C2VSim-FG numerical model, which serves as the basin-wide model for historic, current, and future conditions, includes detailed consideration of climate change scenarios, including projected changes of subsurface inflows to the basin, subsurface outflows from the basin, surface water flows, imported water, precipitation, and evapotranspiration. For purposes of the Management Area Plan~~,~~ (MA Plan), these changes were applied to the Management Area-level water budget, and given its location within the basin incorporates primarily changes in precipitation and evapotranspiration.

Three projected water budget scenarios were developed for this analysis: a Baseline Scenario, a 2030 Climate Change Scenario, and a 2070 Climate Change Scenario per DWR guidance (DWR, 2018). The Baseline Scenario reflects a "no climate change" scenario, the 2030 Climate Change Scenario reflects a moderate level of climate change effects, and the 2070 Climate Change scenario reflects a high level of climate change effects. All three scenarios are used to project the water budget for the Management Area out through 2070.

All scenarios are based on estimated net subsurface inflows from calibrated historical water budget. Components of net subsurface inflows are discussed in **Section 8.2.2** ***Groundwater Inflows and Outflows***.[47]

Baseline Scenario

Per 23-CCR §354.18(e)(2)(B) and 23-CCR §354.18(e)(2)(C), the projected water budgets must use "the most recent land use, evapotranspiration, and crop coefficient information" and "the most recent water supply information as the baseline condition for estimating future surface water supply." The projected water demand contains agricultural and non-agricultural consumptive use. As discussed in **Section 8.2.1**, the 7th Standard Annex Management Area does not receive surface water other than NORSD WWTP inflows. Therefore, the projected water supply contains precipitation, surface water supplies (total NORSD WWTP inflows), and net subsurface inflows. For the purpose of the Baseline Scenario, no climate change factors are applied.

2030 Climate Change Scenario

☑ **23 CCR § 354.18(d)(3)**

In order to estimate the potential effects on the projected water budget of climate change during the GSP implementation period (i.e., between 2020 and 2040), a water budget scenario based on 2030 climate change factors published by DWR was developed. For this scenario, precipitation and ET were both adjusted based on the change factors published by DWR and consistent with the methodology applied in the numerical model. Surface water supplies (i.e., treated effluent) are assumed to be the same as the Baseline Scenario.

2070 Climate Change Scenario

☑ **23 CCR § 354.18(d)(3)**

In order to estimate the potential effects on the projected water budget of climate change towards the end of the planning and implementation horizon (i.e., 50 years out into the future), a water budget scenario based on 2070 "central tendency" climate change factors published by DWR was developed. It should be noted that estimates of climate change impacts on water supplies this far into the future have significant uncertainty. For this scenario, precipitation and ET were both adjusted based on the 2070 "central tendency" change factors published by DWR and consistent with the methodology applied in the numerical model. Surface water supplies (i.e., treated effluent) are assumed to be the same as the Baseline Scenario.

[47] The 7th Standard Annex Management Area landowners are a part of the KCWA Zone of Benefit (Zones 17 and 19) and pay a portion of the costs of State Water Project deliveries to the basin, commensurate with the benefits they receive. However, the KCWA has requested that this Zone of Benefit inflow be omitted from the Annex Area water budget as a condition of KCWA's agreement to cover the undistricted ("white area") lands within the basin. Therefore, net groundwater inflow resulting from the Zone of Benefit contributions are not included in the future water budget estimates for the Management Area, contingent upon KCWA's continued management of undistricted lands in the basin.

8.4.3. Projected Water Budget Results

Results of the projected water budget analyses are summarized in **Table WB-9**. As shown in **Table WB-9**, water budget components are presented as averages over the 20-year historical period and averages over the 50-year analog period for the Baseline, 2030 Climate Change, and 2070 Climate Change Scenarios. Water budget components are grouped into inflows and outflows, relative to the domain or subdomain they pertain to. Also shown in **Table WB-9** is the average annual change in groundwater storage for the historical period and each projected scenario.

In the Baseline Scenario, the water budget components differ only slightly from the historical period. The percent difference from the historical average period to the Baseline Scenario ranges from approximately -3.3% for net subsurface inflows to +2.2% for surface water supplies and non-agricultural consumptive use. This demonstrates that the 50-year analog period is a good representation of the historical conditions. The change in groundwater storage shows a shortfall of -1,510 AFY under the Baseline Scenario. In the 2030 and 2070 Climate Change Scenarios, the changes in groundwater storage are -2,333 AFY and -3,648 AFY respectively. It is noted that this assessment does not take into consideration water rights, ownership of water, and other factors that ultimately will drive the volume of groundwater that can be sustainably extracted from this Management Area. As presented in the beginning **Section 8** in **Table WB-1**, the coordinated Checkbook deficit for this area is -16,976 AFY.

TABLE WB-2

Annual Surface Water Inflows and Outflows by Source Type

Shafter-Wasco Irrigation District

7th Standard Annex Management Area

DWR Water Year (Oct - Sept)	INFLOWS [AFY]			OUTFLOWS [AFY]			
	Recycled Water Deliveries (b)	Total Precip.	**TOTAL SURFACE WATER INFLOWS**	Surface Water Exports	*Natural Outflows*		**TOTAL SURFACE WATER OUTFLOWS**
					Stream-flow out of District	Runoff of Excess Precip.	
Historical Water Budget Period (WY 1995 - 2014)							
1995	2,491	9,575	**12,066**	0	0	0	**0**
1996	2,496	4,692	**7,187**	0	0	0	**0**
1997	2,492	4,625	**7,117**	0	0	0	**0**
1998	2,491	13,142	**15,632**	0	0	0	**0**
1999	2,774	5,750	**8,524**	0	0	0	**0**
2000	3,442	4,642	**8,083**	0	0	0	**0**
2001	3,625	5,217	**8,842**	0	0	0	**0**
2002	3,623	3,675	**7,298**	0	0	0	**0**
2003	3,708	5,667	**9,374**	0	0	0	**0**
2004	3,744	3,558	**7,302**	0	0	0	**0**
2005	3,739	5,401	**9,140**	0	0	0	**0**
2006	3,736	7,358	**11,094**	0	0	0	**0**
2007	3,938	3,060	**6,998**	0	0	0	**0**
2008	4,002	2,372	**6,374**	0	0	0	**0**
2009	3,978	3,225	**7,203**	0	0	0	**0**
2010	3,254	6,317	**9,571**	0	0	0	**0**
2011	4,031	9,542	**13,572**	0	0	0	**0**
2012	4,062	4,658	**8,720**	0	0	0	**0**
2013	4,685	1,446	**6,130**	0	0	0	**0**
2014	4,868	1,958	**6,826**	0	0	0	**0**
TOTAL [AF]	71,177	105,878	**177,056**	0	0	0	**0**
AVERAGE	*3,559*	*5,294*	***8,853***	*0*	*0*	*0*	*0*
%	*40%*	*60%*	-	-	-	-	**-**
Current Water Budget Period (WY 2015)							
2015	3,868	3,950	**7,818**	0	0	0	**0**

TABLE WB-2

Annual Surface Water Inflows and Outflows by Source Type

Shafter-Wasco Irrigation District

7th Standard Annex Management Area

Abbreviations

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
NORSD = North of River Sanitary District
Precip. = precipitation
WWTP = Wastewater Treatment Plant
WY = Water Year

Notes

(a) All values reported in acre-feet per year (AFY).
(b) The Management Area does not receive any natural surface stream flow or imported surface water. Imported water is limited to recycled water from the NORSD WWTP.

TABLE WB-3

Annual Inflows to and Outflows from the Groundwater System and Change in Groundwater Storage

Shafter-Wasco Irrigation District

7th Standard Annex Management Area

	INFLOWS [AFY]							OUTFLOWS [AFY]				CHANGE IN STORAGE	
DWR Water Year (Oct - Sept)	Net Subsurface GW Inflow	Infiltration of Precipit.	Infiltration of Recycled Water Deliveries	Infiltration of Agricutural Pumping Water	Infiltration of Recycled Water within the NORSD WWTP	Infiltration of Dairy and Domestic Water	**TOTAL INFLOWS TO GW SYSTEM**	Ag. Pumping	Dairy Water Use	Industrial and Domestic Water Use	**TOTAL OUTFLOWS FROM GW SYSTEM**	**Annual Change in GW Storage [AFY]**	*Cumulative Change in GW Storage Since WY 1995 [AF]*
Historical Water Budget Period (WY 1995 - 2014)													
1995	2,967	1,644	1,183	7,182	1,120	104	**14,200**	27,189	206	265	**27,660**	**-13,461**	*-13,461*
1996	36,471	1,279	1,250	7,060	1,121	104	**47,285**	30,898	206	271	**31,375**	**15,910**	*2,449*
1997	21,183	1,109	1,204	7,432	1,122	104	**32,154**	29,238	206	273	**29,717**	**2,436**	*4,885*
1998	12,793	2,005	1,469	6,159	1,120	104	**23,651**	19,585	206	273	**20,064**	**3,587**	*8,472*
1999	25,150	1,816	1,515	5,633	1,173	104	**35,391**	25,718	206	276	**26,200**	**9,190**	*17,662*
2000	28,550	971	1,358	6,605	1,393	142	**39,020**	26,618	388	285	**27,291**	**11,728**	*29,391*
2001	8,361	1,092	1,440	6,232	1,624	224	**18,974**	24,385	448	288	**25,122**	**-6,148**	*23,243*
2002	15,739	869	1,444	6,743	1,629	226	**26,650**	29,525	448	291	**30,264**	**-3,614**	*19,628*
2003	15,530	950	1,584	7,057	1,644	227	**26,992**	27,706	448	304	**28,458**	**-1,466**	*18,163*
2004	9,025	883	1,582	7,140	1,680	227	**20,536**	29,867	448	316	**30,632**	**-10,096**	*8,067*
2005	20,410	912	1,643	6,957	1,682	228	**31,833**	25,788	448	327	**26,564**	**5,269**	*13,336*
2006	19,430	1,365	1,616	6,028	1,680	229	**30,348**	23,251	448	353	**24,052**	**6,296**	*19,632*
2007	10,088	739	1,147	6,639	1,717	230	**20,560**	27,142	448	369	**27,960**	**-7,399**	*12,233*
2008	15,860	633	1,113	6,766	1,797	231	**26,400**	27,001	448	378	**27,827**	**-1,427**	*10,806*
2009	8,556	646	1,332	6,713	2,312	231	**19,790**	27,078	448	380	**27,906**	**-8,116**	*2,690*
2010	5,612	1,158	1,081	6,249	2,963	231	**17,293**	21,552	448	380	**22,380**	**-5,086**	*-2,396*
2011	8,473	1,987	1,455	4,925	2,506	231	**19,578**	17,396	448	380	**18,224**	**1,353**	*-1,043*
2012	12,537	1,131	1,447	5,344	1,997	231	**22,688**	26,154	448	380	**26,982**	**-4,294**	*-5,338*
2013	14,533	538	1,412	7,281	1,565	231	**25,560**	31,473	448	380	**32,301**	**-6,742**	*-12,079*
2014	9,721	364	1,267	7,446	1,372	231	**20,402**	29,170	448	380	**29,998**	**-9,596**	*-21,675*
TOTAL	300,990	22,092	27,542	131,592	33,217	3,870	**519,303**	526,734	7,696	6,548	**540,978**	**-21,675**	-21,675
AVERAGE	*15,050*	*1,105*	*1,377*	*6,580*	*1,661*	*194*	***25,965***	*26,337*	*385*	*327*	***27,049***	***-1,084***	-
%	*58%*	*4.3%*	*5.3%*	*25%*	*6.4%*	*0.7%*	-	*97%*	*1.4%*	*1.2%*	-	-	-
Current Water Budget Period (WY 2015)													
2015	17,058	802	1,694	7,197	1,471	231	**28,454**	32,161	448	388	**32,998**	**-4,544**	*-26,219*

Abbreviations

AF = acre-feet
AFY = acre-feet per year
Ag. = Agricultural
DWR = California Department of Water Resources
GW = Groundwater
NORSD = North of River Sanitary District
Precip. = Precipitation
WWTP = Wastewater Treatment Plant
WY = Water Year

Notes

(a) All values reported in acre-feet per year (AFY), except cumulative change in storage (reported in acre-feet).
(b) This table presents annual inflows to and outflows from the groundwater system only. Inflows as infiltration account for deep percolation lag effect .
(c) The total and average values are based on results from DWR Water Year 1995 - 2014.

TABLE WB-4

Annual and Cumulative Change in Groundwater Storage between Seasonal Highs (Mar - Feb)

Shafter-Wasco Irrigation District

7th Standard Annex Management Area

Period of Reference [m/yy]	Annual Change in Groundwater Storage [AFY]	Cumulative Change in Groundwater Storage [AF]
Historical Seasonal High Period (March 1994 - February 2014)		
3/94 - 2/95	-6,824	-6,824
3/95 - 2/96	-1,538	-8,362
3/96 - 2/97	6,597	-1,765
3/97 - 2/98	2,265	501
3/98 - 2/99	11,949	12,450
3/99 - 2/00	9	12,459
3/00 - 2/01	11,085	23,544
3/01 - 2/02	-3,951	19,593
3/02 - 2/03	-4,375	15,219
3/03 - 2/04	21,767	36,986
3/04 - 2/05	-29,219	7,766
3/05 - 2/06	2,223	9,990
3/06 - 2/07	4,472	14,462
3/07 - 2/08	-6,412	8,051
3/08 - 2/09	-14,619	-6,568
3/09 - 2/10	2,414	-4,155
3/10 - 2/11	-7,287	-11,441
3/11 - 2/12	2,178	-9,264
3/12 - 2/13	-9,030	-18,293
3/13 - 2/14	-1,367	-19,661
TOTAL	-19,661	-19,661
AVERAGE	-983	-
Current Seasonal High Period (March 2014 - February 2015)		
3/14 - 2/15	-10,475	-30,136

Abbreviations

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

Notes

(a) The total and average values are based on results from DWR Water Year 1995 - 2014.

TABLE WB-5

Annual Change in Groundwater Storage vs. DWR Water Year Type

Shafter-Wasco Irrigation District

7th Standard Annex Management Area

DWR Water Year (Oct - Sept)	DWR Water Year Type (a)	Annual Change in Groundwater Storage [AFY]
Historical Water Budget Period (WY 1995 - 2014)		
1995	W	-13,461
1996	W	15,910
1997	W	2,436
1998	W	3,587
1999	AN	9,190
2000	AN	11,728
2001	D	-6,148
2002	D	-3,614
2003	BN	-1,466
2004	D	-10,096
2005	W	5,269
2006	W	6,296
2007	C	-7,399
2008	C	-1,427
2009	BN	-8,116
2010	AN	-5,086
2011	W	1,353
2012	D	-4,294
2013	C	-6,742
2014	C	-9,596
Current Water Budget Period (WY 2015)		
2015	C	-4,544

Abbreviations

AFY = acre-feet per year

DWR = California Department of Water Resources

Notes

(a) DWR Water Year Types are as follows: W = wet, AN = above normal, BN = below normal, D = dry, C = critical.

Sources

(1) DWR Water Year Type is obtained from DWR's Water Year Hydrologic Classification Indices for the San Joaquin Valley, accessed on 18 January 2018 (http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST).

TABLE WB-6

Annual Inflows to and Outflows from the Entire System and Change in Groundwater Storage

Shafter-Wasco Irrigation District

7th Standard Annex Management Area

	INFLOWS [AFY] (a)(b)					OUTFLOWS [AFY] (a)(b)							CHANGE IN STORAGE (a)	
DWR Water Year (Oct - Sept)	Sub-surface GW Inflow	Total Precipitation	WWTP Total Inflow	Natural Surface Water Inflows	**TOTAL INFLOWS**	Evapo-transpira-tion (c)	Consumptive Industrial and Domestic Water Use	Consumptive Dairy Water Use	Surface Water Exports + Losses	Natural Surface Water Outflow	Sub-surface GW Outflow	**TOTAL OUTFLOWS**	**Annual Change in GW Storage [AFY]** (d)	*Cumulative Change in GW Storage Since WY 1995 [AF]*
Historical Water Budget Period (WY 1995 - 2014)														
1995	2,967	9,575	3,696	0	**16,238**	29,510	265	103	0	0	0	**29,878**	**-13,461**	*-13,461*
1996	36,471	4,692	3,704	0	**44,866**	28,513	270	103	0	0	0	**28,887**	**15,910**	*2,449*
1997	21,183	4,625	3,699	0	**29,507**	27,181	272	103	0	0	0	**27,557**	**2,436**	*4,885*
1998	12,793	13,142	3,696	0	**29,631**	26,105	272	103	0	0	0	**26,480**	**3,587**	*8,472*
1999	25,150	5,750	4,117	0	**35,016**	25,359	275	103	0	0	0	**25,737**	**9,190**	*17,662*
2000	28,550	4,642	5,108	0	**38,299**	25,932	284	247	0	0	0	**26,463**	**11,728**	*29,391*
2001	8,361	5,217	5,380	0	**18,958**	24,762	286	227	0	0	0	**25,275**	**-6,148**	*23,243*
2002	15,739	3,675	5,377	0	**24,791**	27,621	289	224	0	0	0	**28,134**	**-3,614**	*19,628*
2003	15,530	5,667	5,503	0	**26,699**	27,736	301	224	0	0	0	**28,262**	**-1,466**	*18,163*
2004	9,025	3,558	5,556	0	**18,139**	27,640	313	224	0	0	0	**28,177**	**-10,096**	*8,067*
2005	20,410	5,401	5,549	0	**31,360**	26,001	324	224	0	0	0	**26,548**	**5,269**	*13,336*
2006	19,430	7,358	5,545	0	**32,333**	25,681	348	224	0	0	0	**26,253**	**6,296**	*19,632*
2007	10,088	3,060	5,845	0	**18,993**	25,870	363	224	0	0	0	**26,457**	**-7,399**	*12,233*
2008	15,860	2,372	5,940	0	**24,172**	25,129	371	224	0	0	0	**25,724**	**-1,427**	*10,806*
2009	8,556	3,225	6,314	0	**18,095**	25,669	373	224	0	0	0	**26,266**	**-8,116**	*2,690*
2010	5,612	6,317	6,266	0	**18,195**	23,401	373	224	0	0	0	**23,998**	**-5,086**	*-2,396*
2011	8,473	9,542	6,296	0	**24,311**	22,890	373	224	0	0	0	**23,487**	**1,353**	*-1,043*
2012	12,537	4,658	6,321	0	**23,517**	26,539	373	224	0	0	0	**27,136**	**-4,294**	*-5,338*
2013	14,533	1,446	6,237	0	**22,215**	28,329	373	224	0	0	0	**28,926**	**-6,742**	*-12,079*
2014	9,721	1,958	6,144	0	**17,823**	27,419	373	224	0	0	0	**28,016**	**-9,596**	*-21,675*
TOTAL (e)	300,990	105,878	106,292	0	**513,160**	527,287	6,470	3,904	0	0	0	**537,661**	**-21,675**	*-21,675*
AVERAGE (e)	15,050	5,294	5,315	0	**25,658**	*26,364*	*324*	*195*	*0*	*0*	*0*	***26,883***	**-1,084**	-
%	59%	21%	21%	0%	-	*98%*	*1.2%*	*0.7%*	*0%*	*0%*	*0%*	**-**	-	-
Current Water Budget Period (WY 2015)														
2015	17,058	3,950	5,919	0	**26,927**	29,738	381	224	0	0	0	**30,344**	**-4,544**	*-26,219*

Abbreviations

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
GW = Groundwater
NORSD = North of River Sanitary District
WWTP = Wastewater Treatment Plant
WY = Water Year

Notes

(a) All values reported in acre-feet per year (AFY), except cumulative change in storage (reported in acre-feet).
(b) This table presents inflows to and outflows from the entire water budget system, which includes the groundwater system.

TABLE WB-6

Annual Inflows to and Outflows from the Entire System and Change in Groundwater Storage

Shafter-Wasco Irrigation District

7th Standard Annex Management Area

(c) "Evapotranspiration" includes all estimated crop and vegetative evapotranspirative demands as well as evaporation of excess rainfall and from the NORSD WWTP ponds within the Management Area.

(d) Due to the deep percolation time lag effect in the subsurface domain of the water budget model, the difference between total inflows and outflows does not equal to the change in storage presented here. See Section 3 of Appendix C for further explanation of the time lag effect.

(e) The total and average values are based on results from DWR Water Year 1995 - 2014.

TABLE WB-9
Summary of Projected Water Budget
Shafter-Wasco Irrigation District
7th Standard Annex Management Area

Based on Estimated Net Groundwater Inflows from Calibrated Historical Water Budget

Water Budget Category	Water Budget Component	Historical Period (WY 1995-2014)	Projected		
			Baseline (50-year Synthetic Hydrologic Period)	2030 Climate (scaled from Baseline Period)	2070 Climate (scaled from Baseline Period)
Inflows (b)	Surface Water Supplies	5,315	5,434	5,434	5,434
	Precipitation	5,294	5,258	5,238	5,178
	(Net) Subsurface Inflow (c)	15,050	14,550	14,550	14,550
Outflows	Ag Consumptive Use (d)	26,364	26,223	27,025	28,281
	Non-Ag Consumptive Use	519	530	530	530
Inflows - Outflows	**Equivalent to "Shortfall" (e)**	**-1,084 (f)**	**-1,510**	**-2,333**	**-3,648**

Abbreviations:

AFY = acre-feet per year
KCWA = Kern County Water Agency
SWP = State Water Project
KGA GSA = Kern Groundwater Authority Groundwater Sustainability Agency

Notes:

(a) The projected water budget presented here represents a physical accounting of inflows to and outflows from the Management Area. For purpose of planning Projects and Management Actions, a greater shortfall is used, as shown in Table PMA-2.

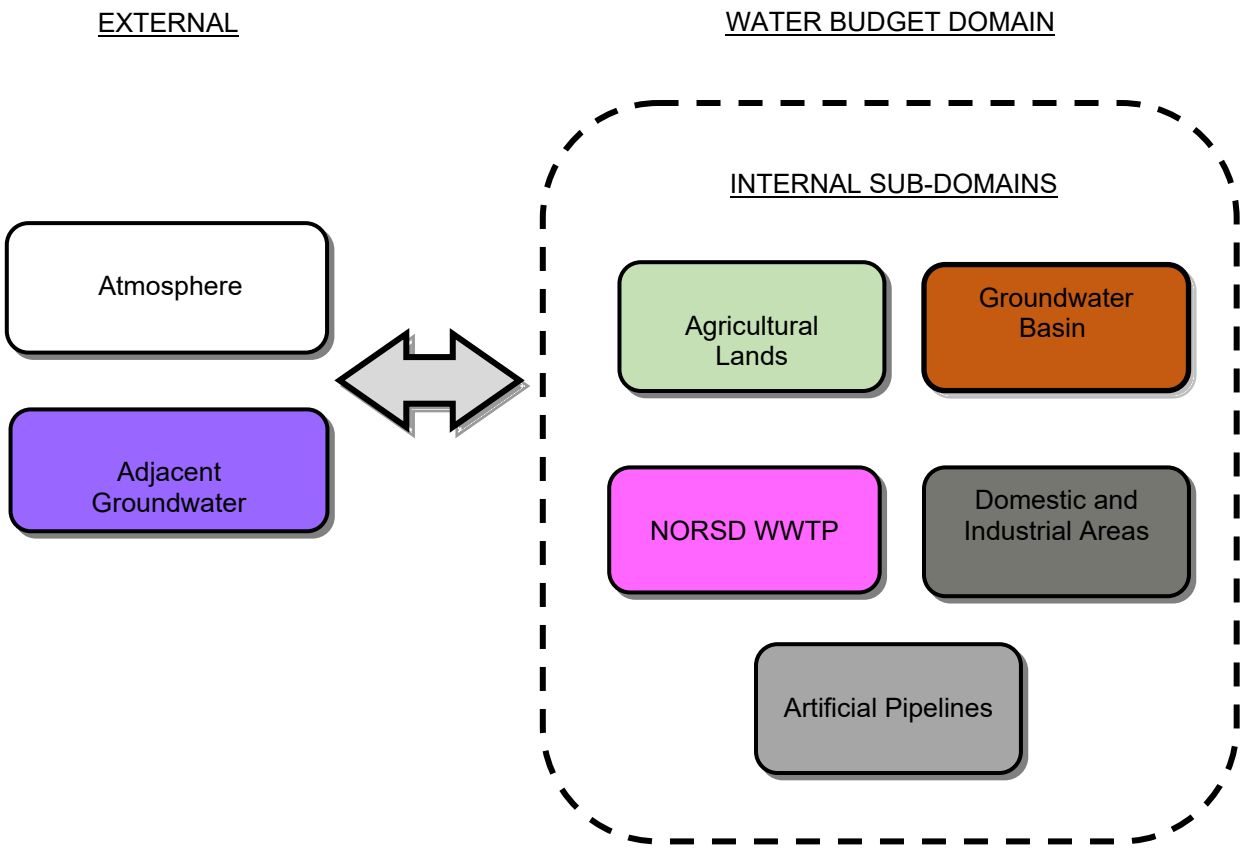
(b) Inflows comprise all water entering the SWID Annex Area from surface (i.e., recycled water and precipitation) and subsurface (i.e., groundwater inflow) sources. Outflows comprise all water leaving the SWID Annex Area under average historical (DWR Water Year 1995-2014) land use conditions.

(c) The 7th Standard Annex Management Area landowners are a part of the KCWA Zone of Benefit (Zones 17 and 19) and pay a portion of the costs of State Water Project deliveries to the basin, commensurate with the benefits they receive. However, the KCWA has requested that the identification of this Zone of Benefit inflow be omitted from the Annex Area water budget as a condition of KCWA's agreement to cover the undistricted ("white area") lands within the Basin. Therefore, net groundwater inflow resulting from the Zone of Benefit contributions are not included as a supply source in the future water budget estimates for the Management Area, contingent upon KCWA's continued management of undistricted lands in the Basin.

(d) The "Ag Consumptive Use" value is not equal to the total applied water demand for agricultural lands because it does not include the excess applied water necessary for irrigation inefficiency. The total applied water would be greater than the consumptive use, with the difference becoming return flow (recharge) to groundwater.

(e) The "Shortfall" is calculated as Inflows - Outflows. A negative Shortfall is the amount of groundwater storage decrease that would occur if the demand (consumptive use) were to stay fixed and were to be met by pumped groundwater.

(f) Due to the deep percolation time lag effect in the subsurface domain of the water budget model, the difference between total inflows and outflows does not equal the change in storage presented here. See Section 3 of Appendix C for further explanation of the time lag effect.



Abbreviations

NORSD = North of River Sanitary District

WWTP = Wastewater Treatment Plant

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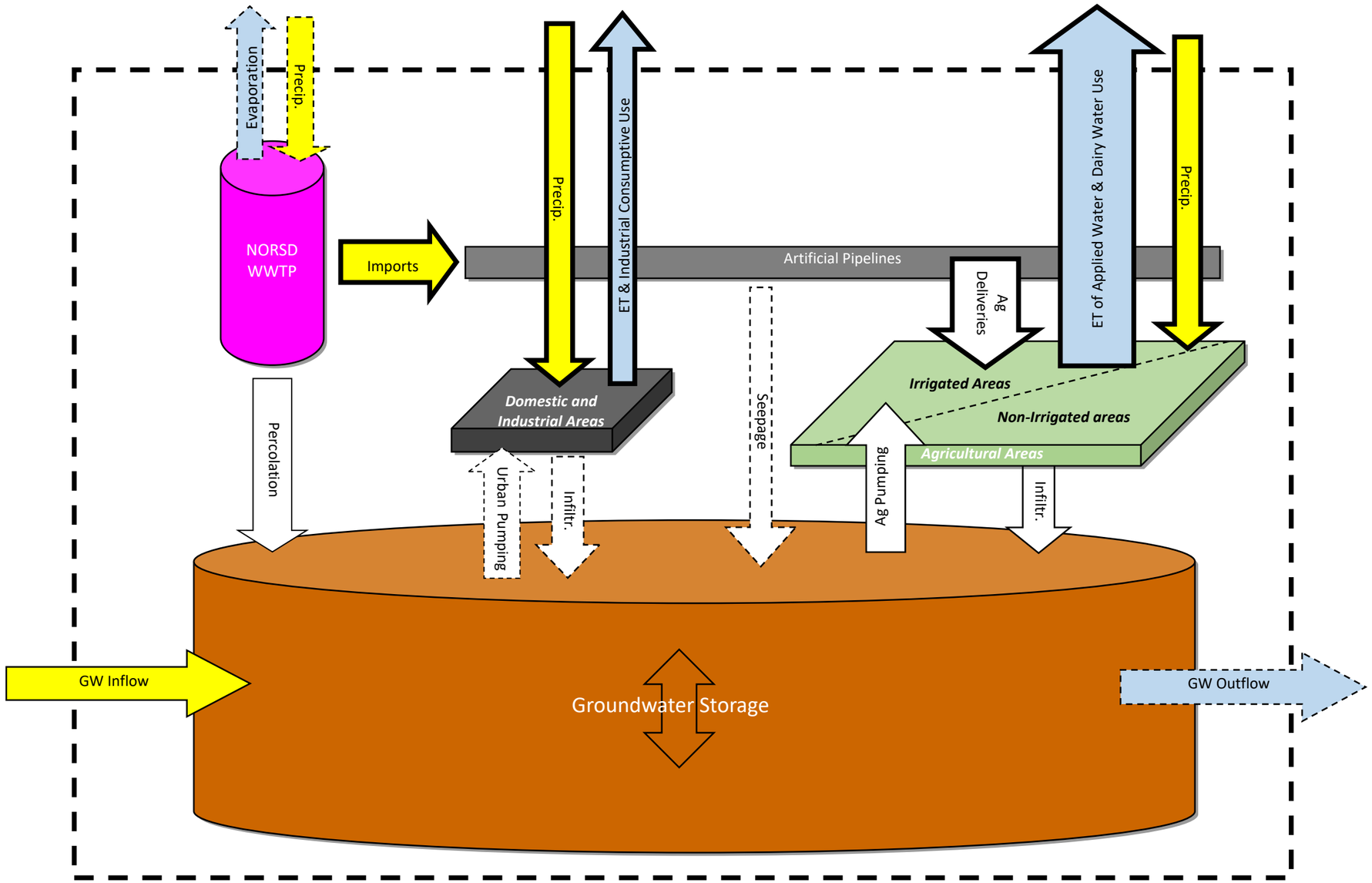
Conceptual Water Budget Domain and Subdomains

SWID 7th Standard Annex Management Area
December 2019
B80079.00

Figure WB-1



WATER BUDGET (WB) DOMAIN

Legend:

- "Raw"
- Likely Negligible
- Inflow to WB Domain
- Internal
- Outflow from WB Domain

Abbreviations

Ag	= agricultural
ET	= evapotranspiration
GW	= groundwater
Infiltr.	= infiltration
NORSD	= North of River Sanitary District
Precip.	= precipitation
WWTP	= Wastewater Treatment Plant

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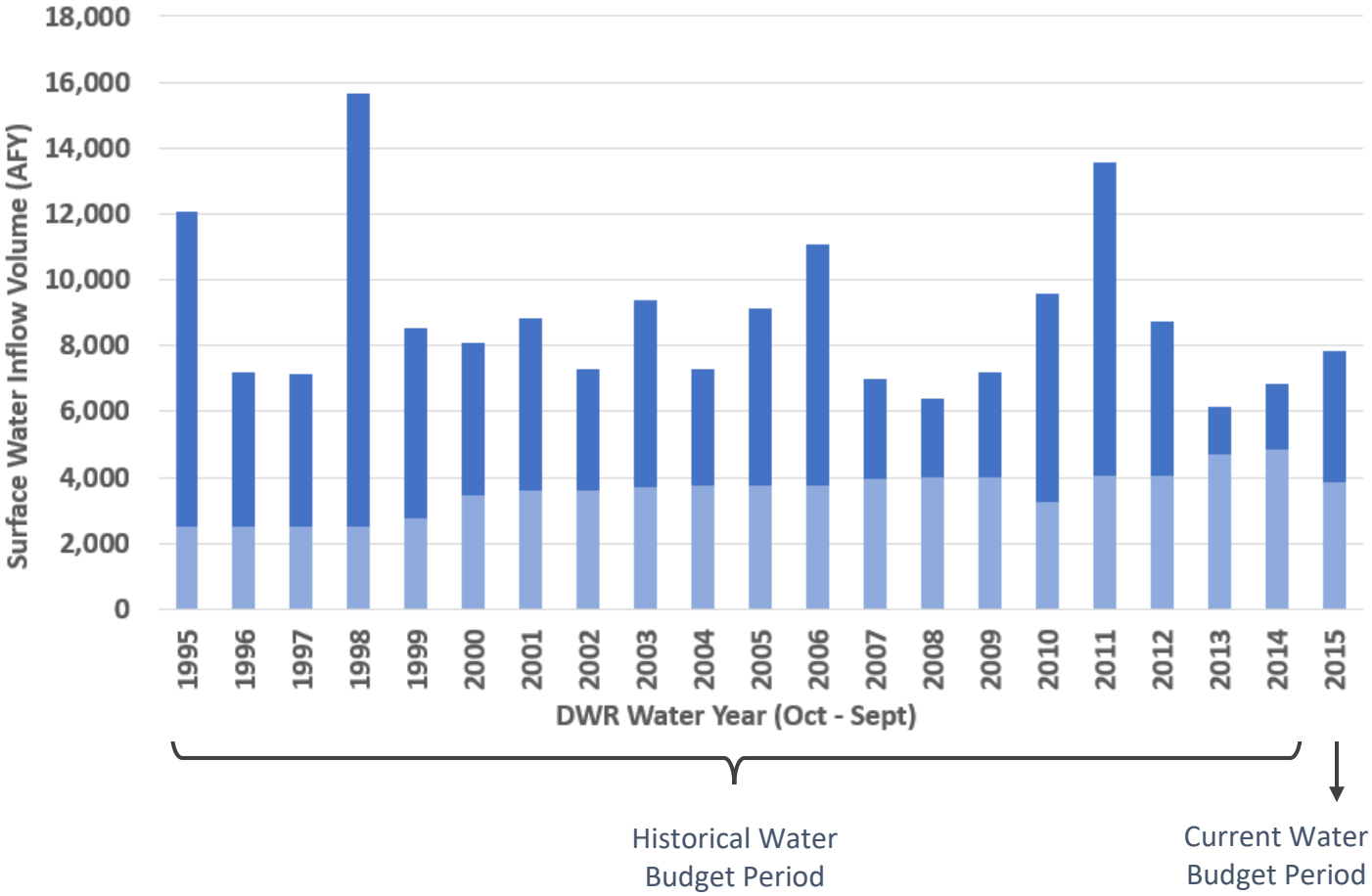
Conceptual Water Budget Components/Linkages

SWID 7th Standard Annex Management Area
December 2019
B80079.00
Figure WB-2



Legend

- Recycled Water Deliveries
- Total Precipitation

Abbreviations

AFY = acre-feet per year
DWR = California Department of Water Resources
NORSD = North of River Sanitary District
WWTP = Wastewater Treatment Plant

Notes

1. The Management Area does not receive any natural surface streamflow or imported surface water. Imported water is limited to recycled water from the NORSD WWTP.

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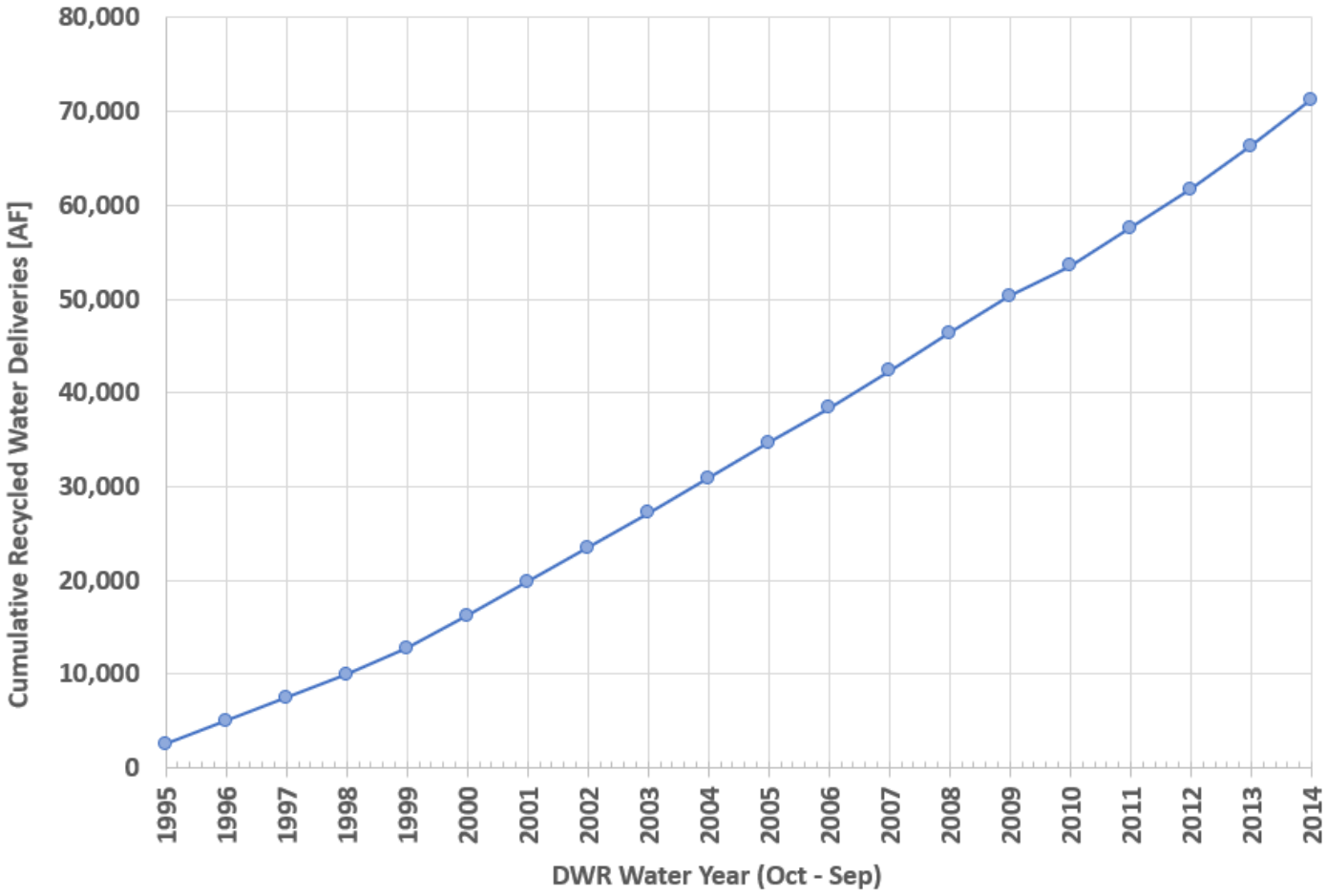
Annual Surface Water Inflows by Source

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00

Figure WB-3



Abbreviations

AF = acre-feet
DWR = California Department of Water Resources

Notes

1. Annual volumes reported by DWR Water Year, which extends October (of the previous year) – September.
2. The cumulative results cover the historical water budget period of interest (i.e. WY 1995 – 2014).

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Cumulative Recycled Water Deliveries, 1995 - 2014

SWID 7th Standard Annex Management Area
December 2019
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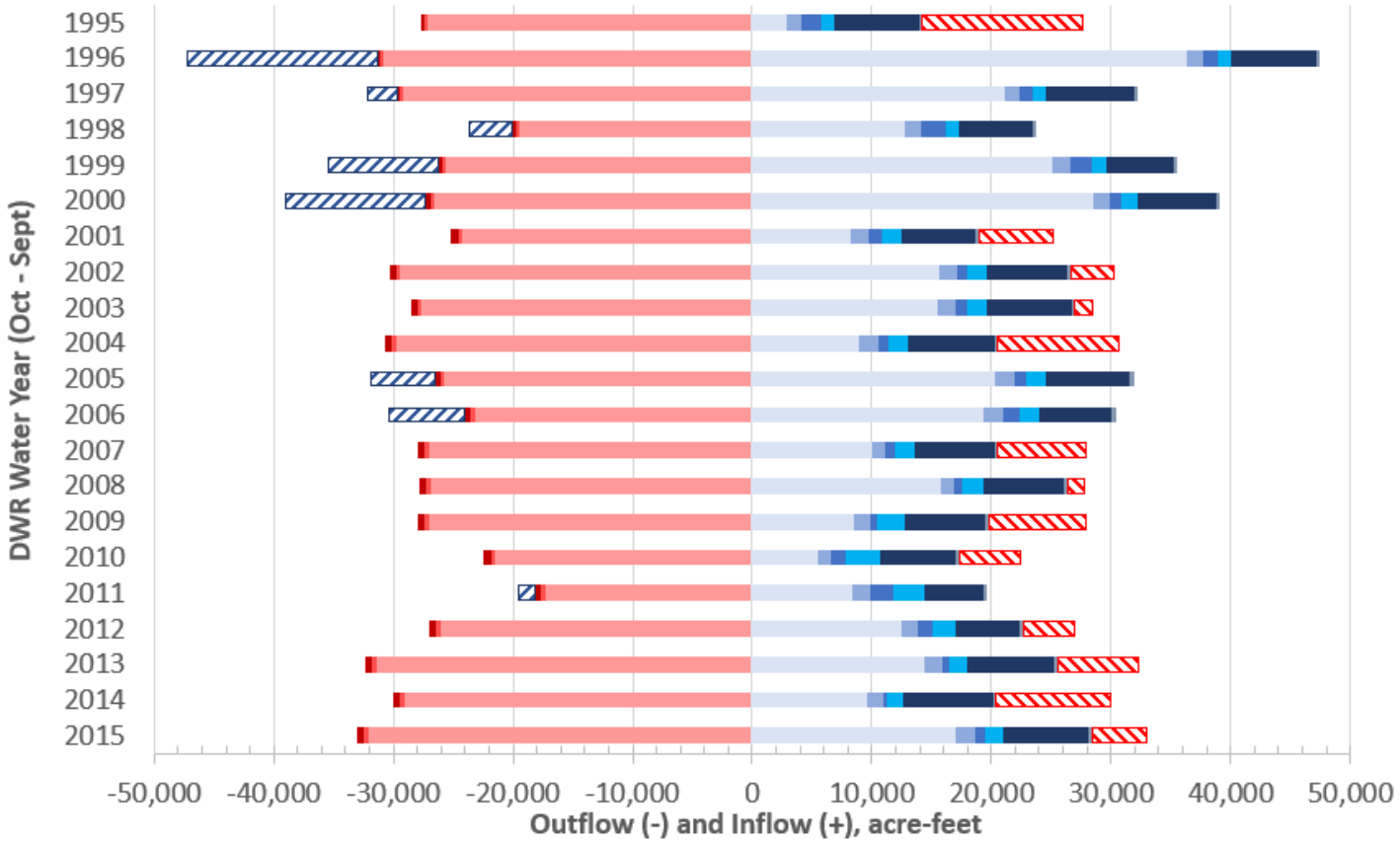
Figure WB-4



Legend

Groundwater Inflows

- Subsurface GW Inflow
- Infiltration of Recycled Water Deliveries
- Infiltration of Precipitation
- Infiltration of Recycled Water within WWTP
- Infiltration of Agricultural Pumping Water
- Infiltration of Dairy and Domestic Water

Groundwater Outflows

- Agricultural Pumping
- Industrial and Domestic Water Use
- Dairy Water Use

Change in Groundwater Storage

- Gain in GW Storage
- Reduction in GW Storage

Abbreviations

DWR = California Department of Water Resources
GW = groundwater
WWTP = Wastewater Treatment Plant

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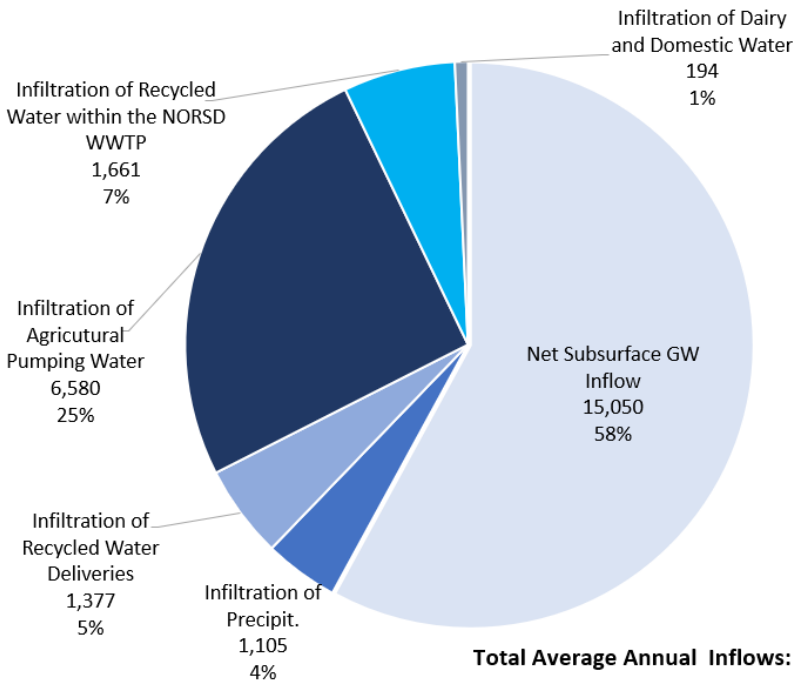
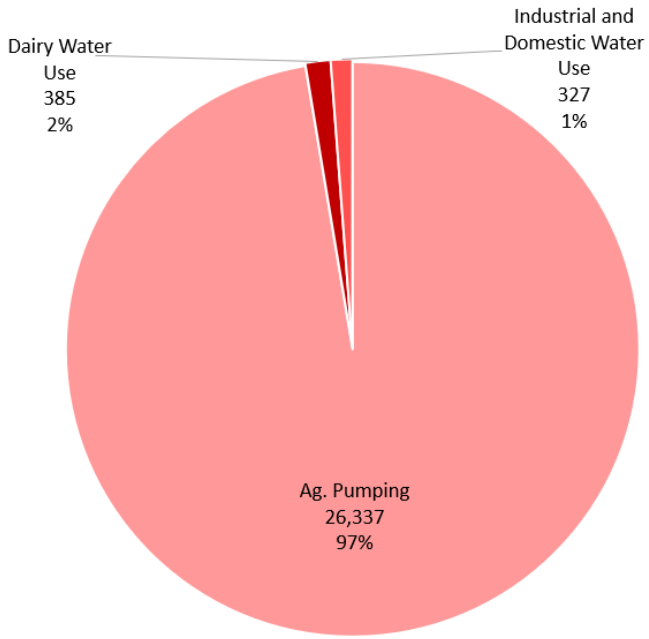
Annual Groundwater Inflows and Outflows

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00
Figure WB-5



Total Average Annual Inflows: ***25,965 AFY***



Total Average Annual Outflows: ***- 27,049 AFY***

Legend

Groundwater Inflows

- Subsurface GW Inflow
- Infiltration of Recycled Water Deliveries
- Infiltration of Precipitation
- Infiltration of Recycled Water within WWTP
- Infiltration of Agricultural Pumping Water
- Infiltration of Dairy and Domestic Water

Groundwater Outflows

- Agricultural Pumping
- Industrial and Domestic Water Use
- Dairy Water Use

Abbreviations

AFY = acre-feet per year
GW = groundwater
NORSD = North of River Sanitary District
WWTP = Wastewater Treatment Plant

Notes

1. All values reported in acre-feet per year (AFY).

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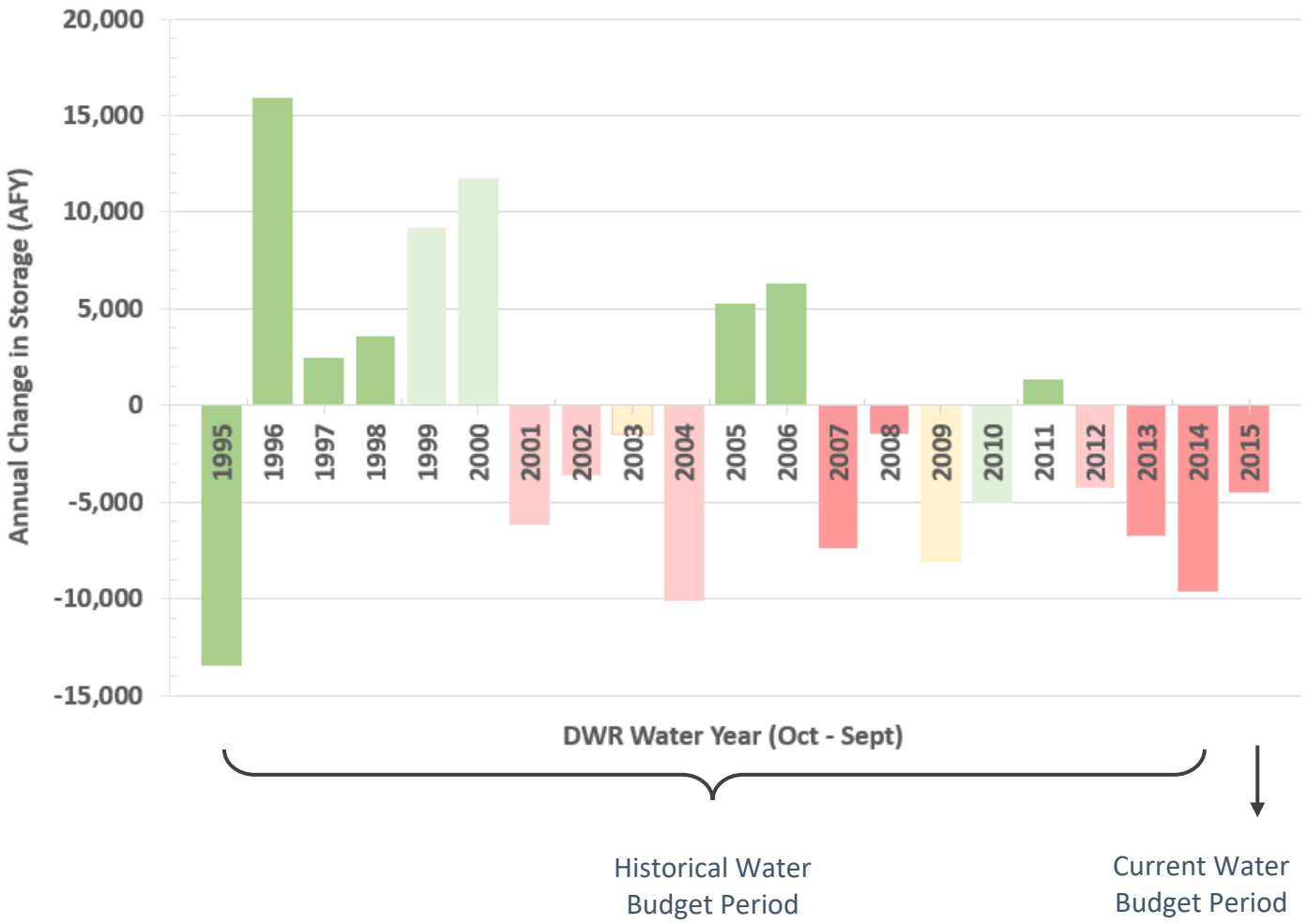
Summary of Groundwater Inflows and Outflows, WY 1995 - 2014

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00
Figure WB-6



Legend

DWR Water Year Type

- Wet
- Above Normal
- Below Normal
- Dry
- Critical

Abbreviations

AFY = acre-feet per year

Sources

1. DWR Water Year Type is obtained from DWR's Water Year Hydrologic Classification Indices for the San Joaquin Valley, accessed on 18 January 2018 (http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST).

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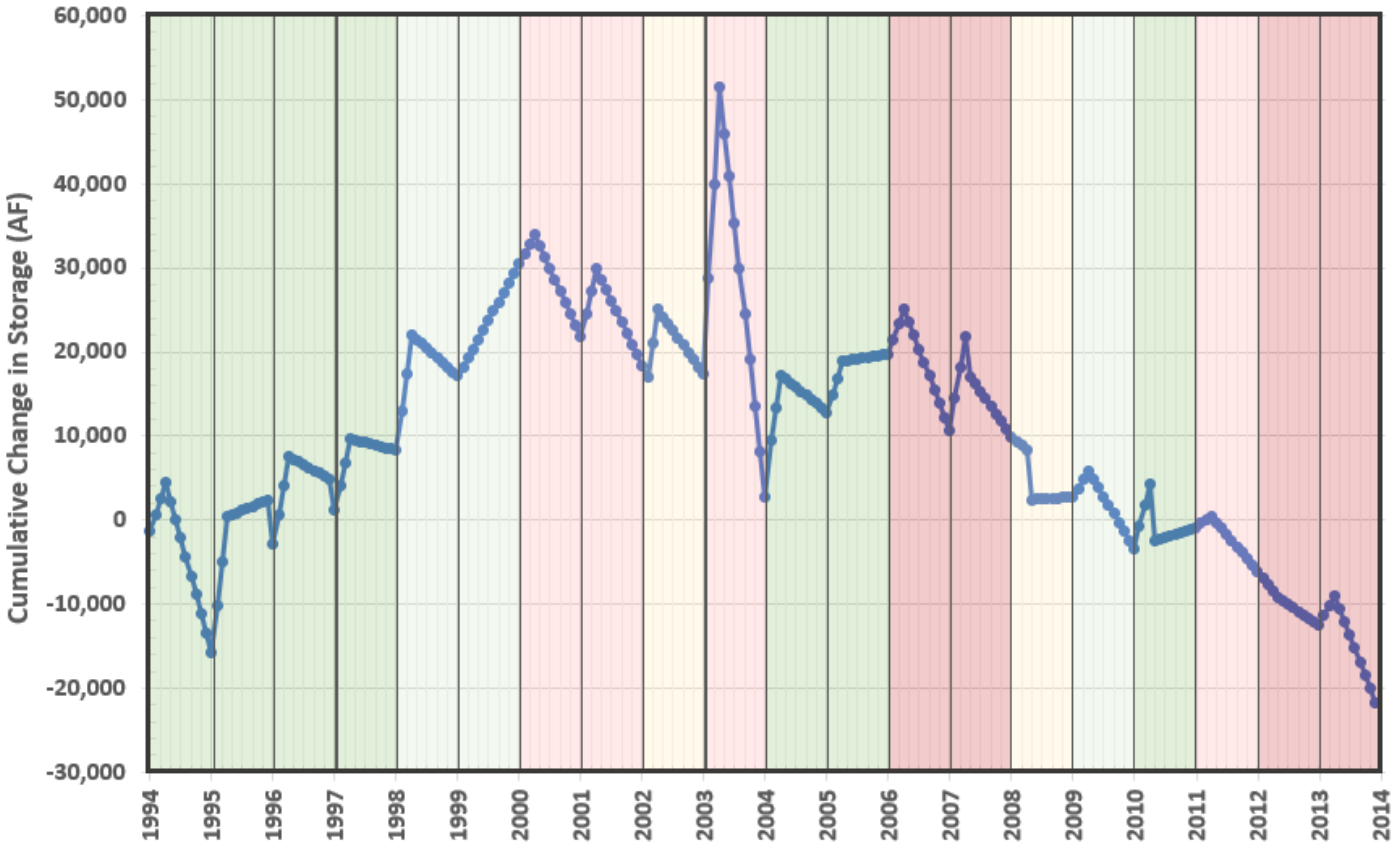
Annual Change in Storage vs. DWR Water Year Type

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00

Figure WB-7



Legend

DWR Water Year Type

- Wet
- Above Normal
- Below Normal
- Dry
- Critical

Abbreviations

AF = acre-feet

Sources

1. DWR Water Year Type is obtained from DWR's Water Year Hydrologic Classification Indices for the San Joaquin Valley, accessed on 18 January 2018 (http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST).

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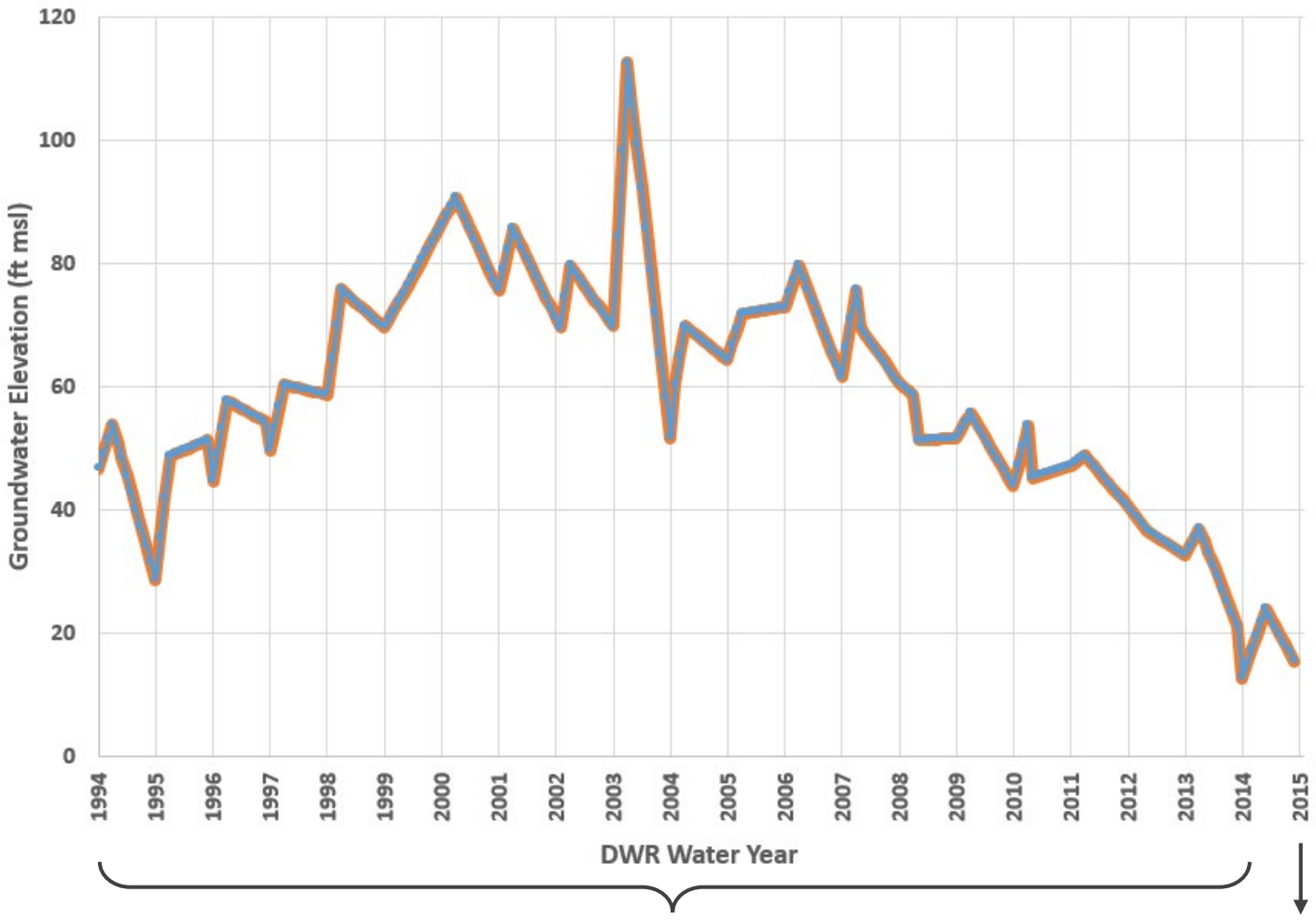
Cumulative Change in Storage vs. DWR Water Year Type

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00

Figure WB-8



Legend

= Groundwater Elevation of Selected Well (ft msl)

= Water Budget Spreadsheet Model-Calculated Groundwater Elevation (ft msl)

Abbreviations

CASGEM = California Statewide Groundwater Elevation Monitoring

DWR = California Department of Water Resources

ft msl = feet above mean sea level

Notes

1. Water levels are shown for well 28S24E25P001M, located within the SWID 7th Standard Annex Management Area.

Sources

1. Water levels are obtained from DWR's SGMA Data Viewer, which includes CASGEM data, accessed on 07 November 2018 (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer).

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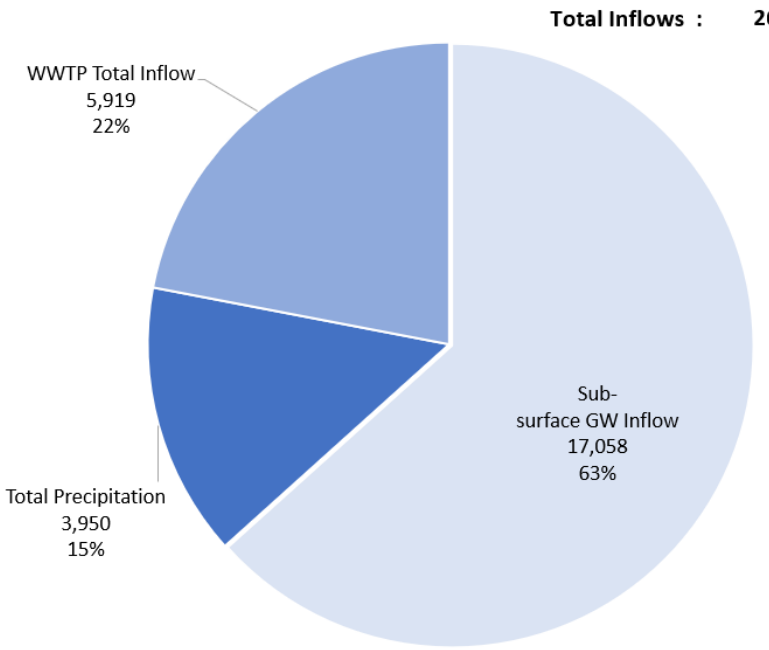
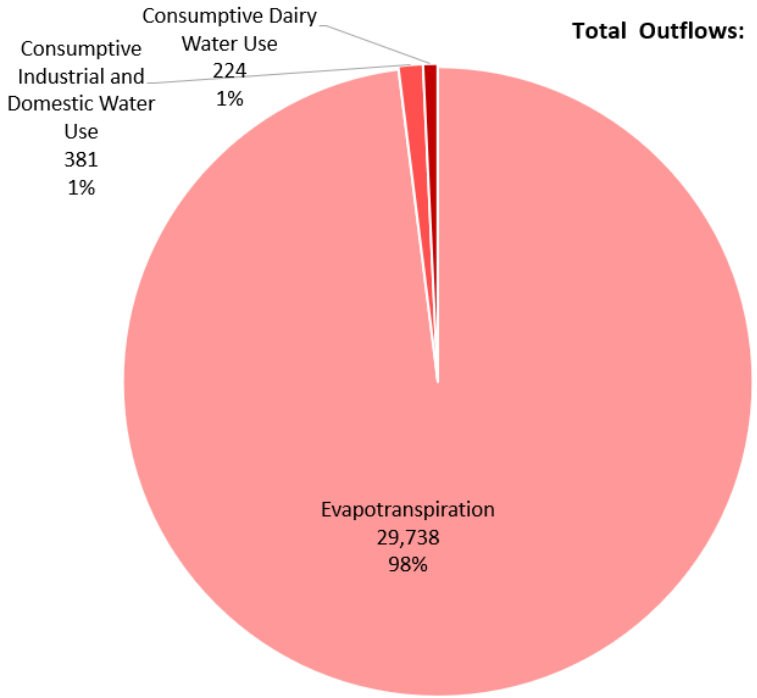
Comparison of Model-Calculated Water Levels and Measured Water Levels

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00

Figure WB-9





Legend

Inflows

- Subsurface GW Inflow
- Recycled Water Deliveries
- Total Precipitation

Outflows

- Evapotranspiration
- Consumptive Industrial and Domestic Water Use
- Consumptive Dairy Water Use

Abbreviations

AF = acre-feet
GW = groundwater
WWTP = Wastewater Treatment Plant

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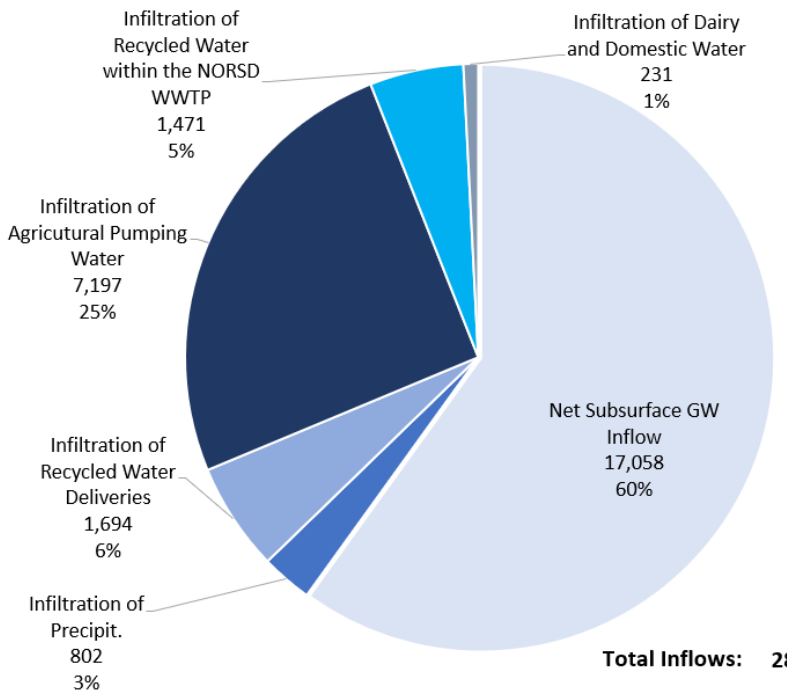
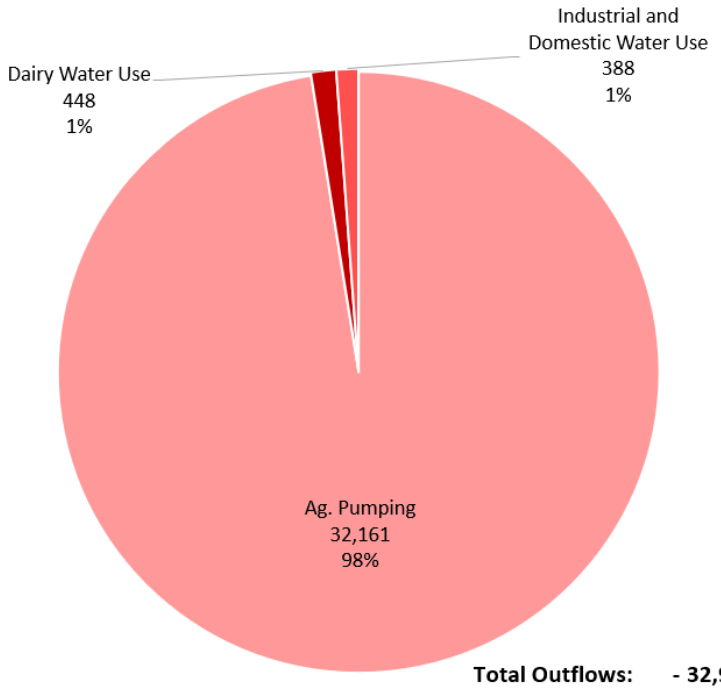
Summary of Total Inflows and Outflows
WY 2015

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00
Figure WB-10



Total Inflows: 28,454 *AF*



Total Outflows: - 32,998 *AF*

Legend

Groundwater Inflows

- Subsurface GW Inflow
- Infiltration of Recycled Water Deliveries
- Infiltration of Precipitation
- Infiltration of Recycled Water within WWTP
- Infiltration of Agricultural Pumping Water
- Infiltration of Dairy and Domestic Water

Groundwater Outflows

- Agricultural Pumping
- Industrial and Domestic Water Use
- Dairy Water Use

Abbreviations

AF = acre-feet
Ag. = Agricultural
GW = groundwater
NORSD = North of River Sanitary District
WWTP = Wastewater Treatment Plant

Notes

1. All values reported in acre-feet (AF).

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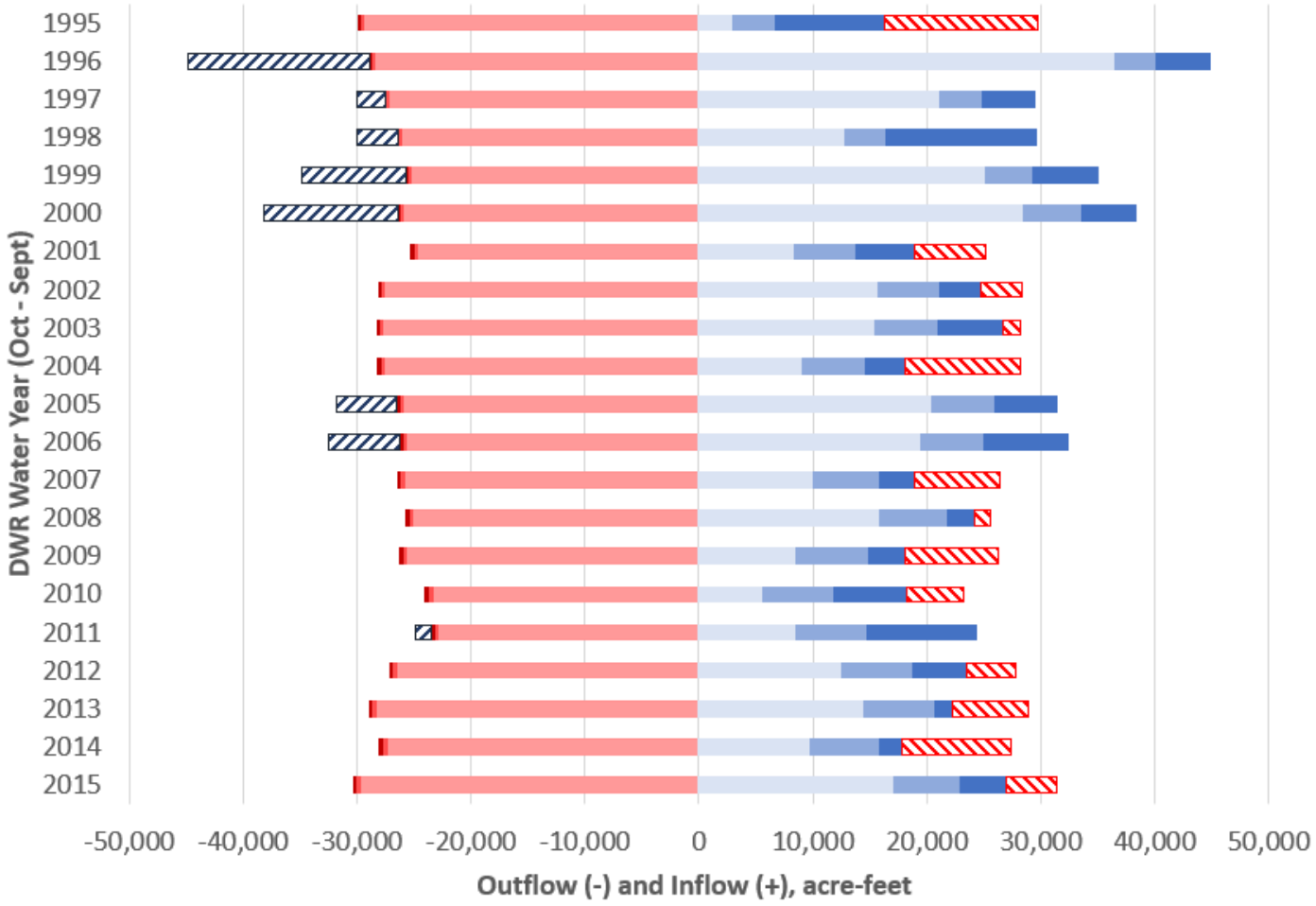
Summary of Groundwater Inflows and Outflows, WY 2015

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00
Figure WB-11



Legend

Total Inflows

- Subsurface GW Inflow
- Total WWTP Inflow
- Total Precipitation

Total Outflows

- Agricultural Evapotranspiration
- Consumptive Industrial and Domestic Water Use
- Consumptive Dairy Water Use

Change in Groundwater Storage

- Gain in GW Storage
- Reduction in GW Storage

Abbreviations

DWR = California Department of Water Resources
GW = groundwater
WWTP = Wastewater Treatment Plant

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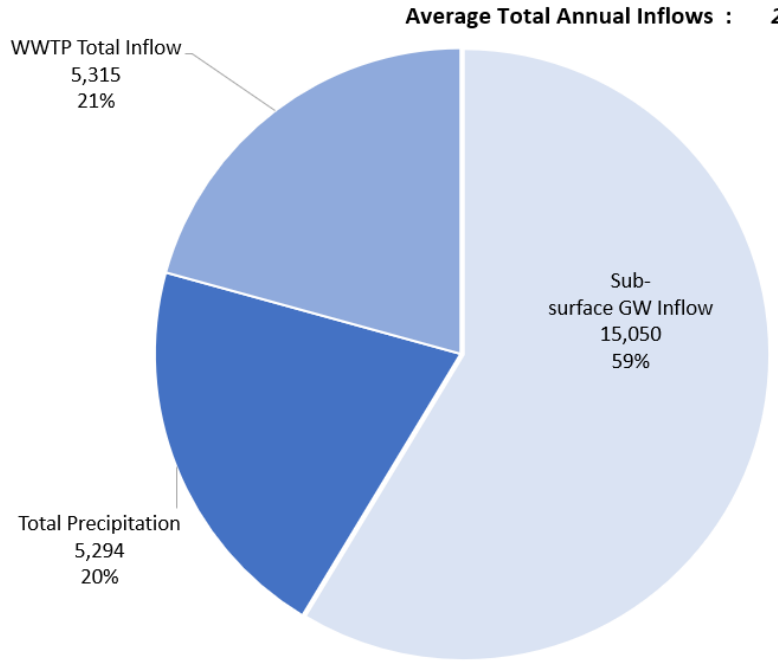
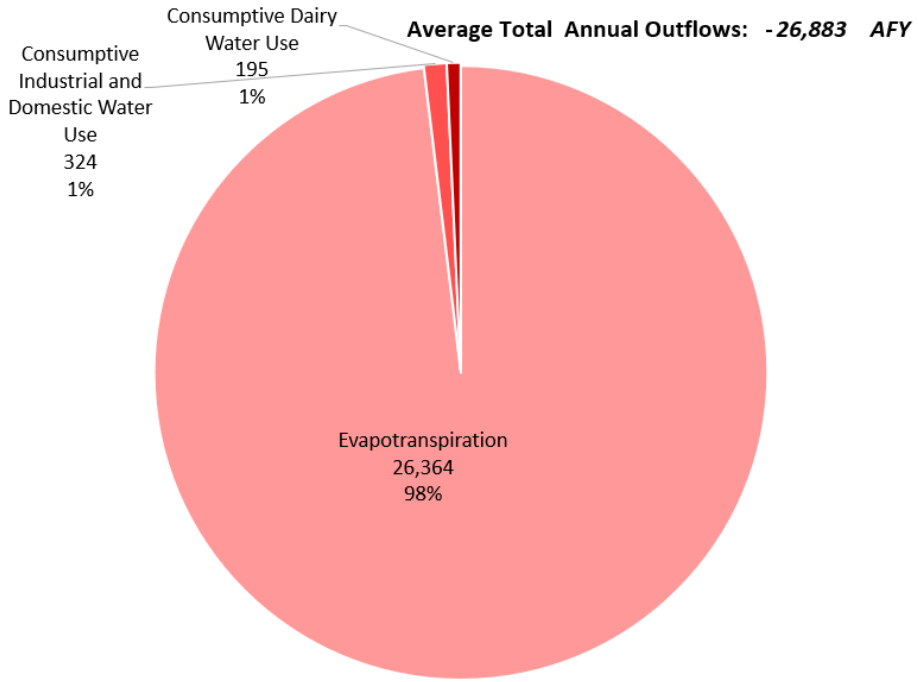
Annual Inflows and Outflows

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00

Figure WB-12





Legend

Average Annual Inflows

- Subsurface GW Inflow
- Total WWTP Inflow
- Total Precipitation

Average Annual Outflows

- Evapotranspiration
- Consumptive Industrial and Domestic Water Use
- Consumptive Dairy Water Use

Abbreviations

AFY = acre-feet per year
GW = groundwater
WWTP = Wastewater Treatment Plant

Notes

1. All values reported in acre-feet per year (AFY).

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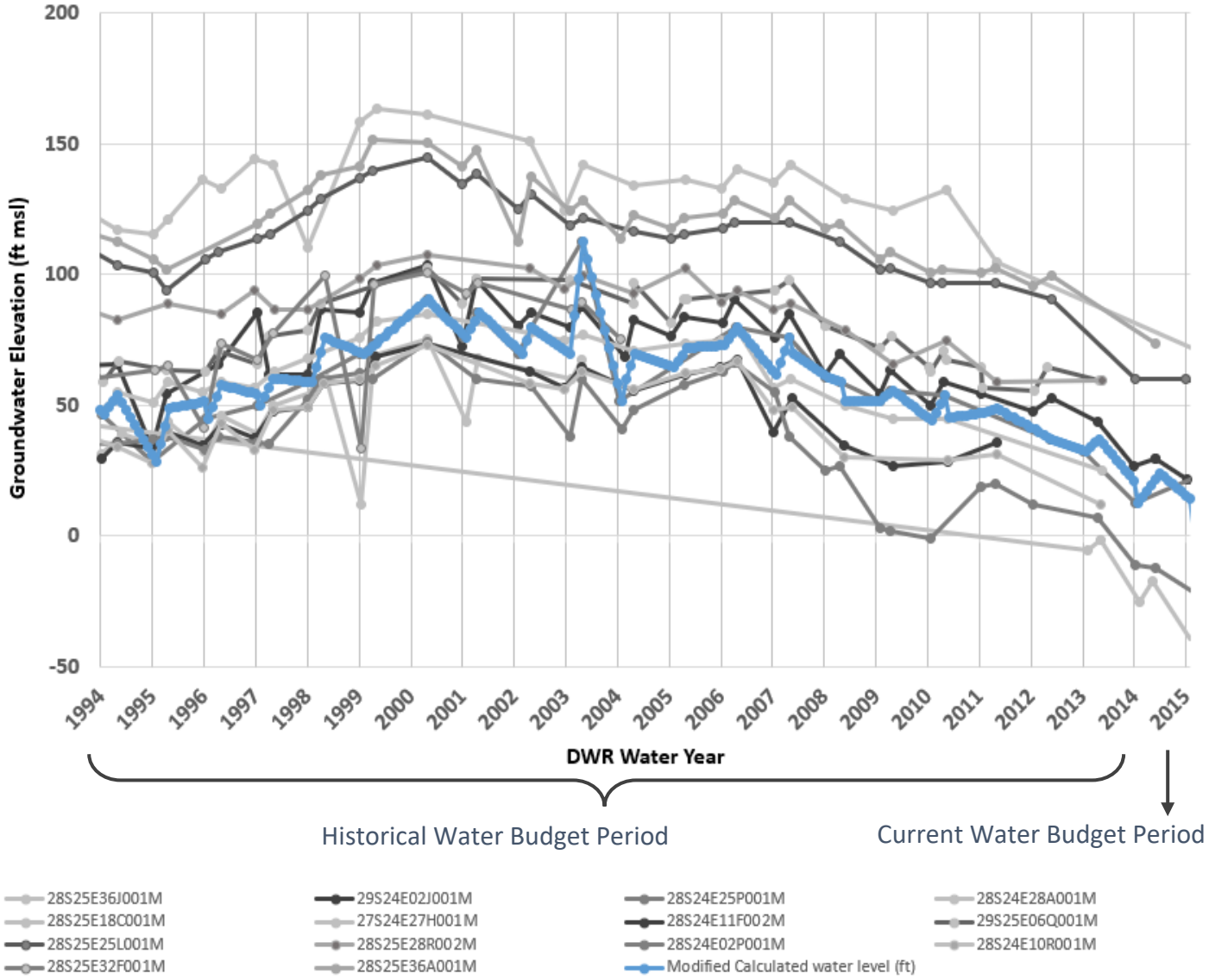
Summary of Total Inflows and Outflows
WY 1995 - 2014

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00
Figure WB-13



Legend

= Measured Water Level (ft msl)

= Water Budget Spreadsheet Model-Calculated Water Level (ft msl)

Abbreviations

ft msl = feet above mean sea level

Notes

1. Water levels shown for selected wells located within and proximate to the Management Area.

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Observed vs. Modeled Change in Water Levels, WY 1995 - 2015

SWID 7th Standard Annex Management Area
December 2019
EKI B80079.00

Figure WB-14

9. MANAGEMENT AREAS

☑ 23 CCR § 354.20(a)

As identified in the KGA Umbrella GSP, multiple Management Areas have been established within the basin. The information presented in this Management Area Plan (MA Plan) is specific to and describes conditions within the 7th Standard Annex Management Area, which is a single management area.

9.1. Description and Justification

☑ 23 CCR § 354.20(b)(1)
☑ 23 CCR § 354.20(c)

As discussed previously in **Section 4** ***Description of the Plan Area***, the Kern County Subbasin is overlain by many entities with water or land use management authority. A subset of these entities formed the KGA GSA. The 7th Standard Annex Area was annexed by SWID in May 2019.[48] SWID is a member of the multi-agency KGA GSA and is locally responsible for SGMA compliance within specific portions of the KGA GSA: the SWID Management Area and the 7th Standard Annex Management Area. Together, the SWID Management Area and the 7th Standard Annex Management Area include all of SWID's sphere of influence area within the basin. Management Areas of the KGA GSA are described and mapped in the KGA Umbrella GSP; the 7th Standard Annex Management Area is shown on **Figure HCM-1**.

The reason for creation of the two SWID management areas is to ensure that SWID maintains maximum flexibility and local control over sustainable groundwater management within its service area. The 7th Standard Annex Management Area is distinct from the SWID Management Area because operationally and contractually, the Annex Area lands do not have access to the same imported water supplies and other groundwater management tools as the SWID Management Area does.

9.2. Minimum Thresholds and Measurable Objectives

☑ 23 CCR § 354.20(b)(2)
☑ 23 CCR § 354.20(b)(4)

The Sustainable Management Criteria developed for the 7th Standard Annex Management Area, including the rationale for their selection, are described in detail in **Section 13** ***Minimum Thresholds*** and **Section 14** ***Measurable Objectives and Interim Milestones***. As identified in the KGA Umbrella GSP, the MOs and MTs vary to some degree between management areas within the basin, reflecting local conditions and management decisions. The Measurable Objective (MO) and Minimum Threshold (MT) for the 7th Standard Annex Management Area described in the following sections were selected to be generally consistent with those of the neighboring management areas. Through ongoing coordination among KGA GSA members, and between GSAs, particularly through regular sharing of monitoring data, the management entities will be able to monitor for and provide a coordinate response to avoid undesirable results throughout the basin.

[48] The annexation of the Management Area by SWID was completed in December 2019, following the passage of a Proposition 218 election and approval by the Kern County LAFCO.

9.3. Monitoring

☑ 23 CCR § 354.20(b)(3)

Monitoring networks for each applicable Sustainability Indicator, including a discussion of the level of monitoring an analysis appropriate for the 7th Standard Annex Management Area, are described in detail in **Section 15** ***Monitoring Network***.

SUSTAINABLE MANAGEMENT CRITERIA

10. INTRODUCTION TO SUSTAINABLE MANAGEMENT CRITERIA

☑ 23 CCR § 354.22

~~SGMA~~Sustainable Groundwater Management Act (SGMA) legislation defines "Sustainability Goal" as "the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield" (California Water Code [CWC] § 10721(u)). SGMA requires Groundwater Sustainability Plans (GSPs) to develop and implement plans to meet the Sustainability Goal (CWC § 10727(a)) and requires that the plans include Measurable Objectives as well as Interim Milestones in increments of five years to achieve the Sustainability Goal within 20 years of the implementation of the plan (CWC § 10727.2(b)(1)).

The GSP Emergency Regulations further define terms related to achievement of the Sustainability Goal, including:

- ~~Interim Milestone (IM) – a target value representing measurable~~ Undesirable Result (UR) – "one or more of the following effects caused by groundwater conditions~~, in increments of five years, set by an Agency as part~~ occurring throughout the basin:

  (1) Chronic lowering of ~~a Plan~~groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.

  (2) Significant and unreasonable reduction of groundwater storage.

  (3) Significant and unreasonable seawater intrusion.

  (4) Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.

  (5) Significant and unreasonable land subsidence that substantially interferes with surface land uses.

  (6) Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water." (CWC § 10721(x));

- Minimum Threshold (MT) – a numeric value for each sustainability indicator used to define undesirable results (23-~~California Code of Regulations [~~CCR~~]~~ §351(~~q))~~;t)).

- Measurable Objective (MO) – specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin (23-CCR §351(s)); and

- ~~Minimum Threshold (MT) – a numeric value for each sustainability indicator used to define undesirable results (23 CCR §351(t)).~~
- Interim Milestone (IM) – a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan (23-California Code of Regulations [CCR] §351(q));

Collectively, the Sustainability Goal, ~~Interim Milestones, Measurable Objectives~~URs, MTs, MOs, and ~~Minimum Thresholds~~IMS are referred to herein as Sustainable Management Criteria (SMCs).

The GSP Emergency Regulations specify how Groundwater Sustainability Agencies (GSAs) must establish SMCs for each applicable Sustainability Indicator. **Sections 11**, **12**, **13** and **14** describe the **Sustainability Goal**, **Undesirable Results**, **Minimum Thresholds**, and **Measurable Objectives**, respectively, developed as part of this Management Area Plan (MA Plan). **Table SMC-1** below presents the SMC status within the MA Plan area. **Table SMC-2** presents a summary of the SMCs as defined within the MA Plan.

Table SMC-1~~.~~. Sustainable Management Criteria Status

Sustainability Indicator	Local Undesirable Results Criteria	Minimum Threshold	Recent Status	Action Taken
Chronic Lowering of Groundwater Levels	URs are triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells (RMW) within the management area over four consecutive bi-annual SGMA required monitoring events.	MT is set at 87 feet above mean sea level (ft msl) for all three water level RMW.	MTs were not exceeded at any RMW.	Continue to monitor and implement the MA Plan.
Depletion of Groundwater Storage	URs are triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	MTs for Chronic Lowering of Groundwater Levels are used as a proxy for Reduction of Groundwater Storage. See above for definitions of those MTs.	MTs were not exceeded at any RMW.	Continue to monitor and implement the MA Plan.
Seawater Intrusion	Groundwater conditions in the basin show that Seawater Intrusion is not present within the Basin, and is not anticipated to be present in the future, and therefore the Sustainability Indicator is not applicable to the Basin.			
Degradation of Groundwater Quality	Until additional groundwater level and groundwater quality information is available to refine the correlation	MT is set for arsenic at its MCL of 10 ug/L.	MT for arsenic was not exceeded at any RMW.	Continue to monitor and implement the MA Plan.

Sustainability Indicator	Local Undesirable Results Criteria	Minimum Threshold	Recent Status	Action Taken
	analysis, it is considered a local UR for Degraded Water Quality within the Management Area if the arsenic concentrations exceed MTs in 40% or more of any RMW within the Management Area over two consecutive annual SGMA required monitoring events, such that it cannot be managed to provide drinking water supply (i.e., that treatment or blending is not possible or practicable).			
Land Subsidence	URs for Land Subsidence are not defined.	No MT is set for Land Subsidence.	There is no significant subsidence since 2015. As shown on **Figure GWC-15**, total subsidence between 2015 and 2021 within the Management Area ranged from -0.05 to -0.11 ft. Annual average ground surface vertical displacement between 2015 to 2021 ranged from -0.03 ft to 0.02 ft.	Continue to monitor and implement the MA Plan.
Depletion of Interconnected Surface Waters	Groundwater conditions in the basin show that Depletion of Interconnected Surface Water is not present within the Basin, and is not anticipated to be present in the future, and therefore the Sustainability Indicator is not applicable to the Management Area.			

Table SMC-2. Summary of Sustainable Management Criteria
SWID 7th Standard Annex Area Management Area Plan (7 Std MA Plan)

LEGEND
Blue text reflects substantive additions relative to 2020 Plan

Sustainability Indicator	Identification of Beneficial Users	Potential Effects on Beneficial Users	Undesirable Result (UR) Causes	Local Undesirable Results Criteria (i.e., Trigger)	Local Undesirable Results Criteria Justification	Minimum Threshold (MT) Definition	Minimum Threshold Justification	Measurable Objective (MO) Definition
Chronic Lowering of Groundwater Levels	Beneficial Users impacted by Chronic Lowering of Groundwater Levels include: - Agricultural and Industrial Water Users (19 wells); - Domestic and Small Community Water Users (9 wells); and, - Municipal Water Users (2 wells).	**Groundwater well dewatering** and associated effects (e.g., increased maintenance costs, including well rehabilitation or redevelopment and pump lowering, and reduced well lifespan due to corrosion of well casings and screens). **Increased pumping lift** and associated effects (i.e., greater energy use, higher pumping costs, increased wear and tear on well pump motors, and reduced well efficiency).	**Increased Pumping** due to: - increase in water use per acre on irrigated land; and/or - new land put into production. **Reduced Recharge** due to: - increased agricultural irrigation efficiency; - reduced recycled water deliveries; and/or - climate change resulting in decreased precipitation and increased evapotranspiration (ET).	**URs are triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells (RMW) within the management area over four consecutive bi-annual Sustainable Groundwater Management Act (SGMA) required monitoring events.**	A **well age analysis** was conducted that showed that approximately 51% of wells within the Management Area will be older than 50 years by 2040 and would likely have to be replaced irrespective of SGMA. As such, it would not be considered significant and unreasonable if fewer wells in the Management Area were impacted due to Chronic Lowering of Groundwater Levels in the Principal Aquifer than the assumed natural well replacement rate (51%). A **well impact analysis** was conducted that showed that the proposed MTs could potentially cause bottom of well screen dewatered in 26% of wells within the Management Area (including 12% of agricultural and industrial wells, 56% of domestic wells, and 0% of municipal wells). These analyses show that potential dewatering of wells within the Management Area due to Chronic Lowering of Groundwater Levels (26%) is fewer than the assumed natural well replacement rate (51%), and therefore it is not considered significant and unreasonable. A **Well Dewatering Mitigation Program** will address well impacted by Chronic Lowering of Groundwater Levels, including agricultural and domestic supply wells.	**Initial MT estimates are set at the three designated RMWs**, using an algorithm taking into consideration: - Trendline projection using historical Spring water level data between 2006 and 2016; - Minimum value of the projected groundwater elevation in 2040 from the three RMWs; and - Well construction information, for the consideration of impacts to beneficial users. - Coordination with adjacent Management Areas to maintain MT gradient to be similar to the current groundwater elevation gradient in vicinity of the Management Area. All RMWs within the Management Area have the same MT value.	MTs are set at levels that would **avoid a depletion of supply** that may lead to URs. MTs consider **historical groundwater level trends** based on the assumption that the conditions experienced over the ten-year period 2006-2016 continue from 2016 through 2040. **Relationship with Other Sustainability Indicators:** Groundwater levels are used as a proxy for groundwater storage. Based on available data no direct correlation can be discerned between water levels and water quality measurements within the Management Area at this time, except at the base of fresh water defined by Page (1973). The base of fresh water is well below the MT for Chronic Lowering of Groundwater Levels. Therefore, the MT for Chronic Lowering of Groundwater Levels is conservative and not expected to exacerbate to water quality within the Management Area. Based on available data no direct correlation can be discerned between water levels and land subsidence measurements within the Management Area at this time. Seawater intrusion and interconnected surface water are not applicable to the Management Area. **Impact to Adjacent Management Areas and Basins:** The MTs have been developed in consideration of and in coordination with the neighboring water agencies within the Kern Subbasin. The method used to develop the MT is consistent with several surrounding Management Areas (i.e., Shafter-	**Initial MO estimates are set at the three designated RMWs**, using an algorithm similar to the MT algorithm that takes into consideration: - Trendline projection using historical Spring water level data between 2006 and 2016; - Minimum value of the projected groundwater elevation in 2030 from the three RMWs; and - Well construction information, for the consideration of impacts to beneficial users. - Coordination with adjacent Management Areas to maintain MO gradient to be similar to the current groundwater elevation gradient in vicinity of the Management Area. All RMWs within the Management Area have the same MO value. **Margin of Operational Flexibility:** The margin of operational flexibility within the Management Area is the difference between the Minimum Threshold (-87 feet above mean sea level [ft msl]) and the Measurable Objective (-29 ft msl): 58 feet (ft).

Table SMC-2. Summary of Sustainable Management Criteria
SWID 7th Standard Annex Area Management Area Plan (7 Std MA Plan)

LEGEND
Blue text reflects substantive additions relative to 2020 Plan

Sustainability Indicator	Identification of Beneficial Users	Potential Effects on Beneficial Users	Undesirable Result (UR) Causes	Local Undesirable Results Criteria (i.e., Trigger)	Local Undesirable Results Criteria Justification	Minimum Threshold (MT) Definition	Minimum Threshold Justification	Measurable Objective (MO) Definition
							Wasco Irrigation District Management Area and North Kern Water Storage District Management Area). **Impact to Beneficial Users:** Well Impact analysis shows that although the proposed MTs could potentially result in some wells being impacted, the impacts would not be unreasonable and would be mitigated through an Well Dewatering Mitigation Program. **State, Federal, and Local Standards:** There are no state, federal, or local standards pertaining to groundwater levels in the Management Area. **Measurement of Minimum Thresholds:** Groundwater levels will be measured in each of the three RMWs semiannually using the monitoring protocols outlined in the Kern Groundwater Authority (KGA) Umbrella Groundwater Sustainability Plan (GSP).	
Reduction of Groundwater Storage	**Same Beneficial Users as the Chronic Lowering of Groundwater Levels sustainability indicator.**	**Reduced groundwater supply reliability** due to reduced quantity of water available, which would be most significant during periods of drought.	**Same causes as the Chronic Lowering of Groundwater Levels sustainability indicator Levels** (i.e., increased groundwater pumping and reduced recharge; see above).	**URs are triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.**	The use of MTs for the Chronic Lowering of Groundwater Levels as a proxy for Reduction of Groundwater Storage has been demonstrated to be appropriate and protective. The amount by which groundwater storage would be reduced if groundwater levels at all RMWs declined to their respective MTs represents 16% of the total usable groundwater storage within the Management Area. The volume of usable storage above the MT for Chronic Lowering of Groundwater Levels corresponds to the volume that would be pumped in roughly three years of pumping at the long-term historical average	**MTs for Chronic Lowering of Groundwater Levels are used as a proxy for Reduction of Groundwater Storage**. See above for definitions of those MTs.	**Use of Groundwater Levels as a Proxy:** MTs for Reduction in Groundwater Storage may be set by using MTs for Chronic Decline in Groundwater Levels as a proxy if it is demonstrated that a correlation exists between the two metrics. The following calculation demonstrates this correlation: Since hydrogeologic storage properties and the MA Plan area are constant when looking at the change in storage (Change in Storage = MA Plan Area * Storage Coefficient * Change in Saturated Thickness), the following analysis is presented in terms of saturated thickness, which is mathematically equivalent to storage volume.	**MOs for Chronic Lowering of Groundwater Levels are used as a proxy for Reduction of Groundwater Storage**. See above for definitions of those MOs.

Table SMC-2. Summary of Sustainable Management Criteria
SWID 7th Standard Annex Area Management Area Plan (7 Std MA Plan)

LEGEND
Blue text reflects substantive additions relative to 2020 Plan

Sustainability Indicator	Identification of Beneficial Users	Potential Effects on Beneficial Users	Undesirable Result (UR) Causes	Local Undesirable Results Criteria (i.e., Trigger)	Local Undesirable Results Criteria Justification	Minimum Threshold (MT) Definition	Minimum Threshold Justification	Measurable Objective (MO) Definition
					rate, assuming no inflow to the systems. Given that the UR definition is based on 40% or more RMWs exceeding their MTs, the actual reduction in storage that would occur if URs for chronic groundwater levels were triggered would be much less, and therefore the UR definition avoids significant and unreasonable effects for the Reduction of Groundwater Storage sustainability indicator.		The change in saturated thickness from current (Spring 2016) groundwater elevations (13.7 ft msl) to the Chronic Lowering of Groundwater Levels MTs (-87 ft msl) is approximately 101 ft. The total usable groundwater storage is calculated to be 624 ft of saturated thickness within the Management Area based on current groundwater elevations and the deepest groundwater extractions from well construction information (-710 ft msl) within the MA Plan Area plus 100 ft reserve for well pumping operations. Therefore, the reduction in usable storage volume if groundwater levels were to decline to the MTs amounts to 16%. **Because volume of usable groundwater storage can be represented by changes in groundwater elevations and the amount of recoverable storage is substantially greater than the volume associated with a reduction in groundwater levels to the MTs for Chronic Lowering of Groundwater Levels, those MTs are considered protective for the Reduction of Groundwater Storage Sustainability Indicator.**	
Seawater Intrusion	Groundwater conditions in the Basin show that Seawater Intrusion is not present within the Basin, and is not anticipated to be present in the future, and therefore the Sustainability Indicator is **not applicable to the Basin**.							
Degraded Water Quality	Beneficial Users impacted by Degraded Water Quality include: - Domestic and Small Community Water Users (9 wells); and, - Municipal Water Users (2 wells). Agricultural use is the dominant beneficial user of groundwater	**Increased costs to treat or blend groundwater to drinking water standards** if it is used as potable supply source. **Potential reduction in "usable storage" volume of groundwater** in the basin if large areas of aquifer are impacted to the point that they cannot be used to support beneficial uses and users.	Potential causes include the addition of constituents of concern (COCs) to groundwater in the principal aquifer **through processes that are causatively related to groundwater recharge or extraction or land use activities.** Addition of COCs to groundwater could happen via deep percolation of	**Until additional groundwater level and groundwater quality information is available to refine the correlation analysis, it is considered a local UR for Degraded Water Quality within the Management Area if the arsenic concentrations exceed the MTs in 40% or more of the RMWs within the Management Area over two consecutive**	Several criteria, or "tests," were utilized by the SOKR GSAs to systematically and transparently assess which Constituents of Concern (COCs) warranted the development of SMCs for to be consistent based on the understanding of groundwater conditions, the relationship between groundwater management (i.e., extraction and recharge to water quality), the regulatory landscape, and relevant regulations. The Management Area then only	The MT is set for arsenic based on regulatory thresholds for drinking water beneficial use set by United States Environmental Protection Agency (USEPA) and State of California. Specifically, the MT is set at the California Maximum Contaminant Level (MCL) for arsenic of 10 micrograms per liter (ug/L).	The GSP Emergency Regulations state that the MT "shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin", and that "the Agency shall consider local, state, and federal water quality standards applicable to the basin." This language indicates that MTs for Degraded Water Quality can reasonably be based on concentrations of water quality	The MO is set at the California MCL for arsenic (10 ug/L).

Table SMC-2. Summary of Sustainable Management Criteria
SWID 7th Standard Annex Area Management Area Plan (7 Std MA Plan)

LEGEND
Blue text reflects substantive additions relative to 2020 Plan

Sustainability Indicator	Identification of Beneficial Users	Potential Effects on Beneficial Users	Undesirable Result (UR) Causes	Local Undesirable Results Criteria (i.e., Trigger)	Local Undesirable Results Criteria Justification	Minimum Threshold (MT) Definition	Minimum Threshold Justification	Measurable Objective (MO) Definition
	identified within the Management Area, and groundwater quality is generally suitable for agricultural uses.		agricultural return flows and leaching, deep percolation beneath shallow point-source contamination sites, and lateral inflows from adjacent areas within the basin with poorer water quality.	**annual SGMA required monitoring events, such that it cannot be managed to provide drinking water supply (i.e., that treatment or blending is not possible or practicable).**	developed SMCs for those COCs that passed all of the following tests. These "tests" include: - Regional Occurrence Test: A COC passes this test if it is detected in a majority of wells within the Management Area. - Anthropogenic Influence Test: This test further draws a distinction between human-influenced versus naturally-occurring effects, that are not necessarily under the purview of GSAs to manage. - Sensitive Beneficial Use Test: A COC passes this test if it has a Primary MCL set by the SWRCB, and therefore could have an impact on drinking water users, assuming the COC passes the other "tests". - Pre-SGMA Condition Test: A COC passes this test if unimpacted beneficial users still exist as of 2015 (i.e., impacts are not significant as of the SGMA effective date). - Other Regulatory Regime Test: A COC passes this test if the constituent loading is not already being managed by another regulatory authority (e.g., ILRP or CV-SALTS), and assuming the COC passes the other "tests". - Groundwater Management "Nexus" Test: A COC passes this test if concentrations are or have the potential to be exacerbated by groundwater management actions taken by the GSAs (i.e., management of groundwater extractions or recharge).		constituents of concern, as quantified by sampling measurements at Representative Monitoring Wells. A MT for Degraded Water Quality is set for arsenic at three water quality RMWs in the Management Area using the California MCL of 10 ug/L since the most sensitive beneficial use of groundwater in the Management Area is for potable supply. **Relationship with Other Sustainability Indicators:** There is **no apparent correlation** between groundwater elevations and water quality measurements based on the historical data, except at the base of fresh water defined by Page (1973). The base of fresh water is well below the MT for Chronic Lowering of Groundwater Levels. Therefore, the MT for Chronic Lowering of Groundwater Levels is conservative and protective to water quality within the Management Area. In addition, based on input provided by the agricultural stakeholders, the growers have not experienced any changes in water quality as groundwater elevations have declined over time. Based on available data no direct correlation can be discerned between water quality and land subsidence measurements in the Management Area at this time. Seawater intrusion and interconnected surface water are not applicable to the Management Area. **Impact to Adjacent Management Areas and Basins:**	

Table SMC-2. Summary of Sustainable Management Criteria
SWID 7th Standard Annex Area Management Area Plan (7 Std MA Plan)

LEGEND
Blue text reflects substantive additions relative to 2020 Plan

Sustainability Indicator	Identification of Beneficial Users	Potential Effects on Beneficial Users	Undesirable Result (UR) Causes	Local Undesirable Results Criteria (i.e., Trigger)	Local Undesirable Results Criteria Justification	Minimum Threshold (MT) Definition	Minimum Threshold Justification	Measurable Objective (MO) Definition
					Per the rationale described and employed herein, because the focus of SGMA rightfully emphasizes those constituents that may be degraded to groundwater management activities (i.e., extraction and recharge), the only COC applicable for the development of Degraded Water Quality SMCs within the Management Area is arsenic. This process notwithstanding, the Management Area is committed to continue to monitor and otherwise evaluate water quality and the COCs as part of on-going SGMA implementation.		By designing MTs for Chronic Lowering of Groundwater Level based on historical trends in groundwater conditions and in coordination with the neighboring water agencies within the Kern Subbasin, these MTs are not expected to cause significant changes to existing regional groundwater gradients and are thus anticipated to be protective in terms of preventing migrations of poor-quality water into or from adjacent management areas. **Impact to Beneficial Users:** Primary MCLs are regulatory thresholds based on criteria for drinking water quality, which is the most sensitive beneficial use. As such, the MT for Degraded Water Quality considers the most sensitive beneficial uses and users of groundwater. In addition, as described previously, agricultural use is the dominant beneficial use identified within the Management Area, and groundwater quality is generally suitable for agricultural uses. **State, Federal, and Local Standards:** State, federal, and local entities have greater authority to enforce water quality standards, especially for anthropogenic-derived pollutant constituents. Water quality issues related to deep percolation of agriculture chemicals (e.g., nitrates) are regulated separately under the ILRP and CV-SALTS. **Measurement of Minimum Thresholds:** Water quality data will be collected at the water quality RMWs annually. Further, activities already undertaken as part of other regulatory compliance efforts will continue during the SGMA implementation	

Table SMC-2. Summary of Sustainable Management Criteria
SWID 7th Standard Annex Area Management Area Plan (7 Std MA Plan)

LEGEND
Blue text reflects substantive additions relative to 2020 Plan

Sustainability Indicator	Identification of Beneficial Users	Potential Effects on Beneficial Users	Undesirable Result (UR) Causes	Local Undesirable Results Criteria (i.e., Trigger)	Local Undesirable Results Criteria Justification	Minimum Threshold (MT) Definition	Minimum Threshold Justification	Measurable Objective (MO) Definition
							timeframe. These data will be evaluated on an annual basis.	
Land Subsidence	Critical Surface Infrastructure is not defined as a Beneficial User in California Water Code (CWC) §10723.2, but is still considered in the development of Sustainable Management Criteria (SMC) for Land Subsidence. The only Regional Critical Infrastructure located within the MA Plan area is a small section of a high-pressure gas pipeline which the Basin GSAs have determined does not warrant further consideration (i.e., Basin is only concerned with the California Aqueduct and the Friant Kern Canal). However, there is other non-critical infrastructure within the Management Area, which is included in the consideration of SMC development.	**Damage to above-ground and near-surface infrastructure (even if not considered critical infrastructure),** such as the North of River Sanitary District (NORSD) Wastewater Treatment Plant (WWTP); utility infrastructure; and industrial facilities.	**Depressurization of aquifers and aquitards due to lowering of groundwater levels**, which can lead to compaction of compressible strata and lowering of the ground surface. Therefore, the causes of URs due to Land Subsidence are generally the same as the potential causes listed above for URs due to Chronic Lowering of Groundwater Levels.	URs for Land Subsidence are not defined.	Based on the **limited to no historical subsidence, the lack of Corcoran clay,** and **the lack of Regional Critical Infrastructure**, no URs for Land Subsidence are defined.	No MT is set for Land Subsidence.	**There is no Regional Critical Infrastructure** identified in the 7 Std MA Plan that has been affected, or has the potential to be affected, by land subsidence. Further, **no significant subsidence** has been identified by the 7 Std MA Plan based on available data and the lack of Corcoran clay. Therefore, no unique Minimum Thresholds are set for this Sustainability Indicator. **Relationship with Other Sustainability Indicators:** Based on available data no direct correlation can be discerned between land subsidence measurements and water levels within the Management Area at this time. Based on available data no direct correlation can be discerned between land subsidence measurements and water quality in the Management Area at this time. Seawater intrusion and interconnected surface water are not applicable to the Management Area. **Impact to Adjacent Management Areas and Basins:** By designing MTs for Chronic Lowering of Groundwater Level based on historical trends in groundwater conditions and in coordination with the neighboring water agencies within the Kern Subbasin, these MTs are not expected to cause significant land subsidence. **Impact to Beneficial Users:** **There is no critical infrastructure** identified in the 7 Std MA Plan that	No MO is set for Land Subsidence.

Table SMC-2. Summary of Sustainable Management Criteria
SWID 7th Standard Annex Area Management Area Plan (7 Std MA Plan)

LEGEND
Blue text reflects substantive additions relative to 2020 Plan

Sustainability Indicator	Identification of Beneficial Users	Potential Effects on Beneficial Users	Undesirable Result (UR) Causes	Local Undesirable Results Criteria (i.e., Trigger)	Local Undesirable Results Criteria Justification	Minimum Threshold (MT) Definition	Minimum Threshold Justification	Measurable Objective (MO) Definition
							has been affected, or has the potential to be affected, by land subsidence. Further, **no significant subsidence** has been identified by the 7 Std MA Plan based on available data and lack of Corcoran clay. **State, Federal, and Local Standards:** There are no state, federal, or local standards pertaining to land subsidence in the Management Area. **Measurement of Minimum Thresholds:** Land subsidence will be monitored through the publicly available TRE Altamira Interferometric Synthetic Aperture Radar (InSAR) dataset. If land subsidence is observed that has the potential to substantially interfere with surface or near surface land uses, the criteria for definition of UR for Land Subsidence will be revisited, and MT for Land Subsidence will be developed, as appropriate as part of the next five-year update.	
Depletion of Interconnected Surface Water	Groundwater conditions in the Basin show that Depletion of Interconnected Surface Water is not present within the Basin, and is not anticipated to be present in the future, and therefore the Sustainability Indicator is **not applicable to the Management Area**.							

Abbreviations:

AF = acre-feet
AFY = acre-feet per year
COC = Constituent of Concern
CV-SALTS = Central Valley-Salinity Alternatives for Long-term Sustainability
CWC = California Water Code
ET = evapotranspiration
ft = feet
ft msl = feet above mean sea level
GSA = Groundwater Sustainability Agency
GSP = Groundwater Sustainability Plan
ILRP = Irrigated Lands Regulatory Program
InSar = Interferometric Synthetic Aperture Radar
MCL = Maximum Contaminant Level
MO = Measurable Objective
MT = Minimum Threshold
NORSD = North of River Sanitary District
RMW = Representative Monitoring Well
P/MAs = Projects and Management Actions
SGMA = Sustainable Groundwater Management Act
SMC= Sustainable Management Criteria
SWID = Shafter-Wasco Irrigation District
SWRCB = State Water Resources Control Board
UR = Undesirable Result
WWTP = Wastewater Treatment Plant
1,2,3-TCP = 1,2,3-Trichloropropane

11. SUSTAINABILITY GOAL

☑ 23 CCR § 354.24

SGMA requires that a Sustainability Goal be defined for the basin (CWC §10727(a)), and the GSP Emergency Regulations further clarify that the Sustainability Goal be defined on a basin-wide basis.

~~The sustainability goal for the Management Area is to maintain an economically-viable groundwater resource for the beneficial use of Annex Area landowners, residents, and businesses (including agricultural, industrial users) by utilizing the area's groundwater resources within the local sustainable yield. Long-term groundwater sustainability will be achieved through the implementation of projects and management actions to both increase water supplies and reduce demands within the Annex Area.~~

~~The local sustainability goal, above, is consistent with and in addition to~~ The basin-wide sustainability goal being adopted by all GSAs in the Kern County Subbasin, defined below:

"The sustainability goal of the Kern County Subbasin is to:

- Achieve sustainable groundwater management in the Kern County Subbasin through the implementation of projects and management actions at the member agency level of each GSA
- Maintain its groundwater use within the sustainable yield of the basin~~.~~ as demonstrated by monitoring and reporting groundwater conditions
- Operate within the established sustainable management criteria, which are based on the collective technical information presented in the GSPs in the Subbasin.
- ~~Implement projects and management actions that include a variety of water supply development and demand management actions.~~
- Collectively bring the Subbasin into sustainability and to maintain sustainability over the implementation and planning horizon~~.~~."

~~Further, the Subbasin sustainability goal includes a commitment to monitor and report groundwater conditions, as required by SGMA, and to continue coordination among the KGA member agencies and all other GSA's in the Subbasin to identify the potential for, or presence of, undesirable results and actions to prevent undesirable results. The coordination process established in the development of this GSP and memorialized in the Coordination Agreement will ensure that the Subbasin is managed as a shared groundwater resource and that the districts within the Subbasin work collaboratively towards achieving and maintaining sustainable groundwater use."~~

12. UNDESIRABLE RESULTS

☑ 23 CCR § 354.26(a)

This section describes the Undesirable Results defined for the 7th Standard Annex Management Area. Pursuant to the GSP Emergency Regulations, which states that Undesirable Results are to be defined consistently throughout the basin (23-CCR § 354.20), definitions of Undesirable Results for the basin have been developed through a coordinated effort of the basin GSAs and are described in the Kern Groundwater Authority (KGA) GSA Umbrella GSP. The basin-wide definitions of Undesirable Results were considered and adjusted where necessary to better reflect the 7th Standard Annex Management Area groundwater conditions.

As discussed below for each Sustainability Indicator, the Undesirable Results definitions for the Basin refer to and rely on Minimum Thresholds established at the local management area level. Specifically, Undesirable Results for the Basin occur when Minimum Thresholds for a certain percentage (by acreage) of management areas are exceeded. Each management area determines what the local Minimum Thresholds values are and what combination of local exceedances constitutes a local Undesirable Result. If a local Undesirable Result manifests in a management area, that area begins to count towards the basin-wide Undesirable Results definition.

12.1. Undesirable Results for Chronic Lowering of Groundwater Levels

The basin-wide definition of Undesirable Results for Chronic Lowering of Groundwater Levels is as follows:

> "The point at which significant and unreasonable impacts over the planning and implementation horizon, as determined by depth/elevation of water, affect the reasonable and beneficial use of, and access to, groundwater by overlying users.
>
> This is determined when the Minimum Threshold for groundwater levels are exceeded in at least three (3) adjacent management areas which represent at least 15% of the sub-basin or greater than 30% of the [Kern County] Subbasin (as measured by each Management Area). Minimum Thresholds shall be set by each of the Management Areas through their respective Groundwater Sustainability Plans."

The above basin-wide definition allows for local definition, within each Management Area of the basin, of the Minimum Thresholds that constitute a significant and unreasonable impact to the reasonable and beneficial use of groundwater by overlying users. As such, it is necessary to consider local conditions and beneficial uses and users within each management area.

12.1.1. Identification of Beneficial Users

Beneficial users impacted by Chronic Lowering of Groundwater Levels in the Management Area include:

1) Agricultural and Industrial Users: The primary use of groundwater in the Management Area is for agricultural purposes. There are 19 agricultural and industrial wells within the Management Area.
2) Domestic and Small Community Users: Groundwater is pumped for domestic use by approximately nine domestic wells.
3) Municipal Users: There are two public supply wells within the Management Area.

~~12.1.1.~~12.1.2. Potential Causes of Undesirable Results

☑ **23 CCR § 354.26(b)(1)**

Per Section 354.26(b)(1) of the GSP Emergency Regulations, potential causes of Undesirable Results due to Chronic Lowering of Groundwater Levels in the 7th Standard Annex Management Area include increased pumping and/or reduced recharge. Because the primary use of groundwater in the Management Area is for agricultural purposes, increased groundwater pumping could occur if new land is put into agricultural production or if water use per acre on existing irrigated land increases. Relative to the volume used for agricultural production, pumping by municipal and industrial users is limited. Based on the size of the population served (about 61[49]), this volume is relatively small and unlikely to substantially increase. Based on a review the current General Plans, and the Western Rosedale Specific Plan, that cover all or a portion of the Management Area, no significant development is anticipated in the Management Area. Reduced recharge could occur due to increased agricultural irrigation efficiency, reduction in recycled water deliveries, and/or due to climate change that results in decreased precipitation and increased evapotranspiration (ET).

~~12.1.2.~~12.1.3. Criteria Used to Define Undesirable Results

☑ **23 CCR § 354.26(b)(2)**
☑ **23 CCR § 354.26(c)**

Per Section 354.26(b)(2) of the GSP Emergency Regulations, the description of Undesirable Results must include a quantitative description of the number of Minimum Threshold exceedances that constitute an Undesirable Result. As discussed further below in **Sections 13** through **15**, Minimum Thresholds and Measurable Objectives were defined using a method of projecting groundwater levels into the future, using the assumption that the conditions experienced over the ten-year period 2006 – 2016 (Spring measurements) continue from 2016 through 2040~~.~~, and through coordination with adjacent Management Areas. This ten-year period includes the worst drought conditions on record, and projects water levels assuming that these severe conditions continued through 2040 (i.e., they project a "worst case scenario" that does not take into account longer term historical conditions or actual conditions that have occurred from 2016 to present). The Minimum Threshold is then set at the theoretical conditions projected in 2040 and raised by 50 feet (ft) and the Measurable Objective is set as the theoretical conditions projected in 2030~~.~~ and raised 50 ft.

These calculations were performed based on water levels at three wells with the Management Area with relatively long records of water level measurement and broad geographic spacing, and the lowest theoretical groundwater level calculated at these three locations is set as the Measurable Objective and Minimum Threshold for the 7th Standard Annex Management Area. The Measurable Objective and Minimum Threshold are assigned to representative monitoring ~~sites~~wells within the Monitoring Network, as further described in **Section 15**. ~~An Undesirable Result for Chronic Lowering of Groundwater Levels~~

[49] Population served by Superior Mutual Water Company was obtained from SDWIS website, accessed on 4 March 2019. https://sdwis.waterboards.ca.gov/PDWW/index.jsp

~~would be identified for the Management Area if the Minimum Threshold is exceeded at one or more of the three representative monitoring sites over three consecutive monitoring periods.~~

An Undesirable Result for Chronic Lowering of Groundwater Levels are triggered for the Management Area when groundwater levels decline below established MTs in 40% or more of any Representative Monitoring Wells (RMW) within the Management Area over four consecutive bi-annual Sustainable Groundwater Management Act (SGMA) required monitoring events. The number of exceedances that equates to at least 40% of RMW for the Management Area is two out of three RMWs.

This method of calculating Measurable Objectives and Minimum Thresholds for chronic lowering of water levels based on a theoretical projection of groundwater elevations relative to 2006 – 2016, is consistent with the methodology used by the Management Areas surrounding the 7th Standard Annex Area (i.e., Shafter-Wasco Irrigation District [SWID] Management Area~~, Semitropic Water Storage District Management Area, Rosedale-Rio Bravo Management Area,~~ and North Kern Water Storage District Management Area).

~~12.1.3.~~12.1.4. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

Per Section 354.26(b)(3) of the GSP Emergency Regulations, the primary potential effects of Undesirable Results caused by Chronic Lowering of Groundwater Levels on beneficial uses and users of groundwater in the 7th Standard Annex Management Area may include groundwater well dewatering and increased pumping lift. Well dewatering is detrimental to wells as it can lead to increased maintenance costs (e.g., well rehabilitation/redevelopment and pump lowering) and reduced well lifespan due to corrosion of well casings and screens. Increased pumping lift results in more energy use necessary per unit volume of groundwater pumped and corresponding higher pumping costs, as well as increased wear and tear on well pump motors and reduced well efficiency.

12.2. Undesirable Results for Reduction of Groundwater Storage

The basin-wide definition of Undesirable Results for Reduction of Groundwater Storage is as follows*:*

> "The point at which significant and unreasonable impacts, as determined by the amount of groundwater in the basin, affect the reasonable and beneficial use of, and access to, groundwater by overlying users over an extended drought period.
>
> This is determined when the volume of storage (above the groundwater level Minimum Thresholds) is depleted to an elevation lower than the groundwater level Minimum Threshold in at least three (3) adjacent Management Areas which represent at least 15% of the Subbasin or greater than 30% of the Subbasin (as measured by the acreage of each Management Area). Minimum Thresholds shall be set by each of the Management Areas through their respective Groundwater Sustainability Plans."

As with Chronic Lowering of Groundwater Levels, the above basin-wide definition allows for local definition, within each Management Area of the basin, of the Minimum Thresholds that constitute a significant and unreasonable impact to the reasonable and beneficial use of groundwater by overlying users.

12.2.1. Identification of Beneficial Users

Reduction of Groundwater Storage is directly correlated to Chronic Lowering of Groundwater Levels. Therefore, the Beneficial Users for each Management Area are the same as those defined in **Section 12.1.1** above.

~~12.2.1.~~12.2.2. Potential Causes of Undesirable Results

☑ 23 CCR § 354.26(b)(1)

Per Section 354.26(b)(1) of the GSP Emergency Regulations, Reduction of Groundwater Storage is generally correlated to Chronic Lowering of Groundwater Levels. Therefore, the potential causes of Undesirable Results due to Reduction in Groundwater Storage are generally the same as the potential causes listed above for Undesirable Results due to Chronic Lowering of Groundwater Levels (i.e., increased groundwater pumping and reduced recharge).

~~12.2.2.~~12.2.3. Criteria Used to Define Undesirable Results

☑ 23 CCR § 354.26(b)(2)
☑ 23 CCR § 354.26(c)

Per Section 354.26(b)(2) of the GSP Emergency Regulations, the criteria used to define Undesirable Results for Reduction of Groundwater Storage in the basin-wide definition above are generally consistent with the criteria used to define Undesirable Results for Chronic Lowering of Groundwater Levels. Put simply, it would be considered significant and unreasonable (i.e., an Undesirable Result) if groundwater storage were to be reduced by an amount that would cause the groundwater levels ~~at representative monitoring sites to exceed their Minimum Threshold for Chronic Lowering of Groundwater Levels~~in at least 40% or more of the Representative Monitoring Wells over four consecutive bi-annual SGMA required monitoring events.

As discussed below in **Section 13.2**, due to the great depth of fresh water and wells able to access it, there is significant usable groundwater storage within the Management Area even below the elevation of the Minimum Thresholds. As such, on a local level it is not necessary to define unique SMCs for Reduction of Groundwater Storage; the criteria set for Chronic Lowering of Groundwater Levels are "protective" and a reasonable proxy.

~~12.2.3.~~12.2.4. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

The primary potential effect of Undesirable Results caused by Reduction of Groundwater Storage on beneficial uses and users of groundwater in the Management Area would be reduced groundwater supply reliability which would be most significant during periods of drought. However, as discussed in **Section 13.2** below, there is significant groundwater storage within the Management Area, and so these effects are unlikely to occur.

12.3. Undesirable Results for Seawater Intrusion

☑ 23 CCR § 354.26(d)

The GSP Emergency Regulations state that "An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators" (23-CCR § 354.26(d)). Because the basin is not located near any saline water bodies, seawater intrusion is not present and not likely to occur. The Seawater Intrusion Sustainability Indicator is therefore not applicable to the basin and no Undesirable Results for this Sustainability Indicator are defined in the basin.

12.4. Undesirable Results for Degraded Water Quality

The basin-wide definition of Undesirable Results for Degraded Water Quality is as follows:

> "The point at which significant and unreasonable impacts over the planning and implementation horizon, as caused by water management actions, that affect the reasonable and beneficial use of, and access to, groundwater by overlying users.
>
> This is determined when the Minimum Threshold for a groundwater quality constituent of concern is exceeded in at least three (3) adjacent Management Areas which represent at least 15% of the sub-basin or greater than 30% of the designated monitoring points within the basin. Minimum Thresholds shall be set by each of the Management Areas through their respective Groundwater Sustainability Plans."

As with Chronic Lowering of Groundwater Levels, the above basin-wide definition allows for local definition within each Management Area of the basin, of the Minimum Thresholds that constitute a significant and unreasonable impact to the reasonable and beneficial use of groundwater by overlying users. Key to the basin-wide definition is the phrase "as caused by water management actions." This phrase rightfully distinguishes between water quality impacts that are due to ~~human actions~~GSA-related water management activities (recharge and extraction) and those that are the result of natural conditions~~.~~ or that pre-date SGMA. Because impacts that were present prior to 2015 or that are due to natural conditions are not caused by (and in some cases, cannot be remedied by) ~~human~~GSA action, those impacts are not considered to be Undesirable Results subject to SGMA compliance.[50,51]

The definition also draws a distinction between localized or isolated (e.g., well specific) effects, that are not necessarily under the purview of GSAs to manage (especially if related to well location and design relative to naturally-occurring or anthropogenically-caused impacts that pre-date SGMA), and broader, groundwater management-related regional effects which can fall under a GSA's purview. This approach is both consistent with the SGMA's definition of URs meaning "…effects caused by groundwater conditions

[50] "SGMA and the GSP Regulations do not require a GSP to address undesirable results associated with degraded water quality that occurred before, and have not been corrected by, January 1, 2015." (DWR Consultation Letter, Cuyama Valley 2020 Groundwater Sustainability Plan, 3 June 2021).

[51] "Department staff recognize that GSAs are not responsible for improving existing degraded water quality conditions. GSAs are required; however, to manage future groundwater extraction to ensure that groundwater use subject to its jurisdiction does not significantly and unreasonably exacerbate existing degraded water quality conditions." (DWR Determination Letter, 180/400 Foot Aquifer Subbasin GSP, 3 June 2021).

occurring throughout the basin" (emphasis added) (CWC § 10721(x)) and reflects the fact that SGMA does not require GSPs to address URs that occurred before, and have not been corrected by, January 1, 2015.

12.4.1. Identification of Beneficial Users

As described in **Section 7.4**, agricultural use is the dominant beneficial use within the Management Area, and groundwater quality is generally suitable for agricultural uses; therefore, agriculture is not considered a beneficial user for purposes of this analysis. Further, water quality issues related to deep percolation of agricultural chemicals such as nitrate are regulated separately under the Irrigated Lands Regulatory Program (ILRP) and Central Valley-Salinity Alternatives for Long-term Sustainability (CV-SALTS).

The most sensitive beneficial use of groundwater is for potable supply. Groundwater served by public water systems must meet water quality regulatory standards (i.e., Maximum Contaminant Levels; MCLs) and these systems are regulated by the State Water Resources Control Board (SWRCB). Domestic wells are not directly regulated, however.

As such, beneficial users impacted by Degraded Water Quality in the Management Area include:

1) Domestic and Small Community Users: Groundwater is pumped for domestic use by approximately nine domestic wells.
2) Municipal Users: There are two public supply wells within the Management Area

~~12.4.1.~~12.4.2. Potential Causes of Undesirable Results

☑ 23 CCR § 354.26(b)(1)

Per Section 354.26(b)(1) of the GSP Emergency Regulations, potential causes of Undesirable Results due to Degraded Water Quality within the 7th Standard Annex Management Area include the addition of constituents of concern (COCs) to groundwater in the principal aquifer through processes that are causatively related to water management or land use activities. As discussed in **Section 7.4**, Total Dissolved Solids (TDS), nitrate, arsenic, 1,2,3-Trichloropropane (1,2,3-TCP), and chemicals associated with point-source contamination sites (petroleum hydrocarbons, volatile organic compounds, other industrial chemicals) are identified as COCs for the Management Area. Addition of COCs to groundwater could happen via deep percolation of agricultural return flows and leaching, deep percolation beneath shallow point-source contamination sites, and lateral inflows from adjacent areas within the basin with poorer water quality.

~~12.4.2.~~12.4.3. Criteria Used to Define Undesirable Results

☑ 23 CCR § 354.26(b)(2)

Per Section 354.26(b)(2) of the GSP Emergency Regulations, the basin-wide definition of Undesirable Results provides for local definition of the combination of Minimum Threshold exceedances that constitute and Undesirable Result in a management area. ~~The State Water Resources Control Board's (SWRCB) Division of Drinking Water regulates the quality of water~~

Under SGMA, the regulatory authority granted to GSAs includes the management of the quantity, location, and timing of groundwater pumping to prevent URs, namely the "significant and unreasonable" impacts to beneficial users. Water quality within the MA Plan area is generally suitable for agricultural uses; therefore, in order to be considered a "significant and unreasonable" impact, water quality would

need to negatively impact potable supply (the most sensitive beneficial user; see above) in a significant portion of the management areas (i.e., not a well-specific issue).

Per CWC § 10727.2(b)(4), "The plan may, but is not required to, address undesirable results that occurred before, and have not been corrected by, January 1, 2015." Therefore, addressing Degraded Water Quality conditions that existed before 2015 is not under the purview of the GSAs. Further, GSAs are responsible for "management of groundwater quality, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin" (CWC § 10727.2(d)(2); emphasis added).

Additionally, regulatory oversight authority for the Management Area's drinking water quality rests with the SWRCB and the County, not necessarily with SWID. Those regulatory oversight and enforcement actions have and will occur on their own mandated timelines. The SWRCB's Division of Drinking Water regulates the quality of water (such as 1,2,3-TCP) served by the single public water system in the 7th Standard Annex Management Area (the Superior Mutual Water Company [SMWC]), and the water quality criteria under which that program operates (i.e., ~~Maximum Contaminant Level [~~MCLs~~])~~ is not superseded by SGMA. Water quality issues related to deep percolation of agricultural chemicals such as nitrate are regulated separately under the ILRP and CV-SALTS.

As depicted on **Figure SMC-1** and described below, several criteria, or "tests", were utilized by the Management Area to systematically and transparently assess which constituents warranted the development of SMCs for to be consistent based on the understanding of groundwater conditions, the relationship between groundwater management (i.e., extraction and recharge to water quality), the regulatory landscape, and the above-listed regulations. The Management Area then only developed SMCs for those constituents that passed all of the following tests. This process notwithstanding, the Management Area are committed to continue to monitor and otherwise evaluate water quality as part of on-going SGMA implementation, in coordination with all other neighboring management areas.

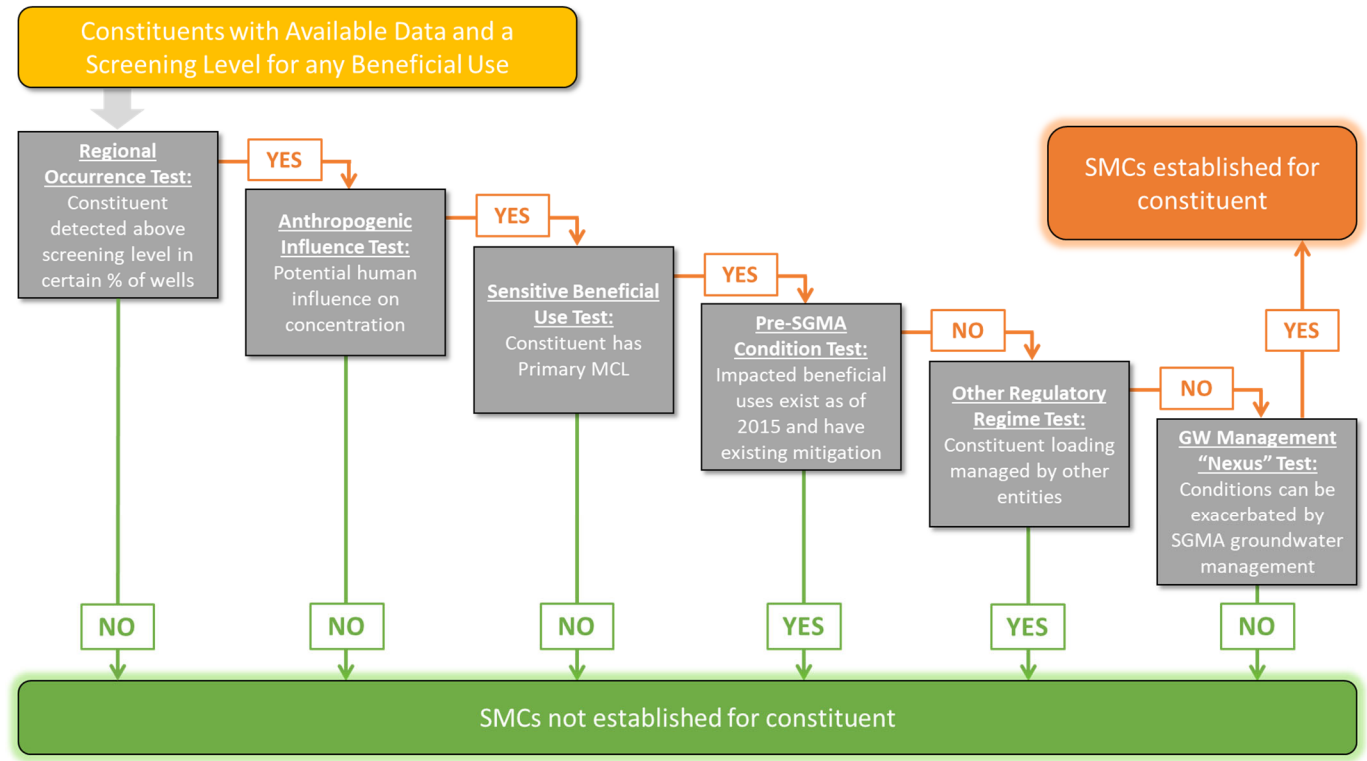
- *Regional Occurrence Test:* A COC passes this test if it is detected in a majority of wells within the Management Area. The test draws a distinction between localized or isolated (e.g., well specific) effects, that are not necessarily under the purview of GSAs to manage (especially if related to well location and design relative to naturally-occurring or anthropogenically-caused impacts that pre-date SGMA) and is consistent with the SGMA's definition of URs meaning "…effects caused by groundwater conditions occurring throughout the basin" (CWC § 10721(x)).
- *Anthropogenic Influence Test:* A COC passes this test if concentrations are potentially influenced by human activity. The definition further draws a distinction between human-influenced versus naturally-occurring effects, that are not necessarily under the purview of GSAs to manage (e.g., as implied by the use of the terms "contamination", "degradation", and "pollution" in the discussion of Degraded Water Quality sustainability indicator in the DWR Sustainable Management Criteria Best Management Practices document, all of which relate to human-influenced effects).
- *Sensitive Beneficial Use Test:* A COC passes this test if it has a Primary MCL set by the SWRCB, and therefore could have an impact on drinking water users, assuming the COC passes the other "tests".
- *Pre-SGMA Condition Test:* A COC passes this test if unimpacted beneficial users still exist as of 2015 (i.e., impacts are not significant as of the SGMA effective date). Per CWC § 10727.2(b)(4), "The plan may, but is not required to, address undesirable results that occurred before, and have not been corrected by, January 1, 2015." Therefore, addressing Degraded Water Quality conditions that

existed before 2015 is not under the purview of the GSAs. However, if beneficial users could be impacted then this COC is still relevant, assuming the COC passes the other "tests".

- *Other Regulatory Regime Test:* A COC passes this test if the constituent loading is not already being managed by another regulatory authority (e.g., ILRP or CV-SALTS), and assuming the COC passes the other "tests".
- *Groundwater Management "Nexus" Test:* A COC passes this test if concentrations are or have the potential to be exacerbated by groundwater management actions taken by the GSAs (i.e., management of groundwater extractions or recharge). GSAs are responsible for "management of groundwater quality, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin" (CWC § 10727.2(d)(2).

Detailed analysis of the available water quality information in the MA Plan area is presented in **Section 7.4 *Groundwater Quality Concerns***; however, per the rationale described and employed herein (see **Figure SMC-1** and **Table SMC-3**), because the focus of SGMA rightfully emphasizes those constituents that may be degraded due to groundwater management activities (i.e., extraction and recharge), the only constituent applicable for the development of Degraded Water Quality Sustainable Management Criteria within the MA Plan area is arsenic, as discussed further below.

Figure SMC-1. Process Flow Chart for SMC Development of Degraded Water Quality



As discussed in **Section 7.4 *Groundwater Quality Concerns*** and shown in **Appendix E**, a detailed analysis of available data was conducted and a correlation between groundwater quality and groundwater levels has not been established in the MA Plan area, with the exception of a suspected correlation between groundwater levels and arsenic concentration. Therefore, the available data indicate that groundwater

extractions or recharge (i.e. actions that can be managed by GSAs) will not exacerbate degraded water quality conditions for the constituents evaluated in detail in **Section 7.4** or increase risks to drinking water beneficial users. Further rationale and considerations for setting or not setting SMCs for each identified constituent within the MA Plan area is provided in **Table SMC-3** below using the process outlined in **Figure SMC-1**.

Table SMC-3. Considerations for Development of Degraded Water Quality SMC

COC	Considerations to Develop SMCs						SMC Developed
	Regional Occurrence Test	Anthro-pogenic Influence Test	Sensitive Beneficial Use Test	Pre-SGMA Condition Test	Other Regulatory Regime Test	GW Manage-ment "Nexus" Test	
Arsenic	X	X	X	X	DDW	X(1)	Yes
Nitrate	X	X	X	X	ILRP/DDW		No
TDS	X			X	CVSALTS/ DDW		No
1,2,3-TCP	(2)	X	X		DDW		No

Abbreviations:
COC = Constituents of Concern
CV-SALTS = Central Valley Salinity Alternative for Long-Term Sustainability
DDW = Department of Drinking Water
GW = Groundwater
ILRP = Irrigated Lands Regulatory Program
SMC = Sustainable Management Criteria
SGMA = Sustainable Groundwater Management Act
TDS = Total Dissolved Solids
1,2,3-TCP = 1,2,3-Trichloropropane

Notes:
(1) Correlation between arsenic concentrations and groundwater levels are not observed within the Management Area, however, arsenic concentrations in some places within the basin are impacted by water management as discussed in the KGA Umbrella GSP.
(2) 1,2,3-TCP is only detected in the SMWC public water system wells and not other wells within the Management Area.

Based on **Table SMC-3** above, SMCs for three out of four constituents identified within the MA Plan area (i.e., nitrate, TDS, and 1,2,3-TCP) are not established because these constituents either do not have a primary MCL (TDS), or do not have regional occurrence and impacts to beneficial users that were present prior to 2015 that are already being mitigated in coordination with another regulatory entity (1,2,3-TCP), or have constituent loading managed by other authority (nitrate), and/or available data do not indicate that the concentrations of these three constituents have been exacerbated by groundwater management actions.

Given that there is a suspected correlation between groundwater levels and arsenic concentration in some parts of the basin (even if not evident in the MA Plan area), SMCs have conservatively been developed for arsenic to be consistent with the other GSPs in the basin. As such, until additional groundwater level and groundwater quality information is available to refine the correlation analysis, it is considered a local UR for Degraded Water Quality within the Management Area if the arsenic concentrations exceed the MTs in 40% or more of the RMWs within the Management Area over two consecutive annual SGMA required monitoring events, such that it cannot be managed to provide drinking water supply (i.e., that treatment or blending is not possible or practicable). The number of exceedances that equates to at least 40% of RMW for the Management Area is two out of three RMWs. Monitoring for all water quality constituents will be conducted at all three RMWs, as discussed further in **Section 15.1.4**~~As discussed in **Section** , insufficient historical data are available to evaluate temporal or spatial groundwater water quality trends within the Management Area, and there is no apparent correlation between groundwater elevations and water quality measurements, as shown in . Agricultural use is the dominant beneficial use within the 7th Standard Annex Management Area, and groundwater quality is generally suitable for agricultural uses. Water quality issues related to deep percolation of agricultural chemicals such as nitrate are regulated separately under the Irrigated Lands Regulatory Program (ILRP) and Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS). Additionally, water quality issues related to drinking water such as 1,2,3-TCP are regulated by the SWRCB. Therefore, based on the existing and potential beneficial uses and users of groundwater within the 7th Standard Annex Management Area, Undesirable Results for Degraded Water Quality are not defined for the Management Area.~~

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~~12.4.3.~~12.4.4. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

Per Section 354.26(b)(3) of the GSP Emergency Regulations, potential effects of Undesirable Results must be identified. The potential effects of Undesirable Results caused by Degraded Water Quality on beneficial uses and users of groundwater may include: increased costs to treat groundwater to drinking water standards ~~if it is~~and/or to ~~be used as a~~procure and provide alternative water supplies to potable ~~supply source~~users; increased costs to blend relatively poor-quality groundwater with higher quality sources for agricultural and non-agricultural uses; limitations on viable crop types depending on crop sensitivity and tolerance to ~~COCs~~constituents in groundwater used for irrigation; and potential reduction in "usable storage" volume of groundwater in the basin if large areas of aquifer are impacted to the point that they cannot be used to support beneficial uses and users.

As discussed in **Section 4.2.1** ***Existing Monitoring Programs in the 7th Standard Annex Management Area***, ~~a basin-wide nitrate control program will be conducted in 2021~~Water quality issues related to deep percolation of agricultural chemicals such as nitrate are regulated separately under the ILRP and CV-SALTS, and the SMWC conducts water quality monitoring as part of its compliance with its public water system permit and is in the process of developing treatment to address issues related to 1,2,3-TCP. These groundwater quality monitoring and treatment programs are expected to continue during the SGMA implementation horizon and will be incorporated into future SGMA reporting and analysis.

12.5. Undesirable Results for Land Subsidence

The basin-wide definition of Undesirable Results for Land Subsidence is as follows:

> "**Undesirable Results:** The point at which the amount of inelastic subsidence, if caused by Subbasin groundwater extractions, creates a significant and unreasonable ~~impacts, as determined by a subsidence rate and extent in the basin, that affects the~~ impact to surface land uses or Subbasin critical infrastructure.
>
> ~~This is determined when subsidence results in significant and unreasonable impacts to critical infrastructure as indicated by monitoring points established by a basin wide coordinated GSP subsidence monitoring plan."~~
>
> ~~The above basin-wide definition for Undesirable Results for Land Subsidence refers to~~ **Critical Infrastructure:** The KCS [Kern County Subbasin] has adopted two classifications for critical infrastructure:
>
> *Regional Critical Infrastructure* is infrastructure located within the Subbasin that serves multiple areas of the Subbasin and whose loss of significant functionality due to inelastic subsidence, if caused by Subbasin groundwater extractions, would have significant ~~and unreasonable~~ impacts to beneficial users. The Subbasin has collectively determined that the only infrastructure that meets the definition for Regional Critical Infrastructure are the California Aqueduct and the Friant-Kern Canal.
>
> *Management Area Critical Infrastructure* is infrastructure located within a particular Subbasin Management Area whose loss of significant functionality due to inelastic subsidence if caused by Subbasin groundwater extractions would have significant impacts to beneficial users within that Subbasin Management Area. Each Subbasin Management Area has identified their respective Management Area Critical Infrastructure in their Management Area Plan or individual GSP.

The KCS GSPs at the time of the submittals on January 31, 2020, expressed that significant data gaps existed with regard to the differing causes of subsidence that may be unique to each of the five areas of interest identified in the KCS. This lack of representative data precluded setting meaningful data-based management objectives for subsidence until additional data was obtained. In the intervening 18 months since submittal of the KCS GSPs in 2020, the KCS has made progress in acquiring the data necessary to set sustainable management objectives. This work includes among other things (some completed and other ongoing) two focused subsidence studies and retaining the Lawrence Berkeley National Laboratory (LBNL) to perform a baseline subsidence and Regional Critical Infrastructure status assessment of the Aqueduct and Friant- Kern Canal.

Based on the data from the WDWA and KCS investigations, it is apparent that key data gaps pertaining to the various causes and rates of subsidence in the KCS still remain and that further study is needed to better define realistic long-term management objectives for the KCS. As requested by the DWR the KGA has developed interim Measurable Objectives for Regional critical Infrastructure~~. There is no "critical infrastructure" that has been affected, or has the likelihood to be affected, by land subsidence. ."~~

No Regional Critical Infrastructure is located within the Management Area (i.e., the California Aqueduct and the Friant Kern Canal). Further, there are no monitoring ~~points~~grid cells located within the 7th

Standard Annex Management Area as identified in the basin-wide coordinated GSP subsidence monitoring plan~~.~~ in the KGA Umbrella GSP. Further discussion of the SMC development for other portions of the basin and subsidence monitoring plan is available in the KGA Umbrella GSP.

12.5.1. Identification of Beneficial Users

There is no Regional Critical Infrastructure within the Management Area that could be significantly and unreasonably affected by land subsidence. However, Management Area Critical Infrastructure, such as the North of River Sanitary (NORSD) Wastewater Treatment Plant (WWTP), utility infrastructure, and industrial facilities, are present in the Management Area and were included in the consideration of SMC development within the MA Plan area.

~~12.5.1.~~12.5.2. Potential Causes of Undesirable Results

☑ 23 CCR § 354.26(b)(1)

Per Section 354.26(b)(1) of the GSP Emergency Regulations, land subsidence can be caused by several mechanisms, but the mechanism most relevant to sustainable groundwater management is the depressurization of aquifers and aquitards due to lowering of groundwater levels, which can lead to compaction of compressible strata and lowering of the ground surface. Therefore, the potential causes of Undesirable Results due to Land Subsidence are generally the same as the potential causes listed above for Undesirable Results due to Chronic Lowering of Groundwater Levels. As discussed in **Section 7.5 *Land Subsidence***, there has been limited to no land subsidence measured and no known occurrences of significant impacts due to land subsidence within the 7th Standard Annex Management Area.

~~12.5.2.~~12.5.3. Criteria Used to Define Undesirable Results

☑ 23 CCR § 354.26(b)(2)

Per Section 354.26(b)(2) of the GSP Emergency Regulations, the basin-wide definition of Undesirable Results refers to significant and unreasonable impacts to Regional Critical Infrastructure. Based on the limited to no historical subsidence or subsidence related impacts to Management Area Critical Infrastructure has been observed in the 7th Standard Annex Management Area and the lack of Regional Critical Infrastructure, no Undesirable Results for Land Subsidence are defined within the Management Area. A basin-wide coordinated GSP subsidence monitoring plan ~~is being~~has been developed. If the results of this monitoring suggest that subsidence is occurring within the Management Area, the criteria to define Undesirable Results for Land Subsidence will be revisited.

~~12.5.3.~~12.5.4. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

Per Section 354.26(b)(3) of the GSP Emergency Regulations, potential effects of Undesirable Results caused by land subsidence on beneficial uses and users of groundwater and overlying land uses within the 7th Standard Annex Management Area could include damage to above-ground and near-surface infrastructure. While there is ~~substantial~~Management Area Critical Infrastructure located in the Management Area (such as the North of River Sanitary District (NORSD) Wastewater Treatment Plant (WWTP); utility infrastructure; and industrial facilities), these facilities are not likely to be affected even if significant subsidence occurs in the area, since grade changes on a localized scale tend to be very minimal.

As noted above and in **Section 7.5 *Land Subsidence***, there has been little to no historical land subsidence within the 7th Standard Annex Management Area and no observed negative effects associated with any such limited subsidence.

12.6. Undesirable Results for Depletions of Interconnected Surface Water

☑ 23 CCR § 354.26(d)

No basin-wide definition of Undesirable Results for Depletions of Interconnected Surface Water has been developed by the basin GSAs, nor has a local definition of Undesirable Results for this sustainability indicator been developed for the 7th Standard Annex Management Area. As described in **Section 7.6 *Interconnected Surface Water Systems***, groundwater levels in the principal aquifer are far below the ground surface within the 7th Standard Annex Management Area, and therefore there is no interconnected surface water. Similarly, as discussed in **Section 7.7 *Groundwater Dependent Ecosystems***, no groundwater dependent ecosystems have been identified within the 7th Standard Annex Management Area.

The GSP Emergency Regulations state that "An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators" (23-CCR § 354.26(d)). Because depletion of interconnected surface water is not considered to be an issue in the 7th Standard Annex Management Area, no Undesirable Results for this Sustainability Indicator are defined in the Management Area.

13. MINIMUM THRESHOLDS

☑ 23 CCR § 354.28(a)

Minimum Thresholds are the numeric criteria for each Sustainability Indicator that, if exceeded, may cause Undesirable Results. Like **Measurable Objectives and Interim Milestones**, discussed in **Section 14** below, this section describes the Minimum Thresholds that have been developed to avoid Undesirable Results for each applicable Sustainability Indicator in the 7th Standard Annex Management Area.

As shown in **Table SMC-4**, Minimum Thresholds within the 7th Standard Annex Management Area are defined at different spatial scales and locations, or not at all, depending on the Sustainability Indicator. Where appropriate, the Minimum Thresholds for the Sustainability Indicators have been set using groundwater levels as a proxy, based on the demonstration "that there is a significant correlation between groundwater levels and the other metrics" (California Department of Water Resources [DWR] Sustainable Management Criteria Best Management Practice [BMP], 2017).

Table SMC-4. Spatial Scale of Minimum Thresholds Definition

Sustainability Indicator	Spatial Scale of Minimum Threshold Definition	Notes
Chronic Lowering of Groundwater Levels	Three (3) representative monitoring sites (i.e., wells)	Three (3) representative monitoring wells will be used to monitor and measure compliance for this sustainability indicator
Reduction of Groundwater Storage	No Minimum Thresholds are defined for this indicator	Chronic Lowering of Groundwater Levels will be used as a proxy
Seawater Intrusion	No Minimum Thresholds are defined for this indicator	Sustainability indicator is not applicable within the Kern County Subbasin
Degraded Water Quality	Three (3) representative monitoring sites (i.e., wells)	Three (3) representative monitoring wells will be used to monitor water quality and measure compliance for this sustainability indicator. Existing monitoring for groundwater quality at selected locations will continue as part of SWRCB regulatory compliance and basin-level monitoring program (CV-SALTS and ILRP)
Land Subsidence	No Minimum Thresholds are defined for this indicator	Sustainability indicator is not applicable within the Management Area
Depletion of Interconnected Surface Water	No Minimum Thresholds are defined for this indicator	Sustainability indicator is not applicable within the Management Area

13.1. Minimum Threshold for Chronic Lowering of Groundwater Levels

☑ 23 CCR § 354.28(b)
☑ 23 CCR § 354.28(c)(1)

Chronic Lowering of Groundwater Levels is arguably the most fundamental Sustainability Indicator, as it influences several other key Sustainability Indicators, including Reduction of Groundwater Storage and possibly Land Subsidence and Depletions of Interconnected Surface Water.

As discussed in **Section 7.1** ***Groundwater Elevations and Flow Direction*** and **Section 7.2** ***Change in Groundwater Storage***, groundwater levels have varied over time in the 7th Standard Annex Management Area and appear to be influenced by both groundwater pumping volumes and climatic variability. Land use and groundwater use from the principal aquifer within the Management Area are not expected to change significantly in the future, except possibly as a result of climate change, which could increase ET from existing irrigated crop lands and/or the implementation of Projects and Management Actions (see **Section 16**), which could introduce incentives or requirements to reduce demands. Climate change could also result in reduced recharge of precipitation to the principal aquifer within and outside of the Management Area.

As such, consistent with the GSP Emergency Regulations (23-CCR § 354.28(c)), the definition of Minimum Thresholds for Chronic Lowering of Groundwater Levels in the ~~7th Standard Annex~~ Management Area is based on consideration of ~~Undesirable Results. There are no state, federal, or local standards that relate~~trends in historical groundwater levels, water year types, projected water use in the Management Area, impacts to ~~this~~beneficial users, and the relationship to other Sustainability ~~Indicator.~~ Indicators and other considerations. Specifically, the information and criteria relied on to establish the MTs for Chronic Lowering of Groundwater Levels includes:

- Historical water level data from the selected Representative Monitoring Wells (or nearby wells), each of which has a long-term historical record of water levels;[52]
- Well construction information (i.e., for consideration of impacts to beneficial users); and
- Coordination with and consideration of adjacent GSAs, basins, and the other applicable Sustainability Indicators.

Specifically, given the potential effects of Undesirable Results for Chronic Lowering of Groundwater Levels, discussed in **Section 12.1.4** above, the Minimum Threshold within the 7th Standard Annex Management Area is defined using a method of projecting a theoretical future water groundwater elevation based on the assumption that the conditions experienced over the recent ten-year period 2006 – 2016 (Spring measurements) continue from 2016 through 2040, referred to herein as the "trendline projection" method. The theoretical groundwater elevation in 2040 based on this projection is calculated for each of the three wells within the Management Area that have relatively long records of water level measurements (i.e., wells 28S24E13H004M, 28S24E25P001M, and 28S25E34J001M~~). The minimum value of the three was selected as the Minimum Threshold for the Management Area for the three water level~~

[52] The representativeness of the wells with long-term hydrograph records is illustrated on **Figure GWC-4** and **Figure SMC-2**. The figure shows that the difference in water level in the local area around each well is small in most cases, indicating that the well is representative of that local area.

~~representative monitoring sites. Groundwater elevation in 2040 based on the trendline projection method for the three wells (i.e., 28S24E13H004M, 28S24E25P001M, and 28S25E34J001M) are defined~~), as shown in **Table SMC-2** and on **Figure SMC-2Figure SMC-1~~Figure SMC-1~~**. It should be noted that incomplete groundwater elevation datasets were available for these three wells; for purposes of this calculation, missing groundwater elevation data were extrapolated based on a correlation to nearby wells.[53] This trendline projection method for identification of ~~Minimum Thresholds~~MTs is consistent with that being used by several of the surrounding management areas.

~~.~~ Then, in order to maintain the resultant MT gradient similar to the current groundwater elevation gradient, the 7th Standard Annex Management Area coordinated the development of the final MT values with the adjacent management areas. The Minimum Threshold for Chronic Lowering of Groundwater Levels within the 7th Standard Annex Management Area is therefore defined as the minimum value of the three projected theoretical 2040 groundwater elevations plus 50 feet, i.e., -87 ft msl, as shown in **Table SMC-2** and on **Figure SMC-2**~~, i.e., -137 feet above mean sea level (ft msl). As discussed in **Section** and **Section** , groundwater levels have varied and appear to be influenced by both groundwater pumping volumes and climatic variability. Land use and groundwater use from the principal aquifer within the 7th Standard Annex Management Area are not expected to change significantly in the future, except possibly as a result of climate change, which could increase ET from existing irrigated crop lands and/or the implementation of Projects and Management Actions (see **Section**), which could introduce incentives or requirements to reduce demands. Climate change could also result in reduced recharge of precipitation to the principal aquifer within and outside of the 7th Standard Annex Management Area. As discussed in **Section** , if the Minimum Threshold for Chronic Lowering of Groundwater Levels is exceeded at one or more of the three representative monitoring sites over three consecutive monitoring periods, Undesirable Results for Chronic Lowering of Groundwater Level would be triggered under the assumption that this would create negative impacts to beneficial uses and users of groundwater.~~.~~

Table SMC-2. MT for Chronic Lowering of Groundwater Levels

Wells with Long Records of Water Level Measurements	Theoretical Groundwater Elevation in 2040 (ft msl)	Basis	Resultant MT Value (ft msl)	Basis
Well 28S24E13H004M	-137	Trendline projection method	-87	Lowest Value from Trendline projection method + 50 ft
Well 28S24E25P001M	-137	Trendline projection method	-87	Lowest Value from Trendline projection method + 50 ft
Well 28S25E34J001M	-81	Trendline projection method	-87	Lowest Value from Trendline projection method + 50 ft

[53] Well 28S24E13H004M and Well 28S25E34J001M only have groundwater elevation measurements from 1969 to 1993 and 1969 to 1994 respectively. The missing groundwater elevation data from 1993/1994 to 2016 are populated through a seasonal extrapolation method using correlation with nearby wells. Then the trendline is calculated using the extrapolated groundwater elevation. Well 28S24E25P001M has groundwater elevation measurements from 1969 to 2018, but the provided records contained missing water level for some dates. The interpolation method used for Well 28S24E25P001M to populate water level is described in Appendix B.

13.1.1. Relationship with Other Sustainability Indicators

☑ 23 CCR § 354.28(b)(2)

As previously discussed, Chronic Lowering of Groundwater Levels and Reduction of Groundwater Storage are directly, if not linearly, related. Therefore, groundwater levels are used as a proxy for the Reduction of Groundwater Storage sustainability indicator, as described in detail in **Section 13.2**, the MTs will not result in a significant and unreasonable loss of groundwater storage within the 7th Standard Annex Management Area.

Based on available data, no direct correlation can be discerned between water levels and trends in water quality within the Management Area at this time (discussed further in **Section 7.4**); as such the MTs are not expected to exacerbate water quality issues.

Based on available data, no direct correlation can be discerned between water levels and Land Subsidence measurements within the Management Area at this time as little to no subsidence has been observed.

As discussed in above, both Seawater Intrusion and Interconnected Surface Water are not applicable to the Management Area.

13.1.2. Impact to Adjacent Management Areas and Basins

☑ 23 CCR § 354.28(b)(3)

The MTs have been developed in consideration of, and in coordination with, the neighboring water agencies within the Kern Subbasin. The method used to develop the MT is generally consistent with that employed in several surrounding management areas (i.e., Shafter-Wasco Irrigation District Management Area, Rosedale-Rio Bravo Water Storage District Management Area, and North Kern Water Storage District Management Area), and as mentioned previously the MTs were adjusted by 50 feet in order to maintain the gradients between adjacent management areas.

13.1.3. Impact to Beneficial Users

☑ 23 CCR § 354.28(b)(4)

A screening of potential well impacts was performed using best available well construction information for ~~domestic,~~active wells within the 7th Standard Annex Management Area. Well construction information for active production (agricultural), industrial, and public supply wells were collected through the Stakeholder Survey (as discussed in **Section 4.5.2**). Since limited domestic well information was collected through the Stakeholder Survey, well construction information for domestic wells was supplemented with the DWR Online System for Well Completion Reports (OSWCR) dataset.[54]

As shown on **Figure SMC-3**~~.~~, depth to top of screen (TOS) and depth to bottom of well screen (BOS) in each well within the Management Area were compared to the depth to the MTs for Chronic Lowering of Groundwater Levels, derived based on consideration of historical water level trends, well construction information, projected groundwater levels, and coordination with adjacent management areas. If the

[54] Domestic wells that are less than 50 years old are assumed to be active and selected for the well impact analysis.

depth to the MT is greater than the depth to TOS but less than the depth to BOS, that well is considered to be partially dewatered, and if the depth to MT is greater than depth to BOS, that well is considered completely dewatered. Results from this screening of potential well impacts are shown on **Figure SMC-3**. and indicate that if water levels reached the MTs throughout the Management Area, that could potentially cause dewatering of 26% of the wells (including 12% of agricultural and industrial wells, 56% of domestic wells, and 0% of municipal wells).

A coupled well age analysis was also performed to help assess if the dewatered well fractions under MT groundwater conditions could be considered a significant and unreasonable impact affecting the reasonable and beneficial use of, and access, to groundwater, per the Basin-wide UR definition. Specifically, well completion dates were compiled from the OSWCR database and used to estimate a "natural well replacement rate" within each Management Area. Here, the "natural well replacement rate" was defined as the total fraction of wells that would reach the end of their usable lifespan (i.e., will be at least 50 years old) by the SGMA implementation deadline (i.e., 1 January 2040) and would thus likely need to be replaced due to their age, irrespective of future groundwater conditions. It was then considered significant and unreasonable if the dewatered well fraction under MT groundwater conditions exceeded the natural well replacement rate within each Management Area over the 20-year SGMA implementation period.

The well age analysis showed that approximately 51% of wells within the Management Area will be older than 50 years by 2040 and would likely have to be replaced irrespective of future groundwater conditions. It was then considered significant and unreasonable if the dewatered well fraction under MT groundwater conditions exceeded the natural well replacement rate within each Management Area over the 20-year SGMA implementation period. As such, it would not be considered significant and unreasonable if fewer wells in the Management Area were impacted due to Chronic Lowering of Groundwater Levels than the assumed natural well replacement rate (51%).

Through this analysis~~, which was performed iteratively with Minimum Threshold and Measurable Objective within the Management Area, it~~ it was determined that although the proposed ~~Minimum Threshold~~groundwater elevation MTs would potentially result in some wells being ~~excessively~~ dewatered within the Management Area, the impacts ~~would not be unreasonable and would be mitigated through an Impacted Well~~(26%) would not be considered significant and unreasonable per the definition above (up to 51%). Furthermore, the Management Area has committed to mitigating potential impacts of dewatering on domestic wells that may occur as a result of SGMA implementation by establishing a *Well Dewatering Mitigation Program* (see **Section 16.2.2** and **Section 17.1.6**~~, as discussed in **Section** .~~). Collectively, the well impacts analysis and the establishment a *Well Dewatering Mitigation Program* demonstrate how the interests of beneficial uses and users of groundwater were considered during development of the MTs for Chronic Lowering of Groundwater Levels.

13.1.4. State, Federal, and Local Standards

☑ 23 CCR § 354.28(b)(5)

There are no state, federal, or local standards pertaining to groundwater levels in the Management Area.

13.1.5. Measurement of Minimum Thresholds

☑ 23 CCR § 354.28(b)(6)

Groundwater levels will be measured in each of the three RMWs semiannually using the monitoring protocols outlined in the Kern Groundwater Authority (KGA) Umbrella Groundwater Sustainability Plan (GSP).

13.2. Minimum Threshold for Reduction of Groundwater Storage

☑ 23 CCR § 354.28(c)(2)

~~The Minimum Threshold for Reduction of Groundwater Storage is defined on a management area or basin-wide basis~~Pursuant to the GSP Emergency Regulations (23 CCR § 354.28(d)) and as ~~the volume of water that can be withdrawn without causing conditions that may lead to Undesirable Results. Because the amount of groundwater in storage is directly, if not linearly, related to groundwater levels, Reduction of Groundwater Storage is closely tied to Chronic Lowering of Groundwater Levels. It is therefore logical to define the~~ further described in the DWR Sustainable Management Criteria BMP (DWR, 2017), Minimum ~~Threshold~~Thresholds for Reduction of Groundwater Storage ~~based on the~~may be set by using groundwater levels as a proxy if it is demonstrated that a correlation exists between the two metrics. One approach to using groundwater levels as a proxy, described in the DWR Sustainable Management Criteria BMP (DWR, 2017), is to demonstrate that Minimum Thresholds for Chronic Lowering of Groundwater Levels~~.~~ are sufficiently protective to ensure prevention of significant and unreasonable occurrences of the Sustainability Indicator in question.

Because of the close relationship between these two Sustainability Indicators, the definition of the Minimum Threshold for Reduction of Groundwater Storage implicitly considers the groundwater level trends, water year types, and projected water use. There are no state, federal, or local standards that relate to this Sustainability Indicator.

~~The Minimum Threshold for Reduction in Groundwater Storage for the 7th Standard Annex Management Area is defined as the available volume of "usable storage" above the Minimum Threshold for Chronic Lowering of Groundwater Levels. This volume is calculated based on the following data and assumptions:~~

- ~~Area of the 7th Standard Annex Management Area (approximately 10,000 acres);~~
- ~~Storage coefficient (0.08);~~
- ~~Average groundwater level in Spring 2016 (13.7 ft msl[55]); and~~
- ~~The Minimum Threshold for Chronic Lowering of Groundwater Levels within the 7th Standard Annex Management Area (-137 ft msl).~~

~~The volume of usable storage in the Management Area is approximately 120,560 acre-feet (AF). This volume corresponds to the volume that would be pumped in roughly five years of pumping at the long-term historical average rate of 25,990 acre-feet per year (AFY), assuming no inflow to the system.~~ To

[55] Average Spring 2016 groundwater level is calculated based on available Spring 2016 measurement within the 7th Standard Annex Management Area.

demonstrate that the Minimum Thresholds for Chronic Lowering of Groundwater Levels are sufficiently protective, a calculation was performed to determine the fraction of total usable groundwater storage that would be removed from the Principal Aquifer if groundwater levels were to decline from current (Spring 2016) levels to their respective Minimum Thresholds for Chronic Lowering of Groundwater Level. This volume is then compared to the volume of usable storage, and it is shown that the usable storage is substantially greater, and therefore the Minimum Thresholds for Chronic Lowering of Groundwater Levels are protective for the Reduction of Groundwater Storage Sustainability Indicator. Because hydrogeologic storage properties and the MA Plan area are constant when looking at the change in storage (Change in Storage = MA Plan Area * Storage Coefficient * Change in Saturated Thickness), the following analysis is presented in terms of saturated thickness, which is mathematically equivalent to storage volume.

The theoretical fraction of usable groundwater storage that would be removed from the primary aquifer if groundwater levels were to decline to the Minimum Thresholds for Chronic Lowering of Groundwater Level is calculated based on the following formula:

Reduction in Usable Storage Volume (%) =

Change in Saturated Thickness from Current Water Level to MT Level (ft) / (Change in Saturated Thickness from Current to Bottom of the Basin – 100 ft Reserve for Well Pumping Operations)

The change in saturated thickness from current (Spring 2016) groundwater elevations (13.7 ft msl) to the Chronic Lowering of Groundwater Levels MTs (-87 ft msl) is approximately 101 ft. This change in saturated thickness corresponds to the volume that would be pumped in roughly three years of pumping at the long term historical average rate of 25,990 acre-feet per year (AFY) (mathematically equivalent to 32.5 ft per year of change in saturated thickness), assuming no inflow to the system. The change in saturated thickness from current groundwater elevations to the bottom of the basin is 724 ft, based on the bottom of the basin elevation of -710 ft msl. The bottom of the basin is based on the deepest groundwater extractions from well construction information within the MA Plan Area. Accounting for the 100-ft reserve for well pumping operations, the denominator of the above equation becomes 624 ft, and therefore the reduction in usable storage volume amounts to 16%. This demonstrates that volume of usable groundwater storage can be represented by changes in groundwater elevations and the amount of recoverable storage is substantially greater than the volume associated with a reduction in groundwater levels to the MTs for Chronic Lowering of Groundwater Levels, and therefore those MTs are considered protective for the Reduction of Groundwater Storage Sustainability Indicator.

As discussed in **Section 12.2.3**, if groundwater storage were to be reduced ~~to exceed their Minimum Threshold~~by an amount that would cause the groundwater levels in at least 40% or more of the Representative Monitoring Wells over four consecutive bi-annual SGMA required monitoring events, Undesirable Results for Reduction in Groundwater Storage would be triggered under the assumption that this would bring negative impacts to beneficial uses and users of groundwater.

13.3. Minimum Threshold for Seawater Intrusion

☑ 23 CCR § 354.28(c)(3)
☑ 23 CCR § 354.28(e)

The GSP Emergency Regulations state that "An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as

described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators" (23-CCR § 354.28(e)). Because the basin is not located near any saline water bodies, seawater intrusion is not present and not likely to occur. The Seawater Intrusion Sustainability Indicator is not applicable to the basin and therefore no SMCs for this Sustainability Indicator are defined in the 7th Standard Annex Management Area.

13.4. Minimum Threshold for Degraded Water Quality

☑ **23 CCR § 354.28(c)(4)**
☑ **23 CCR § 354.28(e)**

The GSP Emergency Regulations (23 CCR § 354.28(c)) state that the MT for Degraded Water Quality shall be the "degradation of water, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results". The GSP Emergency Regulations further state that the MT "shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin", and that "the Agency shall consider local, state, and federal water quality standards applicable to the basin." This language indicates that MTs for Degraded Water Quality can reasonably be based on concentrations of water quality constituents of concern, as quantified by sampling measurements at Representative Monitoring Wells.

As discussed above in **Section 12.4.3**, several criteria, or "tests", were utilized by the Management Area to systematically and transparently assess which constituents warranted the development of SMCs for to be consistent based on the understanding of groundwater conditions, the relationship between groundwater management (i.e., extraction and recharge to water quality), the regulatory landscape, and relevant regulations. The Management Area then only developed SMCs for those constituents that passed all of the applicable tests. The only constituent applicable for the development of Degraded Water Quality Sustainable Management Criteria within the MA Plan area is arsenic, as discussed above in **Section 12.4.3**.

A MT for Degraded Water Quality is set for arsenic at three water quality RMWs in the Management Area using the California MCL of 10 ug/L since the most sensitive beneficial use of groundwater in the Management Area is for potable supply, as shown in **Table SMC-6**.

Table SMC-6. MT and MO for Degraded Water Quality

Representative Monitoring Well	Recent Arsenic Concentration (ug/L) (1)	Arsenic MT (ug/L)	Arsenic MO (ug/L)
Well 33G	8.4	10	10
Well 19H	9.9	10	10
Well 35C	ND	10	10

~~Based on the existing beneficial uses and users of groundwater within the 7th Standard Annex Management Area, there are not Undesirable Results for Degraded Water Quality occurring that are related to groundwater levels and management. Therefore, no unique Minimum Thresholds are set for this Sustainability Indicator.~~

~~Further~~Abbreviations:
IM = Interim Milestone

MO = Measurable Objective
MT = Minimum Threshold
ND = Non-detected
ug/L = micrograms per liter

Notes:
(1) Recent arsenic concentration is measures in 2020.

It should be noted that, as discussed above in **Section 12.4** ***Undesirable Results for Degraded Water Quality***, activities already undertaken as part of other regulatory compliance efforts (i.e., monitoring groundwater quality by SMWC, the only public water system in the 7th Standard Annex Management Area, and CV-SALTS for the entire Central Valley) will continue during the SGMA implementation timeframe. In addition, water quality data will be collected within the Management Area annually from the three water quality RMWs, as discussed in **Section 15**. These data will be evaluated on an annual basis, and if significant and unreasonable impacts caused by water quality issues occur in the future and a causal nexus between groundwater quality and water management activities is discovered, the criteria for development of Undesirable Results and Minimum Thresholds for ~~Degraded Water Quality~~other constituents will be revisited as part of the next five-year update.

13.4.1. Relationship with Other Sustainability Indicators

There is no apparent correlation between groundwater elevations (and groundwater storage, by proxy) and water quality measurements based on the historical data, with the exception of a suspected correlation between groundwater levels and arsenic concentration and at the base of fresh water defined by Page (1973). The base of fresh water is well below the MT for Chronic Lowering of Groundwater Levels. Therefore, the MT for Chronic Lowering of Groundwater Levels is conservative and protective to water quality within the Management Area.

In addition, based on input provided by the agricultural stakeholders, the growers have not experienced any changes in water quality as groundwater elevations have declined over time. Concentrations of measured constituents are generally below drinking water standards (MCL) within the Management Area and existing mitigation programs are in place to address MCL exceedance (such as 1,2,3-TCP).

Based on available data no direct correlation can be discerned between water quality and land subsidence measurements in the Management Area at this time.

Seawater intrusion and interconnected surface water are not applicable to the Management Area.

13.4.2. Impact to Adjacent Management Areas and Basins

The MT for Degraded Water Quality is not expected to impact adjacent management areas' or basins' ability to achieve their sustainability goals, as it is set to the Primary MCL, a regulatory threshold set by the United States Environmental Protection Agency (USEPA) and State Water Resources Control Board (SWRCB) Division of Drinking Water. Also, by designing MTs for Chronic Lowering of Groundwater Level based on historical trends in groundwater conditions and in coordination with the neighboring water agencies within the basin, these MTs are not expected to cause significant changes to existing regional groundwater gradients and are thus anticipated to be protective in terms of preventing migrations of poor-quality water into or from adjacent management areas.

13.4.3. Impact to Beneficial Users

Primary MCLs are regulatory thresholds based on criteria for drinking water quality, which is the most sensitive beneficial use. As such, the MT for Degraded Water Quality considers the most sensitive beneficial uses and users of groundwater. In addition, as described previously, agricultural use is the dominant beneficial use identified within the Management Area, and groundwater quality is generally suitable for agricultural uses. There is no apparent correlation between groundwater elevations (surrogate for groundwater extractions and recharge) and water quality measurements based on the historical data, and as such the constituents identified within the Management Area are not risks to drinking water beneficial users that have been or are expected to be exacerbated by groundwater management actions.

13.4.4. State, Federal, and Local Standards

State, federal, and local entities have greater authority to enforce water quality standards, especially for anthropogenic-derived pollutant constituents. For example, drinking water supplies from public water systems are regulated to primary MCLs set by the USEPA and SWRCB Division of Drinking Water. Water quality issues related to deep percolation of agriculture chemicals (e.g., nitrates) are regulated separately under the Irrigated Lands Regulatory Program (ILRP) and Central Valley Salinity Alternative for Long-Term Sustainability (CV-SALTS).

13.4.5. Measurement of Minimum Thresholds

Water quality data will be collected annually. Further, activities already undertaken as part of other regulatory compliance efforts will continue during the SGMA implementation timeframe. These data will be evaluated on an annual basis, and if significant and unreasonable impacts caused by water quality issues occur in the future, and a causal nexus between groundwater quality and groundwater recharge or extraction is discovered, the criteria for development of URs and MTs for other constituents will be revisited as part of the next five-year update.

13.5. Minimum Threshold for Land Subsidence

☑ **23 CCR § 354.28(c)(5)**
☑ **23 CCR § 354.28(e)**

The GSP Emergency Regulations also state that "An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators" (23 CCR § 354.28(e)).

As discussed in **Section 12.5** ***Undesirable Results for Land Subsidence***, there is no Regional Critical Infrastructure within the 7th Standard Annex Management Area that has been affected, or has the potential to be affected, by land subsidence. Further, as shown on **Figure GWC-14** and **Figure GWC-15**, no significant subsidence has been observed within the 7th Standard Annex Management Area based on available data~~. For these reasons~~ and the lack of Corcoran clay suggests that the risk continues to be small. Therefore, no Minimum Threshold for Land Subsidence is defined herein.

If land subsidence is observed that has the potential to substantially interfere with surface or near surface land uses, the criteria for definition of Undesirable Results for Land Subsidence will be revisited, and Minimum Threshold(s) for Land Subsidence will be developed, as appropriate.

13.5.1. Relationship with Other Sustainability Indicators

Based on available data no direct correlation can be discerned between land subsidence measurements and groundwater elevations (and groundwater storage, by proxy) within the Management Area at this time given that limited subsidence has occurred

Based on available data no direct correlation can be discerned between land subsidence measurements and water quality in the Management Area at this time.

Seawater intrusion and interconnected surface water are not applicable to the Management Area.

13.5.2. Impact to Adjacent Management Areas and Basins

By designing MTs for Chronic Lowering of Groundwater Level based on historical trends in groundwater conditions and in coordination with the neighboring water agencies within the Kern Subbasin, these MTs are not expected to cause significant land subsidence that would impact Regional Critical Infrastructure or impact land uses.

13.5.3. Impact to Beneficial Users

There is no Regional or Management Area Critical Infrastructure identified in the Management Area that has been affected, or has the potential to be affected, by land subsidence. Further, no significant subsidence has been identified by the Management Area based on available data.

13.5.4. State, Federal, and Local Standards

There are no state, federal, or local standards pertaining to land subsidence in the Management Area.

13.5.5. Measurement of Minimum Thresholds

Land subsidence will be monitored through the publicly available TRE Altamira Interferometric Synthetic Aperture Radar (InSAR) dataset. If land subsidence is observed that has the potential to substantially interfere with surface or near surface land uses, the criteria for definition of UR for Land Subsidence will be revisited, and MT for Land Subsidence will be developed, as appropriate as part of the next five-year update.

13.6. Minimum Threshold for Depletions of Interconnected Surface Water

☑ **23 CCR § 354.28(c)(6)**
☑ **23 CCR § 354.28(e)**

As discussed in **Section 7.6 *Interconnected Surface Water Systems*** and **Section 12.6 *Undesirable Results for Depletions of Interconnected Surface Water***, the potential for Undesirable Results for this sustainability indicator is limited due to the hydrogeologic conditions in the 7th Standard Annex Management Area. Groundwater levels in the principal aquifer are far below the ground surface within the 7th Standard Annex Management Area, and therefore there is no interconnected surface water. For this reason, no Minimum Threshold for Depletion of Interconnected Surface Water is defined herein.

14. MEASURABLE OBJECTIVES AND INTERIM MILESTONES

☑ 23 CCR § 354.30(a)
☑ 23 CCR § 354.30(b)

14.1. Measurable Objective and Interim Milestones for Chronic Lowering of Groundwater Levels

☑ 23 CCR § 354.30(c)
☑ 23 CCR § 354.30(e)

The Measurable Objective for Chronic Lowering of Groundwater Levels within the 7th Standard Annex Management Area was also defined using the trendline projection method and through coordination with neighboring management areas as described in **Sections 12.1** and **13.1** above. The theoretical groundwater elevation in 2030 based on this projection was calculated for each of the three selected wells with long records of water level measurement within the Management Area (i.e., wells 28S24E13H004M, 28S24E25P001M, and 28S25E34J001M~~),~~). To maintain MO gradient similar to the current groundwater elevation gradient, the 7th Standard Annex Management Area coordinated with adjacent management areas and used the minimum value of the three ~~was selected~~theoretical groundwater elevations plus 50 feet as the Measurable Objective for the Management Area.

Figure SMC-2 and **Table SMC-7** below show the theoretical groundwater elevations in 2030 based on the trendline projection method at the selected well locations.

Table SMC-7. MO for Chronic Lowering of Groundwater Levels

Wells with Long Records of Water Level Measurements	Theoretical Groundwater Elevation in 2030 (ft msl)	Basis	Resultant MO Value (ft msl)	Basis
Well 28S24E13H004M	-79	Trendline projection method	-29	Lowest Value from Trendline Projection method + 50 ft
Well 28S24E25P001M	-75	Trendline projection method	-29	Lowest Value from Trendline Projection method + 50 ft
Well 28S25E34J001M	-24	Trendline projection method	-29	Lowest Value from Trendline Projection method + 50 ft

The Measurable Objective for Chronic Lowering of Groundwater Levels is therefore defined as the minimum value of the three projected theoretical 2030 groundwater elevations plus 50 feet, i.e., ~~-79~~ -29 feet above mean sea level (ft msl~~.~~).

~~.~~ As described in the Sustainable Management Criteria Best Management Practices (BMP) document (DWR, 2017), "Measurable Objectives should be set such that there is a reasonable margin of operation flexibility (or "margin of safety"), between the minimum threshold and measurable objective that will accommodate droughts, climate change, conjunctive use operations, or other groundwater management activities" (DWR, 2017). Therefore, the margin of operational flexibility within the 7th Standard Annex

Management Area is the difference between the Minimum Threshold (-~~137~~87 ft msl) and the Measurable Objective (-~~79~~29 ft msl): or 58 ~~ft~~feet.

As shown in **Figure GWC-4**, the current groundwater elevations (Spring 2018) within and in close proximity to the 7th Standard Annex Management Area are well above the defined Measurable Objective. Therefore, the Interim Milestones in five-year increments between 2020 and 2040 are defined to be equivalent to the Measurable Objective within the 7th Standard Annex Management Area, which is -~~79~~29 ft msl.

The 7th Standard Annex Management Area has not yet experienced any Undesirable Results ~~of relevant Sustainable Indicators~~, but the Management Area will consistently seek to reduce the projected water supply shortfall (see **Section 8.4.3**) through implementation of Projects and Management Actions described in **Section 16** and achieve and maintain ~~sustainability goals~~the Sustainability Goal by end of the SGMA implementation period (i.e., by 2040).

14.2. Measurable Objective and Interim Milestones for Reduction of Groundwater Storage

☑ **23 CCR § 354.30(c)**
☑ **23 CCR § 354.30(d)**
☑ **23 CCR § 354.30(e)**

~~Because groundwater levels are used as a proxy for monitoring change in storage, the Measurable Objective for~~ As discussed above, the Undesirable Results definition for Reduction of Groundwater Storage ~~is defined as~~ at the ~~change~~basin level refers to a decrease in ~~groundwater~~ storage ~~over the SGMA implementation period~~ that would ~~occur if~~cause water levels ~~within the 7th Standard Annex Management Area reached the Measurable Objective~~to decline below Minimum Thresholds established in each management area for Chronic Lowering of Groundwater Levels ~~discussed above. This volume~~. It is logical to tie these two Sustainability Indicators together, as the amount of groundwater in storage is ~~calculated to be 74,160 AF, using the same calculation methods described in **Section** , based on the trendline projection method through 2030. Therefore, the Measurable~~ directly, if not linearly, related to groundwater levels. Because of the close relationship between these two Sustainability Indicators, the Measurable Objective for Chronic Lowering of Groundwater Levels serves as a proxy for Reduction of Groundwater Storage, and it is not necessary to set a unique Measurable Objective for Reduction of Groundwater Storage. As stated above, the Measurable Objectives for ~~the Management Area is set at 74,160 AF.~~

~~Similar to~~ Chronic Lowering ~~of Groundwater Levels, the margin of operational flexibility for the MO for Reduction~~ of Groundwater ~~Storage is 46,400 AF, which is the difference between the MO and the MT for Reduction~~Levels provide an adequate Margin of ~~Groundwater Storage, and the Interim Milestones in five-year increments between 2020 and 2040 are defined to be equivalent to the Measurable Objective within the 7th Standard Annex Management Area, which is -74,160 AF.~~ Operational Flexibility.

14.3. Measurable Objective for Seawater Intrusion

This sustainability indicator is not applicable to the Basin, and no Undesirable Results, Minimum Thresholds, Measurable Objectives, or Interim Milestones are defined ~~for this indicator~~.

14.4. Measurable Objective for Degraded Water Quality

☑ 23 CCR § 354.30(c)

As discussed above in **Section 12.4.3** and **Section 13.4**, MO for Degraded Water Quality is defined for a single constituent (arsenic) at three RMWs, considering appropriate regulatory criteria while maintaining concentrations at approximately current levels, as shown in **Table SMC-6**~~As discussed above in **Section** , activities already being undertaken as part of other regulatory compliance efforts (i.e., monitoring groundwater quality at SMWC, the only public water system in the 7th Standard Annex Management Area, and the CV-SALTS program for the entire Central Valley) will continue during the SGMA implementation timeframe. Based on the existing beneficial uses and users of groundwater within the 7th Standard Annex Management Area, there are not Undesirable Results for Degraded Water Quality occurring. If a causal nexus between groundwater quality and water management activities is discovered, the Minimum Threshold, Measurable Objectives, or Interim Milestones for Degraded Water Quality within the 7th Standard Annex Management Area will be revisited as part of the next five-year update.~~

. The concentration of 10 micrograms per liter (ug/L) is established as the MO for arsenic, which is the primary maximum contaminant level (MCL) for drinking water. As current arsenic concentrations are below the MO in most cases (i.e., meaning current water quality is better than MO), setting IMs for Degraded Water Quality based on extrapolation between current concentrations and the MOs would suggest that current water quality needs improvement to achieve MO. Therefore, setting arsenic IMs is not considered applicable.

14.5. Measurable Objective for Land Subsidence

☑ 23 CCR § 354.30(c)
☑ 23 CCR § 354.30(e)

As discussed above in **Section 12.5 *Undesirable Results for Land Subsidence*** and as shown on **Figure GWC-14**, there has been no observed occurrence of significant and unreasonable effects of Land Subsidence on critical infrastructure and beneficial uses and users of groundwater in the 7th Standard Annex Management Area. For this reason, SMCs for this sustainability indicator are not applicable to this area, and no Undesirable Results, Minimum Thresholds, Measurable Objectives, or Interim Milestones for this indicator are defined.

If land subsidence is observed that has the potential to substantially interfere with surface or near surface land uses, the criteria for definition of Undesirable Results for Land Subsidence will be revisited, and Measurable Objective(s) for Land Subsidence will be developed, as appropriate.

14.6. Measurable Objective for Depletion of Interconnected Surface Water

As discussed above in **Section 7.6 *Interconnected Surface Water Systems*** and **Section 12.6 *Undesirable Results for Depletions of Interconnected Surface Water***, there is no interconnected surface water within the 7th Standard Annex Management Area. For this reason, no Undesirable Results, Minimum Thresholds, Measurable Objectives, or Interim Milestones for Depletion of Interconnected Surface Water are defined ~~herein~~.

15. MONITORING NETWORK

☑ 23 CCR § 354.32

This section describes the monitoring network designed for the 7th Standard Annex Management Area, subsequently referred to as Monitoring Network. Pursuant to the GSP Emergency Regulations (23-CCR Division 2 Chapter 1.5 Subchapter 2), the Monitoring Network objective is to collect sufficient data for the correct assessment of: the sustainability indicators relevant to the 7th Standard Annex Management Area (see **Section 12**), and the impacts to the beneficial uses and users of groundwater.

15.1. Description of Monitoring Network

☑ 23 CCR § 354.34(a)
☑ 23 CCR § 354.34(b)
☑ 23 CCR § 354.34(d)
☑ 23 CCR § 354.34(f)

As discussed in the sections above, water level and water quality SMCs have been established for the Management Area. ~~In addition to monitoring~~ SWID will monitor water levels and water quality for purposes of compliance with these SMCs~~, SWID will monitor for groundwater quality to fill the water quality data gap and will document the results in future SGMA compliance documents~~. As shown on **Figure MN-1**, the 7th Standard Annex Management Area Monitoring Network includes of five wells: two in the northern portion (well KB 2 and KB 3), one in the southwestern portion (well 28S/24E-35C), one in the southern portion (28S/25E-31J), and one in the eastern portion of the Management Area (well Field 28S/25E-33G). Three of the wells are water level representative monitoring wells (RMWs) for water levels (i.e., wells KB 3, 28S/24E-35C, and 28S/25E-31J), and three of the wells are water quality ~~r monitoring wells~~RMWs (i.e., wells KB 2, 28S/24E-35C, and 28S/25E-33G). Well access agreements ~~are being~~have been established with the well owners and will be documented in a report.

These wells were selected because of their geographic spacing across the Management Area and depths (where known).[56] These wells will provide for adequate monitoring of groundwater elevations and water quality within the principal aquifer unit of the Management Area. **Table MN-1** provides a summary of these wells and their associated construction and location information.

Pursuant to 23-CCR §354.34(a)-(b), the objective of the 7th Standard Annex Management Area Monitoring Network is to collect data with sufficient temporal frequency and spatial density necessary to evaluate this Management Area Plan (MA Plan) implementation as it relates to:

- Monitoring short-term, seasonal, and long-term trends in groundwater (see **Section 7** ***Current and Historical Groundwater Conditions***);
- Demonstrating progress toward achieving measurable objectives described in the Management Area Plan (see **Section 14** ***Measurable Objectives and Interim Milestones***)*;*

[56] Well construction information (including screen interval and installation date) is not available for wells KB 2, KB 3, and 28S/24E-35C. As part of SGMA implementation, it is anticipated that these wells will be video-logged to fill this critical data gap.

- Monitoring impacts to the beneficial uses and users of groundwater (see **Section 4.5.1** ***Beneficial Uses and Users of Groundwater***);
- Monitoring changes in groundwater conditions relative to Measurable Objectives (see **Section 14** ***Measurable Objectives and Interim Milestones***) and Minimum Thresholds (see **Section 13** ***Minimum Thresholds***); and
- Quantifying annual changes in water budget components (see **Section 8** ***Water Budget Information***).

Pursuant to 23-CCR §354.34(d), relevant Sustainability Indicators within the 7th Standard Annex Management Area that will be covered by the Monitoring Network include:

- Chronic Lowering of Groundwater Levels;
- Reduction of Groundwater Storage; and
- Degraded Water Quality.

Pursuant to 23-CCR §354.34(f), the 7th Standard Annex Management Area Monitoring Network consists of five monitoring sites with sufficient spatial distribution and spatial density as discussed above. Groundwater elevations in three water level ~~representative monitoring wells~~RMWs will be measured bi-annually (Spring and Fall) to allow for characterization of groundwater conditions during seasonal highs and lows. Water quality constituents (such as TDS, nitrate, and arsenic) will also be measured annually in three ~~wells~~water quality RMWs to allow for future water quality trend analysis, consistent with the KGA Monitoring Protocols document dated ~~April 2019~~June 2022.

Per 23-CCR §354.34(g), other factors considered in the selection of representative Monitoring ~~Sites~~Wells include:

- Availability of existing technical information about the representative Monitoring ~~Site~~Well (e.g., well location, construction information, condition, status, etc.);
- Quality and reliability of historical data at the representative Monitoring ~~Site~~Well;
- "Representativeness" to local groundwater conditions and nearby well populations (per 23-CCR §354.36); and
- Projected availability of long-term access to the Representative Monitoring ~~Site~~Well.

Summary of the Monitoring Network and additional monitoring sites are provided in **Table MN-1**. Further details about the Monitoring Network for each Sustainability Indicator can be found in **Sections 15.1.1** through **15.1.6**.

15.1.1. Monitoring Network for Chronic Lowering of Groundwater Levels

☑ 23 CCR § 354.34(c)(1)

The 7th Standard Annex Management Area Monitoring Network consists of three representative monitoring wells and will be used to monitor the Chronic Lowering of Groundwater Levels sustainability indicator. Water level Sustainability Criteria (including Minimum Threshold, Measurable Objective, and Interim Milestones) for the three monitoring wells have been defined in **Sections 13** and **14**, respectively. Monitoring Protocols are presented in **Section 15.2**.

As discussed in **Section 7.1 *Groundwater Elevations and Flow Direction***, flow direction throughout the 7th Standard Annex Management Area is predominantly from the southeast to the northwest. Given the location of the three representative monitoring wells – one in the southern side, one in the southwestern side, and one in the northern side of the Management Area (as shown on **Figure MN-1**) – groundwater depths and flow directions can be captured by the Monitoring Network.

Monitoring Well Density

According to DWR's "Best Management Practices – Monitoring Network and Identification of Data Gaps" (DWR, 2016b), monitoring well density should be between 0.2 and ten wells per 100 square miles. The 7th Standard Annex Management Area Monitoring Network density exceeds these guidelines, having three water level monitoring wells per 15.6 square miles in the principal aquifer (equivalent to 19 wells per 100 square miles, or twice the upper range of the DWR guidance).[57] In addition to the wells to be monitored by SWID, the North of River Sanitary District (NORSD) monitors water levels for compliance with its Regional Water Quality Control Board (RWQCB) Waste Discharge Requirements (WDR) Order. Data from the NORSD wells will be included in future annual and 5-year reports for the Management Area. The locations of the wells monitored by NORSD are also shown on **Figure MN-1**.

Monitoring Schedule

Water levels will be measured at a minimum of twice per year (Spring and Fall) to, among other things, document seasonal fluctuations in groundwater levels, capturing the seasonal high and low conditions. Specifically, Spring levels will be measured in approximately March to represent a seasonal high prior to summer irrigation demands. Fall levels will be measured in approximately October to represent a seasonal low after the summer irrigation demands.

15.1.2. Monitoring Network for Reduction of Groundwater Storage

☑ **23 CCR § 354.34(c)(2)**

As described in **Section 12.2.3 *Criteria Used to Define Undesirable Results***, the criteria used to define Undesirable Results for Reduction of Groundwater Storage are the Minimum Thresholds established at a local management area level for Chronic Lowering of Groundwater Levels. As such, the Monitoring Network for Reduction of Groundwater Storage will be comprised of the same Representative Monitoring ~~Sites~~Wells described in **Section 15.1.1 *Monitoring Network for Chronic Lowering of Groundwater Levels***. The information collected from this Monitoring Network will be sufficient to estimate the change in annual groundwater in storage within the principal aquifer.

15.1.3. Monitoring Network for Seawater Intrusion

☑ **23 CCR § 354.34(c)(3)**
☑ **23 CCR § 354.34(j)**

As described in **Section 12.3 *Undesirable Results for Seawater Intrusion***, seawater intrusion is not present and not likely to occur within the basin; therefore, the Seawater Intrusion Sustainability Indicator is not applicable and no Undesirable Results for this Sustainability Indicator are defined for the basin. As such,

[57] The 7th Standard Annex Management Area is about 10,000 acres equivalent to approximately 15.6 square miles.

per the stipulations defined under 23-CCR §354.34(j), a monitoring network has not been defined for the Seawater Intrusion Sustainability Indicator.

15.1.4. Monitoring Network for Degraded Water Quality

☑ 23 CCR § 354.34(c)(4)

The Monitoring Network for Degraded Water Quality consists of three representative monitoring ~~sites~~wells, as shown on **Figure MN-1**. As discussed in **Section 12.4**, **13.4**, and **14.4**, given that the ~~limited amount of water quality measurements and no negative impacts on existing~~most sensitive beneficial ~~uses and users~~use of groundwater ~~within the 7th Standard Annex Management Area~~is potable water, Undesirable Results for Degraded Water Quality ~~are not~~is defined ~~within~~for arsenic, and a MT and a MO for Degraded Water Quality is set for arsenic at three water quality RMWs in the Management Area using the ~~Management Area.~~California Maximum Contaminant Level (MCL) of 10 microgram per liter (ug/L). The Monitoring Network for Degraded Water Quality will be used to collect supplemental data annually to allow for continued evaluation of groundwater quality trends within the 7th Standard Annex Management Area.

Additional to the SGMA-compliant Monitoring Network, ~~SMWC,~~Superior Mutual Water Company (SMWC), as a public water system within the 7th Standard Annex Management Area, is subject to water quality monitoring requirements under the State Water Resources Control Board (SWRCB) Drinking Water Program. Water quality results and monitoring schedule are reported to the SWRCB and made publicly available through the Safe Drinking Water Information System (SDWIS) Drinking Water Watch website. NORSD also monitors water quality for compliance with its RWQCB WDR Order. The NORSD and SMWC wells are shown on **Figure MN-1**.

Additionally, the basin is a Priority 2 basin for nitrate management based on ~~CV-SALTS.~~Central Valley-Salinity Alternatives for Long-Term Sustainability (CV-SALTS). Consequently, CV-SALTS nitrate control program schedule is set to begin in 2021, as described in the KGA Umbrella GSP.

15.1.5. Monitoring Network for Land Subsidence

☑ 23 CCR § 354.34(c)(5)

As mentioned in **Section 7.5 *Land Subsidence***, no significant subsidence has been observed within the 7th Standard Annex Management Area based on available data. Therefore, no Undesirable Results for this Sustainability Indicator are defined for the 7th Standard Annex Management Area. The Basin-wide Monitoring Network for Land Subsidence is included in the KGA Umbrella GSP, including statewide Interferometric Synthetic Aperture Radar (InSAR) conducted by the United States Geological Survey (USGS), monitoring points at existing continuous GPS stations, and available data from Scripps Orbit and Permanent Array Center (SOPAC). If land subsidence that has the potential to substantially interfere with surface or near surface land uses is observed, the criteria for definition of Undesirable Results for Land Subsidence will be revisited, and a Monitoring Network for Land Subsidence may be developed, as appropriate.

15.1.6. Monitoring Network for Depletions of Interconnected Surface Water

☑ 23 CCR § 354.34(c)(6)
☑ 23 CCR § 354.34(j)

As described in **Section 7.6 *Interconnected Surface Water Systems***, groundwater levels in the principal aquifer are far below the ground surface within the 7th Standard Annex Management Area, and therefore there is no interconnected surface water. Similarly, as discussed in **Section 7.7 *Groundwater Dependent Ecosystems***, no groundwater dependent ecosystems have been identified within the 7th Standard Annex Management Area. For this reason, no Undesirable Results or Monitoring Network for this Sustainability Indicator are defined for the Annex Management Area.

15.2. Monitoring Protocols for Data Collection and Monitoring

☑ 23 CCR § 352.2

The 7th Standard Management Area Monitoring Network will adhere to the monitoring protocols established by KGA, which is described in the KGA Umbrella GSP.

15.3. Representative Monitoring

☑ 23 CCR § 354.36

As described in **Section 15.1 *Description of Monitoring Network***, the 7th Standard Annex Management Area has defined a SGMA-compliant Monitoring Network for each relevant Sustainability Indicator to the Management Area that will be used for SGMA reporting purposes to evaluate Plan implementation with respect to meeting the Sustainability Goal defined for the basin through compliance with the Minimum Thresholds and Measurable Objectives described in the Plan. The rationale for selecting Representative Monitoring ~~Sites~~Wells are also described in **Section 15.1 *Description of Monitoring Network***.

As described in **Section 15.1.2 *Monitoring Network for Reduction of Groundwater Storage***, the Monitoring Network for Chronic Lowering of Groundwater Levels will be used as a proxy to monitor Reduction in Groundwater Storage. Groundwater level measurements from these wells will be used to estimate annual change in storage in the 7th Standard Annex Management Area portion of the basin. There are no other Sustainability Indicators for which groundwater levels will be used as a proxy for representative monitoring.

15.4. Assessment and Improvement of Monitoring Network

☑ 23 CCR § 354.38

15.4.1. Review and Evaluation of the Monitoring Network

Per the GSP Emergency Regulations (23-CCR § 354.38), the monitoring network will be reevaluated at least every five years in each five-year GSP update, in relation the circumstances described in 23-CCR § 354.38(e), and will be adjusted, as necessary, for the 7th Standard Annex Management Area.

15.4.2. Identification, Description, and Steps to Fill Data Gaps

Available information for each monitoring wells is shown in **Table MN-1**. The two northern Representative Monitoring ~~sites~~Wells (wells KB 2 and KB 3) and the southwestern Representative Monitoring ~~site~~Well (well 28/S24E-35C) currently lack available well construction information. For the Representative Monitoring ~~Sites~~Wells currently missing construction information, the 7th Standard Annex Management Area has developed a plan to fill these data gaps by conducting video-logging on the identified wells (see **Section 17** ***Plan Implementation***). In the event that these data gaps cannot be readily filled (e.g., through video inspection and logging), the 7th Standard Annex Area will identify alternative sites or develop plans to construct new Representative Monitoring ~~Sites~~Wells for Chronic Lowering of Groundwater Levels as deemed necessary.

For the Representative Monitoring ~~Sites~~Wells still under active use, the 7th Standard Annex Management Area will work to convert these sites to dedicated monitoring sites or will otherwise identify or develop alternative sites by the GSP implementation deadline (i.e., by January 2040).

15.5. Monitoring Reports

☑ 23 CCR § 354.40

Data collected from the SGMA-compliant Monitoring Network will be uploaded to the Data Management System maintained for the basin and reported to the DWR in accordance with the Monitoring Protocols developed for the basin as described in the KGA Umbrella GSP. Details on this Data Management System (DMS) are not currently available, but it is anticipated that member agencies will be able to submit their data to the KGA in a systematic format. In addition, local data will be stored and managed in a 7th Standard Annex Management Area-specific DMS. A copy of the monitoring data will be included in the Annual Report and submitted electronically to DWR. Additional data collected by SWID or other regular monitoring programs in the basin (see **Section 4.2.1** ***Existing Monitoring Programs in the 7th Standard Annex Management Area***) may be used in conjunction with data collected from the SGMA-compliant Monitoring Network to meet compliance with GSP regulations regarding Annual Reporting (23-CCR §356.2) or as otherwise deemed necessary for the 7th Standard Annex Management Area.

TABLE MN-1
Summary of Representative Monitoring Sites
Shafter-Wasco Irrigation District
7th Standard Annex Management Area

Monitoring Site ID	State Well Number	Sustainability Indicators	Well Association	CASGEM Details			Monitoring Site Location (a)		Reference Point		
				Station ID	Well ID	Well Type (CASGEM / Voluntary)	Latitude (° WGS 84)	Longitude (° WGS 84)	Ground Surface Elevation (ft amsl)	Reference Point Elevation (ft amsl)	Reference Point Description
28S/25E-33G	28S25E33G001M	Water Quality	Sill Properties Inc.	NA	NA	NA	35.4515	-119.2834	327	327	UNKNOWN
28S/24E-35C	28S24E35C001M	Water Level and Water Quality	Sill Properties Inc.	NA	NA	NA	35.4561	-119.3595	309	309	UNKNOWN
28S/25E-31J	28S25E31J001M	Water Level	UNKNOWN	NA	NA	NA	35.4489	-119.3146	329	329	UNKNOWN
KB 2	28S25E19G001M	Water Quality	Kirschemann Bros.	NA	NA	NA	35.4779	-119.3145	324	324	UNKNOWN
KB 3	28S25E19H001M	Water Level	Kirschemann Bros.	NA	NA	NA	35.4778	-119.3188	323	323	UNKNOWN

Monitoring Site ID	State Well Number	Well Use	Well Status	Well Construction Details						DWR Well Completion Report No.
				Total Completed Depth (ft bgs)	Borehole Depth (ft bgs)	Top of Perforations Depth (ft bgs)	Bottom of Perforations Depth (ft bgs)	Casing Diameter (in)	Well Capacity (gpm)	
28S/25E-33G	28S25E33G001M	AGRICULTURE	Active	610	610	300	600	16	1,293	22473 (b)
28S/24E-35C	28S24E35C001M	AGRICULTURE	Active	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
28S/25E-31J (c)	28S25E31J001M	MONITOR	Active	500	UNKNOWN	260	500	UNKNOWN	UNKNOWN	UNKNOWN
KB 2	28S25E19G001M	MONITOR	Active	1,000	UNKNOWN	UNKNOWN	UNKNOWN	18	1,500	UNKNOWN
KB 3	28S25E19H001M	AGRICULTURE	Active	960	UNKNOWN	500	960	18	UNKNOWN	UNKNOWN

TABLE MN-1
Summary of Representative Monitoring Sites
Shafter-Wasco Irrigation District
7th Standard Annex Management Area

Abbreviations

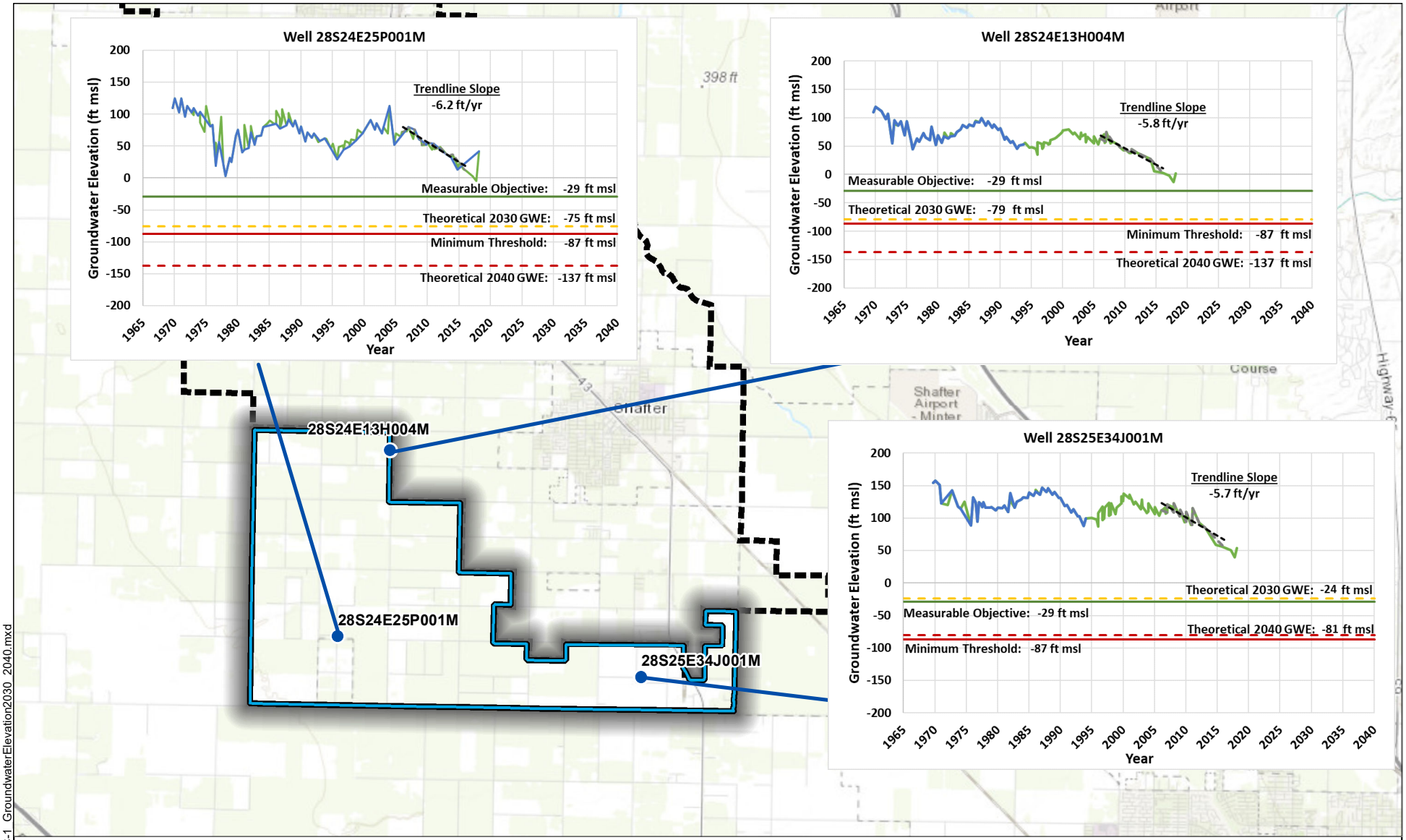
amsl = above mean sea level
bgs = below ground surface
CASGEM = California Statewide Groundwater Elevation Monitoring
DWR = California Department of Water Resources
ft = feet
gpm = gallons per minute
in = inches
NA = not applicable
SWID = Shafter-Wasco Irrigation District
WCR = Well Completion Report
WGS = World Geodetic System

Notes

(a) Well completion report is assumed to be associated with well 28S/25E-33G.

Sources

(a) Well locations were provided by Ken Bonesteel from Provost & Pritchard Consulting Group on 25 November 2019.
(b) Well Completion Report is obtained from DWR Well Completion Report Map Application on 20 February 2019 (https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37).
(c) Well construction information for well 28S/25E-31J was obtained from the Rosedale-Rio Bravo Water Storage District 2017 Operations Report on 25 November 2019 (https://www.rrbwsd.com/wp-content/uploads/2018/12/3e-Final-RRBWSD-2017-Operations-Report-November-2018.pdf).



Path: X:\B80079\Maps\2022\06\FigSMC-1_GroundwaterElevation2030_2040.mxd

Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- Monitoring Well
- Measured Groundwater Elevation
- Interpolated Groundwater Elevation
- Spring 2006- Spring 2016 Groundwater Elevation
- Spring 2006- Spring 2016 Groundwater Elevation Trendline

Abbreviations

ft msl = feet above mean sea level
ft/yr = feet per year
GWE = Groundwater Elevation
SWID = Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Interpolated groundwater elevations are calculated based on correlations with surrounding wells.
3. Measurable Objective and Minimum Threshold are defined as the minimum value of GWE based on a trendline projection through 2030 and 2040 plus 50 ft, respectively, for the three monitoting wells.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 24 June 2022.
2. Well location and groundwater elevation data were obtained from CASGEM on 20 February 2019 (https://water.ca.gov/Programs/Groundwater-Management/Groundwater-Elevation-Monitoring--CASGEM).
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.

N

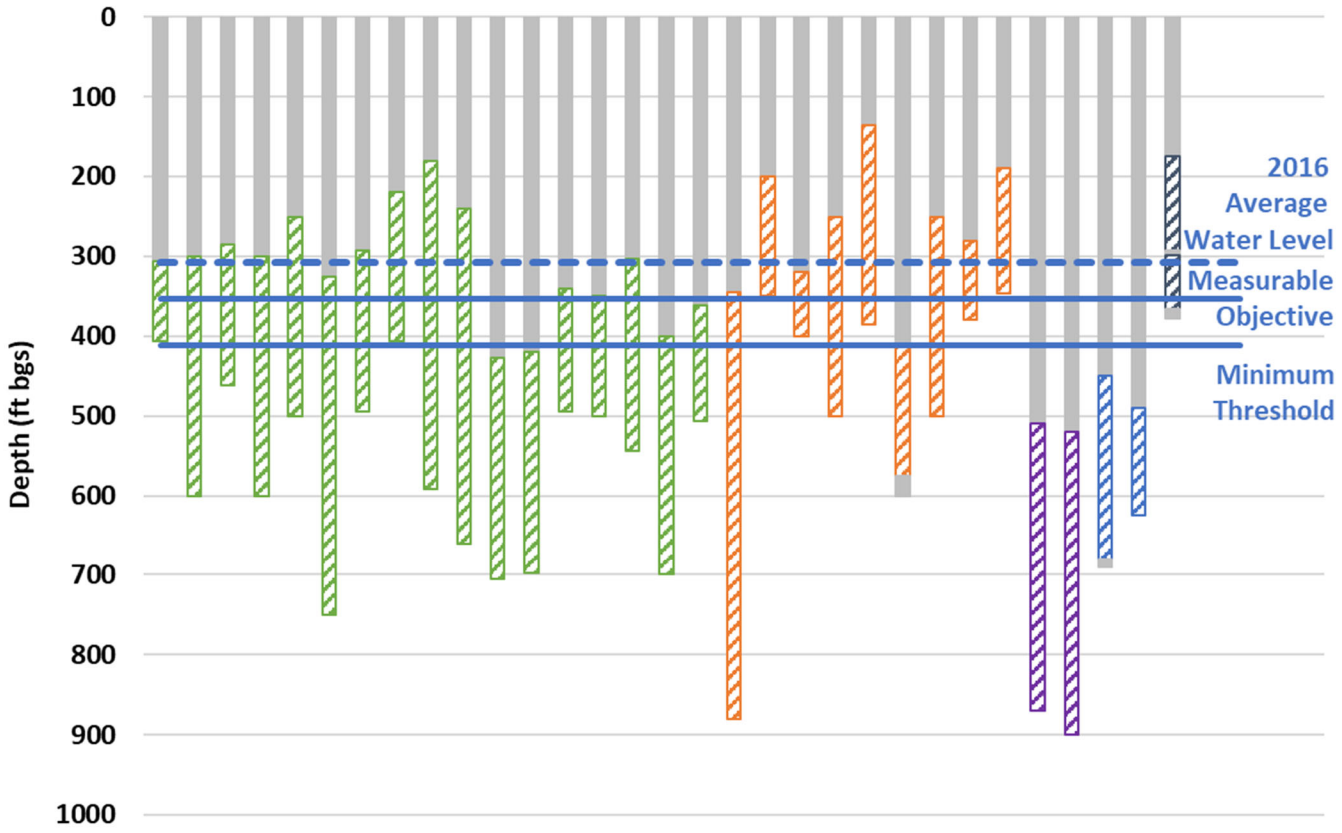
0 2 4

(Scale in Miles)

Basis for Measurable Objective and Minimum Threshold

SWID 7th Standard Annex Management Area
June 2022
B80079.00

Figure SMC-2



Legend

- Blank Casing
- **Well Screen Interval**
- Agricultural Supply Well
- Domestic Supply Well
- Industrial Supply Well
- SMWC Supply Well
- Unknown Well
- Average Water Level

Water Level	Top of Screen Dewatered	Bottom of Screen Dewatered
Measurable Objective	**71%**	**6%**
Minimum Threshold	**81%**	**26%**

Well Type	Top of Screen Dewatered at MO	Bottom of Screen Dewatered at MO	Top of Screen Dewatered at MT	Bottom of Screen Dewatered at MT
Municipal	0%	0%	0%	0%
Domestic	89%	22%	100%	56%
Agriculture	76%	0%	88%	12%

Abbreviations

ft bgs = feet below ground surface
SMWC = Superior Mutual Water Company

Notes

1. For well screens indicated by a question mark (?), only total well depth is known.

Sources

1. Well information obtained from the Stakeholder Surveys and well completion report downloaded from Well Completion Report Map Application on 15 November 2018.

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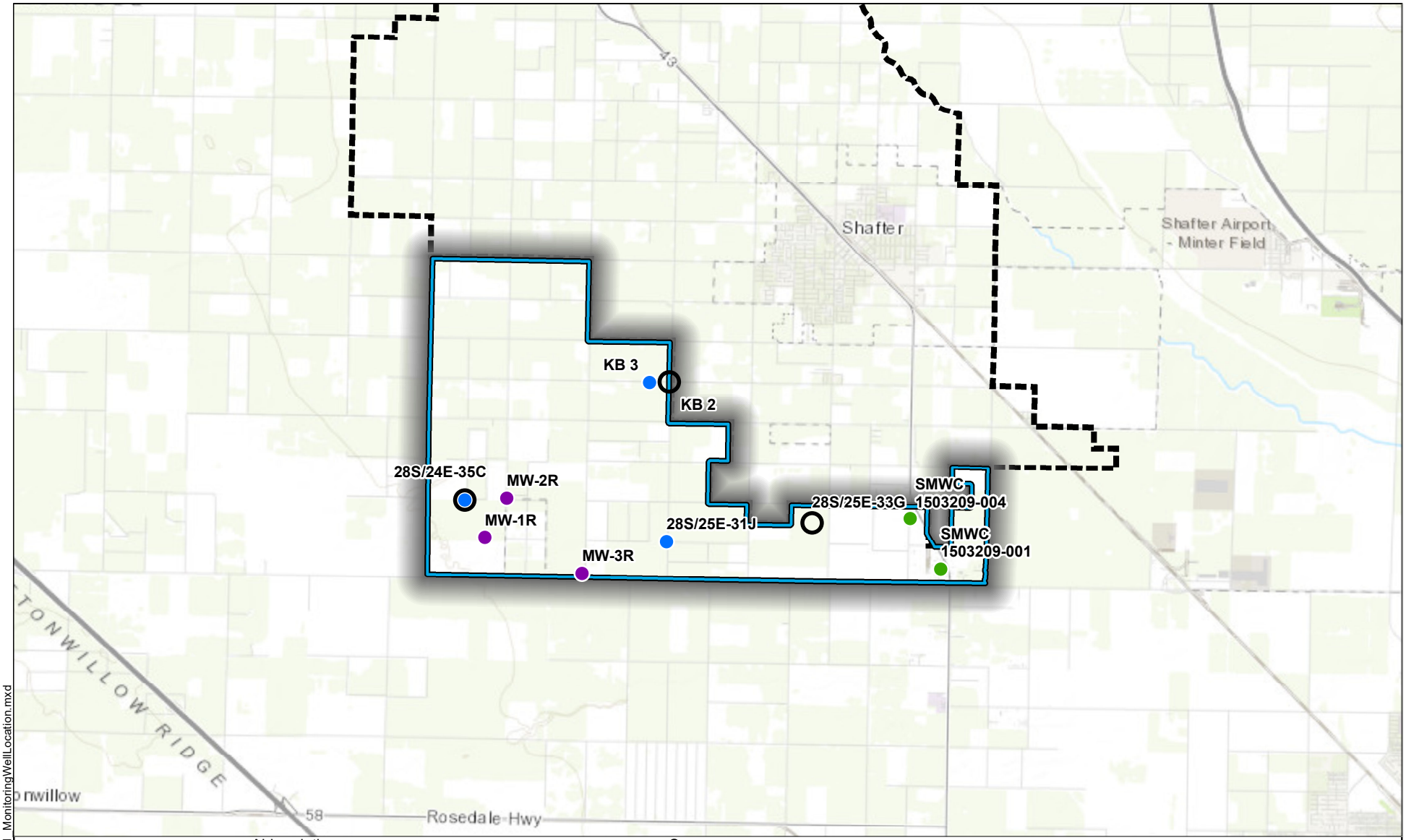
Screening of Potential Well Impacts With Revised MT

DRAFT

SWID 7th Standard Annex Management Area
June 2022
EKI B80079.00
Figure SMC-3



Path: X:\B80079\Maps\2019\11\FigMN-1_MonitoringWellLocation.mxd

Legend

- Shafter-Wasco Irrigation District
- SWID 7th Standard Annex Management Area
- SWID Water Level Monitoring Well (See Note 2)
- SWID Water Quality Monitoring Well
- SMWC Supply Wells (See Note 3)
- NORSD Monitoring Wells (See Note 4)

Abbreviations

CVRWQCB	= Central Valley Regional Water Quality Control Board
NORSD	= North of River Sanitary District
SMWC	= Superior Mutual Water Company
SWID	= Shafter-Wasco Irrigation District

Notes

1. All locations are approximate.
2. Sustainable Management Criteria (SMCs) have been established for water levels. The indicated wells will be used for compliance with these SMCs.
3. The SMWC supply wells are routinely monitored for water quality pursuant to its public water system permit.
4. The NORSD wells are routinely monitored for water levels and water quality pursuant to CVRWQCB Waste Discharge Requirements Order requirements.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained on 2 December 2019.
2. Well locations were obtained from CASGEM on 20 February 2019 (https://water.ca.gov/Programs/Groundwater-Management/Groundwater-Elevation-Monitoring--CASGEM), and stakeholde survey received on 14 September 2018.
3. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.
4. Locations of the SMWC supply wells were received from the SMWC staff on 21 November 2018.

N

0 1.5 3

(Scale in Miles)

Monitoring Well Locations

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SWID 7th Standard Annex Management Area
December 2019
B80079.00

Figure MN-1

PROJECTS AND MANAGEMENT ACTIONS

16. PROJECTS AND MANAGEMENT ACTIONS

☑ 23 CCR § 354.42

Pursuant to the Groundwater Sustainability Plan (GSP) Regulations, this section presents the Projects and Management Actions (P&MAs) proposed by the 7th Standard Annex Management Area to support achievement of the sustainability goal within the 7th Standard Annex Management Area. The P&MAs were developed using a portfolio approach whereby individual P&MAs were identified and grouped into categories based on their expected benefits. Implementation of P&MAs within those benefit categories is estimated to occur along glide paths that will result in closing of the currently identified "deficit" by 2040, as well as in response to observed groundwater conditions relative to the associated Sustainability Indicators. This approach allows for flexible implementation of P&MAs as needed to address future conditions (i.e., out to 2070). The P&MAs presented herein were developed with consideration of costs and benefits and preliminary feasibility analysis; however, each P&MA will require significant further evaluation (i.e., engineering, economic, legal, etc.) prior to, and as a part of, implementation.

This section first presents the goals and objectives of the P&MAs, including the relevant Sustainability Indicators and the benefit categories. Next, a list of specific P&MAs grouped by benefit category and type is presented, information which is also provided in **Table PMA-1**. Following this list is a discussion of: (1) the planned rate of P&MA implementation ("glide path"); (2) public noticing of P&MA development; (3) how the P&MAs address overdraft conditions; (4) a description of the various potentially applicable permitting and regulatory requirements; (5) a discussion of the P&MA status and implementation timeline; (6) a discussion of how the expected benefits will be evaluated; (7) a description of sources of outside water that are relied upon; (8) a discussion of the legal authority required to implement the P&MAs; (9) a summary of estimated costs and how the 7th Standard Annex Management Area plans to meet those costs; (10) a discussion of how recharge and extraction will be managed to avoid depletion of groundwater levels and storage; and (11) a discussion of economic impacts.

16.1. Goals and Objectives of Projects and Management Actions

16.1.1. Relevant Sustainability Indicators

Per the GSP Regulations, GSPs must include P&MAs to address any existing or potential future Undesirable Results for the identified relevant Sustainability Indicators. As discussed in **Section 12 *Undesirable Results***, the relevant Sustainability Indicators in the 7th Standard Annex Management Area include (1) Chronic Lowering of Groundwater Levels, and (2) Reduction of Groundwater Storage. Because groundwater levels and storage area directly correlated, P&MAs that address groundwater levels also address groundwater storage, and the two Sustainability Indicators are considered together in this discussion of P&MAs.

As discussed in **Section 8.4**, a range of shortfalls were identified for the Management Area based on the observed historical change in groundwater storage, a consideration of the current range of native safe yield numbers under development by the KGA, and inclusive of projected climate change conditions. The Management Area is currently using the upper end of the deficit range (i.e., a shortfall of 16,976 AFY) for

purposes of developing and planning P&MAs. This shortfall estimate may change based on further study and future work by the KGA to refine the basin native safe yield and will be revisited in the 2025 update to the MA Plan.

16.1.2. Benefit Categories

☑ 23 CCR § 354.44(b)(5)

The goal of the P&MAs discussed herein is to address significant and unreasonable effects related to the relevant Sustainability Indicators within the 7th Standard Annex Management Area. The primary water management "tools" (i.e., authorities) by which the 7th Standard Annex Management Area can address conditions that may lead to Undesirable Results pertain to management of water quantity – i.e., inflows (supplies) and outflows (demands). Therefore, the primary categories of expected benefits of the P&MAs described herein are:

1) Water supply augmentation, and
2) Water demand reduction.

All of the P&MAs belong to at least one of those two primary categories. In addition, there are secondary/ancillary benefits to many of the P&MAs, including:

1) Water quality improvement,
2) Flood control,
3) Water management flexibility/efficiency, and
4) Improved data to better understand the Basin Setting components.

16.2. List of Projects and Management Actions

☑ 23 CCR § 354.44(b)(1)

The following section provides a list of P&MAs identified by the 7th Standard Annex Management Area, divided into the two primary benefit categories discussed above, both of which address the Chronic Lowering of Groundwater and Reduction of Groundwater Storage Sustainability Indicators. Details of the P&MAs are provided in **Table PMA-1**, including P&MA category, description, involved sustainability indicators, circumstances for implementation, status, time table for initiation and completion, expected benefits, and estimated cost. The numbers indicated below correspond to the project numbers in **Table PMA-1**.

16.2.1. Water Supply Augmentation Projects

The primary expected benefit of the Projects listed below is supply augmentation. This list includes projects to increase groundwater storage/recharge and to increase delivery flexibility.

Projects to Increase Groundwater Storage/Recharge

1. Evaluation of Potential to Utilize Shafter-Wasco Irrigation District (SWID) Kimberlina Ponds or Other Facilities for Recharge
2. Evaluation of Potential to Partner in Kern Fan Groundwater Storage Project

3. 7th Standard Annex Management Area ~~Storage Pond~~Recharge Project
4. Identify Opportunities to Utilize Existing Infrastructure
5. On-Farm Groundwater Recharge

Projects to Increase Delivery Flexibility

6. Flat Rock Canal Extension
7. Develop Policy for and Construction of New Interconnections Within SWID's Conveyance System and Improve "Bottleneck" Issues
8. Increased Recycled Water Deliveries and Recharge

16.2.2. Water Demand Reduction Management Actions

The primary benefit of the Management Actions listed below is water demand reduction. This list includes management actions/policies to reduce overall water demand and to reduce groundwater pumping.

Management Actions/Policies to Reduce Overall Water Demand

9. On-Farm Water Conservation and Participation in Irrigation Scheduling using Remote Sensing
10. Voluntary Rotational Land Fallowing Program
11. Education of Groundwater Use per Acre
12. Well Dewatering Mitigation Program
13. Mandatory Pumping Restriction and/or Land Fallowing

In addition to these specific demand reduction actions, it is noted that a benefit of construction of a recharge facility in the Management Area (~~project~~P&MAs #3 above) is a reduction in demand for the area of the future ponds that will be taken out of agricultural production. As discussed in **Section 16.6.2**, the implementation of these P&MAs are expected to maintain water levels above the MOs. However, in the event that the water level MOs are not maintained for three consecutive years despite the implementation of P&MAs in the Management Area, then as a contingency, SWID will develop a mandatory pumping restriction and/or land fallowing policy, and work to maintain water levels above the MTs~~.~~ (P&MAs #13 above).

16.2.3. Implementation Glide Paths

☑ **23 CCR § 354.44(b)(1)(A)**
☑ **23 CCR § 354.44(d)**

Table PMA-2 shows the glide paths of achieving sustainability goal through 2070, including total increased supply and total shortfall. As discussed in **Section 8.4.2** ***Development of Projected Water Budget Scenarios*** above, the native safe yield of the basin is still under evaluation. Given this uncertainty, and consistent with the projected water budget presented in **Section 8.4.2**, two potential glide path cases are presented in **Table PMA-2**: Case 1 is based on estimated net subsurface inflows from calibrated historical water budget, and Case 2 is based on the current checkbook balance approach.[58] Case 2, incorporating 2030 Climate Change conditions, is considered in the development of P&MAs for the Management Area. The Management Area will make up for 10% of the total shortfall by 2025, and an additional 30% every

[58] It is anticipated that further work to refine/support this native safe yield estimate will be conducted following the January 2020 GSP submission date.

five-year period thereafter, closing the total shortfall of 16,976 AFY by 2040. The Management Area plans to have construction of projects complete by 2035 to allow for full use of the infrastructure before 2040. It is anticipated that by 2040 approximately 10% of the shortfall will be met by demand reduction and 90% will be met by supply augmentation. In addition to the P&MAs to increase supply and reduce demand, ~~Plan implementation will include the development and funding of an Impacted~~a Well Dewatering Mitigation Program has been developed and funded to address wells impacted by lowering groundwater levels, including agricultural and domestic supply wells.

Table PMA-2 also shows the circumstances under which P&MAs are anticipated to be implemented. The volumes presented in the table represent an assumed minimum take for each P&MA. Supply shortfalls are assumed to be preferentially met by treated effluent from the North of River Sanitary District (NORSD) Wastewater Treatment Plant (WWTP), with the remaining shortfall met by a combination of a ~~voluntary rotational~~mandatory pumping restriction and/or land fallowing program, purchased recharge-in-place capacity, and diversion and recharge high flow supplies.

16.2.4. Public Noticing

☑ 23 CCR § 354.44(b)(1)(B)

Public notice requirements vary for the different P&MAs listed above. Some projects that involve infrastructure improvements only may not require specific public noticing (other than that related to construction), whereas certain other projects that involve, for example, purchase recharge-in-place capacity, may require public noticing. In general, P&MAs being considered for implementation will be discussed during regular SWID Board Meetings, which are open to the public. Additional stakeholder outreach efforts will be conducted prior to and during P&MA implementation, as required by law.

16.3. Addressing Overdraft Conditions

☑ 23 CCR § 354.44(b)(2)

The P&MAs presented herein are expected to result in benefits (discussed below) that will address the projected groundwater storage deficit so as to avoid Undesirable Results for relevant Sustainability Indicators and achieve sustainability.

16.4. Status and Implementation Timetable

☑ 23 CCR § 354.44(b)(4)

As stated above, the goal and objective of the P&MAs presented herein is to address any existing or potential Undesirable Results by the SGMA implementation deadline for the basin (i.e., by January 2040). As such, P&MAs will be implemented incrementally on an as-needed basis to achieve this goal. While the exact schedule and timetable for implementation of individual P&MAs is not known at this time, glide paths shown in **Table PMA-2** provide the generally anticipated implementation schedule.

16.5. Permitting and Regulatory Process

☑ 23 CCR § 354.44(b)(3)

Permitting and regulatory requirements vary for the different P&MAs depending on whether they are infrastructure projects, recharge projects, demand reduction management actions, and so forth. The various types of permitting and regulatory requirements (not all applicable to every P&MA) include the following:

- Federal
  - National Environmental Policy Act (NEPA) documentation, if federal grant funds are used;
  - National Pollution Discharge Elimination System (NPDES) stormwater program permit (administered by the California State Water Resources Control Board);
- State
  - California Environmental Quality Act (CEQA) documentation, including one or more of the following: Initial Study (IS), Categorical Exemption (CE), Negative Declaration (ND), Mitigated Negative Declaration (MND), or Environmental Impact Report (EIR);
  - California State Water Resources Control Board permits and regulations regarding recycled water use;
  - California Surface Mining and Reclamation Act (SMARA) regulations;
  - California Division of Safety of Dams regulations;
- Regional
  - San Joaquin Valley Air Pollution Control District (SJVAPCD) permit and regulations;
  - Power and Water Resources Pooling Authority (PWRPA);
- County/Local
  - Encroachment permits – Kern County, KDWD, CalTrans, and others;
  - Kern County grading permit; and
  - Kern County well construction permit.

Currently-identified permitting and regulatory requirements for each P&MA are listed in **Table PMA-1**. As part of the planning and implementation process for all P&MAs, the regulatory and permitting requirements will be evaluated.

16.6. Expected Benefits

☑ 23 CCR § 354.44(b)(5)

The different categories of expected benefits are presented above in **Section 16.1.2 *Benefit Categories***, and the specific expected benefits of each P&MA are presented in **Table PMA-1**. Below is a discussion of how the expected benefits will be evaluated.

16.6.1. Evaluation of Benefits

Each P&MA has expected benefits related to water quantity. Once a P&MA is implemented, it is important for there to be a way to evaluate, ideally to quantify, the benefits resulting from that P&MA. The way in which P&MA benefits are evaluated and quantified depends on the P&MA type. For those P&MAs that involve direct supply augmentation, the benefit is quantified directly through measurement of those flows

and any corresponding measured change in water levels. For P&MAs that involve indirect supply augmentation through, for example, developing new conveyance system interconnections, quantification of the benefit will require a comparison of the observed water supply condition against a hypothetical condition where the P&MA was not in place. For P&MAs that involve water demand reduction the benefit must also be evaluated by comparison of the observed water demand condition (e.g., irrigated acreage) against a hypothetical condition where the P&MA was not in place. Because it is not possible to determine with certainty what the condition without the P&MA would be like, quantification of the benefits is inherently uncertain.

As discussed above, although the P&MAs described herein are laid out along a general timetable defined by incremental elimination of water budget deficits (i.e., the "glide path"), the goals and objectives of P&MA implementation are not necessarily to achieve a certain water budget outcome, but rather to ensure that sustainability goals are achieved by the end of the SGMA implementation period (i.e., by 2040). For this reason, the success of the collective implementation of P&MAs will be determined by whether the Sustainability Goal is achieved.

16.6.2. Evaluation Relative to Water Level Sustainability Criteria

As mentioned in **Section 8 *Water Budget Information***, a numerical groundwater water flow model based on DWR's California Central Valley Groundwater-Surface Water Simulation beta fine-grid model (C2VSim-FG) is developed for the Kern County Subbasin. As part of this process, all Basin GSAs and KGA members were asked to input their proposed P&MAs into the Baseline and 2030 Climate Change C2VSim-FG projected model scenarios to assess water level responses to basin-wide P&MA implementation relative to proposed Water Level Sustainability Criteria defined for each GSA and Management Area (see **Sections 13.1** and **14.1**). The scenarios modeled and presented in **Figure PMA-1** assume that all proposed P&MAs by all entities in the basin are implemented as currently proposed in their respective plans. As shown in **Figure PMA-1**, for each of the three SWID water level monitoring wells within the 7th Standard Annex Management Area, groundwater elevations are expected to meet their Minimum Thresholds with the implementation of P&MAs in both the Baseline and 2030 Climate Change Scenarios. In all three selected well locations, water levels are also maintained above the Measurable Objectives with implementation of P&MAs. The results of this Basin-wide projected modeling exercise thus further support that the proposed P&MAs implementation strategy is expected to result in sustainable management of groundwater levels within the 7th Standard Annex Management Area.

To date water levels have been maintained above the MOs at the RMWs.

16.7. Source and Reliability of Water from Outside the District

☑ 23 CCR § 354.44(b)(6)

Several of the P&MAs discussed below and shown in **Table PMA-1** rely on additional water supplies from outside of the 7th Standard Annex Management Area. As discussed in **Section 6.3.6 *Source and Point of Delivery for Imported Water Supplies,*** NORSD WWTP receives municipal wastewater and a portion of the treated wastewater is used for agricultural irrigation within the 7th Standard Annex Management Area. This water source is considered very reliable and drought-resilient, as the source is water used indoors by municipal users. Use of recycled wastewater for irrigation is permitted under a Waste Discharge Requirement (WDR) Order from the Central Valley Regional Water Quality Control Board (CVRWQCB),

held by Sill Properties and NORSD, and is expected to continue into the future, pursuant to the WDR Order requirements.

Some P&MAs rely on the availability of water during non-drought and non-wet years to fill unused capacity of existing recharge facilities and/or on-farm buried recharge to conduct managed recharge and offset groundwater pumping. If such P&MAs are implemented, they would be pursued in partnership with neighboring entities such as SWID, North Kern Water Storage District, and/or Rosedale-Rio Bravo Water Storage District. The specific water sources are not known at this time and would be dependent on, among other things, available conveyance to a given recharge facility. Given that conveyance and recharge facilities would likely be fully utilized by existing users during the wettest years, the 7th Standard Management Area would likely utilize supplies available in years that are considered more hydrologically "normal." The 7th Standard Annex Management Area will continue its efforts to secure additional water supplies for importation into the 7th Standard Annex Management Area through transfers, exchanges, and purchases, as necessary and possible given pricing and timing constraints.

16.8. Legal Authority Required

☑ 23 CCR § 354.44(b)(7)

Full annexation of the Management Area by SWID was completed 4 December 2019, following the passage of a Proposition 218 election on 13 November 2019. SWID is a Participating Member of the KGA Groundwater Sustainability Agency (GSA), which is organized as a joint powers authority (JPA). The SWID possesses the legal authority to implement the water supply augmentation and demand reduction P&MAs discussed herein. As a GSA, per California Water Code (CWC) § 10725 through 10726.8, the KGA GSA possesses additional legal authorities; if needed, the KGA GSA may act upon SWID's behalf to enforce these P&MAs as necessary or will delegate authority to SWID itself to enforce the GSP within the 7th Standard Annex Management Area.

16.9. Estimated Costs and Plans to Meet Them

☑ 23 CCR § 354.44(b)(8)

Estimated costs for each P&MA are presented in **Table PMA-1**. Given the uncertainty in the scope and timing of these P&MAs, the costs are estimated in amount per acre-foot (AF) plus water costs. These costs include "one-time" costs and ongoing costs. The one-time costs may include capital costs associated with construction, feasibility studies, permitting, environmental (CEQA) compliance, or any other costs required to initiate a given P&MA. The ongoing costs are associated with operations & maintenance (O&M) and/or costs to otherwise continue implementing a given P&MA. It should be noted that depending on the source and nature of funding for the P&MAs, the one-time costs may or may not be incurred entirely at the beginning of the P&MA; in some instances, loans or other financing options may allow for spreading out of "one-time" costs over time.

Potential sources of funding for the various P&MAs are also presented in **Table PMA-1**, and include the following:

- The 7th Standard Annex Management Area funds, generally supported by fees charged by SWID to landowners within the 7th Standard Annex Management Area and

- Grant funding from sources including California Department of Water Resources (DWR), United States Bureau of Reclamation (USBR), and the Federal Emergency Management Agency (FEMA).

Upon implementation of any given P&MA, the available funding sources for that P&MA will be re-examined.

16.10. Economic Analysis

Each of the P&MAs identified require an investment of local and potentially grant funds to implement, and in many cases this investment is substantial. These costs should be weighed against the overall economic benefit gained from using water within the Management Area. The largest use of water within the Management Area is as irrigation of productive agricultural lands.

Based on the 2017 Kern County Agricultural Crop Report (Kern County, 2018), the 2017 gross value of all agricultural commodities produced in Kern County was approximately $7.25 billion and the total harvested area in Kern County was 884,571 acres, or approximately $8,200 per harvested acre of gross value. As shown on **Figure PA-2**, the Management Area includes approximately 7,930 acres of active agricultural land. Based on this rough assessment, agricultural production within the 7th Standard Annex Management Area is on the order of $65 million per year.

TABLE PMA-1
Details of Projects and Management Actions
Shafter-Wasco Irrigation District
7th Standard Annex Management Area

P/MA Name	Type	P&MA Category					Description	Sustainability Indicators Involved						Circumstances for Implementation	Public Noticing Process	Permitting and Regulatory Process Requirements	Status, Time Table for Initiation and Completion, Accrual of Expected Benefits	Expected Benefits
		Surface Water Supply	Groundwater Supply	Groundwater Demand	Infrastructure Improvement	Monitoring		Groundwater Level	Groundwater Storage	Seawater Intrusion	Groundwater Quality	Land Subsidence	Interconnected Surface					
Projects - Increased Groundwater Storage / Recharge																		
Evaluation of Potential to Utilize SWID Kimberlina Ponds for Recharge or other Facilities	Project	X	X				SWID operates the Kimberlina Ponds groundwater recharge facility. The Annex Area will evaluate opportunities with SWID to utilize Kimberlina Pond storage capacity for recharge. The Annex Area will evaluate opportunities to purchase non-SWID water for recharge in the Kimberlina Ponds facilities, when the Ponds have unused capacity (i.e., likely in non-wet and non-drought years).	X	X		X			Evaluation phase to be implemented following adoption of Management Area Plan.	Board meetings, SWID website	No permits anticipated for use of existing infrastructure. Permit requirements will be further evaluated as part of implementation.	- Status: Conceptual, have begun initial discussions; - Initiation: 2020-2024 - Completion: ongoing - Accrual of Benefits: annual - basis	- Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
Evaluation of Potential to Partner in Kern Fan Groundwater Storage Project	Project	X	X		X		The Kern Fan Groundwater Storage Project is under development by RRBWSD and would serve to develop a regional water bank in the Kern Fan to capture and store Article 21 water via the State Water Project (SWP) during conditions when surface water is abundant. The Annex Area could potentially become a funding partner in this project and have access to recharge and storage capacity in the Project.	X	X		X			Evaluation phase to be implemented following adoption of Management Area Plan.	Board meetings, SWID website	No permits needed for initial evaluation phase. Permit requirements will be further evaluated as part of implementation.	- Status: Conceptual, have begun initial discussions with RRBWSD; - Initiation: 2030 - Completion: 2035 - Accrual of Benefits: Over a 50-year period following	- Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
7th Standard Annex Management Area Recharge Project	Project	X	X	X	X		This project would improve water supply reliability and groundwater conditions in the Management Area. Benefits of the developing a groundwater recharge facility within the Management Area include effective conveyance of surface water supplies when they are available, facilitation of water banking and exchange arrangements, and avoidance of direct water quality impacts. A conveyance mechanism, such as the Flat Rocks Canal would be necessary to bring such water to the Management Area.	X	X		X			Following receipt of funding and completion of feasibility study.	Board meetings, SWID website	No permits needed for initial evaluation phase. CEQA required for construction. Additional permit requirements will be further evaluated as part of implementation.	- Status: Preliminary design; Initiation: 2030 - Completion: 2035 - Accrual of Benefits: 1 to 3 - years post construction	- Up to 10,000 AFY of recharge capacity for purchased surface water within the Management Area (assumes 500-acre basin). Increased groundwater levels.
Identify Opportunities to Utilize Existing Infrastructure	Project	X	X				Several entities in the vicinity of the Annex Area have existing groundwater recharge infrastructure, which have unused capacity, particularly in non-wet years. The Annex Area will evaluate potential opportunities with these entities to utilize the unused capacity for recharge of purchased water.	X	X		X			Evaluation phase to be implemented following adoption of Management Area Plan.	Board meetings, SWID website	No permits anticipated for use of existing infrastructure.	- Status: Conceptual, have begun initial discussions - Initiation: 2020-2024 - Completion: ongoing - Accrual of Benefits: annual	- Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
On-Farm Groundwater Recharge	Project	X	X	X	X		In May 2019, the SWID Board adopted a new Buried Recharge policy that allows for on-farm water banking. This allows Annex Area landowners to purchase and recharge non-SWID water on their own properties, as well as those within the original SWID boundary.	X	X		X			In progress	Board meetings, SWID website	No permits anticipated for use of existing infrastructure. Permit requirements will be evaluated for any new infrastructure required.	- Status: Conceptual, have begun initial discussions - Initiation: 2020-2024 - Completion: ongoing - Accrual of Benefits: annual basis	- Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
Projects - Increased Delivery Flexibility																		
Flat Rock Canal Extension	Project	X		X	X		The Management Area will assess the feasibility of this project and seek partnership with other interest entities. This project would provide connection from the Annex Area to the Kern Water Bank Canal, Cross Valley Canal, and Goose Lake Slough. Phase 1 of this project is to distribute Kern River water to the north using gravity from Goose Lake Slough.	X	X		X			Feasibility and partnership formation phase to be implemented following adoption of Management Area Plan.	Board meetings, SWID website	No permits needed for initial evaluation phase. CEQA required for construction. Additional permit requirements will be further evaluated as part of implementation.	- Status: Conceptual, have - begun initial discussions; - Initiation: 2030 - Completion: 2035 Accrual of Benefits: Over a 50-year period following construction	- Improve ability to delivery surface water supplies to the District for irrigation or recharge. Benefits to neighboring entities, who would be key partners in this regional project.

TABLE PMA-1
Details of Projects and Management Actions
Shafter-Wasco Irrigation District
7th Standard Annex Management Area

P/MA Name	Type	P&MA Category					Description	Sustainability Indicators Involved						Circumstances for Implementation	Public Noticing Process	Permitting and Regulatory Process Requirements	Status, Time Table for Initiation and Completion, Accrual of Expected Benefits	Expected Benefits
		Surface Water Supply	Groundwater Supply	Groundwater Demand	Infrastructure Improvement	Monitoring		Groundwater Level	Groundwater Storage	Seawater Intrusion	Groundwater Quality	Land Subsidence	Interconnected Surface					
Develop New Interconnections Within SWID's Conveyance System (and Improve "Bottleneck" Issues)	Project	X			X		The Annex Area can work with SWID to increase the capacity and flexibility of SWID's current conveyance system, to allow access to additional supplies.							Evaluation phase to be implemented following adoption of Management Area Plan.	Board meetings, SWID website	No permits needed for initial evaluation phase. Permit requirements will be further evaluated as part of implementation.	- Status: Conceptual, will - require evaluation of - options and benefits - Initiation: TBD Completion: TBD Accrual of Benefits: TBD	- Improve operational flexibility within the SWID conveyance system to allow for increased capacity to accept surface water supplies when available.
Increased Recycled Water Deliveries and Recharge	Project	X	X	X			Secondary-treated municipal wastewater is from the North of the River Sanitary District is currently used for irrigation and infiltrated into groundwater within the Annex Area. The Annex Area is discussion options to increase recycled water deliveries and recharge of groundwater with secondary-treated wastewater within the Annex Area. Growth rate is projected at 2% and output expected to increase to 14,000 AFY.	X	X		X			Will require an update to the RWQCB Waste Discharge Requirements (WDR) Order	Board meetings	Will require an update to the RWQCB Waste Discharge Requirements (WDR) Order.	- Status: In discussions for increased purchases and distribution - Initiation: In progress - Completion: Ongoing - Accrual of Benefits: annual basis	- Up to 8,180 AFY of treated effluent (based on projected increased WWTP flows), to be used for irrigation to offset groundwater demand.
Management Actions/Policies to Reduce Water Demand																		
On-farm Water Conservation	Mgmt. Action			X			The NRCS is offering landowner incentive programs to assist in implementing various conservation activities, including but not limited to: irrigation system improvements, water/nutrient/pest management, and pump engine replacement. Interested landowners can call (661) 336-0967 or visit the website (www.ca.nrcs.usda.gov) for more information.	X	X		X			Grant funding	Flyers, direct mail, public meetings, SWID website	None anticipated	- Status: not yet initiated; - Initiation: Upon stakeholder interest - Completion: TBD - Accrual of Benefits: beginning 1-3 years after initiation	- Reduce on-farm water demands.
Voluntary Rotational Land Fallowing Program	Mgmt. Action			X			In order to reduce demand within the Management Area, this project would incentivize landowners to fallow their previously farmed lands voluntarily on a rotational basis. This project is implemented on a voluntary rotational basis. Incentives have been established and are funded by the Annex Area landowners through the same funding mechanism used for other SGMA related activities.	X	X					Will require adoption of a policy and funding mechanism	Flyers, direct mail, public meetings, SWID website	No permits needed for initial evaluation phase. Additional permit requirements will be further evaluated as part of implementation.	- Status: Ongoing; - Initiation: 2019 - Completion: Ongoing - Accrual of Benefits: 1 year after initiation	- Up to 2,500 AFY of reduced water demand (assumed 800 acres fallowed per year).
Education of Groundwater Use per Acre	Mgmt. Action			X			This program would provide groundwater users an expected groundwater volume, as an education tool, prior to enforcement actions on groundwater allocations, with the goal of providing awareness of overdraft conditions. This information would be provided in an annual letter, along with average crop demand, GSA average extraction, GW overdraft, and reminders of GSA powers and authorities.	X	X		X			To be implemented following adoption of Management Area Plan.	Flyers, direct mail, public meetings, SWID website	None anticipated	- Status: not yet initiated; - Initiation: Upon GSP implementation - Completion: Until overdraft ends/other programs initiated - Accrual of Benefits:	- Reduce on-farm water demands.
Well Dewatering Mitigation Program	Mgmt. Action				X		This program has been developed whereby a potential remedy will be provided to owners of wells that are demonstrably impacted by groundwater conditions, as defined within the policy. Options will be evaluated, but could include replacement with a deeper well, or connection to a public water system (i.e., the SMWC system). To mitigate the impacts to wells, the program provides funds to landowner for improvements of wells impacted.	X	X					To be implemented when wells that are demonstrably impacted by groundwater conditions as defined within the policy.	Board meetings, SWID website	None anticipated	- Status: Ongoing; - Initiation: 2020 Completion: Ongoing - Accrual of Benefits: - Ongoing	- Address wells impacted by lowering groundwater levels. Prevent loss of water supply.

TABLE PMA-1
Details of Projects and Management Actions
Shafter-Wasco Irrigation District
7th Standard Annex Management Area

P/MA Name	Type	P&MA Category					Description	Sustainability Indicators Involved						Circumstances for Implementation	Public Noticing Process	Permitting and Regulatory Process Requirements	Status, Time Table for Initiation and Completion, Accrual of Expected Benefits	Expected Benefits
		Surface Water Supply	Groundwater Supply	Groundwater Demand	Infrastructure Improvement	Monitoring		Groundwater Level	Groundwater Storage	Seawater Intrusion	Groundwater Quality	Land Subsidence	Interconnected Surface					
Mandatory Pumping Restriction and/or Land Fallowing	Mgmt. Action			X			In the event that the water level MOs are not maintained for three consecutive years despite the implementation of P&MAs in the Management Area, as a contingency, SWID will implement a mandatory pumping restriction and/or land fallowing policy, and work to maintain water levels above the MTs.	X	X					To be implemented in the event that the water level MOs are not maintained for three consecutive years despite the implementation of P&MAs in the Management Area. Will require adoption of a policy and funding mechanism.	Board meetings, SWID website	No permits needed for initial evaluation phase. Additional permit requirements will be further evaluated as part of implementation.	- Status: Ongoing; - Initiation: Upon GSP Implementation; - Completion: Until overdraft ends/other programs initiated - Accrual of Benefits: Immediate	- Reduce on-farm water demands.

Abbreviations:

7th Standard = 7th Standard Annex Management Area
AFY = acre-feet per year
GSA = Groundwater Sustainability Agency
NA = Not Applicable
NRCS = Natural Resources Conservation Service
O&M = Operations & Maintenance
P&MA = Projects and Management Actions
RRBWSD = Rosedale-Rio Bravo Water Storage District
SWID = Shafter-Wasco Irrigation District
TBD = to be determined

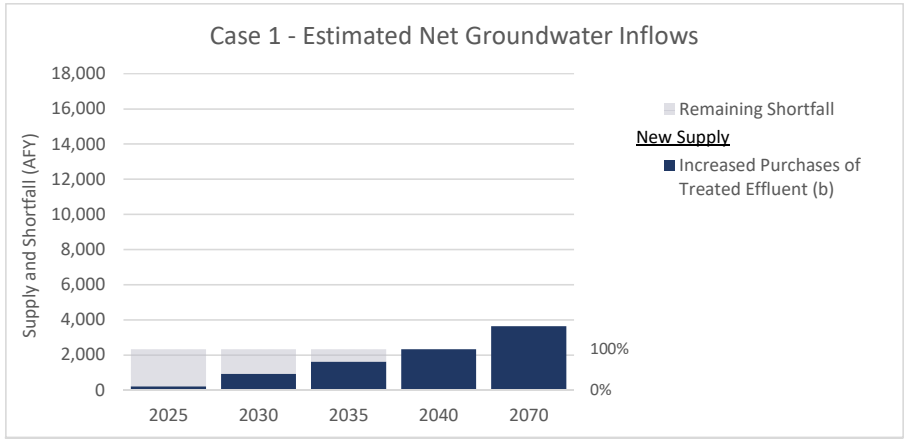
Notes:

(a) Summary table developed based off information provided by the 7th Standard Annex Management Area and its engineering consultant, Provost & Pritchard, on April - August 2019 and June 2022.

TABLE PMA-2
Project and Management Action Glide Path
Shafter-Wasco Irrigation District
7th Standard Annex Management Area

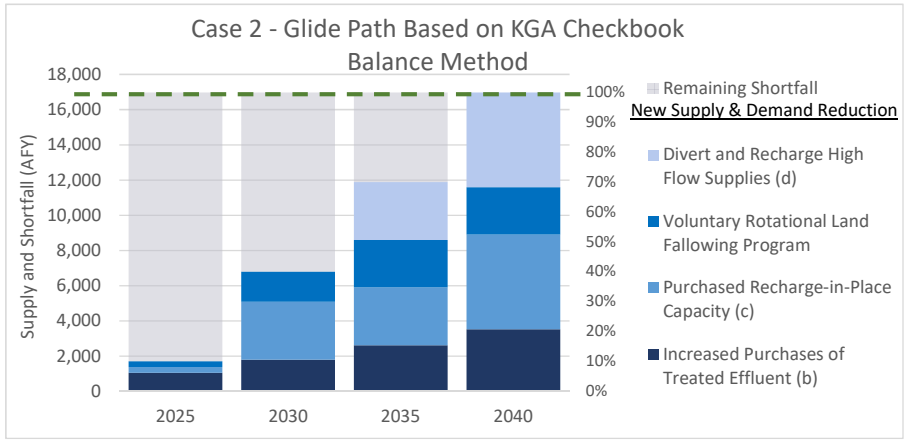
Case 1. Glide Path Based on Estimated Net Groundwater Inflows from Calibrated Historical Water Budget

Glide Path	2025	2030	2035	2040	2070
Target					
Projected 2030 Shortfall (Table WB-8)	-2,333	-2,333	-2,333	-2,333	-3,648
Target Glide Path Supply Increase	233	933	1,633	2,333	3,648
Target Glide Path Supply As Percent of Shortfall	10%	40%	70%	100%	100%
Projects & Management Actions (a)					
Increased Purchases of Treated Effluent (b)	233	933	1,633	2,333	3,648
Purchased Recharge-in-Place Capacity (c)	0	0	0	0	0
Voluntary Rotational Land Fallowing Program	0	0	0	0	0
Divert and Recharge High Flow Supplies (d)	0	0	0	0	0
Total Increased Supply	**233**	**933**	**1,633**	**2,333**	**3,648**
Total Shortfall	**-2,100**	**-1,400**	**-700**	**0**	**0**



Case 2. Glide Path Based on Shortall Calculated by KGA Checkbook Balance Method (e)

Glide Path	2025	2030	2035	2040
Target				
Projected 2030 Shortfall (KGA Checkbook)	-16,976	-16,976	-16,976	-16,976
Target Glide Path Supply Increase	1,698	6,790	11,883	16,976
Target Glide Path Supply As Percent of Shortfall	10%	40%	70%	100%
Projects & Management Actions (a)				
Increased Purchases of Treated Effluent (b)	1,045	1,788	2,608	3,513
Purchased Recharge-in-Place Capacity (c)	326	3,287	3,293	5,386
Voluntary Rotational Land Fallowing Program	326	1,715	2,690	2,690
Divert and Recharge High Flow Supplies (d)	0	0	3,293	5,386
Total Increased Supply	**1,698**	**6,790**	**11,883**	**16,976**
Total Shortfall	**-15,278**	**-10,186**	**-5,093**	**0**



Abbreviations:

ac = acre
AFY = acre-feet per year
GSA = Groundwater Sustainability Agency
KGA = Kern Groundwater Authority
NORSD = North of River Sanitary District
P&MAs = Projects and Management Actions
SWID = Shafter-Wasco Irrigation District

Notes:

(a) The volumes presented represent an assumed minimum take for each P&MA. Supply shortfalls are assumed to be preferentially met by treated effluent, with the remaining shortfall met by a combination of the remaining three P&MAs. For purposes of this table, demand offset is shown as an increase in supply.

(b) Increased purchases of treated effluent takes into account NORSD's projected increased water effluent production (NORSD, 2019).

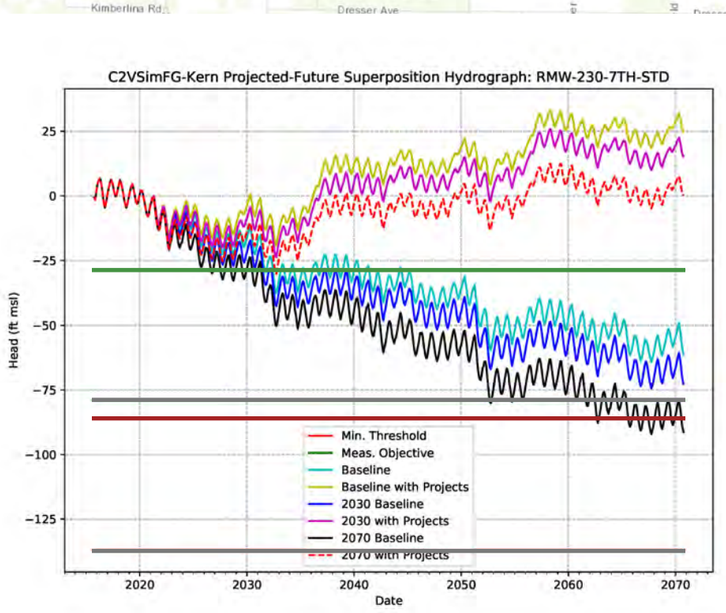
(c) Purchased recharge-in-place capacity includes: (1) working with entities with established recharge facilities such as SWID, North Kern Water Storage District, or Rosedale-Rio Bravo Water Storage District to utilize their unused capacity to recharge purchased water, and (2) utilizing SWID's pending Buried Recharge policy to allow for on-farm water banking, which will allow Annex Area landowners to purchase and recharge non-SWID water on their own properties, as well as those within the original SWID boundary.

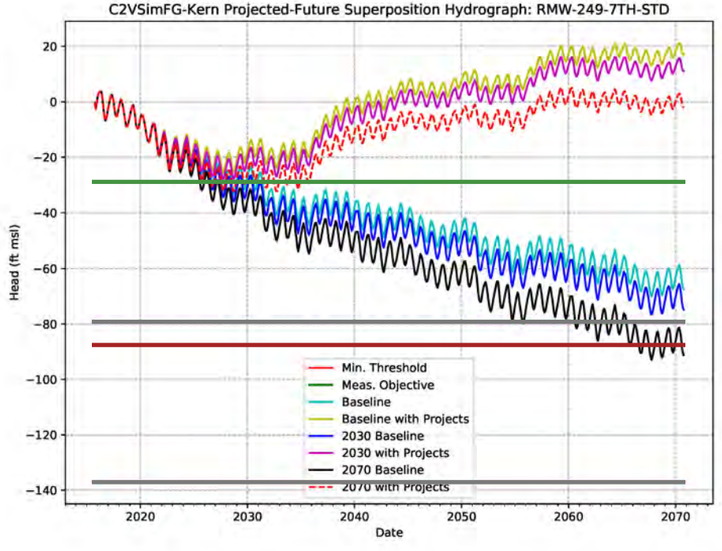
(d) If this project is implemented, it would be pursued in partnership with others. It is assumed that an approximately 320-acre recharge basin will be constructed.

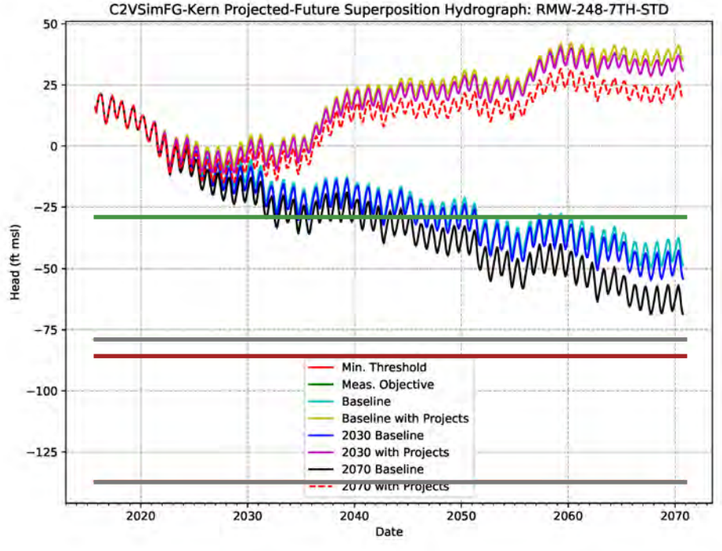
(e) The KGA Checkbook Balance approach was developed by the entities of the KGA GSA and adopted by the KGA board. The intended purpose of the KGA Checkbook Balance is to allocate water shortages/ surpluses and avoid double counting in water budget for current conditions. It is anticipated that further work to refine this Checkbook Balance approach will be conducted following the January 2020 GSP submission date. The KGA Checkbook Balance represents a high end of the range of projected shortfall, and is used by the 7th Standard Annex Area has for planning purposes.

References:

NORSD, 2019. Communications between Pat Ostly (NORSD) and Ken Bonesteel (Provost & Pritchard), April 2019.
KGA GSA, 2019. Kern Sub-basin Water Budget for Current Conditions, November 2019.







Legend

- C2VSim-FG Representative Well Location
- SWID 7th Standard Annex Management Area
- Current SWID Boundary
- Minimum Threshold (revised)
- Measurable Objective (revised)
- Baseline
- Baseline with Projects
- 2030 Baseline
- 2030 with Projects
- 2070 Baseline
- 2070 with Projects
- Old Minimum Threshold / Measurable Objective

Abbreviations

DWR	=	Department of Water Resources
SWID	=	Shafter-Wasco Irrigation District
C2VSim-FG	=	California Central Valley Groundwater-Surface Water Simulation Model, beta fine-grid version
ft	=	feet
P&MAs	=	Projects and Management Actions

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 3 December 2019.
2. The 7th Standard Annex boundary shapefile was received from SWID staff on 2 August 2018.
3. Model-projected hydrographs were provided by Todd Groundwater on 1 December 2019.

N

0 0.75 1.5 3

(Scale in Miles)

C2VSim-FG Projected Hydrographs with and without P&MA Implementation

SWID 7th Standard Annex Management Area

June 2022

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Figure PMA-1

eki environment & water

Path: X:\B80079\Maps\20191212\FigPMA-1_C2VSim Projected Hydrographs_1203.mxd

PLAN IMPLEMENTATION

17. PLAN IMPLEMENTATION

☑ 23 CCR § 351(y)

Per the Groundwater Sustainability Plan (GSP) Regulations, "plan implementation" refers to "an [Groundwater Sustainability] Agency's exercise of the powers and authorities described in the Act, which commences after an Agency adopts and submits a Plan or Alternative to the Department and begins exercising such powers and authorities" (California Code of Regulations [23-CCR] § 351(y)). This section describes the ongoing and planned activities that will be performed by Shafter-Wasco Irrigation District (SWID; District) as part of ~~GSP~~Management Area Plan (MA Plan) implementation within the 7th Standard Annex Management Area (also referred to herein as the "Annex Area" or "Management Area"), with a focus on the first five years. This section does not address any actions by other entities with potential management authority in the Management Area (e.g., the Kern Groundwater Authority (KGA) Groundwater Sustainability Agency (GSA)).

With the passage of a Proposition 218 election (with a 92% yes vote) in November 2019 and full annexation by SWID in December 2019, the Annex Area landowners have taken the critical first steps to (1) establish a governance structure, (2) become a member of the KGA GSA under SWID, and (3) secure a robust funding mechanism to support the development of P&MAs and other SGMA-compliance actions~~.~~, including the Well Dewatering Mitigation Program. Other key ~~GSP~~ongoing and planned MA Plan implementation activities to be undertaken by ~~the District~~SWID over the next five years include:

- Monitoring and data collection;
- Projects & Management Action (P&MA) implementation, including policy development to support GSP implementation;
- Technical and non-technical coordination with other water management entities within the Kern County Subbasin (Kern Subbasin);
- Continued outreach and engagement with stakeholders;
- Annual reporting;
- Enforcement and response actions, as necessary; and
- Evaluation and updates, as necessary, of the District's Management Area Plan (MA Plan) as part of the required periodic evaluations (i.e., "five-year updates").

Each of these activities is discussed in more detail in the sections below.

Since 2019, SWID has taken the following actions:

- Worked with Land IQ to develop a program to increase the accuracy of ET and precipitation measurements by installing and monitoring weather stations to provide ground truthing of the satellite data.
- Developed preliminary plans for construction of two groundwater recharge facilities. One of the projects is expected to be operational in 2023.
- Participated the Subsidence Study and Basin Study that were being coordinated by the KGA GSA.

- Developed implementation policies to help manage water supplies to achieve groundwater sustainability.
- Implemented the voluntary land fallowing program and met the 5-year interim goal within the first two years.

As shown in **Table SMC-1** that presents Sustainable Management Criteria (SMC) status within the MA Plan area, water levels are above the MT for Chronic Lowering of Groundwater Levels for all three water level Representative Monitoring Wells (RMWs). Based on the recent measurement in 2020, TDS, nitrate, and arsenic concentrations are below their recommended SMCL or MCL respectively in all three water quality monitoring wells. The MA Plan area has met the 5-year interim goal within the first two years.

17.1. Plan Implementation Activities

17.1.1. Monitoring and Data Collection

As discussed in **Section 15 *Monitoring Network***, successful sustainable groundwater management relies on a foundation of data to support decision making. As such, collection of data within the Management Area ~~will be~~is a key part of ~~GSP~~MA Plan implementation. These data collection efforts include data on applicable sustainability indicators to be collected from the networks of ~~Representative Monitoring Sites (RMS),~~RMW, as well as other data and information required for management and reporting under the Sustainable Groundwater Management Act (SGMA), as described below.

Monitoring of Applicable Sustainability Indicators

Section 15 *Monitoring Network* discusses the monitoring network (i.e., ~~RMS~~RMW) and protocols that ~~will be~~are used for the applicable sustainability indicators within the Annex Area, including Chronic Lowering of Groundwater Levels, Reduction of Groundwater Storage (using groundwater levels as a proxy), and Degraded Water Quality. Those protocols ~~will be~~are followed in the defined networks as part of ~~GSP~~MA Plan implementation. Data collected ~~will be~~are incorporated into ~~the District's~~SWID's own Data Management System (DMS) for subsequent inclusion in the basin-wide DMS. These data ~~will be~~are used to support coordination efforts within the KGA GSA and the Kern Subbasin (e.g., as part of Annual Reports; see **Section 17.1.5 *Annual Reporting***).

Monitoring results ~~will be~~are evaluated against applicable ~~Sustainable Management Criteria (~~SMCs~~;~~ (i.e., Undesirable Results, Minimum Thresholds, and Measurable Objectives) to support local management efforts.

~~The District~~SWID anticipates that within the first five years of GSP implementation (i.e., in the 2020 – 2025 timeframe), the following ongoing or planned efforts related to monitoring will be performed:

- Refinement of the local DMS to comply with the basin-wide DMS;
- Refinement of the Monitoring Network, including potentially adding, replacing or drilling new wells.
- Semi-annual monitoring for water levels at the ~~RMS~~RMW, with the potential for more frequent (e.g., quarterly) monitoring and/or monitoring of additional well sites;
- Semi-annual monitoring for water quality at the ~~RMS~~RMW, with the potential for monitoring of additional well sites;

- Review of publicly available water quality data collected within the Annex Area, i.e., Safe Drinking Water Information System (SDWIS) monitoring for the Superior Mutual Water Company (SMWC) supply wells; and
- Annual review of publicly available subsidence data.

Collection of Other Required Information

Besides the data on Sustainability Indicators described above, collection and reporting of other types of information is required under SGMA (see further discussion below in **Section 17.1.5 *Annual Reporting***). These other types of information include:

- Groundwater extraction information; and
- Surface water supply data.

Groundwater extraction information (e.g., estimated through ITRC data) ~~will be~~is quantified for inclusion in the Annual Reports through methods described in an appendix of the Coordination Agreement.

No surface water is currently delivered to the Annex Area. Therefore, it is anticipated that surface water supply data to the original SWID area as reported in the SWID Management Area updates will be referenced and will be based on metered imports through the ~~District's~~SWID's conveyance system. Any future surface water deliveries to the Management Area will be summarized and reported, indicating the source/type (e.g., State Water Project [SWP], Kern River, or other) assigned to it to facilitate basin-wide accounting of these supply sources.

17.1.2. Project and Management Action Implementation

A main part of ~~GSP~~MA Plan implementation ~~will be~~is the implementation of P&MAs to address and prevent potential Undesirable Results. As described in **Section 16 *Projects and Management Actions***, a portfolio of P&MAs has been developed with the goal of addressing the relevant Sustainability Indicators in the specific areas of concern within the Annex Area, and each P&MA in the portfolio has certain expected benefits. **Table PMA-1** provides the required details about each P&MA, including the circumstances under which they will be implemented.

For many of the P&MAs shown in **Table PMA-1**, initial steps in implementation ~~will~~ include performing various studies or analyses to refine the concepts into actionable projects and/or policies. Ongoing and planned studies and work efforts ~~may~~ include, but are not limited to, the following:

- Actively coordinate with project stakeholders and partners;
- California Environmental Quality Act (CEQA) studies and documentation;
- Engineering feasibility studies and preliminary design reports;
- Financial and/or economic analysis such as Proposition 218 studies; and
- Legal analyses.

Once the necessary initial studies are completed, P&MAs will undergo, as necessary, final engineering design (in the case of infrastructure projects) and final drafting (in the case of policy-based actions). At that point, construction of projects and/or adoption of policies will occur, followed by ongoing operations and maintenance (O&M), as necessary. It is anticipated that each implemented P&MA will have its own set of monitoring or data collection components to allow for P&MA assessment and, if necessary, modification.

~~The District~~SWID anticipates that within the first five years of ~~GSP~~MA Plan implementation (i.e., in the 2020 – 2025 timeframe), the following ongoing and planned efforts related to P&MA implementation will be performed:

- Identify opportunities and initiate partnership evaluation with neighboring entities (e.g., SWID, Rosedale-Rio Bravo Water Storage District [RRBWSD], and North Kern Water Storage District) (P&MA #1, 2, 4);
- Initiate engineering design, permitting (i.e., CEQA and others), and construction of the 7th Standard Annex Management Area ~~Storage Pond~~Recharge Project (P&MA #3);
- Initiate implementation of On-Farm Groundwater Recharge (P&MA #5);
- Initiate the feasibility and engineering study of the Flat Rock Canal Extension project, including identification of potential grant funding sources (P&MA #6);
- Initiate feasibility and engineering studies to of Develop New Interconnections Within SWID's Conveyance System (and Improve "Bottleneck" Issues) (P&MA #7);
- Initiate negotiation and RWQCB Waste Discharge Requirement (WDR) Order revision process to Increase Recycled Water Deliveries and Recharge project (P&MA #8);
- Initiate outreach for On-Farm Water Conservation and Education of Groundwater Use per Acre (P&MA #9, 11).
- Initiate study of the Voluntary Rotational Land Fallowing Program ~~(P&MA #10~~and Mandatory Pumping Restriction and/or Land Fallowing Program (P&MA #10 and #13).
- Develop Well Dewatering Mitigation Program (P&MA #12)

As a part of several of the above specific P&MA activities, ~~the District~~SWID will actively participate in the local, regional and state-wide water market(s) to secure additional short- and long-term surface water and stored groundwater supplies through exchanges, trades, and sales. ~~The District~~SWID will also actively explore and pursue grant funding source to support other P&MAs listed in **Table PMA-1**.

~~The District~~SWID also anticipates that an integral part of P&MA implementation will involve establishing contracts with the ~~District's~~SWID's landowners to provide, among other things, greater flexibility to ~~the District~~SWID in terms of water purchase and delivery and revenue to support other P&MAs.

17.1.3. Intrabasin Coordination

SWID is a member of the multi-agency KGA GSA. There are ~~10~~13 other GSAs that are located within the Kern County Subbasin: Kern River GSA, Greenfield County Water District, Buena Vista Water Storage District, Olcese GSA, Henry Miller Water District, Semitropic Water Storage District, West Kern Water District, Cawelo GSA, Pioneer GSA, ~~and McFarland GSA.~~McFarland GSA and the South of Kern River GSAs (including Arvin GSA, Wheeler-Ridge Maricopa GSA, and Tejon-Castac Water District [TCWD] GSA). Just as this Management Area Plan has been developed as part of a coordinated GSP process in the Kern Subbasin, coordination amongst all water management entities involved in SGMA in the Kern Subbasin will continue during GSP implementation. This coordination ~~will include~~includes both technical and non-technical matters, as discussed below.

Technical Coordination

Continued technical coordination ~~will be~~is critical to ensure that all entities in the Kern Subbasin as a whole approach local groundwater management using a robust shared framework of data, information, and

technical assumptions. ~~SWID will coordinate~~SWID's ongoing and planned coordination with other water management entities on technical matters ~~including~~include, but not limited to, the following:

- DMS development and maintenance;
- Groundwater model refinement and updates;
- Water budget refinement and collection of supporting data; and
- Basin-wide monitoring and reporting efforts.

Non-Technical Coordination

Non-technical coordination ~~will involve~~involves matters related to policy, advocacy, governance, and the like. ~~The District~~SWID will continue to actively participate in coordination meetings with and amongst fellow KGA members and the other Kern Subbasin GSAs. Specific additional non-technical coordination activities will be pursued, as necessary.

17.1.4. Stakeholder Engagement

The District's Stakeholder Communication and Engagement Plan (SCEP; **Appendix A**) is a key part of the Management Area Plan, and will continue to be refined, updated and executed during GSP implementation. Ongoing and anticipated stakeholder engagement activities include, but are not limited to:

- Regular SGMA updates during District Board meetings;
- Hosting stakeholder workshops, as needed;
- Posting of relevant announcements and information on the District website; and
- Conducting informational discussions and meetings, as necessary, with interested stakeholders.

17.1.5. Annual Reporting

☑ 23 CCR § 356.2(b)(1)(2)(3)

Per the GSP Regulations, an annual report on basin conditions and GSP implementation status is required to be submitted to the Department of Water Resources (DWR) by April 1 of each year following GSP adoption. These annual reports ~~will be~~have been prepared on the basin-level ~~but will require~~ and required input from each local entity, including from SWID. As of now, 2019, 2020, and 2021 Water Year (WY) annual reports have been submitted to DWR. Activities required at the ~~District~~SWID level and the Basin level are described below.

~~District Level~~SWID Activities

In support of the annual reporting requirements, ~~the District will provide~~SWID has provided to the basin-level entity preparing the reports all monitoring data from the ~~RMS~~RMW in its designated monitoring networks, as well as the other required information discussed in *Collection of Other Required Information* above. ~~The District will~~SWID has also ~~provide~~provided review and comment on the draft reports to ensure that local information is properly incorporated into the basin-level reports.

Basin-Level Activities

An entity ~~will be~~is designated at the basin level to compile and consolidate all of the local information into annual reports that meet the requirements of the GSP Regulations (23-CCR § 356.2).

17.1.6. Enforcement and Response Actions

Part of successful management involves the ability to adapt and respond to unforeseen or uncertain circumstances. To the extent possible, methods to address foreseeable problems should be developed before those problems arise. It is anticipated that there may need to be actions taken to enforce compliance with the GSP and any policies adopted thereunder. Such actions, if necessary, will be taken in accordance with applicable laws and authorities.

Basin Exceedance Policy

Undesirable Results for the Chronic Lowering of Groundwater Levels occur when a certain number of MTs are exceeded at RMWs. While a single or isolated exceedance of a MT will not, by itself, cause an Undesirable Result, such an exceedance may be indicative of future or trending exceedances, which could result in Undesirable Results for Chronic Lowering of Groundwater Levels. The KGA GSA developed an action plan related to exceedance of MTs for Chronic Lowering of Groundwater Levels, as shown in **Appendix F**~~*Impacted*~~. If MT is exceeded at a single RMW, the Management Area will follow the action plan to address the exceedance, including coordination between KGA member districts.

Well Dewatering Mitigation Program

In other cases, a response action may be needed that is driven not by a non-compliance concern (e.g., an Undesirable Result), but rather by a physical, social or economic condition that falls outside of the six Sustainability Indicators defined under SGMA. One such condition that may arise is that of wells being impacted by low groundwater levels, including agricultural and domestic supply wells. Impacts could include dewatering of pumps or dewatering of well screens to the point of significant reduction in production. To address this potential occurrence, ~~an Impacted~~a Well Dewatering Mitigation Program ~~will be~~has been developed whereby a potential remedy will be provided to owners of wells that are demonstrably impacted by groundwater conditions, as defined within the policy. Options will be evaluated, but could include replacement with a deeper well, or connection to a public water system (i.e., the SMWC system). The program may be modeled after similar programs developed elsewhere in the basin or around the state (e.g., the Kern Water Bank's program). Costs for such a program is included under **Section 17.2.1** and is included as part of the Proposition 218 process ~~that is currently underway for the Management Area~~for the Management Area. The MA Plan area successfully organized and held election under Proposition 218 to fund MA Plan P&MAs, including the Well Dewatering Mitigation Program.

17.1.7. Periodic Evaluations of GSP

☑ 23 CCR § 356.4

Per the GSP Regulations (23-CCR § 356.4), ~~the District~~SWID will conduct a periodic evaluation of its Management Area Plan, at least every five years, and will modify the Management Area Plan as necessary to ensure that the Sustainability Goal defined for the Kern Subbasin (see **Section 11** ***Sustainability Goal***) is achieved within the Annex Area. The GSP elements that will be covered in the periodic evaluation are described below. It is anticipated that the 2025 plan will require substantial revision, especially on matters related to the water budget, P&MAs, and sustainability criteria, as significant data gathering and data gap filling is anticipated at both the Management Area and Basin-level over the next five years.

Sustainability Evaluation

This section will evaluate the current groundwater conditions for each applicable sustainability indicator within the Annex Area, including progress toward achieving Interim Milestones and Measurable Objectives.

Plan Implementation Progress

This section will evaluate the current implementation status of P&MAs, along with an updated project implementation schedules and any new projects that are not included in this Management Area Plan.

Reconsideration of GSP Elements

Per 23-CCR § 356.4 (c), elements of the Management Area Plan, including the Basin Setting, Management Areas, Undesirable Results, Minimum Thresholds, and Measurable Objective, will be reviewed and revised if necessary.

Monitoring Network Description

This section will provide a description of the Monitoring Network, including identification of data gaps, assessment of monitoring network function with an analysis of data collected to date, identification of actions that are necessary to improve the monitoring network, and development of plans or programs to fill data gaps.

New Information

This section will provide a description of significant new information that has been made available since the adoption or amendment of the Management Area Plan, or the last five-year assessment, including data obtained to fill identified data gaps. As discussed in ***Reconsideration of GSP Elements***, if evaluation of the Basin Setting, Measurable Objective, Minimum Threshold, or Undesirable Results definition warrant changes to any aspect of the Management Area Plan, the new information would also be included. For example, data related to Land Subsidence and Degraded Water Quality will be reviewed and establishment of SMCs will be evaluated, if supported by the data.

Regulations or Ordinances

SWID possesses the legal authority to implement regulations or ordinances related to the Management Area Plan. This section will provide a description of relevant actions taken by SWID, including a summary of related regulations or ordinances.

Legal or Enforcement Actions

This section will summarize legal or enforcement actions taken by SWID and/or the KGA GSA in relation to the Management Area Plan, along with how such actions support sustainability in the Annex Area.

Plan Amendments

This section will provide a description of proposed or complete amendments to the Management Area Plan.

Coordination

This section will describe coordination activities relevant to the Annex Area.

17.2. Plan Implementation Costs

☑ 23 CCR § 354.6(e)

Per the GSP Regulations (23-CCR § 354.6(e) and 354.44(b)(8)), this section provides estimates of the costs to SWID to implement this Management Area Plan and potential sources of funding to meet those costs.

17.2.1. Estimated Costs

Costs to ~~the District~~SWID to implement this Management Area Plan can be divided into several groups, as follows:

- Costs of local groundwater management activities;
- District's proportional share of costs for basin-wide groundwater management activities; and
- Costs to implement P&MAs, including capital/one-time costs and ongoing costs.

Table PI-1~~Tables PI-1~~ through **Table PI-3**~~PI-4~~ provide an estimate of: (1) costs of regular/ongoing SGMA compliance activities and implementation of the Management Area Plan, including five-year updates, (2) costs for implementation of projects and management actions (**Table PI-2**), and (3) total annual costs (**Table PI-3**). These costs are preliminary estimates and are expected to be continually refined through the GSP finalization and implementation processes. The costs presented do not include costs to develop the initial KGA GSA GSP, Management Area Plan, or the annexation of the Management Area into SWID.

17.2.2. Sources of Funding to Meet Costs

As shown in **Table PI-3**, costs for GSP implementation are estimated to be significant – i.e., approximately $2,250,000 per year on average over the next 20 years. To meet these costs, ~~the District~~SWID will need to establish new funding sources or increase existing funding sources. SGMA grants GSAs certain financial authorities (California Water Code [CWC] § 10725.4 and 10730 through 10731), including the ability to raise revenue through use of fees, assessments, pump taxes, and other methods to pay for the costs incurred by the GSA for SGMA compliance. As part of the annexation into SWID, the Annex Area completed a Proposition 218 process on 13 November 2019 to levy assessments within this area, amounting to over $7 million over the next five years, primarily for purposes of funding SGMA compliance activities and P&MAs. Therefore, it is anticipated that Annex Area will meet the estimated SGMA implementation costs through 2040 through a combination of the following:

- District revenue from assessments/fees;
- Special assessments/fees for specific projects;
- Grant funding or other financing options; and/or
- Penalties levied on prohibited activities.

~~This section may be revised to conform with the SWID Management Area, once the SWID Management Area Management Area Plan is made available.~~

17.3. Plan Implementation Schedule

This section discusses a general estimated schedule for ~~GSP~~MA Plan implementation. The GSP Regulations do not specifically require that a schedule for GSP implementation over the 20-year implementation period (i.e., 2020 through 2040) be provided, and any such schedule would be subject to considerable

uncertainty. However, based on certain factors and constraints inherent to the ~~GSP~~MA Plan process, an approximate schedule has been developed. These factors include the following:

- The GSP Regulations require achievement of the Sustainability Goal (i.e., avoidance of Undesirable Results) within 20 years of GSP adoption, which in the case of the Kern Subbasin means by 2040.
- The P&MA implementation glide path discussed in **Section 16.2.3** ***Implementation Glide Paths*** above spells out the general schedule for when expected benefits from P&MAs will accrue between 2020 and 2040.
- The annual reporting and periodic evaluation requirements discussed in **Section 17.1** dictate when certain activities will occur.

Table PI-1. Estimated Costs for Regular/Ongoing SGMA Compliance Activities

Part 1. Regular/Ongoing SGMA Compliance Activities	**Estimated Annual Cost (a)**	**Notes/Assumptions**
Administration	$135,000	
Stakeholder Engagement	$10,000	
Inter-Basin Coordination (KGA)	$20,000	
Field Data Collection and Lab Analysis (Water Level and Water Quality)	$1,000	Additional data will help fill data gaps. Includes lab analysis for water quality samples. Incorporated into SWID's routine water level monitoring.
Annual Reports	$15,500	
5-Year Updates	$35,500	Costs are assumed to be spread over 5-years for purposes of this summary.
Annual Total	***$217,000***	

a) Estimated costs do not include costs for initial GSP development or annexation of the Management Area into SWID.

Table PI-2. Estimated Costs for Implementation of Projects and Management Actions

Part 3. Implementation of Projects and Management Actions	Estimated Costs Per 5-Year Period				Total 20-Year Cost
	2020 – 2025	2025 - 2030	2030 - 2035	2035 - 2040	
Water Purchase	$420,000	$420,000	$420,000	$420,000	**$1,680,000**
Recharge Basin	$2,200,000	$3,250,000	$3,250,000	$3,250,000	**$11,950,000**
Flat Rocks Canal	$3,760,000	$5,500,000	$5,500,000	$5,500,000	**$20,260,000**
Voluntary Rotational Fallowing Incentive	$350,000	$500,000	$500,000	$500,000	**$1,850,000**
Well Dewatering Mitigation Program	$350,000	$500,000	$500,000	$500,000	**$1,850,000**
Total Cost	***$7,080,000***	***$10,170,000***	***$10,170,000***	***$10,170,000***	***$37,590,000***
Average Annual Cost	***$1,416,000***	***$2,034,000***	***$2,034,000***	***$2,034,000***	--

Table PI-3. Estimated Costs for Implementation of the Management Area Plan

GSP Implementation Component	Estimated Costs Per 5-year Period (a)				Total 20-Year Cost
	2020 - 2025	2025 - 2030	2030 - 2035	2035 - 2040	
Regular/Ongoing SGMA Compliance Activities	$1,085,000	$1,085,000	$1,085,000	$1,085,000	**$4,340,000**
Implementation of Projects and Management Actions	$7,080,000	$10,170,000	$10,170,000	$10,170,000	**$37,590,000**
Total	***$8,165,000***	***$11,255,000***	***$11,255,000***	***$11,255,000***	***$41,930,000***
Average Annual Cost	***$1,633,000***	***$2,251,000***	***$2,251,000***	***$2,251,000***	--

a) Estimated costs do not include costs for initial GSP development or annexation of the Management Area into SWID.

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